MLRO 2000 / 3000 GB 23-01-2501

READ AND SAVE
THESE INSTRUCTIONS

INSTALLATION AND OPERATION MANUAL

Reverse Osmosis system

ML RO 2000-3000 series.

Humidification and Evaporative Cooling

Thank you for choosing Condair

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

Manufacturer
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1 General information

1.1 Read me first!

Thank you for choosing the Condair ML RO pure water system.

The Condair ML RO pure water system incorporates the latest technical advances and meets all recognized safety standards. Nevertheless, improper use of the Condair ML RO pure water system may result in danger to the user or third parties and/or damage to property.

To ensure a safe, proper, and economical operation of the Condair ML RO pure water system, please observe and comply with all information and safety instructions contained in the present documentation as well as in the separate documentations for the components used together with the Condair ML RO pure water system

If you have questions after reading this documentation, please contact your Condair representative. They will be glad to assist you.

1.2 About this installation and operation manual

Scope

The subject of this operation manual is the Condair ML RO pure water system. Addtional facility components are described only if is necessary for proper installation and operation of the system.

Since the system offers a wealth of expansion options, this documentation focuses on the standard system only. Adwdtional facility components can be supplied for a variety of applications and performance requirements. Increased humidifcation output will affect a range of facility components. While some accessories are not essential, others form part of the standard system confguration. For further information on accessory parts or individual custom solutions, please consult your customer-specifc schematic diagram or get in touch with your Condair representative.

Details provided in this installation and operation manual are limited to the **installation, commissioning, operation** and **maintenance** of the Condair ML RO pure water system.

This manual is supplemented by various other documents (brochures, purchase order forms, schematic diagrams, etc.). Where required, you will fnd the relevant cross-references to these publications in this documentation.

Conventions

CAUTION!

The catchword "CAUTION" used in conjunction with the caution symbol in the circle designates notes in this manual that, if neglected, may cause damage and/or malfunction of the unit or damage to property.

WARNING!

The catchword "WARNING" used in conjunction with the general caution symbol designates safety and danger notes in this manual that, if neglected, may cause injury to persons.

DANGER!

The catchword **"DANGER"** used in conjunction with the general caution symbol designates safety and danger notes in this manual that, if neglected, may lead to **severe injury or even death of persons.**

Definitions

- **Raw water:**
  The term raw water refers to (untreated) drinking or mains water without any additivs like chlorine, H_2O_2, ozone, etc.

- **Soft water:**
  Soft water is the term applied to water produced by the water softener unit. The water softening process replaces hard ions from calcium and magnesium with sodium.

- **Permeate water (RO water):**
  The term permeate water or reverse osmosis water (RO water) refers to water partially demineralised by the ML RO.

Safekeeping
Please safeguard this manual in a safe place, where it can be immediately accessed. If the equipment changes hands, the documentation must be passed on to the new operator.
If the documentation gets misplaced, please contact your Condair representative.

Language versions
This manual is available in other languages. Please contact your Condair representative for information.

2 For your safety

2.1 Health and safety

Installation, maintenance, repair work or decommissioning should only be carried out by appropriately qualified and properly trained technical personnel. The users are responsible for ensuring their suitability. The customer is responsible for ensuring that the installation of the equipment complies with all local regulations.

Any risks or hazards relating to the system, including during installation and maintenance, should be identified by a competent health and safety representative who is responsible for introducing effective control measures.

All ideograms, signs and markings applied to the unit must be observed and kept in a readable state.

2.2 Hygeine

Please observe the local health and safety executive's technical guidance on the control of Legionellosis in water systems.

The user is responsible for ensuring that the water system complies with local regulations, bylaws and guidelines (such as the HSE ACoP L8, VDI 6022, ISO 22000, HACCP or equivalent). If inadequately maintained, the RO-system, can support the growth of microorganisms, including the bacterium that causes Legionnaires' disease.

The ML RO is produced according to the ISO 22000 standards, which means that we have considered all aspects of this equipment to reduce the risk of Legionnaires' disease and other similar conditions. However, the user is responsible for ensuring that the installation, operation and maintenance work on the equipment is performed in a manner ensuring that the system stays clean!

Any risks or hazards relating to the system, including during installation and maintenance, should be identified by a competent health and safety representative who is responsible for introducing effective control measures.

WARNING!

The ML RO must be installed, operated and maintained in accordance with this manual. Failure to do so could result in contamination that might cause Legionnaires' disease, which can be fatal.

WARNING!

To prevent water stagnation and microbial contamination, the ML RO power supply should be left switched on. If the system is switched off for more than 48 hours, the pipework and system must be disinfected as per the instructions, and a full risk assessment must be undertaken to ensure safe operation

2.3 Guidelines to ensure your system stays clean and prevent the growth of Legionella

- Carry out a risk assessment of the water system using a competent person, and implement an appropriate monitoring and control programme.
- Initiate procedures for checking the UV system, cleaning tanks, changing filters, disinfection etc.
- The ML RO must be connected to a clean, potable mains water supply.
- Enter into a service contract that suits your company
- Stop the system if polluted drinking water is found in your area.
- Avoid water temperatures between 25°C and 45°C that favour the growth of Legionella.
- Do not stop the system unless it is faulty or leaking (avoid water stagnation)
- Refrain from closing nozzles or sections, unless there is leakage or a fault (avoid water stagnation)
- Disinfect the high-pressure system at least once a year and after every maintenance or repair. Always carry out a complete system disinfection if it has been turned off for more than 48 hours
- Have water samples taken and tested for harmful bacteria at least once a year.
- Conduct follow-up measurements until the system is clean if bacteria have been detected in the system.

The Condair service team can help. Condair has expert technicians who can provide:

- Bacteriological troubleshooting on site *
- Cleaning and disinfecting
- Preventive maintenance
- Repair and fault finding
- Training and guidance

*Condair uses a quick method for measuring bacterial activity in the water: the approved and patented BactiQuant. Once the water sample has been taken, we can read the bacteriological quality of the water within 30 minutes, and disinfect the system if necessary.

2.4 Intended use

The ML RO is designed for producing RO water from drinking water and delivering this from it's holding tank via the integrated booster pump to the consumer. If used in another way, this will not be considered as intended usage. Condair A/S cannot be made liable for any damage or injury attributable to the inattentive, inappropriate, negligent or incorrect operation of the equipment, whether or not caused deliberately.

Operation of the equipment in the intended manner requires that all the information in this installation and operation manual be observed (in particular the safety instructions).

Potential danger related to the ML RO.

WARNING!

Risk of electric shock! A person may come in contact with live parts when the pump station/control unit is open. Touching live parts may cause severe injury or death.

Prevention: Before carrying out any work on the system, disconnect power and water supply.

WARNING!

Poorly maintained RO systems may be hazardous.

Prevention: read, understand and follow maintenance guidelines to ensure your system stays safe.

WARNING!

Water produced from a RO system is very aggressive and can cause metals to corrode quickly. The RO system should always be connected to piping / equipment suitable for handling RO water.

Installation, maintenance, repair work or decommissioning should only be carried out by appropriately qualified and properly trained technical personnel. The users are responsible for ensuring their suitability. The customer is responsible for ensuring that the installation of the equipment complies with all local regulations.

Any risks or hazards relating to the system, including during installation and maintenance, should be identified by a competent health and safety representative who is responsible for introducing effective control measures.

All ideograms, signs and markings applied to the unit must be observed and kept in a readable state.

3 Product overview

3.1 Model overview

The MLRO 2000 and 3000 RO-system removes (>95%) of salts and minerals from the RAW water.

The main system components are fitted on an ‘easy-to-place’ base frame (pump skid), the tank that holds 1000/265 liter/gal are placed the on a separate frame, and are normally placed beside the pump skid.

There are two pumps on the pump skid: The RO pump which pumps the raw water through the RO membrane at and into the RO water tank. RO water transfer pump, which delivers pressurized RO water to the consumer.

All components exposed to water are made of corrosion-resistant material. All hoses are steel-reinforced and drinking water-approved.

Both the transfer and RO pump are directly mounted on their electric motors. Power is supplied to the 3-phase asynchronous motors via a magnet-operated protective motor switch.

The transfer pump is protected against dry running by the level sensor in the RO tank that stops the system if the tank is empty.

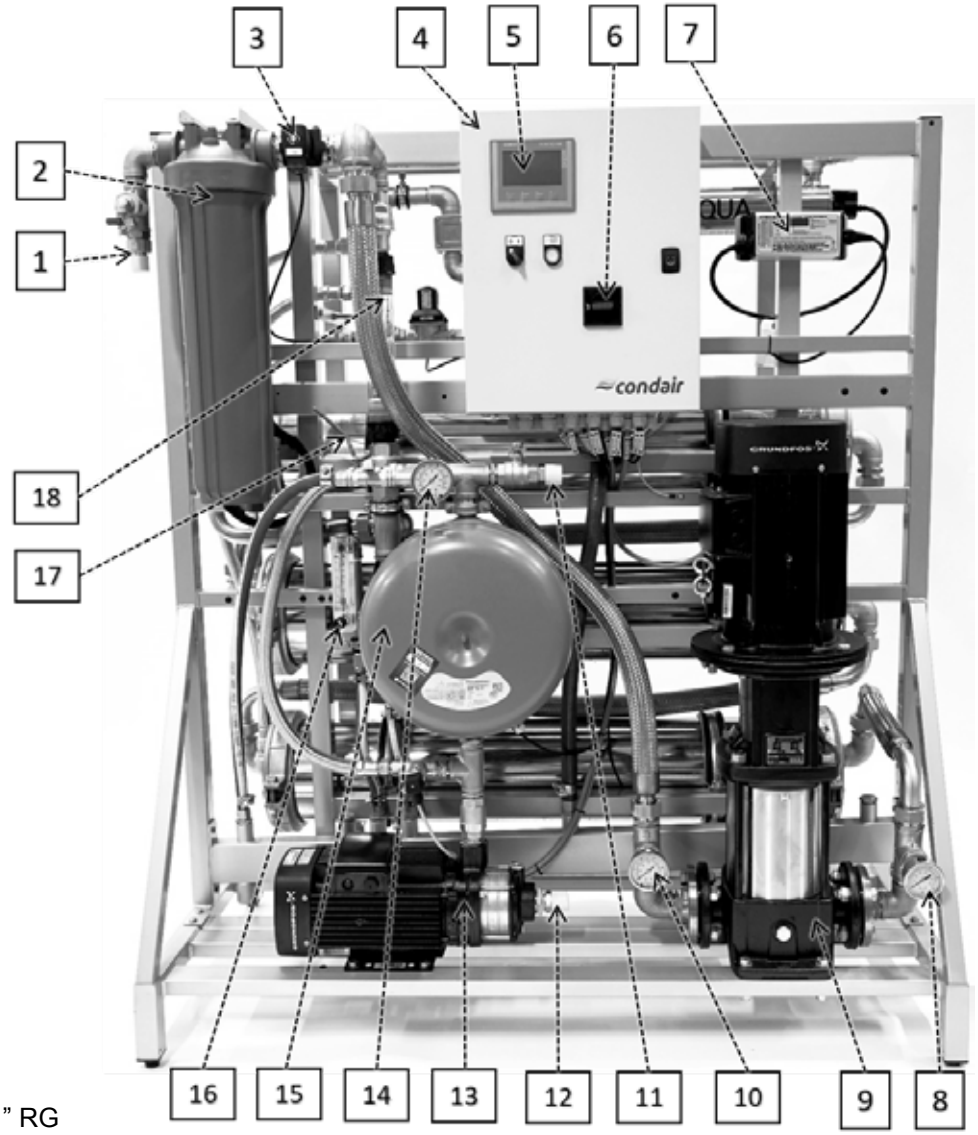
A pressure switch just after the inlet filter protects the RO pump from dry running.

The control unit consists of a touch display and a PLC mounted in the IP 65-rated electrical cabinet.

From the touch screen, the operator can change settings, adjust alarm limits and view hour counters, logged alarms, etc.

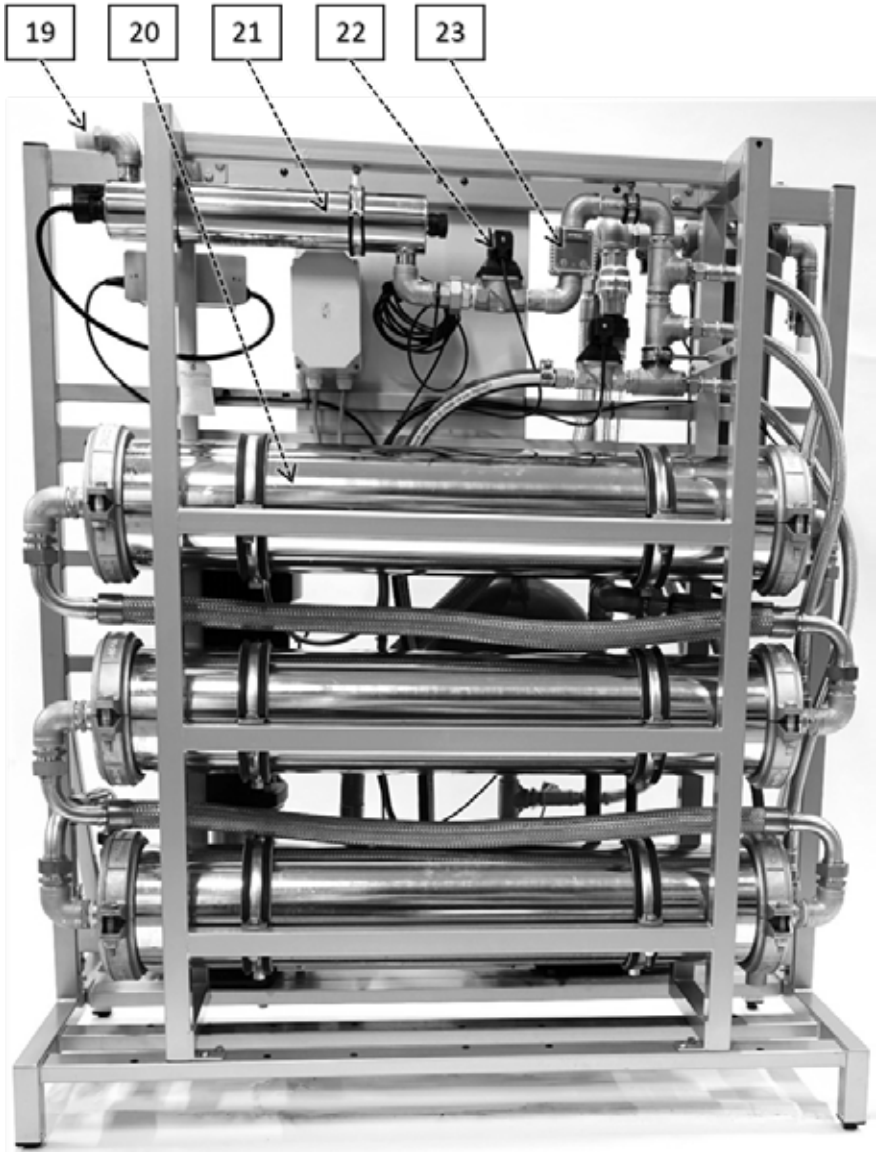
	MLRO 2000	**MLRO 3000**
Pure water output at 5°C (41°F)	2000 l/h (528 gal/h)	3000 l/h (793 gal/h)
Pure water output at 15°C (59°F)	2600 l/h (687 gal/h)	3900 l/h (1030 gal/h)
RO membrane type	2x40" Ø8” NSR 98.5%	3x40" Ø8” NSR 98.5%
Pure water tank	1000/265 liter/gal	1000/265 liter/gal

View Front



1. Inlet 1” RG
2. Filter 20", 25 µm
3. Inlet valve
4. Controller cabinet
5. Touch screen for the controller
6. Main switch
7. UV Power supply
8. RO pump outlet pressure gauge
9. RO pump
10. RO pump suction pressure
11. Outlet permeate to consumer 1” RG
12. Inlet permeate from RO tank
13. Booster pump
14. Permeate pressure gauge
15. Hydrophore, flowthrough, 18 L
16. Valve and flowmeter for drain adjustment
17. Valve for recirculation and RO pump pressure adjustment
18. Flowmeter for recirculation

View Back



19. Permeate outlet for holding tank
20. Membrane housing 40x8”
21. UV lamp
22. Permeate outlet valve MV7
23. Digital water meter

3.2 Functional description ML RO

Osmosis is a natural phenomenon which can be defined as the movement of pure water through a semi permeable membrane from a low to a high concentration solution. The membrane is permeable to water and some ions but rejects almost all ions and dissolved solids.

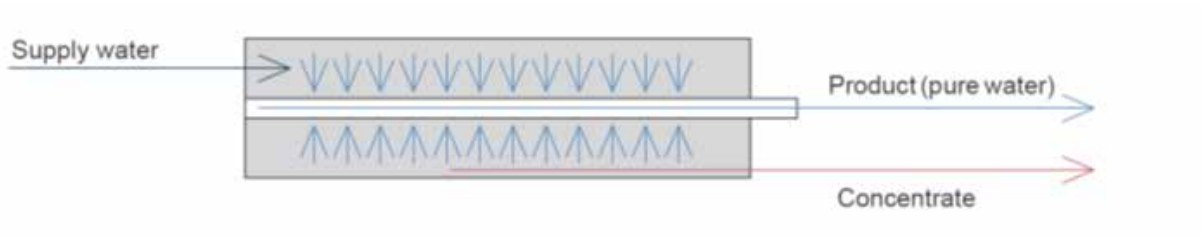
Reverse osmosis is a process which occurs when pressure, greater than the osmotic pressure, is applied to the concentrated solution. Water is forced to flow from the concentrated to the diluted side.

Reverse Osmosis (RO) is a separation technique that is suitable for a wide range of applications, especially when salt and/or dissolved solids need to be removed from a solution. Accordingly, RO can be used for seawater and brackish water desalination, to produce both water for industrial application (Humidification) and drinking water. It can also be applied for the production of ultrapure water (e.g. semi-conductor, pharmaceutical industries).

RO is currently considered one of the most economic and effective process for water desalination.

Cross flow is the configuration applied for membrane separation using RO membrane. As shown in Figure 1.1 the feed water stream flows tangentially to the membrane surface. A fraction of the water in this feed stream passes through the membrane, whereas the majority of the feed flow travels along the surface. Thus, two streams are collected:

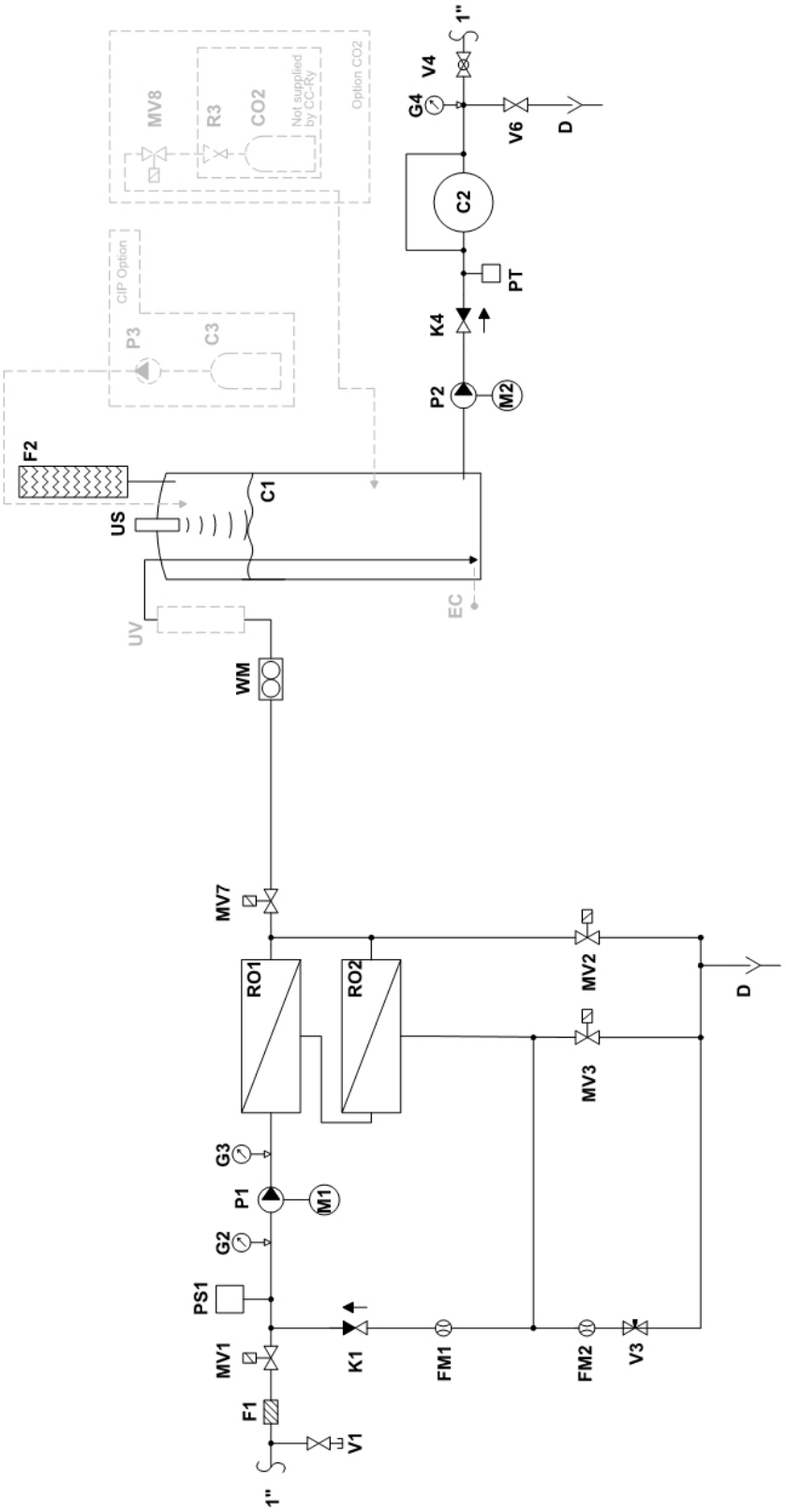
- Product/ permeate, almost pure water containing low concentration of ions
- Concentrate, having high concentration of small particles and dissolved ions



Figre 1.1: Schematic flow of RO membrane

In operation, the RO membrane system is continuously supplied with feedwater, which produces a constant water movement from feed to concentrate. When in cross-flow operation, there is little accumulation of the rejected solutes and fouling or scaling can be minimized.

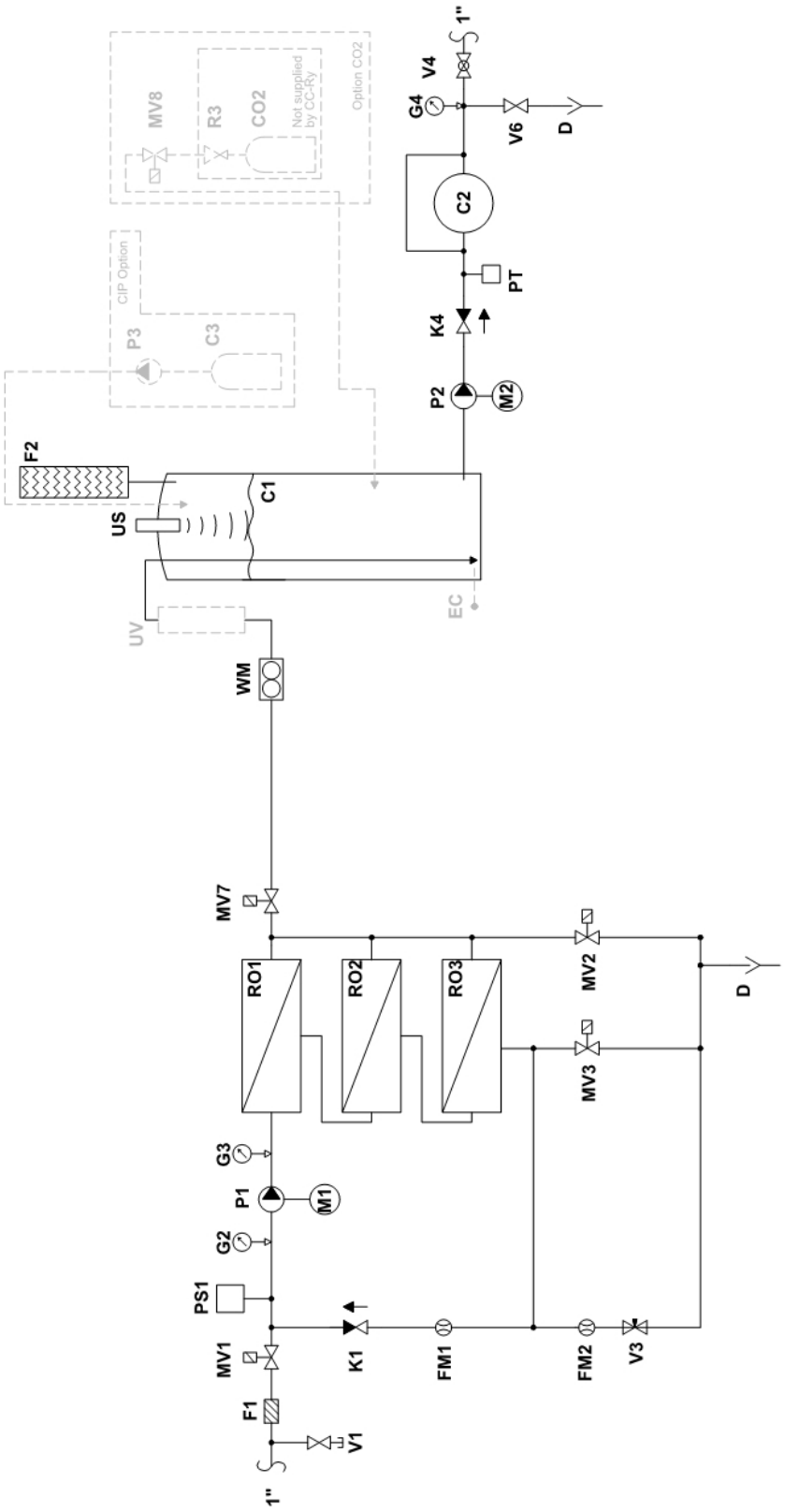
3.3 MLRO 2000 - Piping diagram



3.4 MLRO 2000 - Part specification

C1	Permeate tank, 1000 L external on stand, black plastic
C2	Hydrophore, flowthrough, 18 L
D	Drain pipe, 3/4" RG
F1	Filter 20", 25 µm
F2	Sterile breathing filter 0.2 µm, 10" / 3/4"
G2	Pressure gauge, inlet pressure RO pump
G3	Pressure gauge, RO pump pressure
G4	Pressure gauge, 0-10 bars
K1	Check valve 16 bar, back pressure max 0,1 bar
K4	Check valve
M1/P1	RO pump
M2/P2	Feed pump
MV1	ON/OFF valve, 0-10 bars
MV2	Valve for flushing at start-up
MV3	Valve for membrane flushing
MV7	ON/OFF valve
PS1	Pressure switch, pre-adjusted to 0.5 bar
PS2	Pressure transmitter
RO1-2	40x8" RO membrane in stainless steel housing
US	Ultra sound level sensor
V1	Test water tap 1/8“
V2	Ball valve for pressure adjustment
FM	Flow meter
FM2+V3	Needle valve and flowmeter for concentrate outlet adjustment
V4	Ball valve
V6	Drain valve
WM	Digital water meter for permeate
CO_2 option	
CO2 (Option)	CO_2 container
MV8 (Option)	Valve for CO_2
R3 (Option)	CO_2 pressure regulator
CIP option	
C3 (Option)	CIP container, 1 L plastic bottle
P3 (Option)	CIP pump
EC option	
EC (Option)	Conductivity sensor

3.5 MLRO 3000 - Piping diagram



3.6 MLRO 3000 - Part specification

C1	Permeate tank, 1000 L external on stand, black plastic
C2	Hydrophore, flowthrough, 18 L
D	Drain pipe, 3/4" RG
F1	Filter 20", 25 µm
F2	Sterile breathing filter 0.2 µm, 10" / 3/4"
G2	Pressure gauge, inlet pressure RO pump
G3	Pressure gauge, RO pump pressure
G4	Pressure gauge, 0-10 bars
K1	Check valve 16 bar, back pressure max 0,1 bar
K4	Check valve
M1/P1	RO pump
M2/P2	Feed pump
MV1	ON/OFF valve, 0-10 bars
MV2	Valve for flushing at start-up
MV3	Valve for membrane flushing
MV7	ON/OFF valve
PS1	Pressure switch, pre-adjusted to 0.5 bar
PS2	Pressure transmitter
RO1-3	40x8" RO membrane in stainless steel housing
US	Ultra sound level sensor
V1	Test water tap 1/8“
V2	Ball valve for pressure adjustment
FM	Flow meter
FM2+V3	Needle valve and flowmeter for concentrate outlet adjustment
V4	Ball valve
V6	Drain valve
WM	Digital water meter for permeate
CO_2 option	
CO2 (Option)	CO_2 container
MV8 (Option)	Valve for CO_2
R3 (Option)	CO_2 pressure regulator
CIP option	
C3 (Option)	CIP container, 1 L plastic bottle
P3 (Option)	CIP pump
EC option	
EC (Option)	Conductivity sensor

3.7 Available options

Softener ion exchange type
Status Relay (4 x digital outputs)

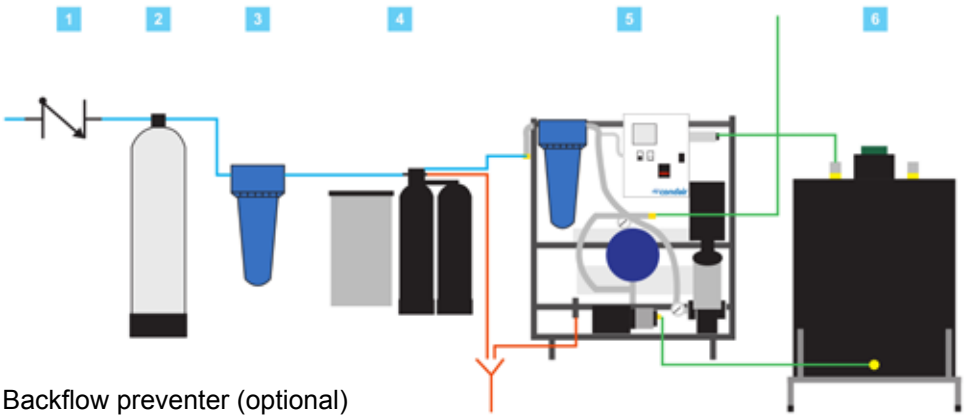
Optional and ancillary equipment can be divided into the two groups:

ML RO options: Added features which are integrated into the controller of the ML RO or placed on its frame, e.g UV filter, conductivity measurement, ultra-pure water (mixed bed), CIP system, CO_2 adding.

Pre-treatment: Stand-alone systems for improving the water quality in order to meet the inlet water quality requirements for the ML RO, e.g. booster pump, non-return valve, silt/pre-filter, carbon filter and softener. Ask your local Condair dealer for additional information on pre-treatment equipment.

Preconditions:	
UV - Lamp	Adding a UV lamp ensures a high level of hygiene in the produced RO water. Condair a/s strongly recommends having a UV lamp when the RO Water is to be used in a adiabatic humidifier
ML EC REG 1 Conductivity sensor (in RO tank)	Measuring the conductivity (µS) of the RO water in the RO tank, incl. Hi/Low alarms.
ML EC-REG 6 (CO_2 mixer)	Mixes CO_2 in the produced water from the RO membrane in order to increase RO water conductivity. (CO_2 tanks and regulator are not included)
Log option	Creates a logfile from the EC measurements (NB! Needs one EC-reg option)
BAS/BMS integration Modbus TCP/IP	Displays the operating humidity and alarm status of the system via a TPC/IP protocol.
CIP (clean-in-place)	Function that adds a small amount of disinfection into the water circuit, to prevent bacterial growth.
PLC webserver access	Access to the PLC's homepage from a standard browser. Displays the operating status and humidity for each zone.
Pulse generator for water meter	The water meter is equipped with a pulse emitter which can be linked to tele-reading systems, the PLC and to M-Bus networks.

3.8 System overview



1. Backflow preventer (optional)
2. Carbon filter (optional)
3. Prefilter (optional)
4. Softner
5. MLRO 2000/3000
6. Pressureless tank 1000 L

Principal system layout MLRO
Figure 1.2 Principal system layout water installation

4 Mounting and installation work

4.1 Safety notes on mounting and installation work

Qualification of personnel

All mounting and installation work must be carried out only by properly instructed and well qualified personnel (e.g. certified plumbers and certified electricians) authorised by the owner. It is the owner's responsibility to verify proper qualification of the personnel.

General notes

Strictly observe and comply with all information given in the present installation and operation manual regarding the positioning and mounting of the Condair RO-A system components and the water and electrical installations.

Observe and comply with all local regulations dealing with water and electrical installations.

DANGER!
Danger of electric shock

The Condair ML RO pure water unit as well as the Condair RS are mains powered. Live parts may be exposed when the units are open. Touching live parts may cause severe injury or danger to life.

Prevention: The Condair ML RO pure water unit and the Condair RS unit must be connected to the mains only after all mounting and installation work has been completed, all installations have been checked for correct workmanship and the units are closed and properly locked.

CAUTION!

Do not use oil, grease, glue, Teflon, silicon, O-ring lubrication, etc. when assembling pipes or hose connections.

All of the above products can act as food for bacteria and are thus pose health risks. Only approved lubricant: Dish soap.

Wash your hands before or wear clean gloves while assembling parts in direct contact with water. Keep dust covers on pipes and hoses until just before assembly.

CAUTION!

Do not fasten the pump station or hoses/pipes to vibrating installations.

4.2 Inspection of the delivery

After receiving:

- Inspect shipping boxes for damage.
  Any damages of the shipping boxes must be reported to the shipping company without delay.
- Check packing slip to ensure all parts has been delivered.
  All material shortages are to be reported to your Condair supplier within 48 hours after receipt of the goods. Condair Ltd. assumes no responsibility for any material shortages beyond this period.
- Unpack the parts/components and check for any damage.
  If parts/components are damaged, notify the shipping company immediately.
- Check whether the components are suitable for installation on your site according to the facility documentation.

4.3 Warranty

ML RO parts are covered by a two-year warranty from the invoice date with the exception of the replacement parts listed in the routine maintenance section. Failure to observe the manufacturer's installation and maintenance recommendations and instructions will invalidate the warranty. Condair A/S cannot be made liable for damage or injury attributable to failure to observe the manufacturer's installation and maintenance recommendations and instructions.

4.4 Storage and Transportation

Storing:

Until installation store the Condair ML RO system components in its original packaging in a protected area meeting the following requirements:

- Room temperature: 5 ... 40 °C
- Room humidity: 10 ... 75 %rh

Transportation:

For optimum protection always transport the Condair ML RO system components in their original packaging and use appropriate lifting/transporting devices.

WARNING!

It is the customer's responsibility to ensure that operators are trained in handling heavy goods and that the operators comply the appropriate regulations on work safety and the prevention of accidents.

Packaging

Keep the original packaging of the components for later use.

In case you wish to dispose of the packaging, observe the local regulations on waste disposal. Please recycle packaging where possible.

4.5 Requirements on siting and installation

Typically, the siting of a Condair RO-A pure water system is determined at the planning stage and set down in the facility documentation. The following general guidance on component siting should be observed in all cases, however:

- All installation work must be performed in accordance with industry good practice and the supply (fitting) regulations from local utilities.
- All Condair RO system components must be installed inside a building in a room which can be locked and which is accessible only to a limited number of people. The room must meet the following requirements:
  - The room temperature must be between +5 °C and +30 °C throughout the year.
  - The room must be equipped with a floor drain with sufficient drain capacity (min. 3000 l/h).

Note: If no floor drain is available all MLRO system components must be installed in tub equipped with a drain connected to the building waste water line.

- The room must be equipped with tap water supply capable to deliver the required water flow according to the table below.

System type	Minimum water flow rate at 2.5 bar flow pressure
MLRO 2000	4000 l/h
MLRO 3000	5000 l/h

- The room must be equipped with a mains power supply, next to the location for MLRO. The mains supply must be placed at a height between 0.6 to 1.3 m above the floor and be equipped with a residual-current circuit breaker (RCCB) and overload protection, according to local bylaws and Regulations.

	MLRO 2000	MLRO 3000
Supply voltage	3*400 VAC+GN+N 50Hz, 6,5 kW, Prefuse 32A	3*400 VAC+GN+N 50Hz, 6,5 kW, Prefuse 32A
	3*480 VAC+GN+N 60Hz, 8 kW, Prefuse 32A	3*480 VAC+GN+N 60Hz, 8 kW, Prefuse 32A

- The room must be equipped with an **open funnel with siphon** connected to the building wast water line with **sufficient drain capacity (min. 3,000 l/h).**
- The installation site should be chosen so that all system components are shielded from thermal and solar radiation.
- Ensure that structures (walls, stanchions, ceilings, etc.) to which the equipment/system components is/are to be mounted have sufficient load-bearing capacity and are suitable for installing the devices.
- Install the Condair ML RO system components in such a manner that they are **freely accessible** with sufficient space available for operation and maintenance purposes.

- To avoid bacterial contamination, drain pipework must not come into contact with the drain water funnel (an air gap of at least 2 cm must be maintained).
- **No modifications must be undertaken** on the MLRO pure water system without the express written consent of Condair.
- The installation of any additional fittings (e.g. valves, etc.) not indicated on the installation schematic is prohibited within the entire Condair system.
- Comply with material specifications at all times.

The manufacturer supplies individual plant schematics for customer facilities. Guidance on installation work is also provided. Installation instructions, schematics, and guidance are binding for the given layout.

4.6 Positioning/mounting the Condair ML RO system components

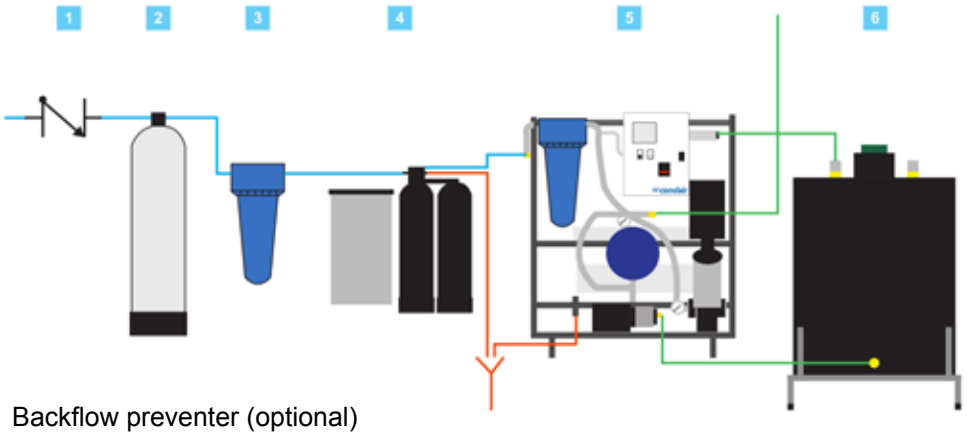
The Condair ML RO system components must be positioned in the order as shown in the figure below.

Position the external pure water tank for the MLRO

Place the external pure water tank as near as possible to the Condair ML RO pure water unit on the floor.

Turn external pure water tank in such a way that the water connector shows in the desired direction.

Secure external pure water tank against tilting with an appropriate securing.order of the MLRO system components in water flow direction.



1. Backflow preventer (optional)
2. Carbon filter (optional)
3. Prefilter (optional)
4. Softner
5. MLRO 2000/3000
6. Pressureless tank 1000 L

Figure 1.2 Principal system layout water installation.

General

Whenever possible place the system components on the same level in the order as shown Fig. 1.2.

Make sure the distances between the components are as short as possible (max. 3 m between each component). Make sure the drain line is as short as possible and the drain funnel is located below the drain connector of the MLRO.
The RO water line from the outlet of the MLRO should be installed in a manner/dimension that ensures the pressure drop in the RO water line do not exceed 1 bar.

Start by examining the types of water treatment systems to be installed and read their installation requirements for supply and drainage.

Mark the location of the different systems in the room and note any missing supply or drains for the systems. Make sure you have the nessesary fixing equipment available: cable ties, cable trays, screws and wall anchors.
Place the ML RO on a hard floor with a drain.

Positioning the optional water softener
Place the water softener at the desired position on the floor. And make sure the mains water supply and a drain is right next to it.

Positioning the MLRO and tank
Place the MLRO at the desired position and align unit with the four screw feet exactly horizontal using a level.

DANGER!
Danger of electric hazard!

Do not connect Condair ML RO pure water unit to the mains yet.

Position the external pure water tank for the MLRO

Place the external pure water tank as near as possible to the MLRO on the floor.

Turn external pure water tank in such a way that the water connector shows in the desired direction.

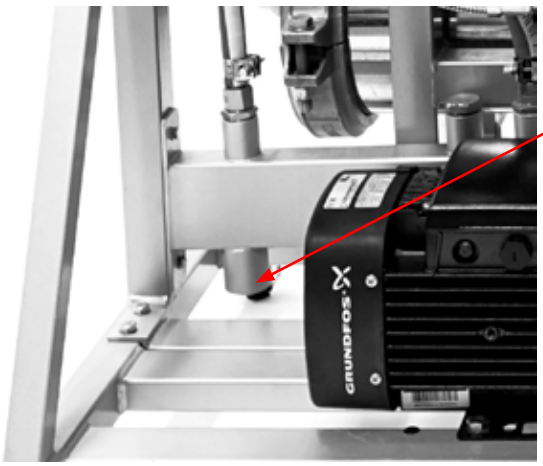
Connect the hoses between MLRO and its tank according to Fig. 1.2: Principal system layout water installation.

Connect the Ultrasonic level sensor with the m12 plug supplied, according to the electrical schemes.

4.7 Water connection

4.7.1 Drain

Connect the ML RO to the floor drain with a tube or hose of a 1" RG female.



1" RG female drain connector.

Remove protecting plug (yellow) from drain connector connector (let the preservation liquid drain (wind-screen wash).
Connect a drainpipe to the water outlet and lead the drainpipe down to an open funnel drain, there must be an airgap, to prevent sewage water entering the RO tank.

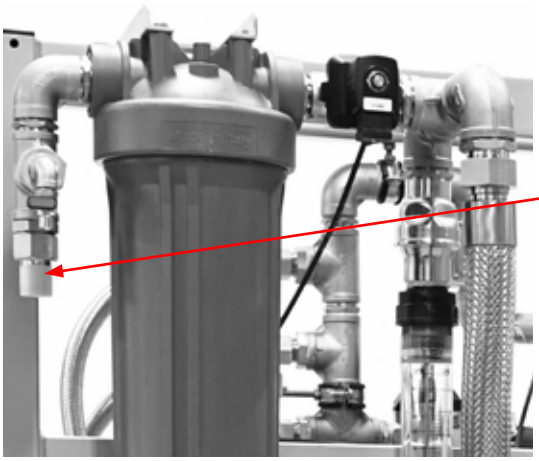
4.7.2 Water connection

WARNING!

Do not open and fill hoses, pumps, filters or tanks with water if the system is not to be started immedietely after installation (48 hours). Stagnang water acts as a breeding ground for potentially dangerous micro-organisms.

Unscrew the filter housing, remove plastic wrapping from the 20” filter elemet and insert it in the filter bowl.

Make shure that the filter element is centered and the o-ring is in place, when the filter bowl is screwing back on the filter bowl.
Connect main water supply (from softner)
Connect the permeat outlet to the RO tank, using the 1” steel braided hose supplied.
Connect the outlet of the RO tank, to the outlet pump using the 1” steel braided hose supplied.

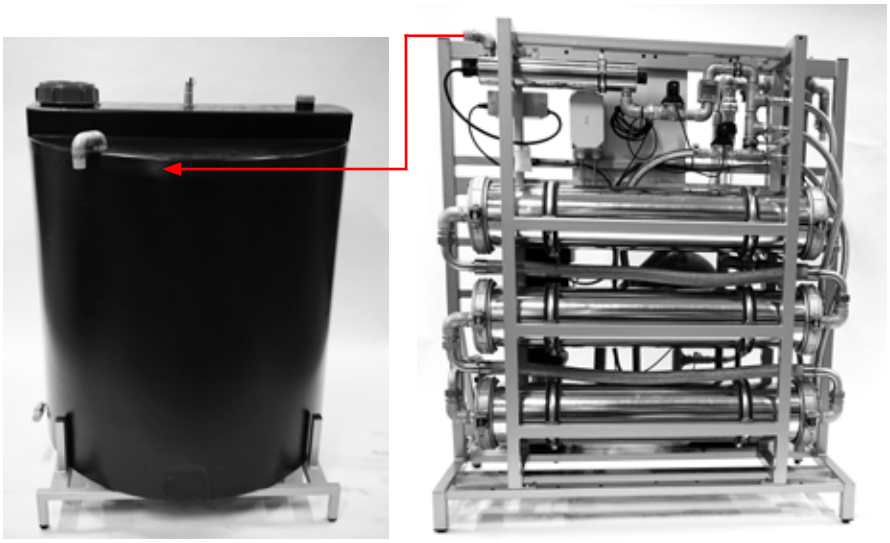


Connect main water supply (from softner)

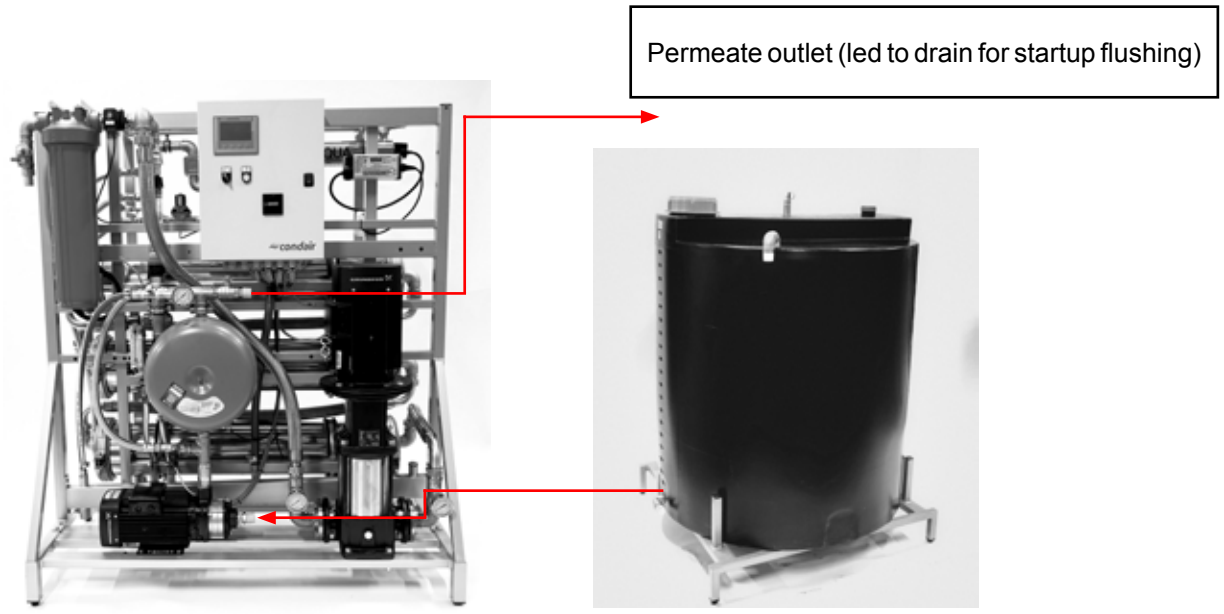
Inlet connection 1" RG male
(optional Hose connector)

4.8 Breathing filter and level sensor

Connect the permeat outlet to the RO tank, using the 1” steel braided hose supplied



Connect the outlet of the RO tank, to the outlet pump using the 1” steel braided hose supplied.



4.8.1 Breathing filter

Remove the cap from the breathing filter mounting .

Remove the plastic wrapper from the breathing filter and moisten the o-rings with tap water.

Push in the breathing filter firmly in place.

4.8.2 Level sensor

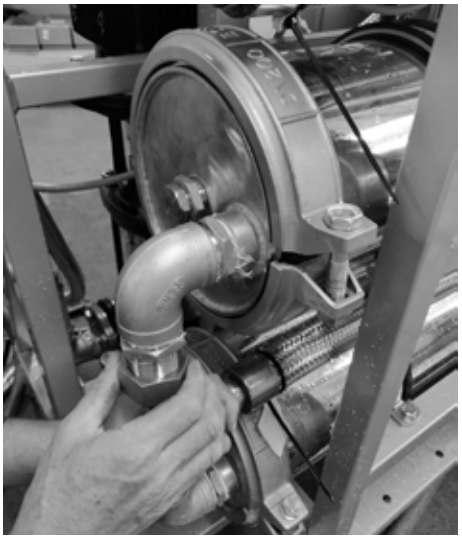
The ultrasonic level sensor on top of the tank needs to be connected.

The cable with M12 plug for connecting the level sensor is curled up under the control panel of the RO system.

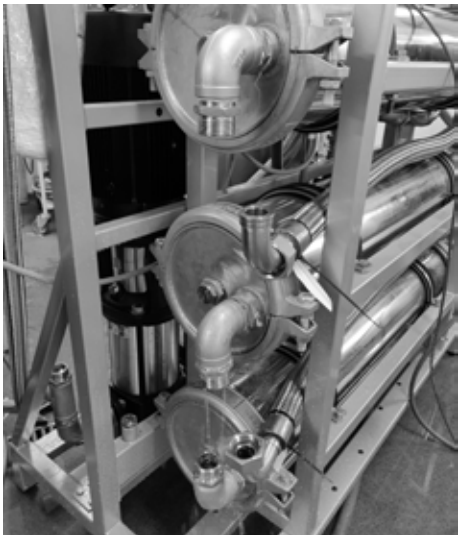
Ultrasonic sensor with the M12 plug mounted.

4.9 Installing membranes

4.9.1 Inserting the membranes in the membrane tube



Unscrew the steel braided tubes (inlet) on the lefthand side of the RO tube (looking from behind of the RO pump skid).

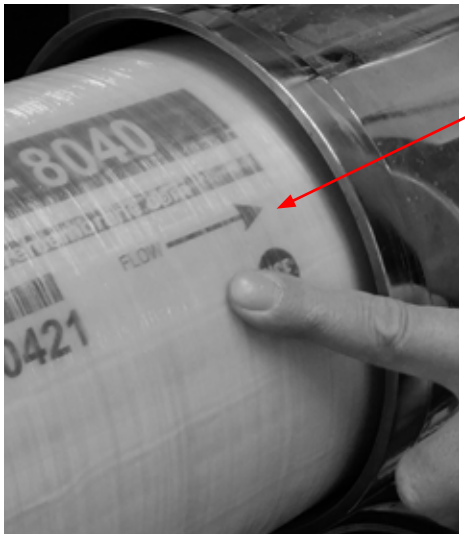


Loosen the clamp holding the endcap, and remove it and the rubber gasket underneath.

Pull the endcap out.

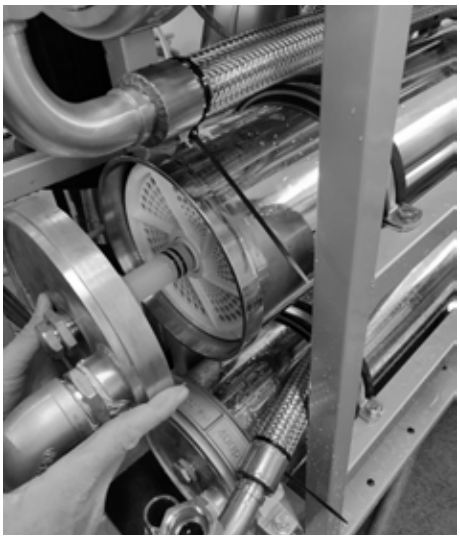
Unpack the RO membrane and insert the RO adapter lubricate with dishwashing soap.
The long end goes into the membrane.

Push in the membrane.



Make sure that the flow direction are correct !!!

Look for the arrow printed at the membrane, it should go in like shown on the photo.



Lubricate the RO membrane adaptor with dishwashing fluid.

Place the RO membrane adaptor (short end) in the endcap.

Push the endcap all the way in until the cap between the RO tube and the endcap are closed. it takes a firm push!

Now put the gasket, clamp, and hoses back on.

Never pressurize a frozen membrane, it should be kept at room temperature for at least 24 hours prior to startup.

Look carefully for leaks around hoses couplings and endcaps, at first startup, and replace the gaskets if needed.

4.10 Electrical installation

4.10.1 Notes on electrical installation

DANGER!
Danger of electrical shock!

Installations and electrical connection must only be done by trained technicians and accordingly to local standards.

High voltages, danger of electric shock! of electric shock! Touching live parts may cause severe injury or death.

- All work concerning the electrical installation must be performed only by **a certified electrician with appropriate training, authorized by the owner.** It is the owner's responsibility to verify the proper qualification of the personnel.
- The electrical installation must be carried out according to the corresponding wiring diagram (found in hard copy inside the electrical cabinet), the notes on electrical installation as well as the applicable local regulations. All information given in the wiring diagrams and notes must be followed and observed.
- All cables must be led into the devices, via appropriate cable strain relief or grommets. The cable for the optional leakage sensor can be led into the Condair ML RO pure water unit from the top via a cable grommet or from the bottom via the cable opening (fix cable with a clamp strap to the unit).
- Make sure all cables are adequately fixed over their entire length, do not rub on any components or become a tripping hazard.
- Observe and maintain maximum cable length and required cross section per wire according to local regulations.
- The mains supply voltages must match the respective voltage and fuse requirements as stated in chapter 9 Technical specifications

5 Operation

5.1 Prior to initial commissioning

Prior to initial commissioning the filter cartridge and the membranes must be installed in the MLRO pure water unit. In this regard please refer to chapter 4.8.

5.2 Initial commissioning

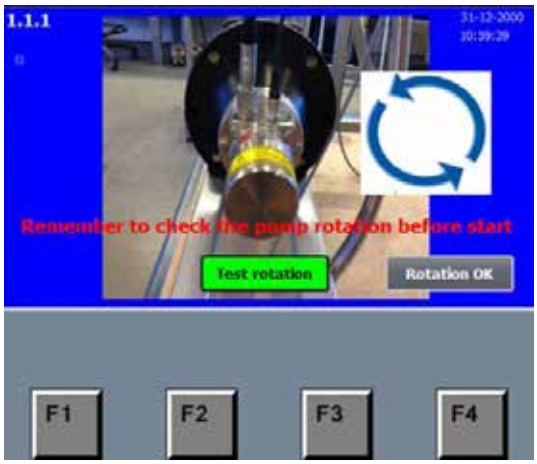
Initial commissioning, testing, and configuration of the MLRO pure water system must be carried out only by Condair Customer Service or trained service personnel authorized by Condair.

The MLRO pure water system may not be operated by the system owner or a person the owner has authorized unless acceptance testing for commissioning has been completed by Condair Customer Service or trained service personnel authorized by Condair. The system owner must also have been instructed in the operation of the unit by Condair. Once commissioning and training in the operation of the unit is complete, the system owner must ensure that the system is operated only by trained personnel. This is an integral part of the Condair product warranty conditions and non-compliance will void the product warranty.

5.3 Startup of the controller

- Put S1 in OFF position
- Start the controller by turning the power switch S3 in ON position
- The display boots

1. Display (D2)
2. ON/OFF (S1)
3. Reset/start (S2/P1)
4. Keyhole
5. Power switch (S3)



1.1.1 Pump rotation check

Every time the system is powered up, you will see the pump rotation check screen.

Verify that the pump rotation is correct.

A technician pin will be required; 197 or higher

A push on the Test rotation starts the high-pressure pump for 5 seconds, so that the rotation can be observed according to the arrows on the pump, always be sure that water is connected to the MLRO before pressing the test button in order to avoid dry-running.

When the rotation control has passed it is possible (by customer's responsibility) to skip this screen in the future (It can be deselected in screen 1.6).

NB! The check rotation screen will still be shown for one minute when the system is powered up, after one minute the screen will change to the home screen.

1.1 Select language

Select language by pressing the flag.

Select the units to use in the screens.

- Litre/hour
- Lb/hour
- Celsius
- Fahrenheit

Press the right arrow (F4) to continue.

2.0 Home screen

Visually displays: running pumps, tank level and pressure after Res. pump (outlet pressure).

If an alarm or warning is triggered, text with the message in question will appear in the bottom of the screen .

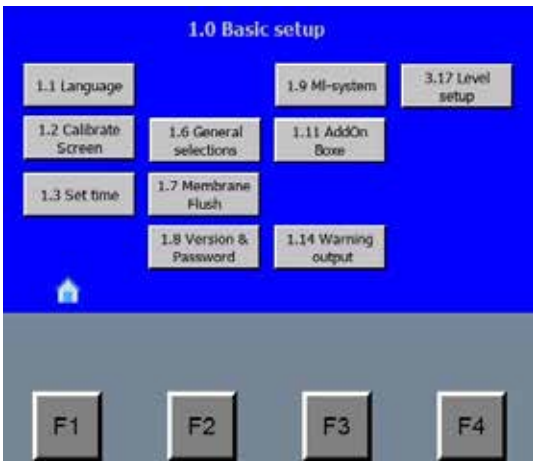
From this page, you can access the menu page, the alarm page, settings as well as other displays.

6 First startup and flushing (new membrane)

6.1 Flushing

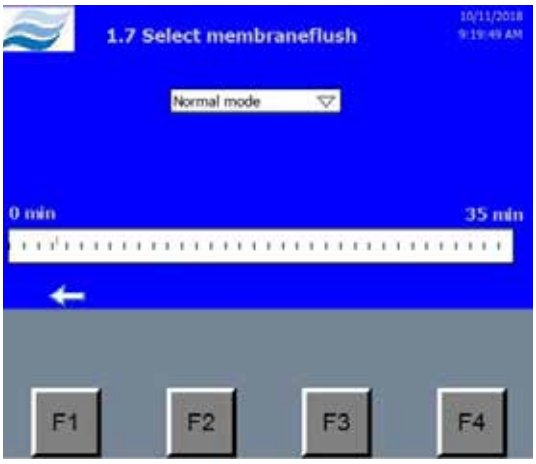
New membranes is conserved with a 10% propylene glycol solution and a new MLRO is conserved from the factory with a mild Ethanol solution. Therefor a thorough rinsing is required before the water from the RO system can be used.

Make sure the inlet water is connected, opened and the RO outlet are led to draining. Loosen the bleeding screw on top of the inlet filter and let all air out of the filter (make sure a filter element is installed)



From the home page 2.0 press F2. This will take you to the basic setup screen (pin 8599)

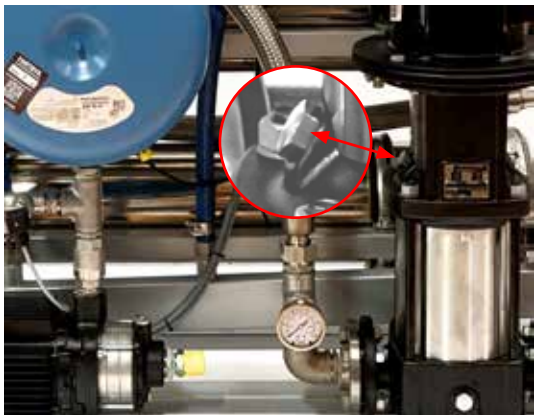
Choose 1.7 Membrane Flush



Choose flush mode from the dropdown menu and turn S1 ON.

The system should now start a flush sequence, that takes about 35 minutes.

NB! Remember to set the back in normal mode after the flush is finished.



While the flush sequence, is in progress, vent the RO pump (NB! the RO pump is not running under the flush sequence).

Open the small center bleeding screw on the RO pump to fill the pump with water and vent any air. Close the valve again. After a few seconds, the air should be out of the system. If not, repeat the procedure.

(If the RO does not build up pressure or is noisy, when the ML RO is running in normal mode after the flush, vent again while the pump is running).

After the flush, press F1 / Home and go to home screen

Now it's time to adjust the RO system go to
6.2 Adjusting the reverse osmosis

6.2 Adjusting the reverse osmosis

Important! the system needs to be adjusted and continuously monitored, failing to do so will cause membrane failure and a quality drop of the permeate.

Explanation of technical terminology

Permeate:

Processed, desalinated water coming out of the membranes

Concentrate:

The water led to the outlet. This water contains a high concentration of salts and minerals.

Feed water:

The inlet water to the ML RO coming from the softener.

TDS:

The amount of dissolved salts, measured in mg/l.

Conductivity:

The designation of the water's salt concentration measured in (µS/cm). The lower the value, the higher the water quality.

Membrane:

The membrane filter element, that desalinates the feed water.

RO:

The abbreviation for reverse osmosis.

RO pump:

The pump that circulates water over the membranes at a pressure of 8-14 bar

Booster pump:

Pumps the permeate from the tank to the consumer.

Softening:

A pre-filter which softens the water, i.e. it removes hardness from the water

Flux or Water Flux:

- Flux or water flux is typically expressed as volume per area per unit of time. Flux is used to express the rate at which water permeates a reverse osmosis membrane. Typical units of measurement are gallons per square foot per day (i.e. GFD or GSFD) or liters per square meter per hour (l/m2/hr).

  The flux of an RO membrane is directly proportional to temperature and pressure. As a rule of thumb, flux decreases by about 3% per 1°C,

6.2.1 Water quality

The feed water, which is to be treated in the MLRO system, must be of drinking water quality. Please read the requirements for inlet water.
If there are doubts about the raw water composition, a water analysis must be made. The MLRO must be connected to a water pressure of minimum 2.5 bar and maximum 6 bar.

MLRO 2000 & 3000	1 °dH	Permeate/concentrate ratio: Approx. 75/25

Water quality (contact Condair for technical advice)		
Content	Symptom	Preventive action
TOC, BOC and COD	Can cause slimy as well as firm hard film.	Can in some cases be micro-filtrated or removed by means of a carbon filter.
Iron, Manganese (ocher)	Precipitation of iron gives a reddish-brown film and precipitation of manganese gives a black deposit.	Sand filter – oxidation, softening, greensand.
Calcium, magnesium (hard water)	The membrane scales.	Softening, antiscalant
Silica	The membrane scales.	Antiscalant.
SDI (silt)	The membranes get clogged.	Microfiltration (absolute), ultrafiltration, flocculation.
Oil	The membrane is greasy from oil.	Carbon filter.
Particles	The membrane gets clogged due to hard deposits.	Microfiltration.
Chlorine, pesti- cides, organic solvents	Membrane deformed. Permeate capacity and quality changed and cannot be CIP-cleaned back to the original capacity. The deformation is not visible.	Free chlorine shall be removed by active carbon filter and chemical cleaning, either with thiosulphate or sulfite.
Bacteria	The membrane is clogged by slime.	Chlorination + de-chlorination, UV, micro- filtration 0.2 µS/cm and ultrafiltration.

6.2.2 Adjustment points

Important! Read the entire chapter before starting.

Tools needed: Conductivity meter, thermometer

FM1; flowmeter measures volume recirculated over the RO membranes in GPM and l/min

V2; Adjusting valve, regulates recirculation flow over the membranes and the pressure over the membranes.

If the pressure over the membranes is increased, the flux increases.

NB! Minimum recirculating: 60 l/min or 15 GPM. If the overall permeate output is higher than expected or inlet pressure low, it is advised to increase recirculation as much as possible.

FM2; flowmeter measures volume of *Concentrate drained in GPM and l/min*

V3(build in FM2); Adjusting valve, regulates how much concentrate is drained.

It regulates the concentration/conductivity on the front side of the membrane.

V3 is also used to fine tune the conductivity of the permeate, the more water is drained the lower conductivity of the produced permeate.

WM; water meter, shows the total volume of permeate produced and the current flow l/min.

The volume of the produced permeate is directly proportional to temperature and pressure on the front side of the membrane.

Select the main measurement unit: Quarts (Qts), Pints (Pts), Litres (Lit), Gallons (Gal);

To choose between the 4 available combinations: • wait for AFM30 to go to Standby, • press the CAL and RESET keys together. Keep these pressed until the word "UNIT" appears on the screen together with the unit of measurement set at that time (in this example Litres / Litres) • Press the reset key to select the desired combination of unit of measurement, amongst those shown below. • Save the new combination by pressing the cal key at length. AFM30 will pass through the start cycle and will then be ready to dispense in the set units.

6.2.3 Commissioning and adjusting

1. Open V2 and V3 fully
2. Start the MLRO By turning S1 to 1/on
3. Let the RO run 5 minutes (vent RO pump and inlet filter if needed)
4. Open V6, and adjust the flow to drain, so the RO tank does not run full.
5. Take a water sample from the inlet (V1) and measure temperature.
6. Adjust V2 until FM1 shows a recirculation of 90 lmin / 25 GPM

7. Read the permeate flow at the WM, and use it to calculate the drainage
   The standard recovery setting for the MLRO is 75%

$$\text{Drain concentrate} = \frac{100 * \text{Permeate flow}}{\text{Recovery \%}} - \text{Permeate flow}$$

e.g.

$$\text{Drain concentrate} = \frac{100 * 58\ l / min}{75\ \%} - 58\ l / min$$

8. Adjust V3 until FM2 shows calculated drainage flow.

9. Use the inlet temperature measured earlier and find the rated permeate flow in table fig. 1.3 and 1.4 bellow

Rated Permeate flow for MLRO 3000 at a given inlet temperature.

°C	°F	lmin	GPM	l/h	gal/h
15	59	65	17,2	3900	1030
14	57	63	16,7	3783	999
13	55	61	16,2	3670	969
12	54	59	15,7	3559	940
10	50	58	15,2	3453	912
9	48	56	14,7	3349	885
8	46	54	14,3	3249	858
7	45	53	13,9	3151	832
6	43	51	13,5	3057	807
5	41	49	13,1	2965	783
4	39	48	12,7	2876	760
3	37	46	12,3	2790	737
2	36	45	11,9	2706	715
1	34	44	11,6	2625	693

Figure 1.3

Rated Permeate flow for MLRO 2000 at a given inlet temperature.

°C	°F	lmin	GPM	l/h	gal/h
15	59	43	11,4	2600	687
14	57	42	11,1	2522	666
13	55	41	10,8	2446	646
12	54	40	10,4	2373	627
10	50	38	10,1	2302	608
9	48	37	9,8	2233	590
8	46	36	9,5	2166	572
7	45	35	9,2	2101	555
6	43	34	9,0	2038	538
5	41	33	8,7	1977	522
4	39	32	8,4	1917	506
3	37	31	8,2	1860	491
2	36	30	7,9	1804	477
1	34	29	7,7	1750	462

Figure 1.4

10. Adjust V2 to match rated flow at the given inlet temperature (NB! Minimum recirculating: 80 l/min or 20 GPM)

11. Repeat step 7 and 8 for fine-tuning.

12. Measure the conductivity of the permeate. Is the quality is satisfactory for the application provided by the RO plant ?. The conductivity of the permeate can be raised/lowered by increasing/decreasing the membrane pressure and recovery (drainage).
    The higher the pressure the better the permeate quality (V2)
    NB! Stay within the limits for minimum recirculation
    The more water is lead to drain the better the permeate quality (V3)
    NB! Water is a precious resource, do not waste it unnecessarily

13. Note all flows and run the system for a couple of hours and then check flows again.
    In the first week of running the MLRO should be checked and fine-tuned ones a day to make sure it's stabile. Thereafter a weekly check should be sufficient.

6.3 Start-up sequence for daily operation

The following description outlines the start-up procedure after an interruption of operation (e.g. after servicing the MLRO pure water system). It is assumed that first-time commissioning has been carried out properly by Condair Customer Service and the MLRO pure water system has been configured accordingly.

DANGER!

Systems with damaged components or installations may present danger to human life or cause severe damage to material assets.

Therefore:

Systems with damaged components and/or systems with damaged or faulty installations must not be operated.

1. Examine the MLRO pure water system and the installations for possible damage.
2. Ensure the softener is operational.
   Note: Regarding the operation and configuration of the water softener control unit please refer to the separate operation manual of the water softener.
3. Open all shut-off valves in the water supply line and the pure water line.
4. Plug in the power supply cable on the MLRO pure water unit.
5. Switch on the unit both main and S1.
   The MLRO control unit carries out an automatic system test (initializing). If a fault is detected during the system test, a corresponding fault message is shown in the maintenance and malfunction indication field (see chapter 7.4) of the standard operating display.
   If the initialization is successful, the MLRO pure water system starts-up automatically and fills the pure water tank. As soon as the preset maximum pressure in the pure water tank is reached, the pump inside the Condair ML RO pure water unit is stopped.
6. Check the flows are the same as before the unit was stopped if any doubt follow instructions in chapter 6.2.

7 Operation

Persons operating the ML RO's controller must have read and understood this manual. Knowing and understanding the contents of the manual is a basic requirement for protecting the personnel against any kind of danger, to prevent faulty operation and to operate the unit safely and correctly.

All safety notes in the installation and operation manual for the ML RO must be observed and adhered to. All work described in this controller manual may only be carried out by properly trained personnel which is authorised by the customer.

If you have questions after reading this documentation, please contact your Condair representative who will be happy to assist you.

7.1 Cabinet overview

1. Display (D2)
2. ON/OFF (S1)
3. Reset/start (S2/P1)
4. Keyhole
5. Power switch (S3)

7.2 Equipment protection

Pressure switch (inlet water)
The ML RO has a pressure switch which monitors the inlet water pressure.

If the inlet water pressure drops, the controller will stop the pump, thus protecting it against dry running. If the water pressure drops, the screen will display ‘PM Water pressure too low’.

Thermal motor relay
Both electrical motors are protected against overheating by ta hermal motor relay.

Description of touch screen
The screen has four F keys. Each of the keys are used to navigate between the different screen images. When these are used, the individual key function is indicated in the description directly above the key.

The touch screen can be operated by gently tapping the relevant screen ‘buttons’ with your finger.
To change a numerical value tap the value on the touch screen, this will make the numerical keyboard pop-up and the new value can be entered. Hit enter to save.

Protection against unwanted changes

The control unit settings are password-protected against unwanted changes. The different user groups have different passwords and different rights.

User	(no password) can read operational information and alarms.
User 1	(password 1234) as above + changing of set points.
Technician	(password 197) as above + changing of operational parameters and choice of membrane rinse.
Master	Master (password 8599) as above + selectable options.
Condair tech	xxxx, as above + factory / service menu.

When a password is required in order to change parameters, a screen will appear where the password can be entered. Parameters can be changed using the numerical keyboard (keys 0-9).

Once the password has been entered, the system is unlocked at the relevant level for five minutes.

7.3 Alarm and warning messages

Alarm text	Cause
2.0 Water pressure too low Warning	Low inlet pressure detected, RO system in auto reset mode
2.1 Water pressure too low Alarm	The water pressure on the water inlet to the pump station is too low. The alarm triggers if the sensor detects water pressure lower than 0,5 bar at a period longer that the preset delay (10 sec).
3.0 UV lamp getting old less than 21 days left	Time to change UV Lamp
3.1 UV lamp too old	UV more than 365 days old
3.2 UV lamp error	Current to UV low, blow out bulb or faulty power supply
3.3 Tank full	RO tank possible overflow detected
3.4 Water under start level	Water too low for safe start of booster pump
3.5 Empty tank before reset	RO tank possible overflow detected, lower water level before reset is possible
4.4 RO pump disabled	RO pump disabled from service screen
4.7 Thermal overload relay tripped	Fault on RO pump/motor, voltage to low/high
5.3 Water quality - EC too low	EC sensor in RO tank outside preset limit
5.4 Water quality - EC too high	EC sensor in RO tank outside preset limit

7.4 Controller menu

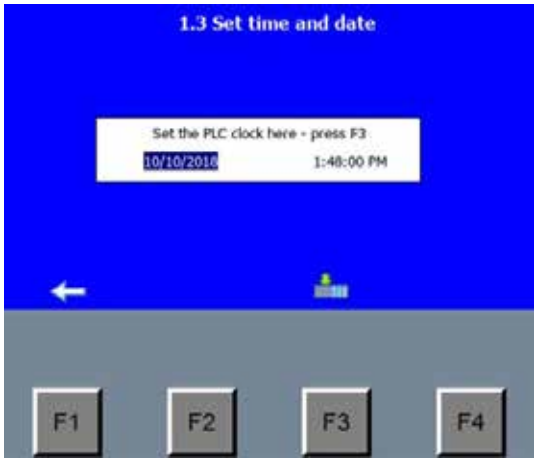
1.0 Basic setup

The Basic setup page provides access to pages and selectable functions:

1.1 Choice of language
1.2 Calibration of screen (follow the guide on screen)
1.3 Set time and date
1.6 General selections (settings)
1.7 Membrane flush
1.8 Version and change passwords (factory settings)
1.9 ML-System (factory settings)
1.11 Shows add-on boxes attached to the pump
1.12 Modbus list shows the data block in real time
1.14 Warning output
3.17 Level setup (size of RO tank and level sensor scale)

Once you have made your selection(s), press Home (F1) to continue.

NB! Some of the buttons is only visible when the option has been selected.

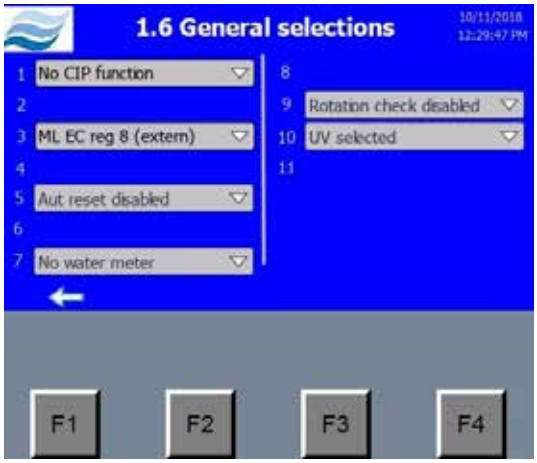


1.3 Set time and date

Time/date can be set (stored in the screen only).

It's important to put it in like this MM/DD/YYYY

NB! Remember to press F3 to set the PLC clock



1.6 General selections

General selection between options and setups for the pump station. Please note that some of the options require hardware that has to be ordered together with the pump. Master pin will be required; 8599

Standard setting is the top choice in the drop-down menus.

1. No CIP function / CIP function extern / CIP intern (spoon)

3. No EC monitoring / EC REG1 /.2/.6/.7/.8 (extern) / EC REG1 /.2/.6 (intern)

5. Aut reset disabled / Aut reset PR enabled (inlet water low pressure/ Auto reset MaxHyg enabled / Auto reset PR & MaxHyg enabled

7. Watermeter selected or not

9. Rotation check enabled (1.1.1) / Rotation check disabled

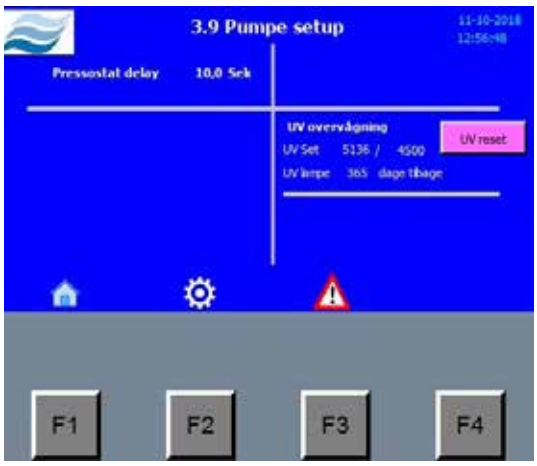
10. UV Selected or not

2.0 Home screen

Visually displays: running pumps, tank level and pressure after Res. pump (outlet pressure)

If an alarm or warning is triggered, text with the message in question will appear in the bottom of the screen.

From this page, you can access the menu page, the alarm page, settings as well as other displays.



3.9 Pump setup

Pressostat del

Alarm delay for inlet pressure (PS1) < 1 bar.

Default: 10 sec.

UV monitoring

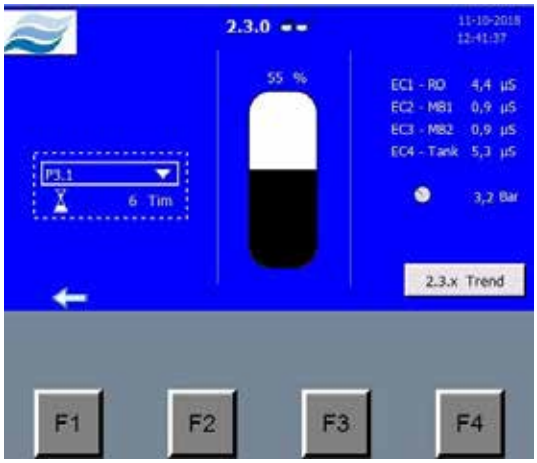
UV set

The pre-set number in the right value must be 50 % lower than the read out number in the left value.

Press UV reset to start a new 365 period (after a UV bulbs change)

3.9.2 RoPa Press setup

Setup outlet pressure from the RO booster pump



2.3.0 Dashboard RO

RO dashboard and access to trend curves

7.5 Weekly inspection

The MLRO system has to be inspected weekly, when in operation.
Check the following:

- Drain, recirculation and permeate flows, should be as noted during commissioning (adjust if not!)
- The entire system for leakage
- Operating display for warning or error messages
- Pressure drop over the inlet filter(s)
- Pre-water treatment:
  Softner; salt level, flush cycle (use hardnes test)
  Carbon filter; test for chlorine down stream
- Note produced permeate volume

If the inspection reveals any irregularities (e.g. leakage, error indication) or any damaged components take the ML RO out of operation. Have a qualified specialist or Condair service technician correct the damage or malfunction.

Fill in the ‘Service form for weekly monitoring of humidifying systems’ provided in the Appendix of this manual. Failing to do so could affect your warranty.

7.6 Disposal

You must observe local laws and regulations when disposing of your ML RO at the end of its working life. The pumps and piping are constructed from stainless steel which may be fully recycled.

8 Maintenance

8.1 Important notes on maintenance

Qualification of personnel

All maintenance work must only be carried out by qualified and trained personnel authorized by the owner. Maintenance and repair of the electrical installation of the ML RO must only be carried out by qualified personnel (e.g. electrician) who are aware of possible dangers and implications. It is the owner's responsibility to verify proper qualifications of the personnel.

General note

The instructions and details for maintenance work must be followed.

Only maintenance work described in this documentation may be carried out. Use only original ML-System spare parts to uphold the system warranty.

Safety

Before maintenance is initiated, the ML RO must be taken out of operation in accordance with instructions in the section 'Taking the ML RO out of operation'. Protect the system against unintentional switch-on.

The ML RO must be serviced at the intervals described in this manual and cleaning and disinfection must be performed by trained and instructed personal.

WARNING

A poorly maintained RO system may endanger health if used to supply an adiabatic humidification system. Therefore it is mandatory to observe the specified maintenance intervals and to carry out maintenance and cleaning in strict accordance with the instructions.

8.2 Maintenance work

To ensure safe, hygienic and economic operation of the ML RO, vital components must be checked and maintained periodically according to the table below. The maintenance intervals and maintenance work stated below are guideline values. Local conditions, quality of the water, etc. could influence the maintenance intervals. After having carried out the maintenance work, fill in the maintenance checklist, sign it and reset any maintenance indications. The relevant personnel is responsible for any maintenance work not carried out.

8.3 Desinfection

Depending on the system hygiene, it is advised that preventative disinfection fluid is added to the ML RO water tank at an appropriate frequency, but at least once a year.
Condair A/S recommends adding the disinfection fluid SANOSIL S010 AG 5% (our code: 155404000) to the tank, desired concentration 0.1%. SANOSIL is safe, non-toxic and eco-friendly which provides a prophylactic, disinfection dose and is effective against all types of microorganisms, including Legionella and E.coli.

Please read the Maintenance section for more information on disinfection.

If you are in any doubt about the suitability of water quality, please contact your Condair distributor who will be happy to support you.

8.4 Maintenance work

To ensure safe, hygienic and economic operation of the ML RO, vital components must be checked and maintained periodically according to the table below. The maintenance intervals and maintenance work stated below are guideline values. Local conditions, quality of the water, etc. could influence the maintenance intervals. After having carried out the maintenance work, fill in the maintenance checklist, sign it and reset any maintenance indications. The relevant personnel is responsible for any maintenance work not carried out.

To be performed	1/2 annually	1/1 annually	2/2 annually	4/4 annually
Review of the system:				
Control of the system's general function	X	X	X	X
Reading of hour meter and water consumption	X	X	X	X
Registration in log book (if available)	X	X	X	X
Control of service schedule (if available)	X	X	X	X
Control of marking (HACCP)		X	X	X
Control of any ADD-ON's and special functions	X	X	X	X
Water softening system				
Analysis of the water's hardness level <1 dH° (Durognost)	X	X	X	X
Function control	X	X	X	X
Cleaning of salt tank			X	X
Control/cleaning and possibly replacement of valves		X	X	X
Reverse Osmosis system (RO-system)				
Measurement of conductivity	X	X	X	X
Replacement of pre filter	X	X	X	X
Control of function and settings of RO-systems	X	X	X	X
Control for leaks	X	X	X	X
Disinfection/cleaning of tank	X	X	X	X
Control of output (produced water, water in drainage)	X	X	X	X
Control of valves	X	X	X	X
Replacement of sterile breather filter		X	X	X
Control and possibly replacement of membrane	X	X	X	X
UV-system (optional)				
Control of UV-systems	X	X	X	X
Control/cleaning of quarts glass on UV-systems	X	X	X	
Replacement of UV-lamp		X	X	X
Control units				
Review and control of programming	X	X	X	X
Replacement of transfer relay replacement		X	X	X
Control and possibly replacement of Contacts K1 (date mark)		X	X	X
In case of CIP (optional)				
Service on CIP	X	X	X	X
In case of CO_2 (optional)				
Function control on CO_2	X	X	X	X
In case of Carbon filter (optional)				
Service on Coal filter		X	X	X
Function control on Coal filter	X	X	X	X
In case of Silt filter (optional)				
Service on Silt filter	X	X	X	X
Disinfection of the system				
	X	X	X	X

8.5 Wear and spare parts

Wear and spare parts				Service intervals			
Designation	Part number	MLRO 2000	MLRO 3000	6 months	12 months	24 months	48 months
Water filter		pcs	pcs				
Filter 25 micron 20"	FB20-20-25	1	1	Change	Change	Change	Change
Air Filter							
Sterile breather filter 10" 0,2 my	104580000	1	1	Check	Change	Change	Change
UV Filter							
UV lamp (bulb) VH410	2584976	1	1	Check	Change	Change	Change
Sleeve Quartz	2587891	1	1	Check	Check	Check	Change
UV Ballast	2586094	1	1	Check	Check	Check	Check
RO membrane							
8" for MLRO	2592350	2	3	Check	Check	Check	Check
Electrical control system							
Inlet pressure pressure switch 0,5 bar	2577652	1	1	Check	Check	Check	Check
Pressure transmitter outlet 4-20 mA	210010026	1	1	Check	Check	Check	Check
24V power supply	2586153	1	1	Check	Check	Check	Check
Contaktor (K1) Siemens 24V	349010218	1	1	Check	Check	Check	Change
On/off valve							
On/off valve	2579147	1	1	Check	Check	Check	Overhaul
Sanosil S010 Ag (1 liter bottle)	155402000			Use for Service	Use for Service	Use for Service	Use for Service

8.6 Weekly check list

Service form for weekly monitoring of MLRO											
Date	Initial	Reading of water meter m^3	Reading of hour meter hours	Reading/messuring of conductivity µS/cm inlet	Reading/messuring of conductivity µS/cm permate	Reading/messuring of conductivity µS/cm brine	Manometer 1	Manometer 2	Difference ΔP (Manometer 1-2)	Testing salt level during softening	Function of softner Hardness test

9 Technical specifications

Specifications	MLRO 2000	MLRO 3000
Capacity, (Inlet water temp 15°C / 59°F)	2600 l/h / 690 gal/h	3900 l/h / 1030 gal/h
Capacity, (Inlet water temp 5°C / 41°F)	2000 l/h / 530 gal/h	3000 l/h / 795 gal/h
Permeate quality (µS/cm)	5 < EC < 30	5 < EC < 30
Permeate/Concentrate ratio	approx. 75 / 25 %	approx. 75 / 25 %
Reservoir tank, liters / gal	1000 / 265	1000 / 265
Size, frame (LxWxH) mm	1400 x 700 x 1600	1400 x 700 x 1600
Size, reservoir tank (LxWxH) mm	790 x 790 x 1860	790 x 790 x 1860
Weight, pumpstation kg	350	400
Weigth, tank (full) kg	1100	1100
Sound pressure level, dB(A)	< 75	< 75
Supply voltage	3x400 VAC+GDN+N, 50Hz, 3,1KW, 16A	3x400 VAC+GDN+N, 50Hz, 3,1KW, 16A
	3x480 VAC+GDN+N, 60Hz, 8KW, 32A	3x480 VAC+GDN+N, 60Hz, 8KW, 32A
Dissolved salt removal	> 95%	> 95%
Water connection, tap water	1" RG	1" RG
Water connection, RO-water	1" RG	1" RG
Water connection, drainage	1" RG	1" RG
Outlet pressure, Permeate	3 bar	3 bar

Preconditions	MLRO 2000	MLRO 3000
Water supply	Drinkingwater quality, 2.5-7 bar @ 4000 l/h / 1060 gal/h	Drinkingwater quality, 2.5-7 bar @ 5000 l/h / 1320 gal/h
Hardness	max. 1 °dH	max. 1 °dH
Conductivity (µS/cm)	150-750	150-750
Free chlorine	0.05 mg/l	0.05 mg/l
TDS	max. 625 mg/l	max. 625 mg/l
Silt index	max. 3	max. 3
KMnO4	max. 10 mg/l	max. 10 mg/l
Fe	max. 0.2 mg/l	max. 10 mg/l
Mn	max. 0.05 mg/l	max. 0.05 mg/l
NTU	max. 1.0	max. 1.0
Temperature Recommended	15°C	15°C
Temperature Max.	max. 25°C	max. 25°C

Notes:

Warranty

Condair Inc. or Condair Ltd. (depending on the entity that supplied the product, and hereinafter collectively referred to as CONDAIR) warrant for a period of two years after installation or 30 months from the manufacturer's ship date, whichever date is earlier, that CONDAIR's manufactured and assembled products, not otherwise expressly warranted, are free from defects in materials and workmanship. Notwithstanding the foregoing, the products listed below have an alternate warranty period:

- GS/GSTC Series heat exchanger(s) are warranted to be free from defects in materials and workmanship for a period of 3 years from installation or 40 months from the manufacturer's ship date, whichever is earlier.
- SAM-e Short Absorption Manifolds, except for the coupling seals, are warranted to be free from defects in materials and workmanship for a total period of 10 years from the manufacturer's ship date.
- Humilife RH humidifiers are warranted to be free from defects in materials and workmanship for a period of 5 years from the manufacturer's ship date. CONDAIR may, at its discretion, replace individual components or Humilife RH units as a whole.
- Spare Parts used for repairs are warranted for the balance of the term of the warranty on the original humidifier or 90 days, whichever is longer.
- No warranty is made against corrosion, deterioration, or suitability of substituted materials used as a result of compliance with government regulations.

CONDAIR's obligations and liabilities under this warranty are limited to furnishing replacement parts to the customer, F.O.B. CONDAIR's factory. The replacement parts are warranted for the balance of the term of the warranty on the original humidifier or 90 days, whichever is longer. Procedure:

1. Customer Requests Warranty as per instructions on the Condair Warranty Form.
2. CONDAIR reviews the warranty claim and will respond in one of two ways:
    a. Warranty Accepted – Replacement Part or credit granted.
    b. Warranty Declined – Response with justification will be provided to the customer.
3. In some cases, CONDAIR may request the part to be returned, freight prepaid by the customer, as part of the warranty acceptance or warranty determination process. Some reasons include:
    a. Part must be analyzed to determine the root cause of failure.
    b. Part must be returned to the supplier for claim/investigation.

When parts are requested to be returned, replacement parts will be sent by CONDAIR to the customer against an invoice from CONDAIR paid by the customer. The cost of the replacement parts will be reimbursed to the customer with a credit note after the parts are received and analyzed by CONDAIR, if the warranty is accepted.

The warranties set forth herein are in lieu of all other warranties expressed or implied by law. No liability whatsoever shall be attached to CONDAIR until said products have been paid for in full and then said liability shall be limited to the original purchase price for the product. Any further warranty, with the exception of a purchased extended warranty described below, must be in writing, and signed by an officer of CONDAIR.

CONDAIR makes no warranty and assumes no liability unless the equipment is installed in strict accordance with the installation manual in effect at the date of purchase, and by properly qualified and licensed professionals capable of installing such equipment.

CONDAIR makes no warranty and assumes no liability whatsoever for consequential damage or damage resulting directly from misapplication, incorrect sizing, or lack of proper maintenance of the equipment.

CONDAIR makes no warranty and assumes no liability whatsoever for damage to the products, humidifier, supply lines, drain lines, steam distribution systems, or the building as a whole caused by freezing.

CONDAIR reserves the right to change the design, specifications, and performance criteria of its products without notice or obligation.

Extended Warranty

Extended warranties are available to purchase under the conditions listed above. Extended warranties must be purchased at the time of the original equipment order.

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