

# Pump P-950

## User Manual

## Important user information



**Meaning:** Consult the instruction manual to avoid personal injury or damage to the product or other equipment.

### **WARNING!**

The Warning sign is used to call attention to the necessity to follow an instruction in detail to avoid personal injury. Be sure not to proceed until the instructions are clearly understood and all stated conditions are met.

### **CAUTION!**

The Caution sign is used to call attention to instructions or conditions that shall be followed to avoid damage to the product or other equipment. Be sure not to proceed until the instructions are clearly understood and all stated conditions are met.

### **Note**

The Note sign is used to indicate information important for trouble-free or optimal use of the product.

Should you have any comments on this instruction, we will be pleased to receive them at:

Amersham Biosciences AB  
SE-751 84 Uppsala  
Sweden

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**Short instructions on back page**

## **About this manual**

This manual comprises two parts; a practical part (sections 1–5) and a reference part (sections A–E). Sections 1–5 contain the necessary information for installing, operating and maintaining the instrument.

# 1 Introduction

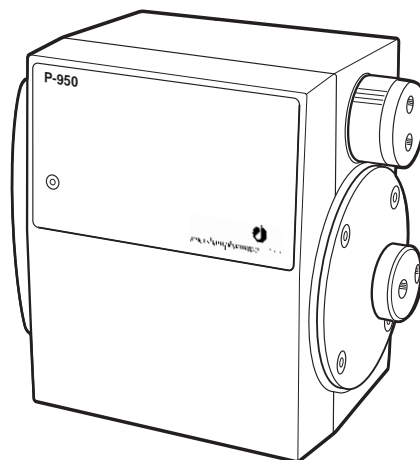
## 1.1 General

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Pump P-950 is a compact single-channel pump for use in liquid chromatography and other applications where constant flow rate is required. It is utilized as a sample pump in ÄKTA™ *design* chromatography systems.

Pump P-950 features:

- Operating pressure up to 1.0 MPa (10 bar, 145 psi).
- Flow rates up to 50 ml/min.
- A pressure sensor connected to the pump outlet.



Pump P-950 works with a wide range of columns and media supplied by Amersham Biosciences.

The pump is controlled from a PC running UNICORN™ control system, version 3.2 or later.

## 1.2 Safety

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- The unit is designed for indoor use only.
- Do not use in a dusty atmosphere or close to spraying water.
- Do not block the outlet of the unit.

**WARNING!** Always disconnect the UniNet-2 connectors before attempting to replace any item on the unit.

**WARNING!** When using hazardous chemicals, all suitable measures, such as protective glasses, must be taken.

**WARNING!** NaOH is injurious to health. Avoid spillage.

**WARNING!** Incorrectly fitted tubing may loosen, causing a jet of liquid to spray out. This is especially dangerous if hazardous chemicals are being used. Connect the tubing by first inserting the tubing fully, then tightening the connector finger-tight.

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## 2 Installation

### 2.1 Unpacking

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Unpack the unit and check the items against the supplied packing list. Inspect the items for obvious damage that may have occurred during transportation.

Keep all packing materials if onward transport of the unit is expected.

**CAUTION!** Read the following information carefully to ensure that the unit is installed correctly.

### 2.2 General precautions

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The unit should be installed in a non-corrosive atmosphere.

The unit should be located in a place of low temperature variations, away from heat sources, draught and direct sunlight.

The unit may be operated at normal ambient temperature in the range +4 to +40 °C.

### 2.3 Installing the pump

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In *ÄKTAexplorer 10 S*, *ÄKTAexplorer 100* and *ÄKTAexplorer 100 Air*, Pump P-950 is installed at delivery.

When installing P-950 as an accessory, refer to the *ÄKTAdesign Optional Configurations User Manual* for information on how to attach the pump to the system.

### 2.4 Connecting UniNet-2 cables

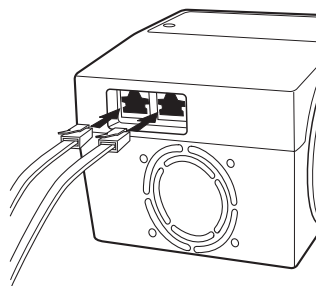
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In *ÄKTAdesign* chromatography systems that include Pump P-950 as a standard component, the UniNet-2 cables are installed at delivery.

Pump P-950 is controlled from a PC running UNICORN version 3.2 or higher via UniNet-2 cables. Power is also supplied through this cable.

**CAUTION!** The mains power to the *ÄKTAdesign* chromatography system must be switched OFF before connecting the unit to the UniNet-2 link.

- 1 Connect two UniNet-2 cables to the UniNet-2 connectors. The unit can be connected in series anywhere in the chain between Pump P-900/ Pump P-920 and the termination plug. The UniNet-2 link connects, in series, Pump P-900/Pump P-920 with Pump P-950 and other modules. The termination plug is connected to the last module in the chain.



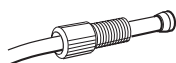
## 2.5 Connecting the tubing

**WARNING!** Incorrectly fitted tubing may loosen, causing a jet of liquid to spray out. This is especially dangerous if hazardous chemicals are being used. Connect the tubing by first inserting the tubing fully, then tightening the connector finger-tight.

In ÄKTAdesign chromatography systems that include Pump P-950 as a standard component, the tubings are installed at delivery.

When installing Pump P-950 as an accessory, connect the three tubings as described below.

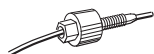
### Pump inlet tubing



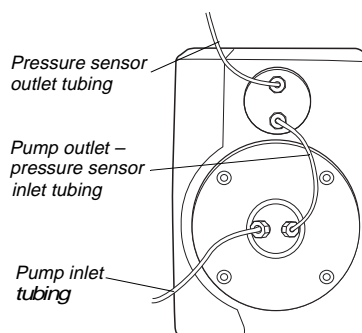
Connect the pump inlet tubing to the lower left-hand port on the pump. Use a male UNF 5/16" connector or a connector with the same threading.

### Pump outlet – pressure sensor inlet tubing

This tubing is usually connected at delivery. If not, connect the tubing (PEEK, i.d. 1.0 mm, o.d. 1/16" and length 150 mm) to the lower right-hand port.



Connect the other end of the tubing to the lower port on the pressure sensor housing. Use 1/16" finger-tight connectors.



### Pressure sensor outlet tubing

Connect the outlet tubing to the upper port on the pressure sensor housing. Use a 1/16" finger-tight connector or a connector with the same threading (UNF 10–32).

**Note:** The tubing dimensions required for different sample application techniques are described in the system documentation.



## 2.6 Purging the pump

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To be able to follow this section, you must know how to operate the pump. Read through chapter 3 *Operation*.

*Note:* To ensure proper operation, avoid pumping while air is trapped in the inlet tubing or in the flow path inside the pump.

Follow the procedure below to remove air from the flow path inside the pump. It should also be used for removing protective ethanol from a new pump.

- 1 Make sure that the outlet tubing of the sample pump does not create any back-pressure.

*Note:* Refer to the system documentation for information on how the injection valve should be set in your system configuration.

- 2 Prepare a container with degassed distilled water and a container with degassed 96% ethanol.
- 3 Submerge the inlet tubing of the sample pump in the distilled water.
- 4 Manually, run the sample pump at **10 ml/min** for 1 minute and then stop the sample pump.
- 5 Move the inlet tubing carefully to the ethanol container.
- 6 Manually, run the sample pump at **50 ml/min** for 2 minutes and then stop the sample pump.
- 7 Carefully move the inlet tubing back to the distilled water.
- 8 Manually, run the sample pump at **1 ml/min** for 5 minutes.
- 9 Manually, run the sample pump at **10 ml/min** for 3 minutes and then stop the sample pump.

*Note:* Be careful not to spill any liquid when moving the inlet tubing between the containers.

*Note:* Remember to stop the flow before moving the inlet tubing between the containers.

# 3 Operation

## 3.1 General

---

Pump P-950 switches on automatically when the ÄKTAdesign chromatography system is switched on.

Pump P-950 is controlled from a PC running UNICORN version 3.2 or higher. It cannot be used as a stand-alone instrument. Control of the pump can be achieved automatically from a method, or manually via the functions available in UNICORN.

## 3.2 User interface

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Pump P-950 is equipped with a green LED on the front panel. The LED indicates the following:

- Flashing light indicates that power is on.
- Steady light indicates that UniNet-2 is connected.

## 3.3 Starting and stopping the pump

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### Preparation before starting

**CAUTION!** Before the start of each run, always ensure that there is an adequate supply of eluent in the reservoir. Avoid pumping without liquid, since this might affect the lifetime of the sealing parts in the pump.

*Note: It is important that all liquids passing through the pump are clean, pure and degassed. Degassing prevents formation of air bubbles, which can cause pressure pulsation and decreased flow rate.*

- 1 Check that there is sufficient solvent present for the run, and that the solvent filter is fully immersed. If the eluent is to be changed, see section 3.7 *Changing eluent*.

*Note: The pump may not work if the liquid vessel is sealed, or if it is placed too far below the pump inlet. Do not close the vessel off completely. Place the vessel on the workbench.*

- 2 Set the pressure limit as described in section 3.4 *Setting the pressure limit*. If the pressure limit is exceeded, the pump is paused.



### Emergency stop

Switch off the power to the ÄKTAdesign system.

### Setting the flow rate and starting the pump

- 1 Select menu **System Control:Manual:Pump** in UNICORN.
- 2 Select the instruction **SampleFlow** in the list.
- 3 Enter the desired flow rate.
- 4 Click on the **Execute** button. The pump starts.

*Note: The moment the pump starts, the back-pressure must not exceed 0.3 MPa.*

- 5 To stop the pump, set the flow rate to 0 and click on **Execute**.

The pump can be run without liquid, but this should be avoided since it might increase the mechanical wear.

## 3.4 Setting the pressure limit

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When applying the sample directly onto the column, it is important to set the pressure limit of the sample pump.

- 1 Select menu **System Control:Manual:Alarm &Mon...** in UNICORN.
- 2 Select the instruction **Alarm\_SamplePressure** in the list.
- 3 Select the **Enabled** mode.
- 4 Enter the desired pressure limit.
- 5 Click on the **Execute** button.

## 3.5 Calibration

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### Calibrating the flow rate

The sample pump should be calibrated when required, or at least once every day before use.

*Note: Use degassed liquid when calibrating the pump.*

*Note: Make sure that the back-pressure during the calibration is less than the expected back-pressure during operation.*

- 1 Purge the pump according to section 2.6 *Purging the pump* to remove any air bubbles from the inlet tubing and the sample pump.
- 2 Place the inlet tubing in a bottle of water or buffer.

- 3 Select menu **System Control:System:Calibrate** in UNICORN.
- 4 Select **P950Flow**.
- 5 Enter the calibration flow rate in the **Flowrate used for calibrate** field. Use the same flow rate as during normal operation.
- 6 Place the outlet tubing from the pump in an empty bottle.
- 7 Click on **Start calibrate**. The pump runs for 1 minute.

*Note: If a larger calibration volume is desired, enter the flow rate value in the **Enter your measured volume** field. Click on **Start calibrate** again to repeat the run. This procedure can be repeated as many times as desired. The measured volume must then be divided by the number of runs before entering it in step 9.*

- 8 Measure the total volume of the liquid collected in the bottle.
- 9 Enter the measured volume in the **Enter your measured volume** field.
- 10 Click on **Set ref value**.  
The flow rate of the pump is now calibrated.

### Calibrating the pressure offset

The pump should be calibrated when required.

- 1 Make sure that the pressure sensor is exposed to atmospheric pressure only.
- 2 Select menu **System Control:System:Calibrate** in UNICORN.
- 3 Select **P950Press**.
- 4 Click on the **Start Calibrate** button.  
The system adjusts the pressure offset of the pump.

## 3.6 Ending the run and storage

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If no further runs are planned, the pump should be flushed immediately with at least 50 ml of pure distilled water. If aqueous buffers have been in use, this is particularly important to prevent salt precipitation.

*Note: If buffers or water are stored at room temperature, there is a risk that bacterial growth may occur.*

**Overnight storage:** Make sure that the pump has been flushed properly with at least 50 ml of pure distilled water.

**Weekend and long-term storage:** Flush the pump with at least 50 ml of pure distilled water and then fill it with 20% ethanol.

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### 3.7 Changing eluent

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**CAUTION!** To prevent precipitation of crystals when changing from a salt-containing buffer to an organic solvent, always flush the pump with water as an intermediate liquid.

*Note: When changing from one eluent to another, it is extremely important that the two eluents are totally miscible with one another. If the two are immiscible, the pump should be flushed first with an intermediate liquid, which is miscible with both eluents. Failure to do so will disrupt the flow from the pump.*

When changing from a salt-containing buffer to an organic solvent, use water as the intermediate liquid to prevent precipitation.

- 1 Stop the pump by setting it in **Pause** mode.
- 2 Change the inlet liquid to the new eluent or to an intermediate liquid.
- 3 Run the pump at a flow rate of 50 ml/min for 2 minutes.
- 4 Stop the pump. If an intermediate liquid is being used, change the inlet liquid to the final eluent.
- 5 Repeat step 3 with the new eluent.

### 3.8 Restart after power failure

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If the power to the pump is interrupted, it automatically restarts after performing a selftest when the power is restored. The calibration values are retained. The default settings for flow rate and pressure limit are reset automatically.

## 4 Maintenance

The connection block has a limited lifetime depending on the flow rate, pressure and eluents used.

**WARNING!** Always disconnect the power supply before attempting to replace any item on the unit.

**WARNING!** Incorrectly fitted tubing may loosen, causing a jet of liquid to spray out. This is especially dangerous if hazardous chemicals are being used. Connect the tubing by first inserting the tubing fully, then tightening the connector finger-tight.

**CAUTION!** Only spare parts approved or supplied by Amersham Biosciences may be used for maintaining and servicing the pump.

### 4.1 Periodic maintenance

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<i>Interval</i>	<i>Action (see procedures below)</i>
Daily	General care
When required	Replace the connection block

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### 4.2 Cleaning-in-place

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Pump a cleaning or sanitizing agent through the pump. The standard recommendation is to use 1 M NaOH and then wash out immediately with buffer and distilled water.

**WARNING!** NaOH is injurious to health. Avoid spillage.

**CAUTION!** NaOH may damage the wetted parts in the pump if left for longer periods. After cleaning using NaOH, flush the pump immediately with buffer and distilled water.

### 4.3 General care

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Inspect the pump daily for eluent leaks.

If, at any time, air bubbles are trapped in the flow path, go through the procedure described in section 2.6 *Purging the pump*.

#### **General recommendations for all eluents**

It is essential that all liquids passing through the pump are clean, pure and degassed. Impure or dirty eluents may also block the channels in the pump assembly, shortening their lifetime. Degassing prevents formation of air bubbles, which can cause pressure pulsation and decreased flow rate.

#### **Additional recommendations for aqueous eluents**

After running with an aqueous eluent, the pump should always be thoroughly washed with pure, distilled water to prevent salt precipitation.

### 4.4 Replacing the connection block

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If there are signs of leakage at the connection block, e.g. liquid dripping through the drainage hole, replace the connection block.

**CAUTION!** Do not disassemble the pump unless there is good reason to believe that the connector block is leaking. Always ensure that sufficient spare parts are available before attempting to replace the connection block.

*Note: Before disassembling the pump mechanism, move the input eluent bottle to below the level of the pump to prevent siphoning.*

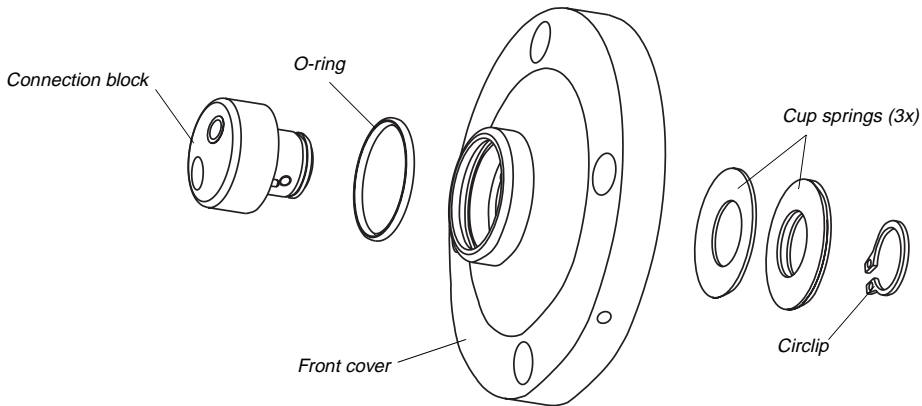
#### **Required spare parts and tools**

- Connection block kit (see *Reference information E* for code no.) containing:
  - Connection block
  - 3 cup springs
  - Circlip
  - O-ring
- Circlip pliers.
- 4 mm Allen key

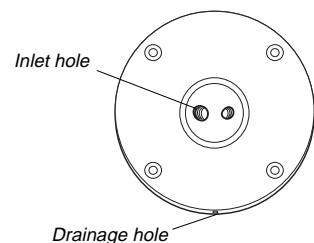
## Replacement instruction

**CAUTION!** Read the following instructions carefully. Avoid fitting the individual parts of the pump assembly incorrectly. Make sure that the orientation of each part is correct before continuing with the next instruction.

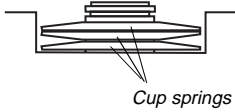
- 1 Switch off the power to the system pump (Pump P-900 or Pump P-920) at the mains switch on the front panel.
- 2 Disconnect the UniNet-2 cables.
- 3 Remove the tubings connected to the connection block on the sample pump.
- 4 Unscrew the four attachment screws for the front cover using the Allen key. Then loosen the cover.



- 5 Use the circlip pliers to pry the circlip off the old connection block. The three cup springs will also come loose.
- 6 Pull out the old connection block from the front cover.
- 7 Remove the old O-ring from the hole in the front cover.
- 8 Wipe the inside of the front cover and the other parts behind the cover with a clean cloth.
- 9 Fit the new O-ring into the hole in the front cover.
- 10 Fit the new connection block into the front cover with the inlet hole (the large hole) pointing to the left and the drainage hole downwards.







- 11 Place the three new cup springs around the connection block as shown opposite.

**CAUTION!** The three cup springs must be oriented and put in position as shown in the figure.

- 12 Using the circlip pliers, mount the new circlip onto the connector block.
- 13 Fasten the front cover using the four attachment screws and the Allen key. Gently tighten the screws crosswise. Make sure that the screws are tightened properly.

*Note: The drainage hole should point downwards.*

- 14 Connect the inlet and the outlet tubings to the front cover.
- 15 Connect the UniNet-2 cables.
- 16 Switch on the power at the mains power switch on the system pump (Pump P-900 or Pump P-920).
- 17 Purge the pump according to section 2.6 *Purging the pump*.
- 18 Check that no liquid emerges from the drainage hole.  
If the leakage has not stopped, call Amersham Biosciences.

## 5 Trouble-shooting

**WARNING!** Always disconnect the power supply before attempting to replace any item on the unit.

**WARNING!** Incorrectly fitted tubing may loosen, causing a jet of liquid to spray out. This is especially dangerous if hazardous chemicals are being used. Connect the tubing by first inserting the tubing fully, then tightening the connector finger-tight.

**CAUTION!** Only spare parts approved or supplied by Amersham Biosciences may be used for maintaining and servicing the pump.

### 5.1 Faults and actions

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If the suggested actions do not correct the fault, call Amersham Biosciences.

<b>Fault</b>	<b>Action</b> (see procedures below)
<b>Large spillage over/into the unit</b>	<ol style="list-style-type: none"><li>1 Unplug the UniNet-2 cable.</li><li>2 Clean and dry the unit with a dry cloth or paper. If necessary, drain the unit by tilting it.</li><li>3 Call Amersham Biosciences for advice.</li></ol>
<b>Leakage</b>	<ol style="list-style-type: none"><li>1 Check all tubing connections for leakage. Replace connectors or connection block if necessary.</li><li>2 Check if there is damage to the pump tubing. Replace if necessary.</li></ol>
<b>Pressure faults</b>	
High pressure limit exceeded	<ol style="list-style-type: none"><li>1 Calibrate the pressure monitor.</li><li>2 Check that the inlet and outlet tubings are not clogged or damaged. Replace if necessary.</li></ol>
Erratic flow or pressure pulsation	<ol style="list-style-type: none"><li>1 Check the tubing connectors.</li><li>2 Check the solvent filter.</li><li>3 Air bubbles may be trapped in the pump. Purge the pump according to section 2.6 <i>Purging the pump</i>.</li></ol>

<b><i>Fault</i></b>	<b><i>Action (see procedures below)</i></b>
<b>Measured volume too low</b>	<ol style="list-style-type: none"> <li>1 Air bubbles may be trapped in the pump. Purge the pump according to section 2.6 <i>Purging the pump</i>.</li> </ol>
<b>Not running</b>	<ol style="list-style-type: none"> <li>1 Check that the system power is on.</li> <li>2 Check the UniNet-2 connection (the indicator on the sample pump should have steady light).</li> </ol>

## **5.2 Removing trapped air bubbles from the pump**

During routine operation, the presence of air bubbles in the pump heads is seen as an erratic flow, a flow that is lower than expected, or an irregular pressure recording.

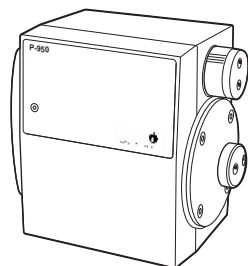
To clear the air from the pump:

- 1 If the air has accumulated due to a leaking tubing connector, replace the connector.
- 2 Purge the pump according to section 2.6 *Purging the pump*.

# Reference information

## A Description

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Pump P-950 is a single-channel laboratory pump for use as a sample pump in ÄKTAdesign liquid chromatography systems.

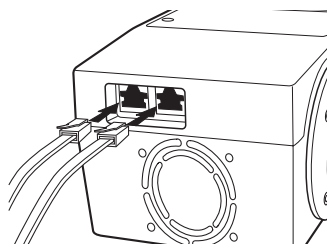
An eluent in an external vessel is drawn into three liquid chambers in the pump. A stepper motor assembly performs the pumping action of the chambers. This assembly acts on the chambers in a sequential order, which gives a smooth flow from the pump

The pressure generated by the sample pump is continuously monitored by the pressure transducer housed in the pressure sensor housing. The signal, which is proportional to the pump pressure, is read by UNICORN via the UniNet-2 connection.

## B Cable connections

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The pump has two connectors on the bottom side for connection to the UniNet-2 communication network. This enables control of the pump from UNICORN, version 3.2 or higher, via Pump P-900 or Pump P-920. The UniNet-2 cable also supplies power to the pump.



## C Liquid delivery

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Pump P-950 has one inlet and one outlet connected to three liquid chambers. The chambers have flexible membranes which do the actual pumping of the liquid. The membranes are actuated by pistons driven by a rotating stepper motor assembly. This gives a sequential operation on the chambers, which results in a smooth and continuous liquid delivery.

Each of the three liquid chambers has a flexible membrane and two holes for inlet and outlet. The inlet to each chamber is fed from the pump inlet. A rotating manifold ensures that only one chamber inlet is connected to the pump inlet at a time. The membranes are actuated by pistons in a sequential order – from completely pressed out to fully retracted. Hence, one chamber will draw solvent while the second is expelling solvent and the third is about to start drawing or expelling.

When a chamber is full, the rotating manifold closes the chamber inlet and opens the chamber outlet instead. Therefore, no check valves are

required. At the same time, the piston starts to press on the chamber membrane. This forces the solvent out from the chamber and through the pump outlet. On the way out, the solvent passes the pressure sensor housing where the pressure is measured.

The sequential pumping action of the pistons is provided by a stepper motor through an axial bearing. The bearing is slightly tilted, which creates a reciprocal motion on the pistons during the rotation.

The stepper motor has automatic speed control to reduce pulsation.

## D Technical specifications

### D.1 Operating data

<i>Flow rate range</i>	0.1–50 ml/min in steps of 0.1 ml/min
<i>Pressure range</i>	0–1.0 MPa (10 bar, 145 psi)
<i>Flow rate accuracy</i>	±3% or ±0.1 ml/min whichever is greater
<i>Flow rate reproducibility</i>	rsd < 2% or ±0.1 ml/min whichever is greater
<i>Viscosity</i>	Max. 5 cP for complete flow range. At reduced flow rate (≤ 10 ml/min): max. 10 cP.
<i>Pressure sensor scale error</i>	Max. ±2%
<i>offset error</i>	Max. 0.01 MPa/week

### D.2 Physical data

<i>Tubing connectors</i>	
<i>pump inlet</i>	male UNF 5/16"
<i>pump outlet</i>	male UNF 10–32
<i>pressure sensor inlet</i>	male UNF 10–32
<i>pressure sensor outlet</i>	male UNF 10–32
<i>Internal volume</i>	1.1 ml including pressure sensor housing
<i>Control</i>	Via UniNet-2 cable connection
<i>Degree of protection</i>	IP 21
<i>Wetted materials</i>	
<i>liquid chambers</i>	Simriz, PEEK
<i>pump outlet and inlet</i>	Polyethene, titanium
<i>rotating manifold</i>	Ceramic, Kalrez
<i>pressure sensor outlet and inlet</i>	PEEK
<i>pressure sensor</i>	titanium

## *Chemical resistance*

The wetted parts are resistant to the chemicals listed below (synergistic effects have not been taken into account; room temperature and limited over-pressure is assumed).

Unless otherwise stated, all concentrations are 100%:

- Acetic acid, 0.1 M
- Acetone, 1%
- Aqueous buffers, pH 2–12
- Decon 90, 10% (for washing only)
- Ethanol, 20%
- Ethanol, 96% (for washing only)
- Ethylene glycol
- Formic acid, 1%
- Guanidine, 6 M
- HCl, 0.1 M
- Isopropanol, 30%
- Lysozyme, 2 mg/ml
- Methanol, 20%
- NaOH, 0.1 M
- NaOH, 1 M (for washing only)
- SDS, 10% (short term use)
- TFA, 0.2%
- Triton-X, 2% (short term use)
- Urea, 8 M

## *Power requirement*

32 V DC

## *Environment*

+4 to +40 °C

10–95% relative humidity

84–106 kPa (840–1060 mbar)

## *Dimensions, H x W x D*

120 x 100 x 140 mm

## *EMC standards*

This product meets the requirements of the EMC Directive 89/336/EEC through the harmonized standard IEC/EN 61326-1 (emission and immunity).

**Note:** The declaration of conformity is valid for the instrument if it is:

- used in laboratory locations
- used in the same state as it was delivered from Amersham Biosciences except for alterations described in the User Manual
- connected to other CE-labelled Amersham Biosciences modules or other products as recommended.

**E Accessories and consumables**

<i>Item</i>	<i>Quant./pack</i>	<i>A/C*</i>	<i>Code no.</i>
Pump P-950	1		18-6083-01
UniNet cable, 0.7 m	1	A	18-1109-74
Connection block kit	1	C	18-1141-03
Finger-tight connector 1/16", for PEEK tubing o.d. 1/16"	10	A	18-1112-55
Tubing connector, male, for 1/8" o.d. tubing	10	A	18-1121-17
Ferrule for 1/8" o.d. tubing	10	A	18-1121-18
Union 1/16" female/M6 male, PEEK	6	A	18-1112-57
Stop plug, 5/16", PEEK	5	A	18-1112-50
Stop plug, 1/16", PEEK	5	A	18-1112-52
PEEK tubing, i.d. 0.75 mm, o.d. 1/16"	2 m	A	18-1112-53
Teflon tubing, i.d. 0.75 mm, o.d. 1/16"	2 m	A	18-1112-54
PEEK tubing, i.d. 1.0 mm, o.d. 1/16"	2 m	A	18-1115-83
Teflon tubing, i.d. 0.063", o.d. 1/8"	3 m	A	18-1121-16

\* ) A = accessory, C = consumable

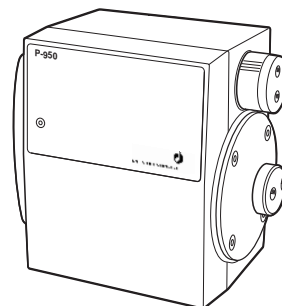




# Short instructions

The following short instructions are intended as a guide for users who are fully familiar with the safety precautions and operating instructions described in this manual. The instructions assume that the unit is installed according to the installation instructions.

Pump P-950 is controlled from UNICORN. For manual control, use the instructions found in **System Control:Manual:Pump**.



- 1 **Switch on the pump** by switching on the power to the chromatography system.
- 2 Set the flow rate by selecting the instruction **SampleFlow**.
- 3 Start the pump by clicking on the **Execute** button.
- 4 Stop the pump by setting the flow rate to 0 and clicking on **Execute**.