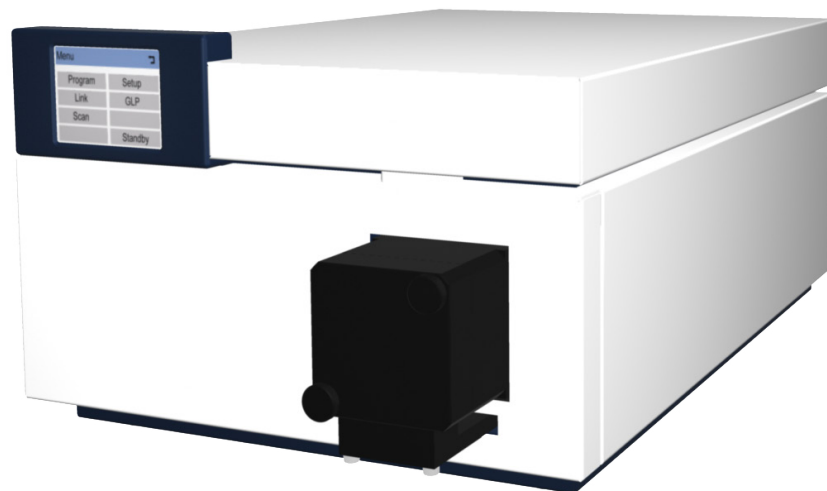


# BlueShadow

## ▶ **Detector 50D** **User Manual**

V7654



# HPLC

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**Note:** For your own safety, **read** the manual and **always** observe the warnings and safety information on the device and in the manual!

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**To whom it may concern** In case you prefer a French language user manual for this product, submit your request including the corresponding serial number via email or fax to KNAUER:

- support@knauer.net
- +49 30 8015010

Thank you.

**A qui que ce soit** Si jamais vous préféreriez un manuel en français pour ce produit contacter KNAUER par email ou par fax avec le no. de série:

- support@knauer.net
- +49 30 8015010

Merci beaucoup.

# Intended Use

## Device Overview

The touchscreen, the LED light for standby mode, and the flow cell can be found on the detector's front side.

### Legend

- ① Touchscreen
- ② LED light for standby mode
- ③ Flow cell with holder

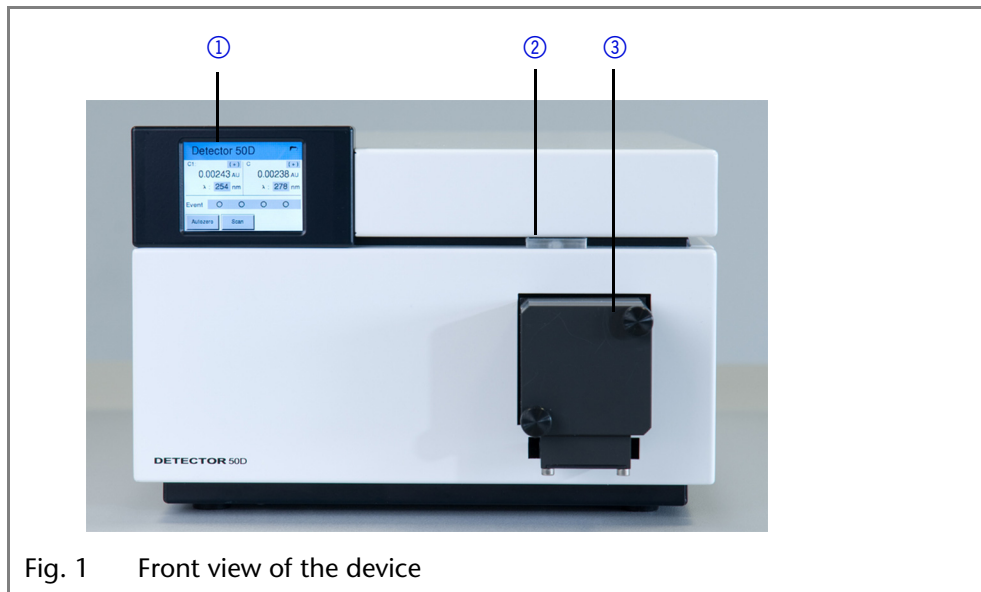


Fig. 1 Front view of the device

The device can be operated from either the chromatography software at the workstation, or the touchscreen.

The rear of the device contains the mains power connection, power switch, connections for external devices, technical symbols and serial number, among other things.

### Legend

- ① Serial number
- ② Integrator outlets
- ③ LAN connection
- ④ RS-232 port
- ⑤ Fan opening
- ⑥ Multi-pin connector
- ⑦ Power switch
- ⑧ Mains power connection

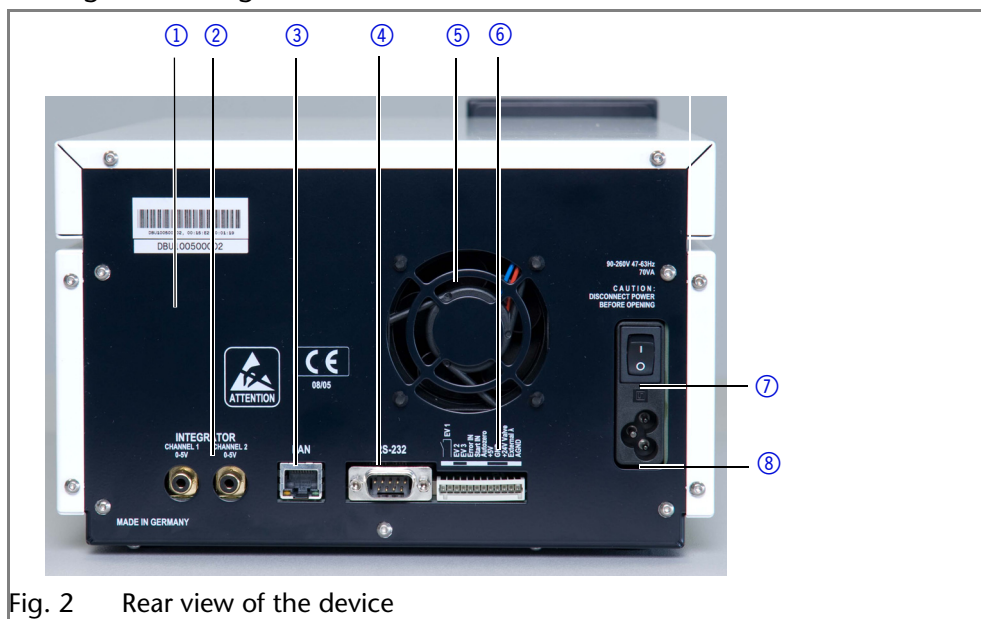


Fig. 2 Rear view of the device

### Remote Control

Normally, the detector is controlled by the chromatography software through a local network (LAN).

### Automatic configuration

The detector connected to the local area network (LAN) is automatically detected by the chromatography software.

### Device status

When used in a local area network (LAN), the system status of the detector can be checked using the chromatography software.

### LAN setting

The detector is set to DHCP (Dynamic Host Configuration Protocol) at the factory. This means that the detector is automatically assigned an IP address within the local network. This setting can be changed manually in the *Setup* menu.

- Laboratory Use*
- Chemical analyses
  - Biochemical analyses
  - Chiral analyses
  - Food analyses
  - Pharmaceutical analyses
  - Environmental analyses

## Features

The detector is a measuring system for fast and precise measurement in the UV range and, with a halogen lamp (optional), also in the visible range. The measurement principle is based on the attenuation of a monochromatic light beam passing through liquid.

- Self-calibration*
- The self-calibration of the detector guarantees operation without external settings. Type and combination of the installed lamps as well as the transmission of the corresponding installed flow cell are analyzed and used for the automatic setting of the integration time, in order to achieve a high level of sensitivity.

- Features*
- Signal linearity and wavelength accuracy are verified by independent measurements as part of a self-calibration.
  - The use of light sources for a specific spectral range is possible (UV: deuterium lamp, Vis: halogen lamp). A tandem operation with both light sources is also possible, allowing a wavelength range of 190–900 nm to be covered without changing the lamp.
  - Within a system, it is possible to measure four wavelengths simultaneously with the help of the software control.
  - Recording of a spectrum of 100 nm width in less than 100 ms.
  - The beam guidance is designed so that no chromatic aberration occurs and thus the best possible useful signal is available, independent of the selected wavelength.
  - Automatic recording and storage of the device-specific characteristics that are important for GLP (Good Laboratory Practice) and OQ (Operation Qualification) or for the device service and device history. These are operating times, operating parameters, wavelength accuracy and reference spectra.
  - Self-running and up-to-date device status diagnostics.
  - Control with HPLC software possible.
  - Easy integration of the detector into complex chromatography systems.
  - Extremely low noise level and baseline drift.
  - High data rates for fast chromatography.
  - Flexible options for use in the entire field of LC applications due to a comprehensive range of flow cells for the detectors, from nano HPLC cells with flow rates  $\approx$  100 nl/min to preparative flow cells with 10 l/min.

## Eluents

Even small quantities of other substances, such as additives, modifiers, or salts can influence the durability of the materials.

**Note:** The list of selected solvents was compiled based on research in the pertinent literature and is only a recommendation. If there is any doubt, contact the Technical Support of the manufacturer.

Suitable eluents	Less suitable eluents	Not suitable eluents
<ul style="list-style-type: none"> <li>▪ Acetone at 4°-25° C (39.2°-77.0° F)<sup>1</sup></li> <li>▪ Acetonitrile</li> <li>▪ Benzene</li> <li>▪ Chloroform</li> <li>▪ Ethyl acetate</li> <li>▪ Ethanol</li> <li>▪ Hexane/heptane at 4°-25° C (39.2°-77.0° F)<sup>1</sup></li> <li>▪ Isopropanol</li> <li>▪ Carbon dioxide (liquid 99.999% CO<sub>2</sub>)</li> <li>▪ Methanol</li> <li>▪ Phosphate buffer solutions (0.5 M)</li> <li>▪ Toluol</li> <li>▪ Dilute ammonia solution</li> <li>▪ Dilute acetic acid (10-50%), at 25° C/ 77.0° F</li> <li>▪ Dilute sodium hydroxide (1M)</li> <li>▪ Water</li> </ul>	<ul style="list-style-type: none"> <li>▪ Dimethyl sulfoxide (DMSO)</li> <li>▪ Slightly volatile eluents</li> <li>▪ Methylene chloride</li> <li>▪ Tetrahydrofuran (THF)</li> <li>▪ Dilute phosphoric acid</li> </ul>	<ul style="list-style-type: none"> <li>▪ Halogenated hydrocarbons, e.g. Freon®</li> <li>▪ Concentrated mineral and organic acids</li> <li>▪ Concentrated bases</li> <li>▪ Eluents containing particles</li> <li>▪ Perfluorinated eluents, e. g. Fluorinert® FC-75, FC-40</li> <li>▪ Perfluorinated polyether, e.g. Fomblin®</li> </ul>

1. valid for the specified temperature range

## Scope of Delivery

**Note:** Only use original parts and accessories made by KNAUER or a company authorized by KNAUER

*Delivery*

Detector with test cell	<input type="checkbox"/>
User manual (EN/DE)	<input type="checkbox"/>
Accessory Kit	<input type="checkbox"/>
Transport protection	<input type="checkbox"/>

# Safety

## Target group

This document address persons who are qualified as chemical laboratory technicians or have completed comparable vocational training.

The following knowledge is required:

- Fundamental knowledge of liquid chromatography
- Knowledge regarding substances that are suitable only to a limited extent for use in liquid chromatography
- Knowledge regarding the health risks of chemicals
- Participation during an installation of a device or a training by the company KNAUER or an authorized company.

If you do not belong to this or a comparable professional group, you may not perform the work described in these instructions under any circumstances. In this case, please contact your superior.

## Safety equipment

When working with the device, take measures according to lab regulations and wear protective clothing:

- Safety glasses with side protection
- Protective gloves
- Lab coat

## What must the user take into account?

- All safety instructions in this document
- The environmental, installation, and connection specifications in this document
- National and international regulations pertaining to laboratory work
- Original spare parts, tools, and solvents made or recommended by KNAUER
- Good Laboratory Practice (GLP)
- Accident prevention regulations published by the accident insurance companies for laboratory work
- Filtration of substances under analysis
- Use of inline filters
- Once the capillaries have been used, never re-use them in other areas of the HPLC system.
- Only use a given PEEK fitting for one specific port and never re-use it for other ports. Always install new PEEK fittings on each separate port.
- Follow KNAUER or manufacturer's instructions on caring for the columns.

More safety-relevant information is listed below:

- flammability: Organic solvents are highly flammable. Since capillaries can detach from their screw fittings and allow solvent to escape, it is prohibited to have any open flames near the analytical system.
- solvent tray: Risk of electrical shock or short circuit if liquids get into the device's interior. For this reason, place all bottles in a solvent tray.
- solvent lines: Install capillaries and tubing in such a way that liquids cannot get into the interior in case of a leak.
- leaks: Regularly check if any system components are leaking.
- power cable: Defective power cables are not to be used to connect the device and the power supply system.



- self-ignition point: Only use eluents that have a self-ignition point higher than 150 °C under normal ambient conditions.
- power strip: If several devices are connected to one power strip, always consider the maximum power consumption of each device.
- power supply: Only connect devices to voltage sources, whose voltage equals the device's voltage.
- toxicity: Organic eluents are toxic above a certain concentration. Ensure that work areas are always well-ventilated! Wear protective gloves and safety glasses when working on the device!

### Where is use of the device prohibited?

Never use the system in potentially explosive atmospheres without appropriate protective equipment. For further information, contact the Technical Support of KNAUER.

### Secure decommissioning

Take the device completely out of operation by either switching off the power switch or by pulling the power plug.

### Opening the device

The device may be opened by the KNAUER Technical Support or any company authorized by KNAUER only.

## Signal words

Possible dangers related to the device are divided into personal and material damage in these instructions.



DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.



WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



NOTICE is used to address practices not related to physical injury.

## Decontamination

Contamination of devices with toxic, infectious or radioactive substances poses a hazard for all persons during operation, repair, sale, and disposal of a device.



### Life-threatening injuries

Health danger if getting in contact with toxic, infectious or radio-active substances.

→ Before disposing of the device or sending it away for repair, you are required to decontaminate the device in a technically correct manner.





All contaminated devices must be properly decontaminated by a specialist company or the operating company before they can be recommissioned, repaired, sold, or disposed of. All materials or fluids used for decontamination must be collected separately and disposed of properly.

### Decontamination Report

Devices without a completed Decontamination Report will not be repaired. If you would like to return a device to KNAUER, make sure to enclose a completed **Decontamination Report** with the device: <http://www.knauer.net/en/knowledge/downloads/service.html>

# Symbols and Signs

The following table explains symbols and labels which are used on the device, in the chromatography software or in the user manual:

Symbol	Meaning
	Electric shock hazard
	Electrostatic discharge hazard, damages to system, device, or components can occur.
	A device or system marked with CE fulfills the product specific requirements of European directives. This is confirmed in a Declaration of Conformity.
	Testing seals in Canada and the USA at nationally recognized testing centers (NRTL). The certified device or system has successfully passed the quality and security tests.

## Unpacking and Setup

### Contacting the Technical Support

You have various options to contact the Technical Support:

- Phone* +49 30 809727-111
- Fax* +49 30 8015010
- E-mail* support@knauer.net

You can make your requests in English and German.

### Location Requirements

*Requirements* The location for the device must meet the following requirements:

- level surface for device or system
  - Protect from heavy ventilation
- Weight 5.3 kg
- Dimensions 242 x 169 x 399 mm (W x H x D)
- Power Supply 100 – 240 V; 50 – 60 Hz; 75 W
  - Air humidity below 90 %, non condensing
  - Temperature range 4 – 40 °C; 39.2 – 104 °F

**NOTICE**

#### Device defect

The device overheats at exposure to sunlight and insufficient air circulation. Device failures are very likely.

- ➔ Set up the device in such a way that it is protected against exposure to direct sunlight.
- ➔ Keep at least 15 cm clear at the rear and 5–10 cm at each side for air circulation.

#### Space Requirements

- Side clearance to other devices:

- At least 5 cm, if there is another device on one side.
- At least 10 cm, if there are devices set up on both sides.
- At least 15 cm on the rear panel for the fan.

**Note:** Make sure that the power plug on the rear of the device is always accessible, so that the device can be disconnected from the power supply.

## Power Supply and Connection

The device is intended for use with AC power networks of 100-240 V. The supplied power cable is to be used to connect the device to the mains supply.

### Power Cable

Only the supplied power cable is to be used to connect the device to the mains supply. Replace defective power cables only with original accessories from KNAUER. Only use power cables with a permission for use from your country. In case of queries contact the Technical Support.

### Power Plug

Make sure that the power plug on the rear of the device is always accessible, so that the device can be disconnected from the power supply.

### NOTICE

### Electronic defect

Damage to the electronics if the device is turned on while connecting or interrupting the power connection.

→ Switch off the device beforehand.

Store all packing materials. Included packing list should be kept for repeat orders.

*Tools* Utility knife

*Procedure*

1. Check for damages caused during transportation. In case you notice any damage, contact the Technical Support and the forwarder company.
2. Set up the delivery so the label is in the correct position. Using the utility knife, cut the adhesive tape. Open the delivery.
3. Remove the foam inserts. Take out the accessories kit and the manual.
4. Open the accessories kit and take out all accessories. Check the scope of delivery. In case any parts are missing, contact the Technical Support.
5. Grip the device at its side panels near the middle and lift it out of the packaging.
6. Remove the foam inserts from the device.
7. Check for damages caused during transportation. In case you notice any damage, contact the Technical Support.
8. Set up the device in its appropriate location.
9. Remove the protective foil and the transport protection.

## Rear View of the Device

The rear of the device contains the mains power connection, power switch, connections for external devices, technical symbols and serial number, among other things.

**Legend**

- ① Serial number
- ② Integrator outlets
- ③ LAN connection
- ④ RS-232 port
- ⑤ Fan opening
- ⑥ Multi-pin connector
- ⑦ Power switch
- ⑧ Mains power connection

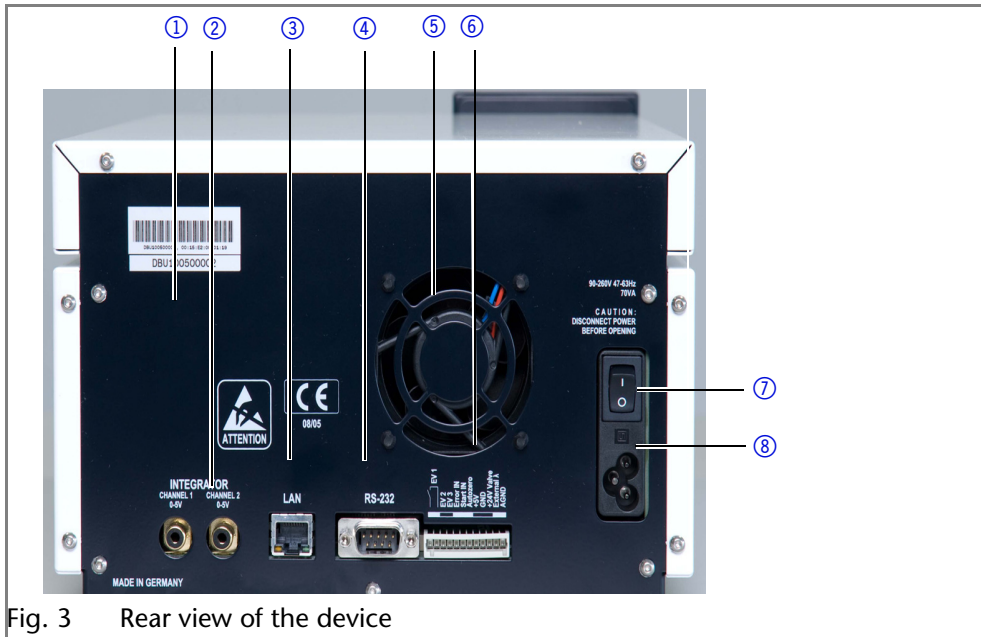


Fig. 3 Rear view of the device

External devices can be connected to the detector in different ways:

- Use the multi-pin connector to connect the detector with external devices.
- Use the LAN connection to connect the detector with external devices within a network.
- Alternatively, connect the detector to a computer by means of the RS-232 port.

### Controlling with the Multi-Pin Connector


**NOTICE**

**Electronic defect**

Connecting cables to the multi-pin connector of a switched on device causes a short circuit.

- Turn off the device before connecting cables.
- Pull the power plug.

### Pin Header Assignments

Connection	Function
 EV 1	<p><b>Relay contact</b>                      0 Contact open                      1 Contact closed</p> <p>Pulse: (contact end 1000 ms)                      Permissible contact load 1A/30 V.</p>
EV 2	<p><b>TTL output</b>                      Low (&lt;0.4 V)                      High (&gt;2.4 V)                      Pulse (high for 1000 ms)</p> <p>The load resistance should be &gt;10 kΩ.</p>
EV 3	Same as EV 2.
Error IN	<p>TTL input                      With a high level, running programs are terminated and the message <b>Error input activated</b> appears.</p>

Connection	Function
Start IN	TTL input With a high level, a program is started in hold mode or a link with the corresponding wait parameter is started.
Autozero	Carry out zero balance.
GND	Reference point for the TTL level.
+5 V	Provides a voltage of 5 V with respect to GND. This makes it possible to supply a consumer switched with event EV 1 (relay). The output is secured at 62 mA.
+24 V Valve	Event-controlled switching of 24 V against GND. The output is secured at 250 mA. This output can be used to operate a fraction valve.
External $\lambda$	Allows external analog control over the detector. The control voltage must be applied against AGND.
AGND	Reference point of the voltage at the input external $\lambda$

To control one device through another, you use the multi-pin connector. To use remote control, you have to connect cables to the terminal strip (everything comes included with delivery). The single ports are used to exchange control signals.

*Prerequisite*

- The device has been turned off.
- The power plug has been pulled.

*Tools:* Depressor tool

**NOTICE**

**Electronic defect**

Connecting cables to the multi-pin connector of a switched on device causes a short circuit.

- Turn off the device before connecting cables.
- Pull the power plug.

**NOTICE**

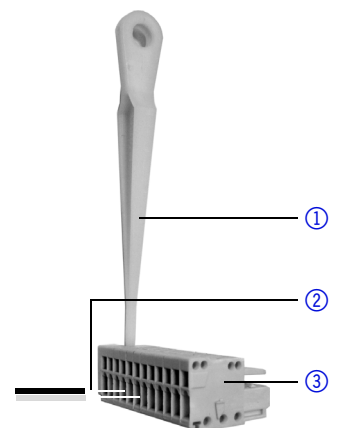
**Electronic defect**

Electrostatic discharge can destroy the electronics.

- Wear a protective bracelet against electrostatic discharge and ground.

*Process*

1. Place the terminal strip ③ on a suitable surface.
2. Push the depressor tool ① into the opening on the upper side.
3. Continue pushing the depressor tool down and lead the cable ② into the front end of the terminal strip.
4. Remove the depressor tool.
5. Check whether the cables are tightly attached.
6. Plug the terminal strip onto the multi-pin connector.



*Next steps*

Finish the installation and perform the initial startup.

## Analog Control

Using the analog port, you can control the wavelength by changing the applied voltage. A Control Unit is required in order to select the option *ANALOG* in the *SETUP* menu.

*Example* To use the analog port for controlling the detector, you have to set a zero point and enter a scaling value.

- Zero point at 0 V = 000 nm
- Scaling: 100 nm per Volt

If 5 V voltage is applied, the wavelength is 500 nm.

## Integrator Connector

The integrator connector sends measuring signals from the detector.

- non-bipolar
- 1 channel
- 0 to 5 V
- DAC 20 bit
- scalable
- adjustable to offset

# Initial Startup

## Checklist before initial operation

Use this checklist to determine whether the detector is ready for initial startup:

- Device is in the correct location.

**Note:** Observe the ambient conditions and space requirements!

- The power connection of the detector is plugged in.

If the detector is part of a HPLC system, the following must be observed:

- The network connection to the router is established
- The KNAUER chromatography software OpenLAB<sup>®</sup>, ChromGate<sup>®</sup> oder ClarityChrom<sup>®</sup> has been installed by KNAUER or a company authorized by KNAUER.
- Capillaries from the column to the UV detector and capillaries from the detector to the waste bottle are securely attached.

## Inserting the Flow Cell

The supply configuration of this detector only includes a test cell (dummy cell), which does not have connections for solvent. It is used, for example, to check the lamp intensity, as a dirty flow cell could distort this value. Before using the device with solvents, the test cell must, therefore, be removed, and a flow cell must be installed.

Proceed as follows:

1. Switch off the device and pull the power plug.
2. Unscrew the knurled-head screws ③ of the cover plate ④. Hold the flow cell securely with your hand during this procedure.
3. Pull out the carriage of the flow cell ⑤ towards the front.
4. Lift the flow cell up and out.
5. Insert new flow cell from above into the flow cell carriage. Continue to hold the flow cell securely.
6. Push the carriage back into the detector.
7. Screw the knurled-head screws back into the cover plate ④ and tighten.

8. Connect the incoming and outgoing capillaries at the inlet ① and outlet ② of the flow cell.

*Legend*

- ① Inlet of the flow cell
- ② Outlet of the flow cell
- ③ Knurled-head screws
- ④ Cover plate
- ⑤ Carriage

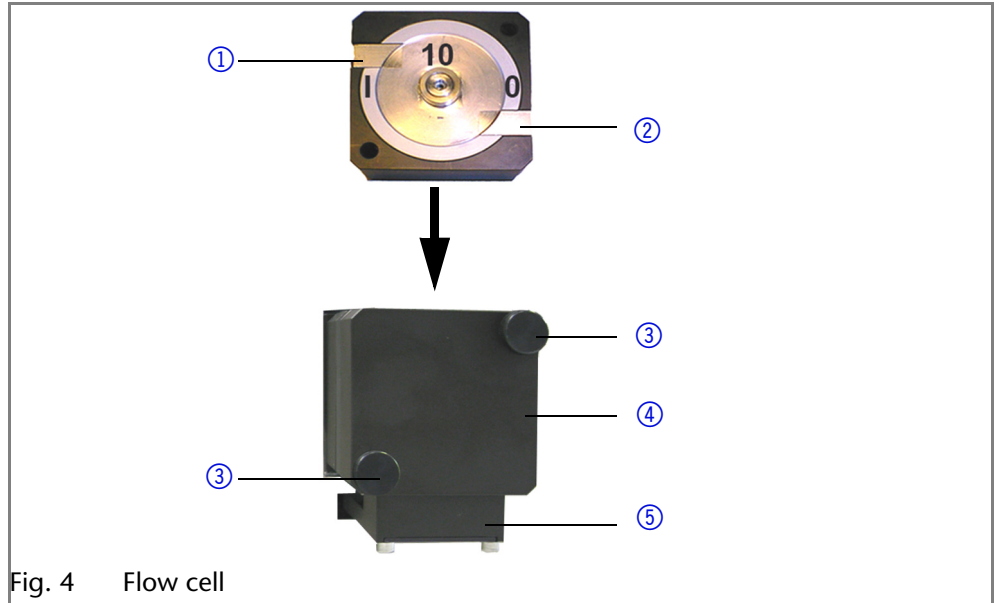


Fig. 4 Flow cell

**Changing the optical path length of the preparative flow cell**

At delivery, the optical path length of a preparative flow cell is set to 2 mm at the factory. This path length can, however, be set to 2, 1.25 or 0.5 mm. To reduce it to 1.25 or 0.5 mm, proceed as follows

- This description applies to preparative flow cells with 1/8" or 1/4" connections.

*Legend*

- ① Threaded ring
- ② Stainless steel cover
- ③ PEEK spacer
- ④ Seal holder (compression bushing)
- ⑤ Fiber optics with PTFE seal

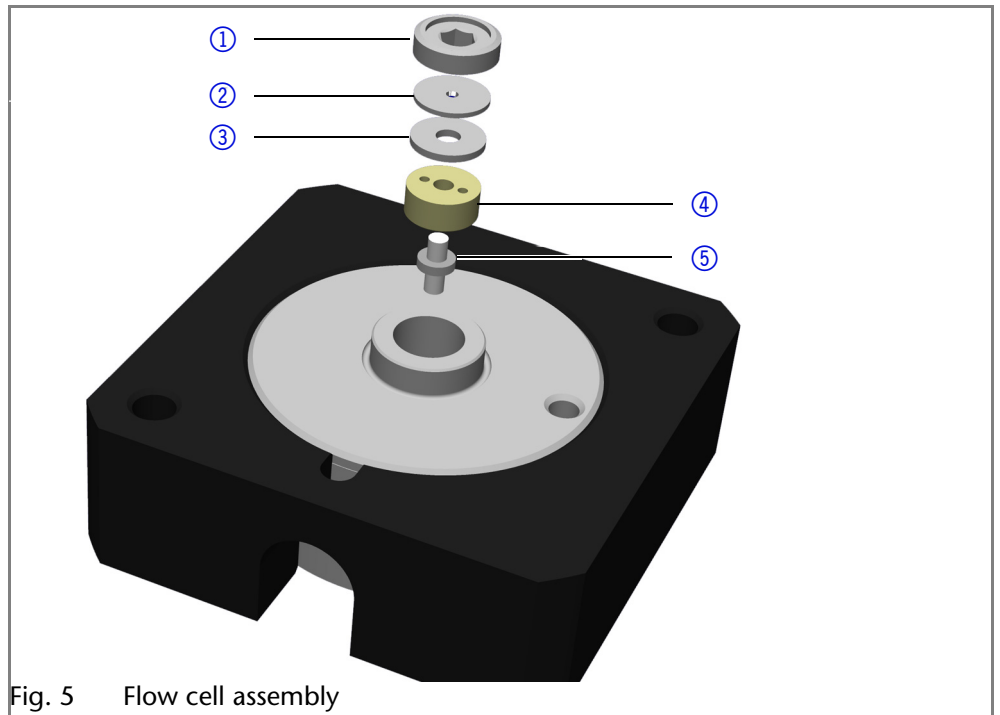


Fig. 5 Flow cell assembly

*Shortening the optical path length*

1. Loosen the threaded ring ① with a hexagonal spanner.
2. Remove stainless steel cover ② and the PEEK spacer ③.
3. Insert the stainless steel cover again and carefully tighten the threaded ring again.

The missing spacer causes the fiber optics ⑤ to be pushed deeper into the flow cell (0.75 mm), resulting in a shortened optical path length of 1.25 mm. To further shorten down to 0.5 mm, the PEEK spacer on the other cell side must also be removed.



*Extending the optical path length*

To extend the optical path length in steps of 0.75 mm, put the spacers back in.

1. Loosen the threaded ring.
2. Remove the stainless steel cover and fiber optics, together with the seal holder, with tweezers.
3. To extend the path length, push the fiber optics out about 1 mm. Please use a clean cloth and avoid touching the fiber optics with your fingers.
4. Push the fiber optics together with the seal holder back into the cell.
5. Insert the PEEK spacer followed by the stainless steel cover.
6. Carefully tighten the threaded ring again.

When tightening the threaded ring, the rod-shaped fiber optics is pushed into the correct position in the cell. Inserting a spacer extends the optical path length by 0.75 mm. The PTFE seal does not need to be replaced when the path length is changed.

## Connecting the Capillaries

Capillaries connect the detector to other devices and lead liquids.

*Prerequisite*

Flow cell has been assembled.

*Tools*

Torque wrench

NOTICE

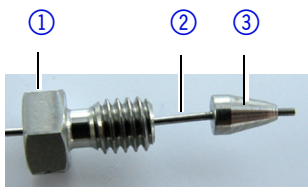
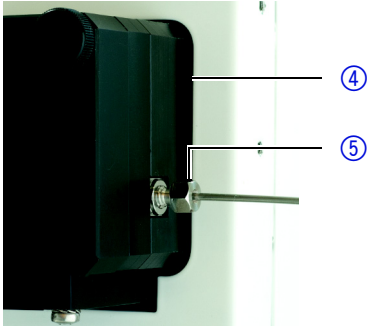
### Component defect

Damage to the ports caused by strongly tightened fittings.

- Use 5 Nm torque for stainless steel fittings.
- Use 0.5 Nm torque for PEEK fittings.

**Note:** PEEK fittings withstand a maximum pressure of 400 bar.

*Procedure*

Steps	Figure
<ol style="list-style-type: none"> <li>1. Push the capillary ② through the fitting ①.</li> <li>2. Push the clamping ring ③ onto capillary.</li> </ol>	 <p>Fig. 6 Capillary fitting</p>
<ol style="list-style-type: none"> <li>3. Manually, screw together the capillary and the flow cell ④. To avoid leaks, tighten the fitting ⑤ with a maximum torque of 5 Nm for stainless steel fittings or 0.5 Nm for PEEK fittings by using the open-end wrench.</li> </ol>	 <p>Fig. 7 Capillary and flow cell</p>

*Result*

Capillaries have been connected and the detector is ready for operation.

### Connecting a Device in a Local Area Network (LAN) to a Computer

This section describes how to set up an HPLC system in a local area network (LAN) and how a network administrator can integrate this LAN into your company network. The description applies to the operating system Windows® and all conventional routers.

**Note:** To set up a LAN, we recommend to use a router. That means the following steps are required:



- Process*
1. On the computer, go to the control panel and check the LAN properties.
  2. Hook up the router to the devices and the computer.
  3. On the computer, configure the router to set up the network.
  4. Install the chromatography software from the data storage device.
  5. Switch on the device and run the chromatography software.

## Configuring the LAN Settings

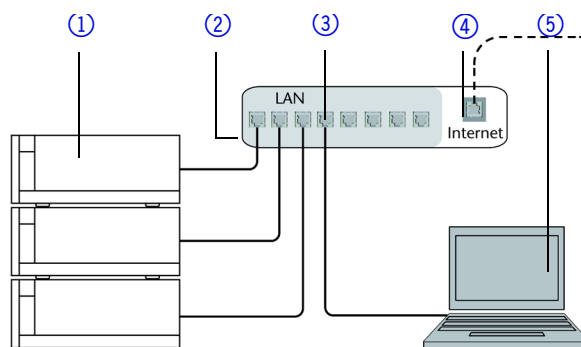
The LAN uses only one server (which is normally the router) from that the devices automatically receive their IP address.

- Prerequisite*
- In Windows®, power saving, hibernation, standby, and screen saver must be deactivated.
  - In case you use an USB-to-COM box, the option "Allow the computer to turn off this device to save power" in the devicemanager must be deactivated for all USB hosts.
  - Only for Windows 7: For the network adapter, the option "Allow the computer to turn off this device to save power" in the Device Manager must be deactivated.

- Process*
1. In Windows 7 choose *Start* ⇒ *Control Panel* ⇒ *Network and Sharing Center*.
  2. Double-click on *LAN Connection*.
  3. Click on the button *Properties*.
  4. Select *Internet Protocol version 4 (TCP/IPv4)*.
  5. Click on the button *Properties*.
  6. Check the settings in the tab *General*. The correct settings for the DHCP client are:
    - a) *Obtain IP address automatically*
    - b) *Obtain DNS server address automatically*
  7. Click on the button *OK*.

## Connecting the Cables

A router ③ has several LAN ports ② and one WAN port ④ that can be used to integrate the LAN into a wide area network (WAN), e.g. a company network or the Internet. In contrast, the LAN ports serve to set up a network from devices ① and a computer ⑤. To avoid interference, we recommend operating the HPLC system separately from the company network.



You will find patch cables for each device and the router in the accessories kit. To connect the router to a WAN, an additional patch cable is required, which is not supplied within the scope of delivery.

- Prerequisite*
- The computer has been switched off.
  - There is a patch cable for each device and the computer.
- Process*
1. Use the patch cable to connect the router and the computer. Repeat this step to connect all devices.
  2. Use the power supply to connect the router to the mains power system.

## Configuring the Router

The router is preset at the factory. You will find a label at the bottom side of the router, on which IP address, user name, and password are printed. These information help to open the router configuration.

- Process*
1. To open the router configuration, start your Internet browser and enter the IP address (not for all routers).
  2. Enter user name and password.
  3. Configure the router as DHCP server.
  4. In the router configuration, check the IP address range and make changes if necessary.

*Result* Once the router has assigned IP addresses to all devices, the chromatography software can be used to remotely control the system.

## Integrating the LAN into a Company Network

A network administrator can integrate the LAN into your company network. In this case you use the WAN port of the router.

*Prerequisite* There is a patch cable for the connection.

- Process*
1. Check that the IP address range of the router and of the company network do not overlap.
  2. In case of an overlap, change the IP address range of the router.
  3. Use the patch cable to connect the router WAN port to the company network.
  4. Restart all devices, including the computer.

## Controlling Several Systems Separately in a LAN

Devices connected to a LAN communicate through ports, which are part of the IP address. If more than one HPLC system is connected to the same LAN and you plan on controlling them separately, you can use different ports to avoid interference. Therefore, the port number for each device must be changed and this same number must be entered into the device configuration of the chromatography software. We recommend to use the same port number for all devices in the same system.

**Note:** The port is set to 10001 at the factory. You must use the same numbers in the device configuration of the chromatography software as in the device, otherwise the connection fails.

- Process*
1. Find out port number and change it on the device.
  2. Enter the port number in the chromatography software.

*Result* The connection is established.

# Operating the Detector

**Note:** Operator errors and clogged capillaries can cause high pressure spikes.

## Control of the Detector with Chromatography Software

The detector can be controlled individually, or as part of an HPLC system by means of a computer and chromatography software.

## Switching the Detector on

The device is switched by the power switch on the back of the device. It begins by initializing the lamps (initializing lamps), then proceeds through a self-test and calibration cycle (calibration is running), and finally registers itself as ready to operate with the *status display*.

The detector is now ready to operate.

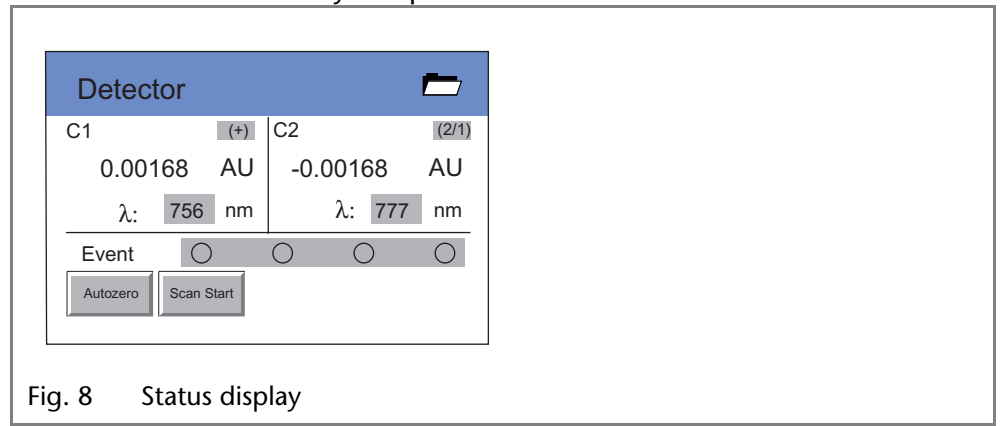


Fig. 8 Status display

## Touchscreen

*Working without chromatography software*

The touchscreen is suitable for the following procedures without chromatography software:

- Monitoring the module functions
- Using special programs for laboratory work:
  - Scan program
  - LAN configuration program
  - Combination of programs (in the *Link* menu)
  - Checking the system conditions as part of quality assurance measures in accordance with good laboratory practices (in the *GLP* menu)
- Standby and wake-up programs (Wake Up)
- Configuring programs for the device (in the *Setup* menu)

### Handling the Touchscreen




With the touchscreen it is possible to input data and commands by tapping certain areas on the screen with a finger or with a blunted object. These areas are highlighted in gray.


Tapping such buttons often calls up a menu with further, self explanatory buttons.

## Overview of Touchscreen Buttons

*Navigation*




In order to navigate the display has buttons with the following meanings:

Button	Function	Explanation
	Scroll	Scroll through all functions
	One level higher up	Tap briefly to move up one level up
	To the device status display	Press and hold for two seconds
	To Main menu	Tap to go to the Main menu

Button	Function	Explanation
	Saves the entry	-

*Controlling the program*

Further buttons help control the program:

Button	Function	Explanation
	Running a program	Starts previously configured program in <i>Program menu</i>
	Pause program	-
	Stop program	-

Other buttons have their functions displayed in plaintext:

Button	Function	Explanation
Restart	Repeat program	-
Finish	Exit loaded program	-
Day	Confirm day	-
Month	Confirm month	-
Year	Confirm year	-
Autozero	Carry out zero balance	
Scan	Acquire spectra	
Scan Out	Move spectra to the integration output	
Disable	Deactivate, skip	
New	Create a new program line with time indicator	-
Load	Load program	-
Edit	Edit program	-
Del/Delete	Delete a program	-
Tab	Table	Program line display

*Autozero scan* **Note:** The detector must perform the so-called autozero scan before recording UV spectra. Here the solvent's spectrum is measured, in order to correct the corresponding scan values.

## Graphical User Interface Structure

The user interface is divided into various areas.

- Program: Device programming
- Link: Creating combination programs
- Scan: Wavelength scan
- Setup: Device presets
- GLP: Device status displayed according to good laboratory practice (GLP)
- Standby mode

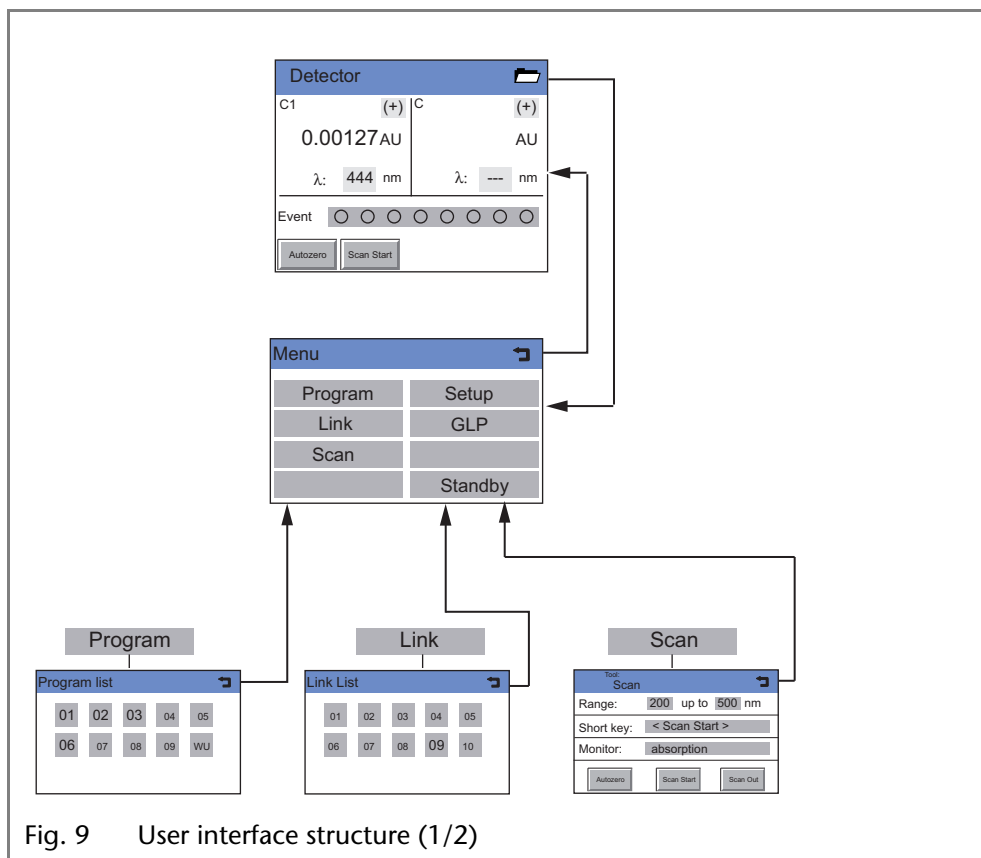


Fig. 9 User interface structure (1/2)

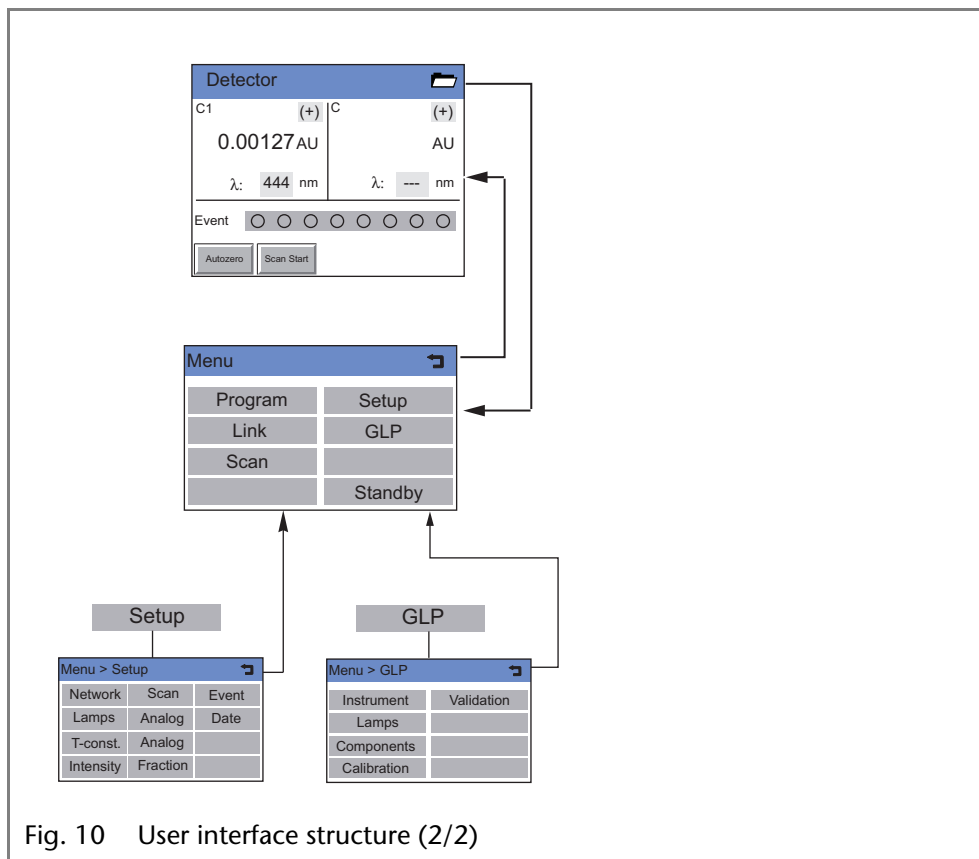


Fig. 10 User interface structure (2/2)

## Status Display Settings

The following settings can be made in the *status display*:

*Signal options*

Channels C1 and C2 have four options for signal output that can be selected by tapping the gray areas next to C1 and C2:

Option	Explanation
(-)	Signal is inverted
(+)	Signal remains unchanged
(1/2)	Displays signal 1 divided by signal 2
(2/1)	Displays signal 2 divided by signal 1

With options (1/2) and (2/1) the absorption ratio can be generated to check the chromatographic separation quality with two wavelengths. The result appears in the window half C1 or C2, respectively. The unit AU has no pertinent meaning.

*Wavelengths*

Tapping the gray fields next to λ opens a virtual number pad in which the measuring wavelengths can be specified. The entry is confirmed with the return key. The entry is deactivated with the *disable* key.

*Events*

Events are electric signals that are effective on the multi-pin connector and are used to control the detector and other devices.

Up to four events can be activated by tapping the gray *Event* button.

*Autozero*

An autozero scan is performed when this button is tapped.

*Scan Start*

The scan menu is opened when this button is tapped.

## Main Menu

*Navigating the Main menu*

Tapping the button  in the *status display* calls up the Main menu:

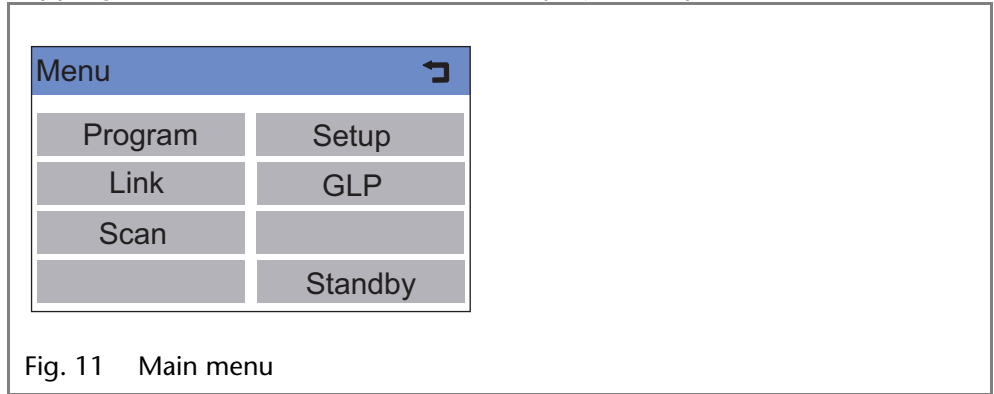


Fig. 11 Main menu


The individual menus are opened by tapping the correspondingly labeled buttons.

## Program Menu

The detector can store ten programs with 50 program lines each. Program 10 (WU) is reserved for a *wake-up* program for a time-delayed execution of the links or programs.

The individual programs are labeled with numbers.

*Navigating Program menu*

1. Tap the *Program* menu in order to display the Program list.
2. Tap the desired program number to edit, open or delete the program.
3. Tap *load* to run a program.
4. Tap *edit* to enter the edit mode.
5. Tap *delete* to delete a program.
6. Tap *tab* to display a program line in a table.
7. Tap  to go to a higher level, or hold it two seconds to go to the Main menu.

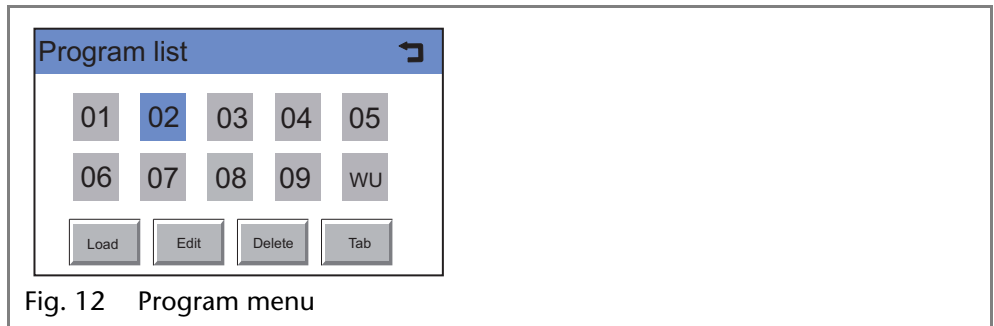


Fig. 12 Program menu

## Creating a Program

**Note:** Occupied programs are represented by large displayed numbers, and free programs are represented by small displayed numbers.

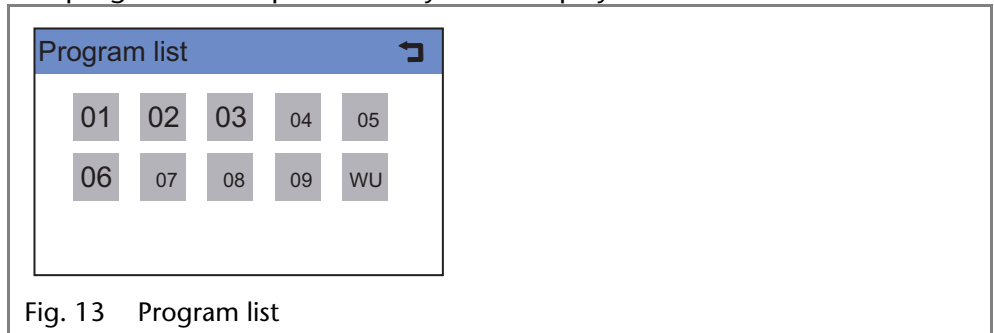





Fig. 13 Program list

- Procedure*
1. Tap the *Program* menu in order to display the Program list.

2. Tap the desired program number and *edit* to edit the program.
3. Enter the desired signal options.
4. Enter the desired wavelengths and save them with  .
5. Enter the event settings.
6. Tap *new* to specify the time.
7. Enter the value and time and tap  to save the settings.
8. Tap  to go to a higher level, or hold it two seconds to go to the Main menu.

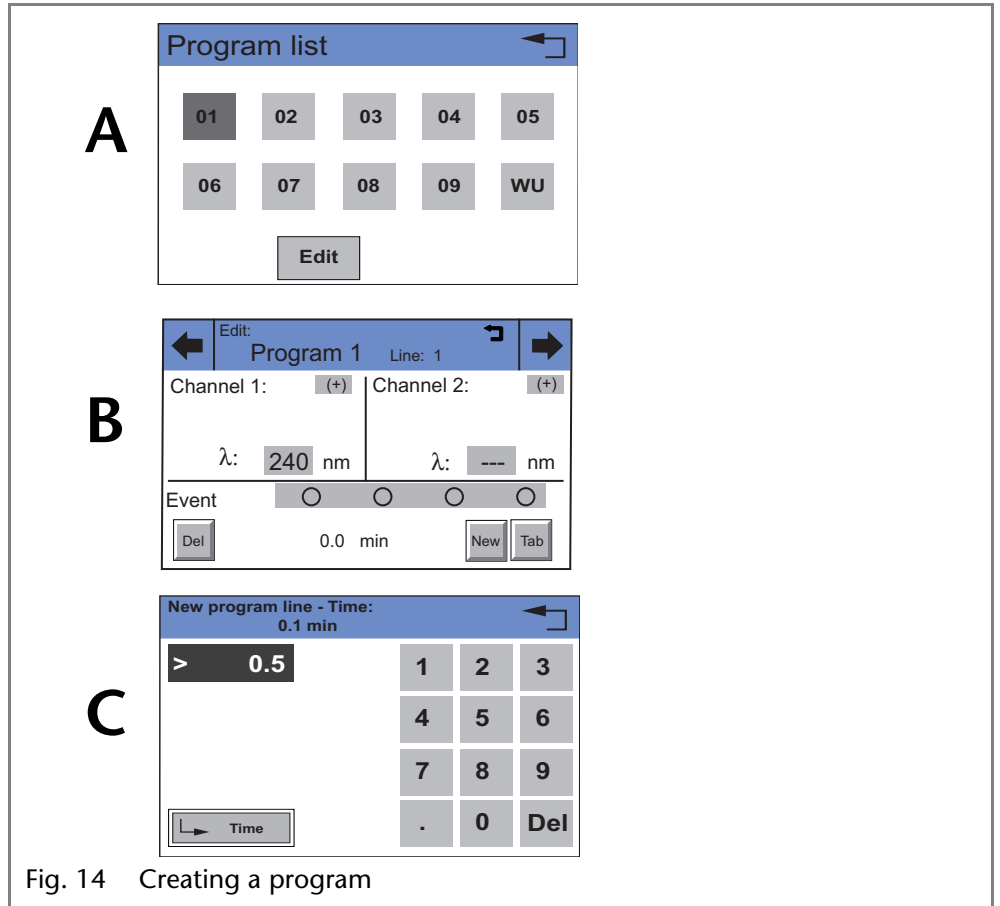


Fig. 14 Creating a program

### Creating Program Lines

New program lines can be created while creating a program.

1. Tap *Tab* in the program's editing window to display the program lines.
2. Tap *New* to create a new program line.
3. Enter the time value.
4. Save setting.
5. Enter value of desired channel.
6. Save setting.

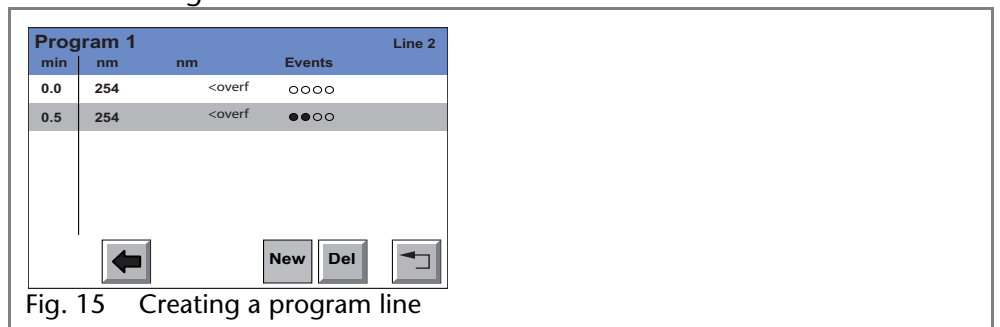


Fig. 15 Creating a program line



## Deleting Program Lines

Program lines can be deleted while creating a program.

1. Tap *Tab* in the program's editing window to display the program lines.
2. Tap  $\leftarrow \rightarrow$  to mark the desired program line.
3. Tap *Del* to delete the desired program line.
4. Confirm the query.
5. Tap  $\leftarrow$  to go to a higher level, or hold for two seconds to go to the Main menu.

## Running a Program

1. Tap the *Program* menu in order to display the Program list.
2. Tap the desired program number and *load* to load the program.
3. Tap  $\blacktriangleright$  to start the program (diagram A).
4. Tap  $\parallel$  to interrupt the program.
5. Tap  $\blacksquare$  to stop the program.
6. Tap **Restart** to repeat the program (diagram B).
7. Tap **Finish** to exit the loaded program

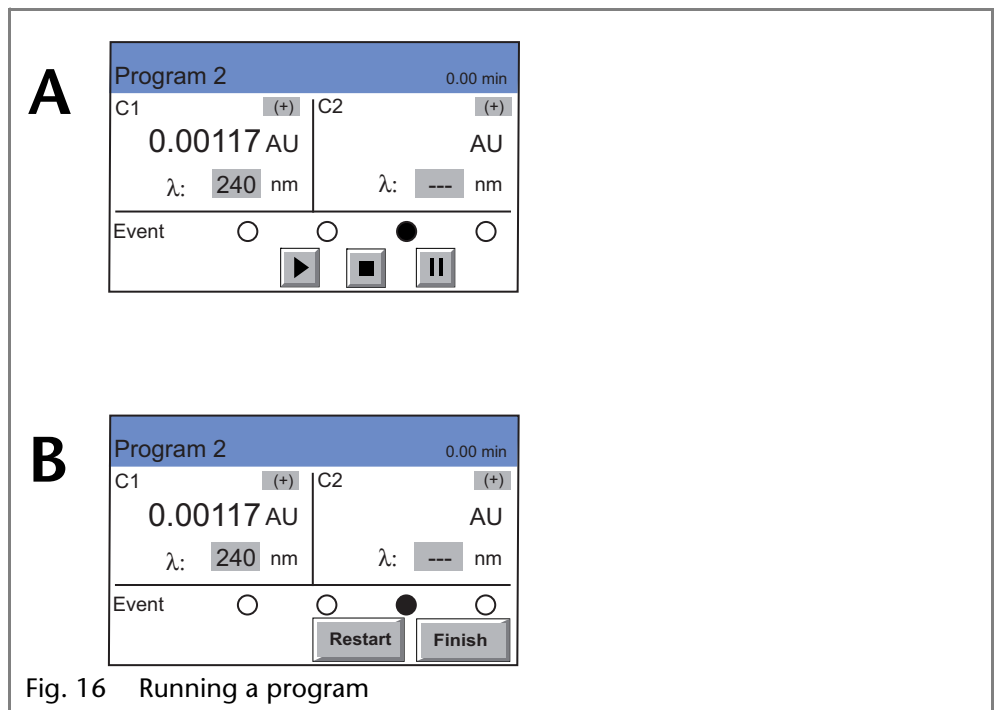



Fig. 16 Running a program

## Changing a Program

1. Tap the *Program* menu in order to display the Program list.
2. Tap the desired program number and *edit* to edit the program.
3. Change the desired value.
4. Save setting.

5. Tap  to go to a higher level, or hold it two seconds to go to the Main menu.

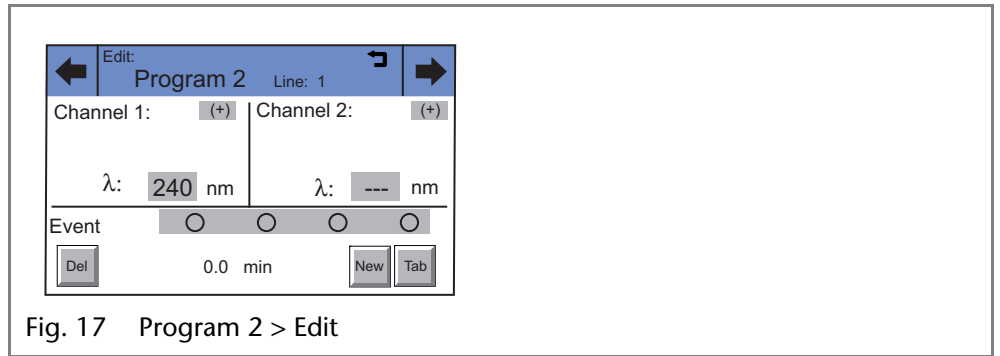




Fig. 17 Program 2 > Edit

### Displaying the Program Lines

1. Tap the *Program* menu in order to display the Program list.
2. Tap the desired program number and *tab* to reach the program line display.
3. Tap  to go to a higher level, or hold it two seconds to go to the Main menu.

### Delete a Program

1. Tap the *Program* menu in order to display the Program list.
2. Tap the desired program number and *delete* to delete the program.
3. Confirm the query.
4. Tap  to go to a higher level, or hold it two seconds to go to the Main menu.





### Creating a Program with a Starting Time

*Program WU*

The program labeled WU serves as a *wake-up program*. It can be used to load a program or link and can be started at a predetermined time.

Note: Make sure that the date and time configured in the *Setup* menu are correct.

*Procedure*

1. Tap the *Program* menu in order to display the Program list.
2. Tap *WU* and *edit* to edit the program.
3. Enter the program or link to be run at the wake-up time in the *wake-up* line and confirm it with .
4. Enter the program start-date and confirm it with .
5. Enter the program start-time and confirm it with .
6. Tap  to go to a higher level, or hold it two seconds to go to the Main menu.

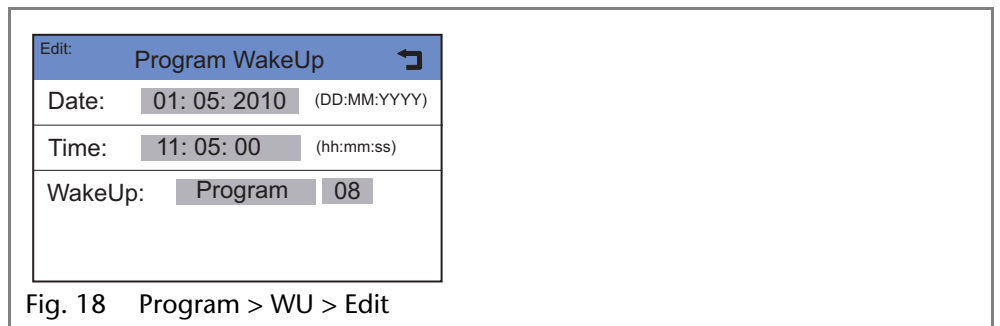


Fig. 18 Program > WU > Edit

*WU > Load*


The *WakeUp* control mode can be started with *WU > load* after answering the security query "*load wakeup program?*" The screen will display the characters *WAKEUP*, as well as the detector's wake-up time and the current time. The screen turns on the power saving mode.

## Link Menu

Links contain connections between existing programs, which can be defined and edited, like the programs themselves.

A maximum of 10 links between defined programs can be created and saved.

*Navigating through  
the Link menu*

1. Tap the *Link* menu to display the Link list.
2. Tap the desired link number to edit, open or delete the link.
3. Tap *Load* to run a link.
4. Tap *Edit* to enter the edit mode.
5. Tap *Delete* to delete a link.
6. Tap *Tab* to display the program line.
7. Tap  to go to a higher level, or hold it two seconds to go to the Main menu.

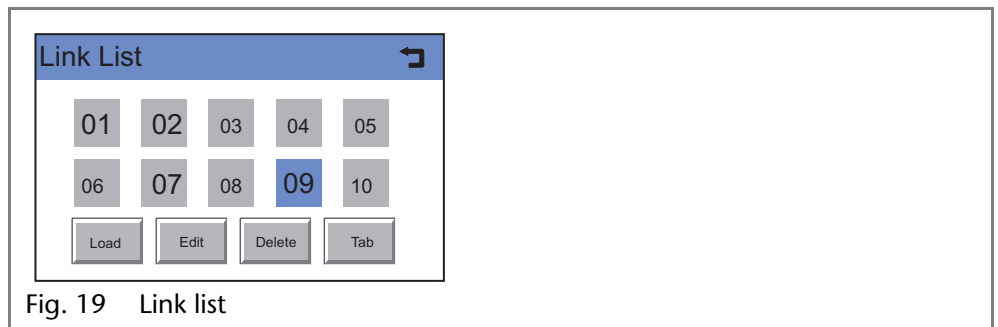


Fig. 19 Link list




## Creating a Link

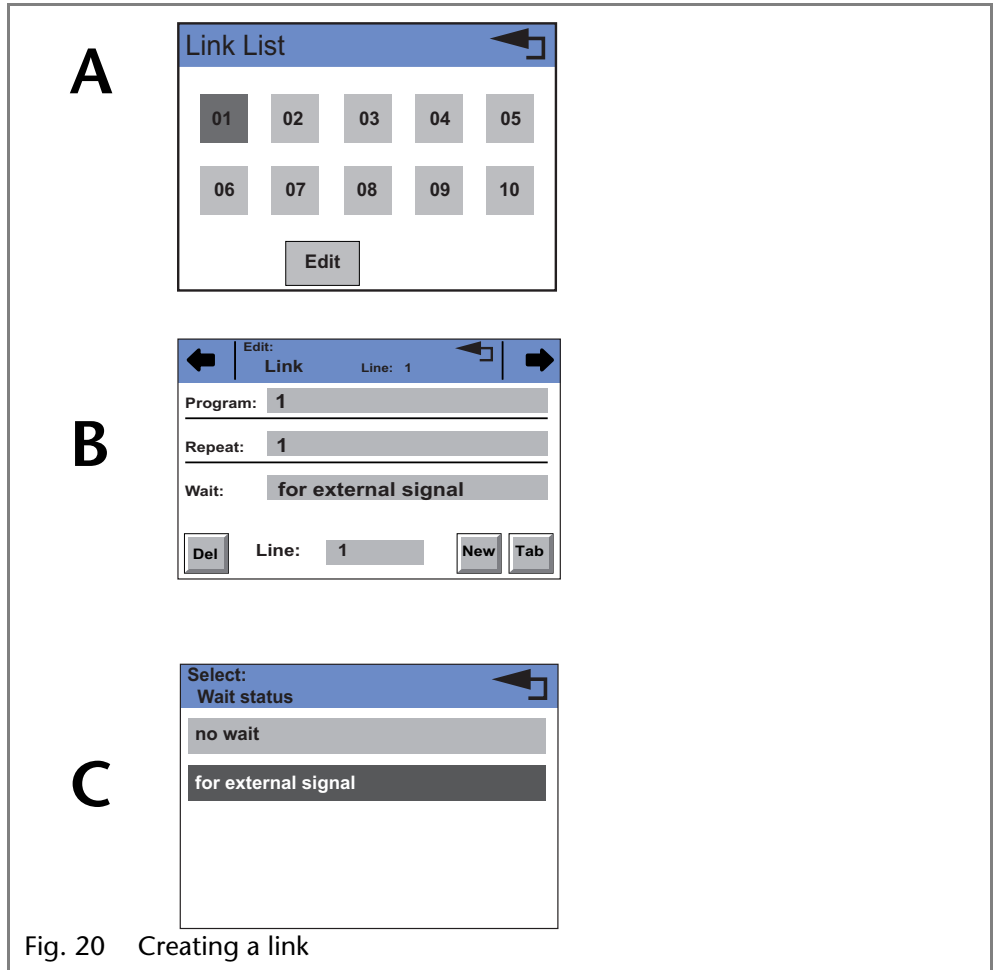
A link can contain up to 50 lines.

Each link contains

- the number of a program, which has to be connected (*line program*, 1 through 9),
- the number of repetitions (*line repeat*, 1 through 50)
- the *wait status* i.e. waiting for an external signal (*for external signal*) or continue without interruption (*no wait*).

*Procedure*

1. Tap the *Link* menu to display the link list (diagram A).
2. Tap the desired link number to edit the link.
3. Enter program number (diagram B).
4. Tap  to save the settings.
5. Enter the number of repetitions (*repeat*) for the previously specified program.
6. Tap  to save the settings.
7. Select the desired option for *wait*: (diagram C).
8. Tap  to go to a higher level, or hold it two seconds to go to the Main menu.

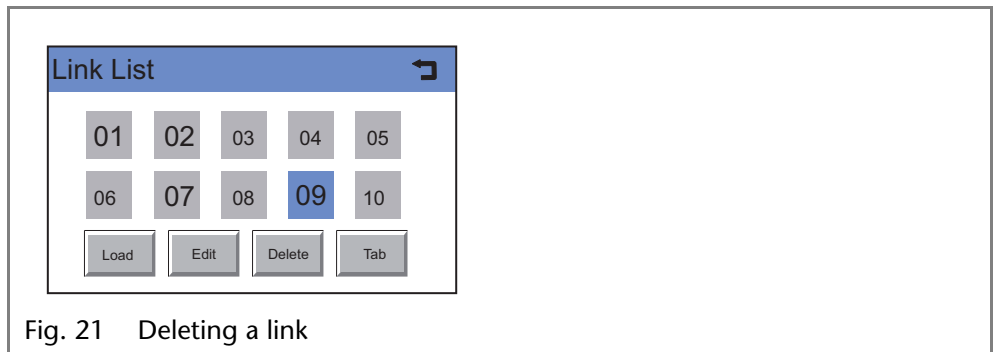


### Executing a Link

1. Tap the *Link* menu to display the Link list.
2. Tap the desired link number and *Load* to load the link.
3. Tap ▶ to start the link.
4. Tap || to interrupt the link.
5. Tap ■ to stop the link.
6. Tap Restart to be able to repeat the link.
7. Tap Finish to exit the loaded link.


### Deleting a Link

1. Tap the *Link* menu to display the Link list.
2. Tap the desired link number and *delete* to delete the link.
3. Confirm the query.
4. Tap ↶ to go to a higher level, or hold it two seconds to go to the Main menu.



## Scan Menu

*Navigating the Scan menu*

1. Tap on the *Scan* menu in the Main menu to display options.
2. Tap the gray highlighted values in the *range* line to determine the wavelength range for autozero and scan.
3. Enter the desired wavelength values and confirm each with .
4. Tap the gray highlighted values in the *short key* line to determine the scan start area display in the status display.

Option	Explanation
<Scan Start>	The button <i>Scan Start</i> appears in the status display.
<Enter screen Scan>	The button <i>Scan</i> appears in the status display.
Disable	Removes the scan button

5. Tap the gray highlighted area of the *monitor* line to make the following selections:
  - *absorption*
  - *intensity of signal channel*
  - *intensity of reference*

Now there are the following options:

6. Tap *Autozero* button to carry out the zero balance of the measuring signal.
7. Tap the *Scan Start* button to start the scan.
8. Tap the *Scan Out* button to output the scan data to the selected integrator output (RCA port on the back of the device).

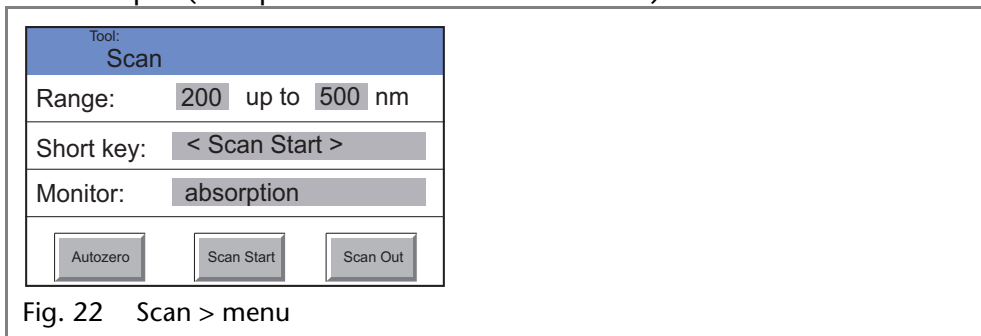




Fig. 22 Scan > menu

## Setup Menu

*Navigating the Setup menu*

In the Setup menu, fundamental parameters for controlling the detector are specified.

1. Tap the *Setup* menu to display options.
2. Tap options to display the current detector parameters.
3. Tap the gray highlighted values to display all available parameters.
4. Tap the desired parameters.
5. Tap  to scroll through the other options in the setup menu.

6. Tap  to go to a higher level, or hold it two seconds to go to the Main menu.

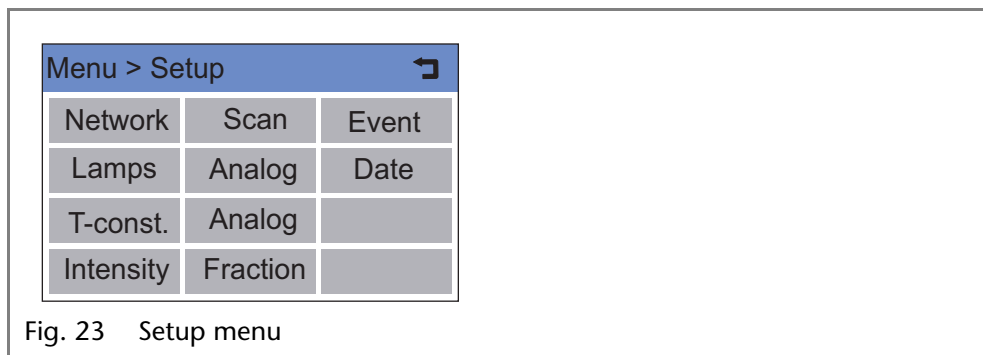


Fig. 23 Setup menu

### Setup Menu Parameters

*Network* The network configuration is displayed:

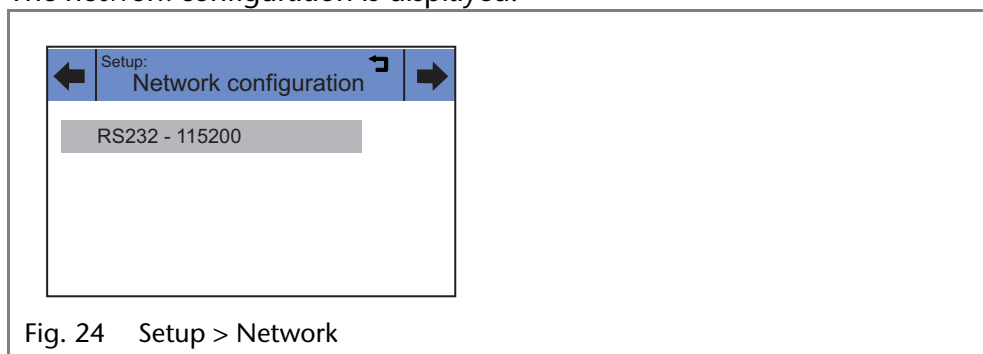


Fig. 24 Setup > Network

Tapping the gray areas opens a list of further configuration options.

*Lamps* The deuterium and halogen lamps can be switched and calibrated.

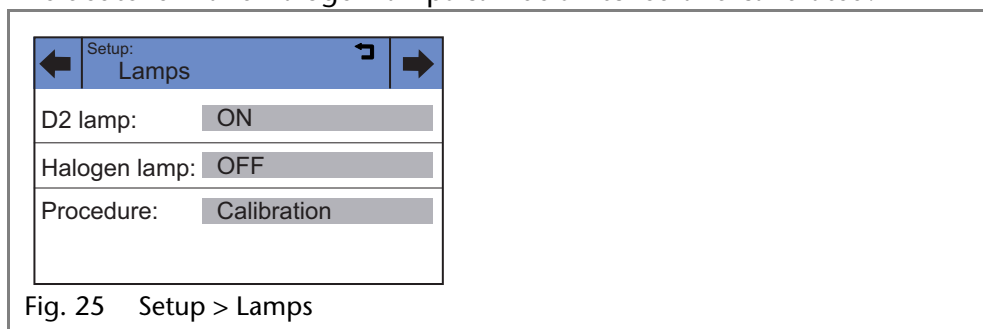


Fig. 25 Setup > Lamps

*T-const.* Here a time constant can be selected from prescribed values from 0.1 s to 10.0 s, to smooth the analog output signal. Smaller time constants can only be set using LAN control with the chromatography software.

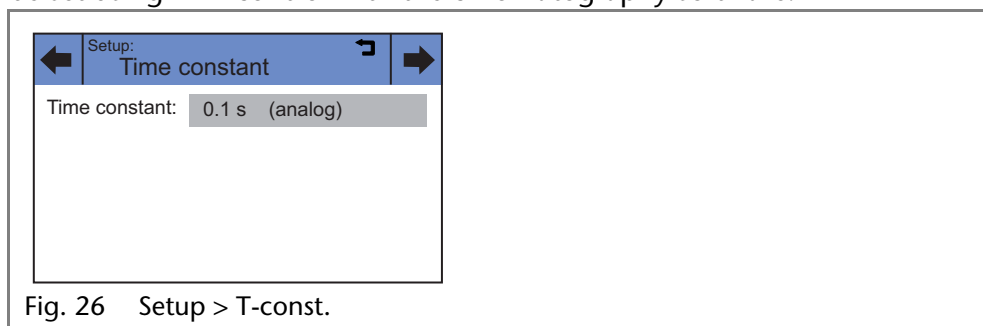


Fig. 26 Setup > T-const.

*Intensity* The intensities in channel C1 are displayed. *Monitor source* can be selected (absorption, signal channel, reference channel).

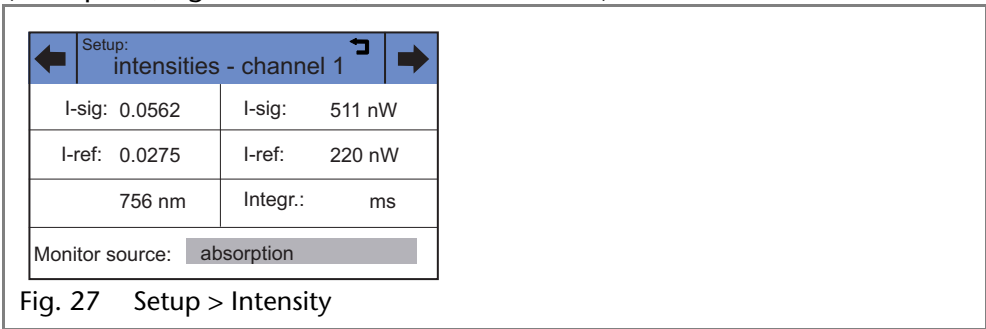


Fig. 27 Setup > Intensity

For checking the functionality of the lamp, the two light intensity values **I-sig** and **I-ref** provide useful information. The right column shows the absolute light intensity that the signal and reference channels in the UV-maximum measure after a calibration. The values are independent from the integration time default setting and can, therefore, be used as a spectra sources quality gauge. The **value I-sig** allows you to draw conclusions about the measurement situation (installed flow cell type, solvent used, bubble free, etc.)

*Scan* Here the integrator channel and the speed can be specified for the scan output. The detector offers two integrator outputs that are accessible at the RCA ports on the back of the device.

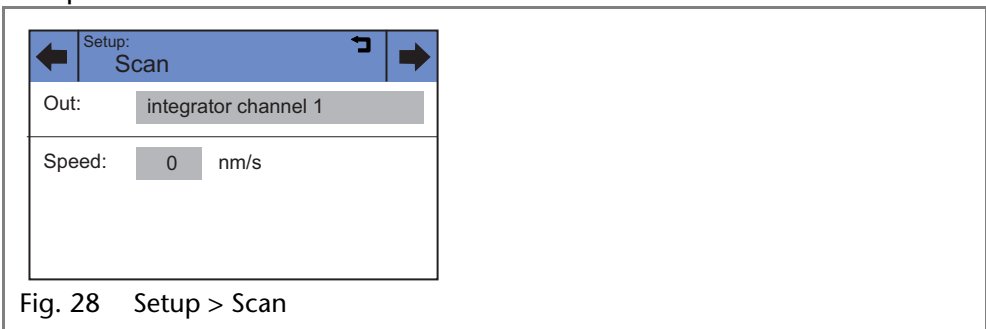


Fig. 28 Setup > Scan

*Analog out* Here the offset (moving the baseline) and scaling (in AU/V) of both integrator outputs can be set.

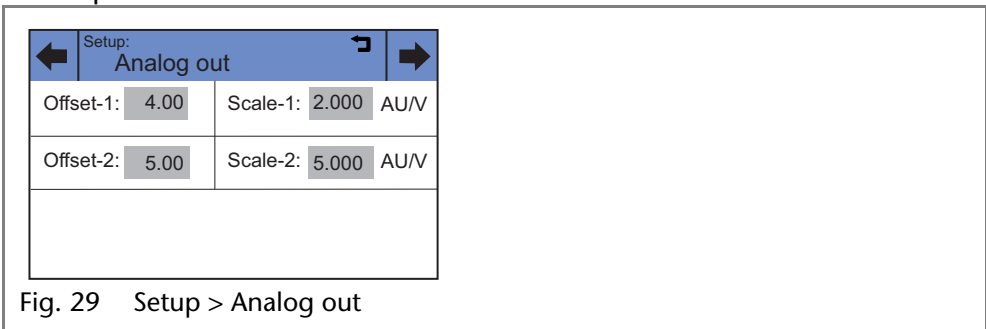


Fig. 29 Setup > Analog out

*Analog in* The *external λ* input on the back of the device enables external control of the detector through a positive analog voltage that is applied against AGND.

By selecting *Set to zero* an applied voltage can be defined as the spectral zero point for the wavelength 000 nm. For this purpose a voltage of 0 V will be normally used.

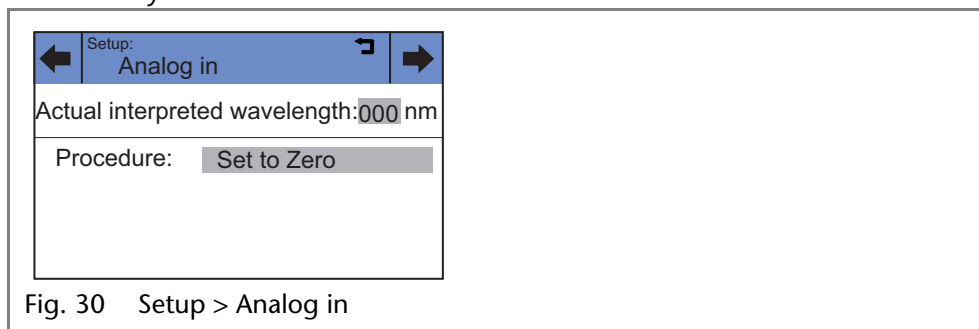


Fig. 30 Setup > Analog in

If the control voltage is raised, then the *actual interpreted wavelength* field shows the corresponding wavelength with a scaling of 100 nm/V. The scaling can be changed with the number keys that appear after tapping the field.

**Note:** For optimal linearity a scaling of 100 nm/V is recommended. The greatest wavelength (900 nm) is then reached with a control voltage of 9 V.

*Fraction*

A fraction collector can be controlled through the multi-pin connector on the back of the detector.

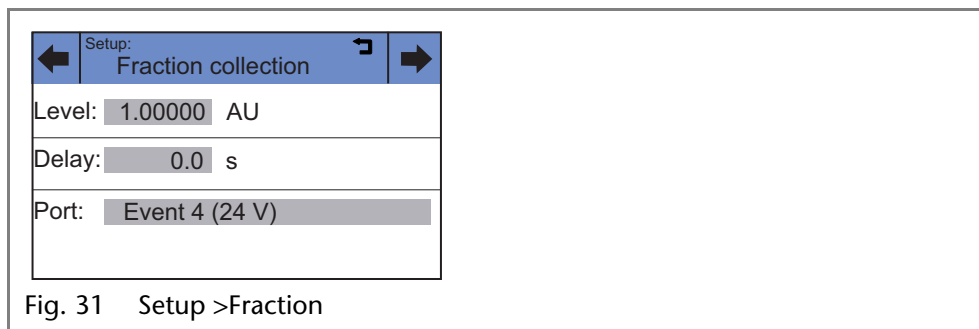


Fig. 31 Setup > Fraction

*Setup > Fraction > Level*

The *Level* line is used to specify the signal height that needs to be exceeded to switch the fraction collector to the next position.

*Setup > Fraction > Delay*

With the value in the *Delay* line, the propagation delay due to the dead volume of the capillaries between detector and fraction collector is taken into account.

*Setup > Fraction > Port*

In order to activate ports 1 and 2 on back of the detector for fraction collecting, event 1 must first be activated from the main screen. The corresponding port (1 or 2) must also be selected in the Fraction collection menu, together with a threshold value (AU) and optionally a delay time. When the threshold value is reached/exceeded, the selected port is opened and the event field remains "active" on the main screen. When the signal falls below the threshold, the port is closed and the event field remains "active" on the main screen.

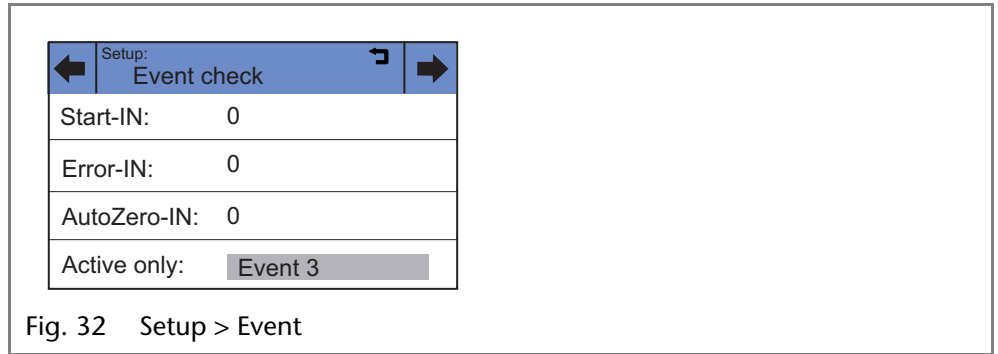
In order to activate ports 3 and 4 on back of the detector for fraction collecting, the corresponding port (3 or 4) must be selected in the Fraction collection menu, together with a threshold value (AU) and optionally a delay time. When the threshold value is reached/exceeded, the selected port is opened and the event field remains "inactive" on the main screen. When the signal falls below the threshold, the port is closed and the event field remains "inactive" on the main screen.

The following event outputs can be selected in the *Port* line:

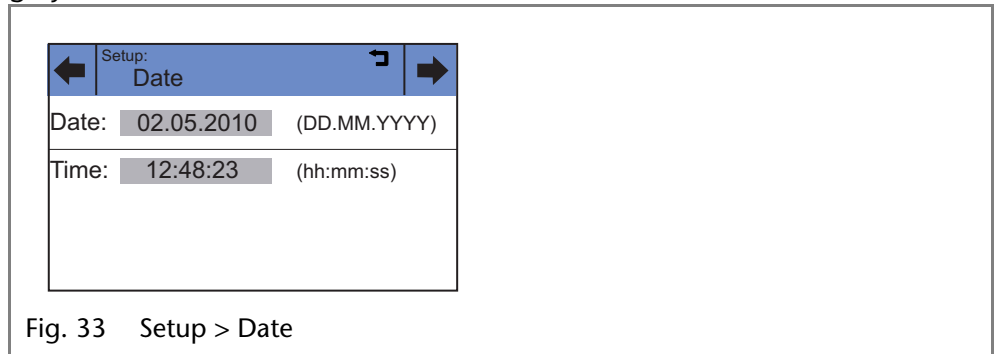
- Event 1 (relay contact EV 1)
- Event 2, Event 3 (TTL outputs EV 2, EV 3)
- Event 4 (switch voltage +24 V valve)



**Event** By tapping the gray field in the *active only* line, the condition of the event connections can be checked.



**Date** Here the date and time for the detector can be entered, after tapping the gray buttons next to *Date* and *Time*.

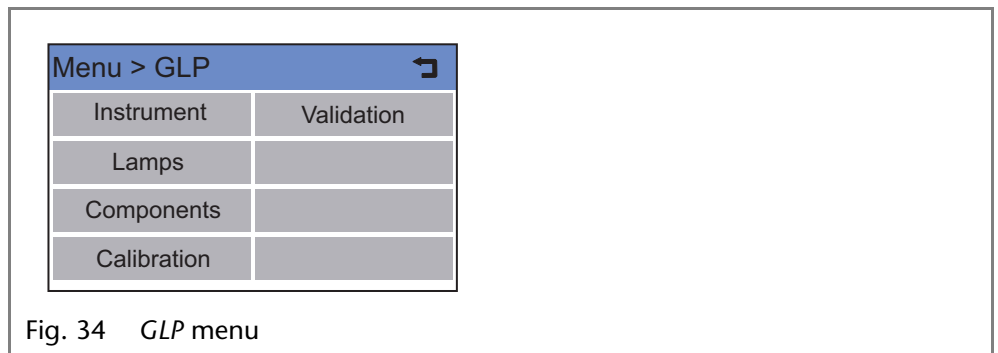


## GLP Menu

The GLP menu is for information purposes only. The submenus provide information about the use of the detector, deliver an overview of the configuration and inform as to the condition of the device. The data can be viewed by tapping the corresponding buttons.

*Navigating through the GLP menu*

1. Tap the *GLP* menu to display operating parameters.
2. Tap the gray highlighted values to display all available options.
3. Tap ◀ ▶ to scroll through the other options in the *GLP* menu.
4. Tap ◀ to go to a higher level, or hold it two seconds to go to the Main menu.



## Standby

By tapping the *Standby* button, the detector goes into the energy saving standby mode. The word **STANDBY** is displayed on the touchscreen and the standby lamp goes on. The event inputs and communication interfaces remain active.

The return from standby mode is made by tapping the touchscreen. The standby lamp goes off, and the device behaves as it would if turned on with the power switch. No calibration takes place, as the set wavelength has been fixed.

# Functionality Tests

- Installation Qualification (IQ)* The customer may request the Installation Qualification, which is free of charge. In case of a request, the Technical Support of KNAUER or from a provider authorized by KNAUER performs this functionality test during the installation.
- The Installation Qualification is a standardized document that comes as part of the delivery and includes the following:
- confirmation of flawless condition at delivery
  - check if the delivery is complete
  - certification on the functionality of the device
- Operation Qualification (OQ)* The Operation Qualification includes an extensive functionality test according to KNAUER standard OQ documents. The Operation Qualification is a standardized document and free of charge. It is not part of the delivery, please contact the Technical Support in case of request.
- The Operation Qualification includes the following:
- definition of customer requirements and acceptance terms
  - documentation on device specifications
  - device functionality check at installation site
- Test intervals* To make sure that the device operates within the specified range, you should test the device regularly. The test intervals are dependent on the usage of the device.
- Execution* The test can be carried out either by the Technical Support of KNAUER or from a provider authorized by KNAUER (for a fee).

## Troubleshooting

- First measures*
1. Check all cabling
  2. Check all screw fittings
  3. Check whether air has gotten into the supply lines
  4. Check device for leaks
  5. Observe system messages on the display

## Possible Problems and Rectifications

Problem	Solution
Baseline drift	► Maintain constant temperature conditions during the measurement.
Device will not turn on	► Inspect the power cable to be sure it is plugged into the power supply.
Device cannot be calibrated	<ol style="list-style-type: none"> <li>1. Tighten the knurled-head screws on the cover plate to prevent incursion from interfering light or an electronic error.</li> <li>2. Insert the test cell.</li> <li>3. Inspect the calibration with a weak absorbing eluent.</li> </ol>
Baseline noise	<ol style="list-style-type: none"> <li>1. Inspect the flow cell.</li> <li>2. Tighten the knurled-head screws on the cover plate to prevent incursion from interfering light or an electronic error.</li> <li>3. Exchange the defective flow cell</li> <li>4. Inspect the service life of the display lamp.</li> <li>5. Reduce the air in the flow cell by using a degasser.</li> </ol>
The relationship of signal to reference is very low	<ol style="list-style-type: none"> <li>1. Purge the flow cell.</li> <li>2. Clean the flow cell window.</li> <li>3. Exchange lamp (spectrum source).</li> </ol>



### Further measures

1. Install maintenance software (Service tool).
2. Save device information and send to manufacturer.
3. Inform the technical support department of the manufacturer.

## Possible LAN Connection Problems

Go through the following steps, in case no connection between the computer and the devices can be established. Check after each step if the problem is solved. If the problem cannot be located, call the Technical Support.

1. Check the status of the LAN connection in the Windows task bar:

-  Connected
-  Connection not established

If no connection was established, test the following:

- Is the router switched on?
  - Is the patch cable connected correctly to the router and the computer?
2. Check the router settings:
    - Is the router set to DHCP server?
    - Is the IP address range sufficient for all the connected devices?
  3. Check all connections:
    - Are the patch cable connected to the LAN ports and not the WAN port?
    - Are all cable connections between devices and router correct?
    - Are the cables plugged in tightly?
  4. If the router is integrated into a company network, pull out the patch cable from the WAN port.

- Can the devices communicate with the computer, even though the router is disconnected from the company network?
5. Turn off all devices, router, and computer. Firstly, switch on the router and wait until its self-test is finished. Secondly, switch on the devices and the computer.
    - Has this been successful?
  6. Replace the patch cable to the device with that no connection could be established.
    - Has this been successful?
  7. Make sure that the IP port of the device matches the port in the chromatography software.

## System Messages

If other system messages than the ones listed below appear, please switch the device off and on again. If the system message appears again, notify the Technical Support of the manufacturer.

The system messages are sorted alphabetically:

System message	Solution
At least one wavelength must be valid	Check whether at least one channel is on. Check whether the wavelengths are within allowed range (190–750 nm).
Calibration failed	Switch the modules off and turn them back on. Check whether lamps, motor and filter are functioning correctly. If the system message appears again, notify Technical Support. Restart calibration at the module or in the chromatography software.
Cannot delete active program/link	First pause link, then delete program.
Cannot edit program from the running link	First pause link, then edit data using chromatography software.
Cannot initialize LAN	Check cables and connections in local area network.
Cannot operate an uncalibrated instrument	Switch the device off and on. Wait until calibration is completed.
Cannot operate with an empty link	Create a link.
D2-Lamp does not start!	Switch off lamp on touchscreen and turn it on again. If the system message appears again, notify Technical Support. The lamp unit has to be replaced.
Data acquisition active	No entries are possible. First stop acquiring measurement data, afterwards you can make a new entry.
Filter move error	Switch the device off and on. If the system message appears again, notify Technical Support.
Instrument remote controlled	This entry is not executable. Quit software.

System message	Solution
Invalid command	Check the cable connections. Change the entry.
Invalid parameter(s)	Check the validity of the parameters.
Invalid time in time table	Correct the time entry.
Invalid time table index	Change the entry in the program line.
Link is loaded	First unload the link then change the link or delete it.
Link is running	Wait until the link has been completed, then change the link or delete it.
No link available	Create a link and edit it.
No link available Pls edit link first	Create a link and edit it.
No time table to start	Edit or enter a time table.
Not enough space to store link	Check the detector. Check the number of program lines. A maximum of 50 program lines are possible.
Not enough space to store program	Check the detector. Check the number of program lines. A maximum of 50 program lines are possible.
Program does not exist	Create a program.
Program is running.	Quit program or wait until program has been completed.
Scan is already active.	Cancel scan procedure or wait until scan procedure has been completed.
This link is used in Wake up	First quit or delete wakeup program (wu = Wake Up), then edit or delete link.
This program is used in a link	First pause or delete link, then edit or delete program.
This program is used in Wake up	First quit or delete wakeup program (wu = Wake Up), then edit or delete program.
Time already exists	Correct the time entry.
Time table is not active	The device is in <i>Standalone mode</i> , no program is running. If you try to quit a non-existent program sequence, this message appears.
Time table is not loaded	First load the program, then start the program.
Time table line is empty	Edit the program line.
Too many lines in program	Check the number of program lines. A maximum of 100 program lines are possible.

System message	Solution
Wrong Line number	Change the entry in the program line.

## Maintenance and Care

Organic solvents are toxic above a certain concentration. Ensure that work areas are always well-ventilated! When performing maintenance tasks on the device, always wear safety glasses with side protection, protective gloves, and an overall.

All wetter components of a device, e. g. flow cells of detectors or pump heads and pressure sensors for pumps, have to be flushed with isopropanol first and water afterwards before being maintained, disassembled or disposed.

### WARNING

#### Eye injury

Irritation of retina through UV light. Concentrated UV light can leak out from the flow cell or the fiber optic connectors.

→ Switch off the device and pull the power plug.

### NOTICE

#### Electronic defect

Performing maintenance tasks on a switched on device can cause damage to the device.

→ Switch off the device

→ Pull the power plug.

Users may perform the following maintenance tasks themselves:

- Regularly check the light intensity of the D<sub>2</sub> lamp.
- Inspect the flow cell assembly
- Clean the flow cell.
- Replace the flow cell.

Proper maintenance of your HPLC device will ensure successful analyses and reproducible results.

## Contact to the Technical Support department

*Contact data for  
Technical Support  
European hotline*

If you have any technical questions regarding the hardware or software of the manufacturer, please use one of the contact options below:

Languages: German and English

Available by telephone: 8 am to 5 pm (CET)

Phone:+49-(0)30-809727-111

Fax:+49-(0)30-8015010

*E-mail:* support@knauer.net

## Maintenance Contract

The following maintenance work on the device may only be performed by the manufacturer or a company authorized by the manufacturer and is covered by a separate maintenance contract:

- Opening the device
- Removing the hood or the side panels.

## Cleaning and Caring for the Device

### NOTICE

#### Device defect

Intruding liquids can cause damage to the device.

- Place solvent bottles next to the device or in a solvent tray.
- Moisten the cleaning cloth only slightly.

All smooth surfaces of the device can be cleaned with a mild, commercially available cleaning solution, or with isopropanol.

## Cleaning the Flow Cell

Increased baseline noise and reduced sensitivity can be a result of a dirty flow cell. Often it is sufficient to rinse the flow cell to restore optimal sensitivity.

**Note:** Dirty lenses or fiber optic connectors could falsify the measurement. Do not touch the lens or the fiber optic connector lenses with bare hands. Wear gloves.

### WARNING

#### Eye injury

Irritation of retina through UV light. Concentrated UV light can leak out from the flow cell or the fiber optic connectors.

- Switch off the device and pull the power plug.

## Rinsing the Flow Cell

The following solvents are recommended for rinsing:

- diluted HCl (1 mol/L)
- 1 ml/L NaOH aq.
- Ethanol
- Acetone

*Tools* Syringe

### NOTICE

#### Performance decrease

Oil drops can contaminate the flow cell.

- Do not use compressed air for drying.

- Procedure*
1. Fill the syringe with eluent.
  2. Inject it into the inlet of the flow cell and allow it to act for 5 minutes.
  3. Fill the syringe with water and inject again.
  4. Remove the flow cell from the detector and use a nitrogen stream to dry it.

*Result* Flow cell is clean.

*Next steps* Check if the baseline noise has improved.

If the rinsing does not have the desired effect, all flow cells can be disassembled to clean the lens.

## Cleaning the Lenses of an Analytical Flow Cell

### Legend

- ① Seal ring
- ② Lens
- ③ Compression part
- ④ Threaded ring

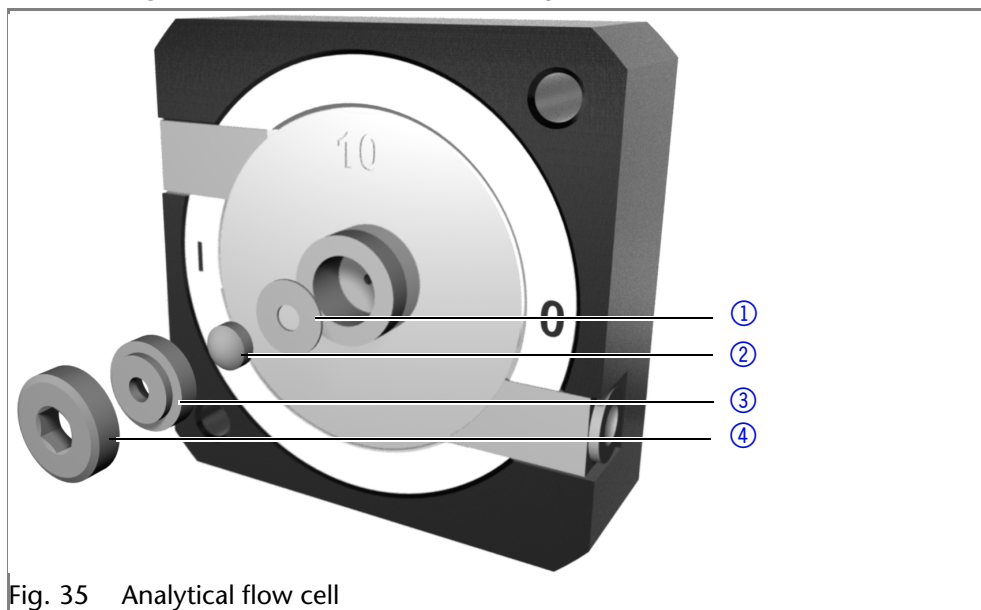


Fig. 35 Analytical flow cell

- Prerequisite**
- Device has been switched off.
  - Power plug has been pulled.
  - Flow cell has been removed.

- Tools**
- Tweezers
  - Allen screwdriver, size 3

- Procedure**
1. Using the allen screwdriver, loosen the threaded ring ④ .
  2. Using tweezers or by gently tapping on a clean surface, remove the compression part ③ .
  3. The lens ② is protected by a seal ring ① . This must be renewed every time the lens is disassembled.
  4. Remove the lens and clean with a clean, soft cloth or with water in an ultrasonic bath.
  5. Afterwards, assemble the flow cell and make sure that the new seal ring does not interrupt the light path.
  6. Using the allen screwdriver, tighten the threaded ring.

**Result** Flow cell can be assembled.

**What to do when...** If the cleaning of the lens does not have the desired effect, the lens has to be replaced.



## Cleaning the Fiber Optics of a Preparative Flow Cell

The preparative flow cells have a rod shaped light guide instead of the concave lens of the analytical cells.

### Legend

- ① Threaded ring
- ② Cover
- ③ Spacer
- ④ Compression bushing
- ⑤ Light guide with seal ring Seal

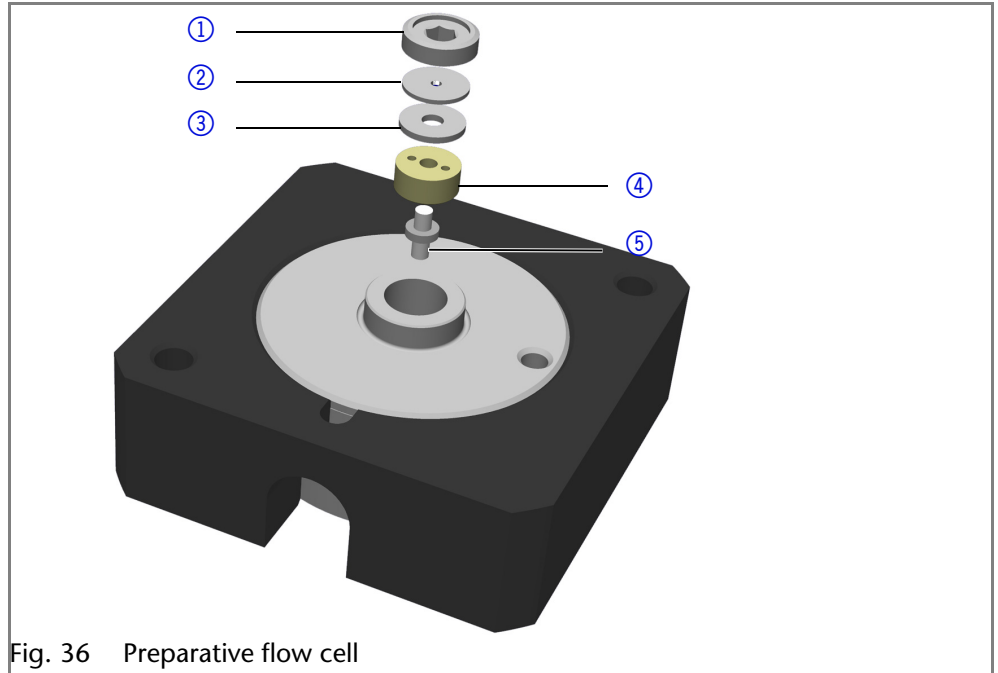


Fig. 36 Preparative flow cell

### Prerequisite

- Device has been switched off.
- Power plug has been pulled.
- Flow cell has been removed.

### Tools

- Tweezers
- Allen screwdriver, size 3

### Procedure

1. Using the screwdriver, loosen the threaded ring ① .
2. Remove the cover ② and the spacer ③ (not part of all flow cells).
3. Using the tweezers, pull out the compression bushing ④ and the light guide ⑤ .
4. Carefully push the light guide out of the holder and strip off the seal. The seal ring needs to be renewed during every cleaning of the fiber optics.
5. Clean the light guide with a clean, soft cloth or with an appropriate solvent in an ultrasonic bath. Make sure that the clean light guide is not touched by fingers.
6. Afterwards, assemble the flow cell and make sure that the new seal ring does not interrupt the light path.
7. Using the screwdriver, tighten the threaded ring ① .

### Result

Flow cell can be assembled.

### What to do when...

If the cleaning does not have the desired effect, the light guide has to be replaced.

## Replacing the Flow Cell



### Eye injury

Irritation of retina through UV light. Concentrated UV light can leak out from the flow cell or the fiber optic connectors.

→ Switch off the device and pull the power plug.

*Legend*

- ① Inlet of the flow cell
- ② Outlet of the flow cell
- ③ Knurled-head screws
- ④ Cover plate
- ⑤ Carriage

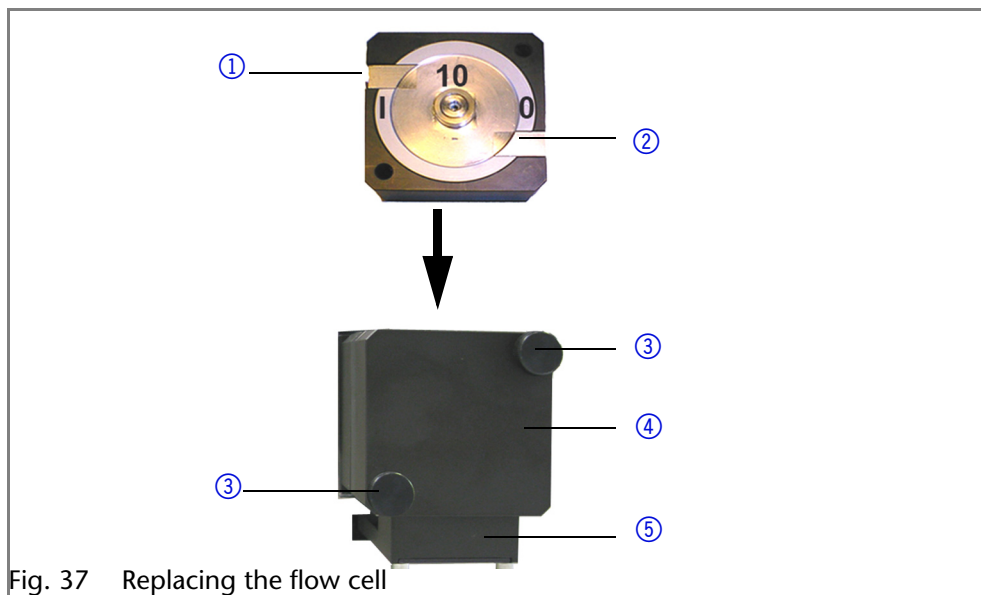


Fig. 37 Replacing the flow cell

*Procedure* Proceed as follows:

1. Switch off the device and pull the power plug.
2. Remove capillaries at the inlet ① and outlet ② of the flow cell.
3. Unscrew the knurled-head screws ③ of the cover plate ④. Hold the flow cell securely with your hand during this procedure.
4. Pull out the carriage of the flow cell ⑤ towards the front.
5. Lift the flow cell up and out.
6. Insert new flow cell from above into the flow cell holder. Continue to hold the flow cell securely.
7. Push the flow cell holder against the detector again.
8. Screw the knurled-head screws back into the cover plate ④ and tighten.

## Storage

The device can be stored within the following ambient conditions:

- Temperature range: 4–40 °C; 39.2–104 °F
- Air humidity: below 90%, non condensing

## Technical Data

<b>Detection</b>	Detector type	Variable multiple wavelength UV/VIS detector
	Detection channels	4
	Light source	Deuterium (D <sub>2</sub> ) with integrated GLP chip (one lamp version) Deuterium (D <sub>2</sub> ) and halogen lamps with integrated GLP chip (two lamp version)
	Wavelength range	190–750 nm (one lamp version) 190–900 nm (two lamp version)
	Spectral bandwidth	6 nm at H $\alpha$ line (FWHM)
	Wavelength accuracy	$\pm 2.0$ nm (verification with integrated holmium oxide filter)
	Wavelength precision	0.4 nm (ASTM E1657-98)

	Noise	$\pm 0.75 \times 10^{-5}$ AU at 254 nm (ASTM E1657-98)
	Drift	$2.0 \times 10^{-4}$ AU/h at 254 nm (ASTM E1657-98)
	Linearity	> 2.8 AU at 270 nm (ASTM E1657-98)
	Time constants	0.1/ 0.2/ 0.5/ 1.0/ 2.0/ 5.0/ 10.0 s
	Integration time	Automatic
<b>Communication</b>	Maximum data rate	80 Hz (LAN) 1 channel 20 Hz (Analog) 1 channel 10 Hz (RS-232) 1 channel
	Input	Error (IN), Start (IN), Autozero, 0 - 10 V Analog IN
	Outputs	Events 1 - 3, + 5 V, 24 V Value
	Analog outputs	2 x 0 - 5 V scalable, 20 bit, offset adjustable
	Control	Digital: LAN-DHCP, RS-232, multi-pin connector Analog: wavelength control Manual: touchpad
<b>Technical parameters</b>	Programming	Timed: wavelengths, events, fraction valve, links, wake up (program, link) 9 programs, 50 program lines
	GLP	Detailed report including lamp recognition, operating hours, lamp(s) operating hours, number of lamp ignitions
	Display	Touchscreen TFT 2.4"
<b>Ambient conditions</b>	Temperature range	4–40 °C, 39.2 –104 °F
	Air humidity	below 90%, non condensing
<b>General</b>	Power supply	100–240 V, 50–60 Hz, 75 W
	Dimensions	242 x 169 x 399 mm (W x H x D)
	Weight	5.3 kg
	Protection type	IP 20
	Height above sea level	maximum 2000 meters

## Legal Information

### Transport damage

The packaging of our devices provides the best possible protection against transport damage. Check the devices for signs of transport damage. In case you notice damages, contact the Technical Support and the forwarder company within three workdays.

## Warranty conditions

The factory warranty for the device is stipulated by contract. During the warranty period, any components with material or design-related defects will be replaced or repaired by the manufacturer free of charge. Please connect to our website for further information on terms and conditions.

All warranty claims shall expire in the event that any unauthorized changes are made to the device. This warranty also excludes the following:

- accidental or willful damage
- damage or errors caused by third parties that are not contractually related to the manufacturer at the time the damage occurs
- wear parts, fuses, glass parts, columns, light sources, cuvettes and other optical components
- damage caused by negligence or improper operation of the device and damage caused by clogged capillary
- packaging and transport damage

In the event of device malfunctions, directly contact the manufacturer.

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Internet: [www.knauer.net](http://www.knauer.net)

## Warranty seal

A warranty seal is attached on some devices. The warranty seal is color-coded. A blue seal is used by the assembly or technical support of KNAUER for devices to be sold. After repair, service technicians stick an orange seal in identical position. If unauthorized persons interfere with the device or the seal is damaged, the warranty claim becomes void.



## Declaration of conformity

The Declaration of Conformity accompanies the product as a separate document.

## Disposal

Hand in old devices or disassembled old components at a certified waste facility, where they will be disposed of properly.

*AVV marking in Germany*

According to the German "Abfallverzeichnisverordnung" (AVV) (January, 2001), old devices manufactured by KNAUER are marked as waste electrical and electronic equipment: 160214.

*WEEE registration*

KNAUER as a company is registered by the WEEE number DE 34642789 in the German "Elektroaltgerätregister" (EAR). The number belongs to category 8 and 9, which, among others, comprise laboratory equipment.

All distributors and importers are responsible for the disposal of old devices, as defined by the WEEE directive. End-users can send their old devices manufactured by KNAUER back to the distributor, the importer, or the company free of charge, but would be charged for the disposal.

*Solvents and other operating materials*

All solvents and other operating materials must be collected separately and disposed of properly.

All wetted components of a device, e. g. flow cells of detectors or pump heads and pressure sensors for pumps, have to be flushed first with isopropanol and then with water before being maintained, disassembled or disposed.

## Abbreviations and Terminology

Here you can find information on the abbreviations and terminology used in this device manual for the detector.

Terminology	Meaning
Degasser	Degasser module for fluids, e.g., in a high-pressure pump.
GLP	Good Laboratory Practice – quality assurance for laboratories.
Gradient	Time-dependent composition of solvent (mobile phase) on low-pressure or high-pressure side of system.
HPLC	High pressure liquid chromatography (HPLC). High-pressure liquid chromatography.
Integration time	The integration time determines how fast the detector reacts to changes in absorbance.
IP address	Unique address of transmitter or receiver in local network or Internet (Internet protocol).
Solvent	Mobile phase (eluent) or carrier for liquid chromatography.
Remote	The detector is completely controlled by the chromatography software.
Dead volume	Volume of capillaries and system components between mixing chamber, injector, and column as well as between column and detector. The dead volume should be kept as small as possible.

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Translation of the original German edition of this manual, version 2.1  
Last manual update: 2017-09-17  
Printed in Germany on environmentally friendly paper from sustainable forests.

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