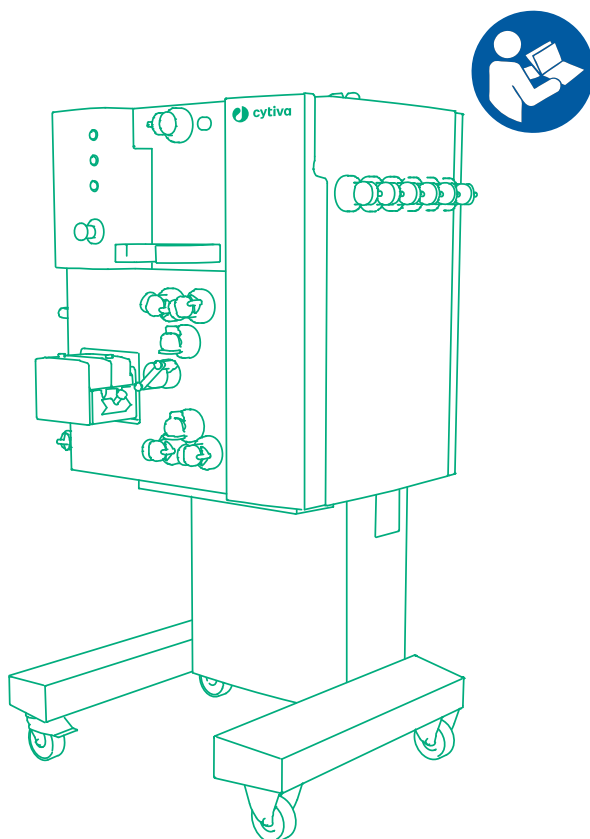
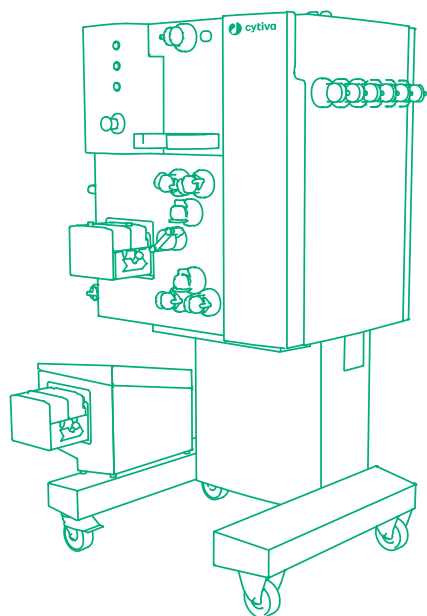


# ÄKTA ready™

## Operating Instructions

Original instructions



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# 1 Introduction

## About this chapter

This chapter contains information about this manual and associated user documentation, important user information, and intended use of the product.

## In this chapter

Section		See page
1.1	Important user information	6
1.2	About this manual	8
1.3	Associated documentation	10
1.4	Additional user documentation - additional/specific documentation	12
1.5	Abbreviations	13

## 1.1 Important user information

### Introduction

This section contains important user information about the product and this manual.

### 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 install, operate, or perform maintenance on the product in any other way than described in the user documentation. If you do, you may be exposed or expose others to hazards that can lead to personal injury and you may cause damage to the equipment.

### Intended use of the product

ÄKTA ready™ is intended to be operated as an isocratic or gradient, low pressure, automated liquid chromatography system using corresponding isocratic or gradient flow kit and ReadyToProcess™ columns.

ÄKTA ready is controlled by UNICORN™ software.

The system is based on proven liquid chromatography techniques, such as ion exchange, affinity chromatography, and hydrophobic interaction.

ÄKTA ready is biocompatible and hygienic, and meets all GLP and cGMP demands for drug development and manufacturing.

ÄKTA ready is not approved for use in a potentially explosive atmosphere or for handling flammable liquids.

Flow kits and columns are not included in the system and are ordered separately. See the Cytiva website for ordering information and lists of available flow kits.

### Prerequisites

In order to operate the system in the way it is intended, the following prerequisites must be fulfilled:

- The user must be acquainted with the use of general bioprocessing equipment and with handling of biological materials.
- The user must read and understand the Safety Instructions chapter in the *Operating Instructions*.

- The user must have a working knowledge of UNICORN software. A user account must have been created according to the *UNICORN Administration and Technical Manual (29191899)*.
- The user must have a working knowledge of Windows operating system.
- The system must be installed in accordance with the site requirements and instructions in the *Operating Instructions*.

## 1.2 About this manual

### Introduction

This section contains information about the purpose and scope of this manual, notes and tips, and typographical conventions.

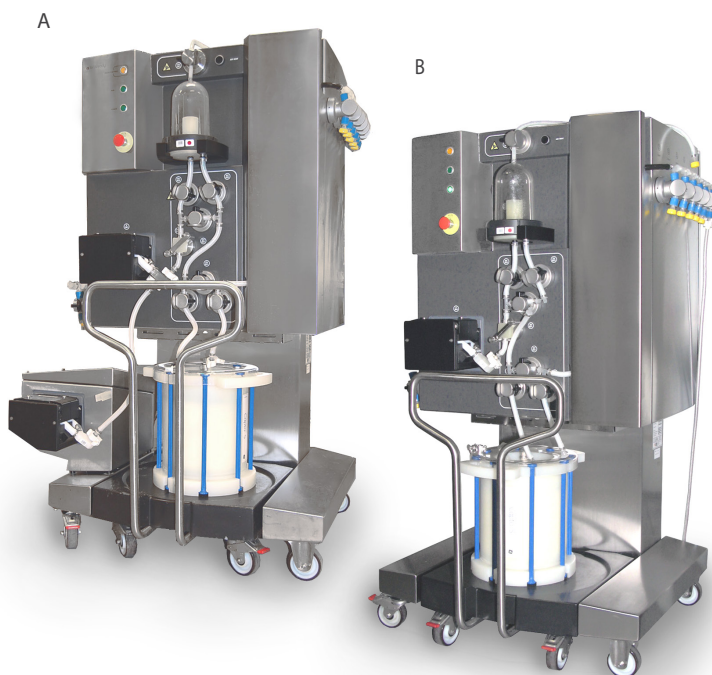
### Purpose of this manual

This manual provides information needed to install, operate and maintain the product in a safe way.

### Scope of this manual

This *Operating Instructions* manual is valid for the ÄKTA ready and ÄKTA ready gradient systems. Both systems are also referred to as "the products" in this manual. This manual also describes the isocratic and gradient flow kits used with the ÄKTA ready and ÄKTA ready gradient systems, respectively.

The illustration below shows ÄKTA ready gradient system (A) and ÄKTA ready system (B). Both systems are shown with the flow kit, the connected ReadyToProcess column, and the column trolley.



The systems are operated using UNICORN.

Detailed information about columns, chromatography resins and buffer tanks is not included in this manual.

## Notes and tips

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

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

## Typographical conventions

Software items are identified in the text by ***bold italic*** text.

Hardware items are identified in the text by **bold** text.

**Tip:** *The text can include clickable hyperlinks to reference information.*

## 1.3 Associated documentation

### Introduction

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

### User documentation for ÄKTA ready

The user documentation is listed in the table below.

Translations of the *Operating Instructions* are provided on the User Documentation CD (or USB flash drive) together with the *Product Documentation*, and *Unpacking Instructions*.

Documentation	Main contents
ÄKTA ready <i>Operating Instructions</i> (28960345) (this document)	Instructions needed to prepare and operate the ÄKTA ready system in a correct and safe way.  System overview, site requirements, and instructions for moving the system within the same building.  Instructions for basic maintenance and troubleshooting.
ÄKTA ready <i>Site Preparation Guide</i> (29135897)	Information needed to prepare the site for installation and use of the ÄKTA ready system.
ÄKTA ready <i>Unpacking Instructions</i> (28994489)	Instructions for handling the delivery package and unpacking the ÄKTA ready system.
ÄKTA ready <i>Flow Kit Product Documentation</i> (28930007)	Describes the ÄKTA ready Flow Kit general specifications and material conformity.

## Related literature

This list describes related literature that can be downloaded or ordered from Cytiva. Contact your Cytiva representative for more details.

Document name	Description	Product code
<i>ReadyToProcess columns User Manual</i>	User Manual	28925644
<i>ReadyToProcess columns</i>	Data file	28915987
<i>Keep your ÄKTA ready operating in peak condition</i>	Preventive Maintenance PM Fact Sheet	28998083
<i>Process chromatography: A guide to optimization, scale-up and validation</i>	Handbook	18112156
<i>Efficiency test of ReadyToProcess columns</i>	Application note	28919821
<i>Ready-to-use fluid management solutions for chromatography systems</i>	Application note	28995879
<i>Purification of a monoclonal antibody using ReadyToProcess columns</i>	Application note	28919856
<i>Downstream scale-up purification of influenza virus using ReadyToProcess equipment</i>	Application note	29043549
<i>Connected polishing and concentration under one automation method</i>	Application note	KA985271017AN

## Access user documentation online

Scan the QR code or visit [cytiva.com/instructions](https://www.cytiva.com/instructions). Enter the title or the document number to access the file.



## 1.4 Additional user documentation - additional/specific documentation

### Introduction

This section describes the product-specific documentation delivered with the product and component documentation.

### Product-specific documentation

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

The following table provides examples of technical specification documents that can be found in the documentation package delivered with the product.

Document	Abbrevia- tion	Purpose/Contents
Piping and Instrumen- tation Diagram	P&ID	Schematic overview of the process flow, components and instruments and the control system.
General Specification	GS	Technical data for the system.
General arrangement drawing	GAD	Physical layout. Provides dimensional data.
Bill of Material	BOM	Description of process-related compo- nents, including wetted materials and specifications.
Declaration of Conformity	DoC	Declaration of Conformity for EU and/or other regions.
Spare Part List	SPL	List of spare parts available from Cytiva.

### Component documentation

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

## 1.5 Abbreviations

### Introduction

This section explains abbreviations that are used in the user documentation for ÄKTA ready.

### Abbreviations

Abbreviation	Definition (English)	Translation (local language)
cGMP	Current Good Manufacturing Practices	Current Good Manufacturing Practices
CIP	Cleaning-in-place	Cleaning-in-place
GLP	Good laboratory practice	Good laboratory practice
HV	Manually actuated valve (hand valve)	Manually actuated valve (hand valve)
I/O	Input/Output	Input/Output
PID	Proportional integral derivative	Proportional integral derivative
rpm	Revolutions per minute	Revolutions per minute
TC	Hygienic tubing connection	Hygienic tubing connection
UPS	Uninterruptible power supply	Uninterruptible power supply
XV	Pneumatically actuated valve (automatic valve)	Pneumatically actuated valve (automatic valve)

## 2 Safety instructions

### About this chapter

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

### In this chapter

Section	See page
2.1 Safety precautions	15
2.2 Labels and symbols	19
2.3 Emergency procedures	21

### Important



#### **WARNING**

**All users must read and understand the entire contents of this general safety chapter, and the specific safety precautions information in each subsequent chapter of this manual to become aware of the hazards involved.**

## 2.1 Safety precautions

### Introduction

ÄKTA ready is powered by mains voltage and handles materials that can be hazardous.

Before installing, operating, or maintaining the system, you must be aware of the hazards described in this manual.

The general precautions presented in this chapter must be considered at all times. The context related precautions are located in their respective chapters.

### Definitions

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.

### General precautions

The following general precautions must be considered at all times. There are also context related precautions, which are written in their respective chapters.



#### **WARNING**

**Risk assessment.** Perform a risk assessment for the process or process environment. Evaluate the effects the use of the product and the operational processes may have on the classification of the hazardous area. The process can cause the hazardous area to increase or the zone classification to change. Implement the risk reduction measures needed, including use of personal protective equipment.



#### **WARNING**

Do not operate the product in any other way than as described in the user documentation.



#### **WARNING**

All installation, maintenance, operation, and inspection must be carried out according to local regulations by adequately trained personnel.



#### **WARNING**

**Protective earth.** The product must be connected to protective earth when energized.



#### **WARNING**

Only authorized personnel may open the electrical cabinet doors. There is hazardous voltage inside the electrical cabinet that can cause human injury or death.



#### **WARNING**

**Hazardous voltage.** The electric cabinet doors may only be opened when the system is taken out of operation and subject to Lock Out / Tag Out (LOTO).

**WARNING**

Do not use the product if it is not working properly, or if it has suffered any damage including:

- damage to the power cord or its plug,
- damage caused by dropping the product,
- damage caused by splashing liquid onto the product.

**WARNING**

**Emergency stop.** Pressing the **EMERGENCY STOP** does not automatically depressurize the flow path.

**WARNING**

**Emergency stop.** Pressing the **EMERGENCY STOP** does not shut off mains power to the cabinet.

**WARNING**

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

## Personal protection

**WARNING**

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

**WARNING**

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

**CAUTION**

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

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

**WARNING**

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

## Flammable liquids and explosive environment

**WARNING**

**Flammable liquids.** This product is **not approved** for handling liquids under conditions when they can be flammable.

**WARNING**

**Explosion hazard:** The product is **not approved** for use in a potentially explosive atmosphere. The product does not fulfill the requirements of the ATEX Directive.

**WARNING**

Some of the chemicals used with the system can be flammable under certain conditions. Make sure to use chemicals only under conditions where they are not flammable. Refer to local and/or national classifications of flammable liquids.



## 2.2 Labels and symbols

### Introduction

This section describes the nameplate, labels, and other safety and regulatory information attached to the product.





### System nameplate

The following symbols and text may be present on the system label.

Symbol/text	Description
Code Number	The number that identifies the system as ÅKTA ready.
System Number	The unique system installation number.
Manufacturing Year/ Month	Manufacturing year and month.
Supply Voltage	Voltage alternatives for ÅKTA ready.
Configured For	Voltage the system is currently configured for.
Frequency	Supply voltage frequency.
Max Power Consumption	Maximum effect of the system.
Pneumatic Supply	Pneumatic supply pressure requirement.
Protection Class	Protection class. Ingress protection according to IEC 60529.
	This symbol indicates that the waste of electrical and electronic equipment must not be disposed of as unsorted municipal waste and must be collected separately. Contact an authorized representative of the manufacturer for information concerning the decommissioning of equipment.
	<b>Warning!</b> Read the user documentation before using the system. Do not open any covers or replace parts unless specifically stated in the user documentation.

### Safety labels

The table below describes the various safety labels that can be found on the system.

Symbol/Text	Description
	<b>Warning!</b> Read the user documentation before using ÄKTA ready. Do not open any covers or replace parts unless specifically stated in the user documentation.
	<b>Warning! Hazardous voltage.</b> Disconnect power before servicing. Authorized personnel only.
	<b>Warning! Pinch hazard.</b> Never put your fingers or any objects other than the intended tubing in the pinch valve openings. Make sure that clothing or other equipment does not get caught in the pinch valves.
	<b>Warning! Rotating rollers/cogwheels.</b> Never touch the pump or pump lid while the pump is running.

## 2.3 Emergency procedures

### Introduction

This section describes how to shut down the ÄKTA ready system in an emergency situation, and the procedure for restarting the system.

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

### Safety precautions



#### **WARNING**

**Emergency stop.** Pressing the **EMERGENCY STOP** does not shut off mains power to the cabinet.



#### **WARNING**

**Pressurized flow path.** During a power failure or emergency stop, the equipment can remain pressurized. Make sure all lines and vessels are depressurized before opening a line or vessel.



#### **WARNING**

**Access to power switch and power cord.** The power switch must always be easy to access. The power cord must always be easy to disconnect.

### Emergency shutdown

In an emergency situation, follow the steps below to stop the run.

**Step      Action**

- 1      Push the **EMERGENCY STOP** button on the front of the system cabinet.



*Result:*

The pump motor stops immediately. The system is set in **Pause** mode.

- 2      Turn the **MAINS POWER** switch to the **O** position to completely turn off power to the system.
- 3      Release the pressure from all lines and the vessel if you need to open the connections: press and hold the **AIR VENT** button to open the air trap valve.

**Power failure**

The following table describes the consequences of power failure to parts of the system.

Power failure	Result
ÄKTA ready cabinet	<ul style="list-style-type: none"><li>• The pump stops immediately.</li><li>• The valves change to their default position.</li><li>• The connection to the control software is lost and UNICORN shows the <b>Connection lost</b> message.</li><li>• The data is temporarily stored in the control unit <b>CU960</b>.</li></ul> <p>After the power is restored, the run goes to the <b>End</b> state. The temporarily stored data is automatically copied to UNICORN.</p>

Power failure	Result
Computer	<ul style="list-style-type: none"> <li>The computer and UNICORN shut down.</li> <li>The connection between UNICORN and ÄKTA ready is lost.</li> <li>The run continues, and data is temporarily stored in the control unit <b>CU960</b>.</li> </ul> <p>After the power and the connection are restored, the temporary data from the control unit <b>CU960</b> is automatically copied to UNICORN. The run continues and can be accessed again through UNICORN.</p>
Compressed air system	<ul style="list-style-type: none"> <li>The inlet and outlet valves close.</li> <li>All other valves open.</li> <li>The pressure is released through the air trap.</li> </ul> <p><b>Note:</b> <i>The purification product may be damaged.</i></p>

Connection to a UPS can enable the system to continue to operate for a limited time. A UPS is not included with the system. Contact your local Cytiva representative for more information about the options for your specific system.

## Restart after emergency shutdown or power failure

To restart the system, follow the steps below:

Step	Action
1	Make sure that the condition that caused the power failure or emergency stop is corrected.
2	Reset the <b>EMERGENCY STOP</b> button by turning it clockwise.



3	Click <b>Continue</b> in UNICORN.
---	-----------------------------------

# 3 System description

## About this chapter

This chapter provides an overview of the technical properties of the ÄKTA ready system.

## In this chapter

Section		See page
3.1	Overview	25
3.2	System illustrations	26
3.3	System components	31
3.4	Flowchart	36
3.5	Flow kits	38
3.6	UNICORN control system	47

## 3.1 Overview

### Description

ÄKTA ready is an automated, low pressure liquid chromatography system that can be operated as an isocratic or a gradient system. ÄKTA ready is used together with the isocratic or gradient flow kit and ReadyToProcess columns.

The documents referred to are part of the documentation package provided in the delivery.

### System overview

ÄKTA ready consists of a stainless steel electrical cabinet and a skid. The cabinet has valves and holders for fitting a flow kit (isocratic or gradient). The system is equipped with four polyurethane casters. Two casters are lockable. The system is equipped with transmitters and connection points for the flow kit sensors and meters.

The system is easy to move and keep clean and is designed for use in a production environment.

Refer to the Bill of Material for more detailed information on the type of transmitters. Refer to the General Specification for information on the materials of construction.

### Control system overview

The system is controlled by the UNICORN software from a free-standing computer. The computer is not supplied with the ÄKTA ready system.



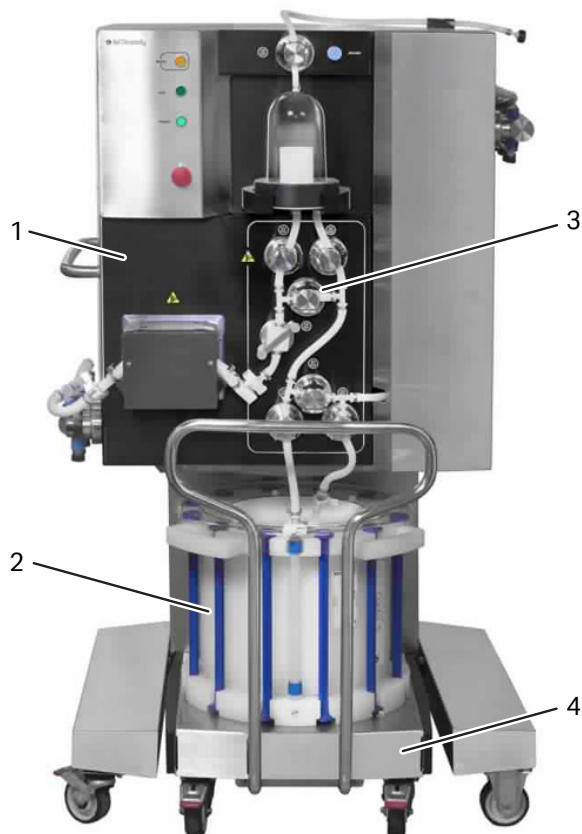
#### NOTICE

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

For more information see [Section 3.6 UNICORN control system, on page 47](#).

## 3.2 System illustrations

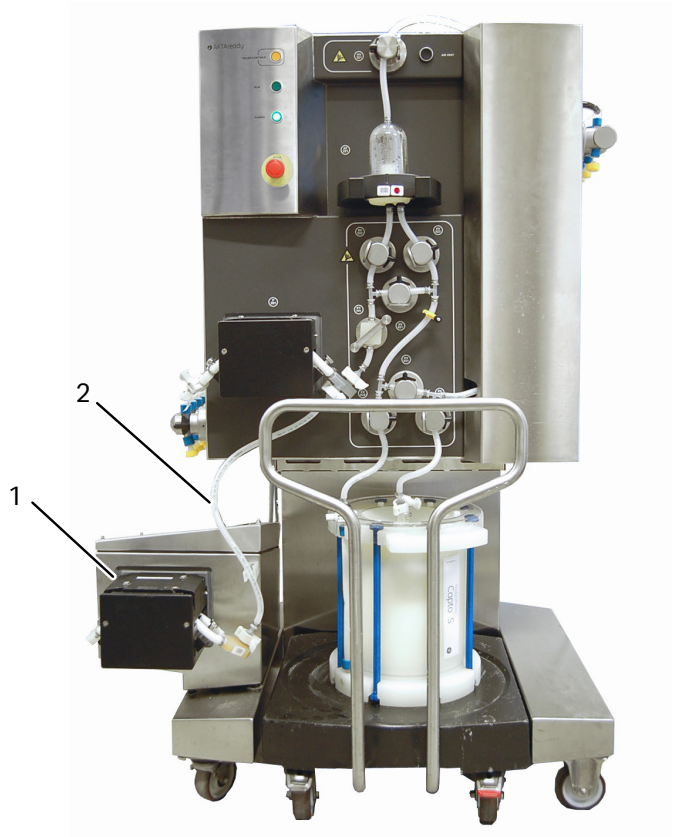
### ÄKTA ready with a flow kit



Part	Function
1	ÄKTA ready cabinet
2	ReadyToProcess column (ordered separately)
3	ÄKTA ready flow kit (ordered separately)  <b>Note:</b> See <a href="#">Section 3.5.1 Flow kit overview, on page 39</a> for more information.
4	Column trolley

ÄKTA ready gradient with a flow kit

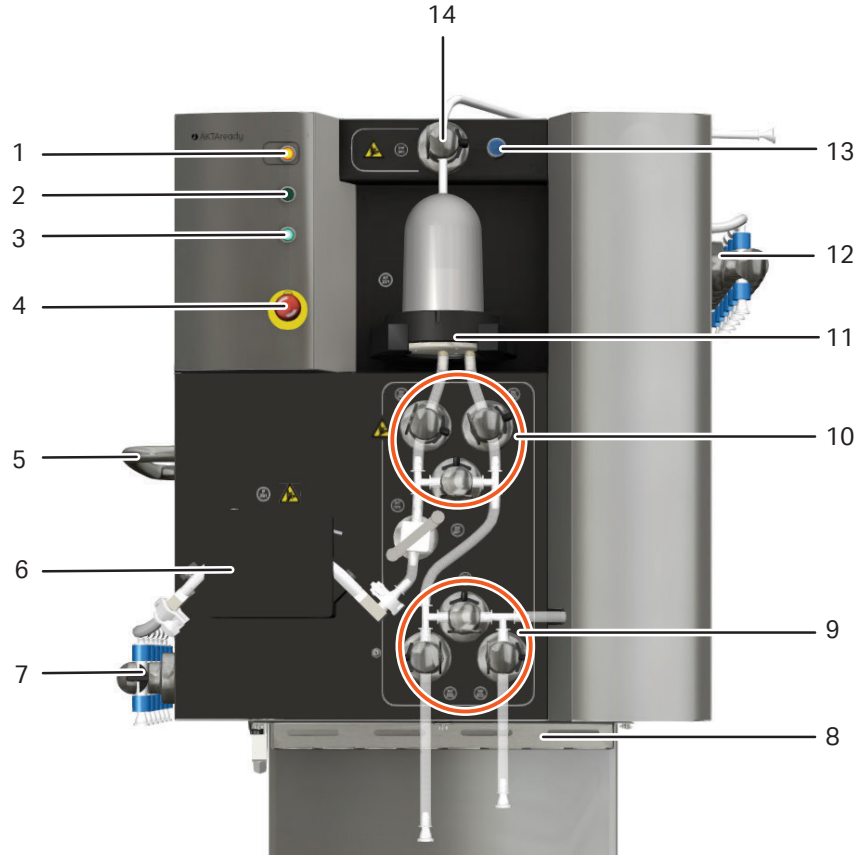
The gradient pump is an optional component of the ÄKTA ready.



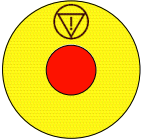
Part	Function
1	ÄKTA ready gradient pump
2	ÄKTA ready gradient flow section
	<b>Note:</b> See <a href="#">Section 3.5.1 Flow kit overview, on page 39</a> for more information.

### ÄKTA ready detailed view

The following illustration shows a detailed view of the ÄKTA ready cabinet front. The system is shown with an isocratic flow kit.



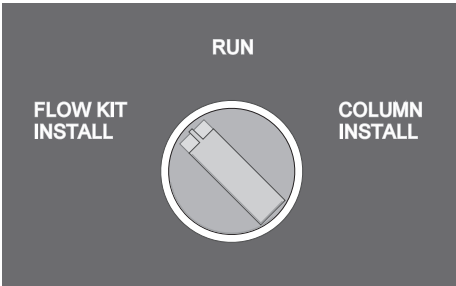
Part	Component	ID tag	Description
1	<b>PAUSE/CONTINUE</b> button and alarm indicator lamp	N/A <sup>1</sup>	Pressing the button pauses an ongoing process. Pressing second time continues the process. Shows steady yellow light during pause. Flashing yellow light indicates UNICORN alarm.
2	<b>RUN</b> indicator lamp	N/A <sup>1</sup>	Shows green light when the system is running. No light when system is idle (e.g., between runs or during pause).
3	<b>POWER</b> indicator lamp	N/A <sup>1</sup>	Shows flashing green light during initial communication connection with UNICORN software, when power is switched on. Steady green light when power is on and communication is established.

Part	Component	ID tag	Description
4	<b>EMERGENCY STOP</b> button  	N/A <sup>1</sup>	Stops the pump and places the system in <b>Pause</b> mode.
5	Handle	N/A <sup>1</sup>	Used to move the system.
6	System pump	<b>P-201</b>	Peristaltic pump for buffer and sample input.
7	Inlet valves	<b>XV-001</b> to <b>XV-006</b>	Six valves for liquid input.
8	Air filter	N/A <sup>1</sup>	Cabinet air filter.
9	Column valves	<b>XV-031</b> to <b>XV-033</b>	Three valves for column connection or bypass.
10	Air trap valves	<b>XV-021</b> to <b>XV-023</b>	Three valves for putting the air trap inline or bypass.
11	Air trap holder	N/A <sup>1</sup>	Holder for the air trap.
12	Outlet valves	<b>XV-051</b> to <b>XV-056</b>	Six valves for liquid outlet.
13	<b>AIR VENT</b> button	N/A <sup>1</sup>	Opens the <b>HV-301</b> valve for releasing excess air from the air trap.
14	Air trap vent valve	<b>HV-301</b>	Manual valve controlling the air flow to the air trap.

<sup>1</sup> Not applicable.

## Installation switch

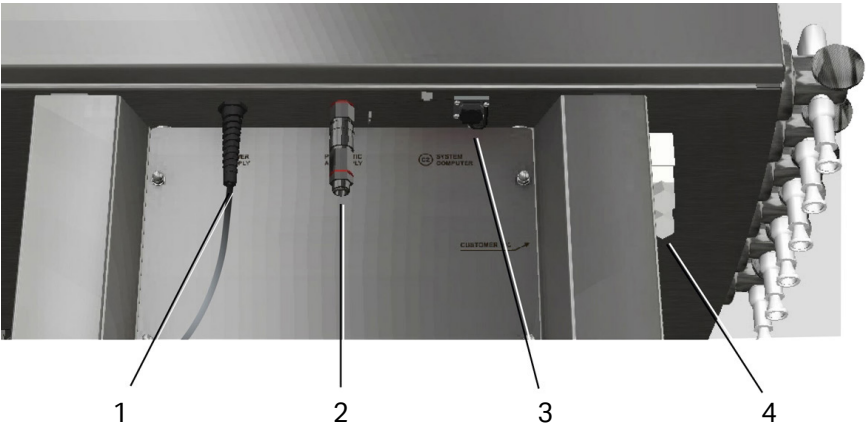
The installation switch is located on the front of the ÄKTA ready cabinet, in the upper right corner. The installation switch is used for opening and closing the valves during the flow kit installation and the column installation. The positions of the installation switch are described below.



Position	Description
<b>FLOW KIT INSTALL</b>	All valves are open. The user can manually open and close the valve safety locks.
<b>RUN</b>	All valves are engaged and controlled by UNICORN. The user cannot open the valve safety locks.
<b>COLUMN INSTALL</b>	The valves between air trap outlet and column inlet are open. Air can be removed from the tubing between the column and the air trap.

Connectors

Connectors for system power, pressurized air, customer I/O, and computer network are located on the back of the system. The following illustration shows the location of the connectors.



Part	ID tag	Description
1	<b>POWER SUPPLY</b>	System power cable
2	<b>PNEUMATIC AIR SUPPLY</b>	Compressed air connector
3	<b>SYSTEM COMPUTER</b>	Ethernet network connector
4	<b>CUSTOMER I/O</b>	User I/O connector

# 3.3 System components

## Introduction

This section provides the overview of ÄKTA ready components.  
For further details and specifications refer to the documentation package provided with the system.

## In this section

Section		See page
3.3.1	Skid and electrical cabinet	32
3.3.2	Pumps	33
3.3.3	Valves	34

### 3.3.1 Skid and electrical cabinet

#### Skid and cabinet

The ÄKTA ready hardware consists of a stainless steel cabinet that is placed on a skid. The stainless steel cabinet contains electrical and pneumatic components, and the control unit. The isocratic pump is attached to the cabinet.

#### Control unit CU-960

A **CU-960** control unit is the controlling interface between UNICORN and the components of ÄKTA ready. The **CU-960** is located inside the electrical cabinet.

The **CU-960** has capabilities to store real time data during short disconnection from the computer. Data stored on the **CU-960** can be uploaded to the computer when communication with the computer is re-established. Data upload from the **CU-960** to the computer is shown on the monitor and can take several minutes. ÄKTA ready can control the system again when the data upload is completed.

For more information about uploading data from the **CU-960** refer to the UNICORN manual package.



#### NOTICE

Unsaved data are lost, if UNICORN or the Windows operating system are forced to close during data upload.

## 3.3.2 Pumps

### Description

ÄKTA ready is equipped with one or two pumps depending on the configuration.

- Pump **P-201** is used for isocratic operation.
- Pumps **P-201** and **P-202** are used for gradient operation.

Each pump is a peristaltic pump with the capacity up to 510 L/h at a back pressure up to 4 bar g.

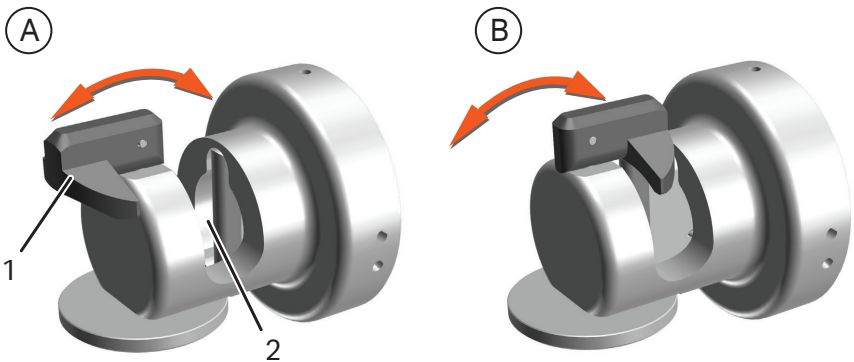
A peristaltic pump is a pump without valves or seals, avoiding clogging or corrosion. The liquid is in contact only with the inside of the tubing that eliminates the risk of contamination. For specifications refer to the General Specification or the manufacturer's user documentation in the product documentation package.

### 3.3.3 Valves

#### Pinch valves

Pinch valves are used to control the path of the liquid through the flow kit. The valves have manually operated safety locks keeping the tubing in place and preventing the valves from accidentally closing during the flow kit installation. Each safety lock is opened by lifting the black handle and turning it outward, and closed by turning the handle inward.

The following illustration shows an unlocked (A) and a locked (B) pinch valve.



Part	Description
1	Safety lock (manually operated)
2	Pinch valve opening for tubing

All valves on the ÄKTA ready system are pinch valves. The system has 19 pinch valves.



**WARNING**

Never put fingers or any objects other than the intended tubing into the pinch valve opening.

#### Air trap valves

The air trap valve set consists of three valves. The table below shows the state of the air trap valves at specific valve positions.

Valve position	Open valves
<b>Bypass</b>	<b>XV-021</b>
<b>Inline</b> (default)	<b>XV-022 + XV-023</b>

When the system is set to the **Pause** mode, the air trap valves remain in the same position as during the run. The user can change this setting in the **System Settings** in UNICORN.

## Column valves

The column valve set consists of three valves.

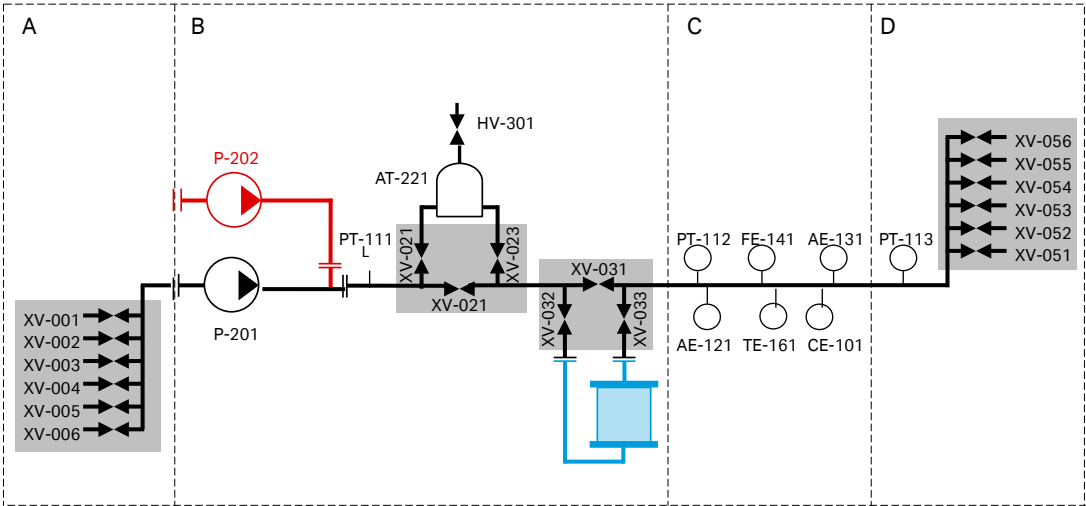
The table below shows the state of the column valves at specific valve positions.

Valve position	Open valves
<b><i>Bypass</i></b>	<b>XV-031</b>
<b><i>Inline</i></b>	<b>XV-032 + XV-033</b>

### 3.4 Flowchart

#### Flowchart illustration

The following illustration shows a schematic diagram of the ÄKTA ready flow path.



Color	Description
Black	Isocratic flow kit components
Red	Gradient flow section
Blue	Column
Gray	Valve blocks

The table below describes the system components shown in the flowchart.

Label	Description
<b>AE-121</b>	pH electrode (optional)
<b>AE-131</b>	UV sensor
<b>AT-221</b>	Air trap
<b>CE-101</b>	Conductivity sensor
<b>FE-141</b>	Flow meter
<b>HV-301</b>	Air trap vent valve
<b>P-201</b>	System pump
<b>P-202</b>	Gradient pump (optional)

Label	Description
<b>PT-111 to PT-113</b>	Pressure sensors
<b>TE-161</b>	Temperature sensor
<b>XV-001 to XV-006</b>	Buffer A inlet valves
<b>XV-051 to XV-056</b>	Outlet valves

## Pressure limits

The table below specifies the maximum operating pressure of parts A to D in the flow path, as shown in the flowchart.

Part	Description	Pressure
A	Inlet valves	0.6 bar (0.06 MPa)
B	Pump, pre-column pressure sensor <b>PT-111</b> , air trap and column	5.0 bar (0.5 MPa)
C	Post-column sensors	2.0 bar (0.2 MPa)
D	Outlet valves and post-column pressure sensor <b>PT-113</b>	0.95 bar (0.095 MPa)

# 3.5 Flow kits

## Introduction

This chapter provides descriptions of the disposable flow kits and an overview of the components.

The flow kit specifications are described in the product documentation provided with each flow kit.

## In this section

Section		See page
3.5.1	Flow kit overview	39
3.5.2	Flow kit sensors	44

### 3.5.1 Flow kit overview

#### Description

ÄKTA ready can be used for isocratic or gradient operation. The table below shows the flow kit components needed for these operations.

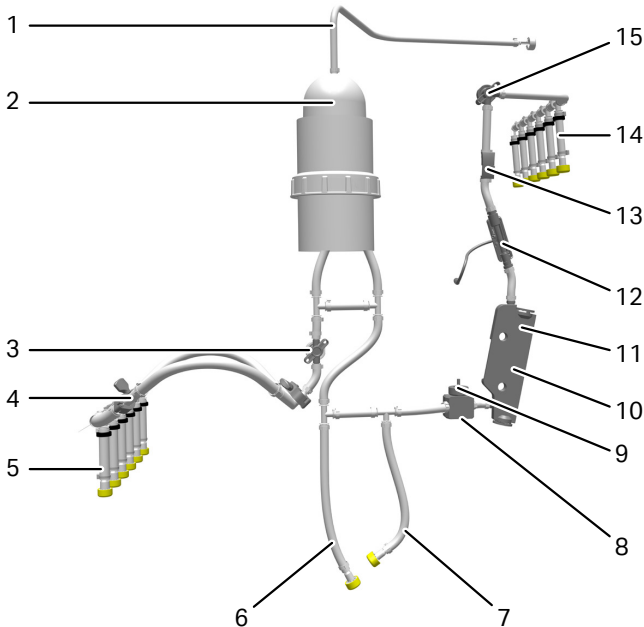
Operation mode	Required flow kit parts
Isocratic	<ul style="list-style-type: none"><li>Flow kit</li></ul>
Gradient	<ul style="list-style-type: none"><li>Flow kit</li><li>Gradient flow section</li></ul>

For specifications and material information, refer to the product documentation provided with the flow kit. For chemical resistance of the flow kit, see [Allowed chemicals, on page 185](#).

#### Illustration of the isocratic flow kit

**Note:** Some flow kit components are flow cells for sensors that are located on the system cabinet. Their ID tags technically refer to the sensors, not to the flow cells. In the table further down the tags are used for identification of both the sensors and the corresponding flow cells.

The following illustration shows the isocratic flow kit.



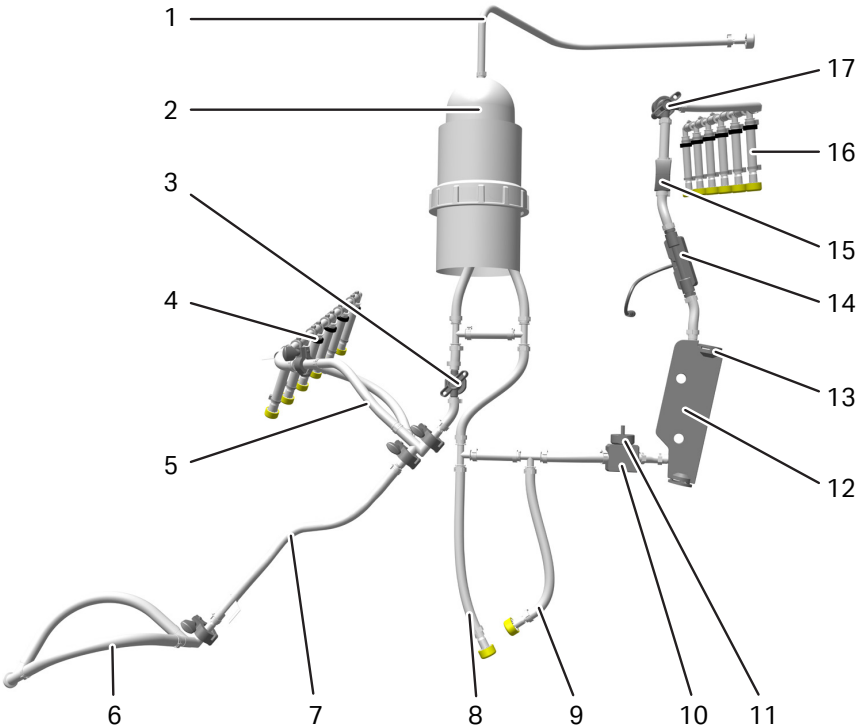
Part	Component	ID tag	Description
1	Air vent tubing	N/A <sup>1</sup>	Air flow to and from the air trap. Manually controlled by the <b>AIR VENT</b> button through valve <b>HV-301</b> .
2	Air trap	<b>AT-221</b>	Allows removal of air from buffers and sample. Manually filled with liquid by pressing the <b>AIR VENT</b> button (air is released).
3	Pressure sensor	<b>PT-111</b>	Measures the pressure after the pump. Part of the safety monitoring of the high pressure.
4	Pump tubing	N/A <sup>1</sup>	Liquid input using a peristaltic pump.
5	Inlet manifold	<b>XV-001</b> to <b>XV-006</b>	Manifold for liquid input. The six inlets correspond to valves <b>XV-001</b> to <b>XV-006</b> .
6	Column inlet tubing	N/A <sup>1</sup>	Connection to column inlet.
7	Column outlet tubing	N/A <sup>1</sup>	Connection to column outlet.
8	Pressure sensor	<b>PT-112</b>	Measures the post-column pressure. Part of the safety monitoring of the medium pressure.
9	pH electrode (optional)	<b>AE-121</b>	The sensor for pH measurement (optional). The electrode is attached to the flow cell of pressure sensor <b>PT-112</b> , replacing the dummy electrode in the holder.
10	Flow meter	<b>FE-141</b>	Measures the liquid flow rate, using ultrasound.
11	Temperature sensor	<b>TE-161</b>	Measures liquid temperature. The sensor uses infrared light and is integrated with the flow meter <b>FE-141</b> .
12	Conductivity sensor	<b>CE-101</b>	Measures liquid conductivity.
13	UV sensor	<b>AE-131</b>	The flow cell for UV detector <b>AE-131</b> .
14	Outlet manifold	<b>XV-051</b> to <b>XV-056</b>	Manifold for liquid outlet. The six outlets correspond to valves <b>XV-051</b> to <b>XV-056</b> .
15	Pressure sensor	<b>PT-113</b>	Measures the pressure after the column and all other sensors. Part of the safety monitoring of the low pressure.

<sup>1</sup> Not applicable.

## Illustration of the gradient flow kit

The gradient flow kit contains the same components as the isocratic flow kit, and in addition this kit contains the gradient flow section. The gradient flow section comprises the jumper tubing and the pump tubing for a gradient run.

The image below shows the complete gradient flow kit. See further down for the detailed image of the gradient flow section.



Part	Component	ID tag	Description
1	Air vent tubing	N/A <sup>1</sup>	Air flow to and from the air trap. Manually controlled by the <b>AIR VENT</b> button through valve <b>HV-301</b> .
2	Air trap	<b>AT-221</b>	Allows removal of air from buffers and sample. Manually filled with liquid by pressing the <b>AIR VENT</b> button (air is released).
3	Pressure sensor	<b>PT-111</b>	Measures the pressure after the pump. Part of the safety monitoring of the high pressure.
4	Inlet manifold	<b>XV-001</b> to <b>XV-006</b>	Manifold for liquid input. The six inlets correspond to valves <b>XV-001</b> to <b>XV-006</b> .
5	System pump tubing	N/A <sup>1</sup>	Liquid input using a peristaltic pump. <b>Note:</b> <i>This tubing is installed in the system pump (<b>P-201</b>) for gradient method only.</i>
6	Gradient pump tubing	N/A <sup>1</sup>	Liquid input using a peristaltic pump. <b>Note:</b> <i>This tubing is installed in the gradient pump (<b>P-202</b>) for gradient methods.</i>

Part	Component	ID tag	Description
7	Jumper tubing	N/A <sup>1</sup>	Connects the pump tubing to the main part of the flow kit (for gradient method only).
8	Column inlet tubing	N/A <sup>1</sup>	Connection to column inlet.
9	Column outlet tubing	N/A <sup>1</sup>	Connection to column outlet.
10	Pressure sensor	<b>PT-112</b>	Measures the post-column pressure. Part of the safety monitoring of the high pressure.
11	pH electrode (optional)	<b>AE-121</b>	The sensor for pH measurement (optional). The electrode is attached to the flow cell of pressure sensor <b>PT-112</b> , replacing the dummy electrode in the holder.
12	Flow meter	<b>FE-141</b>	Measures the liquid flow rate, using ultrasound.
13	Temperature sensor	<b>TE-161</b>	Measures liquid temperature. The sensor uses infrared light and is integrated with the flow meter <b>FE-141</b> .
14	Conductivity sensor	<b>CE-101</b>	Measures liquid conductivity.
15	UV sensor	<b>AE-131</b>	The flow cell for UV detector <b>AE-131</b> .
16	Outlet manifold	<b>XV-051</b> to <b>XV-056</b>	Manifold for liquid outlet. The six outlets correspond to valves <b>XV-051</b> to <b>XV-056</b> .
17	Pressure sensor	<b>PT-113</b>	Measures the pressure after the column and all other sensors. Part of the safety monitoring of the medium pressure.

<sup>1</sup> Not applicable.

The following illustration shows the gradient flow section.



## **Flow kit packaging**

All parts of the flow kit are delivered in double plastic bags and are pre-treated with gamma radiation or autoclaving.

Flow kit components are labeled and equipped with bar codes. The bar codes are primarily used for traceability.

## 3.5.2 Flow kit sensors

### Introduction

This section describes sensors that are part of the flow kit. For further details see the product documentation package provided with the system.

### Conductivity sensor

The conductivity sensor, **CE-101**, is primarily used to verify the conductivity of buffer solutions. The conductivity measurement is temperature-compensated and therefore relies on correct temperature readings. The conductivity sensor cable is connected to the system cabinet using a screw-on connector fastened by a nut. The standard setting of the cell constant is  $12.5 \text{ cm}^{-1}$ .

### Flow meter

The flow meter, **FE-141**, measures the liquid velocity using ultrasound. Transducers are connected to both sides of a straight channel in the flow meter cell. The difference between upstream and downstream ultrasound velocity is measured and the result is used to calculate the flow rate.

The temperature sensor window is located on the back of the flow meter.

### UV sensor

The UV sensor, **AE-131**, is installed in the electrical cabinet. The UV sensor is a transparent rectangular UV flow cell. A UV LED emits light at 280 nm through the liquid flow path. Two detectors measure the UV absorbance of the liquid.

For correct measurements, the UV sensor must be properly fitted, kept clean and dry.



#### NOTICE

Make sure that the temperature of the process liquid is not more than 10°C below the ambient temperature. Larger temperature differences can cause condensation on the UV sensor.

### Air sensors (optional)

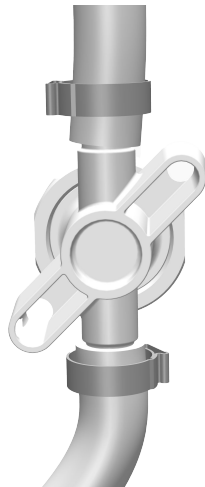
The air sensors, **AE-151** and **AE-152**, are optional accessories. The air sensors are high precision monitors designed for continuous monitoring of air bubbles in the flow path. When air is detected, the system is either paused, or performs an action that is defined in the method.

The air sensors are connected to the **CUSTOMER I/O** connector as described in [Connect air sensors, on page 69](#), and in a separate document *ÄKTA ready air sensor installation* (29051561).

Pressure sensor

The pressure sensors are designed with a flexible membrane that is brought into contact with a transducer (load cell) on the system cabinet for measurement of fluid pressure.

The flow kit comprises three pressure sensors that continuously measure the liquid pressure. The following illustration shows the pressure sensor.



The location and the function of the pressure sensors is described below.

Pressure sensor	Location	Function
<b>PT-111</b>	In the high pressure flow path, directly downstream of the pumps.	Measures the pressure in the flow path before the column.
<b>PT-112</b>	In the medium pressure flow path, downstream of the column.	Measures the pressure in the flow path after the column. The difference between pressures at <b>PT-111</b> and <b>PT-112</b> is the pressure drop over the column and the packed bed.
<b>PT-113</b>	In the low pressure flow path, upstream of the outlet manifold.	Measures the pressure in the flow path before the outlet manifold. Prevents overpressure caused by problems downstream of the outlet (e.g., a blocked outlet tubing or an overfilled bag collecting the product).

## Temperature sensor

The temperature sensor, **TE-161**, measures the temperature using infrared radiation.

## pH electrode (optional)

The pH electrode, **AE-121**, can be attached to a holder on top of the pressure sensor **PT-112**. A pH electrode dummy is installed in the pH electrode holder at the flow kit delivery.

The pH electrode must be calibrated at least once a day (see [Section 6.4.1 Calibrate sensors, on page 156](#)).



### NOTICE

The pH electrode must be sanitized with 70% ethanol before installing it into the flow kit.

## 3.6 UNICORN control system

### Overview

ÄKTA ready is controlled by UNICORN process control software.

UNICORN can save established processes as methods. The methods include the instructions necessary for process operation and documentation.

UNICORN includes a comprehensive system of user access levels. The access levels limit the operations a given user can perform on ÄKTA ready. Access to the system should be given only to qualified and trained personnel.

Information on how to use UNICORN can be obtained from the UNICORN documentation and available tutorials. Contact your local Cytiva representative for advice if required.

System operators are responsible for designing methods which conform to standard operating procedures and Good Manufacturing Practice procedures.

This product and the product control system are technically developed to enable customer organization to meet requirements in FDA 21 CFR Part 11.

### UNICORN installation

UNICORN can be installed on a standalone computer to control several locally attached systems. However, the computer can only show one system at a time. Output data from one system can be displayed on multiple computers. UNICORN can also be installed on a network.

Contact your Cytiva representative for more information.

## Software modules

The UNICORN control software consists of four modules.

Module	Function
<b>Administration</b>	File handling and administration tasks, for example definition of systems and managing user profiles.
<b>Method Editor</b>	Method creation and editing of preprogrammed control of the system.
<b>System Control</b>	Online process control and monitoring using predefined methods or manual control.
<b>Evaluation</b>	<p>Evaluation and presentation of stored results. Two evaluation modules are available.</p> <ul style="list-style-type: none"> <li>• <b>Evaluation.</b></li> <li>• <b>Evaluation Classic</b> (requires an additional e-license).</li> </ul> <p>See the data file 29135786 for the description of the modules.</p>

**Note:** *The modules are active when the program is operating and are not closed when minimized. For example, a minimized **System Control** module may be active and control a process.*

## UNICORN warnings

UNICORN warnings tell the operator that process parameters have exceeded the defined high or low limits. The method continues to run.

## Alarms

If the equipment connected to the system has lower alarm limits than the system, the alarm must be adjusted to that lower value.

The following happens when a signal triggers an alarm:

- The system is set to **Pause** mode.
- Valves and other components move to default positions.
- Certain components (air trap, column) can retain the current valve positions if **Valve Pause Function** is enabled in UNICORN.

# 4 Installation

## About this chapter

This chapter describes how to transport and install ÄKTA ready. The components are either fitted on the system or provided as part of the flow kit.

## In this chapter

Section	See page
4.1 Safety precautions	50
4.2 Site requirements	53
4.3 Included in the delivery	54
4.4 Unpacking	55
4.5 Transport	58
4.6 Connections	61
4.7 Finish installation	70

## 4.1 Safety precautions



### **WARNING**

The product must be installed and prepared by Cytiva personnel or a third party authorized by Cytiva.



### **WARNING**

**Move transport crates.** Make sure that the lifting equipment has the capacity to safely lift the crate weight. Make sure that the crate is properly balanced so that it will not accidentally tip when moved.



### **WARNING**

**Electrical shock hazard.** All installation, service and maintenance of components inside the electrical cabinet must be done by personnel authorized by Cytiva.



### **WARNING**

**Heavy object.** The ramp is not reinforced in the center. Do not use a pallet lifter or forklift on the ramp.



### **WARNING**

**Heavy object.** When rolling the system down the ramp take great care to avoid the wheels slipping off the edge of the ramp.



### **WARNING**

**Heavy object.** Because of the significant weight of the product, great care must be taken not to cause squeezing or crushing injuries during movement. At least two, but preferably three or more, people are recommended when moving the product.



### **WARNING**

**Access to power switch and power cord.** The power switch must always be easy to access. The power cord must always be easy to disconnect.



**WARNING**

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



**WARNING**

**Supply voltage.** Before connecting the power cord, make sure that the supply voltage at the wall outlet corresponds to the requirements for the instrument.



**WARNING**

All electrical installations must be performed by authorized personnel only.



**CAUTION**

The wheels of ÄKTA ready must be locked during normal use. The wheels must be unlocked only when moving the system.



**CAUTION**

Make sure that all tubing, hoses and cables are placed so that the risk of tripping accidents is minimized.



**CAUTION**

The product is designed for indoor use only.



**CAUTION**

Make sure that the common waste outlet is never exposed to back-pressure.



**NOTICE**

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

## 4.2 Site requirements

### Dimensions of ÄKTA ready

Property	ÄKTA ready	ÄKTA ready gradient
Width × Depth × Height	100 × 80 × 165 cm	116 × 80 × 165 cm
Weight (approximately)	230 kg	250 kg
Space required at production location <sup>1</sup>	280 × 300 cm	280 × 316 cm

<sup>1</sup> Including 100 cm free space on all sides of the system.

The additional space at production location is required for containers and hoses, and for easy access to the power switch and the connectors on the back of the system. The back door of the cabinet must be accessible for service.

### Compressed air

- Dry and particle free air
- Airflow 50 NL/min or 6.25 L/min at 7 bar g
- Working pressure 5.5 to 10 bar g

An air hose (5 m, inner diameter of 7.5 mm) for connection to the compressed air supply is delivered with the system.

### Electrical power

The following applies at the delivery:

- A system power cable with an IEC 60309 connector is permanently attached to the back of the system cabinet.
- The system is preconfigured for 230 V AC, 50/60 Hz power supply.

## 4.3 Included in the delivery

### General

ÄKTA ready is delivered with the following components:

- System cabinet
- Column trolley
- Box containing an accessory kit, system documentation folder, and user documentation

ÄKTA ready is delivered pre-assembled in the transport crate. No specific assembly prior to site installation is required.

### Accessory kit

The accessory kit includes the following:

- Bar code scanner (USB)
- Two computer network cables (10 m and 3 m), and an RJ45 coupling connector
- Key for the back door of the system cabinet
- Compressed air tubing (5 m)
- Connector (female) for connecting equipment to **CUSTOMER I/O** (male) connector
- DVD containing UNICORN and ÄKTA ready strategy software
- User documentation, including UNICORN and ÄKTA ready manuals
- Product documentation package
- System logbook
- Labels for configured voltage

A 10 mm wrench for the bolts holding the pump lid is located on the inside of the cabinet front door.

### Associated products

- Flow kit (Low Flow Kit or High Flow Kit)
- Gradient flow section (Low Flow or High Flow section)
- ReadyToProcess columns

The associated products are ordered separately.

## 4.4 Unpacking

### Introduction

This section describes how to unpack ÄKTA ready and the flow kit in a safe way.

### In this section

Section		See page
4.4.1	Unpack ÄKTA ready	56
4.4.2	Unpack the flow kit	57

## 4.4.1 Unpack ÄKTA ready

### Instructions for unpacking

There are no loose parts in the crate. All parts are either attached to the system or located in the accessory kit box.

For a full description on how to unpack ÄKTA ready refer to the following instructions:

- For ÄKTA ready: *ÄKTA ready Unpacking Instructions (28994489)*
- For ÄKTA ready gradient: *ÄKTA ready gradient Unpacking Instructions (29042082)*

### Check for damage

Check the system for damage before starting assembly and installation. If any damage is found, document the damage, and contact your Cytiva representative.

## 4.4.2 Unpack the flow kit

### Flow kit package

ÄKTA ready flow kits are delivered in double plastic bags.

The flow kit package contains the following items:

- Main part of the flow kit
- Inlet manifold
- Pump tubing, including two TC clamps with gaskets
- Petroleum jelly
- Product documentation package

### Unpack flow kit



#### NOTICE

Use caution when opening the plastic bags to avoid damaging the flow kit.

Unpack ÄKTA ready flow kit as follows:

Step	Action
1	Cut open the outer plastic bag in a clean environment near the ÄKTA ready, for example in the air lock, if the system is in a clean room.
2	Take out the items and move the flow kit components to the ÄKTA ready system. Take out the components from their inner plastic bags immediately before installing the flow kit onto the system cabinet.

ÄKTA ready flow kits have plastic end caps to protect the connectors from contamination. Do not remove the end caps until immediately before connecting the flow kit to buffer bags or tanks, and to the column.

## 4.5 Transport

### Before moving the system

Before moving the system, make sure that:

Step	Action
------	--------

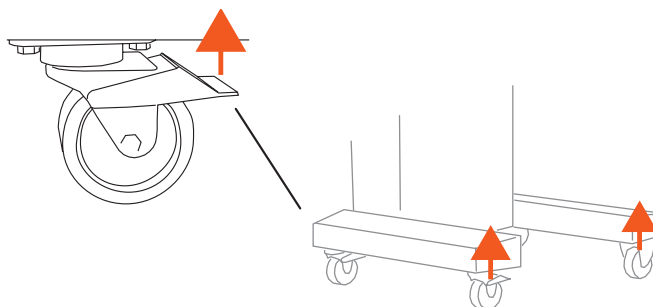
- |   |   |
|---|---|
| 1 | The power supply to the product is switched off.          |
| 2 | All power cords to the product are disconnected.          |
| 3 | All air supply lines to the product are disconnected.     |
| 4 | All process lines to the product are disconnected.        |
| 5 | All communication cables to the product are disconnected. |

*Result:*

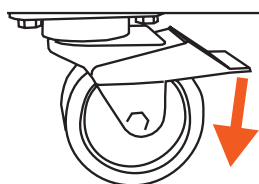
The system is now safe to move.

### Release brakes to move ÄKTA ready

The ÄKTA ready can be rolled on hard and level surface when brakes on the casters are released.

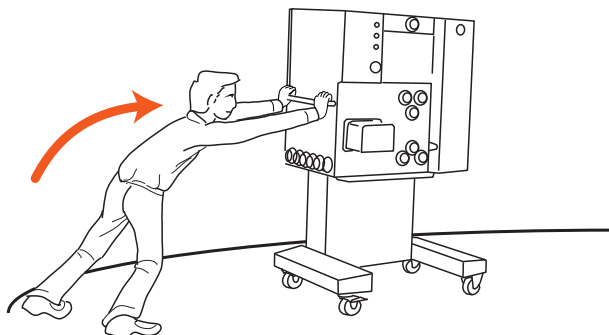


After positioning the system at its designated location, lock the casters.



### Use the handle to move ÄKTA ready

Use the handle on the left side of the cabinet to move the system.



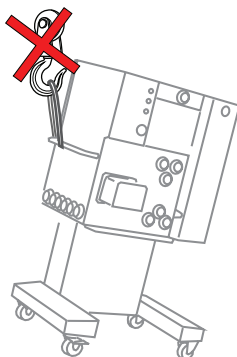
### Lifting ÄKTA ready

There are no lifting hooks on ÄKTA ready. Use a forklift or a pallet jack with a minimum capacity of 400 kg for lifting the system. Appropriate safety precautions must be followed.



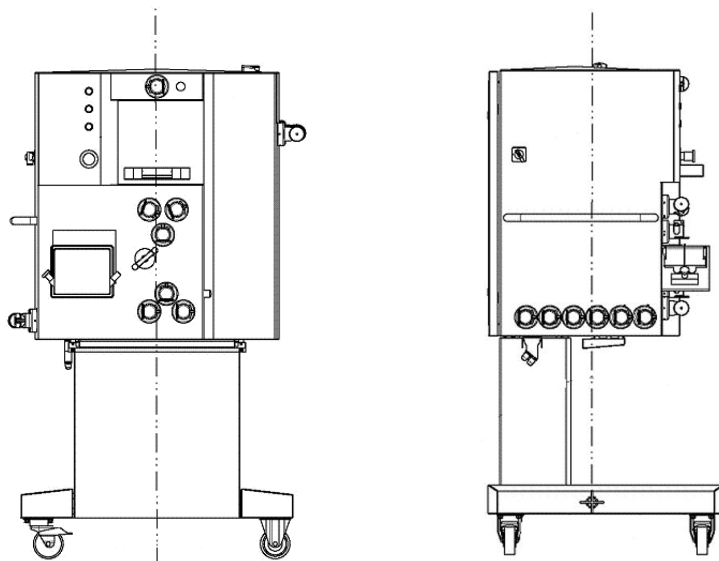
#### CAUTION

Do not attempt to lift the system by the handle on the left side of the system cabinet. The handle is for maneuvering the cabinet on the floor, not for lifting.

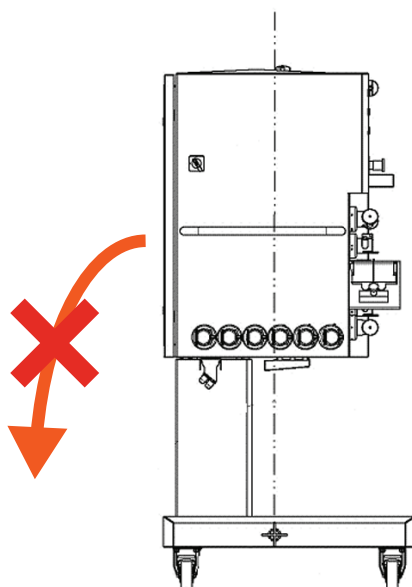


## Center of gravity

The center of gravity for ÄKTA ready is indicated with a dash-dotted vertical line in the drawings below.



**Note:** *The center of gravity line is located slightly towards the back of the cabinet. This causes a tipping hazard and must be taken into consideration when moving or lifting the cabinet.*



## 4.6 Connections

### Introduction

This section describes how to connect the power, compressed air, computer, and equipment to **CUSTOMER I/O** connector of the ÄKTA ready.

### In this section

Section		See page
4.6.1	Connect power	62
4.6.2	Connect compressed air	64
4.6.3	Connection of <b>COMMON WASTE</b> Outlet	65
4.6.4	Connect computer	66
4.6.5	Connect equipment to <b>CUSTOMER I/O</b> connector	67

## 4.6.1 Connect power

### Power connection



#### NOTICE

Do not turn on the **MAINS POWER** switch before all connections are made.

The mains power supply must be connected and configured by authorized service personnel. Contact your Cytiva representative for help.

### Grounding and protective earth

- The protective earth wire must be connected to system ground.
- Ground impedance must conform to the requirements of national and local industrial safety regulations and/or electrical codes.
- The integrity of all ground connections must be periodically checked.

### Mains cable

ÄKTA ready system is delivered with a permanently mounted power cable equipped with an IEC 60309 connector without a plug.

The customer must supply a power plug for the mains cable. The power plug and the socket must comply with the national regulations. The customer must install the power plug on the mains cable, and follow the wire color code shown in the Cytiva electrical drawing. The installation must be performed in accordance with the local codes.

If the mains cable needs to be replaced, the replacement cable must meet the mains cable specifications. Refer to General Specification for the details. The cable must be installed according to national regulations. Contact the Cytiva service personnel for help.

### Electrical requirements

The system is preconfigured for 240V 50/60 Hz AC power supply. The supply voltage can be reconfigured on the T1 transformer if required.

Parameter	Specification
Supply voltage	100 to 240 V AC $\pm 10\%$ Uninterruptable power supply (UPS) and surge protectors are recommended.
Frequency	50 or 60 Hz
Max power	1000 VA

Parameter	Specification
Fuse	16 A
Number of wall outlets	<p>Two outlets</p> <ul style="list-style-type: none"> <li>• One for the ÄKTA ready system.</li> <li>• One for the computer.</li> </ul> <p><b>Note:</b>  <i>Power outlets must be within 1 meter from the instrument and the computer.</i></p>

## 4.6.2 Connect compressed air

### Connection instructions



#### CAUTION

Make sure that correct compressed air pressure is always maintained. Too high or too low pressure can be hazardous and can cause erroneous results and leakage.

Follow the instruction to connect the compressed air supply to the system.

Step	Action
1	Connect the compressed air supply to the air input connector on the back of the system, labeled <b>PNEUMATIC AIR SUPPLY</b> . Use the supplied 5 m air hose (inner diameter 7.5 mm).
2	Switch on the air supply.
3	Verify that there are no air leaks.

### 4.6.3 Connection of **COMMON WASTE** Outlet

#### Conditions for the **COMMON WASTE** connection

Make sure that the following conditions are valid for the common waste outlet:

Step	Action
1	Connect the <b>COMMON WASTE</b> to tubing with at least the same diameter as the common waste outlet connection.
2	Connect the <b>COMMON WASTE</b> to tubing that allows maximum waste flow to be transported away from the product without pooling.

## 4.6.4 Connect computer

### General

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

It is recommended that the computer is dedicated to UNICORN and the related software. Due to the risk for computer viruses it is also recommended that the computer is not directly connected to internet.

See the UNICORN manuals for further details about software requirements and installation.

A 10 m network cable and a 3 m crossover network cable are delivered with the system. To protect the system use only the cables delivered with the system.

### Connect system directly to computer

Follow the steps below to connect the ÄKTA ready directly to the computer.

Step	Action
------	--------

- |   |   |
|---|---|
| 1 | Connect the 10 m cable to the RJ45 connector marked <b>SYSTEM COMPUTER</b> on the back of the system. |
| 2 | Connect the other end of the cable to the computer.   |

### Connect system to hub

Follow the steps below to connect the system to a switch or hub for control via a network.

Step	Action
------	--------

- |   |   |
|---|---|
| 1 | Connect the 10 m cable to the RJ45 connector marked <b>SYSTEM COMPUTER</b> on the back of the system. |
| 2 | Connect the other end of the cable to the 3 m crossover network cable.                                |
| 3 | Connect the crossover network cable to a switch or a hub.   |

## 4.6.5 Connect equipment to **CUSTOMER I/O** connector

### General

The **CUSTOMER I/O** connector is located on the left side of the system cabinet, below the inlet valves. The connector is a 15 pole IP67-proof D-Sub male connector. A corresponding female connector containing a screw terminal block with watertight housing is supplied with the system.

The input voltage is 24 V (acceptable range 15 to 28 V), and the output signal is 24 V (maximally 1 A).

The **CUSTOMER I/O** connector can be used for the following purposes:

- Send a signal to an external alarm device
- Receive a signal indicating that a UPS has been activated
- Connect air sensors

### Connect an alarm or a UPS

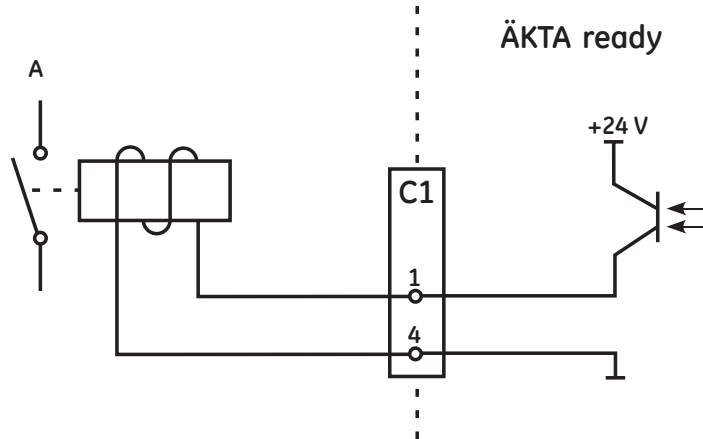
The following information describes the setup for connecting an external alarm or a UPS to ÄKTA ready using the **CUSTOMER I/O** connector. The connector is shown as **C1** in the illustrations further down.

The connector signals are described in the following table.

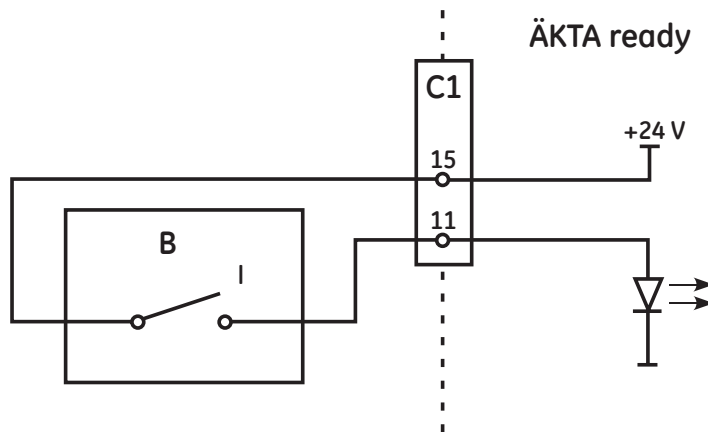
Pin number	Signal
Pin 1	Remote alarm ( <b>A</b> in the illustration below) digital output (+24 V)
Pin 4	GND, digital ground
Pin 11	UPS <b>On</b> ( <b>B</b> in the illustration below), digital input (+24 V)
Pin 15	Digital supply voltage (+24 V)

4.6.5 Connect equipment to **CUSTOMER I/O** connector

Pins **1** and **4** (see image below) provide an output for an alarm device (e.g., a warning light, a buzzer, or similar device). The external alarm is triggered when the internal alarm is activated.

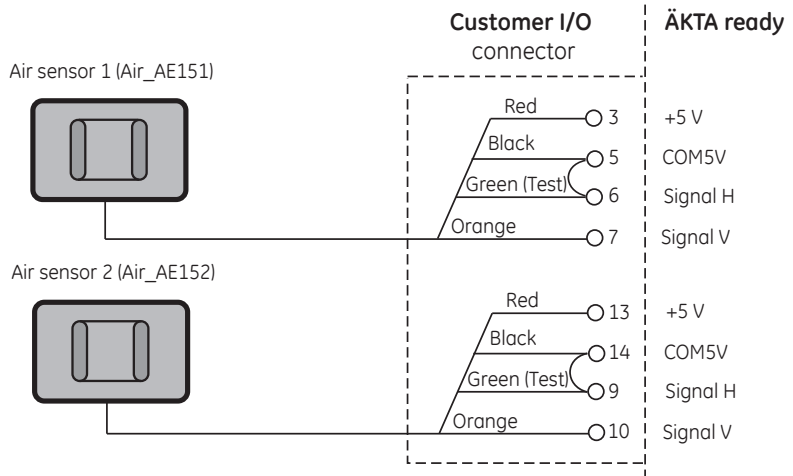


Pins **11** and **15** (see image below) are used to receive an **On** signal (**B**) from an optional UPS during a power failure.



## Connect air sensors

The two air sensors are connected to the **CUSTOMER I/O** as shown in the illustration below. For more information, refer to *ÄKTA ready air sensor installation (29051561)*.



## 4.7 Finish installation

### Establish computer connection

Follow the steps below to set up a connection between ÄKTA ready and the computer.

Step	Action
------	--------

- |   |  |
|---|--|
| 1 | Turn the <b>MAINS POWER</b> switch to <b>I</b> position. |
|---|--|

*Result:*

The green **POWER** indicator lamp on the front of the system is turned on. The light flashes slowly when communication with UNICORN is not established.



- |   |   |
|---|---|
| 2 | Switch on the computer and the computer screen, and verify that a booting process starts. |
|---|---|

*Result:*

When the booting is completed, the UNICORN icon is displayed on the desktop. The software is installed and available.

- |   |   |
|---|---|
| 3 | Double-click the icon to start UNICORN. |
|---|---|

- |   |   |
|---|---|
| 4 | Verify that the green <b>POWER</b> indicator lamp displays a steady green light, indicating that UNICORN can communicate with the system. |
|---|---|

### Equilibrate to temperature

After moving the system to a different temperature environment, allow the system to adjust to the ambient temperature before use. The flow meter may need several hours to adjust. If the system temperature is not properly equilibrated, the temperature readings may be incorrect.

## Install the bar code reader

Follow the steps below to install and configure the bar code reader.

**Note:** *The installation requires bar codes to be scanned from the Quick Start Guide supplied with the bar code reader. The Quick Start Guide is also available on the bar code manufacturer's website.*

Step	Action
1	Connect the bar code reader to the computer with a USB cable, as shown in the <i>Quick Start Guide</i> .
2	Locate the <b>USB Keyboard (PC)</b> interface bar code in the <i>Quick Start Guide</i> and scan it with the bar code reader.
3	Place the bar code reader in its holder. <i>Result:</i> The bar code reader beeps when the installation is complete.
4	Verify the bar code function using an empty <b>Notepad</b> document as described below. <b>a.</b> In the Windows start menu, in the search field, type <code>notepad</code> . <b>b.</b> Click the <b>Notepad</b> item that is displayed as the search result. <i>Result:</i> An empty <b>Notepad</b> document opens. <b>c.</b> Scan any bar code from the <i>Quick Start Guide</i> . <i>Result:</i> A text string appears in the <b>Notepad</b> document, if the bar code reader is installed correctly.

If the bar code reader does not function, locate the *Standard Products Default* bar code in the *Quick Start Guide* and scan the code with the bar code reader. Repeat steps 2 to 4 above.

# 5 Operation

## About this chapter

This chapter provides the information required to prepare, start, operate, and shut down ÄKTA ready.

## In this chapter

Section	See page
5.1 Safety precautions	73
5.2 Start the system and log on to UNICORN	76
5.3 Install flow kit	78
5.4 Perform a component test	106
5.5 Connect a column	112
5.6 Set ÄKTA ready specific parameters in <b>Method Editor</b>	125
5.7 Run a method	134
5.8 Controlled shutdown	144

## 5.1 Safety precautions



### **WARNING**

Operating limits. Never exceed the operating limits stated in this document and on the product nameplate.



### **WARNING**

**Hazardous biological agents during a run.** After using hazardous biological agents flush the whole system tubing with a bacteriostatic solution, neutral buffer, and then water before doing service or maintenance.



### **WARNING**

Use columns that withstand expected pressures. Otherwise the columns might rupture, resulting in injury.



### **WARNING**

Do not touch any part of the pump while the pump is running.



### **WARNING**

Never put fingers or any objects other than the intended tubing into the pinch valve opening.



### **WARNING**

**Cap unused connections before operation.** Make sure that all connections not in use are capped or directed to waste to avoid accidental hazardous leakage during operation.



### **WARNING**

When the system is operated from a remote controlling computer, the operator must always make sure that no one is present and exposed when the system is started and that no one enters the risk area around the system during operation.



**WARNING**

**Hazardous pressure.** The flow rate may under no circumstances exceed the specified column maximum flow rate. High flows might affect the packed medium, causing the pressure to exceed the specified column maximum pressure.



**WARNING**

**Overpressure.** Do not block the outlet tubing as this can create overpressure and can cause injury.



**WARNING**

**Pressurized flow path.** During a power failure or emergency stop, the equipment can remain pressurized. Make sure all lines and vessels are depressurized before opening a line or vessel.



**WARNING**

Before use, make sure that the column is not damaged or otherwise defective. Damaged or defective columns can leak or rupture.



**CAUTION**

Knowledge of how to use the control software is required to safely operate the product. Refer to the control software user documentation as required.



**CAUTION**

Do not insert your fingers or other objects into fans or other moving parts.



**CAUTION**

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



**CAUTION**

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



**NOTICE**

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



**NOTICE**

The flow rate must not exceed the specified column maximum flow rate. Excessive flow can damage the packed bed and damage the flow kit.



**NOTICE**

Verify that the chromatography resin, columns and system components are compatible with NaOH at the concentration, time, and temperatures used.



**NOTICE**

Make sure that tubing connected to the inlets have the same or larger inner diameter than the inlets, and is not longer than 10 m, to prevent negative pressure at the pump tubing inlet and damage to the pump tubing.



**NOTICE**

Make sure that the temperature of the process liquid is not lower than 10°C below the ambient temperature. Larger temperature differences can cause condensation on the UV sensor cell.



**NOTICE**

It is optional to perform a flow kit installation test when installing a flow kit. The test includes functional verification of the sensors.

## 5.2 Start the system and log on to UNICORN

### Introduction

ÄKTA ready is usually kept switched on between runs. The system is switched off only during monthly maintenance and repair, or when not in operation for a longer period of time (more than a few days).

### Start ÄKTA ready

Follow the steps below to start the system.

Step	Action
1	Turn the <b>MAINS POWER</b> switch (on the left side of the cabinet) to <b>I</b> position. <i>Result:</i> The green <b>POWER</b> indicator lamp on the front of the system is turned on. The light flashes slowly when communication with UNICORN is not established.
2	Start UNICORN (see the instructions further down), and wait until the connection is established (the <b>Run</b> button on the toolbar displays green color).
3	Verify that the green <b>POWER</b> indicator lamp displays a steady green light, indicating that UNICORN can communicate with the system.

When ÄKTA ready is turned on, the system automatically performs a stray light calibration. Without the UV sensor this results in a very high calibration factor. Therefore always perform a stray light calibration immediately after the flow kit is installed and purged with water or other liquid.

### Start UNICORN

Follow the steps below to start the UNICORN software.

Step	Action
1	Log on to Windows.
2	Double-click the UNICORN icon on the Windows desktop. <i>Result:</i> The <b>Logon</b> dialog box is shown.
3	In the dialog box, select a user on the <b>Users list</b> and type the password. If you log on for the first time, select the user <b>default</b> and type <code>default</code> as the password.

Step	Action
------	--------

4	Click <b>OK</b> .
---	-------------------

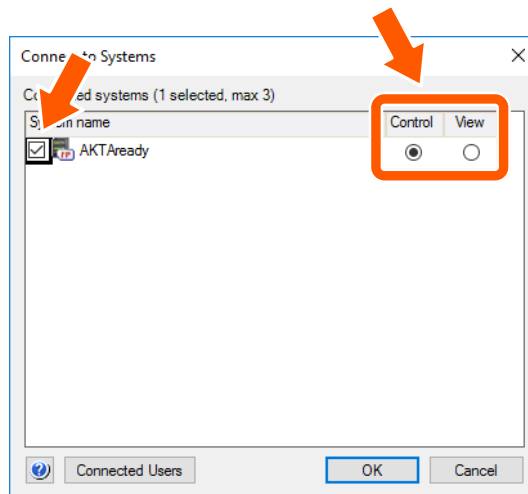
5	In the <b>System Control</b> module, on the <b>System</b> menu, click <b>Connect to Systems</b> .
---	---

*Result:*

A dialog box opens.

6	In the dialog box, do the following:
---	--------------------------------------

- Select the check box for the applicable system.
- Select the applicable option (**Control** or **View**).
- Click **OK**.



**Note:**

*The system name is specified during installation configuration.*

*Result:*

When UNICORN is connected to the system, the **Run** button on the toolbar displays green color, indicating that the system is ready to run.

## 5.3 Install flow kit

### Introduction

This section describes how to install the flow kit and the gradient flow section.

### In this section

Section	See page
5.3.1 Prepare for flow kit installation	79
5.3.2 Create flow kit installation method	81
5.3.3 Install the flow kit for isocratic run	83
5.3.4 Install the flow kit for gradient run	101

### Safety precautions

**NOTICE**

Only use flow kits supplied by Cytiva.

**NOTICE**

It is optional to perform a flow kit installation test when installing a flow kit. The test includes functional verification of the sensors.

## 5.3.1 Prepare for flow kit installation

### Before flow kit installation

- Locate the two TC clamps and gaskets supplied with the flow kit. Prepare three additional clamps and gaskets (not supplied) that are required to install the flow kit and run a component test.
- Prepare a disinfectant solution for sanitization of tubing connectors, for example 70% ethanol.

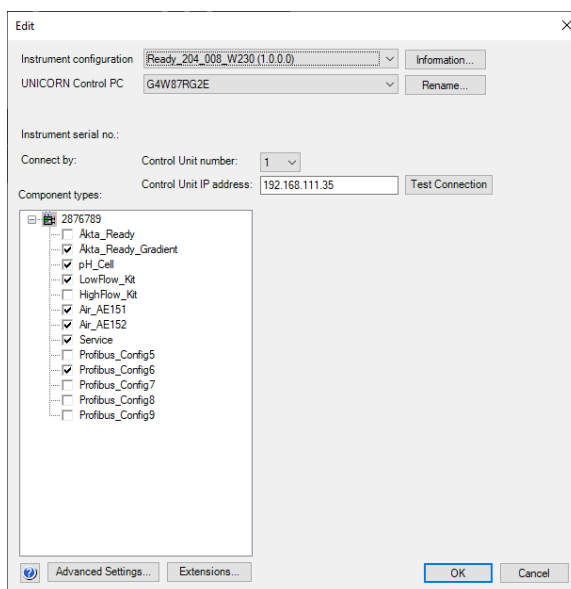
The flow kit connectors are covered with protective end caps at delivery. The protective caps are removed during the installation. The user should store the protective caps, they are needed to cover the connectors before flow kit disposal.

### Perform system setup

Set up the system in the **Administration** module following the steps below.

Step	Action
1	Click <b>System Properties</b> to open the <b>System Properties</b> dialog box.
2	In the dialog box, click <b>Edit</b> .
3	In the <b>Edit</b> dialog box, select the following check boxes as applicable for your system and process.

**Note:**  
**Äkta\_Ready** is selected by default.



Step	Action
	<ul style="list-style-type: none"> <li>a. Select <b>Äkta_Ready_Gradient</b>, if you are working with ÄKTA ready gradient system.</li> <li>b. Select <b>pH_Cell</b>, if pH is to be measured.</li> <li>c. Select <b>LowFlow_Kit</b> (default) or <b>HighFlow_Kit</b>, depending on the installed kit.</li> <li>d. Select one or both air sensors, if used: <b>Air_AE151</b> and <b>Air_AE152</b>.</li> <li>e. Select <b>Service</b>, if you want to display <b>UV_131_S</b> and <b>UV_131_R</b> in the <b>Run Data</b> pane in the <b>System Control</b> module.</li> </ul> <p><b>Note:</b>  <i>If <b>Service</b> is not selected, these UV options are not available.</i></p> <ul style="list-style-type: none"> <li>f. Select <b>Profibus_Config6</b> if not otherwise specified in the <i>Functional Test Record</i>.</li> </ul>
4	Click <b>OK</b> to close the dialog box.

## 5.3.2 Create flow kit installation method

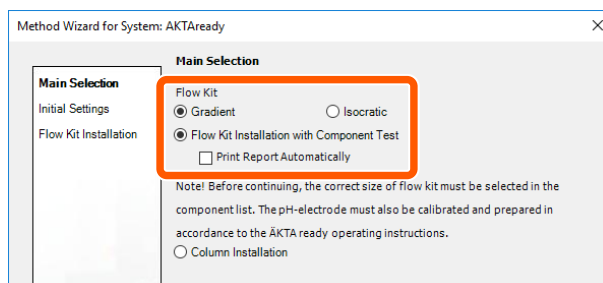
### Create method

The user must simultaneously create the flow kit installation method and install the flow kit. Follow the instructions in an applicable manual section to install the flow kit.

- To install the isocratic flow kit: [Section 5.3.3 Install the flow kit for isocratic run, on page 83](#).
- To install the gradient flow kit: [Section 5.3.4 Install the flow kit for gradient run, on page 101](#)

For both flow kits, create the installation method in the **Method Editor** module following the steps below.

Step	Action
1	On the <b>File</b> menu, click <b>New Method</b> .
2	In the <b>New Method</b> dialog box, click <b>Method Wizard</b> , and then click <b>OK</b> .
3	In the <b>Method Wizard</b> , select the following options: <ul style="list-style-type: none"> <li>a. <b>Gradient</b> or <b>Isocratic</b>, depending on your system.</li> <li>b. <b>Flow kit Installation with Component Test</b>.</li> <li>c. Select the <b>Print Report Automatically</b> check box if you want to print a report with installation information and test results.</li> </ul>



**Note:**

A report can also be printed on demand after the completed test, in the **Evaluation** module.

- |   |  |
|---|--|
| 4 | Click <b>Next</b> to move to the next page in the <b>Method Wizard</b> . <ul style="list-style-type: none"> <li>a. On each new page select and confirm the options as applicable for your system, and then click <b>Next</b>.</li> <li>b. For installation of the flow kit on the system hardware, as requested in the <b>Method Wizard</b>, follow the instructions in the applicable chapters (<a href="#">Section 5.3.3 Install the flow kit for isocratic run, on page 83</a> or <a href="#">Section 5.3.4 Install the flow kit for gradient run, on page 101</a>).</li> </ul> |
|---|--|

Step	Action
5	Save the created flow kit installation method.

## 5.3.3 Install the flow kit for isocratic run

### Introduction

The following sections contain a step-by-step description how to install the flow kit for an isocratic run. The short outline of the procedure is also included as **Flow Kit Installation** in the ÄKTA ready **Installation Wizard**.

It is recommended to use the wizard for kit installation to make sure that all steps are performed in the correct order.

For instructions on how to install the flow kit for gradient run, see [Section 5.3.4 Install the flow kit for gradient run, on page 101](#).

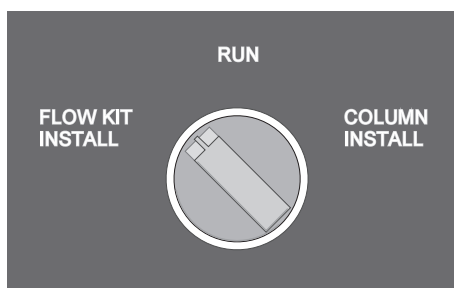
Alternatively, the flow kit can be assembled in a laminar flow cabinet. See [Assembly in a laminar flow cabinet, on page 99](#) for more information.

## Open safety locks on pinch valves

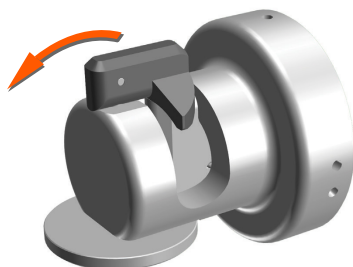
The safety locks keep the pinch valves in an open position. Follow the steps below to open the safety locks.

Step	Action
------	--------

- |   |   |
|---|---|
| 1 | Make sure that UNICORN is in the <b>End</b> mode.                               |
| 2 | Locate the installation switch in the upper right corner of the system cabinet. |
| 3 | Turn the installation switch to the <b>FLOW KIT INSTALL</b> position.           |

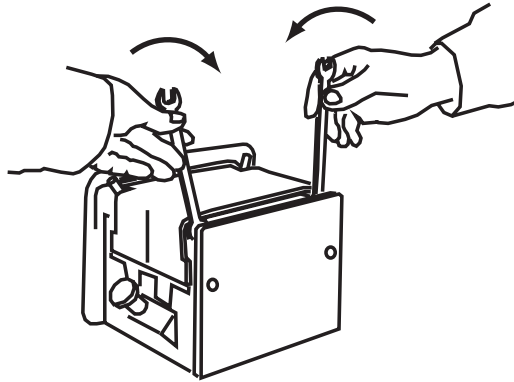


- |   |   |
|---|---|
| 4 | Lift the black handle of the valve safety lock and turn the handle outward 180 degrees. Open the safety locks on all 19 valves. |
|---|---|

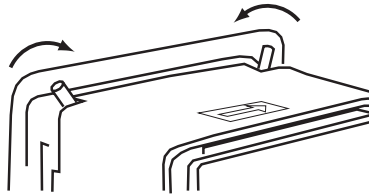


## Remove pump lid

Step	Action
1	Locate the 10 mm wrench on the inside of the cabinet front door.
2	Locate the two bolts holding the pump lid.
3	Rotate the right-hand bolt counterclockwise, and the left-hand bolt clockwise using the wrench, until both bolts are fully open.

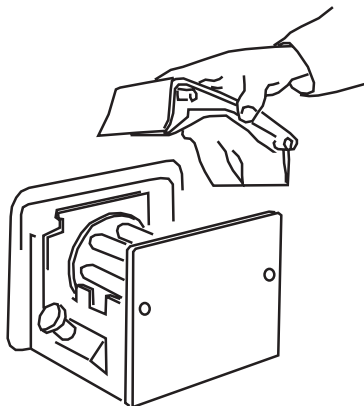


- 4 Verify that the pump lid is fully open: check the position of the two pegs at the back of the lid. The pegs must be in their uppermost position.



Step	Action
------	--------

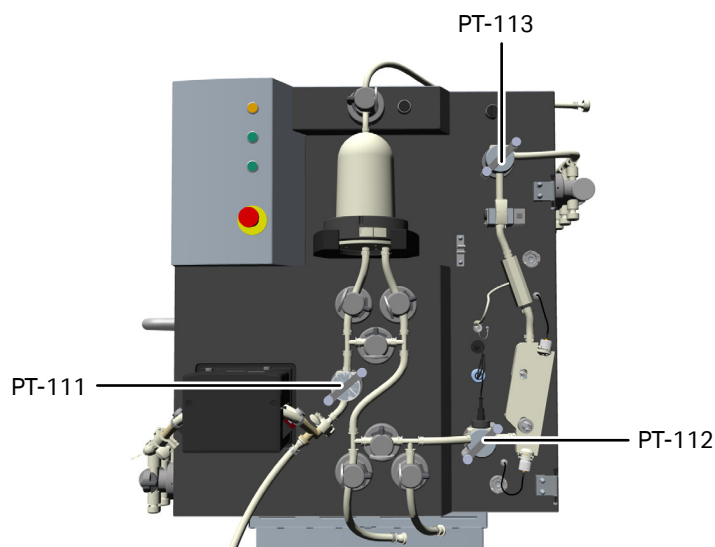
- |   |  |
|---|--|
| 5 | Lift the pump lid and remove it from the pump. |
|---|--|



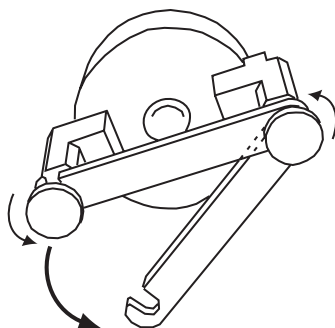
## Open pressure sensor holders

Step	Action
------	--------

- |   |   |
|---|---|
| 1 | Locate the three pressure sensor holders for pressure sensors <b>PT-111</b> , <b>PT-112</b> , and <b>PT-113</b> . |
|---|---|

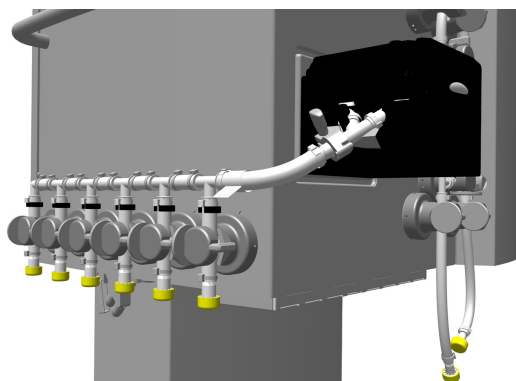


- |   |  |
|---|--|
| 2 | Loosen the screws on the latches, and turn the latches to open position. Do not remove the screws. |
|---|--|



## Attach the inlet manifold

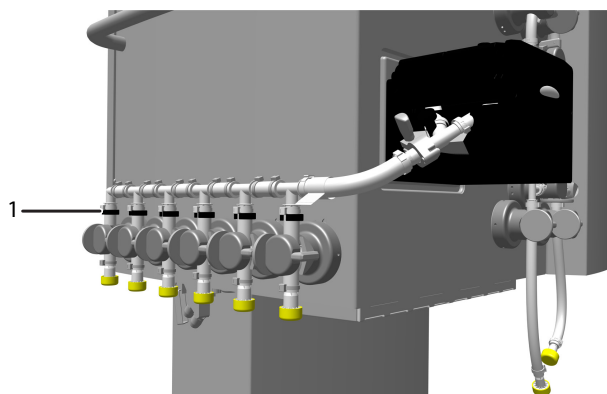
Step	Action
1	Open the bag containing the inlet manifold and the main part of the flow kit.
2	Attach the inlet manifold to the system: insert each inlet tubing into the corresponding inlet pinch valve ( <b>XV-001</b> to <b>XV-006</b> ).



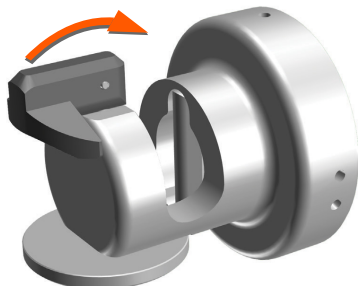
### Note:

*Do not remove the protective end caps from the connectors.*

- 3 Make sure that the spacer rings (shown in black, 1) on each inlet tubing are fastened correctly:
- For a flow kit with only one spacer ring per inlet, fasten the spacer above each inlet pinch valve as shown in the image below.
  - For a flow kit with two spacers rings per inlet, fasten the spacers above and below each inlet pinch valve.

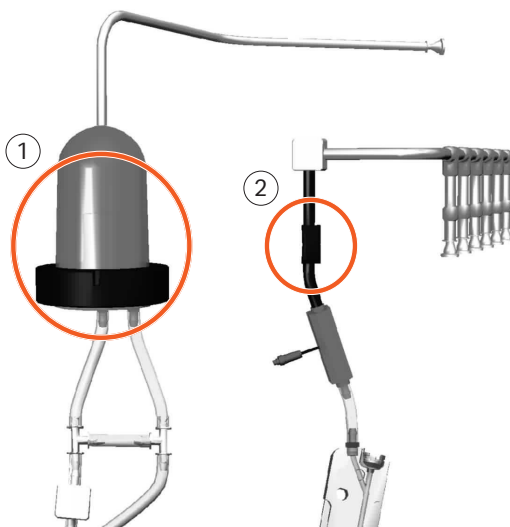


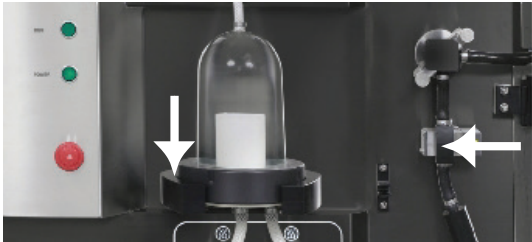
Step	Action
4	Close the safety locks on the pinch valves: lift each black handle and turn the handle inward 180 degrees.



## Attach the main part tubing

Step	Action
1	Lift the main part of the flow kit (see the illustration): <ul style="list-style-type: none"><li>• Hold the air trap (1) in your left hand.</li><li>• Hold the UV sensor (2) in your right hand. Avoid touching the sensor walls.</li></ul>

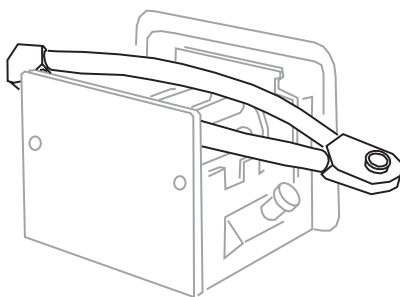


Step	Action
2	Place the air trap in the holder, and insert the UV sensor in the slot to the right of the air trap. Push the UV sensor in completely. A soft click indicates that the sensor is correctly inserted.
	
3	Temporarily hang the outlet manifold on the cabinet door.

## Install the pump tubing for isocratic run

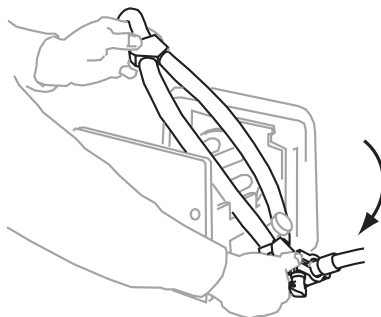
The following instructions are valid for an isocratic run. For installation of pump tubing for a gradient run, see [Section 5.3.4 Install the flow kit for gradient run, on page 101](#).

Step	Action
1	Take the pump tubing out of the flow kit package.
2	Place the tubing on top of the pump rollers of the isocratic pump. The larger connector block (for connection with the main part of the flow kit) must be to the right of the pump.

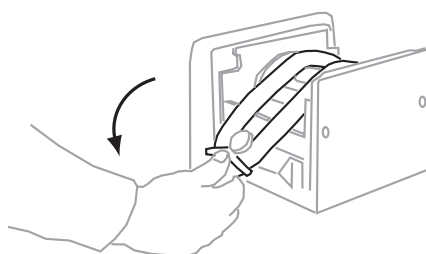


Step	Action
------	--------

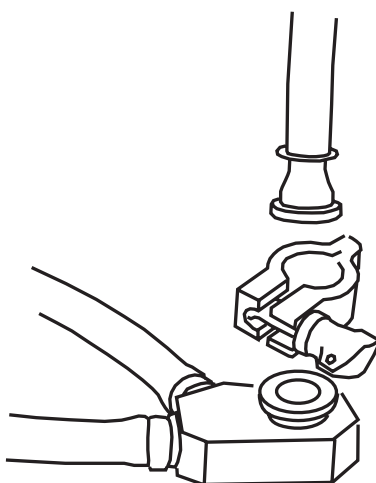
- |   |   |
|---|---|
| 3 | Push the pump tubing over the knob on the right side of the pump. |
|---|---|



- |   |   |
|---|---|
| 4 | Stretch the tubing, and push it over the knob on the left side. |
|---|---|



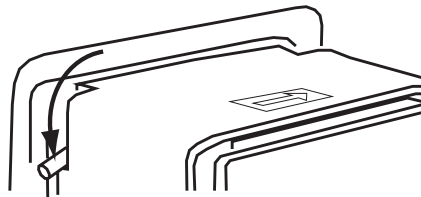
- |   |  |
|---|--|
| 5 | Connect the connector on right side of the pump tubing to the flow kit using a TC clamp. |
|---|--|



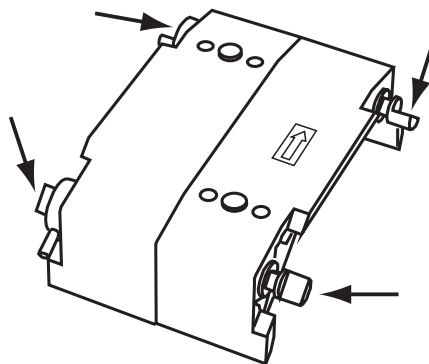
Step	Action
6	Connect the connector on left side to the inlet manifold using a TC clamp.

## Attach the pump lid

Step	Action
1	Make sure that the pump lid is oriented in the correct way. The arrow label on the lid indicates the flow direction and must point to the right. The pegs must be located at the back of the lid, on the side closest to the system.

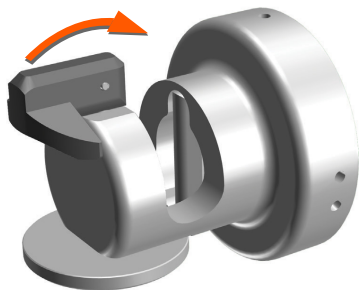


- 2 Press down the pump lid with one hand.
- 3 Attach the pump lid: rotate the right-hand bolt clockwise, and the left-hand bolt counterclockwise using the wrench supplied with the system, until both bolts are tight.
- 4 Verify the position of the pegs at the back of the lid. The pegs must be in their lowermost position when the lid is closed. The system cannot work if the lid is not properly attached.

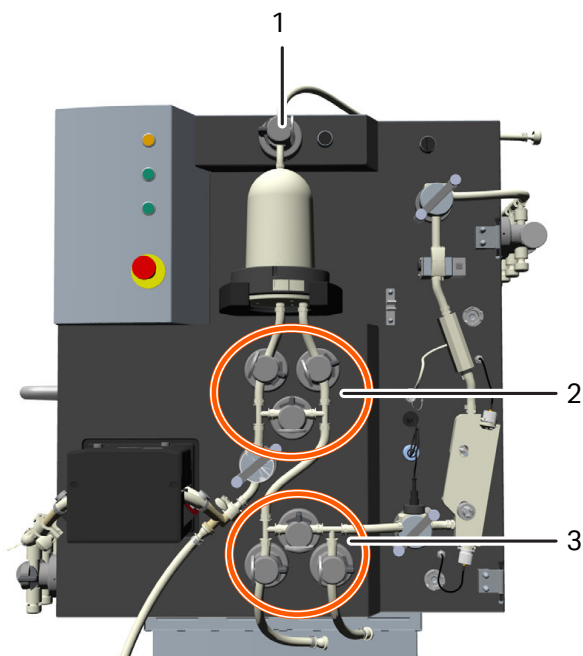


## Install tubing and sensors

Step	Action
1	Insert the tubing into the valves in the order specified below. Close the valve safety lock on each valve after inserting the tubing.

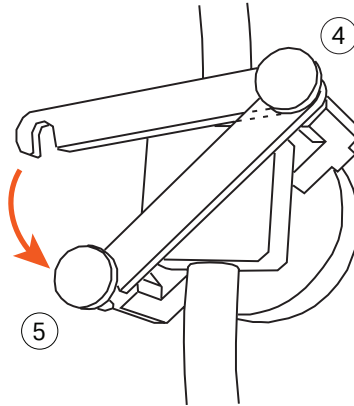


- a. Air trap valves (2)
- b. Column valves (3)
- c. Air release valve (1)

**Note:**

*Make sure the pH cable does not get trapped behind the tubing. The cable must stay attached to its holder on the cabinet.*

Step	Action
2	Push the three pressure sensors into their respective holders on the cabinet (sensors <b>PT-111</b> , <b>PT-112</b> , and <b>PT-113</b> ).
3	Attach the pressure sensors to the cabinet: turn the latch over the pressure sensor body and loosely fasten the screws (4, 5).

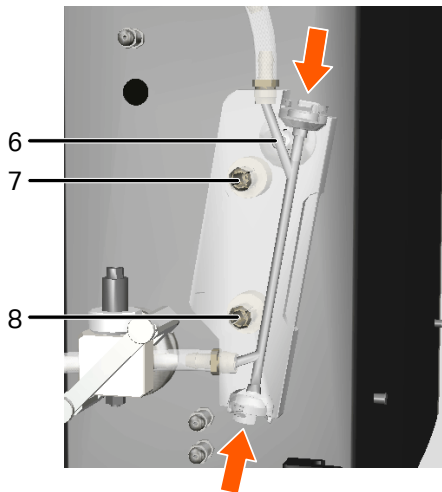


- 4 Verify that the sensor is correctly positioned and that there is no gap between the sensor body and the holder, and then tightly fasten the screws. Apply finger force only.
- 5 Align the holes in the body of the flow meter (**FE-141**) with the two knobs on the cabinet (7 and 8 in the illustration), and push the flow meter onto the knobs.

**Note:**

*A window for the temperature sensor (6) on the back of the flow meter is aligned with the temperature sensor when the flow meter is correctly installed. No further action is necessary to prepare for temperature measurements.*

Step	Action
------	--------

**Result:**

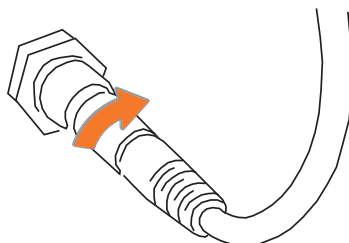
A soft click indicates correct assembly.

- |    |  |
|----|--|
| 6  | Clean the contact surfaces of the transducer connectors (bayonet couplings) and apply a thin smooth layer of petroleum jelly. Make sure that enough petroleum jelly is applied. Any surplus petroleum jelly is pressed out and can be removed with a tissue when connections are made. |
| 7  | Connect the transducers to the connectors at the top and bottom of the flow meter (see arrows in the illustration).  |
| 8  | Unscrew the protective cap from the conductivity connector (on the system cabinet).  |
| 9  | Align the connectors: a ridge on the male connector (on the system cabinet) and a groove on the female connector (on the cable).   |
| 10 | Screw the conductivity sensor cable into the connector on the system cabinet.  |

**Note:**

*Do not use force when inserting the connector.*

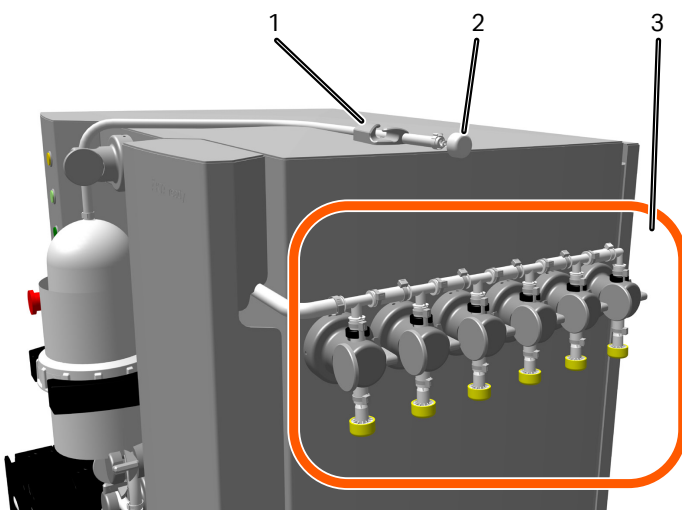
Step	Action
------	--------



## Attach the outlet manifold

Step	Action
------	--------

- |   |  |
|---|--|
| 1 | Attach the outlet manifold (3) to the system: insert each inlet tubing into the corresponding outlet pinch valve ( <b>XV-051</b> to <b>XV-056</b> ). |
|---|--|



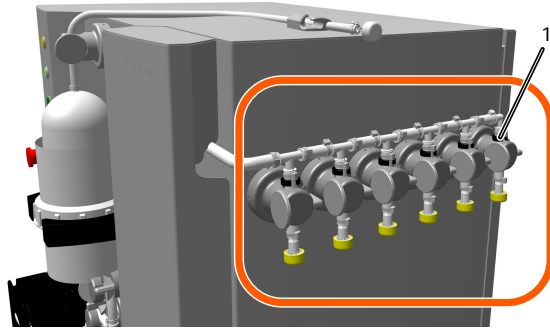
**Note:**

*Do not remove the protective end caps from the connectors.*

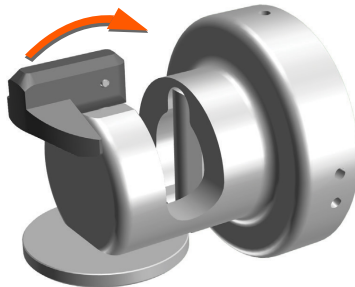
- |   |  |
|---|--|
| 2 | <p>Make sure that the spacer rings (shown in black, 1) on each outlet tubing are fastened correctly:</p> <ul style="list-style-type: none"> <li>For a flow kit with only one spacer ring per outlet, fasten the spacer above each outlet pinch valve as shown in the image below.</li> </ul> |
|---|--|

Step	Action
------	--------

- |  |   |
|--|---|
|  | <ul style="list-style-type: none"><li>For a flow kit with two spacers rings per outlet, fasten the spacers above and below each outlet pinch valve.</li></ul> |
|--|---|



- |   |  |
|---|--|
| 3 | Close the safety locks on all pinch valves: lift each black handle and turn the handle inward 180 degrees. |
|---|--|



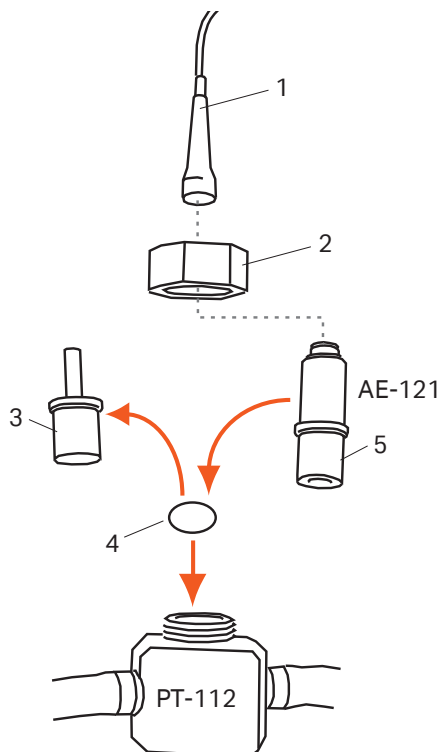
- |   |  |
|---|--|
| 4 | Push the air vent tubing (attached to the top of the air trap) onto the holder (1) on top of the system cabinet. |
| 5 | Remove the protective end cap (2) from the end of the air vent tubing.   |

**Note:**

*The air trap does not work if the protective cap is left in place.*

## Install the pH electrode

Step	Action
1	Unscrew the plastic fastening nut (2) on top of pressure sensor ( <b>PT-112</b> ) and pull out the dummy (3) from the electrode holder.



2	Locate the pH cable on the system cabinet (in the storage position), and unscrew the lower cable connector from the system cabinet.
---	---

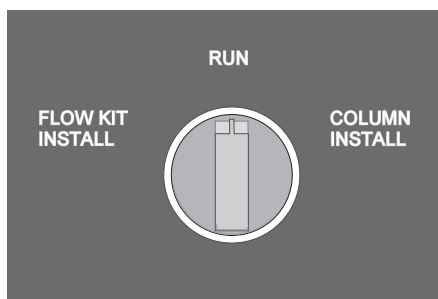
**Note:**

*Do not unscrew the upper connector.*

3	Push the pH cable (1) through the fastening nut (2), and connect pH electrode ( <b>AE-121</b> ) (5) to the cable.
4	Calibrate and sanitize the pH electrode. See <a href="#">Calibrate the pH electrode, on page 160</a> for calibration instructions.
5	Make sure the O-ring (4) is in place in <b>PT-112</b> .
6	Push the pH electrode into the pressure sensor <b>PT-112</b> and fasten it with the nut (2).

## Complete the flow kit installation

Step	Action
1	Verify that the safety locks on all pinch valves are closed.
2	Verify that the three pressure sensors are in place and properly connected.
3	Turn the installation switch to the <b>RUN</b> position.



### Result:

All pinch valves are set to the run position.

- |   |  |
|---|--|
| 4 | Verify that the end cap on the air vent tubing of the air trap has been removed. |
| 5 | Connect the air trap tubing to a waste hose.                                     |



### NOTICE

The end of the air trap tubing must be directed away from the operator.

Perform a component test after installation of a new flow kit. If the installation wizard is used, a component test is automatically included in the installation procedure. See [Section 5.4 Perform a component test, on page 106](#) for instructions.

Perform a stray light calibration. See [Calibrate UV stray light, on page 126](#) for instructions.

## Assembly in a laminar flow cabinet

It is possible to assemble the flow kit parts in a laminar flow cabinet, and then install the assembled kit on the ÄKTA ready system. Although this procedure may decrease the possibility for microbial contamination, Cytiva does not recommend the procedure. The pre-assembly may lead to incorrect orientation of the flow kit parts and cause tensions or damage the flow kit.

If pre-assembling the flow kit, make sure that the flow kit parts are correctly oriented towards each other and towards the ÄKTA ready system (for example, the inlet and outlet manifolds must be correctly oriented). The flow kit must fit on the system without causing restrictions in the flow path. Loosen the TC clamps if needed, adjust the kit components, and then tighten the clamps again.

## 5.3.4 Install the flow kit for gradient run

### Introduction

The following sections contain a step-by-step description on how to install the flow kit for a gradient run, including the gradient flow section. The short outline of the procedure is also included as **Flow Kit Installation** in the ÄKTA ready **Installation Wizard**.

It is recommended to use the wizard for kit installation to make sure that all steps are performed in the correct order.

### Start flow kit installation

All flow kit components are installed in the same way for both the isocratic flow kit and the gradient flow kit, except the pump tubing and the gradient flow section that are installed differently.

Install the gradient flow kit components as described in the following instructions.

Step	Action
1	Open safety locks on pinch valves (see <a href="#">Open safety locks on pinch valves, on page 84</a> ).
2	Remove the pump lids from both pumps (see <a href="#">Remove pump lid, on page 85</a> ).
3	Open pressure sensor holders (see <a href="#">Open pressure sensor holders, on page 87</a> ).
4	Attach the inlet manifold (see <a href="#">Attach the inlet manifold, on page 88</a> ).
5	Attach the main part tubing (see <a href="#">Attach the main part tubing, on page 89</a> ).

Install the pump tubing and the gradient flow section as described in the following section.

### Install pump tubing and gradient flow section

The following instructions are valid for a gradient run. For installation of pump tubing for an isocratic run, see [Install the pump tubing for isocratic run, on page 90](#).

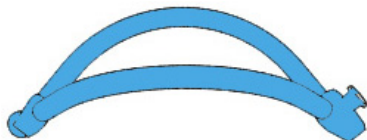
Make sure that the pump tubing for a gradient run is installed in the appropriate pump, as shown below.

Pump tubing delivery	Install in pump
Isocratic flow kit package	Gradient pump
Gradient flow section package	Isocratic pump

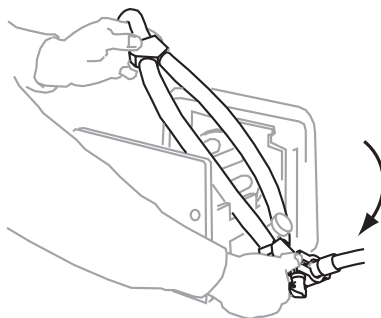
Follow the steps below to install the pump tubing.

Step	Action
------	--------

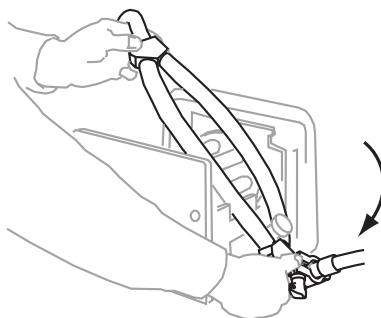
- |   |   |
|---|---|
| 1 | Take the pump tubing out of the isocratic flow kit package. |
|---|---|



- |   |   |
|---|---|
| 2 | Place the pump tubing on the gradient pump rollers (pump <b>P-202</b> ). The larger connector block (for connection with the main part of the flow kit) must be to the right of the pump. |
|---|---|

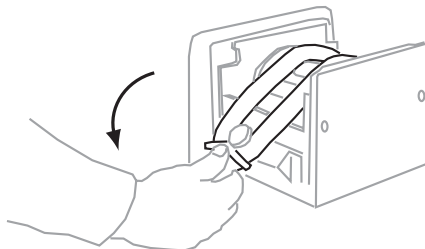


- |   |   |
|---|---|
| 3 | Push the pump tubing over the knob on the right side of the pump. |
|---|---|

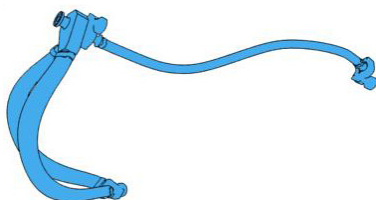


Step	Action
------	--------

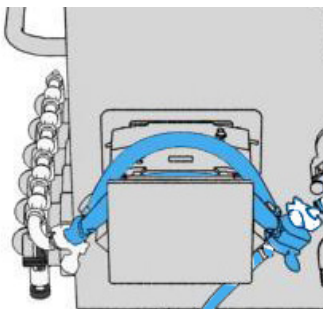
- |   |   |
|---|---|
| 4 | Stretch the tubing, and push it over the knob on the left side. |
|---|---|



- |   |  |
|---|--|
| 5 | Take the pump tubing and the jumper tubing out of the gradient flow section package. |
|---|--|



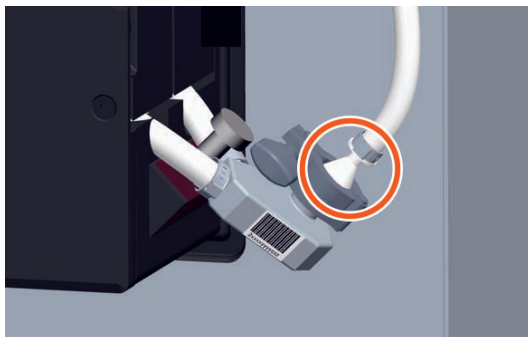
- |   |  |
|---|--|
| 6 | Place the pump tubing from the gradient flow section on the isocratic pump rollers (pump <b>P-201</b> ). |
|---|--|



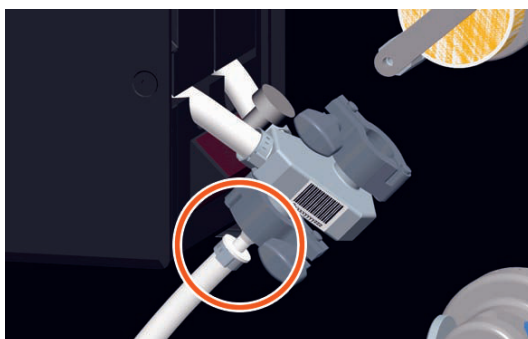
- |   |  |
|---|--|
| 7 | Push the tubing over the knobs on the right and left side of the pump. |
| 8 | Remove the jumper tubing from the gradient flow section package.       |

Step	Action
------	--------

- |   |  |
|---|--|
| 9 | Connect the jumper tubing to the right side of the pump tubing on the gradient pump ( <b>P-202</b> ) using a TC clamp. |
|---|--|



- |    |   |
|----|---|
| 10 | Connect the other end of the jumper tubing to the right side of the pump tubing on the isocratic pump ( <b>P-201</b> ). |
|----|---|



- |    |  |
|----|--|
| 11 | Connect the inlet manifold to the left side of the pump tubing on the isocratic pump ( <b>P-201</b> ) using a TC clamp.          |
| 12 | Connect the gradient buffer B tubing to the left side of the pump tubing on the gradient pump ( <b>P-202</b> ) using a TC clamp. |

## Complete flow kit installation

Follow the steps below to finish installing the gradient flow kit.

Step	Action
------	--------

- |   |   |
|---|---|
| 1 | Attach the pump lids (see <a href="#">Attach the pump lid, on page 92</a> ).  |
| 2 | Close the pinch valves and install the pressure sensors and flow meter (see <a href="#">Install tubing and sensors, on page 93</a> ). |

Step	Action
3	Install the conductivity sensor and the pH electrode (see <a href="#">Install the pH electrode, on page 98</a> ).
4	Attach the outlet manifold (see <a href="#">Attach the outlet manifold, on page 96</a> ).
5	Finish the flow kit installation including the component test and the stray light calibration (see <a href="#">Complete the flow kit installation, on page 99</a> ).

After completing the flow kit installation calibrate the gradient pump (see [Section 6.4.2 Calibrate the gradient pump, on page 165](#)).

**Note:** *The isocratic pump does not need calibration.*

## 5.4 Perform a component test

### Introduction

This section gives instructions on how to perform the component test, and describes the test report.

### In this section

Section		See page
5.4.1	Run a component test	107
5.4.2	The test report	111

### Safety precautions



#### NOTICE

Always perform a component test when installing a flow kit. The component test verifies the functionality of the sensors.

## 5.4.1 Run a component test

### Introduction

The component test is an option that can be included in the flow kit installation method. See [Create method, on page 81](#) for details.

The component test consists of a number of steps to verify the functionality of the ÄKTA ready components, in particular the sensors. The following aspects are tested:

- The type of the flow kit (High Flow or Low Flow)
- Flow meter
- UV sensor
- Conductivity sensors
- Pressure sensors

### Required solutions

The following solutions are needed for the component test:

Solution	Preparation	Low Flow Kit	High Flow Kit
Wash solution	Purified water or 20% ethanol	10 L	25 L
Test solution	<ul style="list-style-type: none"> <li>• 1.0 M NaCl</li> <li>• 1.06 % (v/v) acetone</li> <li>• Purified water</li> </ul>	5 L	10 L

**Note:** The test solution contains acetone and must be freshly prepared to avoid evaporation.

**Test solution preparation protocol** templates are available on the ÄKTA ready Strategy DVD.

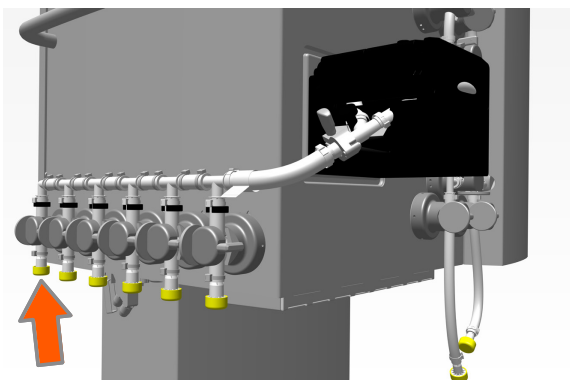
### Prepare the component test

Connect the inlets and outlets as described in the steps below.

Step	Action
1	Remove the protective end cap from <b>Inlet 6</b> , and connect the wash solution.

**Note:**

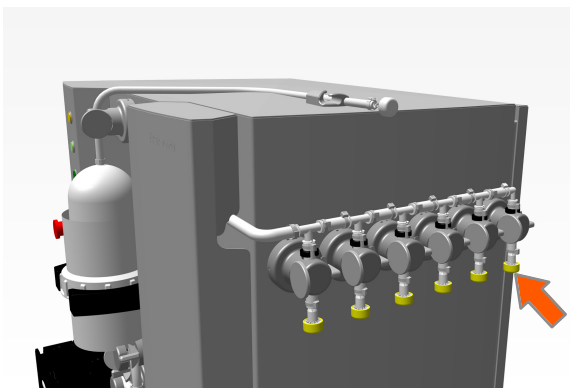
*Containers must not be placed lower than 1 m below the inlets (that is, floor level).*



2	Remove the protective end cap from the inlet for the test solution and connect the test solution. Use the applicable inlet:
---	---

- **Inlet 5** for ÄKTA ready
- **Inlet 7** for ÄKTA ready gradient

3	Remove the protective end cap from <b>Outlet 6</b> , and connect waste tubing to this outlet.
---	---



## Run the component test

The component test is created as part of the flow kit installation method. All information added by the user (for example notes) is included in the test report. Running a component test takes about 10 minutes.

Follow the steps below to start the flow kit component test.

Step	Action
1	<p>In the <b>System Control</b> module, click <b>File:Open</b>, and select the applicable component test.</p> <p><i>Result:</i> The <b>Start Protocol</b> window opens.</p>
2	<p>On the <b>Notes</b> tab, verify the information. Type your input as applicable, and then click <b>Next</b> to continue.</p>
3	<p>On the <b>Questions</b> tab, fill in the information as required, and then click <b>Next</b> to continue.</p> <p><b>Tip:</b> <i>Scan the information using the bar code scanner, or type manually into the text fields.</i></p> <p><b>Note:</b> <i>The <b>Questions</b> tab consists of two pages. Fill in the information on both pages.</i></p>
4	<p>On the <b>Result Name and Location</b> tab, specify the file name and location as applicable.</p>
5	<p>Click <b>Start</b> to start the component test.</p>

See the following section for user actions during a component test.

## Actions during a component test

The test progress can be followed in the UNICORN **System Control** module. Charts show the response curves for the different sensors.

The software issues two messages during the test run.

1. A warning message informing that the UV stray light reduction is activated.

The message is for information only. The user can click **Acknowledge** to close the message. The component test continues independently of user action.

The warning message can be disabled as described in [Calibrate UV stray light, on page 126](#).

2. A message requesting the user to fill the air trap. Do the following:

- a. In the **System Control** module, click **Continue** to start filling the air trap.
- b. Press and hold the **AIR VENT** button on the system cabinet, until the air trap is filled to the half.
- c. In the **System Control** module, click **Continue**.

**Note:** *The user must fill the air trap as instructed above. The component test fails if the air trap is not correctly filled.*

Notes can be added manually at any time during the test run. The notes are included in the test report. To open the notes dialog box click **View** → **Documentation** in the **System Control** module.

## 5.4.2 The test report

### Print the test report

Information about an installation, including the results from the component test, are stored and can be compiled into a printed report. The report can be printed from the **Evaluation Classic** module. To switch to **Evaluation Classic** open the **Evaluation** module, click **File** → **Applications** and select **Switch to Evaluation Classic**.

If the option **Print report automatically** was chosen initially in the installation wizard ([Create method, on page 81](#)), the results from the component test run will be available in the form of a printed report produced immediately after the test has finished.

If the option **Print report automatically** was not chosen, a printed report can be created at a later time.

Follow the steps below to view or print the column test report.

Step	Action
------	--------

- |   |  |
|---|--|
| 1 | In the <b>Evaluation</b> module, click <b>File</b> → <b>Report</b> .<br><i>Result:</i><br>The <b>Generate Report</b> dialog box opens. |
| 2 | In the dialog box, select <b>AKTA ready_FlowKit</b> .  |
| 3 | Click <b>Print</b> or <b>Preview</b> as applicable.  |

## 5.5 Connect a column

### Introduction

This section describes how to install a column on the system. The information in this section is also available in **Column Installation** in the ÄKTA ready installation wizard.

The section also contains instructions for running a column efficiency test and for column rinsing. Both instructions describe optional procedures that can be performed in connection with installing a new column.

For more information refer to the documentation provided with the column.

**Note:** *ReadyToProcess columns are factory tested and are supplied with a certificate stating the results from an efficiency test performed on the individual column.*

### In this section

Section		See page
5.5.1	Install a column	113
5.5.2	Run a column efficiency test (optional)	121
5.5.3	Rinse a column (optional)	124

## 5.5.1 Install a column

### Column types

ReadyToProcess columns are recommended for use with ÄKTA ready. Other types of columns may be used, but may require special safety precautions. The columns must be capable to withstand the maximum system pressure. If not, additional pressure safety devices must be used to prevent a run from reaching too high pressure.



#### **WARNING**

**Hazardous pressure.** The flow rate may under no circumstances exceed the specified column maximum flow rate. High flows might affect the packed medium, causing the pressure to exceed the specified column maximum pressure.



#### **WARNING**

**Overpressure.** Do not block the outlet tubing with, for instance, stop plugs. Blocked outlet tubing can create overpressure and can result in injury.

Contact a local Cytiva representative for more information about using products other than ReadyToProcess columns with ÄKTA ready.

More information about columns and chromatography resin is found on the Cytiva website.

### Prime the flow kit

Before installing a column, the flow kit must be primed with liquid (e.g., purified water) from **Inlet 6** to the column valves, including the air trap.

The flow kit is automatically primed during a component test. Additional priming is not needed if the component test has been performed before the column installation.

## Position the column

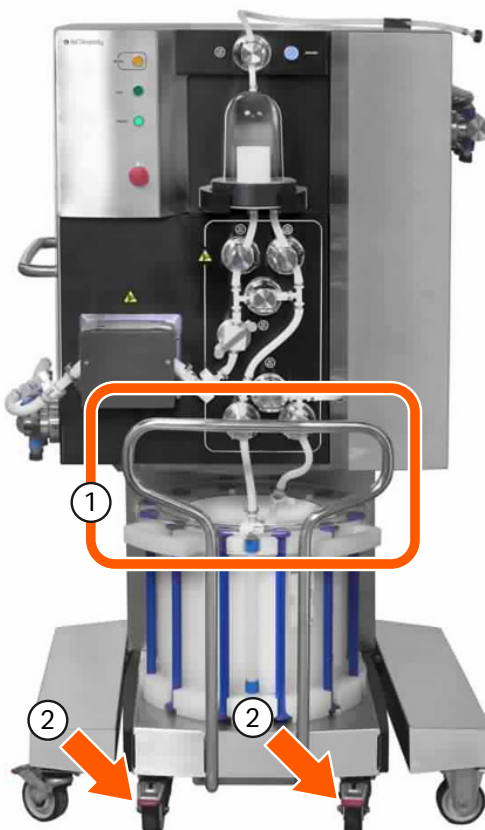


### WARNING

Before use, check that the column is not damaged or otherwise defective. Damaged or defective columns can leak or rupture.

Follow the steps below to position the column correctly.

Step	Action
1	Place the column on the column trolley.
2	Position the column so that the column inlet tubing, marked <b>BOTTOM INLET</b> , is turned toward the handle of the column trolley (1).



Step	Action
3	Roll the trolley into position between the system cabinet leg supports, and lock the trolley wheels (2).

**Note:** *Be careful when transporting smaller columns (for example 2.5 L) on the trolley. Small columns are light and have a narrow base, and can be unstable.*

## Create column installation method

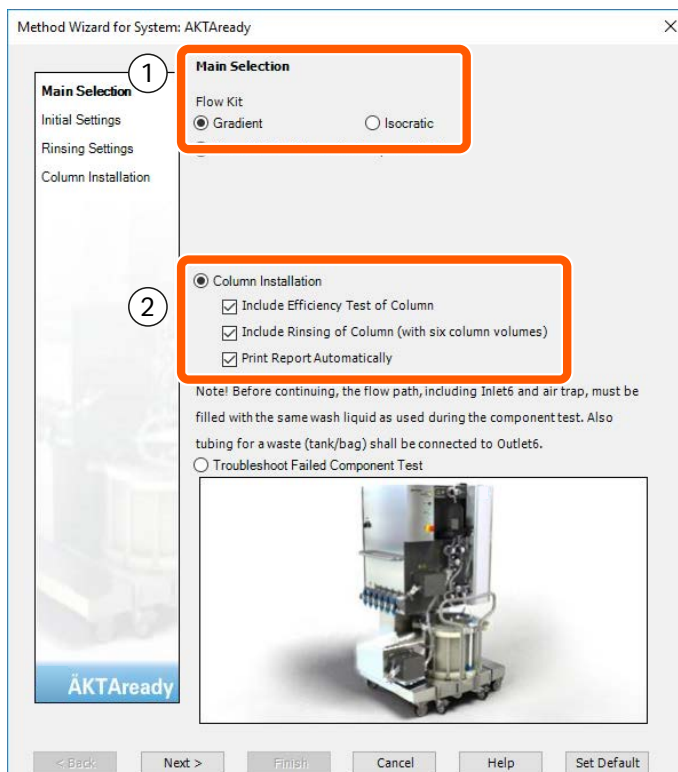
The steps described in here follow the **Column Installation** steps in the ÄKTA ready Installation Wizard. The user must simultaneously create the column installation method, and connect and install the column. Follow the instructions in [Connect the column, on page 118](#) to install the column.

Create the column installation method in the **Method Editor** module following the steps below.

Step	Action
1	On the <b>File</b> menu, click <b>New Method</b> .
2	In the <b>New Method</b> dialog box, click <b>Method Wizard</b> , and then click <b>OK</b> .
3	In the <b>Method Wizard</b> , select the following options: <ul style="list-style-type: none"> <li><b>a. Gradient or Isocratic</b>, depending on your system.</li> <li><b>b. Include Efficiency Test of Column</b> (optional).</li> <li><b>c. Include Rinsing of Column</b> (optional)</li> </ul>

Step	Action
------	--------

- |  |  |
|--|--|
|  | <p>d. Select the <b>Print Report Automatically</b> check box if you want to print a report with installation information and test results.</p> |
|--|--|



**Note:**

See [Section 5.5.2 Run a column efficiency test \(optional\), on page 121](#) and [Section 5.5.3 Rinse a column \(optional\), on page 124](#) for more information about the efficiency test and rinsing.

**Note:**

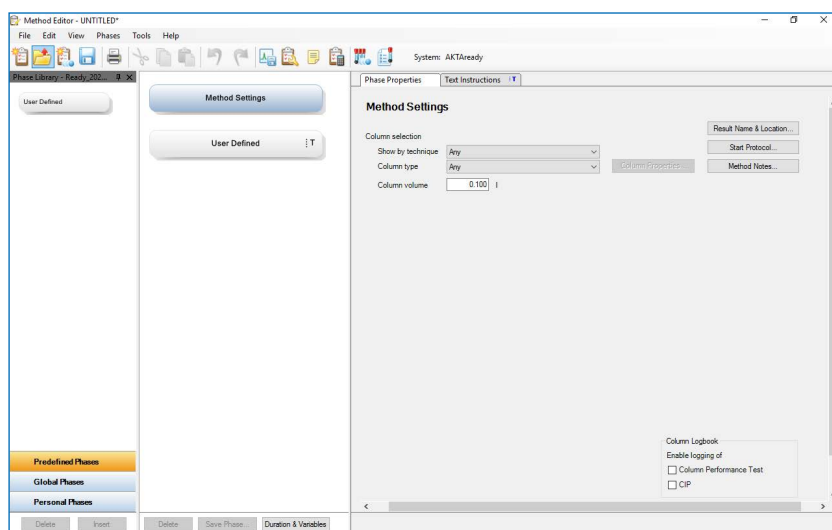
A report can also be printed on demand after the completed test, in the **Evaluation** module.

- |   |  |
|---|--|
| 4 | <p>Click <b>Next</b> to move to the next page in the <b>Method Wizard</b>.</p> <p>a. On each new page select and confirm the options as applicable for your system, and then click <b>Next</b>.</p> <p>b. For installation of column hardware, as requested in the <b>Method Wizard</b>, follow the instructions in <a href="#">Connect the column, on page 118</a>.</p> |
| 5 | <p>Click <b>Finish</b>.</p>  |

Step	Action
------	--------

*Result:*  
 The **Method Wizard** closes.

- |   |   |
|---|---|
| 6 | In <b>Method Editor</b> , select <b>Method Settings</b> and verify that the information is correct. |
|---|---|



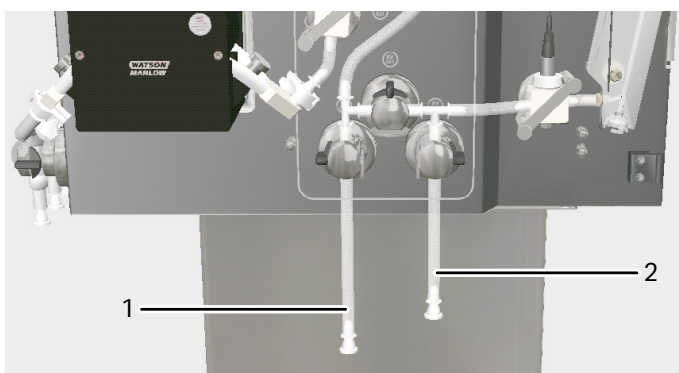
- |    |   |
|----|---|
| 7  | Select <b>User Defined</b> , and verify that the information is correct.                |
| 8  | Save the column installation method.  |
| 9  | Open the saved <b>Column installation</b> method from the <b>System Control</b> module. |
| 10 | Fill in the applicable values for your column.  |

When the **Column installation** method is created and the column is correctly connected to the system, follow the instructions in [Section 5.5.2 Run a column efficiency test \(optional\)](#), on page 121, if applicable.

## Connect the column

Follow the instructions in the **Method Wizard**, as described in [Create column installation method, on page 115](#), to connect the column and create the optional test methods. Follow the steps below to connect a column hardware to the system when following the wizard.

Step	Action
1	Remove the welded tubing ends from the bottom inlet tubing on the column.  <b>Note:</b> <i>Store the welded tubing ends for sealing the column when it is disconnected.</i>
2	Sanitize the connecting tubing with 70% ethanol.
3	To prevent air entering the column via the inlet, fill the column inlet up to the top with 20% ethanol or 2% benzyl alcohol.
4	Remove the protective end cap from the column inlet tubing of the flow kit (1). Connect the tubing to the bottom inlet tubing on the column using a TC clamp.

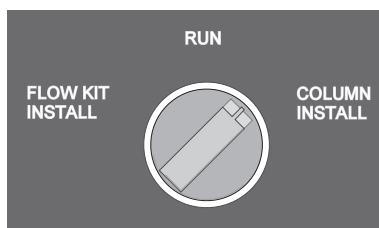


Step	Action
------	--------

- |   |  |
|---|--|
| 5 | Repeat steps 1 to 4 above for the column outlet connector (2). Connect the outlet connector to the top inlet tubing connector on the column. |
|---|--|



- |   |   |
|---|---|
| 6 | Turn the installation switch to the <b>COLUMN INSTALL</b> position. |
|---|---|

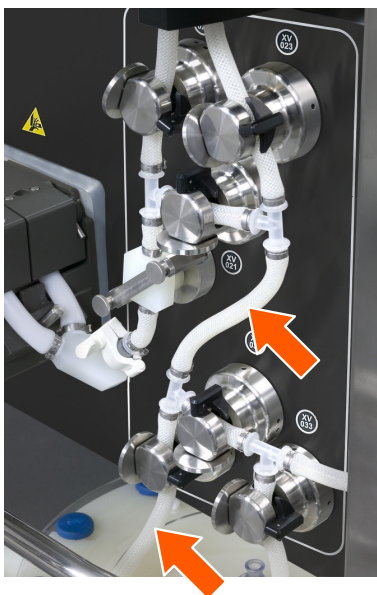


*Result:*

The flow path from the air trap to the column opens.

Step	Action
------	--------

- |   |   |
|---|---|
| 7 | Let the liquid flow from the air trap into the column. Press the <b>AIR VENT</b> button on the system cabinet front to open the air trap and release the air. If necessary, tap, flick or squeeze the tubing (arrows in the following illustration) to release the air, until the tubing is completely filled with liquid and no more bubbles raise up to the air trap. |
|---|---|



- |   |  |
|---|--|
| 8 | Turn the installation switch to the <b>RUN</b> position. |
|---|--|

## 5.5.2 Run a column efficiency test (optional)

### General

A column efficiency test can be included when creating the column installation method with the installation wizard (see [Create column installation method, on page 115](#) for more information). When using the installation wizard, the test results are included in the column installation report.

Alternatively, a column efficiency test can also be created in the **Method Editor** module from a method template.

The column efficiency test must be run in stable conditions at room temperature. The specified flow rates, volumes, and buffers must be used.

For more information about efficiency testing of columns refer to the application note *Efficiency test of ReadyToProcess columns (28919821)*.

### Required solutions

The following solutions are needed for the column efficiency test.

Solution	Composition	Volume	Connection point
Wash solution	Purified water or 20% ethanol	Depends on column volume. See <b>Method Wizard</b> for information.	Inlet 6
Test solution	2% (v/v) acetone in column wash solution	5 L	Inlet 5

**Note:** *The same solvent must be used in wash and test solutions to allow the results to be compared between different tests. 20% ethanol gives lower values than water and therefore influences the test results.*

### Run the test

If the **Include Efficiency Test of Column** option is selected in the **Method Wizard** for column installation, the method for the column efficiency test is created automatically. Save the test before running it, and adjust the test to fit a specific column, as recommended in the **Method Wizard**.

Follow the steps below to start the column efficiency test.

Step	Action
1	In the <b>System Control</b> module, click <b>File</b> → <b>Open</b> , and select the applicable method.

Step	Action
	<p><i>Result:</i>            The <b>Start Protocol</b> window opens.</p>
2	On the <b>Notes</b> tab, verify the information. Type your input as applicable, and then click <b>Next</b> to continue.
3	On the <b>Questions</b> tab, fill in the information as required, and then click <b>Next</b> to continue.
	<p><b>Tip:</b>            Scan the information using the bar code scanner, or type manually into the text fields.</p> <p><b>Note:</b>            The <b>Questions</b> tab consists of two pages. Fill in the information on both pages.</p>
4	On the <b>Result Name and Location</b> tab, specify the file name and location as applicable.
5	Click <b>Start</b> to start the column efficiency test.

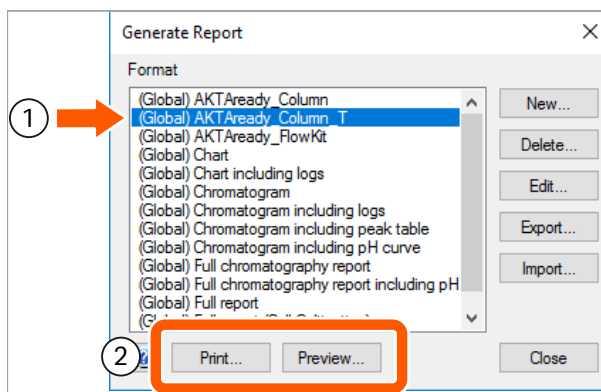
Notes can be added manually at any time during the test run. The notes are included in the test report. To open the notes dialog box click **View** → **Documentation** in the **System Control** module.

## View the test report

Follow the steps below to view or print the column test report.

Step	Action
1	In the <b>Evaluation Classic</b> module, click <b>File</b> → <b>Open</b> → <b>Result Navigator</b> .
2	In the <b>Result Navigator</b> , select the applicable result file and open the file.
3	Click <b>File</b> → <b>Report</b> .
	<p><i>Result:</i>            The <b>Generate Report</b> dialog box opens.</p>
4	In the dialog box, select the format <b>AKTAready_Column_T(1)</b> .
	<p><b>Note:</b>            This format is specifically adapted for the column test report.</p>

Step	Action
------	--------



5 Click **Print** or **Preview** (2) as applicable.

A column test report does not state if the column has passed or failed the test. The user is responsible for comparing the test results with provided acceptance criteria in order to decide if the column has passed.

## 5.5.3 Rinse a column (optional)

### Introduction

The rinsing methods can be predefined or customized by the user. The predefined method is included as an optional step in the column installation wizard (see [Create column installation method, on page 115](#)).

### Required solutions

Purified water or a low salt buffer is used for rinsing. See the column documentation for buffer details. At least 6 column volumes are required. The exact volume is shown in the column installation wizard.

If the same wash solution is used for rinsing and in the column efficiency test (see [Required solutions, on page 121](#)), also the same inlet should be used (**Inlet 6**).

### Rinsing procedure

Column rinsing takes approximately 80 minutes. No user actions are required during this time. It is possible to include notes during a run.

## 5.6 Set ÄKTA ready specific parameters in **Method Editor**

### Introduction

This section describes how to change specific features for ÄKTA ready in the UNICORN **Method Editor**. The changes are applied to existing methods. See UNICORN manuals for instructions on how to create methods.

### In this section

Section		See page
5.6.1	Set UV stray light calibration	126
5.6.2	Set flow meter fine tuning	128
5.6.3	Set totalizers	129
5.6.4	Set <b>PressureFlowControl</b>	131

## 5.6.1 Set UV stray light calibration

### Introduction

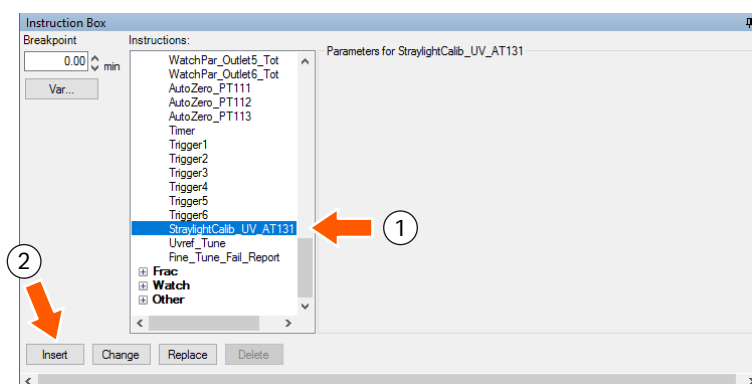
The UV sensor is automatically calibrated when a new flow kit is installed using the installation wizard. In addition, manual calibration of the UV sensor can also be included in the methods.

### Calibrate UV stray light

Place this instruction to the beginning of a method. For the calibration the UV LED is shut down and the stray light is measured during 15 seconds. Other UNICORN instructions cannot be executed at this time, make sure to delay the next instruction for at least 20 seconds to avoid conflict. The base for the stray light calibration instruction (**Base**) must be defined as **Time**.

Follow the steps below to add automatic stray light calibration to a method.

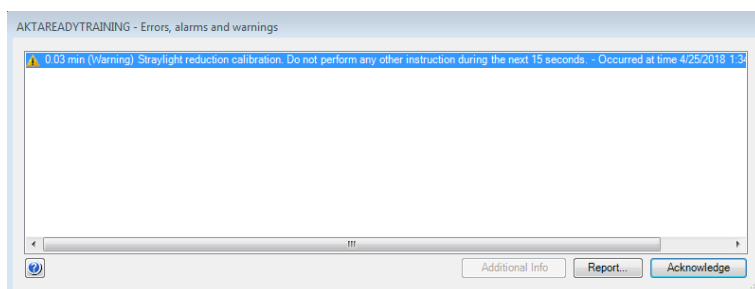
Step	Action
1	In <b>Method Editor</b> , in the <b>Instruction Box</b> , expand <b>Alarms&amp;Mon.</b>
2	Scroll down, and then click <b>StraylightCalib_UV_AT_131</b> (1).
3	Click <b>Insert</b> (2).



When the method is executed and the stray light calibration starts, the following message is shown:

**Stray light reduction calibration. Do not perform any other instruction during the next 15 seconds.**

Step	Action
------	--------



The user must wait until the calibration is completed. No user action is allowed during this time.

- |   |  |
|---|--|
| 4 | After 15 seconds, click <b>Acknowledge</b> . |
|---|--|

## 5.6.2 Set flow meter fine tuning

### Introduction

The flow meter uses ultrasound to measure the flow rate. Fine tuning is used to correct the measured flow rate for differences in sound speed through plastic and liquid.

If the refraction index of the liquid is very similar to the index of the plastic, the fine tuning fails. This may happen for buffers with high salt concentration. The maximal additional error of the flow rate measurement in case of failed fine tuning is  $\pm$  one percent unit, when temperature difference between process liquid and environment is kept within 10°C.

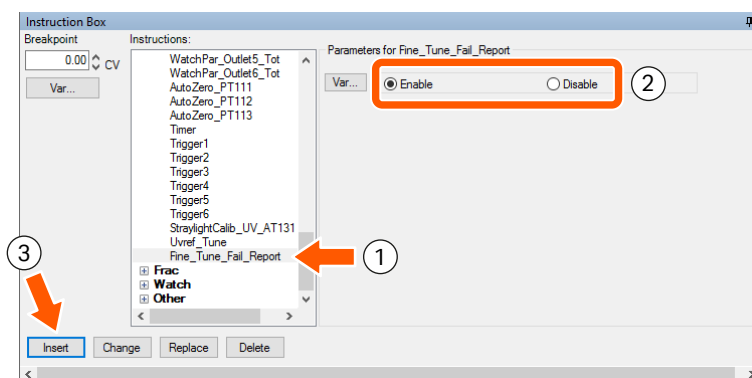
If the system displays ***Fine\_tuning\_flowmeter\_failed*** message, lubricant must be applied to the transducers. See [Apply lubricant to flow meter, on page 151](#) for instructions.

### Enable or disable ***Fine\_tuning\_flowmeter\_failed*** message

Follow the steps below to enable or disable the ***Fine\_tuning\_flowmeter\_failed*** message.

Step	Action
------	--------

- |   |   |
|---|---|
| 1 | In <b>Method Editor</b> , in the <b>Instruction Box</b> , expand <b>Alarms&amp;Mon.</b> |
| 2 | Scroll down, and then click <b><i>Fine Tune Fail Report</i></b> (1).                    |



- |   |  |
|---|--|
| 3 | a. Click <b>Enable</b> (2) to enable the <b><i>Fine_tuning_flowmeter_failed</i></b> message in case of fine tuning failure.<br>b. Click <b>Disable</b> to disable the message. |
| 4 | Click <b>Insert</b> (3).   |

## 5.6.3 Set totalizers

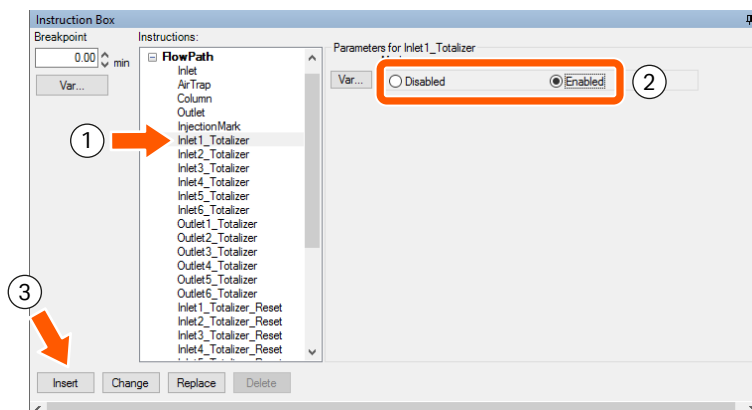
### Introduction

A totalizer monitors the accumulated volumes passing through an inlet or an outlet. Every inlet or outlet has a specific totalizer.

### Set totalizer

Follow the steps below to set or reset a totalizer, or activate a totalizer alarm. The instructions are given for **Inlet 1** as an example.

Step	Action
1	In <b>Method Editor</b> , in the <b>Instruction Box</b> , expand <b>Flowpath</b> .
2	Scroll down, and then click <b>Inlet1_Totalizer</b> (1).



- |   |   |
|---|---|
| 3 | Click <b>Enabled</b> or <b>Disabled</b> (2).  |
| 4 | Click <b>Insert</b> (3).  |
| 5 | To reset a totalizer, do the following: <ol style="list-style-type: none"> <li>Expand <b>Flowpath</b>.</li> <li>Scroll down, and then click <b>Inlet1_Totalizer_Reset</b>.</li> <li>Click <b>Insert</b>.</li> </ol>   |
| 6 | To activate an alarm for an enabled totalizer, do the following: <ol style="list-style-type: none"> <li>Expand <b>Alarms&amp;Mon</b></li> <li>Scroll down, and then click <b>Alarm_Inlet1_Totalizer</b>.</li> <li>On the <b>Setpoint</b> list, select an applicable volume (1.0 to 500 L).</li> </ol> |

Step	Action
------	--------

	<b>d.</b> Click <b>Insert</b> .
--	---------------------------------

**Note:**

*When an alarm is activated, the system is set in the **Pause** mode.*

## 5.6.4 Set **PressureFlowControl**

### Introduction

The **PressureFlowControl** functionality is used to set limits to pressure and flow rate. The functionality adjusts the flow rate to maintain the defined pressure, or maintains the defined flow rate.

To activate the **PressureFlowControl** functionality, the parameters must be defined in the correct order:

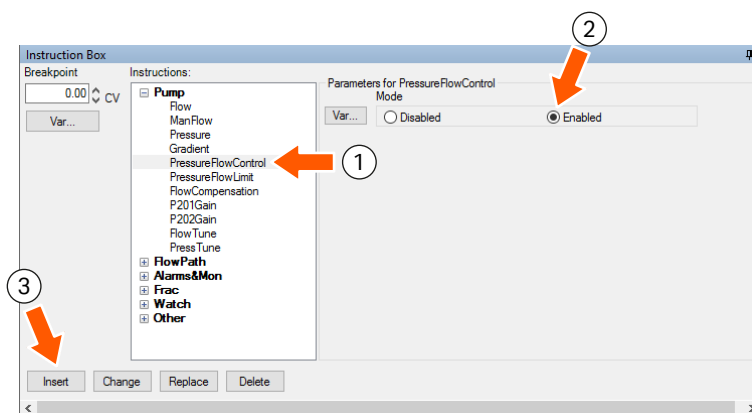
1. **PressureFlowControl** enabled.
2. **Pressure, Flow, PressureFlowLimit** values specified.

The system is paused when the specified limits are exceeded.

### Enable **PressureFlowControl**

Follow the steps below to control the pressure and flow simultaneously during a run.

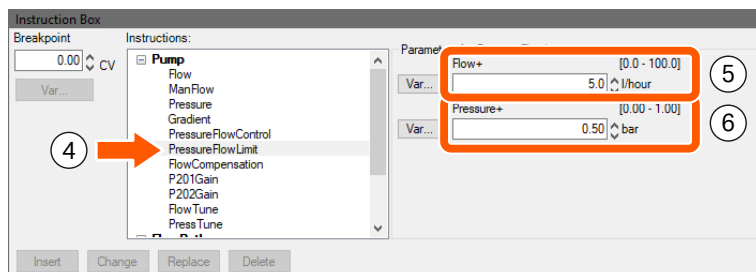
Step	Action
1	In <b>Method Editor</b> , in the <b>Instruction Box</b> , expand <b>Pump</b> .
2	Scroll down on the <b>Instructions</b> list, and then click <b>PressureFlowControl</b> (1).



3. Click **Enabled** (2).
4. Click **Insert** (3).

Step	Action
------	--------

- |   |  |
|---|--|
| 5 | On the <b>Instructions</b> list, click <b>PressureFlowLimit</b> (4). |
|---|--|



**Result:**

The parameters for the function are displayed.

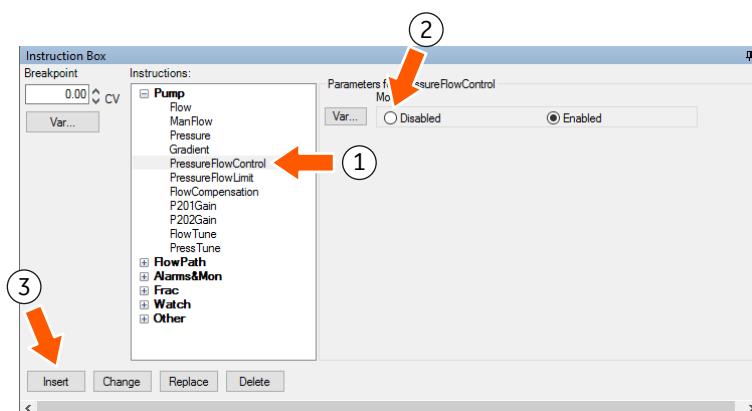
- |   |   |
|---|---|
| 6 | On the <b>Flow+</b> list (5), select an applicable value for flow rate deviation (0.0 to 100 l/hour).   |
| 7 | On the <b>Pressure+</b> list (6), select an applicable value for pressure deviation (0.00 to 1.00 bar). |
| 8 | Click <b>Insert</b> .   |

## Disable **PressureFlowControl**

Follow the steps below to disable **PressureFlowControl**.

Step	Action
------	--------

- |   |   |
|---|---|
| 1 | In <b>Method Editor</b> , in the <b>Instruction Box</b> , expand <b>Pump</b> .              |
| 2 | Scroll down on the <b>Instructions</b> list, and then click <b>PressureFlowControl</b> (1). |



Step	Action
3	Click <b>Disabled</b> (2).
4	Click <b>Insert</b> (3).

## 5.7 Run a method

### Introduction

This section describes how to start, monitor and end a method run.

Running a method on ÄKTA ready is automated. User interaction is required in the preparation phase (for example connecting the column and containers, checking connections and the flow kit). For information on method creation refer to *UNICORN Method Manual (29263510)*.

### In this section

Section		See page
5.7.1	Prepare before a run	135
5.7.2	Run a method	141

## 5.7.1 Prepare before a run

### Safety precautions



#### **WARNING**

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



#### **WARNING**

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



#### **CAUTION**

Do not use chemicals at temperatures above the specified limits.



#### **NOTICE**

Do not run the system at higher temperatures than the specified maximum operating temperature as stated on the system label.

## Connect containers

Connect the containers shown in the table below.



### NOTICE

Make sure that tubing connected to the inlets have the same or larger inner diameter than the inlets, and is not longer than 10 m, to prevent negative pressure at the pump tubing inlet and damage to the pump tubing.

Container	Action
Buffers	<p>Connect the buffer inlet tubing to the appropriate buffer containers. The liquid level in the inlet containers should be equal, and similarly equal in the outlet containers.</p> <p><b>Note:</b> Significant differences in the liquid levels can cause unintended mixing if the valve switch time is too long. Set the valve switch time as applicable. See <a href="#">Set valve switch time, on page 137</a> and <a href="#">Override valve switch time, on page 137</a> for instructions.</p>
Samples	<p>Connect the sample inlet tubing to the appropriate sample containers.</p> <p><b>Tip:</b> Use air sensors for optimal sample application. See <a href="#">Connect air sensor (optional), on page 139</a> for more information.</p>
Fractionation	<p>If fractionation is included in the method, connect the outlet tubing from the outlet valves to applicable fraction collectors.</p>
Waste	<p>Connect the waste tubing to a waste container. Make sure that the waste container is dimensioned for maximum possible volume when the system runs unattended.</p>

## Set valve switch time

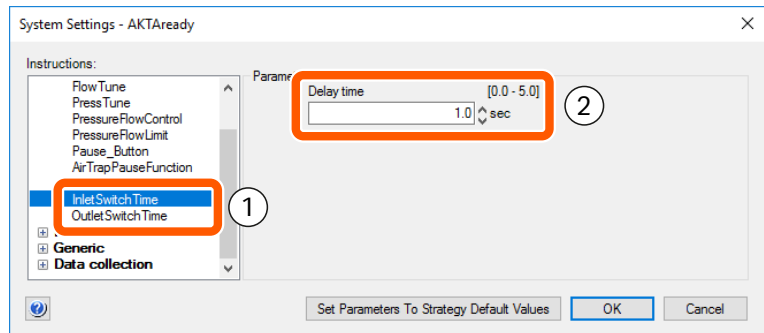
The valve switch time is a short period when two inlet valves or two outlet valves are open simultaneously, as the flow is switched from one valve to another. This allows the pump to run continuously without a blocked flow due to a closed inlet or outlet manifold.

Keep the valve switch time as short as possible. A minimum switch time of 0.1 seconds is required to prevent blockage.

Follow the steps below to set the valve switch time.

Step	Action
------	--------

- |   |  |
|---|--|
| 1 | In the <b>System Control</b> module, click <b>System</b> → <b>Settings</b> → <b>Specials</b> . |
| 2 | Click <b>InletSwitchTime</b> or <b>OutletSwitchTime</b> (1).                                   |



- |   |   |
|---|---|
| 3 | Set the <b>Delay time</b> between 0.1 to 5.0 seconds (2). |
|---|---|

**Note:**

*The default time is 1 second.*

- |   |                   |
|---|-------------------|
| 4 | Click <b>OK</b> . |
|---|-------------------|

## Override valve switch time

On very rare occasions, when simultaneous opening of two valves must be avoided, valve switching can be done manually. Follow the steps below to switch the valves manually.

Step	Action
------	--------

- |   |                        |
|---|------------------------|
| 1 | Stop the system pump.  |
| 2 | Close the first valve. |
| 3 | Open the second valve. |
| 4 | Start the system pump. |

## Set *OutletCloseTime*

The **OutletCloseTime** function specifies the length of the time delay before the outlet valves are closed. This allows the system to get depressurized when the method ends.

Follow the steps below to set the **OutletCloseTime**.

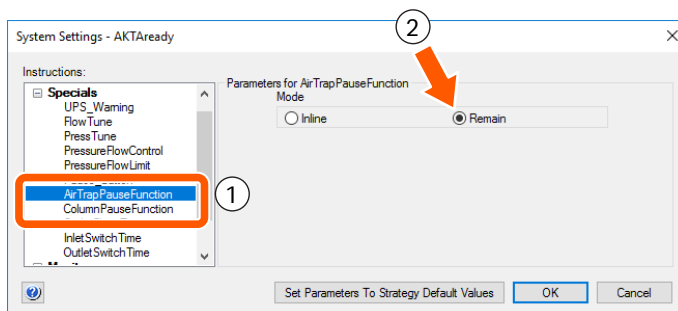
Step	Action
1	In the <b>System Control</b> module, click <b>System</b> → <b>Settings</b> → <b>Specials</b> .
2	Click <b>OutletCloseTime</b> .
3	Set the <b>DelayTime</b> between 1 to 30 seconds (2).  <b>Note:</b> <i>The default time is 7 seconds.</i>
4	Click <b>OK</b> .

## Valve position in *Pause* mode

When the system goes into the **Pause** mode, the air trap valve and the column valve are set to their default positions. The user can disable this function: in such case the valves remain in their current positions during **Pause**.

Follow the steps below to keep the air trap or the column in their current positions.

Step	Action
1	In the System Control module, click <b>System</b> → <b>System Settings</b> .
2	Expand <b>Specials</b> .
3	Select <b>AirTrapPauseFunction</b> or <b>ColumnPauseFunction</b> (1), as applicable.



4	Click <b>Remain</b> (2), and then click <b>OK</b> .
---	---

## Check flow path

Before starting a run, verify that all parts of the flow path are prepared.

- Make sure that the entire flow path, including the tubing to inlet containers, is filled with liquid and that no air bubbles remain in the system.

If air reaches the flow meter during a run, a message **Uncertain flow** is displayed, and the system goes to **Pause** mode.

The air trap can remove small amounts of air from the flow path.

- Prime each inlet, starting with **Inlet 1**. Use the **ManFlow** command to control the pump during priming.
- Equilibrate the column with the solution used for the run, if the equilibration is not included in the method.

## Calibrate equipment

After changing the flow kit, verify the flow readings. If the reading is not shown as zero when no flow is active, the flow meter must be calibrated. See [Calibrate the flow meter, on page 160](#) for instructions.

Before starting a run, make sure that the gradient pump is calibrated (see [Section 6.4.2 Calibrate the gradient pump, on page 165](#)).

**Note:** *The isocratic pump does not require calibration.*

## Connect air sensor (optional)

Make sure that the air sensor is installed on the appropriate inlet tubing, and connected to the **CUSTOMER I/O** port. The air sensor must be installed at appropriate distance from the pump, allowing to stop the pump before air can enter the system. The distance depends on the pump flow rate and the air sensor response time (0.01 min).

For detailed installation instructions, refer to *ÄKTA ready air sensor installation (29051561)*.

Select the applicable air sensor in the **Administration** module, in **System Properties** → **Edit**.

## 5 Operation

### 5.7 Run a method

#### 5.7.1 Prepare before a run

Edit - AKTaready

Instrument configuration: Ready\_202\_W210 (1.0.2.0) Information... Import...

UNICORN Control PC: WIN-2UA41A5KJRR Rename...

Instrument serial no.: 2495840

Connect by: Control Unit number: 1 Control Unit IP address: 192.168.0.1 Test Connection

Component types:

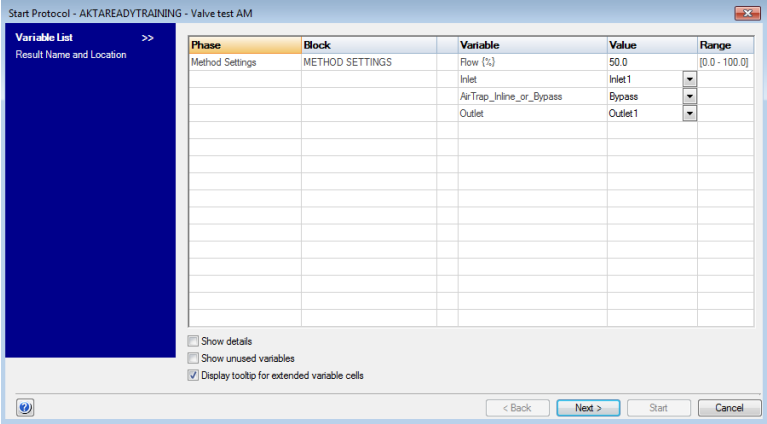
- ☐ AKTaready
  - ☐ Akta\_Ready
  - ☒ Akta\_Ready\_Gradient
  - ☒ pH\_Cell
  - ☒ LowFlow\_Kit
  - ☒ **Ar\_AE151**
  - ☐ Ar\_AE152
  - ☐ Profibus\_Config5
  - ☒ Profibus\_Config6

Advanced Settings... Extensions... OK Cancel

# 5.7.2 Run a method

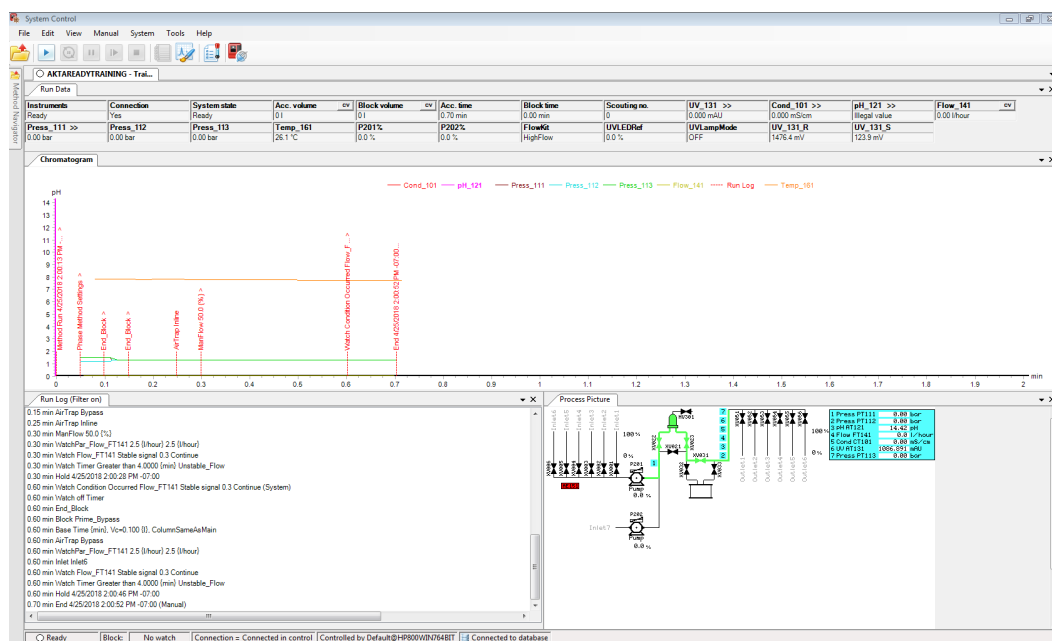
## Start a run

Follow the steps below to start a run.

- | Step | Action   |
|------|--|
| 1    | In the <b>System Control</b> module, click <b>File</b> → <b>Open</b> .   |
| 2    | In the <b>Method Navigator</b> pane, double-click the applicable method.<br><i>Result:</i><br>The <b>Start Protocol</b> window opens. The window comprises several pages.  |
| 3    | <div></div> <div><p>a. Verify and update the available parameters if needed.</p><p>b. Add information as requested.</p><p>c. Add comments if applicable.</p><p>d. Click <b>Back</b> or <b>Next</b> to navigate between pages in the <b>Start Protocol</b>.</p><p><b>Note:</b><br/>See <i>UNICORN manuals</i> for detailed description of the options.</p></div> |
| 4    | Click <b>Start</b> at the bottom of the window to initiate the run.  |

## Monitor a run

The progress of the run can be viewed in detail in the UNICORN **System Control** module. Up to four separate panes can be displayed simultaneously to show different aspects of the run. The layout of the window can be customized by dragging the panes to suitable positions.



For more information regarding the monitoring possibilities in UNICORN refer to the *UNICORN System Control Manual (29191901)*.

## End run automatically

If no unexpected events occur during the run, the method is finished automatically and UNICORN goes to the **End** state. No user action is needed.

## End run before method completion

To end the run before the method has finished follow the steps below.

### Step Action

- 1 In the **System Control** window, on the toolbar, click the **Stop** button.
- 2 Click **OK** in the confirmation dialog box.
- 3 Save the (partial) results, if applicable.

If the stopped run is part of a scouting run, you can also end the scheduled scouting runs. If this option is not selected, the next scouting run starts automatically.

## View results

The results can be viewed and saved using a UNICORN evaluation module. Two evaluation modules are available: **Evaluation** and **Evaluation Classic**. Only the **Evaluation Classic** module supports report formats that are linked to the **Method Wizard**.

See specific UNICORN manuals for more information about viewing results and customizing the result layout.

## 5.8 Controlled shutdown

### Remove flow kit and column



#### **WARNING**

**Hazardous biological agents during a run.** After using hazardous biological agents flush the whole system tubing with a bacteriostatic solution, neutral buffer, and then water before doing service or maintenance.

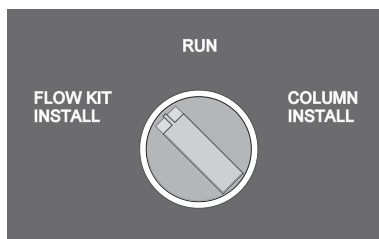
Do not leave a flow kit installed on the system for longer than a few days. The tubing walls stick together where they are pressed. This can cause high pressure alarms when the system is restarted.

Follow the steps below to disconnect and remove the flow kit and the column from the system.

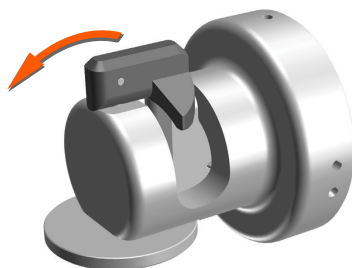
Step	Action
1	Wash the column and the flow kit with water or a neutral buffer. Use a washing method in UNICORN.
2	<p>Disconnect the column, if the column is to be used in the future: follow the steps a to c below.</p> <ul style="list-style-type: none"> <li><b>a.</b> Disconnect the column.</li> <li><b>b.</b> Put the welded tubing ends on the column inlet and outlet.</li> </ul> <p><b>Note:</b> <i>The welded tubing ends were removed when the column was connected.</i></p> <ul style="list-style-type: none"> <li><b>c.</b> Store the column as applicable.</li> </ul>
3	Fill the column and the flow kit with air if the column is not used anymore and needs to be disposed. Fill from an empty inlet, using the <b>ManFlow</b> command.
4	Disconnect the column and all containers connected to the inlets and outlets.
5	<p>Put the protective caps on the inlet and outlet tubing. Put the welded tubing ends on the column inlet and outlet.</p> <p><b>Note:</b> <i>The flow caps and the welded tubing ends were removed when the flow kit and the column were installed.</i></p>

Step	Action
------	--------

- |   |   |
|---|---|
| 6 | Turn the installation switch to the <b>FLOW KIT INSTALL</b> position. |
|---|---|



- |   |  |
|---|--|
| 7 | Remove all flow kit sensors from their holders or connectors.  |
| 8 | Clean the contact surfaces of the flow meter connectors.   |
| 9 | Open the safety locks on all pinch valves: lift the black handle of the valve safety lock and turn the handle outward 180 degrees. Open the safety locks on all 19 valves. |



- |    |   |
|----|---|
| 10 | Remove the pump lid. See <a href="#">Remove pump lid, on page 85</a> for instructions.                                      |
| 11 | Remove the inlet and outlet manifolds from the system cabinet.  |
| 12 | Lift the pump tubing from the pumps.  |
| 13 | Remove the flow kit from the system cabinet.  |
| 14 | Dispose of the empty flow kit and the column. See <a href="#">Disposal of flow kit and column, on page 191</a> for details. |

## Shutdown procedure

Follow the steps below to shut down the system.

Step	Action
------	--------

- |   |  |
|---|--|
| 1 | In any UNICORN module, click <b>File</b> → <b>Exit UNICORN</b> . |
| 2 | Wait until the software is closed.                               |

Step	Action
3	Turn the <b>MAINS POWER</b> switch to the <b>O</b> position.

# 6 Maintenance

## About this chapter

This chapter provides schedules and instructions for preventive maintenance that needs to be performed by the user of the ÄKTA ready system. Instructions for spare part replacement, calibration, and cleaning are also provided.

## In this chapter

Section		See page
6.1	Safety precautions	148
6.2	Maintenance schedule	150
6.3	Maintenance procedures	151
6.4	Calibration	155
6.5	Cleaning	170
6.6	Storage	172

## 6.1 Safety precautions



### **WARNING**

Only personnel authorized by Cytiva are allowed to perform service, installation, and maintenance of components inside the cabinet.



### **WARNING**

**LOCK OUT / TAG OUT (LOTO).** Before any maintenance or decommissioning work is performed on the system, make sure that the following conditions are fulfilled.

- The system is empty and depressurized.
- The system is disconnected from process feed, electrical power and pneumatic supply.
- The system is prevented from accidentally becoming re-energized during maintenance.
- The system is clearly tagged as taken out of operation.
- All process wetted areas are clean and decontaminated.



### **WARNING**

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



### **WARNING**

**Electrical shock hazard.** All installation, service and maintenance of components inside the electrical cabinet must be done by personnel authorized by Cytiva.



### **WARNING**

**Electrical shock hazard.** Always disconnect power before resetting circuit breakers.



**WARNING**

**Hazardous biological agents during a run.** After using hazardous biological agents flush the whole system tubing with a bacteriostatic solution, neutral buffer, and then water before doing service or maintenance.



**CAUTION**

Connectors on the cabinet, such as connectors for pH, conductivity, network, etc., that are not used, should be plugged to prevent cleaning liquid from entering the connector.



**NOTICE**

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

## 6.2 Maintenance schedule

### Introduction

This section provides a schedule for daily and annual maintenance by the user. If the actions suggested in this manual do not solve the problem or if the problem is not covered, contact your Cytiva representative.

Preventive service must be performed annually by qualified service personnel authorized by Cytiva. Contact your local Cytiva representative for more information about the available service agreements. Any abnormal behavior or aberrant noise must be examined and rectified. When a warning is displayed in UNICORN regarding one of the components or sensors, follow the maintenance procedure described in this chapter. If the problem is serious or recurrent, contact your local Cytiva representative.

### Daily maintenance

The table below lists the daily maintenance actions.

Procedure	Instructions
Clean the system.	<a href="#">Section 6.5 Cleaning, on page 170</a>
Calibrate the pH electrode.	<a href="#">Calibrate the pH electrode, on page 160</a>
Calibrate the gradient pump. <sup>1</sup>	<a href="#">Section 6.4.2 Calibrate the gradient pump, on page 165</a>

<sup>1</sup> The gradient pump must be calibrated after installation of a new flow kit, or after replacement of the pump tubing in only one pump.

### Annual maintenance

The table below lists the annual maintenance actions. These actions can be performed by the user or during annual service by Cytiva service personnel.

Procedure	Instructions
Change the air filter.	<a href="#">Replace the air filter, on page 153</a>
Calibrate the pressure sensors.	<a href="#">Calibrate the pressure sensors, on page 162</a>
Test the temperature sensor.	<a href="#">Test the temperature sensor, on page 152</a>
Check the pump.	<a href="#">Pump head maintenance, on page 154</a>
Replace the UV LED and UV filter.	The UV LED and UV filter must be replaced every 5000 hours. Contact a Cytiva service engineer for replacement.

## 6.3 Maintenance procedures

### Apply lubricant to flow meter

If the warning ***Fine\_tuning\_flow\_meter\_failed*** is displayed in UNICORN, there may be insufficient lubricant between the flow meter and the transducers. Follow the instruction below to apply new lubricant.

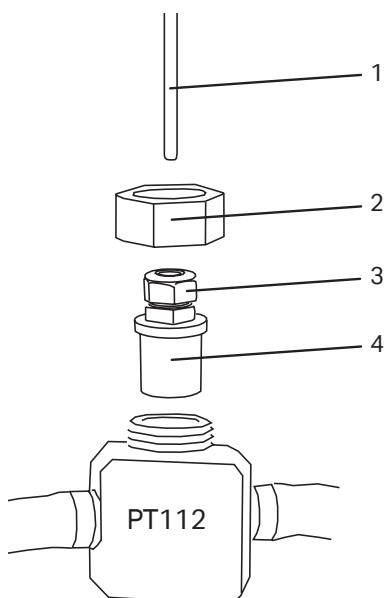
Step	Action
1	Allow the ongoing run to finish.  <b>Note:</b> <i>The maximal additional error of the flow rate measurement in case of failed fine tuning is <math>\pm 1\%</math>, in case the temperature difference between the process liquid and the environment is more than 10°C.</i>
2	Remove the transducers. See <a href="#">Install tubing and sensors, on page 93</a> for instructions.
3	Wipe the transducer contact surfaces clean and apply a thin smooth layer of petroleum jelly on the surfaces.
4	Reconnect the transducers.

## Test the temperature sensor

The accuracy of the temperature sensor can be tested with the Temperature Test Tool. Contact Cytiva to order the tool.

Follow the steps below to test the temperature sensor.

Step	Action
1	Remove the pH electrode or pH electrode dummy from the pressure sensor <b>PT112</b> . Insert the Temperature Test Tool (4) and fasten it with the pH electrode nut (2).
2	Insert a temperature probe, 3 to 6 mm in diameter (1), and tighten the top nut (3) on the Temperature Test Tool.
3	Connect a calibrated temperature meter to the probe and start a manual flow of approximately 50% (independent of the flow kit type).
4	Read the temperature on the reference temperature meter and compare the reading to the temperature displayed in UNICORN ( <b>Temp_161</b> ). Calculate the deviation.
5	If the temperature deviation is greater than described in the General Specification, contact your Cytiva representative.

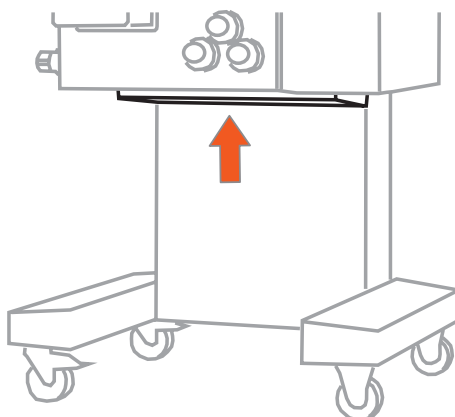


## Replace the air filter

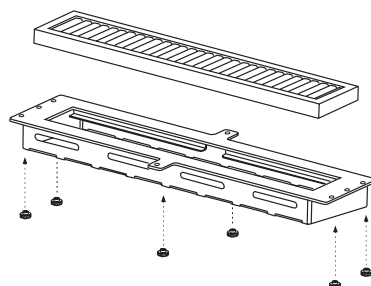
Check the condition of the air filter regularly, it can become clogged under extreme conditions. If the filter is dirty, follow the steps below to replace it.

Step	Action
------	--------

- |   |  |
|---|--|
| 1 | Locate the filter beneath the cabinet front panel (arrow in the illustration). |
|---|--|



- |   |   |
|---|---|
| 2 | Remove the filter cover and the filter by unscrewing the six nuts (see the illustration below). No tools are necessary. |
|---|---|



- |   |   |
|---|---|
| 3 | Wipe clean the bottom surface of the cabinet and the filter cover.  |
| 4 | Place the new filter in the cover with the gasket on top, and attach the filter cover using the nuts. Use finger force to tighten the nuts. |

## Pressure sensor holder kit

A pressure sensor holder kit contains spare parts for pressure sensor holder (latches and screws). When replacing a pressure sensor holder, turn the latch so that it does not interfere with other components when opened. Use only finger force to tighten the screws.

## Pump head maintenance

Changes in vibration or sound of the pump can indicate that pump components need to be replaced. Contact your local Cytiva service engineer to change pump components.

## Replace wheels

Before replacing a wheel, carefully read the instructions about lifting and moving the system, see [Section 4.5 Transport, on page 58](#).

Follow the steps below to replace the wheels.

Step	Action
1	Lift the system using a lifting device until the wheel is off the floor.
2	Loosen the four bolts that hold the wheel to the frame and then remove the wheel.
3	Attach the new wheel using the same bolts.
4	Lower the system until it is standing on the floor.

## 6.4 Calibration

### Introduction

This section describes how to calibrate the sensors and the gradient pump.

### In this section

Section		See page
6.4.1	Calibrate sensors	156
6.4.2	Calibrate the gradient pump	165

## 6.4.1 Calibrate sensors

### Introduction

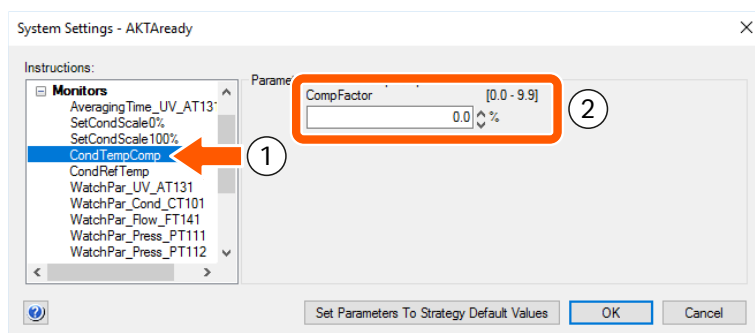
This section describes how to calibrate the conductivity sensor, the flow meter, the pH electrode, and the pressure sensors.

### Calibrate the conductivity sensor

Calibration of the conductivity sensor is generally not needed, because the standard setting of the cell constant that is used in UNICORN, is applicable for the most applications. If a higher precision of the conductivity measurement is required, it is recommended to calibrate the conductivity sensor.

To calibrate the conductivity sensor follow the steps below.

- | Step | Action  |
|------|---|
| 1    | Prepare a calibration solution of 1.00 M NaCl (58.44 g/1000 mL). Let the solution equilibrate to room temperature to achieve correct measurement results.   |
| 2    | Set the temperature compensation factor to zero. Follow the steps a to e below. <ol style="list-style-type: none"> <li>In the <b>System Control</b> module, on the menu, click <b>System</b> → <b>Settings</b> to open the <b>System Settings</b> window.</li> <li>In the <b>Instructions</b> box, expand <b>Monitors</b>.</li> <li>Click <b>CondTempComp</b> (1).</li> </ol> |



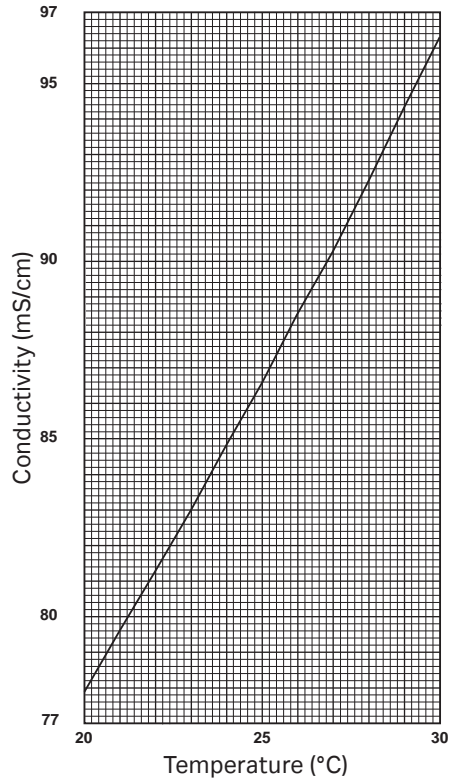
- On the **CompFactor** list (2), set the value to 0.0%.
  - Click **OK**.
- |   |   |
|---|---|
| 3 | Flush the cell with the calibration solution and fill the cell completely. Use at least 15 mL solution. |
| 4 | Wait for 15 minutes after filling the cell, until the cell temperature is stable between 20°C to 30°C.  |

Step	Action
------	--------

- |   |   |
|---|---|
| 5 | In the <b>System Control</b> module, click <b>System</b> → <b>Calibrate</b> .                             |
| 6 | In the <b>Calibration</b> window, on the <b>Monitor to calibrate</b> list, select <b>Cond_Calibr</b> (3). |
| 7 | Read the conductivity value in the <b>Current value</b> text box (4).                                     |

Step	Action
------	--------

- |   |  |
|---|--|
| 8 | Read the theoretical conductivity value on the graph below, and compare the measured value with the theoretical value. |
|---|--|



- If the measured value corresponds to the theoretical value, no further action is needed.
- If the two values differ, proceed to next step.

Step	Action
------	--------

- |   |  |
|---|--|
| 9 | Type the theoretical conductivity value in the <b>Set the reference value</b> box (5). |
|---|--|

Calibration - AKTaready

Monitor to calibrate: Cond\_Calb Current value 0.000 mS/cm

Calibration procedure

Calibrate the monitor. See Help! (5)

Set the reference value 1.0000 mS/cm (5)

Read value 1 (6)

Normally it is not necessary to adjust the cell constant as the flow cell is pre-calibrated on delivery. Set Cond TempComp to 0 in System Settings prior calibration of cell constant. The temperature sensor must be calibrated before adjusting the cell constant. Fill the flow cell with calibration solution of 1.00 M NaCl. Wait until the temperature is constant in the range 20-30 °C. Enter the theoretical conductivity value according to graph in user manual for UPC monitor.

Last calibrated on:

Cell constant: 1/cm

Generate Report Close

- |    |                                |
|----|--------------------------------|
| 10 | Click <b>Read value 1</b> (6). |
|----|--------------------------------|

**Result:**

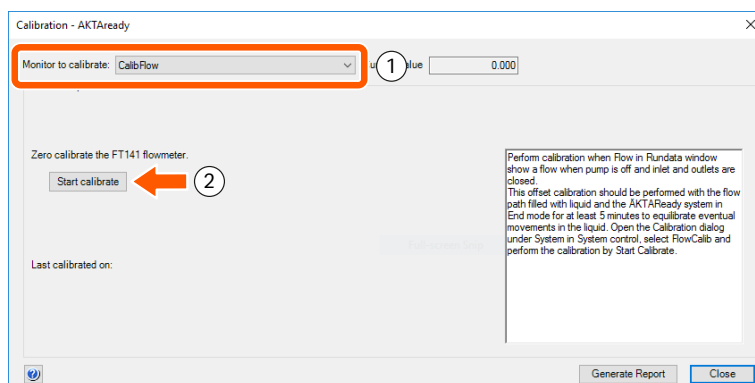
The new conductivity cell constant is automatically calculated and updated.

## Calibrate the flow meter

The flow meter needs to be recalibrated (zero adjustment) when the flow readings differ from zero under no flow conditions (for example, when the system is in the **End** state), or when there is a difference between calculated and actual liquid consumption caused by zero point offset.

Follow the steps below to calibrate the flow meter.

- | Step | Action   |
|------|--|
| 1    | Make sure that the flow kit is filled with liquid and that ÄKTA ready is in the <b>End</b> state.        |
| 2    | In the <b>System Control</b> module, click <b>System</b> → <b>Calibrate</b> .                            |
| 3    | In the <b>Calibration</b> window, on the <b>Monitor to calibrate</b> list, select <b>Calib-Flow</b> (1). |



- |   |  |
|---|--|
| 4 | Click <b>Start Calibrate</b> (2).                |
| 5 | Verify that the flow rate value approaches zero. |

## Calibrate the pH electrode

pH calibration must be done at least once a day. Use pH standard solutions that are applicable for your process.

**Note:** *It is recommended to use fresh pH standard solutions for every calibration.*

- | Step | Action  |
|------|---|
| 1    | Place two cups the pH standard solutions in the holder on the inside of the cabinet front door.   |
| 2    | Unscrew the lower cable connector from the system, and connect the pH electrode to the cable (see <a href="#">Install the pH electrode, on page 98</a> ). |
| 3    | In the <b>System Control</b> module, click <b>System</b> → <b>Calibrate</b> .   |

Step	Action
------	--------

- |   |   |
|---|---|
| 4 | Rinse the pH electrode with purified water and place the pH electrode in the first standard solution.   |
| 5 | Type the pH of the standard solution in the first <b>Set the reference value</b> box (1), and wait for the current pH value to stabilize (2). |

**Note:**

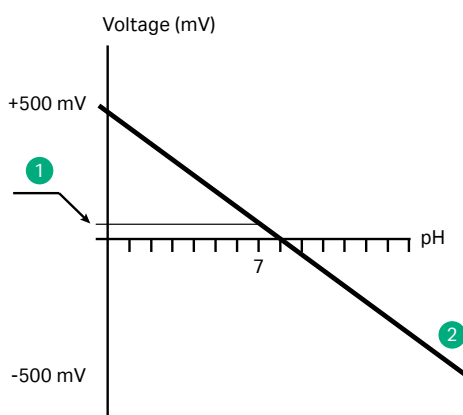
Only one text box is available at this time.

- |    |  |
|----|--|
| 6  | Click <b>Read value 1</b> (3).   |
| 7  | Rinse the electrode with purified water and place it in the other standard solution.   |
| 8  | Type the pH of the standard solution in the second <b>Set the reference value</b> box, and wait for the value to stabilize.  |
| 9  | Click <b>Read value 2</b> .  |
| 10 | Wait until UNICORN calculates the slope and the asymmetry potential.<br><b>Result:</b><br>The slope and the asymmetry potential are shown (4).   |
| 11 | Verify that the slope and the asymmetry potential are within the acceptable range, as specified below. <ul style="list-style-type: none"> <li>• Slope &gt;80%</li> <li>• Asymmetry potential in the range of -60 to 60 mV.</li> </ul> For more information, refer to the guidelines in UNICORN help. |
| 12 | Click <b>Close</b> at the bottom of the <b>Calibration</b> window. <ol style="list-style-type: none"> <li>If the electrode passes, continue as described in step 13.</li> <li>If the electrode does not pass, clean the pH electrode and repeat the calibration.</li> </ol>                          |

Step	Action
13	Sanitize the pH electrode with 70% ethanol.
14	Wait until the pH electrode is dry, and then install the electrode as described in <a href="#">Install the pH electrode, on page 98</a> .

If the cleaning and the new calibration does not bring the parameters into the acceptable range, replace the electrode. Refer to the manufacturer's manual for the pH electrode for instructions on how to replace the pH electrode.

A new pH electrode typically has a slope of 95% to 102% and an asymmetry potential within  $\pm 30$  mV. As the pH electrode ages, its slope decreases and the asymmetry potential increases.



Part	Description
1	Asymmetry potential at pH 7
2	Calibration curve

## Calibrate the pressure sensors

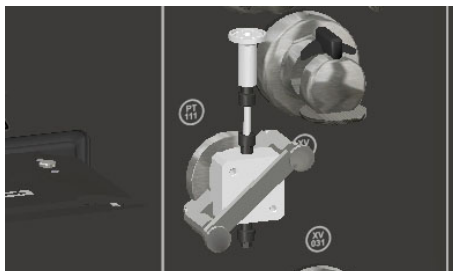
The pressure sensors need to be calibrated when the pressure readings differ from each other more than  $\pm 0.20$  bar, after completing an autozero procedure at atmospheric pressure.

A pressure calibration cell and pump are needed for the calibration. Contact your Cytiva representative for ordering information.

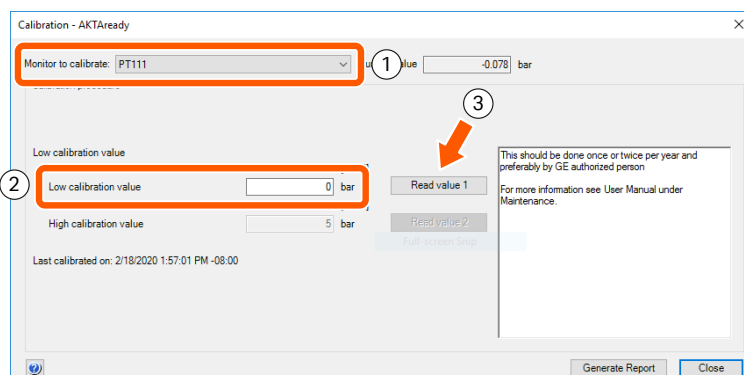
It is recommended to calibrate the pressure sensors without a flow kit attached to the system. Follow the steps below to perform the calibration.

Step	Action
------	--------

- |   |   |
|---|---|
| 1 | Install the calibration cell on pressure meter <b>PT-111</b> (a calibration cell without the pump tubing is shown in the illustration). |
|---|---|



- |   |  |
|---|--|
| 2 | Apply up to 5 bar g pressure to the pressure sensor a few times until the reading at atmospheric pressure is stable. |
| 3 | In the <b>System Control</b> module, click <b>System</b> → <b>Calibrate</b> .  |
| 4 | In the <b>Calibration</b> window, on the <b>Monitor to calibrate</b> list, select <b>PT111</b> (1).                  |



- |   |   |
|---|---|
| 5 | Make sure that <b>Low calibration value</b> is set to 0.0000 bar g (2) and that the cell is at atmospheric pressure (open the vent valve on the pump). Click <b>Read value 1</b> (3).   |
| 6 | Close the vent valve on the pump, and run the pump until the pressure is 5 bar g. Make sure that <b>High calibration value</b> is set to 5.0000 bar g, and select <b>Read value 2</b> . |
| 7 | Release the pressure and wait until atmospheric pressure is reached. Make sure that the pressure reading is 0.00 ± 0.01 bar g.  |
| 8 | Remove the calibration cell. Make sure that the pressure reading is ≤ -0.20 bar g. If the reading is higher, contact Cytiva.  |

Step	Action
------	--------

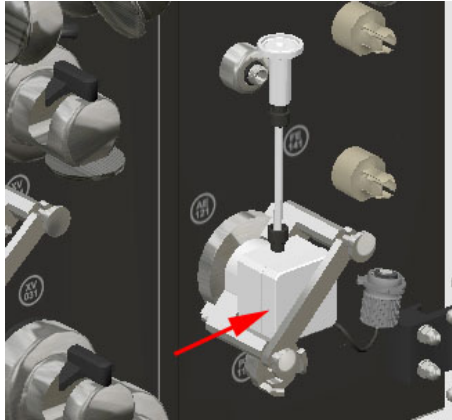
*Result:*

**PT-111** is calibrated.

- |   |  |
|---|--|
| 9 | Repeat the calibration procedure with pressure sensors <b>PT-112</b> and <b>PT-113</b> . |
|---|--|

**Note:**

*The holder for pressure sensor **PT-112** is deeper than the other holders. Insert an adapter block to install the calibration cell correctly (see the illustration below). The adapter block is part of the pressure calibration tool.*



## 6.4.2 Calibrate the gradient pump

### Description

The calibration procedure compensates for differences in capacity of pump A (**P-201**) and pump B (**P-202**) at a given speed due to the pump tubing position and properties. The flow rate and the pump speed (rpm) are linearly proportional. This linearity is used to calculate a compensation factor (**P202Factor**) for synchronization of the pumps and to gain a nominal volumetric gradient.

The **FlowCompensation** function must be activated for each run that uses a calibrated **P-202** pump.

### Prepare for calibration

The gradient pump calibration is always done manually. A column must be connected to the system to make sure that the calibration conditions are similar to a real run. Follow the steps below to remove the air bubbles from the system tubing.

Step	Action
------	--------

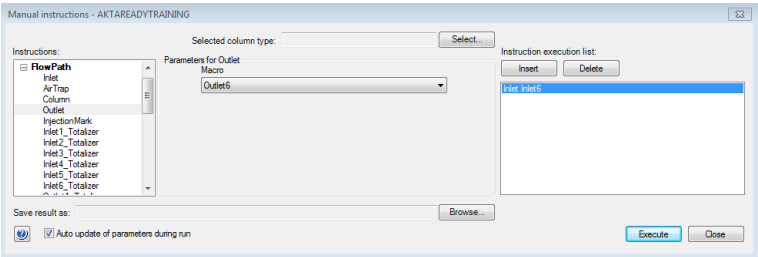
1	In the <b>System Control</b> module, click <b>Manual</b> → <b>Execute Manual Instruction</b> .
---	--

*Result:*

The **Manual Instruction** window opens.

2	Expand <b>FlowPath</b> , and specify the following parameters:
---	--

- Set **Inlet** to the correct inlet, then click **Insert**.
- Set **Outlet** to the correct outlet, then click **Insert**.
- Set **AirTrap** to **Bypass**, then click **Insert**.
- Set **Column** to **Bypass**, then click **Insert**.



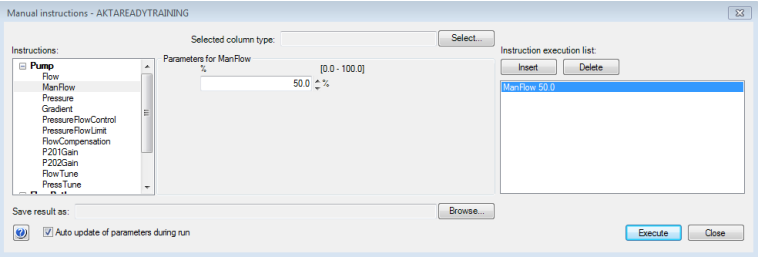
3	Connect the inlet tubing to the applicable buffer container and the outlet tubing to a waste container.
---	---

4	Start the isocratic pump manually:
---	------------------------------------

- a. In the **Instructions** box, expand **Pump**.

Step	Action
------	--------

b. Select **ManFlow**, and then set the **ManFlow** value to 50%.



c. Click **Insert**, and then click **Execute**.

5 Run the pump until the flow rate is stable.

6 Set the gradient pump:

a. Expand **Pump**.

b. Select **Gradient**, and then set **Target** to 100% B.

c. Click **Insert**.

7 Start the gradient pump manually:

a. Expand **Pump**.

b. Select **ManFlow**, and then set **ManFlow** to 50%.

c. Click **Insert**, and then click **Execute**.

8 Run the gradient pump until the flow rate is stable.

9 On the toolbar, click the **Pause** button.

### Calibrate the gradient pump

Follow the steps below to calibrate the pump B (**P-202**).

Step	Action
------	--------

1 Set the flow rate:

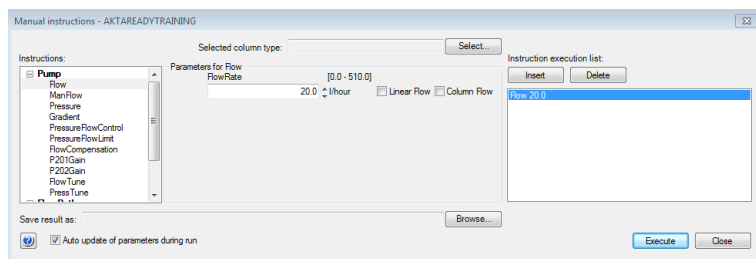
a. Expand **Pump**, select **Gradient**, and then set **Target** to 0% B.

b. Select **Flow**.

c. Set the **FlowRate** to at least 20 L/h for LowFlow Kit and 40 L/h for High-Flow Kit.

Step	Action
------	--------

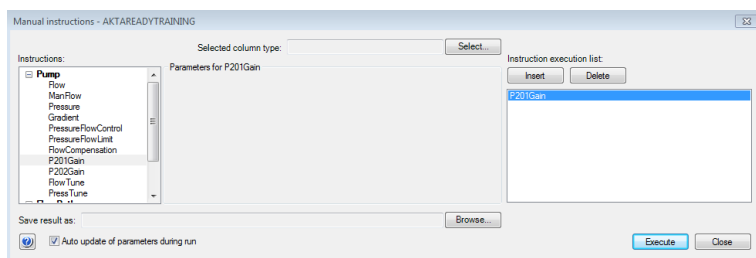
d. Click **Insert**.



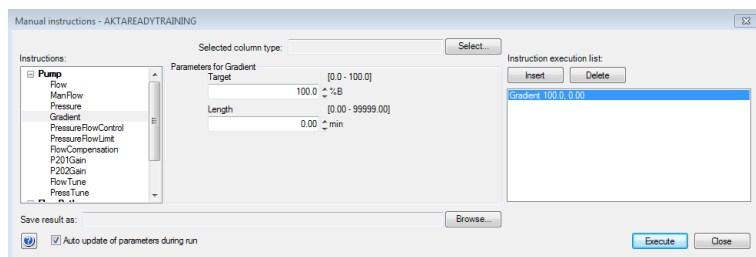
- 2 Set the column inline:
  - a. Expand **FlowPath**, and select **Column**.
  - b. Click **Inline**.
  - c. Click **Insert**, and then click **Execute**.

3 Wait until the flow rate is stable.

- 4 Set the **P-201** pump instruction:
  - a. Expand **Pump**, and select **P201Gain**.
  - b. Click **Execute**.



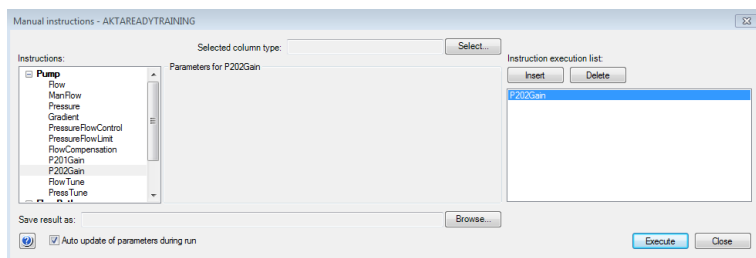
- c. Select **Gradient**, and set **Target** to 100% B.
  - d. Click **Execute**.



5 Wait until the flow rate is stable.

Step	Action
------	--------

- |   |  |
|---|--|
| 6 | <p>Set the <b>P-202</b> pump instruction:</p> <ol style="list-style-type: none"> <li>Expand <b>Pump</b>, and select <b>P202Gain</b>.</li> <li>Click <b>Execute</b>.</li> </ol> |
|---|--|

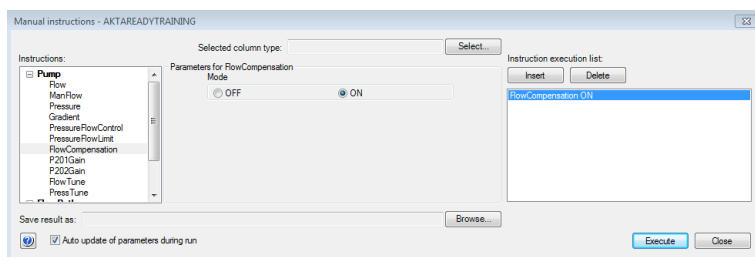


- |  |  |
|--|--|
|  | <ol style="list-style-type: none"> <li>Select <b>FlowCompensation</b>, and then select <b>ON</b>.</li> </ol> |
|--|--|

**Note:**

**FlowCompensation** is switched off when a manual run or a method run ends. **FlowCompensation** must be activated for each subsequent run. See [Activate flow compensation factor, on page 169](#) for instructions.

- |  |   |
|--|---|
|  | <ol style="list-style-type: none"> <li>Click <b>Execute</b>.</li> </ol> |
|--|---|



**Result:**

The calibration changes the **P202Factor** value (the speed correction factor to produce the same flow in both pumps). The value range is 0.95 to 1.05. The **P202Factor** is displayed in the **Run Data** pane in the **System Control** module. If **P202Factor** is not shown, follow the instructions in the next step to display the value.

- |   |   |
|---|---|
| 7 | <ol style="list-style-type: none"> <li>In the <b>System Control</b> module, click <b>View</b> → <b>Run Data</b>.</li> <li>Right-click the <b>Run Data</b> pane, and then click <b>Customize</b> on the shortcut menu.</li> <li>On the <b>Run Data Groups</b> list, select the <b>P202Factor</b> check box.</li> </ol> |
| 8 | On the toolbar, click <b>End</b> to finish the calibration.   |

## Activate flow compensation factor

The **FlowCompensation** function must be activated for each run that uses a calibrated **P-202** pump. Follow the steps below to activate the function.

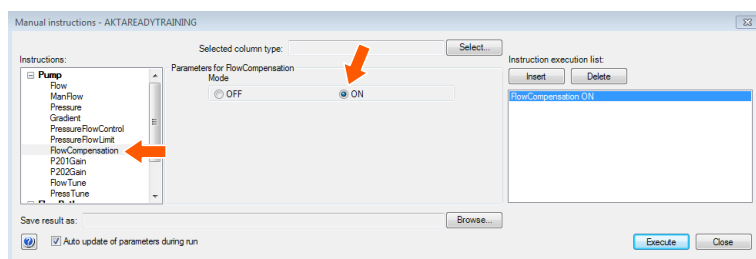
Step	Action
------	--------

- |   |  |
|---|--|
| 1 | In the <b>System Control</b> module, click <b>Manual</b> → <b>Execute Manual Instruction</b> . |
|---|--|

*Result:*

The **Manual Instruction** window opens.

- |   |   |
|---|---|
| 2 | In the <b>Instructions</b> box, expand <b>Pump</b> , select <b>FlowCompensation</b> , and then select <b>ON</b> . |
|---|---|



- |   |                        |
|---|------------------------|
| 3 | Click <b>Execute</b> . |
|---|------------------------|

## 6.5 Cleaning

### Safety precautions



#### CAUTION

Connectors on the system (for example connectors for pH, conductivity, network) that are not used, must be plugged to prevent cleaning liquid from entering the connector.



#### CAUTION

To avoid contamination, make sure the system is thoroughly cleaned before changing the flow kit.



#### NOTICE

When cleaning the flow kit, use 0.5 M NaOH not longer than 2 hours. Flush the flow kit with a suitable rinsing liquid, for example a neutralizing buffer, to remove the NaOH.

### Cleaning

The system must be kept clean and dry for it to function properly. Clean the system by following the instructions below.

- Remove all chemical stains and dust by wiping the outside surfaces of the system and the pump with a clean moist cloth or tissue. Use water with weak detergent for daily cleaning of the cabinet. 70% ethanol or 2-propanol (isopropanol) can be used for sanitization.
- Remove salt crystals from around valves by rinsing carefully with water to and wiping dry.
- Remove infectious or aggressive fluids from the system before service or maintenance by running a CIP solution through the system. Make sure to clean all accessible flow paths.
- Clean the inside of the pump lid and the rollers with water if liquid was accidentally spilled into the pump. Dry all pump external surfaces to avoid corrosion. The interior of the pump is particularly sensitive to NaOH, as it corrodes aluminum.

### After cleaning

After cleaning do the following:

- Make sure there is no liquid on the UV detector windows. If necessary, wipe the windows using soft absorbent tissue.

- If NaOH was used, rinse the system flow path with a neutralizing buffer before rinsing it with water.

**Note:** *Rinsing the system flow path with water directly after cleaning with NaOH causes the tubing inner walls to stick together.*

- Rinse the flow path with water or a suitable liquid to remove the cleaning solution.

## 6.6 Storage

### Prepare for storage

If the system is stored for a period of more than a few days, perform the following:

- Remove the flow kit (see [Remove flow kit and column, on page 144](#)).
- Clean the cabinet (see [Section 6.5 Cleaning, on page 170](#)).
- Before moving the system, turn off the system power and air supply.

Do not leave a flow kit installed on the system for more than a few days. Over time, the tubing walls stick together where the tubing is squeezed. This can cause high pressure alarms when the system is restarted.

# 7 Troubleshooting

## About this chapter

This chapter provides required information to enable users and service personnel to identify and correct problems that can occur when operating ÄKTA ready.

Problems related to sensors and valves are normally revealed during the component test, for troubleshooting see [Section 7.2 Troubleshooting a failed component test, on page 181](#).

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

## In this chapter

Section		See page
7.1	Troubleshooting the system	174
7.2	Troubleshooting a failed component test	181

## 7.1 Troubleshooting the system

### Air in flow path

Problem	Corrective action
Air enters the flow path. The alarm <b>Uncertain flow</b> is displayed and the system enters <b>Pause</b> mode. <sup>1</sup>	<p>Identify the cause, for example, damaged tubing or connector, a dislocated TC gasket, or inlet tubing not properly located in liquid.</p> <p>In rare cases, cavitation due to negative pressure can cause air to enter the flow path. Cavitation can be recognized by a hissing noise. Check for kinks on flow kit tubing.</p> <ol style="list-style-type: none"> <li>1. Locate and correct the problem. Check the flow path, including the inlet containers.</li> <li>2. Remove any air in the flow path using the <b>ManFlow</b> command in UNICORN.</li> <li>3. Click <b>Continue</b> on the toolbar to continue the run.</li> </ol>

<sup>1</sup> The air trap can remove small amounts of air from the flow path. Larger amounts of air reach the flow meter and cause **Uncertain flow** alarm.

### Compressed air

Problem	
Compressed air failure during a run. The alarm <b>No air supply to the system</b> is displayed and the system enters <b>Pause</b> mode.	<p>Identify the cause, for example, a malfunctioning air supply, or a leaking air hose.</p> <ol style="list-style-type: none"> <li>1. Make sure that the supply pressure is above 5.5 bar.</li> <li>2. Correct the air supply problem.</li> <li>3. Continue the run by pressing the <b>PAUSE/CONTINUE</b> button on the system cabinet.</li> </ol>

## Computer

Problem	Corrective action
No system found when starting up UNICORN.	<ol style="list-style-type: none"> <li>1. Make sure the system is switched on.</li> <li>2. Check communication cable and connectors.</li> <li>3. If system is connected to a switch or hub, check that the cross-over cable (3 m) is connected in series with the long (10 m) cable.</li> <li>4. Switch off the computer.</li> <li>5. Turn off the <b>MAINS POWER</b> on the ÄKTA ready system, then turn on the power again.</li> <li>6. Restart the computer.</li> </ol>
Communication failure during a run. Contact between computer and system is broken. <sup>1</sup>	<ol style="list-style-type: none"> <li>1. Make sure the system is switched on. Check network cables and connectors.</li> <li>2. Reboot the computer.</li> </ol>

<sup>1</sup> The system continues to run if the connection to the computer is broken. Data is stored locally and transferred to the computer when the communication is restored.

## Conductivity sensors

Problem	Corrective action
Poor connection.	Make sure the conductivity sensor connector cable is properly connected to the system cabinet (see <a href="#">Install the pH electrode, on page 98</a> ).
Wrong inlets used.	Check that the wash solution is connected to <b>Inlet 6</b> and the test solution to <b>Inlet 5</b> .
Wrong composition of wash solution or test solution.	Make sure that the liquids used are fresh and correctly prepared (see <a href="#">Required solutions, on page 121</a> ).

Problem	Corrective action
Errors in temperature readings.	<p>The conductivity measurement is temperature compensated and is dependent on correct temperature measurements.</p> <ol style="list-style-type: none"> <li>1. Loosen the flow meter. Verify that the flow meter is properly pushed onto the two knobs (see <a href="#">Install tubing and sensors, on page 93</a>). A gap between the temperature sensor window and the sensor can cause incorrect measurements.</li> <li>2. Wipe the temperature sensor window with soft tissue. Dirty or damp sensor window can cause incorrect measurements.</li> <li>3. Make sure that the system temperature is equal to the ambient temperature.</li> <li>4. Make sure that the temperature of the process liquid does not differ from the ambient temperature by more than 10°C.</li> </ol>

## Flow meter

Problem	Corrective action
The message <b>Fine tuning flow meter failed</b> is displayed.	<ul style="list-style-type: none"> <li>• The message indicates that there is not enough lubricant on the transducers. Apply more lubricant as described in <a href="#">Apply lubricant to flow meter, on page 151</a>.</li> <li>• When buffers with high salt concentration are used, you may want to disable the message. See <a href="#">Enable or disable Fine_tuning_flowmeter_failed message, on page 128</a> for instructions.</li> </ul> <p><b>Note:</b></p> <p><i>The maximal additional error of the flow rate measurement in case of failed fine tuning is <math>\pm</math> one percent unit, when temperature difference between process liquid is kept within 10°C.</i></p>
Incorrectly installed pump tubing.	<p>Check that the pump tubing has been correctly attached and the pump lid is correctly closed. Make sure the pegs on the pump lid are turned all the way down (see <a href="#">Install the pump tubing for isocratic run, on page 90</a> and <a href="#">Attach the pump lid, on page 92</a>).</p>
Insufficient pump tubing connection.	<ul style="list-style-type: none"> <li>• Make sure the TC clamps connecting the pump tubing to the main part of the flow kit and to the inlet tubing are properly connected.</li> <li>• Make sure the TC gaskets are in the correct position.</li> </ul>

Problem	Corrective action
Cavitation (small air bubbles produced by under-pressure), which results in unstable flow meter readings.	<p>In rare cases, cavitation due to negative pressure can cause air to enter the flow path. Cavitation can be recognized by a hissing noise.</p> <ol style="list-style-type: none"> <li>1. Check the flow path for kinks. Check the inlet containers.</li> <li>2. Make sure the inlet tubing diameter is equal to or larger than the inlet manifold tubing diameter.</li> <li>3. Remove any air in the flow path using the <b>ManFlow</b> command in UNICORN.</li> <li>4. Click <b>Continue</b> on the toolbar to continue the run.</li> </ol>

## Flow kit and gradient flow section

Problem	Corrective action
Overpressure.	<p>Overpressure can damage the flow kit. If overpressure is detected and the air trap is in-line, press the <b>AIR VENT</b> button on the system cabinet to reduce the pressure.</p> <p>If overpressure is detected when the air trap is bypassed, perform the following steps:</p> <ol style="list-style-type: none"> <li>1. In UNICORN, set <b>Manual Flow</b> to <b>0</b>, and set the air trap in-line.</li> <li>2. Click <b>CONTINUE</b> in UNICORN, or <b>PAUSE/CONTINUE</b> on the system cabinet.</li> <li>3. Press the <b>AIR VENT</b> button on the system cabinet, until the overpressure is released.</li> </ol>
Too high outlet pressure.	<ul style="list-style-type: none"> <li>• Check that connected outlet is actually open.</li> <li>• Check if the outlet is plugged. If so, remove the plug.</li> <li>• Make sure the outlet tubing diameter is equal to or larger than the outlet manifold tubing diameter.</li> <li>• Check if the inner walls of the flow kit tubing stick together where they are pressed. If so, replace the flow kit.</li> </ul>

## Power

Problem	Corrective action
Power failure during a run.	<ul style="list-style-type: none"> <li>• Check the system circuit breaker.</li> <li>• Check the external power supply.</li> </ul> <p>See <a href="#">Power failure, on page 22</a> for the consequences.</p>

Problem	Corrective action
Fuse blows repeatedly.	Shut the ÄKTA ready down using the main switch and contact your local Cytiva representative.

## Pressure sensors

Problem	Corrective action
Incorrect pressure measurement.	<ul style="list-style-type: none"> <li>• Make sure that the pressure sensor is correctly aligned in the holder.</li> <li>• Check that there is no gap between the pressure sensor and the pressure sensor holder.</li> <li>• If necessary, loosen the screws and adjust the sensor position according to the instructions in <a href="#">Install tubing and sensors, on page 93</a>. Tightly fasten the screws, using finger force only.</li> </ul>

## Pump

Problem	Corrective action
Pump is not working.	<ul style="list-style-type: none"> <li>• Check if the <b>EMERGENCY STOP</b> button has been pressed. See <a href="#">Restart after emergency shutdown or power failure, on page 23</a>.</li> <li>• Check if the pump lid is correctly attached and closed. See <a href="#">Attach the pump lid, on page 92</a>.</li> <li>• Check if a valid flow path is defined: at least one inlet and one outlet must be open. Verify in UNICORN or on the system.</li> <li>• A method without pump flow instruction is used. Check the pump function: <ol style="list-style-type: none"> <li>1. In the <b>Method Editor</b> module, in the <b>Instruction Box</b>, expand <b>Pump</b>.</li> <li>2. Click <b>ManFlow</b>, and set a value &gt; 1%.</li> </ol> <p>If the pump is functional, make corrections in the method and include a pump instruction.</p> </li> <li>• If the above actions do not solve the problem, contact your local Cytiva representative.</li> </ul>

Problem	Corrective action
Little or no flow.	<ul style="list-style-type: none"> <li>• Check if the connected inlet is closed.</li> <li>• Check if the containers are placed lower than 1 m below the inlets.</li> <li>• Check if the inlet containers are empty.</li> <li>• Check if the flow kit tubing is worn out. If so, replace the flow kit.</li> <li>• Check if the flow kit tubing is kinked or squeezed, blocking the flow. If so, reinstall or replace the flow kit.</li> <li>• Check if there is air in the pump tubing. If so, increase the pump speed to push the air to the air trap.</li> <li>• Check if the pump rotor is slipping on the drive shaft. Contact Cytiva service personnel for reparation.</li> </ul>
Pulsation of liquid in flow kit.	<ul style="list-style-type: none"> <li>• Check that the viscosity of liquid is within specified range. Refer to the General Specifications.</li> <li>• Check if the pump speed is high enough. If necessary, increase the pump speed.</li> </ul>
Pump tubing travels over pump rotor.	Make sure that tubing connected to the inlets have the same or larger inner diameter than the inlets, and is not longer than 10 m.

## UV sensor

Problem	Corrective action
Drifting UV signal.	<p>Make sure the temperature of the process liquid is not more than 10°C below the ambient temperature. Large temperature differences can cause condensation on the UV sensor.</p> <p>Wipe the UV sensor with a soft tissue to remove condensation, if necessary.</p>
UV signal does not return to zero.	
Insufficient light transmission.	
Condensation on the UV sensor cell.	
UV absorption values are > 5 AU, even without flow kit installed.	Stray light calibration must be done with UV sensor installed. Install a flow kit and do a stray light calibration, see <a href="#">Calibrate UV stray light, on page 126</a> .
Incorrect attachment of the UV sensor.	Make sure that the UV sensor is pushed in all the way, see the instructions in <a href="#">Attach the main part tubing, on page 89</a> .
Wrong inlets used during component test.	Check that the wash solution is connected to <b>Inlet 6</b> , and the test liquid to <b>Inlet 5</b> .
Wrong composition of wash solution or test solution.	Make sure that the solutions used are fresh and correctly prepared (see <a href="#">Required solutions, on page 121</a> ).

## Valves

Problem	Corrective action
The message <b>Valve error</b> is displayed.	<p>A valve lock may be open. Check the valve locks and close them.</p> <p><b>Note:</b> <i>Before closing the manual valve lock, make sure the valve is in open position in the software.</i></p> <ol style="list-style-type: none"> <li>1. Turn the installation switch to position <b>FLOW KIT INSTALL</b>.</li> <li>2. Lift the safety lock handle and turn the handle inward 180 degrees.</li> <li>3. Turn the installation switch back to <b>RUN</b> position.</li> </ol> <p>If both the <b>Valve error</b> message and <b>No air supply to the system</b> message are shown, the alarm is caused by a compressed air supply failure. See <a href="#">Flow meter, on page 176</a>.</p>
Valve safety lock is open.	<p><b>Note:</b> <i>Make sure that the end caps are in place on all unused inlets and outlets before turning the installation switch to <b>FLOW KIT INSTALL</b>. The liquid from the air trap may drain into the flow kit and cause spillage.</i></p> <p>Close the valve safety lock:</p> <ol style="list-style-type: none"> <li>1. Turn the installation switch to position <b>FLOW KIT INSTALL</b>.</li> <li>2. Lift the safety lock handle and turn the handle inward 180 degrees.</li> <li>3. Turn the installation switch back to <b>RUN</b> position.</li> </ol>
Tubing not correctly inserted in a valve.	<p><b>Note:</b> <i>Make sure that the end caps are in place on all unused inlets and outlets before turning the installation switch to <b>FLOW KIT INSTALL</b>. The liquid from the air trap may drain into the flow kit and cause spillage.</i></p> <p>Insert the tubing correctly.</p> <ol style="list-style-type: none"> <li>1. Turn the installation switch to position <b>FLOW KIT INSTALL</b>.</li> <li>2. Open the valve lock.</li> <li>3. Insert the tubing.</li> <li>4. Close the valve lock.</li> <li>5. Turn the installation switch back to <b>RUN</b>.</li> </ol>

## 7.2 Troubleshooting a failed component test

### Introduction

When a component test fails, a **Test Failed** message is shown. For troubleshooting a failed component test it is recommended to use the **Troubleshooting** option in the installation wizard. This will focus specifically on the failed sensor and create a new component test for retesting only the failed sensor.

After troubleshooting with the installation wizard a printed report with date and signature can be created, confirming that the troubleshooting has been performed.

See the following section for instructions on troubleshooting with the installation wizard.

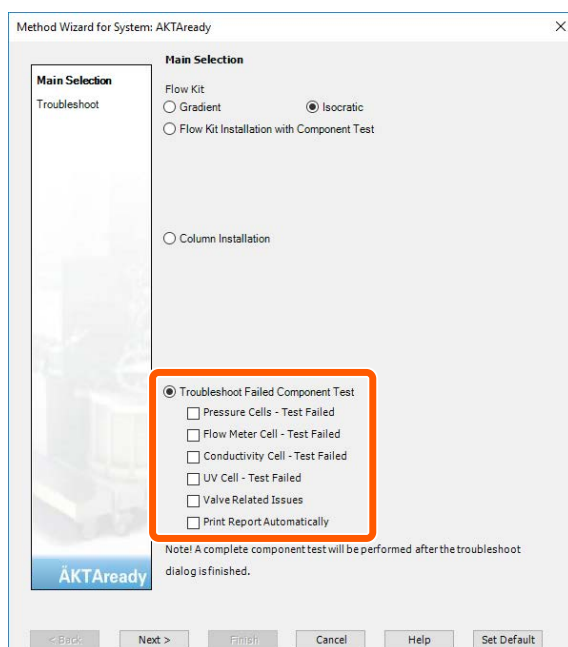
If this troubleshooting fails, see the general troubleshooting instructions in [Section 7.1 Troubleshooting the system, on page 174](#).

## Troubleshoot with installation wizard

Follow the steps below to troubleshoot a failed component test using the installation wizard.

Step	Action
------	--------

- |   |   |
|---|---|
| 1 | In the <b>Method Editor</b> module, click <b>File → New Method</b> .  |
| 2 | In the <b>New Method</b> dialog box, select <b>Method Wizard</b> , and then click <b>OK</b> .   |
| 3 | In the wizard, select <b>Troubleshoot Failed Component Test</b> , and then select the applicable check boxes for the previously failed components for additional troubleshooting. |



- |   |  |
|---|--|
| 4 | Click <b>Next</b> , continue through all following pages. Follow the instructions on each page to perform the corrective actions for the failed component. |
|---|--|

**Result:**

The wizard creates a new method.

- |   |  |
|---|--|
| 5 | Save the method, and then run it in the <b>System Control</b> module.<br>The troubleshooting wizard runs an additional component test. |
|---|--|

# 8 Reference information

## About this chapter

This chapter provides required information that is useful when installing, operating, maintaining, and troubleshooting the ÄKTA ready system. It also contains ordering information.

## In this chapter

Section	See page
8.1 Specifications	184
8.2 Chemical resistance	185
8.3 Environmental requirements	187
8.4 PID control	188
8.5 Recycling information	190
8.6 Regulatory information	192
8.7 Flow kit ordering information	204
8.8 More information	205
8.9 Health and Safety Declaration Form	206

## 8.1 Specifications

### System capacity

Property	ÄKTA ready Low Flow Kit	ÄKTA ready High Flow Kit
Volumetric flow rates	3 to 175 L/h	7.5 to 510 L/h
Pump speed	225 rpm (100%)	340 rpm (100%)
Maximal pressure, peristaltic pump	≥ 4.0 bar	

The following table shows the pressure rating for the flow kit parts. The data is valid for both Low Flow Kit and High Flow Kit.

Pressure rating	Value
Low pressure inlet manifold	0.6 bar
High pressure flow path, upstream of column	5.0 bar
High pressure flow path, downstream of column	2.0 bar
Low pressure outlet manifold	0.95 bar

For more information about the ÄKTA ready system and the flow kits, refer to the product documentation.

## 8.2 Chemical resistance

### Introduction

This section describes recommended cleaning agents for ÄKTA ready as well as the chemicals allowed for use.

### External surfaces

- Water with weak detergent must be used for daily cleaning of the cabinet.
- 70% ethanol or 2-propanol (isopropanol) can be used for sanitization.

### Wetted parts

Only the flow kit components are wetted parts. Consider the compatibility of the wetted parts and your process chemicals before using the system.

Contact your local Cytiva representative if you are not sure about the compatibility of your process chemicals.

### Allowed chemicals

The following table lists chemicals that may be used with ÄKTA ready. The concentrations listed are not normally exceeded during an operating cycle. The maximal allowed exposure time is 48 hours.

The table is intended as a guide. The effects of a chemical will generally be more severe at higher temperatures. Note that the combined effects of chemicals have not been taken into account.

**Note:** The percentage in the table is given in % (v/v).

Chemical	Concentration
Acetic acid	1 M
Acetone	2.5%
Aqueous buffers pH 2-12	<0.3 M
Arginine	2 M
Ammonium sulfate	4 M
Benzyl alcohol	2%
DTE/DTT	100 mM
EDTA	100 mM
Ethanol	20%
Formaldehyde	0.1%
Glycerol	10%
Glycine	2 M

Chemical	Concentration
Guanidine hydrochloride	6 M
Hydrochloric acid	0.1 M
Imidazole	1 M
Mercaptoethanol	20 mM
Pluronic F-68	1%
Polyethylene glycol, PEG 500	5%
Polyethylene glycol, PEG 1000	1%
Polyethylene glycol, PEG 5000	1%
Potassium phosphate	1 M
1-propanol	5%
2-propanol	30%
SDS	1%
Sodium acetate	1 M
Sodium chloride	4 M
Sodium citrate	1 M
Sodium sulfate	1 M
Sodium hydroxide	0.5 M (Maximum exposure time 2 hours)
Sorbitol	1 M
Sucrose	1 M
Triton X-100	1%
Tween 20	1%
Tween 80	1%
Urea	8 M

## 8.3 Environmental requirements

### Environmental specifications

The installation site must comply with the following specifications:

Process	Parameter	Specification
Operation	Allowed location	Indoor use only
	Ambient temperature	2°C to 30°C
	Relative humidity	20% to 95%, non-condensing
	Air	Dust-free filtered air
	Atmospheric pressure	950 to 1050 mbar
Storage, system	Ambient temperature	-25°C to 60°C <sup>1</sup>
Storage, flow kit	Ambient temperature	2°C to 30°C

<sup>1</sup> Storage at room temperature is recommended.

## 8.4 PID control

### Introduction

PID control is a well established and widely used method for feedback control of processes. This section contains general information about PID control, and how it is used in ÄKTA ready.

### Principles

A PID controller uses the difference (error) between the actual (measured) value and a designated setpoint to calculate the adjustment required for keeping a process within defined boundaries.

A typical PID controller is tuned using the following three parameters:

- P — The weight of the current error. Proportional to the error.
- I — The weight of the stationary, or long term change in the error. Reduces effects of error "trends".
- D — The weight of the current rate-of-change of the error. Reduces effects of short term error changes.

### PID parameters

In ÄKTA ready PID control is used to control the pump speed based on flow velocity, as measured in the flow meter. The PID control values are also dependent on chromatography bead size and liquid viscosity.

The default values for the PID parameters are shown in the following table.

Flow kit type	P	I	D
Low Flow Kit	0.3	5 s	0 s
High Flow Kit	0.5	10 s	0 s

### Set PID parameters

In most cases the default PID parameters can be used. If tuning is required, change the I-parameter by large increments.

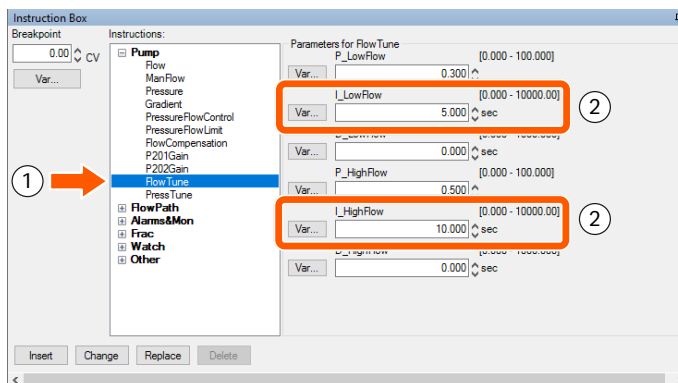
Follow the steps below to change I-parameter in UNICORN.

Step	Action
------	--------

- |   |  |
|---|--|
| 1 | In <b>Method Editor</b> , in the <b>Instruction Box</b> , expand <b>Pump</b> . |
|---|--|

Step	Action
------	--------

2	Click <b>FlowTune</b> (1).
---	----------------------------



3	Locate the I-parameter that corresponds to your installed flow kit (2):
---	---

- **I\_LowFlow** for the Low Flow Kit.
- **I\_HighFlow** for the High Flow Kit.

4	Change the I-parameter depending on the required change.
---	--

- Increase the I-parameter 2× to slow down control.
- Decrease the I-parameter 2× to speed up control.

5	Click <b>Insert</b> .
---	-----------------------

## 8.5 Recycling information

### Introduction

This section contains information about the decommissioning of the product.



#### **CAUTION**

Always use appropriate personal protective equipment when decommissioning the equipment.

### Decontamination

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

### Disposal of the product

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

### Recycling of hazardous substances

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

### Disposal of electrical components



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

### Disposal of batteries

Waste batteries and accumulators must not be disposed of as unsorted municipal waste and must be collected separately. Follow applicable local regulations for recycling of batteries and accumulators.

## Disposal of flow kit and column

Make sure to follow local regulations when disposing of the flow kit and the column. Consult the column documentation for further information about disposing the column.

Follow the steps below for disposal of the flow kit and the column.

Step	Action
1	Disconnect the flow kit and the column as instructed in <a href="#">Remove flow kit and column, on page 144</a> .
2	If required, autoclave the flow kit in an autoclave bag. Make sure to remove the protective caps before autoclaving.
3	Dispose of the empty flow kit and the column in accordance with local regulations.

## 8.6 Regulatory information

### Introduction

This section lists the regulations and standards that apply to the products.

### In this section

Section	See page
8.6.1 Contact information	193
8.6.2 European Union and European Economic Area	194
8.6.3 Great Britain	195
8.6.4 Eurasian Economic Union (Евразийский экономический союз)	196
8.6.5 North America	198
8.6.6 General regulatory statements	199
8.6.7 China	200
8.6.8 Other regulations and standards	203

## 8.6.1 Contact information

### Contact information for support

To find local contact information for support and sending troubleshooting reports, visit [cytiva.com/contact](https://cytiva.com/contact).

### Manufacturing information

The table below summarizes the required manufacturing information.

Requirement	Information
Name and address of manufacturer	Cytiva Sweden AB Björkgatan 30 SE 751 84 Uppsala Sweden
Telephone number of manufacturer	+ 46 771 400 600

## 8.6.2 European Union and European Economic Area

### Introduction

This section describes regulatory information for the European Union and European Economic Area that applies to the product.

### Conformity with EU Directives

See the EU Declaration of Conformity for the directives and regulations that apply for the CE marking.

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

### CE marking



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

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

## 8.6.3 Great Britain

### Introduction

This section describes regulatory information for Great Britain that applies to the product.

### Conformity with UK Regulations

See the UK Declaration of Conformity for the regulations that apply for the UKCA marking.

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

### UKCA marking



The UKCA marking and the corresponding UK Declaration of Conformity is valid for the product when it is:

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

## 8.6.4 Eurasian Economic Union (Евразийский экономический союз)

This section describes the information that applies to the product in the Eurasian Economic Union (the Russian Federation, the Republic of Armenia, the Republic of Belarus, the Republic of Kazakhstan, and the Kyrgyz Republic).

### Introduction

This section provides information in accordance with the requirements of the Technical Regulations of the Customs Union and (or) the Eurasian Economic Union.

### Введение

В данном разделе приведена информация согласно требованиям Технических регламентов Таможенного союза и (или) Евразийского экономического союза.

### Manufacturer and importer information

The following table provides summary information about the manufacturer and importer, in accordance with the requirements of the Technical Regulations of the Customs Union and (or) the Eurasian Economic Union.

Requirement	Information
Name, address and telephone number of manufacturer	See <i>Manufacturing information</i>
Importer and/or company for obtaining information about importer	<p>Cytiva RUS LLC</p> <p>109004, Moscow</p> <p>internal city area Tagansky municipal district</p> <p>Stanislavsky str., 21, building 5, premises I, offices 24,25,29</p> <p>Russian Federation</p> <p>Telephone: +7 985 192 75 37</p> <p>E-mail: <a href="mailto:rucis@cytiva.com">rucis@cytiva.com</a></p>

### Информация о производителе и импортере

В следующей таблице приводится сводная информация о производителе и импортере, согласно требованиям Технических регламентов Таможенного союза и (или) Евразийского экономического союза.

Требование	Информация
Наименование, адрес и номер телефона производителя	См. Информацию об изготовлении
Импортёр и/или лицо для получения информации об импортере	<p>ООО "Цитива РУС"</p> <p>109004, г. Москва</p> <p>вн. тер. г. муниципальный округ Таганский</p> <p>ул. Станиславского, д. 21 стр. 5, помещ. I, ком. 24,25,29</p> <p>Российская Федерация</p> <p>Телефон: +7 985 192 75 37</p> <p>Адрес электронной почты: <a href="mailto:rucis@cytiva.com">rucis@cytiva.com</a></p>

## Description of symbol on the nameplate

## Описание символов на заводской табличке



This Eurasian compliance mark indicates that the product is approved for use on the markets of the Member States of the Customs Union of the Eurasian Economic Union

Данный знак о Евразийском соответствии указывает, что изделие одобрено для использования на рынках государств-членов Таможенного союза Евразийского экономического союза

## 8.6.5 North America

### Introduction

This section describes the information that applies to the product in the USA and Canada.

### NRTL certification



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

This product conforms to UL Std. 61010-1 and is certified to CSA Std. C22.2 No. 61010-1-12.

### FCC compliance

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

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


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

### 8.6.6 General regulatory statements

#### Introduction

This section shows regulatory statements that are applicable to more than one geographical region.

#### KC marking

	The KC symbol indicates RRA registration of compatibility in Korea. The registration number of the product will appear beside the symbol.
	이 기호는 한국에서 호환성에 대한 RRA 등록을 나타냅니다. 제품의 등록 번호는 기호 옆에 나타납니다.

## **8.6.7 China**

### **Introduction**

This section describes the information that applies to the product in China.

### **有害物质声明 (DoHS)**

#### **Declaration of Hazardous Substances (DoHS)**

根据 SJ/T11364-2014 《电子电气产品有害物质限制使用标识要求》特提供如下有关污染控制方面的信息。

The following product pollution control information is provided according to SJ/T11364-2014 Marking for Restriction of Hazardous Substances caused by electrical and electronic products.

## 电子信息产品污染控制标志说明

### Explanation of Pollution Control Label



该标志表明本产品含有超过中国标准 GB/T 26572 《电子电气产品中限用物质的限量要求》中限量的有害物质。标志中的数字为本产品的环保使用期，表明本产品在日常使用的条件下，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。

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

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

本产品在使用寿命结束时不可作为普通生活垃圾处理，应被单独收集妥善处理。

This symbol indicates the product contains hazardous materials in excess of the limits established by the Chinese standard GB/T 26572 Requirements of concentration limits for certain restricted substances in electrical and electronic products. The number in the symbol is the Environment-friendly Use Period (EFUP), which indicates the period during which the hazardous substances contained in electrical and electronic products will not leak or mutate under normal operating conditions so that the use of such electrical and electronic products will not result in any severe environmental pollution, any bodily injury or damage to any assets. The unit of the period is "Year".

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

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

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

## 有害物质的名称及含量

### Name and Concentration of Hazardous Substances

产品中有害物质的名称及含量

Table of Hazardous Substances' Name and Concentration

部件名称 Component name	有害物质 Hazardous substance					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
ÄKTA ready 28906261	X	0	0	0	0	0
ÄKTA ready gradient 29032038	X	0	0	0	0	0

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

**X:** 表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。

- 此表所列数据为发布时所能获得的最佳信息。

**0:** Indicates that this hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in GB/T 26572.

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

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

## **8.6.8 Other regulations and standards**

### **Introduction**

This section describes the additional standards that apply to the product.

### **Additional design considerations**

For additional design considerations, such as ASME-BPE, GMP and cGMPs information refer to the product-specific specification information provided in the documentation package delivered with each equipment.

## 8.7 Flow kit ordering information

### Introduction



#### NOTICE

Only use flow kits supplied by Cytiva.

Both the isocratic flow kit and the gradient flow kit are available with two tubing diameters. The diameter determines the maximum flow rate. For other available flow kit options, see the Cytiva website or contact your local Cytiva representative.

### Isocratic flow kits

Product	Inner diameter (mm)	Product code
ÄKTA ready Low Flow Kit	6.4	28930182
ÄKTA ready High Flow Kit	9.5	28930183

### Gradient flow section

Product	Inner diameter (mm)	Product code
ÄKTA ready gradient Low Flow section	6.4	29021085
ÄKTA ready gradient High Flow section	9.5	29021086

## 8.8 More information

### Spare parts and accessories

Additional information regarding spare parts and accessories can be found in the product documentation package supplied with the system.

Contact your local Cytiva representative for more information and recommendations on spare parts and accessories.

### Contact Cytiva

Contact your local Cytiva representative for more information about the following questions:

- Service
- Method optimization
- Ordering information
- Other issues not covered by this manual

### Training

Cytiva recommends that all new operators attend the training courses available from Cytiva. The courses provide necessary information for inexperienced operators to safely operate ÄKTA ready. With the OptiRun™ virtual reality operator training you can train new operators anywhere at any time on a virtual ÄKTA ready.

Courses in the field of bioprocess development and manufacturing are available from Cytiva Fast Trak™ Training & Education.

For more information about training contact your local Cytiva representative.

## 8.9 Health and Safety Declaration Form

### On site service



### On Site Service Health & Safety Declaration Form

<b>Service Ticket #:</b>	
--------------------------	--

To make the mutual protection and safety of Cytiva 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, 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	Review the actions below and answer "Yes" or "No". Provide explanation for any "No" answers in box below.
<input type="radio"/>	<input type="radio"/>	<b>Instrument has been cleaned of hazardous substances.</b> Rinse tubing or piping, wipe down scanner surfaces, or otherwise make sure removal of any dangerous residue. Make sure the area around the instrument is clean. If radioactivity has been used, perform a wipe test or other suitable survey.
<input type="radio"/>	<input type="radio"/>	<b>Adequate space and clearance is provided to allow safe access</b> for instrument service, repair or installation. In some cases this may require customer to move equipment from normal operating location prior to Cytiva arrival.
<input type="radio"/>	<input type="radio"/>	<b>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.</b>
<input type="radio"/>	<input type="radio"/>	<b>All buffer / waste vessels are labeled.</b> <b>Excess containers have been removed from the area to provide access.</b>
<b>Provide explanation for any "No" answers here:</b>		
<b>Equipment type / Product No:</b>		<b>Serial No:</b>
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.		
<b>Name:</b>		<b>Company or institution:</b>
<b>Position or job title:</b>		<b>Date (YYYY/MM/DD):</b>
<b>Signed:</b>		

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For local office contact information, visit [cytiva.com/contact](https://www.cytiva.com/contact).  
28980026 AD 04/2020

## Product return or servicing



### Health & Safety Declaration Form for Product Return or Servicing

<b>Return authorization number:</b>		<b>and/or Service Ticket/Request:</b>	
-------------------------------------	--	---------------------------------------	--

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

1. 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 Cytiva 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	Specify if the equipment has been in contact with any of the following:	
<input type="radio"/>	<input type="radio"/>	Radioactivity (specify)	
<input type="radio"/>	<input type="radio"/>	Infectious or hazardous biological substances (specify)	
<input type="radio"/>	<input type="radio"/>	Other Hazardous Chemicals (specify)	
<b>Equipment must be decontaminated prior to service / return. Provide a telephone number where Cytiva can contact you for additional information concerning the system / equipment.</b>			
<b>Telephone No:</b>			
<b>Liquid and/or gas in equipment is:</b>		<input type="checkbox"/>	Water
		<input type="checkbox"/>	Ethanol
		<input type="checkbox"/>	None, empty
		<input type="checkbox"/>	Argon, Helium, Nitrogen
		<input type="checkbox"/>	Liquid Nitrogen
		<input type="checkbox"/>	Other, specify
<b>Equipment type / Product No:</b>		<b>Serial No:</b>	
<b>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.</b>			
<b>Name:</b>		<b>Company or Institution:</b>	
<b>Position or job title:</b>		<b>Date (YYYY/MM/DD)</b>	
<b>Signed:</b>			

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For local office contact information, visit [cytiva.com/contact](https://www.cytiva.com/contact).  
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**To receive a return authorization number or service number, call local technical support or customer service.**

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