

Pump P-950

User Manual

Important user information

All users must read this entire manual to fully understand the safe use of Pump P-950.

WARNING!



The Warning sign highlights an instruction that must be strictly followed in order 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 must be followed to avoid damage to the product or other equipment in order to avoid personal injury. 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 and optimal use of the product.

Declaration of conformity

Safety standards

This product meets the requirements of the Low Voltage Directive 73/23/EEC through the harmonized standard EN 61 010-1:1993 + A2:1995.

EMC standards

This product meets the requirements of the EMC Directive 89/336/EEC through the harmonized standard EN 61 326-1:1997 + A1:1998.

The **CE** symbol and corresponding declaration of conformity, is valid for the instrument when it is:

- connected to other CE-marked Amersham Pharmacia Biotech instruments, or
- connected to other products recommended or described in this manual, and
- used in the same state as it was delivered from Amersham Pharmacia Biotech except for alterations described in this manual.

WARNING!

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

Terms and Conditions of Sale

All goods and services are sold subject to the terms and conditions of sale of the company within the Amersham Pharmacia Biotech group which supplies them. A copy of these terms and conditions is available on request.

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

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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.

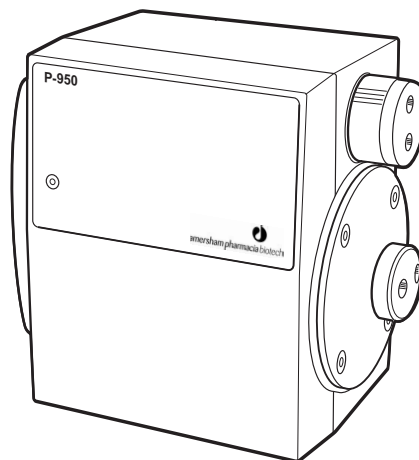
1 Introduction

1.1 General

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

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 Pharmacia Biotech.

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

1.2 Safety

- 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! 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.

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

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

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.

2 Installation

2.1 Unpacking

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

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

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

CAUTION! Make sure that the sample pump is installed and operated at an upright position.

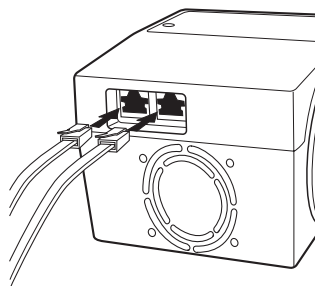
2.4 Connecting UniNet-2 cables

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.



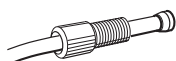
2.5 Connecting the tubing

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.

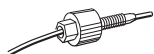
Pump inlet tubing



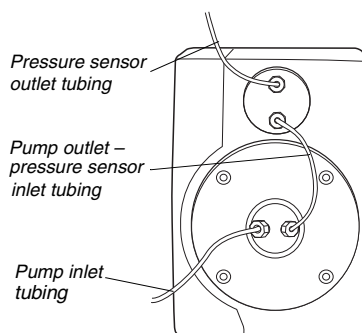
Connect the pump inlet tubing to the lower left-hand port on the pump. Use a male UNF 5/16" connector or a connector with the same threading.

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 Removing trapped air from the pump

***Note:** Make sure that any air in the sample flow path is removed before use. Presence of air in the sampe pump or the flow path may cause pressure pulsation and inaccurate flow.*

The procedure for removing air from the sample flow path depends on the sample application technique that is used. These procedures are descibed in the *ÄKTAdesign Optional Configurations User Manual*.

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

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

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 room tempered, clean, pure and degassed. Degassing prevents formation of air bubbles, which can cause pressure pulsation and decreased flow rate. Purge the pump before use according to the instructions in the ÄKTAdesign Optional Configurations User Manual.

- 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 or on top of the system.

- 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.

***Note:** When applying the sample directly onto the column, some columns generate a back-pressure above 1.0 MPa at their recommended flow rates. If the back-pressure exceeds 1.0 MPa (the upper pressure limit of Pump P-950), the pump stops immediately. To achieve a back-pressure below 1.0 MPa when using these columns, we recommend decreasing the flow rate.*

We particularly recommend decreasing the flow rate of the system pump during equilibration, before sample application, and before switching the sample pump in-line. The sample pump will not start if the back-pressure exceeds 1.0 MPa.



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

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

- 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

The sample pump is calibrated at the factory.

If observing pressure pulsation or flow inaccuracy, first remove any trapped air from the sample flow path. Follow the instruction for your configuration in the *ÅKTA design Optional Configurations User Manual*.

If the inaccurate flow persists, calibrate the pump as shown below.

Calibrating the flow rate

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 Place the inlet tubing in a bottle of water or buffer.
- 2 Select menu **System Control: System: Calibrate** in UNICORN.
- 3 Select **P950Flow**.
- 4 Enter the calibration flow rate in the **Flowrate used for calibrate** field.
- 5 Place the outlet tubing from the pump in an empty bottle.
- 6 Make sure that the Injection valve is set to a position according to the table below:

Sample application technique	Valve position
Loading a sample loop	LOAD
Direct loading onto the column	WASTE
Loading a Superloop	INJECT

- 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

- 1 Expose the pressure sensor 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

If no further runs are planned, the pump should be flushed immediately with at least 50 ml of pure, degassed, 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, degassed, distilled water.

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

3.7 Changing eluent

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

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.

3.8 Restart after power failure

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

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 Pharmacia Biotech may be used for maintaining and servicing the pump.

4.1 Periodic maintenance

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

4.2 Cleaning-in-place

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

Inspect the pump daily for eluent leaks.

If you suspect that air bubbles are trapped in the sample flow path, go through the air removal procedure for your configuration described in the *ÅKTA design Optional Configurations User Manual*.

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

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.

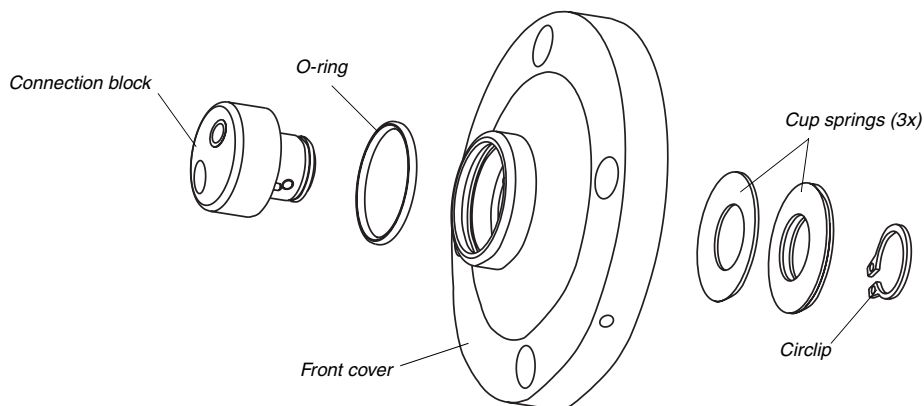
Required spare parts and tools

- 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

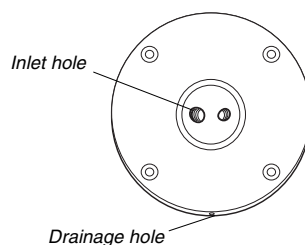
Replacement instruction

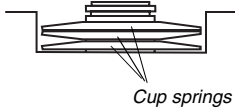
CAUTION! Read the following instructions carefully. Avoid fitting the individual parts of the pump assembly incorrectly. Make sure that the orientation of each part is correct before continuing with the next instruction.

- 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 When running the pump, check that no liquid emerges from the drainage hole.
If the leakage has not stopped, call your local service organisation.

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 Pharmacia Biotech may be used for maintaining and servicing the pump.

5.1 Faults and actions

If the suggested actions do not correct the fault, call your local service organisation.

<i>Fault</i>	<i>Action</i> (see procedures below)
Measured volume too low	<div><div>1</div><div>Air bubbles may be trapped in the pump. Purge the pump according to the ÄKTAdesign Optional Configurations User Manual.</div></div> <div><div>2</div><div>Cavitation might occur due to too high flow rate for the sample application technique used. See the ÄKTAdesign Optional Configurations User Manual for the recommended flow rates.</div></div>
Erratic flow or pressure pulsation	<div><div>1</div><div>Check the tubing connectors.</div></div> <div><div>2</div><div>Check the solvent filter.</div></div> <div><div>3</div><div>Air bubbles may be trapped in the pump. Purge the pump according to the ÄKTAdesign Optional Configurations User Manual.</div></div>
Large spillage over/into the unit	<div><div>1</div><div>Unplug the UniNet-2 cable.</div></div> <div><div>2</div><div>Clean and dry the unit with a dry cloth or paper. If necessary, drain the unit by tilting it.</div></div> <div><div>3</div><div>Call Amersham Pharmacia Biotech for advice.</div></div>
Leakage	<div><div>1</div><div>Check all tubing connections for leakage. Replace connectors or connection block if necessary.</div></div> <div><div>2</div><div>Check if there is damage to the pump tubing. Replace if necessary.</div></div>

<i>Fault</i>	<i>Action (see procedures below)</i>
High pressure limit exceeded	<ol style="list-style-type: none"> 1 Check that the inlet and outlet tubings are not clogged or damaged. Replace if necessary. 2 Calibrate the pressure monitor. 3 Decrease the flow rate.
Not running	<ol style="list-style-type: none"> 1 Check that the system power is on. 2 Check the UniNet-2 connection (the indicator on the sample pump should have steady light).

5.2 Removing trapped air bubbles from the pump

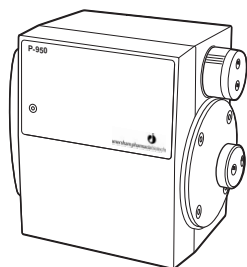
During routine operation, the presence of air bubbles in the pump heads is seen as an erratic flow, a flow that is lower than expected, or an irregular pressure recording.

To clear the air from the pump:

- 1 If the air has accumulated due to a leaking tubing connector, replace the connector.
- 2 Remove air from the sample flow path according to the *ÄKTAdesign Optional Configurations User Manual*.

Reference information

A Description



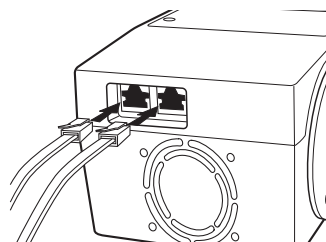
Pump P-950 is a single-channel laboratory pump for use as a sample pump in ÄKTAdesign liquid chromatography systems.

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

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

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, and hence 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 inclined, which creates a reciprocal motion on the pistons during the rotation.

The stepper motor has automatic speed control to reduce pulsation. The pump is also equipped with pressure compensation.

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</i>	
<i>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 × W × D

120 × 100 × 140 mm

E Accessories and consumables

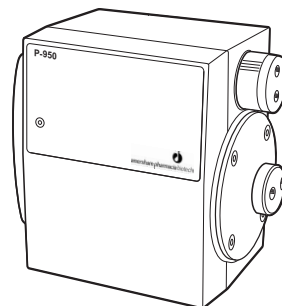
<i>Item</i>	<i>Quant./pack</i>	<i>A/C*</i>	<i>Code no.</i>
Pump P-950	1		18-6083-01
UniNet cable, 0.7 m	1	A	18-1109-74
Connection block kit	1	C	18-1141-03
Finger-tight connector 1/16", for PEEK tubing o.d. 1/16"	10	A	18-1112-55
Tubing connector, male, for 1/8" o.d. tubing	10	A	18-1121-17
Ferrule for 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**.



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