KNAUER

Smartline

SmartMix
Instructions

V5350

Note: For your own safety, read the instructions and observe the warnings and safety information on the device and in the instructions. Keep the instructions for future reference.

Note: In case you require this instruction in another language, please submit your request including the corresponding document number via e-mail or fax to KNAUER.

Support: Do you have questions about the installation or the operation of your instrument or software?

International Support:

Contact your local KNAUER partner for support:

www.knauer.net/en/Support/Distributors-worldwide

Support in Germany

(Austria & Switzerland on case-to-case basis):

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The information in this document is subject to change without prior notice. For the latest version of the instructions, visit our website: www.knauer.net/library.

Sustainability: The printed versions of our instructions are printed according to Blue Angel standards (www.blauer-engel.de/en/uz195).

Table of contents

1. General

1.1 About these instructions

These operating instructions enable the safe and efficient operation of the device. The user must have carefully read and understood these operating instructions before starting any work.

The basic prerequisite for safe operation is compliance with all safety instructions (see “2 Basic safety instructions”, p. 3). In addition to the safety and warning instructions in these operating instructions, the local accident prevention regulations and the national industrial safety regulations apply.

These operating instructions are an integral part of the device. It must be kept in the immediate vicinity of the device and accessible to the user at all times.

You can download these and other instructions from the KNAUER website: www.knauer.net/library

1.2 Signal words

Possible dangers related to the device are distinguished in personal and material damages.

Symbol	Meaning
⚠ DANGER	DANGER (red) indicates a highly hazardous situation. If not avoided, it will result in death or serious injury.
⚠ WARNING	WARNING (orange) indicates a hazardous situation. If not avoided, it could result in death or serious injury.
⚠ CAUTION	CAUTION (yellow) indicates a moderate hazardous situation. If not avoided, it could result in minor or moderate injury.
NOTICE	NOTICE (blue) is used to address issues which are not related to physical injury.

1.3 Additional typographical conventions

Note: Specific information are prefixed with the word “Note” and an information icon.

Note: This is an example.

1.4 Legal information

1.4.1 Liability limitation

The manufacturer is not liable for the following issues:

- Non-compliance of these instructions
- Non-observance of necessary safety precautions
- Improper use
- Operation of the device by unqualified personnel (see “2.2 User qualification”, p. 3)
- Use of non-approved spare parts
- Technical changes by the user such as opening the device and unauthorized modifications
- Violations of General Terms and Conditions (GTC)

1.4.2 Transport damage

The packaging of our devices provides the best possible protection against transport damage. However, check the packaging for transport damage. In case you notice any damage, inform the Technical Support and the shipping company within three workdays.

1.4.3 Warranty conditions

For information on warranty please refer to our general terms and conditions on the website: www.knauer.net/terms

1.4.4 Warranty seal

A blue or orange warranty seal is affixed to some devices.

- A blue seal is used by KNAUER’s Manufacturing or Customer Support for devices to be sold.
- After repair, service technicians attach an orange seal onto the identical position.

After repair, the service technician affixes an orange seal in the same place. If unauthorised persons tamper with the device or if the seal is damaged, the warranty will lapse.

1.4.5 Declaration of conformity

The declaration of conformity is enclosed as a separate document with the product and can be obtained online:
www.knauer.net/en/Support/Declarations-of-conformity

2. Basic safety instructions

The device has been developed and constructed in such a way that hazards arising from its intended use are largely excluded. Nevertheless, the following safety instructions must be observed in order to exclude residual hazards.

2.1 Intended use

Only use the device for applications that fall within the range of the intended use. Otherwise, the protective and safety equipment of the device could fail.

2.1.1 Operating ranges

The device is intended to be used indoors for chromatographic applications.

2.1.2 Foreseeable misuse

Refrain from the use of the device for the following purposes or conditions:

- Medical purposes. The device is not approved as a medical product.
- Operating outdoors. Otherwise, the manufacturer does not guarantee the functionality and safety of the device.
- Operation in potentially explosive areas without special and additional explosion protection. Contact the KNAUER Customer Support for more information.

2.2 User qualification

The users are qualified to handle the device if all of the following points apply:

- They have at least a basic knowledge of liquid chromatography.
- They have knowledge about the properties of the used solvents and their health risks.
- They are trained for the special tasks and activities in the laboratory and know the relevant standards and regulations.
- Due to their technical training and experience, they can understand and carry out all the work described in the operating instructions on the instrument and recognize and avoid possible dangers independently.
- Their ability to react is not impaired by the consumption of drugs, alcohol or medication.
- They have participated in the installation of an instrument or training by KNAUER or an authorized company.

If users do not meet these qualifications, they must inform their supervisors.

2.3 Operator responsibility

The operator is any person who operates the device himself or leaves it to a third party for use and who bears the legal product responsibility for the protection of the user or third parties during operation.

The obligations of the operator are listed below:

- Know and follow the applicable work safety regulations.
- Identify hazards arising from the working conditions at the place of use in a risk assessment.
- Set up operating instructions for the operation of the device.
- Regularly check whether the operating instructions correspond to the current status of the regulations.
- Clearly regulate and specify responsibilities for installation, operation, troubleshooting, maintenance and cleaning and set clear rules.
- Ensure that all personnel who work with the device have read and understood these operating instructions.
- Train the personnel who work with the device at regular intervals and inform them about the dangers.
- Provide the necessary safety equipment to the employees working with the unit (see section below).

2.4 Personal safety equipment

The protective measures required in the laboratory must be observed and the following protective clothing worn during all work on the device:

- Safety glasses with side protection
- Protective gloves in accordance with the prevailing ambient conditions and used solvents (e.g. heat, cold, protection against chemicals)
- Lab coat
- Personalised protective safety equipment which is specified in the particular laboratory.

2.4.1 General requirements

- The user is trained for handling different solvents.
- Note recommended solvents and concentrations in these instructions in order to avoid personal injury or damage to the device. For example, certain chemicals may cause PEEK capillaries to swell or burst.
- Note that organic solvents are toxic above a certain concentration. For handling hazardous solvents see the following section.
- Mobile phases and samples may contain volatile or combustible solvents. Avoid the accumulation of these substances. Ensure good ventilation of the installation site. Avoid open flames and sparks. Do not operate the instrument in the presence of flammable gases or vapors.
- Only use solvents which do not self-ignite under given conditions. This applies especially to the use of a thermostat where liquids could get onto hot surfaces in the interior.
- Degas solvents before use and observe their purity.

2.4.2 Contamination by health-threatening solvents

- Contamination with toxic, infectious or radioactive substances poses a hazard for all persons involved during operation, repair, sale, and disposal of a device.
- All contaminated devices must be properly decontaminated by a specialist company or the operating company before they can be recommissioned, repaired, sold, or disposed .

2.4.3 Avoiding leakage

Risk of electrical shock or short circuit if solvents or other liquids leak into the interior of the device. You can avoid a leakage through the following measures:

- Tightness: Visually check the device or system regularly for leaks.
- Solvent tray: The use of a solvent tray prevents liquids get from the bottles into the inside of the device.
- Eluent lines: Install capillaries and hoses in such a way that, in case of a leak, liquids cannot get into the interior of the devices underneath.
- In case of leakage: Switch off the system. Only take the device into operation if the cause of the leak has been resolved.

2.5 Specific environments

2.5.1 Earthquake-endangered areas

In earthquake-endangered areas, do not stack more than 3 devices on top of each other. Otherwise there is risk of injury due to falling devices or loose parts.

2.5.2 Explosive environment

Never use the system in potentially explosive atmospheres without appropriate protective equipment. For more information, contact the KNAUER Customer Support.

2.5.3 Cooling room

You may operate the device in a cooling room. To prevent condensation, note the following instructions:

- Allow the device to acclimatize for min. 3 hours before taking it into operation.
- After taking into operation, the device should stay switched on.
- Avoid temperature fluctuations.

2.5.4 Wet room

The device must not be operated in wet rooms.

2.6 Maintenance, care and repair

- Avoiding electric shock: Before performing any maintenance and service work, disconnect the device from the power supply.
- Tools: Use only tools recommended or prescribed by the manufacturer.
- Spare parts and accessories: Only use original parts and accessories made by KNAUER or a company authorized by KNAUER.
- PEEK fittings: Use PEEK fittings only for a single port or brand-new PEEK fittings in order to avoid dead volume or not exactly fitting connections.
- Column care: Follow KNAUER or other manufacturer's instructions on caring for the columns (see www.knauer.net/columncare)
- Used capillaries: Do not use any used capillaries elsewhere in the system in order to avoid dead volumes, not exactly fitting connections and spreading contamination.
- Safety features: The device may only be opened by the KNAUER Customer Support of KNAUER or any company authorized by KNAUER (see "1.4.1 Liability limitation", p. 2).
- For more information visit the KNAUER website: www.knauer.net/hplc-troubleshooting

2.7 Service request form and decontamination report

Devices which are shipped without the completed document "Service request form and decontamination report" will not be repaired. If you would like to return a device to KNAUER, make sure to enclose the completed document: www.knauer.net/servicerequest

3. Product information

The KNAUER SmartMix mixers are solvent mixers that are suitable for high-performance liquid chromatography (HPLC). The liquids are mixed statically in the SmartMix mixer.

Fig. 1: SmartMix mixer

3.1 Overview SmartMix mixer

Legend:

① PEEK blind plug (red or black)
② Mixer lid
③ Inlet to the pump
④ Mixer housing
⑤ Mounting boreholes
⑥ Cartridge inside the SmartMix
⑦ Outlet to the column

Front view

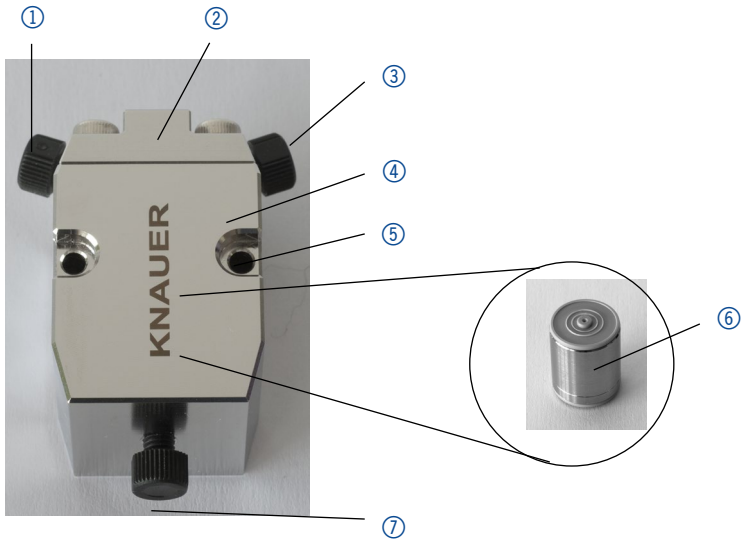


Fig. 2: SmartMix mixer with cartridge

The SmartMix mixer consists of three subassemblies: Mixer lid ②, mixer housing ④, cartridge ⑥.

To differentiate the installed cartridges, the SmartMix mixer is supplied with different PEEK blind plugs:

- The analytical version with the analytical cartridge has a black blind plug.
- The micro version with the micro cartridge has a red blind plug.

3.2 Features

The direction of flow has no influence in SmartMix technology. For this reason, the SmartMix mixer can be used for low-pressure gradient systems (LPG) as well as for high-pressure gradient systems (HPG).

The SmartMix mixer is specially designed for the application of the following mixtures of solvents:

- Water-acetonitrile mixture
- Water-methanol mixture
- Buffer-salt solution mixture

The SmartMix mixer is available in two versions:

- Analytical version
- Micro version

Both versions can be used for pressures up to 1000 bar. Wetted materials are stainless steel, PEEK and Teflon.

To adapt the mixture volume, two versions of cartridges can be inserted in the SmartMix mixer:

- Analytical cartridge (350 µl mixture volume)
- Micro cartridge (100 µl mixture volume)

The dimensions of the cartridges are identical. This enables the switch from the analytical cartridge to the micro cartridge.

3.3 Scope of delivery

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

Note: Check whether the supplied devices and accessories are complete. If a part should be missing, inform the Technical Support of KNAUER.

3.3.1 SmartMix mixer

- SmartMix mixer
- Red or black PEEK blind plug
- Manual

3.3.2 Accessories and spare parts

- Analytical cartridge
- Micro cartridge
- Accessory kit SmartMix:
  - One filler cap made of stainless steel
  - Two Phillips-head screws
  - Two washers
- Spare filter kit:
  - Three filter inserts
  - PEEK sealing ring

3.4 Symbols and labels

Explanations of symbols and labels on the system:

Symbol	Explanation
	**For your own safet**y, read the operating instructions and **always** observe the warnings and safety information on the device and in the operating instructions!

4. Installation

4.1 Mounting the SmartMix onto the pump

NOTICE

Device defect

Leakage can cause damage to the device.

➔ Before startup, replace red or black PEEK blind plug in the LPG system by metal screw fitting (mounting kit F5351).

Tool Phillips screwdriver, PH1 × 80

Legend:

① Metal screw fitting as blind plug
② Assembly screws for SmartMix mixer
③ Capillary to pump
④ Inlet for piston back-flushing
⑤ Front panel
⑥ Pump head
⑦ Pressure sensor and venting valve
⑧ Mixing chamber
⑨ Capillary to tube

Exterior view

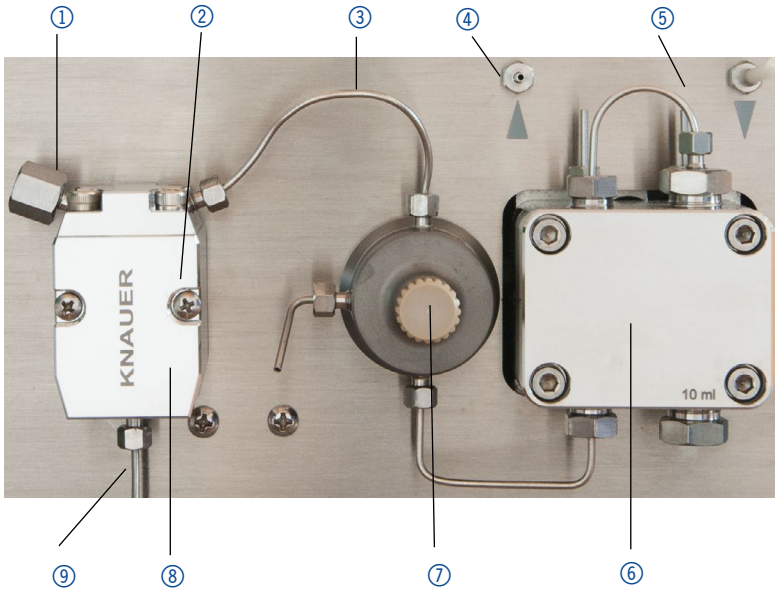


Fig. 3: Mounting SmartMix mixer on the pump

1. Mount the SmartMix mixer to the front panel ⑤ of the pump by two Phillips-head screws ②.
2. Tighten the screws with a Phillips screwdriver.

4.2 Installation in the LPG system

For use in a low-pressure gradient system, the SmartMix mixer is mounted according to figure 4.

Tool Open-end wrench, size 10

Legend:

① Metal screw fitting
② Inlet to the pump B
③ Mixer lid
④ Mixer housing
⑤ Outlet to the column

Schematic diagram

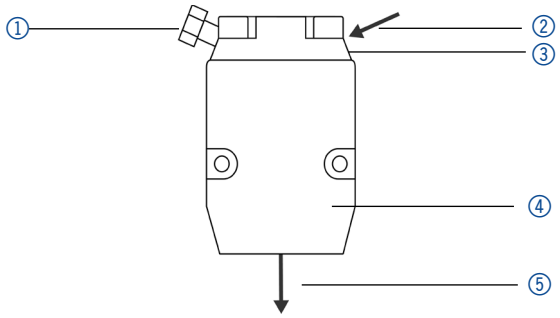


Fig. 4: Installation SmartMix mixer in the LPG system

1. Close the left connection in the LPG system with the metal screw fitting ①. Tighten the screw with the open-end wrench.
2. Connect the capillary leading to the pump by the right inlet to the pump ② on the mixer lid ③.
3. Connect the capillary leading to the column with the outlet to the column ⑤.

4.3 Installation in the HPG system

For use in a high-pressure gradient system, the SmartMix mixer is mounted according to figure 5.

Legend:

① Inlet to the pump A
② Inlet to the pump B
③ Mixer lid
④ Mixer housing
⑤ Outlet to the column

Schematic diagram

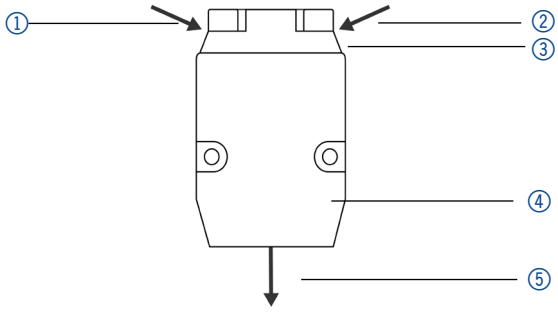


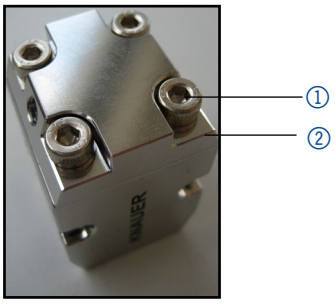
Fig. 5: Installation SmartMix mixer in the HPG system

1. Two pumps are used in the HPG system. Connect the SmartMix mixer to the bottom pump.
2. Connect the capillaries from pump A and pump B with the two inlets to the pumps ① and ② on the mixer lid ③.
3. Connect the capillary leading to the column with the outlet to the column ⑤.

5. Maintenance and care

5.1 Opening the SmartMix mixer

Tool Allen wrench, SW 3.0 × 150

	Steps	Figure
Opening the mixer lid of the SmartMix mixer	1. Screw out the four hexagon screws ① of the mixer lid ② with an Allen wrench. 2. Lift off the mixer lid.	**Exterior view**  **Fig. 6:** Mixer lid

5.2 Exchanging the filter system

NOTICE

Device defect

Leakage can cause damage to the device.

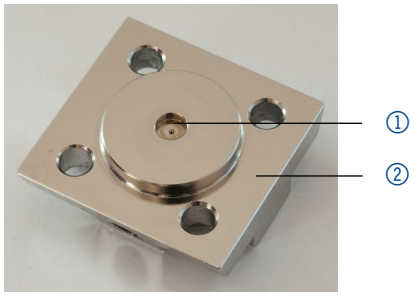
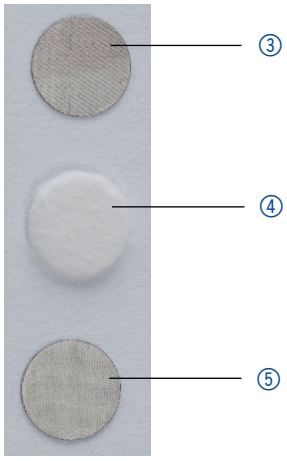
➔ Before startup, replace red or black PEEK blind plug in the LPG system by metal screw fitting (mounting kit F5351).

Functional principle Several filter inserts are inserted into the SmartMix mixer in a specific order. They can be renewed as needed.

Prerequisite
- The SmartMix mixer has been removed.
- The mixer lid of the SmartMix mixer is opened.

Tool
- Tweezers, pointed
- Allen wrench, SW 3.0 × 150

Replacing the filter system

Steps	Figure
1. Remove the filter system ① in the mixer lid ② with a pair of pointed tweezers.	**Internal view**  **Fig. 7:** Remove the filter system from the mixer lid
Note: Observe the sequence when inserting the new filter inserts! Otherwise, the filters will plug up.	
2. Insert the new filter system at position ① in the following order: – 1 unit filter sieves 7 µm ③ – 1 unit glass-fiber filter ④ – 1 unit filter sieves 3 µm ⑤	**Sequence filter inserts** from top to bottom  **Fig. 8:** Insert new filter system in the mixer lid
Note: Put on the mixer lid with the screw fittings of the capillaries ⑥ as shown in the picture.	
3. Put the mixer lid with the replaced filter system onto the mixer housing with the cartridge and the PEEK sealing ring. **4.** Screw tight the four hexagon screws on the mixer lid with the Allen wrench.	

5.3 Replacing the cartridge

The design of the cartridges is different, depending on the version of the SmartMix mixer (see fig. 9).

- The micro cartridge ① has a circumferential groove.
- The analytical cartridge has no groove ②.

Legend:

① Micro cartridge with circumferential groove

② Analytical cartridge

View of the filter cartridges

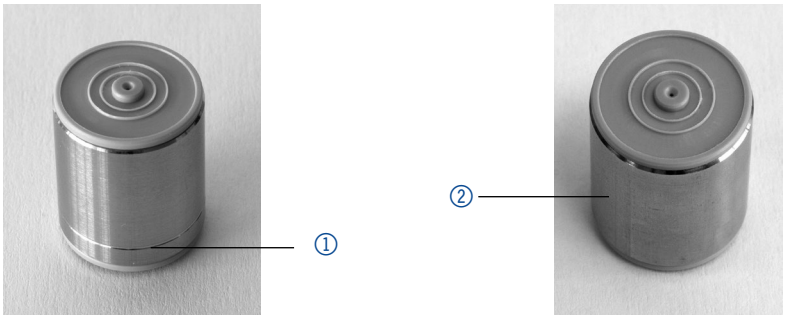


Fig. 9: Cartridges for different mixture volume

Prerequisite

- The capillaries were loosened.
- The SmartMix mixer has been removed.

Tool Allen wrench, SW 3.0 × 150

Note: Do not use any metal tools to take the cartridge out of the housing. Otherwise, the seals of the cartridge could be damaged.

Procedure

1. Loosen and lift off the mixer lid.
2. Remove the PEEK sealing ring which is lying on the cartridge.
3. Check the PEEK sealing ring for possible damage and replace the sealing ring if necessary (filter insert kit A0164-1).
4. Remove the cartridge from the housing.
5. Insert the new cartridge. The insertion direction is irrelevant. Do not remove the filters in the lid.
6. Place the PEEK sealing ring back on the cartridge.
7. Put the mixer lid onto the mixer housing with the cartridge and the PEEK sealing ring.

Note: Put on the mixer lid with the screw fittings of the capillaries ① as shown in the picture.

8. Screw tight the four hexagon screws on the mixer lid with an Allen wrench.

6. Troubleshooting

Issue	Possible cause	Solution
Filter clogged	The pump was switched off automatically, because Pmax was exceeded.	Exchange the filter system
	Pressure increase	Replace cartridge
	Filter system inserted wrong	Exchange the filter system
Unsteady baseline	Cartridge faulty	Replace cartridge
	Filter clogged	Exchange the filter system

7. Transport and storage

At the factory, the HPLC devices are carefully and safely packed for the transport into special shipping boxes.

7.1 Packing the device

Original packaging: Ideally you should use the original transport packaging.

7.2 Transporting the device

Documents: If you want to return your device to KNAUER for repairs, enclose the „Service request form and decontamination report"which can be downloaded from our website.

7.3 Storing the device

- Flushing solution: Pay attention that all hoses and capillaries have been emptied or filled with flushing solution (e. g. isopropanol) before storage. To prevent algae formation, do not use pure water.
- Seals: Close all inputs and outputs with cap fittings.

8. Disposal

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

8.1 AVV-Marking Germany

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

8.2 WEEE registration number

KNAUER as a company is registered by the WEEE number DE 34642789 in the German "Elektroaltgeräteregister" (EAR). The number classifies to category 8 and 9, which, among others, comprises 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.

8.3 Eluents and other operating materials

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

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.

9. Technical data

SmartMix mixer Flow rate

Gradient system	LPG	HPG
Analytical version	0.5 - 2.0 ml/min	< 5 ml/min
Micro version	0.1 - 0.5 ml/min	< 1.5 ml/min

Cartridge

Analytical cartridge	350 µl mixture volume
Micro cartridge	100 µl mixture volume

10. Repeat orders

Name	Order number
SmartMix mixer 350	A5351
SmartMix mixer 100	A5350
Analytical cartridge (350 µl)	A5356
Micro cartridge (100 µl)	A5355
Accessory kit SmartMix: 1 filler cap made of stainless steel 2 Phillips-head screws 2 washers	F5351
SmartMix filter insert kit: 5 filter sieves 7 µm 5 glass-fiber filters 5 filter sieves 3 µm 2 sealing rings for the cartridge	A0164-1

Science Together

KNAUER

Latest KNAUER instructions online:
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