CONDAIR AX

Reverse osmosis system



INSTALLATION AND OPER-ATING MANUAL

Condair AX reverse osmosis system 01/01/2021



Air humidification, dehumidification and evaporative cooling

Thank you for choosing Condair

Installation date (DD/MM/YYYY):
Commissioning date (DD/MM/YYYY):
Site:
Model:
Serial number:

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General safety instructions 1.

1.1 Explanations of symbols and instructions

This operating manual contains important information on the safe operation of the system.

This operating manual, in particular the chapter "Safety instructions" must be observed by all persons working on the system. This applies to the installation company as well as to the system operator. Moreover, the special rules and guidelines for accident prevention that apply to the location of use must also be followed.

In this operating manual, the following symbols are used to indicate hazards for persons and to ensure proper handling of the equipment:



DANGER!

This symbol indicates an imminent danger to the life and health of persons. Failure to observe these instructions results in severe adverse health effects, including life threatening injuries.



WARNING!

This symbol indicates a possible imminent danger to the life and health of persons. Failure to observe these instructions may result in severe adverse health effects, including life threatening injuries



This symbol indicates a possible hazardous situation. Failure to observe these instructions may result in minor injuries or damage to property.



This symbol provides important information on how to handle the equipment correctly. Failure to observe these instructions can lead to faults in the system or problems in the surrounding environment.

1.2 **Operator obligations**

The operator undertakes to only allow persons to work on the system

- who are familiar with the fundamental regulations on occupational safety and accident prevention and have been instructed in the handling of the system,
- who have read and understood the chapter on safety and the warnings in this operating manual and who have acknowledged this with their signature and
- whose safe working practices are checked at regular intervals.

The manufacturer/supplier is not liable for any damage resulting from improper use.

1.3 Personnel obligations

All persons who are commissioned to work on the system or who carry out such work independently undertake the following before commencing work:

- To read the chapter on safety and the warnings in this operating manual and to acknowledge with their signature that they have understood them.
- To observe the fundamental regulations on occupational safety and accident prevention.

When operating the system, the safety instructions must be strictly observed.

1.4 Training of personnel

Only trained and instructed personnel must work on the system.

- The responsibilities of the personnel for assembly, commissioning, operation, set-up, maintenance and repair must be clearly defined.
- Personnel to be trained must only work on the system under the supervision of an experienced person.

1.5 Intended use

The system must only be used for the desalination of drinking water, well water or surface water that is free of particles and metallic ions. The limitations stated in the technical data regarding chemical analysis of the feed water, pressure, temperature and flow rate apply.

Intended use also includes

- compliance with all the instructions in the operating manual
- and adherence to the inspection and maintenance intervals.

Any other usage or usage beyond this is considered contrary to the intended purpose. Non-intended use includes use as a

- filter
- pressure booster
- water distributor.

1.6 Hazards when handling the equipment

- The system has been designed and manufactured in accordance with the latest technology and recognised safety regulations.
- The system must be set up in a way that the operating and control elements are easily accessible at all times. The floor, ceiling and walls must be level and clean.

Nevertheless, its use may cause danger to the life or health of the user or third parties or damage to the equipment or other property. The system may only be used for its intended purpose (see 1.5) and in a perfectly safe condition.

The following residual hazards exist:

Water damage

To prevent flooding due to leakage, the installation site must be equipped with a floor drain and/ or a leakage monitor with corresponding alarm.

Electrocution

Ensure that work on the electrical supply is only carried out by a qualified electrician.

- Check the electrical equipment of the installation regularly. Remove loose connections and scorched cables immediately.
- The switch cabinet must be kept locked at all times. Access is only allowed to authorised personnel.
- If work on live parts is required, a second person must be called in who can switch off the main switch if necessary.
- Do not touch electrical components with wet hands.
- Disconnect the system from the power supply before working on electrical system parts.

Mechanical/Hydraulic Energy

- Some parts of the system are under overpressure of up to 25 bar.
- De-pressurise the system before carrying out any repair or maintenance work!

Hygiene critical applications

There is a risk of microbial contamination of system components if the system has not been adequately preserved. The information on preservation must be observed.

Faults that may affect safety must be eliminated immediately. This is done by the operator or a company commissioned by the operator.

1.7 Protective devices and safety measures to avert hazards

1.7.1 Protective devices

- Before switching on the system, all protective devices must be properly fitted and in working order.
- Protective devices may only be removed after the machine has been switched off and secured against being switched on again.
- The required personal protective equipment for the operating personnel must be provided by the operator and used by the operating personnel when working on the system.
- All protective devices in place must be checked regularly by the operator or a company commissioned by the operator.

1.7.2 Informational safety measures

- The operating manual must be kept at the system's place of use at all times.
- In addition to the operating manual, the generally applicable and local regulations for accident prevention and environmental protection must be made available and observed.
- All safety and danger notices on the system as well as the labelling of the operating and control elements must be kept in legible condition.

Safety instructions for maintenance work

- The operator must ensure that all maintenance, inspection, and assembly work is carried out by authorised, qualified technicians who have sufficiently informed themselves by studying the operating manual in detail.
- Before carrying out any repair or maintenance work, the system must be switched off and secured against being accidentally put into operation. The procedures for shutting down the system described in section "Commissioning and decommissioning" must always be observed.
- Before starting work on electrical equipment of the installation, the relevant section must be checked to ensure that it is de-energised. In addition, the system must be secured against being switched on again.
- Suitable protective clothing appropriate to the hazard must be worn during the work.
- Immediately after completion of the work, all safety and protective devices must be refitted or put into operation.
- Before recommissioning the machine, the points listed in the section "Commissioning and decommissioning" must be followed.

1.9 Disposal of system parts and operating materials

The system parts must be disposed of, if necessary separately, in accordance with local regulations.

1.10 Unauthorised modification and replacement parts

- Modification of or changes to the system are only permitted after consultation with the manufacturer.
- The same applies to any program modifications made to the controller.
- Original replacement parts and manufacturer-authorised accessories are important for your safe-
- ty.

1.8

If other parts are used, the warranty becomes null and void and no liability is accepted for the resulting consequences.

1.11 Warranty and liability

This product complies with the latest technology and has been designed, manufactured and subsequently subjected to quality control in accordance with the applicable codes of practice.

Should there nevertheless be cause for complaint, any claims for compensation against the manufacturer of this product shall be governed by the manufacturer's general terms and conditions of sale and delivery.

Warranty and liability claims for personal injury and damage to property are excluded if they are attributable to one or more of the following causes:

- Non-intended use of the system
- Improper installation, commissioning, operation or maintenance of the system
- Operating the equipment with defective safety devices or improperly fitted or non-functioning safety and protective devices.
- Failure to observe the instructions in the operating manual with regard to transport, storage, assembly, commissioning, operation (continuous keeping of the operations log!), and maintenance of the system.
- Unauthorised, unapproved structural changes to the installation
- Unauthorised modification of the control parameters
- Inadequate monitoring of system components that are subject to wear and tear
- Repairs carried out improperly

Emergencies caused by external forces or acts of God.

1.12 Safety instructions for storage

The reverse osmosis system is protected by a preservative against microbial contamination and against risk of frost down to -10°C. At room temperature (< 25°C), this preservative must be purged and replaced within 6 months at the latest.

At higher temperatures, the protection period is correspondingly shorter (3 months at 30°C). If the system has been out of operation for more than 30 days (the maximum permissible period), more preservative must be added to the system to prevent microbial contamination. In any case, the installation must be protected against direct sunlight during transport, storage and operation.

2.1 Calculation equations

The permeate output, the concentrate output and the permeate conductivity are determined by reading the corresponding measuring equipment on the system. If no indicating instruments (e.g. variable area flow meter) are present, the permeate output and the concentrate output are determined by manual volumetric measurement.

Feed water output	=	permeate output + concentrate output	
Yield [%]	=	(permeate output [l/h]) (feed water output [l/h])	
Concentrate output [l/h]	=	100 *	(permeate output [l/h]) (yield [%]) - permeate output [l/h]
Desalination rate [%]	=	100 *	[1- "permeate" conductivity "Feed water" conductivity]
Salt passage [%]	=	100 - desalination rate [%]	

2.2 Temperature dependency of the permeate output

The permeate output of the system depends on the feed water temperature. The nominal output indicated on the nameplate refers to the design temperature of 15°C specified in the technical data.

The actual output at a given feed water temperature must be calculated using a correction factor from the following table.

The respective temperature-related permeate output is calculated according to the following calculation equation:

Permeate output [I/h] at temperature T [°C] = nominal output * correction factor

!

If the system is operated at a feed water temperature higher than the design temperature, the maximum permeate output specified on the nameplate and in the technical data must not be exceeded!

Temperature T in °C	Information	Correction factor
+10		1.30
+9		1.28
+8		1.25
+7	If the actual permeate output	1.21
+6	exceeds the maximum permissi-	1.18
+5	 ble permeate output, it must be reduced by lowering the working 	1.15
+4	pressure!	1.12
+3		1.09
+2		1.06
+1		1.03
Design temperature	Nominal output=100%	1.00
-1		0.96
-2		0.92
-3	If the actual permeate output is	0.88
-4	below the maximum permissible	0.84
-5	permeate output, it might be	0.80
-6	increased by raising the working	0.77
-7	pressure!	0.74
-8		0.70
-10		0.67

2.3 Conductivity of first permeate

(i) NOTE

After switching on the RO system, permeate with high conductivity is produced for a short time. Therefore, when designing the peripheral system components, it must be ensured that the RO system has a minimum running time of 30 minutes per switching operation.

3. Transport and storage

3.1 Transport to the customer

During transport, all units must be secured against slipping and falling over! Tipping from a fixed position is not permitted! If parts of the equipment protrude from the base area of the pallet, then such protruding parts must not be damaged when further parts/equipment are loaded.

- The transport weight corresponds to the tare weight and can be found in the technical data.
- However, the system may be damaged by extreme frost. The units are filled with a preservative/ antifreeze mixture prior to delivery.

The frost protection is effective down to -10°C.

3.2 Storage at the customer's premises

- The maximum storage period of the system in its original packaging is 3 months at 20°C. After that, the preservative must be flushed out and, if longer storage is desired, replaced.
- The system may be damaged by extreme frost. The units are filled with a preservative/antifreeze mixture prior to delivery.

The frost protection is effective down to -10°C.

3.1 Transport to the installation site

- Use a suitable lifting vehicle to carefully transport the unit to its intended location.
- Take note of any centre of gravity information on the packages.

4. Technical data / Product description

4.1 Technical data

Туре АХ		02	05	12	20	30	50
Recommended quality of the feed water		Soft water 0°dH					
Ratings 1)							
Permeate output at 3 bar	l/h	20	50	120	200	300	500
Permeate output at 1 bar	l/h	25	75	150	250	350	600
Yield when taking in							
- Soft water	%	40	50	70	70	75	75
- Hard water	%				35–40	·	·
Desalination rate	%			9	6 / 98		
Intake pressure (min./max.)	bar				2/6		
Ambient and operating tem- perature	°C		5 / 30				
Working pressure	bar	10					
Airborne noise emitted	dB (A)	< 70					
Hydraulic connection	-						
Feed water	DN	R 1⁄2" IG			DN 20		
Permeate	DN	R 3/8" IG			DN 15		
Concentrate (drain water)	mm	R 1⁄2" IG		C	116 (hose sle	eve)	
Electrical connection	V/ Hz	230/50					
Power consumption	kW	0.18			0.55		
Dimensions W x H x D		1					
System without membrane vessel	mm	600 x 395 x 300		800 x 461 x	k 360	1215	x 461 x 360
Membrane vessel, Ø x height	mm	270 x 580		405 x 6	50	62	0 x 1410
Membrane vessel, content	I	I 24 60 150			150		

1) Ratings apply at

Water temperature	15°C	
Total salt content,	max.	1000 mg/l
Daily operating time, max.	23 h	
Ambient temperature	5 - 30°(C

4.2 Application limits

The membranes are wear parts in the longer term. Their service life depends on the feed water quality and the operating conditions. In order to achieve a projected membrane service life of 3 years, the reverse osmosis systems should be operated with softened water or with hard water according to the system type, in each case in the same quality as drinking water according to the German Drinking Water Ordinance and according to the following additional specification:

Parameter	Unit	Limit value
Free chlorine *	mg/l	< 0.1
Total iron, zinc, manganese **	mg/l	0.2
Silicate ***	mg/l	25
Silt density index ****	-	3
pH value (operation) *****	-	3.6–9.5
pH value (cleaning)	-	2.0–12.0

The feed water must also be free of substances harmful to the membrane, such as:

- Oxidants (e.g. free chlorine, ozone, hydrogen peroxide)
- Surface-active substances (especially cationic)
- Natural organic matter (NOM)

During "softening" pre-treatment, the soft water quality should be monitored. When using antiscalant for hardness stabilisation (while at the same time stabilising e.g. iron, manganese and silicate), the special specifications for the system operation must be observed. If necessary, correct the pH value and/or reduce the permeate yield accordingly. When using hard water, it is to be expected that the membrane will wear out more quickly than when using softened water ("softening" pre-treatment).

* Free chlorine (oxidants) attack the plastic membrane, especially in the presence of metallic ions. This attack is irreversible and leads to a reduction in salt retention and an increase in permeate conductance. Therefore, the feed water of the RO system should contain as little free chlorine as possible.

** Iron/manganese/zinc can be present in undissolved or dissolved form. Undissolved iron/manganese/zinc should be removed by filtration. Dissolved iron/manganese/zinc can be oxidised and then filtered out or stabilised with an antiscalant, for example. Complex iron/manganese/zinc deposits on the membranes are difficult to remove by chemical cleaning.

*** Silicate can leave solid deposits on the membrane that are difficult to remove. The maximum silicate concentration in the RO concentrate should not exceed 100 mg/l when using soft water, therefore only 25 mg/l are permissible, taking into account the concentration in the feed water.

**** the silt density index is a sum parameter. It provides information about the probability of deposits of finely dispersed suspended and colloidal substances on the membranes. For values > 3, the pre-treatment must be improved accordingly.

***** The pH value significantly influences the solubility of many water constituents, especially carbonates and silicates. If necessary, it must be changed to achieve a desired high permeate yield or higher permeate quality.

4.3 **Product description**

4.3.1 Layout

The following P&I diagram shows the structure of an AX reverse osmosis system:



MSR point list			tors	
PI 1	Local display of pump pressure and working pressure	1	Shut-off valve for feed water, manu- ally actuated	
PI 2	Local display of permeate pressure	2	Flow control orifice for permeate or shut-off valve, manually actuated	
PS 1	Pressure switch for checking the wa- ter inlet pressure in the intake line	3	Sampling valve for untreated water, manually actuated	
PS 2	Pressure switch to signal pressure in permeate	K 1	Solenoid valve on intake	
QI 1	Conductivity probe with optional tem- perature sensor	4	Concentrate screen, factory setting	
QS 1	Hardness monitor (optional)	5	Sampling valve for permeate, manu- ally actuated	
US 1	Local process control	6	Flow control orifice, factory standard or flow control valve (optional)	
Hydraulic system components				
F-01	Protective cartridge filter 5µm-10"	M-01	Membrane module	
P-01	High-pressure pump	D-01	Membrane pressure vessel	

4.3.2 Function

The RO feed water reaches the HP pump via a residual hardness monitor (optional accessory, only when using softened water) and a protective cartridge filter (grade of filtration 5 μ m). This pump conveys the water at high pressure (level depends on the size of the system and the desired permeate pressure) through the semi-permeable membranes.

Water largely freed from salts passes through the membranes and forms the permeate (desired product). The retained salts are continuously discharged with the concentrate (drain water to the sewer).

An integrated controller monitors and controls all important functions of the RO system during permeate production and during downtimes.

It controls the HP pump and records the permeate conductivity, furthermore it monitors the inlet pressure and the residual hardness of the feed water (if an optional residual hardness monitor is present), as well as the permeate pressure. All operating, shut-down, flushing and fault statuses are shown in plain text on the display, and faults are signalled by a red LED. A fault message can be sent to the BMS via the alarm relay.

5.1 Installation

5.1.1 Requirements of the installation site

- The space required for the unit is derived from the dimensions specified in the technical data. In addition, there should be 0.8 m of space in front of the unit to allow access for operation and 1.0 m of space to the side for maintenance.
- The place of installation must comply with the ambient conditions as specified in the technical data.
- The installation surface must be level and horizontal and have sufficient load-bearing capacity.
- The room must be well ventilated and frost-proof.
- On site, the necessary electrical connections, as specified in the technical data, must be available at a maximum distance of 1 m from the unit.
- The feed water connection must be provided with a shut-off device.
- Depending on the size of the system, a control air connection must be present.
- The connection for the disposal of rinse water and concentrates must be installed and usable in the required cross-section.



To prevent flooding due to leakage, the installation site must be equipped with a floor drain and/or a leakage monitor with corresponding alarm.

5.1.2 Installation of the system

- Unpack the system
- Check that the delivery is complete and has not been damaged in transit.



Any deviations or damage must be reported to the supplier immediately!

- Carefully transport the unit to the intended site using a suitable lifting device.
- Install the unit on an installation surface in accordance with the requirements above.

5.2 Water connections

5.2.1 Required qualification of assembly personnel

(i) NOTE

The water connection must only be carried out by trained specialist personnel. General directives (DIN, DVGW, SVGW, ÖKGW) and local installation regulations must be observed when installing the system.

5.2.2 Establishing the water connections

Feed water

- Remove the sealing disk from the screw connector in the feed water inlet and keep it.
- Connect the feed water to the feed water connection through a shut-off valve.

Permeate

- Remove the sealing disks from the screw connector in the permeate outlet and keep them.
- Connect the permeate outlet line to the permeate inlet of the consumer (e.g. the humidifier).

Concentrate

- Remove the sealing disk from the screw connector in the concentrate outlet and keep it.
- Route the concentrate outlet line in a free-flowing drop to the free water drain along the shortest possible path. Drain water must be able to flow out without any backwater forming.



All plumbing connections must be connected while not under pressure. Do not crush or kink hoses; connect hose connections securely. Concentrate and drain lines must be routed to the free water drain with a drop. Sealing discs are not present in systems with flange connections.

The following applies only to systems without a membrane pressure vessel:



When the system is not in operation, the back pressure must not exceed 0.3 bar. The cross-section of the on-site permeate line to the consumer must not be larger by more than one rated width than the permeate outlet.

If the back pressure is > 0.3 bar and there is a risk of permeate flowing back, a non-return valve must be installed in the permeate line.

No shut-off device without a pressure relief device may be installed in the permeate line.

5.3 Electrical connection

5.2.1 Required qualification of assembly personnel



The electrical installation must be carried out by an electrician in compliance with the installation guidelines of the VDE, utility suppliers, factory standards, etc. according to the valid country-specific regulations.

5.3.2 Establishing the electrical connections

DANGER!

Before connecting the system to the power supply, make sure that the corresponding on-site main switch is switched off.

- The internal system components are already pre-wired with the controller on delivery.
- The power supply to the system must be established, checked and fused according to the specifications in the electrical wiring diagram.
- For systems supplied with a mains cable/plug, a CEE AC power point fused in accordance with the system power requirements (see "Technical data") must be installed within reach of the length of the mains cable.
- For systems that require a 3-phase AC supply, the power supply to the system must be provided by the customer.

When using a 3-phase AC supply, check the direction of rotation of the HP pump for clockwise rotation.

5.3.3 Connection of external signals from and messages to BMS

Connect

- the permeate container level or the permeate outlet pressure switch
- the forced stop of the residual hardness monitor
- the centralised alarm according to the electrical wiring diagram.

5.3.4 Cable list

It is recommended to use the following cable types:

From controller	To signal/actuator	Cable type	Alternative
Power supply line	Mains supply	NYM-J 3 x 1.5	H05VV-F3 G1.5
Main output	High-pressure pump	NYSLYO 3 x 1	H05VV-F3 G1
Universal output 1	Inlet valve	NYSLYO 4 x 1	H05VV-F3 G1
Universal output 2	Alarm output or concentrate valve (optional)	NYSLYO 4 x 1	H05VV-F3 G1
Switching input 3	Pressure switch	LIYCY 2 x 0.5	
Switching input 2	Forced stop (residual hardness monitor)	LIYCY 2 x 0.5	
Switching input 1	Permeate level or pressure switch	LIYCY 2 x 0.5	
Temperature sensor/ conductivity sensor	Conductivity probe with/without temperature sensor	System cable max. length 0.5 m	

No.	Name	Use	Allocation	Specification
			circuit board: 5 m	nm grid, for solid / finely
	ded conductors up to	1.5 mm²	1	
T1	Supply, feed		N	
T2	(Power IN)	Supply	L	230V, 5060Hz, 6,3 AT
Т3			PE	
T4	Main output		PE	Normally open relay
Т5	(Main Out1)	High-pressure pump	N	output, wet, via 6.3 AT
Т6			L (NO contact)	fuse
T7	Universal output 2		PE	Normally open relay
Т8	(Uni Out 2)	Inlet valve	N	output, wet, via 6.3 AT
Т9			L (NO contact)	fuse
T10			NC (normally closed contact)	
T11	Universal output 2	Alarm output (stand- ard) or concentrate	R (Root)	Relay changeover con-
1 1 1	– (Uni Out 2)	flush valve	NO (normally	tact, dry (not fused!)
T12			open)	
Termi	inals on the side edge	of the circuit board: 2.	5 mm grid, for so	lid / finely stranded con-
ducto	ors up to 0.5 mm ²			
T16				
T17				
T18	No function	All board spaces are not allocated with		
T19		terminals!		
T20				
T21				
T22	Auxiliary supply	Not required!	Uv (+5V DC)	At 100 Ohm
T23		Pressure switch of	IN	For external dry nor-
T24	Switching input 3	the RO feed	GND	mally open / normally closed contact
T25			IN	For external dry nor-
T26	Switching input 2	Forced stop	GND	mally open / normally closed contact
T27			IN	For external dry nor-
T28	Switching input 1	Tank level	GND	mally open / normally closed contact
T29	Temperature sensor Temperature sensor		IN (wire Ws)	
T30	(Temp)	(if present)	GND (wire Br)	KTY81-210 required
T31		Conductivity sensor	IN	
T32	Conductivity sensor	(screen, if present —	GND	 Conductivity sensor K=0.2
T33	– (LF)	do not use)		<u>−−</u> 0.∠

6. Commissioning and decommissioning

6.1 Commissioning

6.1.1 Qualification of commissioning personnel

The system must be commissioned by qualified specialist personnel.

Before commissioning the system, all screw connections must be tightened.

6.1.2 Flushing out the preservative



The preservative solution contains 1.5% sodium bisulphite and 20% glycerine. The flushed-out preservative solution must be discharged into the sewage system in accordance with the locally applicable discharge regulations.

The unit is supplied with the controller set to OFF mode. After switching on the mains power, the actuators connected to the controller (pump, input valve) do not switch on independently.

- Make a temporary hose connection between the sampling valve (5 if present) or (if necessary) between the permeate outlet and the sewage duct.
- Fully open the pump control valve (if present), pressure control valve (6 if present), concentrate control valve (4 if present) and permeate outlet valve (2)
- Open feed water inlet
- Switch on the main switch (if present) or switch on the power supply to the controller on site.
- Open the inlet valve via the control panel (sub-menu "Diagnostics" Inlet valve) and flush the system for at least 30 minutes without switching on the HP pump, using only feed water pressure.
- Exit the "Diagnostics" sub-menu the inlet valve closes again
- Remove the temporary hose connection between the sampling valve (5 if present) or (if necessary) between the permeate outlet and the sewage duct and reconnect the connection line for permeate to the consumer.

6.1.3 Setting up automatic mode

After flushing out the preservative, set automatic mode via the operating mode sub-menu on the controller by selecting "Operating mode ON".

6.1.4 Configuring permeate output and yield

With type CaRO and CaRO ED systems, it is not necessary to configure the permeate output and yield, as the flow rates are put into the correct proportions by self-regulating orifices.

6.1.5 Configuring permeate outlet pressure

The permeate outlet pressure can be selected in the range between 1 and 3 bar on pressure switch

PS 2. The factory setting is 3 bar. If a lower outlet pressure is desired, the charging pressure in the membrane pressure vessel must also be adjusted by increasing or releasing pressure according to the following table:

Permeate outlet pressure at which production is switched off in bar	Charging pressure in the membrane pressure vessel in bar
3.0	2.70
2.5	2.25
2.0	1.80
1.5	1.35
1.0	0.90

6.2 Decommissioning

Prior to each decommissioning, the system must be treated with preservative, which must be flushed out again as described in section 1.2 when the system is put back into operation. Therefore, the system should only be decommissioned if downtimes of > 30 days are expected.

Downtime requiring decommissioning is understood to be a condition in which the system is disconnected both from the water supply and from the power supply. If the system remains connected to the water and power supply, then it can remain idle without any preservation if a daily pause flush is programmed.

Information on preserving the system if downtimes of > 30 days are to be expected can be found in Chapter I.

6.3 Possible water treatment layout



- 1 Dispensing system
- 2 Iron removal
- 3 Water softener
- 4 Activated charcoal filter
- 5 Reverse osmosis system
- 6 Permeate container
- 7 Pressure boosting system

7. Control panel

7.1 Control and display elements



The keyboard includes the following four keys:



- Press the M key to enter the user menu and the main menu or to exit the main menu.
- This navigates to the next menu item in the user menu.
- In the main menu, the M key can be used to exit a sub-menu without applying changes.



- The UP key is needed to move up within a menu.
- It is also used to change the numerical parameters.
- Press once = increase the value by 1.



- The DOWN key is needed to move down within a menu.
- It is also used to change the numerical parameters.
- Press once = decrease the value by 1.

EN	TE	R
	1.5	

Press the ENTER key to navigate one position to the right when entering parameters. Finally, press the ENTER key to save the value and exit the sub-menu.

7.2 User menu

7.2.1 Structure and content

The default value for the user password is 1111. It can be changed by the user in the menu below.





Display of the operating time of the system that has elapsed. Cannot be changed! To skip, press the M key!



Display of the operating time remaining until the next maintenance. Cannot be changed! To skip, press the M key!



OFF — system under voltage, no (automatic) programme sequence. Please use for maintenance work only! ON — System in automatic programme sequence, is required for automatic permeate production!



As an authorised person, change the password immediately after calling up the user menu for the first time! Forgotten your password? Only a technician can restore access.



After a previous drop in inlet pressure below 1 bar with interruption of production: Duration until the inlet valve opens again to attempt a restart.



Lower limit of conductivity for an alarm



Lower limit of conductivity for a warning



Upper limit of conductivity for a warning



Upper limit of conductivity for an alarm



System response to a conductivity alarm. You can select "Switch off" and "Do not switch off". Select "Switch off" only if enough permeate is pre-produced that will suffice until a technician arrives.



Lower limit of temperature for an alarm



Lower limit of temperature for a warning



Upper limit of temperature for a warning



Upper limit of temperature for an alarm



System response to a temperature alarm. You can select "Switch off" and "Do not switch off". Select "Switch off" only if enough permeate is pre-produced that will suffice until a technician arrives.



Press M key to select "No" \rightarrow scrolling display is shown Press ENTER to select "Yes" \rightarrow Technician menu, password request (only for technicians)



7.2.2 Entries/changes in the user menu

In the user menu (see Appendix), you can change user-specific parameters that allow you to adapt the system function to the conditions in the environment.

Press the M key, you will be prompted to enter the password (the default password is 1111):



Press the UP key twice — 1 is displayed — then ENTER. ENTER moves the cursor one place to the right.



Press the UP key twice — 1 is displayed — then ENTER. ENTER moves the cursor one place to the right.



Repeat this procedure twice more. You will briefly see the value 1111 in the display and then you will move to the first user menu item — Operating hours.



Now scroll through each item selected by the cursor by pressing the ENTER key and make changes to values with the UP and DOWN keys.

EXAMPLE: Enter the "Retry time" parameter

Call up the user menu by entering the user password as described above and then navigate to the entry by pressing the M key 3 times:

Retry time

The cursor is already on the digit 6. Set the value to 0 by pressing the DOWN key 6 times and then press ENTER. The cursor is on the second digit:

Retry time

Press the ON key 3 times, the value of the second digit changes to 3. You have set the value 30 s. Press the ENTER key to jump to the last digit, which you do not want to change.



Press ENTER again to save the value of "Retry time" and at the same time jump to the next parameter, the lower limit for the alarm value LF (conductivity). In the same way, skip or change further parameters until the prompt "Expanded? No/Yes" appears, to which you answer "No" by pressing the M key.

Lower limit(A) 0001.0 µS/cm

It is not possible to return to previous items in the user menu. You can only exit the menu after you have completely scrolled through all the items selected by the cursor by pressing ENTER several times. Then re-enter the user password and start again. You can skip parameters that have already been entered correctly by pressing the M key. Only when you have reached the incorrectly entered parameter do you proceed step by step again by pressing the ENTER key to enter the digits.

7.3 Scrolling display

7.3.1 Uninterrupted operating sequence

The scrolling display contains the current permeate conductivity in μ S/cm, the temperature in °C if a temperature sensor is present on the LF (conductivity) measuring cell, as well as the logic states of up to three signals connected to the inputs of the controller, "Forced stop ON/OFF", "Tank level FULL/ EMPTY" and "Inlet pressure ON/OFF". In addition, you will find the "Operating modes" in the display:

Broduction OFF Ready

indicates that in the operating mode "Production OFF", the system is ready for another production phase.

Production OFF PreRejection

indicates that prior to permeate production, the water in the membrane module is displaced to the sewer unless the HP pump is also running.

Production ON

indicates that permeate is being produced.

indicates that at the end of permeate production, the water in the membrane module is displaced to the sewer if the HP pump is also running

indicates that after permeate production, the water in the membrane module is displaced to the sewer unless the HP pump is also running

Production OFF Pause flush

indicates that after a longer production pause — the default is 24 h — a forced flushing takes place, during which the HP pump is switched off

Production ON ause

indicates that after a longer production pause — the default is 24 h — a forced flushing takes place, during which the HP pump is switched on

NOTE

"Production ON" indicates that the HP pump is running and permeate is being produced. "Production OFF" indicates that the HP pump is idle and no permeate is being produced.

7.3.2 Interrupted operating sequence

Current alarms, messages and information are displayed, can be selected and acknowledged on a screen that is shown in addition to the uninterrupted sequence in the rolling display.

The screen that appears has the following layout:



Alarme Warnungen Infos

If there is more than one alarm (left digit > 1), alarms can be selected with the UP and DOWN arrow keys and acknowledged with ENTER. Each alarm must be selected and acknowledged separately. The digits indicate the number of alarms/warnings/information.

EXAMPLE: Acknowledgement of inlet pressure alarm and forced stop

After entering the "Alarms" sub-menu by pressing ENTER, the following screen appears:

Press the UP or DOWN key to display the second alarm or to return to the first alarm. You can now select the displayed alarm by pressing ENTER.



This is followed by the question whether you want to acknowledge the alarm. Press the key again to acknowledge the alarm.

After pressing the M key, the remaining alarm is displayed.



At the same time, the number of pending alarms is reduced by 1. You can now select the remaining

alarm by pressing ENTER.

Forced stop

Press the key again to acknowledge the alarm. Press the M button to exit the "Alarms" sub-menu.

Acknowledge Forced stop



Alarm acknowledgement if the cause of the alarm persists

If an alarm is acknowledged but its cause has not been eliminated, the alarm appears again when the delay time assigned to the cause of the alarm has elapsed.

7.4 Parameters

In order to ensure a meaningful control sequence, the control parameters must be correctly configured at the time of delivery from the factory. During commissioning, the technician can use the following table to check whether the settings are correct and, if necessary, correct them or adjust them to the local situation.

Main menu	Menu tree — p	arameters		Area	Default value	Con- figured value
		Inlet pressure	Contact	Normally closed / nor- mally open	Normally open	
			Message re- sponse	None / display / why / alarm	Alarm	
	Input module		System re- sponse	Do not switch off / switch off	Switch off	
		Delay		000 999 s	060 s	
		max. restart		00 99	03	
		Retry time		000 999 s	120 s	
	Pump module	Start delay		0000 9999 s	0005 s	
		Conductivity	Lower limit (alarm)	0000.0 2000.0 μS/cm	0001.0 µS/cm	
			Lower limit (warning)	0000.0 2000.0 μS/cm	0002.0 µS/cm	
Settings			Upper limit (warning)	0000.0 2000.0 μS/cm	0023.0 µS/cm	
			Upper limit (alarm)	0000.0 2000.0 μS/cm	0025.0 µS/cm	
Se			Correction factor	0.01 9.99	1.00	
			Warning delay	000 999 s	060 s	
			Alarm delay	000 999 s	180 s	
	RO module		System response	Do not switch off / switch off	Do not switch off	
			Lower limit (alarm)	00.0 99.9°C	02.0°C	
		Lower limit (warning)	00.0 99.9°C	05.0°C		
		Temperature	Upper limit (warning)	00.0 99.9°C	30.0°C	
			Upper limit (alarm)	00.0 99.9°C	40.0°C	
			Warning delay	000 999 s	020 s	
			Alarm delay	000 999 s	020 s	
			System re- sponse	Do not switch off / switch off	Do not switch off	

Main menu	Menu tree — parameters		Area	Default value	Configured value	
Tank mo		Design		With overflow / without over- flow	Without over- flow	
	Tank module		Contact	Normally closed / nor- mally open	Normally closed	
		Tank level	Message re- sponse	None / display / why / alarm	None	
			System re- sponse	Do not switch off / switch off	Do not switch off	
			Delay	000 999 s	001 s	
ຣີຍ Control — ON/OFF ທ			Contact	Normally closed / nor- mally open	Normally open	
	Forced stop	Message re- sponse	None / display / why / alarm	Alarm		
		System re- sponse	Do not switch off / switch off	Switch off		
			Delay	000 999 s	005 s	
		Cycle step		Current step	<only display=""></only>	
		Operating hours		Current value	XXXXXX h	
		Maintenance i	nterval		001500 h	
		Pause flush interval		0000 9999 h	0024 h	
	Parameter	Interval flushing time		0000 9999 min	0005 min	
		Pre-discard time		0000 9999 s	0005 s	
		Concentration displacement type Concentration displacement time		Displacement/ flushing	Displacement	
				0000 9999 s	0060 s	
F	Inlet pressure			Present / not present	Present	
Inlet valve Pump Flush valve	Inlet valve	let valve			Present	
			Present / not present	Present		
			Present / not present	Not present		
Rolling time				00 99 s	04 s	

8. Fault elimination

8.1 General information

By using high-quality individual components and due to the built-in safety and monitoring devices, a very high degree of operational reliability is achieved.

Should a malfunction nevertheless occur, the fault can be easily identified and the cause eliminated using the fault table set out below.

If serious malfunctions occur, please contact the manufacturer (see nameplate).



Fault elimination may only be carried out by qualified and instructed personnel in compliance with the safety regulations in chapter A of this operating manual!

Before starting work, the system must be disconnected from the power supply and secured against being switched on again unintentionally!

All lines must be de-pressurised.

8.1.1 Fault reporting to the manufacturer

To ensure effective troubleshooting, please have the following information ready:

- Order number (if available)
- Item number (if available)
- System type
- Operations logs and maintenance logs (if available) from the last year

8.1.2 Fault indication and reset

- Red alarm LED lights up
- Fault message as indication in the display
- For resetting alarm messages on the control panel, please refer to the corresponding section in chapter 7 - Control panel!

8.2 Fault analysis and elimination8.3 Flushing the concentrate

$ig(\mathbf{j}ig)$ note

Please read the following table containing possible malfunctions before contacting the manufacturer's service department!

Fault/message	Possible causes	Remedy
Display unlit	Mains supply interrupted	Establish mains supply
	230VAC/6.3 AT fuse defec- tive	Replace fuse concerned
	Controller defective	Replace controller
Forced stop display ON	Residual hardness sensor triggered (if present)	 Check soft water quality Check sensor and replace it, if required
Display shows "Low inlet pressure" although manom- eter shows inlet pressure in	Feed water pressure too low	 Check pressure differential at the softener Check feed water pressure
the permissible range	Filter F-01 blocked	Replace filter cartridge
	Pressure switch PS-1 defec- tive	Replace pressure switch
	Inlet valve K-1 defective	Replace valve
Display shows "LF Perm" too high	Feed water conductivity too high → Desalination rate too low	Calculate desalination rate Target: > 97% Quick fix: Perform a flushing of con- centrate, see below. After consultation with the manufac- turer: Clean membrane modules Replace membrane modules
System does not go into	"Tank FULL" is displayed	Level sensor (level switch or alterna-
production (HP pump does not run)	although permeate tank is empty	tive pressure switch) defective
	Display shows "Production ON", yet no permeate is being produced	Pump defective
Permeate output too low	Feed water temperature too low	Calculate permeate output according to chapter A
	Permeate back pressure too high	Check permeate line for height, con- strictions and shut-off device
	Modules blocked	After consultation with the manufac- turer: Clean modules Replace modules
	Pump makes grinding noises	Replace pump
HP pump switches on and immediately off again at short	Pressure switch PS-2 defec- tive	Replace pressure switch PS-2
intervals	Membrane pressure vessel is not properly pressurised	Correctly set the charging pressure (chapter E)
Green operating LED flashes	Maintenance interval reached	Request maintenance from the man- ufacturer
Display with incomprehen- sible, previously unknown content → System message	Initialisation error	Notify manufacturer
Red alarm LED flashes	System error	Notify manufacturer

When flushing the concentrate, the concentrate side of the membrane(s) is flushed at a higher speed due to the increase in the concentrate volume flow and, due to the associated increase in shear forces, easily detachable deposits are removed and flushed out.

Flushing the concentrate should last at least 60 minutes and should be carried out as follows:

■ Log the actual values (enter in operations log according to chapter H)

Open the concentrate control valve completely or remove the concentrate screen (depending on the type of system).

- Fully open the pressure control valve (if present)
- Flush for a min. of 60 minutes
- Readjust the operating parameters to the set points
- Wait 10 minutes
- Log the actual values again (enter in operations log according to chapter H)



If the permeate conductivity does not improve permanently after concentrate flushing, the membranes should be replaced.

9. Inspection and maintenance

9.1 Inspection and maintenance work

9.1.1 Safety instructions



The operator must ensure that all inspection, maintenance, and assembly work is carried out by authorised, qualified technicians.

Before carrying out any repair or maintenance work, the system must be shut down and secured against being accidentally put into operation.



Before starting work on electrical installations and equipment, the installation must be checked to ensure that it is de-energised. In addition, the system must be secured against being switched on unintentionally.

Suitable protective clothing appropriate to the hazard must be worn during the maintenance work.

Immediately after completion of the maintenance work, all safety and protective devices must be refitted or put into operation.

9.1.2 General information



In order to ensure the proper operation and function of the system in the long term, regular maintenance work must be carried out and a log of the operating parameters must be kept!

The system operator is responsible for logging the operating parameters. A log sheet must be kept for logging the operating parameters, which allows for continuous documentation of the operating parameters and provides evidence of correct operation. A drop in performance or malfunctions of the RO system can thus be detected and remedied more quickly.

It is recommended to conclude an inspection and maintenance contract with the supplier, who is qualified to carry out the regularly required maintenance work on the system. The maintenance work is documented on the designated maintenance log by the qualified person carrying out the inspection or maintenance.

9.2 Logging the operating parameters

9.2.1 List of parameters to be logged

The following parameters must be checked weekly and entered in the operations log for reverse osmosis systems:

Parameter	Measuring point / remarks
Operating hours of the RO system	Display/menu of the control panel
Residual hardness in the feed water	Check with hardness test kit in feed water
Conductivity of feed water	Checking with hand-held conductivity meter
Temperature of feed water	Checking with hand-held conductivity meter
Fine filter inlet pressure (if present)	Manometer for fine filter inlet pressure
Fine filter outlet pressure (if present)	Manometer for fine filter outlet pressure
HP pump pressure (if present)	Manometer directly after HP pump
Operating pressure	Manometer after HP pump throttle device
Concentrate pressure (if present)	Manometer for concentrate after module
Differential pressure Operating pressure — Concentrate pressure	Δp = calculate from the read values
Permeate output	Permeate flow meter
Concentrate output	Concentrate flow meter
Concentrate recirculation (if present)	Concentrate recirculation flow meter
Permeate conductivity	Display of the control panel
Permeate temperature	Display of the control panel or measure in a sample with a hand-held conductivity meter
Desalination rate of the RO system	Calculation see chapter A
Leak tightness of the system	Visual inspection of the lines, fittings and screw connections

Slight fluctuations in the output parameters (permeate conductivity and permeate output) due to fluctuations in the feed water temperature or due to fluctuating conductivity of the feed water are normal.



If the desalination rate drops below 95% or the permeate output drops by approx. 10% compared to the output at commissioning, a concentrate flush should be carried out in accordance with section 3.2.

9.2.2 Operations log for reverse osmosis systems

Customer:_

System type: _____

Order No.: _____

Commissioned on:

		At com-	Date	Date	Date	Date	Date
Measured variable	Unit	mission- ing					
Operating hours of the RO system	h						
Residual hardness in the feed water	°d						
Conductivity of feed water	µS/cm						
Temperature of feed water	°C						
Fine filter inlet pressure (if present)	bar						
Fine filter outlet pressure (if present)	bar						
HP pump pressure (if present)	bar						
Operating pressure	bar						
Concentrate pressure (if present)	bar						
Differential pressure Operating pressure — Con- centrate pressure	bar						
Permeate output	l/h						
Concentrate output	l/h						
Concentrate recirculation (if present)	l/h						
Permeate conductivity	µS/cm						
Permeate temperature	°C						
Desalination rate of the RO system	%						
Leak tightness of the system	-						



The values at commissioning are to be recorded as a basis for the system assessment. The values are entered weekly in copies of this log sheet. If the values deviate by approx. 15% from the values at commissioning (e.g. differential pressure, permeate output, desalination rate), the supplier should be notified.



Maintenance work for the system must be carried out globally after 4000 operating hours (a maintenance message is sent) and for each system part separately as required, no later than the specified maintenance intervals or described situations (column "No later than as per operating time or described situation")!

9.3.1 Maintenance plan for reverse osmosis systems

In the user menu you can query the operating time remaining until the next maintenance (see chapter F - Control panel).

Operating times are defined as "Production ON" times, i.e. times when the HP pump is running. The following maintenance work must be carried out by the manufacturer's service department:

Component	Action	Interval
Protective filter	Replace the filter cartridge	if differential pressure > 0.5 bar, but at least every 2 months
RO system	Total functional test of all electrical and mechanical parts (see also chapter "Commissioning")	monthly
Check parameters	 Permeate conductivity (QI 1) Working pressure (PI 1) Total hardness of feed water Temperature of feed water pH value Conductivity of feed water Free chlorine Dissolved iron Silt density index SDI 	daily daily weekly weekly monthly as required monthly as required as required
Sensor of hardness control device * (if present)	Replace sensor with a reactivated or new sensor	12 months or after triggering the sensor
Parameter configuration	Check and correct the set operat- ing parameters	as required

* wear part





MSR units and actuators

MSR point list

- PI 1 Local display of pump pressure and working pressure
- PI 2 Local display of permeate pressure
- PS 1 Pressure switch to signal pressure loss in intake
- PS 2 Pressure switch to signal pressure in permeate
- QI 1 Conductivity measurement/signalling

Actuators

- 1 Shut-off valve for untreated water, manually actuated
- 2 Shut-off valve for permeate, manually actuated
- 3 Sampling valve for untreated water, manually actuated
- K 1 Automatic valve on intake, controlled by RO controller
- 3 Sampling valve for permeate, manually actuated
- 4 Concentrate screen, factory setting (determines the volume of concentrate drained)
- C Pressure control valve, overflow valve (sets the circulation volume)

10.3 Dimensions

AX 02

Connections:

- A = Untreated water (PVC Ø 25 mm)
- B = Permeate (PVC Ø 20 mm)
- C = Drain water (hose sleeve Ø 16 mm)

Electrical connection:

230V / 50Hz





Top view





Front view





10.4 **Dimensions**

AX 05, 12 and 20

Connections:

- A = Untreated water (PVC Ø 25 mm)
- B = Permeate (PVC Ø 20 mm)
- C = Drain water (hose sleeve Ø 16 mm)
- D = Permeate connection (flexible hose)

Electrical connection:

230V / 50Hz



Side view





Top view

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10.5 Dimensions

AX 30 and 50

Connections:

Side view



- B = Permeate (PVC Ø 20 mm)
- C = Drain water (hose sleeve Ø 16 mm)

Electrical connection:

230V / 50Hz







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