

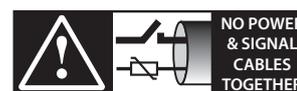
CAREL

# Water Treatment System Large ROL 160 - 1K2 Reverse osmosis plants



## USER MANUAL

**LEGGI E CONSERVA  
QUESTE ISTRUZIONI**  
→ **READ AND SAVE  
THESE INSTRUCTIONS** ←



**READ CAREFULLY IN THE TEXT!**

**WTS - Large ROL**  
+03000131EN - ENG  
Up to date version available on  
[www.carel.com](http://www.carel.com)



## GENERAL WARNINGS



**FAILURE TO CAREFULLY HEED THE WARNINGS SHOWN IN THIS MANUAL COULD LEAD TO FIRE OR EXPLOSION AND CONSEQUENT DAMAGE TO PROPERTY, INJURY OR DEATH.**

- **Do not store or use petrol or other flammable vapours and liquids in the vicinity of this or other appliances.**

### IF YOU SMELL GAS:

1. **Do not attempt to switch on any appliance;**
2. **Do not touch any electrical switches; do not use telephones in the building;**
3. **Call the gas supplier immediately from a neighbour's phone. Follow the instructions given by the gas supplier;**
4. **If you cannot contact the gas supplier, call the fire brigade;**
  - **Installation and maintenance must be performed by a qualified installer, service centre or gas supplier.**

CAREL Industries reverse osmosis (RO) systems are advanced products, whose operation is specified in the technical documentation supplied with the product or can be downloaded, even prior to purchase, from the website [www.carel.com](http://www.carel.com). Each CAREL product, in relation to its advanced level of technology, requires setup/configuration/programming to be able to operate in the best possible way for the specific application. Failure to complete such operations, which are required/indicated in the user manual, may cause the final product to malfunction; CAREL accepts no liability in such cases. The customer (manufacturer, developer or installer of the final equipment) accepts all liability and risk relating to the configuration of the product in order to reach the expected results in relation to the specific final installation and/or equipment. CAREL may, based on specific agreements, act as a consultant for the installation/commissioning/use of the unit, however in no case does it accept liability for the correct operation of the RO system and the final installation if the warnings or suggestions provided in this manual or in other product technical documents are not heeded. In particular, as well as observing the above warnings and suggestions, the following warnings must be observed for correct use of the product:

**ELECTRIC SHOCK HAZARD:** the RO system contains live electrical components. Disconnect the mains power supply before accessing inside parts or during maintenance and installation.

**WATER LEAK HAZARD:** the RO system automatically and constantly fills/drains certain quantities of water. Malfunctions in the connections or in the humidifier may cause leaks.

Environmental conditions, fuel and power supply voltage must all comply with the specified values. All other uses and modifications made to the appliance that are not authorised by the manufacturer are considered incorrect. Liability for injury or damage caused by the incorrect use of the appliance lies exclusively with the user.

Please note that the appliance contains live electrical devices. All service and/or maintenance operations must be performed by specialist and qualified personnel who are aware of the necessary precautions and are capable of performing the operations correctly and in accordance with the safety standards and legislation in force, with specific reference to:

1. Italian law no. 46/90: "Safety standards relating to systems in buildings";
2. Italian Presidential Decree no. 447 of 6 December 1991: "Regulations for the enforcement of law no. 46, dated March 5, 1990, on safety relating to systems in buildings";
3. Italian law no. 10/91: "Regulations for the enforcement of the national plan for energy savings and the development of renewable sources of energy"

## CAUTION

The installation of the product must include an earth connection, using the Schuko plug available in the RO system.

### Caution:

- Disconnect the appliance from the mains power supply before accessing any internal parts.
- Environmental and power supply conditions must conform to the values specified on the product rating labels.
- The product is designed exclusively to demineralize drinkable water.
- Only qualified personnel who are aware of the necessary precautions and able to perform the required operations correctly may install, operate or carry out technical service on the product.
- Only water with the characteristics indicated in this manual must be used.
- All operations on the product must be carried out according to the instructions provided in this manual and on the labels applied to the product. Any uses or modifications that are not authorised by the manufacturer are considered improper. CAREL declines all liability for any such unauthorised use.
- Do not attempt to open the appliance in any way other than described in the manual.
- Observe the standards in force in the place where the RO system is installed.
- The appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.
- Do not install and use the product near objects that may be damaged when in contact with water (or condensate). CAREL declines all liability for direct or indirect damage following water leaks from the humidifier.
- Do not use corrosive chemicals, solvents or aggressive detergents to clean the inside and outside parts of the RO system, unless specifically indicated in the user manual.
- Do not drop, hit or shake the RO system, as the inside parts and the linings may be irreparably damaged,

CAREL adopts a policy of continual development. Consequently, CAREL reserves the right to make changes and improvements to any product described in this document without prior warning. The technical specifications shown in the manual may be changed without prior warning. The liability of CAREL in relation to its products is specified in the CAREL general contract conditions, published on the website [www.carel.com](http://www.carel.com) and/or by specific agreements with customers; specifically, to the extent where allowed by applicable legislation, in no case will CAREL, its employees or subsidiaries/affiliates be liable for any lost earnings or sales, losses of data and information, costs of replacement goods or services, damage to things or people, downtime or any direct, indirect, incidental, actual, punitive, exemplary, special or consequential damage of any kind whatsoever, whether contractual, extra-contractual or due to negligence, or any other liabilities deriving from the installation or use of the product, even if CAREL or its subsidiaries/affiliates are warned of the possibility of such damage.

## DISPOSAL



Fig. 1



Fig. 2

PLEASE READ AND KEEP.

WITH REFERENCE TO EUROPEAN UNION DIRECTIVE 2012/19/EU ISSUED ON 4 JULY 2012 AND RELATED NATIONAL LEGISLATION, PLEASE NOTE THAT:

- Waste Electrical and Electronic Equipment (WEEE) cannot be disposed of as municipal waste but must be collected separately so as to allow subsequent recycling, treatment or disposal, as required by law;
- users are required to take Electrical and Electronic Equipment (EEE) at end-of-life, complete with all essential components, to the WEEE collection centres identified by local authorities. The directive also provides for the possibility to return the equipment to the distributor or retailer at end-of-life if purchasing equivalent new equipment, on a one-to-one basis, or one-to-zero for equipment less than 25 cm on their longest side;
- the equipment may contain hazardous substances: the improper use or incorrect disposal of such may have negative effects on human health and on the environment;
- the symbol (crossed-out wheeled bin, see Figure 1), if shown on the product or on the packaging, indicates that the equipment must be disposed of separately at end-of-life;
- if at end-of-life the EEE contains a battery (Figure 2), this must be removed following the instructions provided in the user manual before disposing of the equipment. Used batteries must be taken to appropriate waste collection centres as required by local regulations;
- in the event of illegal disposal of electrical and electronic waste, the penalties are specified by local waste disposal legislation.

**Warranty on materials:** 2 years (from production date, excluding consumables).

**Approval:** the quality and safety of CAREL products are guaranteed by the ISO 9001 certified design and production system, as well as the ,  marks.

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# 1. INTRODUCTION

Dear Customer,

Thank you for choosing a CAREL reverse osmosis unit. CAREL reverse osmosis units are state of the art. In order to operate your CAREL reverse osmosis unit safely, properly and efficiently, please read these operating instructions.

Only use the CAREL R.O. unit in faultless condition and for its intended use, being aware of safety and hazards, and observing all instructions in this manual.

If you have additional questions, please contact your expert dealer.

For all technical questions or spare parts orders, please be prepared to provide unit type and serial number (see name plate on the unit).

## 1.1 Typographic Distinctions

•	preceded by a bullet: general specifications
»	preceded by an arrow: Procedures for servicing or maintenance which should or must be performed in the indicated order
<input checked="" type="checkbox"/>	installation step which must be checked off.
<i>italics</i>	Terms used with graphics or drawings

## 1.2 Documentation

### Retention

Please retain these operating instructions in a secure, always accessible location. If the product is resold, turn the documentation over to the new operator. If the documentation is lost, please contact CAREL.

### Versions in Other Languages

These operating instructions are available in several languages. If interested, please contact CAREL or your CAREL dealer.

## 1.3 Symbols in Use

### Specific Symbols related to Safety Instructions

According to ANSI Z535.6 the following signal words are used within this document:

- DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
- WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
- NOTICE is used to address practices not related to physical injury.

### 1.3.1 General Symbols

**Notice:** This symbol is used whenever a situation requires special attention beyond the scope of safety instructions.

## 1.4 Intended Use

CAREL reverse osmosis unit used to produce fully demineralized water. It may only be used in accordance with its intended purpose.

### Notice:

- Intended use also includes compliance with the assembly, disassembly and reassembly, commissioning, operating and maintenance conditions and disposal measures prescribed by us.
- Only qualified and authorized personnel may work on and with the system. Persons who carry out transport or work on and with the system must have read the relevant parts of the operating instructions and in particular the chapter "Safety instructions". In addition, the personnel must be informed by the operator of any hazards that may exist. Leave a copy of the operating manual at the place of use of the unit.
- The installation of additional equipment is only permitted with the written approval of the manufacturer.

### Use of the system

- The system is intended for operation (with use of feed water in the drinking water sector) of humidification systems.
- The limit and guide values as per the regulations enforced in the installation country must be taken into account.
- Frost protection and protection against excessive moisture must be ensured
- The permitted surrounding temperature is between 5° C and 40° C
- The use of a system separator according to DIN 1988, part 4 and DIN EN 1717 is obligatory.

**Notice:**

- Avoid water temperatures above 20°C to prevent possible germ growth.
- Due to their construction, CAREL reverse osmosis systems are not intended for outdoor installation.

## 1.5 Unit sizes

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The following reverse osmosis plants belong to the ROL (Reverse-Osmosis-Large) series

- ROL160: max. permeate production rate of 160 l/h
- ROL320: max. permeate production rate of 320 l/h
- ROL460: max. permeate production rate of 460 l/h
- ROL600: max. permeate production rate of 600 l/h
- ROL1000: max. permeate production rate of 1000 l/h
- ROL1K2: max. permeate production rate of 1200 l/h

## 2. SAFETY INSTRUCTIONS

These safety instructions are required by law. They promote workplace safety and accident prevention.

### 2.1 Guidelines for Safe Operation

#### 2.1.1 Scope

Comply with the accident prevention regulation „DGUV Regulation 3“ to prevent injury to yourself and others. Beyond that, national regulations apply without restrictions. This way you can protect yourself and others from harm.

#### 2.1.2 Unit control

Do not perform any work which compromises the safety of the unit. Obey all safety instructions and warnings present on the unit.

In case of a malfunction or electrical power disruption, switch off the unit immediately and prevent a restart. Repair malfunctions promptly.

#### ⚠ Caution: Restricted use.

IEC 60335-1 stipulates as follows:

This device may be used by children of eight years of age and above as well as by persons with reduced physical, sensory or mental capabilities or lack of experience and knowledge so long as they are supervised or have been instructed regarding the safe use of the device and understand the hazards that may result from it. Cleaning and maintenance of the unit must not be undertaken by children without supervision.

🔊 **Notice:** The installation room must be adequately ventilated and be equipped with a floor drain. A water stop mechanism (e.g. leakage detector) can be used as an alternative.

#### 2.1.3 Unit operation

#### ⚠ Caution: Danger of scalding!

Hot surfaces can cause injuries. Protect yourself with suitable protective equipment.

#### 🔊 **Notice: Water leaks possible due to defective connections or malfunctions.**

- Before starting work, the water supply to the reverse osmosis system (RO system) must be shut off.
- The system may be under pressure. Release pressure before starting work.
- The reverse osmosis (RO) systems continuously produce permeate (product water) and concentrate (waste water). Connections and water-carrying components must be checked regularly for correct functionality.

#### 🔊 **Notice: Risk of material damage!**

- The unit may be damaged if switched on repeatedly following a malfunction without prior repair. Rectify defects immediately!
- Regularly check that all safety and monitoring devices are functioning normally. Do not remove or disable safety devices.

🔊 **Notice:** It is essential to leave the RO system connected to the power supply permanently. Only then the automatic rinsing can be carried out (protection against germs).

#### Switch device ON/OFF

The system can be switched on/off in different ways:

- » Interrupt the power supply (pull the plug) or
- » operate the main fuse switch (only ROL units) or
- » press the ESC key (for about 2 seconds).

#### 2.1.4 Mounting, dismantling, maintenance and repair of the unit

🔊 **Notice:** the CAREL reverse osmosis units are IP20 protected. Make sure that the unit is not object to dripping water in the mounting location.

🔊 **Notice:** Do not install CAREL reverse osmosis systems above electrical equipment such as fuse boxes, electrical appliances, etc. In the event of a leakage, leaking water can damage the underlying electrical systems.

#### 🔊 **Notice:**

- Use genuine spare parts only
- After any repair work, have qualified personnel check the safe operation of the unit
- Attaching or installing of additional components is permitted only with the written consent of the manufacturer

### 2.1.5 Electrical

#### **⚠ Caution: Risk of electrical shock!**

Hazardous electrical voltage!

Any work on the electrical system to be performed by certified expert staff (electricians or expert personnel with comparable training) only.

During maintenance or installation work, the device must be disconnected from the power supply and secured against being switched on again. The absence of voltage must be ensured by a measurement.

After electrical installation or repair work, test all safety mechanisms (such as grounding resistance).

#### **📌 Notice**

Use only original fuses with the appropriate amperage rating.

Regularly check the unit's electrical equipment. Promptly repair any damage such as loose connections or burned wiring.

Responsibility for intrinsically safe installation of the CAREL reverse osmosis unit is incumbent on the installing specialist company.

## 3. TRANSPORT

### 3.1 Overview

---

🔔 **Notice:** Proceed carefully when transporting the reverse osmosis unit in order to prevent damage due to stress or careless loading and unloading. Protect the device from moisture during transport; the storage and shipping temperature is 5° to 40°C.

### 3.2 Interim Storage

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Store the unit in a dry place and protect from frost and strong sunlight.

### 3.3 Check for complete and correct delivery of goods

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Upon receipt of the unit, confirm that:

- model and serial number on the name plate match those specified in the order and delivery documents
- the equipment is complete and all parts are in perfect condition

🔔 **Notice:** In case of damage from shipment and/or missing parts, immediately notify the carrier or supplier in writing.

### 3.4 Scope of delivery

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ROL

- Reverse osmosis unit incl. control
- 2 membranes (ROL160, ROL460, ROL600) or 4 membranes (ROL320, ROL1K0, ROL1K2)
- 2 prefilters (5/10 µm)
- manual
- connection material
- Antiscalant canister

## 4. FUNCTION AND STRUCTURE

### 3.1 Mode of operation

#### General principle of reverse osmosis

Osmosis is a natural process, it is understood as the one-sided diffusion of a liquid (here the feed water) through a semi-permeable membrane. A semi-permeable membrane is only permeable for certain substances.

As the liquid moves through a semi-permeable membrane, the pressure on the side with the lower concentration decreases and at the same time the pressure of the more concentrated solution increases until a balance is reached, stopping the water flow. Pressure difference between the two liquids is called "osmotic pressure".

Reverse osmosis, on the other hand, is a technical process in which the natural process is reversed. It involves applying a pressure higher than the osmotic pressure to the concentrated liquid so that the water flows in the opposite direction through the semi-permeable membrane and thus separates the salts solved in the water.

Using this principle, water can be demineralized for drinking water as well as for process and industrial applications.

### 3.2 Influencing factors

The performance of the reverse osmosis membrane depends strongly on the following parameters:

#### Water inlet pressure at the membrane:

- By lowering the working pressure, a reduction in permeate production can be achieved.
- By increasing the working pressure, an increase in permeate production is also achieved.
- The pump pressure can be changed by turning the screw on the pump (see chapter 8.4).
- Be careful not to exceed the maximum pump pressure!

#### Salt content of the feed water:

The higher the salt content, the faster the membrane wear.

#### Temperature of the feed water:

The ROL unit is set up for a feed water temperature of 15°C. Any difference from this temperature will affect the production quantity and the quality of the permeate.

The following table shows the variation of the permeate production quantity by 3% per differing 1°C.

<b>Temperature</b>	15 °C	+1	+2	+3	+4	+5	+6	+7	+8
<b>Correction factor</b>	1	1,03	1,06	1,09	1,12	1,15	1,18	1,21	1,25
<b>Temperature</b>	15 °C	-1	-2	-3	-4	-5	-6	-7	-8
<b>Correction factor</b>	1	0,96	0,92	0,88	0,84	0,8	0,77	0,74	0,7

The colder the feed water, the lower the permeate production and the better/lower the conductivity.  
The warmer the feed water, the higher the production quantity, but the lower the permeate quality.

### 3.3 Operating conditions of the unit

The ROL system can be fed with water from the normal water supply if the water has a maximum hardness up to 50°fH. In order to avoid a reduction of the operating capacity, the water to be treated must comply with certain parameters:

turbidity	< 1 NTU
Iron	< 0,15 ppm
Manganese	< 0,05 ppm
Aluminium	< 0,05 ppm
SDI (Silt Density Index)	< 3
Water temperature	5 to 25 °C
Free chlorine	< 0.25 ppm
Hardness	< 50 °fH
COD	< 10 mg/l
TOC	< 3 mg/l
TDS	< 1000µS/cm
SiO <sub>2</sub>	< 15 ppm
conductivity	< 1000 ppm

**Notice:** Ensure that the water is pre-treated by using a softener or an antiscalant.

### 3.3.1 Recovery value

You can optimise the permeate production by adjusting the flow rates (Ref. 1). The basis for this is the respective recovery value of the plant (see technical data). If the recovery value is 68%, this means a permeate production quantity of 68% of the feed water used for this purpose. The difference to 100% shows the concentrate share.

You can optimise permeate output by adjusting the flow rates (Ref. 1). The basis for this is the relevant recovery value of the system (see technical data). For example, the recovery value for the ROL320 is 68% at a raw water temperature of 18 °C and a TDS value of 500 ppm.

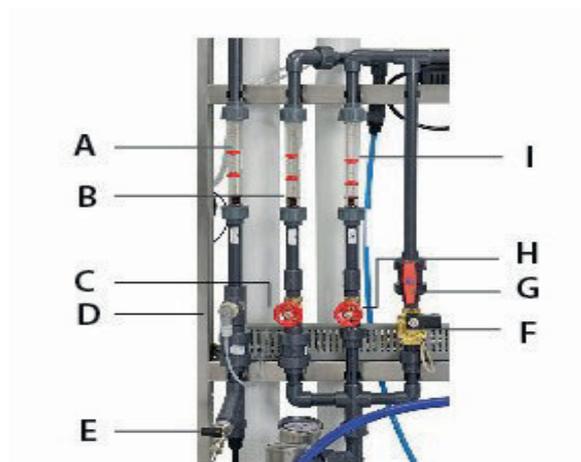
The recovery value is calculated as follows:

$$\text{RECOVERY (\%)} = \frac{\text{Permeate} \cdot 100}{\text{Permeate} + \text{Concentrate}}$$

Regulate the flow rate of the concentrate through the BV03\* valve and read it off the FI03\* flow meter. The circulation is controlled by the BV02\* valve and read off at the FI02\* flow meter. The pressure regulated in this way on the membranes guarantees the specified production output.

The feed water temperature clearly influences both productivity and the quality of the permeate. If the temperature rises (even by only a few degrees), productivity increases (which results in a better recovery value); however, conductivity increases at the same time.

\* see chapter: Commissioning



Ref.1

- A Permeate flow meter
- B Recirculation flow meter
- C Manual recirculation control valve
- D Permeate conductivity probe
- E Attachment for sampling permeate
- F Flushing solenoid valve
- G Manual flushing control valve
- H Manual drain control valve
- I Drain flow meter

## 3.4 Operating sequence

The feed water (raw water) is pumped through the pre-filter, which guarantees the dechlorination and a final filter capacity of 5 µm. This ensures the necessary clarity of the water at the membrane inlet. It is next softened by the addition of an antiscalant. The feed water pressure must be at least 2 to 5 bar during normal operation to ensure a correct supply pressure at the pump inlet.

The **water then flows through the water inlet solenoid valve SV1** and is then directed by the pressure pump at high pressure to the membrane(s).

The **pressure switch PS HIGH** provides a signal when the pressure exceeds 12 bar at the membrane inlet.

Pure water (permeate) passes through the membrane; the salts dissolved in the water are retained by the membrane and drained off (concentrate).

The permeate now flows via the pure water line (scope of delivery) to the expansion vessel or directly to the consumer.

The quality of the permeate leaving the system is controlled by the **conductivity sensor (EC PROBOUT)**.

The production process stops automatically when the water outlet pressure has reached approx. 4 bar at the **pressure switch PS MAX**. The pressure in the following circuit is kept constant by the expansion vessel.

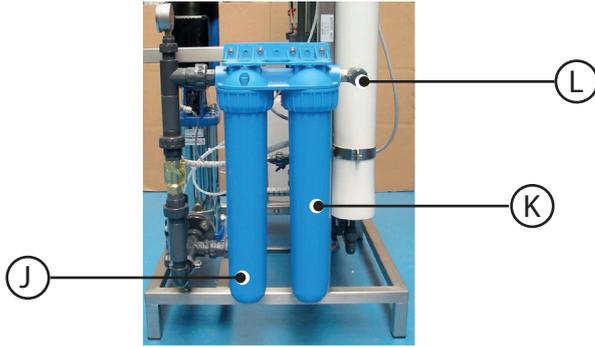
If the pressure in the following circuit at the **pressure switch PS MIN** falls below 2 bar (when the expansion vessel is empty), the unit starts permeate production again.

If the inlet pressure falls below 0.8 bar, the pressure switch **PS LOW** gives the corresponding alarm and interrupts operation.

The permeate production quantity achieved can be read off from the permeate flow rate display (Ref1). If this does not correspond to the specifications in the technical data, please note the measures mentioned in chapter 4.2.

**Notice:** The reverse osmosis (R.O.) units of the ROL series cannot operate without an expansion vessel or permeate collecting tank.

### 3.5 Mechanical construction



Ref. 2  
 J Prefilter CPC 20" 5 µm  
 K Carbon filter CB-EC 10" sx 10 µm  
 L Water inlet

ROL 160-320

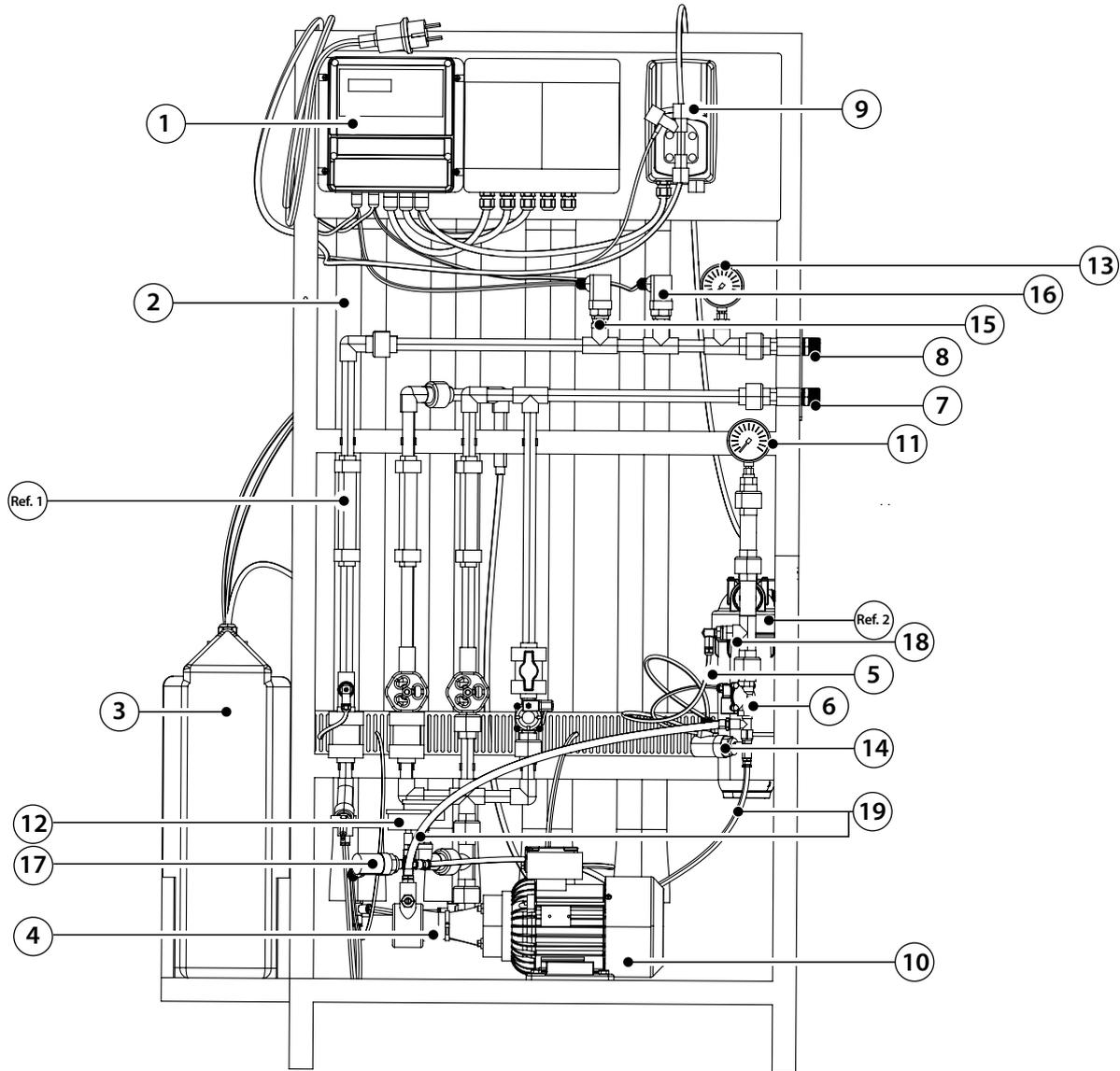


Fig. 3.a

- |   |  |
|---|--|
| 1 Control                               | 11 Pressure gauge feed water / PI      |
| 2 UV-lamp (optional)                    | 12 Pressure gauge membrane inlet / PI  |
| 3 Pressure container (membranes)        | 13 Pressure gauge permeate outlet / PI |
| 4 Antiscalant - tank                    | 14 Pressure switch PS LOW              |
| 5 Pump                                  | 15 Pressure switch / PS MIN            |
| 6 Check valve for antiscalant injection | 16 Pressure switch / PS MAX            |
| 7 System feedwater solenoid valve       | 17 Pressure switch / PS HIGH           |
| 8 Drain water outlet                    | 18 Feed water conductivity sensor      |
| 9 Permeate outlet                       |  |
| 10 Antiscalant pump                     |  |

ROL460 - 1K2

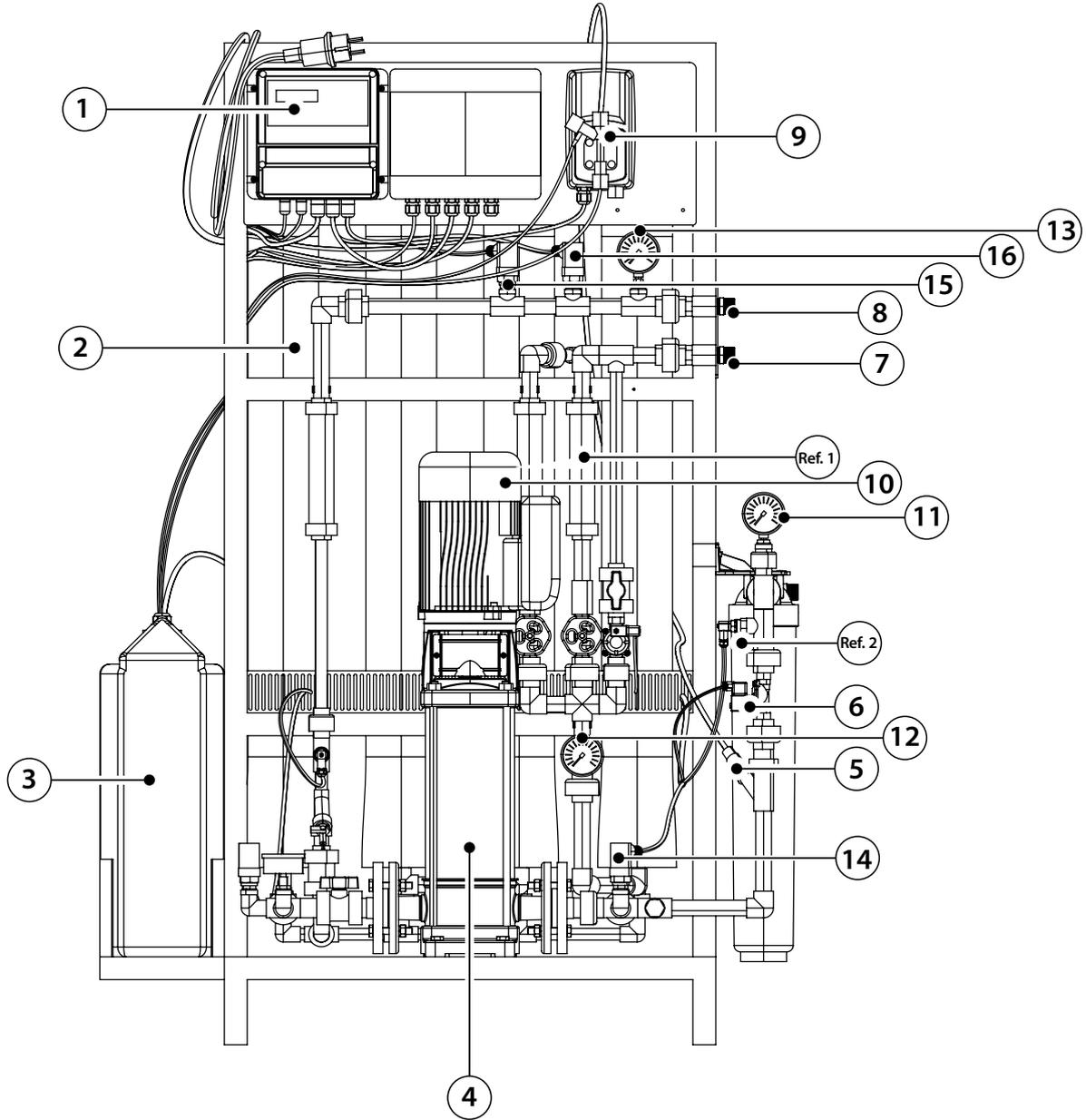


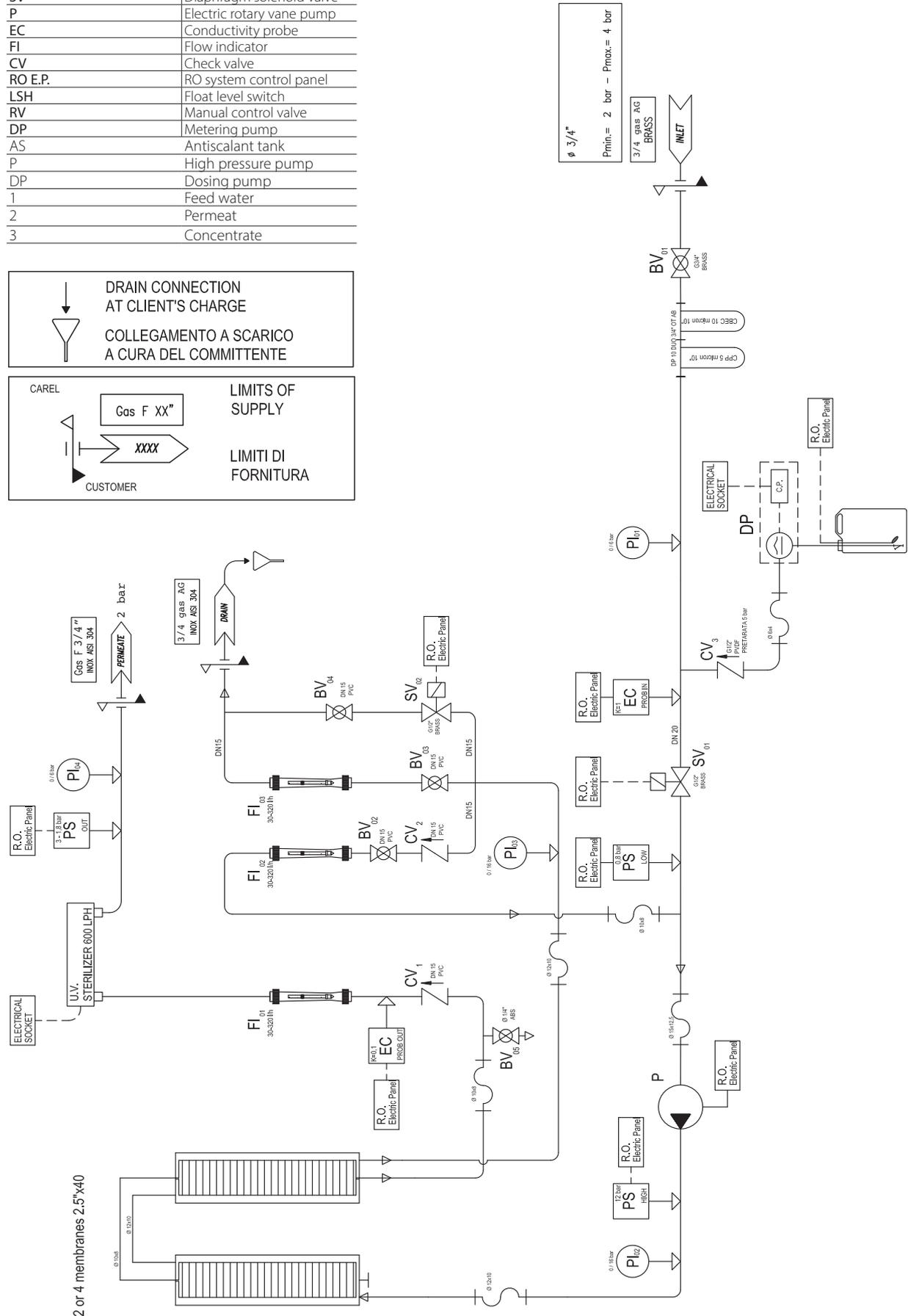
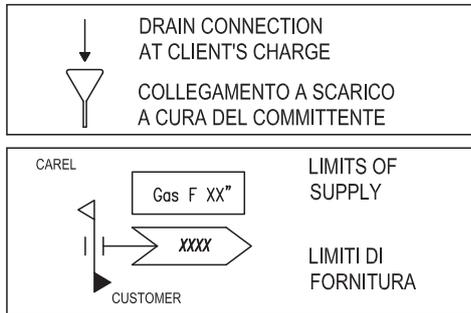
Fig. 4.b

- |    |                                       |    |                                     |
|----|---------------------------------------|----|-------------------------------------|
| 1  | Control                               | 11 | Pressure gauge feed water / PI      |
| 2  | Membrane                              | 12 | Pressure gauge membrane inlet / PI  |
| 3  | Antiscalant                           | 13 | Pressure gauge permeate outlet / PI |
| 4  | Centrifugal multistage motor pump     | 14 | Pressure switch PS LOW              |
| 5  | Check valve for antiscalant injection | 15 | Pressure switch / PS MIN            |
| 6  | System feedwater solenoid valve       | 16 | Pressure switch / PS MAX            |
| 7  | Drain water outlet                    | 17 | Pressure switch / PS HIGH           |
| 8  | Permeate outlet                       | 18 | Feed water conductivity sensor      |
| 9  | Antiscalant pump                      |    |                                     |
| 10 | Motor                                 |    |                                     |

## 4.6 Flowchart

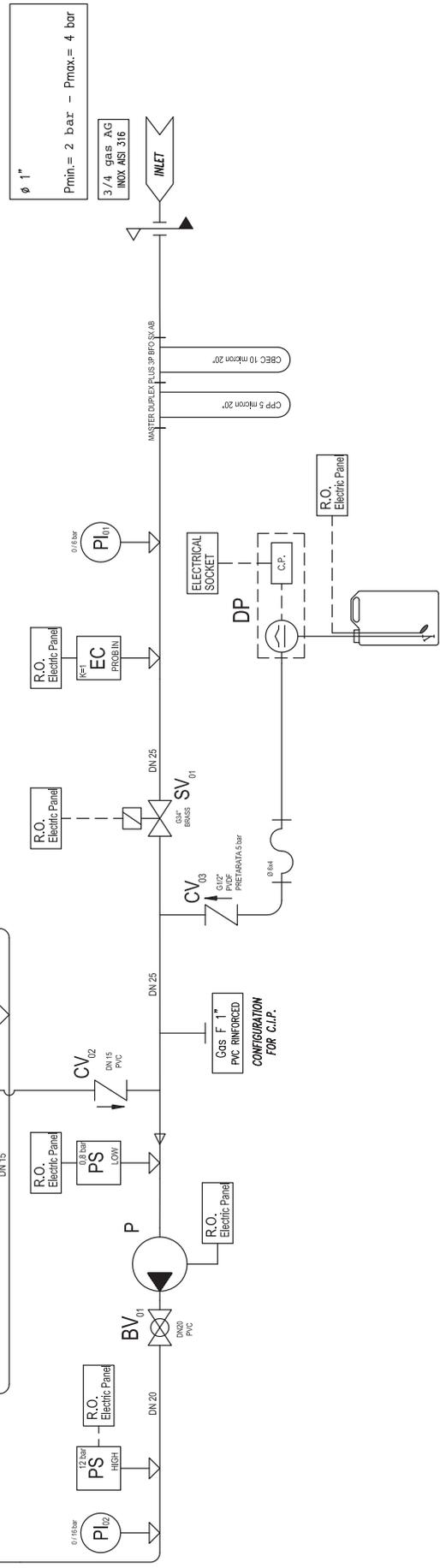
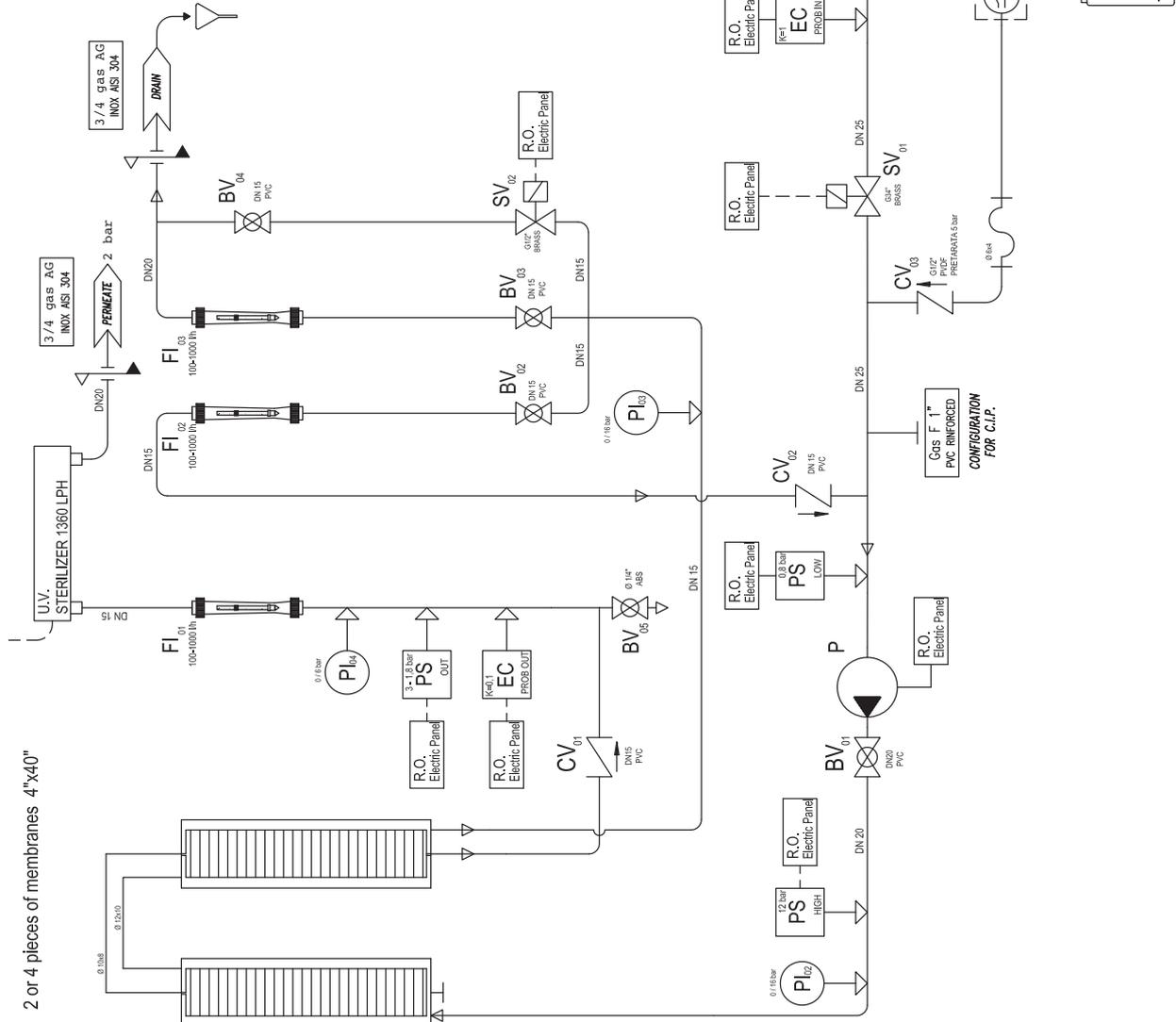
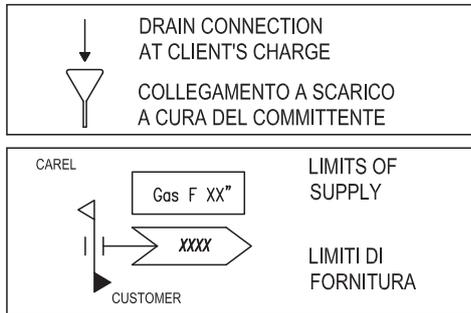
### ROL with 2 membranes

BV	Manual ball valve
PI	Pressure gauge
PS	Adjustable pressure switch
SV	Diaphragm solenoid valve
P	Electric rotary vane pump
EC	Conductivity probe
FI	Flow indicator
CV	Check valve
RO E.P.	RO system control panel
LSH	Float level switch
RV	Manual control valve
DP	Metering pump
AS	Antiscalant tank
P	High pressure pump
DP	Dosing pump
1	Feed water
2	Permeate
3	Concentrate



**WL-ROL with 4 membranes and antiscalant option**

BV	Manual ball valve
PI	Pressure gauge
PS	Adjustable pressure switch
SV	Diaphragm solenoid valve
P	Electric rotary vane pump
EC	Conductivity probe
FI	Flow indicator
CV	Check valve
RO E.P.	RO system control panel
LSH	Float level switch
RV	Manual control valve
DP	Metering pump
AS	Antiscalant tank
P	High pressure pump
DP	Dosing pump
1	Feed water
2	Permeate
3	Concentrate



## 5. MECHANICAL INSTALLATION

### ⚠ Caution: Risk of foot injuries!

Prevent unit from dropping during installation! Helping hand of a second person is advisable.

### ⚠ Caution: Risk of electrical shock!

Hazardous electrical voltage. During installation, the unit must be disconnected from power supply and secured against being switched on again. The absence of voltage must be ensured by a measurement.

### 5.1 Environment Parameters to be met and Mounting Recommendations

When selecting the installation site for the reverse osmosis unit, take the following into account:

- The minimum clearances indicated in the fitting measures section must be observed in order to ensure adequate unit ventilation and allow for unobstructed access in case of maintenance
- Protection class IP20
- By design, HygroMatik reverse osmosis units are not qualified for outdoor installation (electronic components and water-bearing parts may be damaged)
- Ambient temperature must lie between
- +5 and +40 °C (+41 and +104 °F) in order to protect the unit electronics against damage; frost may damage the steam cylinder, the solenoid valve and pump, as well as make hoses burst
- Avoid environments with excessive humidity, as it could have negative effects on the electronics.
- Installation in closed rooms requires aeration and, if necessary, temperature conditioning in order to meet the environmental conditions.
- Make use of existing water connections for supply and draining.
- For proper functioning of the level control, plumb and level installation of the unit is required.
- The optimal feed water pressure for the reverse osmosis units is in the range of 2 bar to 5 bar. If these values are not reached, the installation of a pressure reducer or a booster pump is necessary.
- The on-site waste water connection must be a free outflow according to DIN EN 1717.
- The installation room must be well ventilated and equipped with a floor drain. Alternatively, a water stop device (e.g. leakage detector) can be used.
- Ensure that the system stands firmly.

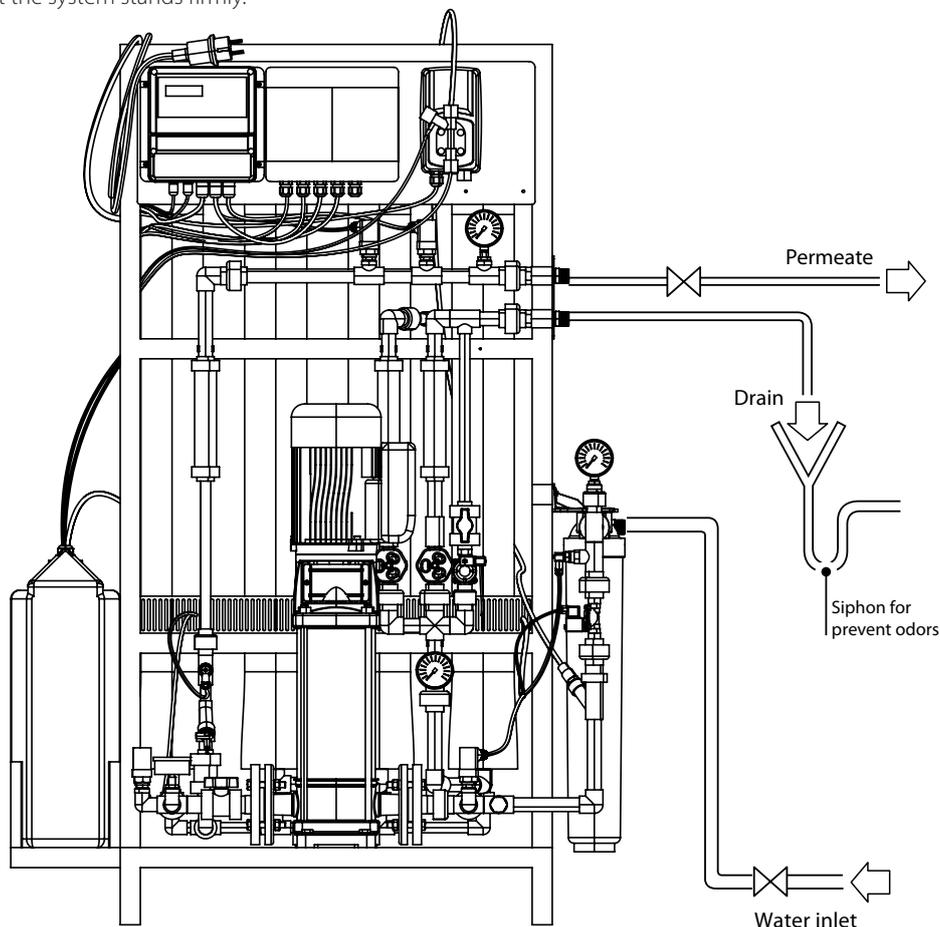


Fig. 5.a

## 5.2 Installation steps

### 5.2.1 Feed water connection

- » Install a shut-off valve
- » Connect the feed water inlet to the system. The diameter of the raw water pipe must be at least equal to the diameter of the connection piece.
- » Observe the information in the technical data.



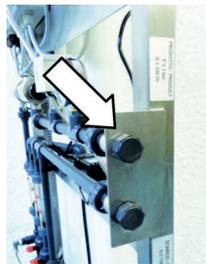
ROL-160/-320



ROL-460 - 1200

### 5.2.2 Permeate pipe connection

- » The diameter of the permeate pipe must be at least equal to the diameter of the connection piece.
- » Connect the permeate pipe to the corresponding connection piece and then connect the pipe (not included in the delivery) to the expansion tank or return pump tank.
- » Note the information in the technical data.



ROL-160/-320



ROL-460 - 1200

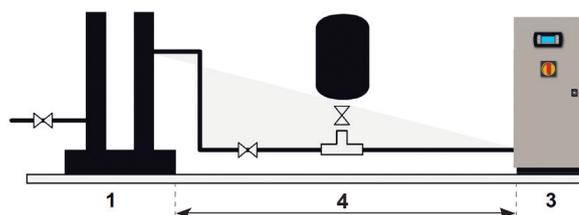
**Notice:** Do never operate the unit with the permeate line closed!

### 5.2.3 Connection of the expansion vessel

- » Mount the holder\* of the expansion tank on a stable wall or ensure a secure stand on the floor.
- » If necessary, connect the connection set to the expansion vessel.



- » Install shut-off valves as shown in the following figure



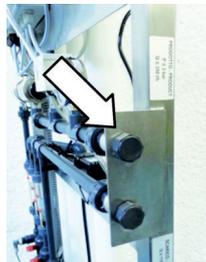
### Notice

- Install the reverse osmosis unit as close as possible to the consumer / humidifier. The maximum distance (4) is 15 metres (up to ROL600) 25 metres (ROL1000/1200)
- The reverse osmosis unit (1) must be installed at the same height of the humidifier (3) and the expansion tank.
- The number of fittings in the pipe should be kept to a minimum. The use of angle joints, T-pieces and reducers increases the pressure losses in the pipe. The diameters shown in the tables provide for a few fittings; if the number of fittings is doubled, the pipe with the next larger diameter must be used.

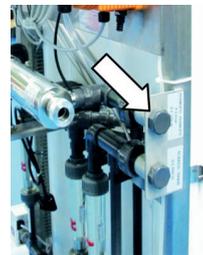
Unit	Length of premeate pipe			
	5 m	10 m	15 m	20 m
	min. innerØ premeate pipe			
ROL-160	10 mm / 0,39 Inch			
ROL-320	10 mm / 0,39 Inch	16,6 mm / 0,65 Inch		
ROL-460	16,6 mm / 0,65 Inch			
ROL-600	16,6 mm / 0,65 Inch			
ROL-1000	16,6 mm / 0,65 Inch		25,4 mm	
ROL-1200	16,6 mm / 0,65 Inch		16,6 mm / 0,65 Inch	

### 5.2.4 Connection of the concentrate line

- » Connect the concentrate pipe to the corresponding connector and connect the pipe (not included in the delivery) to the drain.
- » The diameter of the concentrate pipe must be at least equal to the diameter of the connection piece.



ROL-160/-320



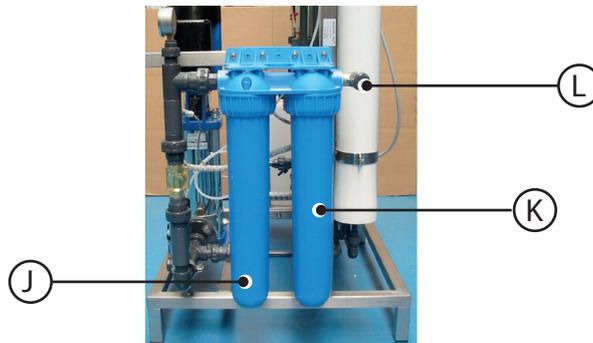
ROL-460 - 1200

**Notice:** Ensure a free outlet and discharge according to DIN EN 1717. Pay attention to the minimum requirement for the free flow distance (between the drain hose and the siphon) of 26 mm to prevent microbial contamination.

### 5.2.5 Inserting the prefilter cartridge(s)

Before installing the filter set in the membrane container, it must be ensured that the feed water line is closed and thus no pressure is applied.

- » Make sure the water inlet valve is closed.
- » Select menu item **14 SystemTest** in the control system menu, control the water outlet valve manually and release any possible rest pressure.
- » Switch off the system (press ESC for 2 seconds), then disconnect the system from the power supply (remove the plug).
- » Remove the filter housing using the installation key supplied.
- » For maintenance: remove the old filters and clean the filter housing.
- » Install the new filter inserts in the correct position.
- » Replace the filter housing and screw it tight with the mounting bowl.
- » Open the water supply and vent the filters using the filters using the screw in the upper part of the membrane housing.



The activated **carbon filter CB-EC (K)** removes the chlorine content from the feed water (L).

The **fine filter CPP (J)** works mechanically. When the feed water flows through the filter strainer unit and retains contaminants larger than 5 µm.

Replacement as part of maintenance: see chapter **Maintenance**.

## 5.2.6 Inserting the membrane(s)

Before installing the membranes in the membrane container, it must be ensured that the feed water line is closed and thus no pressure is applied.

- » Dismantle the crescent-shaped metal plates.
- » Remove the cap of the membrane pressure vessels (by pulling it out upwards) with the enclosed disassembly tool.



Disassembly tool

- » Remove the protective cover of the osmosis membrane (with sterile gloves) without damaging the membrane. Do not remove the protective plastic film adhering to the osmosis membrane! This can be recognised by the printed flow direction arrows.
- » Wet the seal of the osmosis membrane and the pegs at the ends with silicone fat if necessary.
- » Insert the membranes into the container as shown; pay attention to the position/direction of the seal. Make sure that the lip seal is not damaged.
- » Reassemble the top caps of the containers in the correct position and secure them with the metal plates. Check that the screw connection.
- » Re-attach the connectors to the lower part of the containers.
- » Make sure that there are no abnormal tensions on the lines or connections.

**Notice:** Use disposable gloves when installing the pre-filter(s) and membrane(s) to protect them from contamination.

Units with 4 membranes and 2 membranes

The ROL assembly inlet is from the left-hand side membrane, from the bottom

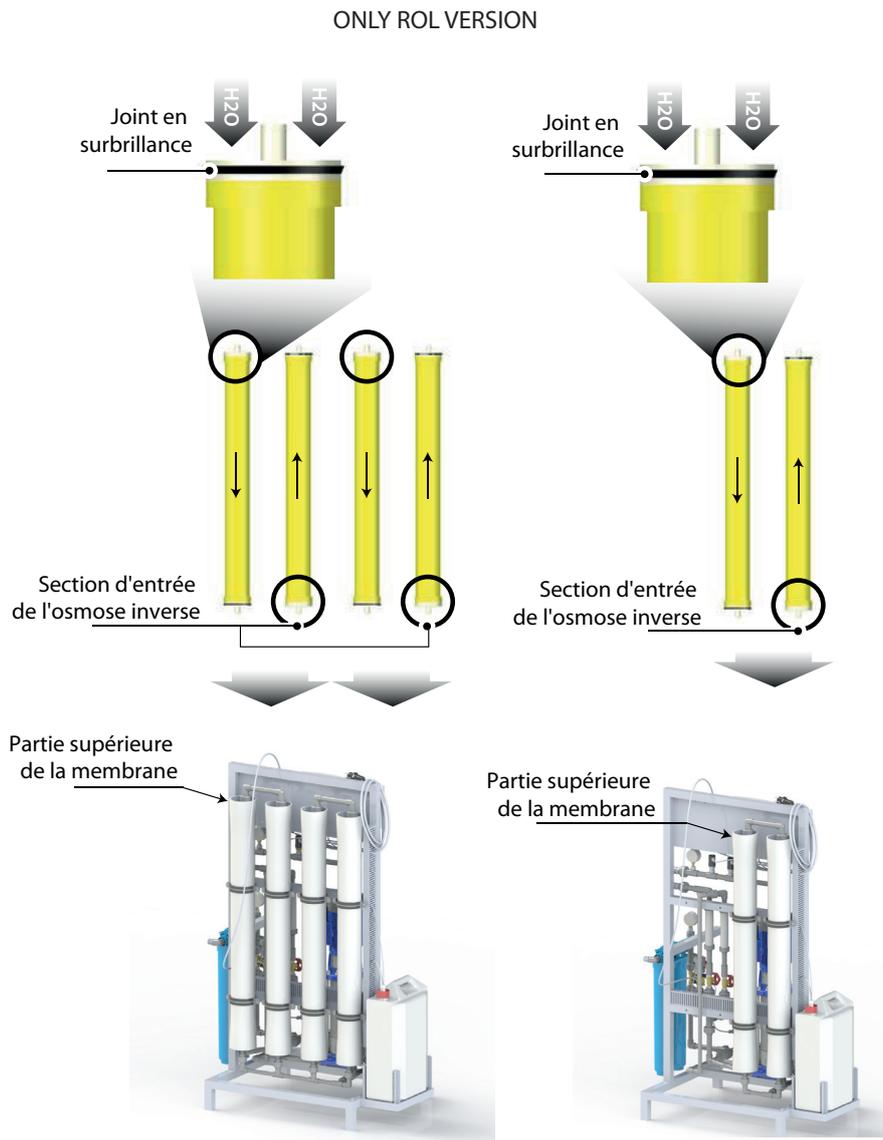


Fig. 5.b

**Notice:**

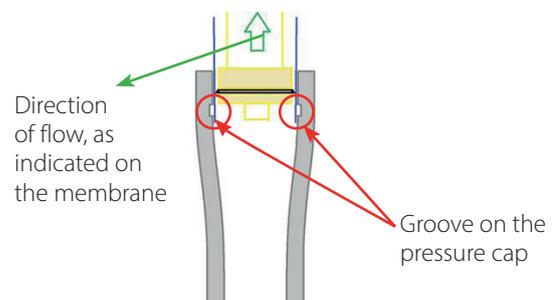
Maximum permitted storage time of the membranes:

- 6 months: if the membranes are supplied already impregnated with a chemical solution and/or glycol
- 1 year: if the membranes are delivered dry or vacuum packed.

Store the membranes at temperatures between 0 and 35 °C.

**Notice:** Before connecting the system to the power supply, it is mandatory to follow the steps described in the chapter **Initial start-up**.

**Notice:** When replacing the membranes with flow in an upwards direction, to avoid damaging the gasket, proceed as follows:



Before inserting the membrane, wrap the membrane with a layer of film measuring approximately 10x25 cm (the film can be recovered from the packaging if needed) and then place it inside the vessel.



Fig. 5.c

As soon as it passes the groove on the pressure cap, remove the film and proceed until the membrane is fully inserted.



Fig. 5.d

## 5.2.7 Installation of the uv quartz lamp (optional)

### ⚠ Caution:

#### Danger from uv radiation

UV radiation is harmful to the skin and eyes: disconnect power to the UV lamp before performing any operations.

### 📌 Notice:

The UV lamp and the quartz are very fragile. Pay extra care when performing the following operations to fit and/or remove the lamp and the quartz:

- » Open the rubber cap (A) and unscrew the plug (B).
- » Slide the lamp (D) approximately five centimetres out of the chamber (G)
- » Securely holding the end of the lamp (D), carefully remove the fourpin lamp connector (C) from the open end of the lamp.
- » Carefully remove the lamp (D) from the chamber (F).
- » Then unscrew the other end of the UV lamp to access to O-ring on the quartz tube.
- » Carefully remove the O-rings (E) from both ends of the quartz tube (F).

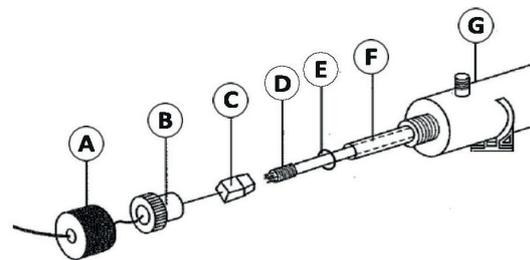


Fig. 5.e

## 6. WATER CONNECTION

Have all plumbing work done only by qualified personnel (plumber or specialist with equivalent training) to minimize risks.

### ⚠ Caution: Risk of electrical shock!

Hazardous electrical voltage! Before starting installation work ensure that the unit is not yet connected to the power supply.

### General Rules

- Obey local water utility regulations
- Verify that necessary safety measures have been taken – in compliance with either German Technical and Scientific Association for Gas and Water (DVGW) guidelines (DIN EN1717) or local regulations – that eliminate backflow of polluted water into drinking water treatment facilities. This may require the installation of a system separator, allowable only when free discharge into the drainage system is given.
- Ensure that there is a free outflow and drain according to DIN EN 1717. Pay attention to the minimum requirement for the free flow distance (between the drain hose and the siphon) of 26 mm to prevent microbial contamination.
- Supply water must not exceed 25°C (77°F)
- Allowable range of water pressure: 1,5 to 4 bar / 22 to 58 psi (150.000 to 400.000 Pa). If the pressure is below 1.5 bar, install a pressure booster, if it is above 4 bar, install a pressure reducer after the reverse osmosis system.
- Install a drain tap shortly before the system to flush the pipe. Flushing the pipe prevents foreign particles such as swarf or sealing material from entering the system from the pipes.

### Connection of the system supply

- » Make sure that the flow rate and pressure correspond to the values given in the technical data.
- » Ensure that the water supply stays closed. This system may only be supplied with water during commissioning (see chapter 8) !

### Connection of the concentrate discharge pipe.

- The diameter of the concentrate pipe must be at least equal to the diameter of the connection piece (see technical data).

🔍 **Notice:** In any case, a particle filter (min. 100 µm) according to DIN 13443-1 should be installed before the reverse osmosis system. Without a water filter there is a risk of damage to the system.

### 🔍 **Notice:**

The following applies to ROL units:

- For safety reasons the water connections are not screwed during transport. They must be screwed during installation.
- Remove the transport locks from the flow pipes.

🔍 **Notice:** for the Australian market and to comply with Watermark requirements, a watermarked approved dual check valve shall be installed in the supply line to the humidifier when connected to potable water. Should on the other hand the humidifier be fed with treated water from a Carel reverse osmosis system connected to potable water, the dual check valve shall be installed in the supply line to the reverse osmosis system.

### Water connections final check

Go down the following water installation checklist:

- ALL screw connections and hoses firmly connected?
- Water supply line flushed before making connections?
- Water connection properly installed?
- Water discharge properly installed?
- Does blow-down water drain freely?
- Water supply line and water discharge leakage-free?

# 7. ELECTRICAL CONNECTION

**⚠ Caution:**  
**Risk of electrical shock!**  
 Hazardous electrical voltage.  
 All work related to electrical installation to be performed by expert staff (electricians or expert personnel with equivalent training) only. Do not connect the reverse osmosis unit to the live power supply before all installation work has been completed.

The customer is responsible for checking expert staff qualification.

**General installation rules**

- All local rules concerning the implementation of electrical installations must be obeyed.
- Electric connector cables to be laid professional.

**🔌 Notice: Possible electronic components destruction through electrostatical discharge!**  
 Prior to commencing electrical installation work, steps must be taken to guard the sensitive electronic components of the unit control against damage from electrostatical discharge.

## 7.1 Procedure for electrical installation

Insert the plug into a suitable socket. The performance values are given in the technical data.

## 7.2 Remote ON/OFF and alarm relay connection

For connection of the remote ON/OFF signal cable and/or the alarm relay signal cables

- » open the front of the electronic control unit to access the terminal strip.
- » Lead the two-wire cable (not included in the scope of delivery) from the corresponding clamp through the cable screw connection in the control panel to the consumers.

**Fuses**

CAREL recommends the use of main fuses with slow - to medium - load characteristic.  
 The reverse osmosis system should be operated by its own residual current circuit breaker.

## 7.3 Electrical installation check list

Check electrical installation with respect to customer-site requirements and local power supply regulations.

- Supply voltage in accordance with name plate voltage rating?
- Have all electrical cable and plug connections been properly tightened?

## 7.4 Connection of the level sensor of the permeate collection tank

If using the ROL unit with a storage tank + booster pump,

- » connect the high level signal to terminals 22 - 23, and the low level signal to terminals 33 - 34.

The high level signal can be enabled in the menu "5 HIGH LEVEL".  
 The low level signal can be enabled in the menu "4 LOW LEVEL".  
 The permeate pressure switch already supplied does not need to be disconnected, as this does not interfere with the operating logic of the float.

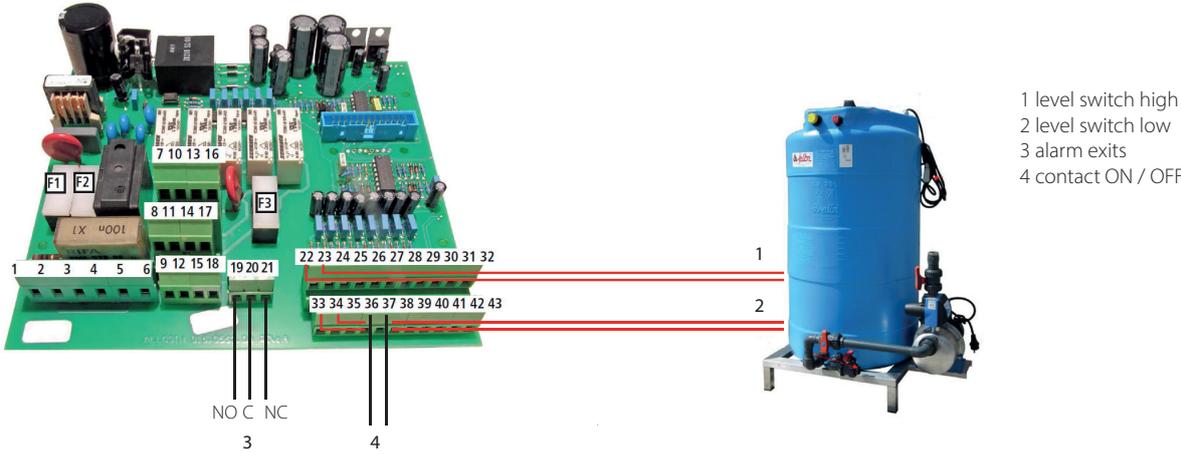


Fig. 7.a

## 7.5 Inputs and outputs of the main board

Clamp	Description	WL-ROL
1[L] - 2[earth] - 3[N]	230-V 50/60 Hz-Input for system power supply	✓
4[L] - 5[earth] - 6[N]	230-V-Output for pump supply	✓
7[L] - 8[earth] - 9[N]	230-V-Output for dosing pump	✓
10[L] - 11[earth] - 12[N]	230-V-Output for inlet valve	✓
13[L] - 14[earth] - 15[N]	230-V-Output for flush valve	✓
19[NO] - 20[C] - 21[NC]	alarm aoutput optional	✓
22[C] - 23[IIN]	input pressure switch Feed water connection / Max pressure	✓
24[C] - 25[IIN]	input high pressure switch pump pressure	✓
26[C] - 27[IIN]	input pump motor protection	X
28[C] - 29[IIN]	input alarm dosing pump	✓
30[shielded] - 31 - 32	conductivity sensor feed water	✓
33[C] - 34[IIN]	input pressure switch Feed water connection / Min pressure	✓
35[C] - 36[IIN]	input low pressure switch	✓
37[C] - 38[IIN]	input Remote-On/Off optional	✓
39[C] - 40[IIN]	input softening filter	✓
41[shielded] - 42 - 43	conductivity sensor row water	✓

## 7.6 Technical sheet: Booster pump (RTM300M2000)

Description	DATA
Tank material	PE
Volume	300 l
Diameter	630mm
Height	1300mm
Width	880mm
Depth	760mm
Voltage	220V
Frequency	50Hz
Power	0.91kW
Inlet (from osmosi)	G ¾" Male
Overfill	G 1" Male
Outlet (from pump)	G 1" Male
Drain tank	G ¾" Male



Fig. 7.b

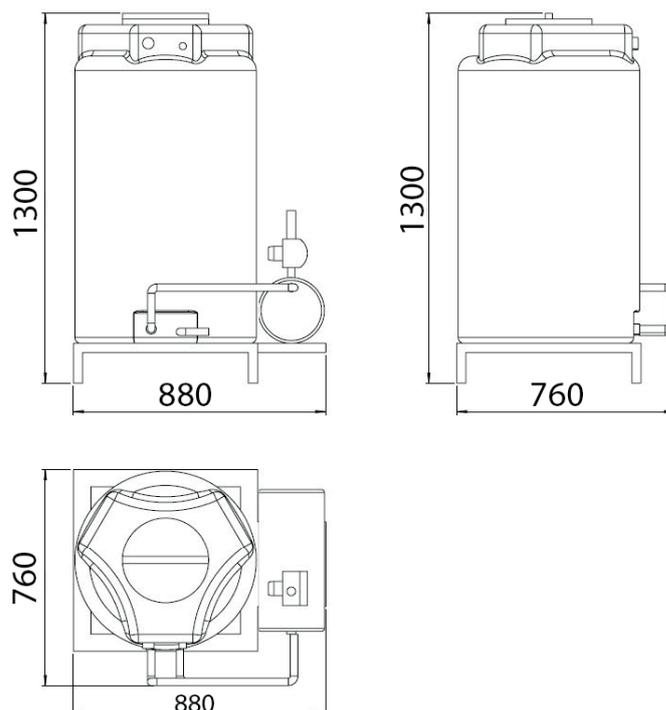


Fig. 7.c

## 8. INITIAL START-UP

### ⚠ Caution

#### Danger due to incorrect operation!

Commissioning may only be carried out by qualified personnel (electricians or specialists with equivalent training).

### ⚠ Caution

#### Risk of electrical shock!

Hazardous electrical voltage!

Follow safety instructions for work on live components.

🔍 **Notice:** Remove the elongated transport locks from the flow tubes (FI01-FI03).

🔍 **Notice:** Do not connect the permeate line to the expansion vessel until all other commissioning steps (especially flushing of the membranes) have been carried out.

🔍 **Notice:** At the beginning of each commissioning with the use of new membrane(s), the ROL unit produces a higher permeate quantity in the first 2-4 hours, which is combined with a higher conductivity.

🔍 **Notice:** The pump may only be operated with the water inlet valve open, otherwise it could be damaged. Exception: initial start-up.

#### Operation steps in the short overview:

**Step 1:** Check mechanical integrity, water connection and cabling

**Step 2:** Removal of the transport lock from the flow tubes (FI01-FI03)

**Step 3:** Flushing the membranes

**Step 4:** Adjustment of recovery value

**Step 5:** Connect the permeate pipe to the extension vessel and thus also to the consumer (It is important that this step is only done at the very end of the commissioning process)

**Step 6:** Filling the anti-scalant canister and adjusting the dosing pump.

**Step 7:** Observe device and check for leaks, eliminate leaks if necessary.

### 8.1 Flushing of the membrane(s)

When the system is started for the first time and each time it is put into operation after a period of non-use, you must remove the chemical maintenance solutions and/or standing water. If the system is not used for a longer period of time, the membrane(s) must be replaced!

#### Ensure no water pressure is applied!

In addition, the membranes must be gradually moistened without being submitted to the working pressure (5-6 bar). The water must flow through the filters and membranes at line pressure for several minutes before the pump can be activated.

#### 🔍 **Notice:** Do not use the water produced during this phase.

- » Lead the hose for the concentrate and the permeate into the drain. Note hygiene guidelines (see chapter water connection).
- » Make sure that the water supply is interrupted.
- » Don't connect the permeate pipe to the consumer!
- » Connect the unit to the power supply and switch the red main switch in the switch box to "ON".

Unit switches off after the self-test with error message "MIN PRESSURE".

- » Press "ENTER" for two seconds, the display shows: "PASSWORD 0000".
- » Enter service password
- » Confirm with "Enter"
- » Select menu item 14 (system test)
- » Press **↑**  
(Open the water inlet valve SV01\*)
- » Press **←**  
(Open the flush valve SV02\*)
- » Open the feed water supply
- » Vent the filter containers via the screw in the upper part of the blue filter containers.
- » Open the hand control valve BV04\* (flushing) completely
- » Let the system flush for **10 minutes**
- » Regulate the pressure at the control valve BV04\* to 1 bar, read on the pressure gauge immediately downstream of the pump (PI02\*).
- » Let the system flush for **10 minutes**

- » Press →  
(switch on the pump)
- » Adjust the pressure at flush valve BV04 to 2 -2.5 bar, read on the pressure gauge immediately downstream of the pump (PI02\*)
- » Let the system run for **5 minutes**
- » Press ←  
(close the flush valve SV02)

The permeate produced in this phase has not yet reached its final quality. However, a part of it can be used to thin the antiscalant in the canister.

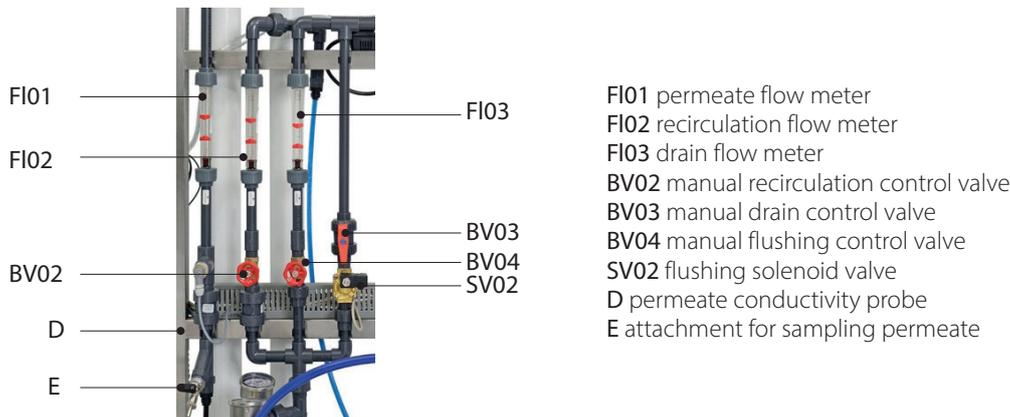
- » Let the unit run for 10 minutes in this mode and continue with the adjustment of the recovery rate.
- » Press →  
(switch off the pump)
- » Press ↑  
(close the water inlet valve SV01)
- » Press **2x "ESC"** (leaving the service level).

The system starts the permeate production.

## 8.2 Adjustment of the permeate quality

Adjust the circulation volume (BV02) and the concentrate volume (BV03) to achieve the optimum recovery and permeate value (see technical data). The flow rates can be read off the flow measuring sensors FI01 (permeate) / FI02 (circulation) and FI03 (concentrate).

Using the example of ROL-1000:



- FI01 permeate flow meter
- FI02 recirculation flow meter
- FI03 drain flow meter
- BV02 manual recirculation control valve
- BV03 manual drain control valve
- BV04 manual flushing control valve
- SV02 flushing solenoid valve
- D permeate conductivity probe
- E attachment for sampling permeate

Circulating flow rate: 450 l/h  
 Concentrate flow rate: 470 l/h  
 This results in a recovery value of 68 percent.

In general, this is calculated as follows:

$$\text{RECOVER (\%)} = \frac{\text{permeate}^*}{\text{permeate}^* + \text{concentrate}^*} \times 100$$

\* quantity

### ⓘ Notice:

- When using an upstream softening system you can reduce the amount of concentrate (lower water consumption) until a recovery value of 75% is achieved.
- Please also note the information on the correction value (chapter 4.2).
- Use the red markings to document the required flow rates

ⓘ Notice: If the permeate quantity (FI01) is within the specified range (see technical data), continue with chapter 8.3

## 8.2.1 Increase of the working pressure before the membranes

If the maximum permeate quantity (FI01\*) is not reached although the recovery value corresponds to the specifications in the technical data, you can increase the permeate quantity by increasing the pressure before the membranes.

### Notice:

**Do not exceed the permitted pump pressure!**

This can lead to pump damage.

**Select a low working pressure!**

Although the diaphragms can be operated at a pressure of 5 to 12 bar, we recommend the lowest possible working pressure (5 to 6 bar), both during commissioning and during normal system operation. This allows for a longer service life of the diaphragm(s).

To increase the pump pressure, proceed as follows:

**Rotary vane pump (in models from 100 l/h to 320 l/h):**

- » Open or close the by-pass valve (bypass) with a slotted screwdriver

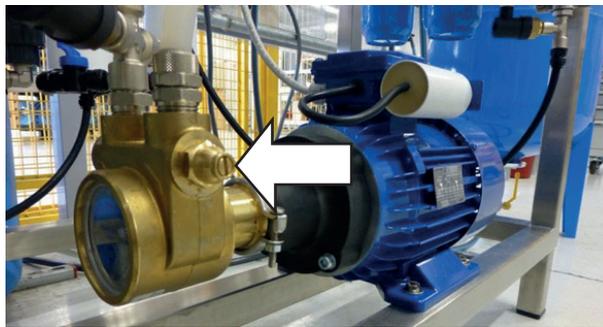


Fig. 8.a

**Multi-step pump (in the models from 460 l/h to 1.000 l/h):**

- » Adjust the ball valve downstream of the pump manually



Fig. 8.b

- » Watch the pressure change on the manometer downstream of the pump and the flow rate change on the pure water flow meter.
- » Adjust until the desired flow rate is reached.
- » **Let the system run for 30 minutes.**
- » During this time, periodically check that the rated parameters (flow rates, pressures and conductivity) stabilise within the limit values.
- » Take a permeate sample (at the extraction point (E\*)) and, if necessary, carry out a chemical-physical and possibly bacteriological analysis to check the suitability of the water for the intended purpose.

\* see figure previous page

## 8.3 Continuation of initial start-up after successful adjustment of the recovery rate

- » Connect the permeate pipe to the following consumer.
- » Open the shut-off cocks of the expansion vessel
- » Check whether the system switches off after reaching the operating pressure (approx. 4 bar).  
When the pressure expansion vessel is completely filled, the pressure rises automatically (read the value on the pressure gauge of the expansion vessel).

If the system does not switch off when the operating pressure exceeds approx 4 bar, consult HygroMatik.

- » Check the system for leaks.
- » If leaks appear, switch off the unit immediately. Locate and eliminate leaks
- » Repeat the tightness test

## 8.4 Filling the antiscalant tank

The antiscalant liquid is used to prevent calcium and magnesium residues present in the feed water from depositing on the membrane, causing a decline in performance and reducing operating life. The dosing pump feeds the desired antiscalant dose into the feed water circuit.

### Filling the canister

Before filling the antiscalant canister, take the required amount of antiscalant (depending on the water hardness) from the table in the chapter Technical Data.

- » Using a measuring cup, thin the antiscalant in the canister with permeate (use the permeate produced during the commissioning phase for this step).
- » Make sure not to damage the float when closing the cap on the tank.

## 8.5 Adjusting the metering pump

When using the recommended antiscalant Permaclean 309

- » Position the flow control knob at 30%



Fig. 8.c

When the activity LED is green, the metering pump supplies an amount 10 times higher than the nominal value. Only use this setting after consultation with the specialist dealer or HygroMatik.

In standard operation, you use the dosing pump with the divider switched on (orange LED lights up constantly).

To supply the dosing pump with the antiscalant mixture from the canister, proceed as follows:

- » Switch off the divider, the colour of the LED changes to green.

The DIVIDER is switched on and off as follows:

- » **Short press** on the ON/OFF button (pump goes into standby mode).
- » **Long press** on the ON/OFF button, after 4 short flashes the LED changes colour.  
Only then release the pressure on the button
- » Set the rotary knob to 100% (fast pulse frequency).
- » Open the vent screw (A)

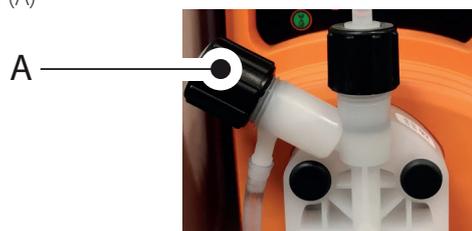


Fig. 8.d

- » Close the vent screw (A) when the transparent tube is completely filled with the antiscalant mixture.

When the antiscalant mixture reaches the pump, the "knocking noises" of the dosing pump become quieter.  
 » Set the rotary knob to 30%.

When the antiscalant mixture is transported bubble-free in the tube:  
 » Switch on the divider, the **orange LED** lights up continuously.

**Notice:** During operation, you can directly change the frequency of the dosing pump via the control knob.

### ED flashing states

status LED (flashes per sec.)	status pump operation
3x RED	Pump powered but voltage too low
2x RED	Pump powered but voltage too high
2x ORANGE	Pump OFF and powered
leuchtet ORANGE, schaltet bei jedem Klopfen aus	Pump ON
always on (RED)	Level alarm

**Notice:**  
 When using the recommended antiscalant Pragmaclean 309, dose it according to the feed water quality (see technical data).

**Only use diluted antiscalant!**

## 8.6 Complete the initial start-up

### Check mechanical intactness, water connection and cabling

- » Check functionality of water and electrical installations
- » Check functionality of the pre-treatment system (if available)

### Checking the feed water

- » Check if the feed water parameters are within the limits given in chapter 4.3.

**Notice:** To ensure the functionality of the seals, the system must be put into operation within one year of the delivery date.

## 8.7 Break of use

The functionality of the reverse osmosis plant is connected to the continuous production of permeate.

For a break in use of up to 10 days, the plant should remain supplied with electricity and water, because the plant periodically rinses the membranes (a periodic rinse of 30 seconds every 24 hours of break in use is factory-set). For breaks in use of more than 10 days up to a maximum period of 1-2 months, the rinsing parameters should be set to 15 minutes every 48 hours.

**Notice:** During breaks in use, the extension vessel or the return pump vessel (if present) must also be emptied.

## 9. MAINTENANCE

### 8.1 General

Regular maintenance is essential to ensure that the CAREL units can achieve a long service life. The necessary maintenance work refers to components that are either subject to mechanical or electrical wear, or whose function is reduced by deposits.

The optimum function and required maintenance intervals of a reverse osmosis unit depend mainly on the existing water quality and the permeate quantity produced. Different water qualities can extend or shorten the maintenance intervals.

The following factors in specific could lead to an early blocking of the membranes:

- Blockage as a result of the deposit of iron or calcium sulphate and calcium carbonate
- Blockage with organic material

In general, a replacement of the membranes becomes necessary if a change in the following basic system parameters (at the same temperature and salinity) is noticed:

- Reduction of the permeate production to a value which is insufficient for the application downstream of the reverse osmosis system.
- Too much increase in the conductivity of the water produced to a value too high for the application downstream of the system.
- Increase of the membrane feed pressure.

### 8.2 Safety instructions for maintenance

#### ⚠ Caution: Risk of electrical shock!

Hazardous electrical voltage!

Any work on the electrical system to be performed by certified expert staff (electricians or expert personnel with comparable training) only.

#### 🔍 Notice: Take care of ESD protection!

The electronic components of the control are very sensitive to electrostatic discharges. In order to protect these components during maintenance, steps must be taken to guard against damage from electrostatic discharge.

#### 🔍 Notice: Removal and replacement of components

If necessary, the parts of the UO unit may only be replaced by qualified personnel. Replacement work must always be carried out with the system at a standstill; contact the supplier or the manufacturer directly for this purpose.

🔍 Notice: Use disposable gloves when installing the pre-filter(s) and membrane(s) to protect them from contamination.

### 8.3 Routine maintenance

#### 8.3.1 Change prefilter

The HygroMatik ROL units are equipped with two different pre-filters.

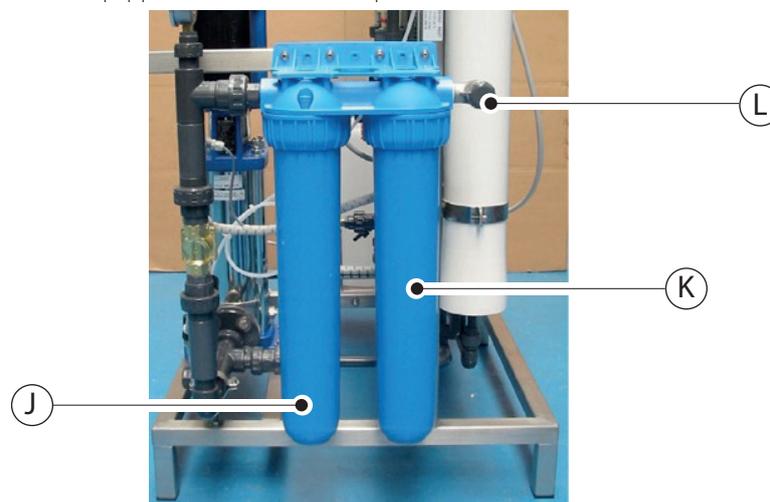


Fig. 8.a

The CB-EC carbon filter (K) is used to reduce the chlorine content in the feed water (L). The presence of chlorine in the water may irreversibly damage the membrane. The carbon filter works by chemical reaction, combining and absorbing the chlorine molecules. Consequently, its performance will decline over time.

**The CB-EC cartridge needs to be replaced:**

- every four months if the chlorine content in the feed water is less than 0.1 ppm.
- every two months if the chlorine content in the feed water is between 0.1 ppm and 0.2 ppm.

The CPP **micron filter (J)** traps impurities around 5 µm in size. The filter works mechanically, letting the feed water flow through a filtering mesh. It is normal for the filter to become blocked over time, letting less water through and increasing the pressure drop.

The **CPP cartridge needs to be replaced** when the system feed water pressure (after having passed through the inlet filter cartridges) is less than 1 bar during normal operation (pressure read on pressure gauge PI01).

**Before replacing the prefilter, check**

- that the ROL system is switched off
  - the inlet valve is closed and there is no pressure on the water line.
- » Remove the pre-filter with suitable tools.
  - » Remove the old filter cartridge and clean the inlet.
  - » Replace the O-ring if necessary.
  - » Moisten the new O-ring and insert it.
  - » Insert a new filter cartridge.
  - » Mount the pre-filter with suitable tools.
  - » Open the water supply and vent the filters via the screw in the upper part of the membrane container.

---

### 8.3.2 Filling of the antiscalant canister

The appropriately dosed antiscalant prevents lime deposits on the membranes. The filling level of the antiscalant canister must be constantly monitored. The consumption of the antiscalant mixture depends on the permeate production and the settings of the dosing pump. The reverse osmosis plant cannot work without antiscalant or softening, because otherwise the membranes would be irreversibly damaged. For this reason, the electronic control stops operation and activates an alarm as soon as it recognizes a low level in the antiscalant canister. To prevent this alarm and the following production stop, check the filling level of the canister regularly and refill it in time.

---

### 8.3.3 Replacing the UV lamp

The UV lamp has a limited operating life. The following intervals are recommended for replacement (whichever comes first):

- 9000 operating hours
- one year

---

### 8.3.4 Reset maintenance counter

Reset the maintenance hour counter in **menu item 13** as described in the chapter **device control**.

---

## 8.4 Special maintenance and repairs

---

### 8.4.1 Membrane exchange

The membranes undergo a natural decline in performance over time, specifically:

- annual reduction in water produced of 7%
- annual increase in outlet water conductivity of 10%

After a certain period of operation, in relation to the characteristics and volume of water treated, the membranes tend to become blocked, with a decline in efficiency. This decline in membrane efficiency may depend on two main factors:

- blockage due to precipitation of iron or calcium sulphate and carbonate
- biological blockage
- infrequent replacement of the CBC (carbon block filter)

Replacement becomes necessary when the system shows variations in the following fundamental parameters (for the same initial feed water temperature):

- decrease in water produced to a level that is insufficient for the application connected downstream of the reverse osmosis system.
- excessive increase in the conductivity of the water produced to a level that is excessive for the application connected downstream of the reverse osmosis system.

Before replacing the membrane(s), check the following:

- The ROL unit is switched off
- The inlet valve is closed, there is no pressure on the water line.

The steps for membrane replacement are described in detail in the chapter mechanical installation.

## 8.4.2 Replacing the metering pump fuse

The fuse on the metering pump shows only be replaced by specialist personnel. The replacement procedure is as follows:

- » Loosen the 2 screws in the upper part of the part of the pump
- » Holding the pump, remove the 6 screws at the rear
- » Slide out the rear part of the pump until it is completely detached from the front part, so as to access the circuit at the front of the pump.
- » Be careful with the spring on the injection element shaft
- » Locate the fuse and replace it with an identical one
- » Reposition the rear part of the pump until it is completely coupled with the front part
- » Tighten the 6 screws on the pump
- » Replace the pump in the unit and tighten the two screws to the frame.

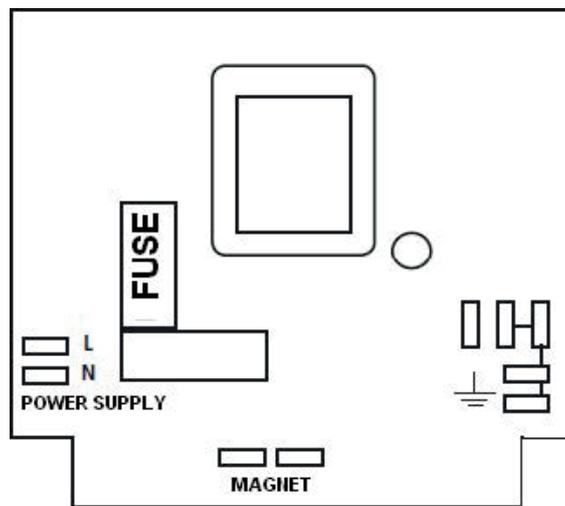


Fig. 8.b

## 8.5 Maintenance scheme

### 8.5.1 Daily maintenance

- » Check if the system is working correctly.
- » Check that there are no leaks in the water-carrying components.
- » Check the water inlet pressure.

**Notice:** The system supply pressure (after the pre-filters) must be at least 2 bar during normal operation. Replace the filter cartridges if the pressure loss is too high.

### 8.5.2 Weekly maintenance

- » Check the max. membran pressure (max.10 bar!).
- » Check the water conductivity of the permeate with the control unit.
- » Note down the data for the listed tests

**Notice:**

- Note that the production quantity of the permeate increases with rising water temperature, while the quality of Permeate is decreasing. Conversely, the production quantity decreases with decreasing temperature, while the quality of the permeate improves.
- The indication of the measured permeate conductivity value on the display of the control unit settles down to the actual value within the first minutes.

### 8.5.3 Maintenance every two months

- » Check that there is not too much free chlorine at the outlet (less than 0.25ppm).

**Replace the pre-filter cartridge:**

- » Every 2 months if the free chlorine content is between 0.1 ppm and 0.2 ppm.
- » Every 4 months if the free chlorine content is less than 0.1 ppm.

🔍 **Notice:** The lifetime of the pre-filter and membrane(s) depends on feed water quality and permeate production rate.

🔍 **Notice:** Maximum permitted storage times of the membranes:

- 6 months: if the membranes are already supplied with a chemical solution and/or impregnated with glycol;
- 1 year: if the membranes are supplied dry or vacuum packed.

## 8.5.4 Maintenance by qualified per-sonnel

---

**Every 6 months:**

Check the pre-filling pressure of the expansion vessel. This value must be 1.5 to 1.8 bar. To check the pressure, the outlet line of the vessel must be temporarily interrupted.

Generally:

- » Check the parameters of the water entering the system.
- » Check the conductivity of the input water and permeate with a conductivity meter.
- » Record the data for the listed tests

**Maintenance schedule**

Unit / spare part	Min. Every 2/4 months		Every 12 months	As needed		
	Sediment filter	Carbon filter	Uv lamp	Membrane (s)	O-ring	Number
ROL160	ROK00FLT3	ROK00FLT2	ROKL00UVL1 / ROK00UVOR	ROKL00ME10	ROKL00OR25	2
ROL320				ROKL00ME20		4
ROL460	ROKL00FLT4	ROKL00FLT5		ROKL00ME30	ROKL00ME40	2
ROL600				ROKL00ME20		4
ROL1000			ROKL00ME30			
ROL1200			ROK00UVOR	ROKL00ME30		

## 10. DECOMMISSIONING

The regular operation of the reverse osmosis unit is dependent on the continuous production of desalinated water.

Even during longer periods of non-use, the system must be connected to the power supply, as hygiene regeneration is regularly carried out in standby. Keep the power and water supply of the system connected.

If the system does not produce any permeate for more than 10 days, the membrane(s) must be replaced and rinsed before restarting (see chapter **Initial start-up and rinsing the membrane**).

### 10.1 Dismantling

---

Once the RO unit will no longer be used, dismantle (demolish or scrap) it by following the installation procedures in reverse order.

**⚠ Caution:** Dismantling of the unit may only be performed by qualified personnel. Electrical dismantling may only be performed by trained electricians.

Obey the safety guidelines in section "Safety Instructions," especially the guidelines for disposal.

### 10.2 Disposal after dismantling

---

The reverse osmosis unit is made up of metal parts and plastic parts. In reference to European Union directive 2012/19/EU issued on 4 July 2012 and the related national legislation, please note that:

The components of the electrical and electronic devices must not be disposed of as municipal waste, and therefore the method of waste separation must be applied. The public or private waste collection systems defined by local legislation must be used.

**📢 Notice:** The operator is responsible for the disposal of unit components as required by law. It must be stressed that if demineralised water (manual mode) or 1-50µS/cm (automatic mode) are selected, the unit will signal maintenance and cleaning via the warning only, without ever shutting down the humidifier.

# 11. CONTROL

The whole operation of the reverse osmosis unit ROL is controlled by a microprocessor. The control-system enables the production process and the control of the RO-unit. The measured values are shown on a LC-display. The control has the protection class IP65.

## 10.1 The control panel

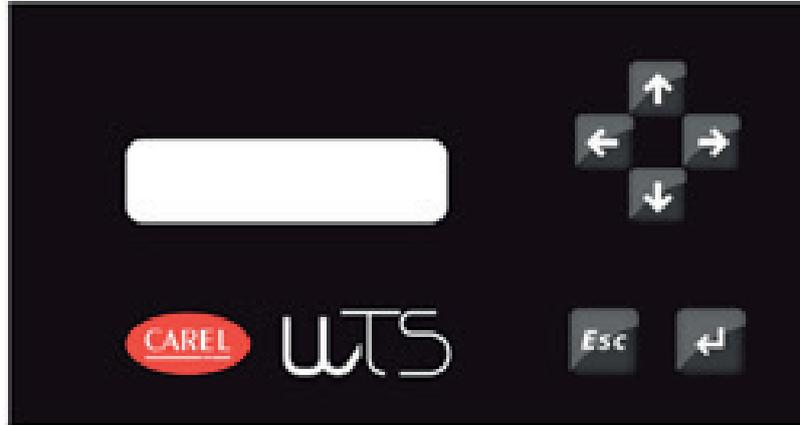


Fig. 10.a

The control panel is separated into three zones:

- the 2 operating keys ESC, ←
- the 4 arrow keys
- LC-display

The **operating keys** are used to navigate through the menus and submenus. The function of the keys is:

**ESC:** Cancel or return to the previous level

↑↓ Arrow keys: Move within a menu, a submenu or a selection list

← : Acceptance and storage of a selected setting

By pressing the arrow keys ↑↓ you can call up the read values:

- Permeate conductivity
- Operating hours
- Remaining time (hours) until the next service

**Access to the main menu:**

- » press ← or about 2 sec, the display shows "PASSWORD 0000"
- » enter the password using the arrow keys (0077)
- » confirm with

The control system regulates the automatic sequence for start-up, production, process shut-down, as well as for periodic rinses by controlling the following actuators:

- Feed water valve (VFEED)
- Permeate flush valve (VPER)
- High pressure pump (PHP)
- Dosing pump Antiscalant (PASC)
- Fault signal/alarm (potential-free changeover relay)

The controller is equipped with the following digital inputs for monitoring the process:

- Overpressure switch (PSHIGH)
- Low pressure switch (PSLOW)
- Level of permeate vessel low (PSMin)
- Filling level permeate vessel full (PSMAX)
- External stand-by signal (INSB)
- Error dosing pump antiscalant (INPASC)
- Malfunction feed water pre-filter (INFIL)

Furthermore, the controller has a conductivity measurement (not temperature compensated) for monitoring the permeate quality, with a freely adjustable limit value.

This means that the unit is switched off and a fault message is output if the limit value of the permeate conductivity is exceeded during operation.

### The different operating states

**Permeate production:** Production of product water. The VFEED, PHP and PASC relays are energized.

**STAND-BY:** Unit is waiting on request. The unit is ready for operation, all relays are off.

**Flushing** (to prevent deposits on the membrane surface): Factory activated in the main menu, flushing (when the unit is switched on), before/after water production and/or cyclically after a certain number of hours. The cyclic flushing can also be done in STANDBY mode.

**Notice:** Never deactivate the flushing function! (Avoidance of microbial contamination)

The production is controlled by the two level switches in the permeate tank:

- $PS_{HIGH}$  starts the production
- $PS_{LOW}$  stops production

In the MinPressure condition, the unit starts the water production: it opens the input solenoid valve and starts the pressure pump.

To avoid damage, a delay of 3 seconds is given after the input solenoid valve has opened.

When the MaxPressure condition is reached, the control unit goes into stand-by mode: the input solenoid valve closes and the pressure pump stops.

In the menu it is possible to deactivate one or both level switches and to operate the system with only one or no level switch at all. If both level switches are deactivated, the system goes into continuous production after switching on the power supply.

When the controller is switched on, a module flush is first carried out (if activated in menu 11).

After switching on the control system and module flushing (if activated in menu 10), the control system goes into production mode if the Min. pressure condition is underrun.

If programmed in menu 11 **CLEANING** the control unit starts an interval rinse during production as well as in standby (against standstill contamination) as soon as the countdown for the rinse interval has ended. The countdown for the rinse interval is reset at each rinse.

## 10.2 Operating states

After switching on the power supply, the version number of the control software appears for a few seconds.

Then the controller returns to the last operating state before switching off.

**WAITING  
START PUMP**

The unit starts after the preset start delay has ended.

**CLEANING: TIME  
LEFT xxM xxS**

$PS_{LOW} = 0$  und  $PS_{HIGH} = 0$

The permeate tank is empty. First, a module rinse is carried out when production is started (if it is programmed). Then the RO plant goes into production.

**SYSTEM WAITING!  
HIGH LEVEL**

$PS_{LOW} = 1$  und  $PS_{HIGH} = 0$

The filling level in the permeate tank is between empty and full. The unit goes into stand-by mode.

**CLEANING: TIME  
LEFT xxM xxS**

**SYSTEM WAITING!  
HIGH LEVEL**

$PS_{LOW} = 1$  und  $PS_{HIGH} = 1$

The pressure switch PSHIGH switches. The permeate tank is full. The unit performs a module rinse (if programmed) and then goes into stand-by mode.

**COND. PERMEATE  
xxx  $\mu$ S**

Shows the permeate conductivity

**SERVICE IN  
xxxxx Hr**

Shows the remaining time (in hours) until the next service.

## WORKING TIME xxxxx Hr

Shows the system operating hours.

## SYSTEM WAITING! IN FILTER

The  $IN_{FIL}$  input for the feed water pre-filter or for the hardness sensor has switched (example: potential-free contact of an upstream softening unit). The unit stops. If the input is free again, the plant restarts automatically.

## SYSTEM STOPPED! FAILED DOSAGE

The  $IN_{PASC}$  input for the Anstiscalant dosing pump (optionally available for WL-ROC 140) has switched. The system stops. If the input is free again, the system restarts automatically.

## SYSTEM WAITING! IN STAND BY

The  $IN_{SB}$  input (external stand-by signal) has switched. The system stops. When the input is free again, the system restarts automatically.

## PERFORM MAINTENANCE

The service hour counter has been counted down. Please make a maintenance and reset the counter.

### 10.2.1 Alarm messages

If one of the following alarm messages appears, the system stops and the alarm relay switches on. This message cannot be confirmed!

- » Disconnect the system from the power supply and eliminate the cause of the alarm.

Further information can be found in the chapter Troubleshooting.

## SYSTEM STOPPED! HIGH PRESSURE

The overpressure switch  $PS_{HIGH}$  for the max. permitted operating pressure has switched. The system stops.

## SYSTEM STOPPED! LOW PRESSURE

The low-pressure monitor  $PS_{LOW}$  for the minimum acceptable feed water inlet pressure has switched. The system stops.

## SYSTEM STOPPED! HIGH COND. OUT

The max. limit value for the permeate conductivity has been reached. The unit stops.

You can return from the operating display level to the main menu by pressing the ENTER key.

## 10.3 Menu navigation

---

- » use the arrow keys to move through the main menu to the relevant parameter
- » press **↵**, to go to the selected submenu
- » press "**ESC**" for about 2 seconds to return to the main menu

### ↑ Button < UP >:

At the operation display level: To scroll up the operation displays.

At the menu level: Scrolls up at the menu level.

In the relevant parameter: To count up the input-values, and to activate (ENABLE) or deactivate (LOCKED) a function.

### ↓ Button < DOWN >:

At the operation display level: To scroll down the operation displays.

At the menu level: To scroll down the menu level.

In the relevant parameter: To count down the input value, and to enable (ENABLE) or disable (LOCKED) a function.

### ← Button < LEFT >:

In the menu: For jumping back to the previous digit within the input field.

### → Button < RIGHT >:

In menu: For jumping to the next digit within the input field.

### Button < ESC >:

In menu level: To leave the menu level and return to the operating display level.

In the parameter: To return to the previous iA longer press (2 sec) switches the system off and on. input field/display or to leave the menu.

**Pressing the button for a longer time (2 sec) switches the system off and on.**

### Button < ↵ >:

In the operating display level: To open the menu level.

At menu level: To open a menu.

In the parameter: To save the entry and jump to the next entry field or return to the menu level.

### 📌 Notice:

By "jumping back with ESC" the earlier entries in this menu item are not saved!

**Always end the menu items with "Skip to next" by pressing the ENTER key until the menu item starts again. This is the only way to save the settings you have made.**

## 10.4 Setting options at operator level

The following factory-set parameters can be changed at the operator level (password 0077).

Setting the required conductivity:

**3B LIMIT OUT**  
xx,x  $\mu$ S

By pressing the arrow keys  $\uparrow\downarrow$  you can set the max. set point

» Confirm the selection with  $\leftarrow$

Setting the required flushing time / flush-ing cycle:

**11G TIME**  
00 min 00 sec

By pressing the arrow keys  $\uparrow\downarrow$  you enter the duration of the flushing time for the periodic module flush..

» Confirm the selection with  $\leftarrow$ . The program jumps to submenu "11H".

**11H WASH CYCLE**  
00 min 15 sec 24 h

By pressing the arrow keys  $\uparrow\downarrow$  you specify the time period between the periodic module flushes.

e.g. change 24h to 48h (usage pause)

» Confirm the selection with  $\leftarrow$ .  
The program jumps back to the main menu.

**Notice:** In the factory settings, parameter 11 CLEANING is preset to ON. If this setting has been changed to OFF in the service level, no entries can be made here in the operator level.

Setting the required language:

In this submenu you can select the language shown on the display.

**16 LANGUAGE**  
**17 SET PASSWORD**

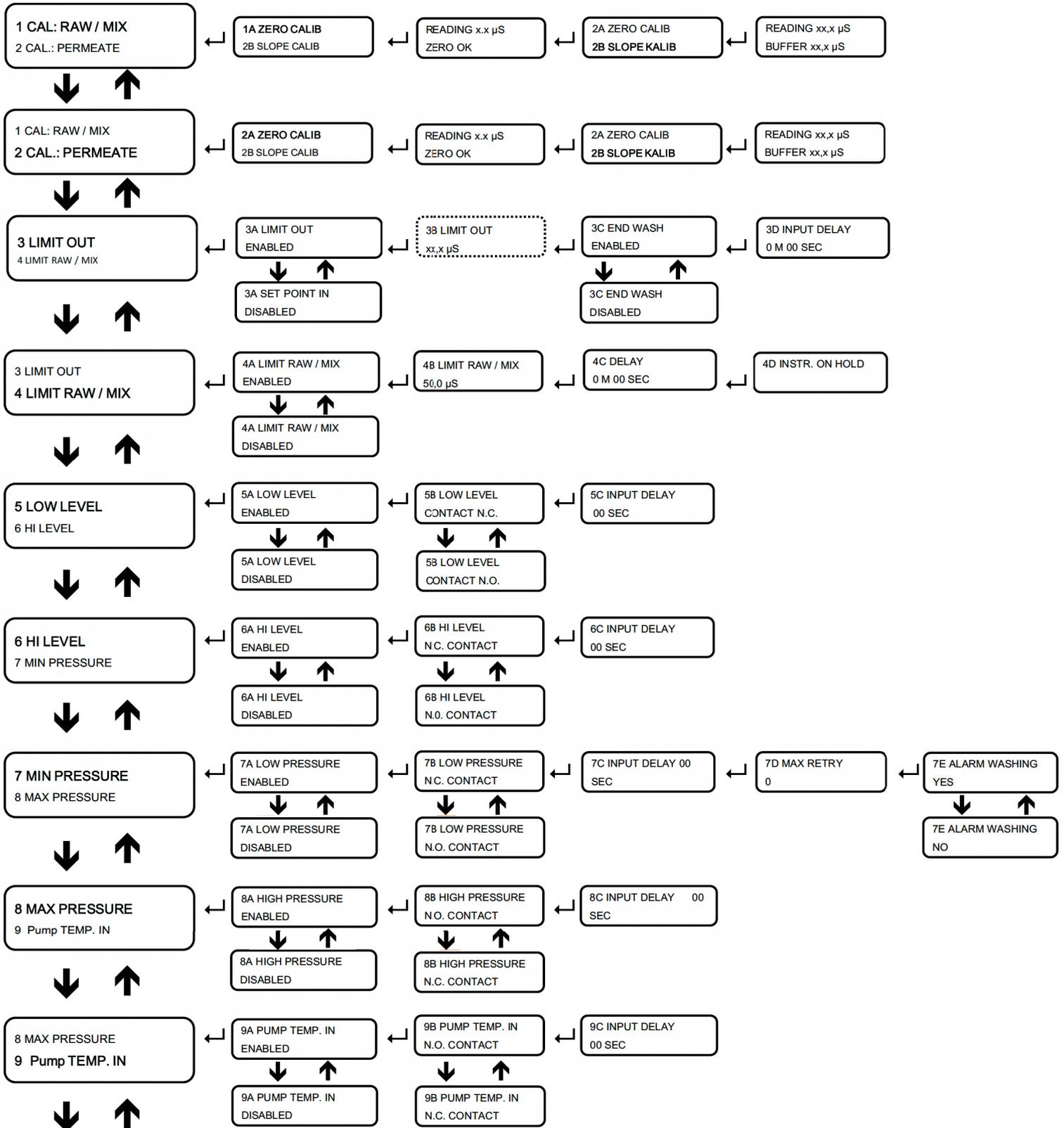


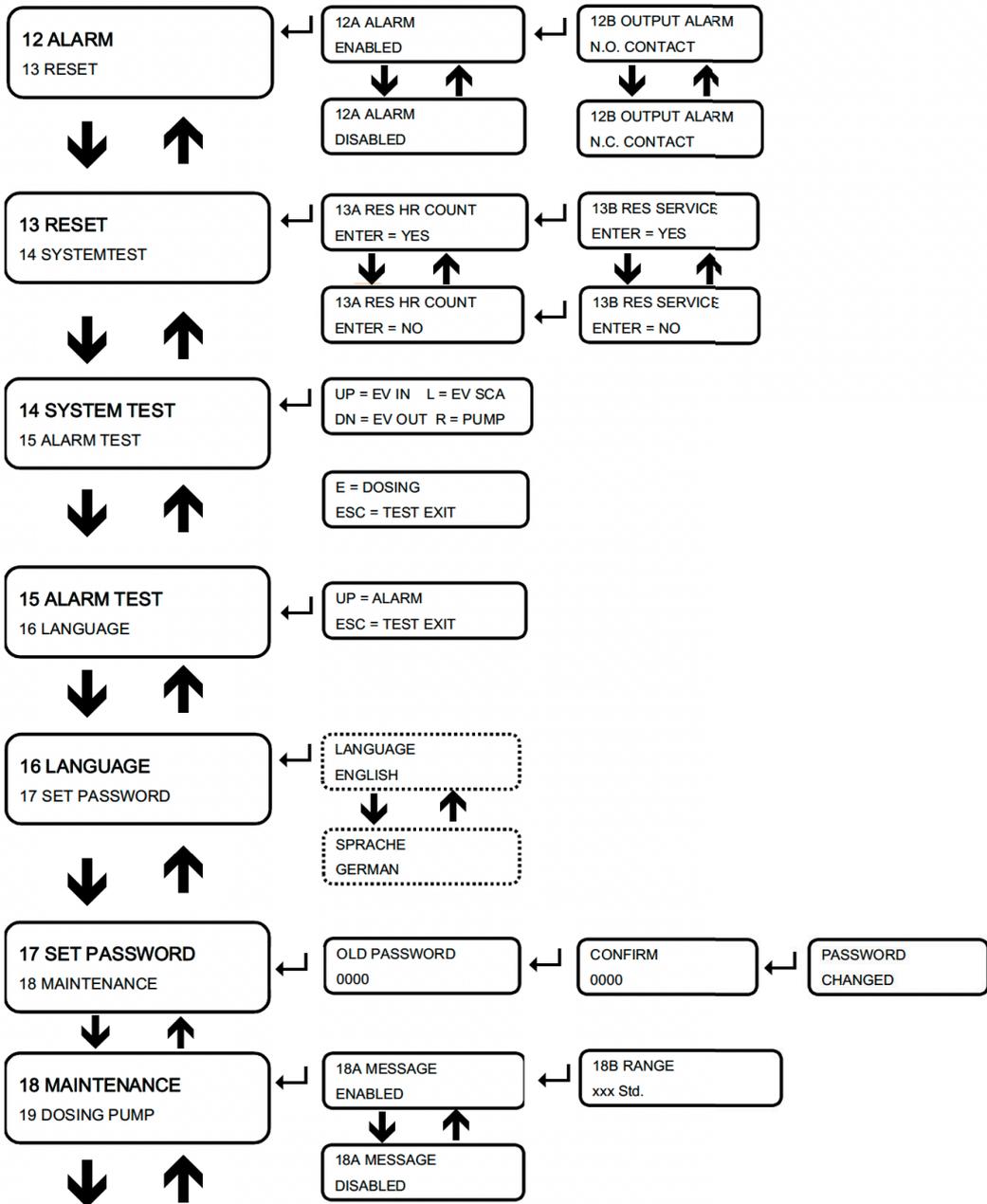
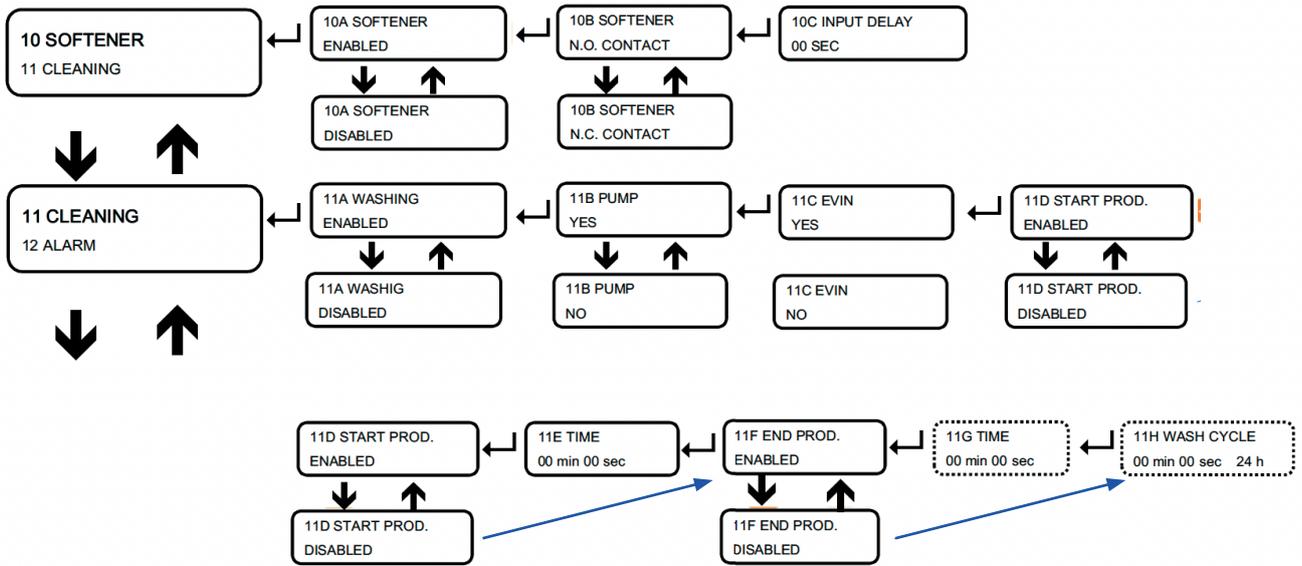
**LANGUAGE**  
**ENGLISH**

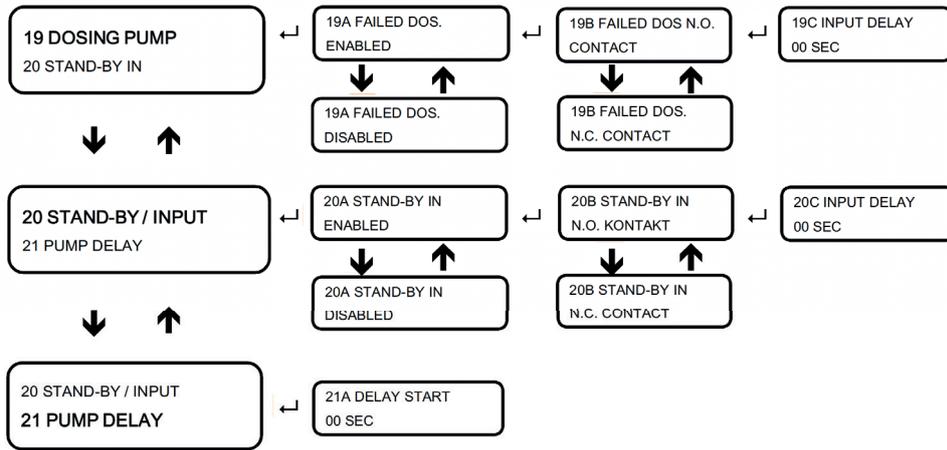
» Press the arrow keys  $\uparrow\downarrow$  to select your language  
» Confirm the selection with  $\leftarrow$ .  
The program jumps back to the main menu.

## 11.5 Menu Structure

The following menu list gives an overview of all parameters of the unit control.  
 At the operator level (password 0077) only the parameters shown here in dashed lines can be changed. The other parameters are only visible at the operator level. Changing them is only possible at the service level.







## 11.6 Setting options at service level

The following chapter is only intended for certified service staff. The password for reaching the service level can be found in the additional information provided with the unit.

CAREL is not liable for damages caused by incorrect parameter settings at this level.

**Notice:**

The parameters have already been configured ex works and may only be changed with the appropriate expertise.

The contact configuration is preset in all submenus. Do not change this carelessly! Otherwise there is a risk of damage to the system.

### 11.6.1 Conductivity sensors

The CAREL RO units ROC 25-80 are equipped with one conductivity sensor (permeate).

The ROL units are equipped with two conductivity sensors. One sensor measures the conductivity of the feed water (ROH/ MIX), the other sensor that of the permeate. Both conductivity sensors are pre-calibrated ex works.

**1 CAL. ROH- / MIX**  
**2 CAL. PERMEATE**

In the case of recalibration during maintenance, the calibration can be carried out either with the help of a buffer solution with known conductivity, or with a conductivity tester according to the principle of comparative measurement.

**Notice:**

When selecting the calibration liquid (not included in the scope of delivery), please note the selected measuring range:

- Note that this conductivity measurement is not temperature-compensated.
- To achieve a high measuring precision it is therefore recommended that the calibration liquid (or the water sample for the comparison measurement) has approximately the same conductivity and temperature as the permeate to be measured.

Display shows three lines:



After a few minutes of running time, measure the conductivity of the permeate and/or raw/ mixed water with an external conductivity meter and enter the measured value in the corresponding parameter:

### 3 LIMIT OUT

- » Press  $\downarrow$  +  $\rightarrow$  at the same time
- » Press  $\leftarrow$  to calibrate
- » Press ESC to exit without calibrating

### 4 LIMIT ROH-/MIX

- » Press  $\downarrow$  +  $\rightarrow$  at the same time
- » Press  $\leftarrow$  to calibrate
- » Press ESC to exit without calibrating

## 11.6.2 Calibration of the probe zero point

- » Remove the conductivity probe from the flow assembly and dry it.
- » Select **2A CAL ZERO** in the main menu

**2 CAL PERMEATE**  
**3 LIMIT OUT**

**2A ZERO CALIB**  
**2B SLOPE CALIB**

**READING 3.12  $\mu$ S**  
**ZERO OK**

A conductivity value is now displayed in the upper line.

- » Confirm the selection with  $\leftarrow$

The display value may be  $> 0 \mu\text{S}$ , but should remain  $< 50 \mu\text{S}$ , otherwise the controller would not accept the calibration. In this case the conductivity probe may be faulty and must be replaced. The display shows the message "ZERO ERROR cal.

- » repeat the calibration or quit the parameter without saving with ESC

## 11.6.3 Calibration of the probe slope

**2A ZERO CALIB**  
**2B SLOPE CALIB**

**READING 12,5  $\mu$ S**  
**BUFFER 15,0  $\mu$ S**

- » In the main menu, select **2B SLOPE CALIB**
- » Enter the conductivity of the buffer solution in the "BUFFER" field according to the table on the bottle label.
- » Hold the sensor in the buffer solution and wait until the "READ" value has stabilized.
- » press  $\leftarrow$ , to confirm the displayed slope value and exit the parameter
- » and press  $\downarrow$ , to return to the main menu

or

- » press ESC to exit the parameter without saving

The buffer value must not be 0, otherwise the calibration is not saved.

## 11.6.4 Permeate set point calibration

With the assistance of the permeate conductivity measurement and a freely adjustable limit value for the permeate conductivity, the unit can be stopped and an alarm message issued if the permeate quality is reduced.

- » Select **3 LIMIT OUT** in the main menu

**3 LIMIT OUT**  
**4 LIMIT RAW/MIX**

Press the arrow keys  $\uparrow\downarrow$  to select whether the set point function should be active or inactive.

**3A LIMIT OUT**  
**ENABLED**

- » Confirm the selection with  $\leftarrow$

If the set point function has been activated, the program jumps to submenu "3B".

**3B LIMIT OUT**  
**50,00  $\mu$ S**

By pressing the arrow keys  $\uparrow\downarrow$  you can set the max. set point

- » Confirm the selection with  $\leftarrow$   
The program jumps to the submenu "3C".

If the permeate conductivity exceeds the limit value set here during production, the system stops, the alarm

message "ALARM CONDUCTIVITY" appears on the display and the alarm output relay picks up.

## 3C END WASH ENABLED

By pressing the arrow keys  $\uparrow\downarrow$  you can select in the submenu "3C FLUSH TIME END" the reaction of the control system when the set point is reached at the end of a module flush.

**SWITCHED ON:** At the end of module rinsing before the transition to the standby state, the permeate conductivity exceeds the limit value. The alarm message "ALARM CONDUCTIVITY" appears on the display and the alarm output relay picks up.

**The unit stops.**

**OFF:** The conductivity control during and after module rinsing is deactivated.

- » Confirm the selection with  $\leftarrow$ .  
The program jumps to the submenu 3D".

## 3D DELAY 0M 00Sec

Enter a delay time by pressing the  $\uparrow\downarrow$  arrow keys. The delay is intended to prevent the system from being switched off abruptly due to temporary measurement value peaks.

0 Sec = no delay  
(Causes an immediate switch-off when the set max. conductivity value is reached. See note at the end of the chapter)

- » Confirm the selection with  $\leftarrow$ .  
The program jumps back to the main menu.

If a module flush is followed by a longer standstill period, an increased conductivity value may temporarily occur. If the parameter 3C is set to ON, this will lead to an unintended shutdown of the system

## 11.6.5 RAW/MIX set point calibration

With the assistance of the feed water conductivity measurement and a freely adjustable limit value for the conductivity, the unit can be stopped and an alarm message issued if the feed water quality is reduced.

- » Select 4 LIMIT RAW/MIX in the main menu

## 4 LIMIT RAW/MIX 5 LOW LEVEL

Press the arrow keys  $\uparrow\downarrow$  to select whether the set point function should be active or inactive.

## 4A LIMIT RAW/MIX ENABLED

- » Confirm the selection with  $\leftarrow$   
If the set point function has been activated, the program jumps to submenu "4B".

## 4B LIMIT RAW/MIX xx,xx $\mu$ S

By pressing the arrow keys  $\uparrow\downarrow$  you can set the max. set point

- » Confirm the selection with  $\leftarrow$ .  
The program jumps to the submenu "4C".

If the feed water conductivity exceeds the limit value set here during production, the system stops, the alarm message "ALARM CONDUCTIVITY" appears on the display and the alarm output relay picks up.

## 4C DELAY ENABLED

Enter a delay time by pressing the  $\uparrow\downarrow$  arrow keys. The delay is intended to prevent the system from being switched off abruptly due to temporary measurement value peaks.

0 Sec = no delay

(see note at the end of the chapter)

- » Confirm the selection with  $\leftarrow$ .  
The program jumps to the submenu 4D".

## 4D INSTR. ON HOLD YES

Press the arrow keys  $\uparrow\downarrow$  to select whether the set point function (monitoring of the conductivity limit value during production) should be active or inactive.

YES= active  
NO = inactive

Confirm the selection with  $\leftarrow$ . The program jumps back to the main menu.

### 11.6.6 Lower level switch LSLOW

With the aid of the level switch, the minimum fill level in the permeate vessel can be monitored and the system can be started automatically if the pressure falls below the required level.

- » Select 5 LOW LEVEL

5 LOW LEVEL  
6 HIGH LEVEL

- » Press the arrow keys  $\uparrow\downarrow$  to select if pressure switch should be active or inactive.

5A LOW LEVEL  
ENABLED

ENABLED= active  
DISABLED = inactive (  
**not recommended**)

- » Confirm the selection with

If the set point function has been activated, the program jumps to submenu "5B".

5B LOW LEVEL  
CONTACT N.O.

Press the arrow keys  $\uparrow\downarrow$  to set the switching direction.

N.O. CONTACT = The input functions as a normally open contact.

N.C. CONTACT = The input works as a normally closed contact

- » Confirm the selection with  $\leftarrow$ .  
The program jumps to submenu "5C"
- » Default value: NC

5C INPUT DELAY  
00Sec

- » Press the arrow keys  $\uparrow\downarrow$  to set the time of delay

0 Sec = no delay  
(see note at the end of the chapter)

- » Confirm the selection with  $\leftarrow$ .  
The program jumps back to the main menu.

### 11.6.7 Upper level switch LS<sub>HIGH</sub>

The pressure switch can be used to control the maximum level in the permeate vessel and stop production when this level is reached.

- » Select 6 HIGH LEVEL in the main menu

6 HI LEVEL  
7 MIN PRESSURE

6A HI LEVEL  
ENABLED

- » Press the arrow keys  $\uparrow\downarrow$  to select if relay input should be active or inactive.

ENABLED= active (ex works)  
DISABLED = inactive

- » Confirm the selection with  $\leftarrow$ .

If the set point function has been activated, the program jumps to submenu "6B".

6B HI LEVEL  
CONTACT N.O.

Press the arrow keys  $\uparrow\downarrow$  to set the switching direction.

N.O. CONTACT = The input functions as a normally open contact.

N.C. CONTACT = The input works as a normally closed contact (**not recommended**)

- » Confirm the selection with  $\leftarrow$ .  
The program jumps to submenu "6C".

6C INPUT DELAY  
00Sec

- » Press the arrow keys  $\uparrow\downarrow$  to set the time of delay

0 Sec = no delay  
(see note at the end of the chapter)

- » Confirm the selection with  $\leftarrow$ .  
The program jumps back to the main menu

## 11.6.8 Calibration low pressure switch

### PS<sub>LOW</sub>

With the help of a pressure switch between the feed water pre-filter and the high pressure pump the system inlet pressure can be monitored. If the pressure falls below a minimum pressure set on the pressure switch during production (e.g. due to a clogged pre-filter), production can be shut down and the system stopped.

7 MIN. PRESSURE  
8 MAX. PRESSURE

7A LOW PRESSURE  
ENABLED

- » Press the arrow keys  $\leftarrow \rightarrow$  to select if pressure switch should be active or inactive.
- » Confirm the selection with  $\leftarrow$ .  
The program jumps to submenu "7B".
- » Default value: ENABLED

7B LOW PRESSURE  
CONTACT N.C.

By pressing the arrow  $\uparrow \downarrow$  keys you set switching direction.

N.O. CONTACT = The input functions as a normally open contact.

N.C. CONTACT = The input works as a normally closed contact

- » Confirm the selection with  $\leftarrow$ .  
The program jumps to submenu "7C"
- » Default value: NC

**Notice:** N.C. contact is set ex works here. Do not change this! Otherwise there is a risk of damage to the system.

7C INPUT DELAY  
00Sec

- » Press the arrow keys  $\uparrow \downarrow$  to set the time of delay

0 Sec = no delay  
(see note at the end of the chapter)

- » Confirm the selection with  $\leftarrow$ .  
The program jumps to submenu "7D".
- » Default value: 05 sec

7D MAX RETRY  
0

By pressing the arrow keys  $\uparrow \downarrow$  you set the number of start-up attempts (0-9).

- » Confirm the selection with  $\leftarrow$ .  
The program jumps to submenu "7E".
- » Default value: 4

7E ALARM WASHING  
YES

The menu item is not assigned.

#### Function of the startup repeats:

If the number of start-up repeats is set to "0", the unit stops as soon as the low-pressure monitor switches (and any delay time set has ended). All output relays are switched off!

The display shows

SYSTEM STOPPED!  
LOW PRESSURE

If the number of start-up repeats is set to e.g. "5", the unit stops as soon as the low-pressure monitor switches (and any delay time set has ended). The feed water valve SV1 stays activated. The display shows

LOW PRESSURE!  
ALARM 1/4

If the minimum inlet pressure returns, the system starts up again automatically. If the system produces constantly for the next 10 minutes without any further disturbance, the repeat counter is reset to "0". If the pressure drops again, the system stops again and the counter is raised.

If the minimum inlet pressure does not return, the system will continue to start up within the next 20 minutes until the number of repetitions is reached. All output relays are now finally switched off! The display shows

SYSTEM STOPPED!  
NO PRESSURE

### 11.6.9 Calibration high pressure monitor PS<sub>HIGH</sub>

The system operating pressure can be controlled by means of a pressure switch between the high pressure pump and the RO modules. If a maximum pressure set on the pressure switch is reached during production (e.g. due to an overly restricted concentrate valve), the system can be stopped.

8 MAX PRESSURE  
9 PUMP TEMP IN

8A HIGH PRESSURE  
ENABLED

- » Press the arrow keys  $\uparrow\downarrow$  to select if pressure switch should be active or inactive.
- » Confirm the selection with  $\leftarrow$ .  
The program jumps to submenu "8B".

8B HIGH PRESSURE  
CONTACT N.C.

- » Press the arrow keys  $\uparrow\downarrow$  to set the switching direction.

N.O. CONTACT = The input functions as a normally open contact.

N.C. CONTACT = The input works as a normally closed contact

- » Confirm the selection with  $\leftarrow$ .  
The program jumps to submenu "8C".

**ⓘ Notice: N.C. contact is set ex works. Do not change this! Otherwise there is a risk of damage to the system.**

8C INPUT DELAY  
00Sec

- » Press the arrow keys  $\uparrow\downarrow$  to set the time of delay

0 Sec = no delay  
(see note at the end of the chapter)

- » Confirm the selection with  $\leftarrow$ .  
The program jumps back to the main menu.
- » Default value: 00 sec

Menu item 9: "High pressure pump TSHP " is not active.

9 PUMP TEMP IN  
10 SOFTENER

### system IN<sub>FIL</sub>

If the upstream softening system is e.g. equipped with an automatic backwashing device and has a potential-free switching contact to show the backwashing, then the control system can shut down the WL-ROC system for the duration of the filter backwashing and put it on hold.

It is also possible to connect an upstream 1-column softening system to the control so that the RO unit goes into standby mode for the duration of the regeneration.

10 SOFTENER  
11 CLEANING

10A SOFTENER  
ENABLED

- » Press the arrow keys  $\uparrow\downarrow$  to select if relay input should be active or inactive.
- » Confirm the selection with  $\leftarrow$ .  
The program jumps to submenu "10B".
- » Default value: Disabled

10B SOFTENER  
CONTACT N.O.

- » Press the arrow keys  $\uparrow\downarrow$  to set the switching direction.

N.O. CONTACT = The input functions as a normally open contact.

N.C. CONTACT = The input works as a normally closed contact

- » Confirm the selection with  $\leftarrow$ .  
The program jumps to submenu "10C".
- » Default value: NC

10C INPUT DELAY  
00Sec

- » Press the arrow keys  $\uparrow\downarrow$  to set the time of delay.

0 Sec = no delay  
(see note at the end of the chapter)

- » Confirm the selection with  $\leftarrow$ .  
The program jumps back to the main menu
- » Default value: 00 sec

### 11.6.11 Module flushing

### 11.6.10 Upstream softening

In this submenu you configure the module flush(es).  
Four flushing procedures can be programmed:

- At start-up of production
- During shutdown of the production
- During production at a programmed time interval
- In standby mode against standstill germination (same time interval as during production)

10 SOFTENER  
11 CLEANING

11A WASHING  
ENABLED

- » Press the arrow keys  $\uparrow\downarrow$  to select if relay input should be active or inactive.
- » Confirm the selection with  $\leftarrow$ .  
The program jumps to submenu "11B".

11B PUMP  
YES

By pressing the arrow keys  $\uparrow\downarrow$  you set whether the high pressure pump should run during flushing.

Yes = Pump ON  
NO = Pump OFF

- » Confirm the selection with  $\leftarrow$ .  
The program jumps to submenu "11C".
- » Default value: PUMP NO

11C EVIN  
YES

Press the arrow keys  $\uparrow\downarrow$  to select, if a flush should be done when **production is started up**.

YES = active  
NO = inactive

- » Confirm the selection with  $\leftarrow$ .  
The program jumps to submenu "11D".
- » Default value: EVIN YES

11D START PROD.  
ENABLED

By pressing the arrow keys  $\uparrow\downarrow$  you set whether a flush should be carried out before each start.

- » Confirm the selection with  $\leftarrow$ .  
The program jumps to submenu "11E".

11E TIME  
00min 00sec

By pressing the arrow keys  $\uparrow\downarrow$  you set the duration of the flushing time.

- » Confirm the selection with  $\leftarrow$ .  
The program jumps to submenu "11F".

11F END PROD.  
ENABLED

By pressing the arrow keys  $\uparrow\downarrow$  you set whether a flush should be carried out at the end of the production.

- » Confirm the selection with  $\leftarrow$ .  
The program jumps to submenu "11G".

11G TIME  
0min 15sec

By pressing the arrow keys  $\uparrow\downarrow$  you set the duration of the flushing time for the periodic module flushing.

- » Confirm the selection with  $\leftarrow$ .  
The program jumps to submenu "11H".
- » Default value: 01 min 00 sec

11H WASHCYCLE  
0min 15sec 24h

By pressing the arrow keys  $\uparrow\downarrow$  you specify the time period between the periodic module flushes.

e.g. change 24h to 48h (usage pause)

- » Confirm the selection with  $\leftarrow$ .  
The program jumps back to the main menu.
- » Default value: 00 min 30 sec 24 h

## 11.6.12 Configuration of the alarm output relay

(See 11.7 wiring diagram)

12 ALARM  
13 RESET



12A ALARM  
ENABLED

- » Press the arrow keys **↑↓** to turn the alarm output on or off.
- » Confirm the selection with **←**.  
The program jumps to submenu "12B".

12B OUTPUT ALARM  
CONTACT N.C.

- » Press the arrow keys **↑↓** to set the switching direction.
- » Default value: NC

N.O. CONTACT = The input functions as a normally open contact.

N.C. CONTACT = The input works as a normally closed contact.

- » Confirm the selection with **↑↓**.  
The program jumps back to the main menu.

## 11.6.13 Operating and service hour counter

The operating hours counter always runs when the system is in production mode. It is for general information and has no further control function.

It counts down the time. As soon as the counter has reached "0 hours", the following message appears on the display: "EXECUTE MAINTENANCE" (do maintenance).

The counter is set in the " 18 MAINTENANCE" submenu.

13 RESET  
14 SYSTEM TEST



13A RES HR COUNT  
ENTER = YES

- » Press the arrow keys **↑↓** to select, if the operation counter should be reset.
- » Confirm the selection with **←**.  
The program jumps to submenu "13B".

13B RES SERVICE  
ENTER = YES

By pressing the arrow keys **↑↓** you select if the service interval should be reseted.

- » Confirm the selection with **←**.  
The program jumps back to the main menu.

### Resetting the parameters to factory settings (except password):

- » Switch off the system
- » Press and hold **↑** and **→** and switch on the system. Only then release the buttons.

### RESET Password:

- » Switch off the system
- » Press and hold **↑** and **ESC** and switch on the system. Only then release the buttons.

### 11.6.14 Function test relay outputs

In this submenu you can check the relay outputs.

10 SOFTENER  
11 CLEANING



11A WASHING  
ENABLED

Display changes automatically

11D START PROD.  
ENABLED

- » Press the keys described below to switch the relay.

UP ↑	Feed water valve
DN ↓	Permeate flush valve VPER
L ←	Concentrate-flush valve VCONC
R →	High pressure pump HP
E ↵	Dosingpump Antiscalant PASC

- » Press the key again to switch the relay back.
- » Press ESC to return to the main menu

**Notice:**

To avoid damage to the unit: Always activate the feed water valve ↑ first before activating the pump →.

### 11.6.15 Function test alarm output relay

In this submenu you can manually activate the alarm output. The switched-on relay is then reset to its switching status as programmed in submenu 12.

15 ALARM TEST  
16 LANGUAGE



UP=ALARM  
ESC=TEST EXIT

- » Press "UP" ↑, to switch the relay.
- » Press the key again to switch the relay back
- » Press ESC to return to the main menu

### 11.6.16 Select language

In this submenu you can select the language shown on the display.

16 LANGUAGE  
17 SET PASSWORD



LANGUAGE  
ENGLISH

- » Press the arrow keys ↑↓ to select your language
- » Confirm the selection with ↵. The program jumps back to the main menu

### 11.6.17 Change password

In this submenu you can change the password to program the main menu.

17 SET PASSWORD  
18 MAINTENANCE

OLD PASSWORD  
0000

- » Press the arrow keys  $\uparrow\downarrow$  to enter your latest password
- » Confirm the selection with  $\leftarrow$ .

If the entry is correct, the program displays "PASSWORD ACCEPTED" and jumps to the next submenu.

NEW PASSWORD  
0000

- » Press the arrow keys  $\uparrow\downarrow$  to enter your new password
- » Confirm the selection with  $\leftarrow$ .  
The program jumps to the screen:

CONFIRM  
0000

Press the arrow keys  $\uparrow\downarrow$  to enter your new password again.

- » Confirm the selection with  $\leftarrow$ .  
The program jumps to the screen:

PASSWORD  
CHANGED

If the entry is incorrect, "CONFIRM ERROR" appears on the display for approx. 2 seconds before the programme jumps back to the "NEW PASSWORD" input display so that the new password can be entered again.

### 11.6.18 Reset password

To reset the password follow the steps below:

- » disconnect the unit from the power supply
- » press the two buttons  $\uparrow$  **ESC** while reconnecting the plug (connect to power supply).

The display will show "RESET PASSWORD" for a few seconds before the pump is started up.

### 11.6.19 Setting the maintenance interval

In this submenu you activate the service interval and enter the countdown of the service hour counter. In the delivery status, the service hour counter is set to 00100 hours. (100 hours). Resetting the countdown is described in submenu 13.

18 MAINTENANCE  
19 DOSING PUMP

18A FAILED DO.  
ENABLED

- » Press the arrow keys to activate or inactivate the service hour counter
- » Confirm the selection with  $\leftarrow$ .  
The program jumps to submenu "18B".

18B FAILED DO.  
CONTACT N.C.

Press the arrow keys to enter the Service interval in hours

- » Confirm the selection with  $\leftarrow$ .  
The program jumps back to the main menu.

### 11.6.20 Dosing pump antiscalant IN<sub>PASC</sub>

If a dosing pump for the dosing of antiscalant is installed instead of an upstream softening system, then either the potential free fault signal output of the dosing pump or the level switch (empty indicator) in the dosing vessel can be connected to the controller.

If the INPASC input is switched, the control system can switch off the RO system for the duration of the fault and put it in the waiting mode. As soon as the fault has been eliminated, the control system automatically returns the RO system to production mode.

19 DOSING PUMP  
20 STAND BY/ INPUT

19A FAILED DO.  
ENABLED

- » Press the arrow keys  $\uparrow\downarrow$  to select if relay input should be active or inactive.
- » Confirm the selection with  $\leftarrow$ .  
The program jumps to submenu "19B".  
Default value: DISABLED

**19B FAILED DO.  
CONTACT N.C.**

- » Press the arrow keys **↑↓** to set the switching direction.

N.O. CONTACT = The input functions as a normally open contact.  
N.C. CONTACT = The input works as a normally closed contact

- » Confirm the selection with **↵**.  
The program jumps to submenu "19C".

**19C INPUT DELAY  
00Sec**

- » Press the arrow keys **↑↓** to set time of delay.
- » Confirm the selection with **↵**.  
The program jumps back to the main menu.
- » Default value: 00 sec

**11.6.21 Stand-by-Input IN<sub>SB</sub>  
(Release contact)**

**20 STAND BY / INPUT  
21 PUMP DELAY**

**20A STAND BY IN  
ENABLED**

- » Press the arrow keys **↑↓** to select if relay input should be active or inactive.
- » Confirm the selection with **↵**.  
The program jumps to submenu "20B".
- » Default value: DISABLED

**20B STAND BY IN  
CONTACT N.O.**

- » Press the arrow keys **↑↓** to set the switching direction.

N.O. CONTACT = The input functions as a normally open contact.  
N.C. CONTACT = The input works as a normally closed contact

- » Confirm the selection with **↵**.  
The program jumps to submenu "20C".

**20C INPUT DELAY  
00Sec**

- » Press the arrow keys **↑↓** to set the time of delay

0 Sec = no delay  
(see note at the end of the chapter)

- » Confirm the selection with **↵**.  
The program jumps back to the main menu.

**11.6.22 Set start delay**

**20 STAND BY/ INPUT  
21 PUMP DELAY**

**21A PUMP DELAY  
00 sec**

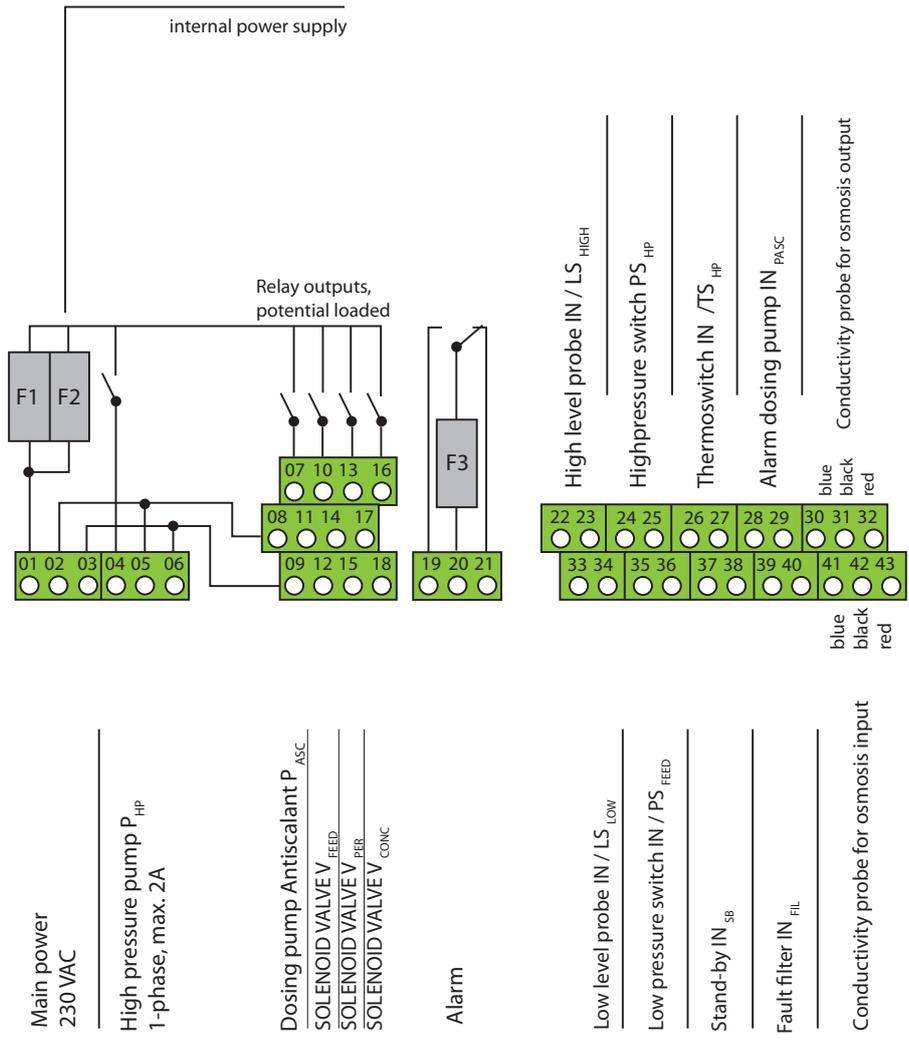
- » Default value: 00 sec

**Notice:**

**Output activation / delay:**

In order to avoid pipeline damage due to "water hammer", a delay of 3 seconds between pump on (or off) and solenoid valve on (or off) and a delay of 2 seconds between pump on (or off) and pressure pump on (or off) has been set at the factory.

# 11.7 Wiring diagram



Power supply, output relay			
01	02	03	Main power IN 230 VAC
L	E	N	
04	05	06	High pressure pump P <sub>HP</sub> 1-phase, max. 2A
L	E	N	
19	20	21	Alarm OUT
L	E	N	
N.O.	C	N.C.	

Output relay			
07	08	09	Dosing pump Antiscalant P <sub>ASC</sub>
L	E	N	
10	11	12	SOLENOID VALVE (EV IN) / V <sub>FEED</sub>
L	E	N	
13	14	15	SOLENOID VALVE (EV OUT) / V <sub>PER</sub>
L	E	N	
16	17	18	SOLENOID VALVE (EV CONC) / V <sub>CONC</sub>
L	E	N	

Digital inputs	
22	High level probe IN / LS <sub>HIGH</sub>
23	
24	High pressure switch IN / PS <sub>HP</sub>
25	
26	Thermoswitch IN ( pressure pump motor) / TS <sub>HP</sub>
27	
28	Alarm dosing pump IN <sub>PASC</sub>
29	

Digital inputs	
33	Low level probe IN / LS <sub>LOW</sub>
34	
35	Low pressure switch IN / PS <sub>FEED</sub>
36	
37	Stand-By IN <sub>SB</sub>
38	
39	Filter IN <sub>FIL</sub>
40	

Conductivity measurement option 1		
30	blue	Conductivity probe for osmosis output ECDI /01 0,0 – 99,9 µS/cm
31	black	
32	red	

Conductivity measurement option 2		
30	blue	Conductivity probe for osmosis output ECDI /1 0,0 – 999,9 µS/cm
31	black	
32	red	

## 12. ERROR DESCRIPTION

If an error appears, the permeate production stops. The display in the control panel switches from the current display to the display of an error code.

### List of possible faults and error codes

Alarm indication on the display	Possible cause	Action
<b>ALARM - CONDUCTIVITY</b>	The conductivity measuring instrument has lost calibration or is no longer working correctly.	Recalibrate or replace the conductivity sensor.
	The feed water parameters have changed.	Contact your supplier or the manufacturer.
	High permeate conductivity due to blocked membrane(s).	Replace the membrane(s).
	Piping blocked	Eliminate the cause of the blockage.
	Delay time too short	If the error occurs after a module flush, change the delay time in parameter 3D. If the error occurs during production, adjust parameter 4C.
Conductivity limit value chosen too low	Check the conductivity limit value entered. Adjust if it's necessary. Note the technical data of the consumer / humidifier.	
<b>SYSTEM STOP - HIGH PRESSURE</b> The PS <sub>HIGH</sub> overpressure switch for the max. permissible operating pressure has switched. <b>Only for ROC 140 and ROL units</b>	The PSHIGH pressure switch is not calibrated or is not working correctly.	Replace the pressure switch.
	Water pressure too high.	Re-adjust the pump pressure.
	Membrane(s) is/are blocked.	Replace membrane.
<b>SYSTEM STOP - NO PRESSURE</b> The PS <sub>LOW</sub> overpressure switch for the min. permissible operating pressure has switched.	The PSLOW pressure switch is not calibrated or is not working correctly.	Check an existing pre-treatment (if any). Replace the pressure switch.
	Decreasing flow rate. Blocking of filter cartridges..	Replace them.
	Water pressure too low.	Check the function of the solenoid valve. Check the water inlet pressure.
<b>System STOP - DOS PUMP</b> (only for systems with dosing pump)	Dosing pump does not work.	Check the fuse and replace it if necessary . Dosing pump is not working, replace it.
	Dosing pump does not work, the magnet "knocks".	The suction filter in the anti-coating canister is blocked. Clean the filter.
	Dosing pump does not work, the magnet does not "knock" or only damped.	Dirt deposits in the valve or valve is blocked. Replace the dosing pump.
	The red LED in the display of the dosing pump lights up.	Level alarm. Refill with anti-calant.

**List of possible faults and error codes (sequel)**

<b>Problem</b>	<b>Possible cause</b>	<b>Action</b>
Reduction of the permeate rate.	Decrease of permeator inlet pressure	Check pump P, make sure it is running correctly, replace it if necessary. Readjust the pressure to the sizing values and adjust the bypass inside pump P if necessary.
	Increase the pressure loss at the membrane due to blockages caused by hardness minerals	Check the process parameters and contact the supplier to arrange for replacement of the membrane(s) if necessary.
	The pressure switches have lost calibration, are worn or no longer function correctly.	Adjust or reset the flow rate and pressure to match the process values. Check the electrical connections.
	Blocked piping.	Correct the cause.
	Reduction of the water flow rate.	If necessary, check the water supply or adjust the shut-off valves in front of the system. Filter cartridges blocked. Replace the filter elements.
	The parameters of the water entering the system have changed.	Contact your supplier or the manufacturer.
Immediate stop (within one minute after start-up).	The pressure switches installed on the PVC distributor of the permeate are not working correctly or are not calibrated.	Check the function of the pressure switches and replace them if necessary.
	Inlet pressure of the expansion vessel is too low. Membrane of the expansion vessel is damaged.	Check the inlet pressure of the expansion tank and replace it if it is damaged.
The solenoid valves do not open	Control board or the solenoid valve coil is not supplied with voltage.	Restore the power supply to the control board and/or check the connections and the solenoid valve supply.
	Solenoid valve is defective.	Replace the solenoid valve.
	Incorrect pressure.	Check the water inlet pressure.
	Process parameters not correct.	Check the parameter settings.
High permeate conductivity	The membrane(s) is/are blocked or contaminated.	Replace the membrane(s). Contact your supplier or the manufacturer. Check the water inlet pressure.
Low water pressure	Low water pressure Inlet valves closed	Check the function of the solenoid valve.
	Decreasing flow rate	Blocked filter cartridges. Replace them.
The osmosis production does not start although it is activated and no alarm has been given.	The pressure switches doesn't supply a signal.	Check the connections and the function of the pressure switches and replace them if necessary.
	The fuse that protects the pump is blown.	Replace the fuse and test pump operation.
The system does not carry out the set sequences.	Power supply failure.	Check the power supply.

# 13. SPARE PARTS

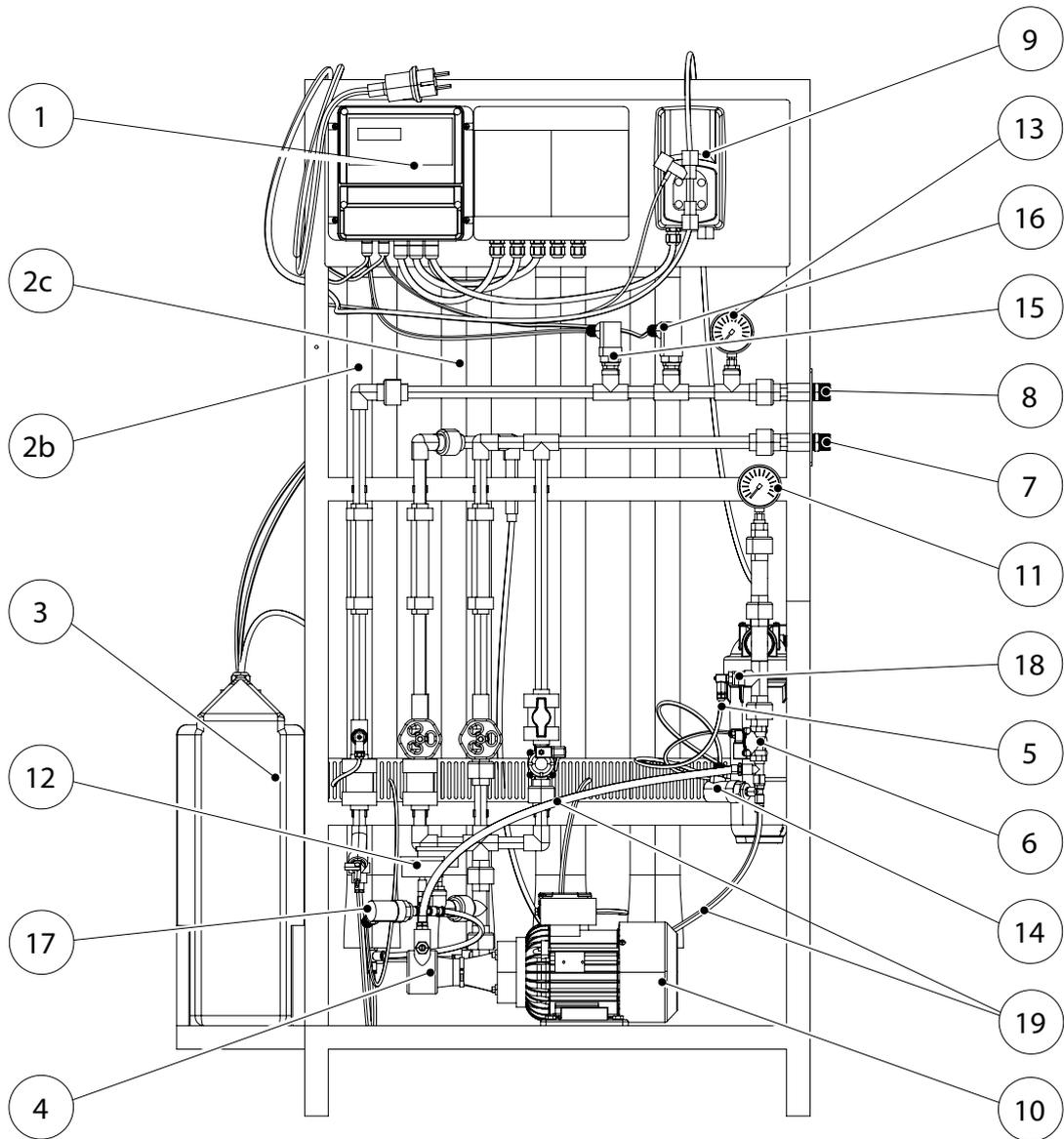
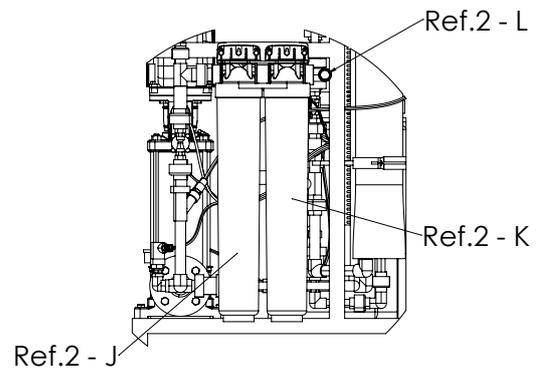
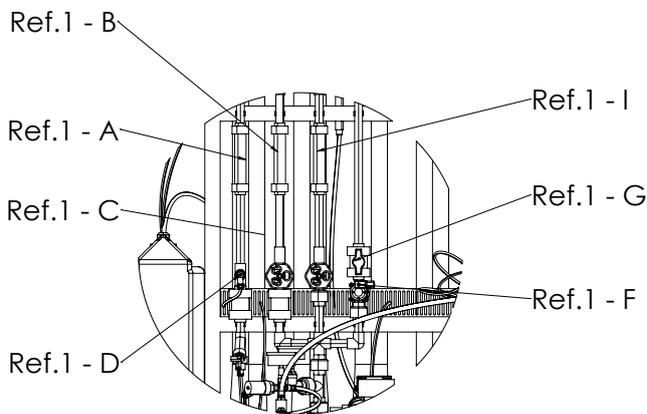
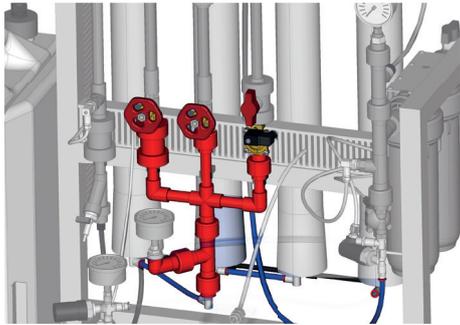
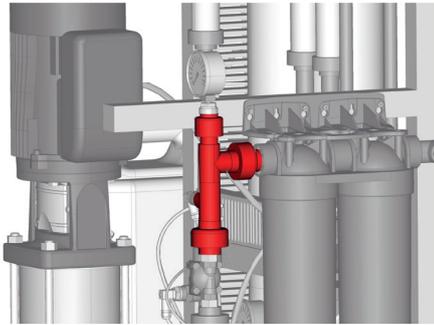


Fig. 13.a

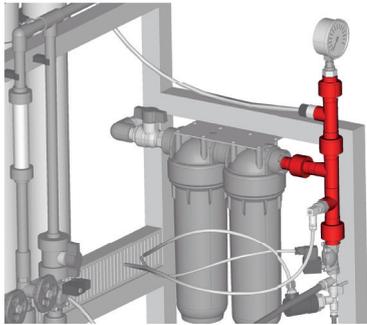




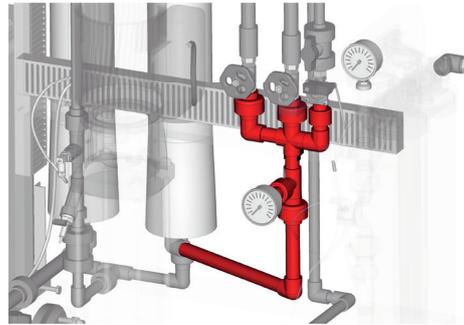
20



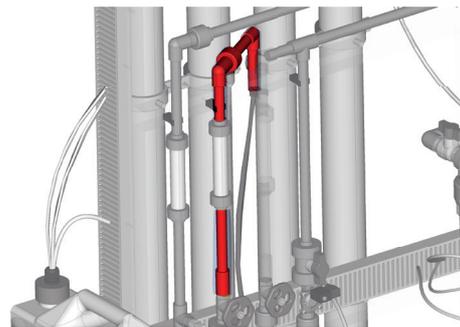
21



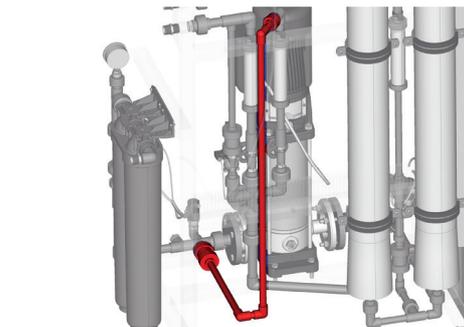
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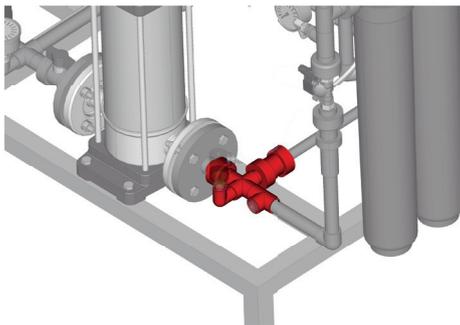
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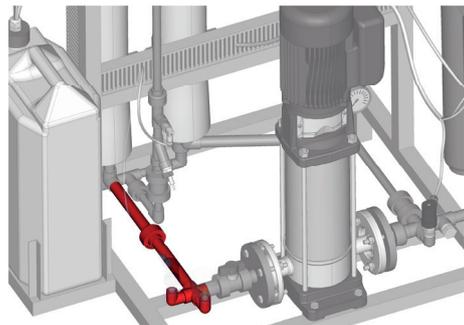
24



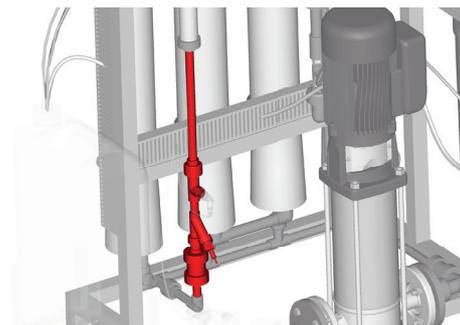
25



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Ref. number	Description	Spare part number	Qty ROL160	Qty ROL320	Qty ROL460	Qty ROL600	Qty ROL1K0	Qty ROL1K2
1	Controller	ROKLO0EP00	1	1	1	1	1	1
2a	Membrane vessel	ROKLO0VS25	2	4				
		ROKLO0VS40			2	2	4	4
2b	Osmotic membrane (ROLxxxxxx0)	ROKLO0ME10	2	4			4	
		ROKLO0ME20			2		4	
		ROKLO0ME30				2		4
		ROKLO0ME1B	2	4				
2c	Membrane vessel O-ring	ROKLO0ME2B			2		4	
		ROKLO0ME3B				2		4
		ROKLO0OR25	2	4				
2d	Vessel top cap	ROKLO0OR40			2	2	4	4
		ROKLO0TC25	2	4				
-	Vessel bottom cap	ROKLO0TC40			2	2	4	4
		ROKLO0BC25	2	4				
-	Caps extraction tool	ROKLO0BC40			2	2	4	4
2e	PVC lower connection between membranes	ROKLO0EXMB	x	x				
		ROKLO0PVCCSP			1	1		
2f	PVC upper connection between membranes	ROKLO0PVCFSP					1	1
3a	Antiscalant tank with cap	ROKLO0PVCRSP			1	1	2	2
3b	Antiscalant liquid - EN 15040 compliant - 10 L drum	ROKLO0AT00SP	1	1	1	1	1	1
		ROKLO0AST0	x	x	x	x	x	x
		ROKLO0AS25	x	x	x	x	x	x
		ROKLO0AS00	x	x	x	x	x	x
4	Rotary vane pump	ROKLO0PUMP	1					
		ROKLO0PU32SP		1				
	Centrifugal multistage motor pump 50 Hz (ROLxxx5xx0)	ROKLO0PUM5			1	1	1	
		ROKLO0PUX5						1
	Centrifugal multistage motor pump 50 Hz (ROLxxx5xxB)	ROKLO0PBM5			1	1	1	
		ROKLO0PBX5						1
	Centrifugal multistage motor pump 60 Hz (ROLxxx6xxx)	ROKLO0PUM6			1	1	1	
		ROKLO0PUX6						1
Centrifugal multistage motor pump 60 Hz (ROLxxx6xxB)	ROKLO0PBM6			1	1	1		
	ROKLO0PBX6						1	
5	Check valve for antiscalant injection	ROKLO0IV00SP	1	1	1	1	1	1
6	Water inlet solenoid valve	ROKLO0IV12	1	1				
		ROKLO0IV34			1	1	1	1
7	*PVC drain line (after flow meter / flushing control valve)*	ROKLO0PVCPSP	1	1				
		ROKLO0PVCISP			1	1	1	1
8	PVC permeate line (after flow meter)	ROKLO0PVCJSP	1	1				
9a	Antiscalant dosing pump	ROKLO0PVCMS			1	1	1	1
		ROKLO0DPO0	1	1	1	1	1	1
9b	Connect tubing kit for dosing pump	ROKLO0DPI			1	1	1	1
10a	Motor 50 Hz w/ elastic joint and adapter (ROLxxx5xxx)	ROKLO0MOT5	1	1				
		ROKLO0MOT6	1	1				
10b	Adapter motor to pump	ROKLO0AD00SP	1	1				
10c	Elastic joint motor to pump	ROKLO0EJO0SP	1	1				
11	Pressure gauge (feed water) / PI 01	ROKLO0MA06	1	1	1	1	1	1
12	Pressure gauge (membrane inlet) / PI 02	ROKLO0MA16	1	1	1	1	1	1
		ROKLO0MA06	1	1				
13	Pressure gauge (permeate outlet) / PI 04	ROKLO0MA16			1	1	1	1
		ROKLO0MA16						
14	Pressure switch / PS LOW	ROKLO0PSLP	1	1	1	1	1	1
15	Pressure switch / PS MIN	ROKLO0PSLL	1	1	1	1	1	1
16	Pressure switch / PS MAX	ROKLO0PSHL	1	1	1	1	1	1
17	Pressure switch / PS HIGH	ROKLO0PSHP	1	1	1	1	1	1
18	Feed water conductivity sensor	ROKLO0CP02SP	1	1	1	1	1	1
19	Flexible hose kit for pump suction and recirculation line	ROKLO0PVCTSP	1	1				
20	PVC inlet water line between filters and solenoid valve	ROKLO0PVCQSP	1	1				
21	PVC inlet water line between filters and solenoid valve	ROKLO0PVCKSP			1	1	1	1
22	PVC fittings on drain/recirculation before control valves	ROKLO0PVCSSP	1	1				
23	PVC fittings on drain/recirculation before control valves	ROKLO0PVCNSP			1	1	1	1
24	PVC recirculation line after control valve	ROKLO0PVCOSP	1	1				
25	PVC recirculation line after control valve	ROKLO0PVCDSP			1	1	1	1
26	PVC fittings at pump suction	ROKLO0PVCHSP						
27	PVC fittings at pump discharge before membranes	ROKLO0PVCEP			1	1	1	1
28	PVC permeate line before flow meter	ROKLO0PVCGSP			1	1	1	1
29	PVC check valve	ROKLO0V20SP	2	2	2	2	2	2
30	Glue for PVC fittings	ROKLO0PVCLSP	x	x	x	x	x	x
		ROKLO0FL20	3	3				
Ref.1 A/B/I	Flow meter	ROKLO0FL25			3	3	3	
		ROKLO0FL32						3
Ref.1 C	Manual control valve	ROKLO0VAL2	2	2	3	3	3	3
Ref.1 D	Permeate conductivity sensor	ROKLO0CP01SP	1	1	1	1	1	1
Ref.1 F	Flushing solenoid valve	ROKLO0IV12	1	1	1	1	1	1
Ref.1 G	Manual ball valve	ROKLO0VALS	1	1	1	1	1	1
Ref.2 K	CB-EC activated carbon filter	ROKCO0FLT2	1	1				
		ROKCO0FLT5			1	1	1	1
Ref.2 J	Sediment filter	ROKCO0FLT3	1	1				
		ROKCO0FLT4			1	1	1	1
Ref.2 K/J	Filter vessel	ROKCO0HOUS	1	1				
		ROKLO0HOU2			1	1	1	1
Ref.2 K/J	Filter vessel O-ring	ROKCO0OR10	2	2				
		ROKLO0OR20			2	2	2	2
Ref.2 K/J	Filter spanner	ROKCO0WREN	x	x				
		ROKLO0WREN			x	x	x	x
<b>Optional kit</b>	<b>Spare part description</b>	<b>Spare part number</b>	<b>ROL160</b>	<b>ROL320</b>	<b>ROL460</b>	<b>ROL600</b>	<b>ROL1K0</b>	<b>ROL1K2</b>
*UV sterilizer 680 l/h ROKLO0DBK1*	UV lamp	ROKLO0UVL1	x	x	x	x		
	Quartz glass	ROKLO0QZL1						
	O-ring for quartz glass	ROKCO0UVORSP						
	Electronic ballast	ROKLO0UVT1						
*UV sterilizer 1360 l/h ROKLO0DBK2*	UV lamp	ROKLO0UVL2					x	x
	Quartz glass	ROKLO0QZL2						
	O-ring for quartz glass	ROKCO0UVORSP						
	Electronic ballast	ROKLO0UVT2						

For ordering spare parts, a template can be found on the [www.CAREL.com](http://www.CAREL.com) website under the „Contact“ tab.  
 Your spare parts order may as well be directed per e-mail to the CAREL main office using the address [hy@CAREL.de](mailto:hy@CAREL.de).  
 Please make sure to specify your unit model and serial number.

# 14. COMMISSIONING REPORT / MAINTENANCE DOCUMENTATION

## Commissioning report for CAREL reverse osmosis systems ROC and ROL

<b>Unit</b>	Type _____	Serial number _____
	Type of pressure expansion vessel _____	
	Date of maintenance _____	
	Company / name _____	
<b>Customer</b>	Commercial / Private _____	
	Street / Number _____	
	Postal code / City _____	
	Contact on site _____	Telephone number _____

		Checked / Value	
<b>Unit condition</b>	Unit delivered complete?	<input type="checkbox"/> yes <input type="checkbox"/> no	
	Transport locks removed?	<input type="checkbox"/> yes <input type="checkbox"/> no	
	All hoses and connections checked for damage?	<input type="checkbox"/> yes <input type="checkbox"/> no	
	All detachable PVC screw connections tightened? (ROL)	<input type="checkbox"/> yes <input type="checkbox"/> no	
	All electrical cables checked for external damage?	<input type="checkbox"/> yes <input type="checkbox"/> no	
<b>General</b>	Distance appliance - pressure expansion vessel	meters	
	Distance pressure expansion vessel - consumer	meters	
	Connection to the drinking water system	<input type="checkbox"/> yes <input type="checkbox"/> no	
	Softening system connected?	<input type="checkbox"/> yes <input type="checkbox"/> no	
	Hoses to the anti-scalant pump and canister connected (if available)?	<input type="checkbox"/> yes <input type="checkbox"/> no	
	Prefilter and membranes in position?	<input type="checkbox"/> yes <input type="checkbox"/> no	
<b>Feed water</b>	Total hardness	°fH	
	Conductivity	µS/cm	
	Temperature	°C	
	Water inlet pressure	bar	
<b>Permeate / Konzentrate</b>	Conductivity permeate	µS/cm	
	Conductivity concentrate	µS/cm	
	Conductivity Mixwater (only ROC with blending kit)	µS/cm	
	Operation pressure	bar	
	Permeate quantity	l/h	
	Concentrate quantity	l/h	
	Demineralisation rate	%	
	Switch-on pressure	bar	
	Switch-off pressure	bar	
	Antiscalant dosing (if available) activated according to operating instructions and canister filled to mixing ratio?	<input type="checkbox"/> yes <input type="checkbox"/> no	

**Note: The commissioning values are to be documented as a basis for the system assessment.**  
A water analysis is to be attached to this protocol.

**Datum / Sign** \_\_\_\_\_

**Maintenance checklist for CAREL reverse osmosis systems ROC and ROL**

Unit	Type	Serial number
	Type of pressure expansion vessel	
	Date of maintenance	
	Company / name	
Customer	Commercial / Private	
	Street / Number	
	Postal code / City	
	Contact on site	Telephone number

The following system components were tested (settings, setpoints, levels, etc.):	Error - free operation		Replace-ment		Remarks
	Yes	No	Yes	No	
Activated carbon pre-filter (ROL)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5 µm-prefilter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
membrane(s)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
electrical connections	<input type="checkbox"/>	<input type="checkbox"/>			
Dosing pump (if available)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Tightness of the unit	<input type="checkbox"/>	<input type="checkbox"/>			
UV lamp (replace after 9000 hours or 1 year)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Measured parameters		Values at		Remarks
		Commis-sioning	Mainte-nance	
Operating hours	hours			
Feed water pressure	bar			
Water pressure behind pre filter	bar			
Total hardness feed water	°fH			
Conductivity feed water	µs/cm			
Temperature feed water	°C			
Conductivity permeate	µs/cm			
Conductivity mixed water (only WL-ROC with blending option)	µs/cm			
Operation pressure	bar			
switch-on pressure (max 2 bar)	bar			
switch-off pressure (max 4 bar)	bar			
Concentrate quantity in relation to the feed water	☺	☹		
Concentrate quantity in relation to the feed water quantity used	☺	☹		
Reset service counter	☺	☹		

Samples taken for analysis	Remarks	
Feed water	<input type="checkbox"/>	
Permeate	<input type="checkbox"/>	

**NOTE: The commissioning values are to be documented as a basis for the system assessment. Copy this form for multiple use.**

Date / Sign \_\_\_\_\_

# 15. TECHNICAL SPECIFICATIONS

**Technical data ROL (Reverse Osmosis Large)**

	ROL 160	ROL 320	ROL 460	ROL 600	ROL 1000	ROL 1200
Permeate production [l/h] *	160	320	460	600	1000	1200
Concentrate production [l/h]*	160	150	460	600	470	570
Circulation [l/h]*	160	150	460	600	450	450
Water consumption during operation [l/h]	320	470	920	1200	1470	1770
Max. Recovery rate [%]	50	68	50		68	
Minimum water flow required for flushing [m3/h] – 2bar	0,9 - 1,2		1,8 - 2,1			
Max. Working pressure [bar]	10					
Feed water temperature [°C]	5 - 25					
Feed water pressure [bar]	2 - 5					
Feed water total dissolved salt [ppm]	< 750					
Feed water conductivity [µS/cm]	< 1000					
Number of membranes	2	4	2	2	4	4
Size of low-energy-membranes	2,5" x 40		4" x 40	4" x 40 XL	4" x 40	4" x 40 XL
Membrane pressure [bar]	7,9	8,8	7,4	7,9	8,1	8,8
Permeate pressure [bar]	2 - 4					
Electrical connection	230V /1Ph /N /50 or 60Hz depending on product code					
Electrical power [kW]	0,95		1,65			
Weight (kg) during operation	75	83	100		125	
Dimensions [mm]	height	1555		1550		
	depth	510		700		
	width	940		1090		
Permeate pipe connection	3/4" AG or John Guest Ø 15 mm				3/4" AG	
Water connection	3/4" AG					
Drainage connection	3/4" AG or John Guest Ø 15 mm				3/4" AG	
Water hardness [°fH]	up to 50					
Drain function	✓					
Conductivity measurement	Permeate and feed water monitoring, alarm function included					

\* Specifications refer to the reference water quality: 15°C, TDS: 500 ppm, 26.7 °fH, permeate pressure: 1 bar

These values are theoretical because they can change with the temperature of the feed water and its chemical and physical qualities. These values were used for feed water with a TDS of 500 ppm and a water temperature of 18°C.

The temperature of the feed water has a great influence on the productivity and quality of the permeate. As the temperature increases, the permeate output also increases, but with a worse conductivity value.

The recovery value is calculated as follows:

$$\text{RECOVERY (\%)} = \frac{\text{Permeate}^*}{\text{Permeate}^* + \text{Concentrate}^*} \times 100$$

\* quantity

If a softening unit (e.g. the WaterLine-D) is connected upstream, the recovery value can increase up to 75%.

## 16. ANTISCALANT

### Dosage specifications:

When using the recommended antiscalant Pragmaclean 309 the correct dosage depends on the ROL size and on raw water hardness, keeping constant at 30% the stroke on the dosing pump.

### ☞ Notice:

Use only diluted antiscalant!

### How to proceed:

Fill the empty canister (20l) with the quantity of antiscalant specified in the table below (l), then fill with permeate water collected from the sample tap up to full tank.

Litres of antiscalant	< 25 °fH	25 to 33 °fH	33 to 50 °fH
ROL160	0.8	0.9	1
ROL320	0.8	1	1.2
ROL460	2.1	2.5	2.9
ROL600	2.7	3.2	3.7
ROL1K0	2.5	3.1	3.7
ROL1K2	3	3.7	4.5







# CAREL

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