

Systeme für Aquakultur,  
 Aquaristik, Labore und  
 zur Wasseraufbereitung

Systems for aqua culture,  
 sea water aquaria, labs and  
 water desalination and purification

Systèmes pour aquacultur,  
 aquariums eau de mer,  
 laboratoires et traitements d'eau



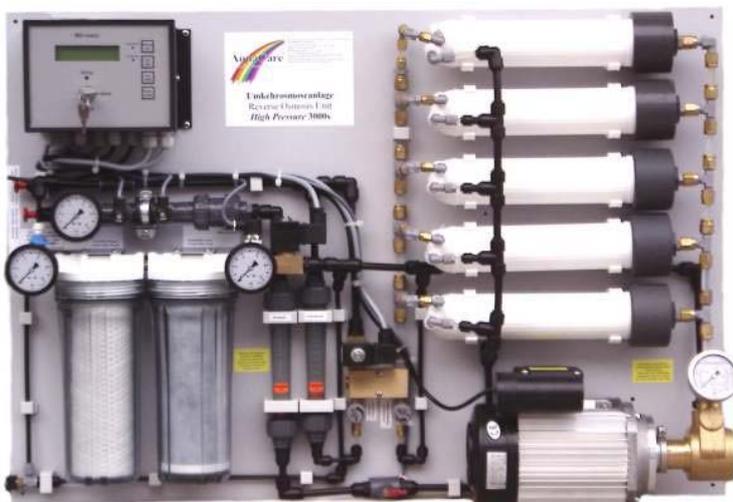
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## Instruction Manual Reverse Osmosis Unit *HighPower* size HP 500...3.000



HP 500 with pressure-less storing tank

modifications possible



HP 3.000 with pressure tank

modifications possible

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# 1. Safety Instructions

## 1.1. General information

This manual contains basic information that are important for assembly, operation, and maintenance. This should be read before mounting by the assembly operator and the responsible operator and/or qualified personnel. This instruction must be disposable the at unit at any time.

Pay attention to this safety instruction as well as to the special instructions within the other chapters. In addition local laws and safety instruction must be minded.

## 1.2. Indication of information



If safety information are important for life or health for persons they are marked with the relevant hazard symbol according DIN 4844-W9.



Safety information marked with this symbol can cause danger for the machine and its function if not respected.



This hints can ease the work with the machine and its maintenance.

At the machine directly marked information as rotation arrow, fluid connections and setting points should be noticed. These marks should be readable at any time.

## 1.3. Qualification of the personnel

The staff for operation, maintaining, inspection and assembly must be qualified for these work. Responsibility and controlling of the personnel should be directed by the operator.

genau geregelt sein.

## 1.4. Dangers if safety information are not minded

If safety information are not minded persons, environment, and the machine can be endangered. Failure of observe lead to loss of the warranty.

Failure of observe can coarse:

- Failure of important functions of the machine.
- Failure of stipulated methods for maintenance.
- Endanger of persons with electric, chemical or mechanical impacts.

## 1.5. Safe working

Working with the machine is only allowed if all safety information of this manual, national laws and rules for preventing accidents and internal working, operating and safety rules of the operator must be minded.

## 1.6. Safety information for the operator

Contact protection for rotating or moving parts should not be removed while operation.

Risks of electrical energy must be averted. Please pay attention to the local laws and information, too.

## 1.7. Safety information for maintaining and assembling personnel

The operator must take care that all works for assembling, inspecting and maintaining are made by authorized and qualified personnel. These persons must be informed about the machine and the works by reading the manual or otherwise.

Working at the machine is only permitted if unit is out of operation. The described procedure of putting out of operation must be redeemed. Immediately after the work safety and protection facilities must be mounted and put into function.

Before starting again all issues treated in the chapter “putting into operation” must be minded.

## 1.8. Arbitrary reconstruction and spare parts production

Reconstruction or modifying the unit are only proper if the manufacture agrees. Original spare

parts and authorized accessories by the manufacturer are made for the safety. The use of other parts can destroy the warranty demands.

## 1.9. Illegal operation

Safety is only guaranteed if the unit is running within the field of application described in „designated use“ in this manual. The technical limits mentioned in manual (chapter “Technical data and unit protocol”) must be redeemed.

## 1.10. Linked aggregates

The listed information dealing with safety and operation in manuals of linked aggregates must be redeemed, too.

## 1.11. Protection against the environment



As a basic principle technique with water may cause water damages. Before installing the system evaluate what damages leaking water is able to cause. A central floor drainage or a leak detecting system may prevent large losses.

# 2. Transport

## 2.1. Mechanical conditions



The unit may be transported only with suitable lifting tools. Pay attention to the transport weight listed in chapter “Technical data and unit protocol”.

## 2.2. Climate conditions



Reverse osmosis membranes are sensitive to frost. If additional safety actions are not done (e.g. frost protection) the temperature should never fall below zero.

If safety actions are done for the transport the frost protection is shown in degree centigrade with a label at the transport box.



The temperature should never drop below the minimum temperature. If the R.O. plant is flushed with water the frost protection does not exist any longer.

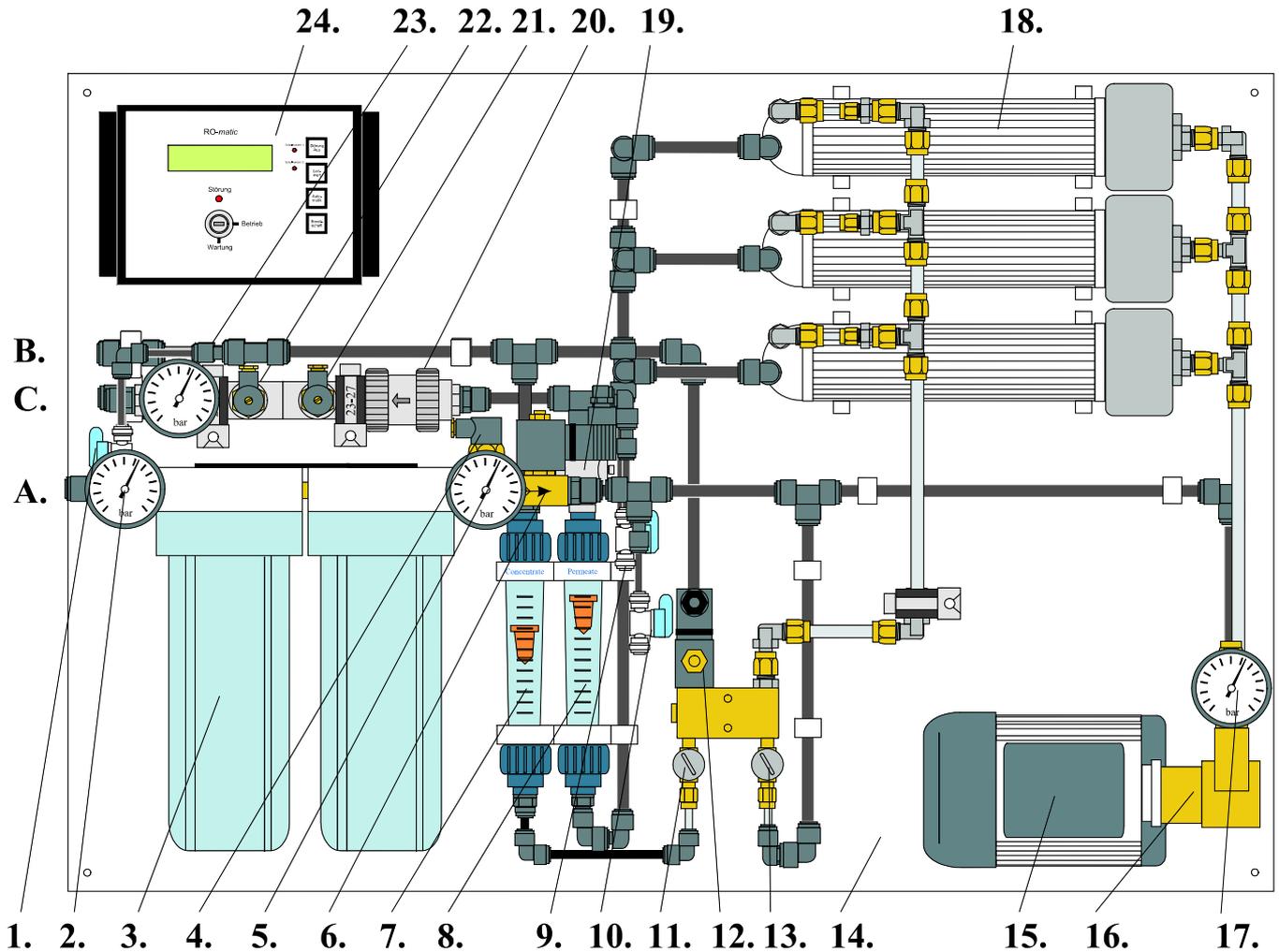
# 3. Designated use

AquaCare reverse osmosis units are built only for particle free water. Depending on the type of plant (tap water, surface water, brackish water, sea water) the feed water should not exceed the maximum concentration of salt (TDS) as shown in the protocol. If you use other waters than shown in the protocol you must ask AquaCare – otherwise the warranty will be lost.

# 4. Configuration

The AquaCare R.O. unit is completely equipped. The unit has to be connected with feed water, drain and pure water line and of course with the electric. Please control the delivery if it is complete and not broken.

## 4.1. Basic equipment



The unit consists of following parts:

1. drain valve for pre-filters
  2. pressure gauge "pre filter";
  3. two pre-filters;
  4. pressure switch "inlet pressure";
  5. pressure gauge "filter pressure";
  6. solenoid "inlet";
  7. flow meter "concentrate";
  8. flow meter "permeate";
  9. sample valve permeate;
  10. sample valve feed water;
  11. needle valve "concentrate";
  12. solenoid "flushing";
  13. needle valve "membrane pressure";
  14. mounting plate;
  15. motor of pump;
  16. roto-vane pump;
  17. pressure gauge "membrane pressure";
  18. membrane housing with membrane inside;
  19. conductivity cell for ROMATIC;
- Only with pressure tank control:
20. check valve;

21. maximum pressure switch;
  22. minimum pressure switch;
  23. pressure gauge "permeate";
- Only with ROMATIC:
24. R.O. control with display of conductivity

- A. feed;  
B. concentrate;  
C. permeate.

## 4.2. Options

Following option might be installed:

- I. Hardness control unit
- II. Pressure switches for pressure tank control
- III. Permeate rejecting valve
- IV. Mounting frame with additional installed technique like: softener, dosing station, desalination unit, pressure tank, storing tank, booster unit, etc.

## 5. Principle of function

With the help of the water pressure (A) the water is pressed through a semipermeable membrane (18.). The membrane is build in that way that even dissolved salts (salt, hardness, nitrate, silicic acid, etc.) and organic substances (pesticides and medicine residuals, etc) are rejected. To prevent blocking of the membrane a part of the water with all the rejected substances is drained continuously (concentrate, B).

Water flow and pure water quality depend on several factors. The better the feed water quality the better the quality of the pure water. The higher the feed water pressure the better the quality and the higher the permeate water flow. Large units are equipped with a pressure pump (15.+16.).

The water temperature affected the pure water flow: the warmer the water the more the water flow (see appendix “temperature correction factor”). The water temperature should never exceed

40°C – otherwise the membranes will be damaged.

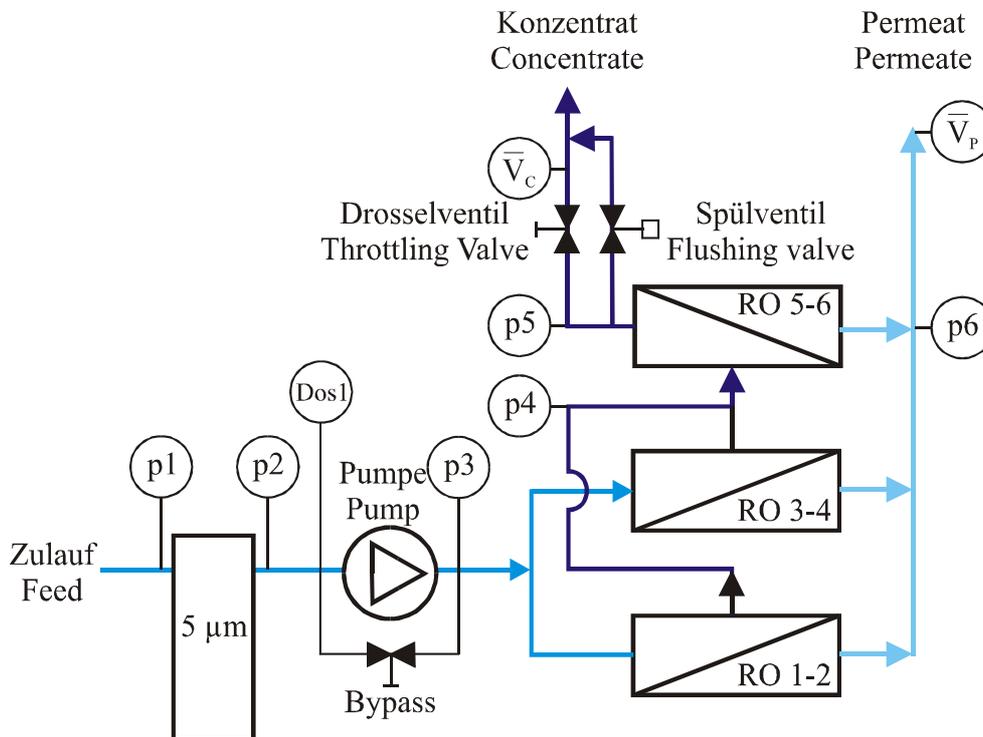
To prevent the membranes against particles every AquaCare R.O. unit has a pre filtration (3.): normally a sediment filter (50 µm) and a combi filter (5 µm). The activated carbon part of the combi filter will adsorb or destroy gaseous substances like chlorine.

The feed water pressure is controlled by a sensor (4.). If the pressure drops below the minimum pressure (see appendix “protocol”) the unit shuts down to prevent the pump for running dry. The pressure pump increases the operation pressure to 8...80 bar – depending on the type of unit.

At the membranes (18.) the water is divided into the pure water (C.) and waste water = concentrate (B.).

For a better recovery a softener or an antiscalling device is necessary.

The whole unit is controlled by a micro processor unit (RO-matic) or an PLC (Programmable Logic Controller).



## 6. Installation

### 6.1. Assembly



To guarantee a faultlessly operation of the R.O. unit it should be erected on an even and stable wall.



On each side of the R.O. unit there should be minimum 0.2 m space to change the membranes without difficulties. At the front you need space for doing the operation and may be to erect a CIP-station (clean in place).



If the ambient temperature exceeds the maximum shown in appendix “protocol” or if the motor is located 1000 meters above sea level or more, it may be necessary to use a motor with a higher rated output (if air cooled).

### 6.2. Water connectors

To operate the unit you must install water inlets and outlets.



The connection with PVC-U must be glued with approved adhesion only. The processing regulation of the adhesion should be minded.

Push fit fittings should be used only with approved tubes / hoses. Cut the tube with a sharp knife and push it into the fitting totally. – For releasing push the collar and pull out the tube.

Connect the feed (A.) with the intended water source. The water must have the specification in quantity and quality as shown in the appendix “protocol”.



If strong impurities, oxidizing agents (e.g. chlorine), iron, manganese, barium or strontium are in the feed water, you must take steps to prevent the R.O. unit against failures. Please ask AquaCare.



If the feed water pressure is not within the limits as shown in the appendix „protocol“ you

must take steps. At too low pressure you need a booster pump, at too high pressure you must use a suitable pressure relief valve.



If you use a softener it should be monitored regularly (e.g. before a regeneration process). The hardness must be below 0.5°dH. If the softener fails the R.O. membranes will block. A automatically working hardness control shuts down the R.O. unit if hard water will reach the membranes.



If you use an antiscaling station the dosing of the chemical must be done carefully. Local laws and safety instruction of the chemical producer must be minded. Dosing of chemicals should be done in combination with a static mixer only.



The waste water = concentrate of the unit should be drained without pressure. The concentrate line **never** be closed or throttled. If the concentration line is very long (more than 5 meters) the diameter of the tube has to be adapted.



The pure water = permeate should flow without pressure (except if a pressure tank is installed). Never close or throttle the permeate line. If the permeate line is longer than 5 meters the diameter of the tube has to be adapted.

If a pressure tank and its control sensors (II.) are installed the permeate line may be throttled or closed after the pressure tank only.



The permeate pressure is shown at the pressure gauge “permeate” and works against the membrane pressure: e.g. operation pressure = 10 bar, permeate pressure = 2 bar, membrane pressure = 10 – 2 = 8 bar. If the water should flow in very long lines or to high points or should be provided with a high pressure an inline booster unit should be installed.



The permeate of a R.O. unit is not contaminated with bacteria. But in the permeate water lines biofilms can occur. To prevent bacterial growth the whole water lines have to be disinfected. Please ask AquaCare.

### 6.3. Electrical connection

The electrical connection must be done by authorized and qualified persons according with the local regulation only.



Before opening a terminal box and before every disassembling of electrical components the supply voltage must be disconnected at all phases (contact opening minimum 3 mm).

The operation voltage and frequency are marked on the unit name plate. Make sure that the unit is suitable for the electricity supply on which it will be used.



If the voltage of the mains is not constant a voltage guard should be installed. If the rolling direction will change a direction guard should be installed.

## 7. Start up the unit



Before start up the unit check out of all connections are done well. Make sure that all PVC-unions or push fit fittings are tight and their o-ring seals are in the correct position.



Check out if units before and after the R.O. unit are installed well and if they are working correctly. Open the inlet water supply.



Check out if the unit gets minimum 1.5 bar pre-pressure (2.). If enough pressure is shown, start the system by switching the main switch (if delivered) or by starting the ROMatic (see appendix). – The inlet solenoid (6.) will open and water is flowing through the system. After about 30 seconds the pump will start. Attention: the unit will only start if a connected pressure tank or pressureless storing tank is empty!

#### Adjusting of the water flows:

If the unit is producing water, permeate flow and concentrate flow must have the right relation.

#### Permeate flow

The AquaCare unit is delivered with the right settings. But different temperatures and feed pressures might cause other settings. The “membrane pressure” should never exceed the maximum as shown in the appendix “protocol” – too low pressures decreases the permeate water flow.

The operation pressure is correct if the “normal flow” is reached. If the permeate flow is higher than 10% of the normal flow the operation pressure should be reduced by opening the membrane pressure valve (13.). If the water flow is too low close this valve carefully.

If the feed water is cold you need higher pressures than with warm feed water.



Higher pressures than the maximum pressure shown in the appendix „protocol” will damage the unit.

Reading out the pressure gauges and flow meter may only be done if the unit is producing water and is **not** in the flushing modus.

#### Concentrate flow

The AquaCare unit is adjusted to the right recovery. The recommended recovery is shown in the appendix “protocol” and should never drop below the minimum.



The concentrate flow is adjusted with the concentrate valve (11.). If you close the valve less concentrate will flow. If you open it more concentrate will flow. **Never close the valve totally!**



The recovery should be the same as shown in the appendix „protocol“. If you reduce the recovery too much (too less concentrate will flow), the permeate flow will decrease and the membranes will be damaged. If too much concentrate is flowing you need too much water and chemicals (softener, antiscalants).

If the recommended recovery is 75% the concentrate must have 25% of the amount permeate + concentrate = feed water. Measurement and adjustment should be done only if the unit is in operation and is **not** flushing.

If a pressure tank (option) is connected the measurement should be done at MINIMUM pressure.

### Blending valve flow (Option)

With the „blending“ valve (IV.) you can mix feed water to the permeate. If an additional flow meter is installed the blended feed water flow is shown. With an additional conductivity meter you can measure the blended water.

If you shut down the unit please look at the manuals of the RO-matic (appendix) or PLC (appendix).

## 8. Maintain the unit

The AquaCare reverse osmosis unit needs less maintenance. But some adjustments and the condition of the pre-filters should be monitored regularly.

### 8.1. Pre-Filters

The life time of the filter cartridges depends on the feed water quality and the operating hours. The life time can vary extremely.

If the pressure difference of the “pre filter” and “post filter” is more than 1 bar (e.g. pre filter = 4.0 bar, post filter = 2.5 bar:  $4.0 - 2.5 = 1.5$  bar difference pressure) the filter cartridges have to be changed.



At more than 2 bar difference pressure the cartridges will collapse.

For changing the cartridges you must stop the R.O. unit (see appendix “RO-matic” or “PLC”). Turn off the main switch (if installed).

Close the water supply. Open the drain valve of the pre filters (1.) as long as the pressure of the gauges show more than 0 bar. Then close the drain valve.

Now open the filter housing with the wrench and take off the cup. Put out the old cartridges and fill in the new one. Use only filter cartridges with the right diameter, length and pore size.

Now closed the filter and take care with the o-ring. Start the R.O. unit as usual.



Only with proper cartridges the R.O. is protected against particles in the feed water. Dirty

or wrong filter cartridges may damage pump and membranes.

### 8.2. Monitoring the permeate

The quantity and quality of the permeate should be monitored regularly. You can read the permeate flow directly at the flow meter (8.). As an option the flow may be controlled automatically with a switch at the flow meter. The quality of the permeate should be read out at the conductivity display of the RO-matic respectively PLC. Please program the limiting values (see appendix “RO-matic” or “PLC”).

Alternatively you can take samples at the sample valve (9.) and measure them with another conductivity meter. At recoveries of more than 50% the conductivity of the permeate must be below 15% of the feed conductivity (sample valve a.); at recoveries below 50% below 10%.

### 8.3. Flushing the membranes

If the water quality is gone worse (0.5% decrease) and/or the water flow is gone lower (10-15% lower) the membranes have to be flushed chemically.



Therefore use a CIP (clean in place) unit (read its manual carefully!).

Alternative take out the membranes of the housings and send them for cleaning to AquaCare.

To take out the membranes shut down the R.O. unit and wait some minutes. Open the tube connectors at the right side of the housing. Screw of the PVC cap and pull the membrane out of the housing. Send the membranes in a plastic coat to AquaCare.

### 8.4. Changing the membranes

If permeate flow or permeate quality is too bad and chemical flushing has not effected the results significantly the membranes have to be changed.

Therefore shut down the unit and take out the membranes as described in the chapter before. Push the membranes into the housings.



Take a little bit silicon fat for the o-rings.

Close the housings and take care that the sealing are in the right position. Take new o-rings if they are older than 1 year.

Put the unit into operation as used.

## 9. Trouble shooting

If you cannot eliminate the disturbance ask your service partner or AquaCare.

### 9.1. The feed pressure is too low – the unit shuts down

**A.**  
Examine if a ball valve in the feed line is closed or not fully open. Examine if the filter drain valve (1.) is closed.

Re-start the R.O. unit again.

The pressure “post filter” must have minimum 1.0 bar during operation. If not ensure a better feed water pressure by using another line or a booster pump.

**B.**  
Check if the pressure difference „pre filter“ – „post filter“ is over 1.0 bar. If so change the filter cartridges (see chapter “maintenance”).

**C.**  
Ask AquaCare.

### 9.2. Too low rejection

**A.**  
Check the pre filters and change the cartridges if necessary.

**B.**  
Change the membranes as shown in chapter “changing the membranes”.

**C.**  
Ask AquaCare

## 10. Warranty

You have 24 months warranty on all AquaCare units excepts spare parts like pump bearings and rotors. You have no warranty if parts are broken by violent (for example totally closed water inlet). For consequential losses AquaCare is not liable.

To asset a claim on membranes a regularly documentation of feed water quality (minimum requirements are shown in appendix “protocol”), of the parameters of the R.O. unit and the permeate quality has to be done.

Minimum feed water quality:  
TDS < 2000 mg/l, iron < 0,1 mg/l, manganese < 0,05 mg/l, strontium and barium not detectable, oxidizing agents like chlorine < 0,1 mg/l (if any carbon filter is installed), silt density index  $SDI_{15min} < 3,0$

# 11. ANHANG: RO-matik Reverse Osmosis Unit Control

ELWA  
Klaus Warzog GmbH

Programmversion: V2.1

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## 11.1. Inputs

1 = mains PE  
2 = mains N  
3 = mains L1

25/26 = moisture sensor  
27/28 = softner / antiscaling dosing  
29/30 = pressure switch inlet  
31/32 = disturbance RO pump  
33/34 = flow meter permeate  
35/36 = flow meter concentrate  
37/38 = level max (storing tank)  
39/40 = level min (storing tank)  
41/42 = level shortage (storing tank)  
43/44 = level empty (storing tank)  
45/46 = disturbance storing tank pump  
47/48 = pressure switch storing tank pump  
49/50 = conductivity sensor permeate  
50/42 = conductivity sensor deionate  
53-56 = -

All contacts are open at disturbance.  
Level contacts at rising water level must open.

## 11.2. Outputs (NO 230 V)

4/5 = inlet valve (additional)	5 A
6/7 = softener / dosing pump	5 A
8/9 = inlet valve R.O. unit	5 A
10/11 = pressure pump R.O.	10 A
12/13 = flushing valve	5 A
14/15 = pump storing tank	10 A
16 = alarm output: potential-free NC	5A
17 = alarm output: potential-free C	
18 = alarm output: potential-free NO	
19 = alarm output Deionate: potential-free NC	5A
20 = alarm output Deionate: potential-free C	
21 = alarm output Deionate: potential-free NO	
22 = alarm output Permeat: potential-free NC	5A
23 = alarm output Permeat: potential-free C	
24 = alarm output Permeat: potential-free NO	

## 11.3. Technical data RO-matic

Electric connection: 230 V +10% -15% 50/60 Hz  
Power: 30 VA  
Ambient temperature: 0-50°C  
Degree of protection: IP 54  
Class of protection: II  
Conductivity: Deionat 0-20 µS/cm  
Permeat 0-200 µS/cm  
Factor of conductivity cell: 0,1  
Fuse: F0, 315 mA  
Dimensions L×W×H: 190 × 144 × 120 mm

Opening in switch panel: 186 × 137 mm  
Display: alphanumeric display 2×20 digits  
Language: German  
Technology: single chip micro processor system

## 11.4. Functions

After power input  
display: **\*\* Bereitschaft \*\*** (stand by)

After pushing button „Automatik“:  
Display: **\*\* Automatik \*\*** (automatic)  
**- Anlaufbetrieb -** (starting sequence)

direct opening of additional inlet valve (terminal 4/5)

1 s delay: dosing pump / softner (terminal 6/7)

1 s delay: inlet valve R.O. pump (terminal 8/9)

30 s delay: R.O. pressure pump (terminal 10/11)

Display: **\*\* Automatik \*\*** (automatic)  
**Deionat xx.x µS/cm**

all contacts in action,  
level contacts in action,  
tank pump will run if level “shortage” and  
“empty” are in condition “filled”

Shut down the unit: push button „Bereitschaft“  
(stand-by)

Display: **\*\* Automatik \*\*** (automatic)  
**- Bereitschaft -** (stand by)

## 11.5. Programming

Turn key switch in position „Wartung“ (maintenance)

Display **\*\* Modus Service \*\*** (modus service)

Push button „Leitwert“ (conductivity)

Display **\*\* Programmierung \*\*** (programming)

Push button „Störung aus“ (disturbance off)

Display: **Schaltpunkt Permeat** (set point)  
**000 µS/cm**

With button „Bereitschaft“ (stand by) chose the right digit

With button „Automatik“ (automatic) or „Leitwert“ (conductivity) choose the value

Set point permeat: 0...199 µS/cm

Choose next step with button „Störung aus“ (disturbance off)

Set point Deionate 0...19,9 µS/cm

Programming see above

Choose next step with button „Störung aus“ (disturbance off) – programming see above

Zeitverzögerung Schaltpunkt Permeat (delay set point permeate) – programming see above

Set point 0...10 min

Red LED „Schaltkontakt 1“ (contact 1) is flushing if conductivity in over the limit; relay contact 1 is working after the programmed delay.

Choose next step with button „Störung aus“ (disturbance off)

Zeitverzögerung Schaltpunkt Deionat (delay set point deionate) - programming see above

Set point 0...10 min

Red LED „Schaltkontakt 2“ (contact 2) is flushing if conductivity in over the limit; relay contact 2 is working after the programmed delay.

Choose next step with button „Störung aus“ (disturbance off)

Einstellung Spülzeit (set flushing time) - programming see above

Set point flushing time 0...10 min

Choose next step with button „Störung aus“ (disturbance off)

Set point 0...24 hours

Leave the programming modus by turning the key switch into position “Betrieb” (operation)

Display: **\*\* Bereitschaft \*\*** (stand by)

## 11.6. Maintenance

Turn key switch in position „Wartung“ (maintenance)

Display **\*\* Modus Service \*\*** (modus service)

Push button „Störung aus“ (disturbance off)

Display: **\*\* Wartung \*\*** (maintenance)

Button „Störung aus“ (disturbance off): manually switching on and off: dosing pump

Display **Dp**

Button „Leitwert“ (conductivity): manually switching on and off: R.O. pump, inlet valve R.O., additional inlet valve

Display: **RO**

Button „Automatik“ (automatic): manually switching on and off: flushing valve

Display: **Sv**

Button „Bereitschaft“ (stand by) manually switching on and off: pump storing tank

Display: **Fp**

Leave modus “maintenance” by turning the key switch to position Betrieb (operation)

Display: **\*\* Bereitschaft \*\***

## 11.7. Operating hours counter

Turn key switch in position „Wartung“ (maintenance)

Display **\*\* Modus Service \*\*** (modus service)

Push button „Automatik“ (automatic)

Display: **Betriebsstunden** (operating hours)

**RO pumpe xxxx Std** (RO pump xxxx hours)

For deleting the hours push button „Störung aus“ (disturbance off) and „Bereitschaft“ (stand by) simultaneously.

Leave modus “operating hours counter” by turning the key switch to position Betrieb (operation)

Display: **\*\* Bereitschaft \*\***

## 11.8. General information for alarms

If a disturbance happens it will be shown in the display. The general alarm contact switches.

If the disturbance is repaired the display is eliminated with the button „Störung aus“ (disturbance off). The alarm relay is not active. Now you can restart the unit.

If the disturbance is not repaired you can inactivate the alarm relay by pushing the button „Störung aus“ (disturbance off). But the display is not cleared.

If more than one disturbances happens the next disturbance is shown if the first is cleared in the display.

If an input is not used you must use a jumper.

## 11.9. Disturbances

**Moisture sensor:**

Terminal: 35/26

at disturbance: shut down of the whole R.O. unit

Display: **\*\* Bereitschaft \*\*** (stand by)

**Störung Feuchtigkeit** (disturbance moisture)

**Softner / antiscalant dosing pump:**

Terminal: 27/28

at disturbance: shut down of additional inlet valve, R.O. inlet valve, R.O. pump

Display: **\*\* Bereitschaft \*\*** (stand by)  
**Störung Enthärtung** (disturbance softener / dosing pump)

#### **Feed pressure:**

Terminal: 29/30

at low feed pressure: after 20 s shut down of additional inlet valve, R.O. inlet valve, R.O. pump

Display: **\*\* Bereitschaft \*\*** (stand by)  
**Störung Stadtw. Druck**  
(missing feed water pressure)

#### **RO pump:**

Terminal: 31/32

at disturbance: shut down of additional inlet valve, R.O. inlet valve, R.O. pump

Display: **\*\* Bereitschaft \*\*** (stand by)  
**Störung HD-RO-Pumpe** (disturbance RO pump)

#### **Pressure / flow permeate:**

at disturbance: after 20 s shut down of additional inlet valve, R.O. inlet valve, R.O. pump

Display: **\*\*Bereitschaft \*\*** (stand by)  
**Störung Permeat** (disturbance permeate)

#### **Pressure / flow concentrate:**

at disturbance: after 20 s shut down of additional inlet valve, R.O. inlet valve, R.O. pump

Display: **\*\*Bereitschaft \*\*** (stand by)  
**Störung Konzentrat** (disturbance concentrate)

#### **Storing tank pump:**

at disturbance: shut down of the whole unit

Display: **\*\* Bereitschaft \*\*** (stand by)  
**Störung Förderpumpe** (disturbance tank pump)

#### **Level control:**

Level min. – level max.: if the water level reaches level max. the unit shuts down and the flushing system works

Display: **\*\* Automatik \*\*** (automatic)  
**Spülung in Betrieb** (flushing in action)

after flushing

Display: **\*\* Automatik \*\*** (automatic)

If the water level sinks below level min. the unit starts automatically.

#### **Level shortage – level empty:**

Control of the storing tank pump.

If the water is below both level switches the storing tank pump shuts down but the R.O. is still working:

Display: **\*\*Automatik \*\*** (automatic)  
**- Tank leer** – (tank empty)

If the water level is above the level “shortage” the storing tank pump is activ

Display: **\*\* Automatik \*\*** (automatic)  
**Deionat xx.x µS/cm**

#### **Permeate rejection:**

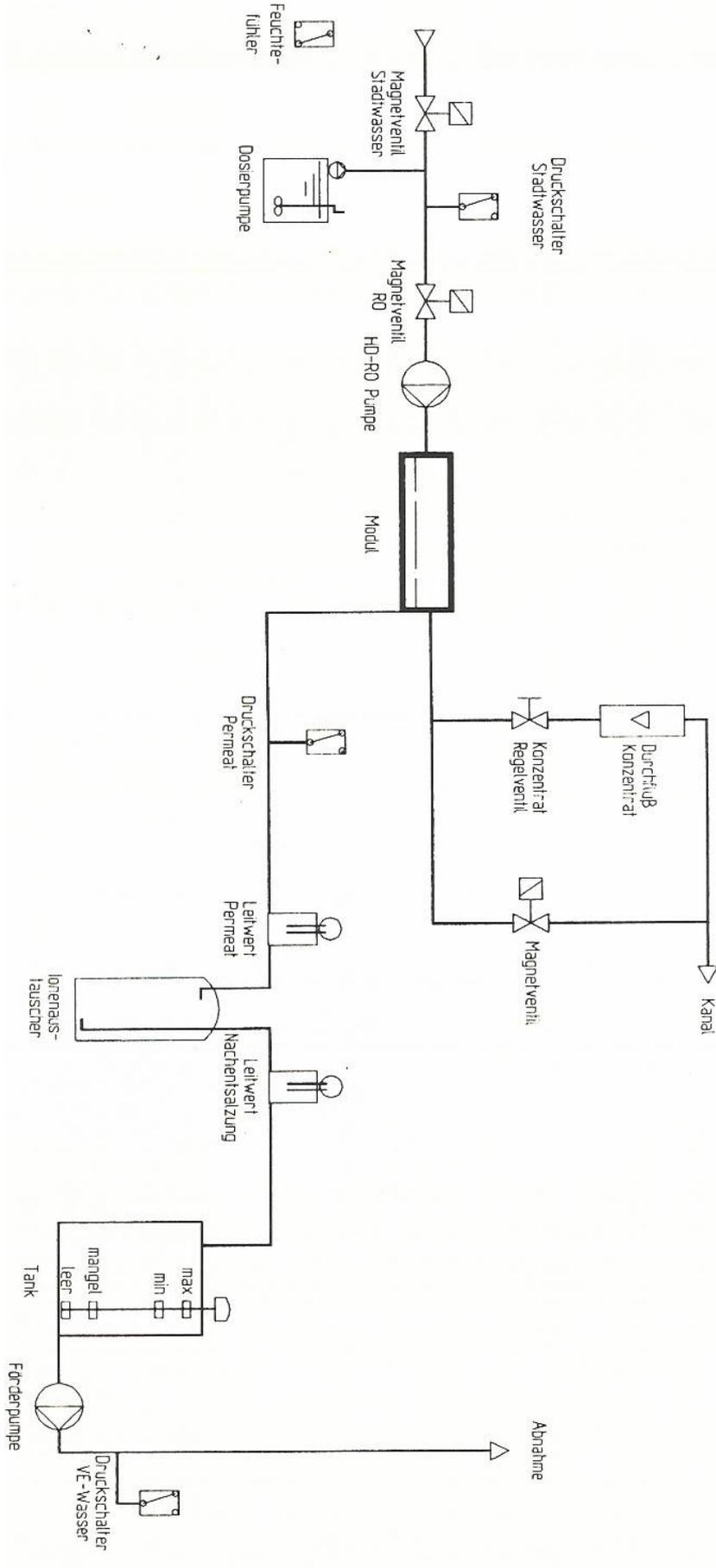
Programming of the time delay of permeate and deionate to „11 min“.

If the water quality is worse than the set point contact 1+2 are active. If the quality gets better than the set point value the relays are inactive. If the set point value is not reached within 10 minutes following disturbance is shown:

Display: **\*\* Bereitschaft \*\*** (stand by)  
**Störung Verwurf.** (disturbance rejection))

# 11.10. Typically RO-matic applications

## RO - Anlage Anwendungsbeispiel



## 12. Appendix: Protocol

<p><b>Customer no.:</b></p> <p>Phone:</p> <p>Fax:</p> <p>Email:</p> <p>Com.</p>	 <p><a href="http://www.aquacare.de">www.aquacare.de</a> </p> <p>AquaCare GmbH &amp; Co.KG.          Josefstrasse 35-37 · D-45699 Herten · Germany          Tel.: +49 / 23 66 / 3 25 52 · Fax: +49 / 23 66 / 10 43 85  <a href="http://www.aquacare.de">http://www.aquacare.de</a> · e-mail: <a href="mailto:info@aquacare.de">info@aquacare.de</a></p>
Type of unit	<b>HighPower HP</b>
Permeate flow	m <sup>3</sup> /h at 1 bar feed pressure 15°C, 500 ppm TDS
Unit no.	2-2009-00
Dimensions L×W×H	950 × 600 × 200 mm
Weight	31 kg
Feed pressure	1...6 bar
Max. operation pressure	16 bar
Operation temperature	4...40°C
Ambient temperature	4...45°C
<p><b>Sediment filter:</b></p> <p>Flow at 0.3 bar</p> <p>Material</p> <p>Number of cartridges</p> <p>Length of cartridges</p> <p>Diameter cartridges</p> <p>Pore size of cartridges</p> <p>Connectors</p> <p>Material of seals</p>	<p>1,2 m<sup>3</sup>/h</p> <p>PP + PVC</p> <p>1 + 1</p> <p>10"</p> <p>2,5"</p> <p>50 µm + 5 µm</p> <p>¼"</p> <p>NBR</p>
<p><b>Dosing pump</b></p> <p>Manufacture</p> <p>Type</p> <p>Model no.</p> <p>Data of running</p> <p>Electrical connection</p> <p>Supply to ROmatic</p>	
<p><b>Static mixer</b></p> <p>Manufacture</p> <p>Material</p> <p>Connectors</p> <p>Injection port</p>	AquaCare
<p><b>Main pump (R.O. pump)</b></p> <p>Manufacturer</p> <p>Type</p> <p>Minimum flow</p>	<p>Roto vane pump</p> <p>MT</p> <p>PO301, PO-E476W54</p> <p>0.3 m<sup>3</sup>/h</p>
<b>Motor:</b>	

type		C011509			
Electrical connection		230 V, 50 Hz, 0,245 kW			
Control:		RO-matic			
Manufacture		ELWA			
No. / Version		___ Version 2.12C (without RC-elements)			
Parameter in delivery condition		flushing time: 1 min; flushing interval: 12 h switch point permeate: 50 µS/cm delay time permeate: 5 min switch point dionate: 5 µS/cm delay time deionate: 5 min			
<b>Valves</b>					
Feed		Typ 214, 0-6 bar, DN6, ¼“, 230 V AC NC (69356)			
Flushing valve		Typ 214, 0-48 bar, DN2, ¼“, 230 V AC NC (69308)			
Mixing valve		-			
Reject valve		-			
<b>Water connections</b>		feed / permeate / concentrate: DN8, d10 push fit fitting sample valve: DN4, d6 push fit fitting			
Pre pressure switch		Timmer: NO 0,2-1 bar / NO 0.2-1 bar			
Check valve permeate		PVC d20 DN 15 with unions (if installed)			
<b>Storing tank</b>		-			
volume		___ l			
material		PE Polyethylene			
connection		SCHOTT connector 10 mm			
connection level switches		grün-gelb / green-yellow: + 1: Minimum 2: Maximum			
<b>R.O. Array:</b>					
no. housing × no. membrane		1 × 1			
Module housing		PP with PVC cap (240 psi, 16 bar)			
Membrane type		CSM RE2012-100 see appendix			
Module no.	1	2	3	4	5
Druckrohr / pressure tube no	09-0501				
Membrane no					
<b>Leakage test</b>			12 h		
Time of test			12 h		
Test pressure			ca. 12 bar		
Pre pressure shut down			ca. 1,0 bar		
Pressure tank control: MIN / MAX			-		
Level control tank			-		
Solenoids			o.k.		
Dosing unit control			-		
<b>Running test:</b>		Testbedingungen /		Normleistung /	
Electrical data:		test conditions		normal conditions	
Voltage L1-N		230 V		<b>230 V ± 10%.</b>	
Current L1		1,59 – 1,68 A		<b>max. 1,7 A</b>	

Pre pressure "pre filter"	3,7 bar	<b>2,0 bar</b>
Filter pressure "post filter"	3,5 bar	<b>1,8 bar</b>
Membrane pressure "pre membrane"	8 bar	<b>max. 16 bar bar</b>
Permeate pressure	0,2 bar	<b>2...4 bar</b>
Temperature	14,5°C	<b>15 °C</b>
Concentrate	40 l/h	<b>mind. 14 l/h</b>
Permeate	40 l/h	<b>40 ±10% l/h</b>
Ratio	1 : 1	<b>mind. 1 : 3</b>
Recovery	50%	<b>max. 75%</b>
Rejection	97,1 %	<b>min. 90%</b>
<b>Conductivity:</b>		
"A" feed water, WTW*	506 µS/cm	<b>500 µS/cm</b>
"B" concentrate, WTW*	1040 µS/cm	
"C" permeate, RO-matic	11 µS/cm	<b>max. 25 µS/cm</b>
"C" permeate, WTW*	14,8 µS/cm	

\* measured with handheld conductivity meter WTW Cond 340i

**Attention: to use only with accepted antiscalants or softener before**

**Attention: recovery not over 75%**

Date: .....03. February 2006

AquaCare: ..... Herr B. Ramsch

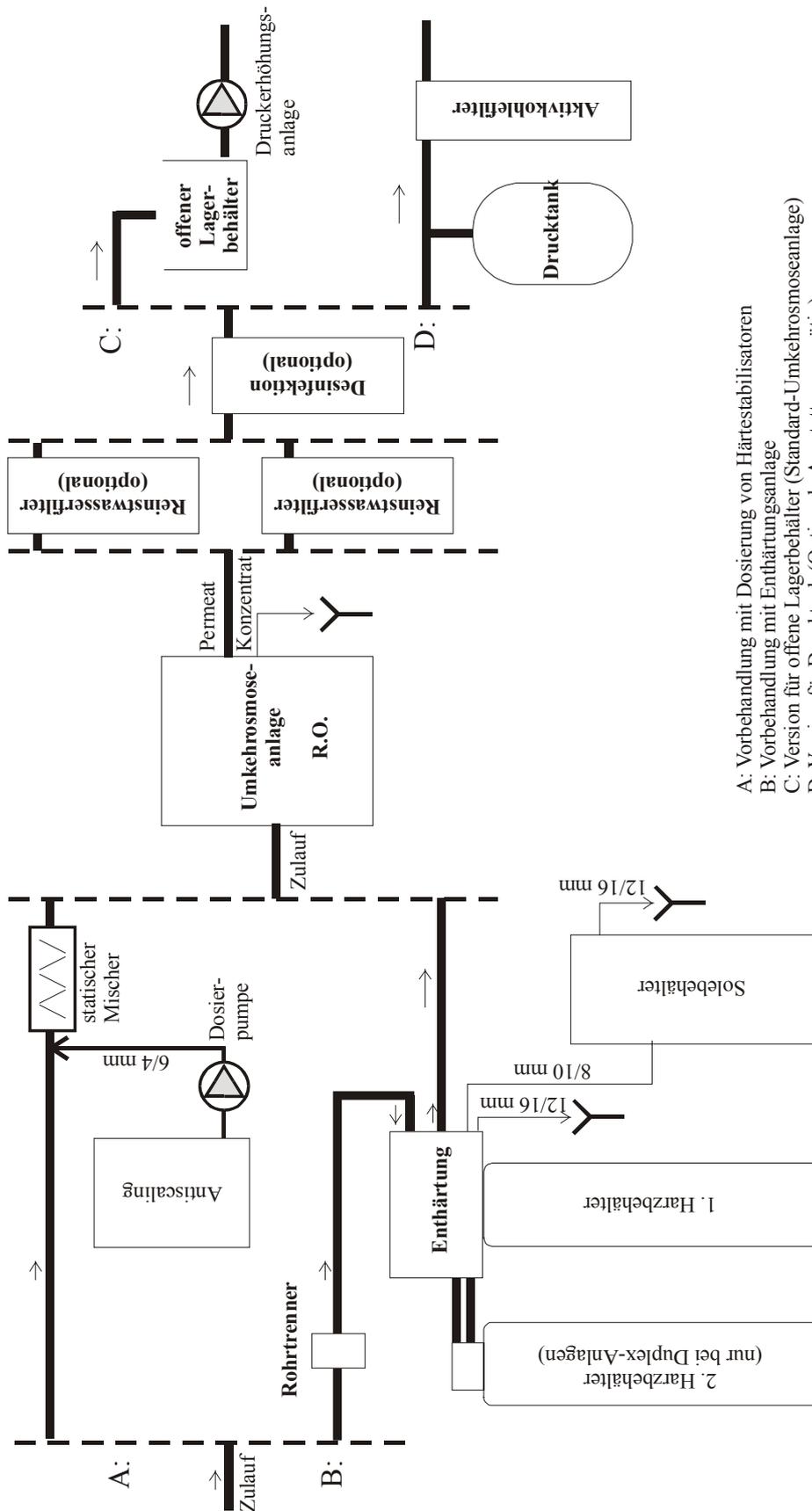
Customer: .....

Signature: .....

.....

# 13. Appendix: sketch (water) of additional units

<b>Anschlussplan (Wasser)</b>		
<b>AquaCare</b> Josefstraße 35-37 D-43699 Herten Germany phone: +49/2366/32552 fax: +49/2366/104385 email: info@aquacare.de	RO_01.CDR Maßstab: -	
Vorbehandlung - Umkehrosmoseanlage - Reinstwasserfilter - Speicherung	Version: 01.12.06 B. Ramsch	



- A: Vorbehandlung mit Dosierung von Härtestabilisatoren
- B: Vorbehandlung mit Enthärtungsanlage
- C: Version für offene Lagerbehälter (Standard-Umkehrosmoseanlage)
- D: Version für Drucktank (Optionale Ausstattungen nötig)

## 14. APPENDIX: Backflow Preventer



## 15. APPENDIX: Softener



### General information:

To adjust the water capacity in  $\text{m}^3$  of the softener you must know the water hardness (German degrees). Take the maximum hardness that can occur with the seasons. If the hardness is extremely changing use a hardness control unit (option) to guard the RO unit.

Calculation: divide the unit capacity (in  $^\circ\text{dH}\cdot\text{m}^3$ , see packing list) by the hardness (in  $^\circ\text{dH}$ ) of the water. Take only 90% of the value (10% security factor) and you get the capacity in  $\text{m}^3$ .

example:

Total hardness:  $15^\circ\text{dH}$ , capacity of the unit  $60^\circ\text{dH}\cdot\text{m}^3$

$60 / 15 = 4$

minus 10% = 3,6 (you have to adjust the capacity of the softener to  $3,6 \text{ m}^3$ )

### Important!

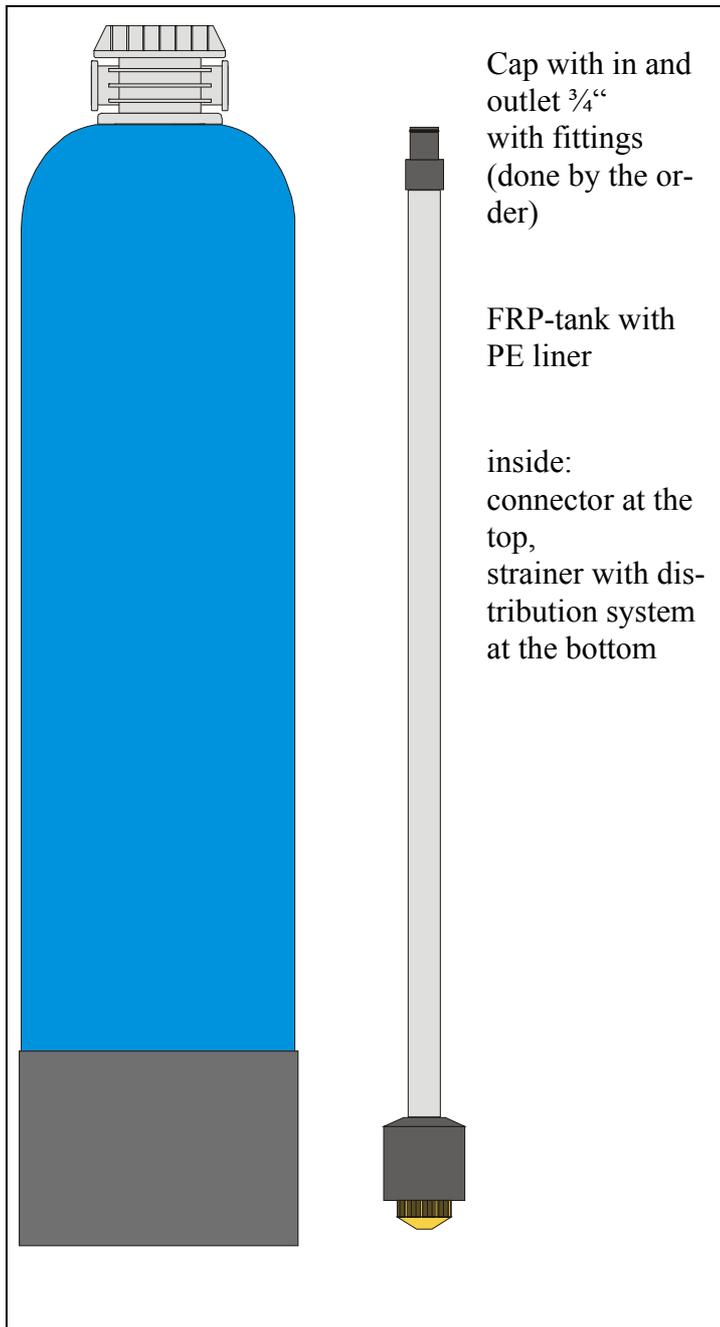
Be sure that the connection from brine tank to the control valve is tight (at modus “sucking brine”) any air bubble should be in the tube.

The salt tablets never be empty. If only 10 cm tablets are in the brine tank fill up the tank immediately. If hard water flows into the RO unit pump and membranes will be damaged. If the maintenance of the bring tank is not sure please use an “salt lack detector”.

### Adjustment of the unit at delivery:

water hardness:  $\_\_\_^\circ\text{dH}$  (see appendix), capacity of the softener  $\_\_\_^\circ\text{dH}\cdot\text{m}^3$ , setting  $\_\_\_ \text{ m}^3$

## 16. APPENDIX: desalination resin



R.O. water contains small amount of salts. To eliminate these rests a high effective ion exchange resin has to be connected after the R.O. unit.

AquaCare offers two versions:

1. The tank has its own conductivity meter and shows the conductivity
2. After the tank a conductivity probe is connected and the conductivity is shown in the RO-matic control of the R.O. system. To show the conductivity of the deionate (water after the resin) press button "Leitfähigkeit" (conductivity). You can set the switch point to your purposes. We recommend 2-3  $\mu\text{S}/\text{cm}$  to be sure that silicic acid is out of the water.

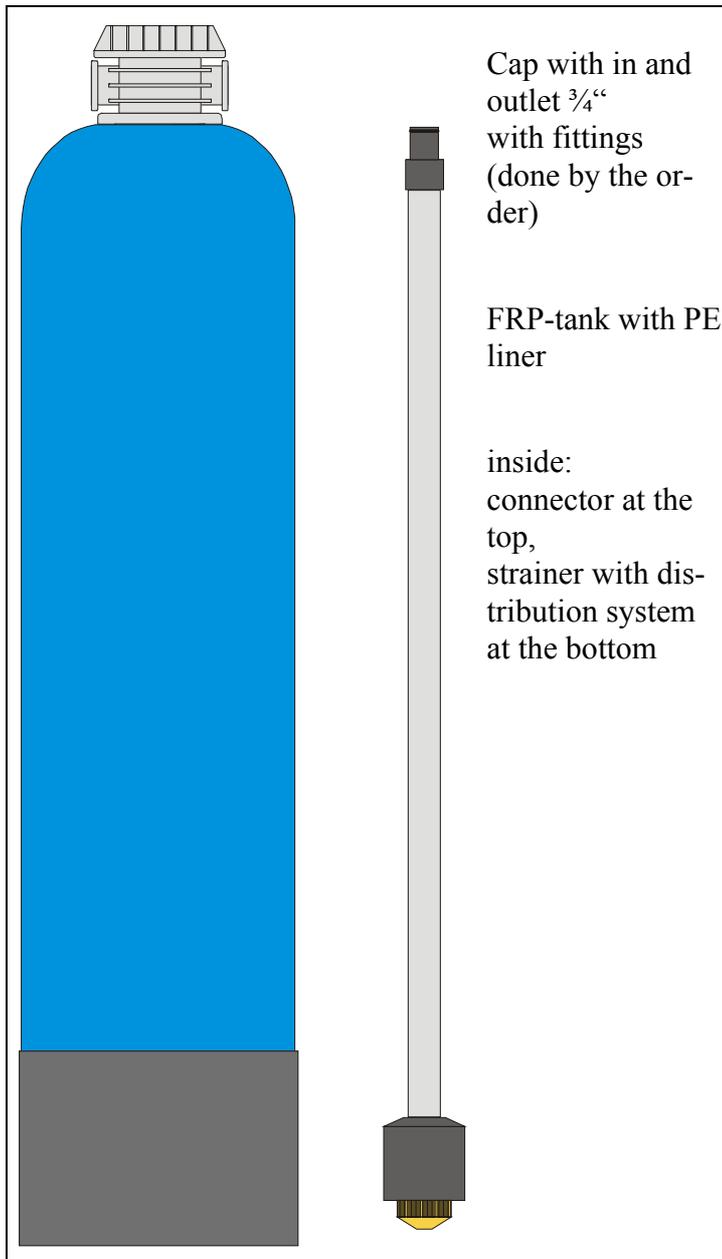
### Changing the resin:

If the water quality gets worse shut down the RO system and disconnect the resin tank from the water line. If necessary remove the electric cable to the conductivity cell. Open the tank by unscrewing the cap. Pour out the old resin and flush with pure water. Fill in the new resin (use a sprue) - attention! Never let resin inside of the middle tube (PVC grey). To fill up the tank to the maximum pour a little bit permeate into the tank and the resin will settle down.

Take care that the o-rings an the top connector has a little bit silicone fat and that any material is fallen inside of the centre tube. The o-ring at the cap should be greased, too. Take care that any resin ball are in the thread.

The operation pressure at 20°C maximum 8.5 bar, maximum temperature: 45°C

## 17. APPENDIX: re-mineralising filter



R.O. water has only less minerals. To enrich the water with calcium and hydrogen carbonate at re-mineralising filter should be mounted after the R.O. unit. The carbonic acid in the permeate will dissolve the material inside of the tank.

If the water contains bacteria the tank should be disinfected regularly. Therefore shut down the R.O. unit and let the water out of the tank. Open the cap and fill disinfection fluid into the tank. After the reaction time drain the fluid and connect the tank to the R.O. system again.

Drain the first two volumes of the tank.

If the tank contains only 3/4 calcite material of the total volume refill the tank totally. Therefore shut down the RO system and disconnect the calcit tank from the water line. If necessary remove the electric cable to the conductivity cell. Open the tank by unscrewing the cap. Fill in the new calcite balls (use a sprue) - attention! Never let the balls inside of the middle tube (PVC grey).

Take care that the o-rings an the top connector has a little bit silicone fat and that any material is fallen inside of the centre tube. The o-ring at the cap should be greased, too. Take care that any balsl are in the thread.

The operation pressure at 20°C maximum 8.5 bar, maximum temperature: 45°C

Size	Order number	Maximum flow in l/h	Minimum hardness at 15°C and maximum flow	Dimensions in mm: Diameter × total height
0.7 Liter	AH0001	6	1°dH	
6 Liter	AH0006	45		
10 Liter	AH0010	75		
14 Liter	AH0014	105		
25 Liter	AH0025	185		220 × 980
30 Liter	AH0030	225		
35 Liter	AH0035	260		
45 Liter	AH0045	330		

At higher temperatures and lower flow the concentrations of calcium and hydrogen carbonate will raise.

## 18. APPENDIX: Membranes

### 18.1. Temperature correction factor of CSM-ThinFilmComposite (TFC)-Membranes

Temperature	TN, BN, BE, TE grade	FE grade	BL, FL grade
5	2.134	2.328	2.093
6	2.049	2.225	2.012
7	1.969	2.128	1.935
8	1.892	2.035	1.861
9	1.818	1.947	1.791
10	1.748	1.864	1.723
11	1.681	1.784	1.659
12	1.617	1.709	1.597
13	1.556	1.637	1.539
14	1.498	1.569	1.482
15	1.442	1.504	1.428
16	1.388	1.442	1.377
17	1.337	1.383	1.327
18	1.288	1.326	1.280
19	1.242	1.326	1.235
20	1.197	1.222	1.192
21	1.154	1.173	1.150
22	1.113	1.127	1.110
23	1.074	1.083	1.072
24	1.036	1.040	1.035
25	1.000	1.000	1.000
26	0.970	0.972	0.971
27	0.940	0.946	0.942
28	0.912	0.920	0.915
29	0.885	0.895	0.888
30	0.859	0.871	0.863
31	0.833	0.847	0.838
32	0.809	0.825	0.815
33	0.785	0.803	0.792
34	0.763	0.782	0.770
35	0.741	0.762	0.748
36	0.720	0.742	0.728
37	0.699	0.723	0.708
38	0.680	0.704	0.689
39	0.661	0.686	0.670
40	0.642	0.669	0.652

To calculate the normal permeate flow at the actual water temperature (1. column) multiply the actual permeate flow with the temperature correction factor of the relevant membrane type (2. + 3. column).

### 18.2. Data of the membrane

## **19. APPENDIX: Dosing Pump**