

### 1 Introduction

Valve INV-907 is a motorised rotary 7-port valve. The valve is used in ÄKTA™ design chromatography systems. It is powered from the ÄKTA design P-900 series system pump, and is controlled from UNICORN™ control system.

The valve has 3 positions used for:

- loading a sample loop
- injecting the sample onto the column
- washing the system pump.

The valve can also be used to switch between upflow and downflow in a column.

Features:

- Completely swept flow path minimises eluent or sample "memory effect".
- Flow rates up to 100 ml/min.
- All wetted parts are plastic PEEK.

### Safety

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

### 2 Installation

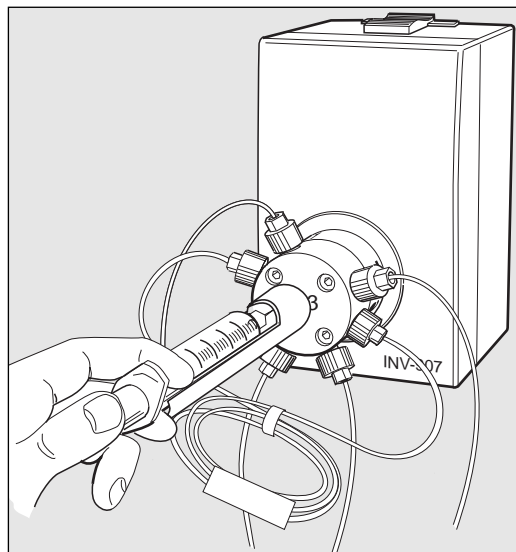
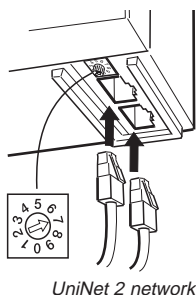
**CAUTION!** Before connecting Valve INV-907 ensure the power is switched OFF at the system pump or the complete system.

#### Unpacking

Unpack the valve and check the items against the packing list. Inspect the items for obvious damage which may have occurred during transportation.

#### Installing the valve

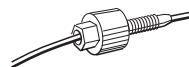
- 1 Connect the valve with two UniNet cables as a part of the UniNet 2 chain.
- 2 Set the ID-switch at the bottom to



the required valve number **0-9**. The number should correspond to that used in UNICORN.

**Note:** All valves must have different numbers.

- 3 Mount the valve vertically, in the way it is shown in the user documentation of your ÄKTA design chromatography system.
- 4 Apply an identification number from the labels supplied. The number should be the same as that of the rotary switch at the bottom of the valve. Place the number so that it is easily readable from the front.
- 5 Connect the tubing.



- 6 When used as an injection valve connect the tubing as follows:

Port	Connect to
1	Column inlet
2	Sample loop or bottom tubing of Superloop
3	Injection port
4	Waste
5	Waste
6	Sample loop or top tubing of Superloop
7	Outlet of the pump

- 7 When used as an upflow/downflow valve, connect the valve as indicated in the user documentation of your ÄKTAdesign chromatography system.

### 3 Operation

The valve is controlled from UNICORN.

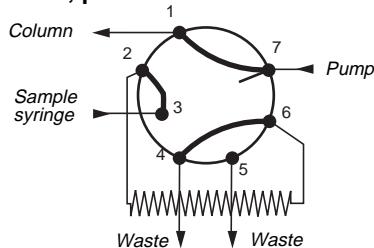
When used as an injection valve use the instruction **InjectionValve** in

**System Control:Manual:Flowpath**. The valve can be set in 3 positions:

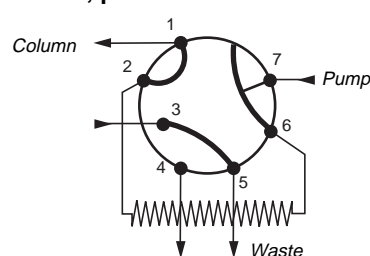
- **LOAD** position 1 (home position)
- **INJECT** position 2
- **WASTE** position 3

If the valve has not been activated it is in position 1.

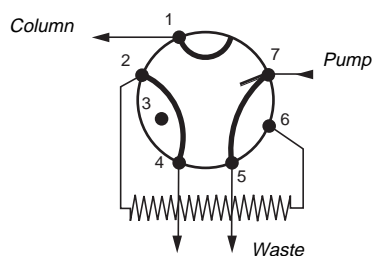
#### LOAD, position 1



#### INJECT, position 2



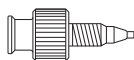
#### WASTE, position 3



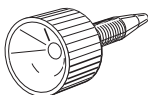
## Manual sample loading

The sample loop and Superloop can be loaded with a syringe. Connect Superloop with the bottom tubing connected to port 2 and the upper tubing to port 6.

For large volumes use a luer female/1/16" male union connected to port 3.



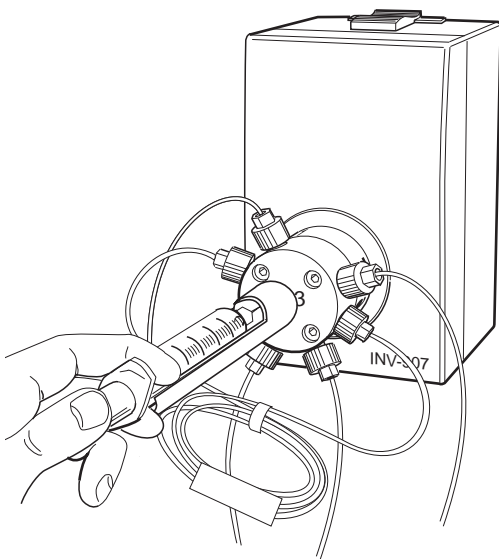
For smaller volumes use an injection needle together with the injection fill port as described below:



Check the fill port nozzle is screwed into the fill port.

**Note:** *The thread is left-handed.*

- 1 Loosely thread the fill port screw into valve port 3.
- 2 Insert the injection needle (0.7 mm o.d.) into the injection fill port.
- 3 Tighten the fill port until the nozzle has formed a seal around the needle tip. When the seal is adjusted correctly, it feels as if you are penetrating a septum at the end of the injection fill port. The seal should provide easy insertion and removal of the needle.
4. Mount the syringe holder on the fill port.



Two techniques can be used for filling the sample loop; partial or complete filling.

Type of filling	Volume to load
Partial filling	max 50% of the sample loop volume
Complete filling	2-5 times the sample loop volume

### Partial Filling

Partial filling is used when high recovery is required. Partial filling allows the injected volume to be changed without changing the loop and does not waste sample.

Partial filling is achieved as follows:

- 1 Set injection valve to position LOAD.
- 2 Load the syringe with a large volume of buffer (5x the loop volume).
- 3 Fill the sample loop carefully with buffer.
- 4 Set the injection valve to position INJECT before taking out the syringe.  
**Note:** *If the syringe is taken out when the injection valve is in position LOAD, self drainage will occur and air will enter the sample loop.*
- 5 Load the syringe with the required volume of sample. No more than half (50%) a loop volume of sample should be loaded into the loop.
- 6 Insert the syringe in position 3 on the injection valve. Set the injection valve to position LOAD.  
**Note:** *Do not load the sample before the valve is in position LOAD.*
- 7 Gently load the syringe contents into the loop.
- 8 Leave the syringe in position. The sample will be injected onto the column when the valve is switched to INJECT in the method.

### Complete filling

In this method a surplus of sample is used to ensure that the sample loop is filled completely, allowing reproducible sample volumes. In preparative applications the sample volume should be at least 2 times the volume of the sample loop. For analytical reproducibility a sample volume 5 times the volume of the sample loop should be used.

With complete filling the sample volume can only be changed by changing the loop size.

Complete filling is achieved as follows:

- 1 Set valve to position LOAD.
- 2 Load the syringe with sample (2-5 times the loop volume).
- 3 Gently load the syringe contents into the loop.
- 4 Leave the syringe in position. The sample will be injected onto the column when the valve is switched to INJECT in the method.

***Note:** If the syringe is taken out before the sample is injected onto the column, self drainage will occur and the loop will be emptied.*

### Emptying the sample loop

When emptying the sample loop a buffer volume of approx. 5 times the sample loop volume should be used to flush the loop and ensure that all sample is injected onto the column.

### Storage

**Overnight:** The valve can be left filled with a buffer.

**Weekend or Long time storage:** Flush the valve with water and then fill it with 20% Ethanol.

## 4 Maintenance

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

Period	Action
Every 12 months or when required	Change channel plate and distribution plate

### Cleaning-in-place

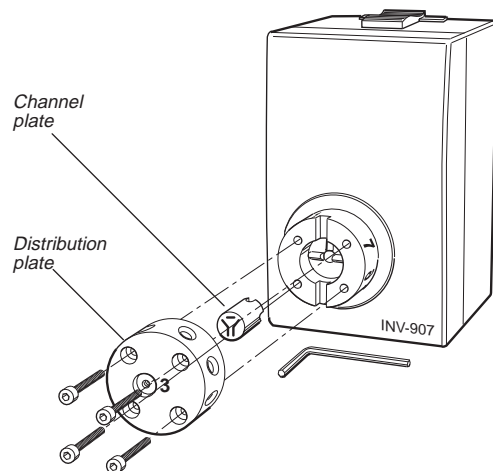
Pump a cleaning or sanitizing agent through the valve. The standard recommendation is to pump 1 M NaOH for 30 minutes and then wash out with buffer.

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

### Changing channel plate and distribution plate

A replacement kit, Valve Kit INV-907, is available, see ordering information in *Reference Information*.

- 1 Ensure that the valve is in position 1 and then disconnect it from the pump.
- 2 Remove the 4 screws on the front using the supplied 3 mm Allen key. Loosen each one equally in turn so the distribution plate comes off parallel to the valve body.



- 3 Slide the screws out.
- 4 Remove the distribution plate containing the ports.
- 5 Remove the old channel plate and insert a new one.
- 6 Remount a new distribution plate so that the text **3** is horizontal and to the right of the central tubing connection. Using the Allen key, tighten the 4 screws in turn, a little at a time, until the distribution plate is fixed to the valve body.

## 5 Trouble shooting

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

<b>Fault</b>	<b>Action</b>
<b>The valve is not switching</b>	
	<ol style="list-style-type: none"> <li>1 Check the connection to the pump. The valve should be connected to the <i>UniNet 2</i> socket, not the <i>UniNet 1</i> socket.</li> <li>2 Check the ID-switch on the valve. The ID number should correspond to the number set in UNICORN.</li> <li>3 Check the <i>UniNet</i> cable and replace if required.</li> </ol>
<b>The valve is switching to wrong position</b>	
	<p>The valve parts may have been incorrectly assembled after replacement.</p> <ol style="list-style-type: none"> <li>1 Check that the distribution plate marking <b>3</b> is horizontal.</li> </ol>
<b>External leakage</b>	
	<ol style="list-style-type: none"> <li>1 Check the tubing connections. Tighten or replace if required.</li> </ol>
<b>Internal leakage</b>	
	<p>Internal leakage are easy to detect at the small hole on the underside of the valve body.</p> <ol style="list-style-type: none"> <li>1 Internal valve parts may be worn. Change channel plate and distribution plate according to section 4.</li> </ol>
<b>High back pressure (clogging)</b>	
	<ol style="list-style-type: none"> <li>1 Do cleaning-in-place according to the instructions in section 4.</li> <li>2 Change channel plate and distribution plate according to section 4.</li> </ol>
<b>Other faults</b>	Contact Amersham Pharmacia Biotech.

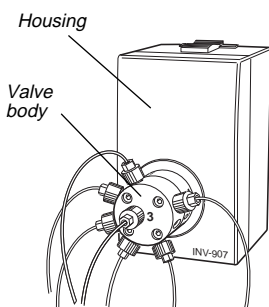
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# Reference information

## Description

The valve consists of two main parts:

- Housing which encloses the motor and electronics.
- Valve body with a rotating central core.



As the channel plate is turned by the motor, different ports are connected.

Valve switching is controlled from UNICORN by reading the actual position of the channel plate.

The geometry of the valve assures that the flow path is completely swept so that solvent or sample "memory effect" is virtually non-existing. The valve rotates the shortest way to the next position (max. 180°). The material used in the switching parts ensures both long mechanical and chemical lifetime.

The valve housing contains no user replaceable items.

## Technical specifications

### Operating data

<i>Max Flow rate</i>	100 ml/min
<i>Max Pressure</i>	25 MPa (250 bar, 3600 psi)
<i>Back pressure</i>	<50 kPa at 100 ml/min with water
<i>Leakage</i>	< 0.1 µl/min at 25 MPa
<i>pH stability range</i>	1–13, 1–14 (<1 day exposure)
<i>Viscosity</i>	Max. 5 cP
<i>Switch time</i>	<260 ms between two adjacent positions
<i>Operating life time</i>	>50 000 cycles, two adjacent positions
<i>Environment</i>	+4 to +40 °C 20-95% relative humidity 84-106 kPa (840-1060 mbar) atmospheric pressure

### Physical data

<i>Internal volume</i>	
<i>Pos 1 LOAD</i>	
Port 1-7	9 µl
Port 2-3	5 µl
Port 4-6	8 µl
<i>Pos 2 INJECT</i>	
Port 1-2	7 µl
Port 3-5	6 µl
Port 6-7	9 µl
<i>Pos 3 WASH</i>	
Port 2-4	8 µl
Port 5-7	9 µl
<i>Flow channel diameter</i>	0.8 mm
<i>Valve principle</i>	Motor controlled valve
<i>Functions</i>	Switching 3 positions controlled from UNICORN
<i>Degree of protection</i>	IP 43
<i>Wetted materials</i>	PEEK (polyetheretherketone)
<i>Chemical resistance</i>	The wetted parts are resistant to organic solvents and salt buffers commonly used in chromatography of biomolecules, except 100% ethylacetate, 100% hexane and 100% tetrahydrofuran (THF)
<i>Power requirement</i>	32 V DC ±10% from the system pump
<i>Power consumption</i>	Up to 9 W
<i>UniNet 2 address</i>	0–9
<i>Inlet and outlet tubing</i>	UNF 10-32 2B "Fingertights" for capillary tubing 1/16" outer diameter
<i>Dimensions, H x W x D</i>	135 x 80 x 120 mm
<i>Weight</i>	1.2 kg
<i>EMC Standards</i>	This product meets the requirement of the EMC Directive 89/336/EEC through the harmonized standards EN 50081-1 (emission) and EN 50082-1 (immunity)
<b>Note:</b> The declaration of conformity is valid for the instrument when it is	
<ul style="list-style-type: none"> <li>• used in laboratory locations</li> <li>• used in the same state as it was delivered from Amersham Pharmacia Biotech except for alterations described in the user manual</li> <li>• connected to other CE labelled Amersham Pharmacia Biotech instruments or other products as recommended.</li> </ul>	

## Accessories and spare parts

<i>Item</i>	<i>Quantity per pack</i>	<i>Code no.</i>
Valve INV-907 including one UniNet cable (fill port, needle and syringe holder are not included)	1	18-1108-40
Injection kit INV-907 including fill port needle and syringe holder	1	18-1110-89
Valve kit INV-907 including channel plate and distribution plate	1	18-1109-05
Sample loops		
100 µl	1	18-1113-98
500 µl	1	18-1113-99
1 ml	1	18-1114-01
2 ml	1	18-1114-02
Superloop, 10 ml	1	18-1113-81
Superloop, 50 ml	1	18-1113-82
Superloop, 150 ml	1	18-1023-85
Cable UniNet, 0.7 m	1	18-1109-74
Mounting bracket	1	18-1109-11
Teflon tubing, i.d. 1/8", o.d. 3/16"	3 m	18-1112-47
Tubing connector for 3/16" o.d. tubing	10	18-1112-49
Ferrule for 3/16" o.d.tubing	10	18-1112-48
Stop plug, 5/16"	5	18-1112-50
Stop plug, 1/16"	5	18-1112-52
Union Luer female/1/16" male	2	18-1112-51
Union 1/16" female/M6 male	6	18-1112-57
Union M6 female/1/16" male	8	18-1112-58
PEEK tubing, i.d. 0.75 mm, o.d. 1/16"	2 m	18-1112-53
Teflon tubing, i.d. 0.75 mm, o.d. 1/16"	2 m	18-1112-54
PEEK tubing, i.d. 1.0 mm, o.d. 1/16"	2 m	18-1115-83
Fingertight connector 1/16"	10	18-1112-55

## Important user information

### 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 Pharmacia Biotech  
SE-751 84 Uppsala  
Sweden

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