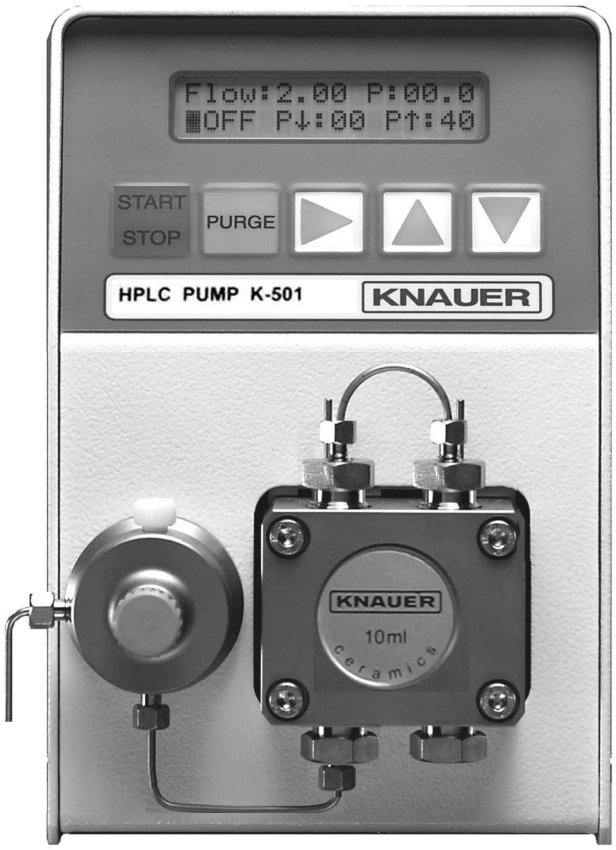
WellChrom
HPLC-Pump K-501
HPLC-Pumpe K-501
Manual / Handbuch

V7543, 02/2001



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Content

Inhalt

Using this manual

This manual refer to the WellChrom HPLC pump K-501 .

Conventions in this manual

The captions used in this manual referring to the figures are identified with square brackets like: see [3] in Fig. X on page Y.

Cursor right: ► up: ▲ down: ▼ left: ◄.

SOP´s in this manual

The **S**tandard **O**perating **P**rocedures (**SOP**) provided with this manual offer a convenient way of structuring complex tasks in the operation of your HPLC pump. They include step-by-step instructions leading the user through all routine tasks during operation. They can be used for documentation purposes and be copied, applied signed, and filed in order to document the performance of the instrument.

IMPORTANT !

Please operate the instrument and all accessories according to instructions and SOP´s in this manual. This ensures proper results and longevity of your equipment.

Table 1 List of SOP´s in this manual

General description

Outstanding feature of the HPLC pump K-501 is its double piston technique, which enables a high consistancy in the flow rate together with a very low pulsation. The HPLC pump K-501 is delivered with the new inert pump heads with ceramic inlays. Two different pump heads are available:

- Analytical pump head (0,001 – 9,999 mL/min),
- Preparative pump head (0,01 – 50 mL/min).

These heads combine the features of the older stainless steel versions with those of the PEEK ones and replace both from now.

The new features are

- Inert, biocompatible.
- The 10 mL pump head is pressure stable up to 400 bar.
- The 50 mL pump head is still pressure stable up to 150 bar.
- The sealings are easily accessible due to the new splitted design.

Four different older pump heads can also be used with the HPLC pump K501. These are the analogous stainless steel and PEEK versions respectively:

- Analytical pump head (0,001 – 9,999 mL/min), stainless steel
- Analytical pump head (0,001 – 9,999 mL/min), PEEK
- Preparative pump head (0.01 – 50 mL/min), stainless steel
- Preparative pump head (0.01 – 50 mL/min), PEEK

The pump heads are easy to exchange simply by loosening of only four screws. The experienced user is able to disassemble the pump heads for cleaning purposes or the exchange of wear and tear parts.

The easy to learn operation and control of the HPLC pump K-501 is performed via a clear keypad and a two line display. The following functions, parameters, and settings may be changed by a manual input:

- START/STOP
- PURGE
- Flow rate
- Pressure thresholds (P_{max} , P_{min})
- Pump head selection (4/6 types)
- Offset correction “measured pressure value”
- Analog input adjustment (offset, amplification)
- PURGE function adjustment (flow rate, check)
- Flow rate adjustment
- Selection of the operating mode (RS-232, analog, standalone)
- GLP report display (total operating time, serial number)

Setup of the HPLC pump K-501

Unpack the instrument and check pump and accessories for any damage due to shipping. Place any claims referring to damage to the transportation company responsible for shipping.
Please check that the HPLC pump K–501 is complete. Use the section Packing list. Please contact our service department, if something is missing, in spite of our thorough control procedures.

Delivery Content

1	***Pump, including pump head 10 or 50mL, and accessories***
1	Power supply cable
1 Set	Tools
1	RS-232 cable
1	Plug strip with connectors
1,5 m	Flat cable
1 Set	Piston backflushing
1	PTFE eluent filter
1 Set	Inlet screw with fittings
1	Operation Manual
1	Guarantee Statement KNAUER

Please fill in the registration card for guarantee and return it immediately.
Please remove the transparent, protective foil from pump outlet and display.

Front View of the HPLC pump K-501

Fig. 1 Front view of the HPLC pump K -501

The assembling of the pump head is described in the chapter on page 7.

Pump head identification

The pump heads are labeled on the front side indicating the ceramics inlay version and the maximum flow rate.

The labels of older stainless steel and PEEK versions respectively show the maximum flow rate only.

These older pump heads can easily be identified by their color:

black:	➜	biocompatible PEEK-version
metallic:	➜	stainless steel version

Connection of the pump head

All connections for liquids are placed at the front of the HPLC pump K-501, Fig. 1 and Fig. 2.

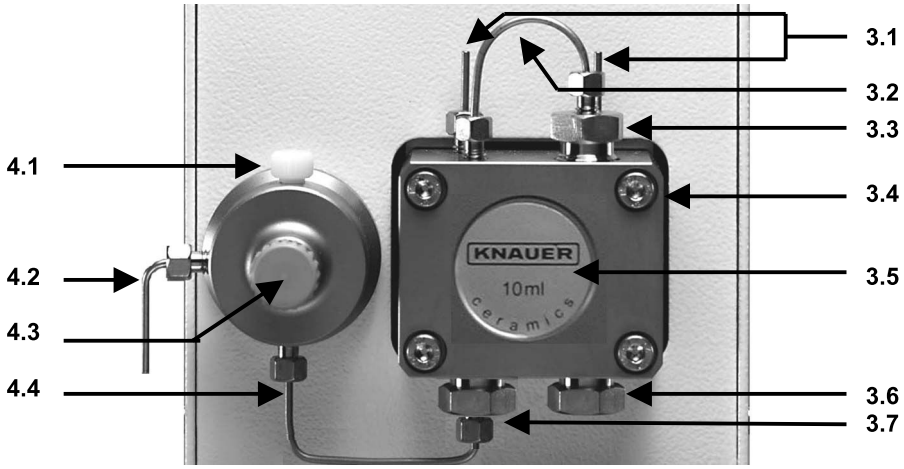


Fig. 2 Pump head and pressure transducer

4	**pressure transducer**
4.1	Outlet
4.2	de-aeration capillary
4.3	de-aeration screw
4.4	Inlet

3	**Pump head**
3.1	Connections for piston backflushing
3.2	Connection capillary
3.3	Pump head outlet
3.4	Pump head screws
3.5	Label with max. flow rate
3.6	Pump head inlet
3.7	Eluent outlet

Display and keypad of the HPLC pump K-501

The display shows status information's of the pump, e.g. the actual flow rate, the measured system pressure, or the actual program status and it enables the check of data input.

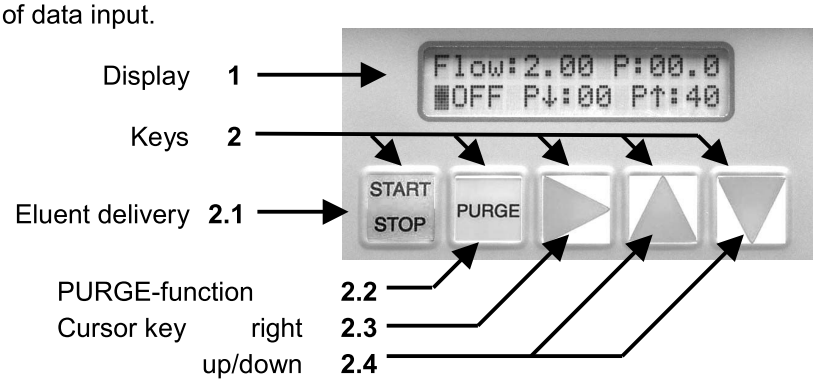
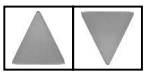


Fig. 3 Display and keypad

The delivery will be started with flow rate set or it will be stopped by pressing the START/STOP key **2.1**.

The PURGE key **2.2** enables the immediate start of the purge function, again with the previous set values.

Pressing the cursor right key **2.3** moves the cursor to the next input field or operation field and confirms the last input.



Pressing the cursor up/down keys you can change the selected parameter or you can choose the.

Fig. 4 Key functions

Rear view of the HPLC pump K-501

Elements on the rear panel

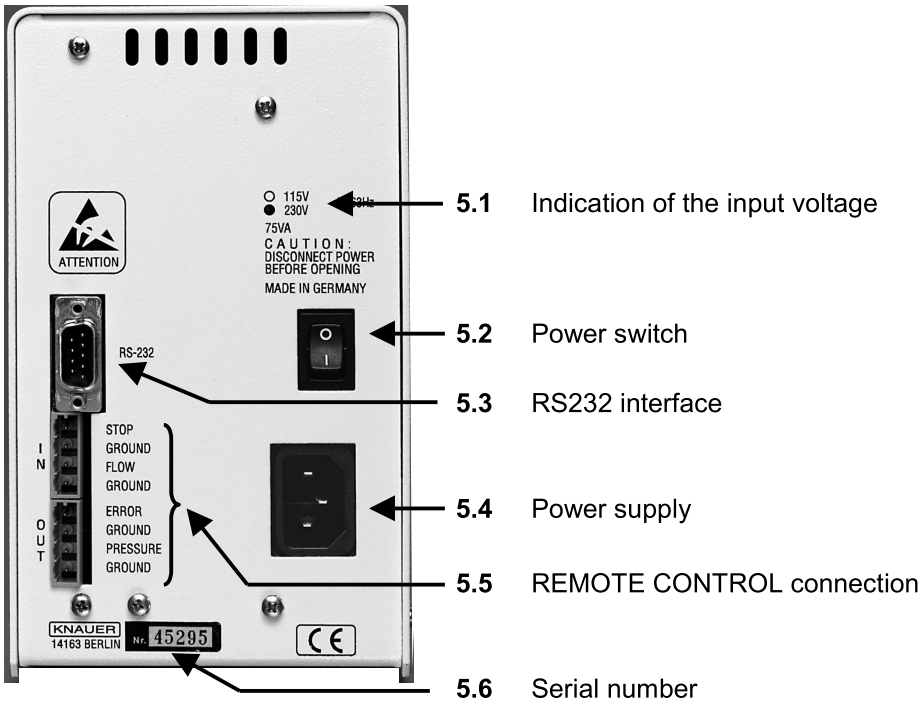


Fig. 5 Rear view of the HPLC pump K-501

The power supply **5.4**, and the power switch **5.2** are there located as well as a RS-232 serial interface **5.3** for external computer control and remote control input and output **5.5** :

IN:	STOP:	connection for START/STOP as short circuit (or TTL-low) against ground
	GROUND:	Ground connection for START/STOP
	FLOW:	Analog input for flow rate control
	GROUND:	Ground connection for flow rate control
OUT:	ERROR:	Output for error signals (open collector) against ground
	GROUND:	Ground connection for error signals
	PRESSURE:	Analog output for pressure signal
	GROUND:	Ground connection for pressure signals

Operating the HPLC pump K-501

CAUTION !

Never operate the HPLC pump K-501 without liquid inside the pump head and the piston backflushing! Otherwise the pump head may be damaged. To proceed the piston backflushing follow the SOP on page 21.

Connection of the pump head

IMPORTANT !

Make sure that all connections in your system are suited for the pressure the pump will produce.

The bushing inlet (item **3.6** in Fig. 2 on page 7) is to connect with the solvent reservoir. For this purpose follow the SOP 1 Connection of eluent tubings having a look on Fig. 6.

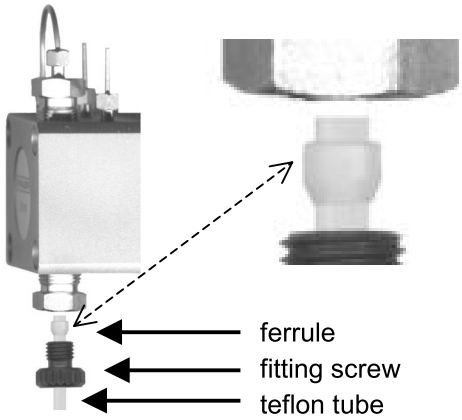


Fig. 6 Pump head: Connection of eluent tubings

SOP 1 Connection of eluent tubings

1. Insert the teflon tube into the fitting screw and the ferrule. Make sure, that the ferrule is in the correct orientation - the flat side to the tube end, to the pump head.
2. Push the tube end as far as it will go into the pump head inlet.
3. Tighten the ferrule with the fitting screw by hand.

Power connection

The WellChrom HPLC pump K-501 operates with 115 or 230 V AC of 47-63 Hz. The setting is done by the manufacturer on customers request. The standard setting is 230 V. If there is on any reasons the need of a change, please contact our service department. The actual setting is indicated on the rear panel of the instrument (Fig. 7).

Fig. 7 Indication of the input voltage

CAUTION ! **Make sure, that the power supply is properly grounded and a correct 3-pol net cable is used. The connection to a faulty voltage source may cause damages.**

Connect the net cable with the power supply socket on the rear panel and switch on the instrument (switch **5.2** in Fig. 5 on page 9. The display appears with the welcome message.

```
* * KNAUER * *
MINI-STAR V1.24
```

The version number of the intern software may depend on the delivery. This message will change to the start menu after about 5 seconds.

SETUP and HELP menus

The cursor normally resides at the first symbol of a field. If the setting is changed, the cursor moves to the first position of the value or option.

Start menu

```
Flow:  3.00     P:00.0
♦ OFF  P↓:00    P↑:01
```

Flow: Displays the current flow rate. The decimal point position adjusts itself according to the pump head.

You only can change the flow rate via the keypad, if the pump is in the **standalone** mode. This is to do this way:

By pressing the ▲ or ▼ key once, the cursor moves to the first digit of the flow rate. Further pressings the ▲ or ▼ keys change the value. The set value will be confirmed and saved by pressing the ► key.

If you are trying to change the flow rate while the instrument is in one of the external control modes, appears for about 2 seconds the error message:

The changed value is not accepted by the system.

P: Displays the current system pressure inquiry. It is not free for manually changes

◆ Start field for setup menus, accessible by pressing the ► key once

You can scroll the menus using the ▲ and ▼ keys. The menus will now be described in that order as the appear when scrolling with the ▲ key.

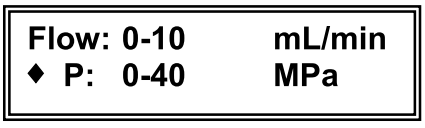
ON Displays the current delivery status

ON:	delivery switched on
OFF:	delivery switched off
PUR:	PURGE function active
STP:	delivery switched on, STOP active

P•: Displays the minimum pressure value P_{min} for automatic cut-off, („00“ = monitoring function not set).
Firstly move the cursor using the ► key to the P•-field. By pressing the ▲ or ▼ key once, the cursor moves to the first digit of the P•-field. Further pressings the ▲ or ▼ keys change the value. The set value will be confirmed and saved by pressing the ► key.

P•: Displays the maximum pressure value P_{max} for automatic cut-off Proceed any change in the same manner as already described for the „P_{min}“ value

Flow ranges



This display is only an informative one. It cannot be changed directly.
Dependent on the selected pump head it shows the possible working ranges:

Table 2 Flow rate and pressure ranges

pump head	flow rate [mL/min]	P [MPa]
10 mL ceramics	0 -10	0 - 40
10 mL stainless steel	0 -10	0 - 40
10 mL PEEK	0 - 10	0 - 25
50 mL ceramics	0 - 50	0 - 15
50 mL stainless steel	0 - 50	0 - 15
50 mL PEEK	0 - 50	0 - 15

Operation mode

CONTROL:
♦ standalone

Pressing the ► key will activate the selection and you can make your choice using the ▲ and ▼keys. The set value will be confirmed and saved by pressing the ► key. The following modes are available:

standalone
Ext: analog
Ext: RS-232

If one of the external modes is selected, the flow rate cannot be changed via the keypad.

Adjusting the PURGE function

PURGE: Flow: 100%
♦ Check: no

The PURGE flow rate can be set within the range of 0 to 110% related to the maximum flow rate of the actual pump head.

Press the ► key once to move the cursor to the fist digit of the PURGE flow rate. Set the desired value using the ▲ or ▼keys. The set value will be confirmed and saved by pressing the ► key.

Furthermore you can activate the inquiry **Check: yes** or deactivate the inquiry **Check: no**. Directly after having saved the PURGE flow rate you can make your choice again using the ▲ or ▼ key. The set value will be confirmed and saved by pressing the ► key.

SOP 2 Activating the PURGE function

1. Open the de-aeration valve item **4.3** in Fig. 2 on page 7 by a left turn and place any jar beneath the de-aeration capillary item **4.2**.

IMPORTANT

Never start purging without having open the valve! Otherwise your column system may be damaged.

2. Press the PURGE key to start the purging with the selected flow rate for about 15 seconds. If the inquiry **Check: yes** is active, the display shows the set PURGE flow rate:

PURGE: (100%) ?

3. Now you have to press the PURGE key once more.
4. You can repeat this as often as you want.

Pump head selection

The following pump heads can be selected:

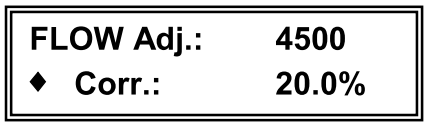
analytical pump heads	10 mL ceramics 10 mL stainless steel 10 mL PEEK
preparative pump heads	50 mL ceramics 50 mL stainless steel 50 mL PEEK

Pressing the ► key will activate the selection (the cursor has moved to the first digit of the flow rate) and you can make your choice using the ▲ and ▼keys now. The set value will be confirmed and saved by pressing the ► key.

HINT !

If you run an older software version, not knowing the new inert pump heads with ceramic inlay, you may use the stainless steel settings for the new pump heads.

Flow rate calibration



Every pump head has a pair of values. By changing “Adjust” (4000 to 6000), the flow rate can be calibrated, means fine tuned to suit the used solvent.

Press the ► key to move the cursor to the first digit of the actual value. Set the desired value using the ▲ or ▼keys. Pressing one of these keys once the value is changed by 1. Pressing the key longer than 5 seconds, the change proceeds permanently as long as the key is pressed. To accelerate the adjustment, the steps are enlarged by a factor of 10 as soon as the last digit changes increasing from 9 to 0 or decreasing from 1 to 0.

The pump head depending correction factor “**Corr**.” cannot be changed by the user.

Offset correction in the pressure display

PRESS : 00.4 MPa
♦ Offs : 00.2 MPa

The first row indicates the actual measured system pressure and the second row the set and saved offset correction value. This correction value adapts the system to the local air pressure conditions. To update the correction follow the SOP 3

SOP 3 Correction the pressure offset

1. Switch off the delivery.
2. Open the de-aeration valve **4.3** (Fig. 2on page 7) by a half left turn.
3. Press the ► key to move the cursor to the "**O**" of Offs.
4. Press either the ▲ or ▼key. The system will actualize and save the offset value automatically and the cursor moves back to the ♦ field.

Offset correction of the analog input

AN-in : 02500mV
♦ Offset : 00010mV

The first row indicates the actual input voltage and the second row the set and saved offset correction value. To update the correction follow the SOP 4

SOP 4 Offset correction of the analog input

1. Set the control voltage to zero.
2. Press the ► key to move the cursor to the "O" of Offs.
3. Press either the ▲ or ▼key. The system will actualize and save the offset value automatically and the cursor moves back to the ♦ field.

Calibration of the analog input

AN-in :05000 mV
♦ Flow :5.00 mL/min

The first row shows the actual input voltage corrected by the set and saved offset which corresponds to the flow rate shown in the second row. The amplification of the analog input, i.e. the ratio of the input voltage to the flow rate can be changed according to the SOP 5:

SOP 5 Calibration of the analog input

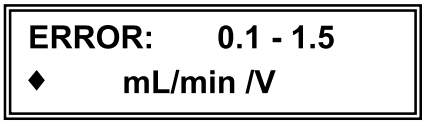
1. Set the desired flow rate value using the controlling software package (e.g. EuroChrom®) or connect to the flow input a corresponding voltage.
2. Press the ► key to move the cursor to the first digit of the shown flow rate and switch off the delivery.
3. Press the ▲ or ▼keys to change the corresponding flow rate.

4. Press either the ▲ or ▼key. The system will actualize and save the flow rate value automatically and the cursor moves back to the ♦ field.

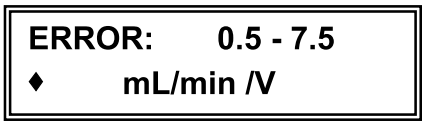
The possible settings are limited depending on the pump head in use:

10 mL pump head:	**0,1 to 1,5 mL/min per 1V**
50 mL pump head:	**0,5 to 7,5 mL/min per 1V**

If this limits are not obeyed, an error message will appear, e.g. for the 10mL pump head:

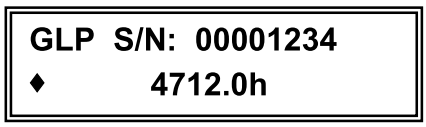


or for the 50mL pump head:



In this case press the ► key to go back to the calibration menu and make the correct settings as described above.

GLP / Serial number



The serial number of the instrument and the total operating hours of the HPLC pump K-501 will be displayed. The resolution of the time counter is 0,1 hours (6 min). The total operation time will be saved in this intervals.

Error messages while operating the pump

General

There are different error messages which may be shown after an error has occurred activating the output **ERROR OUT**. Usually the message may be deleted after at least two seconds by pressing the key **Start / Stop**. In case of a **Motor** error the system will be set back totally.

Errors which may occur during the setup of the HPLC pump K-501, are already described in the sections “Start menu ” on page 11 and “Calibration of the analog input” on page 15.

Motor - Errors

ERROR: Motor 0

The pump may send the motor error messages **0** or **1**. The message **0** may be caused by a blocked motor. In any case you should contact our service if you got this error message.

The Error **1** is not in any case a reason to contact the service. It will for instance occur, if the threshold of maximum power consumption has been trespassed. In this case you should investigate your whole system. The maximum delivery may be exceeded due to a wrong selection of the pump head. If you cannot overcome the error after having checked your system, you should not hesitate to contact the service.

Pressure control

A permanent pressure control is integrated in the pump software. This leads in two cases to an automatical switch off. If the pressure exceeds set value „P_{max}“ the pump will stop immediately showing the message:

ERROR: Pmax

If the system pressure falls below the set value„P_{min}“ for a period of 60 seconds, the pump will stop showing the message:

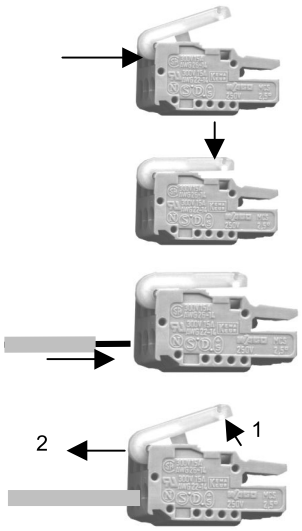
ERROR: Pmin

External control

Assembling a remote control cable

A different type of control cable must be made for each application. Use the set plug strips with connectors enclosed in the delivery to prepare your cable according the following SOP 6.

SOP 6 Connecting Plug Strips



1. Insert the rounded end of the lever latch into the square opening of the selected connector of the plug strip.
2. Press the catch down as indicated by arrow.
3. Insert the uninstalled end of the cable into the opening under the catch.
4. Release the catch and remove the lever latch from the plug. The cable is now firmly anchored in the plug strip

Fig. 8 Connecting Plug Strips

Remote control

The pump can be controlled by external contacts and also can send signals to other instruments.

IN STOP: The pump is stopped by a short circuit or TTL-low at this contact. If a stop signal is received, the pump will halt. The status display will change from **ON** to **STP.** This external control has priority over both the serial commands and those ones, entered via key input. The pump can not be restarted until the signal has been removed. The pump will restart once the signal has been removed (open or TTL-high).

This external control has priority over both the serial commands and those ones, entered via key input. The pump can not be restarted until the signal has been removed.

FLOW: The floe rate can be controlled by a voltage signal between 0 and 10 V. Depending on the pump head installed 10 V correspond to ist limit of 10 or 50 mL/min respectively.

OUT ERROR: A signal (open collector) will be given at this contact if the pump is either halted by an error or if the required rotation speed is no longer achieved due to the back pressure being too high.

PRESSURE: This port provides an analog voltage signal proportional to the actual system pressure, which can be recorded this way.

RS-232 interface

The serial interface at the rear of the instrument, item **5.3** in Fig. 5 on page 9, allows pump control from a computer equipped with a HPLC software package. If you are going to integrate your pump in a HPLC system controlled by a software package like EuroChrom® by KNAUER follow the instructions of the software manual.

Also simple ASCII codes are able to control the pump. ESC sequences are not needed. Thus, a simple terminal program may be used. The specifications for data transfer are:

9600 baud
8 bit
1 stop-bit
no parity check

The following functions can be controlled by the PC. After successful command transfer, the receipt OK will be sent back from the pump. Inadmissible commands are answered by a question mark "?". Each command and each answer must be confirmed using ↵ (=<ENTER>)

The flow rate will be adjusted by the command **Fxxxxx**. Here is **xxxxx** a 5-digit number (representing the flow rate in µL in ASCII code using the numerals 0 to 9. The permissible range depends on the pump head and the corresponding internal setting:

10 mL pump head: **0 up to 9990**
50 mL pump head: **0 up to 50000**

If the selected flow rate lies outside these limits, the command will be ignored and the last entered flow rate will be maintained.

Controlling the pump via the serial interface enables a flow rate selection resolution of 1 µL/min, i.e. better than it can be achieved via the keypad. Please keep in mind that this resolution cannot be shown in the display.

The following table gives a communication example for the 10 mL pump head.

Table 3

Input	Reply	Description
F200	**OK**	Set the flow rate to 200 µL/min Command correctly understood and executed
F2200	**OK**	Set the flow rate to 2200 µL/min Command correctly understood and executed
F22000	**?**	Set the flow rate to 22000 µL/min Command not understood. Flow rate remains at 2200 µL/min

Other commands permissible via RS-232 interface to the HPLC pump K-501:

M1 Starts the pump, using the currently selected flow rate.
Reply : MOTOR_ON

M0 Stops the pump
Reply : MOTOR_OFF

S0 Permits either manual control via the keypad or serial control
Reply : OK

S1 Control is only possible via the serial interface. Only the STOP key is still active
Reply : OK

Pxx.xxx Set maximum pressure threshold (P_{max}) for automatic pump cut-off. xx.xxx=pressure in Mpa
Reply: OK or ?

pxx.xxx Set minimum pressure threshold (P_{min}) for automatic pump cut-off. xx.xxx=pressure in Mpa. The pump cuts-off, if this threshold is not attained for a period of 60 seconds.
Reply: OK or ?

NOTE ! **While you are entering the pressure thresholds, you have to obey the capitalization of "P": "P" for P_{max} and "p" for P_{min}.** All other inputs are not influenced by the capitalization.

P? Current system pressure inquiry
Reply: „Pxx.xxx" whereby xx.xxx indicates the pressure in Mpa

S? Pump status inquiry
Two bytes will be sent back in binary form. The first is the status byte and shows the motor status in bit 4 (1=ON; 0=OFF). The second one shows the last error code (0=no error; 1=motor blocked; 2=stop via the keypad), which will then automatically deleted.

T? Pump model inquiry
16 characters will be sent back showing the description e.g. KNAUER MICRO PUMP

V? Program version inquiry
Reply e.g.: V1.24F

If using serial control, the pump sends the following messages to the PC:

OK The last command was successfully executed

? The last command could not be understood and/or executed

E1 Error message concerning a motor blockage

E3 Error message if maximum pressure P_{max} is exceeded and the pump has stopped

E4 Error message if minimum pressure P_{min} is not attained for a period of 60 seconds and the pump has stopped

Maintenance by the user

You may carry out maintenance and cleaning only on the pump head.
Both pump heads (10 mL and 50 mL) differ only in some sizes. Therefore the descriptions are valid for both of them. If you should use some older pump head versions (stainless steel or PEEK), you should contact our service division to get the corresponding instructions.

Piston backflushing

Backflushing the piston removes traces of salt and other decontaminates from the backside of the pistons.
If you use saline solvents or buffer solution we highly recommend that you continuously backflush in order to prevent crystallization which can damage your piston seals.

SOP 7 Piston backflushing

1. Push a 1/16 ID tube onto both flushing opening, see Piston backflushing capillaries, Pos. **3.1** in Fig. 2 on page 7.
2. Place the low end of the tubing in a flask.
3. Fill the syringe with rinsing liquid.
4. Connect the syringe with the tubing.
5. Press liquid through the pump head, until it flows without any air bubbles into the container.
6. Remove tubings from flush opening.

TIP !

We recommend connecting both flush openings with a tubing to prevent vaporization of solvents and drying out of the piston chamber.

If you want operation with continuous backflushing you can attach two containers of rinsing liquid instead of the priming syringe. The containers should be positioned that one container is located higher than the other, thus ensuring liquid flow through the pump head without any assistance.

Exchanging the pump head

For exchange of the pump head, or for disassembling it in order to clean valves or replace piston seals, piston rods etc.

SOP 8 Removing the pump head

1. Purge the pump head with a suitable cleaning reagent and then with distilled water.

CAUTION !

If organic solvents remain in the pump head, danger of skin irritation may exist.

2. Loosen the eluent outlet, Pos. **3.7** in Fig. 9 on page 23 and the fittings at Valve housing inlet, Pos. **3.6**

3. Use a hexagonal spanner no. 3 (3mm) to loosen just two diagonally opposed head set screws, Pos. **3.4**. Remove the screws.
4. Loosen the two remaining screws carefully, alternating from one to the other, approx. half a turn. This prevents the pump head from tilting and becoming damaged.
5. Once the spring tension has been reduced, hold the pump head firmly in one hand while removing the screws completely with the other hand.
6. Remove the pump head carefully.

SOP 9 Removing and checking piston rods

7. Remove pump head as described in SOP 8 "*Removing the pump head"*. If you only wish to check the piston rods, you don't need to disassemble the pump head any further.
8. Any Piston rod, Pos. **3.17** in Fig. 9 on page 23, may be removed using pliers. Take the tip of the piston using the pliers, and pull it out carefully in a straight line.

TIP !

If one of the rods is broken, the entire pump head needs to be checked for damage.

SOP 10 Disassembling the pump head

All position numbers of the components are related to Fig. 9 on page 23.

1. Apply SOP 9 "*Removing and checking piston rods"* on page 22.
2. Loosen the two retaining plate screws, Pos. **3.19** half a turn, alternating from one to the other to avoid damaging the Retaining plate. Because the two screws are very tight, it may be helpful to either clamp the pump head or to press one of its side surfaces against a table with one hand while loosening the screws.
3. Unscrew the two screws strictly alternating due to strong force of the springs, Pos. **3.15** behind the plate, and remove them.
4. Remove the retaining plate, Pos. **3.18**.
5. Remove the spring guides, **3.16** and the springs **3.15**.
6. Use a SW 5/16 spanner to loosen the spacing bolts, **3.14**. These bolts are seated very tightly. Follow the advice given in step 3.
7. Remove the pressure plate, **3.13**.
8. Remove the pressure discs **3.20** out of the pressure plate **3.13**.
9. To remove the piston seals **3.11a** , the easiest way is to pull them out using a 4mm gimlet or a screw of corresponding diameter.
10. The piston seals **3.11** located in the ceramic seal holder **3.12** are to remove in the same manner.
11. To remove the ceramic seal holders from the housing (not necessary for exchanging the seals) please follow SOP 14 "*Cleaning check*

valves" on page 25 to remove as well the check valves **3.10** as the distance holders **3.10a**.

12. The ceramic seal holders **3.12** can be removed from the housing **3.4**.

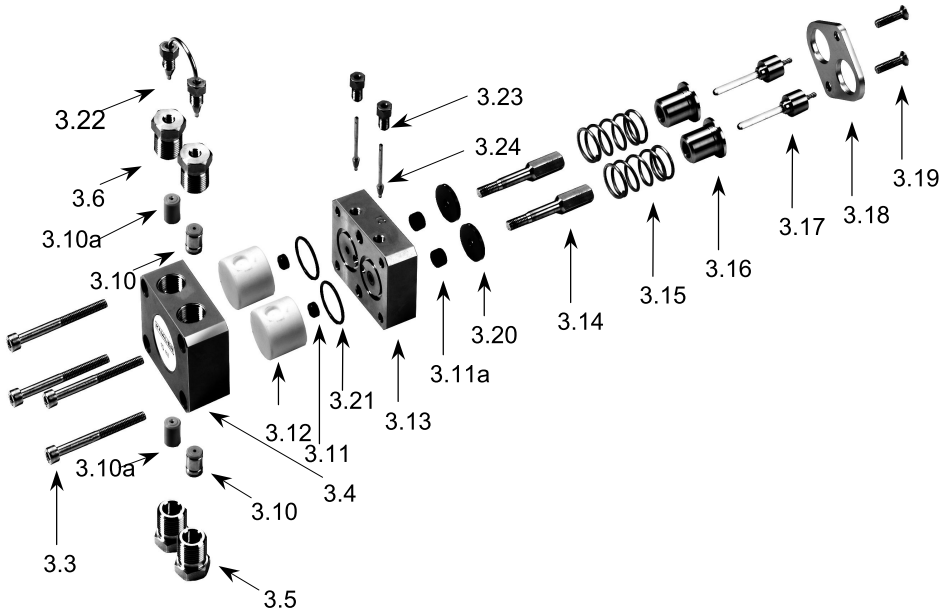


Fig. 9 Explosion view of the pump head

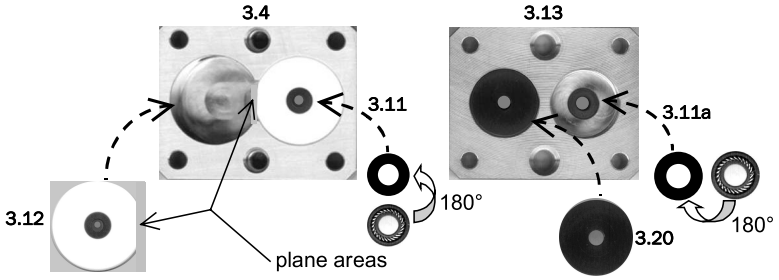
Table 4 Part list of the pump head

Pos.	Description
3.3	Pump head screws
3.4	Housing
3.5	Bushing, inlet
3.6	Bushing, outlet
3.10	Check valves, inlet and outlet
3.10a	Distance holder
3.11	Piston seal, high pressure
3.11a	Piston seal, low pressure
3.12	Seal holder (ceramics)
3.13	Pressure plate
3.14	Spacing bolts
3.15	Springs
3.16	Guide for spring
3.17	Piston rod
3.18	Retaining plate
3.19	Retaining plate screws
3.20	Pressure disc
3.21	O-ring
3.22	Capillary connection
3.23	Screw connection of backflush
3.24	Capillary of backflush

SOP 11 Assembling the pump head

All Positions of components refer to Fig. 9 on page 23. and Fig. 10.

1. Always exchange the piston seals Pos. **3.11** and **3.11a** after disassembly of the pump head and the O-rings, Pos. **3.21** only if nescessary.



3.4	housing	**3.13**	pressure plate
3.11	piston seal	**3.11a**	piston seal
3.12	seal holder (ceramics)	**3.20**	pressure disc

Fig. 10 Parts of the opened pump head

2. If you have removed the ceramic seal holder out of the housing, replace them very carefully with the plane sides faced together. Otherwise the seal holders cannot be replaced without damaging them.
3. With the open side facing downwards press the new piston seals **3.11** carefully into the ceramic seal holder, making sure to keep it straight.
4. Lock the ceramic seal holder in place by attaching the check valves **3.10** and distance holder **3.10a** according to SOP 14 "*Cleaning check valves"* on page 25.
5. Place the O-rings **3.21** in the inner side of the pressure plate **3.13**.
6. Install the pressure plate, item **3.13**. Take care on the orientation of housing and pressure plate. Using the SW 5/16 spanner, tighten the spacing bolts, **3.14** firmly.
7. With the open side facing downwards carefully press the new piston seals **3.11a** into the spaces of the pressure plate, making sure to keep it straight.
8. Cover the seals with the pressure discs **3.20**.
9. Install the two guides for spring, **3.16** and the springs, **3.15**.
10. Install the retaining plate, **3.18**.
11. Insert and tighten the two screws **3.19** strictly alternating due to strong force of the springs, **3.15** behind the plate.
12. Insert the piston rods **3.17** carefully without bending or quenching the rods.
13. The spacing bolts, item **3.14** and the retaining plate screws, item **3.19** must be tightened that they are seated as securely as before.

SOP 12 Installing the pump head

1. Make sure that the pump head is properly assembled, especially check step 13 of the "*Assembling the pump head".*
2. Position the head in a straight line onto the pump housing.
3. Tighten all four pump head set screws, item **3.3** a few turns by hand.
4. Alternating from one to the next, tighten two diagonally opposed screws half a turn at a time, until the pump head is correctly seated.
5. Tighten the two remaining screws. Make sure that all four pump head set screws, item **3.3** are securely tightened.
6. Mount the capillary connection between the pump head outlet and the pressure transducer.
7. Connect the solvent tubings according to SOP 1 "*Connection of eluent tubings"* on page 10.

Check valves

If check valves are contaminated they will no longer open and close correctly. You can remove the check valves for cleaning purposes from the pump head. Disassemble them according to the following instructions.

SOP 13 Replacing check valves

1. Remove the connection to the solvent reservoir.
2. Remove the bushing on the inlet side **3.5**. The lower check valve **3.10** can now be removed together with the bushing.
3. Remove the complete capillary connection **3.22** between the two pump chambers. Loosen the screw fittings alternating, to avoid bending the capillary.
4. Remove the bushing from the outlet side **3.6**.
5. Remove the upper check valve **3.10** using a pair of tweezers.

SOP 14 Cleaning check valves

1. Place the valve in a suitable cleaning solution. Use an ultrasonic bath to clean the valve. If malfunction persists, use steps 2…5 of this SOP
2. Using a knife or a similar, remove the valves seals carefully from the housing.
3. Remove the individual components by gently tapping the housing on the table
4. Clean the individual parts. We recommend an ultrasonic bath.
5. Assemble the check valves in reverse order. Be sure to identify the glossy side of the seating, see Fig. 11 and assemble the check valve properly. Wrong assembly can lead to damage and leakage of the check valve.

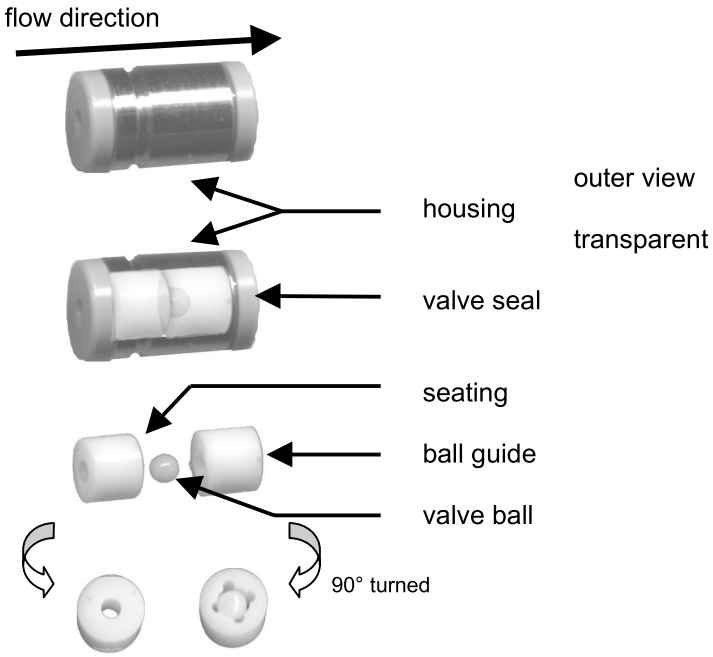


Fig. 11 Check valve, single parts

6. Put the check valves considering the flow direction into the bushing holes 3.5 and 3.6. Screw in the bushings by hand. Tighten the bushings carefully with a spanner by about ½ - ¾ turns.

IMPORTANT

To avoid destruction of the ceramics tighten the screws of the ceramic gasket holder (item 3.5 and 3.6) with 8 Nm using a dynamometric key.

Spare parts and accessories

Pump heads	**KNAUER order number**
Pump head, inert 10mL	A4033
Pump head, inert 50mL	A4034

Cables

Power supply cable, 230V	M1642
RS-232 cable	A0895
Set WAGO connecting rails	A1402
Set signal conductors	A1467

Spare parts	**Pos. No.**	**order number**
check valve unit	3.10	A0684
set of gaskets for check valve		A0863
set of piston seals and O-rings for 10 mL pump head	3.11, 3.11a 3.21	A1514
set of piston seals and O-rings for 10 mL pump head especially for aqueous eluents	3.11, 3.11a 3.21	A1515
2 piston seals (high pressure) and O-Rings for 10 mL pump head	3.11, 3.21	A1414
set of piston seals and O-rings for 50 mL pump head	3.11, 3.11a 3.21	A0981
set of piston seals and O-rings for 50 mL pump head especially for aqueous eluents	3.11, 3.11a 3.21	A0982
2 piston seals (high pressure) and O-Rings for 50 mL pump head	3.11, 3.21	A0768
piston rod, $^1/_8$", 10 mL pump head	3.17	A1410
piston rod, $^1/_4$", 50 mL pump head	3.17	A1411
set of titanum capillaries for biocompatible applycations		A0248

Pos. No. according Fig. 9 Explosion view of the pump head

De-aeration screw, PEEK	A1409

Technical Data

Delivery System	Double-piston pump with main and auxilliary piston
Piston backflushing	standard
Materials with solvent contact	Ceramics, Sapphire, PEEK, stainless steel
Flow Rate Range	
10 mL pump head	0.001 – 9.999 mL/min at external control 0.01 – 9.99 mL/min in stand alone mode
50 mL pump head	0.01 – 49.99 mL/min
Flow accurathy	< 1%, at 1ml/min, 12 MPa
Residual pulsation	< 1,5% at 1mL/min methanol : water (8:2), 12 MPa,
System Protection	Soft start, P_{min} und P_{max} adjustable
Max. Operating Pressure, pump head depending	
10 mL, ceramics	40 MPa
10 mL, stainless steel	40 MPa
10 mL, PEEK	25 MPa
50 mL	15 MPa
Control	RS 232 Interface, Remote connections (Stop, Flow, Pressure, Error),
Display	2 X 16 digits
Gradient	Mit Softwaresteuerung erweiterbar zu einem Hochdruckgradientensystem (HPG) mit bis zu 4 Eluenten
Gradient	With software control expandable to high pressure gradien system (HPG) with up to 4 eluents
Power Supply	90-260 V, 47 - 63Hz, 100 W
Dimensions	105 x 185 x 345 mm (W x H x D)
Weight	3,9 kg

Declaration of conformity

Manufacturer's name

Wissenschaftliche Gerätebau
Dr. Ing. Herbert KNAUER GmbH

Manufacturer's address:

Hegauer Weg 38
14163 Berlin, Deutschland

HPLC pump K-501, Order Numbers A 42401
and A42403 complies with the following requirements and product specifications:

- Low Voltage Ordinance (73/23/EWG);
  EN 61010 – 1 (1993)
- Engineering Guidelines (89/392/EWG)
- EMV Ordinance (89/336/EWG)
  EN 50081 – 1 (1992)
  EN 55011 (1991) Class B
  EN 55022 (1987) Class B
  EN 50082 – 1 (1992)
  IEC 801 – 2 (1984),
  includes IEC 41 B (sec) 81 (1992)
  IEC 801 – 3 (1984)
  IEC 801 – 4 (1988)

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The product was tested in a typical configuration.

Berlin April, 10th 2000

Bernward Rittgerodt (Managing Director)

The CE Shield is attached to the rear of the instrument.

CE

Guarantee statement

The guarantee period of the WellChrom HPLC pump K-120 is 12 months beginning from the date of dispatch from Berlin. Operation inconsistent with manufacturer's instructions or damage caused by unauthorized service personnel are excluded from guarantee. Damage caused by blockages and wear and tear parts such as fuses and seals are not covered by the guarantee. Claims under this guarantee are valid only if the enclosed guarantee card is returned to us at the address shown below within 14 days of receipt of the instrument. Defective pumps should be sent to the manufacturer for repair.

Wissenschaftliche Gerätebau
Dr. Ing. Herbert Knauer GmbH
Hegauer Weg 38
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Tel: 030 – 809 727 – 0
Fax: 030 – 801 50 10
e-mail: info@knauer.net
www.knauer.net

If we find a defect covered by the guarantee, repair or replacement, at our discretion, will be carried out free of charge. Packing and transport costs are borne by the purchaser.