

**IMPORTANT!** Read and save these instructions. This manual to be left with the equipment.



# INSTALLATION AND OPERATION MANUAL

Adiabatic Humidification System  
Condair MLPRO  
Valid from SN 2016-xxx  
US version

# Thank you for choosing Condair

Installation date (DD/MM/YYYY):

Commissioning date (DD/MM/YYYY):

Site:

Model:

Serial number:

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# 1 Introduction

## 1.1 Before You Start!

Thank you for purchasing the Condair ML direct room high pressure adiabatic humidification system.

The Condair ML adiabatic humidifier incorporates the latest technical advances and meets all recognized safety standards. Never-the-less, improper use of the Condair ML adiabatic humidifier may result in danger to the user or third parties, and/or damage to property.

To ensure safe, proper and economical operation of the Condair ML adiabatic humidifier, observe and comply with all information and safety instructions contained in this manual, as well as all relevant documentation of components of the installed humidification system.

If you have additional questions, contact your local Condair representative. They will be glad to assist you.

## 1.2 General

### Limitations

The subject of this manual is the Condair ML direct room humidification pump stations and associated equipment whether ancillary or supplementary. The various options and accessories may only be described in-so-far as is necessary for proper installation and operation of the equipment. Additional information on available options and accessories can be obtained in the instructions that are supplied with them.

This manual is restricted to the installation, operation, technical data and parts of the Condair ML direct room humidification pump stations, and is intended for well trained personnel who are suitably qualified for their respective tasks.

### Symbols Used in This Manual



#### CAUTION!

The word "CAUTION" in conjunction with the general caution symbol is used to provide safety instructions that, if neglected, may cause damage and/or malfunction of the unit or damage to property.



#### WARNING!

The word "WARNING" in conjunction with the general warning symbol is used to provide safety instructions that, if neglected, may cause injury to personnel. Other specific warning symbols may also be used in place of the general symbol.



#### DANGER!

The word "DANGER" in conjunction with the general danger symbol is used to provide safety instructions that, if neglected, may cause severe injury to personnel or even death. Other specific danger symbols may also be used in place of the general symbol.

**Other Related Publications**

This manual is supplemented by other publications such as the ML Heads Installation Guide, which are included in the delivery of the equipment. Where necessary, appropriate cross-references to these publications have been added in this manual.

**Storage of Manual**

Keep this manual in a place where it is safe and readily accessible. If the equipment is moved to another location, make sure that the manual is passed on to the new user.

If the manual is lost or misplaced, contact your Condair representative for a replacement copy.

**Language Versions**

This manual is also available in other languages – contact your Condair representative.

## 2 For Your Safety

### 2.1 Safety



**DANGER!**

Always isolate all supplies to the system before commencing any maintenance or repair.

#### General

Every person who is tasked with the installation, operation or maintenance of the Condair ML adiabatic humidifier must read and understand this manual before performing any work. Knowing and understanding the contents of the installation manual and the operation and maintenance manual is a basic requirement for protecting personnel against any kind of danger, preventing faulty operation, and operating the unit safely and correctly.

All labels, signs and marking applied to the Condair ML adiabatic humidifier must be observed and kept in a readable state.

#### Personnel Qualifications

All procedures described in this manual must only be performed by personnel who are adequately qualified, well trained and are authorized by the customer.

For safety and warranty reasons, any activity beyond the scope of this manual must only be performed by qualified personnel authorized by Condair.

All personnel working with the Condair ML adiabatic humidifier must be familiar with, and comply with the appropriate regulations on workplace safety and prevention of accidents.

#### Intended Use

The Condair ML humidification heads is intended exclusively for adiabatic humidification and/or evaporative cooling using a Condair MLP or MLP-RO high pressure pump station within specified operating conditions (refer to the Condair MLPRO IOM for details). Any other type of application, without the express written consent of Condair, is considered to be not conforming to its intended purpose, and may lead to dangerous operation and will void the warranty.

In order to operate the equipment in the intended manner all information contained in this manual, in particular the safety instructions, must be observed closely.

#### Safe Operation

If it is suspected that safe operation has been compromised, the ML-System should immediately be shut down and secured against accidental power-up.

Shut down the Condair ML Humidification System if:

- Components are damaged, worn or very soiled
- Fans have stopped or are noisy
- Joints, pipes or hoses are leaking
- Unusual or very loud noise

No modifications must be made on the ML-System without the manufacturer's consent. All persons working with the system must report to the owner if any alterations are detected.

Use only original accessories and spare parts available from your Condair representative.

## 2.2 Health & Hygiene



**DANGER!**  
**Risk of infection or serious illness**

The Condair ML System 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.



**DANGER!**  
**Risk of water contamination**

To prevent water stagnation and microbial contamination, the systems 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.

### Health Risks

Please observe the local health and safety codes, standards and technical guidance on the control of Legionella in water systems.

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

Condair ML systems, products and components are 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.

### Water monitoring

The quality of water being used in the Condair ML Humidification System should be checked prior to system commissioning and comply with the guidelines in the high pressure pump manual.

The Condair ML Humidification System must be monitored for hygiene as part of the maintenance program. Please refer to the maintenance section for further guidance.



### **Guidelines for a Hygienic System**

- Carry out a risk assessment of the water system using a competent person, and implement an appropriate monitoring and control program.
- Initiate procedures for changing filters, disinfection etc.
- 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 77 °F (25°C) and 113 °F (45°C), which 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.

### **Disinfection**

Depending on the system hygiene, it is advised that preventative disinfection fluid be added to the MLP RO water tank at an appropriate frequency, but at least once a year.

Condair Ltd. recommends using the disinfection fluid HaloSpray or Sanosil S010 AG 5% (part number: 155404000) to the System via the high pressure pump, desired concentration 0.1%. HaloSpray or 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 pump manual 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.

# 3 Receiving and Storage

## 3.1 Inspection

All Condair products are shipped F.O.B at the factory. All damage, breakage or loss claims are the responsibility of the shipping company. Upon receipt, remove the transit packaging and inspect the components to ensure that no damage has occurred during transit. Inspect the goods as follows:

- Inspect the shipping boxes for damage. Report any shipping box damages to the shipping company without delay.
- Check the goods against the packing slip to ensure that all items have been delivered. Report any shortages to your Condair representative within 48 hours of receipt of the goods. Condair does not assume responsibilities for any shortages beyond this period.
- Unpack the parts/components and check for any damage. If parts/components are damaged, notify the shipping company immediately.
- Verify the model type on the specification label to ensure that it is suitable for your installation.

## 3.2 Storage and Transportation

### Storage

Store the Condair ML adiabatic humidifier in its original packaging inside a protected area that meets the following requirements until it is installed. These requirements also apply if the unit needs to be stored for an extended period of time. If put into storage prior to use, the components must be covered and protected from physical damage, dust, frost and rain. Avoid below freezing temperatures as this can degrade certain wet parts and components, such as RO membranes.

**For storage Condair recommends:**

- Room temperature: 41 to 104°F (5 to 40°C)
- Room humidity: 10 to 75% RH

### Transportation

For optimum protection always transport the unit and components in their original packaging, and use appropriate lifting/transporting devices.

Lifting or handling must only be carried out by trained and qualified personnel. Ensure that the lifting operation has been properly planned and risk-assessed, and that all equipment has been checked by a skilled and competent health and safety representative.

The customer is responsible for ensuring that operators are trained in handling heavy goods, and to enforce the relevant lifting regulations. Refer to the weights and measures section for system weight.

### Packaging

It is recommended that the components be kept in its transit packaging for as long as possible prior to installation.

Keep the original packaging of the unit/components for later use. If the packaging needs to be disposed of, observe local regulations on waste disposal. Recycle packaging where possible.

### Disposal

You must observe local laws and regulations when disposing of your Condair ML system at the end of its working life.

## 4 Site Planning

### 4.1 Prior to Starting

The basic principles for planning described below are theoretical ones. In practice, the necessary humidification capacity is influenced by parameters that cannot be covered by this documentation. For this reason, the values that were determined in theory have to be complemented by practical values or corrected in many cases. Condair's technical service team will be pleased to assist you.

#### **Notes on the planning of direct room air humidification systems in one or more zones.**

Proceed as follows when selecting and/or dimensioning the air humidification system:

- Determine the volume of the room and the air changes
- Determine the set points (temperature and humidity/relative humidity)
- Determine the humidification areas
- Calculate the maximum humidification capacity
- Define the device requirements
- Determine the placement of zone valves and hygrometers

### 4.2 General Notes on Positioning

The positioning of a system is always determined during planning and noted in the system documents. Prior to mounting the ML Direct Room Humidification heads, ensure that all hose layouts, distances between heads and atomization clearances have been considered and adhered to, as per the ML Heads Installation Guide.

The recommended hose layouts, distances between humidification heads and atomization clearances, are shown in the ML Heads Installation Guide. Consult local and national installation regulations. Condair does not accept responsibility for violations of the installation codes.

The following general positioning notes, however, have to be read and complied with in any case:

- Make sure that the construction (rafter, beam, wall, pillar, ceiling construction, etc.) on which the devices and/or system components will be mounted disposes of a sufficient load-carrying capacity and is suitable for fixing
- Position the Condair ML Direct Room Heads in such a way to enable the atomized mist to spread freely. When the mist is prevented from spreading by obstacles (e.g. ceilings, beams, ventilation ducts, airflow, machinery, etc.), turbulences can build up and condensation may occur as a result.
- ML Heads Installation Guide shows the recommended clearances, of the expansion of the atomization stream, and the clearances that have to be maintained. These are ideal and recommended maximum capacities using ML nozzles. Different weather, climate and indoor conditions can alter the spread and distance of the mist.
- As shown in ML Heads Installation Guide, when the nozzles and humidification heads are placed one opposite the other, make sure that a minimum distances are adhered to. This will avoid the streams to condensate each other.
- Pay close attention to the airflow of the room. Do not install humidification heads or nozzles in the immediate vicinity of a supply, return or exhaust system or of a cold-air inlet.

- Do not point humidification heads or their nozzles at cold parts of a building, e.g. outside walls, windows, etc. (risk of condensation).
- Insulate cold-water pipes in the area of the atomizing stream (risk of condensation).
- The evaporation process absorbs heat from the ambient air. For this reason, make sure that the atomized stream is not directed on persons or on places directly above workplaces.
- In order to guarantee optimum humidification, ensure that the atomizers are sensibly distributed in the room.
- The system components have to be mounted in such a way to provide enough space for operation and maintenance.

Please contact Condair's Technical Service Team in case you have questions on positioning and clearances.

### 4.3 Experts on Site

Condair has expert technicians employed by Condair who can provide:

- Pre-site analysis
- Positioning and site assistance or recommendations
- Installation support
- Start-up and commissioning
- Bacteriological troubleshooting on site \*
- Cleaning and disinfecting
- Preventive maintenance
- Repair and fault finding
- Training and guidance

\*Condair uses an industry leading method for measuring bacterial activity in the water; the approved and patented BactiQuant test. This, unique to Condair, field test takes water samples from critical project locations. Thereafter, the bacteriological quality of the water can be read within 30 minutes, and the system can be disinfected if necessary.

Condair follows the guidelines in VDI 6022 for colony forming units (CFU) counts in humidifiers. The CFU count in the humidification water must not exceed 150 CFU/ml, corresponding to a maximum BQ value of 52. Please contact your local Condair representative for further information about our services.

# 5 Product Overview

## 5.1 General Description

The MLP RO series is a combined high-pressure pump station and reverse osmosis system (from now on called RO). The combined system is developed by Condair Ltd. with focus on reliable and hygienic humidification solutions. The system is fitted with an integrated reverse osmosis system and tank for removal (>95%) of salts and minerals in tap water.

The MLP RO comes in four basic models, MLP RO 100, 300, 500 and 800. The number indicates the maximum continuous water outlet (high-pressure) in liters per hour at 59 °F (15°C) (tap water temperature).

There are two or three pumps on the frame: The RO pump which pumps the raw water through the RO membrane at a pressure of 115 - 175 psi (8 - 12 bar) and into the RO water tank, the high-pressure pump that feeds from the bottom of the RO tank and discharges at 1015 psi (70 bar), and (optional or MLP RO 800 always) a RO water transfer pump.

MLP RO's are fitted on 'easy-to-place' frames and all components are assembled, tested and ready for use.

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

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

The high-pressure pump is protected against dry running by the level sensor in the RO tank that stops the system if water level drops. The high-pressure pump is protected against overheating by a temperature sensor that measures the temperature inside the pump.

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

The MLP RO 100 and 300 comes with a 13.2 gallon (50 l) holding tank for the produced RO water, mounted directly on the pump frame where the RO holding tanks of MLP RO 500 and 800 are placed on separate frames (52 gallons (200 l) (200 l) and 132 gallons (500 l) (500 l) respectively). On the MLP RO 100, 300 and 500 models, the high-pressure pump feeds directly from the holding tanks using gravity. Whereas the MLP RO 800 has a booster pump for pumping RO water from the RO holding tank to the high-pressure pump.

The control unit consists of a touch display and a PLC mounted in the IP 65-rated electrical cabinet as well as a power board for control of the high-pressure pump and connection terminals for power supply (208...480V/3N~/50-60Hz).

From the touch screen, the operator can easily change humidity set point in each section, adjust alarm limits and view hour counters, logged alarms, trend curves, etc.

The pump station is electrically wired at the factory. At the installation site, main power supply, humidity signal, external safety chain, step valves and additional options must be electrically connected to the control unit.

## 5.2 Model Designation

The specification label on the side of the Condair ML adiabatic humidifier shows its model number, year made, serial number, power supply and ratings. The breakdown of the model number is shown in [Figure 1](#).

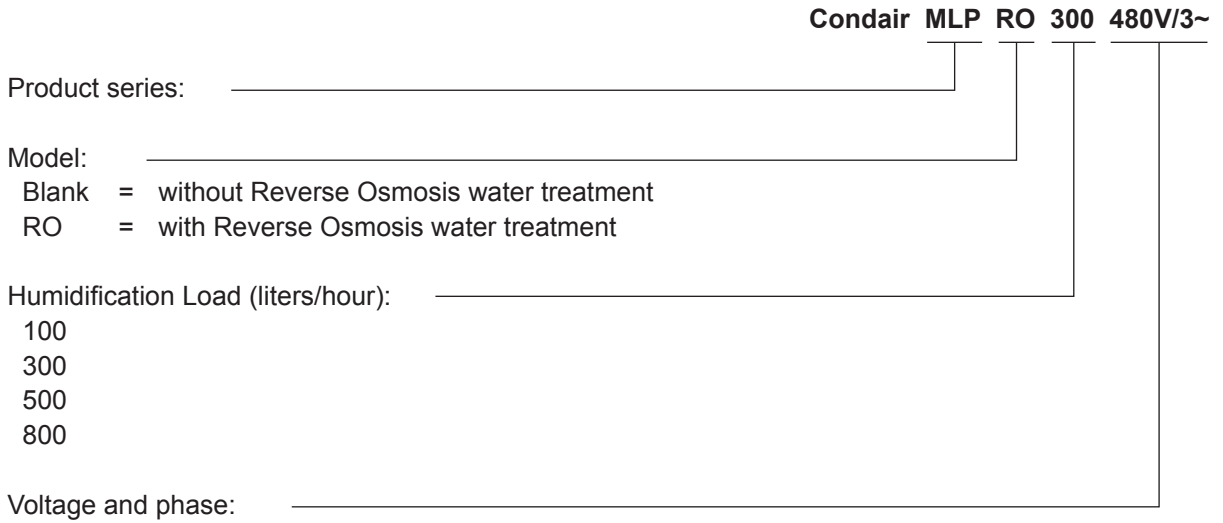


Figure 1: Model designation

### Electrical Schematics and Wiring Diagrams

A copy of the electrical schematics and wiring diagrams can be found on the inside panel of the control panel.

The specification label plate is placed in the upper left corner on the side of the control unit (when facing the front).

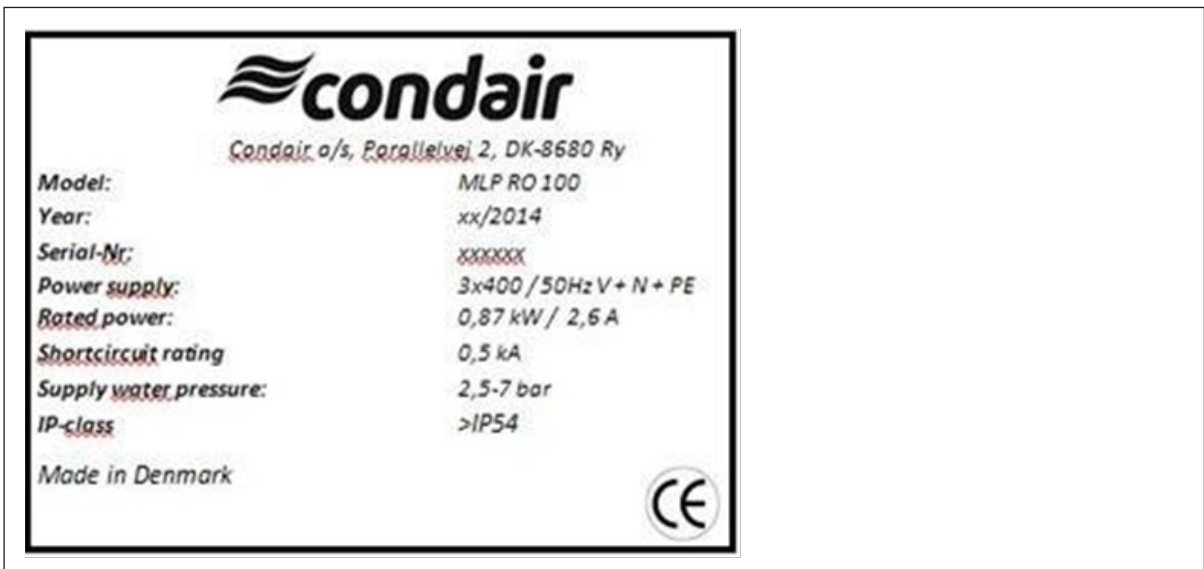


Figure 2: Specification Label

A label with the internal order number and electrical schematic diagram number is placed on the inside of the left-hand cabinet hatch (when facing the front) on the control unit..

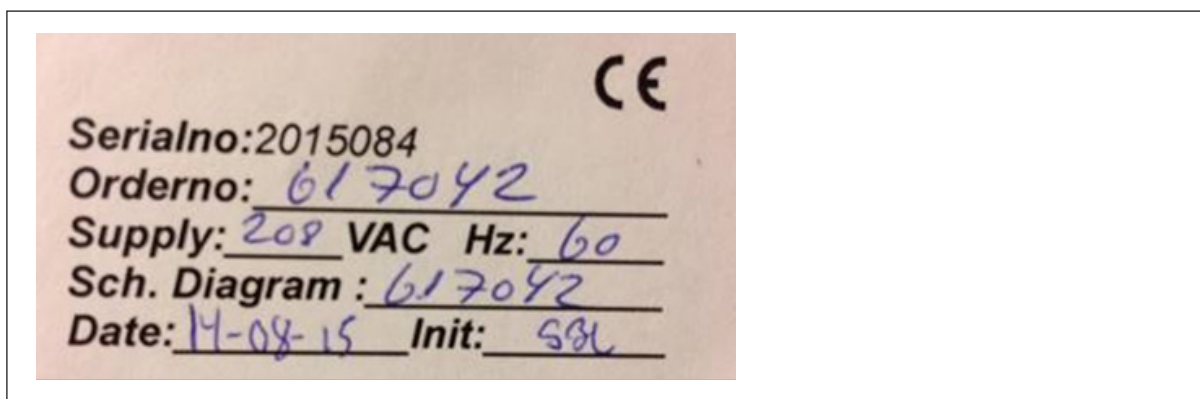


Figure 3: Label with Serial Number and Electrical Schematic Number

### 5.3 Model overview

#### 5.3.1 MLP RO 100/300 - Piping diagram

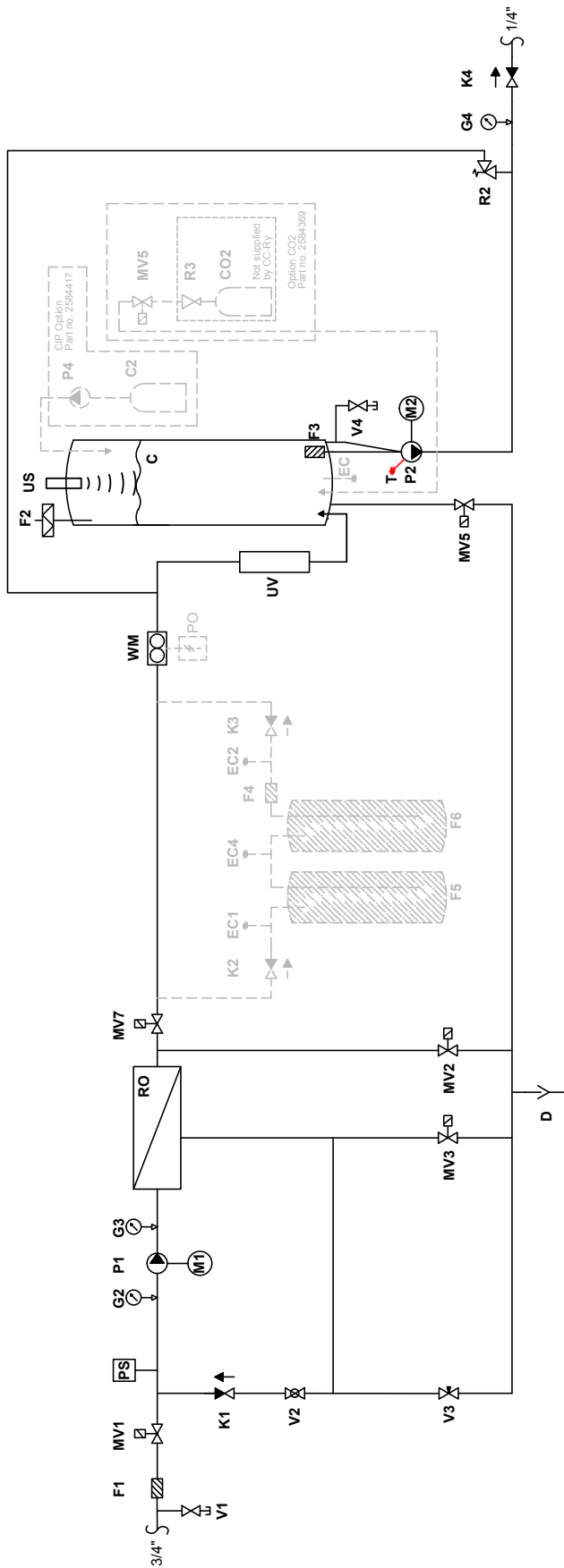


Figure 4: MLP RO 100/300 - Piping diagram



### 5.3.2 MLP RO 100/300 - Overview

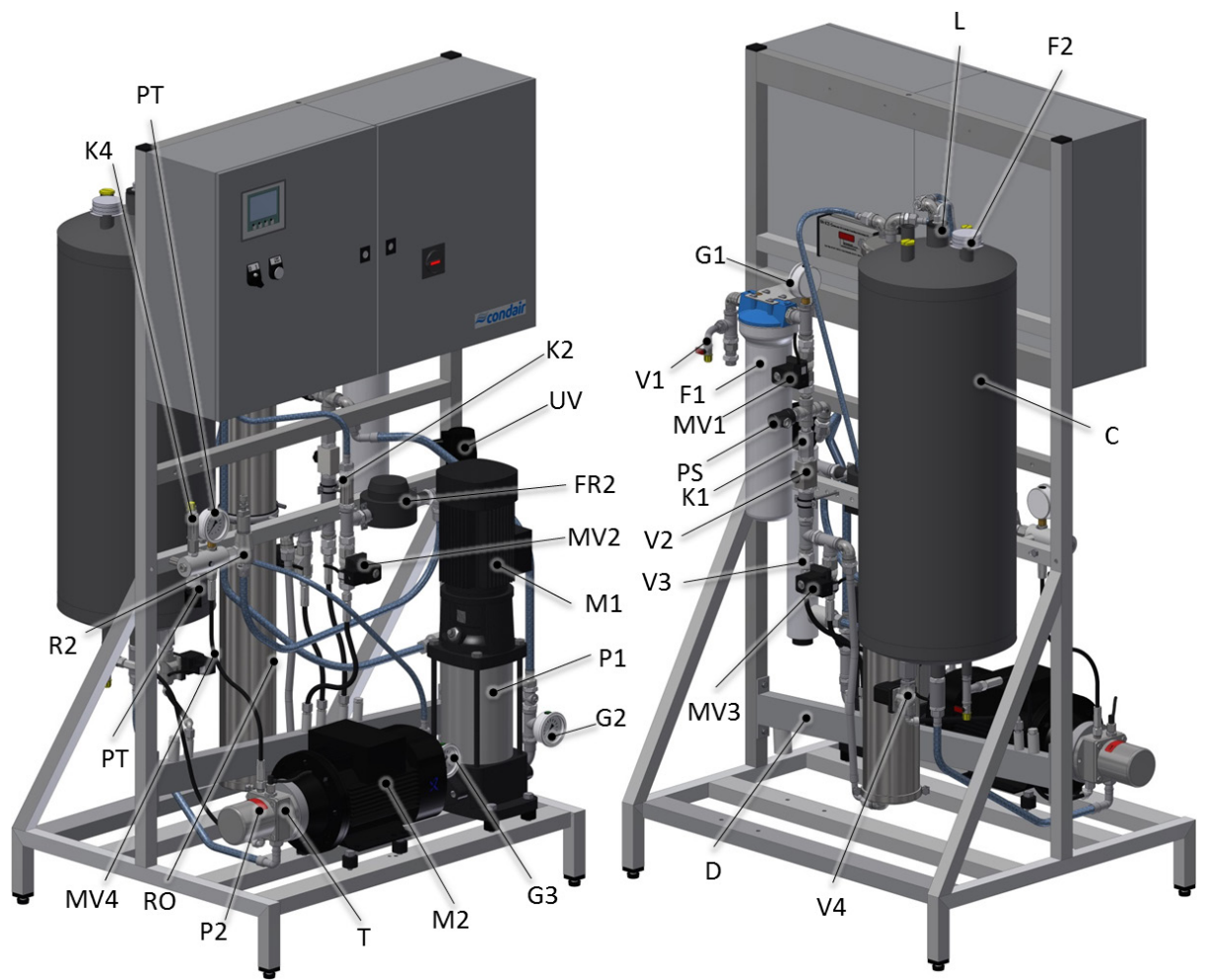


Figure 5: MLP RO 100/300 - Overview

### 5.3.3 MLP RO 100-300 - Part specification

C		Permeate container, 13.2 gallons (50 l), black plastic
D		Discharge system
F1		Filter 20", 5 µm
F2		Sterile breathing filter 0,2 µm
F3		Suction filter
G2		Pressure gauge, input pressure RO pump 0-145 psi (0-10 bar)
G3		Pressure gauge, RO pump pressure 0-145 psi (0-10 bar)
G4		Pressure gauge, high pressure
K1		Check valve 232 psi (16 bar), reverse pressure max 1.5 psi (0.1 bar)
K4		Check valve
M1		Motor, RO pump MLPRO 100: 3x400VAC, 50Hz, 0,37kW, 1,1A MLPRO 300: 3x400VAC, 50Hz, 0,75kW, 1,9A
M2		Motor, high pressure pump MLPRO 100: 3x400VAC, 50Hz, 0,5kW, 1,5A MLPRO 300: 3x400VAC, 50Hz, 0,75kW, 1,9A
MV1		ON/OFF valve, 0-145 psi (0-10 bar), 1/2"
MV2		Valve for flushing at start-up, 0-145 psi (0-10 bar), 1/2"
MV3		Valve for membrane flushing 0-145 psi (0-10 bar), 1/2"
MV5		Drain valve 0-145 psi (0-10 bar), 1/2"
MV7		ON/OFF valve, 0-145 psi (0-10 bar)
PS		Pressure switch 0-145 psi (0-10 bar), pre-adjusted to 7.2 psi
P1		RO pump
P2		PAH high pressure pump 1015 psi (70 bar)
RO		RO membrane in stainless steel housing
R2		Pressure regulator, 435-1522 psi (30-105 bar) standard
T		Thermostat
UV		UV system
US		Ultra sound level sensor
V1		Test water tap 1/8"
V2		Ball valve for pressure adjustment 1/2"
V3		Needle valve for concentrate flow
V4		Test water tap 1/8"
WM		Water meter
CO <sub>2</sub> option		
CO2	(Option)	CO <sub>2</sub> container
MV5	(Option)	Valve for CO <sub>2</sub>
R3	(Option)	CO <sub>2</sub> pressure regulator
Clean-in-Place (CIP) option		
C2	(Option)	CIP container, 32 fl. oz. (1 l) plastic bottle
P4	(Option)	CIP pump
EC REG 8 option		
EC1	(Option)	Conductivity sensor
EC2	(Option)	Conductivity sensor
EC4	(Option)	Conductivity sensor
F4	(Option)	Filter, 5" 5 µ
F5	(Option)	Mixedbed, ion exchange bottle (Acquired locally)
F6	(Option)	Mixedbed, ion exchange bottle (Acquired locally)
K2	(Option)	Check valve
K3	(Option)	Check valve
EC option		
EC	(Option)	Conductivity sensor
PO option		
PO	(Option)	Pulse output for water meter

### 5.3.4 MLP RO 500- Piping diagram

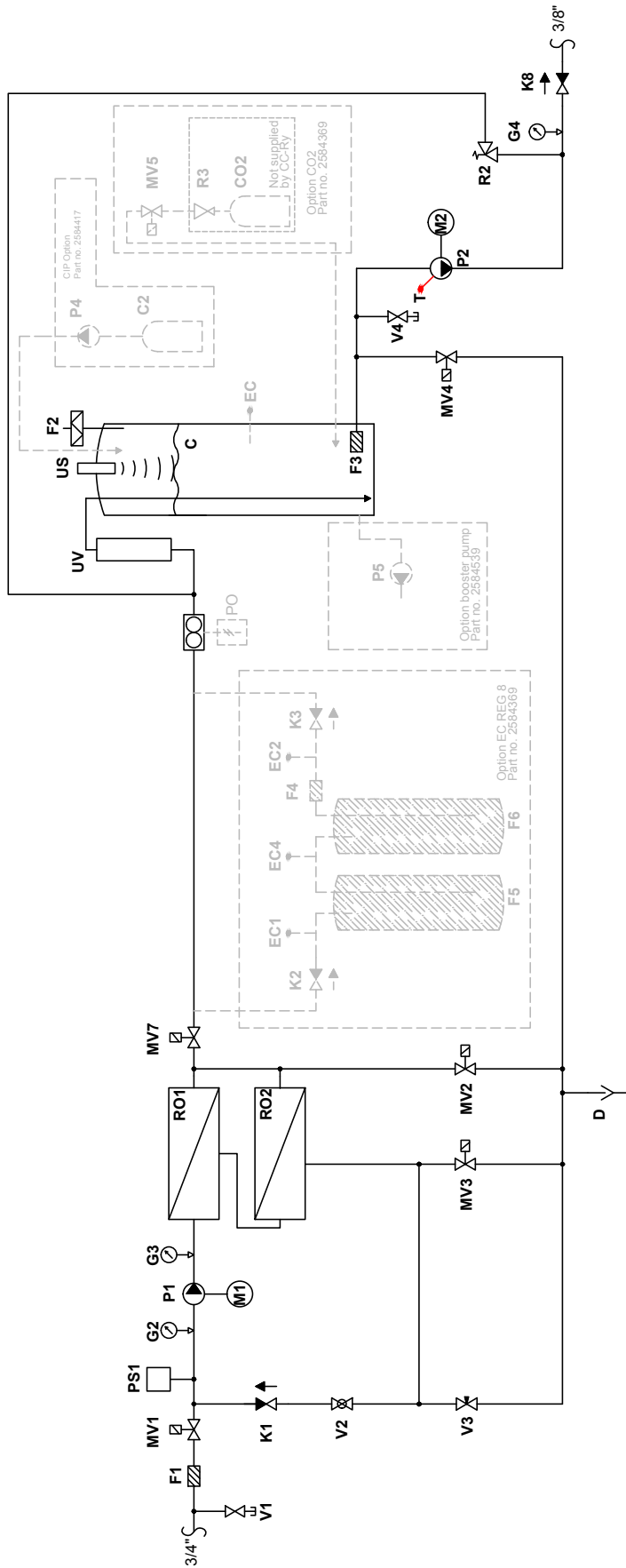


Figure 6: MLP RO 500- Piping diagram

### 5.3.5 MLP RO 500 overview

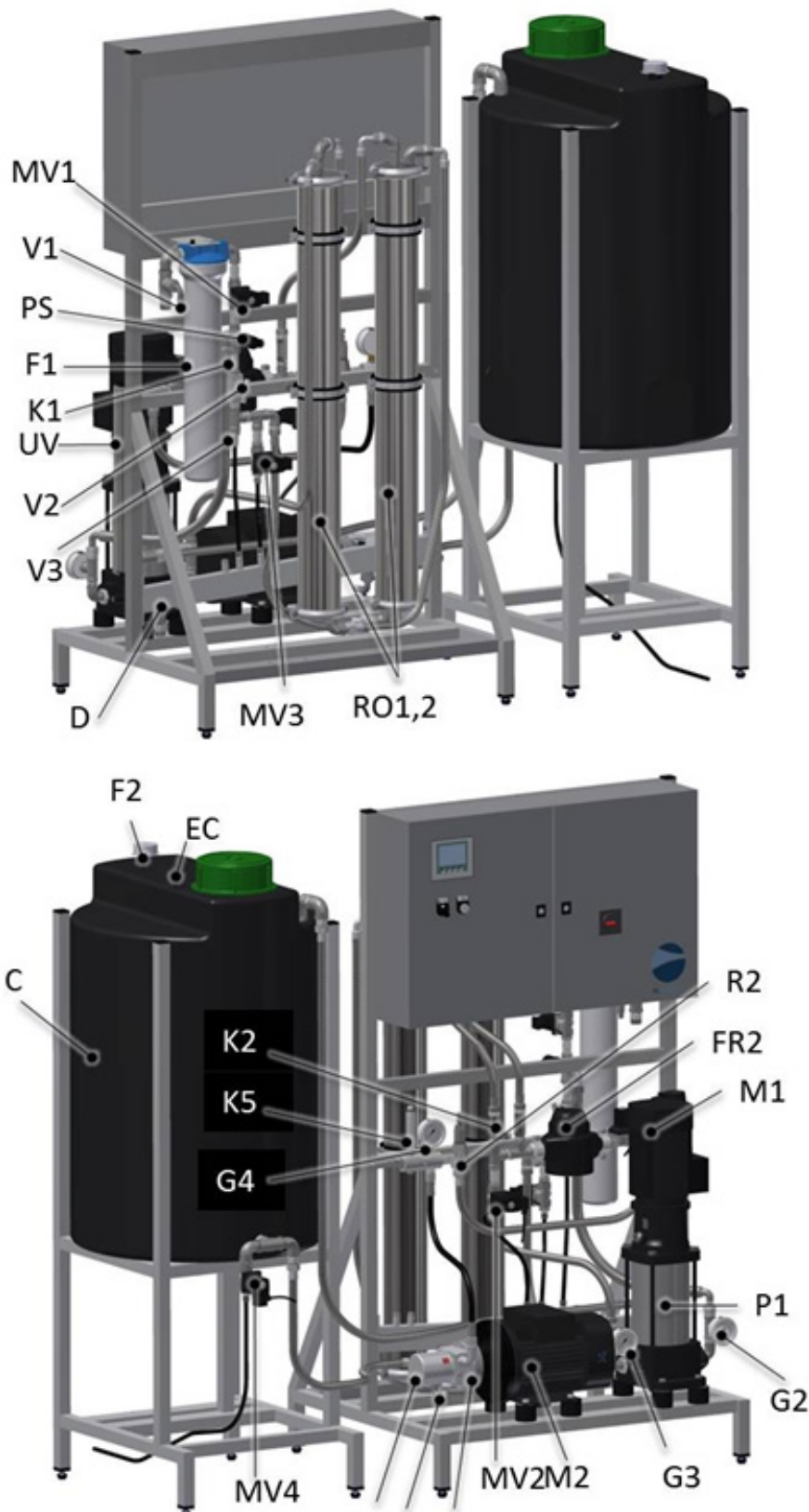


Figure 7: MLP RO 500 Overview

### 5.3.6 MLP RO 500 - Part specification

C		Permeate tank, 52 gallons (200 l) external on stand, black plastic
D		Discharge system, 3/4" RG
F1		Filter 20", 5 µm
F2		Sterile breathing filter 0,2 µm
F3		Suction filter
G2		Pressure gauge, inlet pressure RO pump 0-145 psi (0-10 bar)
G3		Pressure gauge, RO pump pressure 0-145 psi (0-10 bar)
G4		Pressure gauge, high pressure
K1		Check valve 232 psi (16 bar), back pressure max 1.5 psi (0.1 bar)
K8		Check valve, high pressure, 1015 psi (70 bar)
M1/P1		RO pump
M2		Motor, high pressure pump
MV1		ON/OFF valve, 0-145 psi (0-10 bar), 3/4"
MV2		Valve for flushing at start-up, 0-145 psi (0-10 bar), 3/4"
MV3		Valve for membrane flushing 0-145 psi (0-10 bar), 1/2"
MV4		ON/OFF valve 0-145 psi (0-10 bar), 1/2"
MV7		ON/OFF valve, 0-145 psi (0-10 bar), 1/2"
PS1		Pressure switch 0-145 psi (0-10 bar), pre-adjusted to 7.2 psi
P2		PAHT high pressure pump 1015 psi (70 bar)
RO1+2		RO membrane in stainless steel housing
R2		Pressure regulator, 435-1522 psi (30-105 bar) standard
T		PT1000 temperature sensor
US		Ultra sound level sensor
UV		UV system
V1		Test water tap 1/8"
V2		Ball valve for pressure adjustment 1/2"
V3		Needle valve for concentrate outlet
V4		Test water tap 1/8"
WM		Water meter
CO <sub>2</sub> option		
CO2	(Option)	CO <sub>2</sub> container
MV8	(Option)	Valve for CO <sub>2</sub>
R3	(Option)	CO <sub>2</sub> pressure regulator
Clean-in-Place (CIP) option		
C3	(Option)	CIP container, 32 fl. oz. (1 l) plastic bottle
P3	(Option)	CIP pump
EC REG 8 option		
EC1	(Option)	Conductivity sensor
EC2	(Option)	Conductivity sensor
EC4	(Option)	Conductivity sensor
F4	(Option)	Filter, 5", 5 µ
F5	(Option)	Mixed, ion exchange bottle (Acquired locally)
F6	(Option)	Mixed, ion exchange bottle (Acquired locally)
K2	(Option)	Check valve
K3	(Option)	Check valve
EC option		
EC	(Option)	Conductivity sensor
P5 option		
P5	(Option)	Booster pump
Misc. options		
MV6	(Option)	Valve for raw water mix, 0-145 psi (0-10 bar)
V5	(Option)	Needle valve
PO option		
PO	(Option)	Pulse output for water meter

### 5.3.7 MLP RO 800- Piping diagram

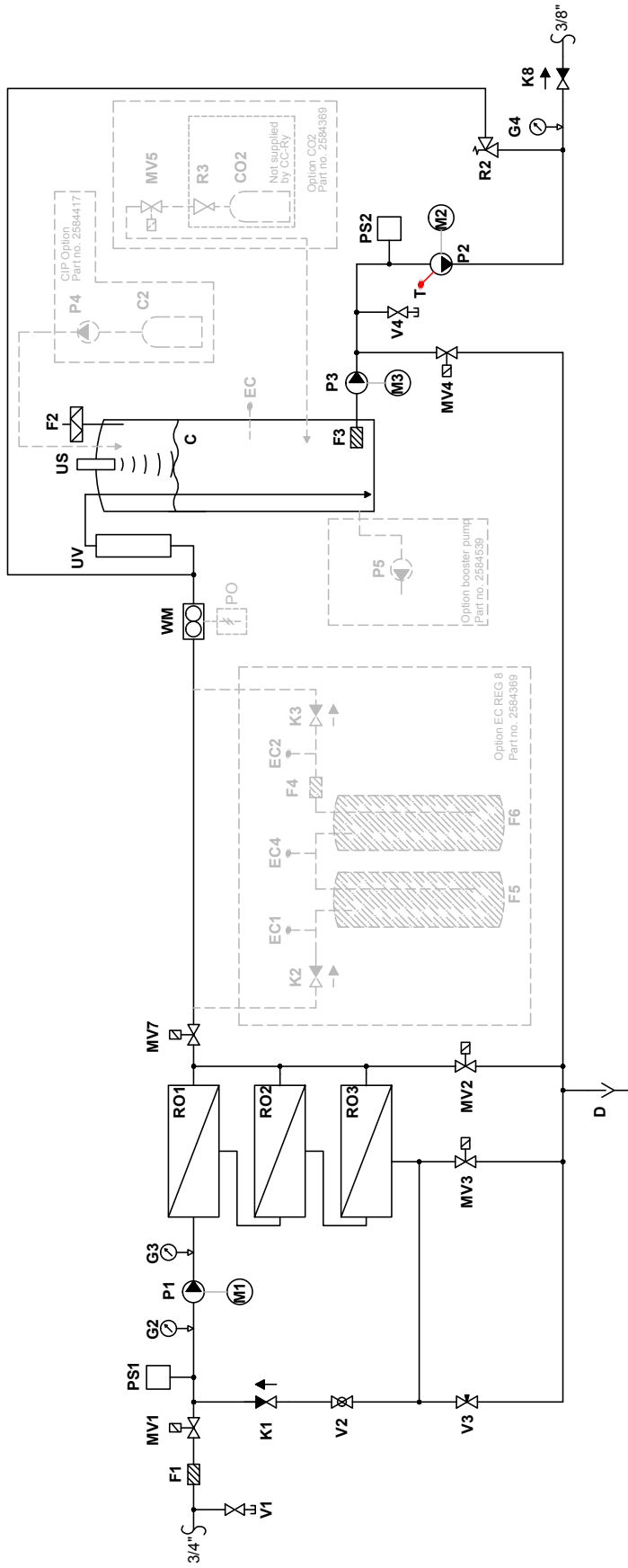


Figure 8: MLP RO 800- Piping diagram

### 5.3.8 MLP RO 800 - Overview

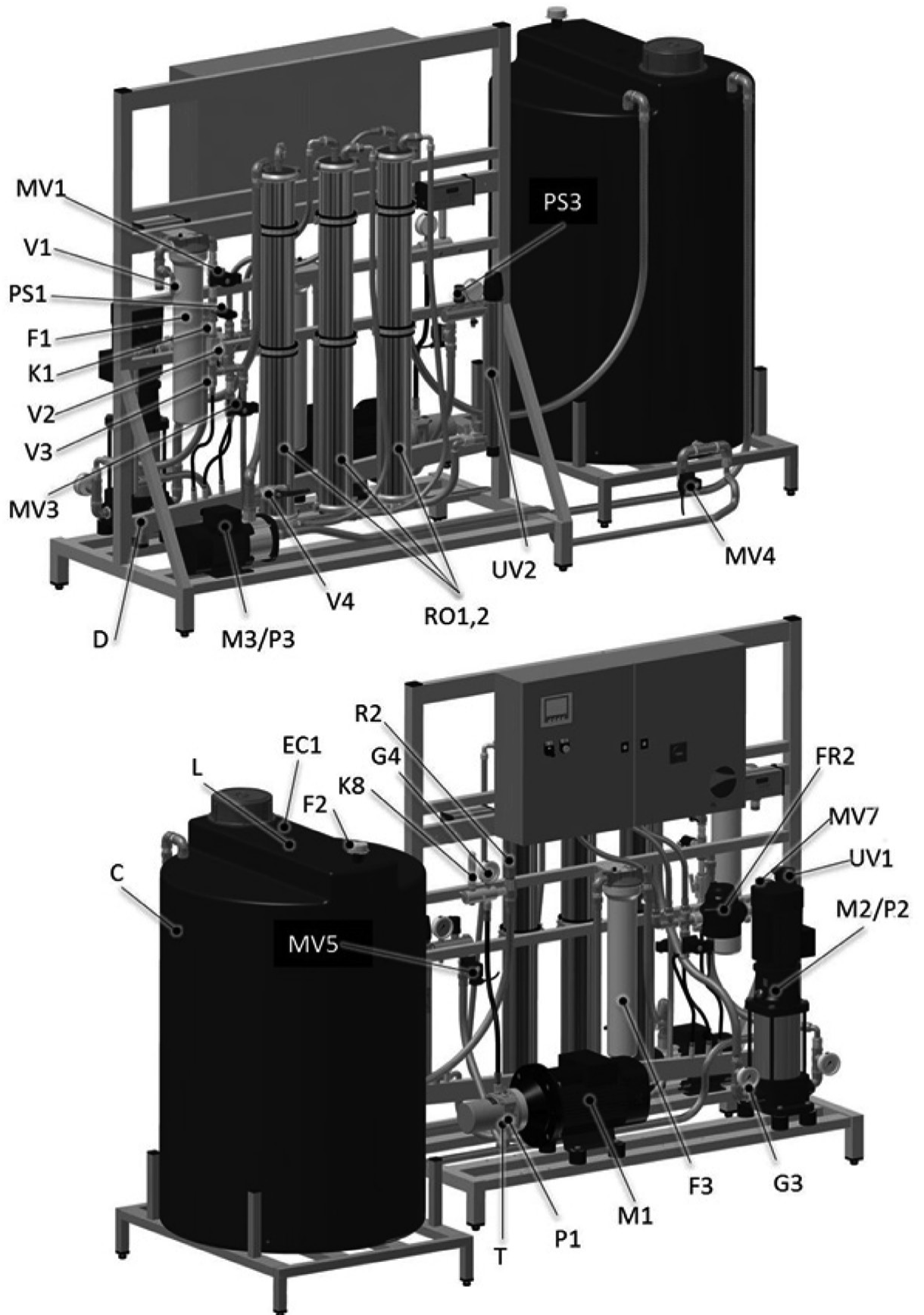


Figure 9: Hydraulic diagram MLP RO 800



### 5.3.9 MLP RO 800 - Part specification

C		Permeate tank, 132 gallons (500 l) external on stand, black plastic
D		Discharge system, 3/4" RG
F1		Filter 20", 5 µm
F2		Sterile breathing filter 0.2 µm
F3		Suction filter
G2		Pressure gauge, inlet pressure RO pump 0-145 psi (0-10 bar)
G3		Pressure gauge, RO pump pressure 0-145 psi (0-10 bar)
G4		Pressure gauge, high pressure
K1		Check valve 232 psi (16 bar), back pressure max 1.5 psi (0.1 bar)
K8		Check valve, high pressure, 1015 psi (70 bar)
M1/P1		RO pump
M2		Motor, high pressure pump
M3/P3		Transfer pump
MV1		ON/OFF valve, 0-145 psi (0-10 bar)
MV2		Valve for flushing at start-up, 0-145 psi (0-10 bar)
MV3		Valve for membrane flushing 0-145 psi (0-10 bar)
MV4		ON/OFF valve 0-145 psi (0-10 bar)
MV7		ON/OFF valve, 0-145 psi (0-10 bar)
PS1		Pressure switch 0-145 psi (0-10 bar), pre-adjusted to 7.2 psi
PS2		Pressure switch, CS
P2		PAHT high pressure pump 1015 psi (70 bar)
RO1-3		RO membrane in stainless steel housing
R2		Pressure regulator, 435-1522 psi (30-105 bar) standard
T		PT1000 temperature sensor
US		Ultra sound level sensor
UV		UV system
V1		Test water tap 1/8"
V2		Ball valve for pressure adjustment
V3		Needle valve for concentrate outlet
V4		Test water tap 1/8"
WM		Water meter
CO <sub>2</sub> option		
CO2	(Option)	CO <sub>2</sub> container
MV5	(Option)	Valve for CO <sub>2</sub>
R3	(Option)	CO <sub>2</sub> pressure regulator
Clean-in-Place (CIP) option		
C2	(Option)	CIP container, 32 fl. oz. (1 l) plastic bottle
P4	(Option)	CIP pump
EC REG 8 option		
EC1	(Option)	Conductivity sensor
EC2	(Option)	Conductivity sensor
EC4	(Option)	Conductivity sensor
F4	(Option)	Filter, 5", 5 µ
F5	(Option)	Mixed, ion exchange bottle (Acquired locally)
F6	(Option)	Mixed, ion exchange bottle (Acquired locally)
K2	(Option)	Check valve
K3	(Option)	Check valve
EC option		
EC	(Option)	Conductivity sensor
P5 option		
P5	(Option)	Booster pump
PO option		
PO	(Option)	Pulse output for water meter



## 5.4 Typical Installation Setup

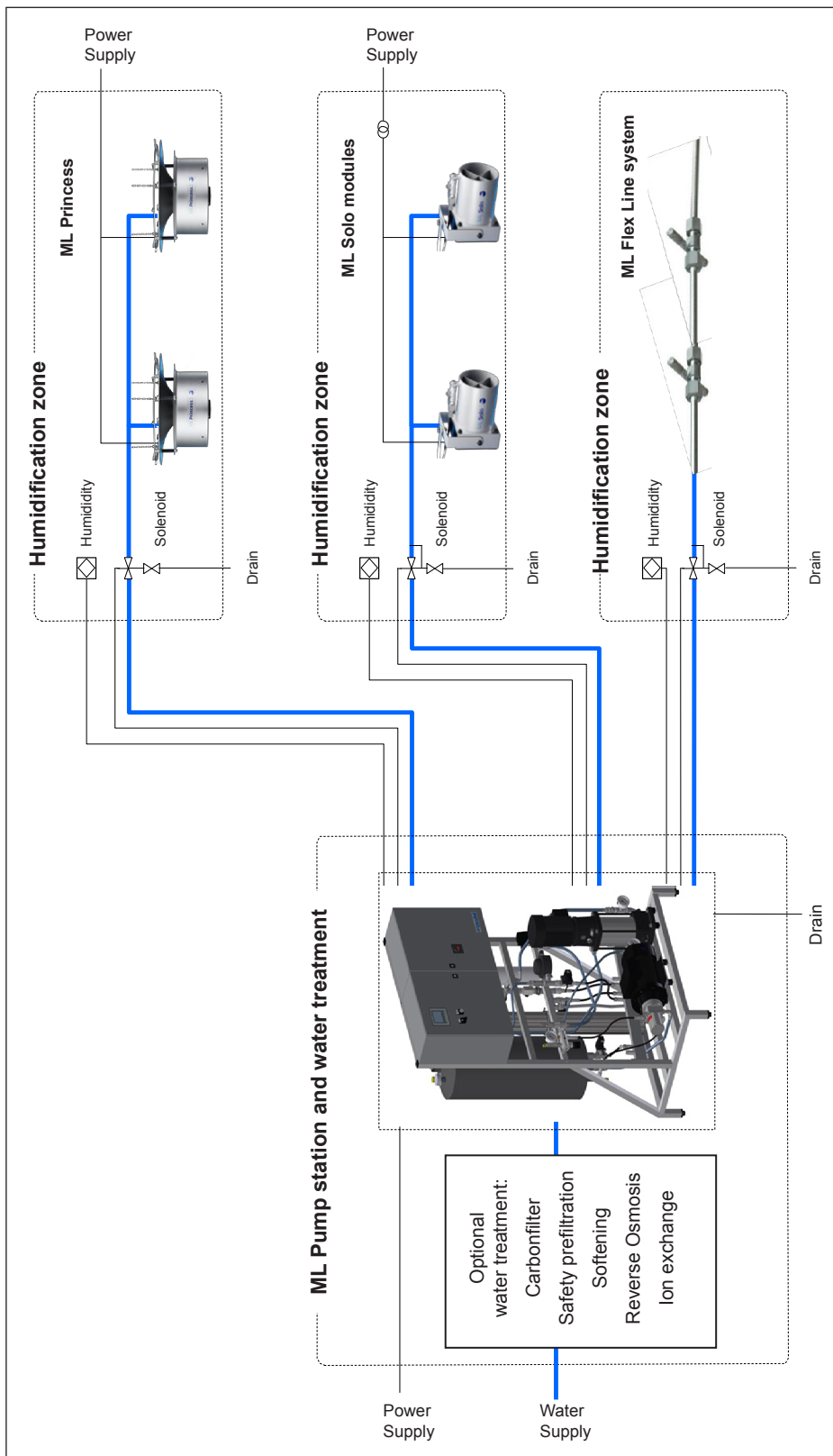


Figure 10: Typical Installation Setup

## 5.5 Entering Water Requirements

The quality of the water being used in the MLP RO system should be checked prior to system commissioning. Condair Ltd. recommends that the MLP RO system be connected to a clean, potable (drinking water quality) mains water supply. If the inlet water does not meet the quality specified in the preconditions table, it may be necessary to install additional water treatment.

Table 1: Inlet water quality requirements

Preconditions	
MLP RO <b>300</b>	2.6 gpm (600 l/h) @ 36-101 psi (2.5 - 7 bar) (dynamic)
MLP RO <b>500</b>	3.1 gpm (700 l/h) @ 36-101 psi (2.5 - 7 bar) (dynamic)
MLP RO <b>800</b>	4.8 gpm (1100 l/h) @ 36-101 psi (2.5 - 7 bar) (dynamic)
Connection inlet:	¾" RG
Water supply:	Drinking water quality
Hardness: MLP RO <b>100/300</b> :	max 20 gpg (342 mg/L (ppm))
Hardness: MLP RO <b>500/800</b> :	max 1 gpg (17 mg/L (ppm))
Conductivity:	120-1000 µS/cm
Free chlorine:	max 0.1 ppm
TDS:	max 625 ppm
Silt index:	max 3.0
KMnO4:	max 10 ppm
Fe:	max 0.2 ppm
Mn:	max 0.05 ppm
NTU:	max 1.0
Temperature:	max 104°F (40 °C) Recommended max 59°F (15°C) (hygienic precaution)

## 5.6 Options

Choosing the right water treatment is essential for successful humidification. In the ML-System program, there is a large variety of water treatment and optional equipment to choose from. The ML-System is designed to be customised to meet the specifications, be it essential water treatment or features. It is possible to combine Condair's ML pump stations, systems, water treatment and optional equipment in more than 100,000 different combinations and it is thus impossible to describe all of them here. In the following, the most commonly used ancillary and optional equipment for the MLP RO system is listed.

Optional and ancillary equipment can be divided into the three following main groups:

### **MLP RO options:**

Added features which are intergraded into the controller of the MLP RO or placed on its frame, e.g. conductivity and hardness alarm, BAS integration, ultra-pure water (mixed bed), Clean-in-Place (CIP) system, CO<sub>2</sub> adding, damping water outlet, holding tanks (RTN). Options cannot be retrofitted and must therefore be listed when ordering

### **Water treatment:**

Stand-alone systems for improving the water quality in order to meet the inlet water quality requirements for the MLP RO, e.g. booster pump, non-return valve, silt/pre-filter, carbon filter and softener. See separate Water treatment / RO manual for further information.

### **High-pressure building installation:**

Added features and optional equipment –e.g. fan speed controller, flow monitor, temperature read-out. Options for the high-pressure building installation will be described in the I/O manual for the high-pressure building installation. See separate High-pressure equipment manual for further information.

Options cannot be retrofitted and must therefore be listed in connection with order placement.

Table 2: Optional equipment for MLP RO

Option	Application
Fan control (Prepare of the control board)	Prepares the control board with terminals I/O for connecting a fan control box.
Fan control box (1-4 zones)	Start/stop fans in each zone between humidification cycles. Only possible if the control board has been prepared for the accessory.
ML EC REG 1 Conductivity sensor (in RO tank)	Measuring the conductivity ( $\mu\text{S}$ ) of the RO water in the RO tank, incl. Hi/Low alarms.
ML EC REG 1 Preparatory	Not incl. sensor, amplifier, sensor cable or fittings.
ML EC-REG 2 (inlet water mixer)	Mixes inlet water in the produced water from the RO membrane in order to raise the conductivity of the RO water
ML EC-REG 6 (CO <sub>2</sub> mixer) For new systems 13 - 52 gallons (50-200 l) RO-tanks / 132 - 264 gallons (500-1000 l) RO tanks	Mixes CO <sub>2</sub> in the produced water from the RO membrane in order to increase RO water conductivity. CO <sub>2</sub> tanks are not included.
Mixed bed, preparation for(mixed bed filters not included)	Prepares the pump station with pipe connections and the control board with terminals I/O for connecting a mixed bed filter system that produces ultra-pure water from the RO water.
RO water outlet MLP RO 100 – 500 / MLP RO 800	Delivers pressurised RO water @ 43.5 psi (3 bar), volume depending on RO size and operation factor.
Overheating protection of the high-pressure pump(flow/ temp-dependent)	Dumps excess water via a solenoid valve if the temperature or flow through the pump comes outside the permissible limit.
Clean-in-Place (CIP) new systems up to 79 gal/h (300 l/h) / up to 211 gal/h (800 l/h)	Integrated function in controller, that adds of 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.
Humidity logger	Logs the humidity in each zone every 15 minutes (1 year back). Data is stored in a .csv comma-separated values file, which can be accessed on a SD card or the PLC's webserver.
BAS/BMS integration Modbus TCP/IP	Displays the operating humidity and alarm status of the system via a TPC/IP protocol.
Backup high-pressure pump	The pump station is fitted with an extra high-pressure pump for redundancy, automatic changeover.
Status relay	Potential-free relays (ready, running, warning, error).
Hardness alarm	Shuts down pump station or triggers an alarm if the hardness of the incoming water exceeds the selected limit.
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.

## 5.7 Accessories

Accessories can be retrofitted.

Table 3: MLP RO accessories list

Accessory	Application
Pulse generator for water meter, retrofit kit	The water meter is equipped with a pulse emitter which can be linked to tele-reading systems, the PLC and to M-Bus networks.
ML control box for induct system	ML satellite unit for connecting and controlling an induct system from an MLP or an MLP RO pump station.
Satellite box (4 zones)	Ads 4 additional zones (humidity I/O and zone valve terminals) to an existing ML-System.
Satellite box (8 zones)	Ads 8 additional zones (humidity I/O and zone valve terminals) to an existing ML-System.
Humidity logger retrofit kit	Logs the humidity in each zone every 15th minute one year back. Data is stored in a .csv comma-separated values file which can be accessed on an SD card or the PLC's webserver.
RO water outlet, Retrofit kit	Delivers pressurised RO water @ 43.5 psi (3 bar) volume depending on RO size and operation factor.
Alarm lamp	Alarm flash which can be placed up to 328 ft. (100 m) from the pump, connects to an alarm output.
Modbus TCP/IP Gateway IP translator	Easy setup op Modbus TCP/IP communication to BAS as IP addresses can be chosen by the costumer onsite.
Remote alarm SMS	Sends a SMS via a prepay SIM-card if the system goes in alarm and when the alarm is cancelled.
Remote alarm email	Sends an email if an alarm is triggered in the system and when the alarm is cancelled. Up to 25 recipients.
BAS/BMS integration Modbus TCP/ IP, retrofit kit	Displays the operating humidity and alarm status of the system via a TPC/IP protocol.

# 6 Installation

## 6.1 General

Strictly observe and perform all installation tasks including the mounting of the unit and connection of the water and power supplies as described in this manual. Observe and comply with all local and national codes dealing with water and electrical installations.

Condair does not accept any liability for installation of humidification equipment by unqualified personnel, or the use of equipment/parts that are not authorized by Condair.

### Personnel Qualifications

All installation work must be performed only by persons familiar with the ML-System pump station and sufficiently qualified for such work. All work on electric installations must only be performed by adequately qualified electricians.

### Safety

The pump station and any control units may only be connected to the mains after all installation work has been completed. All statements relating to correct positioning and installation must be followed and complied with. When installing components of the MLP or MLP RO, use the materials and hoses supplied with the unit. In case of doubt, please contact your Condair supplier.

Observe the following safety precautions:



#### **WARNING!**

**Risk of injury and risk of damage to equipment**

Do not retighten/unscrew hoses while the system is pressurized!



#### **CAUTION!**

**Risk of breeding ground for bacteria**

**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 therefore may pose a health risks.**

**Prevention: 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. Only approved lubricant is dish soap**



#### **CAUTION!**

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



#### **CAUTION!**

**Risk of damage to internal components from electrostatic discharge (ESD)**

**The electronic components inside the humidifier are sensitive to electrostatic discharge (ESD).**

**Prevention: Take appropriate and special measures to protect the electronic components inside the unit against damage caused by ESD.**

**WARNING!****Heavy object - risk of injury!**

The pump station or pump skid are extremely heavy. Smaller models can weigh 275 lbs. (125 kg) while the bigger units can weigh in excess of 550 lbs. (250 kg).

**Prevention:** Always use appropriate lifting device(s), and proper assistance, safety equipment, harness prior to lifting or moving any Condair ML equipment.

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**Recommended Tools**

Condair recommends the following tools for unpacking, measuring, connecting and tightening all things regarding installation.

- Screwdriver set
- Spirit level
- Polygrip pliers
- Wire cutters
- Spanner set
- Tape measure
- Marker
- Box cutter

## 6.2 Site Requirements and Sizing

Please observe the following regarding positioning and installation:

- The pump station must be installed only in a location with a drain in the floor.
- The site must be freely accessible with sufficient space for convenient operation and maintenance.
- Minimum recommended clearance and free space around pump station: 20 inches (0.5 m) side to side, and 32 inches (0.8 m) front and back.
- The pump station is designed for operation in a frost-free and dry environment, never outdoors.
- Do not install the pump station in exposed locations or locations with heavy dust loads.
- The pump station is designed for installation on a load-bearing floor.

### MLP RO Sizing:

#### MLP RO 100/300

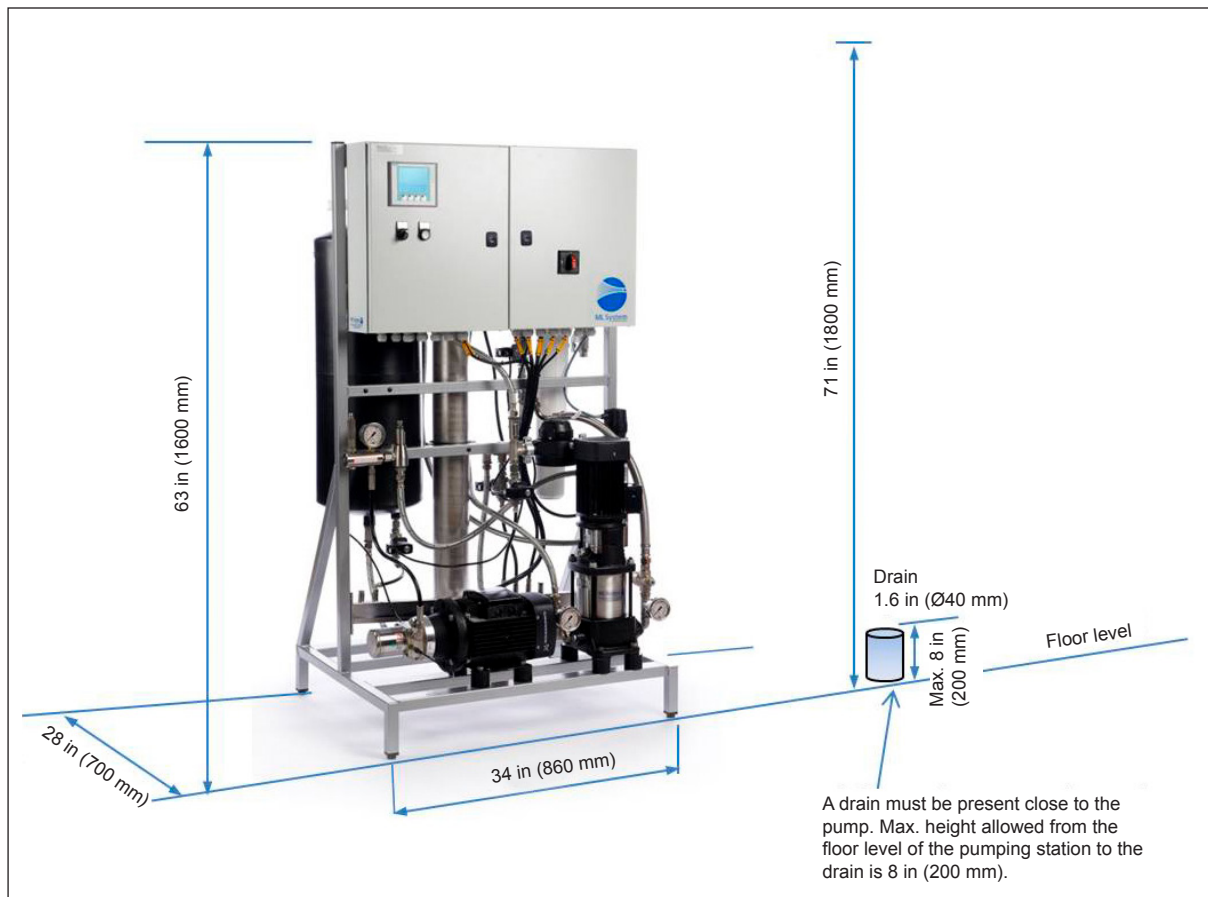


Figure 11: Positioning MLP RO 100/300



## MLP RO 500

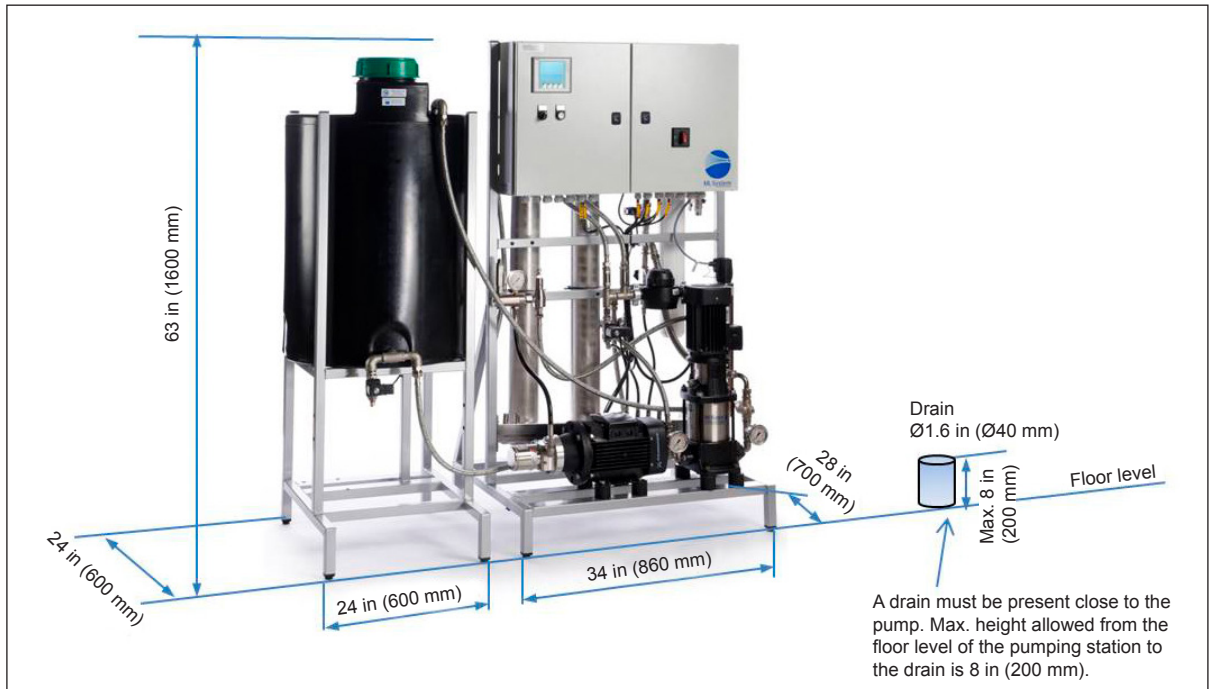


Figure 12: Positioning MLP RO 500

## MLP RO 800

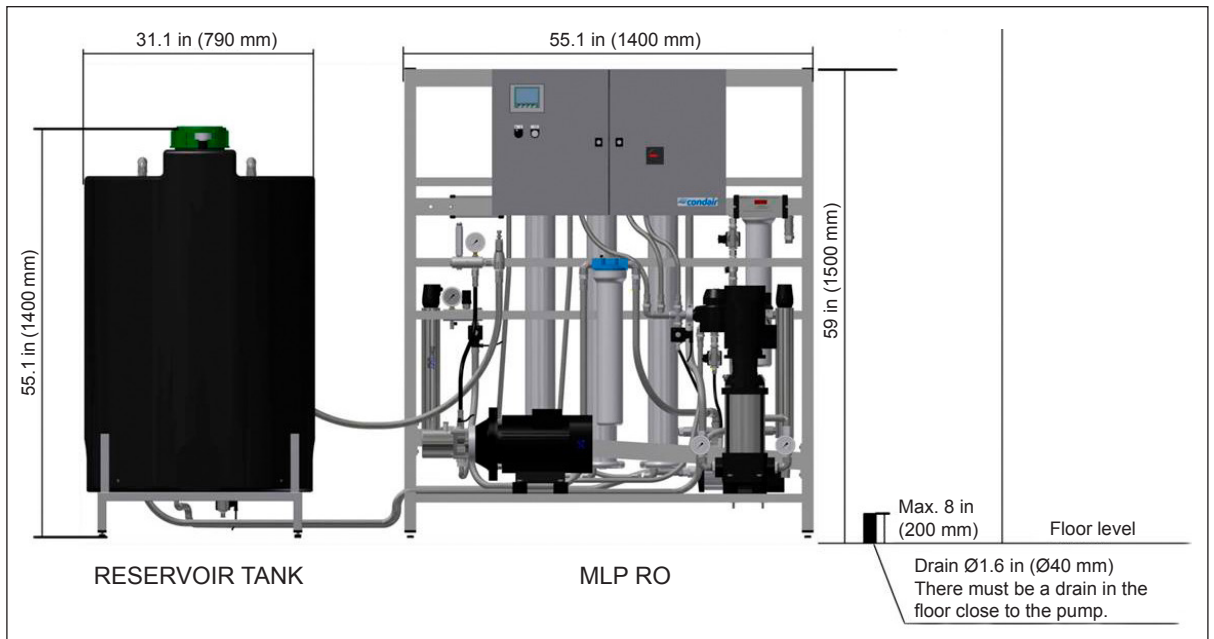


Figure 13: Positioning MLP RO 800

### 6.3 Water Installation

Site requirements prior to positioning the MLP RO pump and tank, it is important to consider the position of water treatment equipment in the room prior to installing the MLP RO and high-pressure unit. It is also crucial that the pump station must be installed in a location with a drain in the floor.

#### 6.3.1 Water Treatment

The water treatment installation parts should be installed in the order shown in the figure below. Please note that the combination of water treatment systems will vary from one installation to the next due as a result of water quality and regulatory requirements in the given location.

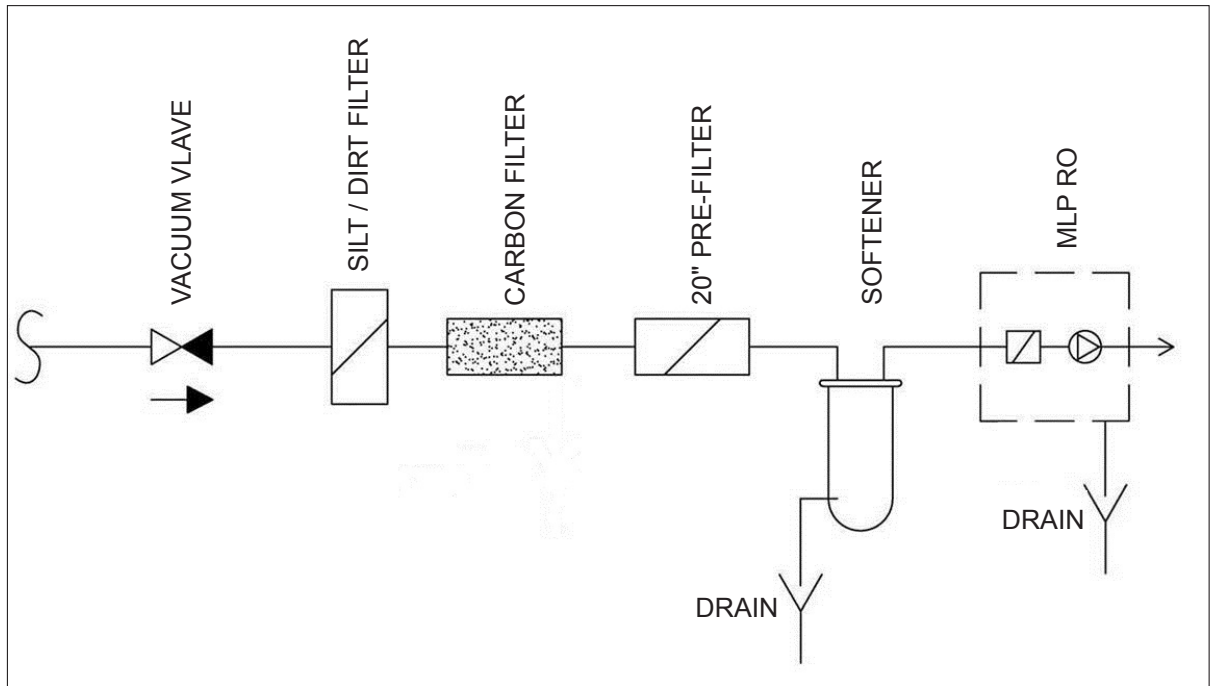


Figure 14: Positioning water treatment equipment

Start by examining the types of water treatment systems to be installed and read their installation instructions as regards location and any 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 necessary fixing equipment available: cable ties, cable trays, screws and wall anchors.

Place the MLP RO on a hard floor with a drain.

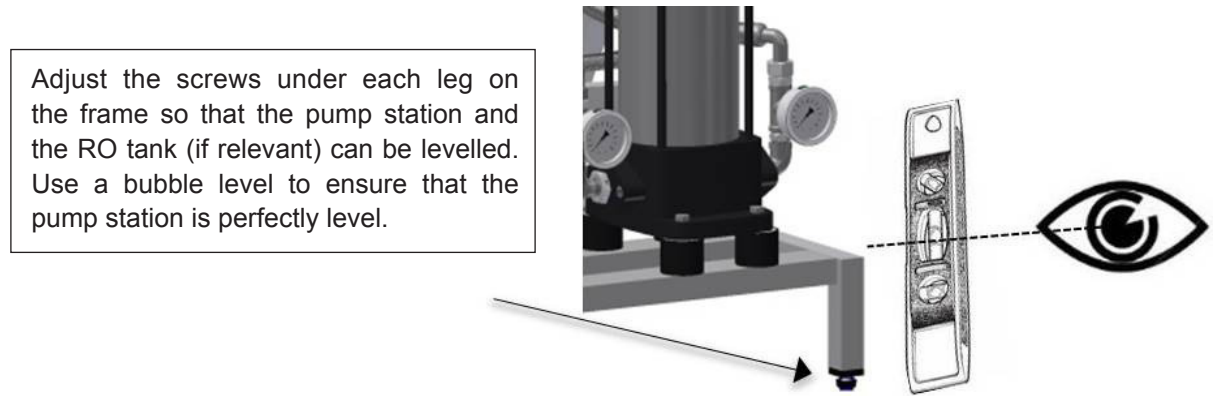


Figure 15: Adjusting the pump station

### 6.3.2 Drainage

Connect the MLP RO to the floor drain with a tube or hose of a 3/4" RG female in the drain connector. On MLP RO 500 and 800, the drain from MV4 on the RO tank must also be led to a drain – either directly or be connected to the drain connector D.

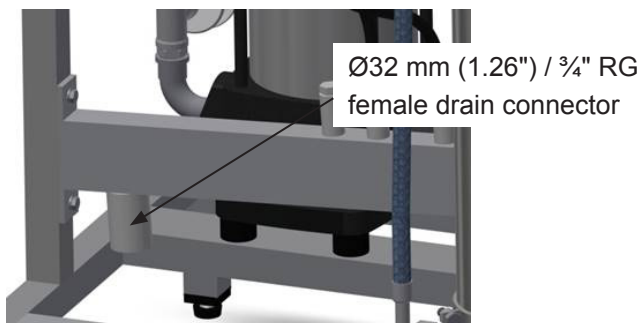


Figure 16: Drain connection

- Remove protecting plug (yellow) from drain connector.
- Connect drain hose to water outlet connector (ø32 mm / 1.26") and lead the drain hose down to an open funnel with a constant down-slope.
- Fix drain hose in its position, so it cannot move during operation.

The drain must have an appropriate down-slope to allow the water to flow freely and without pressure from the drain connector.

### 6.3.3 Water Supply Connection



#### WARNING!

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

Before connecting the MLP RO to the water supply of the building or the water treatment system, it must be ensured that the incoming water is as clean as possible. This is done by running a hose from the supply to the drain and open the shut-off valve completely. Let the water run for at least ten minutes. Shut off the water again and connect MLP RO to the water supply with the supplied hose (3/4", 4.92 ft.).

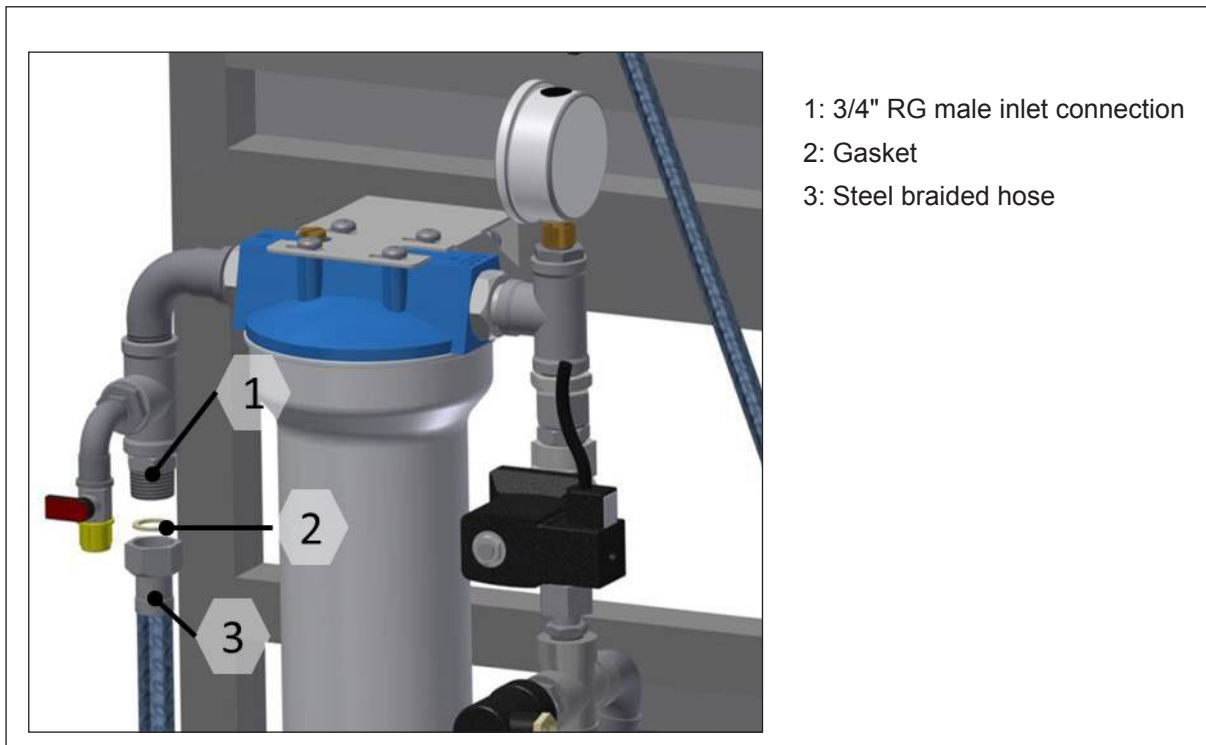


Figure 17: Water supply connection

On MLP RO 500 and 800, the separate RO tank must also be connected to the pump station.

MLP RO 500, two connections: F3 to P2 and UV to C

MLP RO 800, three connections: F3 to P3, R2 to C and UV1 to C

All hoses to the internal connections are supplied with MLP RO and requires that the RO tank is placed right next to the pump station.

## 6.4 Electrical Installation



**DANGER!**

**Danger of electric shock!**

**Installations and electrical connections must only be done by a trained technician and according to local standards.**

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

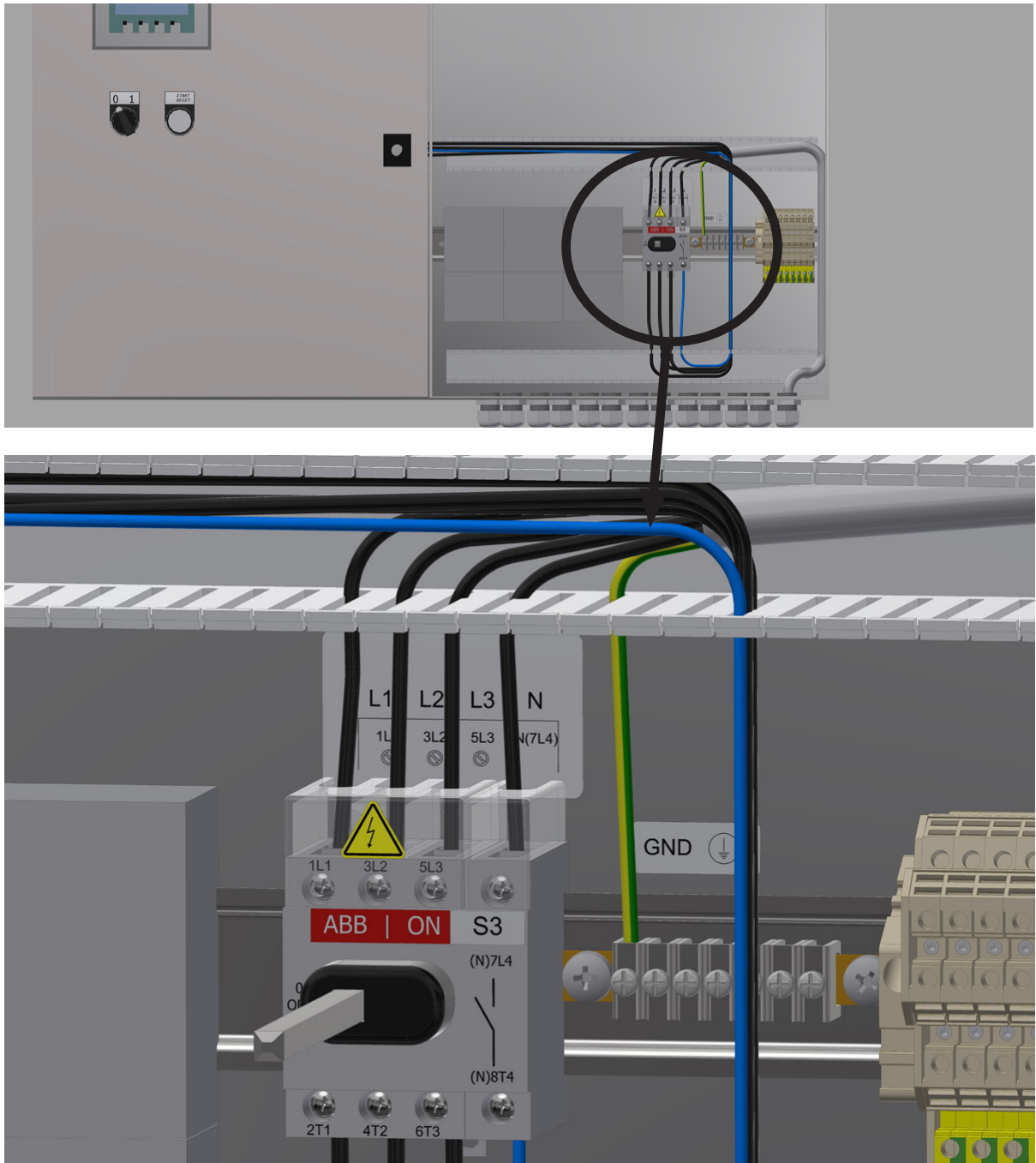
All Connections must be made according to the electrical documentation which is found inside the control unit of the electrical cabinet / main box.

Notes on electrical installation

- Installation must be carried out according to local rules and regulations.
- The electrical installation (power supply, humidity control) must be carried out according to the wiring diagram supplied with the unit and the applicable local regulations. All information given in the wiring diagrams must be followed and observed.
- All cables must be run into the control unit via the cable openings and the use of cable glands.
- Make sure the cables do not rub against vibrating parts.
- The supply voltage must comply with the voltage in the wiring diagram.
- Study the system set-up part to get an overview.
- The pump station comes with a 9.8 feet (3 m) rubber coated power cable.
- Power consumption and size of pre-fuse can be found chapter with product data.

## 6.4.1 Power Supply Connection

- Make sure that electrical supply corresponds to the specifications on the humidification system rating plate.
- Unlock the control panel enclosure door with the provided panel key.
- Insert the power supply cable through a suitable free cable gland and lead the cable to the field terminal block, as shown on the picture of the enclosure below.
- Follow the appropriate electrical wiring diagram for the actual humidification system and connect the power supply leads to the field terminal block accordingly.



# 7 Commissioning



## WARNING!

The system start-up must be carried out or monitored by persons approved and trained by Condair. Errors in the start-up phase may ultimately result in illness, injury and death of humans.



## CAUTION!

When fitting water filters, RO membranes, hoses and other components in direct contact with water please, wear sterile gloves or touch only the packing paper to keep the filter bacteria-free.

Remember to wash your hands!



## CAUTION!

Commissioning of the pump should be the last thing performed at an installation site. When the pump has run with water and the preservation fluid (windscreen wash) has been flushed out, it should always be kept on (summer and winter) in order to keep the system hygienically clean by allowing it to run its automatic flushing and UV routine.

Tools and materials for commissioning work

- Screwdriver set (remember small screwdriver for terminals)
- Polygrip pliers
- Spanner set
- Bucket with litre measure
- Residual hardness test kit, quick method onsite test ML-part: 150400000
- Total hardness test kit, quick method onsite test ML-part: 150401000
- Chlorine-sensitive test strips, quick method onsite test ML-part: 155407200
- Conductivity meter
- BQ water analyses set ML part: 155600010
- Multi-meter (Volt, Amp)

Disconnect the power before starting any commissioning work. Turn the main (red) power switch and the start button to the off position.

## 7.1 Inlet Filter

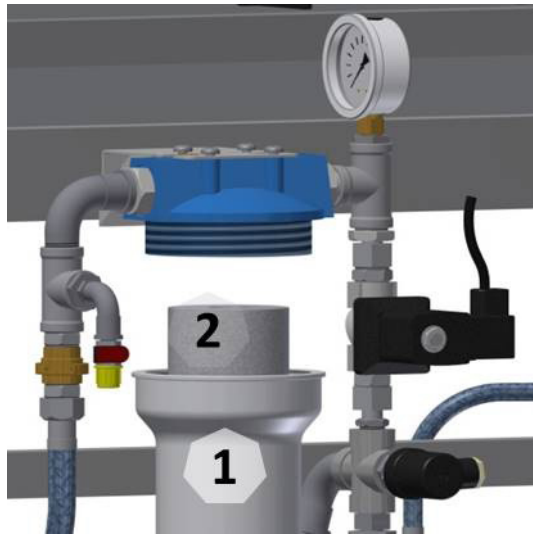


Figure 18: Inlet filter housing and filter

### Insert filter

- Unscrew the filter housing [1] using a filter wrench.
- Insert the filter [2], and make sure that it is centered on the guide knob at the bottom of the filter housing.
- Tighten the filter as much as possible by hand and then use the filter wrench to tighten approx. 1/4 turn.
- Slowly open the water supply
- If the filter housing is hard to tighten or leaks, unscrew it and check that the filter is centered, the O-ring is undamaged and the sealing surface is smooth and free of dirt.

*Note: Do not touch the filter with your bare hands (slide it out of the packing directly into the filter housing).*

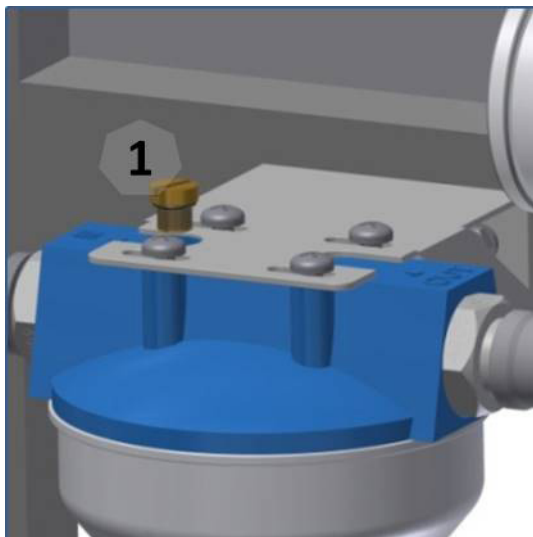


Figure 19: Air-vent screw, inlet filter

### Airing filter:

- Slowly open the water supply (tap) to the MLP RO
- Bleed the filter by loosening the air-vent screw [1] on the filter top until water leaks continuously.
- Retighten the air screw



## 7.2 Insert RO Membrane

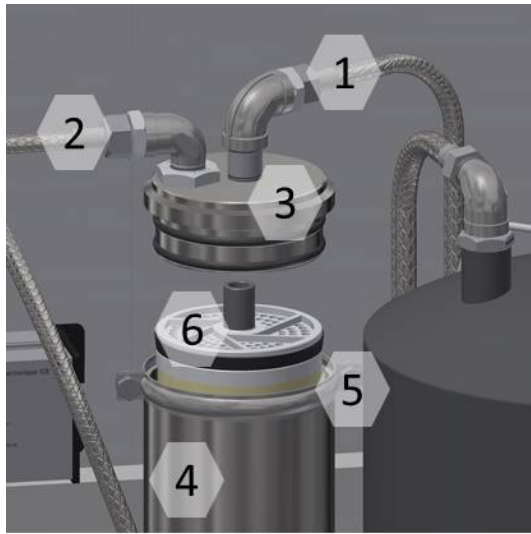


Figure 20: Membrane detail

- 1: Outlet tube
- 2: Inlet tube
- 3: Membrane tube, end cap
- 4: Membrane tube
- 5: hose clamps
- 6: membrane

Start by loosening the hose clamp [5] and then remove the end bottom [3] of the membrane tube. Let the membrane [6] slide into the membrane tube [4]. Make sure that the O-ring on the membrane is facing up (protect the membrane against bacteria, hold on the membrane packaging bag).

Press the membrane all the way to the bottom. If there is no resistance at the end, or if the membrane is very difficult to press down, the reason may be that the inner O-rings in the membrane tube end plate are out of place or have fallen out. Check that both the outer and inner O-rings at the end plate (top and bottom) are in place and undamaged. Now press the end plate in place and reinstall the hose clamp.

Note: Do not use grease or the like to lubricate the O-rings. Moisture with water instead.

## 7.3 RO Breathing filter

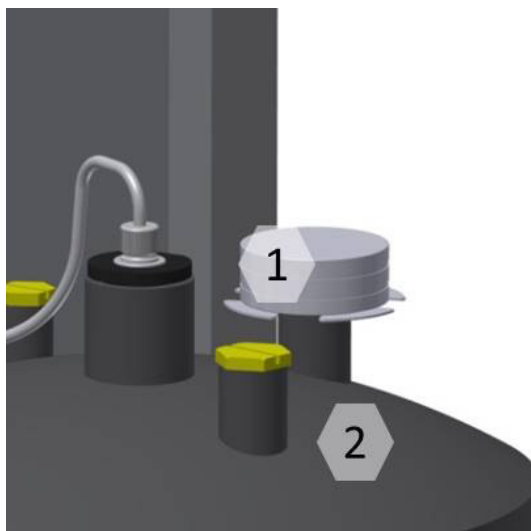


Figure 21: RO tank breathing filter

Sterile breathing filter [1]

RO tank [2]

Remove the yellow protective cap from the RO tank filter adapter (shaped like a small cup).

Unpack the filter [1] and moisten the O-ring with running water.

Avoid touching the nipple and the O-ring with your bare hands.

Press the sterile breathing filter into the filter adapter.

## 7.4 Pump Flush Preparation

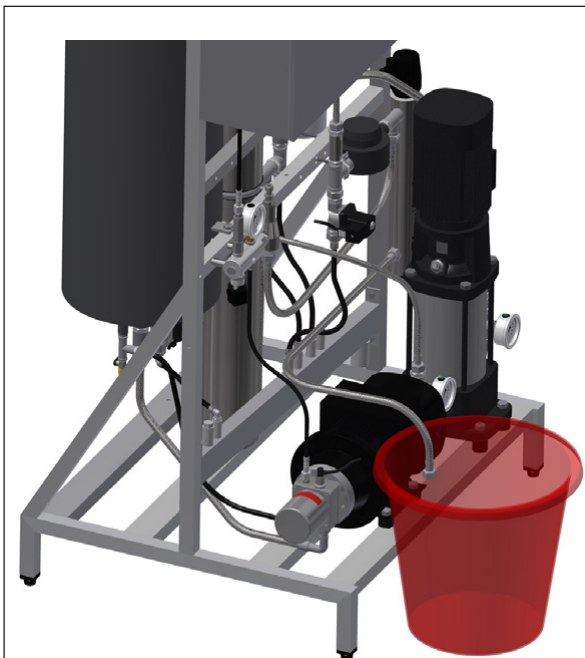


The first time a new pump and/or RO membrane is to be used, it is important to flush out any preservation fluids so that they do not end up in the high-pressure system.



- Remove plugs and strips from the high pressure hose and lead it to a drain or a bucket.

Figure 22: Flushing the pump




- Remove the filling hose for the RO tank (RO hose) and lead it to a drain..

Figure 23: Flushing the RO tank

Before the pump is started for the first time, the controller must be set up

## 7.5 Basic Controller Setup



- 1: Display (D2)
- 2: ON/OFF (S1)
- 3: Reset/Start (S1/P1)
- 4: Keyhole
- 5: Main power switch (S3)

- Put S1 in OFF position
- Start the controller by turning the power switch S3 in ON position
- The display lights up the start center → ▶ START

*Figure 24: Control cabinet*

### Display 1.1.1 - Pump rotation check



Every time the system is switched on after a power break, you will see a screen that tells you to control the pump rotation.

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 MLP before pressing the test button in order to avoid dry-running, for MLP RO observe the RO at start-up instead.

*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).*

## Display 1.1 - Select language



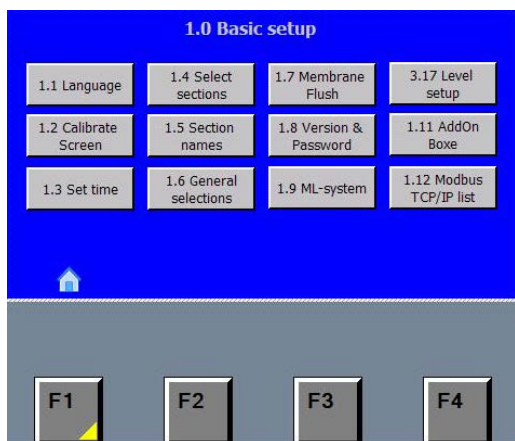
Select language by pressing the flag.

Select the units to use in the screens.

- Liter/hour
- lb/hour
  
- Celsius
- Fahrenheit

Press the right arrow (F4) to continue.

## Display 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.
- 1.4 - Selection of active sections.
- 1.5 - Selection of names for the sections.
- 1.6 - General selections. (settings)
- 1.7 - Membrane flush.
- 1.8 - Version and change passwords.  
(factory settings)
- 1.9 - ML-System. (factory settings)
- 3.17 - Level setup.  
(size of RO tank and level sensor scale)
- 1.11 - Shows add-on boxes attached to the pump
- 1.12 - Modbus list shows the data block in real time.

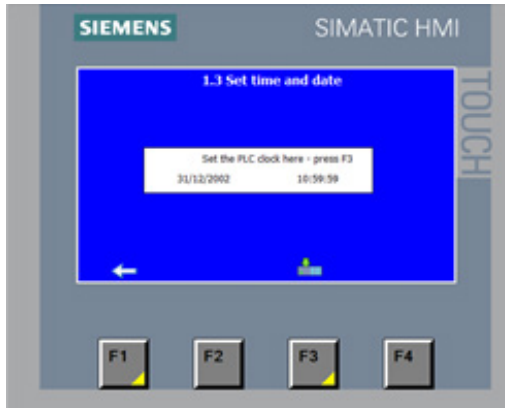
Once you have made your selection(s), press Home (F1) to continue.

*Note! Some of the buttons are only visible when the option has been selected.*

## Display 1.2 - Calibrate Screen

Adjusts the viewing angle, so you can stand upright and operate the screen. When calibrating, do not lean forward in order to get a better view. You will not get the desired effect.

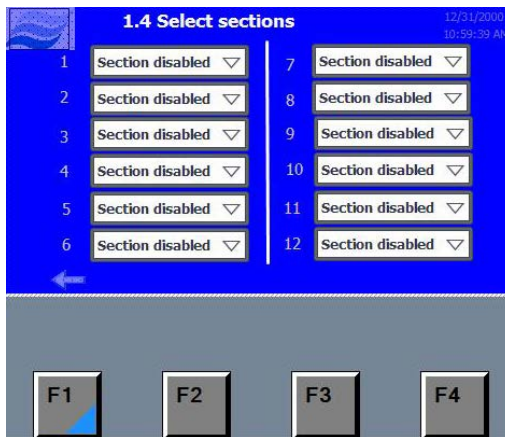
### Display 1.3 Set time and date



Time/date can be set (stored in the screen only). It's important to put it in like this MM/DD/YYYY

Note! Remember to press F3 to set the PLC clock.

### Display 1.4 - Select sections



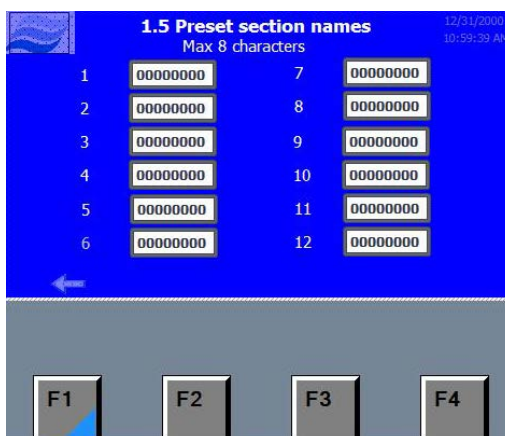
Select which section (zones) is active.

A section is defined as a humidity sensor, a valve set and a max hygostat connected to the controller.

There is 4 section in a standard pump, number of zones can be extended to 12 using the zone add-on box.

- Section disabled.
- Section enabled.

### Display 1.5 - Preset section names

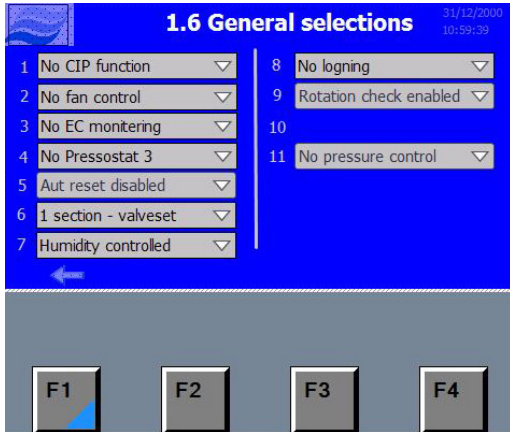


Selection of user-defined section names.

You can use up to 8 characters to define each section.

Default is 1-2-3...11-12.

## Display 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 / Volume dependent CIP.
2. No fan control / Aut. fan control / Constant fan control.
3. No EC monitoring / EC REG1 / EC REG6 / ..7 /..8.
4. No pressostat 3 / Pressostat 3 (only for MLPRO 800).
5. Aut. reset disabled / Aut. reset enabled (inlet water low pressure) / MAX hygostat Auto reset enabled.
6. 1 section – valve set / 1 section – no valve set
7. Humidity controlled (20-80% RH) / Direct controlled (0-10 V) / % controlled (0-100%).
8. No Logging / Logging selected.
9. Rotation check enabled (1.1.1) / Rotation check disabled.
10. —
11. No Pressure Control / Pressure control. (High pressure sensor)

## Display 1.7 - Select membrane flush



Select whether membrane flush.

- Normal mode.
- Membrane flush (remember to put back in normal mode after flushing).

Select Membrane flush, RO pump will now start and the flush program will run for 35 minutes.

Monitor the pump during flushing.



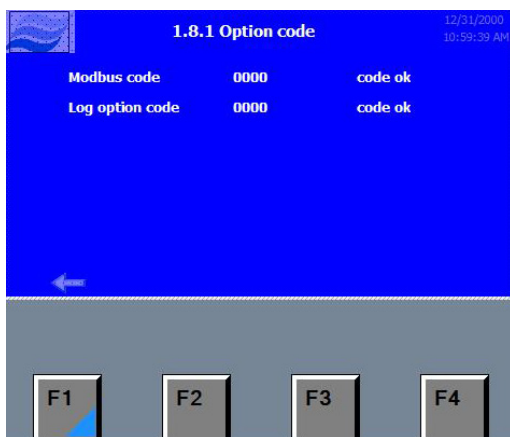
### Display 1.8 - Version & password



Select MLP RO size and select 1-4 or 1-8 sections. This selection is pre-set from factory according to the controller hardware.

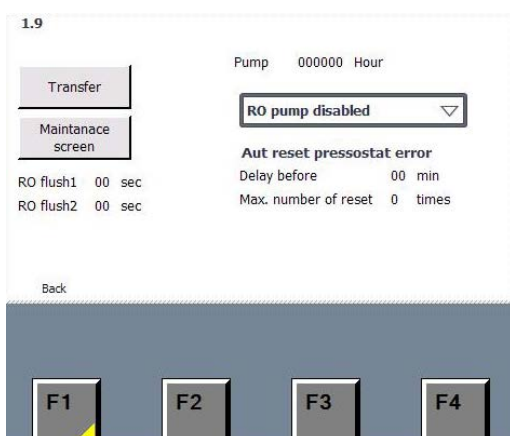
Changing password is only possible with the master password.

### Display 1.8.1 - Option code



Modbus and/or Log option codes has to be obtained from ML-system.

### Display 1.9 - Maintenance



Factory service screen and settings.

RO flush timer 1 (default 20 sec).

RO flush timer 2 (default 30 sec).

- RO pump enabled.
- RO pump disabled.

Auto reset inlet pressure error:

Delay before attempt to reset .(default 30 minutes)  
Maximum number of resets tried .(default 2 times)

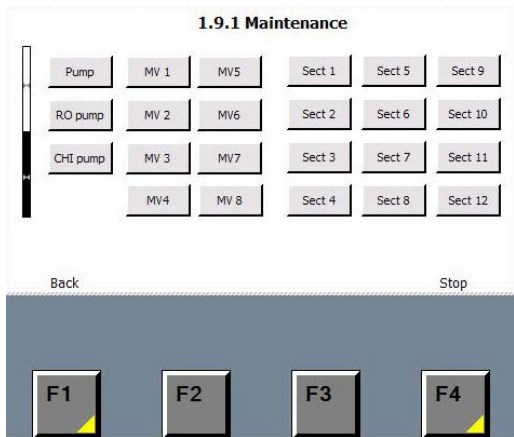
Transfer. (boots PLC)

Maintenance screen. (manual operation of pump)

RO pump disabled / enabled.

For service: closes MV1, MV7 and stops RO pump.

### Display 1.9.1 - Maintenance



Manual operation of all valves and pumps, mainly used for commissioning, when testing zone valves.

**WARNING! All safety features are disabled here, so it is possible to dry-run the HP pump.**

### Display 1.11 - Add-on boxes



When an add-on box is installed correctly it shows up on this screen.

### Display 1.12 - Modbus list 1



Shows in real-time which date the PLC writes to the data block.

Note! If the pump receives a set point from the BAS/BMS it's important that the signal is constantly updated as the unit does not remember the signal in the event of a power cut.



## Display 1.13 - Modbus list 2



Shows in real-time which date the PLC writes to the data block.

Note! If the pump receives a set point from the BAS/BMS it's important that the signal is constantly updated as the unit does not remember all signal in the event of a power cut. Reccomentet sampling time 1 sec.

Using Siemens integer for bool.

1 Integer = 2 Byte



1 integer = 16 Bool



Your system ?? 7 6 5 4 3 2 1 0 15 14 13 12 11 10 9 8

## 7.6 Pump Flush Procedure

Display 1.7 - Select membrane flush

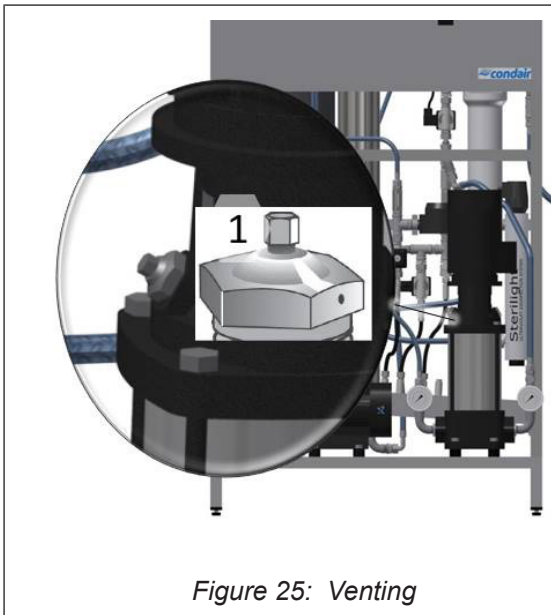


Select whether membrane flush.

- Normal mode.
- Membrane flush (remember to put back in normal mode after flushing).

Select Membrane flush, RO pump will now start and the flush program will run for 35 minutes.

Monitor the pump during flushing.



If the RO pump does not build pressure or is noisy, it must be vented.

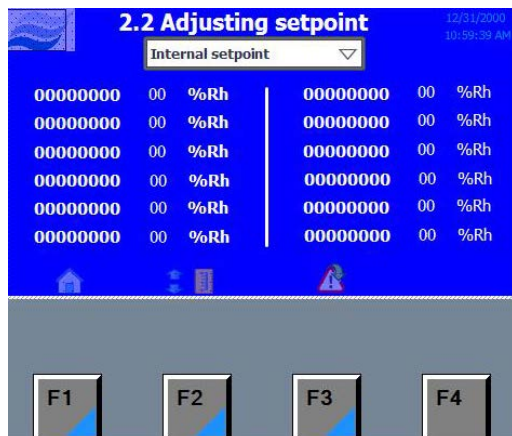
Open the small centre bleeding screw on the RO pump to fill the pump with water and vent any air. Close the valve again. After a few seconds, the system should be out of the system. If not, please repeat the procedure.

Figure 25: Venting

After RO flush, refit the RO hose to the RO tank and set RO back to normal operation. The RO should now begin to produce RO water to the tank.

Venting and flushing the high-pressure pump.

## Display 2.2 - Adjusting setpoint



As soon the water in the RO tank reaches the minimum start level the high-pressure pump will now start if a section calls for humidity and the S1 (on/off switch) is turned to the on position.

Force the HP pump to run by adjusting the set point in a section to 75%.

Let the HP pump flush for 10 minutes.



Turn S1 (on/off switch) to off position, and connect the HP discharge hose to the high-pressure manifold.

Note: It is important to use two wrenches, otherwise there is a danger of the glue breaks and high-pressure manifold leaks.

Figure 26: Connecting HP discharge hose

Leave the main switch turned on and the S1 (on/off switch) in off position. This way the system will perform a flush routine that together with the UV lamp will help keeping the system clean.

## 7.7 Adjusting Reverse Osmosis

### Explanation of technical terminology

*Permeate:*

Processed, desalinated water which is produced by the MLP RO system and supplied to the reservoir tank.

*Concentrate:*

The water led to the outlet. This water contains salts and minerals that have been removed from the water.

*Feed water:*

The water which is led directly to the MLP RO.

*TDS:*

Stands for Total Dissolved Salts. The amount of dissolved salts, measured in ppm.

*Conductivity:*

The designation of the water's salt concentration measured in ( $\mu\text{S}/\text{cm}$ ). The lower the value, the higher the water quality.

*Membranes:*

Is the system filter which desalinates the feed water using high pressure.

*RO:*

The abbreviation for reverse osmosis.

*Transport pump (only on MLP RO 800):*

The pump which transports the processed water from the system reservoir's high-pressure pump.

*Level switch:*

A switch/sensor which emits a signal when the RO system must either be started or stopped, and it stops the transport pump in case of dry running of the reservoir tank.

*Softening:*

A pre-filter which softens the water, i.e. it removes hard minerals from the water, and replaces them with salt.

## 7.7.1 Water Quality

The feed water, which is to be treated in the MLP RO system, must be of drinking water quality. Please read requirements for inlet water in [chapter 5.5 – Entering Water Requirements](#), on [page 26](#) and under product data at the end of this manual.

If there are doubts about the raw water composition, a water analysis must be made. The MLP RO must be connected to a water pressure of minimum 36 psi (2.5 bar) and maximum 101 psi (7 bar). The quality of the treated water will be less than 20 µS/cm at 50 °F (10 °C).

The MLP RO will be adjusted from the factory to the following parameters.

MLP RO 100 & 300	20 gpg / 50 °F (342 mg/L / 10°C)	Permeate/concentrate ratio: Approx. 50/50
MLP RO 500 & 800	1 gpg / 50 °F (17 mg/L / 10°C)	Permeate/concentrate ratio: Approx. 75/25

<b>Water quality (contact Condair for technical advice)</b>		
<b>Content</b>	<b>Symptom</b>	<b>Preventive action</b>
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	Precipitation of iron gives a red-dish-brown film and precipitation of manganese gives a black deposit.	Sand filter – oxidation, -softening, greensand.
Calcium, magnesium (hard water)	The membrane scales.	Softening, anti-scaling agent
Silica	The membrane scales.	Anti-scaling agent.
SDI (silt)	The membranes gets 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, pesticides, 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 thiosulfate or sulphite.
Bacteria	Membrane is clogged by slime.	Chlorination + de-chlorination, UV, micro-filtration 0.2 µS/cm and ultra-filtration.

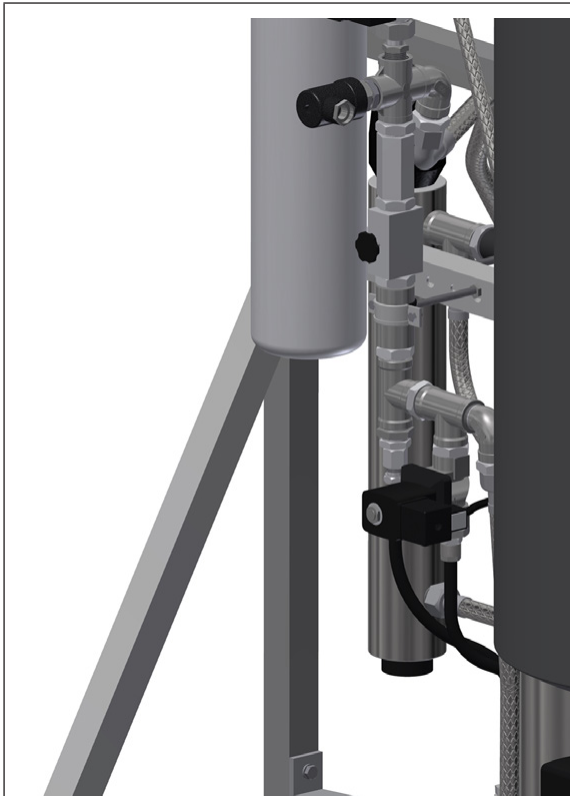
## 7.7.2 Adjusting Outlet Amount

Important! Read the entire chapter before adjustment is started.



Disconnect drain hose from drain manifold and put into a bucket.

*Figure 27: Draining*



Open both the recirculation valve (V2) and the outlet valve (V3).  
Note: Outlet valve (V3) could be a nozzle depending on configuration, if so just leave it in.

*Figure 28: Opening the valves*

The outlet (concentrate) amount must be adjusted. Which amount is suitable on your system depends on the inlet water quality. Too high water recovery will damage the system membranes. On condition that the raw water complies with the water quality requirements, it can operate at a recovery rate of 70-80% with softening depending on the amount of organic material in the water.

MLP RO size	Max permeate capacity (gph)*	Outlet amount (gph) (with softened water)		Outlet amount (gph) (with tap water)	
		Surface water (75% recovery)	Groundwater (80% recovery)	Surface water (50% recovery)	Groundwater (55% recovery)
100	26.4	8.7	6.6	26.4	21.7
300	79.25	24.3	18.2	72.6	59.4
500	132	44.1	33	-**	-**
800	211.3	66	49.7	-**	-**

\* For every degree the inlet water is below 50 °F (10 °C), the permeate capacity (gph) must be adjusted down with 3%.

\*\* We recommend always using softening for MLP RO 500 and 800, as the water consumption and wear on membranes will be relatively high. However, local water conditions may in some cases justify running without. Please ask Condair for advice.

Example: MLP RO 500 with 80% recovery

$$\text{Outlet amount gph} = \frac{100 \times \text{Permeate capacity gph}}{\text{Recovery\%}} - \text{Permeate capacity gph}$$

$$\text{Outlet amount} = \frac{100 \times 500}{80} - 500 = 167 \text{ gph}$$

Start the RO system and adjust the outlet so the desired amount of outlet water has been obtained.

### 7.7.3 Adjusting Permeate Amount

- Adjust the permeate amount with the recirculation valve. Adjust the amount of permeate produced to Max Permeate capacity (gph) of the specific system remember to temperature withdraw 3% from Max Permeate capacity (gph) For every degree the inlet water is below 50°F (10 °C).  
E.g. if the feed water temperature is 46 °F (7.8 °C), for an MLP RO 300 it means that the permeate capacity will be 6% below the normal 72.6 gph (275 l/h), e.g. 68.2 gph (258 l/h).
- When the requested pressure and permeate capacities have been obtained, check again if the outlet amount has been adjusted correctly.  
Please note! The system must be started and stopped two times, and then the flow must be re-checked. The valves can then be readjusted if necessary.
- Check on the RO pump outlet manometer that it shows the correct operating pressure, 87 - 145 psi (6 - 10 bar).  
Please note that the operating pressure may vary by different temperatures and capacities.
- Now check the quality of the processed water on the permeate hose; the conductivity must be below 20 µS/cm (conductivity meter is available as optional equipment).
- Check that the outlet water is below 1000 µS/cm.
- Check that the MLP RO automatically starts and produces treated water.
- Check if the MLP RO automatically shuts down by too low feed water pressure or lacking feed water supply. This is done by slowly closing the feed water supply while the MLP RO is in operation. When the water supply has been interrupted, the MLP RO must stop automatically within 10 sec. In order to put the MLP RO back into operation, the water supply must be re-established and the reset button pushed once. The MLP RO will automatically revert back to normal operation! The system is now commissioned and ready for use.



## 8 Operation

Persons operating the MLP RO's controller must have read and understood this manual.

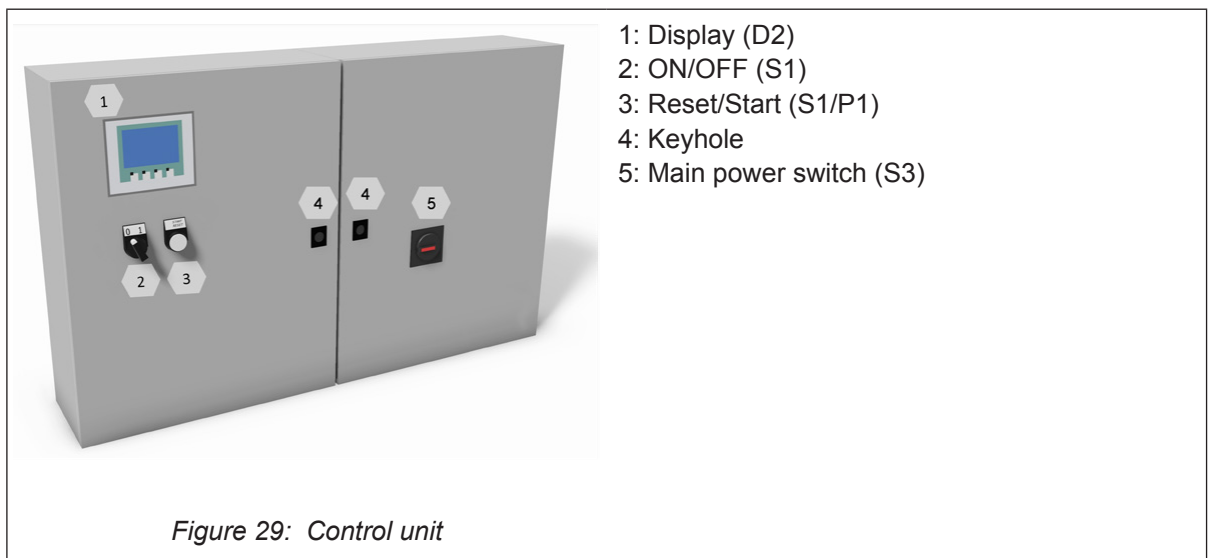
Knowing and understanding the contents of the manuals is a basic requirement for protecting the personnel against any kind of danger, to prevent faulty operation and to operate the unit safely and correctly.

All safety notes in the installation and operation manual for the MLP 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.

### 8.1 Overview Control Unit



## 8.2 Equipment Protection

### Pressure switch (inlet water)

The MLP 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'.

### Max. hygostat to protect against excessive humidification

A max. hygostat can be connected to the control cabinet. If humidity levels rise to a value that exceeds the value set on the max. hygostat, the system stops and the alarm lamp flashes. The system will not restart until the alarm is acknowledged by pressing 'Alarm reset'.

### Temperature switch

The high-pressure pump is protected against overheating by a temperature circuit that measures the current temperature in the pump. The temperature limits can be set individually.

Default settings:

1. If the temperature exceeds 86 °F (30 °C), the control unit will initially attempt cooling by starting the water treatment part and filling up the tank with cold water. If this makes the temperature drop to below 86 °F (30 °C), the function will reset and everything will continue unchanged. While the tank is being filled, the high-pressure pump will continue unaffected.
2. If instead the temperature continues to rise to above 104 °F (40 °C), the pump will stop and start emptying the tank of overheated water and produce new water in the tank. During this process and until the start level has been reached, the pump will remain idle with the alarm text displayed. The pump will start automatically once the start level has been reached.
3. If the temperature exceeds 122 °F (50 °C), the pump will stop immediately and must be reactivated via the reset button once the temperature has dropped again.

### Description of touch screen

The screen has four F keys. Each of the keys is 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 actual touch screen can be operated by gently tapping the relevant screen 'buttons' with your finger. If you want to change a numerical value, press the relevant number key. This will make a numerical keyboard appear on which the new value can be entered. Remember to enter any comma that may be needed.

Any incorrect entry can be deleted using the Backspace button. Once a new value has been entered, press Enter at the bottom right of the image using the numerical keyboard.

## Protection against unwanted changes

On the display, 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 + changes of set points.

Technician (password 197) as above + changes of operational parameters and choice of membrane rinse.

Master (password 8599) as above + selectable options, reset to factory settings.

Technician XXXX, as above + factory / service menu.

Additionally, there are areas of the screen that are protected by extra passwords, to which only the ML-System has access.

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.

## 8.3 Alarm Messages

This page shows alarms and operational messages. The alarm display contains information about when an alarm was triggered and when it was reset. The page shows active alarms and previous alarms. Please note that the system does not have a backup memory, which means that previous alarms will be lost in case of power failure.

### Max. Hygrostat Sect. 1

Max. hygrostat in the current section has dropped out due to excessive humidity. The system has stopped and must be restarted once the humidity level has dropped.

### Sensor error Section 1

The signal from one of the humidity sensors is outside the expected interval of 20 to 80% RH. In order to ensure that it will be possible to start up the system in very dry conditions, the 20% limit is reduced to 5% RH for the first 10 minutes after the system is switched on. If an alarm is triggered, only the affected sections will be stopped.

### Emptying Tank – water too hot

The water is too hot – above 104 °F (40 °C). The tank will be emptied to start level and filled with cold water. The pump will run unchanged in the meantime.

### Pump too hot

The water is too hot – above 122°F (50 °C). The system has stopped and must be restarted once the temperature has dropped.

### Thermal relay error

The protective motor switch for the high-pressure pump is disengaged. Engage the relay and try restarting.

### Water pressure too low

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 7.25 psi (0.5 bar).

**Tank Full**

The water level in the tank is too high – lower the water level and reset the system. Check that the inlet valve MV1 closes tightly when the system is idle.

**Clean in place (CIP) overdosing last day (option)**

The CIP self-monitoring system has detected a possible overdosing. Please call for service.

**Electrical Conductivity (EC):**

EC too high after mix bed  
EC too high RO membrane  
Water quality – EC to low  
Water quality – EC to high

**Add on BOX EC reg error**

The box detected don't match the chosen box.

**Add on BOX CIP error**

The box detected don't match the chosen box.

**Add on BOX EC comm.error**

Network error, check power to Add on box and network cables.

**Add on BOX CIP comm.error**

Network error, check power to Add on box and network cables.

### 8.3.1 Operational Message Display

#### **Water level below start level**

The water level in the container is too low for the pump to start. Once an adequate level has been reached, the system will start automatically.

#### **The pump will start automatically after delay.**

The pump has been paused, e.g. after disinfection. The pump will start automatically after the expiry of the set time.

#### **UV lamp error (option)**

There is an error on the UV lamp.

#### **UV lamp getting old (option)**

21 days to recommended renewal of the UV bulb.

#### **UV lamp error too old**

Replace UV lamp and reset service interval.

#### **CIP pump error (option)**

General pump error.

#### **CIP to low dosing (option)**

Possible under dosing of CIP fluid detected, check CIP bottle and for air in the system.

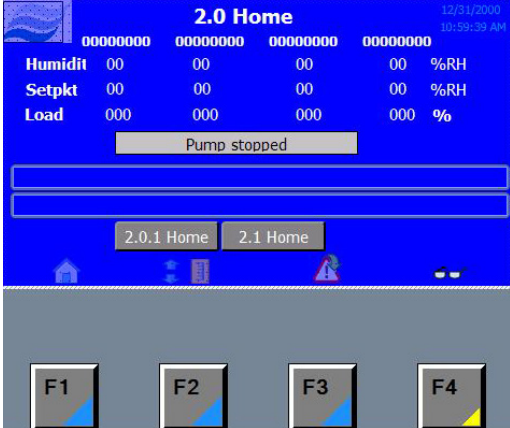
#### **Water level below start level**

The water level in the tank is too low for the transfer pump to start. Once an adequate level has been reached, the system will start automatically.

#### **Mix bed 1 must be changed**

## 8.4 Controller Menu

**Display 2.0 - Home**



Normal operation page

Shows up to four sections at a time. The names of the section changes colour according to the current status.

- White – normal inactive
- Green – active section – humidification is on.
- Yellow flash – humidity out of range.
- Red flashing – alarm on the section.

Humidity, set point and load for each section.

Just tap the set point to go to the set point adjust screen.


If an alarm or message is triggered, a bar will appear across the screen, showing the message.

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

Section 5-8 and 9-12 are shown by pressing 2.0.1 or 2.1 home.

F4: jump to page 2.3.0

**Display 2.2 - Adjusting set point**

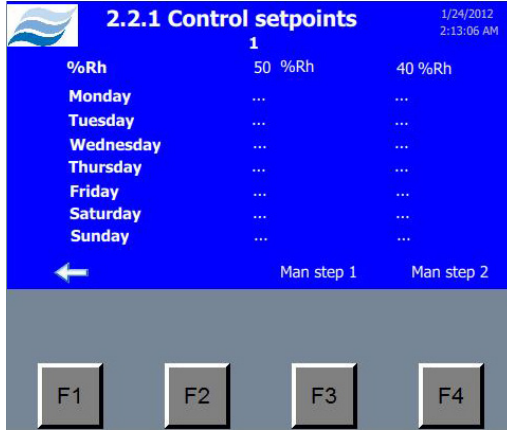


Internal set point / external set point (to be chosen if we are getting a set point from the BAS/BMS via Modbus).

Set points can be adjusted by tapping 00 just right of the section name.

Tapping the % RH of any section will take you to the 2.2.1.

### Display 2.2.1 - Control setpoints



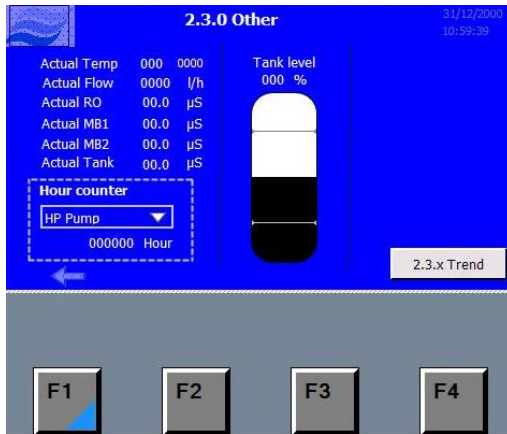
Set points can be setup to change at a given time of the day/week.

At the set point step in the top of the page two inputs can be entered.

E.g. If I want the humidity to be 50% RH Monday morning (8:00AM) I put in 50% RH in top of the first column and 08 (corresponding to 8AM) next to Monday. In the afternoon (5:00PM) you want it to be 30, then you write 30 in top of the second column and 17 (corresponding to 5PM) in next to Monday in the second column.

The set point will then stay at 30 until a new input is given to it.

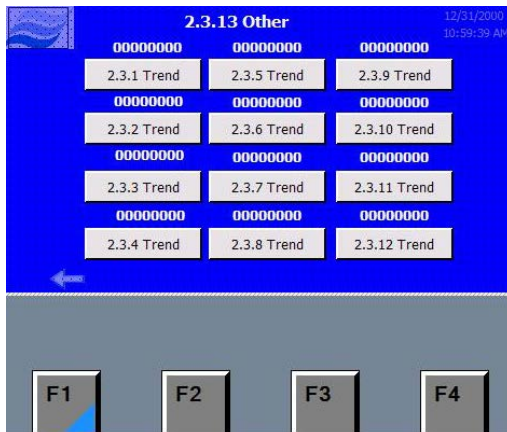
### Display 2.3.0 - Other



Gives a dashboard overview timers, EC., temp, level in tank.

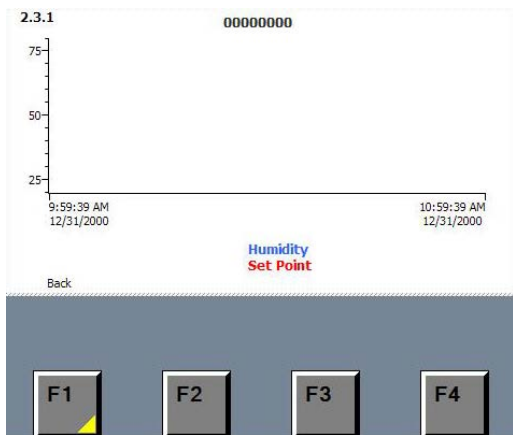
2.3.X Trend -> Trend curves.

### Display 2.3.13 - Other



Those the section you want to see.

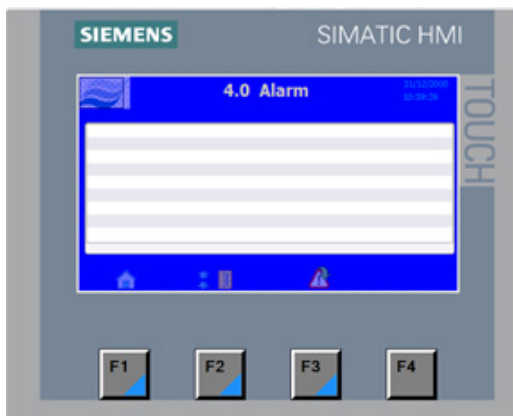
### Display 2.3.1



Shows the trend one hour back. (set point vs humidity)

## 8.4.1 Alarms and User Messages

### Display 4.0 - Alarm

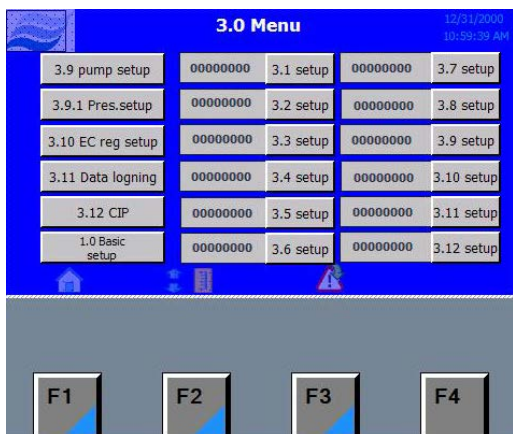


All alarms and operational messages are shown, showing the time at which they occurred and the time when the alarm stopped.

Please note that the alarm log will be reset after a power cut.

## 8.4.2 Parameter Change Menu

### Display 3.0 - Menu



Menu for the pages where the parameters can be changed for each department or access the add-on boxes or basic setup.



### 8.4.3 Settings for Section Parameters

Display 3.1 - Zone controller



HIE: Highest electrical input volt (standard 8V).  
 LOE: Lowest electrical input volt (Standard 2V).  
 HI: Highest reading in display (standard 80%).  
 LA: Lowest reading in display (standard 20%).

#### Hum. Alarm

HI RH% High alarm limit.  
 LO RH% Low alarm limit.

#### PRO

Proportional band in RH%. If measured RH% is lower than (RH% set point – PRO RH %) the controller demands 100% of possible runtime. Lowering the PRO RH% results in a more aggressive regulation.

#### PER

Period time in sec. A period consists of a pause (PAU) and a humidifying pulse.

#### MON

Minimum on time in sec, shortest running time that we allow the pump and valve to operate. For each period that the MON time is not reached (Humidity is close to set point) the calculated time is added to the next MON period until enough time has accumulated to meet the MON and start humidifying cycle.

#### PAU

Forced pause time between humidification bursts, allows the water to be absorbed in the air although the controller calls for 100% run time.

#### FLU (Hygienic flush time)

Time calculated that the pump should run each FDE period in order to avoid stagnant water in the system. (MINIMUM 0.2 min (12 sec) per 30 min FDE.

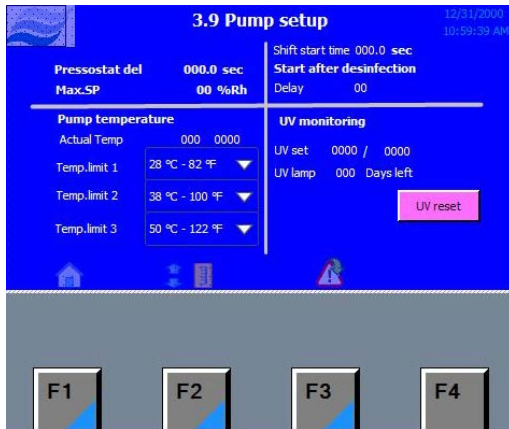
#### FDE

Pause between each FLU (STANDARD 30 min)

Note! FLU and FDE times goes into the flush algorithm and can't be recognized in the flush sequence subsequently as measurable time intervals.

## 8.4.4 Pump

Display 3.1 - Zone controller



### Pressostat del

Alarm delay for inlet pressure (PS1) < 14.5 psi (1 bar).

Default: 10 sec.

### Max.SP

Maximum allowed humidity, only shown if humidity controlled capacity has been chosen (3.13), if the entered value is exceeded system goes in alarm and stops the pump.

### Pump temperature

Shows actual pump temperature and it is possible to change the temperature limits of the pump.

Default:

T1: 82 °F (28 °C)

(starts producing fresh RO water).

T2: 100 °F (38 °C)

(warning – Emptying RO tank by opening MV4).

T3: 122 °F (50 °C)

(alarm – high pressure pumps stops).

### Start after disinfection

Delay in hours the start-up of the system allowing the disinfection to work. It's recommended to let the disinfectant work in 4 hours.

*Note! Be aware that the disinfectant can cause air forming in the pumps so that they might need airing at start-up.*

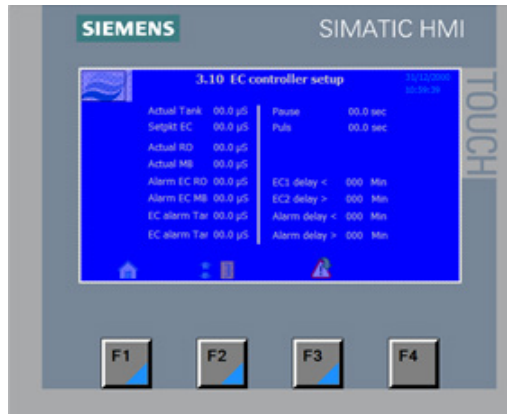
### UV monitoring

UV set.

The pre-set number in the right value must be 50 % lower than the read out number in the left value. After replacement of the UV-lamp reset by pushing the UV reset button.

## 8.4.5 More Options

**Display 3.10 - EC controller setup**



Only available on systems with the options installed.

Shows the actual electrical conductivity measured at different sensors.

Set EC alarms and alarm delays.

### **Pause**

For CO<sub>2</sub> adding option. This set the pause between the pulses of CO<sub>2</sub> when this is added to a RO tank. E.g. 15 sec.

### **Pulse**

Length of the CO<sub>2</sub> pulse added e.g. 2 sec.

**Display 3.10.1 - EC scale**



Scale the EC sensors according to the used type of sensors. Only the sensor for the selected option is visible.

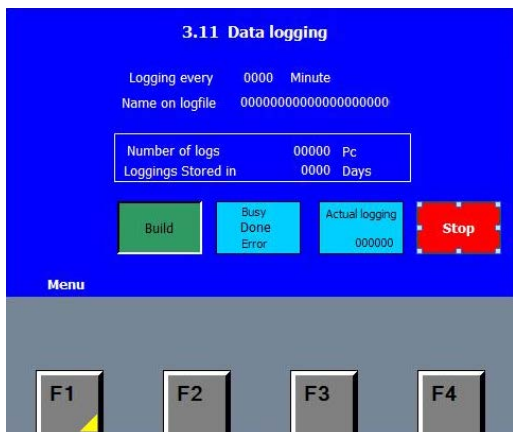
HIE – Highest electrical signal.

LOE – Lowest electrical signal.

HI – Read out with highest electrical signal.

LO – Read out with lowest electrical signal.

### Display 3.11 - Data logging



To start a log file press Build.

In the field "actual logging" the number of logs can be observed.

Setup the desired logging intervals.

Logging stored in days: this number will change up or down depending on how often "logging every xxx minute" is set to.

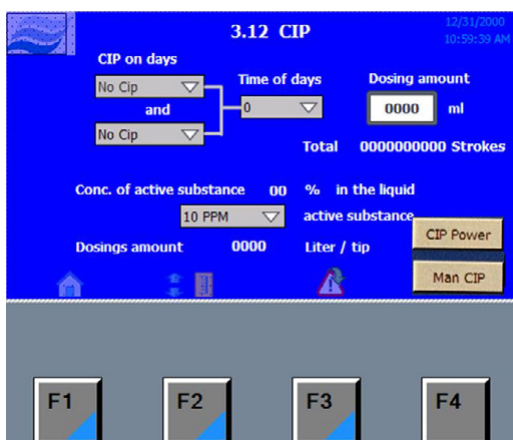
Normally logging 60 min should be sufficient and will give a year of logs.

The logging is setup as a circular logging meaning that when the limit is full it will start overwriting the oldest logs.

To read out the log file you must connect a PC to access the plc's "homepage" using a standard browser.

Read the instruction provided with the logging activation code for further information.

### Display 3.12 - CIP



The disinfecting fluid can be supplied up to twice a week, but never 2 times on the same day.

Choose which days to add disinfecting fluid.

Choose the time of the day.

Choose size of dosing amount 5 -10 -15 ml.

CIP power turns on CIP pump.

Man CIP runs the CIP pump. (used when airing the pump)

### Display 3.17 - Level setup



Automatic scaling should always be used for standard systems.

However it's possible to manually scale the sensor by altering the volt at full and empty tank.

S 98% : Overflow alarm.

S 95% : close inlet valve and stop RO pump.

S 25% : Start RO pump open inlet valve.

S 10% : minimum limit for CO<sub>2</sub> dosing.

S 5% : Low limit / dry run projection, stop transfer / high pressure pump.

## 8.5 Weekly Inspection

During operation, the MLP RO and the humidification system have to be inspected weekly. On this occasion, check the following:

- Entire humidification system for leakage
- Electric installation for damage
- Operating display for warning or error messages
- UV filters
- Pressure drop over filters
- Water treatment systems such as carbon filter, softener, RO

If the inspection reveals any irregularities (e.g. leakage, error indication) or any damaged components take the MLP 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.

# 9 Maintenance

## 9.1 General

Perform only those maintenance procedures described in this manual, and follow all instructions closely. Use only original Condair ML replacement parts.

### Personnel Qualifications

All maintenance work must only be carried out by qualified and trained personnel authorised by the owner. Maintenance and repair of the electrical installation of the Condair MLP RO must only be carried out by well qualified and properly trained personnel (e.g. electrician) authorized by the customer, and who are aware of possible dangers and implications.

It is the customer's responsibility to verify proper qualifications of the personnel.

### Safety

Before maintenance is initiated, the MLP RO must be taken out of operation in accordance with instructions in the section 'Taking the MLP RO out of operation'. Protect the system against unintentional switch-on. The MLP RO must be cleaned and disinfected at the intervals described in this manual and cleaning must be performed by trained and instructed personal.



#### DANGER!

Risk of electric shock!

**The Condair ML humidifier is mains powered. Live parts may be exposed when the access panels are removed. Touching live parts may cause severe Injury or even death.**

**Prevention:** The Condair ML humidifier must be connected to the mains only after all installation work has been completed, checked for correct workmanship, and the access panels are installed properly and fastened securely.



#### DANGER!

Risk of injury and equipment damage

**Poorly maintained humidification systems may be hazardous.**

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



#### WARNING!

Risk of disease and/or illness

Poorly maintained humidification and water systems may encourage bacterial growth and/or endanger health.

**Prevention:** Therefore it is mandatory to observe the specified maintenance intervals and to carry out maintenance in strict accordance with the instructions.



#### CAUTION!

Risk of damage to internal components from electrostatic discharge (ESD)

**The electronic components inside the humidifier are sensitive to electrostatic discharge (ESD).**

**Prevention:** Take appropriate and special measures to protect the electronic components inside the unit against damage caused by ESD.

## 9.2 Maintenance Work

To ensure safe, hygienic and economic operation of the MLP 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 are responsible for any maintenance work not carried out.

Service, to be carried out	Half year	Each year	Every 2 years	Every 4 years
<b>Review of the system</b>				
Testing of the system's overall function	X	X	X	X
Meter reading of water consumption (if present)	X	X	X	X
Reading of pump running hours	X	X	X	X
Logbook registration	X	X	X	X
Control weekly monitoring checklist	X	X	X	X
<b>Water treatment system / incoming water</b>				
Analysis of water hardness (in case of water softening)	X	X	X	X
<b>Pump unit</b>				
Replacement of filters	X	X	X	X
Check the condition of the pump (pressure & noise)	X	X	X	X
Testing of solenoid valves and replacement if necessary	X	X	X	X
Change gasket kit in high pressure relive/reduction valve		X	X	X
Functional testing of max hygrostat circuit	X	X	X	X
Functional testing of high pressure gauge	X	X	X	X
Functional testing of pressure switch (pressostat)	X	X	X	X
Service inspection of PAHT pump (after 24 months or 8,000 running hours)			X	X
Testing of ON/OFF valve and replacement if necessary	X	X	X	X
<b>Reverse osmosis systems/RO</b>				
Measurement of conductivity	X	X	X	X
Testing of overall function and settings for the RO system	X	X	X	X
Leak testing	X	X	X	X
Performance test (produced water, drain water)	X	X	X	X
Testing of valves	X	X	X	X
Replacement of sterile breather filter		X	X	X
Testing of membrane and replacement if necessary	X	X	X	X
Disinfection / cleaning of tank	X	X	X	X
<b>UV system</b>				
Functional testing of UV systems	X	X	X	X
Cleaning of quartz glass on UV systems	X	X	X	
Replacement of UV-lamp		X	X	X
Replacement of quartz glass				X
<b>Humidity sensors</b>				
Testing and adjusting of humidity sensors. Replaced if +/- 10% deviation	X	X	X	X
Checking of max humidity controller (max hygrostat)	X	X	X	X
<b>Control units</b>				
Analysis and testing of programming	X	X	X	X
Transfer relay replacement		X	X	X
Testing of contact K1 and replacement if necessary		X	X	X
<b>Hygiene</b>				
Extraction of water sample from pump (Bacterie test)	X	X	X	X
Disinfection of the system	X	X	X	X

## 9.3 Spare Parts List

Part Description	P/N	MLPRO						Service Cycle
		300		500		800		
		208V	480V	208V	480V	208V	480V	
<b>Water Filters</b>								
20" 5-Micron sediment filter	2300221	1		1		1		3 mo
5" 5-Micron sediment filter (if DI used)	2576615	1		1		1		3 mo
O-ring for filterhouse (only 1 if no DI)	430020050	2		2		2		12 mo
<b>UV Lamps</b>								
8400902 UV lamp for 2GPM Unit - S2Q-PA	2300241	1		1		0		12 mo
8400903 UV lamp for 5GPM - S5Q-PA	2300243	0		0		2		12 mo
<b>Quartz Sleeves</b>								
Quartz Sleeve (QS-330) for S2Q-PA	2300236	1		1		0		24 mo
Quartz Sleeve (QS-463) for S5Q-PA UV	2300237	0		0		2		24 mo
<b>RO Tank Filter</b>								
Filter Sterile breather 0,2 micron RO	104581000	1		1		1		12 mo
<b>RO Membrane</b>								
Membrane 4"x40" 2400-15000	2300201	1		2		3		24 mo
O' ring #210 for 4" s/s	2300113	2		4		6		24 mo
O' ring #342 4" S/S end cap external	2300116	2		4		6		24 mo
<b>Electrical Control System</b>								
Thermal relay 2.2-3.2 A	349010209	0	2	0	0	0	0	36 mo
Thermal relay 4.5-6.3 A	349010203	2	0	0	0	0	3	36 mo
Thermal relay 5.5-8.0 A	349010212	0	0	2	0	0	0	36 mo
Thermal relay 7.0-10.0 A	349010213	0	0	0	0	3	0	36 mo
Thermal relay 2.8-4.8 A	349010202	0	0	0	2	0	0	36 mo
Contaktor, Siemens 230VAC 9A - S00	349010205	2	2	2	2	3	3	36 mo
Relay, Print frame relay	680010177	6		6		6		12 mo
<b>High Pressure Pumps</b>								
Service kit PAHT 4/6.3	104466002	1		1		0		24 mo/8000 hr
Service kit PAHT 10/12.5	104466003	0		0		1		24 mo/8000 hr
<b>Pressure Regulator</b>								
Service kit pressure regulator	104481000	1		1		1		12 mo
Gasket 1/2" connection hose	705020042	2		2		2		12 mo
Gasket 3/4" connection hose	705020043	2		2		2		12 mo
<b>Check Valves</b>								
Check valve 1/4" high pressure	510020000	1		0		0		24 mo
Check valve 3/8" high pressure	510020005	0		1		1		24 mo
<b>Nozzles</b>								
Nozzle Complete stainless 2,5 l/h	103160000	5% of total		5% of total		5% of total		12 mo
Nozzle Complete stainless 4,5 l/h	103150000	5% of total		5% of total		5% of total		12 mo
<b>Disinfection</b>								
Disinfection, Sanosil HM10 Ag 5% - quart	2300001	1		2		0		12 mo
Disinfection, Sanosil HM10 Ag 5% - Gallon	2587665	0		0		2		12 mo
<b>Test Strips</b>								
HACH Test Strips 5-in-1 50 strips	2300144	1		1		1		12 mo





## 9.5 Troubleshooting

### Qualification of personnel

Have faults eliminated by qualified and trained personnel only. Malfunctions caused by the electrical installation must only be repaired by authorised personnel (e.g. electrician).

### Safety

When eliminating faults, the MLP RO must be taken out of operation and prevented from further inadvertent operation.

Make sure the power supply to the MLP RO is disconnected and the water supply is cut off.

### 9.5.1 Condair ML General Troubleshooting

The following table provides malfunctions that do not trigger messages about the cause of the malfunction or information on how to eliminate the source of the malfunction.

Problem	Probable Cause	Corrective Action(s)
<b>Control unit is switched on but the display does not show anything.</b>	Main power supply is off.	Switch power on.
	Fuses of the power supply line blown.	Have an electrician replace fuses of the power supply line.
	Fuse of control unit blown.	Have an electrician replace fuse of the control unit.
	Display or control board defective.	Have a Condair service technician replace the display or the control board.
	Thermal motor protection relay activated.	Motor overheated, pump damaged/ blocked, check pump is running freely. Check power consumption at full load correspond to motor specifications.
<b>Water's dripping from modules/flex/ nozzles</b>	Defect / clogged nozzles	Replace nozzles
	Zone valves defect / leaking	Repair valves
	Air in system	Air the entire system
	Pressure too low	Check / repair PAHT pump
	Water below 5 µS/cm	Adjust RO pressure
<b>Condair MLP RO humidifies permanently.</b>	Nominal humidity value too high.	Reduce nominal humidity value.
	Ambient humidity very low.	No measures to be taken, just wait.
	The internal controller is activated, although an external controller is connected	Deactivate internal controller.

<b>Problem</b>	<b>Probable Cause</b>	<b>Corrective Action(s)</b>
<b>Maximum humidification capacity not reached.</b>	Air change to high	Contact your Condair supplier.
	Defective zone valves	Check the function of valves
	Hygrostat defect	Check calibration and function
	Spray nozzles clogged.	Remove nozzles and replace them
	Hoses to nozzle pipes are leaking or disconnected, or nozzle pipes are leaking.	Check hoses/nozzle pipes and seal, as required
<b>Control unit is switched on but the display of the control unit does not show anything.</b>	Service switch in power supply line is off.	Set service switch in power supply line to On position.
	Fuses of the power supply line blown	Have an electrician replace fuses of the power supply line.
	Fuse of control unit blown	Have an electrician replace fuse of the control unit.
	Display or control board defective	Have a Condair service technician replace the display or the control board.

### 9.5.2 Condair ML Error Messages and Alarms

<b>Error message</b>	<b>Probable Cause</b>	<b>Corrective Action(s)</b>
<b>Max. humidistat</b>	Max. humidistat has been tripped, due to high humidity	Check that ventilation is on Set point is correct Incoming set point signal OK
	Max. humidistat defect or incorrectly set	Change max. humidistat Set correct rel. humidity, e.g. 85% RH
	Max. humidistat circuit damaged or not installed correctly	Check circuit for faults Check settings for max. humidistat in controller are correct If no max. humidistat, a jumper must be installed over terminals (4 & 4+)
<b>Inlet water pressure too low</b>	The inlet water pressure is too low	Check the inlet pressure at maximum flow for pump station according to product data
	The Inlet water pressure is too low for short periods (if inlet pressure and flow seems ok when measured)	Check the water installation for periodically high consumption e.g. cleaning, tank filling and maintenance work
	Defect Inlet pressure switch [PS]	Replace pressure switch
<b>Sensor error</b>	Humidity sensor missing or defect	Install humidity sensor
	Wiring to humidity sensor damaged or incorrectly installed	Replace wiring according to electrical diagram
	Humidity outside range (below 20% RH or above 80% RH)	Check the humidity at sensor and reset if below 20% RH
	Sensor scaling is wrong	Scale the sensor correctly in the controller

<b>Error message</b>	<b>Probable Cause</b>	<b>Corrective Action(s)</b>
<b>Emptying tank - water too hot</b>	Ambient temperature too high at pump location (max. 77 °F (25 °C))	Lower ambient temperature in pump room (max. 77 °F (25 °C))
<b>Stop - Pump too hot</b>	Water flow through high-pressure pump too low	Check flush valve MV5 at step valve block opens and nozzle are not clogged
	Ambient temperature too high at pump location (max. 77 °F (25 °C))	Lower ambient temperature in pump room (max. 77 °F (25 °C))
	Incoming water too warm	Lower inlet water temperature (max. 59 °F (15 °C))
	Inlet pressure / flow missing	Defect inlet valve [MV1] Water supply blocked / closed
	Damaged thermostat or cable [T]	Change thermostat and cable
	High-pressure pump defective	Locate cause of failure, e.g. running hours exceeded 8,000, particles / dirt in system, missing water pressure, defect inlet valve. Change pump when cause of failure has been established and corrected
<b>Tank full</b>	Tank maximum level / overflow has been detected.	RO pump running? Check if the motor start relay is jammed.
	Inlet valve [MV1] leaks.	Change / repair valve.
	Level sensor error.	Check settings in software is correct for the tank size. Replace level sensor.
<b>EC to high after mix-bed</b>	The selected alarm limit is reached.	Mix bed filter full, change filter.
		Alarm limit set incorrectly. (screen 3.3) Alarm Delay to short.
		EC scaling needs to be done. (screen 3.3.1)
<b>EC to high RO membrane</b>	The selected alarm limit is reached.	Membrane warn or RO loop needs to be adjusted.
		Alarm limit set incorrectly (screen 3.3) Alarm Delay to short.
		EC scaling needs to be done. (screen 3.3.1)
<b>Water quality – EC too low or too high</b>	The selected alarm limit is reached.	Alarm limit set incorrectly. (screen 3.3)
		EC scaling needs to be done. (screen 3.3.1)
<b>CIP overdosing last day</b>	Self-monitoring system detects the CIP pump has been running too much in 24 hours cycle.	Press reset and check CIP pump for errors.
<b>CIP pump error</b>	General error detected.	Air the CIP-pump, listen for noise and check pressure.

<b>Error message</b>	<b>Probable Cause</b>	<b>Corrective Action(s)</b>
<b>CIP pump low dosing</b>	Insufficient CIP volume detected.	Check / refill CIP fluid. Air the CIP-pump.
<b>UV lamp error</b>	UV-Bulb or power supply error.	Replace UV-bulb.
		Check/replace power. Supply/transformer.
<b>UV lamp getting old</b>	Less than 3 weeks to UV lamp should be serviced.	Plan service. Reset timer.
<b>UV lamp too old</b>	Time to service UV lamp.	Service the UV lamp according to guide.
<b>Add On box EC-reg error</b>	Choices in the controller does not match the box detected in the network.	Change setting in controller.
<b>Add On box CIP error</b>	Choices in the controller does not match the box detected in the network.	Change setting in controller.
<b>Add On box (EC or CIP) common error</b>	Lost communication to add on box.	Power to EC box disconnected.
		Network cable to EC box disconnected. <sup>72</sup>

### 9.5.3 Resetting Fault Status

Reset a condition in the humidifier with a "Fault" status as follows:

Press the reset button underneath the touch screen.

Note: If the fault has not been eliminated, the error indication reappears after a short while.

# 10 Product Specifications

	MLP RO 100	MLP RO 300	MLP RO 500	MLP RO 800
Capacity, 50 & 60 Hz (Inlet water temp 59 °F (15 °C))	260 lb/h (100 l/h)	700 lb/h (265 l/h)	1161 lb/h (440 l/h)	2085 lb/h (750 l/h)
Water consumption	0.88 gpm (200 l/h)	2.64 gpm (600 l/h)	3.1 gpm (700 l/h)	4.8 gpm (1100 l/h)
Water supply dynamic pressure	36 - 101 psi (2.5 - 7.0 bar)	36 - 101 psi (2.5 - 7.0 bar)	36 - 101 psi (2.5 - 7.0 bar)	36 - 101 psi (2.5 - 7.0 bar)
Softened water recommended	no	no	yes	yes
Water out µS/cm	5< EC< 30	5< EC< 30	5< EC< 30	5< EC< 30
Permeate/Concentrate ratio	55/45	55/45	75/25	75/25
Saline retention	> 95 %	> 95 %	> 95 %	> 95 %
Dimensions w x d x h	34" x 28" x 63" (860x700x1600mm)	34" x 28" x 63" (860x700x1600mm)	34" x 28" x 63" (860x700x1600mm)	34" x 28" x 63" (860x700x1600mm)
Extern RO-tank	13.2 gal (60 l)	13.2 gal (60 l)	52.8 gal (240 l)	132 gal (600 l)
Dimensions Extern RO-tank w x d x h	integrated	integrated	24" x 34" x 37.6" 600x600x955mm	31.5" x 31.5" x 49" 800x800x1250mm
Weight Pump	275 lb (125 kg)	286 lb (130 kg)	485 lb (220 kg)	551 lb (250 kg)
Sound pressure level	< 75 dB(A)	< 75 dB(A)	< 75 dB(A)	< 75 dB(A)
High pressure outlet	1 x 1/4" HPF	1 x 1/4" HPF	1 x 3/8" HPF	1 x 3/8" HPF
Pipe diameter - inlet, "RG	3/4"	3/4"	3/4"	3/4"
Pipe diameter - Drain "RG	3/4"	3/4"	3/4"	3/4"
IP class	IP54	IP54	IP54	IP54
<b>50 Hz</b>				
Electrical conn. 3-phased	Un = 220-240 V			
Absorbed Power [kW]	0.9	1.1	2.1	3
kW -RO	0.37	0.75	0.75	0.75
Pre fuse	16 A	16 A	20 A	25 A
Electrical conn. 3-phased	Un = 308-415 V			
Absorbed Power [kW]	0.9	1.1	2.1	3
kW -RO	0.37	0.75	0.75	0.75
Pre fuse	16 A	16 A	16 A	16 A
<b>60 Hz</b>				
Electrical conn. 3-phased	Un = 208-277 V			
Absorbed Power [kW]	0.9	1.1	2.1	3
kW -RO	0.37	0.75	0.75	0.75
Pre fuse	16 A	16 A	20 A	20 A
Electrical conn. 3-phased	Un = 400-480 V			
Absorbed Power [kW]	0.9	1.1	2.1	3
kW -RO	0.37	0.75	0.75	0.75
Pre fuse	16 A	16 A	20 A	20 A

# 11 Declaration of conformity



## EC - Declaration of Compliance

**Manufacturer:**  
Condair A/S  
Parallelvej 2  
DK-8680 Ry

**We hereby declare, that the following pump systems for humidification purposes:**

ML RO 100; ML RO 300; ML RO 500; ML RO 800; ML RO 1000; ML RO 1500;  
HP 100; HP 200 VFD; HP 300; HP 500; HP 500 VFD; HP 800; HP 800 VFD; HP 1300 VFD  
HP RO 100; HP RO 200 VFD; HP RO 300; HP RO 500; HP RO 500 VFD; HP RO 800; HP RO 800 VFD  
MLP 100; MLP 300; MLP 500; MLP 800; MLP 1000; MLP 2x800; MLP 2x1000; MLP 3x800; MLP 3x1000 MLP RO 100; MLP RO 300;  
MLP RO 500; MLP RO 800  
MLP HRO 100; MLP HRO 300  
MLPD 300; MLPD 500; MLPD 1000;  
MLPG 100; MLPG 300; MLPG 500; MLPG 800; MLPG 1000;  
RTN 200; RTN 500

**Are manufactured in accordance with the following EC directives:**

- 2006/42/EC, Directive on machinery
- 2014/30/EC, EMC (ElectroMagnetic Compatibility) Directive
- 2014/35/EC, The low voltage directive
- 2011/65/EC, ROHS Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

**The following harmonized standards have been applied:**

- EN ISO 12100:2011, Safety of machinery – General principles for design – Risk assessment and risk reduction
- EN ISO 13849-1:2008, Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design.
- EN 55022:2011+AC, Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
- EN 60204-1:2006 + amendments, Safety of machinery – Electrical equipment of machines – Part 1: General requirements

**The following international standards and technical specifications are used:**

- IEC 60034-1 ed. 12.0, Rotating electrical machines - Part 1: Rating and performance
- IEC 60034-5 ed. 4.1, Rotating electrical machines - Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) – Classification
- IEC 60034-6 ed. 2.0, Rotating electrical machines - Part 6: Methods of cooling (IC Code)
- IEC 60034-8 ed. 3.1, Rotating electrical machines - Part 8: Terminal markings and direction of rotation
- IEC 60320 ed. 2.1, Appliance couplers for household and similar general purposes - Part 1: General requirements

DK-Ry, February 25, 2016

Lasse Andresen, Technical Manager

Condair A/S  
Parallelvej 2, DK-8680 Ry  
Tel. +45 8788 2100  
www.condairsystems.dk

## EC - Konformitätserklärung

**Hersteller:**  
Condair A/S  
Parallelvej 2  
DK-8680 Ry

**Wir erklären hiermit, dass die folgenden Pumpensysteme für Befeuchtungszwecke:**

**In Übereinstimmung mit den folgenden EG-Richtlinien hergestellt werden:**

**Folgende harmonisierte Normen wurden angewende:**

**Folgende internationale Normen und technische Spezifikationen werden verwendet:**

# A Appendix

## A.1 Modbus TCP/IP Gateway IP translator (option)

Connect the MODBUS TCP/IP, to a sub net for Condair Ltd..

Allan Bradley 9300-ENA

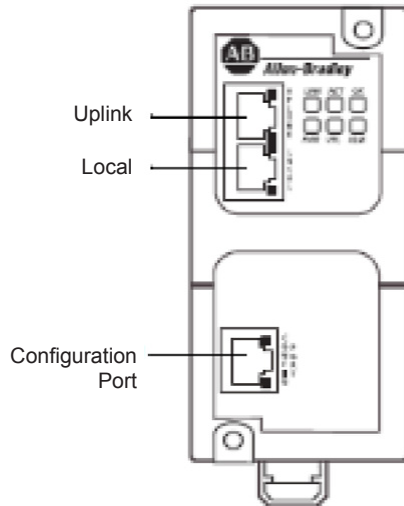
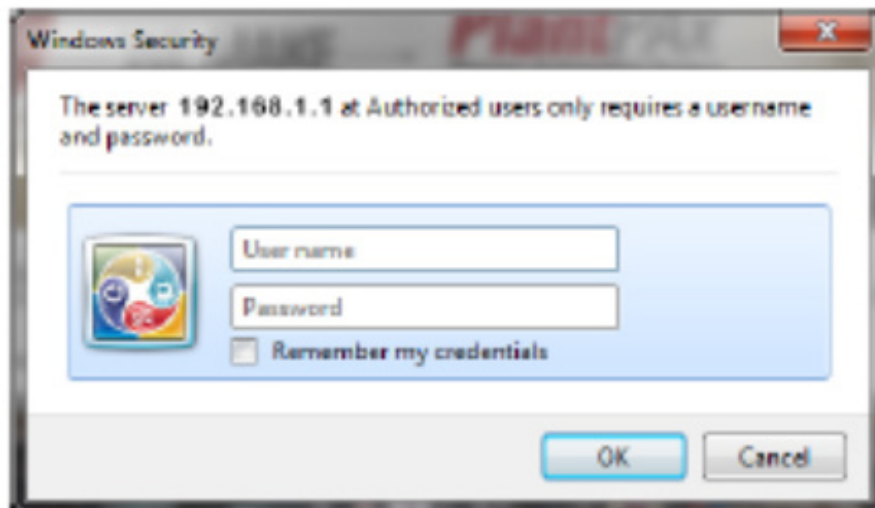


Figure 30: Allan Bradley 9300-ENA

Change your IP on your PC's **network interface controller** to **192.168.1.3** and the **Subnet mask** to **255.255.255.0**

**Connect to the Allan Bradley 9300-ENA Unit according to the following steps:**

1. Open a browser window
2. Enter the default IP address of 192.168.1.1 in the address bar, press Enter, and note the following defaults
  - \*Username should be left blank
  - \*password is PASSWORD





Allen-Bradley 9300-ENA

Expand Minimize

Home

Basic Configuration

- Network
- Security
- Miscellaneous

Applications

- 1:1 NAT
- Discovery

System

- Backup/Restore
- Performance
- Restart/Reset
- Support
- Upgrade Firmware

Network Configuration

**Uplink Interface (Public)**

IP Address: 10.20.30.1

Subnet Mask: 255.255.255.0

Default Gateway: 0.0.0.0

Allow Configuration: Disabled

**Local Interface (Private)**

IP Address: 192.168.100.200

Subnet Mask: 255.255.255.0

Allow Configuration: Disabled

**Configuration Interface**


DHCP Client: Enabled

Assigned IP Address: 192.168.1.1 (default)

Assigned Subnet Mask: 255.255.255.0 (default)

Apply Changes Discard

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UPLINK

LOCAL

CONFIG

Public IP address for the module. Change the IP to fit to the network for the CTS/BMS system.

Allen-Bradley 9300-ENA

Expand Minimize

Home

Basic Configuration

- Network
- Security
- Miscellaneous

Applications

- 1:1 NAT
- Discovery

System

- Backup/Restore
- Performance
- Restart/Reset
- Support
- Upgrade Firmware

Configuration

Basic Example Advanced Example Factory Cells Example

**Network Address Translation**

1:1 NAT: Enabled

**Network Address Translation Rules**

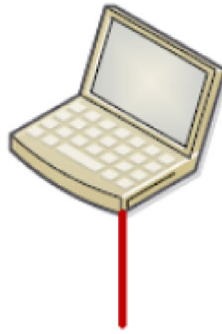
Active	Public IP (Range)	Private IP (Range)	Comment	Edit / Del
<input checked="" type="checkbox"/>	10.20.30.5	192.168.100.220	MODBUS to PLC	
	New IP Range	New IP Address Range		

Apply Configuration applied successfully

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Public IP address for the MODBUS connection. Change the IP to fit to the network for CTS/BMS system. Use this address in the MODBUS connection as server/slave address.

Example net 10.20.30.xx



10.20.30.10

GW = None (no L3 switch or router)



10.20.30.1 (Public IP)

GW = None (no L3 switch or router)

1:1 NAT rules	
Public	Private
10.20.30.5	192.168.100.220



192.168.100.200 (Private IP)

**IMPORTANT!!!!**  
The machine's new gateway is the IP address of the ENA private port (192.168.100.200)

Public address of the machine is 10.20.30.5



PLC  
192.168.100.220



Touch screen

GW = 192.168.100.200

## A.2 Optional Modbus TCP/IP

### MODBUS communication TCP/IP

ML-System humidification controls with PLC control is available with an option that allows connection to CTS / BMS systems via Modbus TCP / IP.

The physical connection is made with a standard Ethernet cable that connects the PLC controller with a standard RJ45 connector.

The option includes changes in the software, and a list of setup and the addresses of parameters to be transferred between the PLC system and CTS / BMS.

The connection gives actual humidity for each section and general information on the system status. And it is possible to change setpoint from the BMS system. In addition, there is also a current "status" integer that describes the plant's operational status so alarms can be transferred to the BMS.

**The Modbus TCP / IP connection is set up with ML-System's PLC as Server/(slave) – and the BMS as a client/(master).**

IP PLC:	192.168.135.220	Subnet mask	255.255.255.0
Connect ID	1		
Port	502		
MB Data addresses	40001 – 40033		
Data format	Integer (int)		

Setpoint 1	R	Integer	40001	%RH
Setpoint 2	R	Integer	40002	%RH
Setpoint 3	R	Integer	40003	%RH
Setpoint 4	R	Integer	40004	%RH
Setpoint 5	R	Integer	40005	%RH
Setpoint 6	R	Integer	40006	%RH
Setpoint 7	R	Integer	40007	%RH
Setpoint 8	R	Integer	40008	%RH
Setpoint 9	R	Integer	40009	%RH
Setpoint 10	R	Integer	40010	%RH
Setpoint 11	R	Integer	40011	%RH
Setpoint 12	R	Integer	40012	%RH
Humidity 1	W	Integer	40013	%RH
Humidity 2	W	Integer	40014	%RH
Humidity 3	W	Integer	40015	%RH
Humidity 4	W	Integer	40016	%RH
Humidity 5	W	Integer	40017	%RH
Humidity 6	W	Integer	40018	%RH

Humidity 7	W	Integer	40019	%RH
Humidity 8	W	Integer	40020	%RH
Humidity 9	W	Integer	40021	%RH
Humidity 10	W	Integer	40022	%RH
Humidity 11	W	Integer	40023	%RH
Humidity 12	W	Integer	40024	%RH
Tank level	W	Integer	40025	%
Actual flow	W	Integer	40026	l/h (lb/h)
EC Ro	W	Integer	40027	µS
EC MB1	W	Integer	40028	µS
EC MB2	W	Integer	40029	µS
EC tank	W	Integer	40030	µS
Status mode	W	Integer	40031	
On/Off	W	Boolean	40032.1	
alarm general	W	Boolean	40032.2	
Level in tank ok	W	Boolean	40032.3	
Water pressure low	W	Boolean	40032.4	
Pump overheated	W	Boolean	40032.5	
Pump2 overheated	W	Boolean	40032.6	
tank overfull	W	Boolean	40032.7	
UV error	W	Boolean	40032.8	
UV age warning	W	Boolean	40032.9	
UV age alarm	W	Boolean	40032.10	
Sensor error	W	Boolean	40032.11	
MaxHyg error	W	Boolean	40032.12	
Cip Alarm	W	Boolean	40032.13	
EC RO alarm	W	Boolean	40032.14	
EC MB1 alarm	W	Boolean	40032.15	
EC MB2 alarm	W	Boolean	40032.16	
EC tank high alarm	W	Boolean	40033.1	
EC tank low alarm	W	Boolean	40033.2	
Too many pump stopped	W	Boolean	40033.3	
Internal setpoint	W	Boolean	40033.4	
Not used	W	Boolean	40033.5	
Not used	W	Boolean	40033.6	
Not used	W	Boolean	40033.7	
Not used	W	Boolean	40033.8	
Not used	W	Boolean	40033.9	

Not used	W	Boolean	40033.10	
Not used	W	Boolean	40033.11	
Not used	W	Boolean	40033.12	
Not used	W	Boolean	40033.13	
Not used	W	Boolean	40033.14	
Not used	W	Boolean	40033.15	
Not used	W	Boolean	40033.16	

### A.3 Setpoint

The ON-time for the pump, when the humidity is between setpoint and (setpoint - proportional band), can be calculated after the formula:

$$T(\text{on}) = \text{Period time} \times (1 - (\text{humidity level} - \text{Setpoint} + \text{Pro.band})/\text{Pro.band})$$

**Example:** Period time: 3 min., Setpoint: 80% RH, Pro.band: 30%, Minimum ON-time 0,2 min.

**With the values from the example above the ON-time for 78, 70 or 60% RH is calculated:**

If the humidity level in the room is 78% RH, the ON-time for the pump is:

$$T(\text{on}) = 3 \times (1 - (78 - 80 + 30)/30) = 3 \times (1 - 0.933) = 0,20 \text{ min.} = 12 \text{ sec.}$$

If the humidity level in the room is 70% RH, the ON-time for the pump is:

$$T(\text{on}) = 3 \times (1 - (70 - 80 + 30)/30) = 3 \times (1 - 0.667) = 1.00 \text{ min.}$$

If the humidity level in the room drops to 60% RH, the ON-time for the pump is:

$$T(\text{on}) = 3 \times (1 - (60 - 80 + 30)/30) = 3 \times (1 - 0.333) = 2.00 \text{ min.}$$

---

**New Proportional band:** If the proportional band in the above example is reduced to 20% instead, the ON-time for the pump will change quicker when the humidity drops in the room.

Period time: 3 min., Setpoint: 80% RH, **Pro.band:** 20%, Minimum ON-time 0.2 min.

If the humidity level in the room is 78% RH, the ON-time for the pump is:

$$T(\text{on}) = 3 \times (1 - (78 - 80 + 20)/20) = 3 \times (1 - 0.90) = 0.30 \text{ min.} = 18 \text{ sec.}$$

If the humidity level in the room is 70% RH, the ON-time for the pump is:

$$T(\text{on}) = 3 \times (1 - (70 - 80 + 20)/20) = 3 \times (1 - 0.50) = 1.50 \text{ min.}$$

If the humidity level in the room drops to 60% RH, the ON-time for the pump is:

$$T(\text{on}) = 3 \times (1 - (60 - 80 + 20)/20) = 3 \times (1 - 0.0) = 3.00 \text{ min. (100%).}$$

If the humidity level in the room drops below 60% RH, (setpoint - pro. band) the pump will run all the time - Minimum OFF-time (PAU).

Note that the running time of the pump changes quicker when the proportional band is lower.

---

New Period time: If the period time is changed, the ON- and OFF-times will change accordingly.

Example: Period time in the example changes from 3 to 5 min.

Period time: 5 min., Setpoint: 80% RH, Pro. band: 20%, Minimum ON-time 0.2 min.

If the humidity level is 70% RH, the ON-time for the pump will be:

$$T(\text{on}) = 5 \times (1 - (70 - 80 + 20)/20) = 5 \times (1 - 0,50) = 2.50 \text{ min.}$$

## A.4 Temperature Sensor

- TS-PT1000 is a PT1000 temperature sensor mounted in stainless steel AISI304 housing
- M12 sensor connector.
- Accuracy:            $\pm 0.54^{\circ}\text{F @ } 32^{\circ}\text{F}$   
                               $\pm 1.26^{\circ}\text{F @ } 176^{\circ}\text{F}$
- 3 types of thread available:
  - M6
  - 1/8" pipe thread
  - 1/4" pipe thread

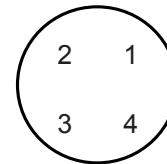
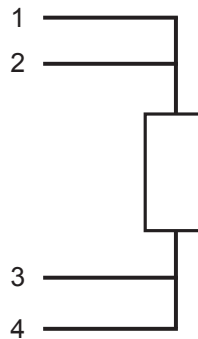


### Connection

PT1000 sensor element:

pin:

pin numbering, M12 socket



### Environment

Degree of protection:	IP65 (IEC 60529) installed with correct M12 connector
Temperature, operation:	-22 °F to 176 °F
Temperature, stock:	-22 °F to 185 °F

### Mechanical specifications

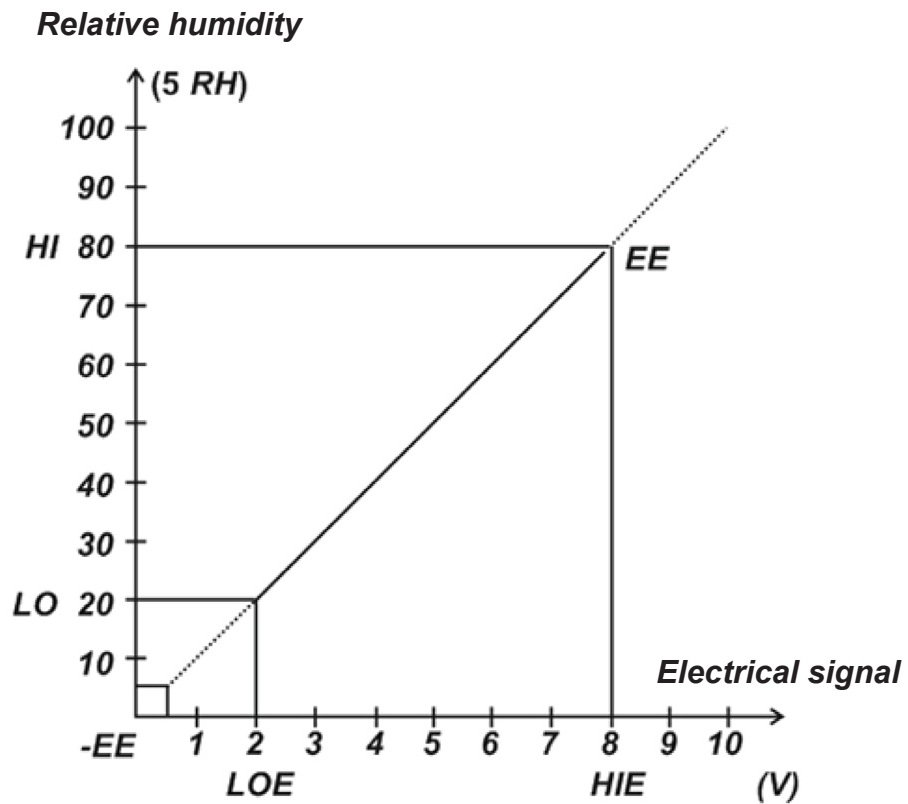
Length:	0.164 inch
Hex width, M6 & 1/8":	0.055 inch
Hex width, 1/4":	0.074 inch
Material, housing:	Stainless steel, AISI 304
Material, M12 socket:	Noryl, black
Weight:	M6 & 1/8": 12 g. 1/4": 21 g.

### Accessories

2 m cable with M12 connector	Note: cable colours: 1 = brown; 2 = white; 3 = blue; 4 = black
Gasket	



## A.5 Electrical Settings in the Humidity Regulator



HIE: Highest electrical input  
LOE: Lowest electrical input  
HI: Highest reading in display  
LO: Lowest reading in display

0-10 minutes after switch on LOE is 0.5 V and LO is 5 % RH  
After 10 minutes LOE changes to 2 V and LO to 20 % RH

# DECLARATION OF CONFORMITY FOR CE CERTIFICATION

In Accordance to ISO/IEC Guide 22

For

WATER SOFTENING UNITS

MANUFACTURER: Kinetico Incorporated  
10845 Kinsman Road  
Newbury, OH 44065  
Phone: 440.564.9111 Fax: 440.564.4407

MODEL NUMBERS: 2020C, 2025S, 2030S, 2050S, 2060S, 2100S, 2175S,  
4050S, 2060S OD, 2100S OD, HT613, HT618, HT621,  
CC206C, CC208C, 2175S, CP213S OD, CP216S OD

REPORT NUMBERS: AAAQ1594-01S

DIRECTIVE: Low Voltage Directive (72/23/EEC), 1973; including  
Amendment (93/68/EEC), 1993

STANDARD: EN 14743 – Water Equipment Inside Buildings: Softeners –  
Requirements for Performance, Safety and Testing

TEST FACILITY: F-Squared Laboratories  
26501 Ridge Rd.  
Damascus, MD 20872

The water softening units, model numbers 2020C, 2025S, 2030S, 2050S, 2060S, 2100S, 2175S, 4050S, 2060S OD, 2100S OD, HT613, HT618, HT621, CC206C, CC208C, 2175S, CP213S OD, CP216S OD are in effective conformance to the Directive and Standard referenced above.

Authorized By: Thomas P. Goshe

Thomas P. Goshe  
Standards and Regulatory Compliance Manager  
Kinetico Incorporated  
June 10, 2010

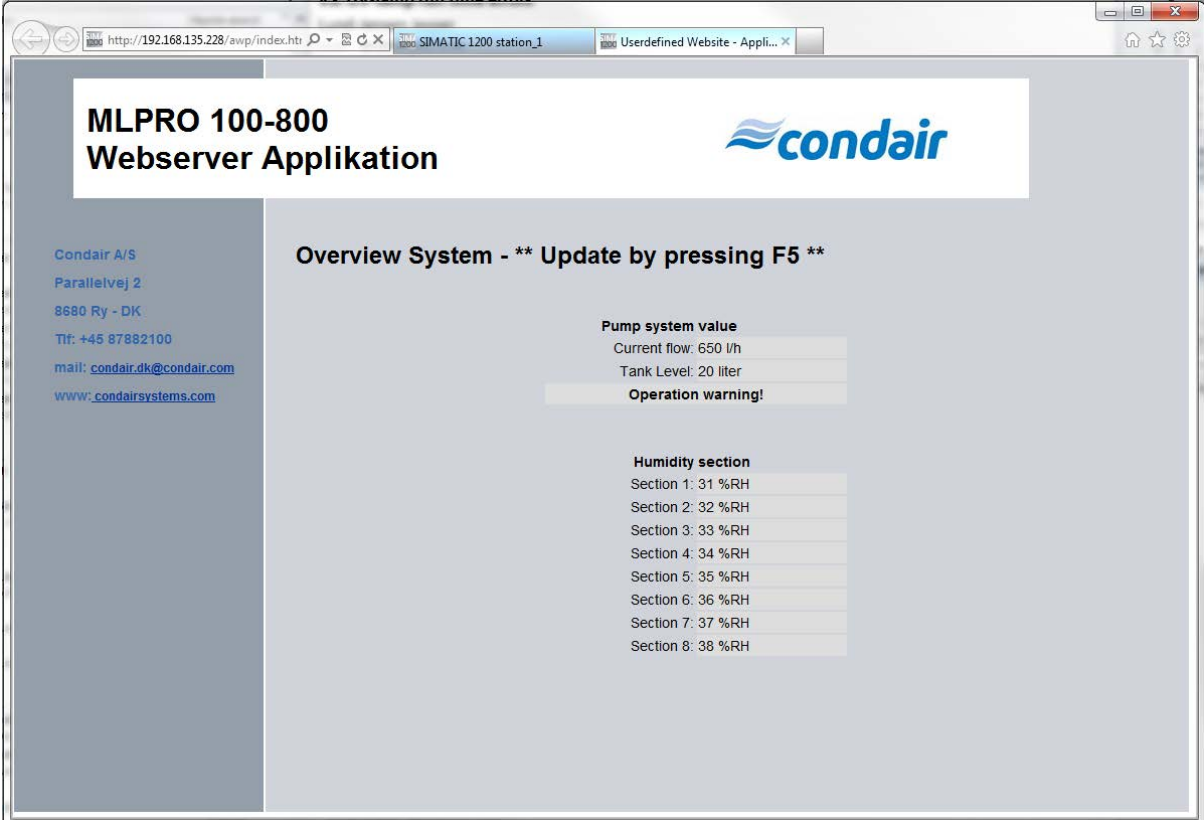
## A.6 ML-system - Condair Ltd.

### Monitoring of humidity and status signals:

As an option the PLC system can through an integrated website be connected to the customer's computer over TCP/IP so that the client can access a page, that shows the status of the system with monitoring of the current humidity in each section.

This page can be opened with most standard browsers - We have tested.

The website in the PLC:



The screenshot shows a web browser window with the following content:

- Page Title:** MLPRO 100-800 Webserver Applikation
- Logo:** condair
- Left Sidebar:**
  - Condair A/S
  - Parallelvej 2
  - 8680 Ry - DK
  - Tlf: +45 87882100
  - mail: [condair.dk@condair.com](mailto:condair.dk@condair.com)
  - www: [condairsystems.com](http://condairsystems.com)
- Main Content:**
  - Overview System - \*\* Update by pressing F5 \*\***
  - Pump system value**
    - Current flow: 650 l/h
    - Tank Level: 20 liter
  - Operation warning!**
  - Humidity section**
    - Section 1: 31 %RH
    - Section 2: 32 %RH
    - Section 3: 33 %RH
    - Section 4: 34 %RH
    - Section 5: 35 %RH
    - Section 6: 36 %RH
    - Section 7: 37 %RH
    - Section 8: 38 %RH

The system displays the current humidity as the page opens - most browsers will then update every 10 seconds. - But you can also manually refresh at any movement by pressing F5.

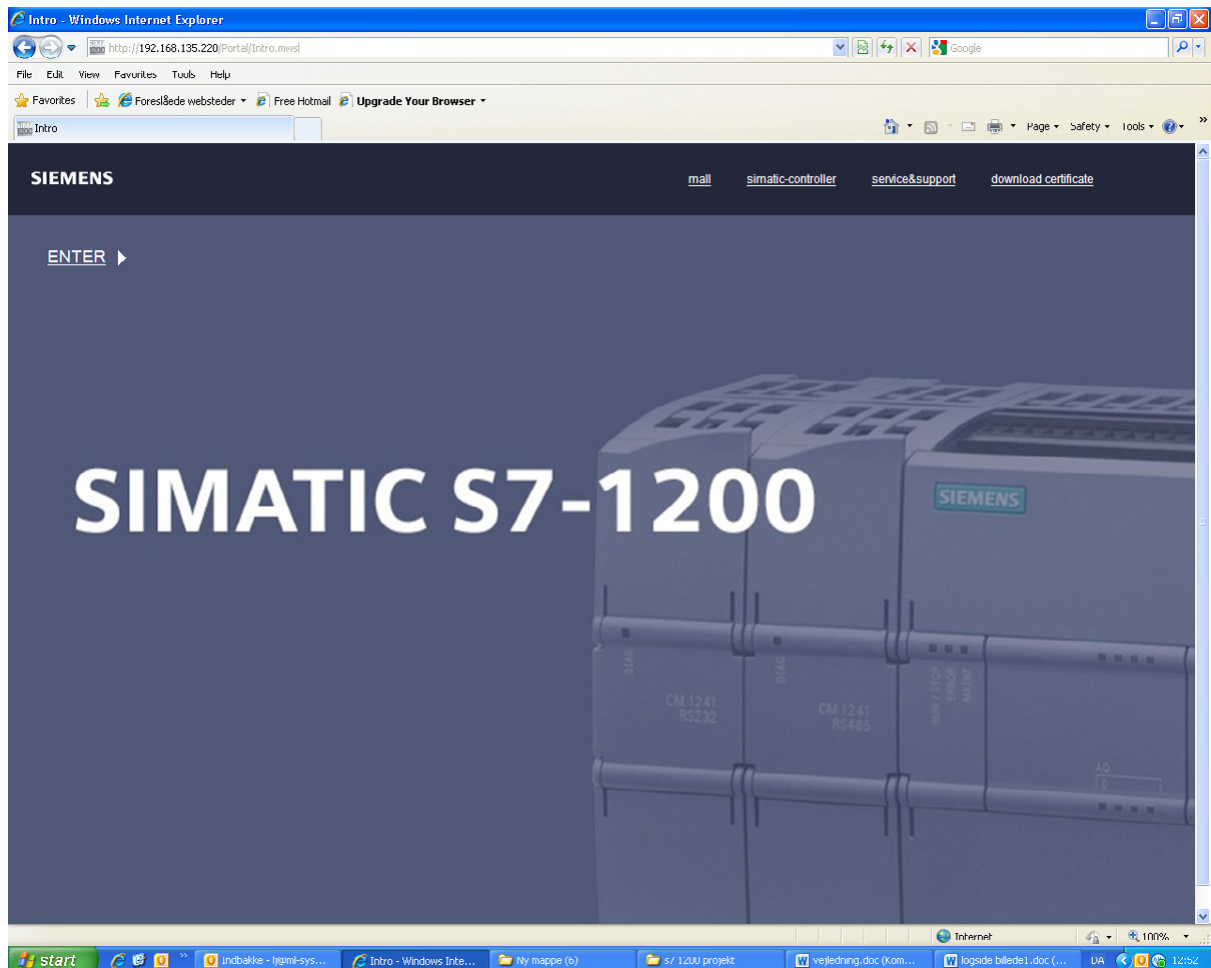
Also shown is a pump station operating status:

- Humidification stopped
- Humidification active
- One or more operating warnings – System still running
- One or more operating alarms – System stopped

In order to obtain access to the data, use an Ethernet connection directly to the PLC system data switch located in the control cabinet to the left of the PLC system.

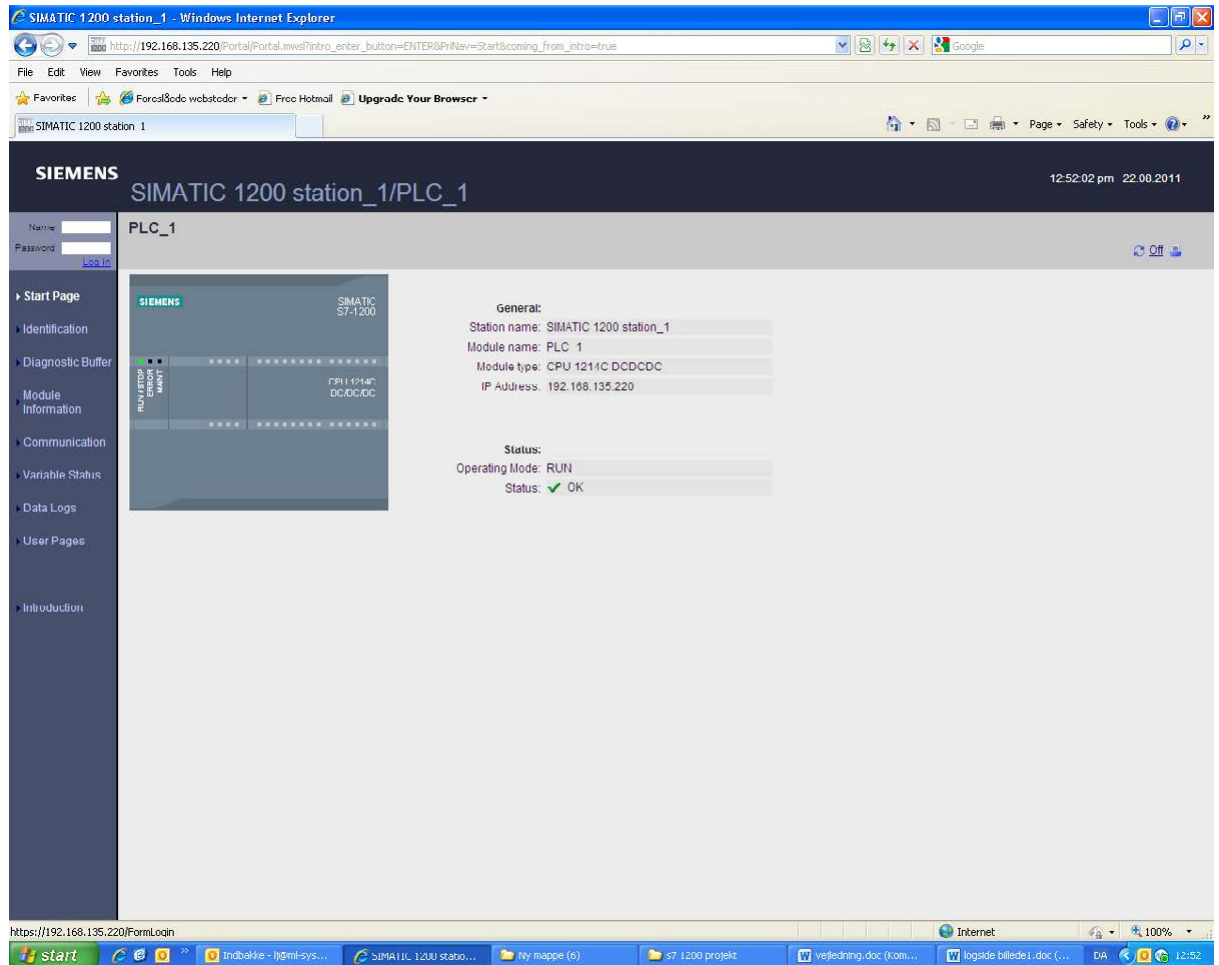
Use a standard web browser and enter the PLC fixed IP address xxx.xxx.xxx.xxx in the address field. This can be done through the company's internal Ethernet network – with separate cable or with a laptop directly into the switch. Perhaps, use a router to get going at this address.

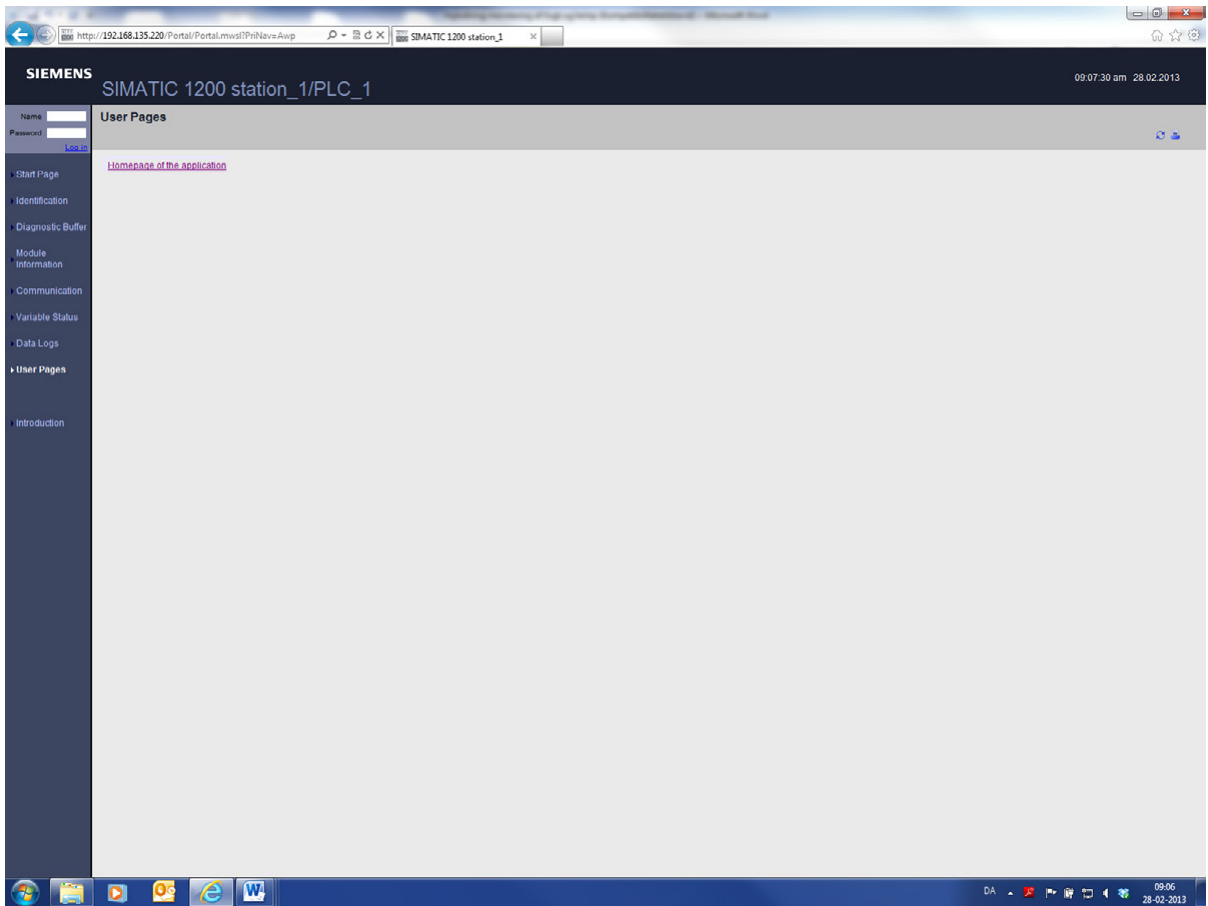
(It is important here to remember that the PC must be located in the same virtual network as the PLC does).



After entering the correct IP address - the following picture appears. Start by downloading and installing Siemens security certificate (download and follow the onscreen instructions).

Then press Enter





Press on the Home Page of the application.

# B Appendix

## B.1 Installation Checklist

The following is a consolidated installation checklist that can be used in the commissioning of the unit:

### Mounting

- Unit installed in the correct location (according to [chapter 4.2 – General Notes on Positioning](#) and [chapter 6.2 – Site Requirements and Sizing](#))?
- Adequate clearance for servicing unit?
- Mounting surface stable, and capable of supporting the full operating weight of the humidifier?
- Unit level?
- Mount humidification heads as per "ML Heads Installation Guide" manual?

### Electrical Connections

- Power supply meet the voltage and current requirements shown on the specification label ([Figure 2 on page 14](#))?
- Power supply have an external dedicated fused disconnect?
- All wiring done according to the wiring diagram and instructions in this manual?
- All cables fastened securely?
- All cables free of tension and pass through cable glands or grommets?
- Electrical installation meet the applicable national and local codes?
- All door panels closed and fastened securely?
- Wire humidification heads according to "ML Heads Installation Guide" manual?

## B.2 Commissioning Checklist

The Condair ML humidifier must always be commissioned for the first time by a service technician from your local Condair representative, by a Condair employee, or by personnel who are well trained and authorized by the customer. It is the customer's responsibility to verify the qualifications of personnel. The intent of the commissioning checklist is to verify that the humidification system has been installed according to the installation manual.

Commissioning of the Condair ML humidifier consists of two steps – an inspection of the site services and the installation prior to start-up, and performance tests of the unit. Complete the "[Pre-Start-Up Checklist](#)" below. Retain this copy in the installation manual, and submit a copy of the completed forms to your local Condair representative.

## B.2.1 Pre-Start-Up Checklist

Inspect the site services and the installation, and fill out the form below.

**Note:** When filling out the form leave the checkbox un-checked if the item does not apply, or if the requirement is not satisfied.

### General data

Serial Number:	
Tag:	
Model:	
Capacity:	
Voltage and Phase:	
Customer/Job:	
Condair representative:	
Customer Address:	
Pump Location:	

### Site Ambient Conditions

Ambient temperature: (Permissible range: 41-95 °F (5-35 °C))	
Ambient humidity level: (Permissible range: 5-95% RH, non-condensing)	

### Site Water Supply

Well water	<input type="checkbox"/>
City water	<input type="checkbox"/>
Softened water	<input type="checkbox"/>
Reverse osmosis (RO)	<input type="checkbox"/>
De-ionized water (DI)	<input type="checkbox"/>

Refer to [Table 1 "Inlet water quality requirements"](#) for water quality requirements. Note: Run the water for approximately five minutes before performing the tests:

Site Water Quality	Measurement <sup>1)</sup>
Conductivity (µS/cm):	
Hardness (gpg):	
Silica (ppm):	
Chlorides (ppm):	
pH level:	

<sup>1)</sup> Test sample must be collected as close as possible to in the humidifier, so that the sample reflects the characteristics of the supply water entering the unit.



### Site Water Supply, continued...

Water supply pressure meets requirement: (Permissible range: 50-100 psig (345-690 kPa),, select checkbox, or enter measurement, as appropriate)	<input type="checkbox"/>	
Water supply temperature meets requirement: (Permissible range: 34-68 °F (1-20 °C), select checkbox, or enter measurement, as appropriate)	<input type="checkbox"/>	
Shutoff valve and union fitting installed upstream (by site):	<input type="checkbox"/>	
No pressure surges: (Surge protection device must be installed, if necessary)	<input type="checkbox"/>	
All debris flushed from supply line:	<input type="checkbox"/>	
No leakages in supply line:	<input type="checkbox"/>	

### Pump Station Mounting

Unit level?	<input type="checkbox"/>
Front clearance:	
Left side clearance:	
Right side clearance:	
Ground clearance:	
Overhead clearance:	

### Electrical Power Connections

Power supply meets voltage and current requirements shown on specification label:	<input type="checkbox"/>
Dedicated external fused disconnect switch installed to local code: (Fusing must not exceed the maximum current rating shown on specification label)	<input type="checkbox"/>
Dedicated external non-fused disconnect switch (if installed) located in vicinity of MLP RO:	<input type="checkbox"/>
Phase-to-phase voltage measurements:	
Proper grounding: (Green wire must be connected to GND in the supply)	<input type="checkbox"/>
All wiring and connectors fastened securely:	<input type="checkbox"/>

## B.2.2 Performance Checklist

Complete the table below. If you would like to break up the number of heads per their respective zones. Indicate the appropriate zone and use more space in the Notes section below, as needed.

Enter all notes and exceptions in the space provided below.

### ML Distribution Heads

Note: For commissioning the distribution system itself, refer to the individual commissioning checklist for the distribution system. Please indicate number of Direct Room Humidification Heads per project:

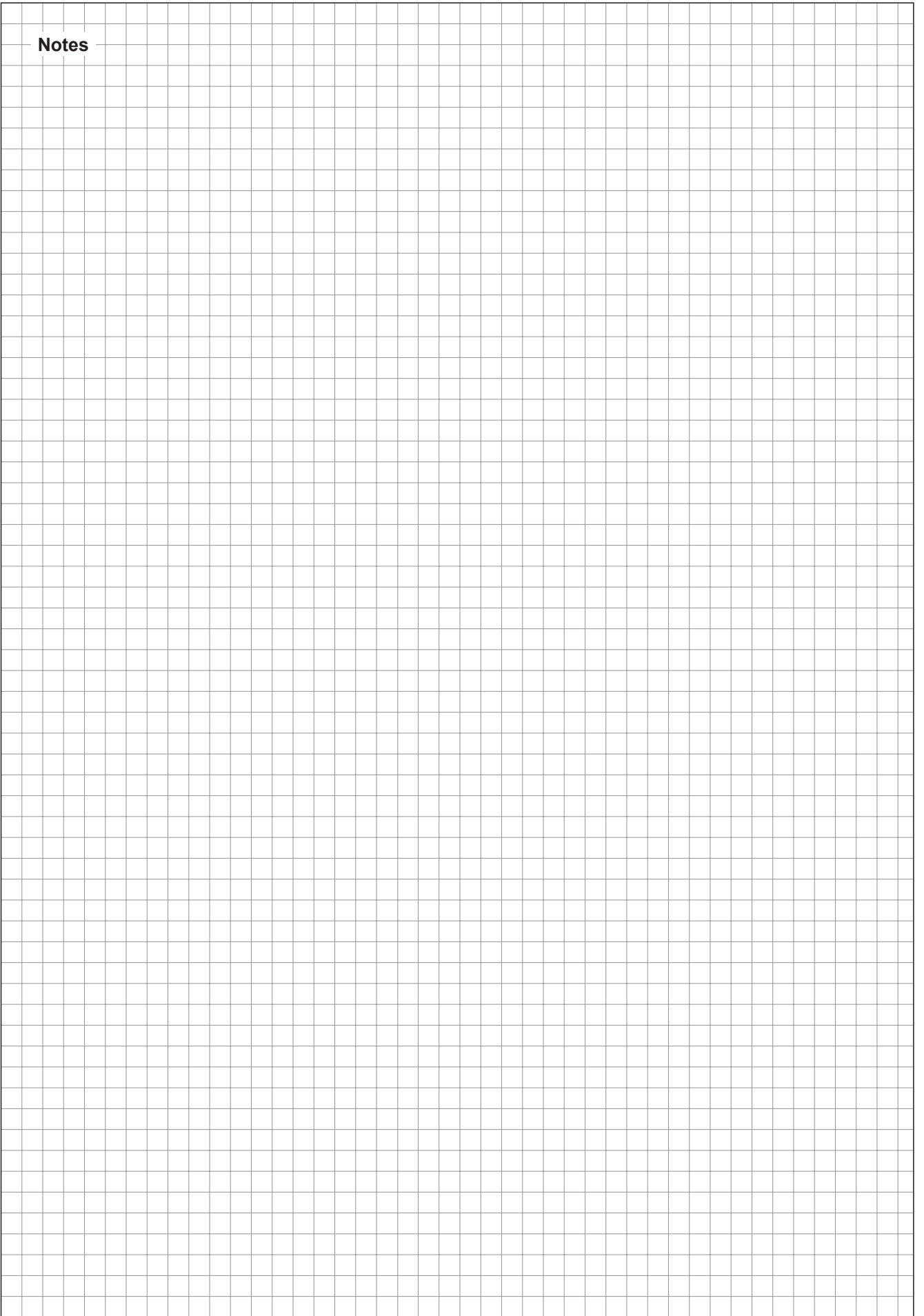
ML Solo	
ML Princess	
ML Flex System	

### Notes

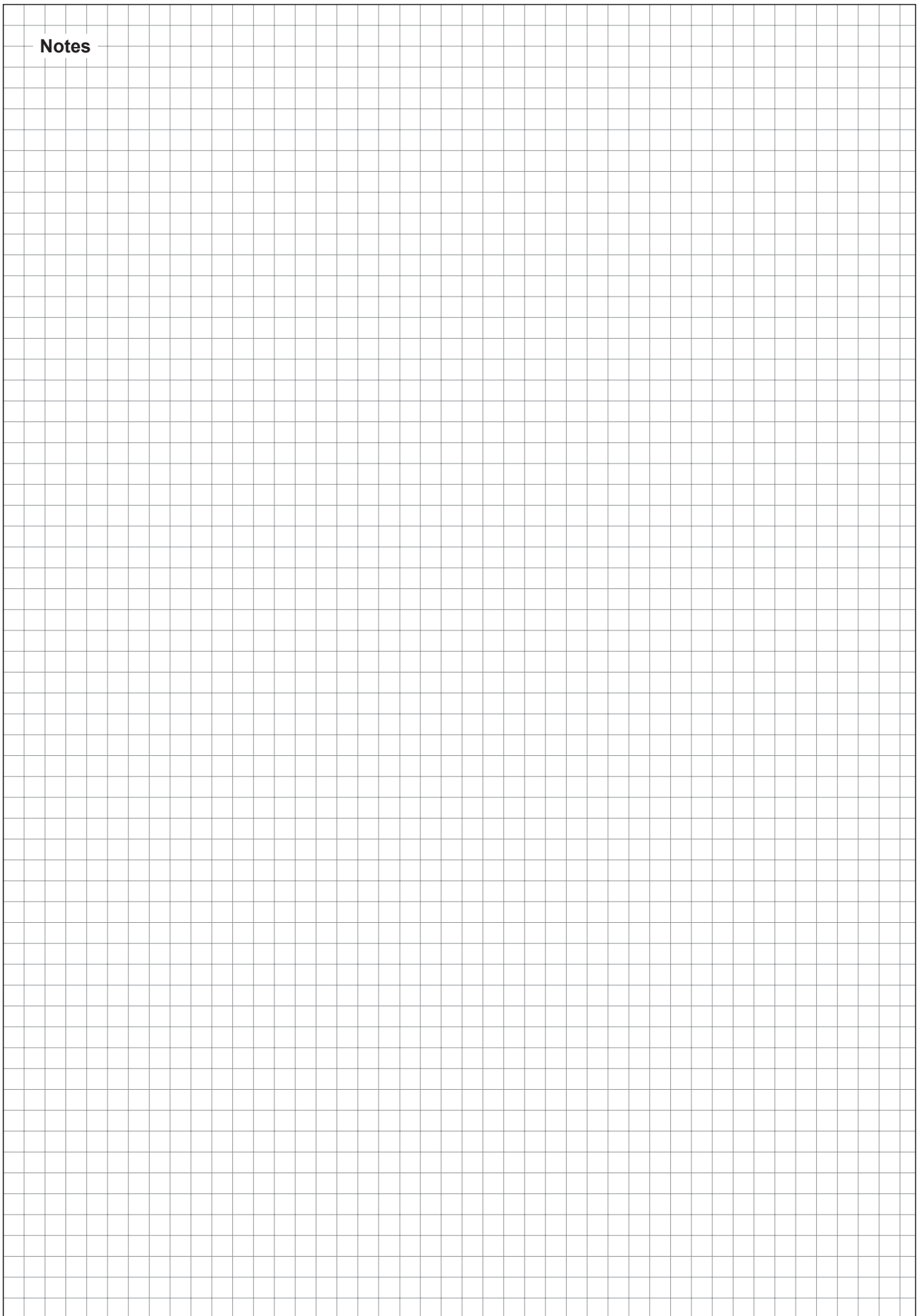
Enter notes and exceptions in the space below.

<b>Notes:</b>			
Commissioned by:		Commissioning Date:	
Company:			

**Notes**



**Notes**



# Warranty

---

Condair Inc. and/or Condair Ltd. (hereinafter collectively referred to as THE COMPANY), warrant for a period of two years after installation or 30 months from manufacturer's ship date, whichever date is earlier, that THE COMPANY's manufactured and assembled products, not otherwise expressly warranted, are free from defects in material and workmanship. No warranty is made against corrosion, deterioration, or suitability of substituted materials used as a result of compliance with government regulations.

THE COMPANY's obligations and liabilities under this warranty are limited to furnishing replacement parts to the customer, F.O.B. THE COMPANY's factory, providing the defective part(s) is returned freight prepaid by the customer. 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.

The warranties set forth herein are in lieu of all other warranties expressed or implied by law. No liability whatsoever shall be attached to THE COMPANY 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 must be in writing, signed by an officer of THE COMPANY.

THE COMPANY's parts or materials that are considered consumables, including but not limited to: cylinders, filters, nozzles, membranes, media, gaskets, O-rings, etc. are NOT covered by the warranty.

THE COMPANY makes no warranty and assumes no liability unless the equipment is installed in strict accordance with a copy of the catalog and installation manual in effect at the date of purchase and by a contractor approved by THE COMPANY to install such equipment.

THE COMPANY 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.

THE COMPANY makes no warranty and assumes no liability whatsoever for damage resulting from freezing of the humidifier, supply lines, drain lines, or quality of the water used.

THE COMPANY retains the right to change the design, specification and performance criteria of its products without notice or obligation.

THE COMPANY's limited warranty on accessories, not of the companies manufacture, such as controls, humidistats, pumps, etc. is limited to the warranty of the original equipment manufacturer from date of original shipment of humidifier.

## **Extended Warranty**

Extended warranties are available to purchase under the conditions listed above.



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Website: [www.condair.com](http://www.condair.com)

