Operating Instructions

Reverse-Osmosis-System
UO 2000 / 2500 / 3000 / 3500 ND

CE

File: BA_GB_DB_UOND20-35_1202_A.doc
July 14, 2005 / koe

Overview of contents

Imprint

The edition date on the cover sheet is definitive.
Subject to technical changes.

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

Danger

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.

Warning

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.

Caution

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/2 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

Danger

- 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 the power supply.
- Mechanical force	- Parts of the system are under excess pressure of up to 25. Release the pressure from the system before repairs and maintenance tasks.

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 tasks

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 members.

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.

2.7 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.

2.8 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.

2.9 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

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

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

3.3 Temperature dependency of permeate output

Danger

The permeate output of the system depends on the temperature of the feed water. The nominal output specified in the technical data and on the rating plate refers to the design temperature specified in Chapter C/2.
The actual output at a specific feed water temperature can be calculated from the following table using a correction factor.

The specific temperature-related permeate output can be calculated according to the following calculation equation:

Permeate output at X °C = Rate output • Correction factor F

T in °C		Correction factor
Design temperature	Nominal output = 100%	1.00
-1		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
-11		0.64

Danger

If the system is operated at a higher feed water temperature than the design temperature, care must be taken not to exceed the maximum permeate output that is specified on the rating plate and in the technical data (C/2)!

After switching on the RO system permeate with high conductivity is produced for a short time. Therefore it is to be made certain during the interpretation of the peripheral equipment technology that a minimum running time of the RO system of at least 30 min per shifting process is ensured.

1. Transport and storage

- Systems of type RS and RSE, ND,KR, AS, ES, combi, ED,NF, UP and EP should be transported upright.

- Systems of type W should be transported lying down.

- Systems of type W/S may be transported either standing or lying down.

Caution

- **During transport, all systems must be secured against slipping and falling over!**

- The transport weight corresponds to the empty weight. For transport weights, please refer to the Technical Data in Chapter C/2.

- The system can be damaged by frost. Because of this, the system must be protected against frost and freezing during transport and storage.

- The maximum storage temperature is 40°C.

- The maximum storage duration for the system in original packing is 3 months at 20 °C. After that, the preservative fluid must be rinsed out and replaced if necessary.

Contents of Chapter C

1. Technical data

System		UO 2000 ND	UO 2500 ND	UO 3000 ND	UO 3500 ND
Code No.		381 301	381 311	381 321	381 331
Control		RO 1000			
Feed water specification					
Feed water pressure min./max.	bar	2/6			
Pressure fluctuations (limit)	bar	± 0.5			
Temperature min./max.	°C	5/35			
Connections					
Feed water	DN	32	32	32	32
Permeate	DN	25	25	25	25
Concentrate	DN	25	25	25	25
Power consumption	kW	3.0		4.0	
Power connection	V/Hz	3x400/50			
Protection type		IP54			
Output data					
Permeate outlet max.	l/h	2000	2500	3000	3500
Concentrate min.	l/h	670	830	1000	1160
Concentrate backflow	l/h	1000	500	600	not present
Permeate counterpressure max.	bar	0.3; without permeate backflow!			
Recovery	%	75			
Salt rejection rate	%	97			
Dimensions and weights					
Dimensions (HxWxD)	mm	1650x2450x700		1650x3450x700	
Weight approx.	kg	240	320	340	380
Environmental data					
Max. ambient temperature	°C	40			
Relative humidity (air)		<95%, non-condensing			

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.

2. Usage limits

Caution

The limit values specified in Chapter C/2 “Technical Data” apply for usage of the system.

3. Product description

3.1 Rating plate

The rating plate is located on the front side of the system. It contains important information on the output and maximum operating parameters of the system.

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!

3.2 Working principle diagram

See the R+I diagram in the appendix

3.3 Functional description

Softened feed water is fed in through a fine filter (5 µm filter unit) to the circuit pump unit. This unit pumps the water through the semipermeable membranes 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 the **permeate**. The salts that are held back are continually rejected into the wastewater channel with the **RO concentrate**. To arrive at a more economical yield and to cause water to flow over the membranes optimally, part of the concentrate is directed back in front of the membranes.

3.4 Short description of the components

Hardness monitoring device (1X02) (Option)	Continuously monitors soft water quality and generates an alarm message if a limit value is exceeded.
Pressure gauge filter inlet (1Pr01)	Display of the inlet pressure.
Fine filter (1F01)	Protects the RO membranes from impurities (filter fineness 5µm).
Pressure gauge filter outlet (1Pr02)	Display of filter outlet pressure.
Sample removal tap for feed water (1V07)	Used to remove samples from the feed water of the system.
Inlet solenoid valve (1V01)	Is always open during permeate production.
Pressure switch (1Pr03)	Monitors the inlet pressure.
Pump (1P01)	Produces the pressure required for the reverse osmosis process.
Pressure gauge pump pressure (1PR04)	Display of the pump pressure.
pump regulating valve	Used to adjust permeate outlet
Pressure gauge operating pressure (1Pr05)	Display of the operating pressure.
Rinse connection, inlet (option 1V10)	Makes it possible to connect to a cleaning station.
Pressure gauge (concentrate pressure) (1Pr06)	Display of the concentrate pressure.
Rinse connection for concentrate (option 1V12)	A 3-way ball cock used as a discharge for cleaning the system.

Concentrate regulating valve (1V06)	Used to set the amount of concentrate to be led away.
Concentrate rinse valve (option 1V03)	Used to force concentrate.
Flow meter for concentrate (1FI01)	Display of the RO concentrate quantity.
pressure regulating valve (1V05)	Controls the amount of concentrate directed in front of the pump.
Flow meter for concentrate recirculation (1FI03)	Display of the RO concentrate recirculation quantity
Permeate measurement cell (1Q02)	Measures the conductivity of the permeate. The control system is used to turn off the system if a limit value is exceeded.
Permeate flow meter (1FI02)	Displays the permeate flow level.
Permeate rinse connection (option 1V11)	A 3-way ball cock used as a discharge for cleaning the system.
Control system	Monitors and controls all important functions during the operation of the system.

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/21. In addition, there should be 1 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/2.

- The minimum bearing capacity at the set-up location must be 150% of the operating weight specified in Chapter C/2.

- 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-1) and must be located no more than 2 m away from the system.

1.2 Setting up the system

☞ Unpack the system.

☞ Check over the delivery for completeness and transport damage. (See Chapter C-3.2 for scope of delivery). 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 holding surface in accordance with the requirements of Chapter C/2.

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

Inlet

☞ 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 output.
☞ Connect the permeate output with the consumer line.

Concentrate

☞ Remove the sealing disk from the concentrate line.
☞ Connect the concentrate output with the drain

Caution

In standstill times of the system the max. 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 presure > 0,3 bar and the danger 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

Danger

Electrical connection tasks may only be performed in Germany by an electrician certified by VDE in accordance with the applicable requirements.

3.2 Connecting the power supply

Danger

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.

3.3 Connecting the accessories / signal exchange

Connections for the

- Product container level
- Forced stop
- Combined malfunction
- Dosing

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 and 20 % glycerin.
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 with run-off channel
- ☞ Open valves 1V04, 1V05 and 1V06 completely
- ☞ Open feed water
- ☞ Set the system into operation (see Chapter F)
  and rinse for minimum 30 minutes

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

1.3 Adjusting the operating parameters

☞Adjust valve 1V04 to middle position (50% open)
☞Adjust min. concentrate flow (see chapter C/2) with valve 1V06
☞Adjust concentrate backflow (see Chapter C/2) with valve 1V05
☞Adjust permeate flow (see Chapter C/2) with valve 1V04
☞If necessary readjust concentrate backflow with 1V06

☞**Record the operating data of the system on a control sheet (see Chapter C/2)**

☞Turn off the system
☞Reconnect the permeate with the tank or consumer


Caution

In no event should the values specified in the technical data for permeate output, yield, operating pressure and product output be exceeded.

The permeate output of the system depends on the temperature of the feed water. For further information see Chapter 3.2.

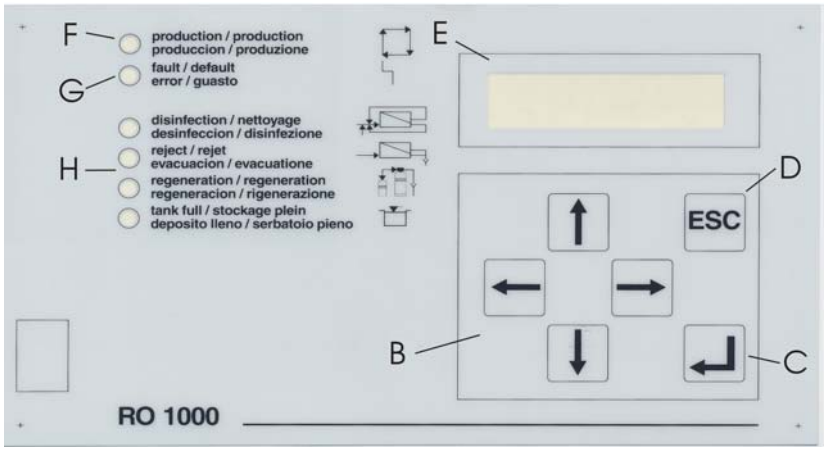
2. Taking the system out of service

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 contact the manufacturer.

Contents of Chapter F

1. Operating and display components

1.1. RO 1000 control system



	Name	Function
A	Main switch	**The main switch is located on the left side of the switch cabinet.** - Turns the system on and off.
B	← ↑ → ↓	- Password entry - Menu selection - Selection
C	ESC	- Confirmation of entries - Brings up a menu
D	↵	- Bestätigung von Eingaben - Menüaufruf
E	Display	Displays: - the current operating state - the conductivity and temperature of the permeate - operating hours - current malfunctions
F	Operation LED (green)	Continuous: → System in operation Flashing: Maintenance request
G	Malfunction LED (red)	Active malfunction
H	Operating states LEDs (yellow)	
	Disinfecting	Disinfecting active
	Rejection	Permeate rejection active
	Regeneration	**Forced stop** entry active Permeate production interrupted
	Tank full	**Upper level** input active Permeate production interrupted

For additional information on the function and operation of the RO 1000 control unit, please refer to the RO 1000 control unit manual in the appendix of these Operating Instructions.

1.2. Operating states

Turned off	System off (all outputs inactive) Malfunction recording off
Operation	
⇒ **Rejection**	1V01 input valve opened, 1P01 pump in operation 1V02 permeate valve (when existing) closed Permeate is being rejected
⇒ **Production**	1V01 input valve opened, 1P01 pump in operation 1V02 permeate valve (when existing) opened System is producing permeate
⇒ **Concentrate rinsing**	1V01 input valve opened, 1V03 concentrated valve opened After a set amount of time elapses, switch over to **tank full**
⇒ **Tank full**	**Upper level** input (terminal 31, 32) opened System in standby until request about level active again
⇒ **Discont. rinsing**	Time-controlled forced production if the operating state **tank full** has been active for the set time
⇒ **Forced stop**	**Forced stop** input (terminal 23, 24) opened Product production interrupted until **Forced stop** input closed again
Disinfecting	System in operation **without any safety devices**

2. Short description of the RO 1000 control system

2.1. Operating structure

Operating and monitoring of the control system takes place on the following 3 levels

Display level

Alternating display of:
- the current operating state
- the conductivity and temperature of the permeate
- operating hours
- current malfunctions

Operating level

- Change of operating mode
- Acknowledgment of malfunctions if parameters are so set
- Calibration of Cy-permeate and T-permeate
- Adjustment of Cy-limit values
- Adjustment of alarm options

The user password is used to bring up the operating level.

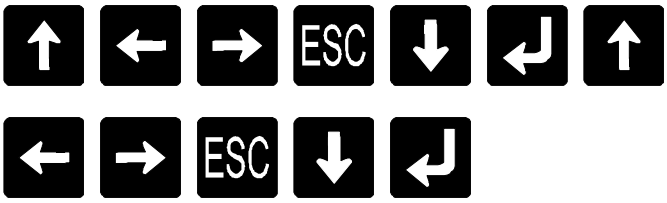
Operator password

Technician level

In addition to the operating level:
- Parameter setting
- Diagnostics

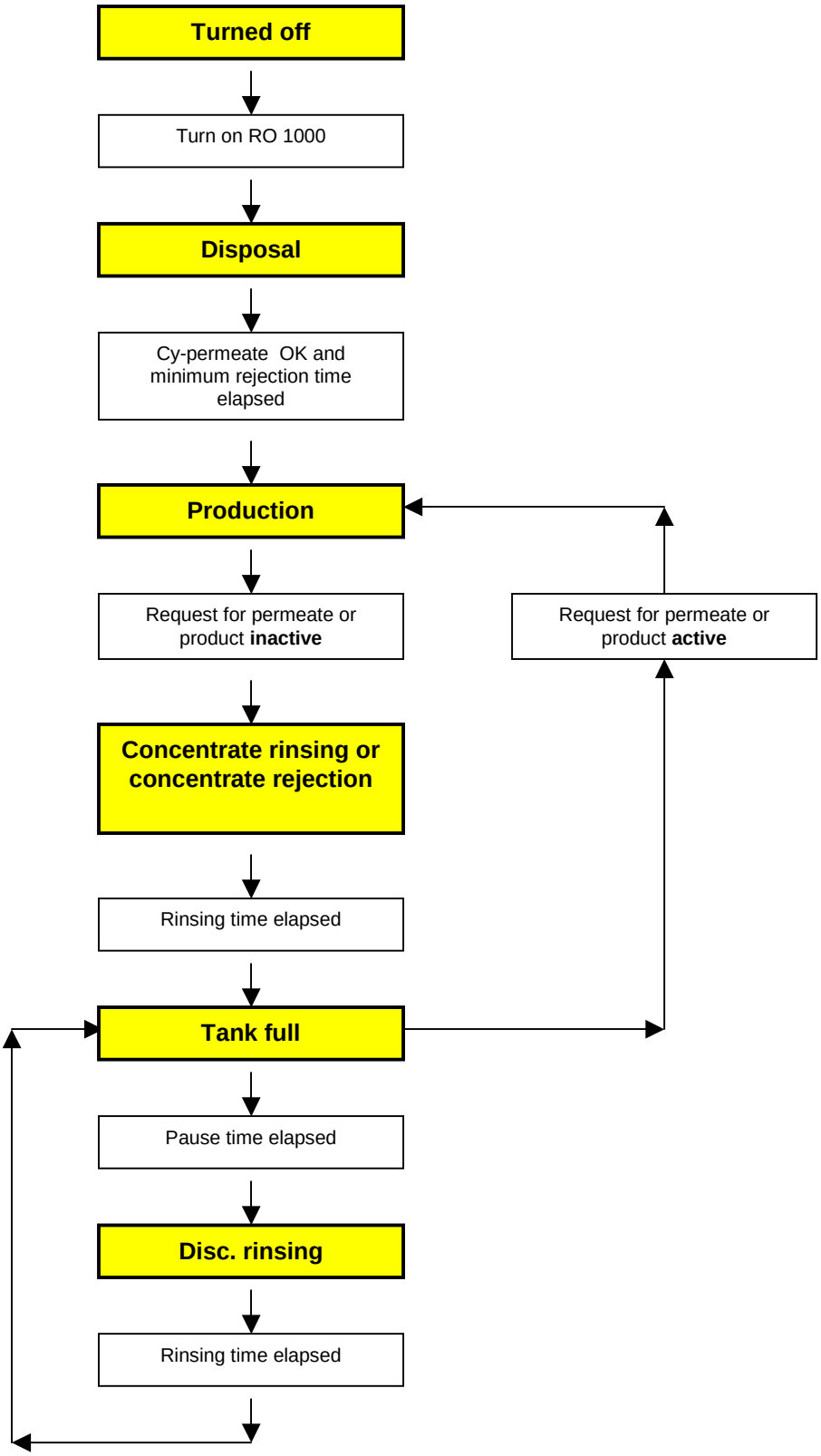
The technician password is used to bring up the technician level.

Technician password



For additional information on operating, calibrating and setting parameters for the RO 1000 control unit, please refer to the RO 1000 control unit manual in the appendix of these Operating Instructions.

2.2. Functional diagram



2.3. Turning on

< 1 Ackn. failure >
2 Operat. mode

1 Ackn. failure
< 2 Operat. mode >

Operating mode
Stop

Operating mode
Operation

Are you sure?
<no> yes

Are you sure?
no <yes>

1 Ackn. failure
< 2 Operat. mode >

RO 1000 - V0x.xx
Disposal

➔ **System goes into operation**

2.4. Turning off

< 1 Ackn. failure >
2 Operat. mode

1 Ackn. failure
< 2 Operat. mode >

Operating mode
Operation

Operating mode
Stop

Are you sure?
<no> yes

Are you sure?
no <yes>

1 Ackn. failure
< 2 Operat. mode >

RO 1000 - V0x.xx
Stop

➔ **System is turned off**

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).


Warning

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

- Red malfunction LED on the control system
- Malfunction message appears on the display

1.3 Malfunction table

Malfunction	Cause	Remedy
Control display dark	Power supply interrupted	Make power supply connection
	10 A fuse F1 defective	Replace the fuse in question
	200 mA 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
Motor / hard water display:	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
	Motor protection switch triggered (if present)	- Check the adjustment of the motor protection switch - Check the motor
Low pressure display:	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
CO exceeded display:	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
EEPROM fail display:	Initialization error	Check parameters according to parameter overview (see control unit manual in the appendix of these Operating Instructions)
Malfunction LED is flashing:	System error	Replace the control system
System does not go into operation	**Tank full** LED is lit even though the permeate tank is empty	Level switch defective
	System in operation	Pump defective
	Forced stop LED is lit	Connected softener is in regeneration

Malfunction	Cause	Remedy
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

1.4 Malfunction reset ☞RO 1000: **ESC**

Contents of Chapter H

1. Maintenance and monitoring tasks

1.1 Safety information

Caution

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.

Warning

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	Control display
Residual hardness in soft water	Check 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 pressure gauge
Fine filter outlet pressure	1Pr02 pressure gauge
Operating pressure (if existing)	1Pr05 pressure gauge
Concentrate pressure	1Pr06 pressure gauge
Permeate output	1FI02 flow meter
Concentrate output	1FI01 flow meter
Concentrate recirculation (if existing)	1FI03 flow meter
Conductivity of permeate	Control display
Temperature of permeate	Control display
Desalinization rate	For calculation see Chapter A 3.2
Absence of leaks in the system	

Minor fluctuations in the conductivity of the permeate and permeate output are normal. The effect of the temperature or a fluctuating conductivity may be reasons for this. When the desalinization rate drops below 97% or there is a drop in permeate output of about 10%, a concentrate rinse should be performed (see 2.1).

2.1 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 away.

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
- ☞ Log record of actual values

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

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

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 tasks 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 off the feed water inlet → RO must switch off	- 6 months
Hose connections	Check hose connections for damage and leaks	- 1 month
- 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
Accessories	see Operating Instructions in the appendix	

Log sheet

Customer:_____ **System Type:**_____

_____ **Item No.:**_____

_____ **Placed in service on:**_____

Date		**Values when placed in service**				
Operating hours	h					
Residual hardness of soft water	°dH					
Conductivity of feed water	µS/cm					
Temperature of feed water	°C					
Fine filter inlet pressure	bar					
Fine filter outlet pressure	bar					
Operating pressure	bar					
Concentrate pressure	bar					
Permeate output	l/h					
Concentrate output	l/h					
Concentrate recirculation (if existing)	l/h					
Conductivity of permeate	µS/cm					
Temperature of permeate	°C					
Desalinization rate	%					
Absence of leaks in the system						

Note: **The values when placed in service must be entered when the system is placed in service.**
After that, this log sheet should be duplicated. As described in chapter H, the operating parameters should be documented weekly.
If there is a significant deviation in actual values from the values when placed in service, the operator should contact the supplier and if appropriate send this log to the supplier as well.

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													
Hose connections													
Conductivity cell pH-sensor (if existing)													
Accessories													

Note: Each maintenance task should be documented with a date and the initials of the person performing the task.
Copies should be made of the maintenance log before the first entries are made!

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													
Hose connections													
Conductivity cell pH-sensor (if existing)													
Accessories													

Note: Each maintenance task should be documented with a date and the initials of the person performing the task.
Copies should be made of the maintenance log before the first entries are made!

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													
Hose connections													
Conductivity cell pH-sensor (if existing)													
Accessories													

Note: Each maintenance task should be documented with a date and the initials of the person performing the task.
Copies should be made of the maintenance log before the first entries are made!

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	(KW 53)
Fine filter														
Pressure switch														
Hose connections														
Conductivity cell pH-sensor (if existing)														
Accessories														

Note: Each maintenance task should be documented with a date and the initials of the person performing the task.
Copies should be made of the maintenance log before the first entries are made!

Contents of chapter I

1. Preserving the system

1.1 General points

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

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

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

The preserving solution contains 1.5 % of sodium bisulphite and 20 % of glycerine.
The preserving solution should be fed into the pipelines 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

1.3 Materials required

- Preserving tank with pump and locking valve
- 3 connecting tubes
- Preserving/neutralisation chemicals: sodium bisulphite (art. no. 530014) and glycerine (art no. 530024)
- Protective clothing (goggles, gloves, apron)

1.4 Connecting the preservation tank

☞ Switch off system
☞ Close the feed water inlet

1.4.1 For systems without cleaning connections

☞ Set up the preservation tank at a height greater than that of the system, so as to ensure that the preserving solution will flow into the RO system without any difficulty
☞ Close off the valve on the preservation tank
☞ Detach the permeate pipe and the concentrate pipe of the RO system

☞ The connecting tubes should be connected as follows:
- Remove hexagon-cap after pressure gauge 1Pr05 and set up a tube connection to the pump of preservation tank
- Set up a tube connection between the preservation tank and the concentrate outlet of the RO system
- Set up a tube connection between the preservation tank and the permeate outlet of the RO

1.4.2 For systems with cleaning connections (optional)

☞ Set up the preservation tank at a height greater than that of the system, so as to ensure that the preserving solution will flow into the RO system without any difficulty

☞ Close off the valve on the preservation tank

☞ The connecting tubes should be connected as follows:
- Connect preservation-pump with 1V10 cleaning connection
- Set up a tube connection between preservation tank and 1V12 concentrate cleaning connection
- Set up a tube connection between preservation tank and 1V11 permeate cleaning connection

1.5 Preparing the preserving solution

Danger

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 chemicals (as shown on table) to the preservation tank.

Important: **Chemicals should be added with caution – stir constantly!**

1.6 Executing the preservation procedure

- ☞ Put the three-way ball valves (1V11 and 1V12) in "Flushing" position*
- ☞ Open the 1V10 tap*
- ☞ Open the 1V06 concentrate control valve and the 1V05 pressure control valve completely
- ☞ Open the locking valve on the preservation tank
- ☞ Switch on preservation-pump
- ☞ Let the preserving solution circulate for ten minutes
- ☞ Switch off the preservation-pump
- ☞ Close the locking valve on the preservation tank
- ☞ Close the 1V10 tap*
- ☞ 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")

* Only for systems with cleaning connections

1.7 Composition of the preserving solution

	Permeate output of the system l/h	Soft water supply l	Sodium bisulphite powder g	Glycerine l
Art. no.			530 014	530 024
Conc. of chemicals			97%	86,5%
	20 - 50	10	100	1,6
	60 - 170	15	150	2,5
	220 - 450	20	200	3,3
	600 - 1000	30	300	4,9
	1500 - 2500	60	600	9,8
	3000 - 5000	80	800	13,0
	- 10.000	160	1600	26,0
	- 15.000	240	2400	39,0
	- 20.000	320	3200	52,0
	- 30.000	750	7500	78,0

The pH value of the preserving solution is 4 or thereabouts.

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

Generally cleaning should be carried out in the following sequence:
alkali → acid → alkali

Please discuss the type of cleaning with the manufacturer before carrying it out.


Warning

Cleaning solution should be disposed with in adherence to the local or country-specific requirements!

2.2 Materials required

- Cleaning tank with pump and 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

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 should 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

- ☞ Put three-way ball valves (1V11 and 1V12) in "Cleaning" position*
- ☞ Open the 1V10 tap*
- ☞ Open the 1V06 concentrate control valve and the 1V05 pressure control valve completely
- ☞ Open the locking valve on the cleaning tank
- ☞ Switch on pump of cleaning tank

Time needed for the cleaning solution to be effective

- ☞ Let cleaning solution circulate for between **30 and 60 minutes**
- ☞ Switch off pump of cleaning tank
- ☞ Close locking valves on the cleaning tank
- ☞ Dispose of cleaning solution (see 1.1, "General points")
- ☞ Close 1V10 tap*
- ☞ Detache tube connection between cleaning tank and RO system
- ☞ Screw down again the hexagon cap

Flushing out the system

- ☞ Open feed water inlet
- ☞ Switch on the RO system (see control manual)
- ☞ Flush out the system for **at least 45 minutes**. Here the flushing liquid that emerges should be disposed of a quantity at a time (see 1.1, "General points")
- ☞ Switch off RO system (see control manual)
- ☞ Detach the connecting tubes
- ☞ Reconnect permeate and concentrate outlets
- ☞ Put the 1V11 and 1V12 taps back into operating position*


Warning

Do not terminate the cleaning procedure until the pH value of the concentrate is the same as the pH value of the feed water.

* Only for systems with cleaning connections

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.

2.6 Cleaning solutions

2.6.1 Acid cleaning

			Cleaning option 1	**Cleaning option 2**
	Permeate outpu of the system l/h	Soft water supply l	Citric acid powder kg	Hydrochloric acid ml
Art. no.			530 015	530 13
Conc. of chemicals			100%	33%
	50 - 250	50	1,0	250
	600 - 1500	100	2,0	500
	2000 - 3500	200	4,0	1000
	4000 - 5000	200	4,0	1000
	6000 - 8000	300	8,0	1500
	10.000 - 15.000	500	10,0	2500
	- 18.000	750	15,0	3750
	20.000 - 25.000	1000	20,0	5000

**The pH value of the preserving solution is 2 or thereabouts.
It should not be allowed to fall below this level.**

2.6.2 Alkali cleaning

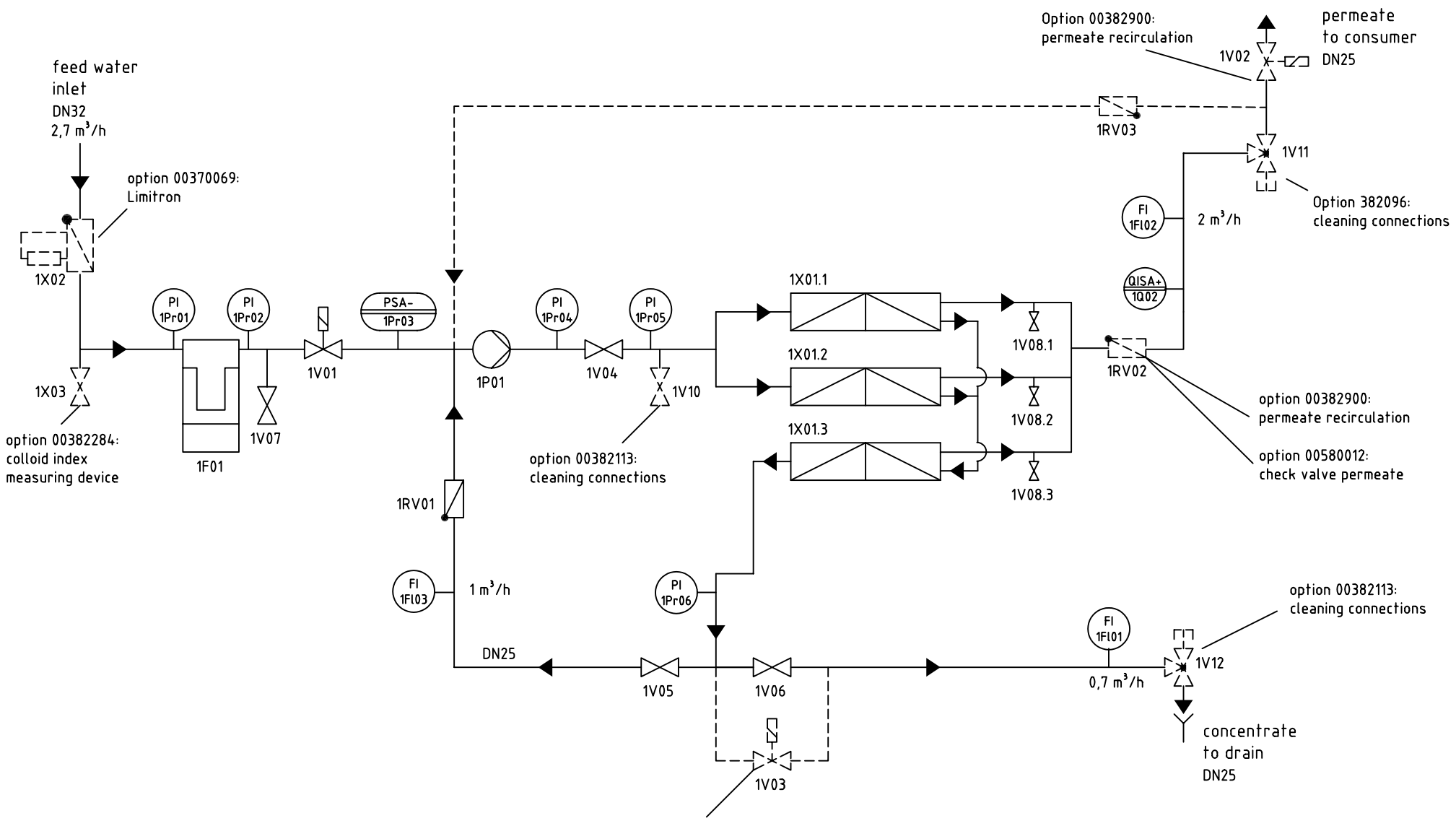
			Cleaning option 1		**Cleaning option 2**
	Permeate outpu of the system l/h	Soft water supply l	NaOH-flakes g	Sodium dodecyl sulphate g	HC310
Art. no.			530 027	530 21	530 051
Conc. of chemicals			100%	90%	-
	50 - 250	50	50	15	250
	600 - 1500	100	100	25	500
	2000 - 3500	200	200	50	1000
	4000 - 5000	200	200	50	1000
	6000 - 8000	300	300	75	1500
	10.000 - 15.000	500	500	125	2500
	- 18.000	750	750	190	3750
	20.000 - 25.000	1000	1000	250	5000

**The pH value of the preserving solution is 12 or thereabouts.
It should not be allowed to fall below this level.**

Appendix

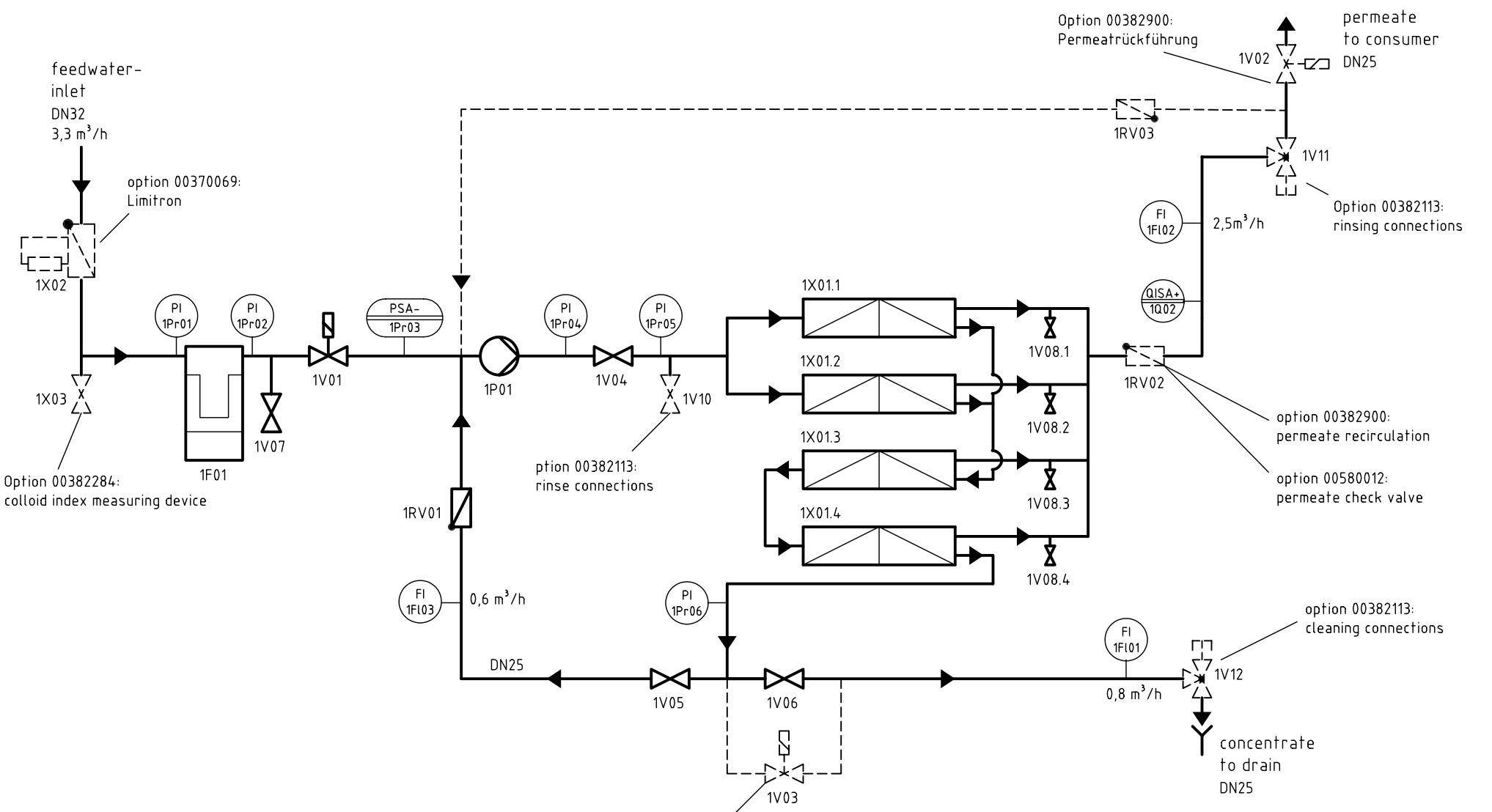
I

R+I flowchart
with
components and spare parts list



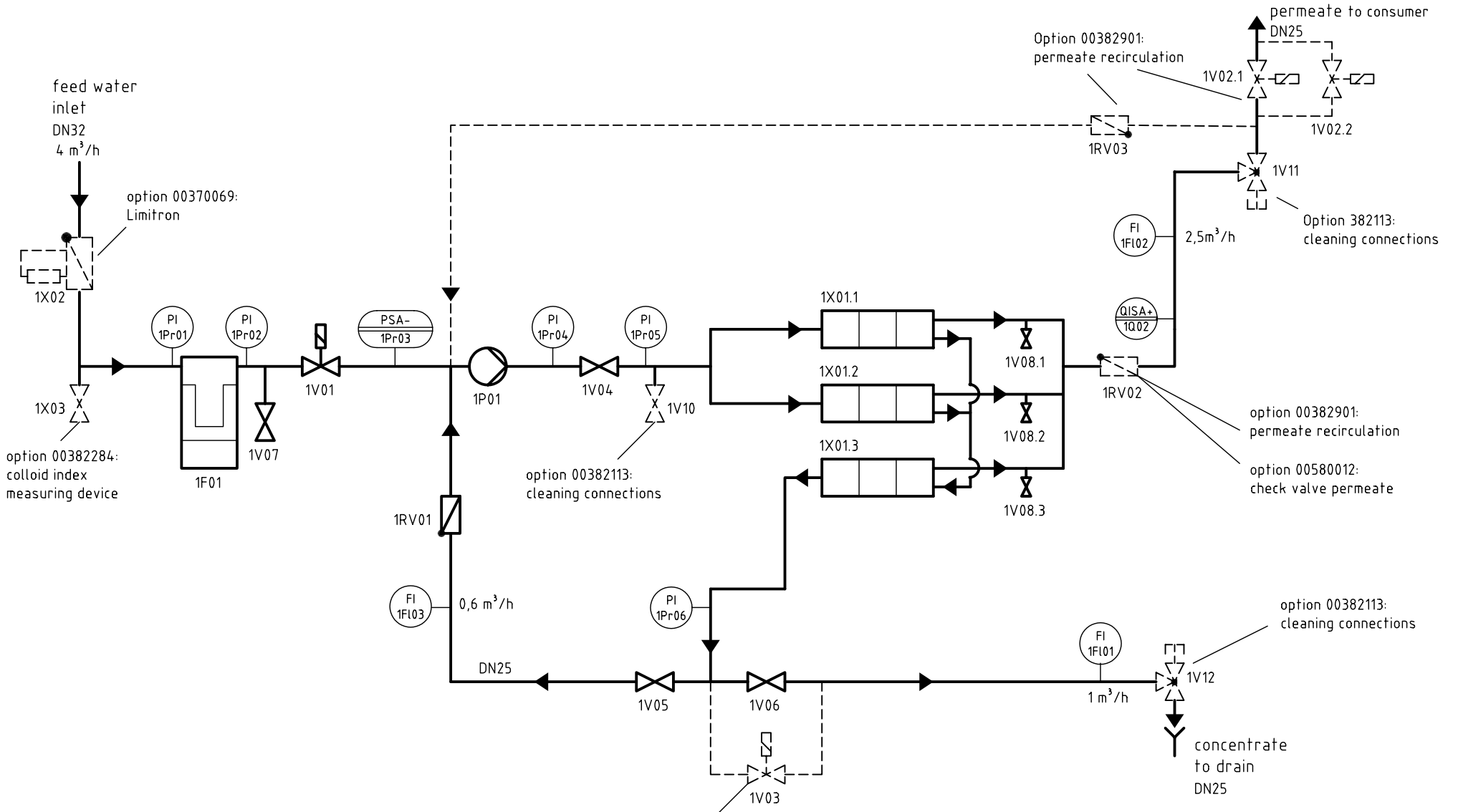
								Oberfläche	Maßstab	Position –	Menge –
									-	-	
									-	-	
							Datum	Name	UO 2.000 ND		
						Bearb.	25.07.05	koe	Reverse Osmosis System		
						Gepr.					
						Norm					
									00381301-30012		Blatt
											Bl
Zust.	Änderung		Datum	Name	EDV Nr.	381301-30012					

UO 2.000 ND **Code-No. 00381301**		**Component List**	
P+I-No.	**Code-No.**	**Description**	
1F01	00 330 050 00 335 101	filter housing 10" Big Blue, 11/2" filter cartridge, 10", 5 µm	
1Fl01	00 580 035	flowmeter concentrate, 150-1600 l/h	
1Fl02	00 580 043	flowmeter permeate 400-4000 l/h	
1Fl03	00 580 035	flowmeter concentrate recirculation 150-1600 l/h	
1P01	00 390 215	pump CR 3-36, 3x400V/50Hz, 3,0KW	
1Pr01	00 630 006	pressure gauge filter inlet, NG63, 1/4"h, 0-10 bar	
1Pr02	00 630 006	pressure gauge filter outlet, NG63, 1/4"h, 0-10 bar	
1Pr03	00 600 012	pressure switch FF4-8, 3/8"	
1Pr04	00 630 209	pressure gauge pump pressure, NG63, 1/4"h, 0-25 bar	
1Pr05	00 630 209	pressure gauge operation pressure, NG63, 1/4"h, 0-25 bar	
1Pr06	00 630 209	pressure gauge concentrate pressure, NG63, 1/4"h, 0-25 bar	
1Q02	00 100 011	conductivity measuring cell permeate	
1V01	00 410 098	solenoid valve, 1", DN20	
1V04	00 415 050	ball valve VA, DN20	
1V05	00 415 003	regulating valve - concentrate recirculation, ball valve 1/2"	
1V06	00 415 003	concentrate regulating valve, ball valve 1/2"	
1V07	00 410 084	sample	
1V08	00 405 050	sample permeate	
1X01	00 400 016 00 395 146	vessel, GFK, 4040-2, 25 bar Low pressure element	
	00 382 342	control with RO 1000	
option 00382113 cleaning set:			
1V10	00 415 004	cleaning connection, ball valve, 3/4"	
1V11	00 405 004	3-way ball valve DN25	
1V12	00 405 004	3-way ball valve DN25	
option 00382900 permeate recirculation:			
1RV02	00 580 012	check valve PVC, DN25, PN16	
1RV03	00 580 012	check valve PVC, DN25, PN16	
1V02	00 405 117	solenoid valve, 1"AG, DN21	
option 00382372 concentrate rinse valve			
1V03	00 410 107	solenoid valve, 1/2", 230V/50Hz	
further options:			
1RV02	00 580 012	check valve PVC, DN25, PN16	
1X02	00 370 069	hardness monitor Limitron 1"	
1X03	00 382 284	colloid index measuring device	



					Oberfläche	Maßstab	Position – Menge –
						-	-
						-	-
					Datum	Name	
				Bearb.	25.07.05	koe	UO 2.500 ND
				Gepr.			Reverse Osmosis Unit
				Norm			
							00381311-30012
Zust.	Änderung	Datum	Name	EDV Nr.	381311-30012		Blatt Bl

UO 2.500 ND **Code-No. 00381311**		**Component List**	
P+I-No.	**Code-No.**	**Description**	
1F01	00 330 050 00 335 101	filter housing 10" Big Blue, 11/2" filter cartridge, 10", 5 µm	
1Fl01	00 580 035	flowmeter concentrate, 150-1600 l/h	
1Fl02	00 580 043	flowmeter permeate 400-4000 l/h	
1Fl03	00 580 035	flowmeter concentrate recirculation 150-1600 l/h	
1P01	00 390 215	pump CR 3-36, 3x400V/50Hz, 3,0KW	
1Pr01	00 630 006	pressure gauge filter inlet, NG63, 1/4"h, 0-10 bar	
1Pr02	00 630 006	pressure gauge filter outlet, NG63, 1/4"h, 0-10 bar	
1Pr03	00 600 012	pressure switch FF4-8, 3/8"	
1Pr04	00 630 209	pressure gauge pump pressure, NG63, 1/4"h, 0-25 bar	
1Pr05	00 630 209	pressure gauge operation pressure, NG63, 1/4"h, 0-25 bar	
1Pr06	00 630 209	pressure gauge concentrate pressure, NG63, 1/4"h, 0-25 bar	
1Q02	00 100 011	conductivity measuring cell permeate	
1RV01	00 580 012	check valve PVC, DN25, PN16	
1V01	00 410 098	solenoid valve, 1", DN20	
1V04	00 415 050	ball valve VA, DN20	
1V05	00 415 003	regulating valve - concentrate recirculation, ball valve 1/2"	
1V06	00 415 003	concentrate regulating valve, ball valve 1/2"	
1V07	00 410 084	sample	
1V08	00 405 050	sample permeate	
1X01	00 400 016 00 395 146	vessel, GFK, 4040-2, 25 bar Low pressure element	
	00 382 342	control with RO 1000	
option 00382113 cleaning set:			
1V10	00 415 004	cleaning connection, ball valve, 3/4"	
1V11	00 405 004	3-way ball valve DN25	
1V12	00 405 004	3-way ball valve DN25	
option 00382900 permeate recirculation:			
1RV02	00 580 012	check valve PVC, DN25, PN16	
1RV03	00 580 012	check valve PVC, DN25, PN16	
1V02	00 405 063	solenoid valve, 1"AG, DN21	
option 00382372 concentrate rinse valve			
1V03	00 410 107	solenoid valve, 1/2", 230V/50Hz	
further options:			
1RV02	00 580 012	check valve PVC, DN25, PN16	
1X02	00 370 069	hardness monitor Limitron 1"	
1X03	00 382 284	colloid index measuring device	



					Oberfläche	Maßstab	Position – Menge –
						-	-
						-	-
					Datum	Name	
				Bearb.	25.07.05	koe	
				Gepr.			
				Norm			
Zust.	Änderung	Datum	Name	EDV Nr.	381321-30012		

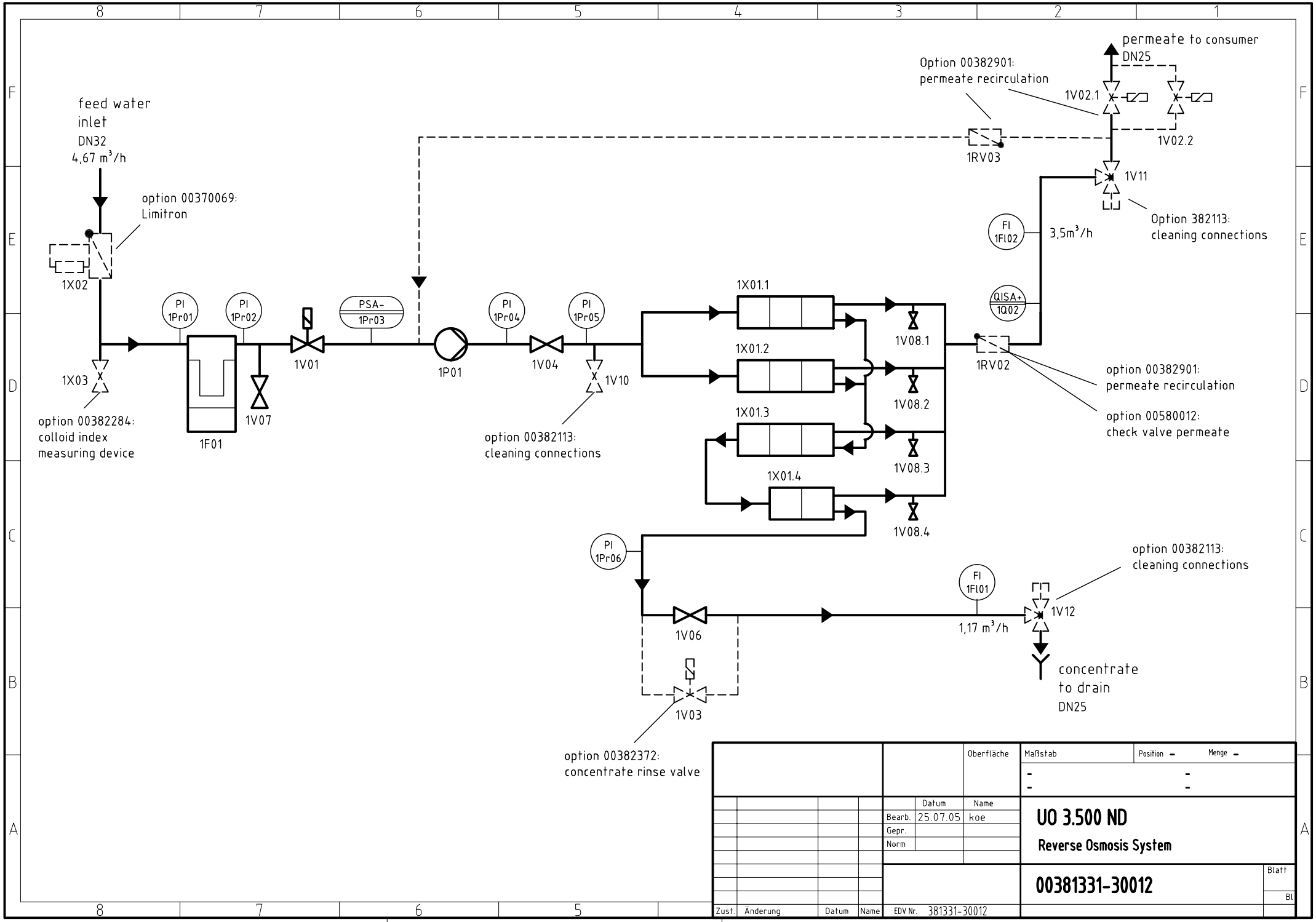
UO 3.000 ND

Reverse Osmosis System

00381321-30012

Blatt Bl

UO 3.000 ND **Code-No. 00381321**		**Component List**	
P+I-No.	**Code-No.**	**Description**	
1F01	00 330 050 00 335 101	filter housing 10" Big Blue, 11/2" filter cartridge, 10", 5 µm	
1Fl01	00 580 035	flowmeter concentrate, 150-1600 l/h	
1Fl02	00 580 043	flowmeter permeate 400-4000 l/h	
1Fl03	00 580 035	flowmeter concentrate recirculation 150-1600 l/h	
1P01	00 390 216	pump CR 5-24, 3x400V/50Hz, 4,0KW	
1Pr01	00 630 006	pressure gauge filter inlet, NG63, 1/4"h, 0-10 bar	
1Pr02	00 630 006	pressure gauge filter outlet, NG63, 1/4"h, 0-10 bar	
1Pr03	00 600 012	pressure switch FF4-8, 3/8"	
1Pr04	00 630 209	pressure gauge pump pressure, NG63, 1/4"h, 0-25 bar	
1Pr05	00 630 209	pressure gauge operation pressure, NG63, 1/4"h, 0-25 bar	
1Pr06	00 630 209	pressure gauge concentrate pressure, NG63, 1/4"h, 0-25 bar	
1Q02	00 100 011	conductivity measuring cell permeate	
1RV01	00 580 012	check valve PVC, DN25, PN16	
1V01	00 410 102	solenoid valve, 11/4", DN32	
1V04	00 415 050	ball valve VA, DN20	
1V05	00 415 003	regulating valve - concentrate recirculation, ball valve 1/2"	
1V06	00 415 016	concentrate regulating valve, ball valve 3/4"	
1V07	00 410 084	sample	
1V08	00 405 050	sample permeate	
1X01	00 400 017 00 395 146	vessel, GFK, 4040-3, 25 bar Low pressure element	
	00 382 342	control with RO 1000	
option 00382113 cleaning set:			
1V10	00 415 004	cleaning connection, ball valve, 3/4"	
1V11	00 405 004	3-way ball valve DN25	
1V12	00 405 004	3-way ball valve DN25	
option 00382901 permeate recirculation:			
1RV02	00 580 012	check valve PVC, DN25, PN16	
1RV03	00 580 012	check valve PVC, DN25, PN16	
1V02.1	00 405 117	solenoid valve, 1"AG, DN21	
1V02.2	00 405 117	solenoid valve, 1"AG, DN21	
option 00382372 concentrate rinse valve			
1V03	00 410 107	solenoid valve, 1/2", 230V/50Hz	
further options:			
1RV02	00 580 012	check valve PVC, DN25, PN16	
1X02	00 370 069	hardness monitor Limitron 1"	
1X03	00 382 284	colloid index measuring device	

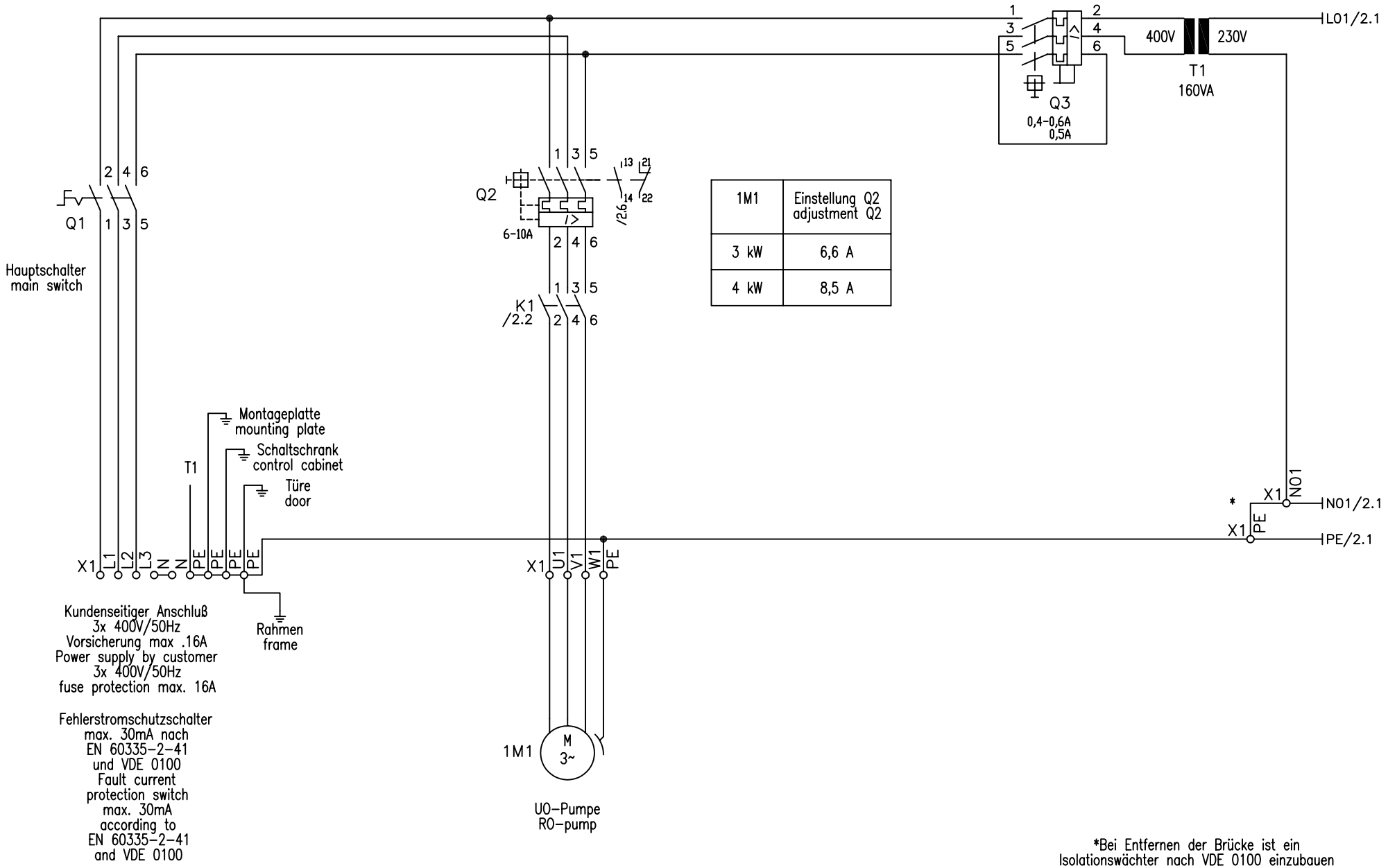


					Oberfläche	Maßstab	Position – Menge –
						-	-
						-	-
					Datum	Name	
				Bearb.	25.07.05	koe	UO 3.500 ND
				Gepr.			Reverse Osmosis System
				Norm			
							00381331-30012
Zust.	Änderung	Datum	Name	EDV Nr.	381331-30012		Blatt Bl

UO 3.500 ND **Code-No. 00381331**		**Component List**	
P+I-No.	**Code-No.**	**Description**	
1F01	00 330 050 00 335 101	filter housing 10" Big Blue, 11/2" filter cartridge, 10", 5 µm	
1Fl01	00 580 035	flowmeter concentrate, 150-1600 l/h	
1Fl02	00 580 043	flowmeter permeate 400-4000 l/h	
1P01	00 390 216	pump CR 5-24, 3x400V/50Hz, 4,0KW	
1Pr01	00 630 006	pressure gauge filter inlet, NG63, 1/4"h, 0-10 bar	
1Pr02	00 630 006	pressure gauge filter outlet, NG63, 1/4"h, 0-10 bar	
1Pr03	00 600 012	pressure switch FF4-8, 3/8"	
1Pr04	00 630 209	pressure gauge pump pressure, NG63, 1/4"h, 0-25 bar	
1Pr05	00 630 209	pressure gauge operation pressure, NG63, 1/4"h, 0-25 bar	
1Pr06	00 630 209	pressure gauge concentrate pressure, NG63, 1/4"h, 0-25 bar	
1Q02	00 100 011	conductivity measuring cell permeate	
1V01	00 410 102	solenoid valve, 11/4", DN32	
1V04	00 415 050	ball valve VA, DN20	
1V06	00 415 016	concentrate regulating valve, needle valve 3/4"	
1V07	00 410 084	sample	
1V08	00 405 050	sample permeate	
1X01	00 400 017 00 400 016 00 395 146	vessel, GFK, 4040-3, 25 bar vessel, GFK, 4040-2, 25 bar Low pressure element	
	00 382 342	control with RO 1000	
option 00382113 cleaning set:			
1V10	00 415 004	cleaning connection, ball valve, 3/4"	
1V11	00 405 004	3-way ball valve DN25	
1V12	00 405 004	3-way ball valve DN25	
option 00382901 permeate recirculation:			
1RV02	00 580 012	check valve PVC, DN25, PN16	
1RV03	00 580 012	check valve PVC, DN25, PN16	
1V02.1	00 405 117	solenoid valve, 1", DN21	
1V02.2	00 405 117	solenoid valve, 1", DN21	
option 00382372 concentrate rinse valve			
1V03	00 410 107	solenoid valve, 1/2", 230V/50Hz	
further options:			
1RV02	00 580 012	check valve PVC, DN25, PN16	
1X02	00 370 069	hardness monitor Limitron 1"	
1X03	00 382 284	colloid index measuring device	

II

Circuit diagram



1M1	Einstellung Q2 adjustment Q2
3 kW	6,6 A
4 kW	8,5 A

	Revision	Datum	Name		Datum	Name
a				gez.	24.01.06	Fre
b						
c				gepr.		
d						

Hauptstromkreis
main supply circuit

Projektbez.
R01000 / 3-4kW

Auftragsnr.

Zeichnungsnr.
382342-01005

Blatt 1
5 Bl.

RO1000

Ausgänge outputs

max. zul. Last 1000VA max. allowed load 1000VA

Ausgänge potentialbehaftet (230V/50Hz) outputs with potential (230V/50Hz)

max. zul. Last 1000VA max. allowed load 1000VA

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

PE	N	L	PE	N	L	PE	N	L	PE	N	L	PE	N	Lö	Ls	PE	N	Ls	W	S	ü	M	E	M	E	M	E	M	E	M	E	S	A	B	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	32	33	34	35	36	37
																																	wß	br	ge	gn

Netz main power

Enthärter softener

UO-Pumpe RO-pump

MV1 UO-Eingang MV1 RO-input

MV2 Permeat MV2 permeate

MV3 Konzentrat MV3 concentrate

Sammelstörmeldekontakt potentialfrei collective fault contact potential-free

Zwangsstop/Regeneration forced stop/regeneration

Motorschutz/Hartwasser Motor protect./hard water

Druckschalter pressure switch

Niveau unten low level

Niveau oben high level

Schirm schield

Meßzelle Permeat measuring cell permeate

Meßzelle measuring cell

Enthärter softener

Option option

Regeneration Einzelenthärter regeneration single-softener Option option

1S2

1S1

8S2

8S3

Q2 /1.4

Limitron 1S3 Option option

K1 A1 A2

1Y1 1Y2 1Y2.1 1Y3

PE/1.8 NO1/1.8 LO1/1.8

/1.4 /1.4 /1.4

Permeatrückführung permeate circulation Option option

Konzentratspüleinrichtung concentrate rinse device Option option

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

	Revision	Datum	Name		Datum	Name
a				gez.	24.01.06	Fre
b						
c				gepr.		
d						

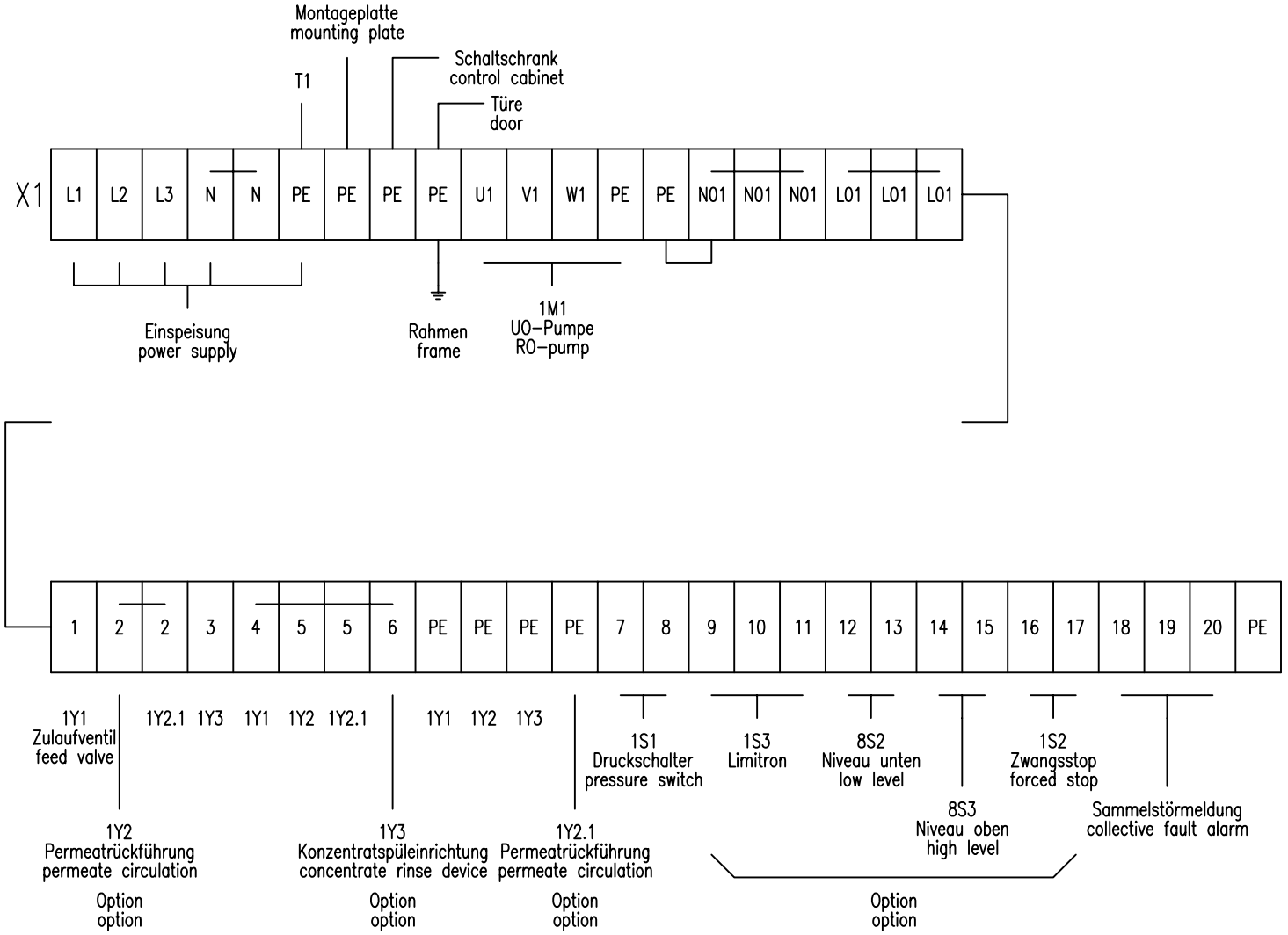
Anschlußbelegung RO1000
Terminals RO1000

Projektbez.: RO1000 / 3-4kW

Auftragsnr.:

Zeichnungsnr.: 382342-01005

Blatt 2 / 5 Bl.



	Revision	Datum	Name		Datum	Name
a				gez.	24.01.06	Fre
b						
c				gepr.		
d						

X1

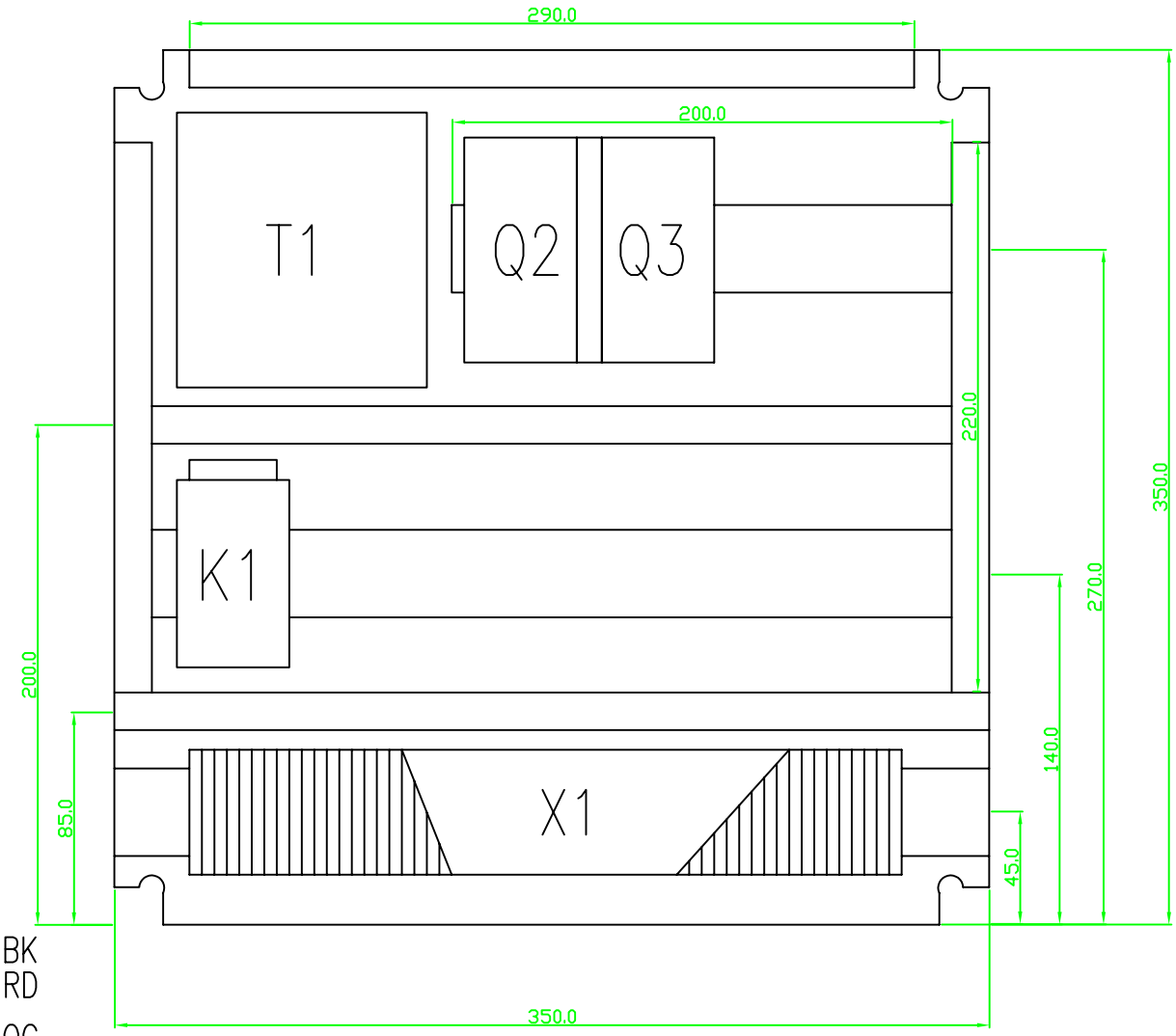
Projektbez.: RO1000 / 3–4kW

Auftragsnr.:

Zeichnungsnr.: 382342–01005

Blatt 3

5 Bl.



Adernfarben / wire colors:

Versorgungsspannung / supply voltage:	BK
Steuerspannung / control voltage:	RD
Fremdspannung / external voltage:	OG
Nullleiter / neutral conductor:	BU
Schutzleiter / protective conductor:	GNYE

	Revision	Datum	Name		Datum	Name
a				gez.	24.01.06	Fre
b						
c				gepr.		
d						

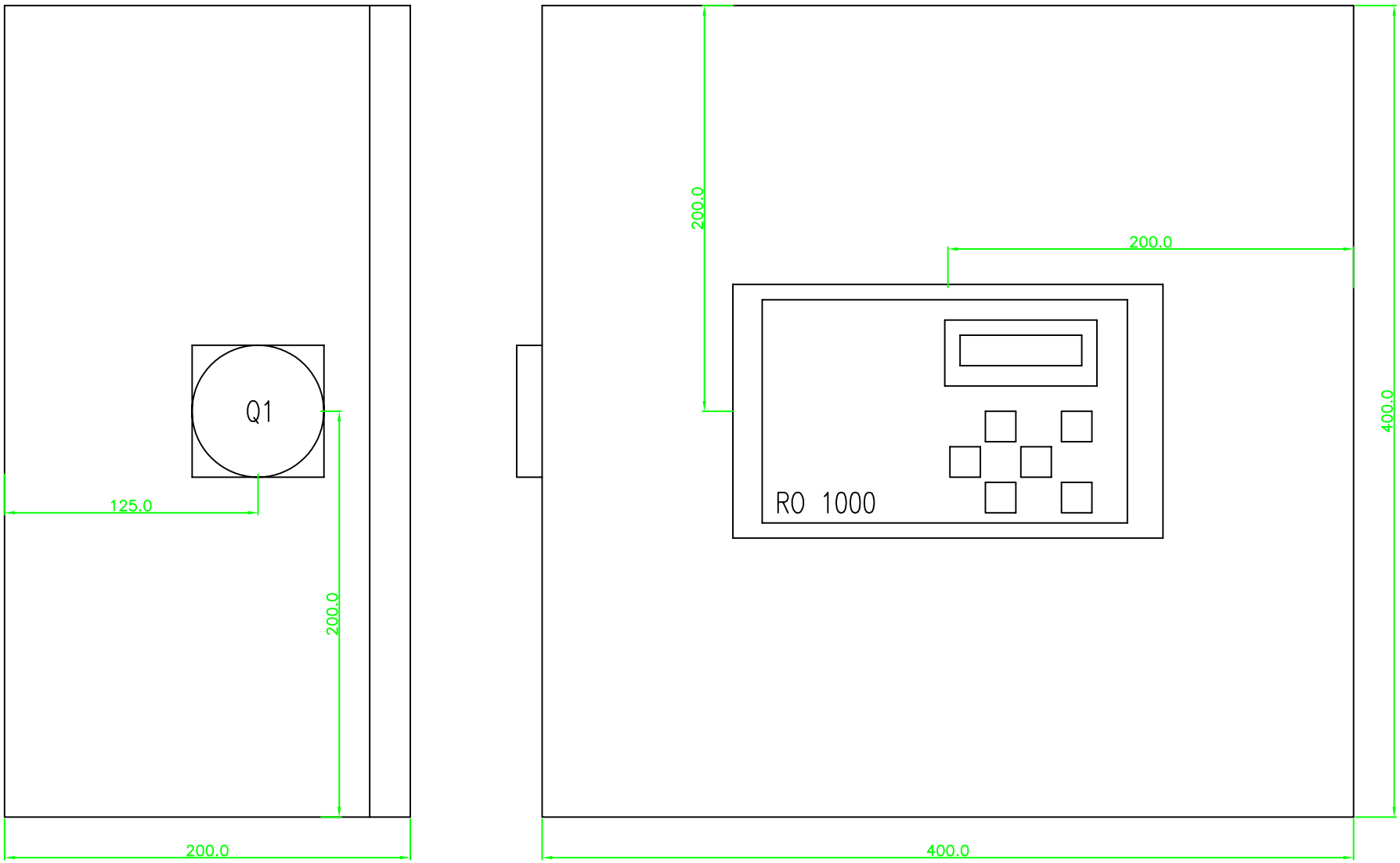
Montageplatte
mounting plate

Projektbez.: R01000 / 3-4kW

Auftragsnr.:

Zeichnungsnr.: 382342-01005

Blatt 4
5 Bl.



	Revision	Datum	Name		Datum	Name
a				gez.	24.01.06	Fre
b						
c				gepr.		
d						

Schaltschrank
control cabinet

Projektbez.
RO1000 / 3-4kW

Auftragsnr.

Zeichnungsnr.
382342-01005

Blatt 5
5 Bl.

III

Control system manual

Control System

RO 1000

MANUAL

Contents

1 General

1.1 General Remarks

The present Manual is the technical documentation of the **RO 1000 control system** for reverse osmosis units.

When studying this manual, it would be useful to have the control system ready for operation so that you can directly try to realize the explained items and functions. As some of the modules are directly related to other ones, it is recommended to follow the given order of the different chapters.

Should there arise any problems or questions during the operation of the control system, please ask for our advice and assistance. Please try to localize the problem as exactly as possible and to record any actions or conditions which caused the problem; this will enable us to help you as quickly as possible.

The supplier does not accept any liability with regard to any faults contained in this documentation. Under no circumstances whatsoever a liability for any damages related directly or indirectly to the delivery and use of this documentation is accepted.

1.2 Scope of Application

The RO 1000 system is a control system for reverse osmosis units of different sizes. Its technical features are:

- microprocessor control with liquid crystal text display and keyboard covered with a protective film.
- LED displays for operation, malfunction, disinfection, disposal, regeneration and tank full
- circuit inputs: regeneration, motor protection (available by Limitent contact), pressure switch, min. permeate level as well as max. permeate level
- relay outputs: inlet valve, outlet valve, concentrate valve, system pump as well as alarm
- conductivity sensor for permeate, optional 2 to 200 µS/cm, resolution: 0.2%, accuracy:1%, temperature compensation with integrated sensor
- self-explanatory menu-assisted operator environment
- all settings and adjustments via keyboard/text display, no mechanical adjustments (potentiometers, trimmers, switches, plug-in bridges)
- any process time can be set
- preselection for tank type (with/without overflow), hardwater production (admissible/not admissible), concentrate displacement/disposal
- hour meter with maintenance interval message
- protection against improper acknowledgement of failures
- permanent display of measured values
- two-point calibration
- technical diagnostic function

1.3 Instructions for Use

The following instructions should be followed when operating the control system:

- Do not switch on/off the control system in quick succession. Wait at least 5 seconds between switching the main switch on and off.
- The control system should only be operated under the ambient conditions (temperature, humidity) mentioned in the technical data (see item 5). It is particularly important to protect the control system against water and humidity. It must not come into contact with splash water or condensed water.
- Manufacturer's seals (trimmer fixation, EPROM labels) must not be damaged. Otherwise the right to assert claims for defect shall lapse.
- Should the control system become defective, take note of the type of problem (consequences) before removing the system. The system can only be repaired if it is completely removed and the failure correctly described.
- The max. admissible load of the circuit outputs as well as the total admissible load of the unit (see item 5) must not be exceeded.

1.4 Safety Instructions

The following safety instructions are imperative:

- Diagnosis (see item 3.3) allows direct manipulation of all actuatores (valves, pumps,.etc.) without interlocks or monitoring. Access to this function therefore requires a password and only should be used by the experts.
- Should the control system not react in the normal way, it has to be switched off immediately and the maintenance service has to be informed.
- Do not try to repair the control system yourself (loss of guarantee), always call the authorized maintenance staff. Only this will guarantee a reliable and safe function of the system.
- When a protection device was activated (fuse, motor circuit breaker) you should first try to clear the problem (e.g. clean the pump) before reactivating the protection device. Frequent actuation always is due to a sensor/actuator failure which also could damage the control system itself.

Non-observance of these instructions may cause damage to the control system and the unit
which may result in a loss of warranty.

1.5 Terms and Definitions

The following scripts will be used for this manual:

Item	Script	Examples
keys	capital letters + bold	**LEFT, UP, DOWN**
LED's	capital letters + bold	**RINSE, DISPOSAL**
inlets/outlets	capital letters + bold	**PUMP FAILURE, INLET VALVE**
operating settings	italics	*ps-hard water, ps-pumps*
operating parameters	italics	*LIM, t-rinse*
operating modes	capitals + underligned	STOP, ON
operating conditions	capitals + underligned	PRODUCTION; DISPOSAL
operating failure	capitals + underligned	MOTOR FAILURE, FORCED STOP

The following abbreviations will be used:

Cy-perm permeate conductivity
t-perm permeate temperature

Remark: The terms **on/off** as well as **STOP and OPERATION** could cause mix-ups; they are therefore defined as follows:

- **On/off** describes the existence/non-existence of the mains supply voltage
- **STOP** and **OPERATION** describe an operating condition which obviously only can exist when the system is switched on.

1.6 Declaration of Conformity

The Control Unit complies with the following standards and test regulations:

(to be fixed in the framework of the CE conformity standards)

2 Installation/Start-up

2.1 Basic Requirements for System Installation

The following remarks have to be observed during installation and connection of the RO 1000 unit:

- The connected consumers must not exceed the max. admissible loads of the circuit outputs as well as the total output of the unit (see item 5) (in case of inductive loads, the phase angles have to be taken into account).
- All inductive consumers (valves, motors, contactors, transformers) of the unit have to be provided with suitable interference suppressors (RC element, varistor, diode)
- Should other devices with a high mains-borne interference level be installed in the surroundings of the control system, suitable external interference suppressors (line filters) have to be installed at the supply voltage input.
- The clamps must not be actuated with too much force.
- The screw-less terminal clamps are suitable for single-core and fine core conductors (without sleeves) of up to 0.5mm² (for sensor and analog output terminals) and up to 2.5 mm² respectively (all further terminals). According to the manufacturer's instructions it is not necessary to use core sleeves.
- All assembly activities have to be done in accordance with the corresponding VDE regulations.

2.2 Start-up

For the first start-up of the unit after its installation, the below-mentioned steps have to be carried out **in the given order**. Should the control system not operate in the described manner or if other malfunctions are discovered, the **electric supply has to be interrupted immediately** (and repaired by the manufacturer).

1. Install control and fix all terminal clamps. It has to be taken into account that the softener output is not protected by fuses. A short-circuit at this output may therefore destroy the conductor lines.

2. Switch on mains supply voltage ⇒ after at most 5 sec a text has to be displayed on the LC display (otherwise switch off ⇒ repair).

3. Carry out diagnostic program (see item 3.3) and test all inputs and outputs of the control unit. Should the fuse on the pc-board become active, one of the valve outputs is short-circuited.

4. Set operating modes and parameters (see item 4).

5. Calibrate sensors (see item 4.4.2).

2.3 Function of Terminals

Terminal arrangement and functions are as follows:

No.	Code	Function	adm. max. load	terminal
1	PE	Mains supply - protective. conduct	1000 VA = max.	2,5 mm²
2	N	Mains supply - neutral conductor	total output	2,5 mm²
3	L	Mains supply - phase	performance	2,5 mm²
4	ENT-PE	softener - protective conductor		2,5 mm²
5	ENT-N	softener - neutral conductor	1000 VA	2,5 mm²
6	ENT-L	softener - phase		2,5 mm²
7	P1-PE	pump 1 - protective conductor		2,5 mm²
8	P1-N	pump 1 - neutral conductor	1000 VA	2,5 mm²
9	P1-Ls	pump 1 - phase		2,5 mm²
10	MV1-PE	inlet valve - protective conduct		2,5 mm²
11	MV1-N	inlet valve - neutral conductor	1000 VA	2,5 mm²
12	MV1-Ls	inlet valve - closer		2,5 mm²
13	MV2-PE	outlet valve - protective cond.		2,5 mm²
14	MV2-N	outlet valve - neutral conductor	1000 VA	2,5 mm²
15	MV2-Ls	outlet valve - closer		2,5 mm²
16	MV2-Lo	outlet valve - opening contact		2,5 mm²
17	MV3-PE	concentrate valve - protective cond.		2,5 mm²
18	MV3-N	concentrate valve - neutral cond.	1000 VA	2,5 mm²
19	MV3-Ls	concentrate valve - closer		2,5 mm²
20	STO-W	trouble message - central contact	230 VAC / 4A	2,5 mm²
21	STO-S	trouble message - closer	resp. 24V DC	2,5 mm²
22	STO-O	trouble message openring contact	/1 A	2,5 mm²
23	REG-M	mass - regeneration		2,5 mm²
24	REG-E	input - regeneration		2,5 mm²
25	MOTL-M	mass - motor protection/limitent		2,5 mm²
26	MOTL-E	input - motor protection/limitent		2,5 mm²
27	DRS-M	mass - pressure switch		2,5 mm²
28	DRS-E	input - pressure switch		2,5 mm²
29	NIVU-M	mass - min. top level		2,5 mm²
30	NIVU-E	input - min. top level		2,5 mm²
31	NIVO-M	mass - max. top level		2,5 mm²
32	NIVO-E	input - max. top level		2,5 mm²
33	SEN-S	sensor permeate screening		0,5 mm²
34	SEN-A	sensor permeate A (white)		0,5 mm²
35	SEN-B	sensor permeate B (brown)		0,5 mm²
36	SEN-C	sensor permeate C (yellow)		0,5 mm²
37	SEN-D	sensor permeate D (green)		0,5 mm²

Attention: Prototypes are equipped with an additional PE terminal instead of the softener output (cl. 4.6)

3 Operational Scope

3.1 Operating settings

The control system allows to preselect the following operating settings (realization see item 4). The resulting control behaviours are described in the chapter Operating Conditions. The standard values (setting after parameter reset) are marked by * in the appropriate field.

ps LIM high function: Preselect if unit is to be switched off if *LIM* is exceeded or if a failure message is sufficient
right of access: user/technician
possible setting: *** switch off**
do not switch off

ps acknowledgment function: Prelesect if acknowledgment of failures is possible in the normal level (=without password) or only in the user/technician level (=with password).
right of access: technician
possible setting: *** without password**
with password

ps concentrate mode function: Preselect if PRODUCTION has to be followed by CONCENTRATE FLUSH (with pump) or CONCENTRATE DISPLACEMENT (without pump).
right of access: technician
possible setting: *** flush**
displacement

ps tank type function: Prelesect if tank is equipped with an overflow or not. Should the tank have an overflow, the produced water continues to flow into the tank during CONCENTRATE DISPLACEMENT/ FLUSH and DISCONTINUOUS RINSE.
right of access: technician
possible setting: *** with**
without overflow

3.2 Operating parameters

The control system allows the following operating parameter settings (realization see item 4). The resulting behaviours are described in the chapter operating conditions. The values in brackets are the standard values after system reset (see item 4.4.4).

LIM	function:	Permeate limit value used to switch the unit off in case limit is exceeded or if a DISPOSAL process is to be finished. If this value is exceeded during PRODUCTION, RINSE or CONCENTRATE DISPLACEMENT/FLUSH for the time defined for *t-delay LIM*, an ALARM MESSAGE will be activated.
	right of access:	user/technician
	possible setting:	meas. range 0.5-50µS/cm (40 µS/cm) **Attention**: the set value must be above *aaLIM*
aaLIM	function:	Permeate limit value activating an ALARM MESSAGE in the display and on/off of the malfunction LED if this value is exceeded for the time defined for *t-delay aaLIM*
	right of access:	user/technician
	possible setting:	0.5-50µS/cm (10 µS/cm) **Attention**: the set value must be lower than *LIM*
t-delay LIM	function	Time delay for wrong permeate limit value (see above)
	right of access:	technician
	possible setting:	0-99 min (1 min)
t-delay aaLIM	function:	Time delay for advance alarm in case of wrong permeate limit value (see above).
	right of access:	technician
	possible setting:	0-99 min (5 min)
t-delay lack of pressure	function:	Time delay to release PRESSURE FAILURE if **PRESSURE SWITCH** is inactive.
	right of access:	technician
	possible setting:	0-99s (1s)
t-delay at start	function	Period of time of permanent pressure at start of operation after opening of the inlet valve before the pumps begin to work.
	right of access:	technician
	possible setting:	0-9.9s (0.5s)
t-pressure available	function:	Period of time until PRESURE FAILURE is released if pumps do not start after opening of inlet valve.
	right of access:	technician
	possible setting:	0-99s (5s)
t rinse	function	Duration of a DISCONTINUOUS RINSE.
	right of access:	technician
	possible setting:	0-99 min (5s)

t rinse interval	function	Time after which a DISCONTINUOUS RINSE process is started provided that the control system was during that time in the operating condition RINSE INTERVAL.
	right of access:	technician
	possible setting:	0-99h (0h)
t concentrate	function	Duration of a CONCENTRATE DISPLACEMENT/FLUSH process at the end of a PRODUCTION (**TANK FULL** active).
	right of access:	technician
	possible setting:	0-99min (1 min)
t min disposal	funtion	Minimum duration of a DISPOSAL process at the beginning of a PRODUCTION. This is the minimum time after which the unit passes to PRODUCTION if the value drops below *LIM*.
	right of access:	technician
	possible setting:	0-999s (5s) **Attention**: the set value must be less than *t max disposa*l. (Pay attention to units)
t max disposal	function:	Maximum duration of a DISPOSAL process. This is the maximum time after which the value has to be below *LIM*, otherwise a failure message will be given.
	right of access:	technician
	possible setting:	1-99min (60 min) **Attention:** the set value must be greater than *t min disposal* (Pay attention to units!)
t maintenance	function	Operating time (hour meter) after which a signal is given that maintenance has to be carried out (flashing **OPERATION**).
	right of access	technician
	possible setting:	0-999999h (3500h) **Attention:** zero setting means that no maintenance message is given.

3.3 Operating modes

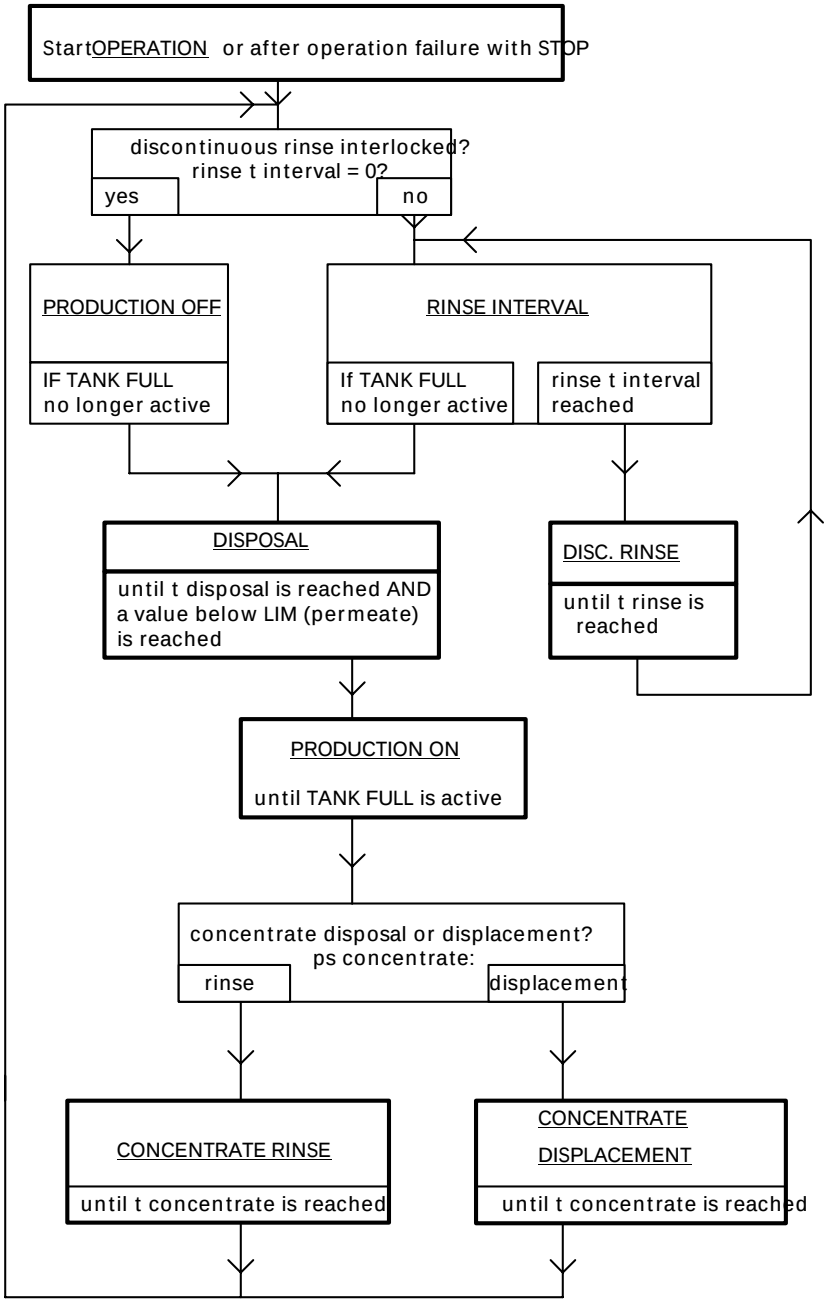
When the control system is switched on, the following four operating modes exist:

STOP	The control system does not carry out any production process. All outputs remain inactive. Failures are not registered.
OPERATION	The control system fulfills the production in accordance with the respective operating conditions in the unit. As long as the unit status is DISPOSAL, PRODUCTION ON, CONCENTRATE DISPLACEMENT/FLUSH or DISCONTINUOUS RINSE, the current operating data (conductivity, temperature, etc.) are displayed one after the other (rolling). Failures are registered, processed and displayed.
DISINFECTION	The control system does not carry out any production process, but **INLET VALVE**, **OUTLET VALVE** as well as the **PUMP** are switched on so that a disinfection can be carried out. No failures are registered.
DIAGNOSIS	The DIAGNOSIS is called via the main menue (see item 4.4.1). For diagnosis purposes, all control outputs can be manipulated via the keyboard and the input status (analog/digital) can be displayed (see item 4.4.5). **Attention:** Failures are **not** registered/displayed.

The current operating mode is maintained when the system is switched off, that means the control system will be in the same operating mode which was running when the system was switched off.

3.4 Operating conditions

When the unit is in OPERATION the control system performs one of the seven possible operating conditions. The following diagram shows the various conditions as well as the reasons for status changes. For that purpose an error-free sequence of operations is assumed.



3.5 Operating failures/failure messages

The control system is able to detect operating failures during OPERATION and DISINFECTION and to display them. Usually, the unit will be stopped if a failure occurs. However, operating settings exist for the failures CY EXCEEDED and HARDWATER which make it possible that such a failure is only displayed without interruption of the production. During the operating mode DISINFECTION, only a MOTOR FAILURE can be detected.

The different operating failures/failure messages as well as their reasons and consequences are as follows:

Denomination	**Reason**	**Consequence**
CY EXCEEDED	Cy perm> *LIM*	Unit switches off if *ps LIM high* = switch-off
FORCED STOP	**FORCED STOP** active	Unit switches off
MOTOR FAILURE/HARD WATER	**MOTOR FAILURE/ LIMITENT CONTACT** active	Unit switches off
LACK OF PRESSURE	**PRESSURE SWITCH** active	Unit switches off

MAINTENANCE — When the preset maintenance interval is over, the LED display **OPERATION** starts to flash (but only if control system is in the operating conditions DISPOSAL, PRODUCTION ON, CONCENTRATE DISPLACEMENT/FLUSH or DISCONTINUOUS RINSE. This alarm message can only be switched off by a technician who has then to enter a new maintenance interval (see item 4.4.4).

Besides the above mentioned failures also other types of failure exist. These are erroneous calibration ranges (failure message on text display), internal system failures (flashing **FAILURE** light) and initialization failures (EEPROM fail message in text display immediately after having switched the system on or during operation). As these failures correspond to malfunctions which the user cannot repair, the supplier has to be informed immediately if such failures occur.

ATTENTION !!! As an internal system failure will interrupt program run, failures will not be monitored. Such a control system **must not** be used any more.

4. Operation

4.1 User interface

The user interface of the RO 1000 consists of a text display (16x2 characters), a keyboard covered with a protective film (6 keys) and 7 indicator lights.

4.1.1 Indicator lights

The indicator lights correspond to the most important operating conditions of the unit. The control system has the following indicator lights:

OPERATION Active, if the control system is in the operating mode OPERATION and if at least one pump is switched on. This indicator light will be a flashing light (instead of a continous light) if the set maintenance interval has run out.

FAILURE Active, if there is an operating trouble. In this case, the reason is displayed. In case of Cy alarm the failure LED flashes. Should the trouble light flash immediately after having the control system switched on, the reason is an internal system failure (see item 3.5).

DISINFECTION Active, if the control system is in the operating mode DISINFECTION.

DISPOSAL Active, if the control system is in the operating condition DISPOSAL.

FORCED STOP Active, if the FORCED STOP input is activated and if the control system is in the operating mode OPERATION.

TANK FULL Active, if the TANK FULL input is activated.

4.1.2 Keyboard

The control system has keys for the functions **UP ↑, DOWN ↓, LEFT ←, RIGHT →, ENTER ↵** as well as **ESC** (on the equipment keyboard, symbols/arrows are used to identify some of them). They allow to call via the menu all functions and to modify the system settings/parameters.

4.1.3 Text display

The purpose of the LC text display is to indicate, besides the indicator lights, the current operating mode or the current unit condition respectively (normal level); it also serves for the (menu-assisted) user communication for control system settings (user/technician level).

4.2 Basic elements

The whole user surface of the control system is composed by basis functions such as password entry, menu selection, selection of settings, numerical entries etc. The description of the basic functions will be followed by the operating elements of the menus for users/techniciens.

4.2.1 Password entry

The entry of the password is the only way to gain access from the normal level to the user/technician level. User and technician have different passwords.

For user's password entry, the following keys have to be actuated in the normal level, **within one minute**.

↑ → ↓ ← ↑

For technician's password entry, the following keys have to be actuated in the normal level, **within one minute**.

↑ ← → **ESC** ↓ ↵ ↑ ← → **ESC** ↓ ↵ ↑

The control system then switches to the corresponding menu branch.

4.2.2 Selection of menu

A menu is used to select or call specific functions. It consists of several numerical menu points (lines) listed one below the other. The text display of the control system always shows two of these menu lines, that means it always displays a two-line section (window) of the whole menu.

If a function or a menu point has to be called in, the desired menu point has to be selected first using the ↑ / ↓ keys. If the menu consists of more than two lines, the displayed section is automatically displaced within the whole menu (scrolled), the selected menu point being marked with arrows at the left and right sides of the display (e.g. ">9 settings<").
This selected menu point is called-in with the ↵ key.
A menu is finished with the **ESC** key (return to normal level). At certain program points (settings, calibrations, uncommitted input) nested menus appear. That means that the selection of a menu point starts a further menu (sub-menu). In that case, the **ESC** key causes return to the preceding menu.

4.2.3 Selection

The selection serves to chose one out of different options (usually operating settings). When a selection is called in (e.g. via a menu) the name of the selection appears in the upper display line (operating settings), the lower line displays the current status (value). With the ↑ / ↓ keys all further options can then be displayed. As soon as the ↵ key is pressed, the currently displayed option is then accepted (stored) as new operating setting.
A selection can be interrupted with the **ESC** key without having carried out any modification.
.

4.2.4 Multiselection

The multiselection allows to select various arguments simultaneously (for the purpose of this paper, argument means any type of setting).
In the lowest line of the text display appears for that purpose a chain of "0" and "1". Each one of these characters represents an argument. A "0" argument is inactive, a "1" argument is active.
A curser (flashing block) can be moved with the ← / → keys between the different characters (arguments), and the corresponding description of the argument then appears in the
upper display line (e.g. name of operating mode). An argument can be activated/inactivated with the ↑ / ↓ key.
The current setting of all arguments is accepted/stored with the ↵ key.

4.2.5 Numerical editing

The numerical editing is required to set the internal operating parameter and to enter the adjusted values. The procedure is the same as used for decade switches.
When numerical editing is called-in (e.g. via a menu), the name of the operating parameter/adjusted value appears in the upper display line. The current value is displayed in the lower line.

A flashing block (cursor) always marks the figure which can be modified; this modification (new setting) can be achieved with the ↑ / ↓ keys. Cursor displacement is achieved with the ← / → keys, so that other figures can be modified, too.
The displayed value is stored as new operating parameter when the ↵ key is actuated. The **ESC** key allows to interrupt the procedure without any storage even if a new figure was entered.

4.2.6 Alphanumerical editing

The alphanumerical editing is required to set the message text for the uncommitted input failure message. The procedure is the same as for numerical editing (see item 4.2.4), with the exception that the ↑ / ↓ keys do not only allow to select numbers but also letters (capital/small) and special characters.

4.2.7 Confirmations

Various menu activities require confirmations in order to avoid data entry errors. The user is asked to confirm that modifications of operating settings/parameters and adjustments are actually correct.
Confirmation is done with the →key (select "yes") followed by the ↵ key. Otherwise, the system will return to the level from which the function was called-in (e.g. menu) without any consequences (no modification wil be stored).

4.3 Operating levels

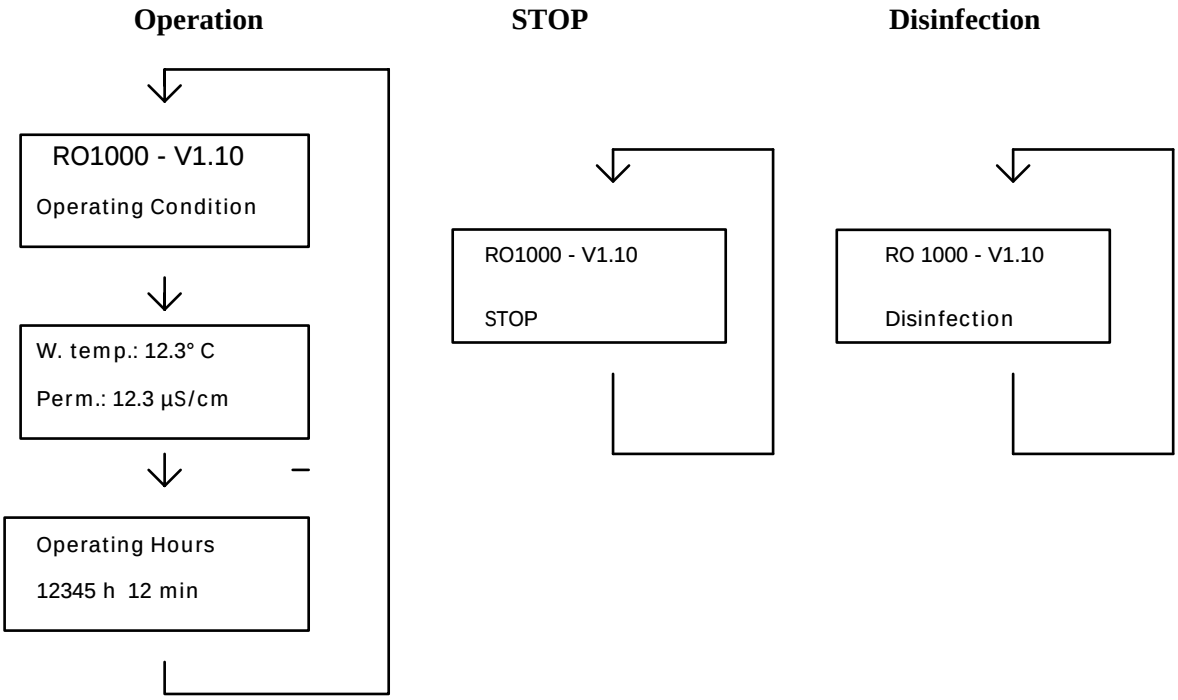
Similar to the operating modes, the user surface has different operating levels:

Normal level:	In this level, the text display shows the operating mode, the operating condition, the current measured values and operating values as well as special messages (maintenance message) by means of different (scrolling) masks (see 4.3.1).
User level:	The user level (see 4.3.2) allows operation and setting of the most important functions and operating settings/parameters respectively as well as the calibration of the conductivity sensors.
Technician's level:	The technician's level is a extended user level: It allows to carry out the functions of the user level, to manipulate ˙ all operating settings/parameters and to fulfil a hardware test by means of a specific diagnostic function.

The different operating levels and their functions as well as the operating options and the displayed texts (as far as possible) are described below.

4.3.1 Normal level

According to the operating mode, the sequence of displays in the normal level is as follows:



The only operation which is admitted is the acknowledgement of a failure (only for *ps acknowledgment* = without password); the purpose is to protect the control system against unintentional/unauthorized manipulations. When the system is switched on, it always is in the normal level, so that is also can be called the basic level.

4.3.2 User's Level

Access to the user level is achieved by entering a user's password (see 4.2.1). This level allows operation and setting of the most important functions and operating settings/parameters respectively. The operating status is not displayed because display is used to represent the menus to do selections and editing.

The functional scope corresponds to that of the main menu (see 4.4.1), but without the menu points Setting and Diagnosis.

If there is no key actuation for more than 10 min. and provided that the current function does not correspond to the display of measured values, the control system automatically returns to the normal level for safety reasons.

4.3.3 Technician's level

The technician's level is an expanded user level. It allows to fulfill the functions at user's level, to manipulate **all** operating settings/parameters and to fulfill a hardware test by means of a diagnostic function. The functional scope covers all menus and sub-menus (see 4.4.).

Access to the technician's level is similar to that to the user's level, that means a specific password has to be entered (see 4.2.1). If there is no key actuation for more than 10 min. and provided that current function does not correspond to the display of measured values or a diagnostic process, the control system returns to the normal level.

4.4 Menu structure

The menu structure of the user surface is shown below. Access to the main menu is achieved by entering a pass word (see item 4.2.1).

main menu
1 ackn. failure
2 operat. mode
3 Cy permeate
4 temp. permeate
5 operat. hours
6 Cy limits
7 options alarm
8 calibration
9 settings
10 diagnosis

calibration menu
1 Cy permeate
2 temp. permeate
3 calibr. reset

setup menu
1 t Cy LIM
2 t Cy alarm
3 t pressure lack
4 t delay at start
5 t press. available
6 t disc. rinse
7 t rinse interval
8 t concentrate
9 t disposal
10 t maintenance
11 ps alarm mess.
12 ps concentrate
13 ps tank type
14 inputs
15 ps language
16 system reset

diagnosis menu
1 digital input
2 digital output
3 lights
4 Cy permeate
5 permeate temp.

4.4.1 Main menu

The details of the different menu points of the main menu are described below.

Menu point:	**Function**:
1 Ackn. failure	This menu point allows to acknowledge an operating failure (the only possibility if ps acknowledgement = with password).
2 Operat. mode	This menu point allows to change the operating mode by means of a selection. For safety purposes, selection only can be made between STOP and OPERATION as well as STOP and DISINFECTION respectively (direct change-over from OPERATION to DISINFECTION is not possible).
2 Cy permeate	Permanent display of current permeate conductivity. To leave this menu point press one of the keys.
4 Temp. permeate	Permanent display of current permeat temperature. To leave this menu point press one of the keys.
5 Hour meter	Calling-in (display) of the operating hours meter.
6 Cy limits	Numerical entry of LIM and aaLIM.
7 Optional alarm	Setting (selection) of ps LIM high
8 Calibration	This menu point assures branching to the calibration menu (see item 4.4.3). The new calibration will be stored if the entered data are acknowledged before leaving the calibration menu.
9 Setting	This menu point assures branching to the setting menu (see item 4.4.4). The modification will be stored of the entered data are acknowledged before leaving the setting menu.
10 Diagnosis	This menu point assures branching to the diagnosis menu (see item 4.4.5). At the beginning of the diagnosis, all actuators of the unit are switched off. The sytem returns to the previous status if diagnosis is completed.

4.4.2 Calibration menu

The calibration menu is used to adjust the sensors. The following functions are available:

Menu point:	**Function:**
1 Cy permeate	Calibration of permeate sensor. If the menu point '1 Cy permeate' is chosen, a submenu appears with two items: '1 **min**. Cy' and **'2 max**. Cy'. '**1 min Cy':** please remove the Cy sensor and press the ↵ key. '**2 max Cy**' **Important!!!** The temperature must be calibrated before calibration of the conductivity. Connect the Cy sensor. Now the current permeate conductivity has to be determined by means of a standard meter, and this value has to be entered by numerical editing. The entered value is equated with the current conductivity after actuation of the ↵ key.
2 temp.permeate	Calibration of permeate temperature sensor. For that purpose the current permeate temperature has to be defined with a standard meter, and this value has to be entered by means of numerical editing. The entered value is equated with the current temperature when the ↵ key is then actuated.
3 calibr. reset	This menu point allows to reset adjustment of the two measuring inputs to the internal standard values. **ATTENTION !!** Internal calibration is not a correct adjustment.

4.4.3 Setting menu

The setting menu allows to modify the following operating settings/parameters:

Menu point:	**Function**:
1 t Cy LIM	Numerical editing of *t delay LIM*
2 t Cy alarm	Numerical editing of *t delay aaLIM*
3 t lack of pressure	Numerical editing of *t delay lack of pressure*
4 t delay at start	Numerical editing of *t delay at start*
5 t press. availabe	Numerical editing of *t pressure failure*
6 t disc. rinse	Numerical editing of *t rinse*
7 t rinse.interval	Numerical editing of *t rinse interval*
8 t concentrate	Numerical editing of *t concentrate*
9 t disposal	Numerical editing of *t disposal*
10 t maintenance	Numerical editing of *t maintenance*
11 ps failure alarm	Selection of *ps acknowledgment*
12 ps concentrate	Selection of *ps concentrate*
13 ps type of tank	Selection of *ps tank type*
14 inputs	Setting of input types (valve with open rest pos./opener)
15 ps language	Selection of *ps language*
16 system reset	As soon as this function is called-in and acknowledged, the internal hours meter will be deleted (set to 0)

4.4.4 Diagnosis menu

The diagnosis allows direct display/manipulation of the input/output conditions for testing purposes. **ATTENTION**!!! Under these conditions, failure detection is **not active**.

Menu point:	**Function:**
1 digital input	Display of the current conditions of the digital inputs (see item 2.3). Display is like a multiselection, but with the difference that the conditions of the arguments cannot be set - they depend on the input conditions.
2 digital output	Manipulation of the digital circuit outputs (see item 2.3) by means of a multiselection.
3 lights	Manipulation of the lights (item 4.1.1) by means of a multiselection.
4 Cy permeate	Permanent display of the current permeate conductivity. This display can be cancelled by actuating one of the keys.
5 temp. permeate	Permanent display of the current permeate temperature. This display can be cancelled by actuating one of the keys.

5. Technical Data

The following table contains all significant technical data of the RO 1000 control.

	min.	**type**	**max.**	**unit**
nominal service voltage	200	230	260	V
main frequenCy	47	-	63	Hz
nominal voltamps	5	-	10	VA
ambient temperature range (operation)	0	-	50	° C
ambient temperature range (storage)	-10	-	70	° C
relative air humidity	15	-	85	%
conductivity range	2	-	200	µS/cm
- accuraCy of measurement (ref. to range end value without sensor)	-	0.5	1	%
- temperature range	0	-	40	° C
switching current of circuit inputs	0	-	30	mA
adm. relay load for 230 V AC	-	-	4	A
adm. relay load for 24 V DC	-	-	1	A
total installed load	-	-	1000	VA
total installed load - solenoid valves	-	-	250	VA
protection class	IP55			

Settings RO 1000 Micro Process Pilot Control

1 Ackn.failure			
2 Operat.mode	STOP		
	OPERATION		
	DISINFECTION		
3 cy-permeate			
4 temperature			
5 hour meter			
6 cy-limits	lim: 050 µS/cm		
	war: 040 µS/cm		
7 ps lim. exc.	do no stop		
	do stop		
8 calibration	1 temp. permeate	XX.X: °C	
	2 cy-permeate	1 cond UNTEN	XXX µS/cm
		2 cond OBEN	XXX µS/cm
	3 calibr.-reset		
9 settings	1 t-delay-LIM	05 min	
	2 t-del.aa-LIM	01 min	
	3 t-low pressure	01 s (8 s)*	
	4 t-press.hys	9,9 s	
	5 t-press.TO	60 s	
	6 t-disc. rinse	00 min	
	7 t-inter rinse	00 h	
	8 t-concentrate	01 min	
	9 t-disposal	min: 005 s	max: 60 min
	10 t-maintenance	003500 h	
	11 ps-acknowl.	without password	
		only with password	
	12 ps-concentrate	displacement	
		rinse	
	13 ps-tank-type	with overflow	
		no overflow	
	14 inputs	1 extern.stop	normally closed
			normally closed
		2 motor ptotection	normally closed
			normally closed
		3 pressure switch	normally closed
			normally closed
		4 tank min	not active
			normally closed
			normally closed
		5 tank max	normally closed
			normally closed
	15 language	english	
		deutsch	
	16 syst.-reset		
10 diagnostic	1 digit.input		
	2 digit.output		
	3 lights		
	4 cy-permeate		
	5 temp.-permeate		

When various settings possible the factory adjustment is the first on the following menue table.

* for 3-phase current/RO pump