Instructions for use

AQUAbase

Reverse osmosis system

Rev. 2.20 – 2017-03-20
Software version 1.00

Art. No.: LA53542_EN_BAV

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Dear Customers,

In these operating instructions, ‘RO’ is used as the abbreviation for the reverse osmosis system. The water treatment system AQUAbase is a medical product and corresponds with the quality requirements according to the norms ISO 23500 and ISO 26722.

If you have problems with this system which you are unable to solve by consulting these operating instructions, please contact either B. Braun directly, your service technician or your authorized B. Braun partner with as precise a description as possible of the problems you are having and your unit details.

These operating instructions must always be kept on the site where the water treatment system is installed.

These operating instructions include basic directives which are to be observed before commissioning and maintenance work. Therefore they must be read by the technical staff/user responsible before commissioning and/or maintenance work.

The system operator is obliged to adhere to the working, maintenance and technical safety check processes described in these operating instructions as well as to the respective intervals.

Where aspects of the operating instructions are not observed, B. Braun cannot guarantee safe operation of the system.

These operating instructions are an integral part of the supplied system and must be handed over to the new owner if the system is resold.

B. Braun reserves the right to alter sections of these operating instructions or technical data without prior notice.

If you have any questions regarding these operating instructions or would like to make any comments or suggestions for improvement, please do not hesitate to contact us directly.

Manufacturer:

B. Braun Avitum AG

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Your personal service department

_____

Name

can be reached at all hours by phone under:

_____

Suggestions for improvement

When working with these operating instructions, you may have an idea that could contribute to improving the contents. Please do not keep this idea to yourself – let us have your suggestions. This will make it possible for us to incorporate your suggestions in subsequent versions.

- Yes, I would like to make a suggestion! My address is:

  Name: .....

  Address: .....

  .....

  Tel.: .....

  Fax .....

- The article and revision numbers of the operating instructions to hand are as follows

  Art. No.: ..... Rev.: .....

- My suggestion for improvement concerns the page(s):

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- My suggestion:

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  Use further pages if necessary. You can also enclose pages copied from these operating instructions with your suggestions entered on them.

Please send your suggestion to:

B. Braun Avitum AG

Schwarzenberger Weg 73-79
34212 Melsungen
Germany
Fax +49 (5661) 75-0

Notes on the operating instructions

The operating instructions contain information on the safe use of the system.

According to the directive governing medical products, the user must convince himself of the correct function and proper state of the medical product before putting it to use, and heed the operating instructions and other information and maintenance instructions enclosed.

The operator must be instructed on the following points and committed to observe them:

- The medical product may only be set up, operated and used by persons who have participated in the required training or have knowledge of and experience with the product.
- The medical product may only be operated according to its **intended purpose** in accordance with the regulations of the current German medical product operator ordinance.
- The user must be committed to only operate the system when it is in the **intended condition.** The system must not be used or applied if there are any faults that could cause harm to patients, employees or third parties. The user must ensure that the devices function and are in the **intended condition** prior to any use.
- The user must be instructed on safe handling of the products. This includes theoretical principles, proper handling and conditions for application.
- The operator is to be instructed on the permissible operating data (e.g. setting data for safety and monitoring facilities, functional tests).
- The user must be instructed on system maintenance and the elimination of operational faults.
- The user is obliged to inform his supervisor/operator immediately as to any changes on the system that affect safety and to observe all the safety instructions.
- The user must be instructed as to the risks, rules of behaviour and necessary protective measures to be taken when dealing with the substances used, and be trained to react correctly in the event of danger and provide first aid.
- Through instructions and checks, the operator must provide for cleanness and clarity where the system is used.
- The operator must fulfil his obligation to clearly regulate who is responsible for commissioning, operating and maintaining the system to ensure that such work is carried out by all the persons involved without any misunderstandings as to who is competent where safety aspects are concerned.

Signs and symbols used in the operating instructions

⚠ DANGER	**The signal word indicates a high-risk hazard which, if not avoided, will cause death or severe injury.**
⚠ WARNING	**The signal word indicates a medium-risk hazard which, if not avoided, may cause death or severe injury.**
⚠ CAUTION	**The signal word indicates a low-risk hazard which, if not avoided, may cause minor or moderately severe injury.**
⚠ ATTENTION	**The signal word warns of material and environmental damage.**
NOTE:	**The signal word points to suggestions / details on the economical use or just to a simpler work step.**
→	**This symbol indicates a cross reference to a chapter within these operating instructions.**

Signs and symbols used for reverse osmosis

Caution, hot surface

Observe the operating instructions

Protective earth connection

Ground connection

Three-phase alternating current with neutral conductor

OFF (power supply, disconnect from mains supply)

ON (power supply, connect with mains supply)

Dangerous voltage

Attention residual risks. Refers to the necessity of examining the operating instructions for important safety-related aspects.

Shows the manufacturer of the medical product in compliance with the EU guidelines 90/385/EEC, 93/42/EEC and 98/79/EC an.

Shows the date on which the medical product was manufactured.

Shows the manufacturer's article number so that a certain medical product can be identified.

Shows the manufacturer's serial number so that a certain medical product can be identified.

A symbol for the temperature limits. The temperature limits the medical product can safely be exposed to are shown.

These operating instructions comprise two parts:

Part 1 – Operating Instructions

Here you will find subjects which are important for the normal operation of the system.

1. Security
2. Area of application and intended use
3. AQUAbase accessories list
4. Use in combination with other equipment
5. Technical Description
6. Fonctions
7. Description of components
8. Commissioning / Decommissioning
9. Turning the equipment on
10. Dialysis mode
11. Standby mode
12. Disinfection (DI)
13. System data input
14. Operating modes
15. Faults / Causes / Elimination

Part 2 – Supplementary Operating Instructions

Here you will find subjects which are important for commissioning and maintenance/technical safety checks.

1. Handover declaration for the operating instructions
2. Transport and setup
3. Work prior to initial commissioning
4. Commissioning
5. Commissioning log
6. System key data
7. Technical data
8. Setup plan and terminal diagram
9. Maintenance and technical safety checks (TSC)
10. Spare and wear parts list AQUAbase
11. Draft letter for municipal water suppliers

Part 1 – Operating Instructions

1. Security

1.1 Risks due to non-observance of safety instructions

Non-observance of the safety instructions can lead to danger for the user and/or the patient. Non-observance may lead to the following risks:

- Failure of important system functions.
- Danger to persons through electrical and mechanical reactions.
- Failure of prescribed methods of maintenance and disinfection (DI)

1.2 General safety

The AQUAbase reverse osmosis system is built to state-of-the-art engineering standards and is safe in operation.

Improper or irregular use can put operating personnel at risk. For this reason:

- Read and carefully observe these operating instructions, especially the safety instructions.
- Keep these operating instructions within easy reach of the reverse osmosis system (RO).
- Commissioning, operation, maintenance and electrical work may only be carried out by authorized, trained and B. Braun-instructed specialists.
- All local safety and accident prevention regulations are always applicable for operating the system. These must be observed and maintained at all times.
- Observe instruction and warning signs.
- Consult a doctor immediately in the case of injuries, accidents or inflammation of the skin.
- The system must be disinfected after being at a standstill for a longer period (> 72 h), but at least once every year (from → Part 1, chapter 12).

1.3 Functional security

1.3.1 Operational safety

⚠ WARNING	**The system pipelines are under pressure!** **→ Before starting work on the system depressurize the pipelines.** **Opening screws or valves can lead to injury!**

- An annual technical safety check (TSC) by B. Braun-authorized specialists is compulsory.
- The system is to be operated only with closed control cabinet.
- Insufficient water quality in the intake can cause an inferior and impermissible product quality (see requirement → Part 1, chapter 2.4).
- If the system comes to a sudden standstill, the operator may not immediately change to another operating mode. The system may have been stopped for manual adjustments to be made. Switching the system on again without warning can lead to severe injuries.
- The reverse osmosis system pipelines are under pressure. Opening screws or valves can lead to injury.
- Avoid contact with the product to be processed if it is a health hazard. First-aid treatment must be given in-house in the event of contact with the product.
- A daily report is to be drawn up on the conductivity values etc. in accordance with → Part 2, chapter 9.2.1 “Medical product log”.

- If the permeate output is reduced by more than 20%, it is recommended that the number of connected consumers be reduced by the same amount so that the functioning of the individual connected devices is not affected.
- It is forbidden to run the pump dry.
- Do not modify, remove, bypass or bridge safety devices.

1.3.2 Safety during servicing

⚠ DANGER	**Electric shock!** **Dangerous voltage when the control cabinet is open.** **→ Switch the reserve osmosis system off at the main switch and disconnect from the mains**

When the control cabinet is open:

- The RO must be switched off at the main switch (1) → Part 1, chapter 7.1 and disconnected from the power supply before maintenance and repair work is started.
- When work is being done on pumps and pressurized pipelines, these must be depressurized first to prevent injuries.
- Any damaged or removed instruction and warning signs or safety labels must be renewed without delay.
- All dismantled safety devices must be properly refitted after maintenance work has been completed.
- Unauthorized conversion work or modifications to the system can impair personal and system safety and are therefore prohibited.
- If the RO has a permanent connection, the system must be disconnected completely from the mains using the upstream separator. (Supply cable, connection terminals and network filter to prevent electromagnetic influence are located before the RO's main switch (1). DIN EN 61010-1/6.11.3)

NOTE:	**Only original spare parts, accessories and consumables from B. Braun are to be used, see → Part 2 from page 10-1 and → Part 1 from page 3-1.** **B. Braun does not accept any liability for damage caused by the use of other spare parts, accessories or consumables.**

1.4 Microbiological safety

When used for the intended use, the RO produces water to dilute haemodialysis concentrates.

According to the specifications of ISO 13959 and the European Pharmacopoeia, permeate quality is influenced by:

- The raw water quality => observance of the EU guideline 98/83/EC is required
- The pretreatment (hardness, chlorine, heavy metals* ...)
- The ring piping (size, material)
- Cleaning and disinfection cycles

After commissioning, the system is handed over in perfect working order (inc. microbiological test).

NOTE:	**The operator is responsible for observing the limit values in accordance with the European Pharmacopoeia (Ph. Eur.) or ISO 13959 with respect to microbiological quality.**

➔ After the RO has been at a standstill (>72 hours), carrying out disinfection is recommended.

➔ There is a risk of the entire water treatment system becoming contaminated if the system is at a standstill for a longer period of time. This is also applicable for the connecting pipework if this is not automatically rinsed.

➔ Check the permeate for its microbiological quality at least every six months (see → Part 1, chapter 2.4 Bacteriology, pyrogenics).

➔ If the alarm limit for the total germ count (50 CFU/ml) as well as the endotoxins (0.125 I.U./ml) is exceeded, carry out disinfection.

➔ A continuously germ load can lead to the development of biofilm. Biofilm can usually only be eliminated by a combination of mechanical and chemical cleaning.

➔ Exceeding the limit values according to the European Pharmacopoeia (Ph.Eur.) or ISO 13959 (see → Part 1, chapter 2.4) requires immediate cleaning and disinfection (alarm limit).

1.5 Residual risks

NOTE:	**Residual risks remain despite the measures taken to avoid such risks.**

Residual risks are potential hazards which are not apparent, e.g.:

- Risks which can result from the product or flushing medium, such as allergies, inflammation of the skin or burns.
- Risks arising as a result of control system faults
- Hazard arising from misconduct of the operator

1. **Electrocution**
   The reverse osmosis AQUAbase is operated with an electrical voltage of 400 V(AC). Improper opening of the switch cabinet or damage to the electrical cables can cause electrocution (risk of fatal injury!).

   Any work on the system that requires the switch cabinet to be opened or contact with the connection cables may only be carried out when the system has been switched off (main switch to “0”) and disconnected from the mains supply.

   If the RO has a permanent connection, the system must be disconnected completely from the mains using the upstream separator. Supply cable, connection terminals and network filter to prevent electromagnetic influence are located before the RO’s main switch (1). (DIN EN 61010-1/6.11.3)

2. **Noise**
   A noise level of less than 80 dB(A) is measured up to a distance of 0.5 m from the system. The law does not require any measures regarding hearing protection for background noises of up to 80 dB(A).

   However, the noise level can increase in a location where several sources of noise are positioned, thus requiring ear protection. Therefore it is recommended that additional sound level measurements be carried out if there are several devices in one room, and all the groups of people affected (cleaning personnel, operators etc.) should be informed about individual hearing protection measures.

3. **Heat radiation**
   Reverse osmosis AQUAbase HT that can be hot cleaned can emit heat radiation during hot cleaning. Parts of the system, such as pipelines and membrane modules passed through, can reach temperatures of up to 90°C which leads to a risk of burning.

   The system is marked with the symbol for “Caution. Hot surface”.

1.6 Contraindications and potential undesirable side effects

1.6.1 Contraindications

Do not use the reverse osmosis system if the chemical or microbiological quality of the raw water is not certain.

Do not use the reverse osmosis system if the raw water does not satisfy the requirements of guideline 98/83/EC.

Do not use the reverse osmosis system if the freedom from disinfectant cannot be proved at all sampling points after chemical disinfection before dialysis.

1.6.2 Side effects

Small amounts of aluminium and nitrate can pass through the reverse osmosis membrane even if the reverse osmosis system is used as intended. Anaemia, neurological problems, cerebral diseases and changes in bone structure have been observed in association with increased aluminium values in the permeate. Nausea and vomiting as well as haemolysis have been observed in association with increased nitrate amounts.

Particularly in the case of increased nitrate or aluminium values in the raw water, make sure that the permeate satisfies the valid limit values for water to dilute concentrated haemodialysis solutions according to Ph. Eur. or ISO 13959.

2. Area of application and intended use

The operator is responsible for the intended use of the system. The operational safety of the system supplied is only given when it is used as intended.

The values specified in the technical data → Part 2from page 7-1 must be observed. Limit values must never be exceeded.

The AQUAbase reverse osmosis system may only be used for the intended purpose and has been designed for a service life of 10 years.

NOTE:	**The intended use is the production of water for diluting haemodialysis concentrates according to the European Pharmacopoeia. and ISO 13959.**

NOTE:	**The quality of the feed water upstream of the water softener (ion exchanger) must comply with the requirements of EC guideline 98/83/EC of the Council dated November 3, 1998, concerning the quality of water for human usage. For B. Braun-specific deviations from or supplements to the guideline, see → Part 2, chapter 7.3**

Intended use also includes observance of the commissioning, operating and maintenance instructions provided by the manufacturer, which are an integral part of these instructions, as well as taking any foreseeable misconduct into account.

During proper use, the minimum salt retention is 90%, based on the raw water conductivity in the feed flow of the reverse osmosis.

The hourly litre capacity of the system is, depending on the type, 250 l/h to 900 l/h. A water temperature of < 10°C in the feed reduces the hydraulic capacity. The device has been designed for continuous operation.

Permeate is not suitable for drinking.

The devices of the AQUAbase and AQUAbase HT series are electrical medical devices that are subject to special precautionary measures in terms of EMC; they must be installed and put into operation according to the instructions in → Part 2, chapter 7.15.

Portable and mobile high-frequency communication equipment can influence electrical medical devices.

⚠ Caution	**Incorrect purpose of use** **The water quality directly after reverse osmosis does not correspond with the requirements of ultra-pure water (UPW).** **→ UPW requires an additional processing level and detailed validation of the overall system.**

The devices of the AQUAbase series may not be used if they are located immediately next to or stacked on top of other devices.

2.1 Functional features

- Modular construction: the system performance can be changed merely by replacing/supplementing the pumps and membranes.
- Standby mode: when it is not in permeate mode, the system regularly switches to a rinsing mode to prevent microbiological growth.
- Unauthorized operating states that could endanger the connected medical products or even the patients are prevented due to measuring equipment and related control measures (alarm and error functions)

Alternatively to hot cleaning there is also the possibility to disinfect chemically:

- Semi-automatic chemical disinfection and cleaning.
- Option “HT”: automatic hot cleaning of reverse osmosis with supply tank.

2.2 Important performance features

- Production of pure water (permeate with a low salt concentration) to dilute haemodialysis concentrates.

2.3 Application regulations

- No products or media are to be processed which, under the influence of pressure and temperature, tend to cause uncontrolled reactions such as higher viscosity, higher temperature, precipitation, frothing or the generation of gas which could cause the system limit values to be exceeded even for only a short time.
- The raw water must be treated in a correctly design pretreatment stage.
- A pretreatment stage can only be carried out subject to previous water analysis or the details provided by the municipal water suppliers. The values of the incoming raw water must be checked and recorded once a year.
- A water analysis must be requested by the system operator once a year.
- The municipal water suppliers (water board) must be consulted regarding the water quality/ chlorination.
- You can find a corresponding sample letter in → Part 2, page 11-1.
- The local regulations for connecting the concentrate to the waste water drainage system must be observed (this also applies to draining disinfectant into the waste water system).
- Feed and waste water must be installed properly according to DIN 1988-100 and DIN EN 1717 or other local regulations.
- Other operational purposes must be agreed in advance with the manufacturer.
- The system may only be transported, installed, used and repaired by specialists.
- Commissioning, operation and maintenance may only be carried out by authorized, trained and instructed specialists.
- Any use over and above this is deemed to be improper. The manufacturer shall not be liable for any damage resulting from this.
- The reverse osmosis system AQUAbase has a short application period (< 30 days) in accordance with guideline 93/42/EEC Annex IX.

2.4 Water quality requirements

In order not to endanger patients' health, and depending on their use, the water qualities of raw water and clean water must meet the respective guidelines that are assigned to the respective purpose:

2.4.1 Feed water/raw water requirements:

AQUAbase reverse osmosis system have been designed in such a way that they can usually be operated with feed water of "water for human consumption" quality in accordance with 98/83/EC with appropriate pretreatment.

The service lifetime of the reverse osmosis membranes used and the permeate quality of the product flow of the reverse osmosis system depend directly on the concentration of the individual water contents and can be/must be optimised through suitable pretreatment methods.

Daily logging of process parameters according to ISO 23500 is recommended
(→ Part 2, chapter 9.2.2).

Definition/Water quality	Drinking water (water for human consumption)	**Feed water for reverse osmosis** AQUAbase	**Dialysis water / permeate** (water for diluting concentrated haemodialysis solutions)		
Directive	98/83/EC	98/83/EC + procedural limit values	ISO 13959	European Pharmacopoeia	Recommendation applied hygiene[1]
Chemical/physical parameters [ppm]					
Sodium (Na)	200	200	70	50	50
Potassium (K)		-.-	8	2	8
Calcium (Ca)		Total hardness < 1°dH or < 1.79°fH	2	2	2
Magnesium (Mg)			4	2	4
Boron (B)	1.0	1			
Barium (Ba)		0.7	0.1		0.1
Beryllium (Be)		0.004	0.0004		0.0004
Ammonium (NH_4)	0.5	0.1		0.2	0.2
Aluminium (Al)	0.1	< 0.01	0.01	0.01	0.01
Metals					
– Copper (Cu)	2	1	0.1	-.-	0.1
– Arsenic (As)	0.01	0.01	0.005	-.-	0.005
– Lead (Pb)	0.01	0.01	0.005	-.-	0.005
– Silver (Ag)	-.-	0.1	0.005	-.-	0.005
– Chromium (Cr)	0.05	0.05	0.014	-.-	0.014
– Selenium (Se)	0.01	0.01	0.09	-.-	0.01
– Stibium (Sb)	0.005	0.005	0.006	-.-	0.005
– Mercury (Hg)	0.001	0.001	0.0002	0.001	0.0002
– Nickel (Ni)	0.02	0.02	-.-	-.-	-.-
– Tin (Sn)	-.-	-.-	-.-	-.-	-.-
– Iron (Fe)	0.2	< 0.1	-.-	-.-	-.-
– Cadmium(Cd)	0.005	0.005	0.001	-.-	0.001
– Zinc (Zn)	-.-	5.0	0.1	0.1	0.1
– Manganese (Mn)	0.05	< 0.01	-.-	-.-	-.-
– Uranium (U)	0.010	0.01	-.-	-.-	-.-
– Thallium (Ti)	-.-	-.-	0.002	-.-	-.-
or sum of heavy metals			0.1	0.1	
Cyanide (CN)	0.05	0.05			0.02
Chlorine (Cl_2)		**Total chlorine: 0.0**	0.1	0.1	0.1
1,2-dichlorethane	0.0030				
Chloramines					0.1
Chloride (Cl)	250	250		50	50
Fluoride (F)	1.5	1.5	0.2	0.2	0.2
Sulphate (SO_4)	250	240	100	50	50
Nitrate (NO3)	50	10	2 (as N)	2	2
Nitrite (NO2)	0.5	0.5			

Definition/Water quality	Drinking water (water for human consumption)	**Feed water for reverse osmosis** AQUAbase	**Dialysis water / permeate** (water for diluting concentrated haemodialysis solutions)		
Directive	98/83/EC	98/83/EC + procedural limit values	ISO 13959	European Pharmacopoeia	Recommendation applied hygiene[1]
Polycyclic aromatic hydrocarbons	0.00010	0.0001			
Benzene	0.0010	**0.001**			
Bromate	0.010	**0.01**			
Tetrachlorethene and trichlorethene	0.010	**0.005**			
Trihalogenmethane	0.050	**0.05**			
Vinyl chloride	0.00050	**0.0005**			
Silicic acid (SIO_2)		**< 10**			
pH Value	6.5 – 9.5	**6.5 – 9.0**			
Temperature		**6 – 30 °C**			
Spec. conductivity	2500 µS/cm at 20 °C	**< 1000 µS/cm at 20 °C**			
Silting index $SDI_{(15)}$ Clouding (NTU)	NTU < 1	**SDI (15 min)** **< 3** As per ASTM 4189			
Microbiological parameters					
Total germ count] [CFU/ml]	< 100 (22 ±2 °C, 44 ± 4h) < 100 (36 ±1 °C, 44 ± 4h)	< 100 (22 °C) < 100 (36 °C)	< 100 (action at 50%) (17–23 °C, 7d)	< 10^2 (30–35 °C, 5 d)	< 100 acc.to RKI (22 ± 2 °C, 3–7 d)
Enterococci	0 CFU/100ml	0 CFU/100ml			
E.-Coli/ coliform	0 CFU/100ml	0 CFU/100ml			
Endotoxins [EU/ml]			<0.25 (action at 50%)	< 0.25	<0.25

1. “Guideline for applied hygiene in dialysis units”, ISBN 978-3-00-044348-0, 2013

Comment:
Directive 98/83/EC and ISO 1399 specify limit values for rare substances that are not listed here; these can be looked up in the original publications. Compared to earlier publications no information regarding phosphate is provided.

⚠ WARNING

Danger of poisoning and pyrogenic reactions.

The operator is responsible for the selection of water treatment equipment and annual inspection of the permeate using the values of Ph. Eur and ISO 13959.

⚠ WARNING

Danger caused by a chemical and/or microbial contamination.

The permeate quality is connected to the quality of supply water. If the quality of supply water reduces significantly, changes to the permeate can lead to the acceptable levels being exceeded.

The operator is responsible for regular monitoring of limit values for supply water.

The water quality in the permeate is shown online via the conductivity (sum parameters of most substances in water). It depends on the pretreatment, the quality of the feed water and the temperature.

3. Accessories List AQUAbase

NOTE:	**If cables, transformers or accessories other than those listed above are used, this may have a negative influence on jamming and noise immunity.**

Item	Article number	Designation	Beschreibung (Description)
1	37754	Sterile filter 20“, 0.2µm, absolute	Membrane filter Steril Hot Polysulfon, pre-rinsed with ultrapure water: Together with an ***Aquaboss***® dialysis water treatment system, the ***Aquaboss***® Hot Rinse hot-water disinfection system and the ***Aquaboss***® sterile hot polysulphone membrane filter, a constant dialysis water quality of < 0.1 KBE/ml is guaranteed.
2	2000011	Water monitor 1”	Autarchic device incl. sensor and safety solenoid valve. Thanks to the de-energized open design, a power supply is not required during operation. As a result, the valve tappet is not heated up, which in turn prevents calcification due to heat input and malfunctioning in the case of a leakage. Automatic periodic rinsing prevents jamming. The solenoid valve is integrated in the ***Aquaboss***® pre-treatment stage if this option has been selected.
3	1350002	Hard water monitor ***Aquaboss***® Softcontrol II	The Aquaboss® hard water monitor is a fully automatic, continuously working, independent measuring system for detecting hardness breakdowns. The Aquaboss® Softcontrol works without chemicals. Since its chemical composition is not altered, the water used can be supplied to the downstream reverse osmosis system without loss. Ion-specific hard water monitoring using the membrane detection principle of monovalent and bivalent ions Independent operating mode without chemicals
4	37962	Disinfectant 5 l	Disinfectant Dialox, 5 l jerry can
5	52819	Minncare Cold Sterilant 6 x 1 kg	Disinfectant Minncare, 6 x 1 kg
6	52820	Minncare Cold Sterilant 2 x 5 l	Disinfectant Minncare, 2x 5 l
7	52821	Minncare Residual Test Strip	Test strips for detecting residues of the Minncare disinfectant
8	899 307	Citric acid solution (company B.Braun) 6 l Citric acid solution (company B.Braun) 10 l	Liquid concentrate for decalcification
9	50663	Flowmeter 100 – 1000 l/h	Variable area flowmeter, polysulphone; hot water resistant

Item	Article number	Designation	Beschreibung (Description)
10	2000050	Filter unit 20”	Combined filter unit 20” single, 1”
11	2000051	Filter unit 20”	Combined filter unit 20” single, hose d25
12	2000052	Filter unit 20”	Combined filter unit 20” single, Mapress
13	2000060	Filter unit 20”	Combined filter unit 20” Duo, lockable, 1”
14	2000061	Filter unit 20”	Combined filter unit 20” duo, lockable, tube d25
15	2000065	Filter unit 20”	Combined filter unit 20” Duo, 1”
16	2000066	Filter unit 20”	Combined filter unit 20” Duo, hose d25
17	2000070	Filter unit 20”	Combined filter unit 20” Duo, lockable, 1½”
18	2000075	Filter unit 20”	Combined filter unit 20” Duo, 1½”

4. Use in combination with other equipment

The operator combines theAQUAbase with further medical products such as loops, media supply units or dialysis machines.

The AQUAbase can be placed on the market completely independently from other medical products. No combination of medical products will be put into circulation by the manufacturer as a standard variation.

The manufacturer, B. Braun Avitum AG, stipulates the following reverse osmosis system requirements for combination with other equipment:

- Devices for the pretreatment of feed water (e.g. softeners, activated charcoal filters etc.) as well as systems for storing or distributing the pure water must meet the requirements of ISO 26722.
- When used in combination with permeate loops, these must be implemented in accordance with EN ISO 11197 (medical electrical equipment, specific requirements for the safety of medical supply units). The pressure loss at the end of the ring piping must not exceed 3 bar with maximum throughput. The minimum flow speed at nominal throughput must not exceed 0.5 m/sec. The inlet and outlet of the ring piping must be able to be locked mechanically.
- When used in combination with media supply units (Medical Product Class I), the tapping points for permeate must be implemented in accordance with EN ISO 11197 (medical electrical equipment, specific requirements for the safety of medical supply units).
- Dialysis units (Class IIb medical products) used in combination must comply with standard DIN / VDE 0753-4 [Guideline for the safe use of medical products in extra-corporal dialysis treatment].
- Furthermore, the dialysis machine must comply with standard IEC 60601-2-16 (special requirements for the safety of haemodialysis, haemodiafiltrations and haemofiltration units).
- A Class EA1 pipe disconnector is adequate for preliminary water treatment only if unhindered intake is ensured through the connected dialysis machines.
- The user must ensure that the devices function and are in a proper condition before using the combination of devices.
- It must be ensured that additional equipment that is connected to the analogue and digital interfaces of the device satisfies the appropriate EN specifications (e.g. DIN EN 60950 for data processing devices, DIN EN 61010-1 for measuring/control/laboratory devices and DIN EN 60601-1 for electro-medical devices). Furthermore, all configurations must satisfy the valid version of the system standard DIN EN 60601-1-1. The person who connects additional devices to the signal input or output section is a system configurator and is therefore responsible for ensuring that the valid version of system standard DIN EN 60601-1-1 is observed. If you have any questions please contact your local dealer or the Technical Services department.

NOTE:	**The reverse osmosis system AQUAbase has been designed for safe operation in combination with the *Aquaboss*® products (ring piping, hot cleaning).**

⚠ WARNING	**Danger of poisoning and pyrogenic reactions.** **Even if the reverse osmosis system produces water of a quality that meets the requirements of the international standard DIN EN ISO 26722, the distribution of this water can impair the quality so much that it no longer meets the requirements of the DIN EN ISO 26722 standard, if the distribution system is not appropriately maintained.** **Maintenance/technical safety checks on the reverse osmosis system and connected distribution system must be undertaken according to the manufacturer's instructions.**

5. Technical Description

The AQUAbase provides the operator with a consumption-controlled reverse osmosis system as a single-level model. A 4-line LCD plain text display allows all operating parameters to be called up and monitored at any time. The plain text display is available in different languages.

An consumer-focused logical control system makes high water yield possible even under unfavourable raw water conditions. In this respect, the raw water consumption depends solely on the permeate requirements of the end user.

A menu-guided plain text display enables the operator to monitor all production parameters and system functions including the disinfection mode in an individual and reproducible way.

Special advantages

- Disconnection from the mains / free water intake as per EN 1717
- User-friendly operation thanks to menu-guided control system with plain text display
- Password protection for adjustable unit data
- Low water consumption including rinsing water for ***Aquaboss***® softener and standstill rinsing
- Shut-down and standstill flushing with leakage monitoring during standby mode
- Compact model
- Durable stainless steel design
- Low energy consumption
- Hot sanitation of the ***Aquaboss***® AQUAbase HT version

5.1 Functional principle

The AQUAbase works on the reverse osmosis principle. Reverse osmosis describes the process of pressure-operated cross-filtration. Water flows at high pressure (up to max. 15 bar) tangentially over a semi-permeable membrane. As is the case with normal filtration, the system is cleaned by allowing one component (water) of the mixture to be separated to pass through the membrane with almost no hindrance, while other components (dissolved and undissolved water contents) are held back to a greater or lesser extent and leave the filtration unit in the concentrate flow. This is a purely physical separation process in the molecular range which does not change the components being separated either chemically, biologically or thermally.

5.2 Design features

5.2.1 Single pipe construction

The single pipe construction ensures the membrane has a long service life. The membrane pipe is made of stainless steel (1.4571/1.4404).

5.2.2 AQUAbase HT Hot-disinfectable Full Fit elements

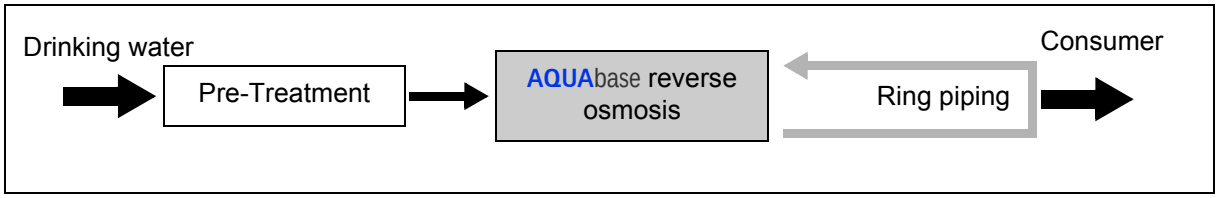
All hot-disinfectable reverse osmosis systems from the AQUAbase HT series are equipped with special Full Fit reverse osmosis elements, which are exceptionally suited to use in microbiologically sensitive water treatment systems due to their external, high-precision manufactured, knurled polypropylene surface structure.

5.2.3 Minimum dead space piping in stainless steel

A minimum of dead space throughout the entire system has been provided. Moreover, the risk of biofilm growth on the pipe walls is restricted to a considerable extent by the high flow rate and the resulting shear forces.

6. Functions

6.1 Basic flow diagram



Water treatment for generation of water to dilute concentrates for haemodialysis generally consists of a pretreatment (e.g. filter, softener, activated carbon...), reverse osmosis

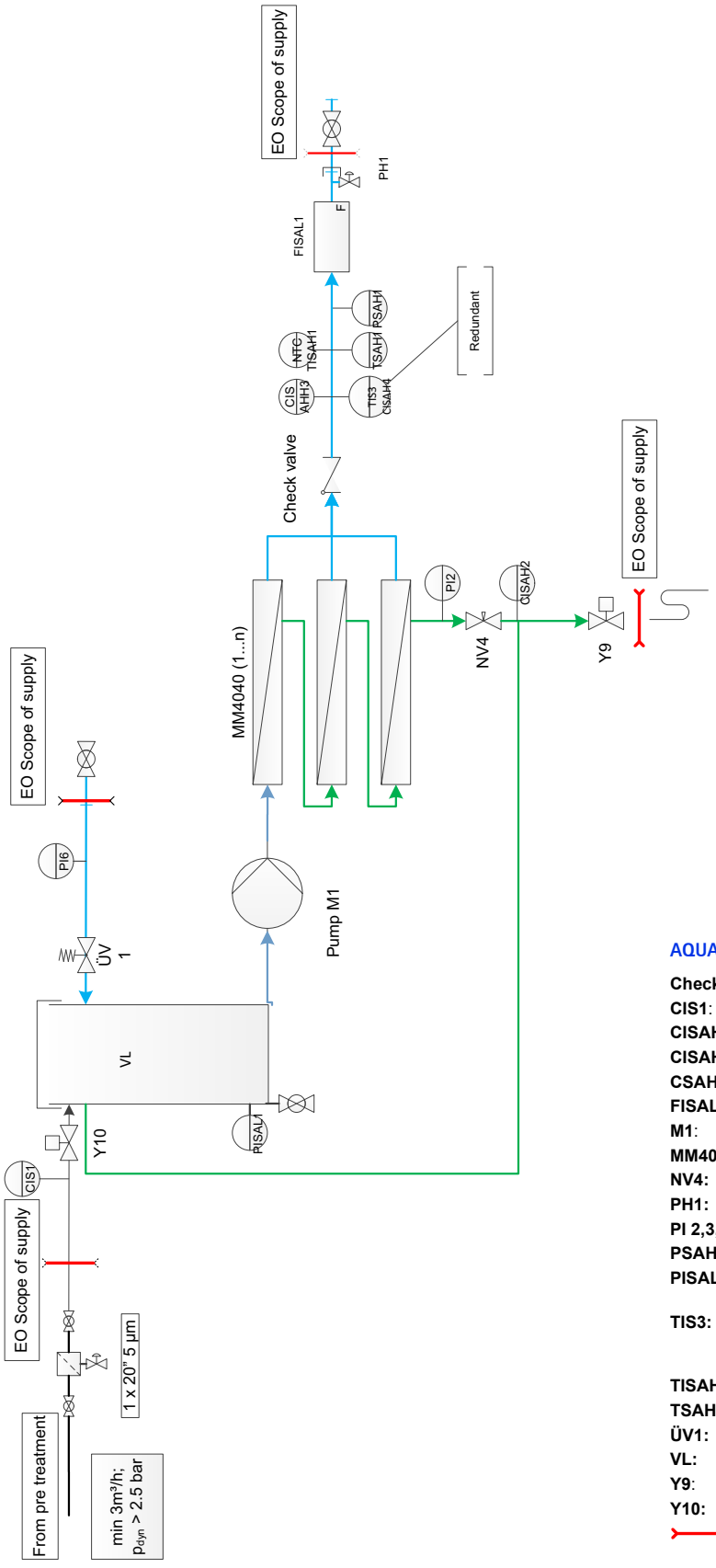
AQUAbase
or → AQUAbase HT

and a ring piping through which the product water circulates and is made available to the user at different tapping points. Both the reverse osmosis and the ring piping are medical products which can be put into circulation independently of one another.

All reverse osmosis systems produce water for the dilution of haemodialysis concentrate.

6.2 Process diagram

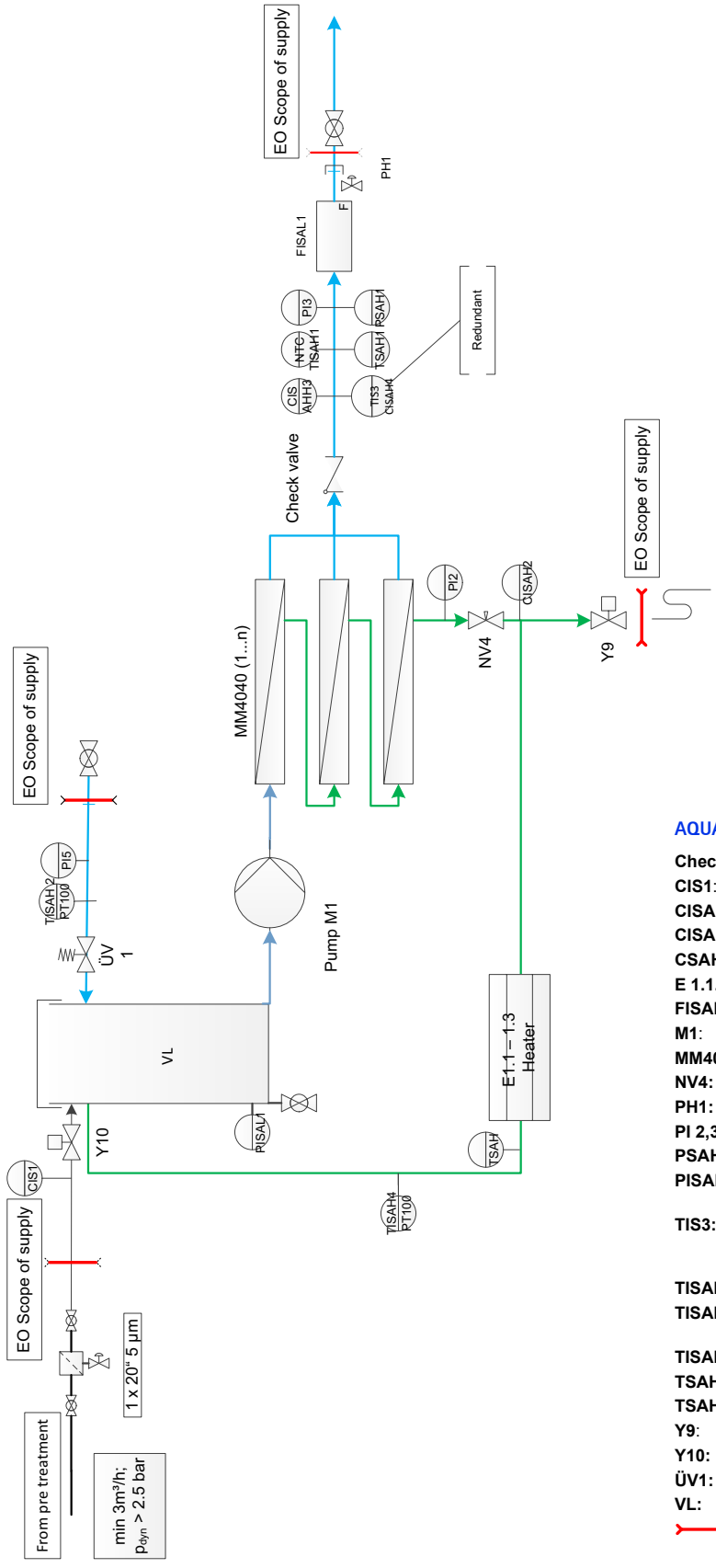
6.2.1 AQUAbase process diagram



AQUAbase *legend*

Check valve:	Return valve
CIS1:	Raw water conductivity
CISAH2:	Concentrate conductivity
CISAHH3:	Permeate conductivity
CSAH4:	External conductivity measurement
FISAL1:	Permeate flow
M1:	Pump 1
MM4040 (1…n):	Membrane module
NV4:	Throttle valve concentrate
PH1:	Ring piping feed valve
PI 2,3,5:	Manometer
PSAH1:	Ring piping pressure monitoring
PISAL1:	Level control pressure sensor supply tank
TIS3:	Temperature compensation for ext. conductivity measurement (for CISAH4)
TISAH1:	Permeate temperature
TSAH1:	Permeate temperature
ÜV1:	Ring piping overflow valve
VL:	Supply tank
Y9:	Concentrate discharge
Y10:	Raw water feed
	Supply limit of reverse osmosis system

6.2.2 AQUAbase HT process diagram



AQUAbase HT *legend*

Check valve:	Return valve
CIS1:	Raw water conductivity
CISAH2:	Concentrate conductivity
CISAHH3:	Permeate conductivity
CSAH4:	External conductivity measurement
E 1.1. – E 1.3:	Heating
FISAL1:	Permeate flow
M1:	Pump 1
MM4040 (1…n):	Membrane module
NV4:	Throttle valve concentrate
PH1:	Ring piping feed valve
PI 2,3,5:	Manometer
PSAH1:	Ring piping pressure monitoring
PISAL1:	Level control pressure sensor supply tank
TIS3:	Temperature compensation for external conductivity measurement (for CISAH4)
TISAH1:	Permeate temperature
TISAH2:	Permeate temperature ring piping return
TISAH4:	Heater temperate control
TSAH:	Heater temperature
TSAH1:	Permeate temperature
Y9:	Concentrate discharge
Y10:	Raw water feed
ÜV1:	Ring piping overflow valve
VL:	Supply tank
	Supply limit of reverse osmosis system

6.3 Functional description

6.3.1 Water supply

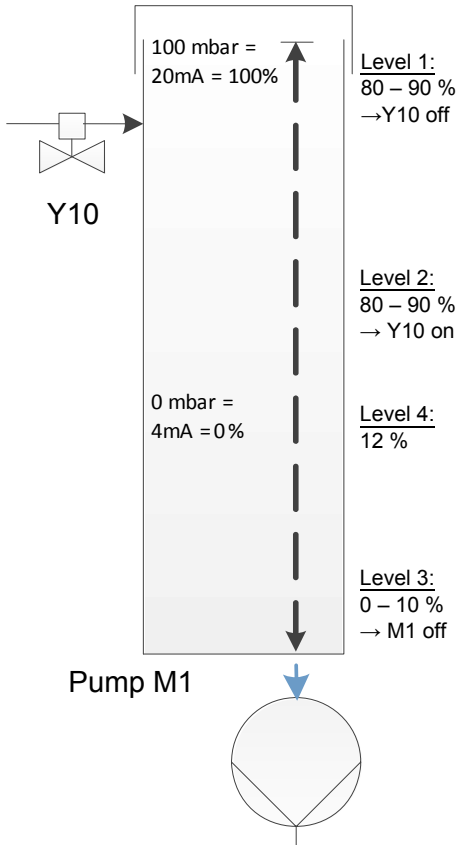
In general the system is fed by soft water which is made available through an upstream softening plant. A 5 µm-prefilter protects the reverse osmosis membranes from coarse contaminations. There are various pre-filter variations to select (see → Chapter 3, Accessories).

Chlorinated drinking water must be treated with an activated carbon filter because chlorine irreversibly damages the membranes. Chlorine must not be detectable in the feed water of the reverse osmosis (→ Part 2, chapter 7 “Technical data”).

These pre-treatment units are not included in the scope of supply of an AQUAbase.

6.3.2 Supply tank

The pre-filtered softened water enters the supply tank through feed valve **Y10**. The level in the supply tank is controlled with pressure sensor **PISAL1**. Pressure sensor **PISAL1** protects the built-in circulation pump against low water levels. If the level drops below the switch point **PISAL1 (level 3),** the pump switches off. The pump must not be operated if the water level in the container has undercut the **level 3 / PISAL1**.



The following are connected to the supply tank:

- Raw water feed via **Y10**
- Ring piping return
- Soft control (optional)
- Overflow
- Aeration and ventilation filter (tank respiration)
- Outlet to pump M1
- Tank emptying

6.3.3 Control according to conductivity

Measured and assessed according to the process diagram:

Raw water conductance **CIS 1**
Concentrate conductance **CISAH2**
Permeate conductance **CISAHH3**

For additional safety the conductivity is recorded independently from the control (CISAH4) und the temperature compensated.

The output of the reverse osmosis system is regulated by the yield in % Water Conversion Factor (WCF). The concentrate of the reverse osmosis stage is returned to the supply tank for economic reasons. The higher the water yield, the higher the average conductivity in the supply tank. However, in order not to impair the permeate quality or to damage the membrane during operation with this operating mode, the concentrate flow has to be drained regularly.

6.3.4 System production pressure

The production pressure must be maintained. Production pressure that is increased too much increases the surface load and may lead to inadequate membrane flooding and thus to membrane damage.

The amount of permeate increases proportionally with production pressure **PI2.** The production pressure is adjusted by **NV4.** Only personnel authorized by the manufacturer are permitted to make such adjustments.

6.3.5 Ring piping pressure

Factors which influence pressure in the ring piping:

- The maximum consumption (number of dialysis stations and other consumers)
- The minimum flow speed required (to avoid the formation of biofilm)
- The minimum supply pressure at the last tapping point
- The pipe geometry (pipe cross-section etc.)

At the end of the ring piping, overflow valve **ÜV1** regulates the pressure in the ring piping and balances out the setting factors. The overflow valve **ÜV1** at the end of the ring piping must be set to pressure **PI5** according to requirements. At full demand rate, the required amount of permeate must be fed into the ring piping with the required pressure. The default setting of **ÜV1** is 2.5–3.5 bar.

6.3.6 Prevention of excess pressure in the ring piping

An increase in pressure after reverse osmosis may well be possible if a shutoff cock is blocking the ring piping. The pressure switch **PSAH1** prevents the pressure increasing above the set value “Pressure **PSAH1**”. After the system is switched off, the corresponding message appears on the display.

An unauthorised increase in pressure when the system is switched on leads to the system being switched off via pressure switch **PSAH1** (error message Alarm **403** or Error **403**).

6.3.7 Temperature-dependent discharge

On reaching a permeate temperature over 35 °C (upper temp. limit value; parameterizable from 20–35 °C) the system drails the concentrate via **Y9** for 1 min. This happens until the temperature has fallen under the lower set temp. limit value.

The system switches off if the permeate temperature rises to above 38 °C (error message **Error 428**).

6.3.8 Standby mode

If no permeate is required for a longer period of time (e.g. weekend or night), the system can be switched to “standby mode”. In this operating mode the system flushes itself in preset cycles, incl. the connected ring piping. This prevents the formation of biofilm, which is fostered at dialysis-free times due the lack of circulation.

The system is switched on automatically at the set times to flush out the ring piping and the modules.

The system is switched on at the main switch (1). The standby mode is selected via the function keys or programmed to auto mode by entering the standby flushing data.

NOTE:	**During “standby mode” no permeate withdrawal is permitted from the ring piping and thus no dialysis is possible.** **Operators can change to dialysis mode at any time by pressing the dial key.**

Activation of permeate temperature monitoring prevents uncontrolled increase of the temperature exceeding a set value.

If the temperature rinsing is OFF: Temperature monitoring is tripped (see menu 3.3), the started intermediate flushing is interrupted. After falling under a programmed lowest temperature value and after expiry of the set standby pause, the next standby flushing is started.

If temperature rinsing is ON: The water is discharged according to the set start and stop values via Y9. There is no leak monitoring if the temperature rinsing is ON.

AQUAbase HT also offers the opportunity to carry out thermal disinfection of the reverse osmosis during the standby mode with the aid of the installed heater. The settings for hot cleaning are made in menu 9. Performance of thermal disinfection (hot cleaning) is described under → Part 1, chapter 12.5.

6.3.9 Shut off rinsing

A shutdown flushing mode is carried out when changing over from dialysis to standby mode.

With the system running, water intake via **Y10** is shut down until the liquid level has dropped below level **PISAL1**. During this time, concentrate is discharged in alternation via **Y9**.

6.3.10 Leak messages

To prevent major leaks during “standby mode”, the system inc. the ring piping is checked for water loss.

If the filling level in the supply tank drops to below **PISAL1** during standby mode, this means that water is being lost in the ring piping or in the system, and the system shuts down (error message **Error 416**).

7. Description of components

7.1 Description of the system

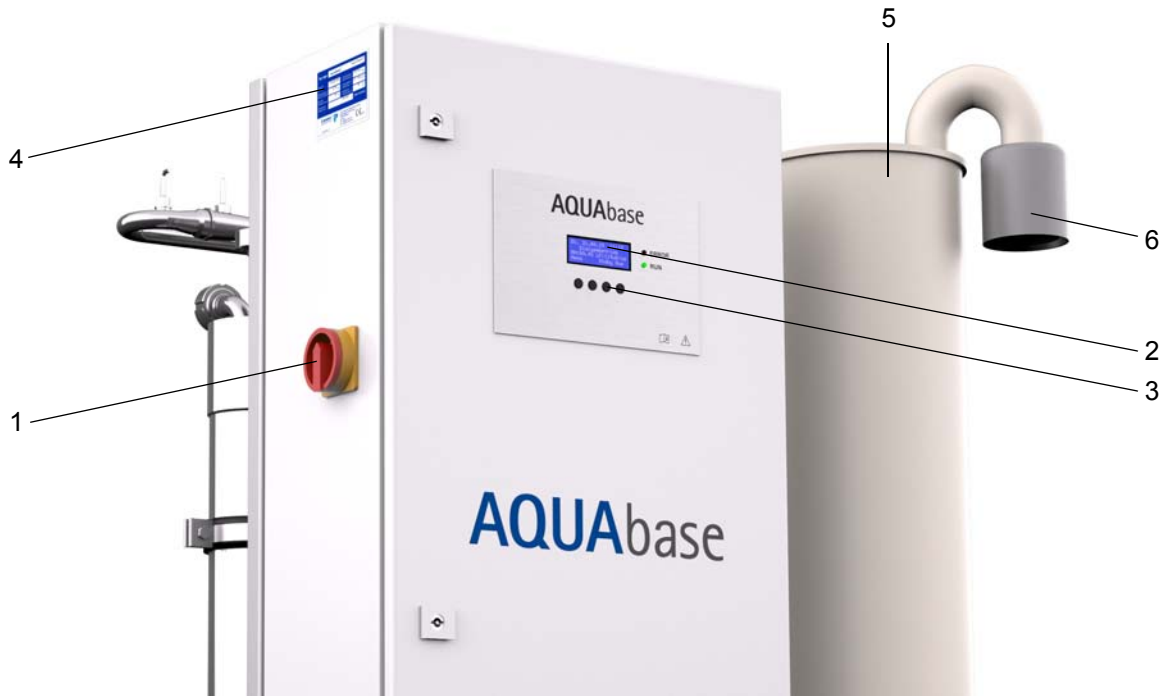
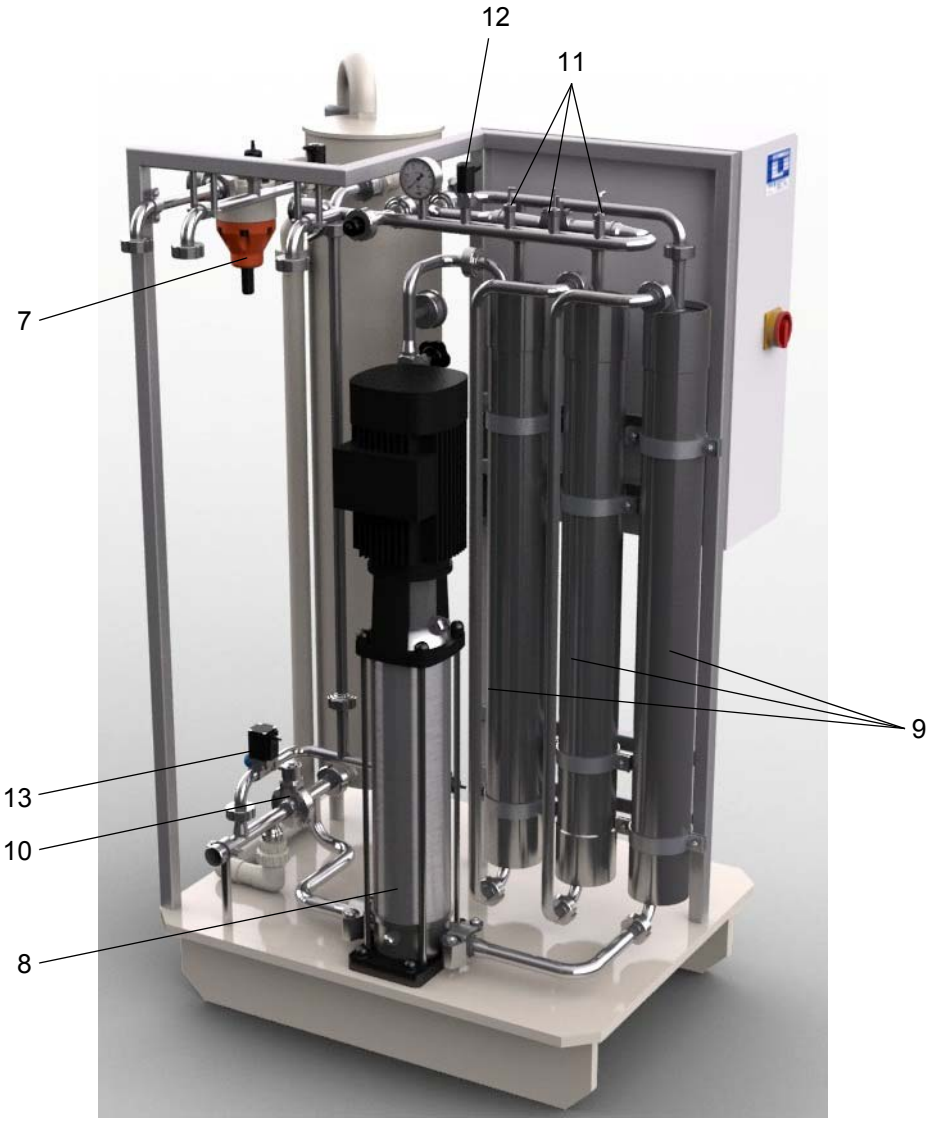


Figure 7-1: AQUAbase

1. Master switch
2. Display – 4 lines with 20 characters each
3. Display-guided key control (function keys F1, F2, F3, F4)
4. Nameplate
5. Supply tank
6. Sterile filter



7. ÜV1
8. Pump M1
9. Membrane module MM4040 (1…n)
10. Disc valve
11. Temperature sensors/temperature switch
12. Pressure switch
13. Solenoid valve Y9

7.2 Display and keypad

The parameters and operating states are displayed on a 4-line LCD display.

To the right of the display there are 2 LEDs, which either indicate normal operation (green) or an error/ alarm (red).

Operator guidance using the display and the four keys is a simple and quick way of viewing and changing operating parameters (only personnel authorised by the manufacturer may change values relevant to operation).

B. Braun advises proceeding with the help of the operating instructions when using the system for the first time and when operators are not familiar with the system.

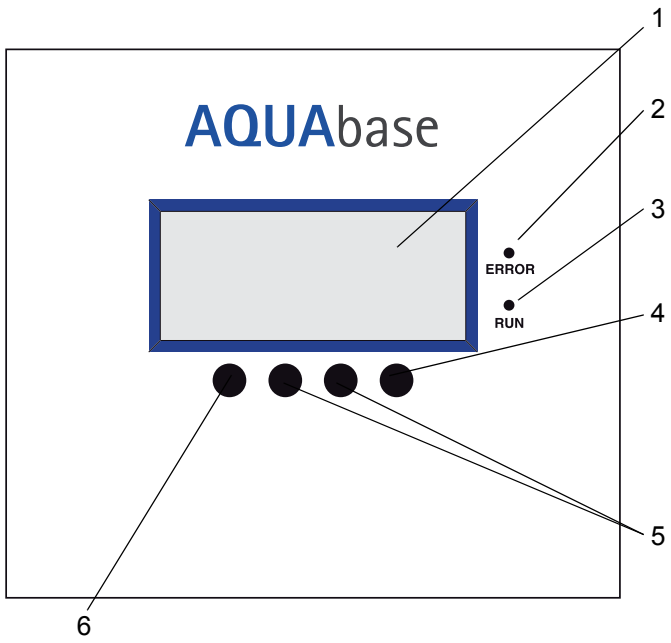


Figure 7-2: Display with function keys

1. LCD display, 4 lines
2. LED red, error/alarm
3. LED green, operation
4. Enter key (F4)
5. Setting keys (F2, F3)
6. Menu key, ESC (F1)

8. Commissioning / Decommissioning

- Commissioning, operation and maintenance may only be carried out by authorized, trained and B. Braun-instructed specialists. Electrical work is to be carried out only after completely disconnecting the system from the power supply and only by authorized, trained and instructed electricians.

DANGER	**Electric shock!** **Dangerous electrical voltage with the switch cabinet door opened** **→ Switch the reserve osmosis system off at the main switch and disconnect from the mains**

- Read and carefully observe these operating instructions, especially the safety instructions → Part 1 from page 1-1 before starting up, operating and servicing the system!
- When putting into operation, check to make sure all water connections have been made properly → Part 2 from page 3-1 and that all connections are leakproof.
- Commissioning is documented in the commissioning log (→ Part 2 from page 5-1).

8.1 System start-up

Open the water feed (upstream of the system) and switch the system to **ON** at the main switch.

1. Initial test.
2. The supply tank is emptied.
3. After the level falls short of switch point **PISAL1** the tank fills up again.
4. The control unit switches on the pump and the system starts to produce permeate.
5. The pump must be bled (see → Part 2, chapter 4 “Commissioning”) upon initial commissioning or commissioning after opening water conducting parts.

8.2 Production stoppage

The system can be left filled with water for a short time e.g. overnight, if it is not to be operated in the standby mode. However, there is an increased risk of contamination in the system and ring piping in this case. After the reverse osmosis has been at a standstill for > 72 hours, disinfection is recommended.

The system should be switched on some time before the first dialysis to flush out the system and ring piping. There is a standby mode for periods without dialysis.
→ Part 1 from page 12-1.

8.3 Machine start-up after shutdown due to a fault

If the system is at a standstill due to a fault, the cause will be shown on the display. The cause of the fault should be addressed if possible → Part 1 from page 15-1.

The control system may need to be reset, depending on the problem. This is done by switching the main switch off and on again or by pressing the reset key on the display.

8.4 Putting the machine out of operation

If the system is to be shut down for a longer period, it is recommended that the system be treated with preservative. Please consult our “Technical information sheet PRESERVATION” → Part 1 from page 8-3 for information about preserving the system. When the system has been shut down for longer periods, it must be checked for softener contamination.

After a longer period of standstill, the system is put into operation again as described under “Work before commissioning” → Part 2 from page 3-1.

NOTE:	**During preservation, the system must be clearly marked with the following information:** **- Type of the preservative** **- Date of preservation** **- Contact to responsible physician and operators.**

After preservation, disinfection must be carried out according to → Part 1, chapter 12 before normal start-up to exclude any hazard to the patients! Preservation is recorded in a separate log provided for this purpose, as well as in the medical product log (→ Part 2, chapter 9.2.1).

8.5 Return and disposal

The medical product contains a battery. Used batteries should be taken for recycling. The battery is located on the CPU in the control cabinet and can be lifted off the PCB using a screwdriver:

Carry out the following steps:

1. Main switch to “0”
2. Screw the EMC cover off
3. Replace the battery

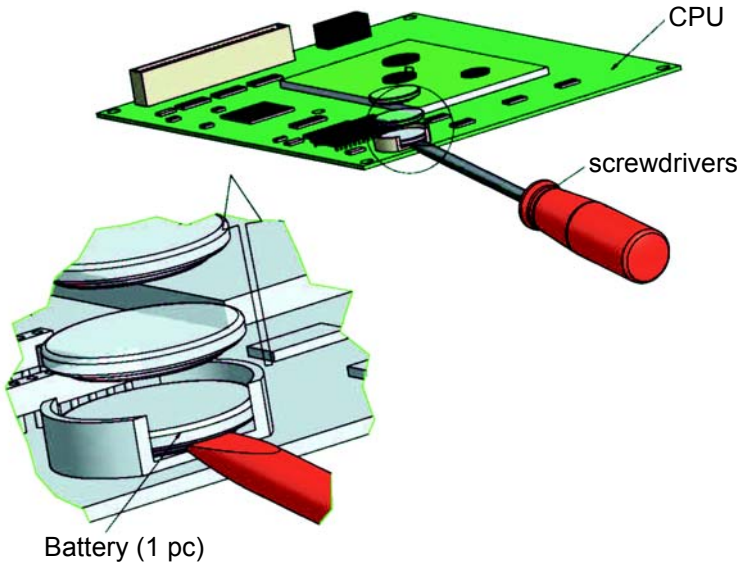


Figure 8-1: Battery removal

In accordance with legislative regulations, B. Braun Avitum AG offers to take back systems it supplies and dispose of these as stipulated by legislation.

NOTE:	**The materials used correspond with the requirements of the GUIDELINE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND THE COUNCIL of 8. June 2011 on the Restriction of certain Hazardous Substances (ROHS) in electrical and electronic devices.**

8.6 Technical memo for PRESERVATION with sodium metabisulphite

NOTE:	**Observe the manufacturers' safety data sheets.**

Protection against contamination and stabilization of reverse osmosis membranes

- Before preservation, flush the membranes with good-quality water free of chlorine (dissolved solid matter: SDI < 5). Use 60 litres of water for each 4-inch membrane.
- The growth of microorganisms is prevented by the bisulphite withdrawing oxygen.

Table 8-1: Filling volumes of preservative / antifreeze

	Conservation	Stabilisation	Antifreezes			
Number of modules	Sodium meta-bisulphite [mg/l] 0.5 – 1 %	$MgCl_2$ [gr] 200–350 mg/l	Glycerin 86% for -5°C [litres]	Glycerin 86% for -9°C [litres]	Glycerin 86% for -17°C [litres]	Total volume of liquid for RO [litres]
1	25.5 – 51	10.5 – 18	5	11	19	51
2	27 – 54	11 – 19	6.5	13	21	54
3	28.5 – 57	11.5 – 20	7	15	23	57

Preservation using sodium metabisulphite

- If biofouling of the membrane is not to be expected and if the membrane is to be protected for storage, a solution with 0.5–1 wt./vol.% sodium metabisulphite can be used.
  9.5% wt./vol.% glycerin must be added to guarantee frost protection down to -5 °C.
- It is helpful to produce a basic solution with sodium metabisulphite in a 20-fold concentration and to fill the supply tank with this basic solution.

Stabilisation

- 200 – 350 mg/l magnesium chloride ($MgCl_2$) must be added to maintain membrane stability if this solution is to be stored for longer than one month.
- Let the preservative solution circulate through the membrane. Recirculate the solution through the mixing tank for at least 20 minutes. The temperature must not exceed 35 °C.
- It is helpful here, too, to produce a basic solution with $MgCl_2$ in a 20-fold concentration and to fill the supply tank with this basic solution.

Emptying the supply tank

- Empty the mixing tank down the waste drain when the protective treatment has been completed.
- Only leave the preservative solution in the membrane after completing the steps above if the membrane will not be subject to frost.

NOTE:	**If the system is exposed to a temperature of 0 °C (during transport etc.), it must be emptied completely (especially the membrane), as otherwise freezing water could cause the pipelines and membrane to be destroyed.**

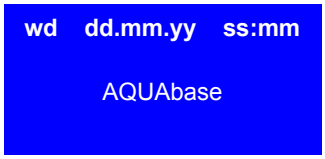
Flushing

- To flush out the preservative solution (element 4040), a maximum permeate production and a concentrate flow of at least 60 l/min (35 min – 45 min) is required.
- Flushing can be terminated when the conductivity in the permeate (display) is 2–10 µS/cm (depending on yield and raw water constitution).

NOTE:	**During preservation, the system must be clearly marked with the following information:** **- Type of the preservative** **- Date of preservation** **- Contact to responsible physician and operators.**

After preservation, disinfection must be carried out according to → Chapter 12 before normal start-up to exclude any hazard to the patients! Preservation is recorded in a separate log provided for this purpose, as well as in the medical product log (→ Part 2, chapter 9.2.1).

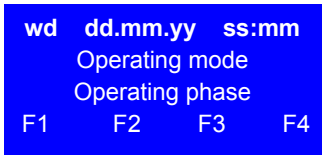
9. Turning the equipment on



CPU test

After switch-on at the main switch (1), a CPU initial test is carried out:

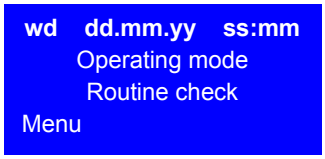
Once the initial test has been processed correctly, the red LED illuminates briefly once and the green LED is permanently illuminated. The tank is emptied and refilled during the initial test. Dialysis is not possible during the initial test. If the initial test is not processed correctly within 15 minutes, a fault message is issued with specification of a fault code.



Operating status and phase display

Following the successful initial test, operating status and phase are shown on the display. The system always starts up in the mode it was in when switched off.

Activities can be activated using the function keys F1, F2, F3 and F4 depending on the status.



Maintenance request

Alternating with the operating modes of the system, the respective due service requests are displayed. If routine checks are due, this is indicated additionally by flashing in the 3rd line.

Indication of a fault / error message

A fault text appears if a fault is determined during operation. The system may be switched off, depending on the type of fault.

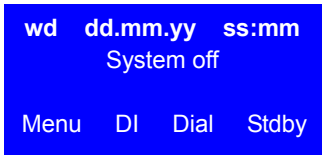
(→ Part 1, page 15-1 et seq.).

NOTE:	**After the power supply has been interrupted, the system always switches to the mode of operation that was last active.**

10. Dialysis mode (Dial)

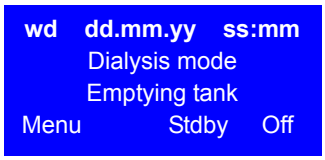
Dialysis mode (permeate production) supplies the connected dialysis machines. (Among other things, the dialysis machine dilutes haemodialysis concentrate to provide ready-to-use dialysate.)

NOTE:	**Disinfection is not permitted during dialysis.**



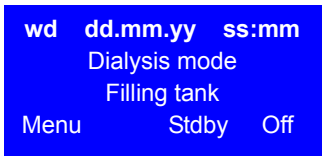
Initial menu for initiating dialysis mode

After the functional key Dial has been pressed, the selected system operating status appears in the menu. The respective operating phase is simultaneously displayed. Filling/emptying the supply tank is shown as a separate operating phase.



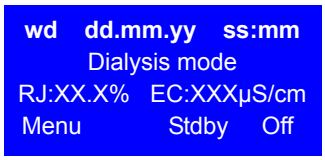
Dialysis mode, operating phase “Emptying tank”

If there is still some water in the supply tank when the system is started up (e.g. following start after standby) the supply tank is emptied in a first step. Then the supply tank is filled with raw water/softened water.



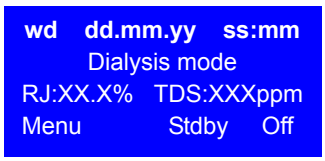
Dialysis mode, operating phase “fill tank”

The system automatically switches to dialysis mode after filling the tank.



Dialysis mode, display of permeate conductivity

During operation the permeate conductivity (cond. in µS/cm) and the reserve (RJ in %) is faded in as an operating phase.



When selecting the unit display in US units (see menu 7.3 language), during operation the permeate conductivity appears in “total dissolved solids” (TDS in ppm) and the reserve is displayed as the “Rejection Rate” (RJ in %).

11. Standby mode (operation at dialysis-free times)

If no permeate is required for a longer period of time (e.g. weekend or night), the system can be switched to “standby mode”. In this operating mode the system flushes itself in preset cycles, including the connected ring piping. This counteracts the formation of biofilm which is promoted in periods without dialysis due to lack of circulation.

The system is switched on automatically at the set times to flush out the ring piping and the modules.

The system is switched on at the main switch (1). The standby mode is selected via the function keys or programmed to auto mode by entering the standby flushing data.

NOTE:	**During “standby mode” no permeate withdrawal is permitted from the ring piping and thus no dialysis is possible.** **Operators can change to dialysis mode at any time by pressing the dial key.** **Withdrawal of permeate during standby mode leads to a leakage signal.**

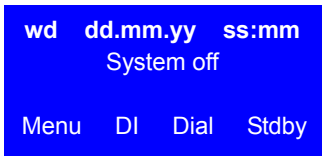
Activation of permeate temperature monitoring in menu 3.3 prevents uncontrolled increase of the temperature exceeding a set value.

If the temperature rinsing is OFF: Temperature monitoring is tripped (see menu 3.3), the started intermediate flushing is interrupted. After falling under a programmed lowest temperature value and after expiry of the set standby pause, the next standby flushing is started.

If temperature rinsing is ON: The water is discharged according to the set start and stop values via Y9. There is no leak monitoring if the temperature rinsing is ON.

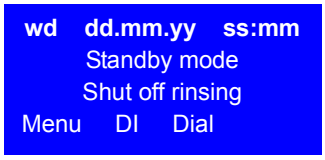
Hot cleaning (option)

AQUAbase HT also offers the opportunity to carry out thermal disinfection of the reverse osmosis during the standby mode with the aid of the installed heater. The settings for hot cleaning are made in menu 9. Performance of thermal disinfection (hot cleaning) is described under → Part 1, chapter 12.5.



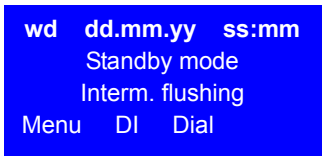
Initial menu for initiating standby mode

To activate this operating mode, press the function key Stdby during dialysis operation or another operating mode.



Standby, display of the “Shut off rinsing” operating phase

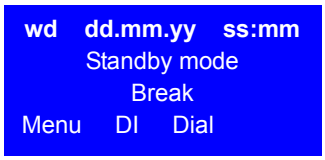
After initiating standby mode, shutdown flushing is shown as the operating phase. During shutdown flushing, the tank contents are discharged and refilled after a waiting period of 60 seconds.



Standby mode, display of operating phases “Break” and “Intermediate flushing”

After completed shutdown flushing an intermediate flushing is immediately initiated and after completion the system switches to break.

After shutdown flushing has been completed, the operating phase “break” is shown between intermediate flushing.



The information “Standby Mode Break” is shown on the display between two intermediate flushings.

12. Disinfection (DI)

If possible, thermal disinfection of the reverse osmosis system AQUAbase is preferable to chemical disinfection. A B. Braun reverse osmosis system may only be disinfected (DI) by B. Braun-authorized and trained personnel. Disinfection is recommended at least once per year. The reverse osmosis must be disinfected (DI) if the germ count is found to be higher than normal (action limit: 50 CFU/ml).

Disinfection of the AQUAbase is carried out following instructions of the operator:

- After initial commissioning and flushing out the preservative
- As a preventative measure
- When the microbiological action, warning or alarm limits are attained or exceeded
- After opening the system for maintenance or repair work or other constructional intervention

12.1 Before disinfection (DI)

To increase the effectiveness of disinfection (DI), it must be ensured that the membrane modules are free of organic and chemical contamination. The membrane modules must be cleaned beforehand with **citric acid** to remove hardness salts or iron deposits on the membrane.

In case of systems that cannot be disinfected thermally due to their construction, the disinfection of the water carrying parts is carried out with disinfectants containing peracetic acid. Chemical disinfectants must comply with EN 1040 (Chemical disinfectants and antiseptics: test procedure for bactericide basic action).

The following disinfectants (combination treatments) have been approved for the disinfection (DI) of AQUAbase reverse osmosis systems:

- Puristeril® 340 (Fresenius)
- Dialox® (Seppic / Gambro Medizintechnik)
- Peresal® (Henkel Hygiene GmbH)
- Minncare Cold Sterilant (Minntech)

⚠ DANGER	Chemical disinfection. **Acute risk of poisoning during chemical disinfection.** • **The system may only be disinfected (DI) during the dialysis-free period! It must not be possible to carry out dialysis.** • **The permeate must be disconnected from the dialysis machines before the disinfection process is started.** • **If a softener is used: softeners may only be used with a pipe disconnector of the type EA1 or with a free intake.** • **Disinfection of the reverse osmosis system must be signaled using appropriate measures in the treatment rooms. (See → Part 2, page 11-2.)** • **The disinfectant must not be stored on the reverse osmosis system. The manufacturer's specifications must be heeded for storage of the disinfectant.** • **Acute risk of poisoning if disinfectants or cleaning agents are taken or administered.** • **Cleaning and disinfection may only be carried out by order of the attending physician.**

The AQUAbase was tested for its material resistance in combination with the approved disinfectants and released.

Disinfection is recorded in a separate log provided for this purpose, as well as in the medical product log (→ Part 2, chapter 9.2.1).

The warning instructions of the disinfectant manufacturers must be observed when these products are being used, and personal protective equipment must be worn.

12.2 Performance of chemical disinfection (DI)

Disinfection working steps

1. Reverse osmosis system flushing
2. Fill the supply tank with permeate
3. The commercial preparation is to be provided as an approx. 2.0% solution for reliable water bacteria disinfection (see → Table 12-1). In this respect, a basic solution is used in the supply tank, where the concentration of the disinfectant must not exceed 8% (otherwise the membrane would be damaged!). Consult B. Braun in the case of proven contamination by fungi/yeast or spores.
4. The contents of the supply tank are run until a standardised concentration of disinfectant is achieved in the full system. (This can be determined by comparing the conductivity in the ring piping feed and return for example). The reaction time (with the final concentration of the disinfectant) is at least 20 minutes. The reaction time of the disinfectant in its diluted form on membranes must not exceed 30 minutes and must be completed directly by a rinsing process.

NOTE:	**Contamination in the water treatment system can lead to an unspecified disinfectant reaction to occur which can greatly reduce the concentration of the effective disinfectant. In certain cases, the amount of disinfectant needed can differ greatly from the calculated requirement.**

NOTE:	**The colouring of the test strips merely indicates that the disinfectant concentration is above the limit to be determined by the test strip. It cannot be used to determine the concentration of the active ingredient.**

5. Following disinfection (DI), the reverse osmosis system and ring piping are flushed with permeate.

   The following tests are available for specifically testing for disinfectant residue:
   - for H_2O_2 (peroxide test – Merck item no. 10011) or
   - for peroxyacetic acid (peroxyacetic acid test – Merck item no. 110084)
   - for Minncare (Minncare Residual Test Strips – Art # 52821)

NOTE:	**Make sure the contents are well mixed in the supply tank, because layers can form on the bottom of the tank due to the different specific densities of the disinfectant and permeate.**

A separate check must be made at all individual permeate tapping points to make sure there is no disinfectant left in the system. B. Braun recommends a repeat test to ensure there is no disinfectant left in the system after the disinfected and flushed reverse osmosis has stood still for 30 minutes.

⚠ WARNING	**Poisoning hazard!** **Ensure that the permeate is free of disinfectant on each treatment station after disinfection and before starting dialysis.**

Table 12-1: Disinfectant – application concentration

Preparation	Conc	pH
A) Puristeril®	3 %	2.0
B) Dialox®	2 %	2.5
C) Peresal®	2 %	2.3
D) Minncare®	1 %	3.5
E) Minncare®	3 %	2.5

Table 12-2: Disinfectant – application concentration

Number of 4” modules (4040)	Disinfectant in litres		
	A–C	D	E
1	0.4	0.2	0.6
2	0.8	0.4	1.2
3	1.2	0.6	1.8

Ring piping, running metres with internal diameter of 20 mm	Disinfectant in litres		
	A–C	D	E
50	0.3	0.15	0.45
100	0.6	0.3	0.9
150	0.9	0.45	1.35
200	1.2	0.6	1.8
250	1.6	0.8	2.4
300	1.9	0.9	2.7
350	2.2	1.1	3.3
400	2.5	1.25	3.5

Surge tank volume in litres	Disinfectant in litres		
	A–C	D	E
25	0.2	0.1	0.3
50	0.3	0.15	0.45

⚠ ATTENTION

Contamination of drinking water!

Before beginning disinfection, ensure that a softener and reverse osmosis may only be used with a pipe disconnector of the type EA1 or with a free intake.

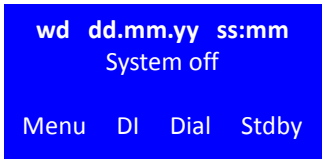
NOTE:

Only use disinfectants approved by B. Braun.

12.3 Cleaning before disinfection

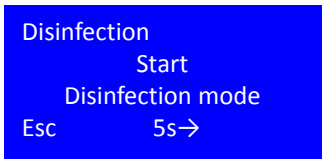
B. Braun recommends cleaning the membranes with citric acid (e.g. B.Braun citric acid solution 50%) before each disinfection. Cleaning takes place in the same way as chemical disinfection and can be started by the menu guide “DI – disinfection” from the operating mode “Off”.

12.4 Disinfection menu guide



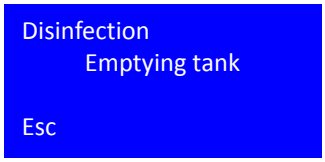
The AQUAbase has a menu-guided disinfection program. The disinfection times are set under menu 4 Disinfection mode.

Disinfection of the device is triggered by pressing the function key DI in the initial menu or in standby mode.



Initial screen at start of disinfection mode

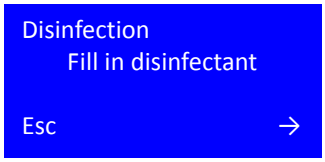
The user moves to the following disinfection phase by pressing the **5s ->** key for more than 5 seconds. Pressing the Esc key returns the user to the old operating mode. The disinfection process (DI) can only be cancelled during the programme sequence at a later stage if this was permitted in the initial settings. (The ESC function is only faded in after activation of the cancel possibility under menu item 4.4 entry of disinfectant permitted/blocked).



Filling the disinfectant

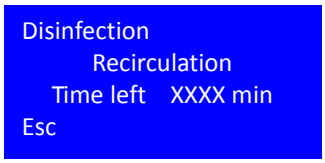
In a first step the fill level of the supply tank is checked. If the supply tank is full, the adjoining screen is shown and the supply tank is emptied.

Afterwards the supply tank (VL) is filled to 10% of the maximum filling level.



Fill in disinfectant

Next the system will request the addition of disinfectant to the supply tank. The disinfectant solution is added via the disinfectant filling opening in the lid of the supply tank (remove protective stopper). Only the disinfectants (DI) and quantities listed by B. Braun may be used for disinfection.

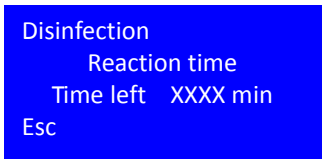


Recirculation mode

Confirm the entry and move to the next disinfection phase by pressing the -> key “Recirculation”. The tank is filled up to a defined maximum filling level (menu 6.7). Disinfection (DI) is cancelled prematurely by pressing **ESC**.

Recirculation mode with display of remaining testing time

After the recirculation time has expired the screen changes to the reaction mode. Esc can be pressed to end recirculation mode prematurely.



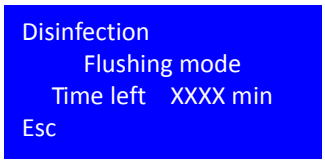
Reaction time with display of remaining testing time

After the reaction time has expired the screen changes to the flushing mode display. **ESC** can be pressed to end reaction time prematurely.

Move to the next disinfection phase by pressing the -> key.
Disinfection (DI) is cancelled prematurely by pressing **Esc**.

“Flushing mode”: After flushing mode has been initiated, the time left is shown on the display.

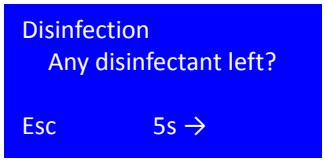
NOTE:	**Make sure that the local discharge conditions for waste water containing disinfectants are complied with.**



Flushing mode with display of remaining testing time

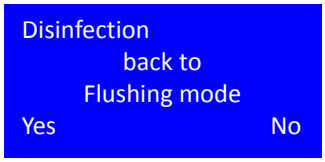
Flushing is effected alternating between filling the tank, activation of the solenoid valves involved and complete emptying of the supply tank. Using the ESC key, the flushing mode can be cancelled and the request to prove the presence of disinfectant appears prematurely (B. Braun however, does not advise cancelling any flushing mode prematurely).

10 Minutes before expiry of the flushing time the software asks to check for any residual disinfectant. The test is confirmed by pressing the → key.



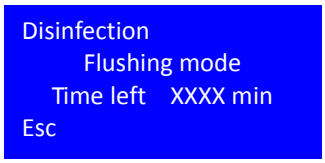
Carrying out proof of disinfectant

If proof of no residual disinfectant was successful, this is confirmed by pressing the → key for **5s** (5 sec).



Extending the flushing phase

If there is residual disinfectant in the system the user is requested to switch back to flushing mode by pressing **Yes**. **No** activates the operating mode **End of disinfection (DI).**



If yes:

Pressing the “yes” key returns the user to the flushing mode.

End of disinfection (DI)

If no:

Pressing -> moves the system out of disinfection mode and into the initial state.

12.5 Thermal disinfection (option)

Hot disinfection is optionally available for AQUAbase reverse osmosis using the AQUAbase HT series.

Hot cleaning is a chemical-free alternative to the disinfection modes, which optimises the microbiological quality of the permeate and is carried out in standby mode.

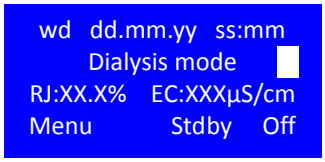
The “HT” option includes a heating module with a 3 x 2 kW heat output, which heats the reverse osmosis system up to 85°C and serves as thermal disinfection. Thermal disinfection covers the entire system from the supply tank and reverse osmosis module to permeate feed into the ring piping and consists of the operating phases heating – hold temperature – cooling.

⚠ **WARNING**	**Danger of poisoning due to detached construction materials and destruction of components!** **→ Only temperature-resistant original materials up to a minimum of 90°C must be used.**

12.6 HT option – hot cleaning reverse osmosis

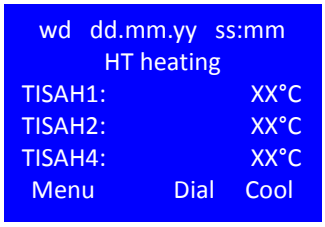
Parameterisation for hot cleaning takes place under menu 9 HT operation. Hot cleaning can either be time-controlled or started by hand. Menu 9 HT operation is only available when the option HT is available and DI 14 has been activated.

If hot cleaning is planned for today, this is indicated in the dialysis mode via an ASCII character in the second line of the operating display on the right edge:

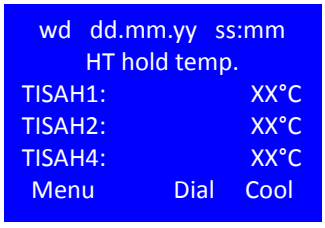


After ending the dialysis mode and before starting hot disinfection, reverse osmosis runs through shut off flushing of the standby mode.

Heating phase

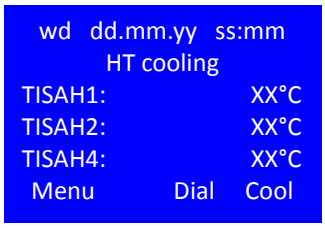


After finishing shut off flushing, the system immediately starts hot disinfection with the operating phase HT heating. This is ended as soon as the specified target temperature (menu 9.1) is reached. The temperature displays of the three temperature measuring points of reverse osmosis are shown in alternation.



Hold phase

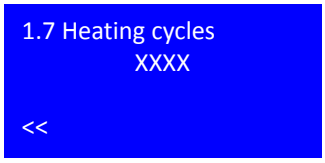
The temperature is held according to the specifications from menu 9.4 after reaching the heat-up temperature.



Cooling phase

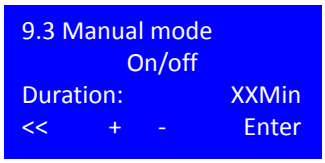
After expiry of the holding phase, the system changes into the cooling phase in which the reverse osmosis system is cooled to the set temperature in menu 9.2 by supplying fresh water into the supply tank.

As soon as the set cooling temperature is reached, the system changes back to the standby mode to the programmed flushing cycles (see → Chapter 11 “Standby mode”).



Heating cycles counter

The successful completion of hot cleaning is shown in display menu 1.7 Heating cycles by a higher counter number. The counter number is not increased if hot disinfection is cancelled (manually or due to a fault message) and disinfection has not been successfully carried out.



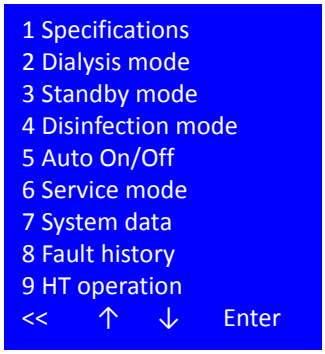
Manual mode

In addition to starting hot cleaning automatically, hot cleaning can also be started manually. The requirement is that reverse osmosis is in the standby mode.

The option manual mode “on” and a duration in minutes are selected once only in menu item 9.3, and only for today, to start the manual mode. Hot cleaning is started by pressing the Enter key after entering the operating parameters. The disinfection temperature corresponds with the value recorded in menu 9.1. The entries are automatically deleted after completing hot cleaning.

NOTE:	**EN ISO 15883-1 stipulates a reaction time of 10 minutes for an A0 value of 600 at a temperature of 80 °C. Lower temperatures require longer heating phases to kill off most vegetative bacteria, yeasts, fungi and viruses.** **(Reference: EN ISO 15883-1 “Washer-disinfectors – Part 1: General requirements, terms and definitions and tests”)**

13. System data and parameters input



The program branches into the parameter setting level by requesting the program item **Menu** from the basic control unit state and during the dialysis mode. System characteristics can be retrieved in the sub-programme items in this level. In addition, the system control parameters can be modified.

Parameters that are related to the system's functional safety and parameters used by technical service personnel for checking system functions are password-protected and may only be changed by authorized personnel.

If the option of hot cleaning HT is installed, this will be shown in the menu under item 9. If this mode is not available the menu list will stop at section 8 “Fault history”.

Selecting the menu item

<< Switches to the previous menu

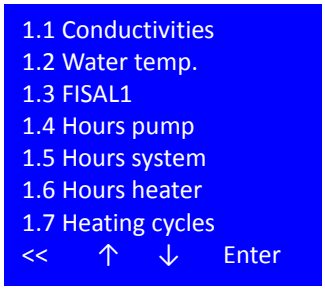
↑ previous menu item / selection.

↓ subsequent menu item / selection

Enter Activate selection

⚠ ATTENTION	**Entering incorrect values can endanger the proper functioning of the control system.**

13.1 Specifications, menu item 1



Menu item 1 provides access to the operating data of reverse osmosis. The specifications data can be accessed without password entry.

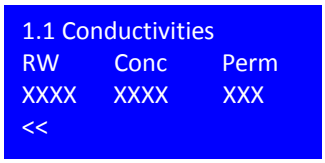
Selecting the menu item

<< Switches to the previous menu

↑ previous menu item / selection.

↓ subsequent menu item / selection

Enter Activate selection



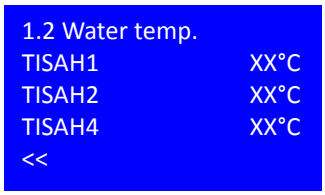
Menu item 1.1 leads the user to a collective screen for all measured conductivities.

RW: Conductivity of raw water in µS/cm or ppm TDS

Conc: Conductivity of concentrate in µS/cm or ppm TDS

Perm: Permeate conductivity µS/cm or ppm TDS

<< Return to specifications menu



In **menu item 1.2** Water temp. the operator gains access to the collective screen of recorded temperatures.

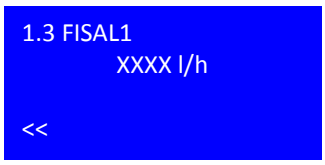
The optional temperature measurements TISAH2 and TISAH4 are shown in alternation every 5 seconds, TISAH2 and TISAH4 are only shown for system type AQUAbase HT RO (DI14=1).

TISAH 1 Temperature of permeate in °C or °F

TISAH 2 (Option HT) temperature end of ring piping in °C or °F

TISAH 4 (Option HT) Control temperature heater in °C or °F

<< Return to specifications menu

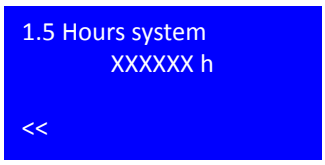


In **menu item 1.3** FISAL1 the operator gains access to the display of the current measured permeate volume in l/h.

<< Return to specifications menu

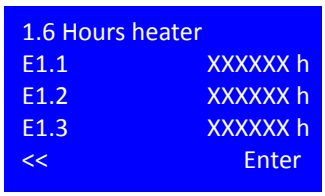
The operating time of pump M1 is shown in **menu item 1.4** in hours [h].

<< Return to specifications menu



The operating time of the device is shown in **menu item 1.5** in hours [h].

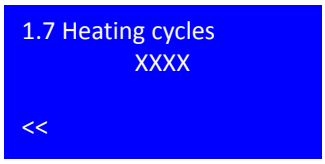
<< Return to specifications menu



Additional specifications for the hot cleaning HT option

If the hot cleaning HT option is installed, the operating time of heater E1.1 to E1.3 is shown in **menu item 1.6** in hours [h].

<< Return to specifications menu

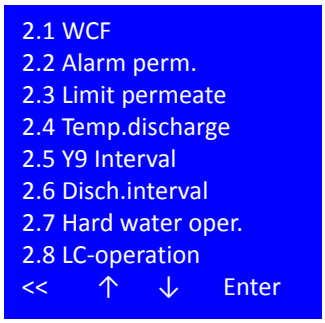


If the hot cleaning HT option is installed, the number of error-free completed device heating cycles are shown in **menu item 1.7**.

<< Return to specifications menu

13.2 Dialysis mode, menu item 2

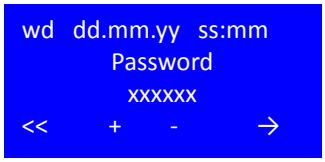
Customised settings of reverse osmosis can be viewed in **menu item 2** Dialysis mode.



Access to the display of each menu point is gained without requesting a password. The parameter change requires entry of a password. The password is automatically deactivated after 20 minutes without an entry.

Entry of customer password

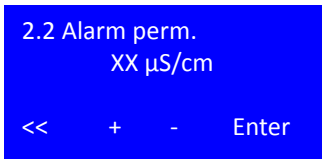
When selecting the edit function and after selection of a menu item, the control system asks for a 6-digit, customer-specific alphanumerical password to be entered.



Enter the right combination with +/-, continue with →, return with ←. Confirm with enter after reaching the last position.

Menu item 2.1 WCF (Water Conversion Factor = yield)

After entering the customer password, the water yield can be set in the range 25 – 90% (Default 50%) in menu 2.1.

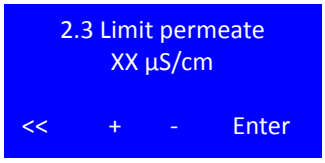


Menu item 2.2 Permeate alarm value

The permeate alarm value determines the conductivity at each it should be signalised to the operator that the permeate quality on CISAHH3 is outside the required quality.

If the alarm value is exceeded during the dialysis mode, alarm 408 is emitted, the system remains in operation and the concentrate discharge takes place time-controlled as defined in menu 2.6. Alarm is self-acknowledging after falling under the alarm value.

Adjustment range 5 – 60µS/cm, Default 30µS/cm

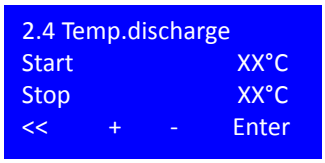


Menu item 2.3 Limit value permeate

The permeate limit determines the conductivity on CISAHH3 at which reverse osmosis undertakes safety-related shutdown.

Error 409 is emitted and the system stops if the limit is exceeded during the dialysis mode. The error can be acknowledged by restarting the system after addressing the cause of the error.

Adjustment range 5 to -200 µS/cm, Default 90 µS/cm



Menu item 2.4 Temp.discharge

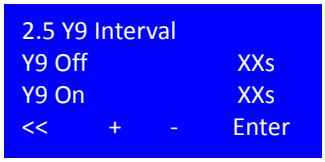
The temperature discharge determines the permeate (start) temperature in the dialysis mode at which the contents of the supply tank are continuously discharged and replaced with fresh water until the target (stop) temperature has been reached.

Set the target value with +/-; continue with Enter

Adjustment range start temperature: 20 – 37°C; Default: 37°C

Adjustment range stop temperature: 18 – 35°C; Default: 35°C

Reverse osmosis stops with Error 428 when a permeate temperature of >38°C is reached. The error can be acknowledged by restarting the system after addressing the cause of the error.

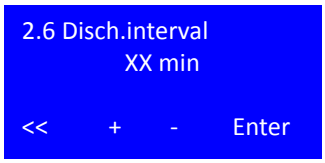


Menu point 2.5 Y9 Interval

In the event of failure of the conductivity measurement in the raw water (CIS 1 – Alarm 410 cond. measurement raw water) and / or concentrate (CIS 2 – Alarm 411 cond. measurement concentrate) or LC-operation, the system automatically changes to time-controlled concentrate discharge, which is regulated by indexing Y9 (discharge time in seconds).

Set the target value with +/-; continue with Enter

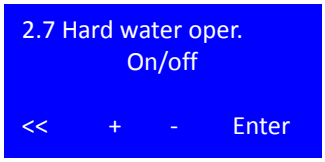
Adjustment range Y9 5 – 60 seconds, Default 5 seconds



Menu point 2.6 Disch.interval

The setting menu 2.6 defines the interval for discharge. If the interval is reached, the discharge process is triggered for one minute. The opening times of Y9 during the discharge specify the settings in menu 2.5.

The concentrate discharge interval become active in the operating phases LC-operation and hard water operation or if alarm 410 or alarm 411 is pending. Adjustment range 1 – 15 minutes; default 10 minutes.



Menu item 2.7 Hard water operation

Activation of the hard water operation overwrites the specified yield in menu 2.1 WCF with a fixed yield of 33%.

Adjustment range: on/off

Default value: off

Menu item 2.8 LC-operation

LC-operation is selected if permeate is selected as feed water (= raw water), therefore water with conductivity of 50µS/cm. This may the case if reverse osmosis is used as a 2 RO level. Activation of the LC-operation overwrites the specified yield in menu 2.1 WCF and controls the concentrate discharge with the values defined under 2.5 Y9 Interval as well as in menu 2.6 Concentrate discharge interval.

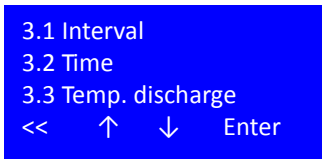
There is no alarm for too low measurement values in the raw water or concentrate (alarm 410, 411) when selecting LC-operation.

Adjustment range: on/off

Default value: off

13.3 Standby mode input data, menu item 3

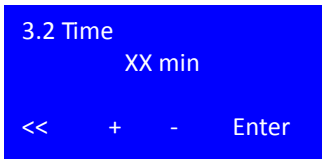
Access to the display of each menu point is gained without requesting a password. The parameter change requires entry of a password. The password is automatically deactivated after 20 minutes without an entry.



Menu items 3.1 – 3.3 serve the purpose of programming the flushing intervals during the standby mode. The control system offers the possibility of starting the system during standstill periods (night) at repeat intervals for a programmable flush duration. This flushes the reverse osmosis and the ring piping and reduces the hazard of system contamination during standstill times.

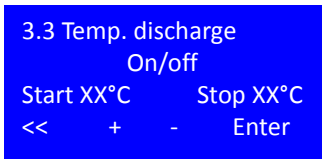
Menu item 3.1 Interval

Adjustable between 0 and 180 min, default 90 min.



Menu item 3.2 Time

Adjustable between 0 and 10 min, default 5 min.



Menu item 3.3 Temp. discharge

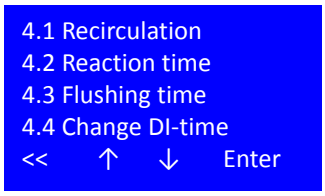
If the system reaches a limit temperature there is the possibility to cool down the system to a lower, adjustable temperature value by feeding raw water.

Adjustment range:	on/off	default: off
Start: adjustment range	20 – 37 °C	default 37°C
Stop: adjustment range	18 – 35 °C	default 35°C

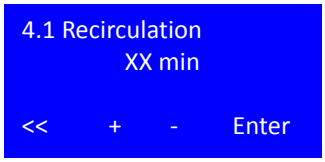
⚠ **ATTENTION**	**Danger of leaks.** **Activation of temperature flushing includes discharge and refilling water into reverse osmosis. Leak monitoring does not take place at this time.**

13.4 Disinfection mode input, menu item 4

Access to the display of each menu point is gained without requesting a password. The parameter change requires entry of a password. The password is automatically deactivated after 20 minutes without an entry.



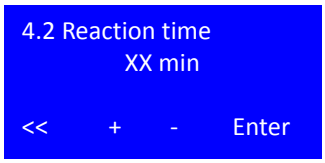
Menu item 4 offers the user the possibility, after entering a password, of adjusting the parameters for disinfection to the specific requirements of the installation.



Menu item 4.1 Recirculation

The recirculation time is the time required to achieve an even concentration of disinfectant in reverse osmosis and the ring piping. The recirculation time increases with the extent of reverse osmosis and the length of the connected ring piping.
(See → tables 12-1 and 12-2)

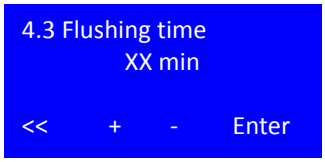
Adjustment range: 5 – 60 min Default 20 min



Menu item 4.2 Reaction time

The reaction time is the contact time of the disinfectant with the inside surfaces of reverse osmosis and the connected ring piping in its end concentration. The contact time depends on the disinfectant used.

Adjustment range: 20 – 60 min Default 20 min



Menu item 4.3 Time

The flush duration is the time in hours [h], which the system needs to flush the disinfectant out of the system after completing the disinfection process The flush time depends on the concentration of disinfectant, the total volume of the system and the volume flow, which is flushed through Y9 into the drain.

Adjustment range: 0.5 – 24 h Default 2 h

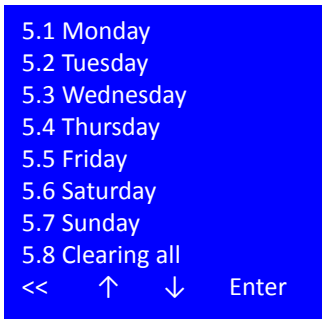
Menu item 4.4 Input disinfection

Menu item 4.4. gives the user the opportunity to disable the cancel function (Esc key) during the disinfection process. When selecting the option “disabled”, the “Esc” key does not appear on the display during disinfection, all disinfection steps must be carried out according to the time specifications from menu 4 and cannot be shortened.

Adjustment range: permitted / disabled Default: permitted

13.5 Auto. Operation entry, menu item 5

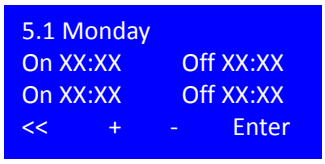
Access to the display of each menu point is gained without requesting a password. The parameter change requires entry of a password. The password is automatically deactivated after 20 minutes without an entry.



Menu items 5.1 – 5.8 are used for programming the automatic start of reverse osmosis. A maximum of two automatic start and stop times can be entered for each weekday.

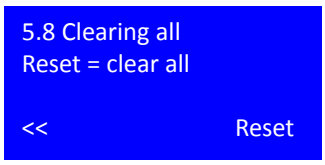
If the system is to remain in use through 24:00 / 00:00 h (change of day), no stop time is given for the first day of operation, the stop time is programmed as first time value for the 2nd day. In case of missing time entries the timer searches for up to 3 days in advance for logic entries.

NOTE:	**After automatic mode has finished the control unit automatically switches to the initial operating mode (system “off” or “standby mode”).**



Menu item 5.1 Selection of on/off times

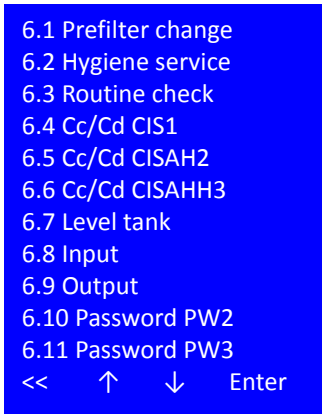
Adjustment range: 00:01 to 23:59, 00:00 = --.-- = off
Default: --.--



Menu item 5.8 Clearing all

Pressing the reset key deletes all weekly entries 5.1 – 5.7.

13.6 Service mode, menu item 6



In the service programme the basic system parameters can be set or the digital inputs can be viewed and all outputs can be individually set and deleted for test purposes. Access to the display of each menu point is gained without requesting a password. The parameter change requires entry of a password PW2 or PW3 (technician password). The password is automatically deactivated after 20 minutes without an entry.

⚠ ATTENTION	**The entry of incorrect values can impair the correct function of the control system or operational safety of the system** **Settings may only be made by authorized trained personnel.**

Menu items 6.1 – 6.3 Reminder functions

The control has reminder functions for regular work associated with fault-free operation of the system. This includes a) Pre-filter change; b) Hygiene service and c) Maintenance. This work must be carried out at regular intervals to guarantee fault-free operation of the system.

Menu item 6.1 Set/reset pre-filter change

Reminder function to change the pre-filter The displayed date states the date of the next planned replacement on the basis of week numbers.

Adjustment range: 4 – 8 weeks Default: 6 weeks

After expiry of the timer, the message “pre-filter change due” appears

Continue by pressing the enter key. The reset key is shown instead of the enter key if the date display flashes.

The pre-filter change is confirmed by pressing the reset key. After confirming that the filter change has been completed, the timer is set to the new date according to the week.

Menu item 6.2 Set/reset hygiene check

Reminder function for microbiological sampling from the system. The displayed date states the date of the next planned replacement on the basis of month numbers.

Adjustment range: 0 – 12 months Default: 6 months

After the timer expires, the message “hygiene check due” appears.

Continue by pressing the enter key. The reset key is shown instead of the enter key if the date display flashes.

The microbiological sampling is confirmed by pressing the reset key. After confirming that the filter change has been completed, the timer is set to the new date according to the month.

Menu item 6.3 Set/reset pre-filter change

Reminder function to carry out annual maintenance/service check. The displayed date states the date of the next planned replacement on the basis of month numbers.

Adjustment range: 3; 6; 9; 12 months Default: 6 months

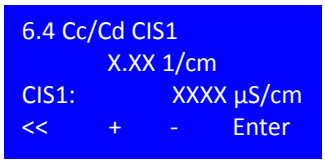
After the timer expires, the message “maintenance due” appears.

Continue by pressing the enter key. The reset key is shown instead of the enter key if the date display flashes.

The performed maintenance/service check is confirmed by pressing the reset key. After confirming that the filter change has been completed, the timer is set to the new date according to the month.

Menu items 6.4 – 6.6 Cell constants

The control system assesses three conductivities CIS1; CISAH2 and CISAHH3. The **cell constants** (also *electrode code* or *resistance capacity*) is the ratio of the electrode surface to their distance from each other. The cell constants are measured in cm^{-1}. Cell constants are set specifically for each electrode before initial commissioning in the factory. Changing the values leads to changes in the displayed conductivity.

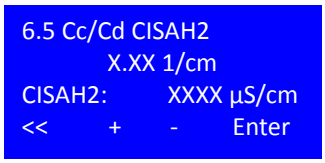


Menu point 6.4 Cc/Cd CIS1

This menu sets the cell constant of the conductivity electrode for the raw water. (CIS = Conductivity Indicator Switch). The resulting, temperature-compensated conductivity is displayed in the third line.

Adjustment range: 0.05 – 0.50 cm^{-1} Default: 0.15 cm^{-1}

Measurement range: 50 – 5000 µS/cm, ± 5 µS/cm
500 – 1000 µS/cm, ± 25 µS/cm

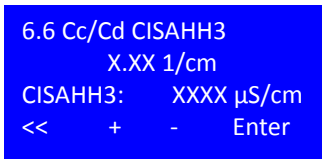


Menu point 6.5 Cc/Cd CISAH2

This menu sets the cell constant of the conductivity electrode for the concentrate. (CIS = Conductivity Indicator Switch = Alarm (A) if a limit value (H) is exceeded). The resulting, temperature-compensated conductivity is displayed in the third line.

Adjustment range: 0.05 – 0.50 cm^{-1} Default: 0.15 cm^{-1}

Measurement range: 50 – 1000 µS/cm, ± 5 µS/cm
1000 – 7700 µS/cm, ± 25 µS/cm

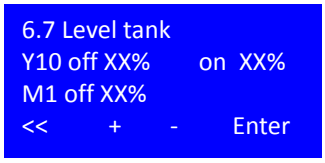


Menu point 6.6 Cc/Cd CISAHH3

This menu sets the cell constant of the conductivity electrode for the permeate (CIS = Conductivity Indicator Switch = Alarm (A) if a limit value 1 and 2 (HH) is exceeded). The resulting, temperature-compensated conductivity is displayed in the third line.

Adjustment range: 0.05 – 0.50 cm^{-1} Default: 0.15 cm^{-1}

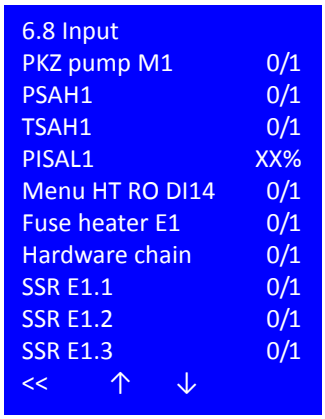
Measurement range: 1 – 30 µS/cm, ± 1 µS/cm
30 – 200 µS/cm, ± 3 µS/cm



Menu item 6.7 Level tank

AQUAbase has pressure-controlled level detection in the supply tank. The level change of the filling level in the tank results in a proportional change to the static pressure on the pressure sensor, so that the filling level (in %) can be calculated on the basis of the measured pressure. The switch points for the raw water inlet valve Y10 and the pump protection function are set in this menu.

Adjustment range:	Y10 Off:	82 – 99%	Default: 82%
	Y10 On:	50 – 80%	Default: 50%
	M1 Off:	0 – 10%	Default: 0%



Menu item 6.8 Input

Selection of menu item 6.8 allows operators to observe all switch states of the digital inputs even during the dialysis mode.

PKZ pump M1: switch status of the motor protection switch of motor M1 (pump)

PSAH1: Pressure switch PSAH1 maximum pressure exceeded. Hardware chain

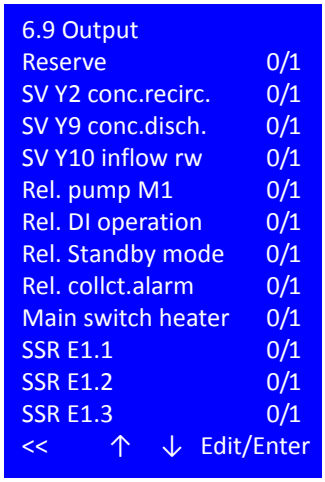
TSAH1: Permeate temperature exceeded.

PISAL1: Tank filling level in %

Menu HT RO DI14: Wire bridge DI 14 set for option HT.

Hardware chain heating: main switch response switched.

Monitoring the heater – unauthorised switching of load relay.



Menu item 6.9 Output

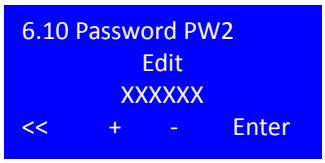
With menu item 6.9, the current switched outputs can be viewed and, after entering the PW3 technician password, all solenoid valves, alarm relays and heaters can be manually activated.

To password entry via edit.

Set outputs with +/-, confirm with Enter, back with <<

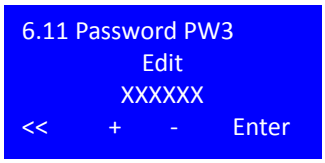
When accessing menu 6.9 with password PW2/PW3 the current mode of operation is interrupted and all outputs are switched off. The control is reset, followed by an initial test when leaving menu 6.9. After a successful initial test, the system returns to the status before entering the service programme in menu 6.9.

⚠ ATTENTION	**Risk of system damage!** **The limits are not monitored when manually switching the outputs in the service menu. All safety shutdowns are deactivated.** **Manual switching may only be done by authorized trained personnel.**



Menu item 6.10 Password PW2

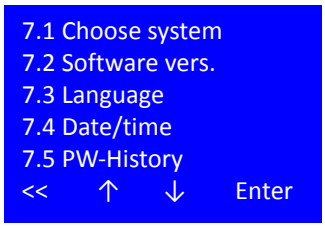
Password 2 (PW2) is a variable master password for the customer. Upon delivery, the system password is set to “la0101”. The password allows access to all configuration levels. The password can be freely selected from 6 alphanumerical characters and must be saved with enter.



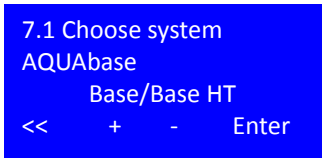
Menu item 6.11 Password PW3

Password 3 (PW3) is the customer password and, specified as Default “ab0100”, PW3 allows access to all parameters with the exception of menu 7. The password can be freely selected from 6 alphanumerical characters and must be saved with enter.

13.7 System data, menu item 7

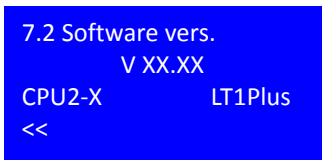


The settings in this submenu have an influence over the configuration of the system and may only be changed by authorized trained specialists. The data change requires entry of a password PW2 (technician password).



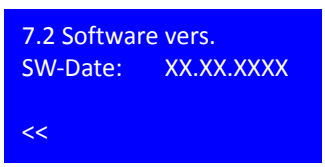
Menu item 7.1 Choose system

The system type determines whether the HT option is activated in the system.
Activation of the HT option is only possible when the wire bridge DI14 is also set. By setting the HT option, sub-menu 9 is activated in the basic menu and the necessary acuators and sensors for hot cleaning are activated.

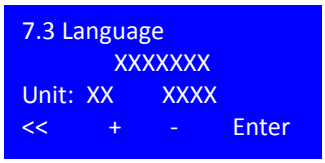


Menu item 7.2 Software vers.

The SW version and the installed control hardware of the CPU and power pack are verified in menu item 7.2.



Simultaneously pressing the middle two function keys for 2 seconds shows the compilation date of the SW and therefore the SW revision.

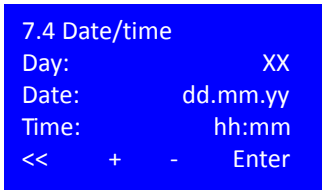


Menu item 7.3 Language

The display language and the displayed physical units are selected in this menu point.

The SW is not supplied in all available language versions. Please contact B. Braun for selection of the appropriate combination of display languages for your region.

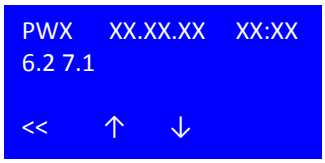
EU [metric] and US [imperial] units are available. The choice of units influences the display of pressure (bar/psi) and temperatures (°C/°F) and conductivity (µS/cm / ppm TDS)



Menu item 7.4 Date / time

Adjustment range	Weekday:	Mon – Sun
	Day [dd]:	01 – 31
	Month [mm]:	01 – 12
	Year [yy]:	00 – 99
	Hour [hh]:	00 – 24
	Minute [mm]:	00 – 60

NOTE:	**Standard and daylight saving times are not automatically recognized or updated!**



Menu item 7.5 Password entry history

The last 19 password entries with details of the date and time and menu items visited after activation are archived in this menu item.

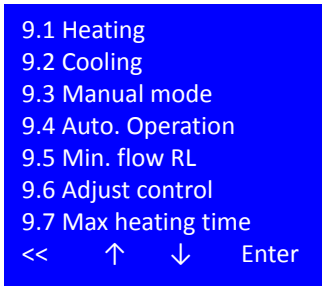
13.8 Error history, menu item 8

Menu item 8 Error history

The last 50 alarm and error messages can be viewed here in chronological order with details of the date, time and the time of acknowledgment under this menu item.

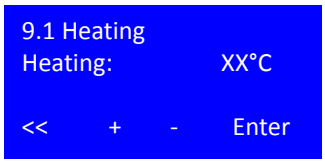
The oldest entry is written over when the memory capacity is full.
The error log is backed up by a battery supply in EEPROM to prevent deletion in case of power failure.

13.9 HT operation, (option) menu item 9



All parameters are defined in the menu items of sub-menu 9 to carry out hot cleaning. This menu item is only available for HT versions (see menu item 7.2).

The parameter change requires entry of a password PW2 or PW3 (technician password). The password is automatically deactivated after 20 minutes without an entry.



Menu item 10.2 Heating

The target temperature for hot cleaning the reverse osmosis system is defined in this menu item.

Adjustment range: 80 – 85°C
Default: 80°C

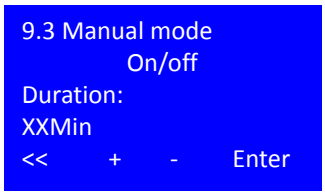
Confirm with enter after selecting the target temperature.

Menu item 9.2 Cooling

The temperature that needs to be reached after hot cleaning so that it can return to the dialysis mode is defined in this menu item. The system is cooled by adding fresh water.

Adjustment range: 35 – 40°C
Default: 40°C

Confirm with enter after selecting the target temperature.



Menu item 9.3 Manual mode

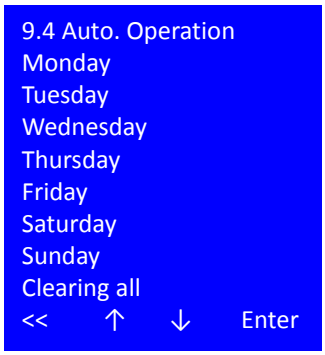
Switching the manual mode activation hot cleaning of the system, once only, at the next possible time (start of standby phase). The activation is deleted again when hot cleaning begins.

Adjustment range: on/off
Default: off

Confirm and continue with enter after selecting the manual mode.

The duration states the time that the system is held for after reaching the target temperature to enable disinfection.

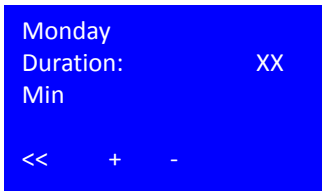
Adjustment range: 20 – 90 min
Default: 20 min



Menu item 9.4 Auto. Operation

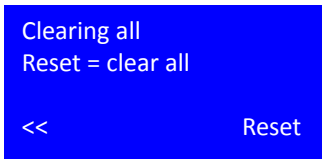
The weekdays for carrying out hot disinfection are specified under this menu item by defining an individual hold time. The entered values are kept after carrying out hot cleaning.

Hot cleaning is only carried out on the days on which a hold time is recorded.

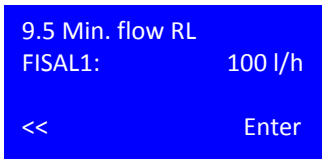


Adjustment range: Off / 20 – 90 min
Default: 20 min

With << return to 9.4



Pressing the reset key deletes all weekly entries (off).



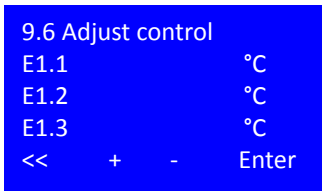
Menu item 9.5 Min. flow RL

A minimum flow must be guaranteed to prevent overheating of the heater modules during hot cleaning. This is measured in the permeate via FISAL 1.

Default: 100 l/h

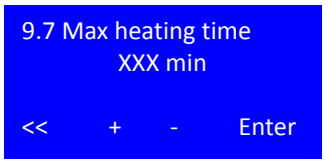
Menu item 9.6 Adjust control

Heaters E1; E2; E3 are regulated to their target temperature via TISAH4. Depending on the extent of reverse osmosis or length of the ring piping, it may be necessary to switch individual heaters on or off before or after reaching the target temperature, either to prevent overheating due to heat delivery after shutdown or, in case of long ring piping, to compensate temperature losses in the ring piping caused by overshooting.



This can be implemented for each individual heater using an adjust control. Each heater can be regulated within a range of -5 to +10°C.

Adjustment range: -5°C to +10°C
Default: 0°C



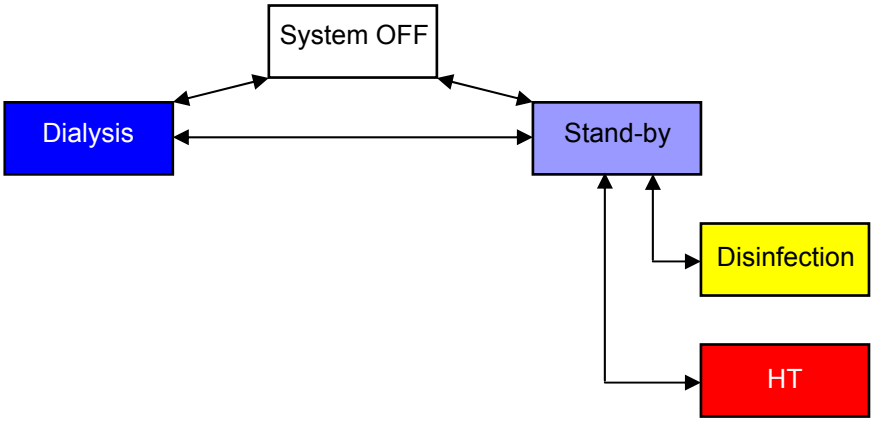
Menu item 9.7 Maximum heat-up time

A typical heat-up time, which is maintained in case of correct function, for reverse osmosis and the ring piping [in min] can be determined for each installation. Significantly exceeding this time indicates an error.

Adjustment range: 60 – 180 min
Default: 60 min

14. Operating modes

14.1 Overview of operating modes



14.2 Names of of digital inputs and outputs

Table 14-1: Digital inputs

Name	Assignment	Beschreibung (Description)	Analysis AQUAbase DI14=0	Analysis AQUAbase HT DI14=1
DI 01	Motor protection switch pump M1	0 = fault, 1 = no fault	Yes	Yes
DI 02	PSAH1	0 = fault, 1 = no fault	Yes	Yes
DI 03	TSAH1	0 = fault, 1 = no fault	Yes	Yes
DI 04	Reserve			
DI 05	Reserve			
DI 06	Reserve			
DI 07	Reserve			
DI 08	Reserve			
DI 09	Reserve		No	Yes
DI 10	Hardware chain heating	0 = fault, 1 = no fault	No	Yes
DI 11	ELR heating E1.1 defective	If DO05 = 0 but DI11 = 1 (timeout 500ms)	No	Yes
DI 12	ELR heating E1.2 defective	If DO06 = 0 but DI12 = 1 (timeout 500ms)	No	Yes
DI 13	ELR heating E1.3 defective	If DO07 = 0 but DI13 = 1 (timeout 500ms)	No	Yes
DI 14	Menu 9 HT operation	Menu 9 only visible if DI14 = 1	No	Yes

Table 14-2: Digital outputs

Name	Assignment	Beschreibung (Description)	Analysis AQUAbase DI14=0	Analysis AQUAbase HT DI14=1
DO 01				
DO 02	Solenoid valve Y9		Yes	Yes
DO 03	Solenoid valve Y10		Yes	Yes
DO 04	Main switch heater E1		No	Yes
DO 05	Semi-conductor switch heater E1.1		No	Yes
DO 06	Semi-conductor switch heater E1.2		No	Yes
DO 07	Semi-conductor switch heater E1.3		No	Yes
DO 08	Pump M1		Yes	Yes

Table 14-3: Further abbreviations

Cool	Placeholder for
#)	Start condition: Level 4 lower level switch 12% exceeded and delay 10s expired Start if Ratio cond.(conc./rw) > control value 1 or cond. permeate > limit 1 or cond.concentrate > control value 3 or measurement range cond.concentrate achieved or time controlled or temperature > limit value
0	Off
1	on
Y9	Y9 indexing in function menu item 6.22
AUTO	On, if level 2 Off, if level 1
(-xxs)	Time delay of xx seconds
(Mx.xx)	Can be set in the menu x.xx

Level 1	→	Y10 off →	Menu 6.7	82–99%
Level 2	→	Y10 on →	Menu 6.7	50–80%
Level 3	→	Tank empty →	Menu 6.7	00–10%
Level 4	→	e.g. Fill tank 1	12% (fix)	

14.3 AQUAbase operating modes

The table on the following two pages lists the possible operating modes.
The legend with the characters to be explained can be found on → page 14-6.

	AQUAbase HT																			
	AQUAbase																			
Line	Operating mode	Operating phase	DO 01 Y2	DO 02 Y9	DO 03 Y10	DO 04 Main switch heater E1	DO 05 SSR E1.1	DO 06 SSR E1.2	DO 07 SSR E1.3	DO 08 Pumpe M1 ON	Relais K1102 Dialysis mode	Relais K1103 Disinfection	Relais K1104 Standby mode	Relais K1105 Reserve	Relais K1106 Alarm	DI 01 Motor prot. M1 OK	DI 02 PSAH1	DI 03 TSAH1	DI 09 Fuse heater E1 OK	DI 10 Hardware chain
1	**System off**	OFF	0	0	0	0	0	0	0	0	0	0	0	0	0	//	//	//	//	//
2	**Dialysis mode**	Empty tank	0	1	0	0	0	0	0	1	1	0	0	0	0	1	1	1	//	//
3		Filling tank	0	0	#2	0	0	0	0	0	1	0	0	0	0	1	1	1	//	//
4		Dialysis mode	1	0	#3	0	0	0	0	1	1	0	0	0	0	1	1	1	//	//
5		Concentrate discharge	1/0 Y2/Y9	1/0 Y2/Y9	#3	0	0	0	0	1	1	0	0	0	0	1	1	1	//	//
6		Temperature discharge	1/0 Y2/Y9	1/0 Y2/Y9	#3	0	0	0	0	1	1	0	0	0	0	1	1	1	//	//
7	**Standby mode**	Shut-off rinsing Empty tank	0	1	0	0	0	0	0	1	0	0	0	0	0	1	1	1	//	//
8		Filling tank 1	0	0	#12	0	0	0	0	0	0	0	0	0	0	1	1	1	//	//
9		Filling tank 2	0	0	#2	0	0	0	0	0	0	0	0	0	0	1	1	1	//	//
10		Interm. Flushing	1	0	0	0	0	0	0	1	0	0	1	0	0	1	1	1	//	//
11		Temperature flushing	1/0 Y2/Y9	1/0 Y2/Y9	#3	0	0	0	0	1	0	0	1	0	0	1	1	1	//	//
12		Empty tank	1/0 Y2/Y9	1/0 Y2/Y9	0	0	0	0	0	1	0	0	1	0	0	1	1	1	//	//
13		Filling tank 1	0	0	#4	0	0	0	0	0	0	0	1	0	0	1	1	1	//	//
14		Filling tank 2	0	0	#2	0	0	0	0	0	0	0	1	0	0	1	1	1	//	//
15		Break	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	//	//
16	**Disinfection**	Start 5s→	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	//	//
17		Empty tank	1/0 Y2/Y9	1/0 Y2/Y9	0	0	0	0	0	1	0	1	0	0	1	1	1	1	//	//
18		Filling tank	0	0	#12	0	0	0	0	0	0	1	0	0	1	1	1	1	//	//
19		Fill in disinfectant	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	//	//
20		Recirculation mode	1	0	#2	0	0	0	0	1	0	1	0	0	1	1	1	1	//	//
21		Reaction mode	0	0	#2	0	0	0	0	0	0	1	0	0	1	1	1	1	//	//
22		Flushing mode	1/0 Y2/Y9	1/0 Y2/Y9	#3	0	0	0	0	1	0	1	0	0	1	1	1	1	//	//
23		End flushing mode Check disinfectant request	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	//	//
24	**HT mode**	HT heating	1	0	#8	1	#6	#6	#6	1	0	1	0	0	1	1	1	//	1	1
25		HT Hold temp.	1	0	0	1	#6	#6	#6	1	0	1	0	0	1	1	1	//	1	1
26		HT cooling	1	#9	#3	0	0	0	0	1	0	1	0	0	1	1	1	//	//	//

DI 11 SSR E1.1 defective	DI 12 SSR E1.2 defective	DI 13 SSR E1.3 defective	DI 14 Menü 9 HT operation	AI 01 4...20mA PISAL1 Filling level Supply tank	AI 02 4...20mA TISAH2 Permeate RL return	AI 03 4...20mA TISAH4 Contr. Heat.	AI 04 4...20mA FISAL1	LF IN 01 CIS1 Raw water	LF IN 02 CISAH2 Conzentrate	LF IN 03 CISAHH3 Permeate	Temp IN 05 NTC TISAH1 Permeate	Conditions	Display
//	//	//	//		Display	Display	Display	Display	Display	Display	Display		Display 1
0	0	0	//	#1	Display	Display	Display	Display	Display	Display	Display	• #1: Until Lev3 reached	Display 2
0	0	0	//	#2	Display	Display	Display	Display	Display	Display	Display	• #2: Y10=1 until Lev1 reached	Display 3
0	0	0	//	#3	Display	Display	Display	1	1	1	1	• #3: Lev1→Y10=0, Lev2=1→Y10=1 • cond. and temperature assessment only after 120s	Display 4
0	0	0	//	#3	Display	Display	Display	1	1	1	1	• Y2/9: According to setting M2.5 or according to M2.8 for LC operation • If level 3 is reached during concentrate discharge (tank empty), close Y9 until level 1 (tank full) is reached, then continue with discharge.	Display 4
0	0	0	//	#3	Display	Display	Display	1	1	1	1	• According to setting M2.4 • Y2/9: According to setting M2.5 or according to M2.8 for LC operation • If level 3 is reached during temperature discharge (tank empty), close Y9 until level 1 (tank full) is reached, then continue with discharge.	Display 4
0	0	0	//	#1	Display	Display	Display	Display	Display	Display	1	• #1: Until Lev3 is reached or timer max. empty time (300s) is reached, then automatically continue to interm. flushing.	Display 8
0	0	0	//	#1/#12	Display	Display	Display	Display	Display	Display	1	• #12: Until Lev4 exceeded→Y10=1 • Continue to line 9 after 1 minute	Display 8
0	0	0	//	#2	Display	Display	Display	Display	Display	Display	1	• #2: Y10=1 to Lev1 reached • if Lev1 is reached, continue to line 10	Display 8
0	0	0	//	#2	Display	Display	Display	Display	Display	Display	1	• Time-controlled acc. to M3.2	Display 9
0	0	0	//	#3	Display	Display	Display	Display	Display	Display	1	• #3: Lev1→Y10=0, Lev2=1→Y10=1 • Start: acc. to M3.3, Temp.flush on + start value reached • Stop: acc. to M3.3 stop value reached or max. flush time = 300sec. is reached • Max. flush time reached, continue to line 12, empty tank	Display 9
0	0	0	//	#1	Display	Display	Display	Display	Display	Display	1	• #10: every 30sec. for 5sec. Y5=0 und Y6=1 • #1: Until Lev3 is reached the continue to line 13 or timer max. empty time (300s) is reached, then automatically continue to interm. Flushing	Display 9
0	0	0	//	#4	Display	Display	Display	Display	Display	Display	1	• #4: Until Lev3 exceeded→Y10=1 • Continue to line 14 after 1 minute	Display 9
0	0	0	//	#2	Display	Display	Display	Display	Display	Display	1	• #2: Y10=1 to Lev1 reached • if Lev1 is reached, continue to line 15	Display 9
0	0	0	//	//	Display	Display	Display	Display	Display	Display	1	• Time-controlled acc. to M3.1 • Leak monitoring active	Display 10
0	0	0	//	//	Display	Display	Display	Display	Display	Display	1	• Continue with key 5s→ or return with Esc.	Display 13
0	0	0	//	#1	Display	Display	Display	Display	Display	Display	1	• #1: Until Lev3 reached	Display 14
0	0	0	//	#12	Display	Display	Display	Display	Display	Display	1	• #12: Until Lev4 exceeded→Y10=1	Display 15
0	0	0	//	#1	Display	Display	Display	Display	Display	Display	1	• Continue via display and entry keys	Display 16
0	0	0	//	#2	Display	Display	Display	Display	Display	Display	1	• #2: Y10=1 until Lev1 is reached • Time-controlled acc. to menu 4.1	Display 17
0	0	0	//	#2	Display	Display	Display	Display	Display	Display	1	• #2: Y10=1 until Lev1 reached • Time-controlled acc. to menu 4.2	Display 18
0	0	0	//	#3	Display	Display	Display	Display	Display	Display	1	• #3: Lev1→Y10=0, Lev2=1→Y10=1 • Time-controlled acc. to menu 4.3 • Check disinfectant after expiry • Disinfectant "Check disinfectant freedom" 10 min before end of flushing mode, alternating 15s with display "flushing mode time left".	Display 19 Display 20 Display 21
0	0	0	//	//	Display	Display	Display	Display	Display	Display	1	• Keyboard back to flushing mode or end disinfection, • End = return to basic state, standby mode or off	Display 21 Display 22 Display 23 Display 24
#7	#10	#11	1	#8	1	1	1	Display	Display	Display	1	• #6: Control 0/1 acc. to M9.1 + 9.6. HLS E1(DO05)/2(DO06)/3(DO07) switch-off if ΔT ≥2°C/Min., switch on again if ΔT ≤2°C/Min. • #8: in first 60s Lev1→Y10=0, Lev2→Y10=1, then Y10=0 Leak monitoring active • #7: If DO05 = 0 =>DI11 = 0 • If DO05 = 1 => DI11 = 1 If DO05 = 0 => DI11 = 1 then error 537 #10: If DO06 = 0 =>DI12 = 0 • If DO06 = 1 => DI12 = 1 If DO06 = 0 => DI12 = 1 then error 538 #11: If DO07 = 0 =>DI13 = 0 • If DO07 = 1 => DI13 = 1 If DO07 = 0 => DI13 = 1 then error 539	Display 25
#7	#10	#11	1	//	1	1	1	Display	Display	Display	1	• Time-controlled acc. to M9.3 or 9.4? • #6: Control 0/1 according to M10.?, ELR E1/2/3 switch-off if ΔT ≥2°C/Min., switch on again if ΔT ≤2°C/Min. Leak monitoring active • #7: If DO05 = 0 =>DI11 = 0 • If DO05 = 1 => DI11 = 1 If DO05 = 0 => DI11 = 1 then error 537 #10: If DO06 = 0 =>DI12 = 0 • If DO06 = 1 => DI12 = 1 If DO06 = 0 => DI12 = 1 then error 538 #11: If DO07 = 0 =>DI13 = 0 • If DO07 = 1 => DI13 = 1 If DO07 = 0 => DI13 = 1 then error 539	Display 26
//	//	//	1	#3	1	1	1	Display	Display	Display	1	• #9: Close Y9 if ΔT ≥ 2°C/Min., open if ΔT ≤ 2°C/Min. • #3: Lev1→Y10=0, Lev2=1→Y10=1 • If temperature M9.2.? Cooling reached, return to line 15 "Standby mode break"	Display 27

Explanation of characters

//:	Status irrelevant		
#+code:	Conditions		
Display:	Display but no assessment		
(-?s)			
1			
0			
Lev1	→Level Y10 OFF	→Menu 6.9	→Y10 off: 80 … 99%
Lev2	→Level Y10 ON	→Menu 6.9	→Y10 on: 50 … 80%
Lev3	→Tank empty level	→Menu 6.9	→M1 off: 0 … 10%
Lev4	→12%		
Relay K1106 alarm:	Relay is inverted		

15. Faults / Causes / Elimination

15.1 Fault messages

Errors and alarm messages									
Fault type	**Fault no.**		**Error text**	**Delay in seconds**	**Self-acknowl-edging**	**Reset key**	**Active AQUAbase**	**Active AQUAbase HT**	**Dig. Input in case of fault**
Error	413	wd dd.mm.yy ss:mm Error 413 Ext. CD-Measuring Menü Reset	Ext. CD-Measuring	No	No	No	Yes	Yes	
Alert	403	wd dd.mm.yy ss:mm Alarm 403 Exc.press. rp. PSAH1 Menü Reset	Exc.press. rp. PSAH1	No	Yes	No	Yes	Yes	DI02 = 0
Error	403	wd dd.mm.yy ss:mm Error 403 Exc.press. rp. PSAH1 Menü Reset	Exc.press. rp. PSAH1	0	No	Yes	Yes	Yes	DI02 = 0
Alert	405	wd dd.mm.yy ss:mm Alarm 405 Pump M1 Menü Reset	Pump M1	0	No	No	Yes	Yes	DI01 = 0
Alert	407	wd dd.mm.yy ss:mm Alarm 407 Recipient tank empty Menü Reset	Recipient tank empty	5	Yes	No	Yes	Yes	
Alert	408	wd dd.mm.yy ss:mm Alarm 408 Cond.perm. >al. val. Menü Reset	Cond.perm. >al. val.	0	Yes	No	Yes	Yes	
Error	409	wd dd.mm.yy ss:mm Error 409 Cond.perm. > limit Menü Reset	Cond.perm. > limit	0	No	Yes	Yes	Yes	
Alert	410	wd dd.mm.yy ss:mm Alarm 410 Cond. raw water Menü Reset	Cond. raw water	0	Yes	No	Yes	Yes	
Alert	411	wd dd.mm.yy ss:mm Error 411 Cond. concentrate Menü Reset	Cond. concentrate	0	Yes	No	Yes	Yes	
Error	412	wd dd.mm.yy ss:mm Error 412 Cond. Permeate Menü Reset	Cond. Permeate	0	No	Yes	Yes	Yes	
Error	416	wd dd.mm.yy ss:mm Error 416 Leakage alarm Menü Reset	Leakage alarm	0	No	No	Yes	Yes	
Alert	100	wd dd.mm.yy ss:mm Alarm 100 RTC Menü Reset	RTC	0	No	No	Yes	Yes	
Alert	419	wd dd.mm.yy ss:mm Alarm 419 Raw water inflow Menü Reset	Raw water inflow	300	Yes	No	Yes	Yes	DO03 >300s =1 and simultaneously AI01<value Menu 6.7 Y10 off
Alert	420	wd dd.mm.yy ss:mm Alarm 420 Cond.conc./rw >limit Menü Reset	Cond.conc./rw >limit Flow conc. too low	1800	Yes	No	Yes	Yes	

Errors and alarm messages					
Analogue input	**Cause / Condition**	**Initiate status if operating phase dialysis mode**	**Initiate status if operating phase standby mode**	**Initiate status if operating phase disinfection**	**Initiate status if operating phase HT**
	External cond. measurement (JUMO) has switched.	System OFF	System OFF	System OFF	System OFF
	Ring piping pressure too high Pressure switch (PSAH1) has triggered.	Pump M1 off	Pump M1 off	Pump M1 off	Pump M1 off
	Pressure switch PSAL1 triggered 3x within 1 minute.	System OFF	System OFF	System OFF	System OFF
	Motor protection switch triggered.	System OFF	System OFF	System OFF	System OFF
AI01 ≤ 4mA	Pressure sensor PISAL1 dropped below	Pump M1 off	Leakage alarm	Pump M1 off	Leakage alarm
CISAHH3	Permeate conductivity on CISAHH3 Alarm value (menu 2.2) exceeded	System remains in operation, concentrate discharge time-controlled see menu 2.6	No impact	No impact	No impact
CISAHH3	Permeate conductivity on CISAHH3 Limit (menu 2.3) exceeded	System OFF	No impact	No impact	No impact
CIS1	Cond.raw < 25µS/cm or ADC value > 252	System remains in operation, concentrate discharge time-controlled see menu 2.6	No impact	No impact	No impact
CISAH2	Cond.conc. <30 µS/cm or ADC value>252	System remains in operation, concentrate discharge time-controlled see menu 2.6	No impact	No impact	No impact
CISAHH3	e.g. wire break Cond.perm = 0 or value ADC > 240	System OFF	No impact	No impact	No impact
AI01 ≤ 4mA	Pressure sensor PISAL1 was undercut during standby mode pause or intermediate rinse.	No impact	System OFF	No impact	System OFF
	Real time clock defective or data transmission to real time clock interrupted.	System continues to run, no automatic operation possible	System continues to run, no automatic operation possible	System continues to run, no automatic operation possible	System continues to run, no automatic operation possible
	Tank inlet Y10 more than 300 sec continuously open without the tank being filled (PISAL1 Menu 6.7 value Y10 off is not achieved).	System continues to run, fault message is displayed	No impact	No impact	No impact

Errors and alarm messages									
Fault type	**Fault no.**		**Error text**	**Delay in seconds**	**Self-acknowl-edging**	**Reset key**	**Active AQUAbase**	**Active AQUAbase HT**	**Dig. Input in case of fault**
Error	420	wd dd.mm.yy ss:mm Error 420 Cond.conc./rw >limit Menü Reset	Cond.conc./rw >limit	10	No	No	Yes	Yes	
Error	425	wd dd.mm.yy ss:mm Error 425 TISAH1 Temp.too low Menü Reset	TISAH1 Temp.too low	0	No	No	Yes	Yes	
Error	428	wd dd.mm.yy ss:mm Error 428 TISAH1 temp.>limit Menü Reset	TISAH1 temp.>limit	60	No	Yes	Yes	Yes	
Alert	530	wd dd.mm.yy ss:mm Alarm 530 TISAH1 temp too high Menü Reset	TISAH1 temp too high	5	Yes	No	No	Yes	
Alert	531	wd dd.mm.yy ss:mm Alarm 531 TISAH2 temp too high Menü Reset	TISAH2 temp too high	5	Yes	No	No	Yes	
Alert	532	wd dd.mm.yy ss:mm Alarm 532 TISAH4 temp too high Menü Reset	TISAH4 temp too high	5	Yes	No	No	Yes	
Alert	534	wd dd.mm.yy ss:mm Alarm 534 Max heating time Menü Reset	Max heating time	0	No	No	No	Yes	
Alert	535	wd dd.mm.yy ss:mm Alarm 535 Hardware chain Menü Reset	Hardware chain	0	No	No	No	Yes	DO04 = 1 + DI10 = 0
Alert	536	wd dd.mm.yy ss:mm Alarm 536 Flow RL too low Menü Reset	Flow RL too low	10	No	No	No	Yes	
Error	537	wd dd.mm.yy ss:mm Error 537 ELR E1.1 defect Menü Reset	ELR E1.1 defect	0	No	No	No	Yes	DI11
Error	538	wd dd.mm.yy ss:mm Error 538 ELR E1.2 defect Menü Reset	ELR E1.2 defect	0	No	No	No	Yes	DI12
Error	539	wd dd.mm.yy ss:mm Error 539 ELR E1.3 defect Menü Reset	ELR E1.3 defect	0	No	No	No	Yes	DI12
Alert	540	wd dd.mm.yy ss:mm Alarm 540 Power failure Menü Reset	Power failure	0	No	No	No	Yes	
Alert	541	wd dd.mm.yy ss:mm Alarm 541 Breaking HT Menü Reset	Breaking HT	0	No	No	No	Yes	

Errors and alarm messages					
Analogue input	**Cause / Condition**	**Initiate status if operating phase dialysis mode**	**Initiate status if operating phase standby mode**	**Initiate status if operating phase disinfection**	**Initiate status if operating phase HT**
CIS1 CISAH2	Ratio cond. (conc./raw water) greater than 7.	System continues to run, fault message is displayed	No impact	No impact	No impact
CIS1 CISAH2	Ratio cond. (conc./raw water) greater than 9. Message is suppressed during alarm 410 or 411.	System OFF	System OFF	System OFF	System OFF
TISAH1	Wire break or temperature ≤ 0°C	System OFF	System OFF	System OFF	System OFF
TISAH1	Permeate temperature ≥ 38 °C	System OFF	System OFF	Recirculation mode is terminated and changed to reaction mode	No impact
TISAH1	Temperature TISAH1 > 90°C	No impact	No impact	No impact	Always error 425 in case of wire break. HT cooling phase, alarm is self-acknowledging after falling under 90°C, cooling phase is continued
TISAH2	Temperature TISAH2 > 90°C or cable break.	No impact	No impact	No impact	HT cooling phase, alarm is self-acknowledging after falling under 90°C, cooling phase is continued
TISAH4	Temperature TISAH4 > 90°C or cable break.	No impact	No impact	No impact	HT cooling phase, alarm is self-acknowledging after falling under 90°C, cooling phase is continued
TISAH1 TISAH2 TISAH4	RO did not manage to reach the heating temperature in the specified maximum heating time according to M9.7.	No impact	No impact	No impact	HT cooling phase
	If digital input DO04 is controlled, a signal must be applied to digital input DI10. Switch on delay DO04 and read in DI10 = 10 sec. Otherwise counted errors are possible. - Fuse blown - Bimetal switch triggered	No impact	No impact	No impact	HT cooling phase
FISAL1	Error only active when pump is on. Flow on FISAL1 < limit. Setting menu 9.5.	No impact	No impact	No impact	HT cooling phase
	DO05 = 0 and DI11 = 1	System OFF	System OFF	System OFF	HT cooling phase
	DO06 = 0 and DI12 = 1	System OFF	System OFF	System OFF	HT cooling phase
	DO07 = 0 and DI13 = 1	System OFF	System OFF	System OFF	HT cooling phase

Errors and alarm messages					
Analogue input	**Cause / Condition**	**Initiate status if operating phase dialysis mode**	**Initiate status if operating phase standby mode**	**Initiate status if operating phase disinfection**	**Initiate status if operating phase HT**
	After power failure, the system must change to emergency cooling if the temperature on TISAH1 and/or TISAH2 and/or TISAH4 is ≥36°C.	No impact	No impact	No impact	HT cooling phase
	If the "Duration" time from menu 9.3 or 9.4 could not be met or if the target temperature from menu 9.1 has been undercut during the operating phase HT temp. hold for 5°C for longer than 5 minutes.	No impact	No impact	No impact	No impact but alarm message

Part 2 – Supplementary Operating Instructions

7. Technical data 7-1

1. Handover declaration for the operating instructions

1.1 AQUAbase reverse osmosis system

AQUAbase system .....

Serial number .....

Year of construction .....

1.2 Customer's address

Company .....

Street .....

Postcode, city .....

1.3 Confirmation of handover of operating instructions

We have purchased the system specified under section 1.1.
Together with the system, we were also given the operating instructions for:

System number .....

in the languages

..... Quantity .....

..... Quantity .....

Company stamp

Customer name, block letters

.....

....

Date Customer's signature

1.4 System handover date

.....

1.5 Maintenance and servicing personnel

The following persons have been named by the customer and have been instructed and trained on the system by B. Braun and made aware of:

Protective equipment, hazardous areas, impermissible types of operation, set-up, operation, maintenance and servicing.

.....	.....
Name (customer staff)	Signature
.....	.....
Name (customer staff)	Signature
.....	.....
Name (customer staff)	Signature

☐ B. Braun commissioning log

☐ Customer-specific commissioning log

Company stamp/Customer's signature

The system was handed over to the customer by

Name, block letters

.....

.....	.....
Date	Customer's signature

2. Transport and setup

NOTE:	**Only have transport carried out by experienced transport experts.**

There are handling instructions printed on the packaging; these must be heeded.

- Fragile goods – handle with care.

- Transport and storage must be carried out in such a manner that the arrows on the packaging point upwards. Rolling, swinging, severe tilting or tumbling and other such ways of handling must be avoided.

- The goods must be protected from the wet and high humidity.

- The product has been preserved accordingly for the temperature range prevalent during transport.

- If the system is to be kept in storage for more than 6 months, preservation must be repeated.
- The weight of the system including packaging can be up to 1000 kg. For this reason, lifting gear should be used which is dimensioned for this load and can bear it.

The system is delivered in a wooden crate.

- Check the shipment for transport damage and completeness.
- In the event of any transport damage, keep the packaging and inform the forwarding agent and manufacturer immediately.
- Remove the system carefully from the wooden crate.
- Place device on solid, even ground.

2.1 Scope of Supply

The system is packed and delivered with the following components:

- Completely assembled system
- These operating instructions
- Circuit diagram
- QA acceptance log

3. Work prior to initial commissioning

Before commissioning, the following work must be carried out by the customer / a service technician:

- Setup and alignment of the system
- Connection to the pre-treatment stage
- Installation water connection
- Sewage connection
- Installation of the electrical connection
- Initial commissioning incl. language selection in the menu navigation
- Complete commissioning log

3.1 Requirements at the place of installation

Connections to the media supply and pretreatment stage are not supplied with the reverse osmosis system.

- Horizontal industrial floor with a permissible load of at least 500 kg/m^2.
- Impact- and vibration-free.
- 0.5 m free space on all sides of the system for maintenance work (with opened switch cabinet doors).
- Acid-resistant floor covering.
- Protect the control cabinet from direct water jets and high levels of dust
- The system is suitable for operation in roofed and weather-protected locations (e.g. closed rooms).

3.2 On-site connections to media supply

Connections to the media supply and pretreatment stage are not supplied with the AQUAbase system.

3.3 Pretreatment stage, hydraulic connection

The system must be connected to an upstream pretreatment stage. This is supplied either as an optional extra by B. Braun (see the separate operating instructions for installation instructions) or must be installed by the customer.

- Drinking water connection (feed reverse osmosis system) 1” with ball valve 1”
  (min. 3 – 6 bar flow pressure at full system performance).
- Pipe disconnector, connection 1”, type EA1
- Before the softening plant is disinfected, it must be disconnected completely from the mains and the reverse osmosis.
- Return flushing pre-filter with 130 µm filter unit with manometer, 1” connection.
- Water meter, 1”
- Leakage or system shutoff valve DN 20
- Activated charcoal if necessary
- Softening plant with sufficient capacity (note min. flow pressure 3 bar)
- Pre-filter 5µm
- The drinking water pressure must not exceed 6 bar. Note the connection values in the technical data and additional information about raw water requirements.
  → Part 2, page 7-1.

NOTE:	**The quality of the feed water upstream of the water softening plant (ion exchanger) must comply with the requirements of EC guideline 98/83/EC of the council of November 3, 1998, concerning the quality of water for human usage.**

The following water connections must also be made available for reverse osmosis:

- Ring piping feed (dairy coupling NW20)
- Ring piping return (dairy coupling NW20)
- The connections are to be made by means of a 19 x 27 fabric hose and a threaded hose connector for flexible connection.

3.3.1 Sewage connection

The following waste water connections must also be made available for the reverse osmosis system:

- Drain with siphon DN50.
- When installing the drain, take care that the waste water connection to the drain is implemented as a free intake in accordance with DIN 1988-100 and EN 1717.
- Floor drain DN70 (5000 l/h water throughput) at the lowest point in the room or in a closed floor trough in connection with Aqua Control.
- For additional information about setup layout see → Chapter 8.1 “setup plan”.
- The waste water connections for the softening plant and reverse osmosis should be able to be routed through the floor drain (odour trap).
- When operating in combination with hot water disinfection, the drain pipes must be stable up to temperatures of 95°C.

3.3.2 Electrical connections

- The AQUAbase requires a 16A-CEE socket (50Hz), protected by a residual current-operated circuit breaker 30 mA
- Observe backup fuse requirements in accordance with national regulations
- 4x shockproof socket (Schuko 230 V) protected by residual current-operated circuit breaker (FI)
- Alarm cable 2 × 0.75 mm² (option)

For specifications see → Part 2, chapter 7.1.

⚠ DANGER	**Electric shock!** **Danger of fatality due to dangerous voltage.** **→ Electrical work may only be carried out by authorized, trained and instructed electricians!**

3.3.3 Permanent system connection

The following safety equipment must be installed on-site for permanent connection to be possible:

- Over-current circuit breaker max. 16 A
- Residual current-operated circuit breaker 30mA / 4-pole
- Device or power switch 16A
- Supply cable at least 5 x 2.5 mm2 (L1, L2, L3, N, PE)

NOTE:	**A permanent system connection must always be carried out in accordance with national requirements and regulations by authorized personnel.**

The function of the device or power switch as a separator of the reverse osmosis from the mains must be marked by a label. The switch must be near the device and easily accessible for the operator. Over- and undervoltages in the power supply can damage the reverse osmosis system. B. Braun Avitum AG recommends that the reverse osmosis system is only connected to emergency power supplies according to EN 6280-13.

The separator must meet the requirements in accordance with IEC 60947-1 and IEC 60947-3.
The function of the switch as separator of the RO from the mains must be be marked by a label.

When a permanent mains cable is attached, it has to meet the requirements according to DIN EN 61010-1/6.10.2.

Permanent connection cables must correspond with the requirements from EN 61010-1/6 10.2. Central AQUAbase reverse osmosis systems are configured with a right rotary field in the factory. Check the rotary field before commissioning the system.

3.4 Setup and alignment of the system

The system is set up on a flat surface near the power and water connections provided. Make sure that the connections and control elements are easily accessible (electrical supply cable: 5 m).

3.4.1 Connection to the pre-treatment stage, water connection

The water supply of the system is connected by a hose connection DN 20 to the pretreatment stage.

For additional information about setup layout see → Chapter 8.1 “setup plan”.

3.4.2 Installation waste water connection

Connection of the system via rigid or flexible piping to the waste water DIN 50-note free draining.

The concentrate hose must be routed into the drain and secured over a free-drop path of at least twice its inner diameter.

3.4.3 Installation of the electrical connection

⚠ DANGER	**Electric shock!** **Danger of fatality due to dangerous voltage.** **→ Electrical work may only be carried out by authorized, trained and instructed electricians!**

- Earth stainless steel loop (6 mm^2).
- Equipotential bonding from osmosis switch cabinet to earthing bar of the house (6 mm^2).
- Check whether the local operating voltage, frequency and fuse protection corresponds to the data on the type plate and the technical data → Part 2, chapter 7. The system must not be connected in the event of any deviations.
- The command devices to control the system are mounted in a control box on the front of the system.
- The command devices and relays have already been wired to a terminal strip in accordance with the circuit diagram inside the control box at the factory.
- The AQUAbase is connected with a 16 A CEE plug (50Hz), item no. 37700 incl. 5 m cable or permanent connection.

The following command/display elements are mounted in the building installation:

- Main switch / circuit interrupter
- Power protection switch
- Residual current-operated circuit breaker

Depending on the customer's equipment, B. Braun or authorized personnel can connect an alarm device according to the wiring diagram. It must be ensured that all signals which are connected to the system from external facilities are provided as potential-free contacts in the appropriate supplementary equipment.

4. Commissioning

Initial commissioning may only be performed by trained specialists or a trained representative authorized by B. Braun. Incorrect commissioning of the system can lead to damage to the system and personal injury. The customer/operating personnel are instructed fully on the use of the system when it is commissioned.

Documentation and monitoring of the water quality are carried out as per ISO 23500.

Before initial commissioning, care must be taken that the pretreatment system has been sufficiently flushed and all pre-filters are installed.

The water can be used for the intended purpose after successfully completing validation.

4.1 Language selection

First of all, the display language set must be checked and changed if necessary. The menu guide and display messages can be provided in German, English and French.

The system is switched on at the main switch. Via the main menu 7.3 the respective required language is selected with the **- / +** keys. You access the submenu with **Enter** and select the necessary units. The selection is confirmed with **Esc** and the main menu is shown on the display.

4.2 Flushing out the preservative

As a rule, the system is supplied with preserved membranes. This is why the preservative must be flushed out before the system is connected to the ring piping. Care must be taken that the **open** permeate line is long enough to reach the waste water connection or an appropriate floor drain.

- The water supply is opened and the system switched on at the main switch. A self-testing sequence is performed (initial test). The device is now ready for operation. The device can be put in the desired operating mode by using the display and buttons.
- Select the **dialysis** operating mode to flush out the preservative. The supply tank starts to fill up. Once the level is above the lower switch point **PISAL1**, the control unit switches the pump on and the system starts (temporary) permeate production (in this case to flush out the system and the permeate hose). On the display it can be checked if the set production pressure of approx. 15 bar is reached.

If too little pressure (< 5 bar) should build up over a longer period of time (30 seconds), the pump may not be rotating in the correct direction (right rotary field). In this case, the system must be switched off at the main switch, disconnected from the power supply and two phases of the power supply are exchanged. Note the rotation arrows on the pump head (→ Fig. 4-1 to 4-3). Electrical work may only be carried out by authorized, trained and instructed electricians.

⚠ ATTENTION	**Irreversible pump damage, air in the pump body** **Bleed all the pumps and the modules in the pressure pipes.** **→ Open the bleeding screw carefully until a constant water flow occurs. Then close the bleeding screw (see → Fig. 4-1 to 4-3)**

Figure 4-1: Open the bleeding screw

Figure 4-2: Constant flow of water is achieved

Figure 4-3: Close the bleeding screw

After being switched on again, the pump will build up the required operating pressure.

If the system is running in dialysis mode, the conductivity indicator (on the display) indicates whether the permeate conductivity is decreasing. If the conductivity has reached a normal value (2–10 µS/cm depending on raw water condition and set yield), the device can be switched off using the keyboard and the ring piping can be fully connected.

After the system has been flushed, the ring piping is also rinsed and aerated for some time. Then disinfection must be carried out. → Part 1, page 12-6. After disinfection it must be ensured that there is no disinfectant left in the device and ring piping → Part 2, chapter 9.2.3 “Disinfection protocol”.

5. Commissioning log

After the system has been commissioned, the following commissioning log is to be completed and signed by the persons involved.

At the time when the system is handed over, the pretreatment unit and the reverse osmosis system are to be connected to the municipal drinking water network in accordance with legislation and local regulations.

If the plant and equipment are moved to another location, the operator is obliged to install the entire system in compliance with the legal and local regulations applicable at the new site.

5.1 System parameters

Then the set system parameters must be adapted to local conditions.

→ Part 2 from page 7-2.

Commissioning log

CLIENT	ORDER NUMBER .....
SYSTEM NAME	ADDRESS .....
SOFTWARE	SERIAL NUMBER (S(/N) .....
S/N LT	S/N PUMP M1 .....
S/N MEMBRANE MM1	S/N CPU .....
MM2	MM3 .....

Other Applicable Documents

Quality acceptance log (date, no, tester) ..... ☐

Operating instructions rev./language ..... ☐

Circuit diagram rev./no. ..... ☐

Spare parts list ..... ☐

Handover declaration for the operating instructions (→ OI part 2 – page 1-1) ..... ☐

Testing equipment/testing equipment number: .....

Electrical safety (Secutest SIII): .....

Conductivity/temp. measurement: .....

Visual inspection:

Surface/ ID/ Overall impression / Damage

.....

All accessories present:

.....

Check for correct power supply (reference: nameplate V / Hz / kVA) ☐

Combination with other medical devices (hot cleaning system, ring piping)

Hot-water cleaning system type / serial number ..... Ring piping manufacturer / dimension / length / material ☐

Functional inspection:		OK	n.OK
1.	**Connection AQUAbase to ring piping** (water supply, DN 20/ DN25)	☐	☐
	Check for leaks (30 min at ..... bar)	☐	☐
	Water hardness in RO feed (setpoint: < 1°dH) ..... °dH	☐	☐
	Free chlorine in the RO feed (setpoint: <0.1 mg/l) ..... mg/l	☐	☐
2.	**Connection/ installation of accessory parts** (water monitors, warning lights,...)		
	.....	☐	☐
3.	**Electrical connection of switch cabinet**	☐	☐

4. Repeat test on medical electrical devices according to DIN EN 62353 (IEC 62353)

⚠ ATTENTION: Performance of test according to EN 62353 (IEC 62353)

Test before commissioning:

Safety class: 1

Mains connection: PIE ☐ PIE = (permanent installed equipment)

NPS ☐ NPS = (non-detachable power supply cord)

4.1	**Visual inspection** Mains connection cable, overall system:			☐ OK ☐ n.OK
4.2	**Earth conductor resistance** Measurement between mains connection cable and housing	**Measurement** R_{SL}	**Limit** <0.300Ω	☐ OK ☐ n.OK ☐ OK ☐ n.OK
4.2.1	Measurement between mains connection cable and mounting plate	R_{SL}	<0.300Ω	☐ OK ☐ n.OK
4.2.2	Measurement between mains connection cable and doors/front panel	R_{SL}	<0.300Ω	
4.3	**Isolation resistance** Scan all accessible, conducting parts with a test probe	R_{ISO}	>2.0MΩ	☐ OK ☐ n.OK
4.4	**Deflection current** Mains connection PIE: for permanent installed equipment (PIE) measurement of the DEVICE DEFLECTION CURRENT is not necessary. Mains connection NPS: measurement of the DEVICE DEFLECTION CURRENT is necessary.			
	Device deflection current (replacement measurement):	I_{EGA}	<1.0mA	☐ OK ☐ n.OK
4.5	Function test	☐ OK ☐ n.OK		
4.6	Measurement log available	☐ OK ☐ n.OK		
4.7	Safety or functional faults have not been established.	☐		
4.8	No direct risk – the detected defects can be addressed quickly.	☐		
4.9	Device must be taken out of operation until the defect is addressed.	☐		
4.10	Device does not correspond with the requirements – modification/replace of components/decommissioning is recommended.	☐		
4.11	The next repeat test is required in:	☐ 12 months		

....

Test carried out by Date, signature

5. Functional test
(manual measurements with approved testing equipment only!) Motor protection switch

Motor protection switch	Rated current pump	Type motor protection switch	Set switchpoint Simple rated current	☐ OK ☐ n.OK
M1				

	OK	n.OK
PISAL1 Dry run/pump protection	☐	☐
Fuses fault messages	☐	☐
Temperature shutdown	☐	☐
Service program outputs (manual setting of outputs possible)	☐	☐

Potential-free outputs	OK	n.OK			
Disinfection mode	☐	☐	Dialysis mode	☐	☐
Standby mode	☐	☐	Collective alarm	☐	☐

Testing mechanical components		
Check valves functional	☐	☐
K4 tank drain functional	☐	☐

Dialysis mode	Reference		Measurement		OK	n.OK
Raw water conductivity (Message in display, CIS 1 Cell constants CC: ..... 1/cm)	µS/cm	Deviation to man. reference measurement Target < 10 µS/cm	µS/cm		☐	☐
Concentrate water conductivity (Message in display, CISAH 2 Cell constants CC: ..... 1/cm)	µS/cm	Deviation to man. reference measurement Target < 10 µS/cm	µS/cm		☐	☐
Conductivity permeate (message in display, CISAHH 3) Cell constants CC: ..... 1/cm)	µS/cm	Deviation to man. reference measurement Target < 2 µS/cm	µS/cm		☐	☐
Temperature concentrate TISAH4 (if available)	°C	Deviation to man. reference measurement Target < 3°C	°C		☐	☐
Temperature ring piping end ROII TISAH2 (if available)	°C	Deviation to man. reference measurement Target < 3°C	°C		☐	☐
Temperature permeate TISAH1	°C	Deviation to man. reference measurement Target < 3°C	°C		OK	n.OK
Concentrate pressure PI2 ± 5% (see specifications → Part 2, chapter 7.1)	bar	Concentrate pressure PI4 ± 5% (if available) (see specifications → Part 2, chapter 7.1)	bar		☐	☐
Permeate output ± 2%) (see specifications → Part 2, chapter 7.1)	l/h	Calculated salt retention (setpoint: > 95%) $\frac{Conductivity_{Raw\ water} - Conductivity_{Permeate}}{Conductivity_{Raw\ water}} \times 100$	%		☐	☐

LC-operation	act. ☐	n.act. ☐	Reference		Measurement	
Conductivity permeate (message in display, CISAHH 3)			µS/cm	Permeate output (setpoint: see enclosures chart “system output” ± 2%)		l/h
Permeate temperature (manual measurement)			°C	Concentrate flow volume (manual measurement)		l/h

Hard water operation (function test with softened water!)	☐	☐	Reference		Measurement	
Conductivity permeate (message in display, CISAHH 3)			µS/cm	Permeate output (setpoint: see enclosures chart “system output” ± 2%)		l/h
Permeate temperature (manual measurement)			°C	Concentrate flow volume (manual measurement)		l/h

HT operation	☐	☐	Reference		Measurement	
heat-up time (<180 min)			min	heat-up temperature (>60°C)		°C
meter heating cycle (setpoint +1)				cooling temperature (<40°C)		°C

– Introduction of concentrate discharge via menu 2.6	☐ OK	☐ n.OK
– Introduction of hard water operation via menu 2.7	☐ OK	☐ n.OK

Power failure test		
– Switch system on and operate in dialysis mode.		
– Interruption to power supply (using the main switch).		
– The previous operating mode (dialysis mode) is reinstated when supplying the power again.	☐ OK	☐ n.OK

Set switching points

Menu	Name	Unit	Scope	Factory setting	Customer setting
1	**Specifications**				
1.1	Conductivities	µS/cm TDS (=ppm $_{(NaCL)}$)	50 … 7700	-	
1.2	Water temp.	°C °F	0 … 100	-	
1.3	FISAL1	l/h	1 … 6000	-	
1.4	Hours pump	h	0 … 999999		
1.5	Hours system	h	0 … 999999		
1.6	Hours heater				
	E1.1	h	0 … 999999	-	
	E1.2	h	0 … 999999	-	
	E1.3	h	0 … 999999	-	
1.7	Heating cycles	-	0 … 9999	-	
2	**Dialysis mode**				
2.1	WCF	%	25 … 90	50	
2.2	Alarm perm.	µS/cm	5 … 60	30	
2.3	Limit permeate	µS/cm	5 … 200	90	
2.4	Temp.discharge				
	Start	°C	20 … 37	37	
	Stop	°C	18 … 35	35	
2.6	Disch.interval	min	1 … 15	10	
2.7	Hard water operation	-	On/off	Off	
2.8	LC-operation	-	On/off	Off	
3	**Standby mode**				
3.1	Interval	min	0 … 180	90	
3.2	Time	min	1 … 10	5	
3.3	Temp. discharge				
	Start	°C	20 … 37	37	
	Stop	°C	18 … 35	35	
4	**Disinfection mode**				
4.1	Recirculation	min	5 … 60	20	
4.2	Reaction time	min	20 … 60	20	
4.3	Flushing time	h	0.5 … 24.0	2	
4.4	Change DI-time	-	permitted/disabled	permitted	
5	**Auto On/Off**				
5.1	Monday	On: ss:mm Off: ss:mm	00:00 = Off 00:01=23:59 (h)	-	
5.2	Tuesday	On: ss:mm Off: ss:mm	00:00 = Off 00:01=23:59 (h)	-	
5.3	Wednesday	On: ss:mm Off: ss:mm	00:00 = Off 00:01=23:59 (h)	-	
5.4	Thursday	On: ss:mm Off: ss:mm	00:00 = Off 00:01=23:59 (h)	-	

Menu	Name	Unit	Scope	Factory setting	Customer setting
5.5.	Friday	On: ss:mm Off: ss:mm	00:00 = Off 00:01=23:59 (h)	-	
5.6	Saturday	On: ss:mm Off: ss:mm	00:00 = Off 00:01=23:59 (h)	-	
5.7	Sunday	On: ss:mm Off: ss:mm	00:00 = Off 00:01=23:59 (h)	-	
5.8	Clearing all	-	-	-	-
6	**Service mode**				
6.1	Prefilter change	Weeks	4 … 8	6	
6.2	Hygiene service	Months	0 … 12	6	
6.3	Routine check	Months	0, 3, 6, 9, 12	6	
6.4	Cc/Cd CIS1	1/cm µS/cm	0.05 … 0.50 Display	15	
6.5	Cc/Cd CISAH2	1/cm µS/cm	0.05 … 0.50 Display	15	
6.6	Cc/Cd CISAHH3	1/cm µS/cm	0.05 … 0.50 Display	15	
6.7	Level tank				
	Y10 off	%	82 … 99	82	
	Y10 on	%	50 … 80	50	
	M1 off	%	0 … 10	0	
6.8	Input				
	PKZ Pump M1		0 … 1		
	PSAH1		0 … 1		
	TSAH1		0 … 1		
	PISAL1	%	0 … 100		
	Menu HT RO DI14		0 … 1		
	Fuse heater E1		0 … 1		
	Hardware chain heater		0 … 1		
	SSR E1.1		0 … 1		
	SSR E1.2		0 … 1		
	SSR E3.3		0 … 1		
6.9	Output				
	SV Y9 conc.disch.	-	0/1	-	
	SV Y10 inflow rw	-	0/1	-	
	Rel. pump M1	-	0/1	-	
	Rel. DI operation	-	0/1	-	
	Rel. standby mode	-	0/1	-	
	Rel. dialysis	-	0/1	-	
	Rel. collct.alarm	-	0/1	-	
	Main switch heater	-	0/1	-	
	SSR E1.1	-	0/1	-	
	SSR E1.2	-	0/1	-	
	SSR E1.3	-	0/1	-	
6.10	Password PW2	-	aa0000 – zz9999	ab0100	
6.11	Password PW3	-	aa0000 – zz9999	lu0101	

Menu	Name	Unit	Scope	Factory setting	Customer setting
7	**System Data**				
7.1	Choose system	-	Base/Base HT	Base	
7.2	Software vers.	-	Display	-	
7.3	Language		Deutsch English Nederlands Francais Svenska Norsk Espanol Italiano	EN	
7.4	Date/time	DD:MM:YY / ss:mm	DD:MM:YY / ss:mm	-	
7.5	PW-History				
9	**HT operation**				
9.1	Heating	°C	80 … 85	80	
9.2	Cooling	°C	35 … 40	40	
9.3	Manual mode	min	0/1 20 … 90	0 20	
9.4	Auto. Operation	min	20 … 90	20	
9.5	Min. flow RL	l/h	100	100	
9.6	Adjust control E1.1 E1.2 E1.3	- °C °C °C	- -5 … +10 -5 … +10 -5 … +10	- 0 0 0	
9.7	Max heating time	min	60 … 180	60	

Switching points programmed ☐

Perform disinfection ☐ or **perform hot disinfection** ☐

Record disinfection with sep. disinfection log ☐
and subsequent sampling for chemical analysis acc. to ISO 13959

Sample number: ……

Training of responsible personnel/customer (see handover declaration)
Programming phases ☐
Use of operating instructions ☐

Programming carried out according to customer's wishes:

.....

Repairs carried out:

.....

Comments/established defects:

.....

.....

.....

Date ..... **Date** .....

Signature technician B. Braun ..... **Signature customer** .....

6. System key data

Manufacturer's address

B. Braun Avitum AG
Schwarzenberger Weg 73-79
34212 Melsungen
Germany

Tel +49 (5661) 71-0
Fax +49 (5661) 75-0
www.bbraun.com

Copyright

ISO 9001 and EN 13485 certified
CE mark CE 0123
Made in Germany (EU)

Nameplate

The type plate is on the left-hand side of the switch cabinet.

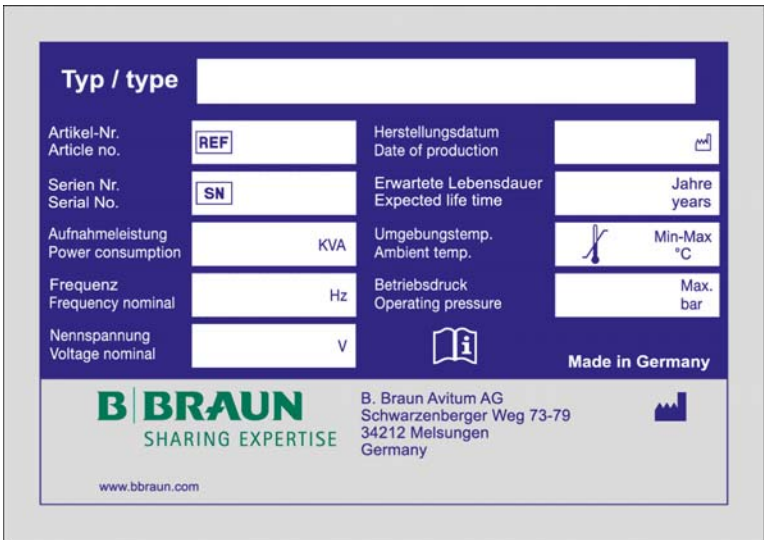


Figure 6-1: Example of a type plate

When ordering spare parts, please quote the following:

- Equipment type
- Serial number (SN)
- Description and article number
- Required quantity

NOTE:	**Only original spare parts, accessories and consumables from B. Braun are to be used. → Part 2, page 10-1 and → Part 1, page 3-1.** **B. Braun does not accept any liability for damage caused by the use of other spare parts, accessories or consumables.**

7. Technical data

7.1 Specifications

(REFERENCE: DOCUMENT ID 085)

		AQUAbase			AQUAbase HT		
Type		***300***	***600***	***900***	***250***	***500***	***750***
Article no.		1101030	1101060	1101090	1101225	1101250	1101275
Number of treatment stations ***		8/6	16/12	25/18	6/5	12/10	18/15
Membrane(s)	Amount	1	2	3	1	2	3
	Type	TS-L1-440 (52742)	TS-L1-440 (52742)	TS-L1-440 (52742)	ROHSM (52802)	ROHSM (52802)	ROHSM (52802)
Pressure PI2*	bar	16.6	16.6	16.6	15.8	15.8	15.8
Salt retention		Single-value ions > 95%; dual-value ions > 97.5%					
Permeate flow **	l/h	300	600	900	250	500	750
Pumps Grundfos CRN	M1	1-33 2.2kW (52860)	3-29 2.2kW (51950)	3-33 3kW (52348)	1-33 2.2kW (52860)	3-29 2.2kW (51950)	3-33 3kW (52348)
El. connection	V/Hz	3N ~ 400V / 50Hz (CEE 16A)					
Partial load absorption	KVA	3.46	3.46	4.74	3.46	3.46	4.74
Full load absorption	KVA	n./a.	n./a.	n./a.	9.48	9.48	10.76
Heating capacity	kW	n./a.	n./a.	n./a.	3x2	3x2	3x2
Safety class	IP	44 (pumps 55)					
Check fuse	AT	16					
Alarm outputs		Potential-free, changeover 40V/2A					
Softened water connection		V4A hose connection NW 20 (hose: 25 x 4.5)					
Ring piping input		Connecting hose (reverse osmosis RL) VA: Art# 5096201 + 9361300					
Ring piping return		Connecting hose (reverse osmosis RL) VA: Art# 5096201 + 9361300					
To drain		1”					
Width	mm	990	990	990	980	980	980
Depth	mm	805	805	805	805	805	805
Height	mm	1705	1705	1705	1705	1705	1705

* Raw water temperature: 10°C; membrane performance deviation ± 15%

** Raw water: 10°C, 500 ppm NaCl; counterpressure 3.0 bar;
calculated membrane age: 3 years, flux decline 3 years: 10%; total WCF: 75%

*** With continuous HD flow 500/800 ml/min. Some dialysis machines need higher flow rates for flushing

Subject to changes

7.2 Design data

Design data	
Permeate output	see → 7.1 “Specifications”
Electrical connections	400 V / 50 Hz / CEE 16 A triggering current via 30 mA residual-current-operated circuit breaker Nameplate → Part 2, page 6-1, clockwise rotation field or permanent connection
Permeate concentrate ratio	25 % for hard water operation 75 % for soft water operation
Ambient temperature	5 – 40 °C
Internal temperature of housing (control)	5 – 70 °C
Internal temperature of housing (hydraulics)	5 – 90 °C
Relative air humidity (control)	max 75 % rel. hum., non-condensing
Materials in contact with product	Stainless steel 1.4404; 1.4571; 1.4435, Ethylene-Propylene-Diene (EPDM), Polypropylene, Polysulphone, Polyvinylidene fluoride (PVDF), Polyamide

7.3 Feed water / raw water requirements

AQUAbase reverse osmosis systems have been designed in such a way that they can usually be operated with feed water quality of “drinking water” quality (according to 98/83/EC) (→ Part 1, chapter 2.4). B. Braun specifies different maximum values to 98/83/EC for individual water contents (see table → Part 1 from page 2-3).

The service lifetime of the reverse osmosis membranes used and the permeate quality of the product flow of the reverse osmosis system depend directly on the concentration of the individual water contents and can be optimized through suitable pretreatment methods.

The critical parameters are highlighted in → Part 1, chapter 2.4.1, in the column “Feed water for reverse osmosis” in these operating instructions (**bold print**).

Raw water requirements	
Water intake (raw water)	At least four times the pure water capacity (when using a pretreatment system, the minimum water consumption for this system must be added)
Dynamic pressure, minimum (removal only)	2.5 bar
Static pressure, maximum	6.0 bar
pH range	9.0 ≥ pH ≥ 5.0
Free chlorine (permanent load)	max. 0.0 ppm
Fine filter 5 µm Silt Density Index (SDI)	≤ 3
Raw water setting value TDS (as NaCl)	500 ppm
Temperature range	10 – 30 °C

7.4 Ring piping requirements

Ring piping requirements	
Flow speed (min.)	0.5 m/s (at maximum consumption)
Pressure at the ring piping end (min.)	2.5 bar (at maximum consumpion) Pressure loss Dp < 3 bar
Material	PVDF, PEX, PVC recommended: stainless steel 316 L electro-polished with R_a <0.8 µm
Pressure resistance (min.)	10 bar
Construction of tapping points	Minimum dead space acc. to 6-d rule (GMP)

⚠ WARNING	**Danger of poisoning due to detached construction materials and destruction of components!** **→ Only temperature-resistant original materials up to a minimum of 90°C must be used.**

7.5 RO modules

RO modules	
Spiral wound membrane module	D= 4”; H= 40”
Material	PA Composite
Max. chlorine concentration in the feed	0 ppm
SDI_{15}	< 3
pH range during dialysis/standby mode	5 – 9
pH range for chemical cleaning (only briefly)	2 – 11

7.6 Pumps

Pumps	
Material	Pump housing: stainless steel 1.4408 impeller: stainless steel AISI 316
Mechanical seal	EPDM or FKM
IE class	IE3
Type of protection	IP55
Insulation class	f
Ambient temperature max.	60 °C
Net weight	39–50 kg

7.7 Membrane pressure pipe

Membrane pressure pipe MM 4040	
Pressure	max. 25 bar
Material	1.4404 AISI 316 L
Connections	
Soft water feed	R 1/2” (after processing dairy coupling NW20)
Permeate drain	R 1/2” (after processing dairy coupling NW20)
Concentrate drain	R 1/2” (after processing dairy coupling NW20)

7.8 Wiring diagram

Wiring diagram	
Electrical circuit diagram no.	
– AQUAbase	87 253 XX

7.9 Command equipment

The control system consists of an operating unit (with CPU) and a power pack (LT1plus). The power pack can be supplemented by an external data and address bus. The operating unit and the power pack are connected by means of a flat ribbon cable. With the exception of RS232, external connections are made with plug block terminals via the power pack.

7.9.1 LC display

LC display	
Character height	4.75 mm
Number of characters per line	20
Number of lines	4
Background illumination:	blau

7.9.2 LED display

LED display	
System under voltage	LED “RUN” (green) lights up
Alert	LED “ERROR” (red) and LED “Run” (green) flash alternately
Error	LED “ERROR” (red) flashes

7.9.3 Operation

Operation of the CPU II is by means of 4 short-stroke keys (display-guided).

7.9.4 Data retention

Data retention	
Setting and program data	Stored by EEPROM
Guaranteed data retention	10 years
Min. guaranteed storage cycles	100´000
Real time clock	buffered by lithium battery

7.9.5 Watchdog

The correct program sequence is monitored by an integrated watchdog (micro-controller).
When the CPU watchdog is triggered, the system is reset and an internal system test is carried out.
(Max. reset time = 2 sec.)

7.9.6 Safety circuit LT1PLUS

If the power pack watchdog is not addressed in good time, operation is interrupted immediately and a system fault is signaled (max. reset time = 1 second). Data transfer is monitored by a safety circuit in the power pack. Triggering the safety circuit leads to Error 413 being triggered.

7.10 Input and output signals

7.10.1 Digital inputs

Digital inputs	
Amount	max. 32
Voltage	24 V DC, low safety voltage
Line current	1.0 to 2.0 mA DC

Assignment of digital inputs

Name	Assignment	Description	Assessment AQUAbase DI14=0	Assessment AQUAbase HT DI14=1
DI 01	Motor protection switch pump M1	0 = fault, 1 = no fault	Yes	Yes
DI 02	PSAH1	0 = fault, 1 = no fault	Yes	Yes
DI 03	TSAH1	0 = fault, 1 = no fault	Yes	Yes
DI 04	Reserve			
DI 05	Reserve			
DI 06	Reserve			
DI 07	Reserve			
DI 08	Reserve			
DI 09	Reserve		No	Yes
DI 10	Hardware chain heating	0 = fault, 1 = no fault	No	Yes
DI 11	ELR E1.1 defect	If DO05 = 0 but DI11 = 1 (Timeout 500ms)	No	Yes
DI 12	ELR E1.2 defect	If DO06 = 0 but DI12 = 1 (Timeout 500ms)	No	Yes
DI 13	ELR E1.3 defect	If DO07 = 0 but DI13 = 1 (Timeout 500ms)	No	Yes
DI 14	Menu 9 HT operation	Menu 9 only visible if DI14 = 1	No	Yes
DI 15	Reserve			
DI 16	Reserve			
DI 17	Reserve			
DI 18	Reserve			
DI 19	Reserve			
DI 20	Reserve			
DI 21	Reserve			
DI 22	Reserve			
DI 23	Reserve			
DI 24	Reserve			
DI 25	Reserve			
DI 26	Reserve			
DI 27	Reserve			
DI 28	Reserve			
DI 29	Reserve			
DI 30	Reserve			
DI 31	Reserve			
DI 32	Reserve			

7.11 Analogue inputs conductivity recording

Analogue inputs conductivity recording	
Amount	4
Activation	9V AC, 5kHz rectangle
Current potential	Low safety voltage
Resolution	8bit
Internal fuse	Short-circuit and limited external voltage protection
Cell constant	0.15
Adjustment	0.10 … 0.50 can be adjusted individually
Comments	Temperature compensation as function of analog temperature input as per EN27888 Temp. range 0 – 40 °C

7.11.1 Raw water CIS 1

Raw water		Assessment AQUAbase DI14=0	Assessment AQUAbase HT DI14=1
Measuring range	50 ... 2’000 µS/cm	Yes	Yes
Accuracy	Range, 50 ... 5000 µS/cm, ± 5 µS/cm Range, 500 ... 1’000 µS/cm, ± 25 µS/cm		
Load impedance	3'000 ... 150 Ohm (cell constant 0.15 taken into account)		
ext. wiring	Parallel resistance of 30 kΩ (wire break monitor)		

7.11.2 Concentrate CISAH2

Concentrate		Assessment AQUAbase DI14=0	Assessment AQUAbase HT DI14=1
Measuring range	50 … 7700 µS/cm	Yes	Yes
Accuracy	Range 50 µS/cm, ± 5 µS/cm … 1000 µS/cm Range 1000 … 7700 µS/cm, ± 25 µS/cm		
Load impedance	3000 … 50 Ohm (cell constant 0.15 taken into account)		
ext. wiring	Parallel resistance of 30 kΩ (wire break monitor)		

7.11.3 Permeate CISAHH3

Permeate		Assessment AQUAbase DI14=0	Assessment AQUAbase HT DI14=1
Measuring range	1 … 200 µS/cm	Yes	Yes
Accuracy	Range 1 … 30 µS/cm, ± 1 µS/cm Range 30 … 200 µS/cm, ± 3 µS/cm		
Load impedance	150,000 … 750 Ohm (cell constant 0.15 taken into account)		
ext. wiring	Parallel resistance of 30 kΩ (wire break monitor)		

7.12 Analogue input temperature measurement NTC

TISAH1 permeate temperature		Assessment AQUAbase DI14=0	Assessment AQUAbase HT DI14=1
Connection	Permeate temperature	Yes	Yes
Sensor type	Temperature sensor NTC		
Measuring range	0 … 100 °C		
Outlet	NTC, two-wire		
Accuracy	± 1°C		

7.13 Analogue inputs 4…20mA

Amount	5
Current potential	Low safety voltage
Resolution	8bit
Type	4…20 mA interface

Analogue input 1: PISAL 1 filling level of supply tank		Assessment AQUAbase DI14=0	Assessment AQUAbase HT DI14=1
Connection	Pressure sensor	Yes	Yes
Sensor type	Pressure transducer JUMO MIDAS		
Measuring range	0 … 100 mbar		
Material	Silicon sensor with stainless steel separating membrane (piezo resistive)		
Outlet	4 … 20mA, two-wire		
Type of protection	IP65		

Analogue input 2: TISAH 2 temperature permeate return		Assessment AQUAbase DI14=0	Assessment AQUAbase HT DI14=1
Connection	Temperature sensor	No	Yes
Sensor type	PT100		
Measuring range	-20 … +120 °C		
Material	Stainless steel 1.4571		
Outlet	4 … 20mA, two-wire		
Type of protection	IP65		

Analogue input 3: TISAH 4 temperature control heating		Assessment AQUAbase DI14=0	Assessment AQUAbase HT DI14=1
Connection	Temperature sensor	No	Yes
Sensor type	PT100		
Measuring range	-20 … +120 °C		
Material	Stainless steel 1.4571		
Outlet	4 … 20mA, two-wire		
Type of protection	IP65		

Analogue input 4: FISAL 1 flow measurement		Assessment AQUAbase DI14=0	Assessment AQUAbase HT DI14=1
Connection	Permeate flow	Yes Display only	Yes
Sensor type	Flow sensor		
Measuring range	1 … 6000 l/h		
Outlet	4 … 20 mA, two-wire		

7.13.1 CSAH4 (external conductivity measurement; Jumo)

CSAH4		Assessment AQUAbase DI14=0	Assessment AQUAbase HT DI14=1
Connection	Conductivity permeate	Yes	Yes
Sensor type	Conductivity electrode		
Measuring range	1 … 1000 µS/ cm		
Hysteresis	5 µS/cm		
Temperature compensation	25°C		
Protection type:	IP20		

7.13.2 Digital outputs

Digital outputs, control valves	
Amount	Max. 32
Voltage	24 V DC, low safety voltage
Load	390mA at 24 V DC, 150 mA at 9 V DC (economy mode) or 4A activation current (max. 1 sec.1 valve simultaneously) max. 3A/output port (8 outputs)
Internal fuse	Short-circuit-proof, temperature protection
Simultaneity	max. 4 solenoid valves

7.13.3 Assignment of digital outputs

	Assignment	Assessment AQUAbase DI14=0	Assessment AQUAbase HT DI14=1		Assignment	Assessment AQUAbase DI14=0	Assessment AQUAbase HT DI14=1
1	Reserve			17	Reserve		
2	Solenoid valve Y9	Yes	Yes	18	Reserve		
3	Solenoid valve Y10	Yes	Yes	19	Reserve		
4	Main switch heater E1	No	Yes	20	Reserve		
5	Semi-conductor switch heater E1.1	No	Yes	21	Reserve		
6	Semi-conductor switch heater E1.2	No	Yes	22	Reserve		
7	Semi-conductor switch heater E1.3	No	Yes	23	Reserve		
8	Pump M1	Yes	Yes	24	Reserve		
9	Reserve			25	Reserve		
10	Reserve			26	Reserve		
11	Reserve			27	Reserve		
12	Reserve			28	Reserve		
13	Reserve			29	Reserve		
14	Reserve			30	Reserve		
15	Reserve			31	Reserve		
16	Reserve			32	Reserve		

7.13.4 Relay outputs power

Relay output pump M1 / contactor	
Number of relays	2
Relay coil	24 V DC / 15 mA
Contact	Change-over contact
Load	40 V / 8A
Internal fuse	None

Relay	Name	Contact	Key functions. In order to…	Assessment AQUAbase DI14=0	Assessment AQUAbase HT DI14=1
K1101	Reserve				
K1102	Dialysis mode	Change-over contact	On in dialysis mode	Yes	Yes

7.13.5 Relay output general

Relay output pump M1 / contactor	
Number of relays	4
Relay coil	24 V DC / 15 mA
Contact	floating
Load	4 V DC / 2 A
Internal fuse	None

Relay	Name	Contact	Key functions. In order to…	Assessment AQUAbase DI14=0	Assessment AQUAbase HT DI14=1
K1103	Disinfection	Make contact	closed, active in dialysis mode and during hot cleaning	Yes	Yes
K1104	Dialysis mode	Make contact	closed in standby mode after shut-off rinsing	Yes	Yes
K1105	Alert	Change-over contact	Relay is inverted, no alarm applied, dropped upon alarm	Yes	Yes
K1106	Reserve	Make contact	-	-	-

7.14 Interfaces

7.14.1 Interface RS232

Serial interface for data traffic with host computer (PC, mainframe etc.).
Connection via standard interface 5V-V24 or 5V current loop.

Baud rate:	1200bit/s
Parity:	none
Bit/character:	8
No. of start bits:	1
No. of stop bits:	1

7.15 EMC guidelines

The devices of series AQUAbase listed in the EMC table comprises all variants of the series.

– AQUAbase

– AQUAbase HT

Guidelines and manufacturer's declaration – electromagnetic transmission		
The devices of the AQUAbase series are designed for operation in an environment as described below. The customer or user of a AQUAbase should ensure that it is operated in such an environment.		
Transmission measurements	**Conformity**	**Electromagnetic environment – guidelines**
HF transmission according to CISPR 11	Group 1	The AQUAbase uses high-frequency energy solely for its internal functions. Therefore its HF transmission is very low and it is unlikely that there will be any interference with neighbouring devices.
HF transmission according to CISPR 11	Class B	The AQUAbase are suitable for use in all facilities including the home, as well as in facilities that are directly connected to a public power supply network that also supplies buildings that are used for residential occupancy.
Transmission of harmonics according to IEC 61000-3-2	Class A	
Transmission of voltage fluctuations/flickering according to IEC 61000-3-3	matches	

Guidelines and manufacturer's declaration – electromagnetic interference			
The devices of the AQUAbase series are designed for operation in the electromagnetic environment described below. The customer or user of a AQUAbase should ensure that it is operated in such an environment			
Test of interference immunity	**IEC 60601 test level**	**Conformity level**	**Electromagnetic environment – guidelines**
Electrostatic discharge (ESD) according to IEC 61000-4-2	± 6 kV contact discharge ± 8 kV air discharge	± 6 kV contact discharge ± 8 kV air discharge	Floors should be made of wood or concrete or have ceramic tiles. If the floor covering is made of synthetic material, the relative humidity must be at least 30%.
Fast transient electrical emissions/bursts according to IEC 610004-4	± 2 kV for mains cables ± 1 kV for input and output cables	± 2 kV for mains cables ± 1 kV for input and output cables	The quality of the supply voltage should correspond to that of a typical commercial or hospital environment.
Surges according to IEC 61000-4-5	± 1 kV differential mode voltage ± 2 kV common mode voltage	± 1 kV differential mode voltage ± 2 kV common mode voltage	The quality of the supply voltage should correspond to that of a typical commercial or hospital environment.
Voltage dips, short-term interruptions and fluctuations in the voltage supply according to IEC 61000-4-11	<5 % U_T (>95 % dip in U_T) for 1/2 period 40 % U_T (60 % dip in U_T) for 5 periods 70 % U_T (30 % dip in U_T) for 25 periods <5 % U_T (>95 % dip in U_T) for 5 s	<5 % U_T (>95 % dip in U_T) for 1/2 period 40 % U_T (60 % dip in U_T) for 5 periods 70 % U_T (30 % dip in U_T) for 25 periods <5 % U_T (>95 % dip in U_T) for 5 s	The quality of the supply voltage should correspond to that of a typical commercial or hospital environment. If the user requires use of advanced functions for the AQUAbase even if interruptions in the power supply occur, it is recommended that the AQUAbase be fed from an uninterruptible power supply or a battery.
Magnetic field for the power supply frequency (50/60 Hz) according to IEC 61000-4-8	3 A/m	3 A/m	Magnetic fields in the mains frequency should correspond to the values typical of those found in a commercial or hospital environment.
NOTE: U_T is the AC supply voltage before applying the test level			

Guidelines and manufacturer's declaration – electromagnetic interference			
The devices of the AQUAbase series are designed for operation in the electromagnetic environment described below. The customer or user of a AQUAbase should ensure that it is operated in such an environment			
Test of interference immunity	**IEC 60601 test level**	**Conformity level**	**Electromagnetic environment – guidelines**
			Portable and mobile radio devices should not be used more closely to the AQUAbase, including the cables, than the recommended electrical clearance that is calculated for the appropriate equation for the transmitting frequency.
			Recommended electrical clearance:
Guided HF emission according to IEC 61000-4-6	3 V_{eff} 150 kHz to 80 MHz	3 V	d = 0.35 √ P
Radiated HF emission according to IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	10 V/m	d = 0.35 √ P for 80 MHz to 800 MHz d = 0.70 √ P for 800 MHz to 2.5 GHz
			P is the maximum rated power of the transmitter in Watts (W) according to the information provided by the transmitter manufacturer, and d is the recommended electrical clearance in metres (m).
			For all frequencies, the field strength of stationary radio transmitters according to local inspection[1] should be less than the conformity level.[2]
			 Interference is possible in the neighbourhood of all devices that are marked with the following symbol.
NOTE 1: The higher frequency range applies for 80 MHz and 800 MHz.			
NOTE 2: These guidelines may not be applicable in all cases. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

1) The field strength of stationary transmitters such as base stations of mobile phones and mobile land radio communications service devices, amateur radio stations and AM and FM radio and television transmitters can theoretically not be predetermined precisely; to determine the electromagnetic environment in terms of stationary transmitters, the location should be studied in detail. If the measured field strength at the spot where a AQUAbase is used exceeds the above conformity level, the AQUAbase should be observed to ensure that it functions properly. If unusual performance characteristics are observed, additional measures may be necessary, such as changing the orientation or moving the AQUAbase to another location.

2) Over the frequency range of 150 Hz to 80 MHz the field strength should be less than 3 V/m.

Recommended electrical clearances between portable and mobile HF telecommunication devices and a AQUAbase

The AQUAbase is designed for operation in an electromagnetic environment in which HF emissions are monitored. The customer or user of a AQUAbase can help avoid electromagnetic interference by maintaining the minimum clearance between portable and mobile HF telecommunication devices (transmitters) and a AQUAbase – depending on the output and on the communication device, as described below.

Nominal power of the transmitter	**Electrical clearance depending on the transmitting frequency**		
	150 kHz to 80 MHz	**for 80 MHz to 800 MHz**	**800 MHz to 2.5 GHz**
W	d = 0.4 √ P	d = 0.4 √ P	d = 0.7 √ P
0.01	0.04	0.04	0.07
0.1	0.13	0.13	0.22
1	0.40	0.40	0.70
10	1.3	1.3	2.2
100	4.0	4.0	7.0

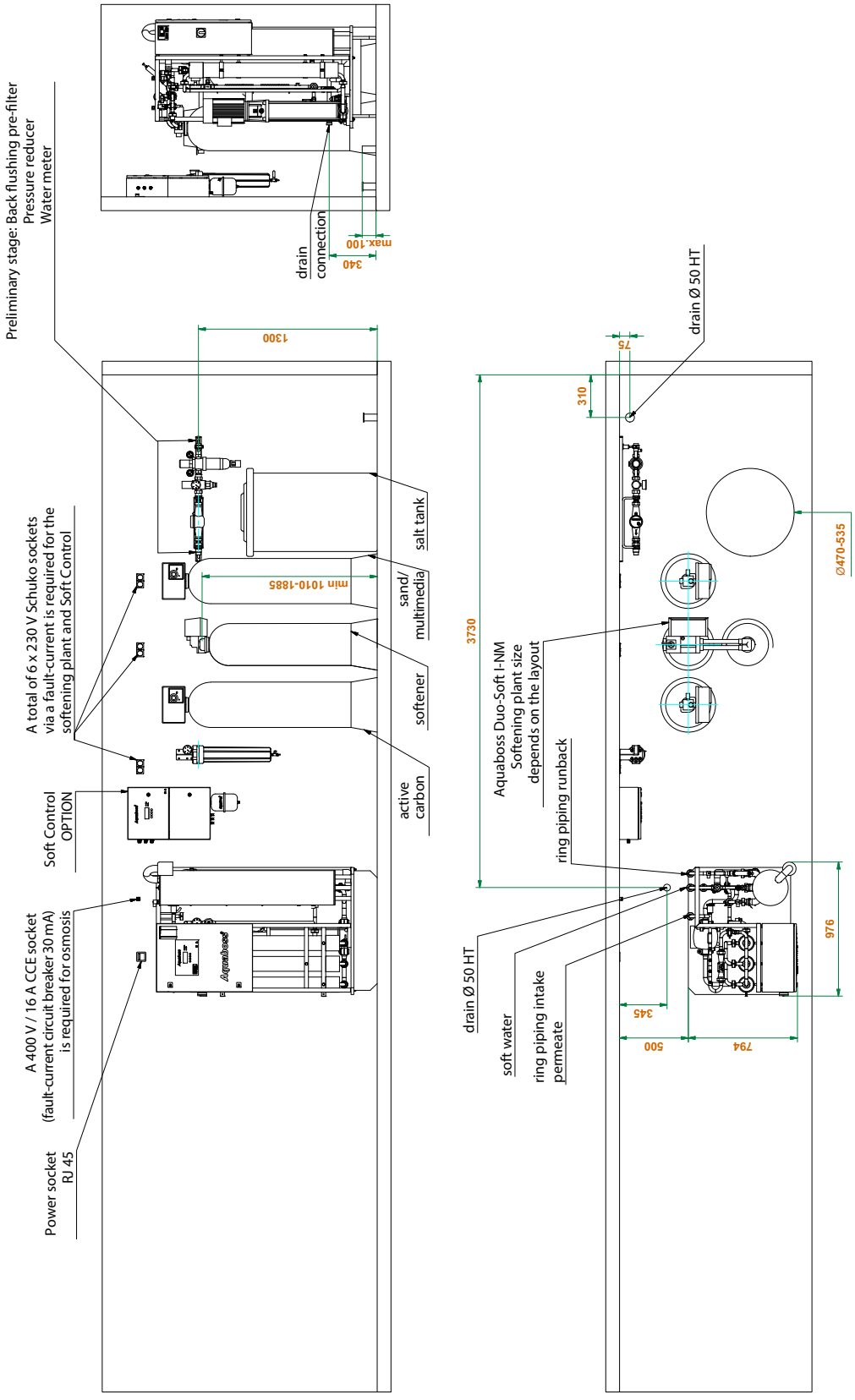
In the case of transmitters whose maximum nominal power is not listed in the table above, the recommended electrical clearance of d in metres (m) can be determined using the equation that belongs in the respective column, whereby P is the maximum electrical clearance in Watts (W) according to the information provided by the transmitter manufacturer.

NOTE 1: The higher frequency range applies for 80 MHz and 800 MHz.

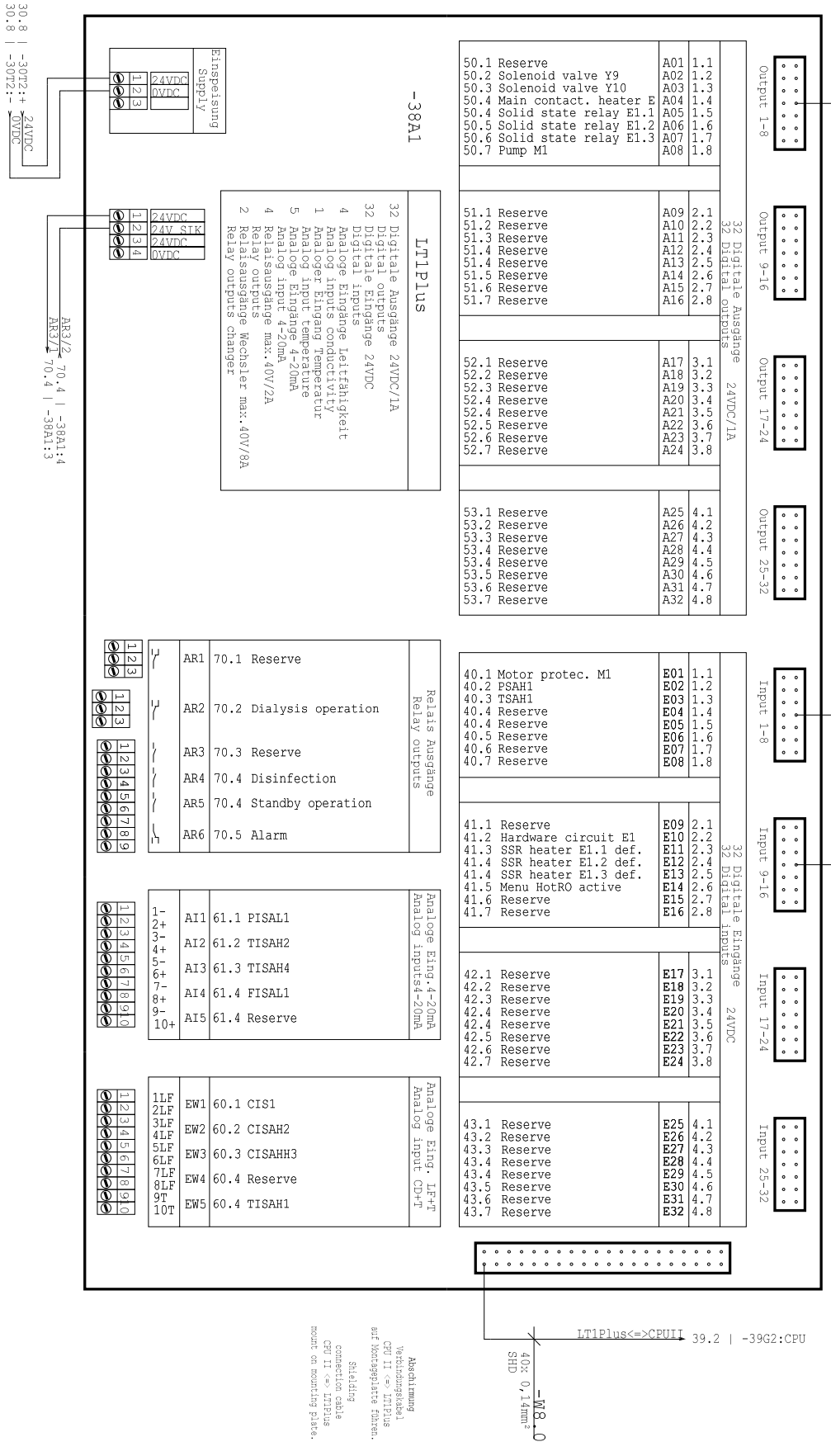
NOTE 2: These guidelines may not be applicable in all cases. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

8. Setup plan and terminal diagram

8.1 AQUAbase installation plan



8.2 AQUAbase terminal diagram



9. Maintenance and technical safety checks (TSC)

The functional safety of the reverse osmosis system can only be maintained if the medical product log is maintained as intended and made accessible to technicians during the technical safety check / routine check work.

The AQUAbase is a low-maintenance system:

- If the system is operated with an upstream softening plant, care must be taken that soft water is always available. Check the soft water regularly.
- Comparison / adjustment of the conductivity values must be carried out once a month by means of a hand-held measuring instrument.
- The prefilter has to be replaced every 4-8 weeks. A reminder message can be programmed under menu item 6.10.
- The ventilation and venting filter for tank respiration has to be replaced once yearly.

NOTE:	**Follow the instructions on specific checks for your system.** **→ Part 2, page 9-2** **Keep the medical product log.** **→ Part 2, page 9-4** **Observe instructions for routine check and the technical safety check.** **→ Part 2, page 9-6**

⚠ WARNING	**Component failure due to non-compliance with the maintenance and technical safety checks!** **Reverse osmosis system immobilization and therefore permeate production is not possible.** **→ An annual technical safety check (TSC) by B. Braun-authorized specialists is compulsory.**

⚠ WARNING	**Risk to the patient due to system failure or non-compliance with the demands on the permeate.** **→ After maintenance, repair, exchange or components or other changes, the operator must provide documented proof that the system corresponds with the original specifications (permeate quality, material compatibility).**

⚠ WARNING	**Danger of poisoning and pyrogenic reactions.** **Even if the reverse osmosis system produces water of a quality that meets the requirements of the international standard DIN EN ISO 26722, the distribution of this water can impair the quality so much that it no longer meets the requirements of the DIN EN ISO 26722 standard, if the distribution system is not appropriately maintained.** **Maintenance/technical safety checks on the reverse osmosis system and connected distribution system must be undertaken according to the manufacturer's instructions.**

⚠ WARNING	**Danger of poisoning and pyrogenic reactions.** **Non-compliance with the manufacturer's maintenance instructions and disinfection instructions can lead to a decline in the permeate quality or functional impairment to the system.**

9.1 Specific checks for your system

On this form, you will find the stipulations entered by B. Braun for specific checks which have been laid down especially for your system. The specific checks must be carried out at the intervals given here.

Independently of this, the medical product log (→ Part 2, page 9-4) must be kept and the maintenance and technical safety check measures (→ Part 2, page 9-6) must be carried out and logged.

Specific checks to be carried out	Description	Interval	Information

9.2 Medical product log and maintenance / technical safety check log

NOTE:	**The operator has to keep a medical product log for the systems AQUAbase.** **The medical product log provides important information on the functionality of the reverse osmosis system and should therefore be kept near the device.** **Operating log → Part 2, page 9-5** **Maintenance and technical safety check log → Part 2, page 9-6** **Maintenance and technical safety check plan → Part 2, page 9-7**

The functional safety of the reverse osmosis system can only be maintained if the medical product log is maintained as intended and made accessible to technicians during the technical safety check / routine check work.

Completely and correctly kept logbooks are absolutely essential to determine the type of maintenance and checks to be carried out periodically.

The type of activity, the date carried out and the person doing the work must be entered in the respective log book every time a check is made.

Sample pages for the medical product log and the maintenance and technical service check log are provided in these operating instructions. You can copy these pages as often as required.

9.2.1 Medical product log

The medical product log AQUAbase and AQUAbase HT contains information on the system and an operational log.

System details:	
1. Description/system type:	
2. Serial number	
3. GMDN Code	14 – 437
4. Date of handover to the operator	
5. Names of trained persons (block letters)	
6. Functional tests	As per operational log
i Interval	Daily
ii Authorised	Trained personnel from point 5 Trained personnel from B. Braun Avitum AG
7. Safety inspections	As per bill of material
i Interval	Annually
ii Authorised	Trained personnel from B. Braun Avitum AG
8. Functional faults	See entry in operational log
9. Report of incidents to authorities and manufacturer	See entry in operational log

9.2.2 Operating protocol AQUAbase

The plant performance must be recorded daily in the medical product log in accordance with the medical products operator's directive dated June 29, 1998, including details of all operation conditions.

Serial no.: .....

Month / year: .....

Date	Pretreatment: Free chlorine	Pretreatment: Hardness (°dH °fH)	Permeate conductivity CISAHH3 (µS/cm)	Raw water conductivity CIS1 (µS/cm)	Concentrate conductivity CISAH2 (µS/cm)	Flow FISAL1 in l/h	Pressure PI2 in bar	Pressure PI3 in bar	Temperature in °C TISAH1	Remarks and also malfunctions, their consequences, operating errors, events	Visa
01											
02											
03											
04											
05											
06											
07											
08											
09											
10											
11											
12											
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Maintenance and technical safety check log for AQUAbase

All the maintenance, technical safety checks, disinfection and cleaning carried out on the system must be recorded in the maintenance and technical safety check log.

The technical safety checks are to be carried out annually.

Serial no.: .....

Maintenance work carried out	Datum	Running time in h	Description of maintenance work, remarks	Visa

Maintenance plan and technical safety check TSC

AQUAbase

Dialysis centre: .....

Contact: .....

Street: .....

Postal code/city: .....

Test equipment number

Conductivity: .....

Electrical safety: .....

Temperature: .....

Serial number (SN): .....

System type: AQUAbase ❑
AQUAbase HT ❑

Number of modules: .....

Inventary number: .....

Order number: .....

Manufacture date: ...../.....

Date: .....

1.	**Pretreatment (option)**	Changed	Carried out / OK	Last replacement month / year	Values / data / remarks
1.1	Overall visual assessment, inc. air-tightness; complete pretreatment		☐		
1.2	Water filter, flushing type				Type
1.2.1	Check degree of soiling (visual inspection)		☐		
1.2.2	Carry out flushing operation		☐		
1.3	Water monitor				Type
1.3.1	Function test		☐		
1.4	Pipe disconnector				Type
1.4.1	Function test, disconnection and flow setting		☐		
1.5	Read water meter		☐		m³

2.	**Sand/iron filter (optional)** Type: ....., SN:	Changed	Carried out / OK	Last replacement month / year	Values / data / remarks
2.1	Overall visual assessment inc. seals		☐		
2.2	Check control head for functioning		☐		

3.	**Softening plant / Ion exchanger** Type: ....., SN:	Changed	Carried out / OK	Last replacement month / year	Values / data / remarks
3.1	Overall visual assessment inc. seals		☐		
3.2	Start manual regeneration		☐		
3.3	Replace resin every 10 years	☐			
3.4	Clean injector if required		☐		
3.5	Replace brine valve if required		☐		
3.6	Clean salt tank (annually)		☐		
3.7	Salt filling level		☐		cm
3.8	Set brine filling level		☐		cm
3.9	Raw water hardness				°dH
3.10	Soft water hardness 1°dH		☐		°dH
3.11	Set capacity		☐		m³
3.12	Bypass valve setting (check)		☐		
3.13	Check control head for functioning		☐		

4.	**Active carbon filter** Type: ....., SN:	Changed	Carried out / OK	Last replacement month / year	Values / data / remarks
4.1	Overall visual assessment				
4.2	Check control head for functioning		☐		

5.	**Reverse osmosis system**	Changed	Carried out / OK	Last replacement month / year	Values / data / remarks
5.1	Total running time of system				
5.2	Running time pump M1				
5.3	Overall visual assessment inc. seals		☐		
5.4	Pre-filter Check filter change interval, min. every 6 weeks – check in log chapter 9	☐			
5.5	Dairy couplings checked and re-tightened, seals replaced every 5 years		☐		
5.6	Module cover screws OK		☐		
5.7	Flap setting K4=closed		☐		
5.8	Replace ventilation and aeration of tank (annually)	☐			
5.9	Solenoid valves				
5.9.1	Check Y9, Y10 for function		☐		
5.9.2	Replace all SV coils + sets of seals (every 5 years)	☐			
5.10	Pressure switch check function of switching point	Switch point	PSAH1 ☐		6.0 bar ± 2.0 bar ☐ OK ☐ n.OK
5.11	Pumps and motors				
5.11.1	Check sliding ring seal in pump head, replace if necessary	M1 ☐ _____	Testing M1 ☐		Tight, no running noises
5.11.2	Check motor protection switch, adjust if necessary	M1 ☐ ____ (A)	☐	set: _____ (A)	(1.0 x the nominal current)
5.11.3	Check pressure sensor PISAL1		☐		
5.12	System data				
5.12.1	If necessary update software (when replacing software pay attention to valid operating manual!)	☐			SW version old
					SW version new
5.12.2	Measurements check				

5.12.2.1 Conductivity
testing equipment number: .....

	Reference	Measurement	Deviation	OK	n.OK
☐ Softened water	µS/cm	µS/cm		☐	☐
☐ Concentrate	µS/cm	µS/cm		☐	☐
☐ Permeate	µS/cm	µS/cm		☐	☐

Check with calibrated manual device: max. deviation for SW and conc. ± 10 µS/cm, max. deviation for permeate ± 2 µS/cm

5.12.2.2 Temperature

	Reference	Measurement	Deviation	OK	n.OK
☐ TISAH1	°C	°C	°C	☐	☐
☐ TISAH2	°C	°C	°C	☐	☐
☐ TISAH4	°C	°C	°C	☐	☐

Check with calibrated manual device: max. deviation. ± 3 ° C

5.12.2.3 FISAL1 system performance

	Reference*	Measurement	Deviation**	OK	n.OK
	[l/h]	[l/h]	[l/h]	☐	☐

* See type plate
** OK if ≥ 100% of reference value

5. **Reverse osmosis system**	Changed	Carried out / OK	Last replacement month / year	Values / data / remarks
5.12.2.4 Pressures				

	Reference*	Measurement	Deviation**	OK	n.OK
	[bar]	[bar]	[%]	☐	☐

* See QA log
** OK, -25% reference value < measurement value > +25% reference

5.12.3 Check/read out alarm/limit values		☐ OK ☐ n.OK	

	Set value	Measured value upon triggering	Value within range of ± 2 µS
5.12.3.1 Alarm value	..... µS/cm	..... µS/cm	☐ OK ☐ n.OK
5.12.3.2 Limit value	..... µS/cm	..... µS/cm	☐ OK ☐ n.OK

5.12.4 Check temperature discharge	Start value	Measurement	Switch point ± 3 °C
	.....°C	.....°C	☐ OK ☐ n.OK
	.....°C	.....°C	☐ OK ☐ n.OK

5.12.5 Check fault history		☐		
5.12.6 Fill out “Service report” log		☐		
5.12.7 Initiate all operating states		☐		
5.12.8 Log system performance		☐		
5.13 Electrical installation				
5.13.1 Check terminals – tight fit of all cables		☐		
5.13.2 Check insulation of all cables, replace if necessary		☐		
5.13.3 Replace CPU battery (every 5 years)		☐		
5.13.4 Check setting of ÜV1 each year (2.0 bar ± 0.5 bar)			☐	

6. **Cleaning & disinfection** (only if required or when stipulated by the operator: _____)		Carried out / OK		Values / data / remarks
6.1 Citric acid flushing **		Yes ☐ No ☐		
6.2 Disinfection carried out **		Yes ☐ No ☐	Disinfection filling opening sealed again? Yes ☐ No ☐	
6.3 Hot disinfection carried out **		Yes ☐ No ☐	.....min (min. at 80 °C) ..... °C (20 min)	☐ OK ☐ n.OK

** according to separate log (see → Part 1, chapter 12)

7. **Special work**	Changed	Carried out / OK	Last replacement month / year	Values / data / remarks	
7.1 Module replacement		☐		Serial no. old	Serial no. new
7.2 Pump replacement		☐		Serial no. old	Serial no. new
7.3 Motor replacement		☐		Serial no. old	Serial no. new
7.4 Replace coils Y9, Y10		☐			
7.5 Replace relay on all relay modules		☐			
7.6 Replace seals on flaps K4 if required		☐			
7.7 Other				Comments:	

8.	Repeat test on medical electrical devices according to DIN EN 62353 (IEC 62353)	Measurement	Limit	Values / data / remarks
	⚠ **ATTENTION: Performance of test according to EN 62353 (IEC 62353)**			
	☐ Repeat test ☐ Check after service Safety class: 1 Mains connection: PIE ☐ PIE = (permanent installed equipment) NPS ☐ NPS = (non-detachable power supply cord)			
8.1	**Visual inspection** Mains connection cable, overall system:			☐ OK ☐ n.OK
8.2	**Earth conductor resistance** Measurement between mains connection cable and housing	R_{SL}	<0.300Ω	☐ OK ☐ n.OK
8.2.1	Measurement between ,mains connection cable and mounting plate	R_{SL}	<0.300Ω	☐ OK ☐ n.OK
8.2.2	Measurement between mains connection cable and doors/front panel	R_{SL}	<0.300Ω	
8.3	**Isolation resistance** Scan all accessible, conducting parts with a test probe	R_{ISO}	>2.0MΩ	☐ OK ☐ n.OK
8.4	**Deflection current** Mains connection PIE: for permanent installed equipment (PIE) measurement of the DEVICE DEFLECTION CURRENT is not necessary. Mains connection NPS: measurement of the DEVICE DEFLECTION CURRENT is necessary. Device deflection current (replacement measurement):	I_{EGA}	<1.0mA	☐ OK ☐ n.OK
8.5	Function test	☐ OK ☐ n.OK		
8.6	Measurement log available	☐ OK ☐ n.OK		
8.7	Safety or functional faults have not been established.	☐		
8.8	No direct risk – the detected defects can be addressed quickly.	☐		
8.9	Device must be taken out of operation until the defect is addressed.	☐		
8.10	Device does not correspond with the requirements – modification/replace of components/ decommissioning is recommended.	☐		
8.11	The next repeat test is required in:	☐ 12 months		

....

Test carried out by Date, signature

9.	Handover	Carried out / OK	Values / data / remarks
9.1	Start dialysis / standby operating mode	☐	
9.2	Have fault-free handover confirmed	☐	

NOTE:	**It is recommended to have the successful technical safety check/disinfection verified by determining the germ count / endotoxin content.**

....

Service technician, block letters Place / date, signature

The system has been accepted in perfect condition

....

System operator, block letters Place / date, signature

9.2.3 DISINFECTION LOG

Client		
Street		
Postal code and city		
Disinfection ordered by		on
Disinfection initiated by		on

Execution: **OK**

1. Inform responsible persons about DI ❑
2. Disconnect dialysis device ❑
3. Clearly mark system for disinfection ❑
   See → page 11-2 “DANGER – Disinfection/cleaning is being carried out”.
4. Perform disinfection using the program default “DI” or “D” ❑

NOTE:	**The warning and safety instructions of the operating manual must always be followed!**

Disinfection carried out on the following:

	Reverse osmosis system	SN:
	Ring piping	
	Tapping points permeate/sampling	

Disinfectant used:

Expiry date		Quantity	
Concentration		Circulating time	
Reaction time		Flushing time	

1. After disinfection (DI), flushing the reverse osmosis (RO) and ring piping with permeate ❑
2. specific check for disinfectant residue for: ❑
   - H_2O_2 (peroxide test – Merck item no. 10011) *or*
   - peracetic acid (peracetic acid test – Merck item no. 110084) *or*
   - chlorine (chlorine test – Merck item no. 117925)
3. Check for disinfectant residue at all permeate tapping points (individually) ❑
4. Repeated check for disinfectant residue after 30 min. standstill of the disinfected and flushed RO ❑

I have made sure that the check for residual disinfectant is negative at all tapping points ❑

NOTE:	**It is guaranteed that a test to prove there is no residual disinfectant in the system will be carried out at all tapping points before the next dialysis begins.** **To prove effective disinfection, a determination of bacterial count in the permeate is recommended within 5-7 days of disinfection.** ❑

Analysis: Total germ count (TGC) according to ISO 13959 should be < 100/ml endotoxin with LAL test: setpoint < 0.25 EU/ml

Sampling:
- wear sterile single-use gloves
- Clean sampling tap (at least ring piping and return) with alcohol
- Open sampling tap and flush with constant jet for 3–5 min.
- Fill permeate sample in sterile sampling container (at least 200 ml), close immediately or filter using a Sampling filter (item no 50346) with coupling (item no. 50327) (write down amount of water!)
- Store the sample in a dry place and deliver within 6 hours to an accredited testing laboratory

End of disinfection: _____ Signature of customer: _____

City/date _____ Signature of technician:_____

9.2.4 CLEANING LOG

Client		
Street		
Postal code and city		
Cleaning ordered by		on
Cleaning initiated by:		on

Execution: **OK**

1. Inform responsible persons about cleaning ❑
2. Disconnect dialysis devices ❑
3. Clearly mark system for cleaning ❑
4. Perform cleaning using the program default “DI” and cleaning log ❑
5. Write down time periods: Start _____ Stop _____ ❑

NOTE:	**The warning and safety instructions of the operating manual must always be followed!**

System and serial no.	**OK**	**N/A**		
Reverse osmosis	☐		SN.:	
Ring piping + secondary rings	☐	☐		Ring piping length:
	Before cleaning		**After cleaning**	**Unit**
Permeate conductivity				µS/cm
pH value in the concentrate				--
Permeate hourly throughput				l/h
Permeate temperature				°C

Cleaning solution used:

Expiry date		Quantity	
Concentration		Circulating time	
Reaction time		Flushing time	

I have made sure that

– the permeate conductivity determined after cleaning is less or equal to the permeate conductivity before cleaning (max. +3µS/cm) ❑

– the pH value in the concentrate has the same value (±0.1 pH) before and after cleaning ❑

NOTE:	**It has been ensured that disinfection will be carried out after cleaning of the reverse osmosis system, the ring piping and secondary rings.** ❑

End of cleaning: _____ Signature of customer: _____

Place/date: _____ Signature of technician: _____

10. Spare and wear parts list AQUAbase

A detailed spare parts list is included in the scope of delivery for the system.

See TM 182

11. Draft letter for municipal water suppliers

To the

[municipal water supplier]

.....

.....

[City], [Date]

Dear Customer,

Artificial kidneys make high demands on the quality of water used. For your information, I have enclosed a copy showing the present quality standard for water used to dilute concentrated haemodialysis solution. If this quality standard is not met, it can lead to situations which threaten the lives of patients.

Especially chemicals such as aluminium, fluorides, free chlorine and chloramines, which are generally used for municipal water treatment, can have a detrimental effect on the health of haemodialysis patients.

In our dialysis centre, we have installed a water treatment system which, under normal conditions, enables us to achieve the standard of water quality required for diluting concentrated haemodialysis solutions. This water treatment system has been designed and configured to process the average composition of water that you supply.

The system consists of a softening plant and a reverse osmosis system. These components are capable of removing all the water components harmful to patients found in drinking water.

We would like to ask you to inform us immediately if there are any changes in the composition of the water, particularly about the use of any disinfectants such as chlorine, or dosing of any other chemicals, so that we can take the necessary steps to protect our patients.

We would like to thank you in advance for your considerate cooperation.

Yours sincerely

DANGER

➔ Acute risk of poisoning during chemical disinfection/cleaning

Cleaning and disinfection may only be carried out by order of the attending physician.

The permeate must be disconnected from the dialysis devices before the disinfection and cleaning process is started.

After disinfection/cleaning, make sure that the permeate is free of residues from chemicals used for cleaning and disinfection before connecting the hose with the dialysis machine at each delivery point.

Art. No.: 53264