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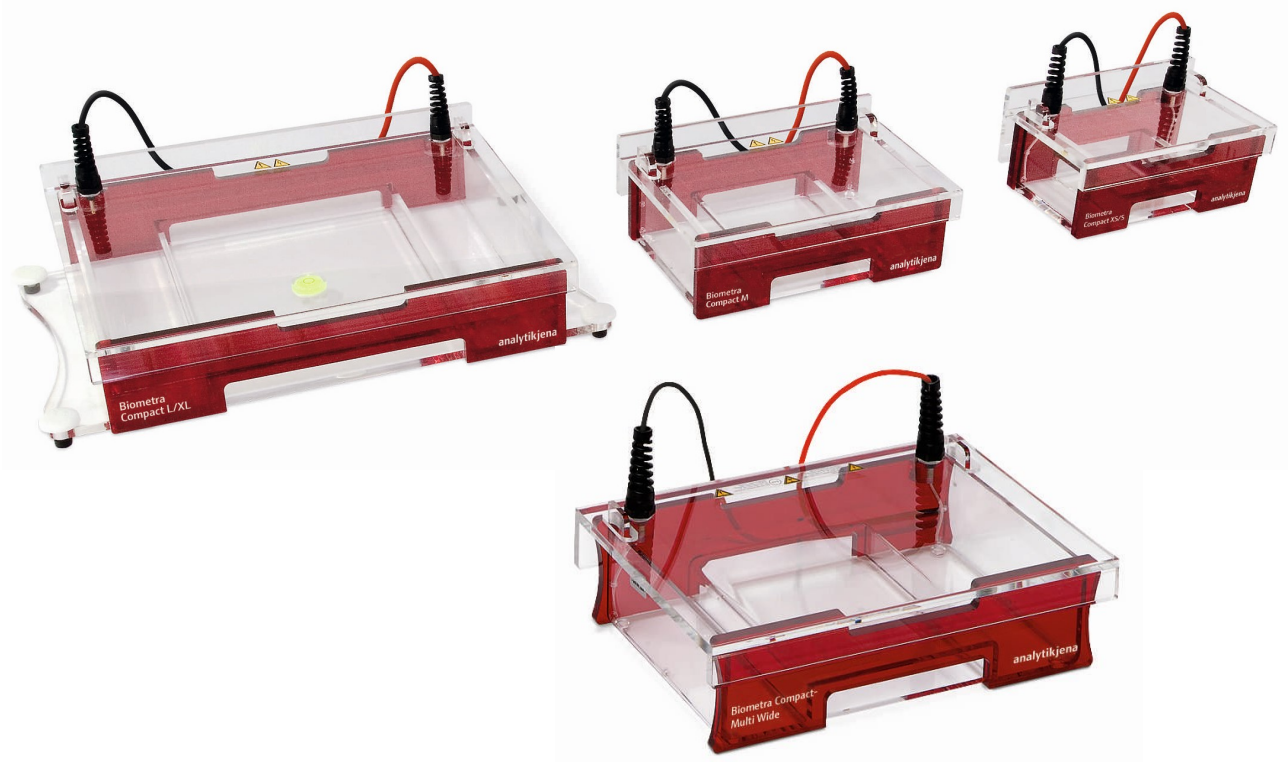
Operating Manual

Biometra Compact-Family
Agarose gel electrophoresis apparatus



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For a proper and safe use of this product follow the instructions. Keep the operating manual for future reference.

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1 Notes on this operating manual

Content

This user manual describes the following device models:

- Biometra Compact XS
- Biometra Compact S
- Biometra Compact M
- Biometra Compact L
- Biometra Compact XL
- Biometra Compact Multi-Wide

In this manual, these models are collectively referred to as the **device**. Any differences between the models are explained in the relevant section.

The device is intended to be operated by qualified specialist personnel under observance of the operating manual.

The operating manual provides information about the design and operation of the device and provides operating personnel with the necessary know-how for safe handling of the device and its components. Furthermore, the operating manual includes information on the maintenance and servicing of the device as well as information on potential causes of malfunctions and their correction.

Conventions

Instructions for actions occurring in chronological order are numbered and combined into action units.

Warnings are indicated by a warning triangle and a signal word. The type, source and consequences of the hazard are stated together with notes on preventing the hazard.

Elements of the control and analysis program are indicated as follows:

- Program terms are in bold (e.g., the **System** menu).
- Menu items are separated by vertical lines (e.g., **System** | **Device**).

Symbols and signal words used in this manual

The user manual uses the following symbols and signal words to indicate hazards or instructions. These warnings are always placed before an action.

WARNING

Indicates a potentially hazardous situation which can cause death or very serious (possibly permanent) injury.

CAUTION

Indicates a potentially hazardous situation which can cause slight or minor injuries.

NOTICE

Provides information on potential material or environmental damage.

2 Intended use

The electrophoresis devices of the Biometra Compact family are used for the separation of nucleic acids using immersed agarose gels.

The devices are made of robust acrylic glass.

The Biometra Compact XS, S, M, L and XL models are supplied with a Bigfoot safety lid that can be placed upright on a stand after removal from the device.

The electrophoresis chambers are supplied complete with a gel tray and 2 to 4 combs depending on the model. The Compact L and Compact XL models for large gels have leveling feet and a spirit level for horizontal alignment.

To cast the gels, you can use one of the separately available gel casting systems for the Biometra Compact family. The gel casting systems can be ordered from Analytik Jena.

3 Safety

For your own safety and to ensure error-free and safe operation of the device, please read this chapter carefully before commissioning.

Follow all safety instructions described in this manual.

3.1 Safety labeling on the device

Warning and mandatory action labels have been attached to the device and must always be observed. Damaged or missing warning and mandatory action labels can cause incorrect actions leading to personal injury or material damage.

- Do not remove the warning and mandatory action signs.
- Replace damaged signs.

The following warning and mandatory action signs are used:

Warning/mandatory sign	Meaning
	General warning sign, observe operating manual!
	Fragile device parts!
	Risk of electric shock!
	Operate only with direct current.

3.2 Requirements for the operating personnel

The device must only be operated by qualified specialist personnel instructed in the use of the device. The operating personnel must meet the following requirements:

- Operate the device only after instruction and training.
- Know and avoid dangers when working with the device.
- Wear personal protective equipment such as protective gloves, lab coat and safety goggles.
- Training by Analytik Jena is recommended.

The operator of the device is responsible for compliance with safety and occupational health regulations. The operator must meet the following requirements:

- Provide information about national regulations on work safety and accident prevention and observe them during operation of the device.
- Instruct the operating personnel in the safe operation of the device. In doing so, also convey the contents of the manuals for the device system.

3.3 Safety instructions for transport and commissioning

Transport

There is a risk of injury when lifting and carrying, especially from unsecured parts.

- Empty the device and secure all loose parts, e.g. with adhesive tape. Close the lid.
- Only transport the device in its original packaging. Insert all transport locks.

Ambient conditions during commissioning

The device is dangerous if it is installed in an unsuitable environment.

- Place the device on a flat, dry surface.

Electrical conditions

The device may be dangerous if the conditions for the electrical connection are not met.

- Only devices that comply with protection class 2 are approved as power supply units for the electrophoresis systems. Please observe the specifications provided in the instruction manual for the power supply unit used.
- Check the electrical requirements of the device before connecting to a power supply unit.
- Only use the supplied cables to connect to a power supply unit.
- Observe the notes on electronics in the operating manual of the power supply unit.
- Disconnect the cable connection between the device and the power supply unit before storing them.

If liquid leaks from the device in the event of a defect while it is standing on a power supply unit, an electric shock may occur.

- Never place the device on top of a power supply unit.

3.4 Safety instructions for operation

Electrical hazard

Lethal voltages may occur in the device.

- Before each start-up, make sure that the device and its safety devices are in proper working condition.
- If there are malfunctions of electrical components, immediately switch off the power supply unit, disconnect it from the mains supply and disconnect the connection between the device and the power supply unit.
- Do not remove or bypass any protective devices such as the housing.
- Before opening the lid, switch off the power supply unit and disconnect the power connection to the device.
- Do not operate the device in extreme humidity (max. 80 % (≤ 31 °C), decreasing linearly up to 50 (at 40 °C)) or in locations where condensation occurs.

Hazard from substances

The device can be used to handle hazardous substances. The operator is responsible for the safe handling of these substances.

- If the device has been contaminated with hazardous substances, decontaminate it as described in the operating manual. Use other methods only after consultation with Analytik Jena.

3.5 Safety instructions for maintenance and cleaning

There is a risk of electric shock if contact is made with live components, which may lead to serious injury.

Unauthorized servicing can lead to maladjustment or damage of the device and its system components.

- Only carry out the maintenance actions listed in the operating manual.
- Before maintenance and cleaning, switch off the power supply unit and disconnect the power connection between the device and the power supply unit. Only work on a live device if this is expressly required by the operating manual.
- Use only original spare parts, wear parts and consumables. These have been tested and ensure safe operation.
- After maintenance, ensure that all safety devices are fully functional again.
- Rinse the device with water. Do not use alcohol, organic solvents, abrasive cleaners or bleach.

3.6 Behavior during emergencies

In an emergency such as a laboratory fire, live devices put rescue personnel at risk.

- If possible, switch off the device and its components at the power switch and disconnect the power cable from the mains socket.

4 Design and function

Components of the device

The following figure shows the components of the devices using the Biometra Compact S model as an example:

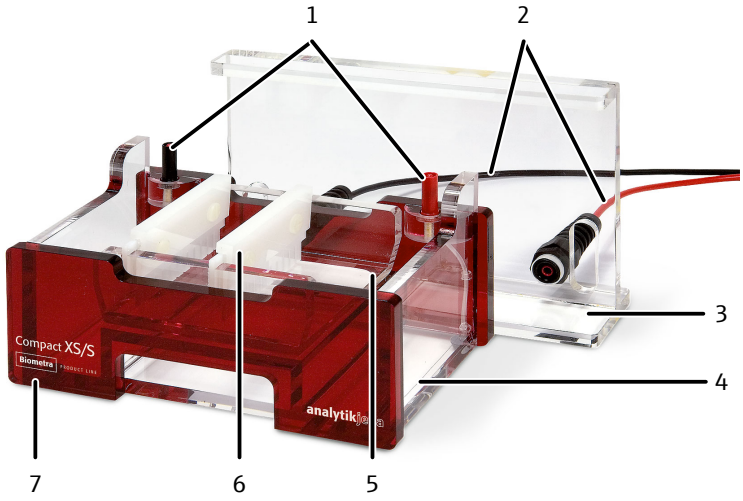


Fig. 1 Structure of the electrophoresis chamber, using the Biometra Compact S as an example

1 Contact pin for the power cable in the lid
2 Power cable for connection to the power supply unit
3 Bigfoot safety lid
4 Electrode, running along the bottom of the chamber
5 Gel tray
6 Comb
7 Electrophoresis chamber

The electrophoresis chamber for the Biometra Compact L and Biometra Compact XL models has leveling feet and a spirit level for horizontal alignment.

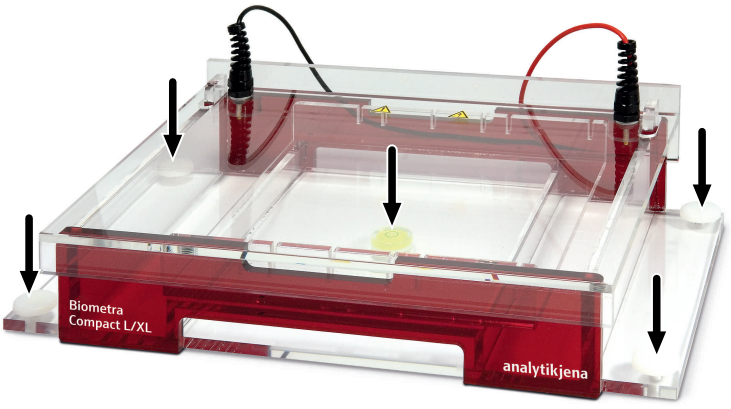


Fig. 2 Biometra Compact L/XL electrophoresis chamber with spirit level and leveling feet

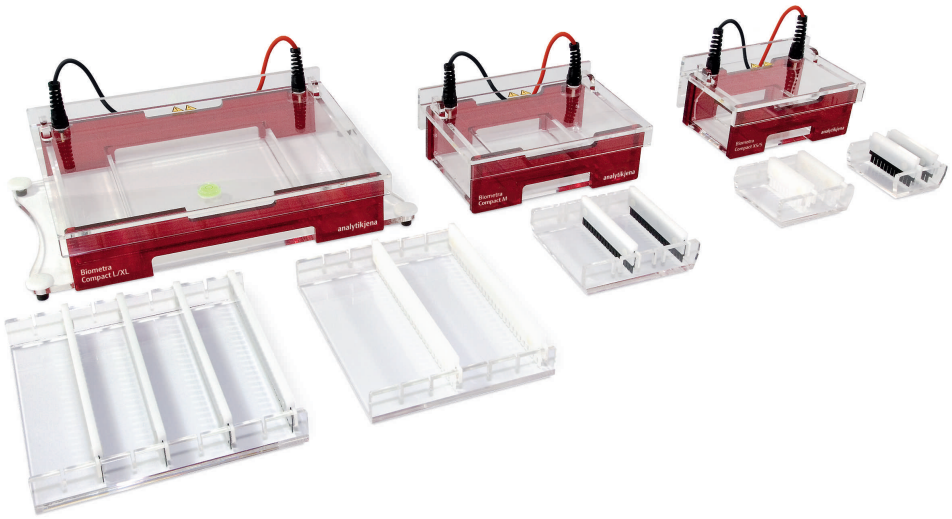


Fig. 3 Biometra Compact L/XL, M and XS/S

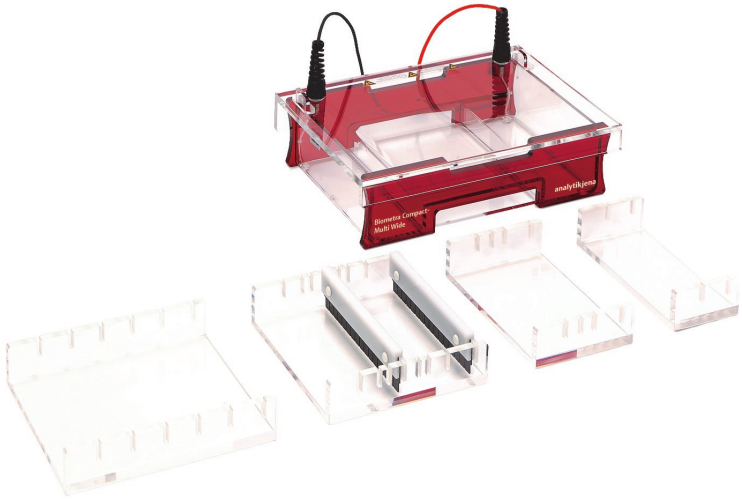


Fig. 4 Biometra Compact Multi-Wide

Type plate

The type plate is located on the bottom of the device and includes the following information:

- Manufacturer and address
- Device type and model
- Year of manufacture
- Country of production
- Electrical connection data
- Serial number
- Conformity and test sign
- Disposal instructions (Do not dispose of as domestic waste!)

5 Installation and commissioning

5.1 Installation conditions

Climatic conditions

The requirements for the ambient conditions at the installation location are set out in the specifications. If required, ensure that the room is temperature-controlled.

Installation location requirements

- This laboratory device is designed for inside use.
- Avoid direct sunlight and radiation from heaters onto the device. If necessary, provide air conditioning.
- Place the device on a heat-resistant and acid-resistant surface.
- Make sure the system is in a horizontal position. The large Biometra Compact L and Biometra Compact XL electrophoresis chambers have leveling feet and a spirit level.
- Do not place the device on top of a power supply unit.

Spatial requirements

Take note of the dimensions of the individual models, which can be found in the specifications.

5.1.1 Spatial requirements

CAUTION

Risk of electrical shock

If the electrophoresis device is placed on the power supply unit, buffer liquid leaking out in the event of a fault may enter the power supply unit and cause an electric shock.

- Never place the electrophoresis device on a power supply unit!

The space requirements of the individual models are listed in the table below. In addition to the devices, space is also required for the power supply unit.

Model	Dimensions (W x L x H)
Biometra Compact XS/S	13.6 x 21.6 x 10.6 cm
Biometra Compact M	17.7 x 25.8 x 10.9 cm
Biometra Compact L/XL	29.4 x 38.2 x 11.2 cm
Biometra Compact Multi-Wide	29.5 x 21.0 x 8.5 cm

5.1.2 Power supply

Note the following points regarding the power supply:

- Do not place the device on top of a power supply unit.
- The device may only be connected to a suitable power supply unit using the connection cables supplied.
- Connect the device only to an earthed power supply unit with direct current.
- Before connecting to the power supply unit, take note of the electrical requirements of the device during electrophoresis and set them accordingly on the power supply unit.

Model	Recom-mended voltage	Maximum voltage	Maximum current	Maximum power
Biometra Compact XS/S	85 V	180 V (DC)	200 mA	12 Watt
Biometra Compact M	108 V	180 V (DC)	250 mA	20 Watt
Biometra Compact L/XL	170 V	250 V (C)	500 mA	30 Watt
Biometra Compact Multi-Wide	125 V	180 V (DC)	250 mA	20 Watt

5.2 Installation

NOTICE

Keep the original packaging

Transport damage can only be avoided if the device is transported in its original packaging.

- Keep the original packaging for transport, e.g., in case the device must be returned to the manufacturer for repair.

Proceed as follows for the installation:

- Remove the electrophoresis chamber and accessories from the packaging. Wait until the device has reached room temperature before putting it into service.
- Verify that the delivery is complete. Check all components of the device for transport damage.
  If the delivery is incomplete or in case of transport damage, contact Analytik Jena.
- Place the electrophoresis chamber on a flat, firm and dry surface near the power supply unit.
- Set up the large Biometra Compact L and XL models horizontally using the leveling feet and a spirit level.

  ✓ The electrophoresis chamber is set up.

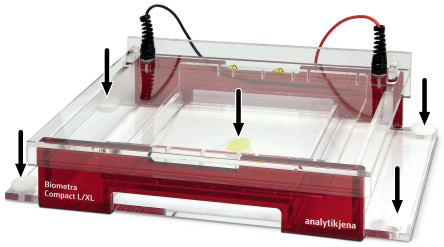


Fig. 5 Biometra Compact L/XL electrophoresis chamber with spirit level and leveling feet

6 Operation

6.1 Selecting and preparing the running buffer

6.1.1 Notes on the running buffer

The electrophoresis buffer used for the analysis of macromolecules contains buffer ions (salts) that are dissociated in aqueous solution and ensure a constant pH value. In addition, the conductivity of the solution is increased or the electrical resistance is lowered. Furthermore, electrophoresis running buffers often contain substances that protect the target molecule from degradation. This includes, for example, EDTA, which inhibits the activity of almost all DNA-cleaving enzymes (DNases and RNases) due to the complexation of divalent cations.

Either TRIS-acetate-EDTA (TAE) buffer or TRIS-borate-EDTA (TBE) buffer is used as standard in gel electrophoresis.

TRIS-acetate buffer (TAE)

TRIS-acetate buffer is particularly suitable for the separation of nucleic acid fragments with a high molecular weight (> 4 kbp). Compared to TBE buffer, it has a lower buffer capacity and is characterized by fast migration rates. Double-stranded, linear DNA migrates significantly faster in TAE buffer than in TBE buffer at the same resolution. In addition, supercoiled DNA is separated much more efficiently. TAE buffer is especially recommended for voltages < 150 V.

NOTICE! Due to its lower buffer capacity, TAE must be regularly recirculated or mixed during full-length electrophoresis, especially at higher voltages.

TRIS-borate buffer (TBE)

The TRIS-borate buffer is particularly suitable for the separation of small nucleic acid fragments (0.1 to 3 kbp), as significantly smaller, finer pores are formed in the agarose, resulting in a more compact matrix. TBE buffer has a higher buffer capacity and lower heat generation at comparable voltages compared to TAE buffer. Therefore, it is primarily used for electrophoresis with high voltage (> 150 V).

6.1.2 Preparing the running buffer

- Select the TBE or TAE buffer according to the requirements of the experiment.
- Prepare the running buffer as a concentrated solution according to the tables below.
- Store the running buffer at room temperature.

NOTICE! Follow the information in the specifications regarding the required buffer volumes for the corresponding electrophoresis chambers and gels.

Master solution for 5x TBE

The following table gives a master solution for 5x TBE (TRIS-borate-EDTA) of 1 liter.

Dilute to a 0.5x TBE (45 mM TRIS-borate, 1 mM EDTA) for use.

TRIS base	54.0 g
Boric acid	27.5 g
0.5 M EDTA (pH 8.0)	20.0 ml
Deionized or distilled water	To make up to 1000 mL

Master solution for 50x TAE

The following table gives a master solution for 50x TAE (TRIS-acetate-EDTA) of 1 liter.

Dilute to a 1x TAE (40 mM TRIS-acetate, 1 mM EDTA) for use.

TRIS base	242.0 g
Acetic acid	57.1 ml
0.5 M EDTA (pH 8.0)	100.0 ml
Deionized or distilled water	To make up to 1000 mL

6.2 Preparing the gel

The models of the Casting System Biometra Compact allow easy and quick preparation of agarose gels. You can insert the gel tray of the electrophoresis chamber directly into the corresponding gel casting system.

For instructions and tips for preparing and inserting the gels, refer to the operating manual of the Casting System Biometra Compact.

Tips for preparing the gel

- High-percentage agarose gels (>3 %) prepared from standard agaroses lose flexibility and are sometimes brittle.
- The resolution of the bands can be improved by using thin combs.

Gel concentration

Prepare an agarose solution suitable for the DNA fragment sizes you want to be separated. The table below gives an overview of the suggested agarose concentrations for different DNA fragment sizes.

NOTICE! The buffer used for preparation of the gel should always be the same as the running buffer in the buffer chamber.

Agarose concentration	DNA fragment size	Recommended buffer (TAE: TRIS-acetate-EDTA buffer; TBE: TRIS-borate-EDTA buffer)
0.5 %	1 kbp - 30 kbp	1x TAE
0.7 %	0.8 kbp - 12 kbp	1x TAE
1.0 %	0.5 kbp - 10 kbp	1x TAE
1.2 %	0.4 kbp - 7 kbp	0.5 - 1x TBE
1.5 %	0.2 kbp - 3 kbp	0.5 - 1x TBE
2.0 %	0.2 kbp - 3 kbp	0.5 - 1x TBE
3.0 %	0.1 kbp - 3 kbp	0.5 - 1x TBE

6.3 Placing gel in the electrophoresis chamber and adding buffer

WARNING

Risk of electrical shock

At higher volumes, the buffer may overflow during electrophoresis and cause electric shock.

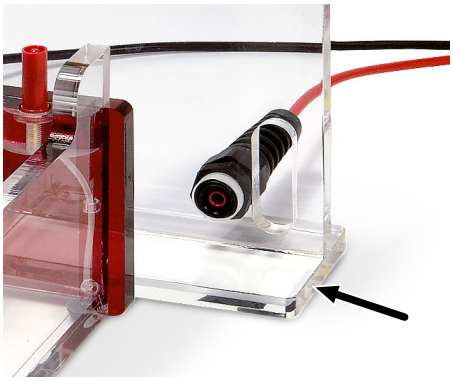
- Do not fill the buffer beyond the maximum line.

NOTICE

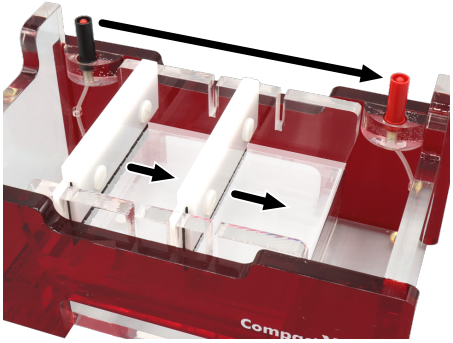
The gel may dry out if left dry for too long. Pour buffer over the gel as soon as possible when ready and it has been places in the electrophoresis chamber.

Once the buffer and gel have been prepared, you can ready the electrophoresis chamber for use. To do this, proceed as follows:

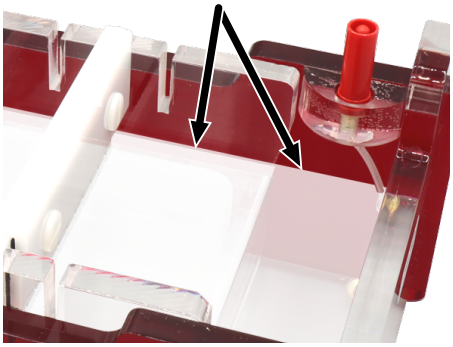
- Remove the lid from the electrophoresis chamber: Place your thumbs on the raised parts to the left and right of the power cables. With your other fingers, grasp under the edge of the lid and pull the lid vertically upwards.



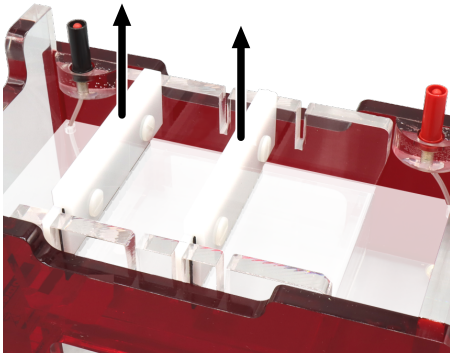
- Place the lid vertically on the stand.



- Carefully remove the gel tray with the solidified gel from the gel casting system.
- Observe the orientation of the gel tray (see picture): Place the gel tray in the electrophoresis chamber so that the sample wells are closer to the cathode (black). The DNA samples migrate towards the anode (red) during electrophoresis.



- Immediately after placing the gel tray in position, add the buffer to the electrophoresis chamber. Observe the following instructions:
  - The gel must be poured over evenly.
  - It is recommended to fill up the buffer so that the gel is covered with an additional 1 ... 2 mm of buffer.
  - Do not exceed the line for the maximum buffer height marked on the electrophoresis chamber.



- Carefully remove all combs from the gel.
- Adjust the buffer height as required.
  - ✓ The gel tray with the cast gel is placed in the electrophoresis chamber.

6.4 Preparing and applying samples

6.4.1 Required sample volumes

The required sample volumes for the individual sample wells depend on the chamber model and the combs and gel thicknesses used. The following tables summarize the required sample volumes. The sample volumes refer to gels with a thickness of 5 mm.

Biometra Compact XS/S

Number of wells	Volume for comb 1.0 mm	Volume for comb 1.5 mm	Suitability for multi-channel pipette
1 + 2 markers	-	342 µl + 2x 30 µl	-
8	30 µl	45 µl	9.0 mm spacing
11	20 µl	30 µl	-
13	16 µl	24 µl	-
16	12 µl	18 µl	4.5 mm spacing

Biometra Compact M

Number of wells	Volume for comb 1.0 mm	Volume for comb 1.5 mm	Suitability for multi-channel pipette
1 + 2 markers	-	594 µl + 2x 30 µl	-
11	36 µl	54 µl	-
13	30 µl	45 µl	9.0 mm spacing
18	20 µl	30 µl	-
21	16 µl	24 µl	-
25	12 µl	18 µl	4.5 mm spacing

Biometra Compact L/XL

Number of wells	Volume for comb 1.0 mm	Volume for comb 1.5 mm	Suitability for multi-channel pipette
1 + 2 markers	-	1284 µl + 2x 30 µl	-
22	36 µl	54 µl	-
26	30 µl	45 µl	9.0 mm spacing
36	20 µl	30 µl	-
42	16 µl	24 µl	-
52	12 µl	18 µl	4.5 mm spacing

Biometra Compact Multi-Wide

Number of wells	Volume for comb 1.0 mm	Volume for comb 1.5 mm	Suitability for multi-channel pipette
1 + 2 markers	528 µl + 2x 16 µl	793 µl + 2x 24 µl	-
2 + 2 markers	261 µl + 2x 16 µl	392 µl + 2x 24 µl	-
4 + 2 markers	127 µl + 2x 16 µl	191 µl + 2x 24 µl	-
14	36 µl	55 µl	-
16	30 µl	46 µl	9.0 mm spacing
22	20 µl	30 µl	-
26	16 µl	24 µl	-
32	12 µl	18 µl	4.5 mm spacing

6.4.2 Notes on the sample buffer

The sample buffer serves the following purposes:

- Dye (bromophenol blue and xylene cyanol FF): migrates through the gel together with the sample, allowing visual monitoring of migration in the electric field
- Sucrose: increases the density of the sample, sample becomes heavier and sinks into the sample wells when applied to the gel

Notes on the dyes

Please also note the following instructions for the use of bromophenol blue and xylene cyanol FF:

- Bromophenol blue migrates through agarose gels about 2.2 times more quickly than xylene cyanol FF, independent of the agarose concentration (range 0.5 % ... 1.4 %).
- Bromophenol blue migrates in 0.5x TBE at about the same rate as linear double-stranded DNA with a length of 300 bp.
- Bromophenol is not suitable for samples in which DNA fragments with a length of 200 ... 400 bp are expected. The dye covers possible important DNA bands after the end of the run.
- Xylene cyanol FF migrates at approximately the same rate as linear double-stranded DNA with a length of 4 kbp.
- Xylene cyanol FF is not suitable for samples in which DNA fragments with a length of 3 ... 5 kbp are expected. The dye covers possible important DNA bands after the end of the run.

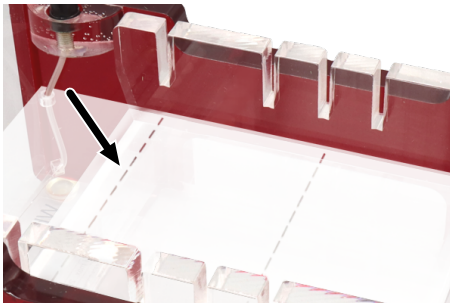
6.4.3 Preparing and applying samples

Mix the samples with a sample buffer for nucleic acids and then apply them to the gel.

- Prepare the sample buffer. Prepare only 1 ... 10 mL of buffer volume. A suitable 6x loading buffer contains the following components:

0.25 %	Bromophenol blue
0.25 %	Xylene cyanol FF
40 %	Sucrose in distilled water

- Store the sample buffer at 4°C until use.
- Check the required sample volume. The sample volume depends on the chamber model and the combs and gel thicknesses used. For the required sample volumes, refer to the instructions in the previous chapter.
- Dilute the sample buffer to a 1x concentration
- Add the diluted sample buffer to the samples.
  - ✓ The samples are loaded with loading buffer and can be applied to the gel.



- Place the samples in the gel sample wells. Multichannel pipettes can be used if the sample wells are made with compatible combs.
  - ✓ The samples are placed in the sample wells. Electrophoresis can be started.

NOTICE! Visualization strips can be placed under the electrophoresis chamber for better visibility of the sample wells. You can obtain these visualization strips from Analytik Jena as separate accessories.

6.5 Carrying out electrophoresis

6.5.1 Notes on electrophoresis

During electrophoresis, bubbles should form at the anode and cathode due to electrolysis. Within a few minutes, the bromophenol blue should migrate from the wells into the body of the gel. Allow the gel to run until the bromophenol blue and xylene cyanol FF have migrated the appropriate distance through the gel.

Buffer circulation

Buffer circulation is not required for standard agarose gel electrophoresis. If buffer circulation is required, switch off the power supply, remove the lid and gently mix the running buffer. Then reattach the lid and continue the electrophoresis.

NOTICE! Due to its lower buffer capacity, TAE must be regularly recirculated or mixed during full-length electrophoresis, especially at higher voltages.

Recommended voltage settings

At low voltages, the migration rate of linear DNA fragments is proportional to the applied voltage.

In order to achieve maximum resolution of DNA fragments larger than 2 kb, agarose gels should be operated at no more than 5 V/cm. The distance is the shortest path between the electrodes, not the length of the gel.

The table below gives the recommended voltages for optimal fragment resolution for each device model. The recommendations are derived from the rate of 5 V/cm related to the electrode distance in the respective device model:

Device model	Voltage (corresponding to 5 V/cm electrode distance)
Biometra Compact XS/S	85 V
Biometra Compact M	108 V
Biometra Compact L/XL	170 V
Biometra Compact Multi-Wide	125 V

Migration rate

Linear DNA migrates approximately inversely proportional to log10 of its molecular weight.

When separating native plasmids, several bands can usually be detected. This phenomenon can be explained by the different conformations of the molecules:

Migration rate	Molecules
Fast	Supercoiled DNA
Medium	Open chain DNA (linearized plasmid DNA)
Slow	Relaxed circled DNA
	Nicked circled DNA (plasmid with single strand break)

Fluorescent dyes

When running gels with fluorescent dyes, please note that this chemical compound can lead result in altered running behavior of the DNA.

6.5.2 Starting and stopping electrophoresis

NOTICE

Vibrations can cause the samples to move and flow out of the sample wells.

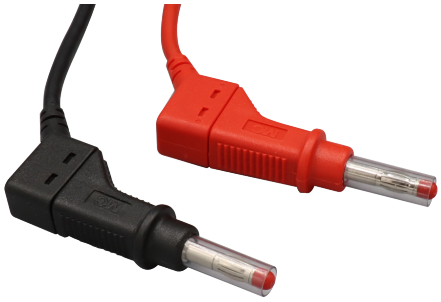
- Avoid strong vibrations and movement of the electrophoresis chamber.

Starting electrophoresis

Electrophoresis can be started once the gel and buffer are in the electrophoresis chamber. To start, follow the steps below:

▶ Carefully place the lid on the electrophoresis chamber.

NOTICE! Avoid strong vibrations and movement of the electrophoresis chamber. Vibrations can cause the samples to move and flow out of the sample wells.



Stopping electrophoresis

- Connect the electrophoresis chamber to the power supply unit using the electrical lead cables.
- Set the correct voltage. The voltage required depends on the thickness, length, and concentration of the gel as well as the electrophoresis buffer used. For the correct voltage, refer to the information in the rest of the chapter.

  ✓ Electrophoresis has started.

⇨ The bands have migrated the appropriate distance through the gel.

- Switch off the voltage at the power supply unit.
- Disconnect the cable connections between the power supply unit and the electrophoresis chamber.
- Electrophoresis has stopped. The electrophoresis chamber can be opened.

6.6 Gel staining

WARNING

Health hazard due to ethidium bromide

Ethidium bromide is a possible carcinogenic substance. Take special care when using ethidium bromide.

- If possible, use ready-made solutions to avoid handling ethidium bromide dust.
- Wear suitable protective clothing when handling ethidium bromide.
- Dispose of used ethidium bromide solution and gels that have come into contact with it according to applicable local regulations.

Once electrophoresis has ended, you can stain the samples for visualization.

The gel trays are UV transparent. You can leave the gel on the gel tray for staining and then place it, along with gel tray on the UV transilluminator. Alternatively, you can remove the gel from the gel tray and stain and visualize without the gel tray.

Use of staining solutions

Different staining solutions can be used to stain the gel, for example:

- SYBR Green
- SYBR Gold
- Ethidium bromide

You can buy staining solutions commercially or make your own.

Preparation of ethidium bromide staining solution

Staining with fluorescent ethidium bromide staining solution is one possible method for visualizing DNA in agarose. You can prepare ethidium bromide staining solution yourself.

⚠ WARNING! Ethidium bromide is a possible carcinogenic substance. If possible, use commercially purchased ready-to-use solution to avoid handling ethidium bromide in dust form yourself. Wear appropriate protective clothing whenever handling ethidium bromide or ethidium bromide staining solution.

The table below lists the ingredients for 1 liter of a master solution of ethidium bromide (10 mg/ml). You can store this solution in a suitable dark place.

Ethidium bromide	100 mg
Sterile, deionized water	10 ml

Dilute the master solution to 0.5 µg/ml for use as a staining solution. The table below indicates the volumes of master solution and electrophoresis buffer for dilution.

Master solution (10 mg/ml)	50 µl
Electrophoresis buffer	1000 ml

Staining

Proceed as follows for staining:

⇨ Electrophoresis has stopped.

⇨ The power supply unit is switched off. The cable connection between the electrophoresis chamber and the power supply unit is disconnected.

- Remove the gel tray from the buffer chamber. Make sure that the gel does not slide off the gel tray.
- Place the gel tray in a suitable volume of staining solution. The staining solution must cover the entire gel.

NOTICE! The gel trays are UV transparent. You can leave the gel on the gel tray for staining and then place it, along with gel tray on the UV transilluminator. Alternatively, you can remove the gel from the gel tray and stain and visualize without the gel tray.

- Leave the gel in the staining solution for a sufficient amount of time (if using the self-prepared ethidium bromide solution described: 15 ... 30 min). A rocking platform can be used to ensure uniform staining.
- Decolorize the stained gel in water or electrophoresis buffer for a sufficient amount of time (when using the suggested ethidium bromide solution: 10 ... 30 min).

6.7 Visualizing the staining

After staining the gel, you can visualize the staining with UV light or blue light, depending on the dye used.

Notes for visualization

The gel trays of the Biometra Compact family are UV transparent, therefore the gel does not have to be removed from the gel tray for visualization on a light table. However, the gel tray does slightly reduce the visualization sensitivity. The exposure time may therefore need to be extended slightly.

For follow-up applications such as isolation of a DNA fragment, it is important to keep the exposure of the gel to ultraviolet light as short as possible, as UV radiation promotes the formation of pyrimidine dimers, as a result of which spontaneous mutations or strand breaks may occur.

Visualization

Proceed as follows for visualization:

- Briefly rinse the gel with deionized water to remove residual staining solution.
- Place the gel on a UV transilluminator.

7 Troubleshooting

Error indication	Explanation	Suggested solution
The agarose runs out during casting.	The gel tray is not straight in the gel casting system. The edges of the gel tray are not in full contact with the sealing material.	Check the gel tray is correctly seated in the gel casting system.
The agarose has set unevenly or skewed.	The gel tray was placed on an uneven work surface to cast the gel.	Use a leveling table to cast the gels.
	The gel tray shows slight deformation because the agarose gels were repeatedly cast with agarose that was too hot.	Replace damaged or deformed gel trays immediately.
The samples do not sink into the wells.	DNA sample buffer was not added to the samples. The concentration of sample buffer used was too low.	Use an appropriate DNA sample buffer to prepare the nucleic acid samples. Ensure the correct concentration (final concentration: 1x in the nucleic acid sample)
The gel does not run. No gas bubbles rise at the electrodes.	The electrophoresis cables are not connected to the power supply.	Check the connection of your electrophoresis chamber to the power supply and make sure that the cables and connections are intact.
	The circuit in the electrophoresis chamber is broken.	Check the platinum wires of the electrophoresis chamber.
	The gel is not completely coated with buffer.	Adjust the buffer level so that the gel is covered with 1 ... 2 mm of buffer.
	Distilled water was used as running buffer.	Repeat the electrophoresis with the correct running buffer.
The samples run in the wrong direction.	The gel tray was inserted into the buffer chamber the wrong way.	The gel tray must be placed in the buffer chamber so that the outermost comb position is oriented towards the cathode (black, +).
Different relative running rate in certain areas of the gel.	The electrodes are defective.	Check that the electrodes are intact and emit current evenly along their entire length: When switched on, there must be homogeneous bubble formation along the platinum wire.
	The thickness of the agarose gel is uneven.	Cast the gel only on flat work surfaces or use a leveling table.

Error indication	Explanation	Suggested solution
The nucleic acid bands are not straight or are skewed. The running front is curved (smiling effect).	The agarose gel did not completely solidify before electrophoresis was started.	Allow the agarose gel to solidify for 30 ... 45 min. You can put the gel in the refrigerator for 10 ... 15 min to let it set faster.
	The gel wells were damaged when the comb was removed.	After inserting the gel tray with gel and coating the gel with buffer: Loosen the comb by carefully moving it back and forth and then pull it straight up out of the agarose gel. Clean the comb thoroughly after each use.
	The samples are rinsed out of the wells during loading.	Pipette the samples carefully and slowly into the wells.
	Gel wells are overloaded with too large a volume of sample.	Cast a thicker gel or use a comb with wider teeth.
	The gel is not evenly coated with running buffer.	Increase the buffer level with fresh running buffer so that the gel is covered 1 ... 2 mm with buffer.
	The sample volume was too small.	Always load enough sample into a gel well so that it is at least 1/3 full.
	The gels were run at too high a voltage. The buffer heated up too much during the run.	Reduce the applied voltage and follow the instructions in this operating manual.
The bands are diffuse. There are longitudinal streaks in the bands.	The gels were run at too high a voltage.	Reduce the applied voltage and follow the instructions in this operating manual.
	The running capacity of the buffer was exceeded.	Use fresh buffer and check the buffer master solution. Reduce the voltage and mix the buffer regularly.
	The agarose was not completely dissolved or boiled before casting. The agarose was too warm when it should be solid.	Let the gel harden in the refrigerator for 10 min.
	There were dirt particles in the gel base.	Use clean water and rinse the glass vessels before preparing the agarose.
	Too much DNA was applied.	Dilute the sample.
	When loading the gel, the gel well was damaged by the pipette tip.	Pipette the samples carefully and slowly into the wells.

Error indication	Explanation	Suggested solution
	The sample was incompletely restricted by restriction enzymes.	Check the enzyme activity and extend the reaction step if necessary.
	The sample is contaminated with nucleases.	Heat-inactivate enzymes before loading the gel. Follow the manufacturer's instructions.
	The salt concentration in the sample is too high.	Reduce the salt concentration (≤ 0.1 M) by ethanol precipitation or spin column purification kits.
		Alternatively: Let the samples rest in the gel well for 15 ... 30 min before starting the electrophoresis run. Excess salts can diffuse into the buffer..
No bands or markers can be detected.	The salt concentration in the buffer is too low.	It is important to use distilled or demineralized water for the running buffer and gel to ensure a consistent base for the use of the buffer salts. However, if the buffer salts are not added, no current will flow.
	The salt concentrations in agarose gel and running buffer are different.	The buffer used to prepare the agarose gel and the running buffer must be identical.
The bands in the low molecular range are poorly resolved.	The agarose concentration is too low.	Increase the agarose concentration in the gel solution or use polyacrylamide gels.
The bands in the high molecular range are poorly resolved.	The agarose concentration is too high.	Decrease the agarose concentration in the gel solution.
The bands migrate slowly.	The salt concentration in the buffer is too high.	Make sure the concentration of the buffer is correct. Never use undiluted (concentrated) running buffer.
	The gel was overcoated with too much running buffer (> 5 mm).	Remove excess buffer
Low signal intensity after staining the bands.	The concentration of nucleic acids in the sample was too low.	Increase the sample volume to be analyzed.
	Poor staining of the gel with the fluorescent dye.	Replace the staining bath. Gels containing the fluorescent dye during electrophoresis can be re-stained in the staining bath.
	The nucleic acids have run out of the gel.	Stop the electrophoresis earlier.

Error indication	Explanation	Suggested solution
		Determine by experiment the appropriate running time for electrophoresis. You can use power supplies with a timer function to stop electrophoresis automatically after a defined period of time.
Samples can be detected in the wells.	Nucleic acids have broken down.	
	There is high molecular chromosomal DNA in the samples which could not migrate into the gel matrix due to its size.	Use pulsed-field gel electrophoresis (PFGE) to separate high molecular DNA of chromosomal size.

8 Maintenance and care

WARNING

Warning of biohazard

The device handles biological and biochemical substances that are potentially pathogenic.

- Wear personal protective equipment when handling these substances.
- Observe all instructions and specifications in the safety data sheets. Observe national regulations when handling these substances.
- Decontaminate and clean the device after use.

NOTICE

Use only the cleaning and disinfecting agents recommended here for care of the device. Consult with Analytik Jena before using any agents other than those recommended. The use of unsuitable cleaning agents and disinfectants may result in damage to the device.

The operator may not undertake any service or maintenance work to this device and its components other than those specified and described here.

Observe the instructions in the "Safety instructions" section for all maintenance work. Compliance with the safety instructions is a requirement for the error-free operation of the device. Observe all warnings and instructions that are attached to the device or displayed by the control software.

The device requires little maintenance. Maintenance is limited to cleaning the device with a mild cleaning solution in warm water.

Observe the following instructions for cleaning:

- Clean the device after each use.
- Rinse all parts of the device with deionized water and allow to air dry.
- Never autoclave the device or place it in a microwave oven.
- Do not try to unscrew the contact pins. The platinum electrodes are connected to the contact pins. Unscrewing the contact pins will break contact with the electrodes; in this case current can no longer flow.
- When preparing gels for RNA electrophoresis, it is essential to remove RNAses. Use suitable commercially available solutions. Observe the following points during removal:
  - The selected solution must not contain any aggressive components or organic solvents.
  - Wipe the acrylic components of the gel casting system with the solution, but do not incubate in it for too long.
  - After handling, thoroughly rinse all treated surfaces twice with distilled water.

Recommended cleaning and disinfection agents

Analytik Jena recommends the following cleaning and disinfection agents:

Cleaning and disinfection agents	Manufacturer
Descosept Spezial	Dr. Schuhmacher GmbH
acryl-des	Schülke & Mayr GmbH
HEXAWOL	Dreiturm GmbH

Chemicals not recommended

The use of the following chemicals is strongly **discouraged**:

- Alcohols (ethanol, methanol, isopropanol)
- Aromatic hydrocarbons (benzene, phenol, toluene, acetone, methyl ethyl ketone)
- Chlorinated hydrocarbons (tetrachloromethane, chloroform)

9 Returning the product

WARNING

Risk of damage to health due to improper decontamination

- Decontaminate the device professionally and document the cleaning measures before returning the device to Analytik Jena.
- The customer service department will send you the decontamination declaration when you register the return.

NOTICE

Risk of device damage due to unsuitable packaging material

- Only transport the device and its components in the original packaging.
- Empty the device completely and attach all transport locks before transporting the device.

- Clean all device components from biologically hazardous, chemical, and radioactive contamination.
- When registering the return, you will receive a decontamination declaration from customer service. Complete the declaration and attach the signed decontamination declaration to the outside of the shipment.
- Only use the original packaging for the shipment and insert the transport lock. If the original packaging is no longer available, please contact Analytik Jena or your local distributor.
- Attach the following warning label to the packaging:
  "**CAUTION! SENSITIVE ELECTRONIC DEVICE!**".
- Enclose a sheet with the following data:
  - Name and address of the sender
  - Name and telephone number of a contact for inquiries
  - A detailed description of the fault, the precise conditions and situations under which the fault occurs

10 Disposal

At the end of its service life, the device and its electronic components must be disposed of as electronic waste in accordance with the applicable regulations.

11 Specifications

11.1 Technical data

	XS/S	M
Dimensions	13.6 x 21.6 x 10.6 cm	17.7 x 25.8 x 10.9 cm
Weight	1.0 kg	1.5 kg
Buffer volume	360 ml	580 ml
Size of gel trays	8.2 x 7.1 cm 8.2 x 10.5 cm	12.4 x 14.5 cm
Distance between electrodes	17.0 cm	21.5 cm
Maximum buffer temperature	50 °C	

	L/XL	Multi-Wide
Dimensions	29.4 x 38.2 x 11.2 cm	29.5 x 21.0 x 8.5 cm
Weight	3.2 kg	1.6 kg
Buffer volume	1660 ml	1100 to 1300 ml
Size of gel trays	23.9 x 20.0 cm 23.9 x 25.0 cm	15.0 x 7.0 cm 15.0 x 10.0 cm 15.0 x 15.0 cm 15.0 x 18.0 cm
Distance between electrodes	34.0 cm	25.0 cm
Maximum buffer temperature	50 °C	

Electrical figures

	XS/S	M	L/XL	Multi-Wide
Maximum voltage	180 V (DC)	180 V (DC)	250 V (C)	180 V (DC)
Recommended voltage (corresponding to 5 V/ cm electrode distance)	85 V	108 V	170 V	125 V
Maximum current	200 mA	250 mA	500 mA	250 mA
Maximum power	12 Watt	20 Watt	30 Watt	20 Watt

11.2 Ambient conditions

Work environment	Intended for indoor use only.
Ambient temperature	4 to 40 °C
Humidity	max. 80 % (≤ 31 °C), decreasing linearly up to 50 (at 40 °C)
Maximum altitude	2000 m above sea level
Air pressure	75 to 106 kPa

11.3 Standards and directives

Protection type	The housing is protection type IP 20.
Device safety	The device complies with the following safety standards ■ EN 61010-1
Guidelines for China	The device contains substances subject to regulation (according to the directive GB/T 26572-2011). Analytik Jena guarantees that, if the device is used as intended, these substances will not leak within the next 25 years and therefore will not pose a threat to the environment or health within this time period.
EU directives	The device meets the requirements of the Directive 2011/65/EU. The device is designed and tested in accordance with standards meeting the requirements of EU Directive 2014/35/EU. The device leaves the factory in a perfect condition with regard to safety. To maintain this condition and to ensure safe operation, the user must strictly observe the safety and operating instructions contained in this operating manual. For accessories delivered with the device and system components from other manufacturers, the information provided in their respective operating manuals has priority.

12 Revision overview

version	Effective date	Changes
A	10/2023	First version
B	12/2024	Corrections to abbreviations and units

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