

# BlueShadow

## ► Analytical 2-Channel Degasser 20DG User Manual

V7632A



# 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!

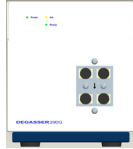
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# Overview

**HPLC** High pressure liquid chromatography (HPLC) is a method for separating substance mixtures, determining substances, and measuring their concentration.

**BlueShadow  
Degasser 20DG**



Dissolved gases in the solvent can cause bubbles in pumps and the detector. Good chromatographic separation therefore requires degassing of the solvent. The analytical 2-channel Degasser 20DG is equipped with two degassing chambers and can thus degas two solvents simultaneously.

## Degassing Principle

As the solvent flows through the short Teflon AF<sup>®</sup> tubes, the dissolved gases are removed from the solvent by means of a vacuum on the other side of the membrane. An integrated vacuum pump maintains a constant vacuum.

The special pump design makes it possible to let a small blast of air flow around the pump head, to remove solvent fumes which could escape from the vacuum chamber.

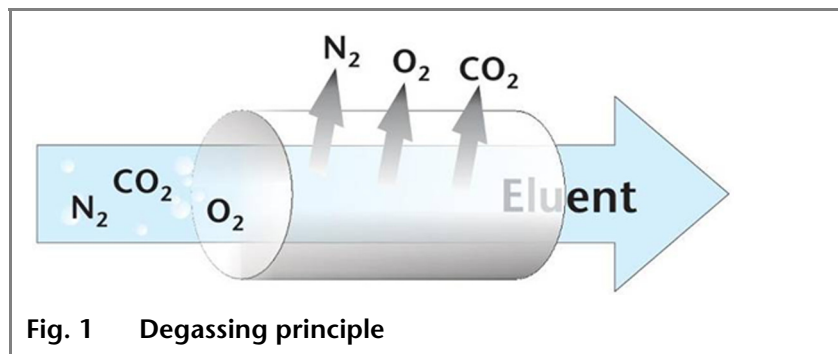


Fig. 1 Degassing principle

## Degassing Principle of the Teflon AF<sup>®</sup> Membrane

- Structural properties of the Teflon AF membrane accelerate the degassing process.
- Due to the molecular structure of the Teflon AF membrane, only a very small surface is required for degassing the solvent. Thus the risk of carryover during a solvent change is reduced.
- The solvophobic and hydrophobic properties of Teflon AF reduces the risk of contamination between the individual solvent chambers.

**Room ventilation,  
A/C system,  
sunlight**

Always use the device in rooms that are well-ventilated, and are preferably equipped with an air-conditioning system. When setting up the device at the installation location, make sure that it is protected against direct sunlight.

- Checking 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.

## Laboratory Use

- Chemical analyses
- Biochemical analyses
- Chiral analyses
- Food analyses
- Pharmaceutical analyses
- Environmental analyses

## Where is it prohibited to use the device or system?



**DANGER!** Explosion hazard, if the device is used in potentially explosive atmospheres without appropriate protective equipment! Let specialists carry out protective measures.

# Features

- Reliable and convenient degassing of two eluents at the same time.
- Teflon AF<sup>®</sup> allows higher gas diffusion rates
- Continuous vacuum pump operation for low hysteresis and high baseline stability
- Chamber volumes lower than 0.5 ml, thus eluent changes are faster
- Very good physical and chemical stability

# Safety

## Laboratory Regulations

### Adherence to laboratory regulations

- Observe national and international regulations pertaining to laboratory work!
  - Good Laboratory Practice (GLP) of the American Food & Drug Administration
  - For development of methods and validation of devices: Protocol for the Adoption of Analytical Methods in the Clinical Chemistry Laboratory, American Journal of Medical Technology, 44, 1, pages 30–37 (1978)
  - Accident prevention regulations published by the accident insurance companies for laboratory work

## Solvents

**Note** Even small quantities of other substances, such as additives, modifiers, or salts can influence the durability of the materials. The list of selected solvents was compiled based on research in the pertinent literature and is only a recommendation by the manufacturer. In the event of doubt, contact the KNAUER technical support.

### Suitable solvents

Solvents suitable for use in HPLC:

- Acetone
- Acetonitrile
- Benzene
- Chloroform
- Acetic acid (10–50%), at 25 °C (77 °F)
- Ethyl acetate
- Ethanol
- Hexane/Heptane
- Isopropanol
- Methanol
- Phosphoric acid
- Toluene
- Water

### Solvent tray

To avoid damage from leaks, always place solvent bottles in a solvent tray on the device.

### Toxicity

Organic solvents 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!

Connect the silicone tube (inner diameter: 3.0 mm) at the olive-type tube fitting of the exhaust, and lead the gases or liquids into a suitable collecting container or to a fume hood.

**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!

**Self-ignition point** Only use solvents that have a self-ignition point higher than 150 °C under normal ambient conditions!

**Unsuitable solvents** The following solvents can attack the components of the pump and are therefore not suitable:

- Mineral and organic acids (except in buffer solutions)
- Bases (except in buffer solutions)
- Liquids containing particles
- Perfluorinated hydrocarbons

**Suitable to only a limited extent** The following solvents are suitable to only a limited extent for use in the pump:

- Methylene chloride
- Tetrahydrofuran (THF)
- Dimethyl sulfoxide (DMSO)
- Volatile solvents
- Fluorinated hydrocarbons

**Leaks and clogged tubes** • Regularly check for leaks or clogged tubes.

## Protective Measures

1. Only perform maintenance tasks described in this manual.
2. All other maintenance tasks are to be performed exclusively by KNAUER or a company authorized by KNAUER.

Without exception, the following applies to all maintenance tasks that can be performed by the user:

1. Switch off the device and pull the power plug!
2. Never open a device! High voltage poses a life-threatening risk.

## Power Supply and Mains Connection

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

**Note** To separate the degasser from the mains, remove the switched-mode power supply from the rear of the device.



## Target Group

### To what should the user pay particular attention?

To make your HPLC separations as efficient as possible, pay close attention to the following:

#### Checking for clogged tubes and for leaks

- Regularly check for leaks or clogged tubes.

#### Using filtered solvents

- Use ultra-pure, filtered solvents – *gradient grade* – for HPLC.

**The device open may only be opened by the technical service department.**





Only allow the technical support of KNAUER or a company authorized by KNAUER to open the devices for maintenance and repair work.

### What expertise should users have to safely operate an HPLC device or device system?

- Completed qualification as chemical laboratory technician or comparable vocational training
- Fundamental knowledge of liquid chromatography
- Participation in an installation of the system performed by the manufacturer or a company authorized by the manufacturer, or suitable training on the system and chromatography software
- Basic knowledge of Microsoft Windows®
- Knowledge regarding substances that are suitable only to a limited extent for use in liquid chromatography

# Symbols and Labels

Explanations of symbols and labels on the degasserl

Symbol	Explanation
	Hazard symbol indicating microelectronic devices that can be damaged by electrostatic discharge when touched.
	CE (Conformité Européene) mark for equipment that complies with the pertinent EU directives and comes with a declaration of conformity from the manufacturer.
	Marking for devices that comply with the canadian requirements for laboratory equipment: CAN/CSA-C22.2 No. 61010-1, second edition, including Amendment 1, or a later version.
	Disconnect from power source before opening unit.

# Packaging and Transport

At the factory, the device was carefully packed for safe transport.

## Checking for signs of damage during transport

Check the device for signs of damage that occurred during transport. If the shipment is incomplete or damaged, inform KNAUER within three workdays. Also inform the freight carrier about transport damage.

## Fastening Material and Shipping Boxes

The device is held in place and protected by foam inserts at the top and bottom. Please keep the transport box and the foam inserts.

## Removing the packaging material

- Remove the foam insert on the top of the device.

## Remove device from packaging

- Grip the device at its sides, near the front panel, and lift it out of the packaging.

## Scope of Delivery

- 2-channel BlueShadow Online Degasser 20DG
- Accessories**
  - User manual DE/EN
  - Power supply 24 V/60 W
  - Accessory kit
- Use original parts and original accessories**
  - Only use original parts and accessories made by KNAUER or a company authorized by KNAUER.

## Checking the Scope of Delivery

1. Check whether the device and accessories are complete.
  2. If a part is missing, inform the technical support of KNAUER.
- Technical support hotline of KNAUER:

**European hotline** Languages: German and English  
Available by telephone: 8 am to 5 pm (CET)  
Phone:+49-(0)30-809727-0  
Fax:+49-(0)30-8015010

**E-mail contact:** info@knauer.net

## Space Requirements

- Side clearance to other devices:
  - If there is a device on one side, min. clearance of 5 cm.
  - If there are devices on both sides, min. clearance of 10 cm.
- At least 30 cm gap to the rear of the device.

## Installation Site

- Ambient conditions of the installation site**
- Air humidity: Below 90% (non-condensing)
  - Temperature range: 4–40 °C; 39.2–104 °F
  - Sunlight: When setting up the device at the installation location, make sure that it is protected against direct sunlight.

# Installation

## Front View of the Device

### Connections on the front

On the front of the device, there are 2 analytical degasser chambers with one inlet and outlet each. The direction of flow does not influence the function. Unused channels have to be closed with filler caps to prevent contamination of the disconnected chambers.

### LEDs

Three LEDs on the front provide information on the following functions:

- POWER
  - Shows that the power supply of the degasser is active and the device is on.
- INIT
  - Shows that the vacuum has not yet reached the work range. Usually, the INIT LED lights up when the device is switched on and goes out as soon as the vacuum drops below 130 mbar.
- READY
  - Shows that the vacuum is within the work range. Usually this indicator lights up when the vacuum has been generated and stays on as long as the degasser is in use.

### Legend

- ① LEDs
- ② Inlet, chamber 1
- ③ Outlet, chamber 1
- ④ Inlet, chamber 2
- ⑤ Outlet, chamber 2

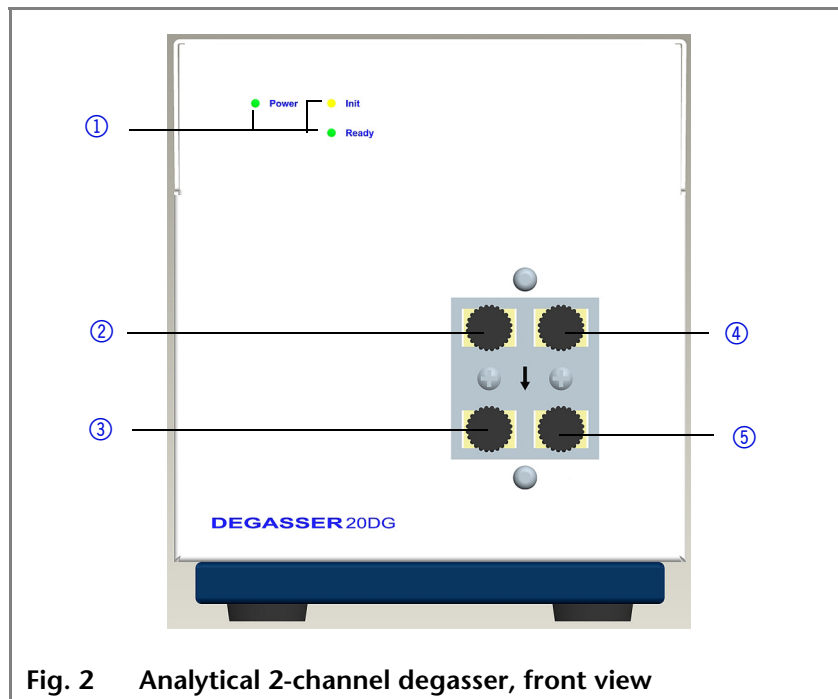


Fig. 2 Analytical 2-channel degasser, front view

## Rear View of the Device

On the rear of the degasser, there is a gas outlet (exhaust). It is used to pump out air and, in some cases, solvent fumes. If nec-

essary, it can be connected with a fume hood or other extraction device.

### Legend

- ① CE mark
- ② Serial number
- ③ Warning 1
- ④ Warning 2
- ⑤ Mains connection
- ⑥ Gas outlet

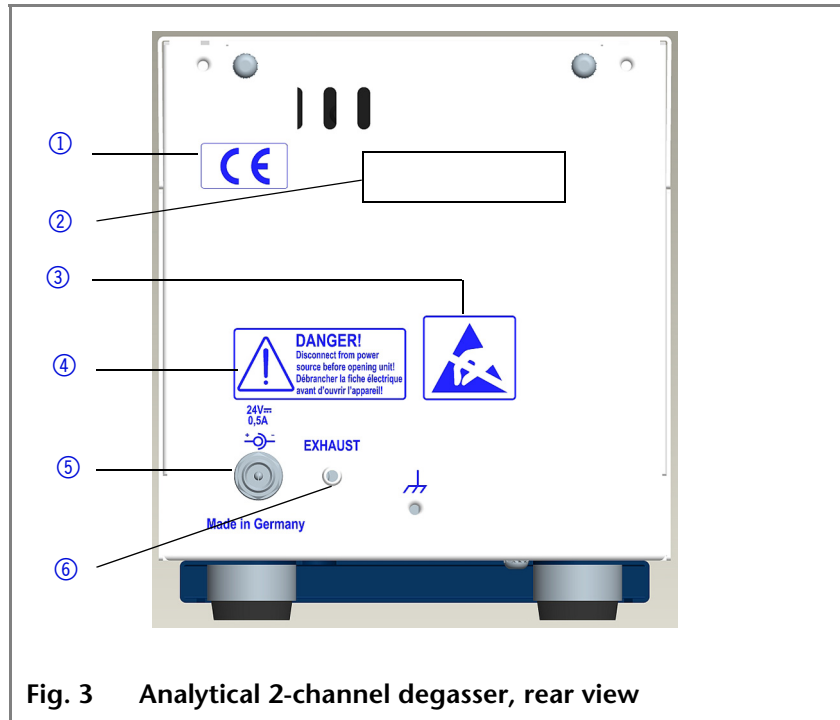


Fig. 3 Analytical 2-channel degasser, rear view

## Screw Fitting of the Solvent Tube

- Make sure that the tapered side of the seal ring ① faces the screw fitting ② of the solvent tube.

### Legend

- ① Seal ring
- ② Screw fitting

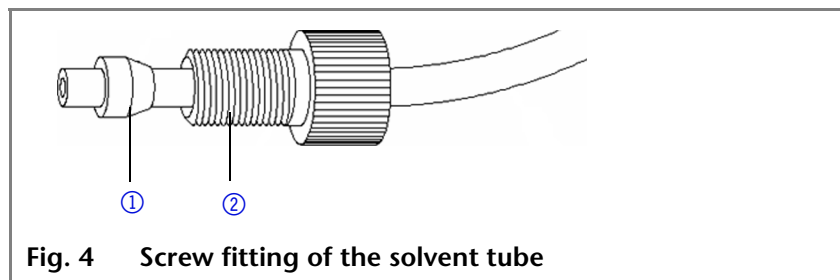


Fig. 4 Screw fitting of the solvent tube

## Solvent Tube Connection

Suitable solvent tubes are included in the device accessories.

- Make sure that the tube has a straight ending.
- Only tighten screw fittings by hand.
- Use the supplied filler caps to seal off all unused inlets and outlets.

## Connecting the Degasser with a Pump

Each degassing chamber features an inlet and an outlet.

- Connect the chambers vertically from top to bottom.
- Remove the filler caps from the degassing chamber inlets and outlets that are to be used, and keep the filler caps.
- Use filler caps to close unused inlets and outlets.
- The inlets of the degasser chambers are connected to the solvent containers by means of Teflon tubes.
- At the outlets of the degassing chambers, Teflon tubes are also to be connected, using screw fittings and seal rings. These tubes are then connected to the respective pump.

# Startup

## Switching on the Degasser

### Requirements

- All lines have been connected correctly.
- Unused degasser chambers have been sealed off with filler caps.

### Procedure

1. Connect the power supply unit of the device to the mains. During the start procedure, the INIT LED lights up for approx. 30 seconds. After the specified vacuum value has been reached, the INIT LED goes out and the READY LED lights up. The device is now ready for operation.
2. Switch on the HPLC pump.
3. To perform a solvent change, first flush with a liquid in which both solvents are soluble. We recommend 2-propanol, for example. Due to the low chamber volume, only small amounts of the solvents are needed for flushing.
4. When you stop the HPLC pump, also switch off the degasser.

## Flushing the Degasser

Flush the degasser and the connecting tubes with the appropriate solvent prior to use.

### Note

Prior to changing the solvent in the degasser, flush with a liquid in which both solvents are soluble.

## Flushing the Degasser with a Syringe

Usually, 2 ml solvent is adequate for flushing.

1. Connect the solvent tube to the outlet of the degassing chamber.
2. Connect the syringe to the solvent tube.
3. With the syringe, extract solvent through the degasser until there are no air bubbles in the solution any more.
4. Repeat step 1–4 for the degassing chambers that are to be used.

## Flushing the Degasser with the Pump



**CAUTION!** Very high pressures damage the degasser membrane. The membrane can withstand a maximum pressure of 7 bar. Do not connect the degasser to the pump outlet.

1. Configure the pump: Flow rate 2 ml/min.
2. Start the pump and flush for 1 to 2 minutes.



## Leak Test

The vacuum is continuously checked by means of a built-in microprocessor and the pump output is adjusted. This can be used to detect leaks.

### Procedure in the event of a detected leak

- If a leak is detected, the microprocessor of the degasser automatically increases the pump speed to maintain the vacuum.
- If it is not possible to achieve the required vacuum within 30 minutes by means of the increased pump output, the INIT LED lights up at the degasser to indicate that there is possibly a leak in the system.
- The degasser is automatically switched off and goes into "safety mode".

## Switching Off the Degasser

Here a differentiation is made between short-term and long-term switch-off.

### Short-Term Switch-Off



**CAUTION! Damage to the degasser caused by buffer solutions.**

**Do not use buffer solutions when using a degasser.**

### Procedure

1. Remove critical solvent from the degassing chambers and other system components by flushing for example with isopropanol (2-propanol).
2. Subsequently flush with water.
3. Connect the capillary of the pump outlet directly with a waste container.
4. If the degasser is switched off for several days (e.g. over the weekend), flush the device with methanol water (60:40) prior to ending operation.
5. Switch off the degasser.

### Note

Damage to the degasser that results from using buffer containing solvents are not covered by the warranty.

## Long-Term Switch-Off

- Procedure**
1. Remove critical solvent from the degassing chambers and other system components by flushing with a suitable solvent.
  2. Connect the capillary of the pump outlet directly with a waste container.
  3. First flush the degasser with water and subsequently with isopropanol.
  4. Switch off the degasser and remove the connection tubes to the degasser.
  5. The degasser chambers can be dried by means of laboratory gas.
  6. Seal all inlets and outlets of the degasser with filler caps and subsequently store the device at a safe and dry location.
  7. Prior to reusing the degasser, flush the device with an appropriate solvent (e.g. isopropanol) for a short time.
  8. When the column is reinstalled, flush the degasser with the appropriate mobile phase prior to operation.

# Maintenance and Care

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

## Contact with the Technical Support

### Contact data for the technical support

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

Technical support hotline:

### European hotline

Languages: German and English  
Available by telephone: 8 am to 5 pm (CET)  
Phone:+49-(0)30-809727-0  
Fax:+49-(0)30-8015010

### E-mail contact:

info@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 or removing housing parts.

## What is to be done if the degasser leaks?

If the degasser leaks, solvent can reach the motor and there reach the degasser exhaust and flow out. In this case, the automatic pump control will switch the device off.

- Inform the Technical Support of the manufacturer.

## Tightening the Screw Fittings

1. If there is a leak at the screw fitting of the solvent tube, carefully tighten the screw fitting.
2. If it still leaks, loosen and check the screw fitting.
3. If no damage or deformation is visible at the seal ring and at the screw fitting, repeat step 1.
4. If it still leaks, replace the screw fitting and seal ring.

## Cleaning and Caring for the Device



**CAUTION!** 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.

## Preventative Measures

To ensure that the degasser can constantly run at maximum capacity, pay attention to the following:

- Only use ultrapure solvent as mobile phase. If water is used as solvent, it also has to fulfill this standard, i.e. be filtered and deionized.
- Filter all solvents to prevent clogging.
- Use only ultrapure gas to dry the degasser.
- Properly flush all capillaries and tubes before installing them.
- Observe the information on switching off the degasser.

# Disposal

Drop-off old devices at the certified waste facilities, where they will be disposed of properly.

**AVV marking** 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 "ElektroAltgeräteRegister" (EAR). It belongs to category 8, under which fall all medical devices and laboratory equipment.

Within the meaning of the WEEE directive, all distributors and importers are responsible for the disposal of old devices. End-users can send their old devices, which must have been manufactured by KNAUER, back to the distributor, the importer, or the company free of charge, but would be charged for their disposal.

# Decontamination

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



**DANGER! Danger if getting in contact with toxic, infectious or radio-active substances. Before disposing off or sending away contaminated devices, commission an expert with the decontamination.**

All contaminated devices have to be decontaminated properly by a specialized company or the operating company before these may be recommissioned, repaired, sold or disposed of.

All materials or fluids used for decontamination must be collected separately and disposed of properly.

# Storage

## Ambient Storage Conditions for the System

Temperature range: 4–40 °C; 39.2–104 °F

Air humidity: Below 90% humidity (non-condensing)

# Troubleshooting

First measures for troubleshooting:

- Check all screw fittings
- Check whether air has gotten into the supply lines
- Check device for leaks

Further measures:

- Check errors against error list
- Contact the Technical Support hotline of the manufacturer

## Error List and Solutions

Problem	Cause	Solution
The device is on, but all 3 LEDs are off and the device is not energized.	<ul style="list-style-type: none"> <li>▪ Fuse blown</li> <li>▪ Defective power supply</li> </ul>	<ul style="list-style-type: none"> <li>▪ Contact the service department.</li> </ul>
The INIT LED is lit constantly and the pump is audibly running at high speed	<ul style="list-style-type: none"> <li>▪ Pump is busy with the starting process or the degassing capacity has to be increased.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Normal procedure. If this process takes a long time, it could be an indication that there is an error in the system.</li> </ul>
INIT LED flashes at 1s intervals and the vacuum pump is running.	<ul style="list-style-type: none"> <li>▪ Possibly the microprocessor or monitoring system has a malfunction.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Contact the service department.</li> </ul>
Is it possible to check whether the degasser is working properly when the POWER and READY LEDs are lit, but the pump is not audibly running?	<ul style="list-style-type: none"> <li>▪ At low rotational speeds, the pump can hardly be heard, although the vacuum is good and the degassing process is taking place.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Compare the baseline of non-degassed methanol at 251 nm with the baseline of degassed methanol. If the degasser is working properly, the baseline of the non-degassed methanol should have significantly higher noise.</li> </ul>
Air bubbles occur in the solvent tubes of the degasser outlet.	<ul style="list-style-type: none"> <li>▪ Loose or damaged screw fittings</li> </ul>	<ul style="list-style-type: none"> <li>▪ Check the inlet and outlet fittings. Replace old fittings, if necessary.</li> </ul>
No solvent flow	<ul style="list-style-type: none"> <li>▪ Air in the pump head</li> </ul>	<ul style="list-style-type: none"> <li>▪ Flush the pump head.</li> </ul>
	<ul style="list-style-type: none"> <li>▪ If buffer solution is left in the degasser for an extended period, it can cause clogging in the degasser.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Use another degasser chamber. Carefully let water flow into the clogged degasser chamber to dissolve the buffer. If this does not help, contact the service department.</li> </ul>

# Technical Data

## Ambient conditions

Temperature range	4–40 °C; 39.2–104 °F
Air humidity	Below 90% humidity (non-condensing)

## BlueShadow Degasser 20DG



Dimensions	85 x 165 x 315 mm
Weight (kg)	2.3
Power supply	85-265 V, 50–60 Hz, 20 W
Channels	2
Degasser function	Gas permeation through a fluoropolymer membrane
Inner diameter of the Teflon AF <sup>®</sup> capillaries	1.14 mm
Maximum flow rate	10.0 ml/min
Pressure drop	1.37 mm (Hg/ml/min)
Max. pressure resistance	7 bar
Dead volume	approx. 285 µl per channel
Wetted materials	PEEK, glass-filled PTFE, Teflon AF <sup>®</sup>



# Legal Information

## Warranty Conditions

The manufacturer's warranty for the device is valid for 12 months after the date of dispatch. All warranty claims shall expire in the event that any unauthorized changes are made to the device.

During the warranty period, any components with material or design related defects will be replaced or repaired by the manufacturer free of charge.

This warranty excludes the following:

1. Accidental or willful damage
2. Damage or errors caused by third parties that are not contractually related to the manufacturer at the time the damage occurs
3. Wear parts, fuses, glass parts, columns, light sources, cuvettes and other optical components
4. Damage caused by negligence or improper operation of the device and damage caused by clogged capillaries
5. Packaging and transport damage

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

Wissenschaftliche Gerätebau  
Dr. Ing. Herbert Knauer GmbH  
Hegauer Weg 38  
14163 Berlin, Germany  
Phone: +49 30 809727-0  
Fax: +49 30 8015010  
E-Mail: [info@knauer.net](mailto:info@knauer.net)  
Internet: [www.knauer.net](http://www.knauer.net)

## Transportation Damages

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

# Abbreviations and Terminology

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

Terminology	Explanations
GLP	Good Laboratory Practice – quality assurance for laboratories.
Gradient	Time-dependent composition of solvent (mobile phase) on low-pressure or high-pressure side of the system.
HPG	High Pressure Gradient. Operating mode of an HPLC system. The solvent is mixed on the high pressure side of the pump.
HPLC	High Pressure Liquid Chromatography.
Solvent	Mobile phase (eluent) or carrier for liquid chromatography.
LPG	Low Pressure Gradient. Operating mode of an HPLC system. The solvent is mixed on the low pressure side of the pump.

# Declaration of Conformity

**Manufacturer name  
and address**    Wissenschaftliche Gertebau  
Dr. Ing. Herbert KNAUER GmbH  
Hegauer Weg 38  
14163 Berlin, Germany

**BlueShadow  
Degasser 20DG**    Order number C55337.0  
complies with the following requirements and product  
specifications:

- DIRECTIVE 2006/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast)
- DIN EN 60799 (June 1999) Electrical accessories - Cord sets and interconnection cord sets
- IEC 61010-1 (2010 + Corrigendum: 2011) Safety requirements for electrical equipment for measurement, control and laboratory use
  - Low voltage directive (2006/95/EC)
- EN 61000-3-2 (2005 + A1:2008 + A2:2009) Electromagnetic compatibility (EMC) Part 3-2
  - EMC standard (2004/108/EC)
- IEC 61326-1 (2006) Electrical equipment for measurement, control and laboratory use – EMC requirements
  - EN 61326-1 Corrigendum 2 (2011)
- Directives for an environmentally sound use of electrical and electronic equipment
  - RoHS directives 2002/95/EC (2003) and 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment
  - WEEE directive 2002/96/EC (2003) and 2012/19/EU on waste electrical and electronic equipment

Berlin, 2013-08-29



Dr. Alexander Bünz (Managing Director)

The mark of conformity has been applied to the rear panel of the device.



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