20250305 DE

CONDAIR AT+

Reverse osmosis unit

ASSEMBLY AND OPERATING INSTRUCTIONS

Condair AT+ reverse osmosis unit
03.01.2025

Air humidification, dehumidification
and evaporative cooling

condair

Thank you for choosing Condair

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

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1. General Safety Instructions

1.1 Explanation of symbols and instructions

These operating instructions contain important specifications on the safe operation of the system.

These operating instructions, particularly the chapter on safety instructions, must be observed by all those who carry out work on the system. This applies to the installation company as well as the system operator. In addition, the special rules and regulations for accident prevention that apply to the usage location must be observed.

In these operating instructions, the following symbols are used to indicate personal hazards and guidance on the proper handling of the system:

DANGER!

This symbol indicates an imminent threat to personal health which may be fatal. Failure to observe these instructions may result in serious health hazards or even life-threatening injuries.

WARNING!

This symbol indicates a potential threat to personal health which may be fatal. Failure to observe these instructions may result in serious health hazards or even life-threatening injuries.

CAUTION!

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

NOTE

This symbol provides important information on the proper handling of the system. 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 ensure that all those working on the system

- are familiar with the basic health and safety and accident prevention regulations and have been instructed in the handling of the system,
- have read and understood the chapter on safety and the warnings in these operating instructions and have confirmed this by their signature, and
- have their safety-conscious work checked at regular intervals.

1.3 Personnel obligations

Prior to commencing work, all individuals who are commissioned to work on the system or carry out such work independently undertake to:

- read the chapter on safety and the warnings in these operating instructions and confirm by their signature that they have understood them.
- observe the basic health and safety and accident prevention regulations.

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

1.4 Training of personnel

Only trained and instructed personnel may work on the system.

- The responsibilities of the personnel for assembly, commissioning, operation, set-up, maintenance and repair must be clearly defined.
- Personnel who have not as yet been trained may only work on the system under the supervision of an experienced co-worker.

1.5 Intended use

The system may only be used for the desalination of drinking water, well water or surface water which is free from particles and metal ions. The restrictions regarding the chemical analysis of the feed water, pressure, temperature and flow rate specified in the technical data apply.

Intended use also includes

- observance of all instructions and notes in the operating instructions
- and compliance with inspection and maintenance intervals.

Any other usage or usage beyond this is considered non-intended use. Non-intended use includes use as a

- filter
- pressure booster
- water distributor.

The manufacturer/supplier is not liable for any damage resulting from non-intended use.

1.6 Hazards when handling the equipment

- The system has been designed and manufactured in accordance with the latest technology and the recognised safety regulations.
- The system must be installed in such 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 pose a health hazard to the user or third parties or put their lives at risk, or cause damage to the system itself or other property. The system is only to be used for its intended use (see 1.5) and in a safe condition.

The following residual hazards exist:

Water damage

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

Electric shock

- Work on the electrical supply may only be carried out by a qualified electrician.
- Check the system's electrical equipment on a regular basis. Any loose connections or scorched cables must be removed immediately.
- The control cabinet must be kept locked at all times. Access is only allowed to authorised personnel.
- If work needs to be carried out on live parts, a second person must be called in so that they can switch off the main switch if necessary.
- Do not touch the electrical components with wet hands.
- Disconnect the system from the power supply before working on electrical system parts.

Mechanical/hydraulic energy

- Some system parts 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 preservation instructions must be observed.

Faults which could impair safety must be rectified immediately. This is ensured by the operator himself or an operator-commissioned company.

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 checked to ensure they are in working order.
- Protective devices may only be removed after the machine has been switched off and secured against being switched back on.
- The required personal protective equipment for the operating personnel must be provided by the operator and worn by the operating personnel when they are working on the system.
- All existing protective devices must be checked regularly by the operator or an operator-commissioned company.

1.7.2 Informational safety measures

- The operating instructions must be kept at the usage location permanently.
- In addition to the operating instructions, the generally applicable and local regulations for accident prevention and environmental protection must be provided and observed.
- All safety and hazard notices on the system as well as the labelling of the operating and control elements must be kept in legible condition.

1.8 Safety instructions for maintenance work

- The operator must ensure that all maintenance, inspection and installation work is carried out by authorised and qualified specialist personnel who have acquired the necessary information by studying the operating instructions.
- Prior to all repair and maintenance work, the system must be switched off and secured against unintentional start-up. The procedure for shutting down the system described in the “Commissioning and Decommissioning” chapter of the technical documentation must be observed at all times.
- Before any work is started on the system’s electrical equipment, the corresponding section must be checked to ensure that it is not live. In addition, the system must be secured against being switched back on.
- Suitable protective clothing appropriate to the hazard level in question must be worn while the work is being carried out.
- Immediately after completion of work, all safety and protective devices must be reattached and/or reactivated.
- Before recommissioning the machine, the points listed in the “Commissioning and Decommissioning” chapter must be followed.

1.9 Disposal of system components and operating materials

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

1.10 Unauthorised modification and production of spare parts

- Conversion or modifications to the system are only permitted following consultation with the manufacturer.
- This also applies to PLC program changes.
- Original spare parts and manufacturer-authorised accessories are important for your safety.
- If other parts are used, the warranty becomes void and no liability is accepted for the resulting consequences.

1.11 Warranty and liability

This product incorporates the latest technical advances and has been designed, manufactured and subsequently subjected to quality control in accordance with the applicable rules of technology.

Should there nevertheless be cause for complaint, any claims for compensation against the manufacturer of this product are subject to the manufacturer’s general terms and conditions of sale and delivery. The fine filter must be replaced regularly. See section 9.3.

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

- Non-intended use of the system
- Improper assembly, commissioning, operation and maintenance of the system
- Operating the system with defective safety devices or improperly installed or non-functioning safety and protective devices
- Non-compliance with the instructions in the operating instructions regarding transport, storage, assembly, commissioning, operation (note: the operating log should be filled in on a continuous basis), and maintenance of the system
- Unauthorised, unapproved structural changes to the system
- Unauthorised modification of the control parameters
- Inadequate monitoring of system components that are subject to wear and tear
- Improperly performed repairs
- Emergencies caused by external forces or acts of God

1.12 Safety instructions for storage

CAUTION!

The reverse osmosis unit 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.

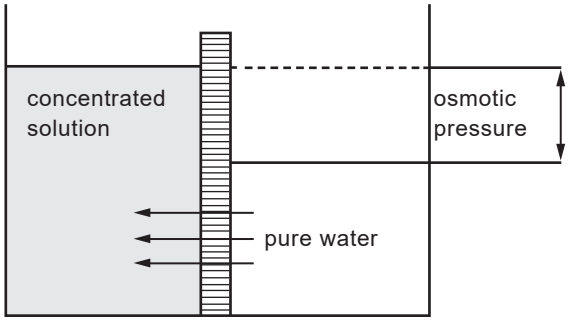
2. Principles of Reverse Osmosis Units

2.1 Principle of reverse osmosis

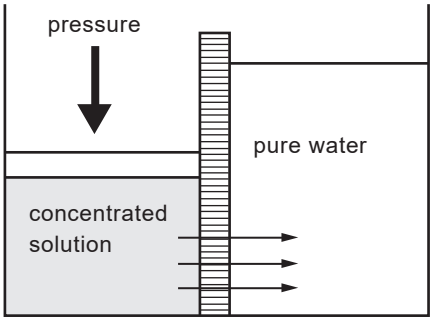
Osmosis is a process on which almost all natural metabolic processes are based. If you separate two solutions of different concentrations in a system through a semi-permeable membrane, the more concentrated solution always tends to dilute.

This process (osmosis) continues until osmotic equilibrium is reached. In the reverse osmosis process, the direction of the osmotic flow is reversed. For this purpose, pressure must be applied to the concentrated solution.

This pressure must be significantly greater than the osmotic pressure created by the natural equilibrium.



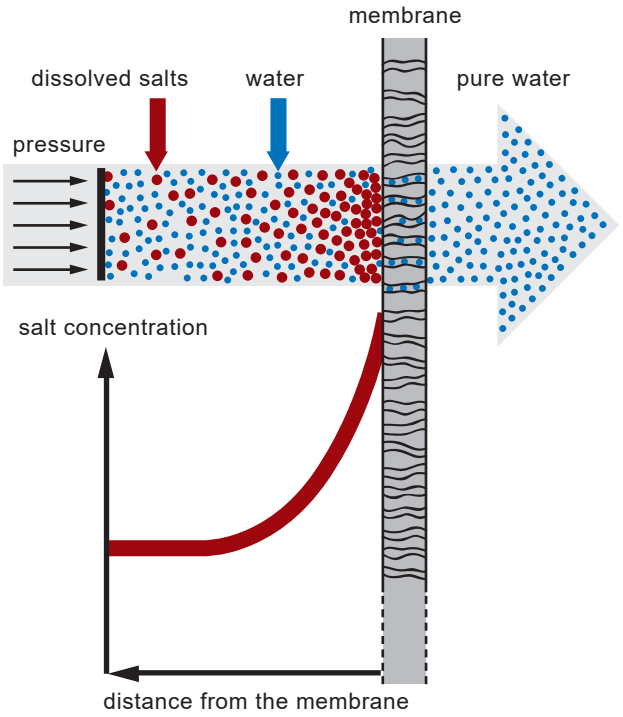
Osmosis



Reverse osmosis

Synthetic membranes are used in water treatment systems that work according to the principle of reverse osmosis. These membranes are permeable to the water molecules. The substances dissolved in the water are largely retained by the membranes. The “concentrated solution” (e.g. drinking water or process water) flows over this membrane at high pressure.

This results in the separation of this solution into a partial stream with water containing the retained substances (reject).



2.2 Calculation equations

The permeate output, the reject 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 reject output are determined by manual volumetric measurement.

Feed water output = permeate output + reject output

$$\text{Yield [\%]} = \frac{\text{(permeate output [l/h])}}{\text{(feed water output [l/h])}}$$

$$\text{Reject output [l/h]} = 100 * \frac{\text{(permeate output [l/h])}}{\text{(yield [\%])}} - \text{permeate output [l/h]}$$

$$\text{Desalination rate [\%]} = 100 * \frac{\text{[1- “permeate” conductivity}}{\text{“feed water” conductivity]}}$$

Salt passage [%] = 100 - desalination rate [%]

2.3 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 [l/h] at temperature T [°C] = nominal output * correction factor

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

CAUTION!

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!

2.4 Conductivity of first permeate

NOTE

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

3. Transport and Storage

3.1 Transport to the customer

CAUTION!

All units must be secured against slipping and falling over during transport. Allowing the unit to tip out of its fixed position is not permitted. If system parts are protruding from the base area of the pallet, such protruding parts must be protected against damage while other parts/units are being loaded.

- The transport weight corresponds to the empty weight and is specified in the technical data.
- The unit may still be damaged by extreme frost. The units are filled with a preservative/anti-freeze mixture before delivery. The frost protection is effective down to -10°C.

3.2 Storage at the customer’s premises

- The maximum storage period of the original packed unit is 3 months at 20°C. The preservative must then be rinsed out and, if longer storage is desired, replenished.
- Extreme frost may damage the unit. The units are filled with a preservative/antifreeze mixture before delivery. The frost protection is effective down to -10°C.

3.3 Transport to the installation site

- Transport the unit to the intended location with care using a suitable lifting vehicle.
- Observe any specifications relating to the unit’s centre of gravity on the packaging.

4. Technical data / product description

4.1 Technical data

Typ AT+		08	15	30	55	80	100
Quality of the feed water [1]		Soft water 0°dH					
Permeate output at 2 bar [2]	l/h	100	190	370	720	1.000	1.250
Permeate output at 4 bar [2]	l/h	80	150	300	550	800	1.000
Yield, max.	%	75					
Raw water pressure min./max.	bar	2.5					
Water temperature min./max.	°C	5/25					
Desalination rate	%	99.4					
Working pressure	bar	ca. 10.5					
Pump type		Procon 600		CR 3-15			
Electr. connection	Volt	230		3x400/50			
Installed power consumption	kW	0.55		1.1			
Actual power consumption	kW	na.		0.90-0.88	0.92-0.91	0.94-0.91	0.95-0.93
Quantity membranes	(M-01)	1	2	1	2	3	4
Membrane type		PERMEA BW2540 HF		PERMEA BW4040 EHF			
Prefilter		10“-5µ					
Hydraulic connection							
Raw water		DN 20					
Permeate		DN 15					
Reject		DN 15					
Dimensions (without membrane vessel)							
Height	mm	1,500					
Width	mm	600					
Depth	mm	600					
Weight	kg	45	51	61,5	72	81,5	91
Membrane expansion tank [3]	l	60	60	60	60	60	60

1) Limit values of the pre-treated water*

Salt content, max.	1.000 mg/l
pH-value	3-11
Silt density index	< 3,0
Free chlorine	< 0,1 mg/l
Total Fe, Zn, Mn	< 0,2 mg/l
CFU	< 100

2) 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

3) Option:
Specifications are standard, but other sizes can also be used.

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 units should be operated with softened water or with hard water depending on the unit type, in each case in the same quality as drinking water according to the German Drinking Water Ordinance and according to the following additional specifications:

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 exact specifications for operating the unit 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 unit 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 reject 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

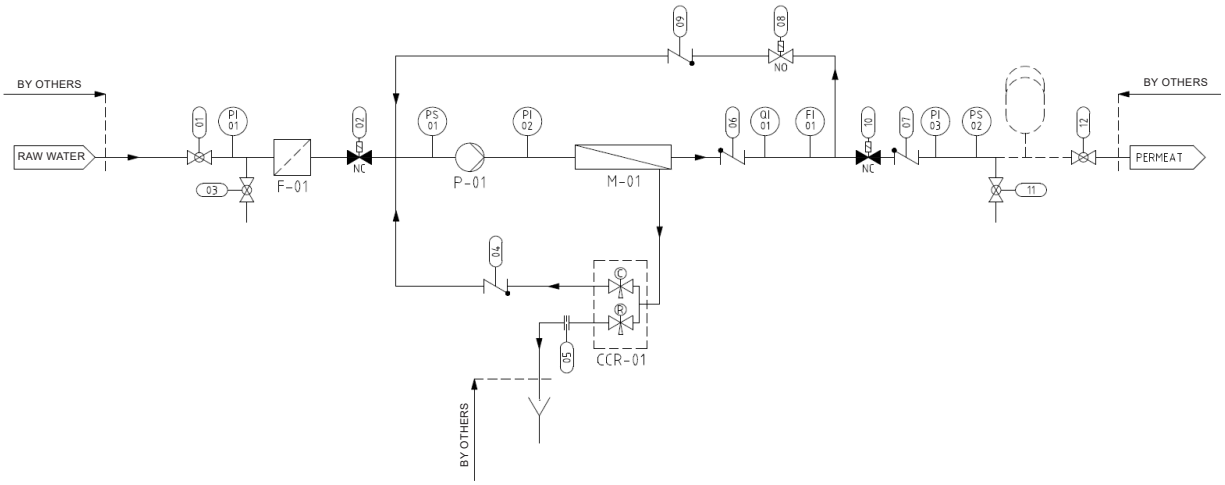
4.3.1 Function

The RO feed water reaches the frequency-controlled HP pump via a residual hardness monitor (optional accessory, only when using softened water) and a protective cartridge filter (grade of filtration 5 µm). This pump conveys the water at high pressure (level depends on the permeate flow being drawn 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 reject (drain water to the sewer).

An integrated controller monitors and controls all important functions of the RO unit during permeate production and during downtimes. It controls the HP pump so that either the permeate pressure or the permeate flow rate remains constant. Alternatively, uncontrolled operation is possible. It monitors the inlet pressure and the residual hardness of the feed water (if an optional Limitron or Testomat residual hardness monitor is present), the reject pressure and the operationally critical flows for permeate, reject and circulation, as well as the permeate conductivity. All operating, shut-down, rinsing 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.

4.3.2 Structure

The following RI diagram shows the structure of an AT+ reverse osmosis system



MSR point list / Hydraulic system components		Actuators	
PI 01	Local display of the inlet pressure	01	Shut-off valve feed water, manually operated
PI 02	Local display of the pump pressure or working pressure	02	Solenoid valve (NC) Feed
PI 03	Local display of the permeate pressure	03	Sampling valve for raw water, manually operated
PS 01	Pressure switch for checking the water upstream pressure in the feed line	04	Non-return valve Concentrate return
PS 02	Pressure switch for signaling permeate pressure	05	Reject orifice, Factory setting
QI 01	Conductive conductivity probe	06/07	Permeate non-return valve
FI 01	Flow meter	08	Solenoid valve (NO) Permeate circulation
CCR-01	Concentrate control block	09	Non-return valve Permeate circulation
F-01	Protective candle filter 5µm-10“	10	Solenoid valve (NC) Permeate
P-01	High pressure pump	11	Permeate sampling valve, manually operated
M-01	Membrane module	12	Permeate shut-off valve

5. Installation and Assembly

5.1 Installation

5.1.1 Installation site requirements

- The space required for the unit is specified in the dimensions provided 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 meet the ambient conditions according to 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.
- The necessary electrical connections, as specified in the technical data, must be available on-site 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 unit size, a control air connection must be available.
- The connection for the disposal of rinse water and reject must be installed and usable in the required cross-section.

WARNING!

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

5.1.2 Installation of the unit

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

NOTE

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

- Transport the unit to the intended location with care using suitable lifting equipment.
- The installation is carried out on an installation surface in accordance with the requirements above.

5.2 Water connections

5.2.1 Required qualification of assembly personnel

NOTE

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

5.2.2 Establishing the water connections

Feed water

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

Permeat

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

Reject

- Remove the sealing disc from the screw connection in the reject outlet and keep it.
- Route the reject outlet line in a free-flowing drop to the free water drain along the shortest possible path. The waste water must be allowed to drain without backpressure.

NOTE

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

WARNING!

When the system is at a standstill, the back pressure must not exceed 0.3 bar.
The cross-section of the cross-section of the on-site permeate line to the consumer may be a maximum of one nominal diameter larger than the permeate outlet. With a back pressure >0.3 bar and the risk of permeate backflow, a non-return valve must be installed in the permeate line must be installed. No shut-off device without overpressure protection may be installed in the permeate line.

5.3 Electrical connection

5.3.1 Required qualification of assembly personnel

DANGER!

The electrical installation must be carried out by a qualified electrician in compliance with the installation regulations VDE, EVU, factory standard, etc. and in accordance with the applicable country-specific regulations.

5.3.2 Making the electrical connections

DANGER!

Before connecting the system to the power supply, ensure that the corresponding main switch provided by the customer is switched off.

- The internal system modules are already wired to the control unit on delivery.
- The power supply to the system must be established and checked and fused in accor dance with the specifications in the electrical connection diagram.
- For systems supplied with a mains connection cable/plug, a fused CEE AC socket outlet corresponding to the system output (see technical data) must be installed within reach of the length of the mains connection cable.
- For systems that require a 3-phase AC voltage supply, the power supply to the system must be power supply to the system must be provided by the customer.

NOTE

When supplied with 3-phase AC voltage, the direction of rotation of the HP pump must be checked for clockwise rotation.

5.3.3 Connection of external sensors and messages to the ZLT

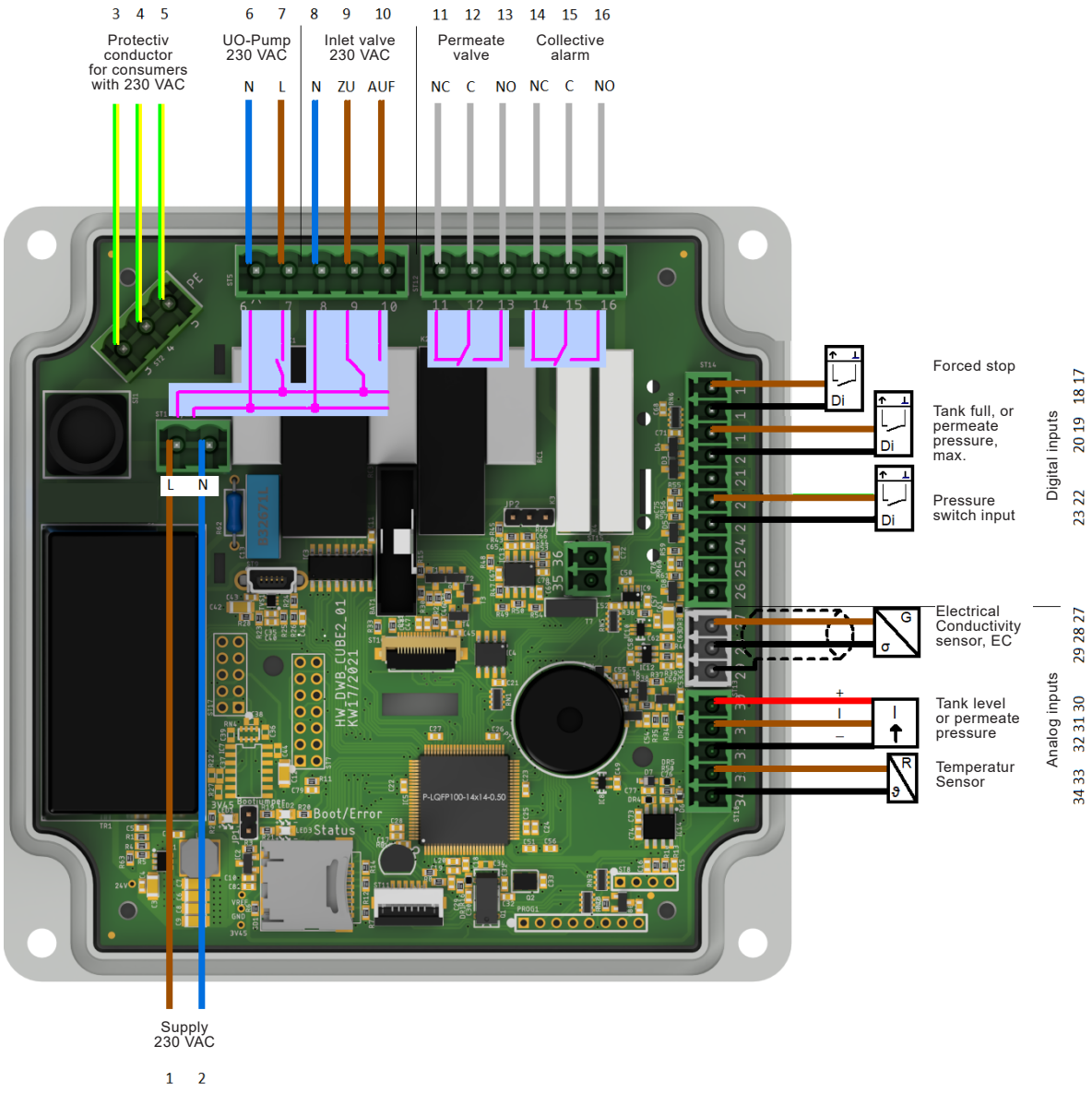
The connection of

- Forced stop residual hardness control device
- Collective fault according to the electrical connection diagram.

5.3.4 Electrical connection diagram

Kl. Nr.	Usage	Des.	Function
1	-	L	Phase, 230V AC supply
2	-	N	Neutral conductor, supply
3	-	PE	Protective conductor
4	-	PE	Protective conductor
5	-	PE	Protective conductor
6	UO high-pressure pump	N	Neutral conductor, consumer
7		Lno	Relay, normally open contact, supply switching 230V AC
8	Inlet solenoid valve	N	Neutral conductor, consumer
9		Lnc	Relay, normally closed contact, supply-switching 230V AC
10		LNO	Relay, normally open contact, supply switching 230V AC
11	Permeate solenoid valve	NC	Relay, normally closed contact, potential-free
12		C	Relay, changeover contact, potential-free
13		NO	Relay, NO contact, potential-free
14	Alarm output collective message	NC	Relay, normally closed contact, potential-free
15		C	Relay, changeover contact, potential-free
16		NO	Relay, NO contact, potential-free
17	Forced stop	IN	Input for ext. potential-free NO contact against GND
18		GND	Mass
19	Permeate pressure, max. (digital sensors)	IN	Input for ext. potential-free NO contact against GND
20		GND	Mass
21	Pressure switch input	24V	Sensor supply +24V DC
22		MI	Multi-input
23		0V	Mass
24	not used	24V	Sensor supply +24V DC
25		MI	Multi-input
26		0V	Mass
27	Conductivity sensor, conductive	EC	Input EC sensor, electrical conductivity
28		0V	Mass
29		PE	Shield
30	Permeate pressure (analog transmitter)	24V	Sensor supply +24V DC
31		MI	Multi-input
32		0V	Mass
33	Temperature sensor	Tmp	Temperature sensor input
34		0V	Mass
35	not used	MO	Multi-output
36		0V	Mass

Terminals on the side edge of the circuit board: 2.5mm pitch, for single/fine-wire conductors up to 0.5mm² Terminals in front of the relays, lower edge of the circuit board: 5mm pitch, for single/fine-wire conductors up to 1.5mm² When using digital encoders, no sensor supply is required. No sensor supply is required when using digital encoders.


3 4 5
Protectiv conductor for consumers with 230 VAC
6 7
UO-Pump 230 VAC
N L
8 9 10
Inlet valve 230 VAC
N ZU AUF
11 12 13
Permeate valve
NC C NO
14 15 16
Collective alarm
NC C NO
PE
L N
Supply 230 VAC
1 2
Forced stop
Tank full, or permeate pressure, max.
Pressure switch input
Digital inputs
17 18 19 20 21 22 23
Electrical Conductivity sensor, EC
Tank level or permeate pressure
Temperatur Sensor
Analog inputs
24 25 26 27 28 29 30 31 32 33 34
HW_DWB_CUBE2_01
KW17/2021
Boot/Error
Status

5.3.5 Cable types

The use of the following cable types is recommended:

Designation	Cable type	Alternative
Power supply	NYM-J 3 x 1,5	H05VV-F3 G1,5
UO High-pressure pump	NYSLYO 3 x 1	H05VV-F3 G1
Inlet solenoid valve	NYSLYO 4 x 1	H05VV-F3 G1
Permeate solenoid valve	NYSLYO 4 x 1	H05VV-F3 G1
Alarm output	NYSLYO 4 x 1	H05VV-F3 G1
Pressure switch input	LIYCY 2 x 0,5	
Forced stop (for example residual hardness analyzer)	LIYCY 2 x 0,5	
Diaphragm vessel - pressure sensor (digital)	LIYCY 2 x 0,5	
Diaphragm vessel - pressure sensor (analog)	LIYCY 3 x 0,5	
Conductivity probe with/without temperature probe	System cable max. length 0.5m	

6. Commissioning and Decommissioning

6.1 Commissioning

6.1.1 Qualification of commissioning personnel

CAUTION!

The unit must be commissioned by qualified specialist personnel.

NOTE

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

6.1.2 Rinsing out the preservative

WARNING!

The preservative solution contains 1.5% sodium bisulphite and 20% glycerine. The rinsed preservative solution is discharged into the sewage system in accordance with the local discharge regulations.

NOTE

The system is supplied with the control unit set to OFF mode. After the mains voltage is applied, the actuators connected to the control unit (pump, inlet valve) do not switch on automatically.

- Make a temporary hose connection between the sampling valve (11 - if present) or (if necessary) between the permeate outlet and the sewer
- Open the feed water inlet
- Switch on main switch (if present) or switch voltage to control unit on site
- Open the inlet valve via the control unit (Diagnostics - Inlet valve submenu) and flush the system for at least 30 minutes without switching on the HP pump, using feed water pressure only.
- HP pump (if fitted) Open bleed screw to bleed until only water comes out, then close again
- Exit the Diagnostics submenu - the inlet valve closes again
- Remove a temporary hose connection between the sampling valve (5 - if present) or (if necessary) between the permeate outlet and the waste water channel and restore the connection line for permeate to the permeate tank.

6.1.3 Establishing automatic mode

After rinsing out the preservative, automatic mode is established in the submenu operating mode submenu on the control unit by selecting „Automatic operating mode“.

6.1.4 Adjustment of permeate output and yield

With AT+ systems, it is not necessary to adjust the permeate output and yield, as the volume flows are brought into the correct ratio by self-regulating orifices.

6.2 Decommissioning

NOTE

The system must be treated with preservative before each decommissioning, which must be rinsed out again as described in section 6.1.2 when the system is recommissioned. Therefore, the system should only be taken out of operation if downtimes of > 30 days are expected.

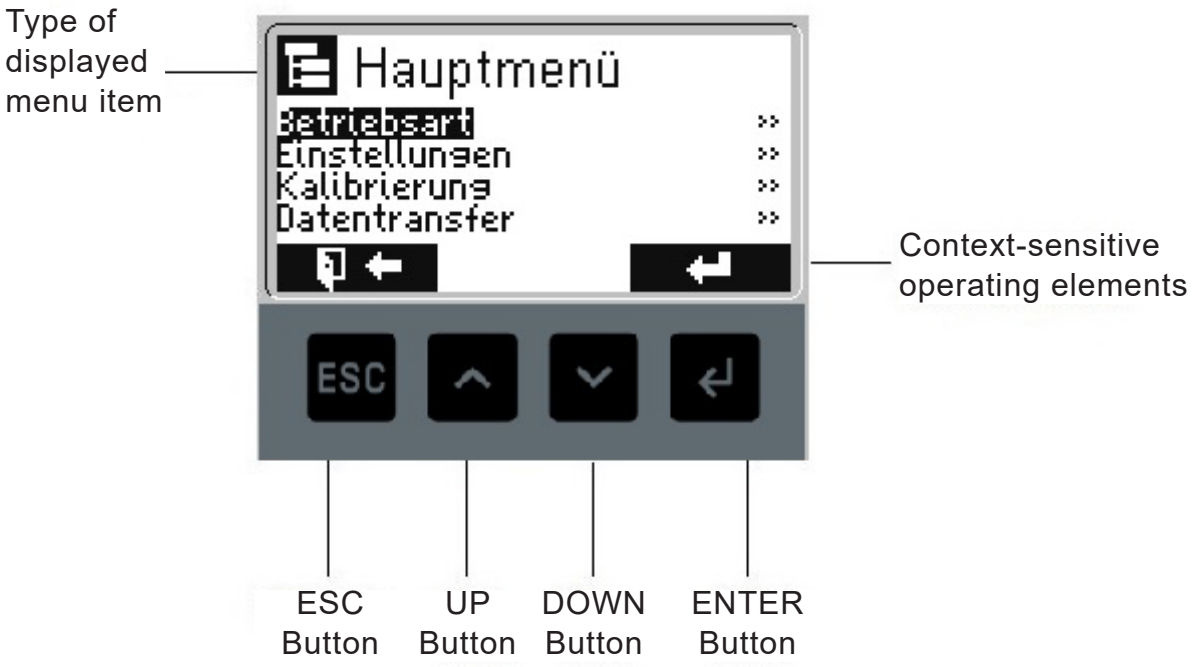
Shutdown, which requires decommissioning, is understood to mean a state in which the system is disconnected on both the water side and the voltage side. If the If the system remains con nected on the water side and the voltage side, it can also remain without preservation if a daily pause flush is programmed.

Information on preserving the system in the event of expected downtimes of > 30 days can be found in Chapter I - Preservation.

7. Control system

7.1 Main display, main menu

7.1.1 Main display (Main)



7.1.2 Context-sensitive menu elements

The display shows elements that are related to the current display content:


Main menu or submenu thereof


Input for logical parameter, setting with the **UP** or **DOWN** Buttons

Input for numerical parameters, set with the **UP** or **DOWN** Buttons, Advance with Enter


Factory setting for the parameter


Permissible range for the parameter

7.1.3 Context-sensitive operating elements

These elements appear in the display above the buttons to which they are assigned and chan ge from time to time because they are associated with certain menu contents:


Back without saving with **ESC** Button


Confirm entry with **Enter** Button

Acknowledge message with **ESC** Button

Call up the main menu with the **Enter** Button

Display messages from the scrolling display with the **ESC** Button

7.1.4 Buttons

The control panel has the following four buttons:

In the main menu, a submenu can be exited with the ESC Button without sa ving changes or the main menu can be exited completely.

The UP button is used to move upwards in menus. It is also used to change parameters: Numerical parameters → Press once = increase the value by 1. Logical parameters → Press once = select the logical alternative

The DOWN button is used to move downwards in menus. It is also used to change parameters: Numerical parameters → Press once = decrease the value by 1. Logical parameters → Press once = select the logical alternative

To enter numerical parameters, press the ENTER button once to navigate one position to the right. Finally, the ENTER button saves the value temporary and exits the relevant submenu. Note the „Save?“ prompt that appears later when exiting the menus.

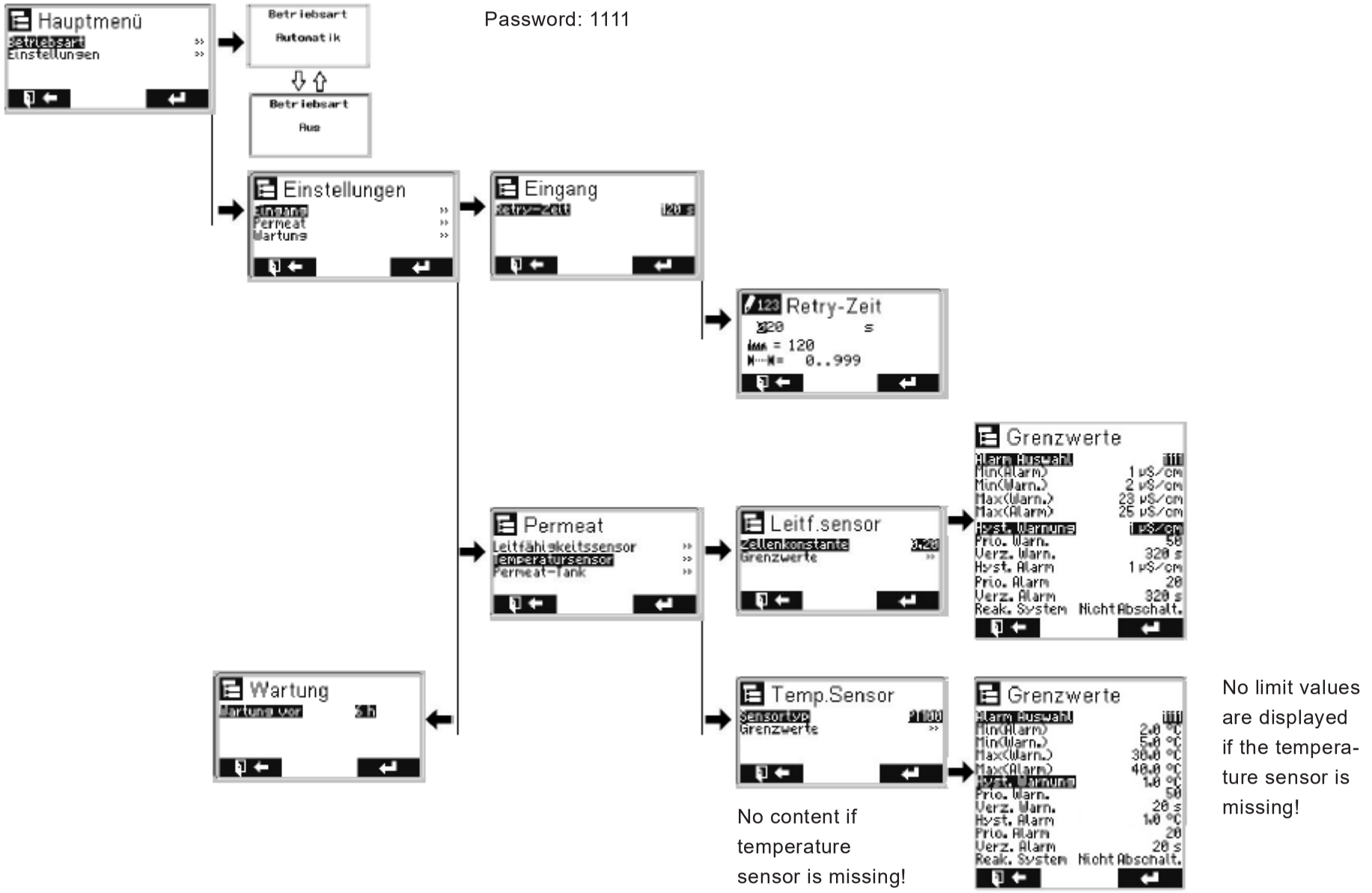
7.2 User menu

7.2.1 Overview

The user menu can be found on the following page. In the user menu, user-specific parameters can be changed to adapt the system function to the conditions in the system environment:

- Operating mode (OFF or automatic)
- Retry-time
- Lower and upper limit values for temperature and permeate conductivity
- Messages and system reactions when these limit values are reached

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


Hauptmenü
Betriebsart
Einstellungen
Betriebsart
Automatik
Betriebsart
Aus
Password: 1111
Einstellungen
Eingang
Permeat
Wartung
Eingang
Retry-Zeit
20 s
Retry-Zeit
320 s
= 120
0..999
Permeat
Leitfähigkeitssensor
Temperatursensor
Permeat-Tank
Leitf.sensor
Zellenkonstante
3.20
Grenzwerte
Grenzwerte
Alarm Auswahl
Min(Alarm) 1 µS/cm
Min(Warn.) 2 µS/cm
Max(Warn.) 23 µS/cm
Max(Alarm) 25 µS/cm
Hyst. Warnung 1 µS/cm
Prio. Warn. 50
Verz. Warn. 320 s
Hyst. Alarm 1 µS/cm
Prio. Alarm 20
Verz. Alarm 320 s
Reak. System Nicht Abschalt.
Wartung
Wartung vor 3 h
Temp.Sensor
Sensortyp Pt100
Grenzwerte
Grenzwerte
Alarm Auswahl
Min(Alarm) 2.0 °C
Min(Warn.) 5.0 °C
Max(Warn.) 30.0 °C
Max(Alarm) 40.0 °C
Hyst. Warnung 1.0 °C
Prio. Warn. 50
Verz. Warn. 20 s
Hyst. Alarm 1.0 °C
Prio. Alarm 20
Verz. Alarm 20 s
Reak. System Nicht Abschalt.
No content if temperature sensor is missing!
No limit values are displayed if the temperature sensor is missing!

7.2.2 Settings

7.2.2.1 Retry-time

Main menu → Settings → Input → Retry time

After input valve K1 opens, a short delay time (factory-set to 60 s) is active during which the pressure must build up. If no pressure has built up after this delay, input valve K1 is closed. After a set **retry-time*** has elapsed (factory setting 120 s), input valve K1 is opened again and checked once more to see whether pressure has built up. If the pressure has built up within the delay, the control unit switches to pump start-up. If the pressure has not built up again, the test for the inlet pressure is repeated until a maximum number of restart attempts (3 attempts are set at the factory) is reached, after which a **low pressure** alarm is triggered.

NOTE: Below you will find an example of how to navigate and set a parameter in the menu

You call up the user menu by entering the user password, select with  the entry Settings, then (Enter) Input, then (Enter) Retry-time:

Change the numerical value for Retry time using the cursor keys  !

7.2.2.2 Limit values, delays, hysteresis

Limit values, delays and **hysteresis** can be defined to trigger messages (warnings or alarms).

Main menu → Settings → Permeate → Conductivity sensor (or temperature sensor)

The Limit values submenu is explained below using the conductivity sensor as an example. The explanation applies in the same way to the temperature sensor if one is present.

Under **Alarm selection**, select whether a message should appear when a maximum value is exceeded or a message should appear when a minimum value is exceeded or not reached:

Current: Max (alarm) = 1 means: An alarm is displayed if the maximum conductivity is exceeded!

Select minimum limit values for a Min(Warn) warning or for a Min(Alarm) alarm and maximum limit values for a Max(Warn) warning or for a Max(Alarm) alarm in the event that these conductivity values are exceeded or not reached.

A delay delay, a **hysteresis hyst.** and a **priority prio.** can also be defined separately for each message (warning or alarm). Finally, it is also possible to define a **reaction of the React**. **System** reaction in the event of an alarm.

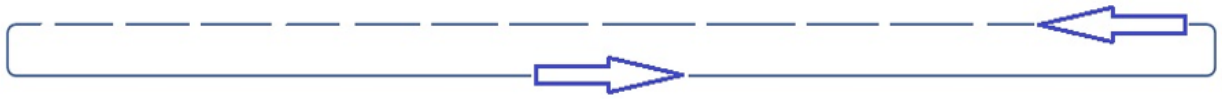
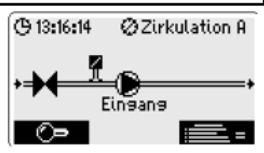
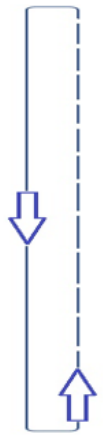
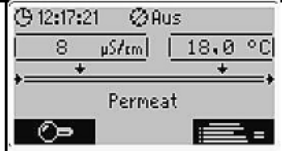
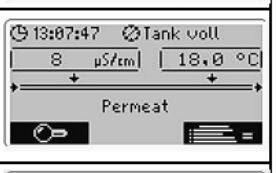
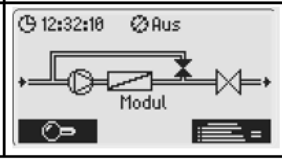
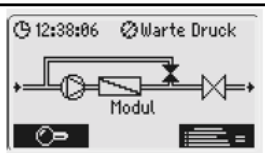
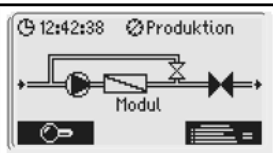
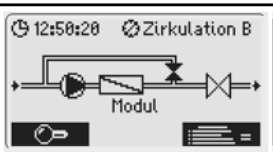
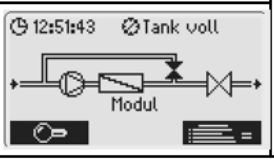
7.3 Rolling display

7.3.1 Uninterrupted operation

The scrolling display contains the current permeate conductivity in µS/cm, the temperature in °C, if a temperature sensor is present on the EC measuring cell, as well as the logical statuses of the up to three sensors connected to the inputs of the control unit Tank full ON/OFF and Input pressure ON/OFF.

All possible „operating states“ can be found in the following table.

Active system elements are displayed in black throughout, inactive elements are grayed out.

Operating mode:	OFF	Automatic process					Scrolling of the display
	System switched off						
Sequences	Operating states:	Pressure test	Circulation A	Production	Circulation B	Full tank	
Input							
Permeate							
Module							

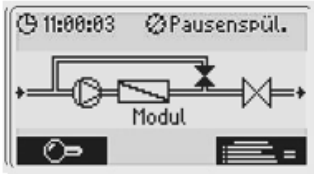
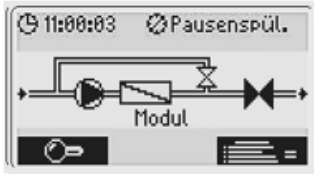
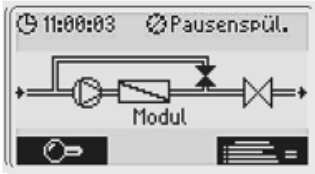
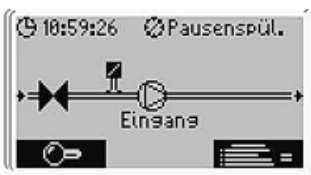
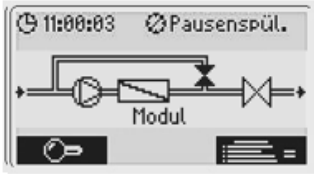
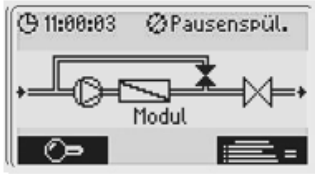
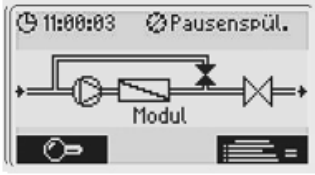
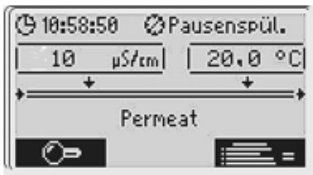
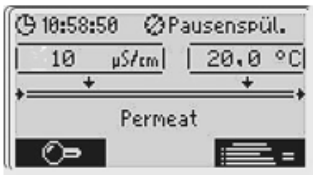
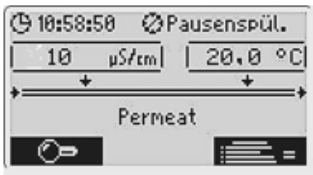
* **Pressure test**: If insufficient raw water pressure is detected after the **delay time** (factory setting: 10s), the inlet valve closes during the **retry-time** (factory setting: 120s). Only then is a new attempt at pressure detection made until the **maximum number of restart attempts** (factory setting: 3) is reached!

7.3.2 Displays during break flushing

The design of the tank (with or without overflow) determines whether the P-01 UO pump may be switched on during pause flushing (i.e. intermittent operation during production breaks due to a full tank). If the tank has an overflow, the HP pump P-01 is switched on and the ad ditionally produced permeate is drained via the overflow. If there is no overflow (as is the case when using a diaphragm pressure tank), the pause flush takes place without the P-01 UO pump being switched on.

HINT: The time displays in the example masks have no logical value, they have no meaning.

HINT: Systems of both AT+ series, the permeate tank without overflow setting is preset as standard. The following table contains the possible displays of the AT+ series for pause flushing:

Phases	Circulation A / Fault	Production	Circulation A / Displacement
Tank type	**Permeate tank with overflow**		
Input*			
Module			
Tank type	**Permeate tank without overflow**		
Input*			
Module			
Tank type	**Permeate tank without or with overflow**		
Permeat**			

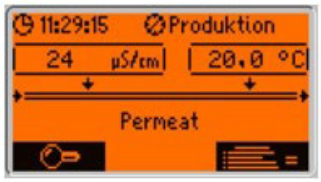
* The inlet pressure is monitored!

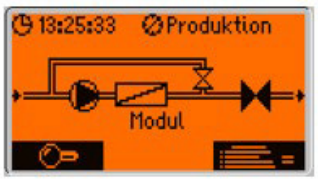
** No limit value monitoring for conductivity and temperature!

7.3.3 Disrupted operations

7.3.3.1 Coloring of the display

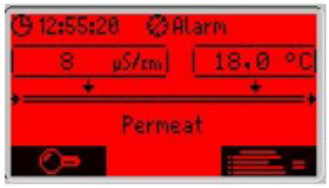
In the event of a warning, the background of the display appears completely orange.

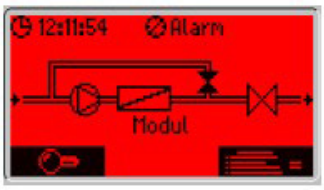




Call up the cause of the warning with the ESC button under the magnifying glass symbol! 

In the event of an alarm, the background of the display appears completely in red.





Call up the cause of the warning with the ESC button under the magnifying glass symbol! 

7.3.3.2 Possible warnings

Below you will find an overview of all possible warnings:

7.3.3 3 Uninterrupted operation

HINT: Depending on the selection of the „Reaction system“ parameter, production is stopped or not in the event of an alarm!

Below you will find an overview of all possible alarms:

HINT

Alarm acknowledgement if the cause of the alarm persists.
If an alarm whose cause has not been eliminated is acknowledged,
the alarm appears again when the delay time assigned to the alarm cause has expired.

7.4 Parameters

The control parameters must be set correctly on delivery from the factory in order to ensure a sensible control sequence. During commissioning or maintenance, the technician can use the following table to check whether the settings are correct and correct them if necessary or adapt them to a local situation that has changed in the meantime.

Settings	Submenu	Submenu	Submenu	Default value (for discrete value = bold)	Range
Input >>	Inlet valve >>	Contact type		**active=energized** / active=not energized	
	Pressure switch >>	Contact type		**occupied=active** / not occupied=active	
		Alarm >>	Delay	3 s	0 … 999 s
			Priority	20	0 … 99
			React. Message	**Alarm** / warning / info / none	
			React. System	**Fixed switch off** / switch off / N. switch off.	
	max. restart			3	0 … 99
	Delayed pressure build-up			10 s	0 … 999 s
	Retry-time			120 s	0 … 999 s
	UO-Pump >>	Contact type		**active=energized** / active=not energized	
Circulation >>	Configuration >>	Circulation		available / **not available**	
	Circulation time* >>			5 min	0 … 99 min
	Verz.* Permeate valve*>>			2 s	2 … 10 s
	Circulation alarm*>>	Max. Circulation time*		10 min	0 … 99 min
		Delay*		0 s	0 … 999 s
		Priority*		15	0 … 99
		React. Message*		**Alarm** / warning / info / none	
		React. System*		**Fixed switch-off** / not switch-off	
Permeate >>	Conductivity sensor >>	Cell constant		0,2	
		Limit values >>	Alarm selection	1 1 1 1	
			Min(Alarm)	1 µS/cm	0 … 999 µS/cm
			Min(Warn)	2 µS/cm	0 … 999 µS/cm
			Max(Warn)	23 µS/cm	0 … 999 µS/cm
			Max(Alarm)	25 µS/cm	0 … 999 µS/cm
			Hyst. Warn.	1 µS/cm	0 … 999 µS/cm

Settings	Submenu	Submenu	Submenu	Default value (for discrete value = bold)	Range
			Prio. Warn.	50	0 … 100
			Delay Warn.	320 s	0 … 999 s
			Hyst. Alarm	1 µS/cm	0 … 999 µS/cm
			Prio. Alarm	20	0 … 100
			Delay Warn.	320 s	0 … 999 s
			React. System	**Do not switch off /** switch off	
	Temperature sensor >>	Sensor type (autom. recognized)	**not editable!**	**Display of the detected sensor type**	
		Limit values >>	Alarm selection	1 1 1 1	
			Min(Alarm)	2 °C	0 … 99,9 °C
			Min(Warn)	5 °C	0 … 99,9 °C
			Max(Warn)	30 °C	0 … 99,9 °C
			Max(Alarm)	40 °C	0 … 99,9 °C
			Hyst. Warn.	1 °C	0 … 99,9 °C
			Prio. Warn.	50	0 … 100
			Delay Warn.	20 s	0 … 999 s
			Hyst. Alarm	1 °C	0 … 99,9 °C
			Prio. Alarm	20	0 … 100
			Delay Alarm	20 s	0 … 999 s
			React. System		
	Permeate tank >>	Sensor type		**Digital /** Analog	
		Tank full***		occupied=active / **not occupied=active**	
		Range**		**4…20 mA** / 0…20 mA	
		Current value tank empty**		19,00 mA	0 … 20 mA
		Current value tank full**		19,99 mA	0 … 20 mA

Settings	Submenu	Submenu	Submenu	Default value (for discrete value = bold)	Range
		Tank type		**without overflow** / with overflow	
		Debounce sensor***		3 s	0 … 99,9 s
		Tank full alarm >>	Delay	0 s	0 … 999 s
			Priority	20	0 … 100
			React. Notification	Alarm / warning / info / **none**	
			React. System	Fixed switch off / switch off / **N. switch off.**	
Forced stop >>	Contact type			**occupied=active** / not occupied=active	
	Alarm >>	Delay		5 s	0 … 999 s
		Priority		20	0 … 100
		React. Notification		**Alarm** / warning / info / none	
		React. System		**Fixed switch off** / switch off / N. switch off	
Parameter >>	Pause production			300 s	0 … 999 s
	Flushing interval			24 h	1 … 100 h
	Displacement time****			180 s	0 … 999 s
	Discard time			1 s	0 … 999 s
Rolling >>	Rolling time			4 s	0 … 999 s
Maintenance >>	Maintenance before				
	Maintenance completed? >>	**Execute=Enter!**		Resetting the maintenance timer	
	Maintenance (Warn)			1400 h	0 … 9999 h
	Maintenance (Alarm)			1500 h	0 … 9999 h
	Priority			0	0 … 99
	React. System			Shutdown / **N. Shutdown**	

*** Entry appears for systems with permeate valve for circulation = present**

**** Entry only appears for permeate tank >> Sensor type = Analog**

***** Entry only appears for permeate tank >> Sensor type = Digital**

****** For systems without permeate valve (circulation) Setting value = 180 s**

8. Faults and fault elimination

8.1 General instructions

The use of high-quality individual components and the built-in safety and monitoring equipment ensure a very high level of operational readiness.

Sollte dennoch eine Betriebsstörung auftreten, kann der Fehler anhand der nachfolgend aufgeführten Störungstabelle leicht erkannt und die Ursache beseitigt werden.

If serious faults occur, please contact the manufacturer (see rating plate).

WARNING!

Faults may only be rectified by qualified and trained specialist personnel in compliance with the safety regulations in chapter 1 of these operating instructions.
must be carried out!

The system must be disconnected from the power supply before starting work and secured against unintentional restarting!

All pipes must be depressurized.

8.1.1 Fault report to the manufacturer

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

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

8.1.2 Fault display and reset

- Fault message alarm as red display
- Please refer to the corresponding section in Chapter 7 - Control system to reset alarm messages from the control system!

8.2 Fault analysis and elimination

NOTE

Please read the following table with possible faults before contacting the manufacturer‘s contact the manufacturer‘s service department!

Fault/message	Possible causes	Troubleshooting
Display unlit	Mains supply interrupted	Establish mains supply
	Fuse 230VAC/6.3 AT defective	Fuse in question Replace
	Control defective	Replace control unit
Forced stop alarm display	Residual hardness sensor triggered (if present)	■ Check Soft water quality ■ Check sensor and replace if necessary
Low pressure alarm display, although pressure gauge indicates pressure in the permissible range	Feed water pressure too low	■ Check the pressure difference at the softener ■ Check feed water pressure
	Filter F-01 blocked	Replace filter cartridge
	Pressure switch PS-1 defective	Replace pressure switch
	Inlet valve K-1 defective	Replace valve
Display alarm LF Perm too high	Conductivity Feed water too high →Desalination rate too low	Check settings After consultation with the manufacturer: ■ Cleaning membrane modules ■ Replace membrane modules
System does not go into production (HP pump not running)	Tank full is displayed although Permeate tank is empty	Level sensor (level switch or alternative pressure switch) defective
	Display Production, but no permeate is produced	Pump defective
Permeate output too low	Feed water temperature too low	Permeate output according to chapter 1 Calculate
	Permeate back pressure too high	Permeate line at height, constrictions and shut-off device check
	Modules blocked	After consultation with the manufacturer: ■ Clean modules ■ Replace modules
	Pump makes grinding noises	Replace pump
Maximum circulation time exceeded	Permeate conductivity too high	Check settings After consultation with the manufacturer: ■ Cleaning membrane modules ■ Replace membrane modules
Message (yellow display) Warning Maintenance coming soon	Time for maintenance warning reached	Maintenance from the manufacturer request
Message (red display) Alarm Maintenance required	Time for maintenance alarm reached	Carry out maintenance at short notice
Display with incomprehensible, previously unknown content → System message	Initialization error	Inform manufacturer

9. Inspection and Maintenance

9.1 Inspection and maintenance work

9.1.1 Safety instructions

CAUTION!

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

Prior to all repair and maintenance work, the unit must be shut down and secured against unintentional start-up.

WARNING!

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

Suitable protective clothing appropriate to the hazard level in question must be worn while the maintenance work is being carried out.

Immediately after completion of the maintenance work, all safety and protective devices must be reattached and/or reactivated.

9.1.2 General instructions

NOTE

In order to ensure the proper operation and function of the unit 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 unit 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 in 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 units:

Parameter	Measuring point/Comments
Operating hours of the UO system	Control unit display/menu
Residual hardness in the feed water	Check with hardness test kit in the feed water
EC from feed water	Check with hand-held conductivity meter
Feed water temperature	Check with hand-held conductivity meter
Inlet pressure fine filter (if available)	Pressure gauge inlet pressure fine filter
Fine filter outlet pressure (if available)	Pressure gauge outlet pressure fine filter
HP pump pressure (if available)	Pressure gauge directly after HP pump
Operating pressure	Pressure gauge after throttling device HP pump
Concentrate pressure (if available)	Pressure gauge concentrate by module
Differential pressure Δp = Operating pressure - concentrate pressure	Calculate from the read values
Permeate output	Permeate flow meter
Concentrate output	Flow meter concentrate
Concentrate return (if available)	Flow meter concentrate return
Permeate conductivity	Control unit display
Permeate temperature	Calculation see chapter 1
Desalination rate of the UO system	display of the control unit or in a sample with a hand-heldConductivity meter
Tightness of the system	Calculation see chapter 1
Tightness of the system	Visual inspection of the pipes, fittings and fittings and screw connections

NOTE

Minor fluctuations in the performance 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.

WARNING!

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.

9.2.2 Operating protocol for reverse osmosis systems

Customer: _____
System type: _____
Order no.: _____
Commissioning on: _____

Measured variable	Unit	During commis-sioning	Date	Date	Date	Date	Date
Operating hours of the UO system	h						
Residual hardness in the feed water	°d						
EC from feed water	µS/cm						
Temperature of the feed water	°C						
Inlet pressure Fine filter (if available)	bar						
Outlet pressure Fine filter (if available)	bar						
HP pump pressure (if available)	bar						
Operating pressure	bar						
Concentrate pressure (if available)	bar						
Differential pressure Operating pressure Concentrate pressure	bar						
Permeate flow rate	l/h						
Concentrate flow rate	l/h						
Concentrate recirculation (if applicable)	l/h						
Permeate conductivity	µS/cm						
Permeate temperature	°C						
Desalination rate of the RO system	%						
Tightness of the system	-						

NOTE

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

9.3 Maintenance

NOTE

Maintenance work for the system must be carried out globally after 4000 operating hours (a maintenance message is issued) and separately for each system component as required, at the latest in accordance with the specified maintenance intervals or described situations (column „At the latest after Operating time or described. Situation“)!

9.3.1 Maintenance schedule for reverse osmosis systems

In the user menu, you can query the operating time remaining until the next maintenance (see Chap. 7 - Control system). The operating time is defined as times from „Production ON“, i.e. times during which the HP pump is running. The following maintenance work must be carried out by the by the manufacturer‘s service centre:

Plant section	**Work to be carried out**	**At the latest after operating time or described situation**
Fine filter	Replace filter cartridges * and clean filter housing *	■ 3 Months ■ with a pressure drop of 0.8 bar
Pressure switch	Function test by shutting off the feed water inlet → HP pump must switch off	■ 6 Months
Sensor hardness control unit * (if available)	Replace sensor with a reactivated or new sensor	■ 12 Months resp. ■ after triggering the sensor
EC measuring cell(s)	EC check with EC hand-held measuring device as reference device, recalibration if required	■ during commissioning ■ 12 Months ■ when changing the feed water quality
Filter mat * for Enclosure fan (if available)	Check degree of soiling and clean if necessary	■ 1 Months
	Replace filter mat	■ 6 Months
Rotary vane pump *, 230V/ 0.25 kW and 0.55kW (if available)	Replacing the pump	■ 8000 Operating hours
HP centrifugal pump * (if available)	Cleaning the fan	■ 8000 Operating hours
UO membranes *	Replacing the membranes	■ 3 Years or ■ if the demineralisation rate and permeate output have fallen by more than 15% compared to the commissioning values.

* Wear part

9.3.2 Operating protocol for reverse osmosis systems

Object			
Systems, series/object no.			
Order		Original order	
Date of use	Please enter date!	Service technician	

General review	Yes	Np
Even surface available	☐	☐
Inlet water quality checked	☐	☐
Inlet properly connected	☐	☐
Pump rotation direction checked	☐	☐
Permeate line properly connected	☐	☐
Reject line properly connected	☐	☐
Permeate quantity and reject quantity set according to specification	☐	☐
Pump pressure and concentrate pressure checked	☐	☐
Pre-pressure diaphragm pressure vessel set (only for types ED, EDF, CaRO ED)	☐	☐
Comparative measurement of conductivity carried out with hand-held EC meter	☐	☐
Desalination rate checked	☐	☐
Programming of the control unit checked according to specifications	☐	☐
Fault messages checked	☐	☐
Visual inspection of fittings, pumps, modules and pipework for leaks	☐	☐
Filter cartridges of the fine filter checked	☐	☐
Filter change carried out	☐	☐
Hardness control device available	☐	☐
Hardness control unit setting made and checked	☐	☐
Hardness sensor replaced	☐	☐
Report read out with Grundfos GO app and dongle (only for systems with Grundfos pump)	☐	☐
Floor drain and/or leakage monitoring available	☐	☐

Current measured values		Unit	Real value
Measured values	Total hardness before UO	°dH	
	Conductivity	µS/cm	
	Temperature	°C	
	Pressure fine filter input	bar	
	Pressure fine filter output	bar	
	Permeate conductivity	µS/cm	
	Pressure pump	bar	
	Pressure concentrate	bar	
	Permeate pressure	bar	
	Permeate quantity	l/h	
	Concentrate quantity	l/h	
Calculated values	Volume flow feed	l/h	
	Yield	%	
Switching cycle	Switching pressure On	bar	
	Switching pressure Off	bar	
	Pre-pressure diaphragm pressure vessel	bar	
	Limit value EC max. permeate	µS/cm	
Consumption data	Operating hours	h	
	Meter reading input raw water	m³	
	Permeate meter reading	m³	

Comments

_____
_____
_____
_____
_____

10. Preservation

10.1 General instructions

NOTE

If the system is shut down for more than 30 days, the system must be preserved. If the system is out of operation for a longer period: The preservation must be rinsed out after 3 months at the latest and replaced if necessary.

The system is recommissioned in accordance with chapter 5 of these operating instructions. Preservation is carried out with the system switched off.

Please observe the system diagram for preservation according to chapter 10.4!

WARNING!

The preservative solution contains 1.5% sodium bisulphite and 2.5% sodium bicarbonate and, in the antifreeze variant, an additional 20% glycerine. Preservative solution is discharged into the sewerage system in accordance with the applicable discharge regulations.

10.2 Preparation for preservation

10.2.1 Preservation options

- Sodium metabisulphite + sodium bicarbonate without additives:
  Preservation without antifreeze
- Sodium metabisulphite + sodium bicarbonate with added glycerine:
  Preservation with frost protection down to -10°C
- Ready-to-use preservative with antifreeze

10.2.2 Required material

- Preservation container with drain valve
- 3 connection hoses
- Chemicals for preservation: sodium metabisulphite, sodium bicarbonate and glycerine
- Protective clothing (goggles, gloves, apron)

10.2.3 Connecting the preservation container

- Switch off the UO system
- Close the feed water inlet

10.2.3.1 Systems without special flushing connections

- Raise the preservation container above the system to ensure that the preservative solution can flow properly into the UO system
- Close the drain valve on the preservation container

- Separate the permeate and reject lines on the UO system
- Establish a hose connection between the preservation container and the reject outlet of the UO system
- Establish a hose connection between the preservation tank and the permeate outlet of the UO system

10.2.3.2 Systems with special flushing connections (optional)

NOTE

The special rinsing connections (only available as an option) with 3-way changeover valves for quickly establishing a preservation circuit are located in the feed water line, permeate line and reject outlet line.

- Raise the preservation container above the system to ensure that the preservative solution can flow properly into the UO system
- Close the drain valve on the preservation container
- Connect the drain of the preservation tank to the rinsing connection in the inlet of the UO system
- Connect the hose between the preservation tank and the rinsing connection in the reject outlet line
- Connect the hose between the preservation tank and the flushing connection in the permeate line

10.2.4 Preparing the preservative solution

DANGER!

Risk of chemical burns!

When handling the preservative chemicals, the general accident prevention accident prevention regulations and the information in the respective safety safety data sheet must be observed!

Wear protective clothing when pouring the chemicals into the preservation container: Safety goggles, rubber gloves and rubber apron.

- Depending on the size of the system, add soft water to the preservation tank according to the table at the end of the section.
- Check connections for leaks.
- Add sodium bicarbonate (NaHCO3) to the water provided according to the table and dissolve while stirring. dissolve while stirring.
- Add sodium bisulphite (NaHSO3) according to the table, in portions, stirring constantly to avoid foaming.
- If frost protection is required: Add glycerine according to the table while stirring and stir until uniform.
- Alternatively, pour a ready-to-use preservative with antifreeze into the flushing tank.

NOTE

Slowly add the chemicals to the water, stirring constantly.

Composition of the preservative solution

Permeate output of the system (l/h)	**Soft water template** (l)	**Sodium bisulphite powder** (kg)	**Sodium bicarbonate** (kg)	**Glycerine** (l)
Conc. only chemical		97%		86,5%
Concentration Chemical in preservative solution		1,5% w/w	2,5% w/w	20% v/v
20-80	10	0,20	0,32	2,9
100-500	20	0,39	0,63	5,8
550-1500	50	0,97	1,6	14,5
1550-3500	100	1,93	3,1	29,0
3550-9500	200	3,87	6,25	58,0
9550-12000	250	4,84	7,8	72,5
12050-17000	300	5,80	9,4	87
17050-20000	400	7,74	12,5	116
20050-30000	500	9,67	15,6	145

WARNING!

The pH value of the preservative solution is approx. 7.

10.3 Carrying out the conservation

- Close the feed water inlet
- Switch the control unit to „Switched off“ operating mode
- Fully open the concentrate control valve and pressure control valve
- Move the 3-way ball valves to the „Flush“ position*
- Open the drain valve on the preservation container
- Set the control unit to „Cleaning“ or „Preservation“ mode
- Alternatively: Switch the UO system to an operating mode in which the monitoring by connected sensors is switched off or (if such an Boperating mode is not provided) disconnect connected sensors (forced stop, input pressure, level) and, depending on the function, provide the inputs with wire jumpers or leave them open so that undisturbed production is established (see operating instructions of the control system).

WARNING!

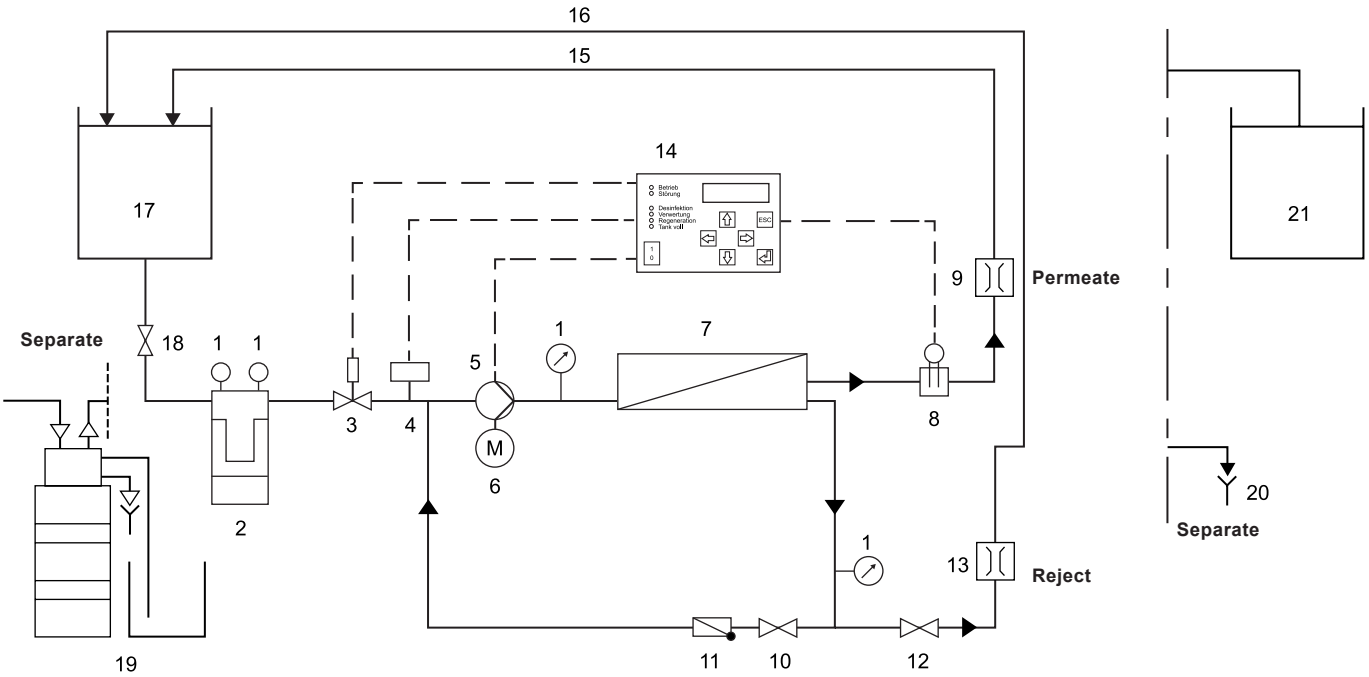
The system runs without any safety devices. Avoid dry running of the HP pump.

- Allow the preservative solution to circulate for 10 minutes
- Switch off the control unit
- Close the drain valve on the preservation container
- Set the 3-way ball valves to the „Operation“ position*
- Disconnect hose connections
- Seal the feed water inlet, permeate and concentrate outlet with sealing discs
- Dispose of any preservative solution remaining in the preservative container (see section „General information“)

*Only for systems with special flushing connections

10.4 System diagram for preservation

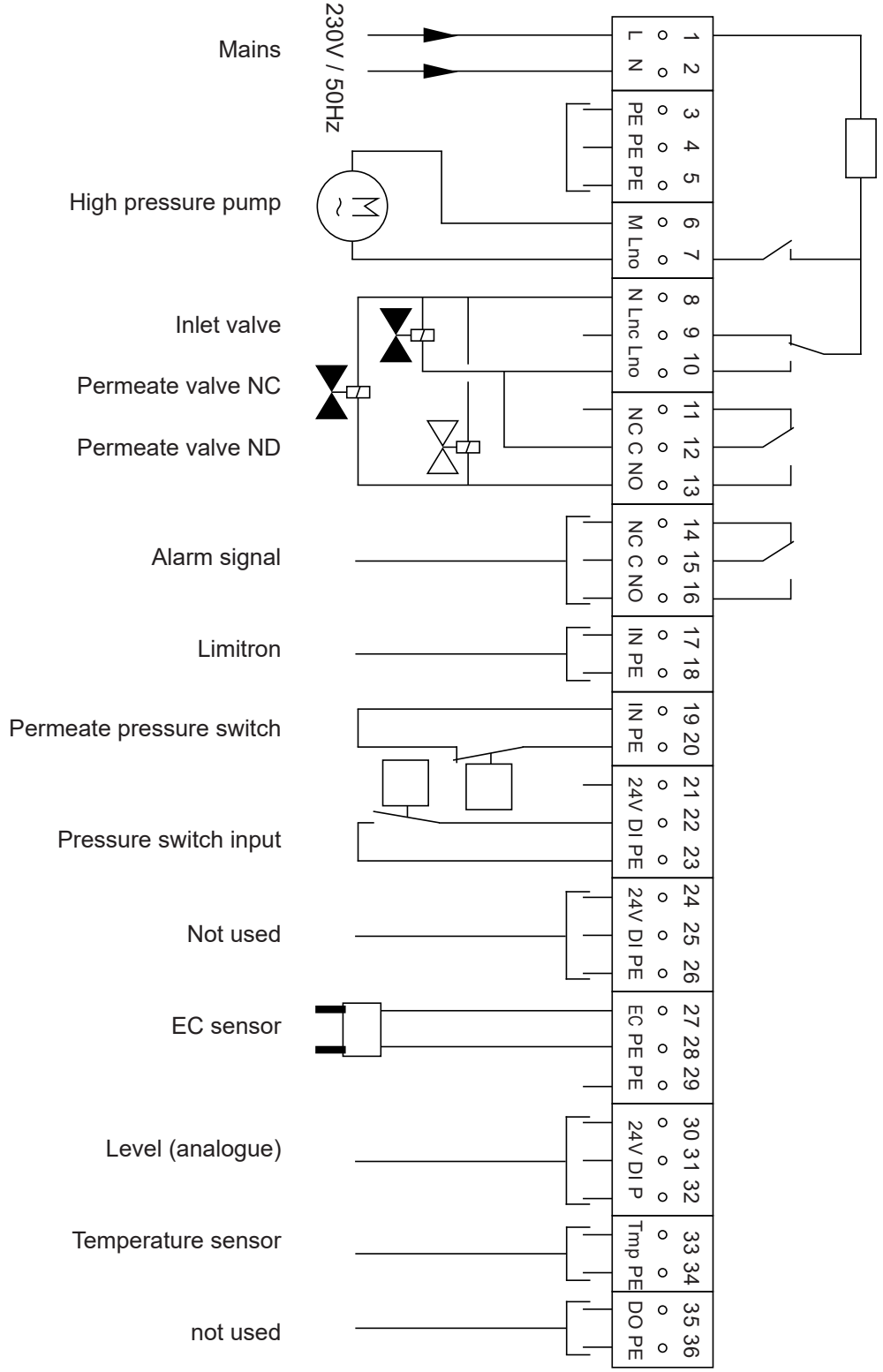
1 - Pressure gauge
2 - Fine filter
3 - Solenoid valve
4 - Pressure switch
5 - Pump
6 - Motor
7 - Membrane module
8 - Measuring cell
9 - Flow meter (permeate)
10 - Pressure control valve
11 - Non-return valve
12 - Concentrate control valve
13 - Flow meter (reject)
14 - Control unit
15 - Permeate
16 - Reject
17 - Preservation tank
18 - Drain valve
19 - Softener
20 - Sewer connection
21 - Permeate tank



11. Circuit diagram

11.1 Switch box

See below for a picture of the terminal strips in the control box (230 V and 400 V).



A detailed electrical circuit diagram of the connection box (400V) with the internal wiring can be found on the following pages.

11.2 Dimensional drawings

Condair AT+80 Permeate valves

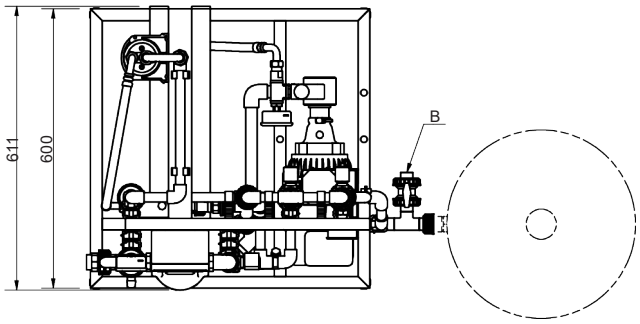
Connections:

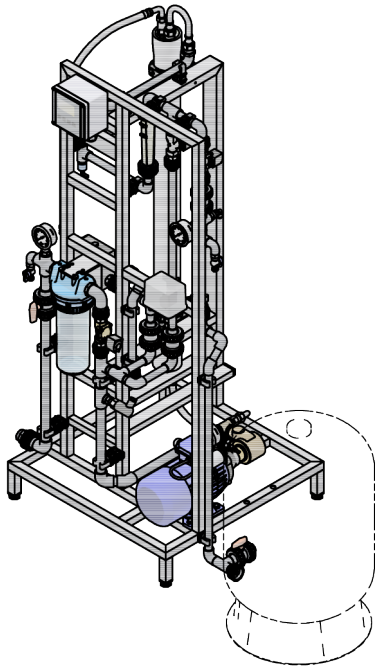
A=Inlet (PVC Ø25mm)
B=Permeate (PVC Ø20mm)
C=Waste water (PVC Ø20mm)

Electrical connection:

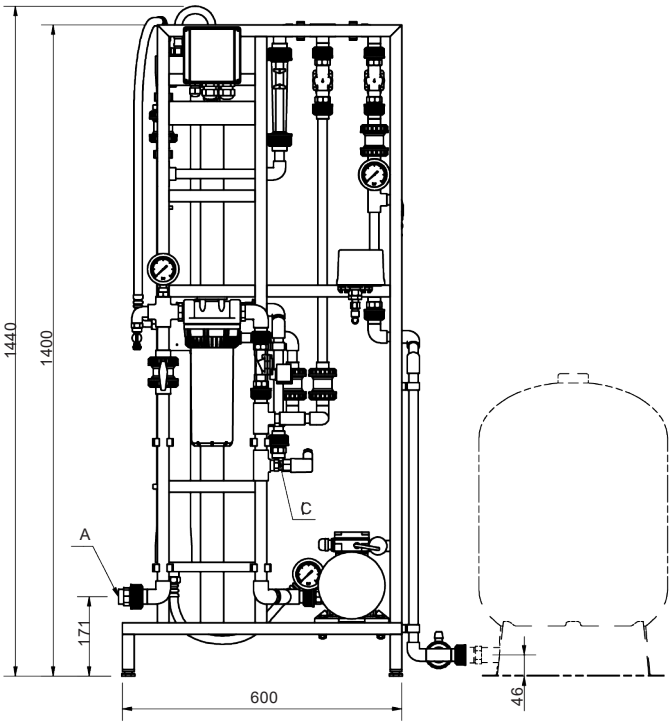
230V. 50Hz

Top view





Front view



Condair AT+15 Permeate valves

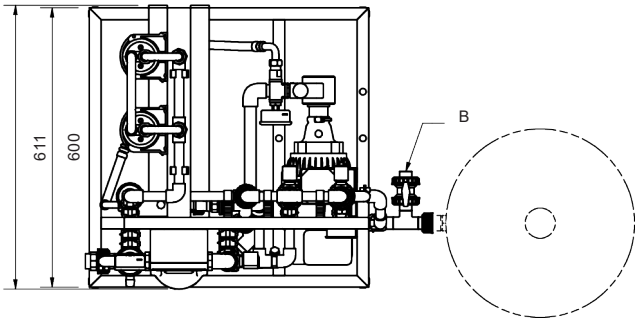
Connections:

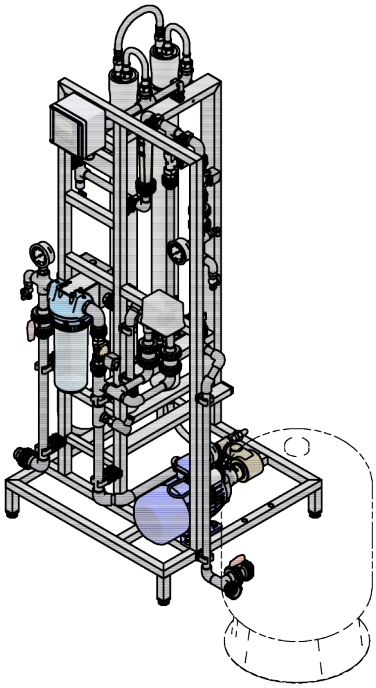
A=Inlet (PVC Ø25mm)
B=Permeate (PVC Ø20mm)
C=Waste water (PVC Ø20mm)

Electrical connection:

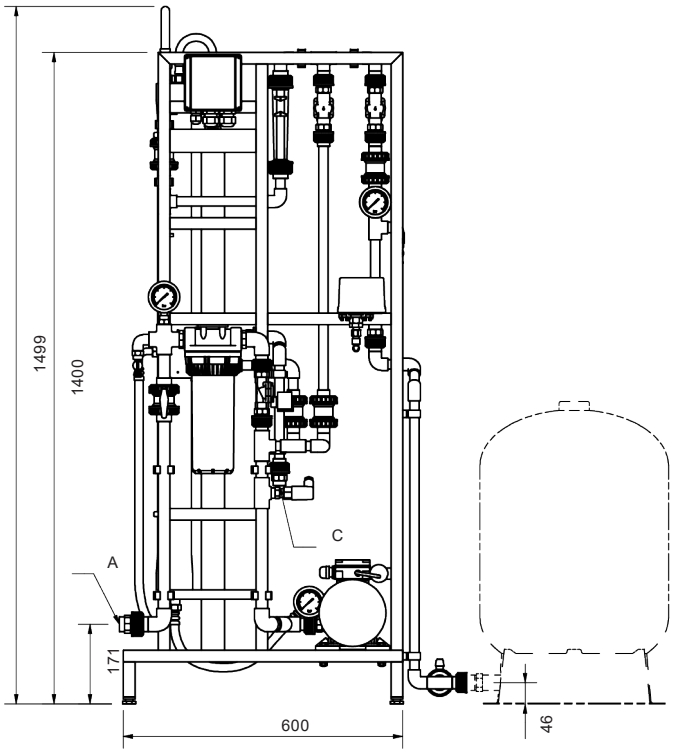
230V. 50Hz

Top view





Front view



Condair AT+30 Permeate valves

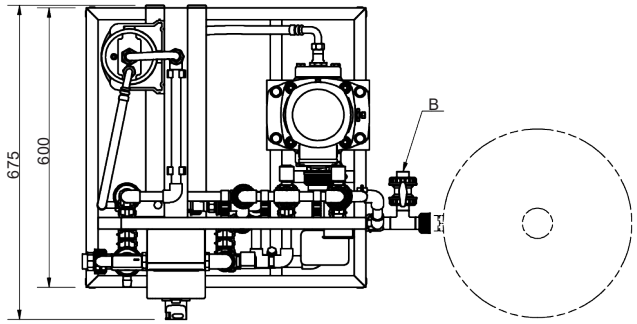
Connections:

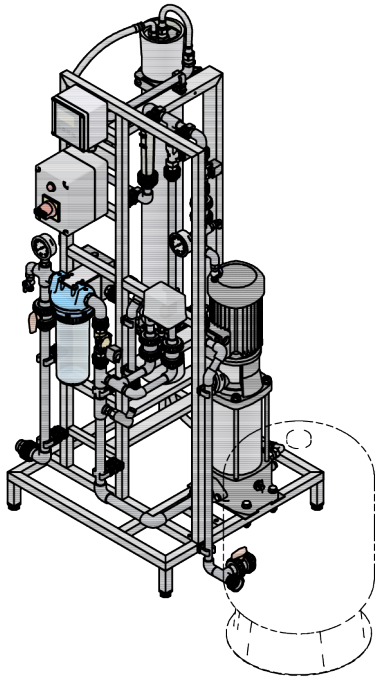
A=Inlet (PVC Ø25mm)
B=Permeate (PVC Ø20mm)
C=Waste water (PVC Ø20mm)

Electrical connection:

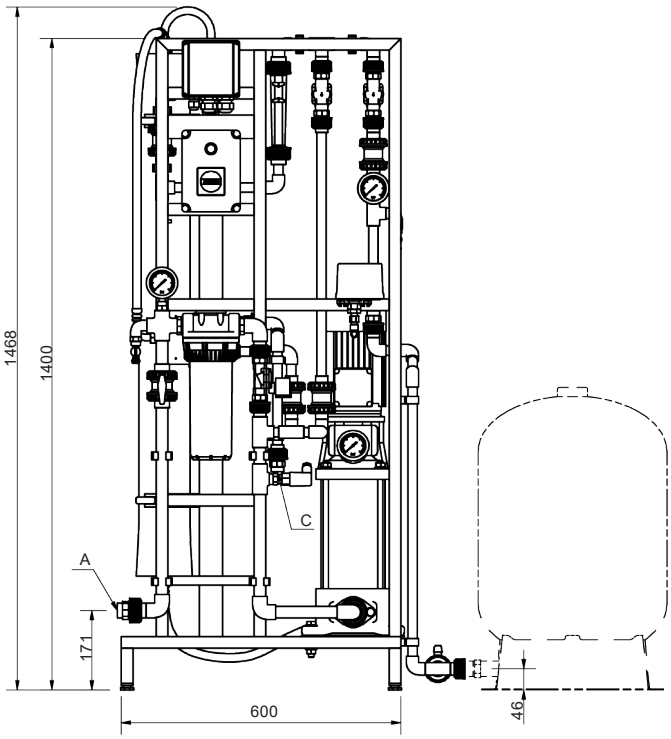
3x400V. 50Hz.

Top view





Front view



Condair AT+55 Permeate valves

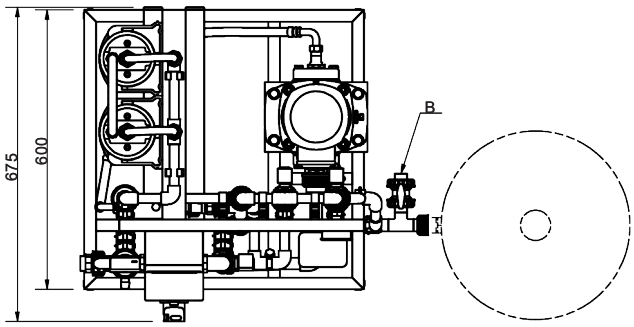
Connections:

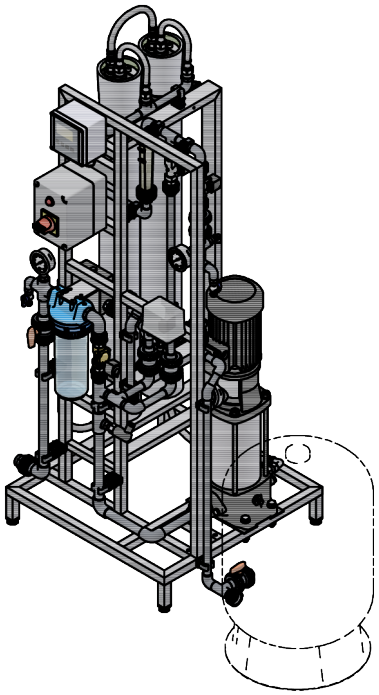
A=Inlet (PVC Ø25mm)
B=Permeate (PVC Ø20mm)
C=Waste water (PVC Ø20mm)

Electrical connection:

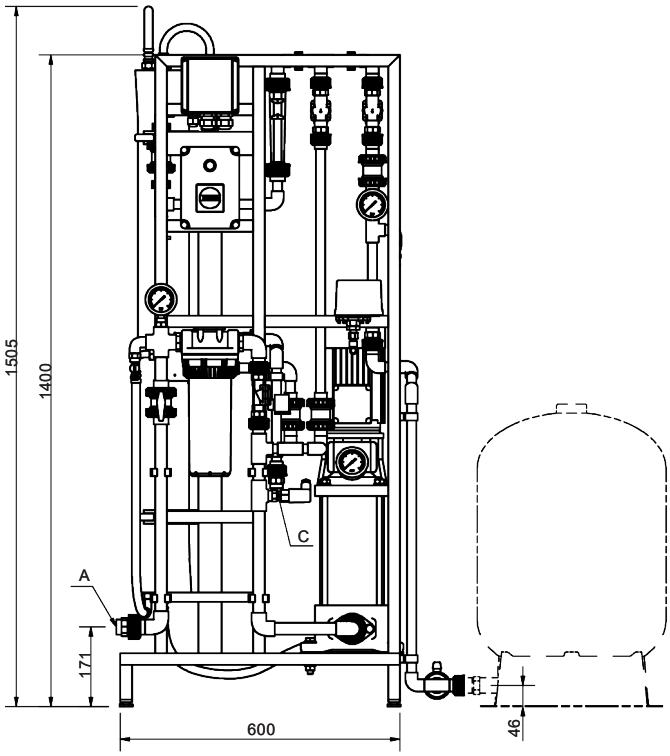
3x400V. 50Hz.

Top view





Front view



Condair AT+80 Permeate valves

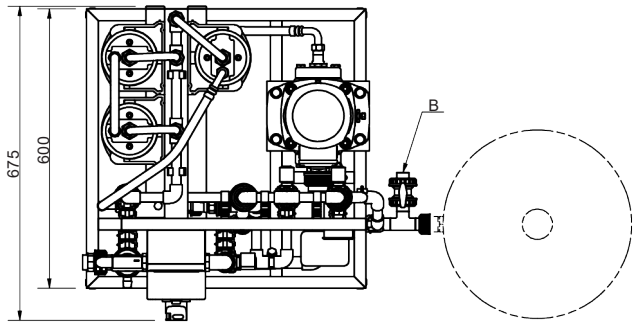
Connections:

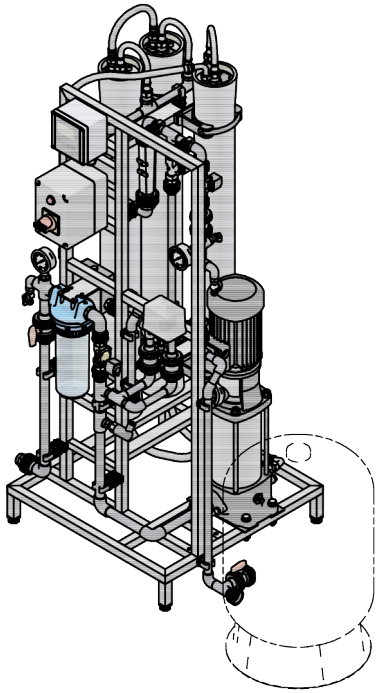
A=Inlet (PVC Ø25mm)
B=Permeate (PVC Ø20mm)
C=Waste water (PVC Ø20mm)

Electrical connection:

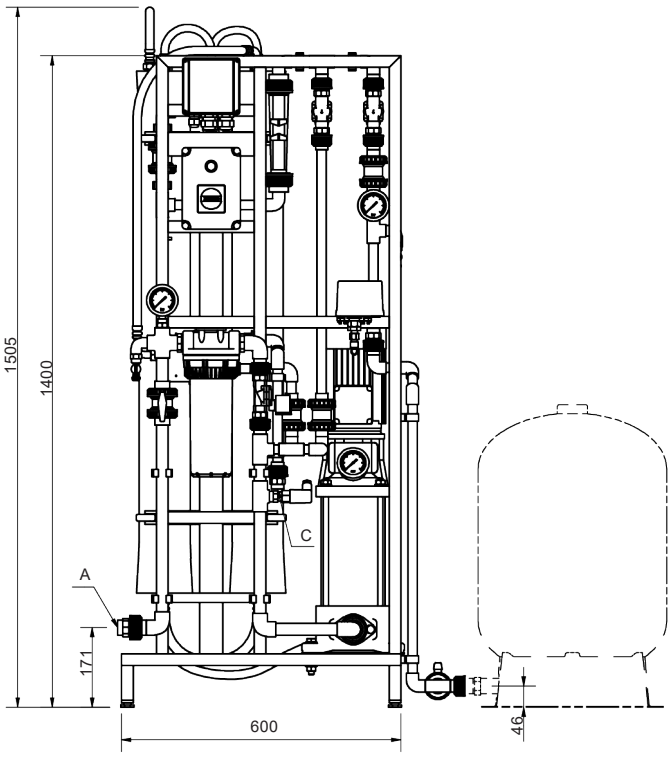
3x400V. 50Hz.

Top view





Front view



Condair AT+100 Permeate valves

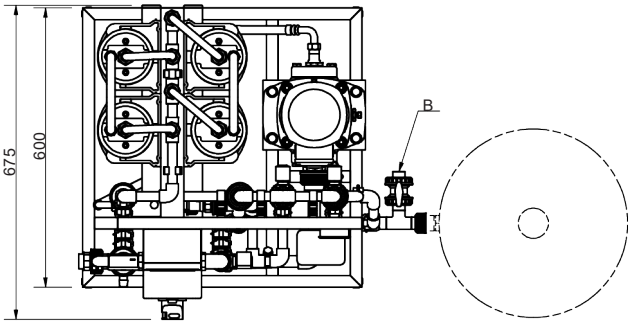
Connections:

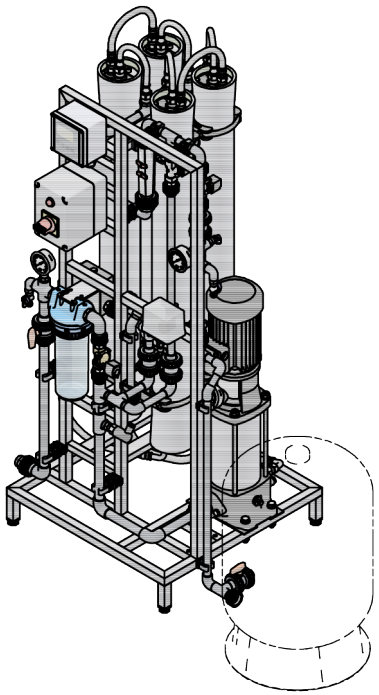
A=Inlet (PVC Ø25mm)
B=Permeate (PVC Ø20mm)
C=Waste water (PVC Ø20mm)

Electrical connection:

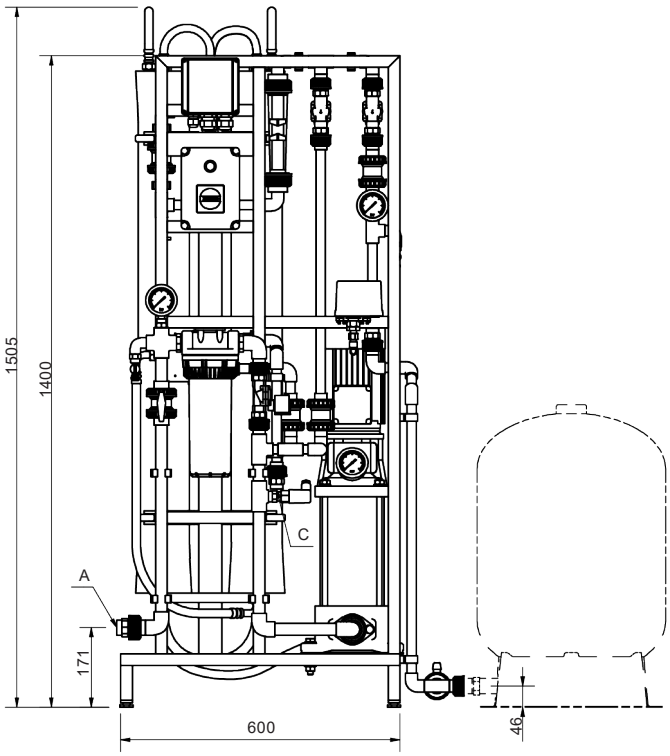
3x400V. 50Hz.

Top view



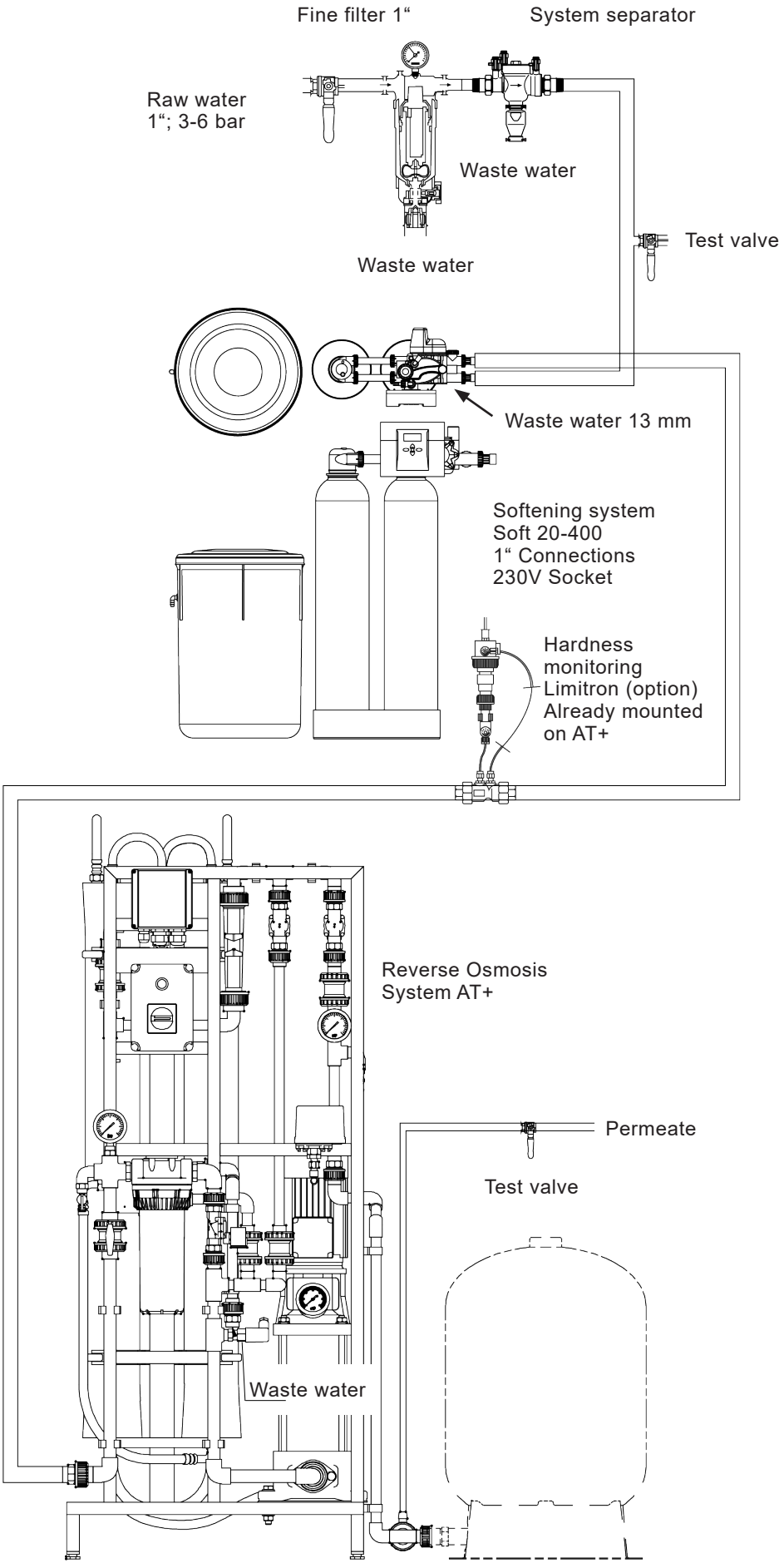


Front view



12. Attachment

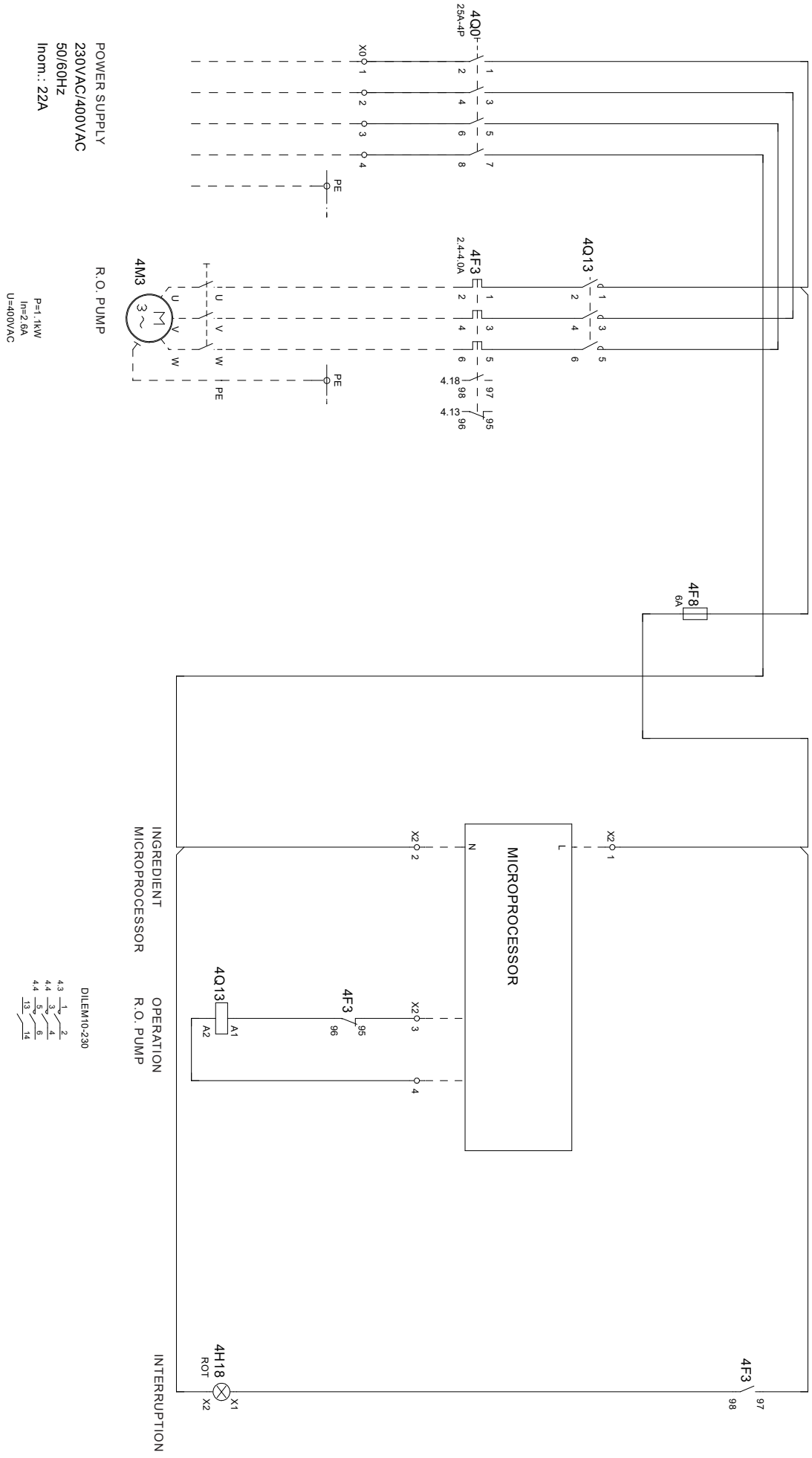
12.1 Assembly structure (diagram)



General:	
Terminal block code:	
X0	Power supply 230/400VAC
X1	Main current 230/400VAC
X2	Control current 230VAC
X3	Control current max. 50VAC/50VDC
X4	Sensor/analogue and digital input
X6	External (special) voltage
■ If a power supply (voltage) is required when the sensor is active, the sensor determines the terminal control code (X4) ■ If a power supply (voltage) is required for corrections equipment, the power supply determines the terminal row code (X3)	

General:		
Used wire colours:		
Main stream 230/240VAC	Phase L1, L2, L3 Zero Earth	Black Blue Green/Yellow
Control current 230VAC	Phase Switching wire Zero Earth	Brown Black Blue Green/Yellow
Control current max. 50VAC	Phase Switching wire Zero	Orange Orange White
Control current max. 50VDC	Phase Switching wire Zero	Red Red White
Rule Devices	Sensor / Analogue input Digital input	Grey Red
Rule Devices	Correction apparatus Analogue output	Violet
External voltage	Potential-free contact	Transparent

12.3 Main current / control current



12.4 X0

Name	Con-nection	External lower part	X0	Bridge	Page/ Path
Power supply 230VAC/400VAC 50/60Hz Inom: 22A			1		4.0
=			2		4.1
=			3		4.1
=			4		4.2

PE CLAMP = EARTH

12.5 X2

Name	Con-nection	External lower part	X2	Bridge	Page/ Path
Microprocessor power supply		L	1		4.11
=		N	2		4.11
Operation R.O. Pump			3		4.13
=			4		4.14

PE CLAMP = EARTH

Quantity	ODK	Type designation	Manufacturer	Type designation
1	4Q13	DILEM10-230	MOELLER	Contactor 4kW 3P1no 230VAC
1	4H18	M22-A	MOELLER	Fixing adapter
1	4H18	M22-CLED230-R	MOELLER	LED frontm. 85-264VAC red cage
1	4H18	M22-L-R	MOELLER	Signallamp IP67 red
1	4Q0	OHYS2AJ		
1	4Q0	OT25FT4N2		
1		SABP131815GE	ENSTO	Polyester enclosures 125x175x150mm
4	X0	WDU2.5	WEIDMUELLER	Terminal 2.5qmm
4	X0	WDU4	WEIDMUELLER	Terminal 4qmm
2	X0	WPE 4	WEIDMUELLER	Earth terminal 4qmm
1	4F8	WSI 6	WEIDMUELLER	Fuseterminal WIP 6qmm 6.3A PA
1	4F3	ZB32-4.0	MOELLER	Overload relay 2.4-4.0 DILM17-32
1	4F3	ZB32-XEZ	MOELLER	Bracket for overload relay ZB32

Notes

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If you have any questions regarding this documentation, please contact the head office in Germany.

Condair GmbH

Regional Centre **South**
Parkring 4
D-85748 Garching
Phone +49 (0) 89 / 20 70 08-0

Regional Centre **South-West**
Zettachring 6
D-70567 Stuttgart
Phone +49 (0) 711 / 25 29 70-0

Regional Centre **Central**
Nordendstraße 2
D-64546 Mörfelden-Walldorf
Phone +49 (0) 61 05 / 963 88-0

Regional Centre **West**
Münsterstraße 246
D-40470 Düsseldorf
Tel. +49 (0) 211 / 54 20 35-0

Regional Centre **North**
Lüneburger Strasse 4
D-30880 Laatzen - Rethen
Phone +49 (0) 511 / 51 54 13 11

Regional Centre **East**
Chausseestrasse 88
D-10115 Berlin
Phone +49 (0) 30 / 921 03 44-0

Condair **Austria**
Perfektastrasse 45
A-1230 Vienna
Phone +43 (0) 1 / 60 33 111-0

Condair GmbH
Branch office Garching
Parkring 3, 85748 Garching
Phone +49 (0) 89 20 70 08-0, www.condair.de