ÄKTA™ start

Maintenance Manual

Original instructions

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1 Introduction

About this chapter

This chapter contains important user information, description of safety notices, regulatory information, intended use of ÄKTA start, and list of associated documentation.

In this chapter

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1.1 About this manual

Purpose of this document

The *ÄKTA start Maintenance Manual* provides you with the instructions needed to unpack, maintain and troubleshoot ÄKTA start in a safe way.

Nomenclature conventions

The nomenclature used in this manual are explained in the table below.

Concept	Explanation
ÄKTA start	The instrument.
Frac30	The Fraction collector.
UNICORN™ start	The software installed on a computer.
ÄKTA start System	The entire liquid chromatography system, including instrument, Fraction collector and software.

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, **Buffer valve**).

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

ÄKTA start is a liquid chromatography system used for preparative purification of proteins at laboratory-scale. The system can be used for a variety of research purposes to fulfill the needs of the users in the academia and in the life sciences industry.

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

Prerequisites

In order to follow this manual and use the system in the manner it is intended, it is important that:

- you understand the concepts of liquid chromatography
- you have read and understood the *Safety instructions* chapter in the *ÄKTA start Maintenance Manual*.

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 describes the directives and standards that are fulfilled by ÄKTA start.

Manufacturing information

The table below summarizes the required manufacturing information. For further information, see the EC 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 below, by fulfilling the corresponding harmonized standards. For further information, see the EC Declaration of Conformity document.

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

CE marking

The CE marking and the corresponding EC 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 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.	EN standard is harmonized with EU directive 2006/95/EC
EN 61326-1, IEC 61326-1 (Emission according to CISPR 11, Group 1, class A)	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

WARNING

This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

FCC statement

ÄKTA start complies with FCC 47 CFR Part 15b.

Note: *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.*

Regulatory compliance of connected equipment

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

Environmental Conformity

Requirement	Description
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)

1.4 Associated documentation

Introduction

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

User documentation on the CD

The user documentation listed in the table below is available on the ÄKTA start User Documentation CD. A display help is available from the Instrument Display.

Documentation	Main contents
ÄKTA start Operating Instructions	Instructions needed to install, operate and maintain ÄKTA start in a safe way.
ÄKTA start Instrument Display Help	Dialog descriptions of the functionality menu for ÄKTA start (only accessible from the Instrument Display).
ÄKTA start Maintenance Manual	Detailed instrument and module descriptions, including instructions needed to maintain and troubleshoot ÄKTA start.
ÄKTA start System Cue Card	A condensed guide to prepare and run chromatographic techniques on ÄKTA start.
ÄKTA start Maintenance Cue Card	A condensed guide to handling routine maintenance operations and troubleshooting ÄKTA start.

From the Help menu in UNICORN start or on the UNICORN start DVD, the following user documentation is available.

Documentation	Main contents
UNICORN start 1.0 User Manual	Overview and detailed descriptions of the system control software designed for ÄKTA start, which includes process picture map for real time monitoring, method editor, evaluation and administration modules.
UNICORN start Online Help	Dialog descriptions for UNICORN start (only accessible from the Help menu).

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/AKTA.
2	Click ***ÄKTA Lab-Scale Systems***.
3	Select ***ÄKTA start*** from the list.
4	Click ***Related Documents***.
5	Select to download the chosen literature.

Access documentation from mobile units

Scan the code using your mobile phone or tablet computer to access the product page for ÄKTA start. Select documents to download under the ***Related Documents*** tab.

2 Safety instructions

About this chapter

This chapter describes safety precautions and emergency shutdown procedures for the product. The labels on the system and recycling procedures are also described.

In this chapter

This chapter contains the following sections:

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2.1 Safety precautions

Introduction

ÄKTA start is powered by mains voltage and handles 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 injuries 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

WARNING

Always follow these General precautions to avoid injury when using ÄKTA start.

- Do not operate ÄKTA start in any other way than described in the ÄKTA start user documentation.
- Operation and user maintenance of ÄKTA start should be performed according to the instructions described in *ÄKTA start Operating Instructions* and *ÄKTA start Maintenance Manual*.
- Do not use any accessories not supplied or recommended by GE.
- Do not use ÄKTA start if it is not working properly, or if it has suffered any damage, for example:
  - damage to the power cord, its plug or the Frac30 cable
  - damage caused by dropping the equipment
  - damage caused by splashing liquid onto it

Using flammable liquids

WARNING

When using flammable liquids with ÄKTA start, follow these precautions to avoid any risk of fire or explosion.

- **Fire Hazard**. Before starting the system, make sure that there is no unintentional leakage in the instrument or tubing.
- **Explosion hazard**. To avoid building up an explosive atmosphere when using flammable liquids, make sure that the room ventilation meets the local requirements.

CAUTION

To avoid hazardous situations when unpacking, installing or moving ÄKTA start, follow the precautions below.

ÄKTA start is filled with denaturated alcohol (50% C2H5OH (ethanol)) at delivery. **The denatured alcohol mixture can be hazardous to humans if consumed.** Flush out the denaturated alcohol before assembling, testing or integrating ÄKTA start into the intended process context.

Personal protection

WARNING

To avoid hazardous situations when working with ÄKTA start, take the following measures for personal protection.

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

CAUTION

To avoid hazardous situations when working with ÄKTA start, take the following measures for personal protection.

- Always use appropriate personal protective equipment during operation and maintenance of ÄKTA start.
- **Spillage hazard**. When using ÄKTA start use personal protective equipment like goggles, lab coat, protective shoes and gloves to avoid any circumstances of spillage.
- **Cut injuries**. The tubing cutter is very sharp and must be handled with care to avoid injuries.
- **Hazardous substances.** 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, maintenance and decommissioning of the equipment.

Installing and moving the instrument

WARNING

To avoid damage to person when installing or moving ÄKTA start, follow the instructions below.

- **Moving the instrument horizontally**. One person is recommended when moving the instrument horizontally.
- **Supply voltage**. Make sure that the supply voltage at the wall outlet corresponds to the marking on the instrument, before connecting the power cord.
- **Power cord**. Only use grounded power cords delivered or approved by GE.
- **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.
- **Installing the computer (optional)**. The computer should be installed and used according to the instructions provided by the manufacturer of the computer.
- **Disconnect power**. Always switch off power to ÄKTA start before an instrument module is removed or installed, or a cable is connected or disconnected.

CAUTION

To avoid damage to person when installing or moving ÄKTA start, follow the instructions below.

Protective ground. ÄKTA start must always be connected to a grounded power outlet.

NOTICE

To avoid damage to ÄKTA start or other equipment when installing or moving the instrument, follow the instructions below.

- **Vents on ÄKTA start**. To ensure adequate ventilation, keep papers and other objects away from the vents of the instrument.
- Any computer used with the equipment shall comply with IEC 60950 and be installed and used according to the manufacturer's instructions.
- Frac30 should not be connected or disconnected from ÄKTA start when the instrument is powered ON.

System operation

WARNING

To avoid personal injury when operating ÄKTA start, follow the instructions below.

- **Rotating the instrument**. Make sure that there is always at least 20 cm of free space around ÄKTA start to allow for sufficient ventilation. When turning or moving the instrument, take care not to stretch or squeeze tubing or cables. A disconnected cable may cause power interruption or network interruption. Stretched tubing may cause bottles to fall, resulting in liquid spillage and shattered glass. Squeezed tubing may cause increase in pressure, or block liquid flow. To avoid the risk of knocking over bottles, always place bottles on the buffer tray and turn or move carefully.
- **Hazardous chemicals during run**. When using hazardous chemicals, run the ***System cleaning*** template to clean and flush the entire system tubing with distilled water, before service and maintenance.
- **Setting**. Check that the correct outlet size settings are used. Make sure that tubing and fittings are properly connected and secured. Make sure that the pressure limit settings are correct before starting the run.

CAUTION

To avoid personal injury when operating ÄKTA start, follow the instructions below.

- **Max weight on Buffer tray**. Do not place containers with a volume of more than 1 liter each on the Buffer tray. The maximum allowed weight on the Buffer tray is 5 kg.
- **Large spillage**. Switch off ÄKTA start and unplug the power cord, if large spillage occurs.

NOTICE

To avoid damage to ÄKTA start or other equipment when operating the instrument, follow the instructions below.

- **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.
- **Pre-fill UV flow cell**. Make sure that the **UV flow cell** is pre-filled with liquid before starting the system.
- **Avoid condensation.** If ÄKTA start is kept in a cold room, cold cabinet or similar, keep the instrument switched on in order to avoid condensation.
- **Avoid overheating.** If ÄKTA start is kept in a cold cabinet and the cold cabinet is switched off, make sure to switch off the instrument and keep the cold cabinet open to avoid overheating.
- **Place the computer in room temperature.** If ÄKTA start is placed in a cold room, place the computer outside the cold room and use the PC Connectivity cable delivered with the instrument to connect to the computer.
- **Keep the pump cover open when not using the system**. Open the peristaltic pump cover after you switch off the equipment. This will enhance the life time of the pump tubing.

Maintenance

WARNING

To avoid damage to person when performing maintenance on ÄKTA start, follow the instructions below.

- **Electrical shock hazard**. Do not open any covers or parts unless specified in the user documentation. Except for the maintenance and service described in the user documentation, all other repairs should be done by service personnel authorized by GE.
- Only spare parts and accessories that are approved or supplied by GE may be used for maintaining or servicing ÄKTA start.
- **Disconnect power**. Always switch off power to the instrument before replacing any component on the instrument or cleaning the instrument, unless stated otherwise in the user documentation.
- **Spillage Hazard**. Avoid spillage of fluids on the surfaces of the instrument which have cables, plugs and other wirings. Be careful if there is spillage of fluids on the tray while trying to remove the tray from ÄKTA start.
- 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).

CAUTION

To avoid damage to person when performing maintenance on ÄKTA start, follow the instructions below.

- **Hazardous UV light**. Always switch off power to the instrument before replacing the **UV flow cell**.
- If hazardous chemicals are used for system or column cleaning, wash the system or columns with a neutral solution in the last phase or step before maintenance.

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.

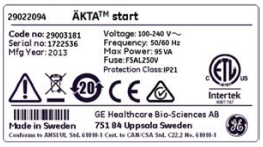
2.2 Labels

Introduction

This section describes the safety labels and labels concerning hazardous substances that are attached to ÄKTA start. The instrument serial number is also visible from the instrument product label which is illustrated here.

Labels on ÄKTA start

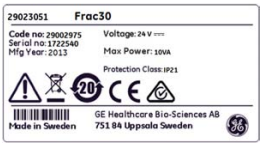
The illustrations below show the labels that are attached to ÄKTA start.

Label	Description	Placement
	Instrument label including safety symbols and specification.	
	Do not open any covers on the instrument. This will void the warranty.	
	**Keep the pump cover open when not using the system.** Open the pump cover after you switch off the instrument.	

Label	Description	Placement
	**This product does not comply with the ATEX directive and must not be used in explosive atmospheres.**	
	**Pinch hazard. Switch off the Pump before tubing loading.**	

Label on Frac30

The illustration below shows the labels that are attached to Frac30.

Label	Description	Placement
	Instrument label including safety symbols and specification.	
	Do not open any covers on the instrument. This will void the warranty.	

Safety symbols

The following safety symbols are used in the labels:

Label	Meaning
	Warning! Do not use ÄKTA start before reading the *ÄKTA start Operating Instructions*. Do not open any covers or replace parts unless specifically stated in the user documentation.
	The system complies with the requirements for electromagnetic compliance (EMC) in Australia and New Zealand.
	The system complies with applicable European directives.
	This symbol indicates that ÄKTA start has been certified by a Nationally Recognized Testing Laboratory (NRTL). NRTL means an organization that 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

The following symbols on the labels concern hazardous substances:

Label	Meaning
	This symbol indicates that 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 equipment.

Label	Meaning
	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 Electronic Information Products*.

2.3 Emergency procedures

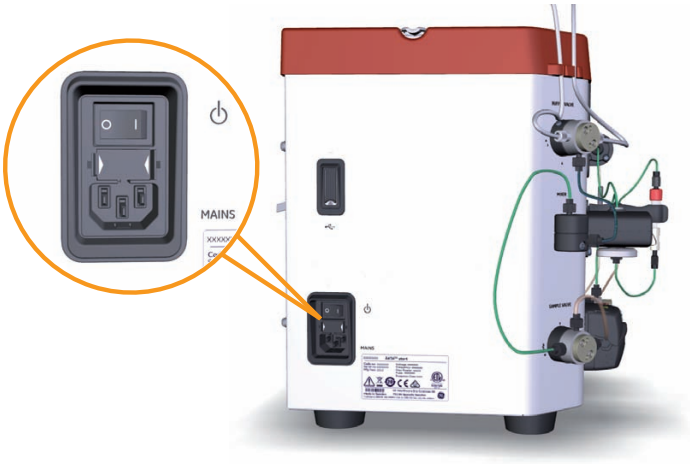
Introduction

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

Emergency shutdown

In an emergency situation:

Switch off power to the instrument by pressing the power switch to the **O** position or by disconnecting the power cord from the instrument. The run is interrupted immediately.



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.

Power failure

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

Power failure to...	will result in...
ÄKTA start 	• The run is interrupted immediately. • The data collected up to the time of the power failure is available on the USB memory stick *or*, if the system is connected to a computer, UNICORN start.
UNICORN start on a computer 	• The computer with UNICORN start installed shuts down. • On the ÄKTA start Instrument Display, all four touch buttons will be highlighted. • The run is interrupted immediately. • Data generated up to 10 seconds before the power failure can be recovered. ***Note:*** *The UNICORN start client may close down during a temporary overload of the processor. This may appear as a computer failure. The run continues and you can restart the UNICORN start client to regain control.*

2.4 Recycling procedures

Introduction

This section describes the procedures for disposal and recycling of ÄKTA start.

Decommissioning of the equipment

ÄKTA start must be decontaminated before decommissioning. Follow local regulations for scrapping of the equipment.

Disposal, general instructions

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

Recycling of hazardous substances

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

Disposal of electrical components

Waste comprising 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 equipment.

2.5 Declaration of Hazardous Substances (DoHS)

Introduction

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

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

Symbols used in pollution control label

电子信息产品污染控制标志说明

Label	Meaning
	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.

Label	Meaning
	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

List of hazardous substances and their concentrations

产品中有毒有害物质或元素的名称及含量

Indication for each major part if substance exceeds limit

Value	Meaning
O	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. 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	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 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

List of hazardous substances

Component name 部件名称	Hazardous substance 有毒有害物质或元素					
	Pb 铅	Hg 汞	Cd 镉	Cr6+ 六价铬	PBB 多溴联苯	PBDE 多溴二苯醚
ÄKTA start, 29-0220-94 [1]	X	0	0	0	0	0
Frac30, 29-0230-51 [1]	X	0	0	0	0	0
UNICORN start, 29-0187-51 [1]	0	0	0	0	0	0

1 The product has not been tested as per the Chinese standard *SJ/T11363-2006 Requirements for Concentration Limits for Certain Hazardous Substances in Electronic Information Product*.

3 System description

About this chapter

This chapter provides an overview of ÄKTA start, and the optional Frac30 (Fraction collector). For details about the Instrument Display, refer to *ÄKTA start Operating Instructions*.

In this chapter

This chapter contains the following section:

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3.1 System overview

Introduction

ÄKTA start is the main instrument included in a liquid chromatography system intended primarily for preparative purification of proteins at laboratory-scale. The system can be used for a variety of research purposes to fulfill the needs of the users in the academia and in life sciences industry.

ÄKTA start is operated and controlled from the Instrument Display. In addition, the UNICORN start software can be used to control ÄKTA start and to analyze the data acquired during chromatography runs. UNICORN start offers several additional features that are described in detail in *UNICORN start 1.0 User Manual*.

This section gives an overview of the ÄKTA start System.

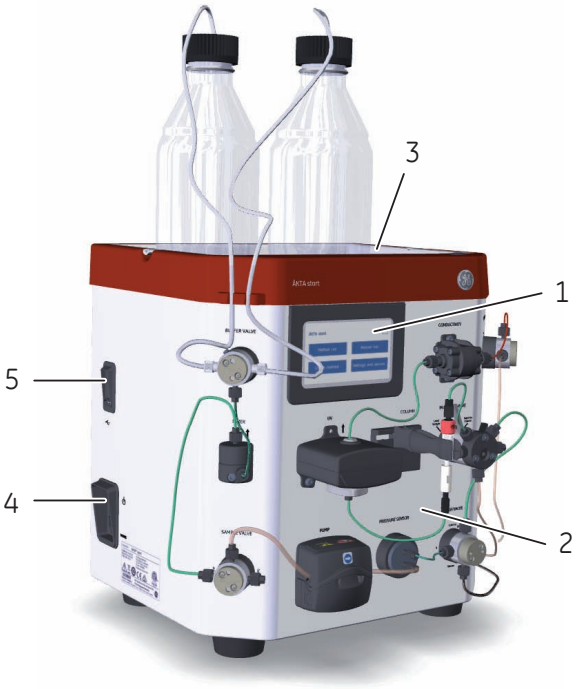
Illustration of the system

The illustration below shows the ÄKTA start System with UNICORN start installed on a computer.

Part	Description
1	ÄKTA start (instrument).
2	Frac30 (Fraction collector).
3	UNICORN start (software installed on a computer).

Illustration of the instrument

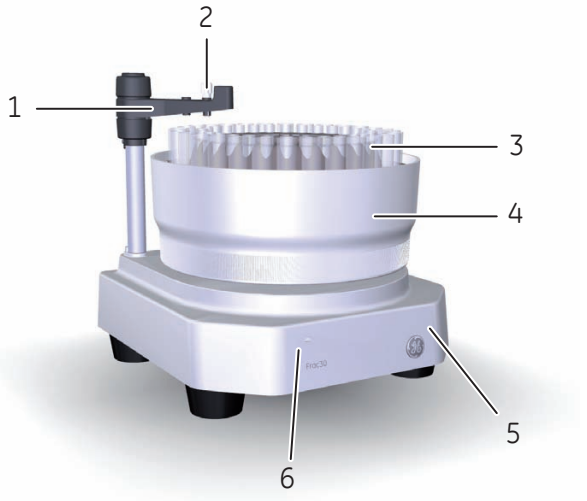
The illustration below shows the main parts of the instrument.



Part	Description	Function
1	Instrument Display	User interface for controlling the system and visualization of the runtime data.
2	Wet side	The modules interconnected by tubing have the following functions: • to deliver the liquid in a specified flow path and divert the flow as required, • to monitor the UV absorbance and conductivity of the liquid.
3	Buffer tray	Location intended for the placement of buffer bottles used during chromatography runs.
4	Power switch	Connects or disconnects the power.
5	USB port	To connect a USB memory stick for storage of results and transfer of files.

Illustration of the Fraction collector

The illustration below shows the Fraction collector; Frac30.



Part	Description	Function
1	Dispenser arm assembly	Holds and positions the tubing holder for dispensing the liquid into fractions.
2	Tubing holder	Holds the tubing used for dispensing the liquid fractions into the collection tubes.
3	Collection tubes	10 to 18 mm diameter tubes used to collect the fractions.
4	Bowl assembly	Holder for collection tubes, which supports tubes of four sizes.
5	Base unit	Case for electromechanical assembly and holder for the Bowl assembly.
6	LED	Power on indicator.

Main features of ÄKTA start

The main features of ÄKTA start are listed below:

- ÄKTA start is a compact and one step purification solution for quick and reliable purification of proteins.
- A simple and modern system offered to automate the protein purification workflow by providing features like automated sample injection, fraction collection, real-time monitoring.
- Method templates are available for all common chromatography techniques such as Affinity Chromatography, Ion Exchange Chromatography, Gel filtration, and Desalting.
- Quick start methods are available for purifying several common proteins.
- Predefined system methods are available for cleaning the flow path.
- ÄKTA start is operated using a touch screen on the instrument.
- In addition, the system can be operated from a computer connected to the instrument using the UNICORN start software.
- ÄKTA start is offered with a dedicated Fraction collector, Frac30, allowing to collect the fractions in four different tube sizes.

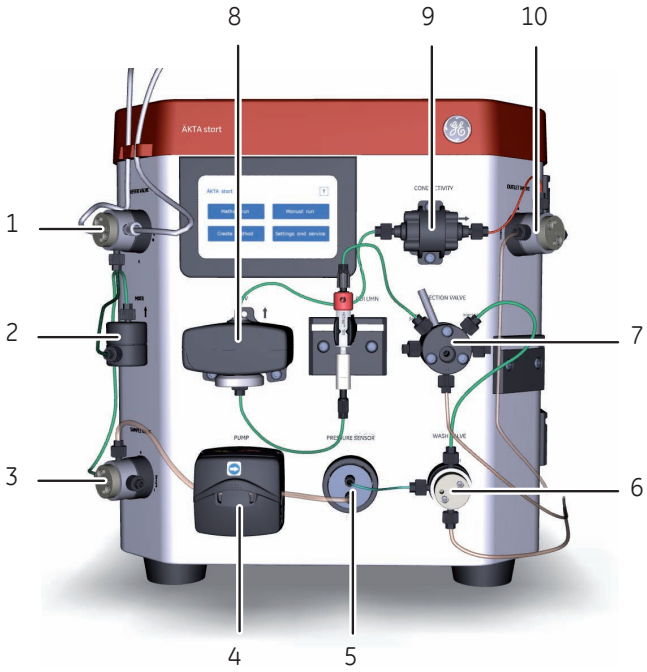
3.2 Instrument

Introduction

This section provides an overview of ÄKTA start.

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	Description
1	**Buffer valve**	A 3-port valve that is used as a switching valve for gradient formation. It enables the use of two buffers, which are required for forming a gradient during runs.

Part	Function	Description
2	**Mixer**	A static mixer that is used for mixing of buffers A and B.
3	**Sample valve**	A 3-port valve that allows either the buffer or the sample to enter the flow path. The **Sample valve** enables direct application of the sample onto the column using the **Pump**.
4	**Pump**	A peristaltic pump, which delivers buffer or sample to the flow path with a flow rate of up to 5 ml/min. For cleaning procedures, the **Pump** can flush the flow path at a flow rate of 10 ml/min.
5	**Pressure sensor**	The **Pressure sensor** reads the pressure in the flow path and senses overpressure.
6	**Wash valve**	A 3-port valve that is used to divert the flow path to waste. The **Wash valve** switches automatically during the predefined cleaning procedure, ***Pump wash***. In a manual run, the valve can be set to the intended position by configuring the run parameters.
7	**Injection valve**	A 6-port manually operated valve that is used to transfer the sample loaded in the sample loop on to the column. A sample loop is connected to the appropriate ports of the valve. The valve is switched manually to positions: • ***Load sample*** (default): to allow the loading of the sample into the sample loop. • ***Inject to column***: to transfer the sample from the loop on to the column during a chromatography run.
8	**UV**	The **UV** Monitor continuously measures the absorbance of the liquid in the **UV flow cell** at a set wavelength of 280 nm. The **UV flow cell** has a path length of 2 mm.

Part	Function	Description
9	**Conductivity**	The **Conductivity** Monitor continuously reads the conductivity of the liquid in the **Conductivity flow cell**. The conductivity is automatically calculated by multiplying the measured conductance by the cell constant of the flow cell. The cell constant is factory-calibrated. The **Conductivity flow cell** is provided with a temperature sensor that measures the temperature of the liquid in the **Conductivity flow cell**. ***Note:*** *The buffers used should be within the conductivity range of the instrument (0 to 300 mS/cm).*
10	**Outlet valve**	A 3-port valve that is used to direct the flow to the Fraction collector, or to Waste.

4 Unpack ÄKTA start and Frac30

About this chapter

This chapter provides the necessary instructions to unpack ÄKTA start. Read the entire *Installation* chapter in *ÄKTA start Operating Instructions*, before starting to install ÄKTA start.

In this chapter

This chapter contains the following sections:

Section	See page
4.1 Unpack ÄKTA start	43
4.2 Unpack Frac30	48
4.3 Accessories package	54

Introduction

This chapter describes how to unpack ÄKTA start and Frac30.

Note: *Save all the original packing material. If the system has to be repacked, for transportation or otherwise, it is important that the system can be safely packed using the original packing material.*

4.1 Unpack ÄKTA start

Instruction

Follow the instructions below to unpack the instrument.

CAUTION

Take care not to damage any module or the capillary tubing when lifting the instrument or when removing the plastic bag.

CAUTION

ÄKTA start is filled with denaturated alcohol (50% C2H5OH (ethanol)) at delivery. **The denatured alcohol mixture can be hazardous to humans if consumed.** Flush out the denaturated alcohol before assembling, testing or integrating ÄKTA start into the intended process context.

Note: *ÄKTA start with packaging weighs about 12 kg. No lifting equipment required,* ***one*** *person can lift and move the instrument.*

Step	Action
1	Open the delivery box by cutting the adhesive tape at the top of the box.

Step	Action
2	Take out the document placed at the top of the package and read the *Unpacking Instructions*. ***Note:*** *Save the documents for future reference.* 
3	Take out the box placed at the top of the package. The box contains the accessories delivered with the instrument. 

Step	Action
4	Hold the red strap, and then lift the instrument out of the delivery box.

5	Open the strap lock and remove the strap.

Step	Action
6	Remove the foam cushion from the top of the instrument.

7	Remove the foam cushion from the bottom of the instrument by carefully lifting the instrument.

Step	Action
8	Remove the plastic bag by gently tilting the system back and forth while pulling out the plastic bag.

4.2 Unpack Frac30

Instruction

Follow the instructions below to unpack the Fraction collector.

CAUTION

Take care not to damage the Dispenser arm when lifting Frac30 or when removing the plastic bag.

NOTICE

Never lift the Fraction collector Frac30 by the Dispenser arm. This may damage the fraction collector.

Note: *Frac30 with packaging weighs about 6 kg. No lifting equipment required,* ***one*** *person can lift and move the Fraction collector.*

Step	Action
1	Open the Frac30 delivery box by cutting the adhesive tape at the top of the box.

2	Take out the document placed at the top of the package and read the *Unpacking Instructions*.

Step	Action
3	Holding the red strap, lift the fraction collector out of the delivery box. Place the Fraction collector on the laboratory bench.

4	Open the strap lock and remove the strap.

Step	Action
5	Remove the foam cushion from the top of the Fraction collector.

6	Remove the foam cushion from the bottom of the fraction collector by carefully lifting the Fraction collector.

Step	Action
7	Remove the plastic bag.

8 Remove the Bowl assembly from the Base unit:

- Gently move the Dispenser arm counterclockwise to the end position.
- Push the Drive assembly and hold it at the retracted position. At the same time, lift the Bowl assembly.

Step	Action
9	Remove the foam cushion located on the Base unit.

10	Re-assemble the Bowl assembly on to the Base unit: • Orient the Bowl to match the aligning groove and the aligning features located on the bowl holder. • Slightly push the Drive assembly laterally and lower the Bowl assembly onto the Base unit.

NOTICE

Never use the Dispenser arm assembly to lift or hold Frac30. To lift the module, use the handle provided on the bottom plate.

Note: *Do not damage or break the warranty seal label during unpacking of Frac30.*

4.3 Accessories package

Illustration of the accessories package

The illustration below shows the accessories box and the user documentation included with ÄKTA start at delivery.

ÄKTA start

Part	Description
1	*Unpacking Instructions*
2	*System certificate*
3	*Product documentation*
4	*Maintenance Cue Card*
5	*System Cue Card*
6	CD containing user documentation files and an unpacking video. The CD includes *Operating Instructions* and *Maintenance Manual* in English and translated versions.
7	Accessories box

5 Service and settings

About this chapter

Regular maintenance of ÄKTA start is required to ensure safe operation and optimal performance. This chapter provides instructions for periodic maintenance, including calibration and configuration, as well as other required maintenance.

In this chapter

This chapter contains the following sections:

Section	See page
5.1 Preventive maintenance	56
5.2 Clean before planned maintenance or service	58
5.3 Access the modules	59
5.4 UV Monitor	62
5.5 Pump	74
5.6 Buffer valve	82
5.7 Sample valve	85
5.8 Wash valve	88
5.9 Outlet valve	91
5.10 Conductivity Monitor	94
5.11 Pressure sensor	101
5.12 Frac30	103
5.13 Instrument Display	109
5.14 System	118
5.15 Main board	127

5.1 Preventive maintenance

Introduction

Preventive maintenance should be performed on a daily, weekly and monthly basis. For cleaning instructions, refer to *ÄKTA start Operating Instructions*.

Preventive maintenance schedule

Interval	Maintenance action
Daily	Visually inspect the instrument for leakages in the flow path. Check the **Pump** for leakage. If there are signs of liquid leaking from the **Pump**, check the integrity of the pump tubing and the tubing connections.
Daily	Clean the column and the system flow path after use and leave the system filled with demineralized water. ***Note:*** *If the instrument is not going to be used for a few days, prepare the system for storage.*
Weekly, or when required	Visually inspect the inlet filters and clean them if necessary. (Cleaning procedure: immerse and leave the inlet filters in 1 M NaOH for about 2 hours).
Weekly, or when required	Clean the system flow path with 0.5 to 1 M NaOH and rinse with demineralized water. ***Note:*** • *Do not leave the **UV flow cell** in NaOH for more than 20 minutes.* • *Cleaning may be necessary more or less frequently, depending on the system usage and the nature of the samples.*
When required	Clean the instrument externally. (Cleaning procedure: wipe the surface with a damp cloth. Wipe off stains using a mild cleaning agent or 20% ethanol.)

Interval	Maintenance action
When required	Clean the Fraction collector. ***Note:*** *Frac30 is not a spill free design. There will be some spillage when tubes shift position, depending on the flow rate.*
Yearly, or when requried	Visually inspect the drive sleeve on the Fraction collector. Replace if worn out.
When required	• Perform ***System cleaning***, ***Pump wash A*** and ***B***, ***Washout fractionation tubing***. • Clean the **UV flow cell**. • Clean the **Conductivity flow cell**.
Weekly, or when required	Calibrate the **Pump**.
When required	Calibrate the **UV flow cell**.
When required	Calibrate the **Conductivity flow cell**.
When required	Perform ***Zero offset*** calibration for the **Pressure sensor**.
When required	Replace the inlet filters.
When required	Replace the tubing and connectors.

5.2 Clean before planned maintenance or service

On site service and product return

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.

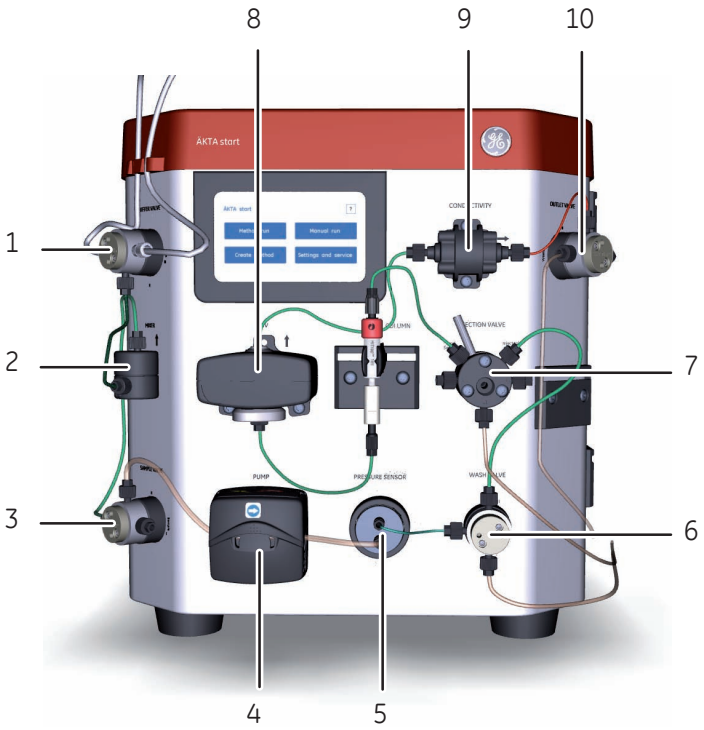
Where it is stated that planned maintenance and/or service of ÄKTA start must be performed by GE service personnel, a *Health & Safety Declaration Form* must be completed before this is started.

Please complete the checklist in the *On Site Service Health & Safety Declaration Form* or the *Health & Safety Declaration Form for Product Return or Servicing*, depending on whether the instrument is going to be serviced on site or returned to GE for service, respectively. Copy the form you need from *Section 8.1 Health and Safety Declaration Form, on page 204* or print it from the PDF file available on the User Documentation CD.

5.3 Access the modules

Illustration of the modules

The illustration below shows the locations of the modules placed on the wet side of the instrument.



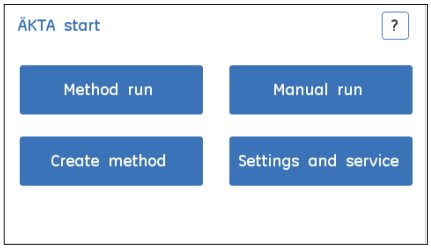
Part	Module	Service & settings instructions
1	**Buffer valve**	*Instructions, on page 82*
2	**Mixer**	-
3	**Sample valve**	*Instructions, on page 85*
4	**Pump**	*Section 5.5 Pump, on page 74*
5	**Pressure sensor**	*Instructions, on page 101*
6	**Wash valve**	*Instructions, on page 88*
7	**Injection valve**	-

Part	Module	Service & settings instructions
8	**UV**	*Section 5.4 UV Monitor, on page 62*
9	**Conductivity**	*Instructions, on page 95* *Instructions, on page 97* *Instructions, on page 98*
10	**Outlet valve**	*Instructions, on page 91*

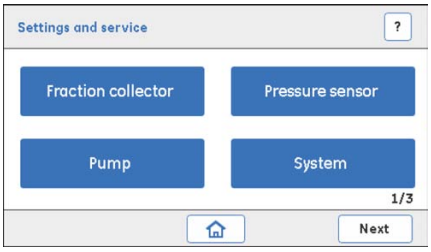
Instructions

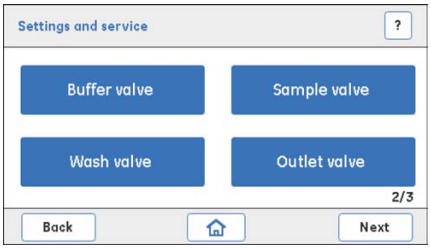
Maintenance and service of the different modules are operated from the Instrument Display. For instructions about maintenance of a module, see the specific sections in this chapter.

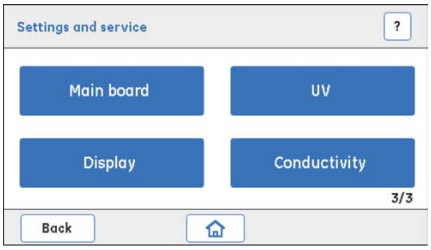
Step	Action
1	Tap ***Settings and service*** to access different modules for parameter setting or maintenance.



Step	Action
2	Tap ***Next*** or ***Back*** to move through the screens 1 to 3. Tap the intended module button to select a specific module for maintenance.







5.4 UV Monitor

Introduction

This section describes how to access the **UV** Monitor options, perform calibrations and edit **UV** settings.

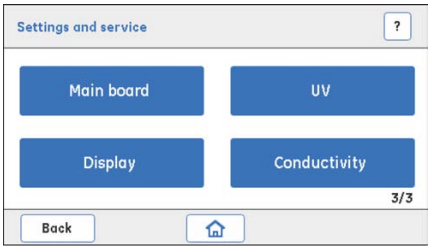
In this section

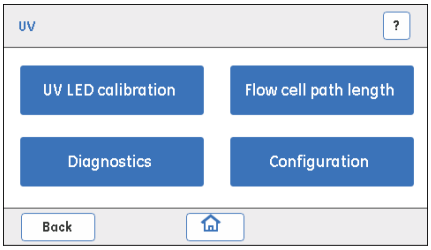
This section contains the following subsections:

Section	See page
5.4.1 UV LED calibration	64
5.4.2 Diagnostics	66
5.4.3 Flow cell path length	69
5.4.4 Reset number of run hours	72

Access the UV Monitor options

Follow the instructions below to access the options for calibrating and troubleshooting the **UV** Monitor.

Step	Action
1	In the ***Settings and service*** screen, tap ***Next:Next*** to access the 3rd screen. *Result*: The following screen opens. 

Step	Action
2	Tap ***UV*** to access the **UV** Monitor options. *Result*: The ***UV*** screen opens. 

5.4.1 UV LED calibration

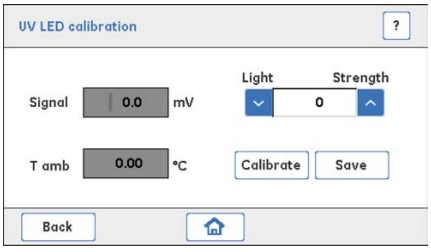
Description

UV LED calibration is used for calibrating the **UV LED** intensity to get the desired response level of the photo detector.

Parameter	Description
Light	Light intensity needed to get the expected response at the photo detector.
T amb	**UV** temperature sensor reading.
Signal	The output of the photo detector at any time (mV).

Instructions

Follow the instructions below to calibrate the UV LED.

Step	Action
1	Make sure that: • The **UV flow cell** is assembled tightly. • The inlet and outlet tubing and the fingertight connectors are properly tightened to block any stray light from entering the **UV flow cell**. • The system is not exposed to direct sunlight.
2	Flush the **UV flow cell** with demineralized water using the **Pump**. Make sure that there are no air bubbles in the **UV flow cell**.
3	Tap ***UV LED calibration***. *Result*: The following screen opens. 

Step	Action
4	Set the ***Light*** strength value to 500 using up/down arrows or enter the value. Tap ***Calibrate***. *Result*: A confirmation screen opens. 
5	Tap ***OK*** to automatically adjust the ***Light*** strength value to get a minimum ***Signal*** response of 2500 mV. • If the ***Signal*** value is *above* 2500 mV, tap ***Save.*** • If the ***Signal*** value is *below* 2500 mV use the arrows to increase the ***Light*** strength until the ***Signal*** is above 2500 mV.
6	Tap ***Save***. *Result*: The calibrated ***Light*** strength value is saved and stored in the permanent memory on main board.

5.4.2 Diagnostics

Description

Diagnostics is used to conduct a ***Dark current test*** and/or a ***Stray light test*** to assess any electrical noise or presence of stray light.

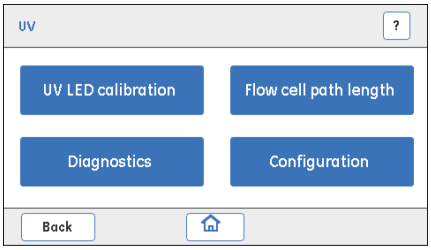
Test	Description
Dark current test	• Switches off the **UV LED** during the test. • The test result is presented as ***Pass*** if the ***Signal*** response has a value of max 50 mV.
Stray light test	• Checks the absorbance when the **UV flow cell** is filled with 15% acetone. • Absorbance ***(Abs)*** should have a value > 2000 mAU.

Check for electrical noise

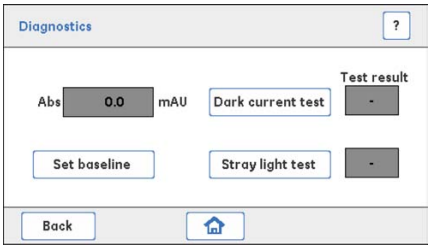
Follow the instructions below to perform a ***Dark current test***.

Step	Action
1	Make sure that: • The **UV flow cell** is assembled tightly. • The inlet and the outlet tubing, and connectors are tightened to block any stray light from entering. • The system is not exposed to direct sunlight.
2	Flush and fill the **UV flow cell** with demineralized water using a syringe. Make sure that there are no air bubbles in the syringe.

Step	Action
3	Tap ***Diagnostics***.



Result: The ***Diagnostics*** screen opens.



4	Tap ***Set baseline*** to capture a new reference value for the test.
5	Tap ***Dark current test***. The result is displayed as ***Pass*** or ***Fail***: • ***Pass***: the **UV** Monitor is working as it should. • ***Fail***: replace the **UV** Monitor.

Check for presence of stray light

Follow the instructions below to perform a ***Stray light test***.

Step	Action
1	Flush and fill the **UV flow cell** with 15% acetone using a syringe. Make sure that there are no air bubbles in the syringe.

Step	Action
2	Tap ***Stray light test***. The result is displayed as ***Pass*** or ***Fail***: • ***Pass***: the **UV** Monitor is working as it should. • ***Fail***: clean, reassemble and secure the **UV flow cell** and the connected tubing. Make sure that the detector is not exposed to e.g., direct sunlight. If the test fails again, replace the flow cell and then possibly the **UV** Monitor, or contact a GE Service Engineer.
3	Flush the system with demineralized water so that the ***Abs*** value returns close to zero.

5.4.3 Flow cell path length

Description

A ***Flow cell path length*** test is used to derive the actual path length of the **UV flow cell**. The test should be performed when the **UV** Monitor or the **UV flow cell** has been replaced, and when normalized UV absorption comparisons between different systems are needed.

Parameter description

Parameter	Description
Cell	Path length of the **UV flow cell** (mm).
Abs	The absorbance of the liquid in the **UV flow cell** (mAU).
C amb	Ambient temperature compensation constant.
C drft	UV LED drift compensation constant.

NOTICE

UV Configuration of ***C amb*** and ***C drft*** values must be performed by a GE Service Engineer. The ***C amb*** and ***C drft*** values should not be altered by a user.

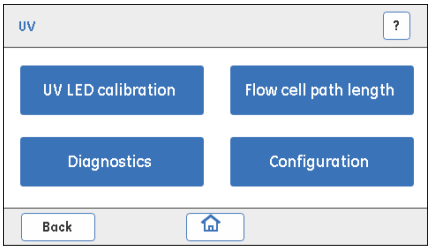
Prerequisites

- Buffer A: immerse Buffer A inlet into demineralized water.
- Buffer B: freshly prepared 1.0% acetone solution (vol/vol), which is expected to give an absorbance value of 340 mAU.

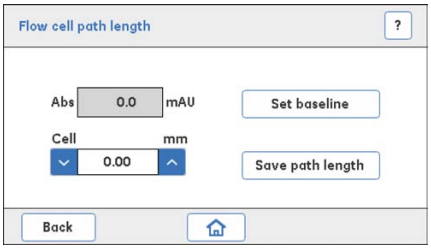
Instructions

Follow the instructions below to perform a ***Flow cell path length*** test and set a new cell length.

Step	Action
1	Flush the **UV flow cell** with demineralized water using the **Pump**, and then leave the **UV flow cell** filled with water.
2	Tap ***Flow cell path length***.



Result: The following screen opens.



3	Set the ***Cell*** value to ***2.00 mm*** by using the up/down arrows or enter the value in the text box.
4	Flush the **UV flow cell** thoroughly and leave it filled with demineralized water. Tap ***Set baseline*** to capture a new reference value for the test. *Result*: ***Abs*** should show a value close to **0** mAU.
5	Flush the **UV flow cell** with 1.0% acetone solution, and then leave it filled. Note the new ***Abs*** value.
6	Calculate the actual ***Flow cell path length*** by using the following formula: ***Cell*** (mm) = 2.00 * (new ***Abs*** value / 340)

Step	Action
7	Update the calculated ***Cell*** length value by using up/down buttons or enter the value. Tap ***Save path length*** to save the value to permanent memory. ***Note:*** *The **Abs** value should be 340 ± 5% mAU, confirming that normalization has been done.* ***Note:*** *For higher precision, instead of using acetone, use the Fe2(SO4)3 kit, product number: 18-1129-63.*

5.4.4 Reset number of run hours

Instructions

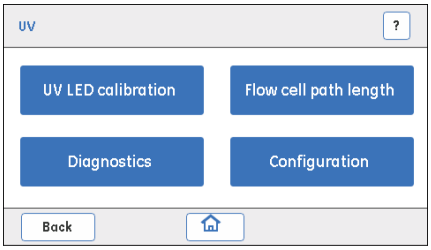
Follow the instructions below to reset the number of run hours of **UV** Monitor.

NOTICE

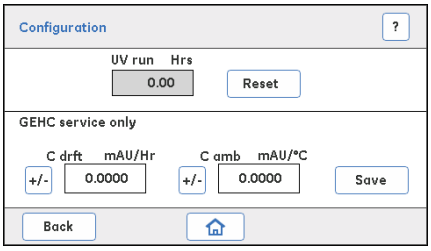
UV Configuration of ***C amb*** and ***C drft*** values must be performed by a GE Service Engineer. The ***C amb*** and ***C drft*** values should not be altered by a user.

Note: *After replacing the **UV** Monitor, it is required to reset the number of run hours of **UV** Monitor.*

Step	Action
1	Tap ***Configuration***.



Result: The ***Configuration*** screen opens.



Step	Action
2	Tap ***Reset***. *Result*: A confirmation screen opens 
3	If the **UV** Monitor has been replaced, tap ***Yes***. Or, If the **UV** Monitor has not been replaced, tap ***No*** to cancel the action.

5.5 Pump

Introduction

This section describes how to perform pump diagnostics, calibrations and handle the pump tubing log.

In this section

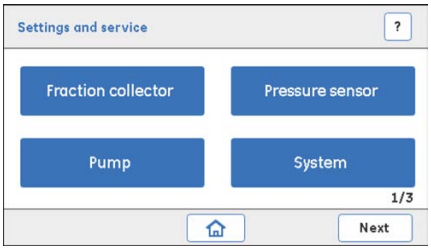
This section contains the following sub-sections:

Section	See page
5.5.1 Diagnostics	76
5.5.2 Calibration	78
5.5.3 Pump tubing log	80

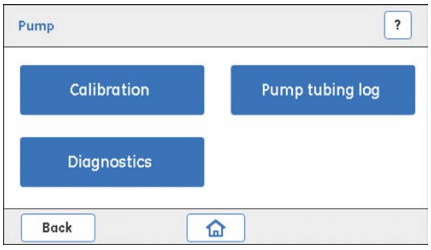
Access the Pump service options

Follow the instruction below to access the options for Pump calibration and troubleshooting.

Step	Action
1	In the ***Settings and service*** screen, tap ***Pump***.



Result: The ***Pump*** screen opens.

Step	Action
2	Tap to select the intended option. 

5.5.1 Diagnostics

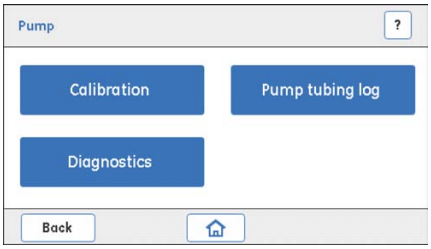
Parameter description

Parameter	Description
Flow rate	Setting of the desired flow rate (ml/min).
Pump run	Displays the actual number of run hours for the **Pump**.

Check the Pump flow rate

Follow the instructions below to perform **Pump** diagnostics.

Step	Action
1	Immerse the buffer inlet tubing **A** in demineralized water.
2	In the ***Pump*** screen, tap ***Diagnostics***.



Result: The ***Diagnostics*** screen opens.

3	Use the up/down arrows to set the desired ***Flow Rate*** value in the range 0.5 to 5 ml/min

Step	Action
4	• Prime the **Pump** and the flow path. Tap ***Start flow*** to run the **Pump**. • Place the outlet tubing from the **Wash valve** (**Waste** port) in a pre-weighed collection tube. ***Note:*** *Before starting Diagnostics, prime the flow path with water and make sure that the outlet tubing where the pumped water is collected, is filled with demineralized water. This ensures that the volume of the collected water corresponds to the pumped volume.*
5	Collect at least 1 ml of water in the collection tube. Measure and note the collection time.
6	• Tap ***Stop flow*** to turn the **Pump** *OFF*. • Note the volume of the collected water (weigh the pre-weighed collection tube containing the collected water and estimate the volume of the pumped water). • Calculate the flow rate and verify that it corresponds to the set flow rate. ***Note:*** *If the collected water does not correspond to the required volume (i.e., the **Pump** does not deliver water with the intended flow rate), inspect the condition of the pump tubing, then re-calibrate the **Pump** and re-diagnose.* If the collected water does not correspond to the required volume replace the Pump tubing. After replacing the pump tubing, calibrate and diagnose the **Pump** again. If the collected water does not correspond to the required volume replace the **Pump**.
7	If the **Pump** is replaced with a new one, tap ***Reset*** to reset ***Pump run*** to 0 hours.

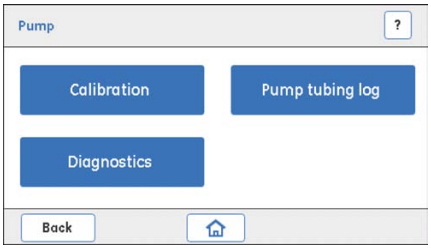
5.5.2 Calibration

Parameter description

Parameter	Description
Flow Rate	The intended flow rate used for **Pump** calibration.
Collected Volume	The volume of liquid collected for a certain period of time at the set flow rate. The ***Collected Volume*** value and the expected value of the volume corresponding to the set flow rate are used internally for calibration.

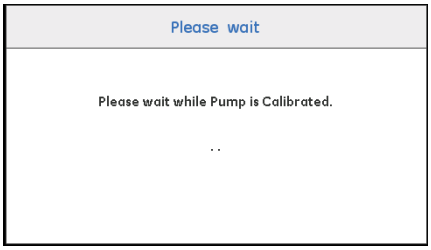
Instructions

Follow the instructions below to calibrate the **Pump**.

Step	Action
1	• Immerse the buffer inlet tubing **A** in demineralized water. • Place the outlet tubing from the **Wash valve** in a pre-weighed collection tube. ***Note:*** *Before starting the calibration, prime the flow path with water and make sure that the outlet tubing where the pumped water is collected is filled with demineralized water. This ensures that the volume of the collected water corresponds to the pumped volume.*
2	In the ***Pump*** screen, tap ***Calibration***.  *Result*: The ***Calibration*** screen opens.

Step	Action
3	Use the up/down arrows to set the desired ***Flow Rate***.

4	• Tap ***Start flow*** to start the **Pump**. • Collect water for at least one minute in the pre-weighed collection tube. • Tap ***Stop flow*** to turn the **Pump** OFF. • Note the volume of the collected water (weigh the pre-weighed collection tube containing the collected water and calculate the volume of the pumped water) and then set the ***Collected Volume*** value equal to this volume.
5	Tap ***Calibrate***. *Result*: The following screen opens.



6	Wait while the calibration is running. The calibration is done when the ***Calibration*** screen re-opens.

5.5.3 Pump tubing log

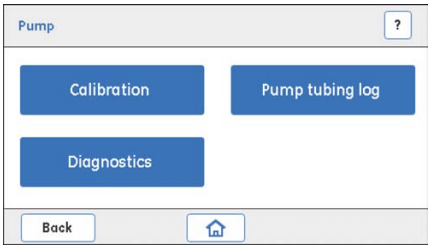
Parameter description

Parameter	Description
Tubing run	• Indicates how many hours the pump tubing has been used. • When the pump tubing is replaced, use the ***Reset*** button to reset the number of hours to 0.

Instructions

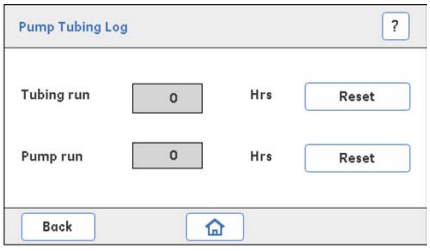
Follow the instructions below to check the Pump tubing log and to reset the number of hours the pump tubing has been used.

Step	Action
1	Tap ***Pump tubing log***.



Result: The ***Pump tubing log*** screen opens.

2	In the ***Pump tubing log*** screen, tap ***Reset***.



Result: A confirmation screen opens.

Step	Action
3	Tap ***Yes*** if the pump tubing has been replaced. Or, If the pump tubing has not been replaced, tap ***No*** to cancel the action. 

5.6 Buffer valve

Description

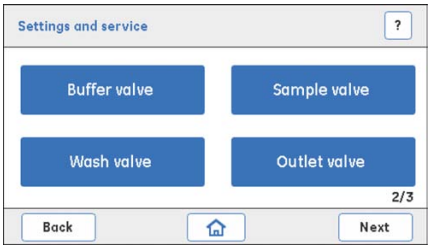
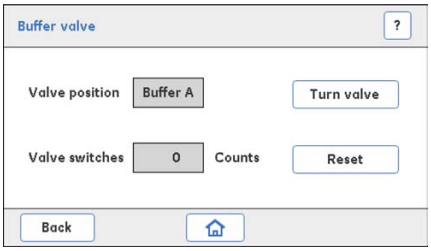
The **Buffer valve** can be switched to allow the inlet of either buffer A or buffer B, or a mixture of A and B (gradient).

Parameter	Description
Valve switches	• Indicates how many times the valve has switched between buffer A or buffer B. • When a valve has been replaced, the number of counts has to be reset to 0. • ***Turn valve*** switches the valve between its two positions, for example the ***A*** and ***B*** inlet ports. This option is used for troubleshooting the valve.

Instructions

Follow the instructions below to check if the **Buffer valve** functions properly.

Step	Action
1	• Immerse the buffer inlet tubing A and B in demineralized water. • Place the outlet tubing from the **Wash valve** in the waste bottle.
2	Start the **Pump**: • In the ***Settings and service*** screen, access ***Pump***:***Diagnostics*** screen. • Enter the desired flow rate and then start the **Pump** by tapping ***Start flow***, and then tap ***Back***:***Back*** to return to the ***Settings and service*** screen.

Step	Action
3	In the ***Settings and service*** screen, tap ***Next*** to access the 2nd screen. *Result*: The following screen opens.  In the ***Settings and service*** screen, tap ***Buffer valve***. *Result*: The ***Buffer valve*** screen opens. 
4	• Check that the valve position ***Buffer A*** is selected. • Tap ***Turn valve*** to check that the **Buffer valve** switches between ***Buffer A*** and ***Buffer B*** on the Display. There is also a click sound when the valve switches. • Check that the flow is delivered from the ***Buffer A*** inlet or the ***Buffer B*** inlet, according to the selected valve position. ***Note:*** *The **Buffer valve** is by default in the **Buffer A** position (the liquid is delivered from the **Buffer A** inlet).*
5	Visually inspect the flow at the outlet. If the water is not flowing properly, check the following and fix accordingly: • Is there a blockage in the tubing? • Are the connectors tightly connected?
6	Stop the **Pump**: • In the ***Settings and service*** screen, access ***Pump*:*Diagnostics*** screen. • Stop the **Pump** by tapping ***Stop flow***.

Step	Action
7	If these checks indicate that the valve is faulty, replace the **Buffer valve**.
8	If the valve has been replaced, tap ***Reset*** to set the ***Valve switches*** counter to 0. *Result*: A confirmation screen opens.  Tap ***Yes*** to confirm the reset if the valve has been replaced. Or, If the valve has not been replaced, tap ***No*** to cancel the action.

5.7 Sample valve

Description

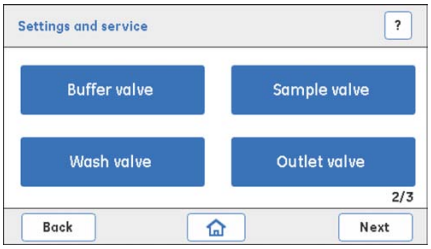
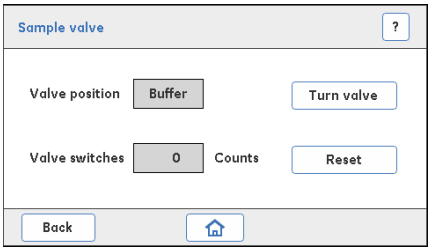
The **Sample valve** can be switched to allow the inlet of either buffer or sample.

Parameter	Description
Valve switches	• Indicates how many times the valve has switched. • When an old valve is defective and replaced, the number of counts (Valve switches) has to be reset to 0. • ***Turn valve*** switches the valve between its two positions, for example the ***Buffer*** and ***Sample*** inlet ports. This option is used for troubleshooting the valve.

Instructions

Follow the instructions below to check if the **Sample valve** functions properly.

Step	Action
1	• Immerse the buffer inlet tubing A and the sample inlet tubing in demineralized water. • Place the outlet tubing from the **Wash valve** in the waste bottle. • Check that ***Buffer A*** is selected in the ***Buffer valve*** screen.
2	Start the **Pump**: • In the ***Settings and service*** screen, access ***Pump***:***Diagnostics*** screen. • Enter the desired flow rate and then start the **Pump** by tapping ***Start flow***.

Step	Action
3	In the ***Settings and service*** screen, tap ***Next*** to access the 2nd screen. *Result*: The following screen opens. 
4	In the ***Settings and service*** screen, tap ***Sample valve***. *Result*: The ***Sample valve*** screen opens. 
5	• Check that the Valve position ***Buffer*** is selected. • Tap ***Turn valve*** to check that the **Sample valve** switches between ***Buffer*** and ***Sample*** on the Display. There is also a click sound when the valve switches. • Check that the flow is delivered from the Buffer inlet or the Sample inlet according to the selected valve position. ***Note:*** *The **Sample valve** is by default in the **Buffer** position (the liquid is delivered from the **Buffer** inlet).*
6	Visually inspect the flow at the outlet. If the water is not flowing properly, check the following and fix accordingly: • Is there a blockage in the tubing? • Are the connectors tightly connected?

Step	Action
7	Stop the **Pump**: • In the ***Settings and service*** screen, access ***Pump***:***Diagnostics*** screen. • Stop the **Pump** by tapping ***Stop flow***.
8	If these checks indicate that the valve is faulty, replace the **Sample valve**.
9	If the valve has been replaced, tap ***Reset*** to set the ***Valve switches*** counter to 0. *Result*: A confirmation screen opens.  Tap ***Yes*** to confirm the reset if the valve has been replaced. Or, If the valve has not been replaced, tap ***No*** to cancel the action.

5.8 Wash valve

Description

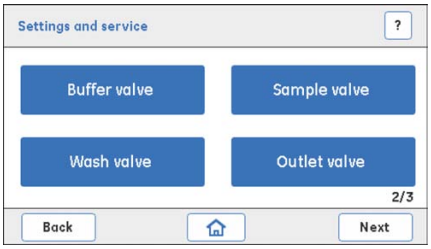
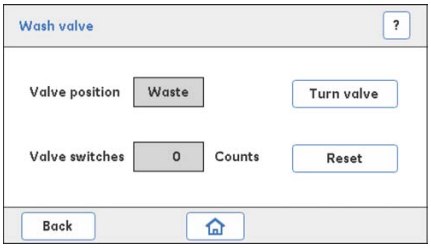
The **Wash valve** can be switched to divert the flow either to column or to waste.

Parameter	Description
Valve switches	• Indicates how many times the valve has switched. • When an old valve has been replaced, the number of counts has to be reset to 0. • ***Turn valve*** switches the valve between its two positions, for example the ***Waste*** and ***Column*** outlet ports. This option is used for troubleshooting the valve.

Instructions

Follow the instructions below to check if the **Wash valve** functions properly.

Step	Action
1	• Immerse the buffer inlet tubing A in demineralized water. • Place the outlet tubing from the **Wash valve** and the outlet tubing from the **Outlet valve** in the waste bottle. • Check that: - ***Buffer A*** is selected in the ***Buffer valve*** screen - ***Buffer*** is selected in the ***Sample valve*** screen
2	Start the **Pump**: • In the ***Settings and service*** screen, access ***Pump***:***Diagnostics*** screen. • Enter the desired flow rate and then start the **Pump** by tapping ***Start flow***.

Step	Action
3	In the ***Settings and service*** screen, tap ***Next*** to access the 2nd screen. *Result*: The following screen opens.  In the ***Settings and service*** screen, tap ***Wash valve***. *Result*: The ***Wash valve*** screen opens. 
4	• Check that the valve position ***Waste*** is selected. • Tap ***Turn valve*** to check/listen that the **Wash valve** switches between ***Waste*** and ***Column***. There is a click sound when the valve switches. • Check that the flow is diverted to the ***Waste*** outlet or the ***Column*** outlet according to the selected valve position. ***Note:*** *The **Wash valve** is by default in **Waste** position (the flow is diverted to waste).*
5	Visually inspect the flow at the outlet. If the water is not flowing properly, check the following and fix accordingly: • Is there a blockage in the tubing? • Are the connectors tightly connected?
6	Stop the **Pump**: • In the ***Settings and service*** screen, access ***Pump*:*Diagnostics*** screen. • Stop the **Pump** by tapping ***Stop flow***.
7	If these checks indicate that the valve is faulty, replace the **Wash valve**.

Step	Action
8	If the valve has been replaced, tap ***Reset*** to set the ***Valve switches*** counter to 0. *Result*: A confirmation screen opens.  Tap ***Yes*** to confirm the reset if the valve has been replaced. Or, If the valve has not been replaced, tap ***No*** to cancel the action.

5.9 Outlet valve

Description

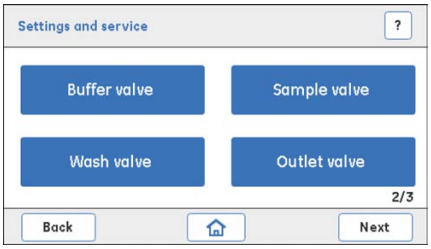
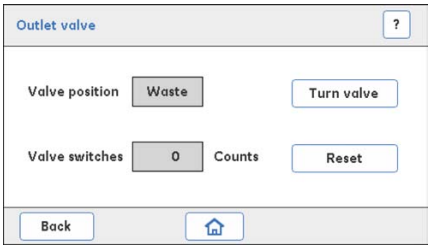
The **Outlet valve** can be switched to divert the flow, either to waste or to the Fraction collector.

Parameter	Description
Valve switches	• Indicates how many times the valve has switched. • When a valve has been replaced, the number of counts has to be reset to 0. • ***Turn valve*** switches the valve between its two positions, for example the ***Waste*** and ***Collection*** outlet ports. This option is used for troubleshooting the valve.

Instructions

Follow the instructions below to check if the **Outlet valve** functions properly.

Step	Action
1	• Immerse the buffer inlet tubing A in demineralized water. • Place the outlet tubing from the **Outlet valve** in the waste bottle. • Check that: - ***Buffer A*** is selected in the ***Buffer valve*** screen - ***Buffer*** is selected in the ***Sample valve*** screen - ***Column*** is selected in the ***Wash valve*** screen
2	Start the **Pump**: • In the ***Settings and service*** screen, access ***Pump***:***Diagnostics*** screen. • Enter the desired flow rate and then start the **Pump**, tap ***Start flow***.

Step	Action
3	In the ***Settings and service*** screen, tap ***Next*** to access the 2nd screen. *Result*: The following screen opens.  In the ***Settings and service*** screen, tap ***Outlet valve***. *Result*: The ***Outlet valve*** screen opens. 
4	• Check that the valve position ***Waste*** is selected. • Tap ***Turn valve*** to check that the **Outlet valve** switches between ***Waste*** and ***Collection***. There is also a click sound when the valve switches. • Check that the flow is diverted to the ***Waste*** outlet or the ***Fraction collector*** outlet according to the selected valve position. ***Note:*** *The **Wash valve** is by default in **Waste** valve position. Hence, the flow is diverted to Waste.*
5	Visually inspect the flow at the outlet. If the water is not flowing properly, check the following and fix accordingly: • Is there a blockage in the tubing? • Are the connectors tightly connected?
6	Stop the **Pump**: • In the ***Settings and service*** screen, access ***Pump*:*Diagnostics*** screen. • Stop the **Pump** by tapping ***Stop flow***.

Step	Action
7	If these checks indicate that the valve is faulty, replace the **Outlet valve**.
8	If the valve has been replaced, tap ***Reset*** to set the ***Valve switches*** counter to 0. *Result*: A confirmation screen opens.  Tap ***Yes*** to confirm the reset if the valve has been replaced. Or, If the valve has not been replaced, tap ***No*** to cancel the action.

5.10 Conductivity Monitor

Introduction

This section describes how to perform **Conductivity** Monitor calibrations and edit the Cell constant settings.

In this section

This section contains the following sub-sections:

Section	See page
5.10.1 Set the Cell constant value	95
5.10.2 Temperature sensor calibration	97
5.10.3 Conductivity flow cell calibration	98

Description

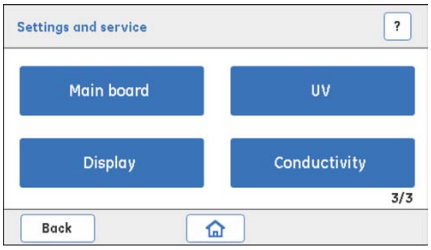
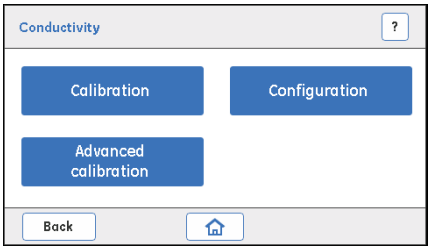
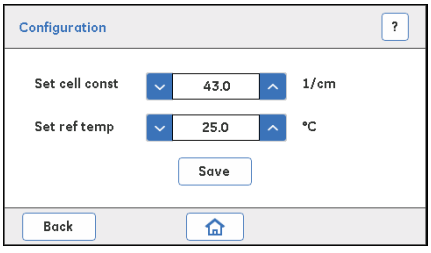
The **Conductivity** Monitor consists of a conductivity cell with two parallel cylindrical electrodes positioned in the flow path of the cell. One of the electrodes has a temperature sensor for measuring the temperature of the liquid in the cell.

Parameter	Description
Cell constant ***(Set cell const)***	The Cell constant is a characteristic of the conductivity cell, defined as the ratio of the distance between the electrodes and the area of an electrode.
Reference temperature (***Set ref temp***)	Ambient temperature variations influence the conductivity. In Handbooks and other documentation, the conductivity values are most often given at a certain Reference Temperature (20°C or 25°C). To compare with those values, the actual conductivity has to be re-calculated to conductivity at the reference temperature.

5.10.1 Set the Cell constant value

Instructions

If the flow cell has been replaced, a new cell constant value has to be set. Follow the instructions below to set the Cell constant value.

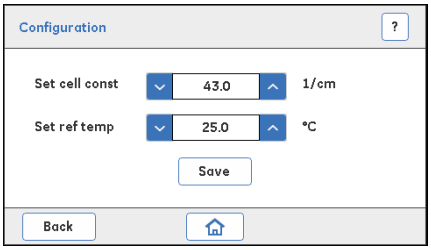
Step	Action
1	In the ***Settings and service*** screen, tap ***Next:Next*** to access the 3rd screen. *Result*: The following screen opens.  Tap ***Conductivity***. *Result*: The ***Conductivity*** screen opens. 
2	Tap ***Configuration***. *Result*: The ***Configuration*** screen opens. 

Step	Action
3	Set the Cell constant value (***Set cell const***) for the new **Conductivity** flow cell by using the up/down arrows. Tap ***Save*** to save the new value. ***Note:*** • *The Cell constant value is provided on the packaging of the* ***Conductivity flow cell****.* • *If a Cell constant value is not available, calibrate the* ***Conductivity flow cell*** *as explained in Section 5.10.2 Temperature sensor calibration, on page 97 and Section 5.10.3 Conductivity flow cell calibration, on page 98.*

Set the reference temperature

Note: *For the system to recalculate the measured conductivity to conductivity at a certain reference temperature, enter the temperature in the* ***Set ref temp*** *field.*

Note: *Make sure that the checkbox* ***Enable temperature compensation*** *in the* ***Conductivity:Calibration*** *screen is checked.*

Step	Action
1	In the ***Conductivity***:***Configuration*** screen, set the reference temperature (***Set ref temp***) value in the range 4°C to 35°C. 
2	Tap ***Save*** to save the new reference temperature.

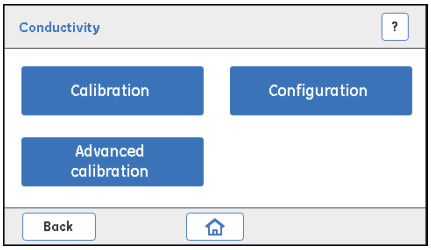
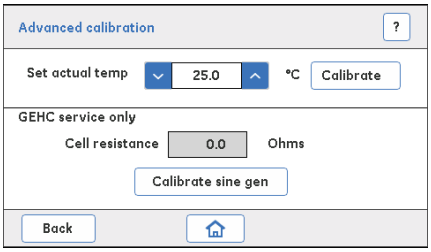
5.10.2 Temperature sensor calibration

Instructions

Follow the instructions below to calibrate the temperature sensor.

NOTICE

The option ***Calibrate sine gen*** must be performed by a GE Service Engineer.

Step	Action
1	Place a precision thermometer in the flow cell path directly after the **Conductivity flow cell** (i.e., immediately after the conductivity tubing which is connected to **Outlet valve**), and then pump demineralized water through the system with a flow rate of 0.5 ml/min.
2	In the ***Conductivity*** screen, tap ***Advanced calibration***.  *Result*: The ***Advanced calibration*** screen opens. 
3	Note the temperature and enter it into the ***Set actual temp*** text box, and then tap ***Calibrate*** to carry out the temperature calibration. ***Note:*** • *Make sure that the temperature of the **Conductivity flow cell** has stabilized and measure the temperature of the calibration solution with a precision thermometer.*

5.10.3 Conductivity flow cell calibration

Prerequisites

Calibration solution:

- 1.00 M NaCl

  or,

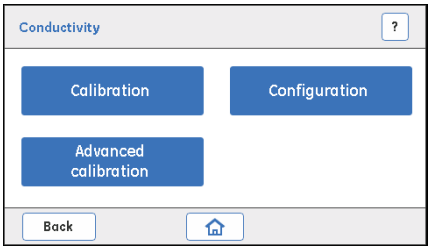
- 100 mS/cm conductivity standard solution

Instructions

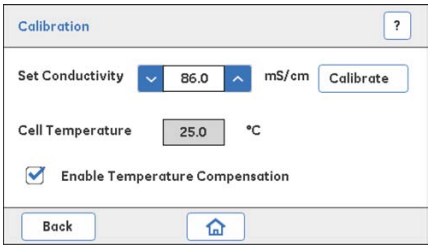
Follow the instructions below to calibrate the **Conductivity flow cell**.

Note: *Temperature compensation is enabled by default (factory setting). If you want to disable temperature compensation, tap the* ***Enable temperature compensation*** *checkbox in the* ***Calibration*** *screen.*

Step	Action
1	Fill the **Conductivity flow cell** with conductivity standard solution.
2	In the ***Conductivity*** screen, tap ***Calibration***.



Result: The ***Calibration*** screen opens.

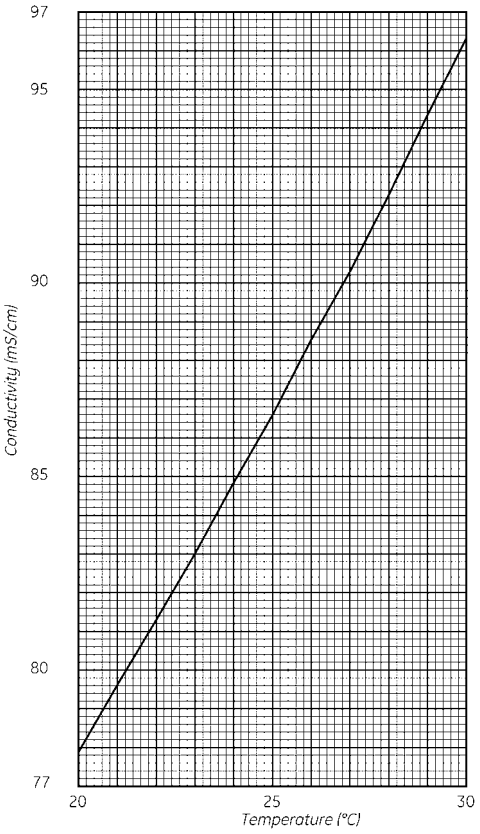


Note:

Make sure that the checkbox for ***Enable Temperature Compensation*** *is checked.*

Step	Action
3	Note the current temperature of the calibration solution in the **Conductivity flow cell** as displayed in the ***Cell Temperature*** field.
4	In the ***Calibration*** screen, enter the conductivity value at the current temperature in the **Set Conductivity** field and then tap ***Calibrate*** to carry out the **Conductivity** calibration. ***Note:*** • *If a certified conductivity standard solution is used, use the supplied theoretical conductivity value corresponding to the temperature in question.* • *If a manually prepared 1.00 M NaCl calibration solution is used, get the conductivity value at the current temperature from the graph for conductivity of the 1.00 M NaCl as a function of temperature presented below.*

Conductivity of 1.00 M NaCl at 20–30°C



Step	Action

Axis	Description
x	Temperature (°C)
y	Conductivity (mS/cm)

5.11 Pressure sensor

Parameter description

Parameter	Description
P set	Displays the current pressure in the flow path (MPa).

Instructions

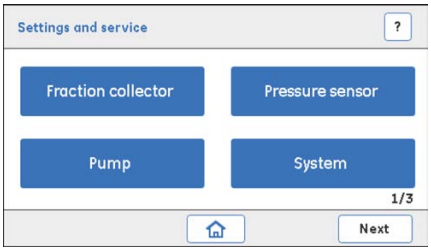
Follow the instructions below to set the pressure to **0** when the **Pressure sensor** is exposed to atmospheric pressure only (***Zero offset***).

NOTICE

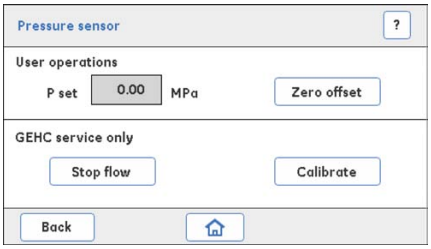
Calibration of **Pressure sensor** must be performed by a GE Service Engineer, and must be done when the **Pressure sensor** has been replaced.

Step	Action
1	Disconnect the inlet tubing from the **Pressure sensor** to expose the sensor to atmospheric pressure only. ***Note:*** *Make sure that the Pump is OFF before disconnecting the tubing.*

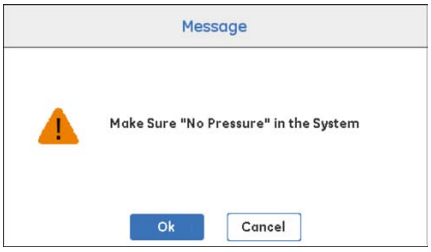
Step	Action
2	In the ***Settings and service*** screen, tap ***Pressure sensor***.



Result: The ***Pressure sensor*** screen opens.



3	In the ***Pressure sensor*** screen, tap ***Zero offset***. *Result*: A Message screen opens.



Make sure that there is no back pressure in the system, and then tap ***OK***.

5.12 Frac30

Introduction

This section describes how to enable or disable Frac30, perform diagnostics and handle the run log.

In this section

This section contains the following subsections:

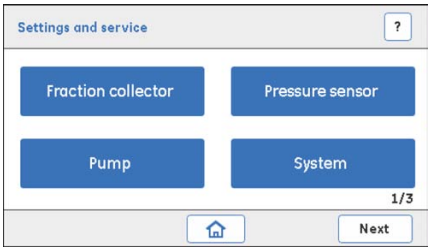
Section	See page
5.12.1 Enable or disable Frac30	104
5.12.2 Diagnostics	105
5.12.3 Run Log	107

5.12.1 Enable or disable Frac30

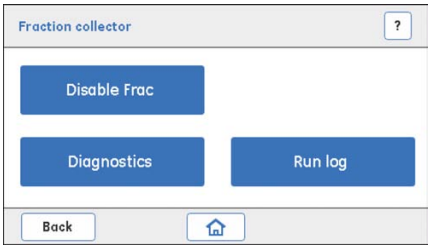
Instructions

Follow the instructions below to enable or disable Frac30.

Step	Action
1	In the **Settings and service** screen, tap ***Fraction collector***.



Result: If the Fraction collector is enabled, the following ***Fraction collector*** screen opens.



If the Fraction collector is not enabled, the following screen opens.

2	Tap ***Enable Frac*** to enable the Fraction collector. Or, To disable the Fraction collector, tap ***Disable Frac***.

5.12.2 Diagnostics

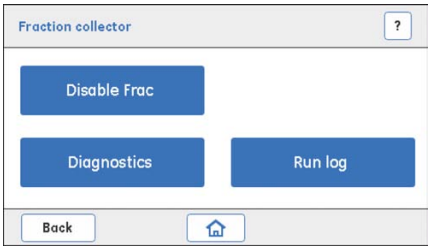
Parameter description

Parameter	Description
Feed tube test	Checks that Frac30 rotates the Bowl assembly correctly and shifts one tube at a time.
Home test	Checks that Frac30 rotates the Bowl assembly correctly and shifts from the current position to the home position (tube number 1).

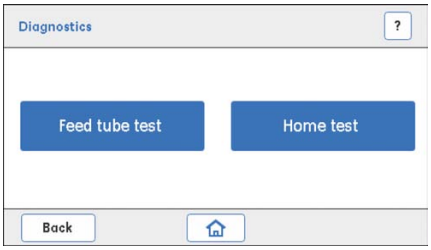
Instructions

Follow the instructions below to run a diagnostics test on Frac30.

Step	Action
1	In the **Fraction collector** screen, tap ***Diagnostics***.



Result: The **Diagnostics** screen opens.



2	Tap ***Feed tube test*** and visually observe that Frac30 rotates from one tube to the next.

Step	Action
3	Tap ***Home test*** and visually observe that Frac30 rotates to home position (tube no. 1) from current position. ***Note:*** *If Frac30 does not rotate the Bowl assembly, check if the Frac30 cable is connected properly to ÄKTA start.* *If the cable is not connected properly, connect the cable properly and secure it in position with a screw driver if required.*

5.12.3 Run Log

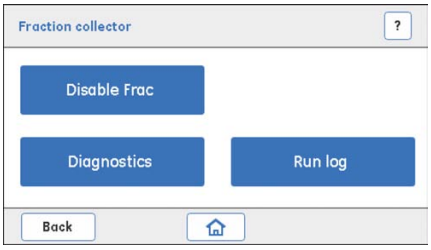
Parameter description

Parameter	Description
Run log	Displays the number of hours of drive sleeve usage.

Instructions

Follow the instructions below to reset the ***Run log***.

Step	Action
1	In the **Fraction collector** screen, tap ***Run log***.



Result: The **Run log** screen opens.

Step	Action
2	If the drive sleeve has been replaced, tap ***Reset*** to set the ***Run time*** to 0. *Result*: A confirmation screen opens.  Tap ***Yes*** to confirm the reset if the drive sleeve has been replaced. Or, If the drive sleeve has not been replaced, tap ***No*** to cancel the action.

5.13 Instrument Display

Introduction

This section describes how to calibrate and test the Instrument ***Display***.

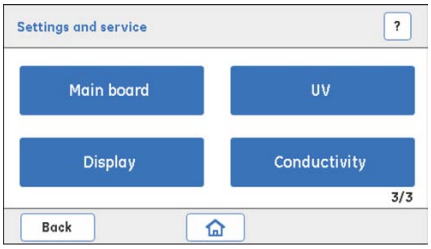
In this section

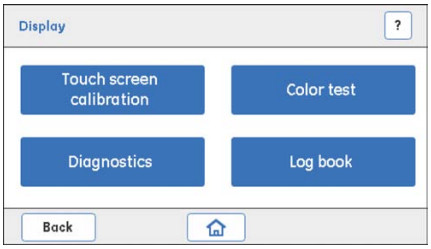
This section contains the following subsections:

Section	See page
5.13.1 Touch screen calibration	111
5.13.2 Color test	114
5.13.3 Diagnostics	115
5.13.4 Log book	116

Instructions

Follow the instructions below to select an option to calibrate and/or diagnose the Instrument ***Display***.

Step	Action
1	In the ***Settings and service*** screen, tap ***Next:Next*** to access the 3rd screen. *Result*: The following screen opens. 

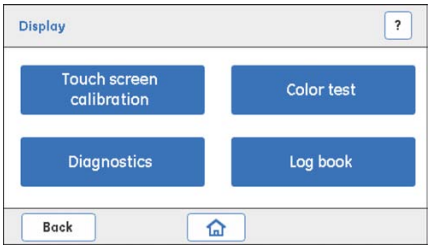
Step	Action
2	Tap ***Display*** to access the Instrument Display options. *Result*: The ***Display*** screen opens. 

5.13.1 Touch screen calibration

Instructions

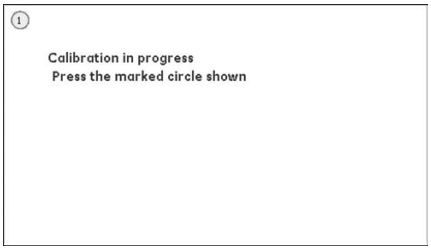
Follow the instructions below to calibrate the Touch screen.

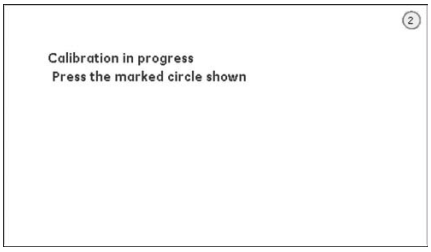
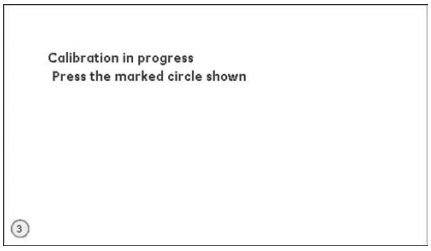
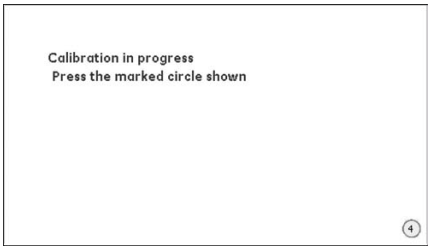
Step	Action
1	In the ***Display*** screen, tap ***Touch screen calibration***.

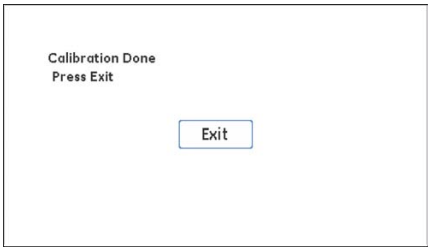


Result: A warning screen opens.

2	Tap ***Yes*** to proceed with the calibration of the Touch screen. *Result*: The following screen opens.



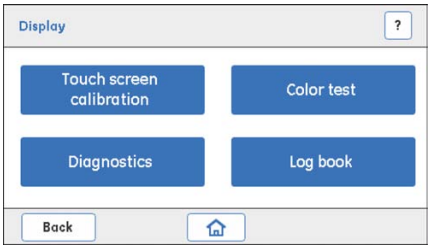
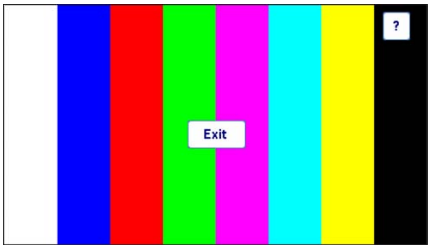
Step	Action
3	Tap precisely on the marked circle ***1***. *Result*: The following screen opens. 
4	Tap precisely on the marked circle ***2***. *Result*: The following screen opens. 
5	Tap precisely on the marked circle ***3***. *Result*: The following screen opens. 

Step	Action
6	Tap precisely on the marked circle **4**. *Result*: The following screen opens. 
7	Tap ***Exit***. ***Note:*** *If the calibration fails, repeat the test. If the calibration fails again, contact a GE Service Engineer.*

5.13.2 Color test

Instructions

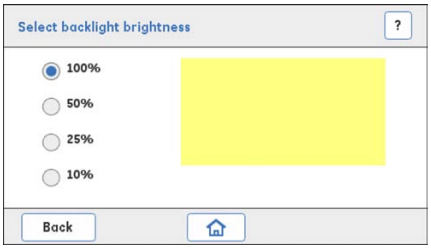
Follow the instructions below to test the colors of the Touch screen.

Step	Action
1	In the ***Display*** screen, tap ***Color test***.  *Result*: The following screen opens. 
2	Tap ***Exit***. *Result:* The Color test is completed. ***Note:*** *If the test fails, contact a GE Service Engineer.*

5.13.3 Diagnostics

Instructions

Follow the instructions below to perform diagnostics of the Touch screen.

Step	Action
1	In the ***Display*** screen, tap ***Diagnostics***. *Result*: The following screen opens. 
2	In the ***Select backlight brightness*** screen, tap a radio button to select the intended brightness (%). *Result*: The rectangle shows the backlight brightness at the selected brightness level.
3	Tap ***Back*** to return to the ***Display*** screen.

5.13.4 Log book

Description

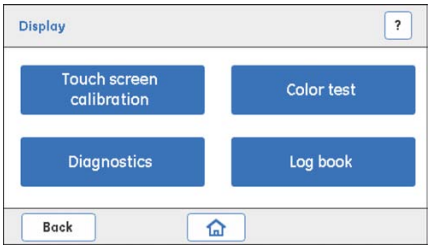
The ***Log Book*** displays the number of hours the Instrument Display has been used. If the Instrument Display has been replaced, it is required to reset to 0 the number of hours of display usage.

Note: *The instrument display must be replaced by a GE Service Engineer.*

Instructions

Follow the instructions below to read the ***Log book*** for the Display.

Step	Action
1	In the ***Display*** screen, tap ***Log book***.



Result: The following screen opens.

Note the number of hours the Instrument Display has been used.

Step	Action
2	If the Instrument Display has been replaced, tap ***Reset*** to set the number of hours to 0. *Result*: A confirmation screen opens.  Tap ***Yes*** to confirm the reset if the Instrument Display has been replaced. Or, If the Instrument Display has not been replaced, tap ***No*** to cancel the action.

5.14 System

Introduction

This section describes how to handle firmware updates and export system reports. It also describes how to set delay volumes and switch valve timing.

In this section

This section contains the following subsections:

Section	See page
5.14.1 Firmware update	120
5.14.2 Export system report to USB	123
5.14.3 Delay volume setting	124
5.14.4 Switch valve timing	125

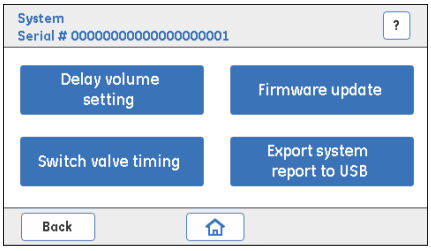
Parameter descriptions

Parameter	Description
Delay volume setting	The delay volume represents the volume of liquid found in the flow path between the outlet of the **UV** Monitor and the collection tubes. This option is used to set the delay volume (ml).
Firmware update	This option is used to update the firmware version of the instrument whenever a new firmware is available on the ÄKTA start product support page, refer to www.gelifesciences.com/AKTA.
FPGA update	ÄKTA start has a dedicated digital drive mechanism to improve the life of modules. This is controlled by a digital logic and the firmware can be updated in the field by selecting ***FPGA update***. The required updating files can be downloaded from the ÄKTA start product support page, refer to www.gelifesciences.com/AKTA.

Parameter	Description
Switch valve timing	Used for optimizing the switch valve timing. It is recommended to optimize the timing of switch valve (**Buffer valve**) when wavy gradients are obtained or when fluctuations in the step gradient are observed during either system performance tests or chromatography runs. Available options: • ***Switch valve timing A*** (default): to set switch valve timing to 4 sec. • ***Switch valve timing B*** : to set switch valve timing to 5 sec. • ***Advanced timing***: to set the switch valve timing to any value from 3.0 to 5.0 sec (0.1 sec increments).
Export system report to USB	For exporting details on the running condition of the **UV**, **Pump**, pump tubing, all the solenoid valves and the latest 4 error messages with ***Error codes***, to a USB memory stick. The latest Firmware version and FPGA version can also be exported. The data is used by a GE Service Engineer when troubleshooting the instrument.

Instructions

Follow the instructions below to manage the system options.

Step	Action
1	In the ***Settings and service*** screen, tap ***System*** *Result*: The following screen opens. 
2	Tap to access a desired system option.

5.14.1 Firmware update

NOTICE

Before tapping the ***Firmware update*** ensure that the system is connected to a stable source of power such as a UPS. During firmware update the system should not be switched off.

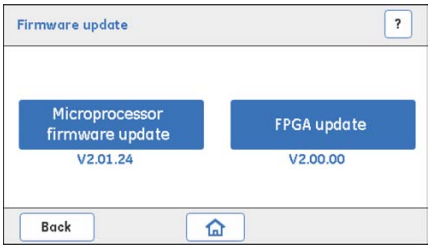
Prerequisites

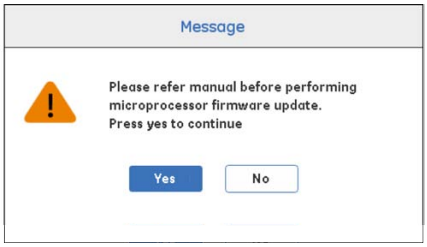
- USB memory stick with at least 10 MB free space.
- Delete any previous AKTASTRT.src files located on the USB memory stick.
- Download the latest AKTASTRT.src file from the product support page onto the USB memory stick, refer to (www.gelifesciences.com/AKTA).

Instructions

Follow the instructions below to update the firmware.

Step	Action
1	Plug the USB memory stick into the USB port located on ÄKTA start.
2	In the ***System*** screen, tap ***Firmware update***. *Result*: The following screen opens.



Step	Action
3	Tap ***Microprocessor firmware update***. *Result*: The following screen opens.  Tap ***Yes*** and then wait for approximately 3 minutes for the update to be done. ***Note:*** *When the firmware update is completed, the instrument automatically restarts and displays the version of the firmware.*
4	From the product support page (www.gelifesciences.com/AKTA), download ***AKTASTRT.dat*** for FPGA update.
5	Tap ***FPGA update***. Result: The following screen opens. 
6	Tap ***Yes***. The updating may take up to 5 minutes. *Result*: The following screen opens. 

Step	Action
7	Once the firmware is updated, perform the following calibration sequence: • ***Display:Touch screen calibration*** • ***Pressure sensor:Zero offset*** • ***Pump : Calibration:Flow rate*** • ***UV:UV LED calibration*** • ***Conductivity:Advanced calibration*** (temperature sensor calibration) • ***Conductivity:Calibration*** (flow cell calibration)

5.14.2 Export system report to USB

Instructions

Follow the instructions below to export the system report to a USB memory stick. Use the system report in further contacts with GE Service Engineers.

Step	Action
1	Plug the USB memory stick into the USB port located on ÄKTA start.
2	In the ***System*** screen, tap ***Export System Report to USB***. *Result*: The files INSTLOG.TXT and ERRORLOG.TXT are exported to the USB memory stick.
3	Remove the USB memory stick from the USB port and connect it to a computer.
4	Check the content of the system report files INSTLOG.TXT and ERRORLOG.TXT, see section *System report file parameters*.

System report files parameters

The content of the ***INSTLOG.TXT*** file contains the following parameters:

- ÄKTA start serial no.
- ***Firmware*** version
- ***FPGA*** version
- **Pump** run
- **Pump** tube run
- **UV LED** run time
- **Buffer valve** count
- **Wash valve** count
- **Outlet valve** count
- **Sample valve** count

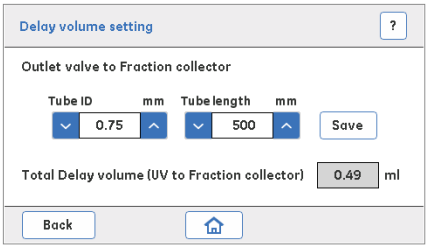
The content of the ***ERRORLOG.TXT*** file contains Error codes, for example:

- ***501***: Over Pressure
- ***301***: Fraction collector failure
- ***603***: Illegal operation, restart instrument

5.14.3 Delay volume setting

Instructions

Follow the instructions below to set the delay volume.

Step	Action
1	In the ***System*** screen, tap ***Delay volume setting***. *Result*: The following screen opens. 
2	Enter the internal diameter (ID) and length of the tubing from the **Outlet valve** to Frac30 in the respective fields, and then tap ***Save***. Result: The total delay volume from the **UV** Monitor to Frac30 is displayed in the ***Total Delay volume*** field. ***Note:*** *The delay volume from the **UV** Monitor to the **Outlet valve** is constant (0.27 ml) in all ÄKTA start instruments.*

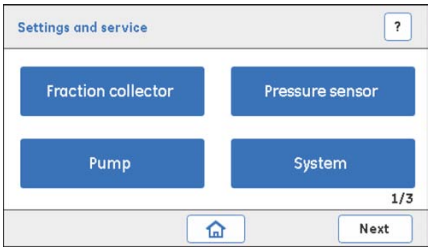
Note: ***Delay volume setting*** *needs to be set when the tube between* ***Outlet valve*** *and Frac30 has been replaced.*

5.14.4 Switch valve timing

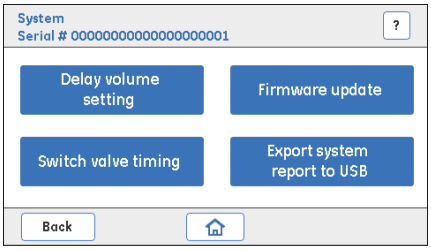
Instructions

Follow the instructions below to set the ***Switch valve timing***. For more details, refer to *ÄKTA start Operating Instructions* section *Switch valve timing*.

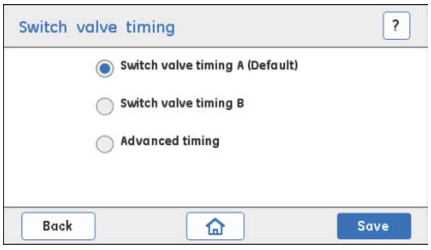
Step	Action
1	In the ***Settings and service*** screen, tap ***System***.



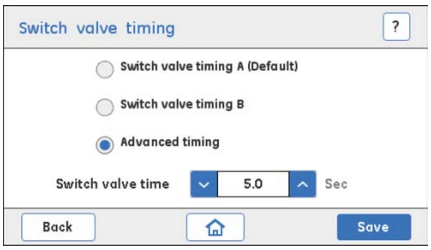
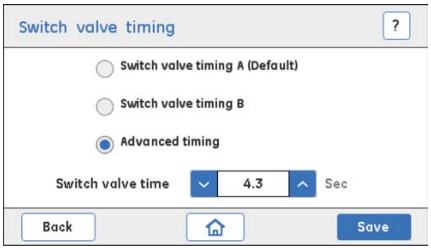
Result: The following screen opens.



2	In the ***System*** screen, tap ***Switch valve timing***. *Result*: The following screen opens.



3	Tap the radio button to select ***Switch valve timing B*** (switch time 5 sec.). Tap ***Save*** to save the timing.
4	Perform ***Gradient run***, either by performing ***System performance method*** or manually set the ***B concentration*** (Buffer valve) to 50%. Observe for the fluctuations.

Step	Action
5	If wavy gradients still are obtained, or if fluctuations on step gradient levels are large, then select ***Advanced timing***. *Result*: The following screen opens.  Set switch valve time in the range of 3.0 to 5.0 sec (0.1 sec increments) by pressing the up/down arrows.
6	Tap ***Save*** to save the optimized timing. 

5.15 Main board

NOTICE

The ***Main board*** screen is reserved for operations performed by a GE Service Engineer *only*. Do not perform any further operations from this screen. Tap ***Back*** or ***Home*** to return to the previous screen or to go to the ***Home*** screen.

6 Troubleshooting

About this chapter

This chapter contains information regarding troubleshooting procedures. *Warning messages and Error codes* are provided, and possible causes and solutions to those codes are described.

In this chapter

This chapter contains the following sections:

Section	See page
6.1 UV	129
6.2 Conductivity	132
6.3 Frac30	133
6.4 Pump	134
6.5 Pressure sensor	135
6.6 Main board and Power Supply	136
6.7 System related error messages	138
6.8 Troubleshooting flow charts	139

Introduction

For ÄKTA start and Frac30 there are two kinds of Troubleshooting procedures:

- *Basic* - Application related troubleshooting. For instructions, refer to section *Basic Troubleshooting* in *ÄKTA start Operating Instructions*.
- Troubleshooting with the aid of ***Warning messages*** and ***Error codes*** displayed on the Touch Screen. This is described in this chapter.

For information about Troubleshooting related to UNICORN start, refer to the *UNICORN start 1.0 User Manual*.

6.1 UV

Warning messages

Warning code	Description	Possible cause	Action
111	**UV** intensity low	In the ***Settings and service:UV*** screen: When trying to calibrate; if the detector voltage is less than 2500 mV, even for a max UV light strength of 1024.	• Flush the **UV flow cell** and mount it in a secure way *Or*, • Replace the **UV flow cell** if needed, and try to calibrate again. For instructions, see: *Section 7.4 UV flow cell, on page 161* *Section 5.4.1 UV LED calibration, on page 64*
112	**UV** intensity high	In the ***Settings and service:UV*** screen: When trying to save the UV light strength after calibration, if the signal is greater than 4000 mV.	• Set a lower UV light strength (max 500 counts). • Tap **Calibrate** to get a signal at about 2500 mV.
113	**UV** reaching end of lifetime	In the ***Settings and service:UV*** screen: When trying to save the UV light strength after calibration, if the UV light strength is in the range of 1016 to 1020.	• Order a new **UV** Monitor. • Perform **UV LED** calibration. For instructions, see: *Section 5.4.1 UV LED calibration, on page 64* *Section 5.4.3 Flow cell path length, on page 69*

Warning code	Description	Possible cause	Action
114	**UV** reached end of lifetime	In the ***Settings and service:UV*** screen: When trying to save the UV light strength after calibration, if the UV light strength is 1020.	• Order a new **UV** Monitor. • Perform **UV LED** calibration. For instructions, see: *Section 5.4.1 UV LED calibration, on page 64* *Section 5.4.3 Flow cell path length, on page 69*
115	Flush **UV flow cell** and mount securely	In the ***Settings and service:UV*** screen: When trying to calibrate, if there are repeated calibrations and the signal strength is decreasing.	• Flush the **UV flow cell** and mount it in a secure way. • Recalibrate.
116	**UV** baseline ignored	In the ***Settings and service:UV*** screen: Calibration and run time: When the UV signal is *not* in the range of 2500 mV and 4000 mV, auto zero cannot be performed.	• Flush the **UV flow cell** and mount it in a secure way. • Try to recalibrate. If the voltage is still less than 2500 mV, change UV module.

Error messages

Error code	Description	Possible cause	Action
101	**UV** module failure	During power up, too little light is reaching the detector, i.e., too high absorbance in the cell or to weak light source.	See *Troubleshooting Flow chart 1, on page 139*

Error code	Description	Possible cause	Action
102	**UV** module failure	During power up, stray light test has failed, light is "leaking" in to the detector.	See *Troubleshooting Flow chart 2, on page 140*
103	**UV** module failure	UV module cable may be loose or disconnected, no communication with **UV** module. Main PWA failure.	See *Troubleshooting Flow chart 3, on page 141*

6.2 Conductivity

Error messages

Error code	Description	Possible cause	Action
201	**Conductivity** module failure	• Loose cable connector. • The temperature sensor is not functioning.	See *Troubleshooting Flow chart 6, on page 144*

6.3 Frac30

Error messages

Error code	Description	Possible cause	Action
301	Fraction collector failure	• The cable connected between ÄKTA start and Frac30 is not working. • Drive sleeve worn out. • Sensors are not working. • The Frac30 internal cable is not working. • Motor failure. • Main board failure.	See *Troubleshooting Flow chart 4, on page 142*

6.4 Pump

Error messages

Error code	Description	Possible cause	Action
401	**Pump** failure	• **Pump** is not working.	• Contact a GE Service Engineer. • See *Troubleshooting Flow chart 5, on page 143*
-	No flow from the **Pump**.	The rollers are not rotating.	• Check the condition of the pump tubing. • Check that there is no blockage on the inlet (or outlet). • Open the pump head and visually check if the pump rollers are rotating freely when starting the **Pump** from the ***Diagnostics*** screen. If not, check if the **Pump** connector is connected or if anything is stuck between the rollers.

6.5 Pressure sensor

Error messages

Error code	Description	Possible cause	Action
501	Overpressure	• Blockage in the tubing, valves or in the column. • Improperly selected Flow rate. • Wrong pressure setting used for chosen application.	• Check tubing and valves by disconnecting one at a time starting from the Fraction collector going backwards towards the **Pump**. When pressure is released the blockage has been found, clean or replace tube to resolve the issue. • Clean the column/separation media with suitable solution (1 M NaOH) or replace the column with a new one. • Check the specification and pressure of the columns for correct flow rate.
502	**Pressure sensor** failure	The sensor is not connected or not calibrated.	• Perform ***Zero offset***. • Contact a GE Service Engineer.

6.6 Main board and Power Supply

Warning messages

Warning code	Description	Possible cause	Action
011	System over-temperature	• Instrument temperature is out of range (4°C to 35°C)	• Tap ***Continue*** on the Touch screen. • If the system is in a cold chamber, make sure that the temperature is not below +4°C. • Make sure that there is adequate ventilation surrounding the system. • Make sure that the system is not standing in direct sun light. • System operation is not affected by this warning, the system can continue to be used.

Error messages

Error code	Description	Possible cause	Action
001	EPROM error		• Contact a GE Service Engineer.
002	MPWA temperature	• Instrument temperature is way out of range (4°C to 35°C)	• Contact a GE Service Engineer. • The system cannot be used in this condition.

Error code	Description	Possible cause	Action
003	Power supply monitor error	Voltage has gone out of operating range.	• Contact a GE Service Engineer. • With assistance from a GE Service Engineer, check the Power supply for voltages.

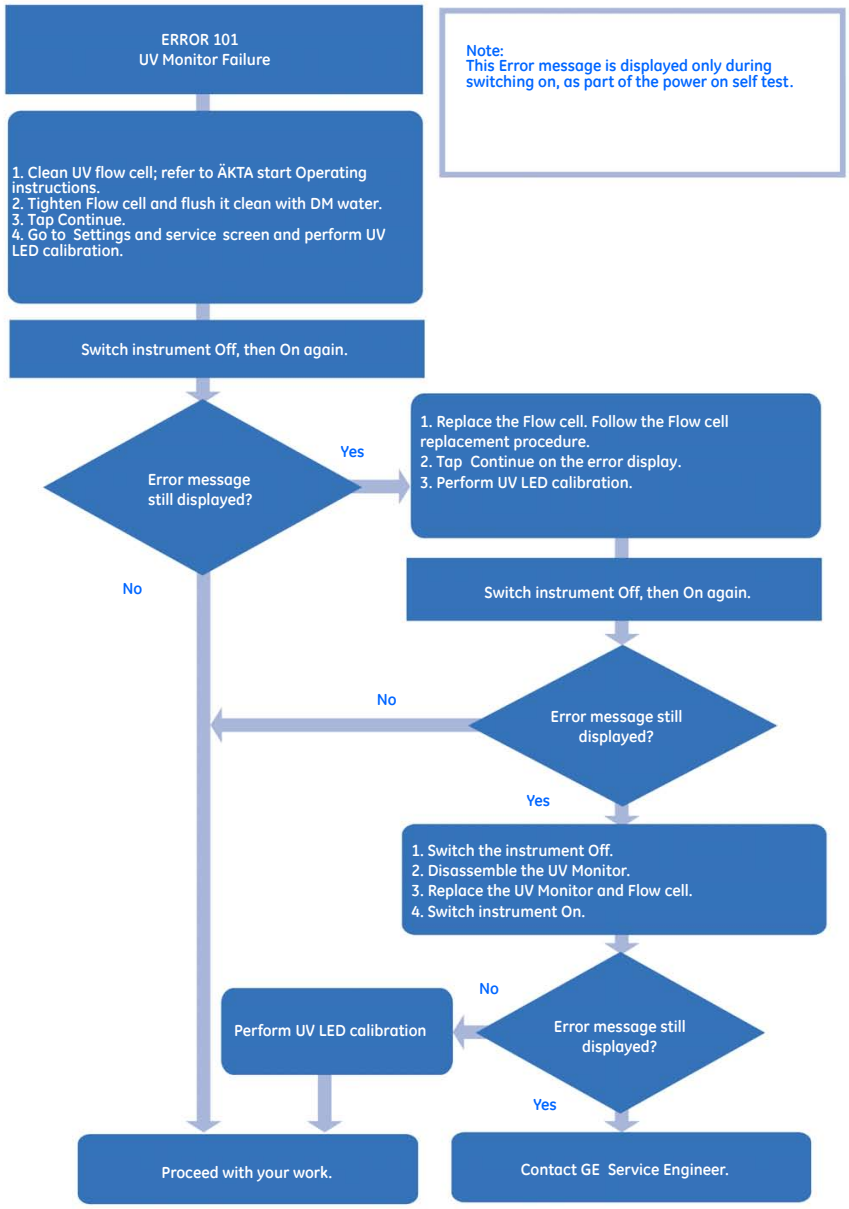
6.7 System related error messages

Error messages

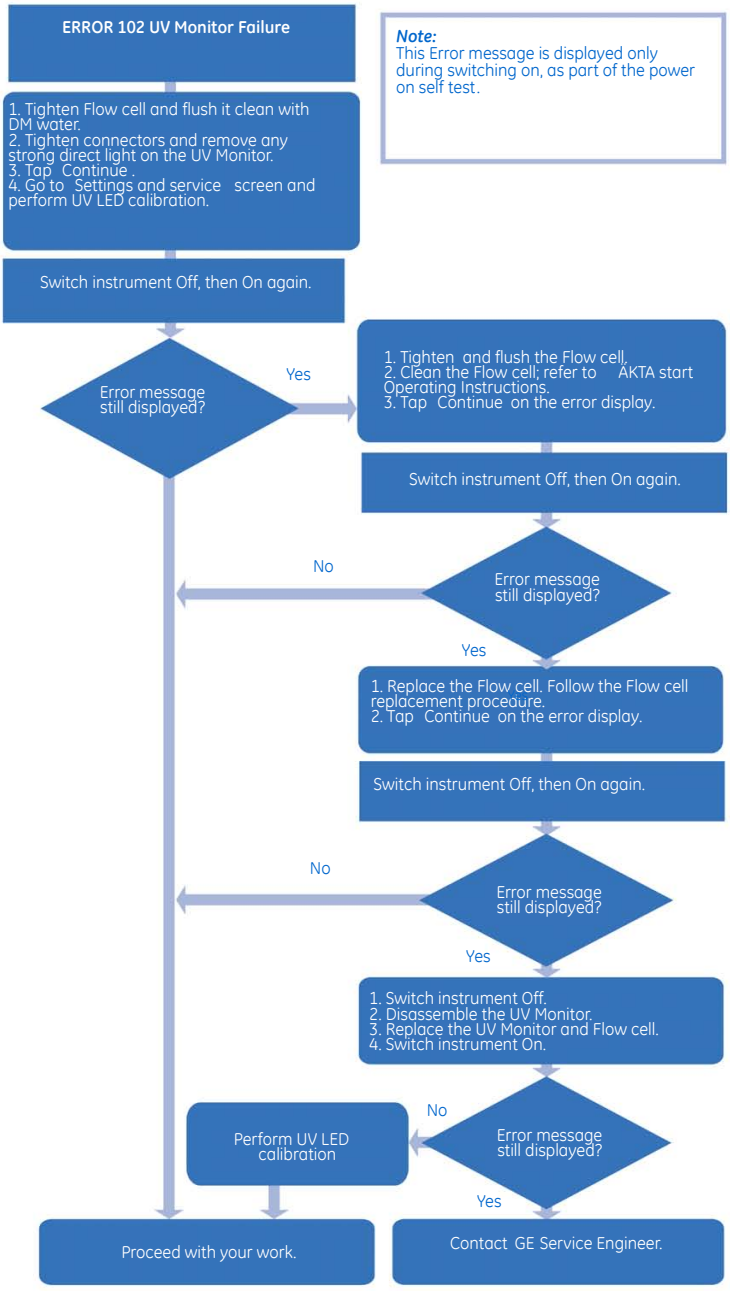
Error code	Description	Possible cause	Action
601	Method Error. Reload Method	Incomplete method. Wrong method loaded.	Reload the method.
602	Illegal opcode Reload Method	Incomplete method. Wrong method loaded.	Reload the method.
603	Illegal Operation, Restart Instrument	Wrong operations in the system. User is trying to work on features that are not supported.	Restart the system.

6.8 Troubleshooting flow charts

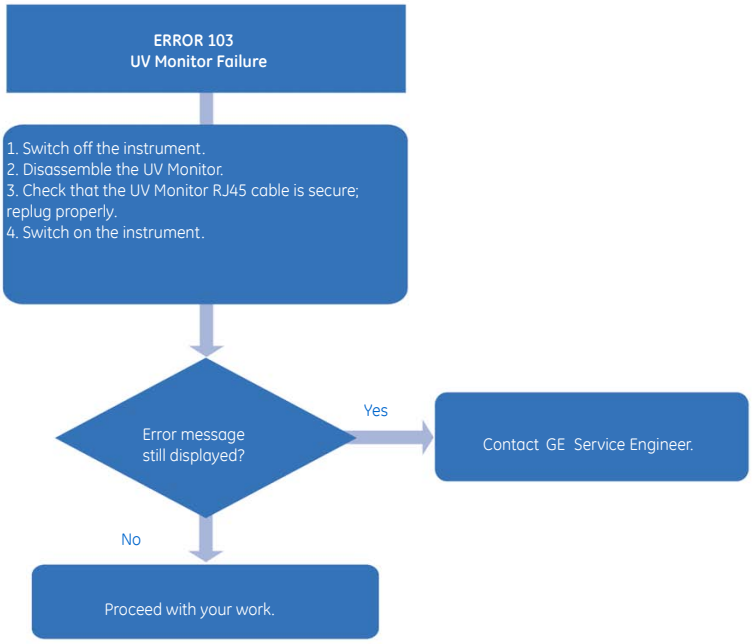
Troubleshooting Flow chart 1



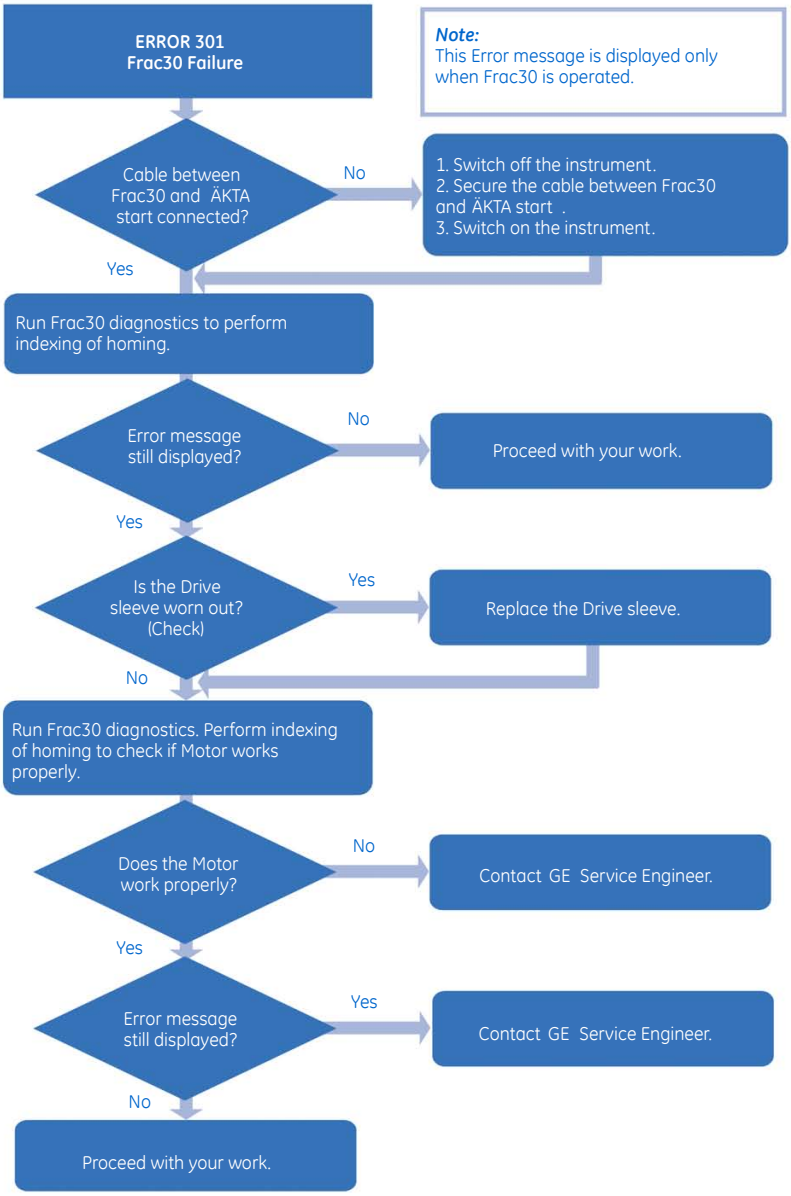
Troubleshooting Flow chart 2



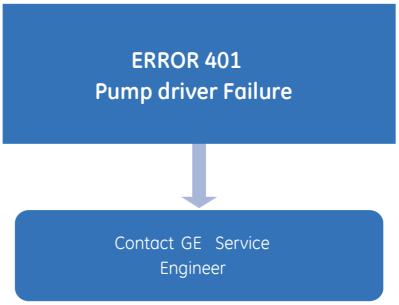
Troubleshooting Flow chart 3



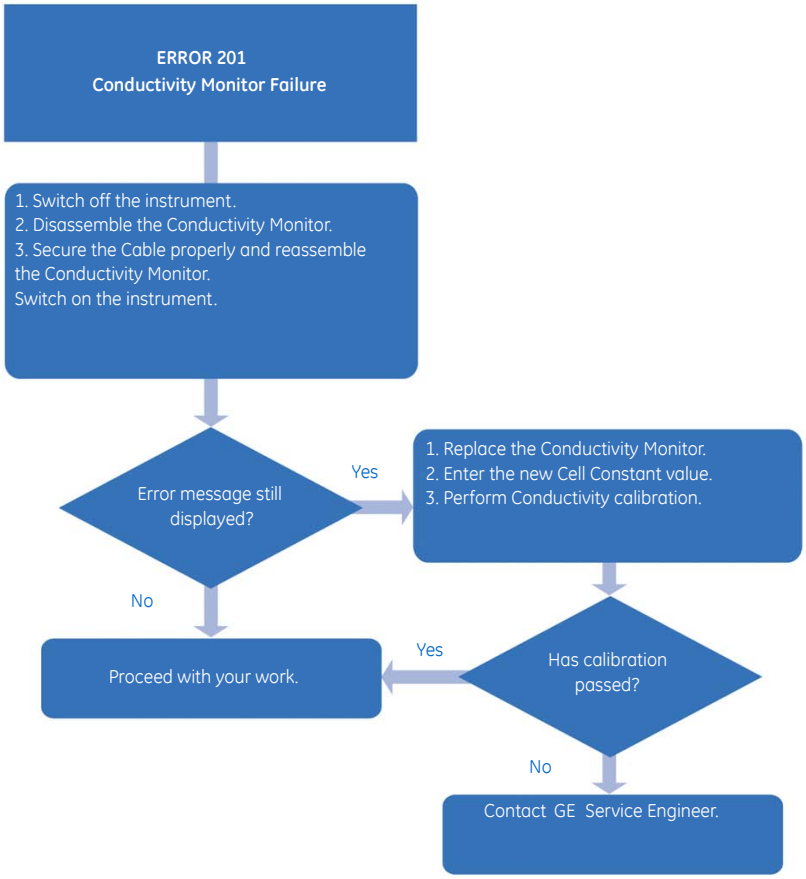
Troubleshooting Flow chart 4



Troubleshooting Flow chart 5



Troubleshooting Flow chart 6



7 Disassembly

About this chapter

This chapter contains instructions how to disassemble, remove and replace all the modules that can be disassembled by the user.

In this chapter

This chapter contains the following sections:

Section	See page
7.1 Buffer valve	149
7.2 Mixer	153
7.3 UV	156
7.4 UV flow cell	161
7.5 Sample valve	163
7.6 Pump	167
7.7 Pump tubing	172
7.8 Wash valve	175
7.9 Outlet valve	179
7.10 Conductivity Monitor	182
7.11 Injection valve	186
7.12 Injection valve kit	189
7.13 Frac30 Bowl assembly	192
7.14 Fuse	200

Introduction

The design of ÄKTA start allows all wet modules, except for the **Pressure sensor**, to easily be disassembled and reassembled by a user.

NOTICE

Replacement of modules located on the inside of the instrument must be performed by a GE Service Engineer only. If an internal part needs to be replaced, please contact a GE Service Engineer.

Internal modules include:

- Main board
- Display Sub assembly
- Power supply
- **Pressure sensor**

Precautions

WARNING

To avoid personal injury when performing maintenance on ÄKTA start, follow the instructions below.

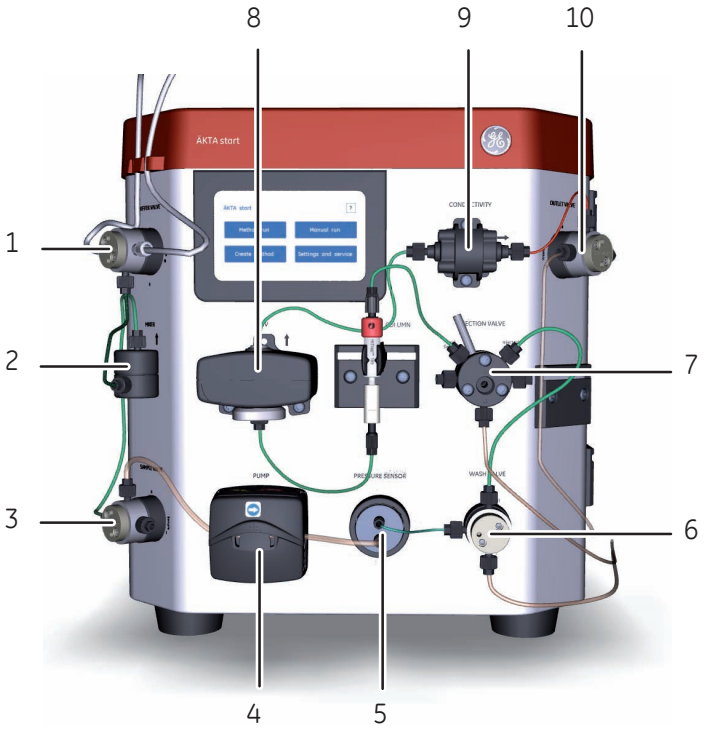
- **Electrical shock hazard.** Do not open any covers or parts unless specified in the user documentation. Except for the maintenance and service described in the user documentation, all other repairs should be done by a GE Service Engineer.
- **Disconnect power.** Always switch off power to the instrument before replacing any component on the instrument or cleaning the instrument, unless stated otherwise in the user documentation.

NOTICE

Replacement of modules located on the wet side of the instrument must be performed by trained laboratory staff only.

Illustration of the modules

The illustration below shows the locations of the modules placed on the wet side of the instrument.



Part	Module	Disassembly instructions
1	**Buffer valve**	*Instructions, on page 149*
2	**Mixer**	*Instructions, on page 153*
3	**Sample valve**	*Instructions, on page 163*
4	**Pump**	*Instructions, on page 167*
5	**Pressure sensor**	-
6	**Wash valve**	*Instructions, on page 175*
7	**Injection valve**	*Instructions, on page 186*
8	**UV**	*Instructions, on page 156*

Part	Module	Disassembly instructions
9	**Conductivity**	*Instructions, on page 182*
10	**Outlet valve**	*Instructions, on page 179*

7.1 Buffer valve

Note: *In case of multiple valve failures, make sure that the valves are not mixed. Replace the valves one by one by removing one valve at a time from the instrument.*

Required tools

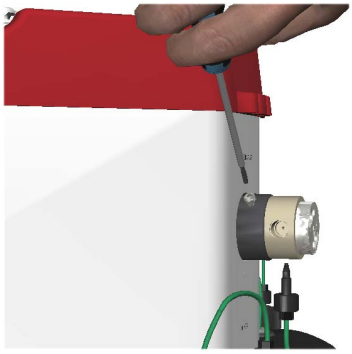
Tool	Dimension
Torx driver	T10

Instructions

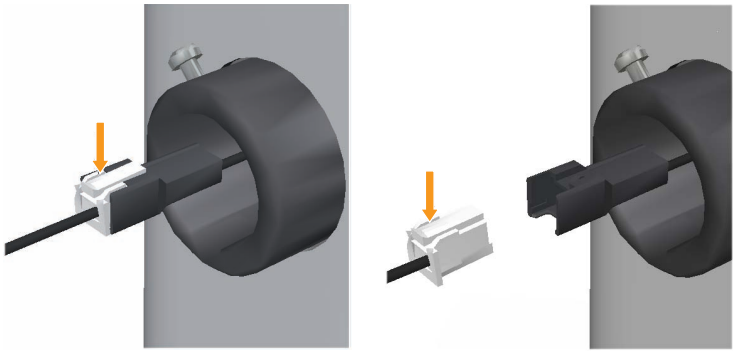
Follow the instructions below to remove and replace the **Buffer valve**.

> **WARNING**
>
> **Disconnect power.** Always switch off power to the instrument before replacing any component on the instrument or cleaning the instrument, unless stated otherwise in the user documentation.

Step	Action
1	Switch off the instrument by pressing the Power Switch to the **O** position.
2	Remove the inlet and outlet tubing from the valve ports.

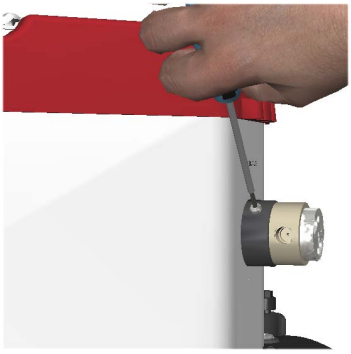
Step	Action
3	Loosen the M3 screw from the valve using a T10 torx driver, supplied with the equipment at delivery. ***Note:*** *The screw can be located on different places on the top circumference of the holder.* 
4	Slowly remove the **Buffer valve** until a cable is visible. The cable is assembled with two connectors interconnected.  

Step	Action
5	Press on the connector and remove the connector and cable.



6	Disconnect the connector from the valve side.
7	Remove the valve and leave the connector as it is.

Step	Action
8	Replace with a new **Buffer valve**, connect the cable, and reconnect the tubing to the valve ports. ***Note:*** *Before replacing the valve, make sure that the part number (P/N) on the new valve matches with that of the old valve (29003271, Buffer valve CTV-31-516U-1).*



9	Make sure that the ports are aligned to the markings on the instrument chassi.
10	Switch on the instrument by pressing the Power Switch to the **I** position.

7.2 Mixer

Required tools

Tool	Dimension
Torx screwdriver	T20

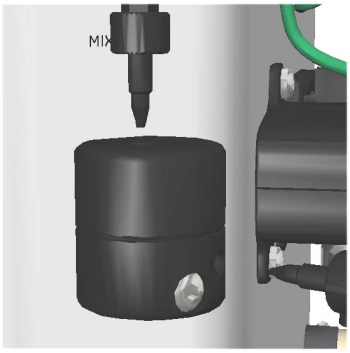
Instructions

Follow the instructions below to remove and replace the Mixer.

WARNING

Disconnect power. Always switch off power to the instrument before replacing any component on the instrument or cleaning the instrument, unless stated otherwise in the user documentation.

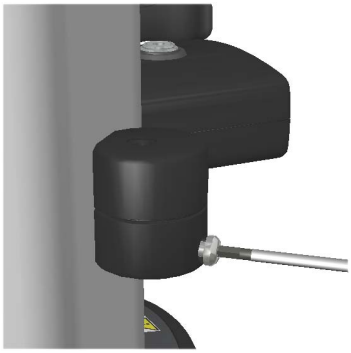
Step	Action
1	Switch off the instrument by pressing the Power Switch to the **O** position.
2	Remove the inlet and outlet tubing from the ports.

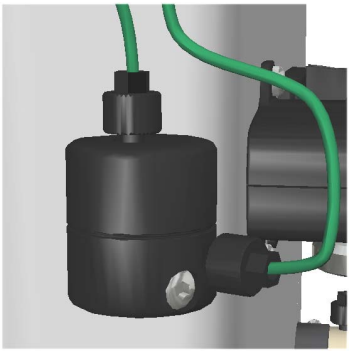


Step	Action
3	Loosen the M4 screw from the **Mixer** using a T20 screwdriver, supplied with the equipment at delivery.

4	Remove the **Mixer**.

Step	Action
5	Replace with a new **Mixer** and reconnect the tubing to the ports.





6	Switch on the instrument by pressing the Power Switch to the **I** position.

7.3 UV

Required tools

Tool	Dimension
Torx screwdriver	T20

Instructions

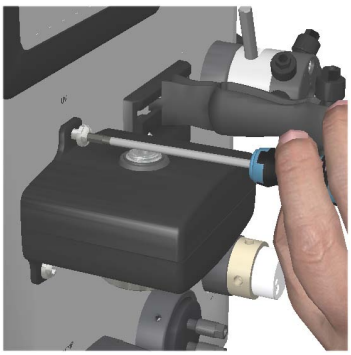
Follow the instructions below to remove and replace the **UV** Monitor.

WARNING

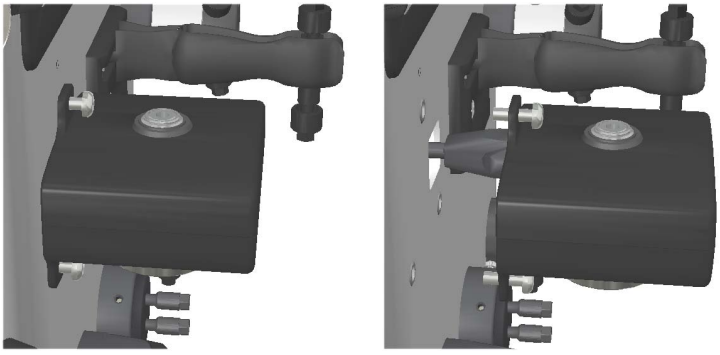
Disconnect power. Always switch off power to the instrument before replacing any component on the instrument or cleaning the instrument, unless stated otherwise in the user documentation.

Step	Action
1	Switch off the instrument by pressing the Power Switch to the **O** position.
2	Remove the inlet and outlet tubing from the ports.

Step	Action
3	Unscrew the one screw at the top of the **UV** Monitor, and then the two screws at the bottom using a T20 screwdriver, supplied with the equipment at delivery.



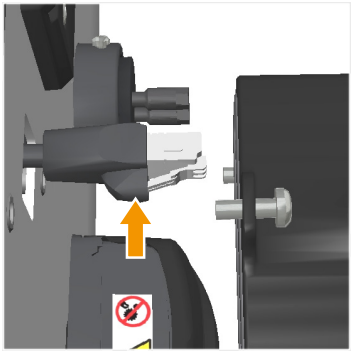
Step	Action
4	Slowly remove the **UV** Monitor until you get access to the **RJ45** connector plugged into the module.



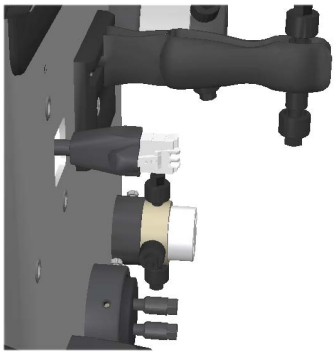
5	Press the latching tab and disconnect the **RJ45** connector from the **UV** Monitor side.

Note:

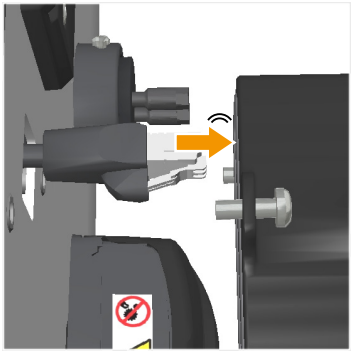
*Make sure that the **RJ45** connector is not moved inside the cabinet. The connector needs to be retained outside the cabinet for re-assembling of a new **UV** module.*



Step	Action
6	Remove the **UV** Monitor and leave the **RJ45** connector as it is.



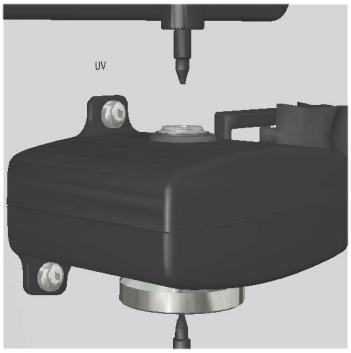
Step	Action
7	Connect the **RJ45** connector to the new **UV** monitor.



Note:

*Make sure that there is a click sound when the **RJ45** connector is connected. The **UV** monitor may not work properly if the **RJ45** connector is not properly connected.*

Step	Action
8	Reconnect the tubing to the ports.



9	Switch on the instrument by pressing the Power Switch to the **I** position.

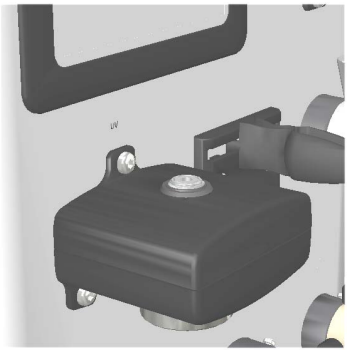
7.4 UV flow cell

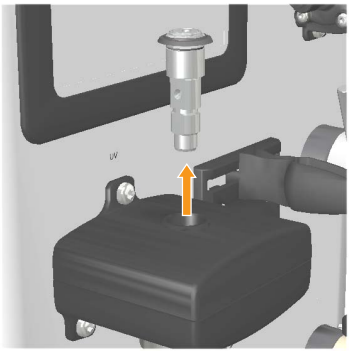
Instructions

Follow the instructions below to remove and replace the **UV** flow cell.

Step	Action
1	Disconnect the inlet and outlet tubing from the **UV** Monitor.
2	Rotate the locknut in the anticlockwise direction.

3	Pull up the **UV** flow cell.





4	Put a new **UV** flow cell in place from above so that it fits in properly, and simultaneously tighten the locknut.

Step	Action
5	Place the protective cover around the flow cell to protect the electronics inside the optical unit from liquid spillage.

Note:

*The protective cover should be assembled after completing the assembly of the **UV** flow cell inside the **UV** Monitor by just press-fit.*

6	In the ***Settings and Service*** screen, tap ***UV***. In the ***UV*** screen, perform a ***UV LED calibration*** and a ***Flow cell path length test***. This is described further in UV LED Calibration and Flow cell path length test.

7.5 Sample valve

Required tools

Tool	Dimension
Torx driver	T10

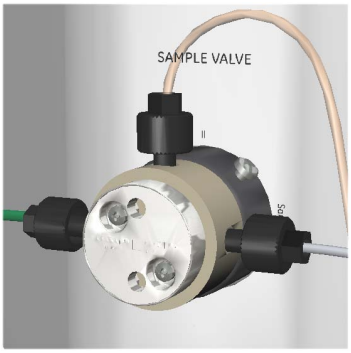
Instructions

Follow the instructions below to remove and replace the **Sample valve**.

WARNING

Disconnect power. Always switch off power to the instrument before replacing any component on the instrument or cleaning the instrument, unless stated otherwise in the user documentation.

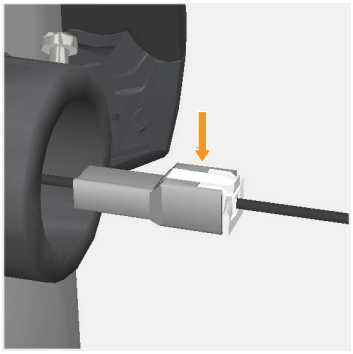
Step	Action
1	Switch off the instrument by pressing the Power Switch to the **O** position.
2	Remove the inlet and outlet tubing from the ports.

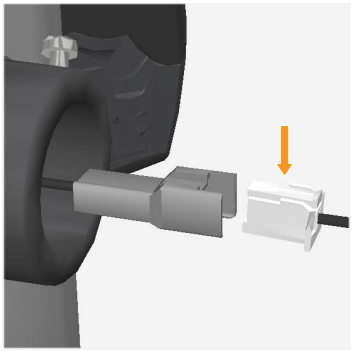


Step	Action
3	Loosen the screw from the valve using a T10 torx driver, supplied with the equipment at delivery. ***Note:*** *The screw can be locate on different places on the top circumference of the holder.*

4	Slowly remove the **Sample valve** until a cable is visible. The cable is assembled with two connectors interconnected.

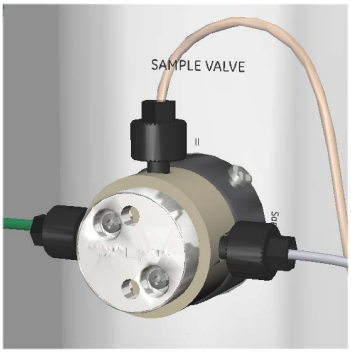
Step	Action
5	Disconnect the connector from the valve side.





Step	Action
6	Remove the **Sample valve**.

Step	Action
7	Replace with a new **Sample valve**, connect the cable, and reconnect the tubing to the valve ports.



Note:

Before replacing the valve, make sure that the part number (P/N) on the new valve matches with that of the old valve (29003272, Sample valve CTV-31-32U-3).

8	Make sure that the ports are aligned to the markings on the instrument chassi.
9	Switch on the instrument by pressing the Power Switch to the **I** position.

7.6 Pump

Required tools

Tool	Dimension
Torx driver	T20

Instructions

Follow the instructions below to remove and replace the **Pump**.

WARNING

Disconnect power. Always switch off power to the instrument before replacing any component on the instrument or cleaning the instrument, unless stated otherwise in the user documentation.

NOTICE

Keep the pump cover open when not using the system. Open the peristaltic pump cover after you switch off the equipment. This reduces the risk of shortening the life time of the pump tubing.

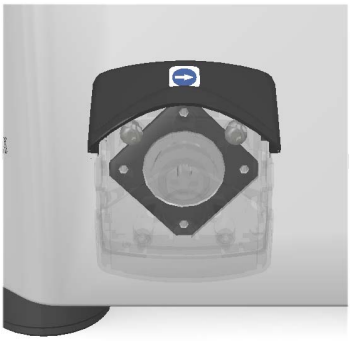
Step	Action
1	Switch off the instrument by pressing the Power Switch to the **O** position.

Step	Action
2	Open the top cover to remove the tubing from the **Pump**.

Step	Action
3	Loosen the two M4 screws from the **Pump** using a T20 screwdriver, supplied with the equipment at delivery.

Note:

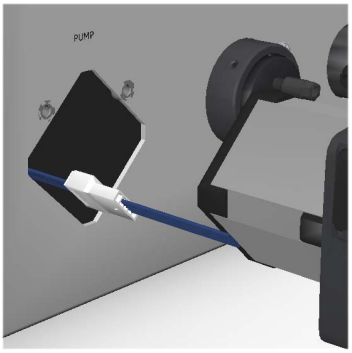
*Make sure that the pump connector is not moved inside the cabinet. The connector needs to be retained outside the cabinet for re-assembling of a new **Pump** module.*



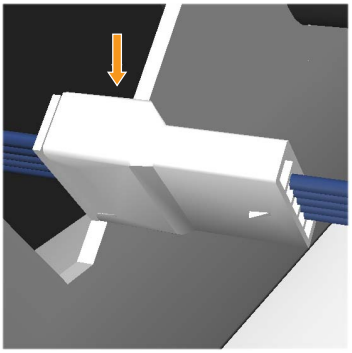
Note:

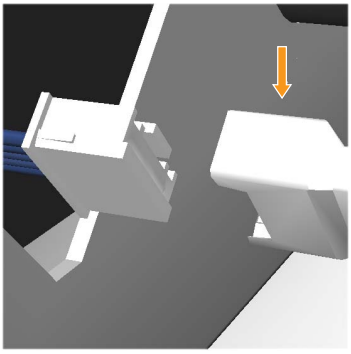
*While loosening the screw, make sure to hold the screw in your hand before it is completely out of the **Pump**. There is a risk that the screw will fall into the pump head if proper care is not taken during the disassembly.*

Step	Action
4	Slowly remove the **Pump** until a cable is visible. The cable is assembled with two connectors interconnected.



5	Disconnect the connector from the **Pump** side.



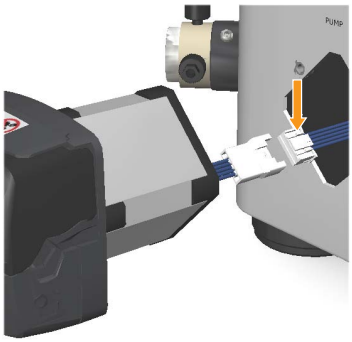


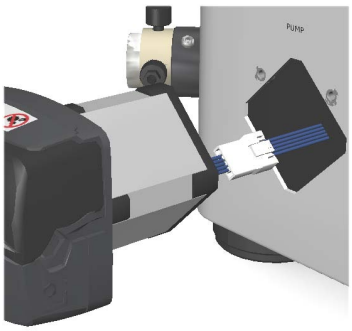
Step	Action
6	Remove the **Pump**.

Note:

*Make sure that the pump cable is placed away from the fan, on the left side of the instrument after removing the **Pump**. This safety precautions is to ensure that the cable does not get stuck in the ventilation fan.*

7	Replace with a new **Pump**, install the new **Pump** in reverse order.





8	Place the **Pump** tubing between the rollers and the track of the new **Pump**.
9	Switch on the instrument by pressing the Power Switch to the **I** position.
10	In the ***Pump*** screen, tap ***Diagnostics*** and then reset the number of hours of ***Pump run*** to ***0***.

7.7 Pump tubing

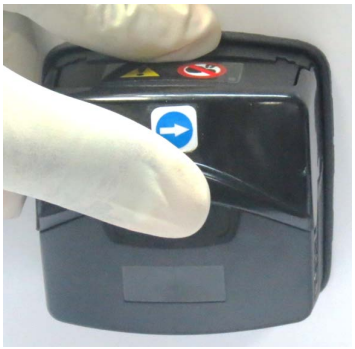
Instructions

Follow the instructions below to remove and replace the pump tubing.

WARNING

Disconnect power. Always switch off power to the instrument before replacing any component on the instrument or cleaning the instrument, unless stated otherwise in the user documentation.

Step	Action
1	Switch off the instrument by pressing the Power Switch to the **O** position.
2	Open the top cover until it is fully open.



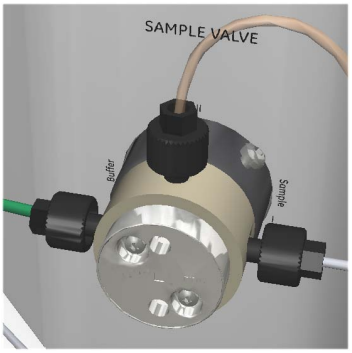
Step	Action
3	Place the tubing between the rollers and the track, press against the pump head inner wall.

Note:

Make sure that the pump tubing is not twisted or stretched against the rollers.

4	Lower the top cover until it clicks into its fully closed position. The track closes automatically and the tubing is stretched correctly as the track closes.

Step	Action
5	Connect the pump tubing to the **Sample valve** and to the **Pressure sensor**.



Step	Action
6	Switch on the instrument by pressing the Power Switch to the **I** position.

7.8 Wash valve

Required tools

Tool	Dimension
Torx driver	T10

Instructions

Follow the instructions below to remove and replace the **Wash valve**.

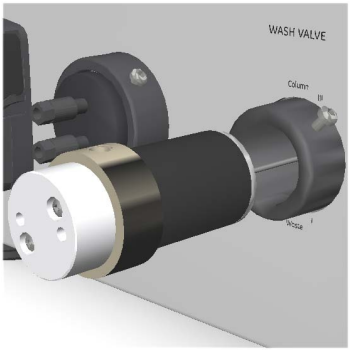
WARNING

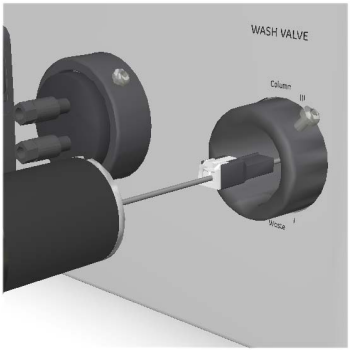
Disconnect power. Always switch off power to the instrument before replacing any component on the instrument or cleaning the instrument, unless stated otherwise in the user documentation.

Step	Action
1	Switch off the instrument by pressing the Power Switch to the **O** position.
2	Remove the inlet and outlet tubing from the ports.

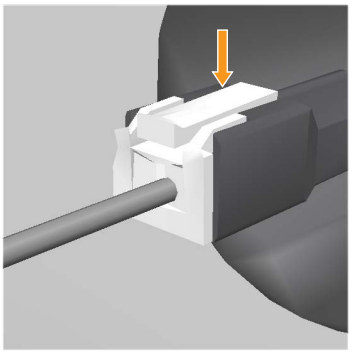
Step	Action
3	Loosen the M3 screw from the **Wash valve** using a T10 torx driver, supplied with the equipment at delivery. ***Note:*** *The screw can be located on different places on the top circumference of the holder.*

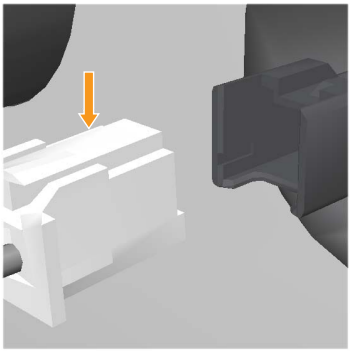
4	Slowly remove the **Wash valve** until a cable is visible. The cable is assembled with two connectors interconnected.



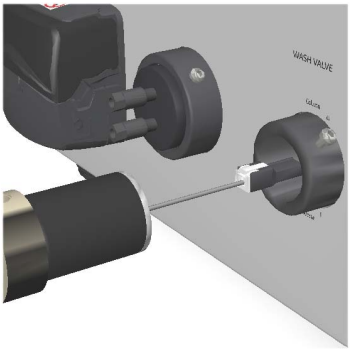


Step	Action
5	Disconnect the connector from the valve side.





6	Remove the **Wash valve** from the instrument.
7	Replace with a new **Wash valve**. Connect the cable, and then reconnect the tubing to the valve ports.



Note:

Before replacing the valve, make sure that the part number (P/N) on the new valve matches with that of the old valve (29014870 AA Wash valve CTV-3-32UH-2).

8	Make sure that the ports are aligned to the markings on the instrument chassi.

Step	Action
9	Switch on the instrument by pressing the Power Switch to the **I** position.

7.9 Outlet valve

Required tools

Tool	Dimension
Torx driver	T10

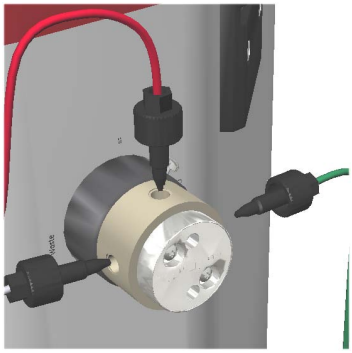
Instructions

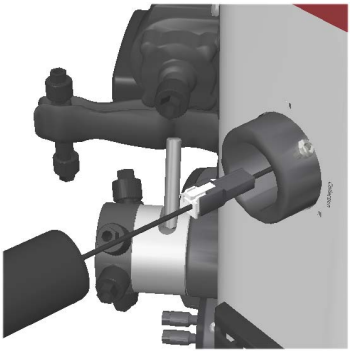
Follow the instructions below to remove and replace the **Outlet valve**.

WARNING

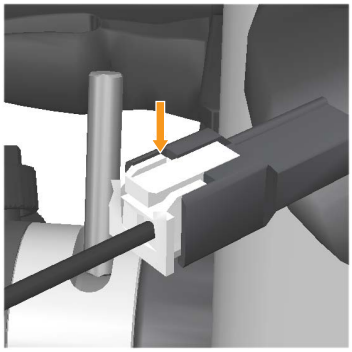
Disconnect power. Always switch off power to the instrument before replacing any component on the instrument or cleaning the instrument, unless stated otherwise in the user documentation.

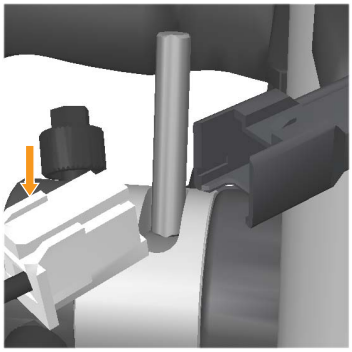
Step	Action
1	Switch off the instrument by pressing the Power Switch to the **O** position.
2	Remove the inlet and outlet tubing from the ports.



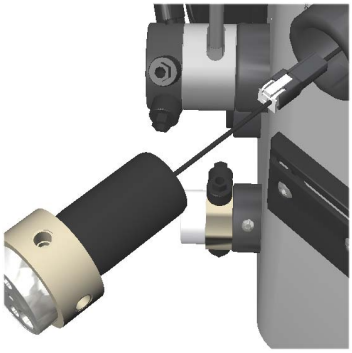
Step	Action
3	Loosen the M3 screw from the **Outlet valve** using a T10 torx driver, supplied with the equipment at delivery. ***Note:*** *The screw can be located on different places on the top circumference of the holder.* 
4	Slowly remove the **Outlet valve** until a cable is visible. The cable is assembled with two connectors interconnected.  

Step	Action
5	Disconnect the connector from the valve side.





6	Remove the **Outlet valve**.
7	Replace with a new **Outlet valve**. Connect the cable, and then reconnect the tubing to the valve ports. ***Note:*** *Before replacing the valve, make sure that the part number on the new valve matches with that of the old valve (29003274 Outlet valve CTV-31-32U-1).*



8	Make sure that the ports are aligned to the markings on the instrument chassi.
9	Switch on the instrument by pressing the Power Switch to the **I** position.

7.10 Conductivity Monitor

Required tools

Tool	Dimension
Torx screwdriver	T20

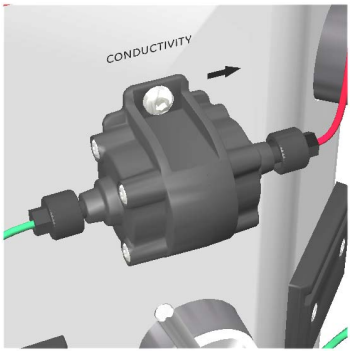
Instructions

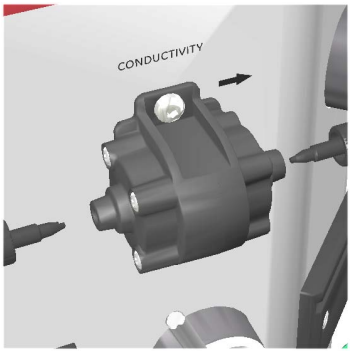
Follow the instructions below to remove and replace the **Conductivity** Monitor.

> **WARNING**
>
> **Disconnect power.** Always switch off power to the instrument before replacing any component on the instrument or cleaning the instrument, unless stated otherwise in the user documentation.

Note: *If required, twist the connector to bring the connector out of the instrument hole, before disassembly the* ***Conductivity*** *Monitor.*

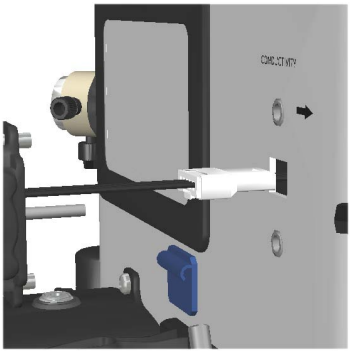
Step	Action
1	Switch off the instrument by pressing the Power Switch to the **O** position.
2	Remove the inlet and outlet tubing from the ports.



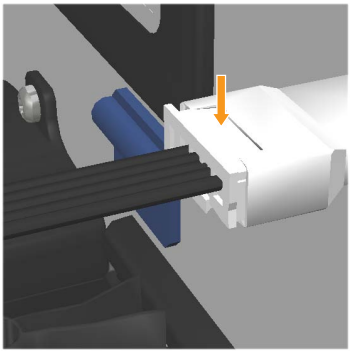


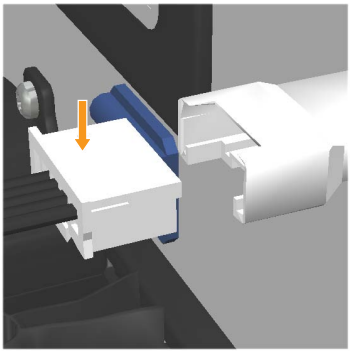
Step	Action
3	Loosen the M4 screws from the **Conductivity** Monitor using a T20 screwdriver, supplied with the equipment at delivery.

4	Slowly remove the **Conductivity** Monitor until a cable is visible. The cable is assembled with two connectors interconnected.



Step	Action
5	Disconnect the connector from the **Conductivity** Monitor side.

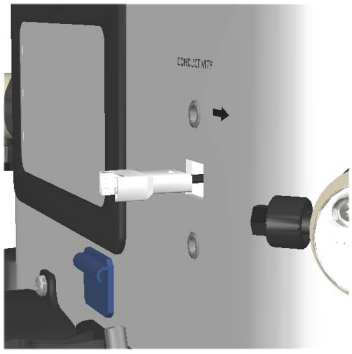


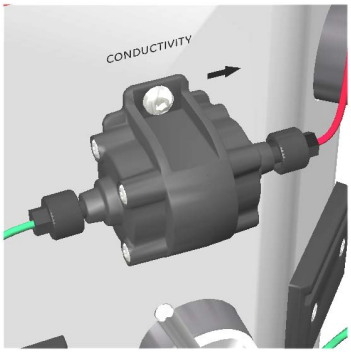


6	Remove the **Conductivity** Monitor and leave the connector as it is.

Note:

Make sure that the connector is not moved inside the cabinet. The connector needs to be retained outside the cabinet for re-assembling of a new ***Conductivity*** *module.*



Step	Action
7	Replace with a new **Conductivity** Monitor and reconnect the tubing to the ports. 
8	Switch on the instrument by pressing the Power Switch to the **I** position.
9	In the ***Settings and service*** screen, access the ***Conductivity*** screen to set the cell constant for the new **Conductivity flow cell**. For details, see *Chapter 5 Service and settings, on page 55*.

7.11 Injection valve

Required tools

Tool	Dimension
Torx driver	T10

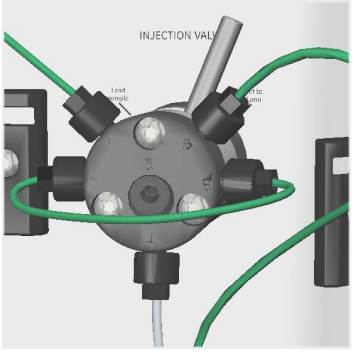
Instructions

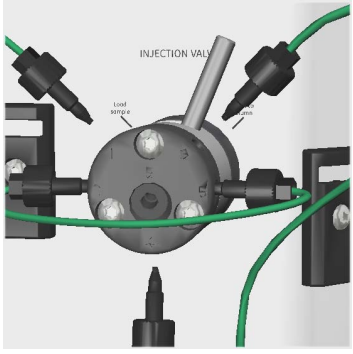
Follow the instructions below to remove and replace the **Injection valve**.

WARNING

Disconnect power. Always switch off power to the instrument before replacing any component on the instrument or cleaning the instrument, unless stated otherwise in the user documentation.

Step	Action
1	Switch off the instrument by pressing the Power Switch to the **O** position.
2	Remove the inlet and outlet tubing from the ports.

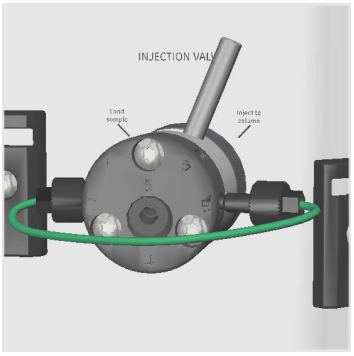


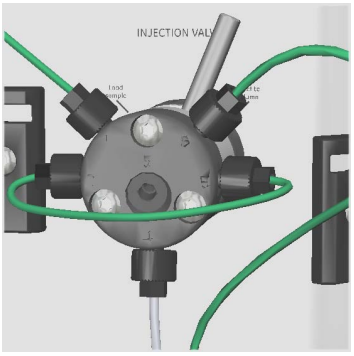


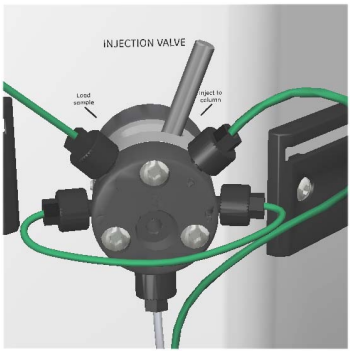
Step	Action
3	Loosen the M3 screw from the **Injection valve** using a T10 torx driver, supplied with the equipment at delivery.

Step	Action
4	Remove the **Injection valve**.

Step	Action
5	Replace with a new **Injection valve** and reconnect the tubing to the ports.







6	Make sure that the ports are aligned to the markings on the instrument chassi.
7	Switch on the instrument by pressing the Power Switch to the **I** position.

7.12 Injection valve kit

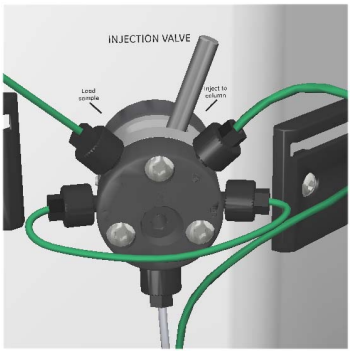
Required tools

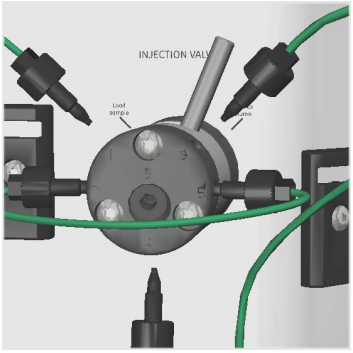
Tool	Dimension
Torx driver	T10

Instructions

Follow the instructions below to remove and replace the **Injection valve** kit.

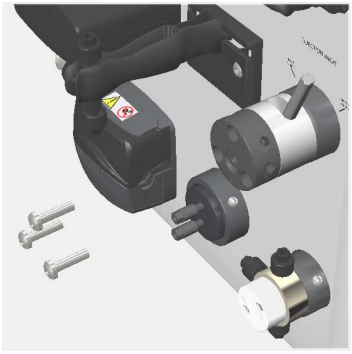
Step	Action
1	Make sure that the valve is in position: **Inject**, and then disconnect the inlet and outlet tubing from the ports.



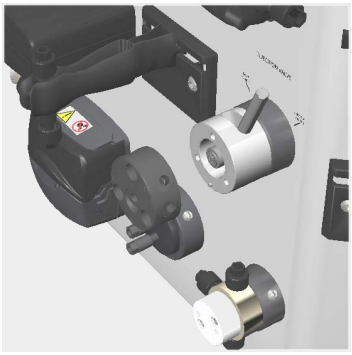


Step	Action
2	Remove the 3 screws on the front side, using the supplied torx driver. Loosen each screw equally in turn, so the distribution plate comes off in parallel to the valve body.

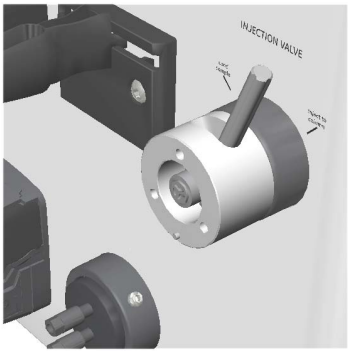
3	Slide the screws out.

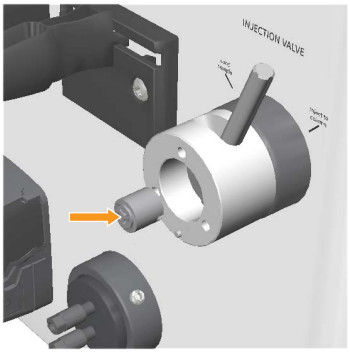


4	Remove the distribution plate containing the ports.



Step	Action
5	Remove the old channel plate and insert a new one.





6	Remount a new distribution plate so that the marks on the plate match the marks on ÄKTA start. Using the torx driver, tighten the 3 screws in turn, a little at a time, until the distribution plate is fixed to the valve body.

7.13 Frac30 Bowl assembly

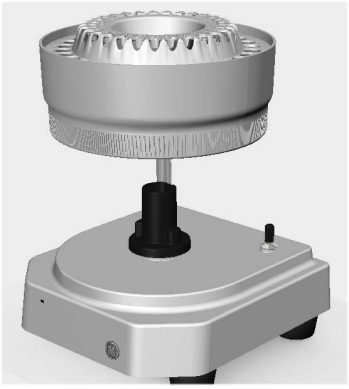
Remove the Bowl assembly

Follow the instructions below to remove the Frac30 Bowl assembly.

Step	Action
1	Gently move the Dispenser arm counterclockwise to the non-dispensing (end) position.

2	Push the drive assembly laterally and hold it at the retracted position.

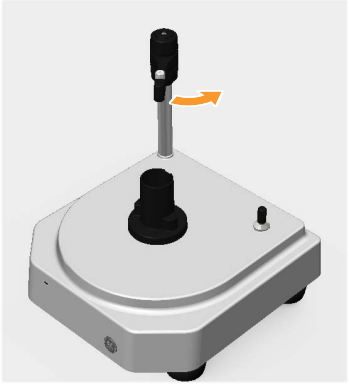
Step	Action
3	Lift and remove the Bowl assembly.



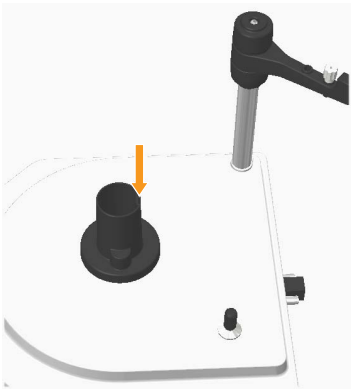
Mount the Bowl assembly onto the Bowl holder

Follow the instructions below to mount the Frac30 Bowl assembly onto the Bowl holder.

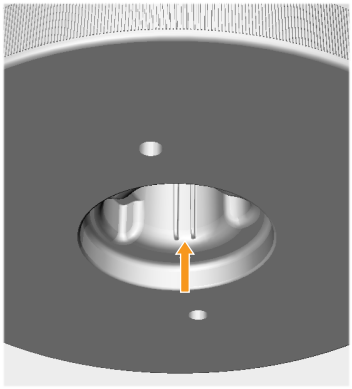
Step	Action
1	Make sure that the Dispenser arm is in the non-dispensing position.



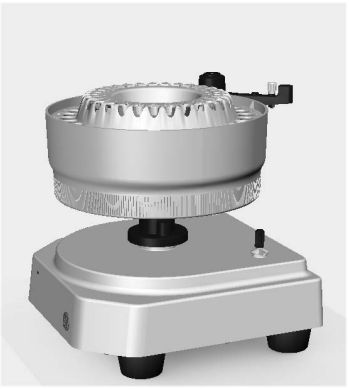
Step	Action
2	Note the position of the aligning groove on the Bowl holder.



Step	Action
3	Note the position of the aligning ribs on the Bowl.



Step	Action
4	Hold the Bowl assembly and orient the Bowl with the aligning ribs oriented towards the aligning groove on the Bowl holder.



Note:

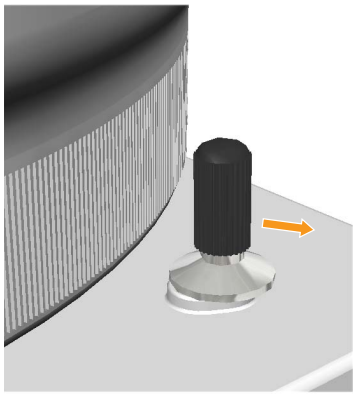
Do not lift the fraction collector by holding the Dispenser arm.

Tip:

If it is hard to locate the alignment feature in corresponding parts, hold the Bowl assembly near the top of the Bowl holder and rotate the Bowl holder unless the aligning ribs gets located.

5	After locating the aligning features, leave the Bowl to slide freely into the Bowl holder.

Step	Action
6	Hold the Drive assembly at the retracted position to completely assemble the Bowl assembly on the Bowl holder.



Remove and fix the drive sleeve

Follow the instructions below to remove and replace the drive sleeve.

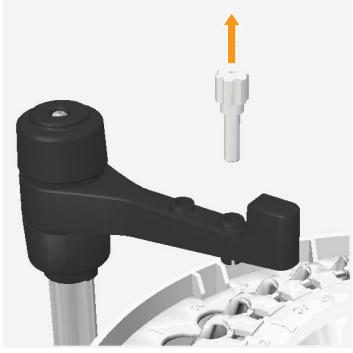
Step	Action
1	Cut the old drive sleeve with a cutter, and then remove the drive sleeve.

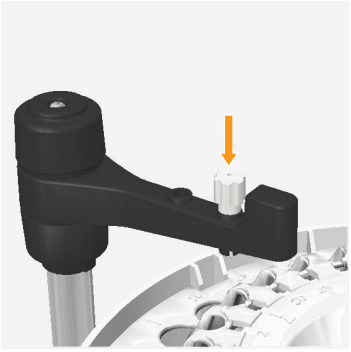
Step	Action
2	Mount a new drive sleeve by pressing and sliding it onto the drive.

Remove and fix the Tubing holder

Follow the instructions below to remove and replace the Tubing holder.

Step	Action
1	Pull out the Tubing holder from the Dispenser arm.



Step	Action
2	Press down the new Tubing holder into the Dispenser arm until it is stopped by the dispensing arm stopping feature. 

7.14 Fuse

Required tools

Tool	Dimension
Flat screwdriver	-

Remove the Fuse

Follow the instructions below to remove the **Fuse**.

Step	Action
1	Use the flat screwdriver provided, and push the *Snap feature* on the left side of the **Fuse** holder, in the direction indicated by the arrow mark.

Step	Action
2	Use the flat screwdriver, and push the *Snap feature* on the right side of the **Fuse** holder, in the direction indicated by the arrow mark.

3	It should now be possible to slide out the **Fuse** from the holder, pull out the **Fuse** by hand.

Mount the Fuse

Follow the instructions below to replace the **Fuse**.

Step	Action
1	Align the **Fuse** holder guide feature to the rectangular slot of the **Mains** filter.

2	Push the **Fuse** holder into the rectangular slot until it fits into the rectangular groove of the **Mains** filter.

8 Reference information

About this chapter

This chapter includes Health and Declaration forms for service, and ordering information for ÄKTA start.

In this chapter

Section	See page
8.1 Health and Safety Declaration Form	204
8.2 Ordering information	206

8.1 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:			

DOC1149542/28-9800-26 AC 05/2014

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.

DOC1149544/28-9800-27 AC 05/2014

8.2 Ordering information

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

Accessories list

Part	Accessory description	Code no.
Pump	Marprene Tubing	29-0240-12
	Peristaltic Pump	29-0239-92
Solenoid valve	**Buffer valve**	29-0238-95
	Sample valve	29-0238-96
	Wash valve	29-0238-97
	Outlet valve	29-0238-98
Manual **Injection valve**	**Injection valve**, Manual	29-0239-58
	Valve kit, Manual INV	29-0239-17
Mixer	Mixer, ÄKTA start	29-0239-60
UV	UV module, ÄKTA start	29-0240-18
	Flow Cell 2 mm UPC-900	29-0113-25
Conductivity	Conductivity Cell, ÄKTA start	29-0240-21
Sample loops	Sample Loop, PEEK, 10 µl	18-1120-39
	Sample Loop 100 µl, INV-907	18-1113-98
	Sample Loop 500 µl, INV-907	18-1113-99
	Sample Loop 1.0 ml, INV-907	18-1114-01
	Sample Loop 2.0 ml, INV-907	18-1114-02
	Sample Loop 5 ml, PEEK	18-1140-53
	Sample Loop	18-1161-24
Superloop™	Superloop 10 ml ÄKTA	18-1113-81
	Superloop 50 ml ÄKTA	18-1113-82
	Superloop 150 ml	18-1023-85

Part	Accessory description	Code no.
Fittings	Tubing Connector 1/8"	18-1121-17
	Ferrule for 1/8" tubing	18-1121-18
	Union Luer Female/HPLC Male	18-1112-51
	Fingertight Connector 1/16"	18-1112-55
	Stop plug 1/16", PKG/5	18-1112-52
	Stop plug, 5/16", PKG/5	18-1112-50
	Union, 1/16" female/1/16" female, for 1/16" o.d. tubing, titanium	18-3855-01
	Union Valco F/F	11-0003-39
	Fill port	18-1127-66
Tubing	Inlet tubing Kit, ÄKTA start	29-0240-32
	Complete tubing kit, ÄKTA start	29-0240-34
	PEEK tubing i.d. 0.75 mm (1/16")	18-1112-53
	PEEK tubing i.d. 1.0 mm (1/16")	18-1115-83
	PEEK tubing, 2 m/i.d. 0.5 mm/o.d. 1/16"	18-1113-68
Cables	Mains cable, 115 V	19-2447-01
	Mains cable, 220 V	19-2448-01
	Cable Assy OTH USB	29-0240-36

Part	Accessory description	Code no.
Miscellaneous	Inlet filter assembly	18-1113-15
	Inlet filter set, 10 Filters/Nets	18-1114-42
	Screw lid GL45 kit, ÄKTA	11-0004-10
	Tubing cutter	18-1112-46
	Column clamp o.d. 10 to 21 mm	28-9563-19
	Short column holder	18-1113-17
	T-Slot holders	29-0240-38
	Buffer tray ÄKTA start	29-0240-39
	Accessory Box	29-0240-37
	Operating Instructions, printed	29-0270-57
	Maintenance Manual, printed	29-0603-08
	Injection kit	18-1110-89
Software	UNICORN start DVD, license access code and manual package	29-0187-51
Frac30	Frac30 Assembly	29-0230-51
	Drive sleeve	19-6067-02
	Tubing holder	18-6464-01
	Bowl Assembly, Frac30	29-0240-45
	Cable Assembly, Frac30	29-0240-65

ÄKTA start spare parts

Item	Code no.
Packaging Kit for ÄKTA start	29-0320-87
Packaging Kit for Frac30	29-0337-03

Service tools

Item	Code no.
Torx driver T10	29-0031-71
Torx driver T20	28-9513-03
Flat screwdriver	56-4656-00

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

GE Healthcare Bio-Sciences AB
Björkgatan 30
751 84 Uppsala
Sweden

www.gelifesciences.com/AKTA

GE Healthcare Europe GmbH
Munzinger Strasse 5, D-79111 Freiburg, Germany

GE Healthcare UK Limited
Amersham Place, Little Chalfont, Buckinghamshire, HP7 9NA, UK

GE Healthcare Bio-Sciences Corp.
800 Centennial Avenue, P.O. Box 1327, Piscataway, NJ 08855-1327, USA

GE Healthcare Japan Corporation
Sanken Bldg. 3-25-1, Hyakunincho Shinjuku-ku, Tokyo 169-0073, Japan

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