Operating Instructions

Reverse-Osmosis-System

UO 120/ 300/ 500

CE

Translation of the original instructions

Overview of Contents

Appendix

Imprint

Contents of Chapter A

1 Notes on using the Operating Instructions

Purpose:

The Operating Instructions are intended for users of the system and contain information on how to operate and maintain the system safely and reliably.

Availability:

The Operating Instructions must always be available at the place where the system is in use.

Subdivision:

The Operating Instructions consist of a number of chapters named by letters of the alphabet. An outline of all the chapters appears on Page 1.
The header and page numbering, along with the letter identifying each chapter, make it easier for you to orient yourself.
For information on the content of a specific chapter, please refer to the contents on the first page of that chapter.

Conventions/abbreviations:

OI	Operating Instructions
TD	Technical Documentation
RO	Reverse Osmosis
Permeate	Product water resulting from RO
Product	Product water from the UP system
CY	Conductivity
-	Enumerated items
☞	Steps to be performed

2 General safety information

2.1 Explanation of symbols and references

This symbol refers to an immediate danger that threatens the safety and life of persons. Failure to observe these notices will have severe consequences on health and safety, including life-threatening injuries.

This symbol refers to a possible danger that threatens the safety and life of persons. Failure to observe these notices may have severe consequences on health and safety, including life-threatening injuries.

This symbol refers to a possibly hazardous situation.
Failure to observe these references may result in minor injuries and/or damage to property.

This symbol points out important information for working with the system in a proper manner. Failure to observe these references may result in malfunctions in the system or disturbances in the environment.

2.2 Additional safety requirements

Country-specific requirements, standards and regulations must be observed.

2.3 Usage in accordance with intended purpose

The RO-system is used to desalinate softened water. The system must only be operated with water supplied in accordance with the quality described in Chapter C and the operating parameters specified there.
The system must not be operated unless it is in proper working order. Any malfunctions must be rectified immediately.

2.4 Operating staff

Only persons who have read and understood these Operating Instructions are permitted to operate the system. When operating the system, it is particularly important to observe the safety information strictly.

2.5 Residual dangers

Water damage

To avoid accumulation of spills caused by leaks, the area in which the system is set up must be equipped with a floor drain and/or a leak monitoring system and corresponding alarm.

Electrical shock

Do not touch electrical components with wet hands.
Before performing tasks on parts of electrical system, disconnect the system from electrical power supply.

Mechanical force

Parts of the system are under excess pressure of up to 25 bar (g). Release the pressure from the system before repairs and maintenance tasks.

Hygiene-critical applications

Danger of contamination of system components due to non sufficient execution of cleaning / disinfection of the unit.

Adhere to the information provided regarding cleaning and disinfection.

2.6 Bringing the system to a stop in the event of an emergency

- ☞ Turn off the main switch
- ☞ Shut off the water supply

After remedying the damage:

- ☞ Open the water supply
- ☞ Turn on the main switch

2.7 Safety information for maintenance task

The operator must take pains to ensure that all maintenance, inspection and assembly tasks are performed by authorized and qualified professionals who have been sufficiently informed for the task at hand by thoroughly studying the Operating Instructions. These tasks must be properly performed by professionally trained staff member.

The system must be shut down and protected from being placed in operation again unintentionally before all repair and maintenance tasks. It is absolutely essential to observe the procedure described in these Operating Instructions for shutting down the system.

Before beginning tasks on the electrical equipment of the system, a check must confirm that power has been disconnected from the corresponding section of the system. In addition, the system must be secured to prevent it from being turned on again unintentionally.

Protective clothing suitable for the hazard at hand must be worn while performing the task. Immediately after the maintenance tasks are completed, all safety and protective equipment must be set back in place and functionality restored

2.8 Disposing of system parts and operating materials

When they need to be discarded, system parts must be disposed of according to local requirements including separately, if so required.

2.9 Unauthorized conversion and manufacturing replacement parts

Conversion or modification of the system is only permitted with the approval of the manufacturer. The same applies to making changes in the programming for the control system. Original replacement parts and accessories authorized by the manufacturer enhance safety. Use of other parts will void the warrantee.

2.10 Warrantee claims and liability

This product corresponds to the state of the art and was designed and manufactured in accordance with applicable rules of the technology, after which it was subjected to a quality control process.
If there should nevertheless be any grounds for complaint, please direct requests for replacement to the manufacturer of this product in accordance with the general terms and conditions of sale and delivery.

3 Basic principles of reverse osmosis systems

3.1 The principle of reverse osmosis

Osmosis is a process on which nearly all natural metabolic processes are based. If two solutions of varying concentrations are separated in a system by a semipermeable membrane, the solution with the higher concentration will always have a tendency to become more diluted. This process (osmosis) will continue until osmotic equilibrium is achieved.

In the process of reverse osmosis, the direction of the osmotic flow is reversed. To achieve this, pressure must be exerted on the concentrated solution. This pressure must be considerably greater than the osmotic pressure that arises due to the natural balancing of differing concentrations.

Synthetic membranes are used in water treatment systems that work on the principle of reverse osmosis. These membranes are permeable for water molecules. The content materials dissolved in the water are held back by the membranes. High pressure causes the concentrated solution (for example drinking water or process water) to flow through these membranes. The result is a separation of this solution into a partial flow with water in which the content materials that are held back are located (concentrate).

3.2 Calculation equations

$$\textbf{Yield [\%]} = \frac{\text{permeate output}[l/h] \bullet 100\%}{\text{feed water input}\,[l/h]}$$

feed water input = Permeate output + concentrate output

$$\textbf{Concentrate output [l/h]} = \frac{\text{permeate output}[l/h] \bullet 100\%}{\text{yield}\,[\%]} - \text{permeate output}\,[l/h]$$

$$\textbf{Desalinization rate [\%] = [1-}\frac{Cy_{\text{permeate}}}{Cy_{\text{raw water}}}\textbf{]} \bullet 100\%$$

3.3 Dependencies of permeate output

The permeate output of the system depends on the particular feed water parameters like temperature, feed water pressure and salinity and thus may be lower.
The nominal output specified in the technical data (chapter C) refers to the corresponding design parameters.

Generally, when adjusting the unit, do not exceed max. permeate output and do not underrun min. amount of concentrate.

In addition the following applies to units with permeate output ≥ 600 l/h; do not underrun min. amount of concentrate recirculation.

In addition the following applies to units with permeate output of 120 - 500 l/h; do not exceed max. pump pressure.


Danger

If the system is operated at a higher feed water temperature than the design temperature; do not to exceed the maximum permeate output that is specified in the technical data (chapter C)!

3.4 Conductivity of first permeate

After switching on the RO system, permeate with high conductivity is produced for a short time. Therefore, assure that during the system design of the peripheral systems engineering a minimum running time of the RO system of at least 30 min per shifting process is guaranteed.

Transport and Storage

Units have to be transported in upright position and in its original packaging.

All units must be secured against slipping and falling over during transport!

The transport weight corresponds to the empty weight. For transport weights, please refer to the Technical Data in Chapter C.

Prior delivery, units are filled with preserving- and antifreeze mixture. Antifreeze agent is effective down to -10° Celsius. The unit can be damaged by frost. Because of this, the unit must be protected against frost and freezing during transport and storage.

The min. /max. storage temperature is 0 - 40°C.

The maximum storage duration for the units in their original packing is 12 months at 20 °C. After that, the preservative fluid must be rinsed out and replaced if necessary.

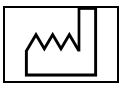
Contents of Chapter C

1 Rating plate

The rating plate is located on the system. It contains information on the current system and the particular installed options.
To ensure fast and problem-free processing of warrantee claims, technical information or customer service, be sure to indicate the system type, item number and manufacturing number.

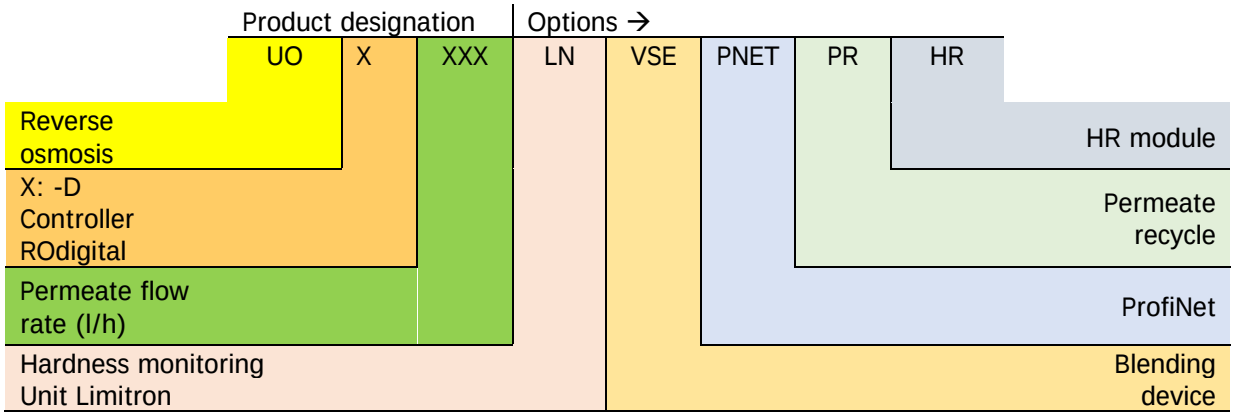
1.1 Rating plate specifications

Specifications and pictograms on the rating plate of the system:

	Pictogram and / or Specification
☞ CE-marking	
☞ Type designation	UO ... or UO-D ...
☞ Item no.:	381 xxx or 387 xxx
☞ Serial number	AF YY-xxxxxx (AF year-consecutive number)
☞ Year of manufacture	 (year)
☞ Electrical connection	(V/Hz)
☞ Power input	(kW)
☞ Pre-Fuse	 (A)
☞ Protection type	(IP)
☞ Application class	
☞ Consult operating manual!	
☞ Indoor installation	

1.2 Identification of the system

The type designation on the rating plate consists of the product designation and the installed options. Use the following matrix to get an explanation for the type designation of the particular existing unit.



2 Available Options

The available options are shown in the PID and the spare parts list; both are located in the appendix of this manual. The following table shows the available options including their item-numbers for the particular system type.

option	LN	VSE	PNET	PR	HR
Item – no.:	370038	383765	542070	383764	383767
UO xxx	x	x	-	x	x
UO-D xxx	x	x	x	x	x

x available option
\- option not available

2.1 Description of the Options

Hardness monitoring unit LN

Device for continuously monitoring the feed water hardness. The hardness monitoring unit has a floating contact for the signal exchange. In case of a detected hardness breakthrough, the RO-unit will be shut-down.

Blending device VSE

Automatic bypass of the RO System to blend permate with feedwater in the outlet tank, to adjust the specific conductivity after the RO system. The maximum output corresponds to the permeate flow rate of the unit.

Profinet connection PNET

Standardized possibility to transfer all measured and logged data to customer-side PLC e.g. central control system. Only available for units with ROdigital controller.

Permeate recycle PR

The first permeate at unit's start-up is recirculated to pump 1P01 until the adjusted permeate minimum quality is reached. The permeate valve 1V02 will be switched to "recirculation"" or "production" depending on the conductivity measured at 1Q02.

HR-Module

Membrane-modules with higher retention rate (typically >98.5%) for higher permeate quality.

Depending on the particular feed water parameters like temperature, feed water pressure and salinity, there will a decrease in permeate output accordingly, when using HR modules.

3 Technical data

System		UO 120	UO 300	UO 500	UO-D 120	UO-D 300	UO-D 500
Item-no.:		381921	381922	381923	387141	387142	387143
Control		RO 524			RODigital		
Feed water specification							
Feed water pressure min. /max.	bar	3/6					
Pressure fluctuations (limit)	bar	±0,5					
Temperature min./max.	°C	5/35					
Connections							
Feed water	DN	20					
Permeate	DN	10					
Concentrate	DN	10					
Power consumption	kW	0,55					
Power connection	V/Hz	230/50					
Protection type		IP54			IP 44		
Output data							
Permeate outlet max. *	l/h	120	300	500	120	300	500
Concentrate at 75% yield	l/h	40	100	167	40	100	167
Pump pressure max.	bar	16					
yield, depending on feed water quality	%	75-80					
Salt rejection rate min.	%	97					
Salt rejection rate min. with option HR	%	>98.5					
Dimensions and weights							
Dimensions (HxWxD)	mm	400x340x1190					
Weight approx.	kg	50	60	70	50	60	70
Environmental data							
Ambient temperature min./max.	°C	5/40					
Relative humidity	%	<95, non condensing					
Sound level max.	dB(A)	75					

*****(see sec. A 3.3)

Systems are designed for softened drinking water without chlorine in accordance with the German Drinking Water Regulation with a salt content of 1000 mg/l and at a feed water temperature of 15 °C. Max. permeate counter pressure 0.3 bar!

4 Usage limits

In order to attain the life span of 3 years calculated for the membranes, reverse osmosis installations must be supplied, in accordance with the installation type, with softened water (types ND, KR, e.g.) or tap water with stabilised hardness level (type AS, e.g.) They also must be operated in compliance with the German Drinking Water Regulation and the specifications below. Membranes are wearing parts. The degree of wear depends on the feed water quality and the operating conditions.

Parameter	Unit	Limit
Free chlorine *	mg/l	not detectable*
Iron **	mg/l	0.2
Manganese **	mg/l	0.05
Silicate ***	mg/l	25
SDI [4]	-	3
pH level during operation [5]		3.6-9.5
pH level during cleaning		2-12

The feed water must be free from substances that damage the membrane.
These are in particular:

- oxidants (e.g. free chlorine, ozone, hydrogen peroxide)
- surfactants (especially if cationic)
- biocides and inhibitors
- natural organic matter (NOM)

If the UP feed water is softened, the soft water quality is to be observed. If antiscalant is added for hardness stabilisation (i.e. when iron, manganese and silicate are stabilised at the same time), the manufacturer's specifications must be complied with. If necessary, the pH or the permeate output must be adjusted.

***** Free chlorine (oxidants) corrodes the plastic membrane, especially if metal ions are present. This attack is irreversible and will cause a decrease of the salt retention rate while increasing the permeate conductance. This is why the feed water of the UP installation should not contain any free chlorine.

****** Iron/manganese can be present in a dissolved or undissolved state. Undissolved iron or manganese should be removed by filtration. Dissolved iron/manganese can be oxidised and then removed by filtration or stabilised, for example, by means of an antiscalant. Iron/manganese deposits on the membranes can generally be removed by chemical cleaning.

******* Silicate may form solid deposits on the membranes which are hard to remove. The maximum silicate concentration in the RO concentrate should not exceed 100 mg/l if soft water is used. In RO installations, type KR, the maximum silicate concentration in the RO feed water is 10 mg/l for this reason.

[4] The SDI is a sum parameter. It indicates the degree to which suspended matter will likely form deposits on the membrane. If the SDI > 3, prefiltration must be improved accordingly.

[5] The pH level considerably influences the solubility of many water compounds.
It may be necessary to modify the pH level in order to obtain the desired permeate yield or quality.

5 Product description

5.1 Working principle diagram

See the PID in the appendix.

5.2 Functional description

The feed water passes through the hardness monitoring device 1X02 (optional) and the fine filter 1F01 to enter the RO unit.
Pump 1P01 conveys the water through the semipermeable membranes 1X01.x.at high pressure. As a result of the high pressure, some of the water diffuses through the membranes.
The result is purified water that is almost completely free of salts, colloids, germs and pyrogens. This water, which is led off, is referred to as **permeate**.
The salts that are held back are continually rejected into the wastewater channel with the **RO concentrate**. The control unit of the system monitors and controls all important functions during permeate production and downtime.

Contents of Chapter D

1 Set-up

1.1 Requirements for the set-up location

- The space required for the system may be derived from the measurements specified in Chapter C. In addition, there should be 1.0 m in front of the system and 0.8 m of space on each side available for operating and maintaining the system.

- The room in which the system is set up must meet the environmental conditions specified in Chapter C.

- The set-up surface must be even and run horizontally.

- The room must be well ventilated and not exposed to freezing temperatures.

- To avoid accumulation of spills caused by leaks, the area in which the system is set up must be equipped with a floor drain and /or a leak monitoring system and corresponding alarm.

- The necessary electrical connections must be available on the construction side (see Chapter C) and must be located no more than 2 m away from the system.

- The feed water connection must be provided with a shut-off valve.

- Depending on unit size, there must be control air connection.

1.2 Setting up the system

☞ Unpack the system.

☞ Check over the delivery for completeness and transport damage.
Any deviations or damage must be reported to the manufacturer immediately.

☞ Move the system carefully to the place provided for it with a suitable lifting device.

☞ The system must be set up on a proper surface in accordance with the requirements of Chapter C

2 Water-side connections

2.1 Necessary qualifications of the assembly staff

The water-side connection must only be made by trained professional staff members. Observe general regulations (in German-speaking countries, DIN, DVGW, SVGW and ÖKGW) as well as local installation requirements while installing the system.

2.2 Making the hydraulic connections

Feedwater

- ☞ Remove the sealing disks from the screw connection in the inlet.
- ☞ Connect the inlet

Permeate

- ☞ Remove the sealing disks from the screw connection in the permeate outlet.
- ☞ Connect the permeate outlet with the consumer line

Concentrate

- ☞ Remove the sealing disk from the concentrate outlet.
- ☞ lay the concentrate outlet to the wastewater drain

Wastewater connection (if applicable)

- ☞ lay the wastewater outlet (HT-pipe) to the wastewater drain

Prevent recontamination!
Do not connect the concentrate outlet piping with the wastewater drain directly.

Caution

During standstill times of the system the maximum back pressure of 0.3 bar must not be exceeded. The cross section of permeate piping by customer may only be one nominal width greater than the permeate output piping of the system. At a back pressure > 0.3 bar and the risk of permeate backflow, a check valve has to be installed into permeate piping. It is only allowed to install a shut-off valve into permeate piping, if also a relief valve is installed.

3 Electrical connection

3.1 Necessary qualifications of the assembly staff

Electrical connection tasks may only be performed by an electrician in accordance with the applicable country-specific regulations.

3.2 Circuit diagram of the system

The circuit diagram of the system is located in the appendix of this operating manual.

3.3 Connecting the power supply

Before connecting the power supply, make certain that the corresponding main switch is turned off. Make the power supply connection in the control cabinet with a fixed connection according to the circuit diagram.

☞ When using three-phase alternating current, ensure that the direction of the rotating field and the direction of rotation of the pump are of right-hand rotation.

3.4 Connecting the accessories / signal exchange

Connections for the

– Product container level

– Forced stop

– Combined malfunction

should be made according to the circuit diagram.

Contents of Chapter E

1 Placing the system in service

1.1 Qualifications of the commissioning staff

The system must be placed in service by qualified professionals.

Before the system is placed in service, all screw connections must be retightened.

1.2 Rinsing out the preservative fluid

The preservative solution contains 1.5% sodium bisulfite, 20% glycerine and 2.5% sodium bicarbonate. The preservation fluid should be drained out into the run-off channel in accordance with applicable regulations governing pouring and draining.

- ☞ Connect the product permeate outlet with run-off channel
- ☞ Open valves 1V05 and 1V06 completely
- ☞ Open feed water
- ☞ Switch main-switch On
- ☞ Set the system into operation (see Chapter F) **and rinse for minimum 45 minutes**

The higher permeate conductivity during the rinsing of the system can cause a shutdown of the system.
In this case quit the malfunction (see Chapter F) and continue rinsing.

1.3 Adjusting the operating parameters

☞ Adjust permeate flow (see Chapter C) on 1Fl02 with valve 1V05

☞ Adjust concentrate flow (see chapter C) on 1Fl01 with valve 1V06

☞ If necessary re-adjust permeate flow with valve 1V05

☞ Record the operating data of the system on a log sheet (see Chapter H)

☞ Turn off the system

☞ Reconnect the permeate with the tank or consumer

Generally, when adjusting the unit, do not exceed max. permeate output and do not underrun min. amount of concentrate. In addition the following applies to units with permeate output of 120 - 500 l/h; do not exceed max. pump pressure.

The permeate output of the system depends on the particular feed water parameters like temperature, feed water pressure and salinity. For further information, see Chapter A/3.3.

1.4 Adjustments on blending device VSE

Adjustment of the amount of blending water for option VSE:

☞ with the start of pump 1P01, solenoid valve 1V14 opens

☞ adjust the amount of blending water on 1Fl14 with valve 1V15

The amount of soft water intended for blending must not exceed the max. permeate output of the unit.

2 Taking the system out of service

Taking the system out of service refers to a down time of >30 days for the system. When the system is taken out of service, it must be preserved. For information on preserving the system, please see chapter I.

Contents of Chapter F

1 Operating and display components

	Description	Operatin
A	Main switch	- Turns the system on and off - malfunction acknowledgement[BE]
B	Key button	- Call up desinfection - Call up calibration
C	Display	Display of: - current conductivity of permeate - current operating state - malfunction
D	LED operation (green)	Permanent: → system in operation, no malfuncon Flashing: → malfunction active
E	LED desinfection (red)	Permanent: → desinfection activ

For additional information on the function and operation of the RO 524 control unit, please refer to the RO 524 control unit manual in the appendix of these Operating Instructions.

2 Operating states

Operation

Display: **cy**

Input **NV0** (terminal 24,25) closed

Inlet valve 1V01 opened, pump 1P01 in operation

System is producing permeate

Tank full

Display: **b0**

Input **NV0** (terminal 24,25) opened

System is turned off

Discont. Rinsing

Display: **b2**

Time-controlled permeate production, if operating state **Tank full**

has been active for the set time

Forced stop

Display: **b1**

Input **REG** (binding post 26,27) opened

System is turned off till Input **REG** closed again

Desinfection

Display: **b3**

System in operation **without any safety devices**

3 Short description control system

3.1 Turn on system

☞ Main switch 0/I (A) in position **I**

➔ Display: **88**: Initialisation

➔ Display: **b0**: Tank full

➔ Display: **15**: Operation with display of conductivity of permeate (e. g. 15 µS/cm)

***(** Only for systems with conductivity measuring, z. B. 15 µS/cm)

3.2 Turn off system

☞ Main switch 0/I (A) in position **0**

For additional information on the calibration and settings of the RO 524 control unit, please refer to the RO 524 control unit manual in the appendix of these Operating Instructions.

Contents of Chapter G

1 General information

The use of high-quality individual components and installing safety and monitoring equipment in our systems allows us to reach a very high level of operational availability.

If an operating malfunction should nevertheless arise, the error can easily be detected using the following malfunction table and the cause eliminated.

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

Only qualified professional personnel with the appropriate training should eliminate malfunctions, taking into consideration the safety requirement in Chapter A of these Operating Instructions!

Power must be disconnected from the system before beginning these tasks, and the system must be protected to ensure it is not turned on again unintentionally!

Pressure must be released from all lines.

1.1 Malfunction message to the manufacturer

To ensure effective help in resolving malfunctions, please have the following information on hand:

- Manufacturing number
- Item number
- System type
- Log sheets and maintenance sheets from the last 4 months

1.2 Malfunction display

- green operation-LED is flashing
- **E**<fault number> appears in the display

1.3 Malfunction reset

- Switch off system for a short time
- After turning on the system again, the malfunction is eliminated

2 Malfunction table

Malfunction	Cause	Remedy
Control display dark	Power supply interrupted	Make power supply connection
	10 A fuse F1 defective	Unscrew the front plate and replace the fuse in question
	1,6 A fuse F2, F3 defective	
	Flat band cable between the motherboard and the display unplugged	Unscrew the front plate and plug the cable back in
	Control system defective	Replace the control system
Display **E2**: Hard water	Hard water sensor triggered (if present)	- Check the soft water quality - Check the sensor and replace if necessary
	Wire jumper defective	Restore the wire jumper
Display **E3, E5**: Low pressure	Feed water pressure too low	- Check the pressure difference - on the softener Increase the feed water pressure
	Filter blocked	Replace the filter cartridge
	Pressure switch defective	Replace the pressure switch
	1V01 input valve defective	Replace the valve
Display **E7**: Conductivity of permeate to high	Conductivity of feed water too high	Calculate desalinization rate Target: > 97%
	Desalinization rate too low	After consultation with the manufacturer: - Clean RO modules - Replace RO modules
System does not start	Display **b0** tank full, although permeate tank empty	Level switch defective
	Display **1-99** system in operation	Pump defective
	Display **b1** forced stop	Connected softener is in regeneration
Permeate output too low	Feed water temperature too low	Calculate permeate output according to Chapter A3.3
	Permeate counterpressure too high	Check permeate line
	Modules blocked	After consultation with the manufacturer: - Clean RO modules - Replace RO modules
	Pump defective	Replace pump
	Pump stops turning	turn the pump with a screwdriver on the fan side once clockwise

Contents of Chapter H

1 Maintenance and monitoring tasks

1.1 Safety information

The operator must ensure that all maintenance, monitoring and assembly tasks are performed by authorized and qualified trained personnel.
The system must be shut down and protected from being placed in operation again unintentionally before all repair and maintenance tasks.

Before beginning tasks on the electrical systems and equipment, a check must confirm that power has been disconnected from the system. In addition, the system must be secured to prevent it from being turned on again unintentionally.
Protective clothing suitable for the hazard at hand must be worn while performing the maintenance tasks.
Immediately after the maintenance tasks are completed, all safety and protective equipment must be set back in place and functionality restored.

1.2 General information

To ensure long-term problem free operation of the system, maintenance tasks must be performed at regular intervals and a record must be kept of operating parameters. The record of operating parameters and maintenance tasks should be kept by the operator of the system himself.

Signing a maintenance contract with the supplier makes it possible for the supplier to take over the responsibility of performing regular maintenance tasks on the system.
A record book should be kept to record operating parameters. It is located in the appendix of these operating instructions. The purpose of this record keeping is to have continuous documentation of the operating parameters. This makes it easier to detect a drop in output or incorrect functionality of the system and then to eliminate the problem.
The documentation of maintenance tasks should be kept on the maintenance log that is provided for this purpose.

2 Logging operating parameters

The following parameters must be checked and recorded **weekly**:

Parameter	Measurement point/remarks
Operating hours RO (if existing)	Control display
Residual hardness in feed water	Measurement with the hardness kit on the 1V07 tap
Conductivity of feed water	Verification with conductivity measurement device
Temperature of feed water	Verification with conductivity measurement device
Fine filter inlet pressure	1Pr01 manometer
Fine filter outlet pressure	1Pr02 manometer
Operating pressure	1Pr05 manometer
Permeate output	1FI02 flow meter
Concentrate output	1FI01 flow meter
Conductivity of permeate	Control display / check with handheld measurement device
Temperature of permeate	Control display / check with handheld measurement device
Desalinization rate	For calculation see Chapter A 3.3
Absence of leaks in the system	

Minor fluctuations in the (conductivity of permeate and permeate output) are normal. The effect of the temperature or a fluctuating conductivity in supply water may be reasons for this.

When the desalinization rate drops below 95% or there is a drop in permeate output of about 10%, a concentrate rinse should be performed (see 3.2).

3 Maintenance

Maintenance tasks should be performed when needed, but no less often than at the maintenance specified intervals!

3.1 Maintenance tasks

The following maintenance task should be performed:

System part	Task to be performed	Maintenance interval
Fine filter	Replace the fine filter cartridges and clean the filter housing	-3 months -if the pressure drops by 0.8 bar
Pressure switch	Functional test by blocking the feed water inlet → RO has to switch off	-6 months
Sensor hardness monitoring device (if existing)	Replace sensor	- 12 months - after triggering of sensor
- Conductivity cell(s) - pH-sensor (if existing)	Check of parameters with reference device, if necessary new calibration	- on start-up - 1 year - if quality of feed water changes
Filter mat for control cabinet fan (if existing)	Check fouling factor and clean as required	- 1 month
	Replace filter mat	- 6 month
Rotary vane pump, 230V/ 0,25 and 0,55kW (if existing)	Exchange of pump	- 8000 working hours
Accessories	see Operating Instructions in the appendix	

3.2 Performing a concentrate rinse (water brushing)

During a concentrate rinse, the increase in the flow of concentrate flows more strongly through the membrane(s). Because of this, soluble accretions are more readily removed and rinsed out.

The duration of a "water brushing" should be at least 60 minutes, and it should be performed as follows:

- ☞ Log record of actual values
- ☞ Open the 1V06 concentrate valve
- ☞ Open the 1V05 pressure control valve
- ☞ Allow to rinse for at least 60 minutes
- ☞ Adjust the operating parameters to the target values
- ☞ Wait for 10 minutes
- ☞ Log record of actual values

Note:

If the conductivity of permeate does not improve permanently after a concentrate rinsing, a chemical cleaning of the membranes, resp. exchange of the membranes must be performed.

In this case, it is essential to contact the supplier to agree upon the further procedure!

Log sheet

Customer: _____System Type: _____
Item No: _____Placed in service on: _____

Parameters	Value PID/ Measuring point	Unit	Values when placed in service	Date	Date	Date	Date
Operating hours RO (if existing)	Control display	h					
Residual hardness in feed water	0V07	°dH					
Conductivity of feed water	1V07	µS/cm					
Temperature of feed water	1V07	°C					
Fine filter inlet pressure	1Pr01	bar					
Fine filter outlet pressure	1Pr02	bar					
Operating pressure	1Pr05	bar					
Permeate output	1FI02	l/h					
Concentrate output	1FI01	l/h					
Conductivity of permeate	Display Control	µS/cm					
Temperature of permeate	Display Control	°C					
Desalinization rate	-	%					
Hose connections	-	-					
Absence of leaks in the system	-	-					

Note:

Values of commissioning have to be logged, in order of further performance evaluation of the unit. Log the values weekly in **copies** of this log sheet. If there are **deviations** of more than **15%** to the commissioning values (e.g. operation pressure, differential pressure, permeate performance, desalination rate), the **supplier** has to be **contacted.**

Maintenance log

Customer: _____ **System type: _____**

_____ **Item No.: _____**

_____ **Placed in service on: _____** **CW _____**

1. Quarter / year: _____

System part	CW 1	CW 2	CW 3	CW 4	CW 5	CW 6	CW 7	CW 8	CW 9	CW 10	CW 11	CW 12	CW 13
Fine filter													
Pressure switch													
hardness monitoring device (if existing)													
Conductivity cell pH-sensor (if existing)													
Filter mat for control cabinet fan (if existing)													
Accessories (if existing)													
Rotary vane pump, 230V/ 0,25 and 0,55kW													

Note: Each maintenance task must be documented with a date and the initials of the person performing the task.

Maintenance log

Customer: _____ **System type: _____**

_____ **Item No.: _____**

_____ **Placed in service on: _____** **CW _____**

2. Quarter / year: _____

System part	CW 14	CW 15	CW 16	CW 17	CW 18	CW 19	CW 20	CW 21	CW 22	CW 23	CW 24	CW 25	CW 26
Fine filter													
Pressure switch													
hardness monitoring device (if existing)													
Conductivity cell pH-sensor (if existing)													
Filter mat for control cabinet fan (if existing)													
Accessories (if existing)													
Rotary vane pump, 230V/ 0,25 and 0,55kW													

Note: Each maintenance task must be documented with a date and the initials of the person performing the task.

Maintenance log

Customer: _____ **System type: _____**

_____ **Item No.: _____**

_____ **Placed in service on: _____** **CW _____**

3. Quarter / year: _____

System part	CW 27	CW 28	CW 29	CW 30	CW 31	CW 32	CW 33	CW 34	CW 35	CW 36	CW 37	CW 38	CW 39
Fine filter													
Pressure switch													
hardness monitoring device (if existing)													
Conductivity cell pH-sensor (if existing)													
Filter mat for control cabinet fan (if existing)													
Accessories (if existing)													
Rotary vane pump, 230V/ 0,25 and 0,55kW													

Note: Each maintenance task must be documented with a date and the initials of the person performing the task.

Maintenance log

Customer: _____ **System type: _____**

_____ **Item No.: _____**

_____ **Placed in service on: _____** **CW _____**

4. Quarter / year: _____

System part	CW 40	CW 41	CW 42	CW 43	CW 44	CW 45	CW 46	CW 47	CW 48	CW 49	CW 50	CW 51	CW 52
Fine filter													
Pressure switch													
hardness monitoring device (if existing)													
Conductivity cell pH-sensor (if existing)													
Filter mat for control cabinet fan (if existing)													
Accessories (if existing)													
Rotary vane pump, 230V/ 0,25 and 0,55kW													

Note: Each maintenance task must be documented with a date and the initials of the person performing the task.

Content of Chapter I

1 Preserving the system

1.1 General points

After 12 months at most the preserving agent should be flushed out and replaced if necessary.

When the system is shut down for more than 30 days, it must be preserved.

When it is put into operation again, please follow the procedure described in chapter E of this operating manual.

Preservation / Cleaning is carried out by shut down of the system.

With 2 pass RO-systems, every stage will be preserved and cleaned separately.

With 2 pass RO-systems the components of the 2nd stage are designated wit "2" after the aggregate designation. For example the pressure regulating valve of stage 1 is 1V05, the pressure regulating valve of stage 2 is 1V25.

With systems of type combi (C=single water-softening unit) or (CD= duplex water-softening unit) only the RO-part is preserved. The softener will not be preserved.

Warning

The preservative solution contains 1.5% sodium bisulfite, 20% glycerine and 2.5% sodium bicarbonate. The preserving solution should be fed into the drain in accordance with the directives that apply in the given case.

1.2 Preserving options

- ☞ Sodium bisulphite: preserving without antifreeze
- ☞ Sodium bisulphite + glycerine: preserving with antifreeze to a temperature of 10°C
- ☞ ready-to-use preserving agent incl. antifreeze (item. no. 530055)

1.3 Materials required

- ☞ Preserving tank with locking valve
- ☞ Connecting tubes
- ☞ Preserving/neutralization chemicals: sodium bisulphite (item no. 530058), glycerine (item no. 530024) and sodium bicarbonate (item no. 530197)
- ☞ Protective clothing (goggles, gloves, apron)

1.4 Connecting the preservation tank

- ☞ Switch off system
- ☞ Close the feed water inlet
- ☞ Set up the preservation tank (9B01) at a height to ensure that the preserving solution will flow into the RO system by gravity
- ☞ Close valves (9V01) at the preservation tank
- ☞ Detach the cut-off pipes at the feed water inlet, the permeate pipe and the concentrate pipe of the RO system
- ☞ The connecting tubes should be connected as follows:
    - Connect the outlet from the preservation tank with the feed water cut-off point of the RO system
    - Set up a tube connection between the preservation tank and the concentrate cut-off point of the RO system
    - Set up a tube connection between the preservation tank and the permeate cut-off point of the RO

1.5 Preparing the preserving solution

Danger of fumes!

In handling cleaning chemicals, please have regard to the general instructions for avoidance of accidents and to what is stated in the relevant safety data sheet.

When pouring the chemicals into the preservation tank, protective clothing should be worn – protective goggles, rubber gloves and rubber apron.

- ☞ Charge the preservation tank with a quantity of soft water as specified in the table (see 1.7, depending on the size of the system).
- ☞ Check that the connections are adequately sealed.
- ☞ Prepare the preserving solution by adding the chemical sodiumbicarbonate ($NaHCO_3$), according to table 1.7, to the already filled in water in the preservation tank. Dissolve by stirring constantly.
- ☞ add the chemical sodiumbisulfite ($NaHSO_3$), according to table 1.7, in portions, stir constantly in order to prevent foaming
- ☞ add glycerine, according to table 1.7, stir constantly to homogenize the batch
- ☞ resp. fill the preservation tank with the ready-to-use preserving agent incl. antifreeze (item. no. 530055)

Important:

Chemicals should be added with caution – stir constantly.

1.6 Executing the preservation procedure

- ☞ Open the 1V06 concentrate-regulation valve and the 1V05 pressure-regulation valve completely
- ☞ Open the locking valve (9V01) on the preservation tank
- ☞ Switch the RO system to "Disinfection" operating mode (see control manual)

Attention:

System running without any safety devices.

- ☞ Let the preserving solution circulate for ten minutes
- ☞ Switch off the RO system (see control manual)
- ☞ Close the locking valve (9V01) on the preservation tank
- ☞ Detach the tube connections
- ☞ Close off feed water input and permeate and concentrate outlets with sealing disks
- ☞ Dispose of preserving solution (see 1.1 "General points")

1.7 Composition of the preserving solution

	Permeate output of the system (l/h)	**Soft water supply** (l)	**Sodium bisulphite powder** (kg)	**Glycerine** (l)	**Sodium-bicarbonate** (kg)
item no.			530 058	530 024	530 197
conc. of chemicals			97%	86,5%	
conc. in preserving solution			1,5% w/w	20% v/v	2,5% w/w
	- 500	20	0,39	5,8	0,63
	550 - 1500	50	0,97	14,5	1,6
	1550 - 3500	100	1,93	29,0	3,1
	3550 - 9500	200	3,87	58,0	6,25
	9550 -12.000	250	4,84	72,5	7,8
	12.050 - 17.000	300	5,80	87	9,4
	17.050 – 20.000	400	7,74	116	12,5
	20.050 - 30.000	500	9,67	145	15,6

The pH value of the preserving solution is about 7.

2 Cleaning the system

2.1 General points

If the conductivity of the permeate rises by as much as 15%, or if the permeate output falls by as much as 10%, it is recommended that the membrane modules should be cleaned.

There is a distinction to be made between two types of cleaning:

1.) Acid cleaning to remove carbonate and iron deposits

2.) Alkali cleaning to remove organic impurities and silica scaling

Generally cleaning should be carried out in the following sequence: alkali → acid
Please discuss the type of cleaning with the manufacturer before carrying it out.

Cleaning solution shall be disposed with in adherence to the local or country-specific requirements.

2.2 Materials required

- ☞ Cleaning tank with locking valve
- ☞ Three connecting tubes
- ☞ Universal indicator paper, pH 0-14 (art. no. 630074)
- ☞ Preserving/ neutralising chemicals (see 2.6 "Cleaning solutions")
- ☞ Conductivity measurement device for comparative measurement
- ☞ Protective clothing (goggles, gloves, apron)

2.3 Connecting the cleaning tank

☞ see section 1.4

2.4 Preparing the cleaning solution

Danger of fumes!

In handling cleaning chemicals, please have regard to the general instructions for avoidance of accidents and to what is stated in the relevant safety data sheet.

When pouring the chemicals into the cleaning tank, protective clothing shall be worn – protective goggles, rubber gloves and rubber apron.

- ☞ Charge the cleaning tank with the quantity of soft water specified in the table.
- ☞ Check that the connections are adequately sealed
- ☞ Prepare the cleaning solution by adding the chemicals (as shown on table 2.6) to the cleaning tank.

Important

Chemicals should be added with caution – stir constantly.

2.5 Executing the cleaning procedure

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

Charging the system with the cleaning solution

- ☞ Open the 1V06 concentrate-regulation valve and the 1V05 pressure-regulation valve completely
- ☞ Open the locking valve (9V01) on the cleaning tank 9B01
- ☞ Switch the RO system to "Disinfection" operating mode (see control manual)

Attention:

System running without any safety devices.

Application time for cleaning solution to be effective

- ☞ Let cleaning solution circulate for between 30 and 60 minutes
- ☞ Switch off RO system (see control manual)
- ☞ Close locking valve (9V01) on the cleaning tank
- ☞ Take notice of the sufficient contact time of 12h for the alkaline cleansing agent A12
- ☞ Dispose of cleaning solution (see 1.1, "General points")

Flushing out the system

- ☞ Open feed water inlet
- ☞ Switch RO system to "Disinfection" operating mode (see control manual)
- ☞ Flush out the system for at least 45 minutes. The flushing fluid that accumulates, may be discarded batch wise (see 1.1, "General points")
- ☞ Switch off RO system (see control manual)
- ☞ Detach the connecting tubes
- ☞ Reconnect the feed water inlet and permeate- and concentrate-outlets

Do not terminate the cleaning procedure until the pH value of the concentrate is the same as the pH value of the feed water. The typical pH-value after neutralisation is about 6.5-9.

The temperature of the cleaning solution must not exceed 35° C.
If the pH value shows no further change between the input and outflow of the cleaning solution, the cleaning procedure may be terminated.

If cleaning of the RO-unit is carried out via a manual cleaning unit (MRA) , each component of the MRA (incl. pump) shows resistance against the cleansing detergents mentioned here.

Nevertheless, the MRA has to be rinsed clear after each cleaning. Use water to flush out any detergent residues. Finish rinsing when the rinsing water shows pH-neutrality.

2.6 Cleaning solutions

2.6.1 Acid cleaning

			optimal
	Permeate output of the system (l/h)	**Soft water supply** (l)	**Cleansing agent S2** (kg) alternatively citric acid
item no.			**530 183**
conc. of chemicals			100%
	- 500	50	1,0
	550 - 1500	100	2,0
	1550 - 3500	200	4,0
	3550 - 9500	300	6,0
	9550 -12.000	400	8,0
	12.050 - 17.000	500	10,0
	17.050 – 20.000	700	14,0
	20.050 - 30.000	1000	20,0

The pH value of the cleansing agent solution is about 2.
It should not be allowed to fall below this level.
Note the safety data sheet of the cleansing agent.

2.6.2 Alkali cleaning

			optimal		alternatively	
			normal fouling	**heavy fouling**		
	Permeate output of the system (l/h)	**Soft water supply** (l)	**Cleansing agent A12 1%** (kg)	**Cleansing agent A12 2%** (kg)	**Sodium-dodecylsulfate** (g)	**NaOH flakes** (g)
item no.			530 177	530177	530 021	530027
conc. of chemicals			100%	100%	90%	100%
	- 500	50	0,5	1,0	15	50
	550 - 1500	100	1,0	2,0	30	100
	1550 - 3500	200	2,0	4,0	60	200
	3550 - 9500	300	3,0	6,0	90	300
	9550 -12.000	400	4,0	8,0	120	400
	12.050 - 17.000	500	5,0	10,0	150	500
	17.050 – 20.000	700	7,0	14,0	210	700
	20.050 - 30.000	1000	10,0	20,0	300	1000


Warning

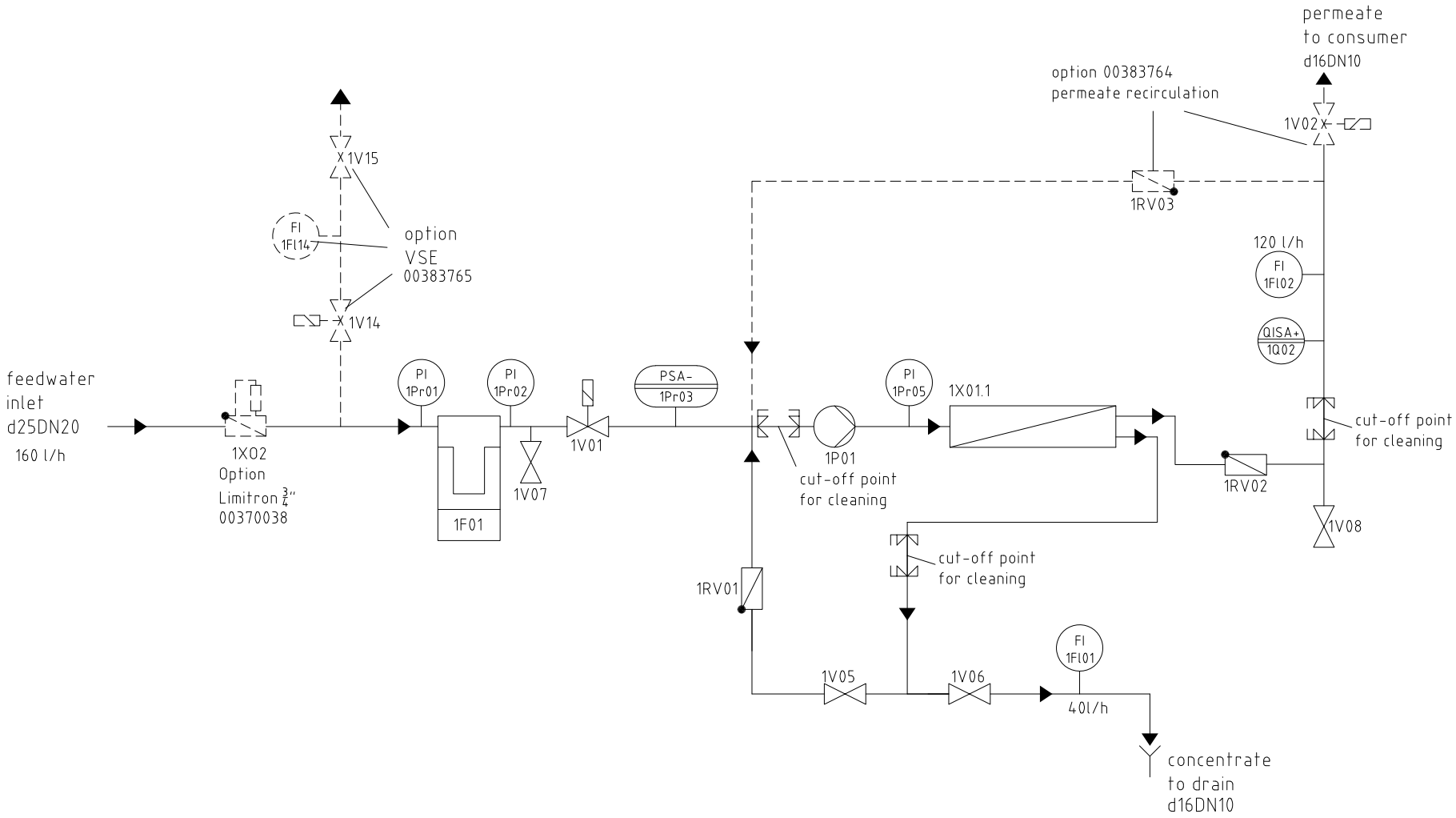
The pH value of the cleansing agent solution is about 12.
It should not be allowed to fall below this level.
Note the safety data sheet of the cleansing agent.

Note the following advices for the application of cleansing agent A12.
The sufficient contact time for the alkaline cleansing agent A12 is 12h.
After cleaning procedure use either cleansing agent S2 or citric acid for neutralization. The typical pH value after neutralization is about 6.5-9.

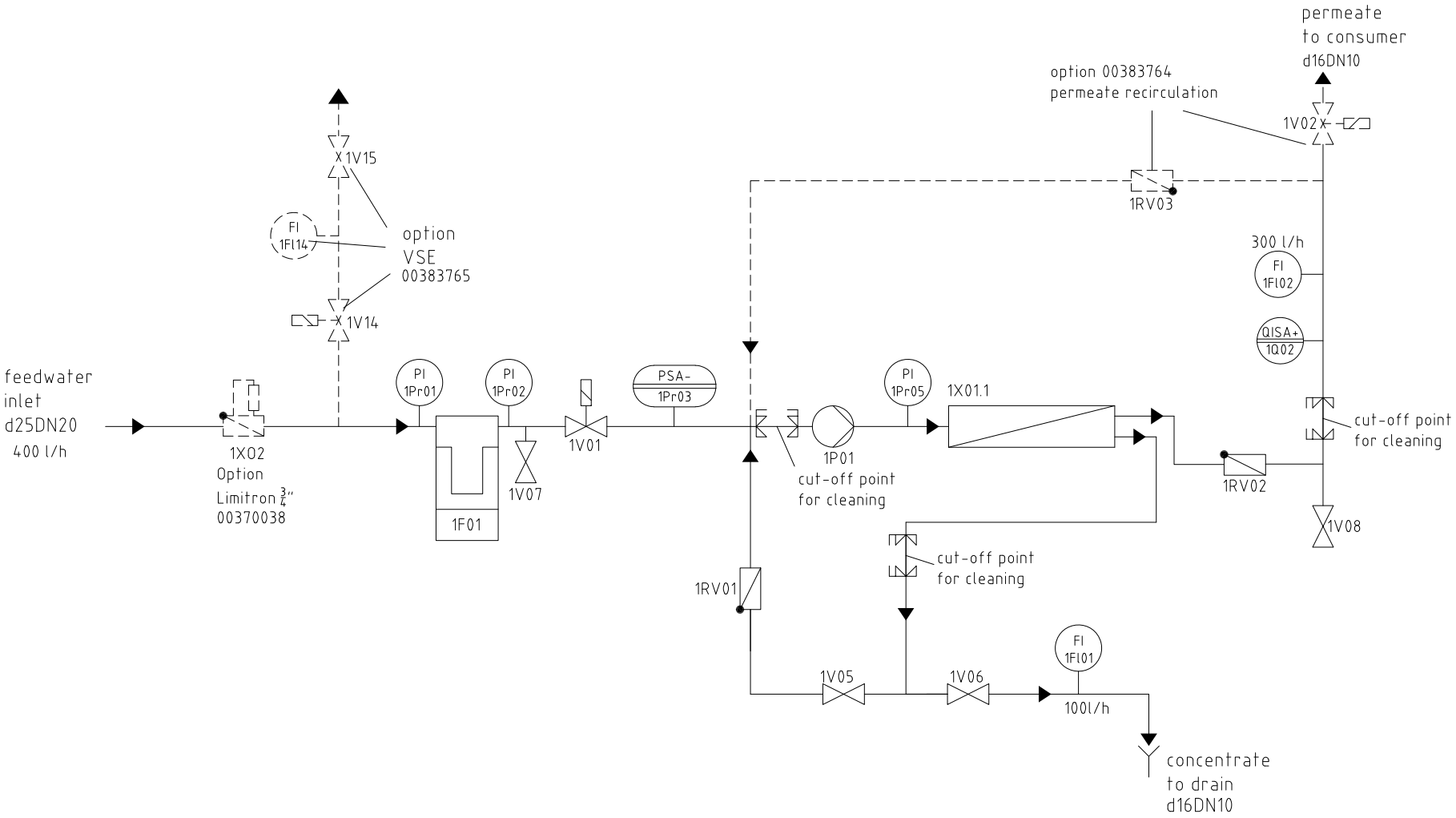
In case of extensive formation of foam during application of cleansing agent A12, use defoam fluid. (item no. 530185)


Caution

Use only this mentioned defoam liquid. Other defoam liquids may destroy the RO-unit´s membranes.



				Allgemein-Toleranzen DIN ISO 2768 - mK	Oberfläche
				Maßstab 1:1	Position – Menge –
				–	
				–	–
				Datum	Name
				Bearb. 10.05.2016	eng
				Gepr. 10.05.2016	eng
				Norm	
				UO 120	
				####	
				00381921-30000	Blatt
B	Filter, Manom.	23.03.2017	di		Bl
Rev.	Änderung	Datum	Name	EDV Nr. 00381921-30000.dwg	



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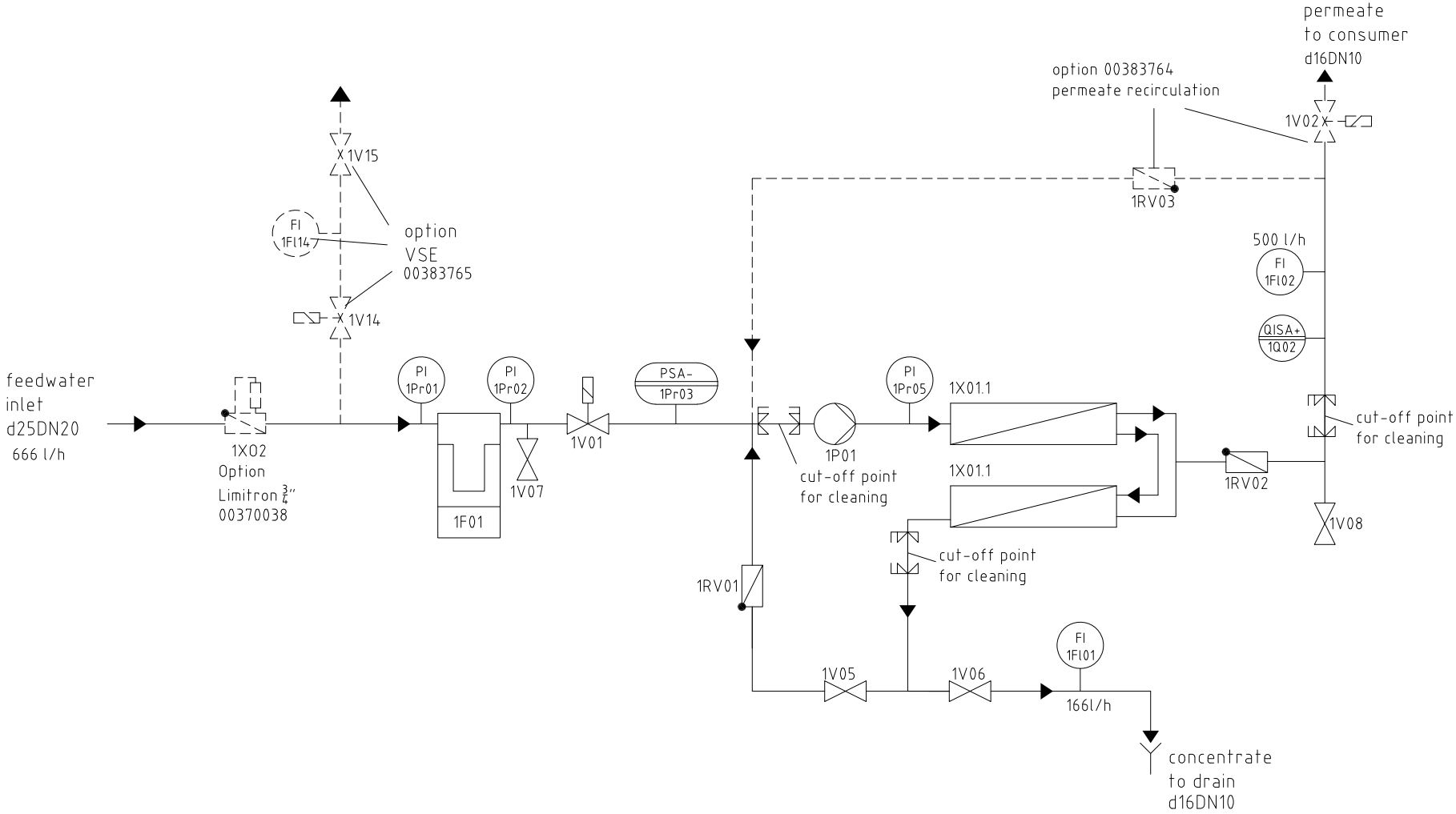
						–	
					Datum	Name	UO 300
				Bearb.	10.05.2016	eng	####
				Gepr.	10.05.2016	eng	
				Norm			
							00381922-30000 Blatt
B	Filter, Manom.	23.03.2017	di				Bl
Rev.	Änderung	Datum	Name	EDV Nr. 00381922-30000.dwg			



				Allgemein-Toleranzen DIN ISO 2768 - mK	Oberfläche
				Maßstab 1:1	Position – Menge –
				–	
				–	–
				Datum	Name
				Bearb. 10.05.2016	eng
				Gepr. 10.05.2016	eng
				Norm	
				UO 500	
				####	
B	1Pr01, 1Pr02	23.03.2017	di	00381923-30000	Blatt Bl
Rev.	Änderung	Datum	Name	EDV Nr. 00381923-30000.dwg	

spare parts list

item: **RO-unit 120**

item number: **381921**

item no	position (PID)	quantity	unit	w/s	description	additional information	Option **
00 335 056	1F01	1	pcs	w	filter cartridge	5", 5µm	
00 630 005	1Pr01, Pr02	1	pcs	s	pressure gauge	0-10 bar	
00 410 214	1V01	1	pcs	s	solenoid valve	24V/DC	
00 405 119	1V02	1	Pièce	E	Solenoid Valve 6281	3/4 AG DN13 0.2 - 10 bar	PR
00 410 107	1V14	1	Pièce	E	Solenoid Valve 6281	EV A 0.2 - 16bar 230V	VSE
00 600 062	1Pr03	1	pcs	s	pressure switch	0,5 bar	
00 390 781	1P01	1	pcs	w	pump 2539 MS	with smallparts	
00 640 042	1P01	1	pcs	s	motor	0,55 kW	
00 630 209	1Pr05	1	pcs	s	pressure gauge	0-25 bar	
00 650 140	1X01	4	pcs	w	o-ring	2 pcs end cap	
00 395 229	1X01	1	pcs	w	membrane module	4021 ND	
00 370 035	1X02	1	pcs	s	foot piece for Limitent and Limitron		LN
00 370 034	1X02	1	pcs	s	head piece for Limitent and Limitron		LN
00 370 031	1X02	1	pcs	w	spare sensor for Limitent and Limitron	max. stocking period: 6 months when storage in original packaging	LN
00 335 054	1X03	100	pcs	w	filter membranes for VIM	0,45 µm	VIM
00 300 007	1X03	1	pcs	s	filter for blocking measure		VIM
00 100 065	1Q02	1	pcs	s	conductivity measuring cell	1-99 µm	
00 545 282		1	pcs	s	control	RO 524, 24V/DC	
00 383 053		1	pcs	s	foil neutral	RO 524	
00 540 904		10	pcs	s	microfuse	10 A T	
00 540 908		10	pcs	s	microfuse	0,2 A T	

Revision	Date	Name	*w = wear part
Format	02.09.16	hk	s = spare part
1Pr01, 1Pr02	24.03.17	Die	** check identification plate, if option is implemented

spare parts list

item: **RO-unit 300**

item number: **381922**

item no	position (PID)	quantity	unit	w/s	description	additional information	Option **
00 335 056	1F01	1	pcs	w	filter cartridge	5", 5µm	
00 630 005	1Pr01, 1Pr02	1	pcs	s	pressure gauge	0-10 bar	
00 410 214	1V01	1	pcs	s	solenoid valve	24V/DC	
00 405 119	1V02	1	pcs	E	Solenoid Valve 6281	3/4 AG DN13 0.2 - 10 bar	PR
00 410 107	1V14	1	pcs	E	Solenoid Valve 6281	EV A 0.2 - 16bar 230V	VSE
00 600 062	1Pr03	1	pcs	s	pressure switch	0,5 bar	
00 390 781	1P01	1	pcs	w	pump 2539 MS	with smallparts	
00 640 042	1P01	1	pcs	s	motor	0,55 kW 220/240V/50Hz	
00 630 209	1Pr05	1	pcs	s	pressure gauge	0-25 bar	
00 650 140	1X01	4	pcs	w	o-ring	2 pcs end cap	
00 395 146	1X01	1	pcs	w	membrane module	4040 ND	***
00 395 147	1X01	1	pcs	w	low pressure element HR	4040 HR	HR
00 370 034	1X02	1	pcs	s	head piece for Limitent and Limitron		LN
00 370 031	1X02	1	pcs	w	spare sensor for Limitent and Limitron	max. stocking period: 6 months when storage in original packaging	LN
00 335 054	1X03	100	pcs	w	filter membranes for VIM	0,45 µm	VIM
00 300 007	1X03	1	pcs	s	filter for blocking measure		VIM
00 100 065	1Q02	1	pcs	s	conductivity measuring cell	1-99 µm	
00 545 282		1	pcs	s	control	RO 524, 24V/DC	
00 383 053		1	pcs	s	foil neutral	RO 524	
00 540 904		10	pcs	s	microfuse	10 A T	
00 540 908		10	pcs	s	microfuse	0,2 A T	

Revision	Date	Name	
Format	02.09.16	hk	s = spare part
1Pr01, 1Pr02	24.03.17	Die	** check identification plate, if option is implemented
			*** dispensable with option HR

spare parts list

item: **RO-unit 500**

item number: **381923**

item no	position (PID)	quantity	unit	w/s	description	additional information	Option **
00 335 056	1F01	1	pcs	w	filter cartridge	5", 5µm	
00 630 005	1Pr02	1	pcs	s	pressure gauge	0-10 bar	
00 410 214	1V01	1	pcs	s	solenoid valve	24V/DC	
00 405 119	1V02	1	pcs	E	Solenoid Valve 6281	3/4 AG DN13 0.2 - 10 bar	PR
00 410 107	1V14	1	pcs	E	Solenoid Valve 6281	EV A 0.2 - 16bar 230V	VSE
00 600 062	1Pr03	1	pcs	s	pressure switch	0,5 bar	
00 390 781	1P01	1	pcs	w	pump 2539 MS	with smallparts	
00 640 042	1P01	1	pcs	s	motor	0,55 kW 220/240V/50Hz	
00 630 209	1Pr05	1	pcs	s	pressure gauge	0-25 bar	
00 650 140	1X01	4	pcs	w	o-ring	2 pcs end cap	
00 395 146	1X01	1	pcs	w	membrane module	4040 ND	***
00 395 147	1X01	1	pcs	w	low pressure element HR	4040 HR	HR
00 370 034	1X02	1	pcs	s	head piece for Limitent and Limitron		LN
00 370 031	1X02	1	pcs	w	spare sensor for Limitent and Limitron	max. stocking period: 6 months when storage in original packaging	LN
00 335 054	1X03	100	pcs	w	filter membranes for VIM	0,45 µm	VIM
00 300 007	1X03	1	pcs	s	filter for blocking measure		VIM
00 100 065	1Q02	1	pcs	s	conductivity measuring cell	1-99 µm	
00 545 282		1	pcs	s	control	RO 524, 24V/DC	
00 383 053		1	pcs	s	foil neutral	RO 524	
00 540 904		10	pcs	s	microfuse	10 A T	
00 540 908		10	pcs	s	microfuse	0,2 A T	

revision	date	name	*w = wear part
Format	02.09.16	hk	s = spare part
1Pr01, 1Pr02	24.03.17	Die	** check identification plate, if option is implemented
			*** dispensable with option HR

1 2 3 4 5 6 7 8

Beschreibung Description	UO 120–500 (C), (CD)
Versorgungsspannung supply voltage	230V/50Hz, N, PE
Vorsicherung Fuse protection	16 A
Steuerspannung control voltage	24 VDC
Mind. Zuleitung mini. Power cable	3x1,5 mm²
max. Strom max. current	5 A

	Revision	Datum	Name		Datum	Name
a				gez.	24.05.16	Ay
b						
c				gepr.	06.10.16	Lei
d						

Deckblatt
cover sheet

Projektbez.
UO 120–500 (C), (CD)

Auftragsnr.

Zeichnungsnr.
545800–01000

Blatt 1
5 Bl.

Projekt Information
Project Information

Schaltschrankausführung
control cabinet assembly

Hersteller manufacturer	Bopla
Maße dimensions	212x184x105 mm
Schutzart protection type	IP 54

Vorsicherung :
Fuse protection :

Sicherung Fuse	Aderndimensionierung wire dimensions	Wago Klemmen Wago connector
16A	1,5 mm2	2002
20A	2,5 mm2	2002
25A	4 mm2	2004
32A	6 mm2	2006
40A	10 mm2	2016
50A	10 mm2	2016
63A	16 mm2	2016
80A	25 mm2	---
100A	35 mm2	---

Verdrahtungsfarben
wiring colours

Hauptstromkreis main circuit	schwarz black	1,5–35 mm²
N–Leiter N–conductor	hellblau light blue	1,5–35 mm²
Schutzleiter protective conductor	grün/gelb green/yellow	1,5–35 mm²
Steuerspannung 230VAC control voltage 230VAC	rot red	0,75 mm²
Steuerspannung 0VAC control voltage 0VAC	rot/weiß red/white	0,75 mm²
Steuerspannung 24VDC control voltage 24VDC	dunkelblau dark blue	0,75 mm²
Steuerspannung 0VDC control voltage 0VDC	grau gray	0,75 mm²
Dig. Eing. Microcontroller Dig. Input microcontroller	violett purple	0,75 mm²
Dig. Ausg. Microcontroler Dig. Output microcontroller	Siehe oben Steuerspannung see the control voltage	0,75 mm²
Analoge Messleitung + analog measuring circuit +	weiß white	0,75 mm²
Analoge Messleitung – analog measuring circuit –	weiß/blau white/blue	0,75 mm²
	weiß white	0,5 mm²
Fremdspannung external voltage	orange orange	0,75 mm²

	Revision	Datum	Name		Datum	Name
a				gez.	24.05.16	Ay
b						
c				gepr.	06.10.16	Lei
d						

Projekt Information
Project Information

Projektbez.
UO 120–500 (C), (CD)

Auftragsnr.

Zeichnungsnr.
545800–01000

Blatt 2
5 Bl.

RO524

Ausgänge outputs 230VAC max. 6A

Jumper

Ausgänge outputs 250VAC/24VDC max. 6A

24VDC 0,5A

Aktiv sobald eine Störung vorliegt Active if fault exists

Eingänge inputs

Eingänge potentialfrei, gebrückt bei Nichtbelegung
inputs potential-free, bridged in case of no use

L	N	N	L	N	L1	PE	PE	PE	PE	PE	PE	W	S	Ö	M	Ls	M	Ls	M	E	M	E	M	E	M	E	M	E	C	D
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

Netz main power

Enthärter softener

UO-Pumpe RO-pump

Netz main power

Sammelstör-meldekontakt potentialfrei collective fault contact potential-free

MV1 UO-Eingang MV1 RO-input

MV2 Permeat MV2 permeate

Druckschalter pressure switch

Niveau unten low level

Niveau oben high level

Zwangsstop/Regeneration forced stop/regeneration

Motorschutz/Hartwasser Motor protect./hard water

Meßzelle Permeat measuring cell permeate

W0 1 2 GN/YE

Anschluss 230V/50Hz
CEE-Stecker 16A
Supply 230V/50Hz
CEE-plug 16A

W4-0X02 2 1 GN/YE

Enthärter softener

0X02
EH

Rahmen frame

W1-1P01 2 1 GN/YE

1P01 M 1~

230V/50Hz

W9-1V14 BU GN/YE BN

1V14

Option option VSE

W10-1V01 GN/YE BU

1V01

BN

W11-1V02 GN/YE

1V02

BU BN

Option option PR

W23-1PR03 BN

WH

1PR03

P

8L02 Q

8L03 Q

W17-8L02/3 1 2 *

W19-STOP BN

WH

W8-1X02 GN

WH

1X02

Limitron Option option LN

W16-1Q02 BN

WH

1Q02 Meßzelle measuring cell

Enthärter softener Regeneration regeneration Meldung information

* Bei ext. Beschaltung Brücke entfernen
Remove bridge in case of external connection

	Revision	Datum	Name		Datum	Name
a				gez.	24.05.16	Ay
b						
c				gepr.	06.10.16	Lei
d						

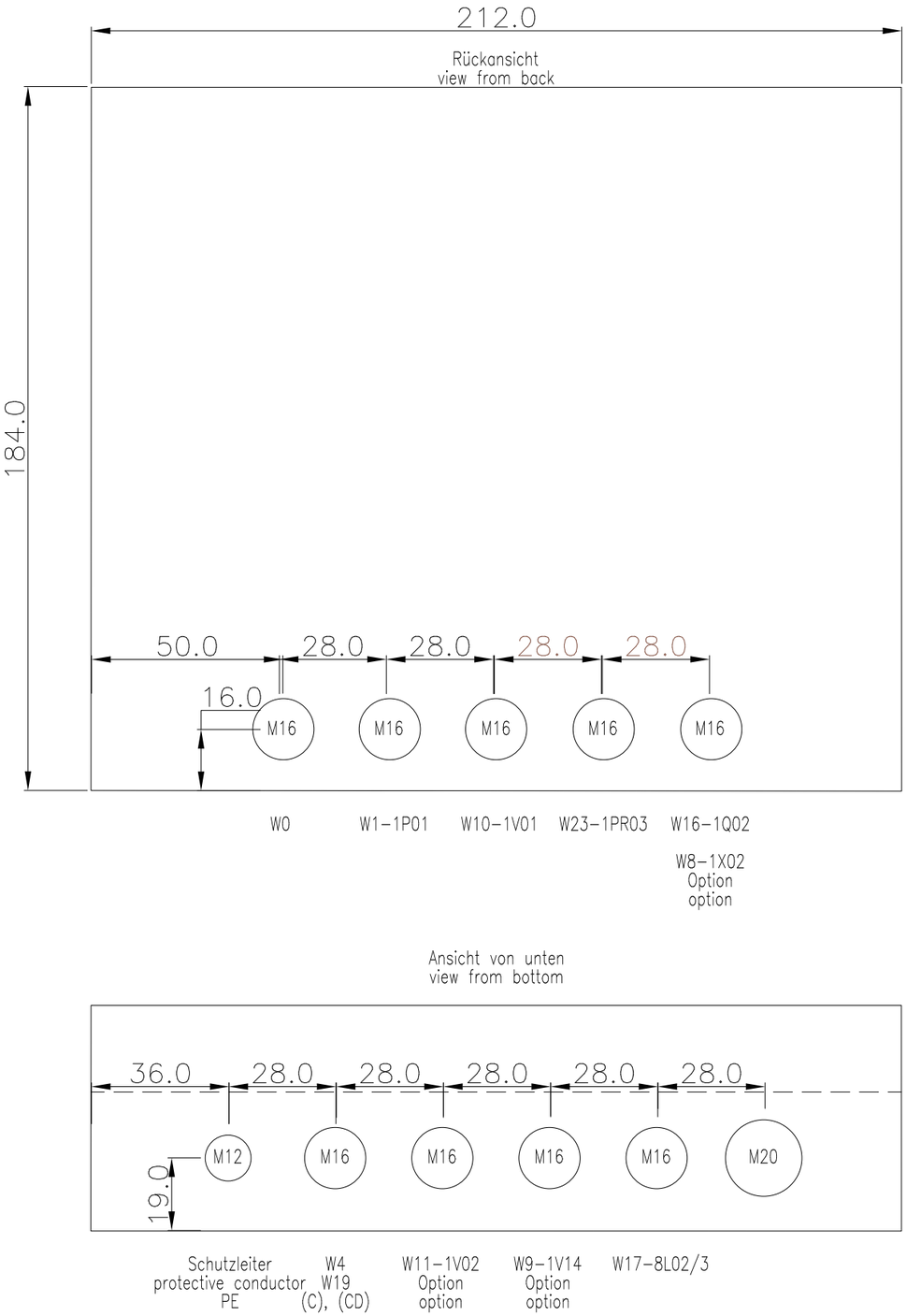
Anschlußbelegung RO524
Terminals RO524

Projektbez.
UO 120-500 (C), (CD)

Auftragsnr.

Zeichnungsnr.
545800-01000

Blatt 3
5 Bl.



	Revision	Datum	Name		Datum	Name
a				gez.	24.05.16	Ay
b						
c				gepr.	06.10.16	Lei
d						

GEHÄUSE
BOX

Projektbez.
UO 120-500 (C), (CD)

Auftragsnr.

Zeichnungsnr.
545800-01000

Blatt 4
5 Bl.

1 2 3 4 5 6 7 8

cable list

no.	unit	device ID	location	type	used	order number	destination from unit	destination from location	destination from device ID	destination to unit	destination to location	destination to device ID
1		W0		Oelflex 3×1.5	3	1119303						RO524
2		W1-1P01		Oelflex 3×1.5	3	1119303			RO524			1P01
3		W4-0X02		Oelflex 3×1.5	3	1119303			RO524			0X02
4		W8-1X02		LIYY 3×0.25	2	0028303			RO524			1X02
5		W9-1V14		PVC 3×0,75	3	709675			RO524			1V14
6		W10-1V01		PVC 3×0,75	3	709607			RO524			1V01
7		W11-1V02		PVC 3×0,75	3	709607			RO524			1V02
8		W16-1Q02		YSLY-OZ 2×0.75	2	0028602			RO524			1Q02
9		W17-8L02/3		Oelflex 4×0.75	4	0028602			RO524			8L02
10		W19-STOP		YSLY-OZ 2×0.75	2	0028602			RO524			
11		W23-1PR03		YSLY-OZ 2×0.75	2	0028602			RO524			1PR03

	Revision	Datum	Name		Datum	Name
a				gez.	24.05.16	Ay
b						
c				gepr.	06.10.16	Lei
d						

Kabelliste
cable list

Projektbez.
UO 120-500 (C), (CD)

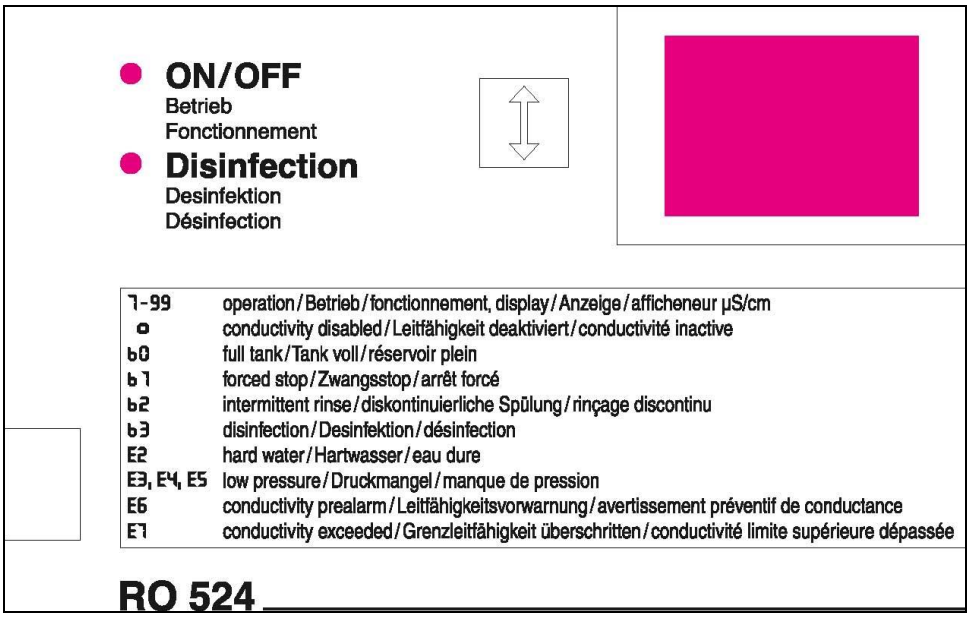
Auftragsnr.

Zeichnungsnr.
545800-01000

Blatt 5
5 Bl.

Operating instructions

RO 524 control system



Last update	Date	Author	Remarks / Software Version
1	04.04.14	Mü	Additional: *MV1(1V01) **MV3(1V03)
2	12.08.15	Mü	Update, page 3 – 1.1 chapter

CE

Translation of original instructions

Table of Content

1 Description of functions

1.1 Normal operation

Following **"power-on"**, the control system starts an initialization cycle with a duration of two seconds. During initialization, **"88"** is displayed and the LEDs are off.

The control system then switches over to normal operation, the display switches to operation (**"b0"**) and the green LED lights up.

If the level in the tank makes it necessary to fill it, i.e. both level switches are closed, the solenoid valve *MV1 will open.

(The unit may also be equipped with one level switch only; in this case, a jumper must be installed on the low level switch.)

The water pressure is then checked by the pressure switch.

If the pressure signal is not available, an automatic shut down is initiated after a preset time and **"E5"** is displayed.

If the pressure signal is received, the pump is started up after a preset time and the water conductivity measured is indicated.

This operating status is changed if the upper level switch closes, indicating that the tank is full.

In this case, the pump is switched off and the concentrate valve **MV3 is opened; **"b0"** is displayed.

The inlet solenoid valve *MV1 is closed again after a displacement time and the concentrate valve **MV3 is also closed after a preset time.

If the pressure switch signals low pressure to the control unit while the pump is running, the green LED flashes and **"E3"** is displayed until the pressure switch signals the pressure again. After a preset time, the pump is restarted.

The control system then switches over to normal operation with the exception that the two signals "normal operation" and **"E3"** are displayed alternately.

The installation starts up again automatically after 1 minute. If the alarm occurs again, the delay is doubled until the 32 minute maximum is reached. The restart delay remains 32 minutes until the installation is switched off at the mains switch.

If the conductivity exceeds the warning value for five minutes while the pump is running, the green LED flashes and the conductivity is displayed alternately with **"E6"** until the conductivity falls below this value. Normal operation then resumes.

If the conductivity exceeds the conductivity alarm limit for five minutes while the pump is running, a centralised alarm is initiated, the green LED flashes and the conductivity is displayed alternately with **"E7"**.

If the alarm limit is exceeded, the unit is automatically shut down and **"E7"** is displayed.

If the conductivity measurement is disabled, the control system displays a run indicator (lowercase *o*) instead of the conductivity on the right side of the 7-segment display and the conductivity limit warning values will be not monitored anymore.

Malfunction signals are reset by switching the unit **ON and OFF**. The flashing green LED is then lit continuously.

1.2 Regeneration (forced stop)

The unit can be set to "**regeneration**" or "**forced stop**" by operating (opening) the appropriate inlet.

The pump is then shut down immediately and the inlet solenoid valve *MV1 is closed.

If the inlet is closed, the control unit is switched back to normal operation.

This is the case when an individual water softening unit is installed upstream of the unit.

1.3 Hard water (Limitron)

If the "**hard water**" or "**Limitron**" switch is activated (opened), an emergency shut-down is initiated and "**E2**" is displayed

1.4 Disinfection (to be carried out by technically qualified staff only)

To switch to the "disinfection" operating mode, press the button before switching the power on and keep the button pressed during initialization, while "**88**" is displayed.

After five seconds, "**b3**" is displayed, the inlet solenoid valve *MV1 is switched on, a centralised alarm is initiated and the red LED starts flashing slowly.

If meanwhile the button has been released, the pump will be started up after a further time delay of five seconds and the conductivity value will be displayed alternately with "**b3**".

To switch back to normal operation, press the push button again. The pump will be shut down immediately. The concentrate valve **MV3 will be opened.

Then, the inlet solenoid valve *MV1 will be closed and, if applicable, the concentrate valve.

Caution:

> In this mode of operation, all safety functions are deactivated. Operation only permitted under close supervision.
>
> Make sure that the water pressure is correct in order to prevent damage to the pump

1.5 Intermittent flushing

If the inlet solenoid valve *MV1 is switched off for a preset time in normal operation, in other words if the tank is still full, the control system will switch to "intermittent flushing".

"**b2**" is displayed, the concentrate valve **MV3 will be opened first and then the inlet solenoid valve *MV1 will be opened.

The valves are switched off in reverse order and with the same time intervals. The control system switches back to normal operation.

If the pressure switch signals low pressure to the control unit, the green LED flashes and a centralised alarm is initiated.

"**E3**" is displayed until the pressure switch signals the pressure again.
Calibration (to be carried out by technically qualified staff only)
To switch to the "calibration" mode, press the push button before switching the power on and keep the button pressed during initialization while "**88**" and then "**b3**" are displayed.

The conductivity value is displayed alternately with "**C**". A centralised alarm is initiated and the red LED starts flashing slowly. The green LED is lit and the pump is switched on.

Each time you press the button, the conductivity offset value is increased by approx. 2%.

Each time you press the button, the current conductivity value is displayed immediately and the current offset is stored irrespective of whether mains power is available.

When you reach the maximum offset, the conductivity measurement will be switched off and "OF" will be displayed.

The offset will be switched to minimum value the next time the push button is pressed until, after having pressed the button 62 times, the initial value is displayed again.

Calibration mode can only be terminated by switching the power off.

It is only necessary to use the calibration function if the conductivity measuring cell has been replaced.

1.6 Emergency shut-down

Emergency shut-down means that the pump is shut down immediately and the concentrate valve **MV3 is opened.

The corresponding malfunction signal "**E**" is displayed, the green LED flashes rapidly and a centralised alarm is initiated.

First the solenoid valve V1 will be closed and then, if applicable, the concentrate valve **MV3.

An emergency shutdown can only be reset by switching the power off.

2 Operating parameters

The following table lists the factory setting, precision and limit of the operating parameters.

Note:
Operating parameters can only be programmed by the manufacturer!

Parameter	Precision	Limits		Setting
		min.	max.	set by manufacturer
TIME_PRESSURE_AVAILABLE	0.05 sec.	0.1 sec.	9.9 sec.	**9.9 sec.**
TIME_PRESSURE_STARTUP	0.05 sec.	0.1 sec.	9.9 sec.	**9.9 sec.**
TIME_DISPLACEMENT	1.0 min.	0 min.	99 min.	**3 min.**
CONDLIM	0.5 µS/cm	1 µS/cm	99 µS/cm	**50 µS/cm**
CONDWARN	0.5 µS/cm	1 µS/cm	99 µS/cm	**40 µS/cm**
TIME_COND	1.0 min.	1.0 min.	250 min.	**5 min.**
TIME_PRESSURELOW	0.05 sec.	0.1 sec.	9.9 sec.	**1.0 sec.**
TIME_INT_FLUSH_START	1.0 h	1.0 h	250 h.	**24 h**
TIME_VALVE_DELAY	0.05 sec.	0 sec.	60 sec.	**10 sec.**
COND_OFFSET	0.5	-30	+30	**-20**

Parameters which are set to 0 are disabled.

Description of parameters

TIME_PRESSURE_AVAILABLE — Time from switching on the inlet solenoid to malfunction signal "E5".

TIME_PRESSURE_STARTUP — Time from pressure detection (pressure switch ON) to pump start-up.

TIME_DISPLACEMENT — Time from pump shut-down (switching on of concentrate valve **MV3) to switching off the inlet solenoid valve *MV1.

CONDLIM — Conductivity limit at which the malfunction signal "E7" (also alternately with the conductivity value) is displayed after a delay of 5 min.

CONDWARN — Conductivity limit at which, after a delay of 5 min., warning "E6" is displayed alternately with the conductivity value.

TIME_COND — Time between exceedance of the conductivity limit and shut-down of unit with continuous "E7" signal.

TIME_PRESSURELOW — Time during pump operation before malfunction "E3" (low pressure) is signalled with the pressure switch off.

TIME_INT_FLUSH_START — Time before intermittent flushing is started with the inlet solenoid valve off (tank full).

TIME_VALVE_DELAY — Time to avoid simultaneous valve activation.

COND_OFFSET — Offset for conductivity measuring cell calibration.

3 Status and malfunction signals

Signal	Explanation
88	Signal during initialization**.**
b0	Signal in normal operation; **"tank full"** if the pump is not switched on (normally when the tank is full)
b1	**"Emergency stop/regeneration"** mode
b2	**"Intermittent flushing"** mode displayed alternately with the conductivity value when the pump is running
b3	**"Disinfection"** mode displayed alternately with the conductivity value when the pump is running
C	**"Calibration"** mode displayed alternately with the conductivity value
OF	Displayed in **"calibration"** mode if conductivity measurement is to be switched off
□	Displayed in all operating modes except **"calibration"** if the conductivity measurement is disabled
E2	**"Hard water"** or Limitron emergency shut down, displayed if the corresponding switch is opened
E3	Malfunction signal if no pressure is measured for a certain time with the pump running (**"low pressure"**)
E5	**"Low pressure"** signal shown if no pressure is measured for a preset time after switching on the inlet solenoid valve *MV1
E6	**"Conductivity warning"** signal shown if the conductivity warning limit is exceeded for more than 5 minutes; displayed alternately with other operating signals
E7	**"Conductivity alarm"** signal shown if the conductivity alarm limit is exceeded for more than 5 minutes; displayed alternately with other operating signals

4 Terminal allocation

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
L	N	N	L	N	L1	PE	PE	PE	PE	PE	PE	W	S	Ö																
Mains 230V		Soft. 230V		Pump 230V									STO		Valve *MV1 24VDC		Valve **MV3 24VDC		PS		LLEV		HLEV		REG		MOT		Cond. Sensor	

x 1	L	230V AC power supply, phase conductor 1
x 2	N	230V AC power supply, neutral
x 3	N	230V AC power supply for softener, neutral
x 4	L	230V AC power supply, phase conductor 1 max 5A
x 5	N	pump motor P1, neutral
x 6	L1	pump motor P1, normally open contact max. 3.8A
x 7	PE	230V AC power supply, earth
x 8	PE	earth
x 9	PE	earth
x 10	PE	earth
x 11	PE	earth
x 12	PE	earth
x 13	STO C	centralised alarm contact (central control), 250V AC, 6A, changeover contact – floating
x 14	STO NO	centralised alarm contact (central control), 250V AC, 6A, normally open – floating
x 15	STO NC	centralised alarm contact (central control), 250V AC, 6A, normally closed, floating
x 16	*MV1 earth	solenoid valve *MV1, earth
x 17	*MV1	solenoid valve *MV1 normally open contact, 24VDC, 0.5A
x 18	**MV3 earth	solenoid valve **MV3, earth
x 19	**MV3	solenoid valve **MV3 normally open contact, 24VDC, 0.5A
x 20	PS earth	pressure switch – earth
x 21	PS	pressure switch input 24V DC, 10mA
x 22	LLEV earth	low level switch – earth
x 23	LLEV	low level switch input 24V DC, 10mA
x 24	HLEV earth	high level switch – earth
x 25	HLEV	high level switch input 24V DC, 10mA
x 26	REG earth	regeneration (emergency stop) – earth
x 27	REG	regeneration (emergency stop) - input 24V DC, 10mA
x 28	MOT earth	motor circuit breaker (hard water, Limitron)- input
x 29	MOT	motor circuit breaker (hard water, Limitron)- input 24V DC, 10mA
x 30	COND sensor	conductivity sensor input
x 31	COND sensor earth	conductivity sensor – earth