Schenker®

COD: 100S12/24.T.2021

Installation, use and maintenance manual

SMART 100

Touch screen 12/24 V dc

CE

INDEX

1. LAYOUT OF MANUAL

1.1 Structure of the manual

The manual is divided into chapters, which gather all the information necessary to use the system without risk. Within each chapter there is a subdivision in paragraphs to focus on essential points; each paragraph can be pointed out with a subtitle and a description.
At the top of each page the heading section is reported in order to remind the reader the field of the page.

Within the chapter, for example chapter 1, we will have:

1	Chapter title
1.1	Paragraph title
1.1.1	Subtitle
1.1.1.1	Further subtitles

The numbering of the pages, figures and tables, is reset to each chapter; therefore, we will find the prefix indicating the chapter and the page number, figure or table in progressive that starts from number 1 at the beginning of each chapter.

1.2 Description of the pictograms

The following symbols will be used in the manual to highlight particularly important indications and warnings:

ATTENTION:
This symbol indicates accident prevention regulations for the operator and / or for any exposed persons.

CAUTION:
This symbol indicates that there is the possibility of damaging the system and / or its components.

NOTE:
This symbol indicates useful information.

2. GENERAL WARNINGS AND INFORMATION TO THE RECIPIENT

2.1 Important information

To safeguard the operator's safety and to avoid possible damage to the machine, before carrying out any operation on the machine, it is essential to read carefully all the instructions manual.

This manual must be complete and legible in its entirety, every operator involved in the use of the machine, or responsible for maintenance or adjustment operations, must know its location and must have the possibility to consult it at any time.

The descriptions and illustrations provided in this publication are not binding.

SCHENKER ITALIA reserves the right to make any modifications it deems appropriate.

This manual was drafted according to the requirements of the 2006/42 / EC Machinery Directive.

2.2 Safety warnings

- Wear protective equipment suitable for service operation.
- Do not remove safety devices or accident prevention protection.
- To check if the plant is correctly installed contact a Schenker service point.
- Verify that the electric and hydraulic connections are in keeping with the indicated specifications.
- Avoid using the plant if the sea water is polluted.
- Children and inexperienced people shall not touch or operate the plant.
- Check periodically that no leaks are present. Avoid installing the plant where a leak may cause damage and/or jeopardize the safety of the vessel.
- Maintenance should only be carried out by suitably qualified persons or Schenker personnel.

ATTENTION

Any technical changes or operating conditions indicated that affect the correct operation or safety of the machine must only be carried out by the manufacturer's technical staff or by technicians formally authorized by the manufacturer. Otherwise, SCHENKER ITALIA declines any responsibility for changes or damages that may result from it.

2.3 Warranty

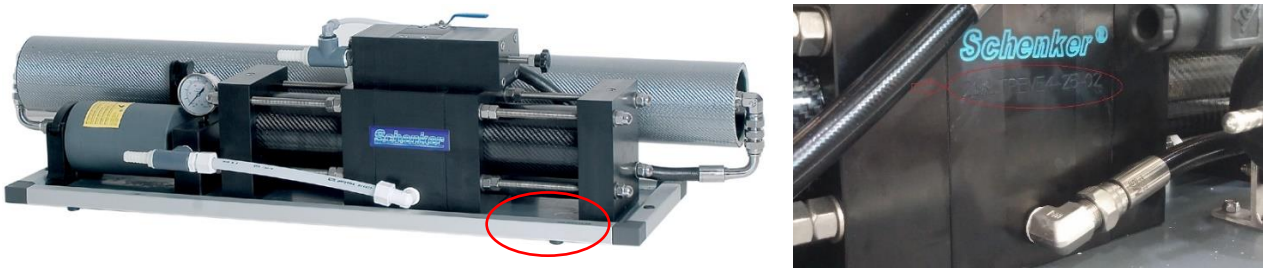
The equipment and the relevant accessories are guaranteed 12 months from delivery. The guarantee does not include consumable items (filters, carbon filters, membranes, etc.). The “ERS” pressure amplification device is guaranteed 36 months, provided that the annual maintenance is per-formed at a Schenker service point.
The guarantee covers faults, defect of materials and parts. It is limited to the replacement or re-pair of faulty parts. The expense for the disconnecting and reinstalling on the vessel and transport of the equipment from or to our Service Point, or our factory will be at the customers own expense.
The under guarantee delivered parts transport, will be at customer’s own risk.
In case of repairs under guarantee performed by our technicians on the customer vessel, the faulty parts replacement cost will be at Schenker's expense, while manpower and travel expenses will be charged to the customer. The guarantee does not include faults caused by negligence in operating, maintenance and installation of the device (if not carried out by an authorised Schenker Service point).
Dismantling by non-authorized personnel will render void all guarantees. Schenker Italia cannot be held liable for any direct or indirect damage caused by the malfunctioning equipment, limiting its responsibility to the repair and replacement of faulty parts.

ATTENTION

SCHENKER ITALIA declines any responsibility for improper use of the machine, for damages caused as a result of operations not covered by this manual or unreasonable use.

2.4 Identification of the unit

All the watermakers manufactured by Schenker Italia can be identified by a serial number printed on a label which is pasted upon the aluminium frame near the manometer. The same serial number is also recorded on the central black block of the energy recovery system (ERS).



Serial number
Fig. 2-1

2.5 Legislative reference

2.5.1 Directives and standards concerning machine safety

- Machinery Directive 2006/42 / EC, in force since December 29, 2009;
- Low Voltage Directive 73/23 / EEC and subsequent amendments and additions: 93/68 / CEE implemented by the Law of 18 October 1997 n. 791.
- Electromagnetic Compatibility Directive 89/336 / EEC and subsequent amendments and additions: 93/31 / CEE implemented with D.L. December 4, 1992 n. 476.
- Standards UNI EN 292/1 and 292/2 (safety of machinery);

2.5.2 Respect for the environment – requirements for removal and disposal

ATTENTION

Removal and disposal of materials, as result of the decommissioning of the machine, must be performed in accordance with the regulations in force, for the safeguard and protection of the environment

With regard to removal and disposal, it should be noted that the materials of which the machine is made of are not of a dangerous nature and consist essentially of:

- Stainless Steel;
- Aluminium;
- Plastic;
- Carbon fibre;
- Motors, cables and consumable electrical materials;
- Rubber and polyurethane seals.

After dismantling the machine, the various materials must be segregated according to the regulations of the country in which the machine has been removed.

The machine does not contain dangerous components or substances that require special removal procedures.

ATTENTION

Different legislations are in force in the different countries, therefore the prescriptions imposed by the laws and by the agencies designated by the Countries must be observed.

3. PRODUCT PRESENTATION

ATTENTION

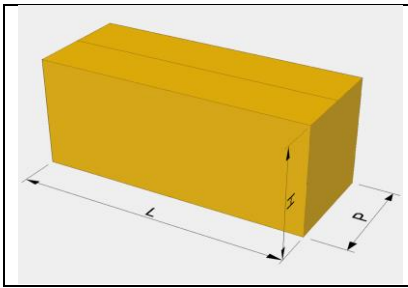
Be sure to follow general safety instructions.

- Wear protective equipment suitable for the transport and handling operations.
- Lift the machines with equipment appropriate to the weight and size of the box, taking the utmost care and following carefully the instructions on the present use and maintenance manual (attachment points for loading devices, etc.).
- Make sure that the lifting equipment used is in good condition and correctly maintained.
- Do not stand or pass under the groups to be moved during lifting or transport operation.

3.1 Transport and material handling

The watermaker unit is transported in a cardboard box. In the following table dimension and weight are indicated.

MATERIALS HANDLING
fig. 3-1



Model	L cm.	W cm.	H cm.	Weight Kg.
Smart 100	131	54	50	71

Packaging dimensions and weight
tab.3-1

3.2 Stock

ATTENTION

To avoid damage to the system, store the unit in a dry place at a temperature of between 5°C and 40°C. Very cold temperatures could led to a freezing of the fluid inside the system with the consequence of a permanent damage of the system.

3.3 Packaging

3.3.1 Packaging contents

PACKAGING (photo is purely for information)
FIG. 3-2

SMART 100	
Watermaker	Pump group
Active carbon filter with electrovalve	White filter key
Mesh filter	Non-return valve with Tee fitting
Remote panel with electric box	10 mt extension cable for remote panel
Intallation kit	Small metal parts
6x8 pipe for production	Pipe fittings

3.4 Attached documents

The packaging contains the technical documentation (use and maintenance manual, electric and hydraulic scheme, warnings and instructions).

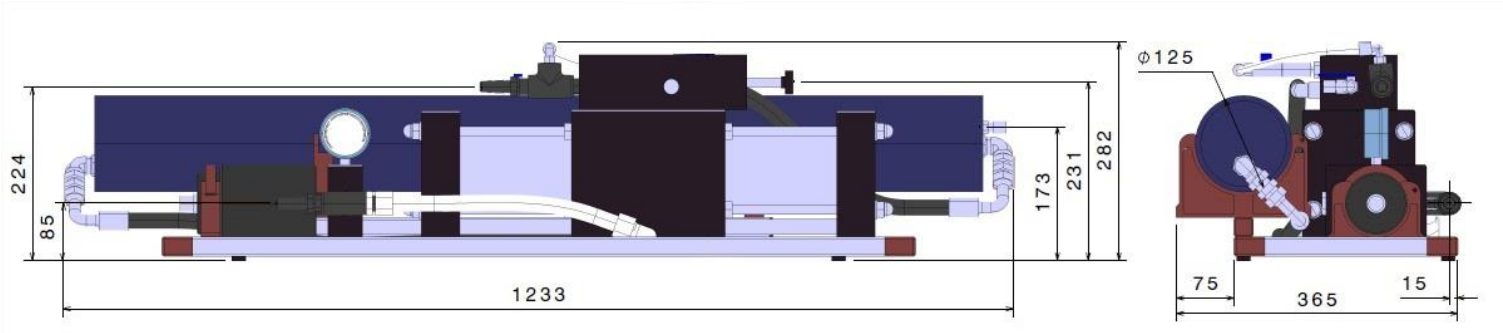
ATTENTION

- Lift the system only using the aluminium structure and not trough the Inox SS fittings.
- Read carefully the use and maintenance manual before installing the system.
- Use only recommended material for the installation (especially pipes, fittings and seals) in accordance with the present manual.
- Do not store the unit under temperature of 5° and above 40°C.

DOCUMENTS INCLUDED IN THE PACKAGING (photo is purely for information)
FIG. 3-3

3.5 Technical data

WATERMAKER GROUP



WATERMAKER DIMENSIONS
FIG. 3-4

Weight:	37 Kg
Hydraulic Connection	
Seawater inlet:	¾'' fitting, 20mm internal diameter reinforced pipe.
Exhaust:	½'' fitting, 16mm internal diameter reinforced pipe.
Fresh water:	¼'' fitting, 6x8mm pipe.

PUMP GROUP

Dimensions

Length:	37 cm
Width:	15 cm
Height:	23 cm
Weight:	11 Kg

Hydraulic Connection

Water inlet:	¾'' fitting, 20mm internal diameter reinforced pipe.
Water outlet:	¾'' fitting, 20mm internal diameter reinforced pipe.

Feed pump type: Rotary vane pump

Filters: n. 1 Cartridge filter 5 microns 2.32" x 9 ¾''
n. 1 Active carbon filter 2.32" x 9 ¾''

Power supply: 12 VDC +/- 15% (100S12 version)
. 24 VDC +/- 15% (100S24 version)

Average electric consumption: 400 Watt/h average

Nominal fresh water production: 100 Lit/h +/- 20% @ seawater 25 °C salinity 35.000 ppm

CEE conformity: In compliance with directives 89/392 CEE sect.1 (general safety machines requirements), 89/336 CEE (electromagnetic compatibility), 73/23 CEE (electric safety requirements)

3.6 Features of the product

The water produced by a Schenker plant, produced from clean seawater has a high purity, but the potability may not be guaranteed as bacterium may be present in the watermaker, caused by non-observance of shutdown and cleaning procedures. It is essential that correct shut down and storage procedures are followed to ensure continued purity of the product water. UV treatment of the product water may be beneficial.

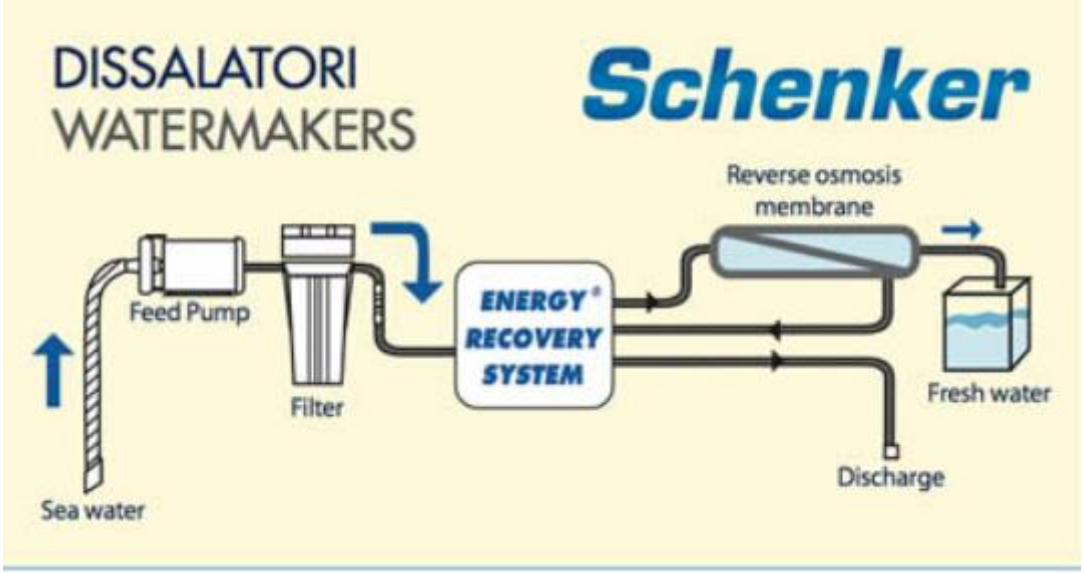
3.7 Advantages of the Energy recovery system

Introduction

Thank you for choosing a Schenker Watermaker.
As all the equipment, the knowledge of operating and maintenance procedures allows to use the system in the best way, and to guarantee a perfect functioning throughout the years. We invite you to read carefully this manual and to keep it for a quick reference.

Functioning principles

The Schenker watermakers, as alternative to the high-pressure pumps of traditional systems, utilizes the ENERGY RECOVERY SYSTEM patented device, which amplifies the pressure of common low-pressure pumps, and recoup all the hydraulic energy back from the membranes, allowing a high energy efficiency.
The lack of high-pressure pumps makes the system silent and vibrations free, and enormously simplify the use because no adjustment is necessary for its operating.



FUNCTIONING SCHEME
FIG. 3-5

3.8 Composition of the machine

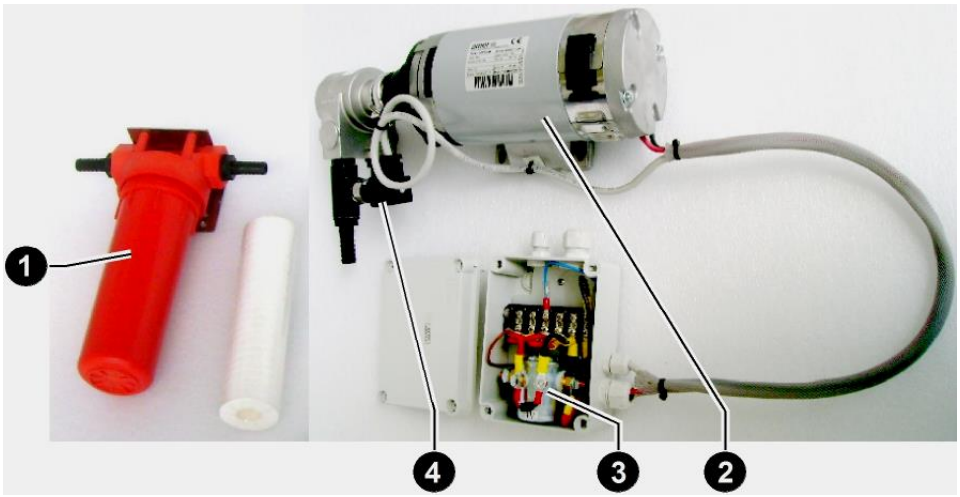
The machine is composed of the following parts:

1. PUMP GROUP
2. WATERMAKER GROUP

3.8.1 Pump group

This pump has the duty of picking the sea water up and send it to the watermaker group, through the pre filter. The pump group is composed of the following parts:

- 5 micron cartridge filter
- Rotative pump
- High pressure switch
- Pump box
- Accumulator



PUMP GROUP AND FILTER 12-24 V DC
FIG. 3-6

1. 5 micron cartridge filter
2. Pump head with CC motor
3. Pump box with relays
4. High pressure switch

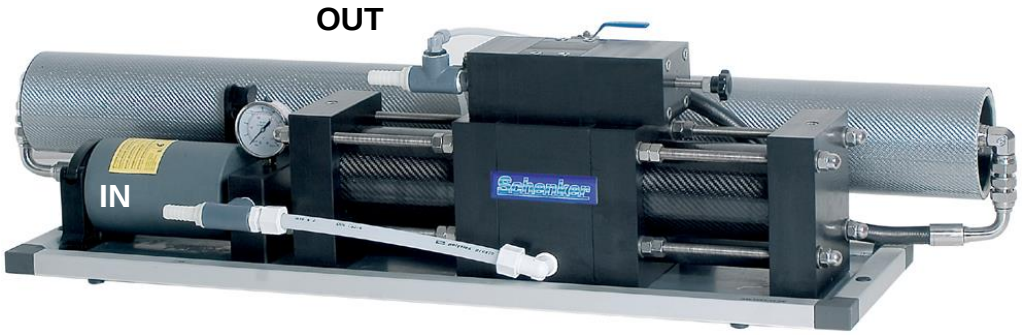
3.8.2 Watermaker group

WATERMAKER GROUP
FIG. 3-7

1. Manometer
2. Accumulator
3. Reverse osmosis membrane
4. Fresh water production (grey plastic fitting)
5. Positioner knob

WATERMAKER GROUP (TOP VALVE VIEW)
FIG. 3-8

1. Reset valve
2. Depressurization valve
3. Concentrate water discharge
4. Signal pressure switch



CONCENTRATE OUTLET (OUT) AND SEAWATER INLET (IN)
FIG. 3-9

The watermaker group is composed of the following parts:

- Reverse osmosis membranes
- Energy Recovery System
- Manometer
- Flowmeter
- Depressurization valve
- Positioner
- Reset valve
- Probe (pressure switch)
- Electric box

Reverse osmosis membrane. It is installed inside the glass fibre high-pressure housing. Membrane is n.1 x SW4040 type. Its purpose is to separate the intake high-pressure seawater in two flows: one for the salt-water drain and one for the fresh water production.

Energy Recovery System. It is the black, carbon fibre unit. It has the function to amplify the pressure supplied by the pumps and to recoup the hydraulic energy back from the membranes. The ERS device makes periodic cycling by a hydraulically controlled automatic valve. The cycles are noticeable through a ”beat” issued periodically by the watermaker unit. The unit is based on cylinders and a central body containing the hydraulic valve necessary for the system functioning.

Manometer. It is located on the front panel of the watermaker, and it measures the working pressure of the watermaker.

Accumulator. It is a grey PVC reservoir of air, installed in the watermaker. Its function is to reduce and stabilize the pressure peaks during the watermaker functioning. The device has to be pre-charged with air through the specific valve. The air pressure precharge is about 6 Bar. The pressure dimmer is charged in factory at the right pressure.

Depressurization valve. It is used for the air bleeding of the unit. It is recognizable by a blue lever and it is located on the top valve of the ERS. Its function is to depressurize the system and to allow the bleeding of air. The valve must be closed during normal working conditions (vertical position), and it is opened during the air bleeding operations (horizontal position).

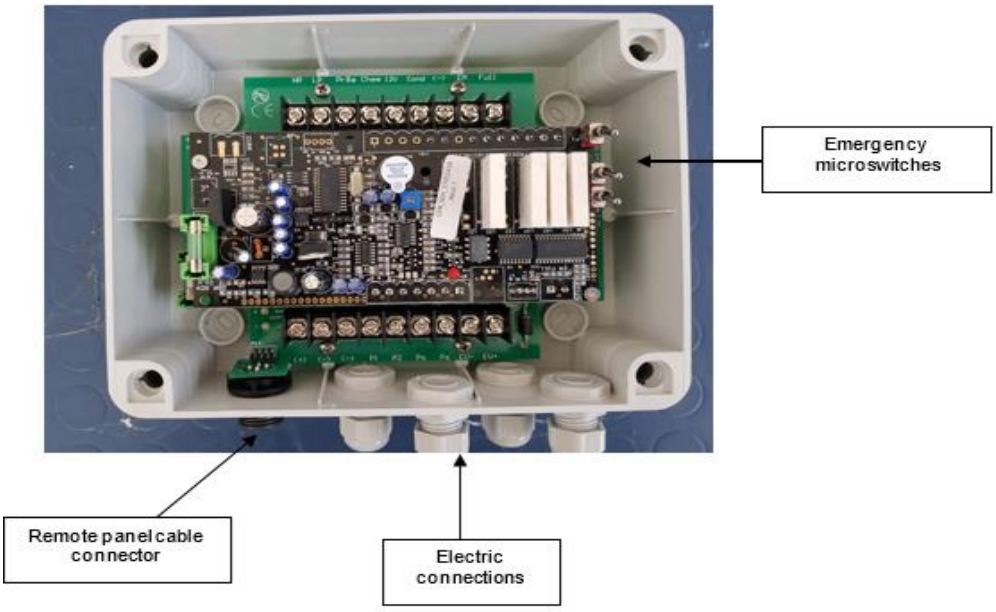
Positioner. It is a stainless steel threaded arm, with a black knob, located on the right side of the watermaker. Its function is to reset the unit in case of hydraulic block.

Reset valve. It is installed on the watermaker on the top of the ERS and it is recognizable by the little blue plastic lever. The valve must be closed during normal functioning (lever perpendicular to the valve). Such valve has the function to allow the reset of the ERS in case of a system block. It must be opened before acting on the valve positioner.

High pressure switch. It Is hydraulically connected with the pump group. It stops the system if the pump pressure exceeds 13 bar. In this case a high-pressure alarm is activated on the control panel.

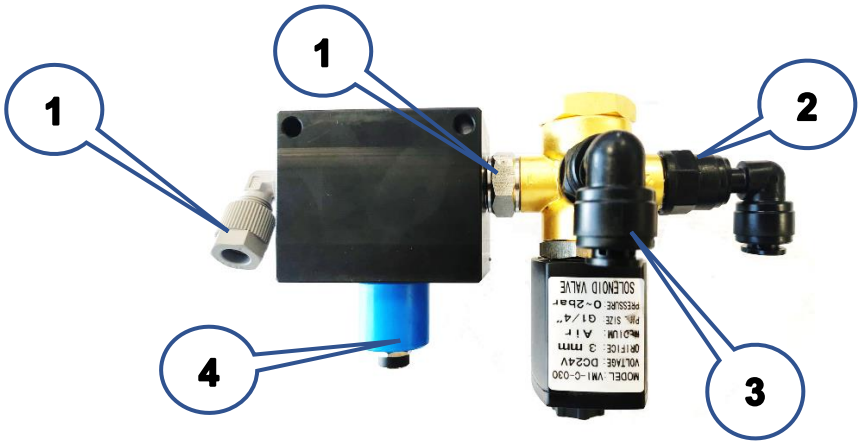
Probe (pressure switch). It is a device, hydraulically connected to the left side on the main valve of the Energy Recovery System. Its function is check that the cycling of the machine is correct. It is set at 1,3 bar.

Computer box. It is an external unit. It has to be installed relatively close to the watermaker, in a position protected from water. It is connected to the remote panel and controls the functions of the watermaker automatically.
The microswitches P1and EV allow the direct command of the pump the electrovalve respectively. They can be used, as an emergency solution, for starting the watermaker in case of total failure of the electronic computer. In normal condition they have to be switched off.



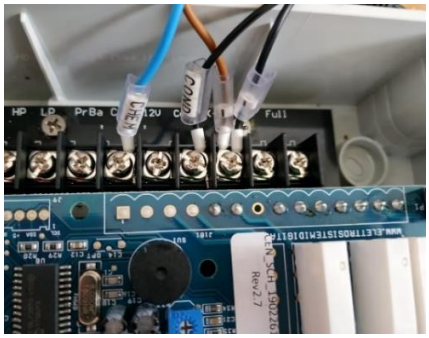
COMPUTER BOX WITH SWITCHES
FIG. 3-10

Diverting valve (optional). It checks the conductivity of the fresh water. The remote panel gives ad advice in case the fresh water quality is not good
The 2 cables of the probe must be connected on the PCB of the electric box, clamps **Cond** and **(-).**
The 2 cables of the valve must be connected on the PCB of the electric box, clamps **Chem** and **(-).**
A tee fitting for the discharge line is provided with the diverting valve.



DIVERTING VALVE
FIG. 3.11

1. IN – from membrane outlet
2. OUT – discharge connection
3. OUT – tank connection
4. Probe



DIVERTING VALVE ELECTRIC CONNECTIONS
FIG. 3-12

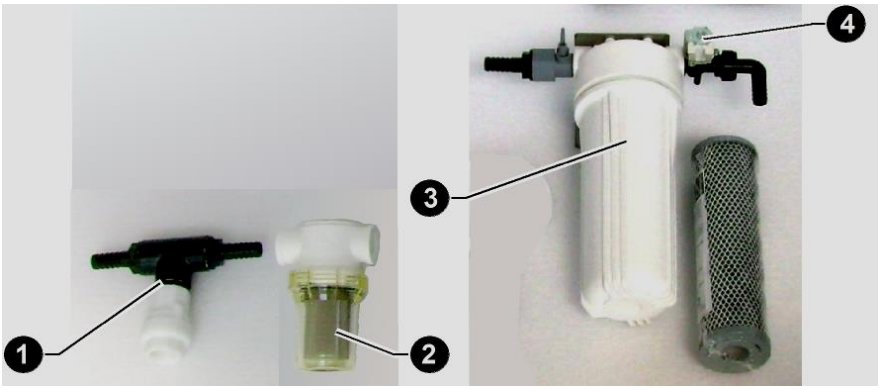
DIVERTING VALVE HYDRAULIC CONNECTIONS
FIG. 3-13

1. Connection from diverting valve
2. Discharge from the watermaker
3. Outboard discharge

3.8.3 Accessories

The main accessories of the watermaker are the following:

- Active carbon filter
- Electrovalve
- Non-return valve
- Mesh filter (strainer)



ACCESSORIES
FIG. 3-13

1 Non-return valve
2 Mesh filter (strainer)
3 Active carbon filter
4 Elettrovalve

Active carbon filter. This filter is connected between the fresh water pressurized system of the vessel and the electro valve on the filter holder. On the filter inlet is positioned a manual valve that allows to replace the cartridge without depressurize the fresh water system of the vessel.

Electrovalve. It has the function of switching from seawater intake to fresh water tank when washing the watermaker.

Non-return valve. It avoids the emptying of the inlet pipes. It must be installed vertically. It avoids also the leak of fresh water from the seacock while washing procedure.

Mesh filter. The machine is equipped with a strainer to protect the pump from macro sediments. It is placed between the seacock and pre-pump.

4. MOUNTING AND INSTALLATION

4.1 General criteria

Before starting with the installation, it is important to carefully plan all the activities, by evaluating all the possible solution to be adopted. The main points to focus on are the following:

- Individuate the seawater inlet
- Positioning of the main units (pump group, watermaker group, active carbon filter).
- Positioning of the thermal-magnetic circuit breaker.
- Passage of the pipes and electric cables.

CAUTION
For a correct installation of the watermaker, in order to avoid issues along the different ways of operating condition, please follow carefully the general instruction below:

- ***Consider to install the through-hull fitting in a central and deep position, in the way that no air could be aspirated.***
- ***The non-return valve has to be installed under the seawater level and as close as possible to the through-hull fitting, in vertical position.***
- ***The pump must be installed as low as possible respect to the seawater level and as close as possible to the seawater intake (through-hull fitting).***
- ***The watermaker unit must be horizontally positioned, and arranged on an adequate support which is able to sustain the weight (about 40 Kg).***

CAUTION
The pump group must be installed in a ventilated place, in order to facilitate the cooling. In addition to this, a place not exposed to condensation and dripping should be adopted.

ATTENTION
The external surface of motor and pump can reach high temperature; therefore, it is recommended to avoid any contact with inflammable liquids and materials.

NOTE
Once individuate the correct installation solution, it is recommended to first make a schematic draft of the hydraulic and electric connection, and attach them to the present manual for future needs as first reference.

4.2 Components mountings

4.2.1 Pump group

The rotary vane pump must be installed below the sea level and as close as possible to the water inlet; furthermore, the pump cannot run dry.
The pump group should be installed in an adequately ventilated room, with the purpose to facilitate the cooling of the motor, and not subject to condensation or drippings. **The max permitted room temperature must not exceed 45°C**.
Avoid the contact or the proximity with inflammable material or liquid, since the motor surfaces can reach elevated temperatures. Avoid locating the pump wherever a possible loss of water can involve damages or jeopardize its safety. The pump must be installed on a base sufficiently horizontal, suitable to sustain the weight of the group. The pump is normally fixed on the support structure by passing bolts.

4.2.2 Watermaker group

Concerning the watermaker unit installation there are not height limits respect to the seawater level. Anyway, it should be installed above both pumps.
Avoid to install the system wherever any possible leak may cause damages to the vessel or jeopardize its safety, since possible leaks due to accidental causes (pipe bursting, pipe clamp loosening, equipment failure, etc.) may cause water losses.
The hydraulic intake and outlet connections are positioned on the left of the unit. Therefore, it is necessary to foresee a minimum distance of 20 cm. to allow the pipes laying. The watermaker unit must be installed on a base sufficiently horizontal, suitable to sustain the weight of the group. **The max allowed room temperature must not exceed 40°C**. It is advisable to install the unit in such position to make the instrumentation easily visible, and make the valves (located on the right of the unit) easily accessible. The watermaker is normally fixed on the support structure by passing bolts.

4.2.3 Accessories

The non-return valve has to be installed vertically as close as possible to the seawater intake, following the direction of the arrow.
The active carbon filter (and the attached electrovalve) has to be placed next to the pump group, if possible, on a vertical side easily accessible.

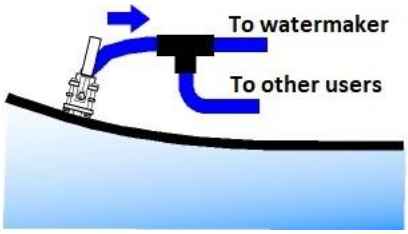
4.3 Installation

4.3.1 Water intakes and discharges

For a correct installation of the watermaker it is necessary to arrange the following water intake and discharge out of the board:

- Seawater intake.
- Fresh water intake for washing.
- Brine discharge.

4.3.2 Seawater intake

Seacock with through-hull fitting	It is ideal a specific sea water intake, size ¾'' minimum in a central position, well under the water surface even when the vessel is well heeled over. The skin fitting is recommended. It must be oriented to the bow of the vessel. In case of high speed vessel (over 15 knot) it is advised to make some holes on the backside of the shape, in order to reduce dynamic prevalence during navigation.	Size 3/4" 
Pre-existing seacock adapting (alternatively)	As alternative, it is possible Tee into a pre-existent water inlet as long as the following conditions are met: • 3/4'' minimum size**;** • No air can be introduced into the system from other use ie: salt water taps in galley; • Must always be under the water surface even when the vessel is well heeled over. • Must be far from WC discharge. ***CAUTION*** ***Do not use the pre-existing water inlet of the cooling system dedicated to the motor.***	Size 3/4" 

INSTALLATION NOTES

- Allow a minimum 3/4" on-off ball valve on the water intake.
- The pipe connections, especially if under the seawater level, must be secured with double pipe clamps.
- An easily inspected mesh type filter will be required close to the water intake. The filter has to be of 50 microns. It is possible to use filters from existing outlets.
- The seawater intake must be at least 3/4" size.
- Downstream the seawater intake must be installed a strainer and a non-return valve. The water flow inhaled by the watermaker is about 20 lit/min.

Mesh Filter		
Strainer on existing hull (alternatively)	In case of seawater intake with pre-existing net filter, it is possible to use it as long as the following conditions are met: • Flow rate capacity of the filter is adequate to the whole intakes it serves.	Filtration grade of the strainer is **50 mesh.**

INSTALLATION NOTES
The filter has to be connected next to the through-hull fittings, and must be easily accessible for inspection.

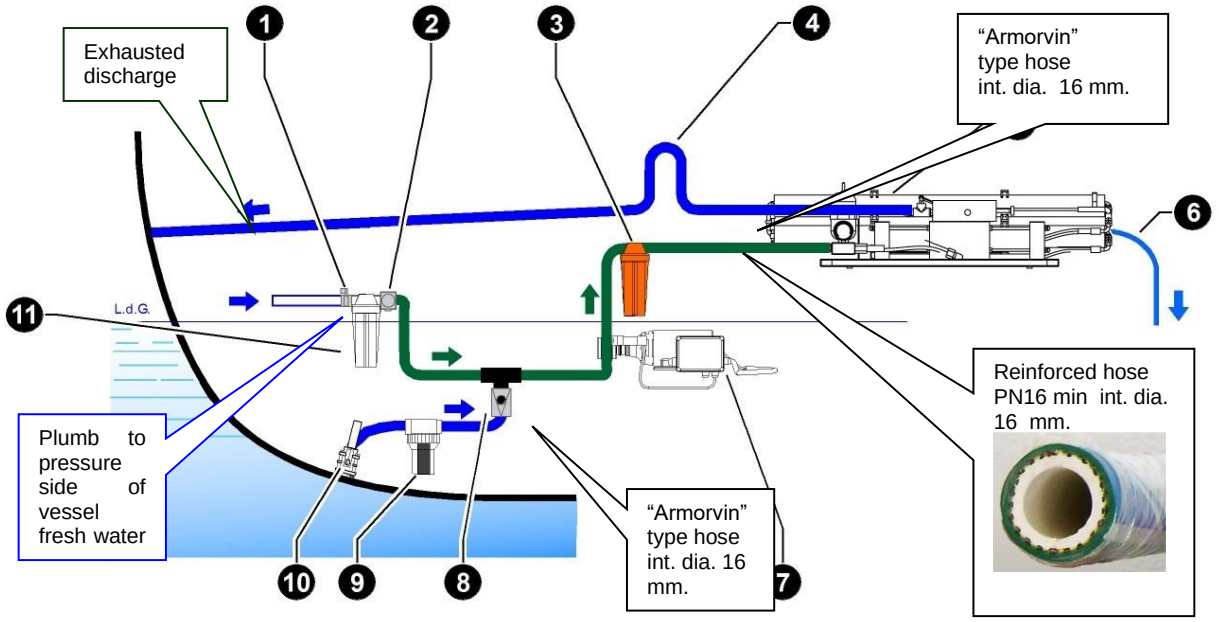
4.3.3 Fresh water intake for washing

Fresh water intake for washing	Tee in downstream of the vessel's fresh water pressure system. The following conditions must be respected: • The flow of the existing fresh water pump must be **min 20 lit/min.** • Flushing must always be performed with the pressure water system ON.	***Min. flow rate must be 20 lit/min. at 1 bar.***

4.3.4 Brine discharge

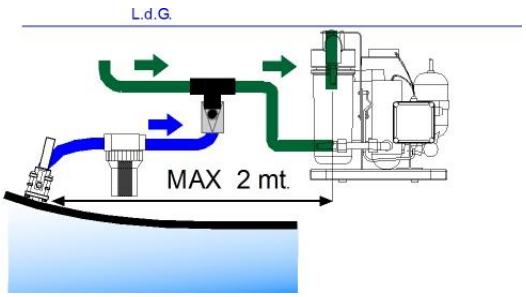
Salt water discharge	The salt-water drain shall be ½'' minimum size and it has to be preferably above the seawater level.	**Minimum size ½''**
Pre-existing salt water discharge (alternatively)	It is possible to use offtakes from existing apparatuses, provided that: • It is not the engine cooling water drain or apparatuses that drain out water with elevated pressure.	

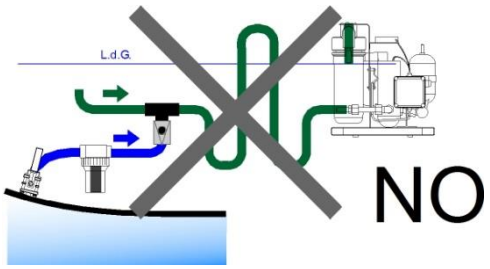
4.4 Hydraulic connections



HYDRAULIC CONNECTION AND HOSES
FIG. 4-1

1. Pressurized fresh water valve
2. Elecrovalve
3. 5 micron filter
4. Swan neck upward - Discharge
5. Watermaker
6. Fresh water outlet
7. Pump group
8. Non return valve
9. Mesh filter
10. Water inlet
11. Active carbon filter



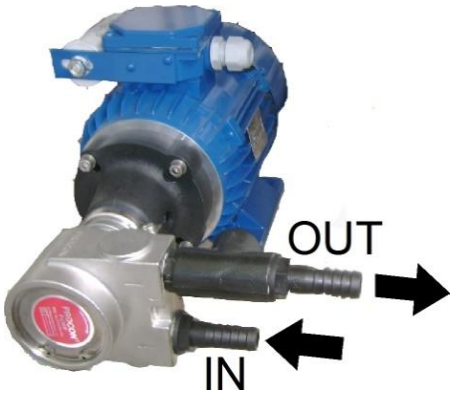


The hydraulic section that is continuously under consistent pressure is the pump outlet – 5 m. filter – watermaker inlet connections . For this section is necessary to use a good quality **PN 16 min.** reinforced pipe. An inadequate pipe could burst, jeopardizing seriously the safety of the vessel.

The hydraulic connections are:

Low pressure connections – max 3 bar	• Connection between seawater intake – mesh filter – non-return valve inlet – pump group	**Armorvin reinforced pipe PN6 with 20 mm internal diameter**
	• Connection between the discharge of the watermaker – through hull discharge fittings of the vessel	**Armorvin reinforced pipe PN6 with 16 mm internal diameter**
Medium pressure connections – max 13 bar	• Connections fresh water pressurized system– carbon filter-backflow valve outlet–pump inlet • Connections pump outlet-5 microns filter– watermaker inlet.	**Rubber reinforced pipe PN 16 minimum, internal diameter 20 mm.**
Low pressure connections - max 3 bar	• Watermaker - fresh water tank	**¼'' fittings, Small plastic blue pipe 6x8mm provided within the scope of supply**

PUMP CONNECTIONS:
Connect the in/out pipe to the pump as follows:



WATERMAKER INTAKE AND DISCHARGE
FIG. 4-2

CAUTION
The pump has to be placed as close as possible to the seawater intake and as low as possible respect to the seawater level; furthermore, it is recommended to avoid long and convoluted path of the connection hoses.

ATTENTION
The use of an improper pipe can cause a break which prevent the security of the vessel.

WATERMAKER CONNECTIONS:

WATERMAKER INLET (Sea water inlet from the pump):
Make use of the external holder located on the left side of the watermaker (marked **IN**).

WATERMAKER OUTLET (Discharge outboard):
Make use, for this connection, of the holder located on top of the pressure amplifier, inside the watermaker unit (marked OUT). Create a Swan neck upward, when the drain outlet on the vessel is positioned below the watermaker unit, in order to guarantee a water head.

PRODUCTION FRESH WATER CONNECTION
The connection has to be made using the small pipe supplied with the equipment. The connection has to be made between the polyethylene pipe that comes out the watermaker unit (on the right), and the upper side of the tank, on a ¼" outlet if available.
It is possible, in case of metal tanks, to make a ¼" threaded hole to connect the supplied male connector.
Another option is to Tee into the tank air vent pipe.There are no particular limits on the connection length.

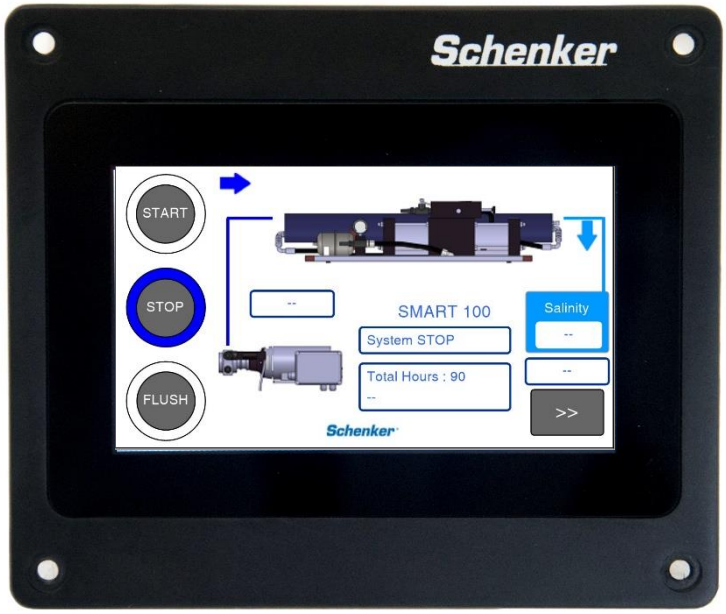
4.5 Electric connections

ATTENTION

These steps have to be performed by a qualified technician/operator, by referring to the electrical drawings provided within this document.

4.5.1 Remote control panel mounting

The remote control panel has the following dimensions:
width 135 mm. *height 116 mm.*
It can be fixed on any internal boat panel, provided that the area behind is free of humidity and condensation and there is enough depth to house the rear part of the panel (approx. 50 mm.).
The cut to be performed on the boat covering panel, to encase the remote control panel, has the following dimensions:
width 110 mm. *height 90 mm.*
The remote control panel can be connected through the pre-wired multiple cable of a 10mt standard length provided. It is possible to require to the factory a longer cable if necessary.



REMOTE CONTROL PANEL
fig. 4-3

4.5.2 Electric connections: wires (SMART 100 12/24V DC)

The electric connectors are positioned inside the small electric box connected to the computer box. The power supply, coming from the service batteries, needs to be connected to the terminals – and + . The connection to the vessel panel needs to be performed downstream the voltmeter and the ammeter of the vessel panelboard. The connecting terminal must be suitable to support the plant electric load (approx. 500 Watt). A 63 Ampere automatic circuit breaker for 12V DC systems must be installed on the power supply, while a 32 Ampere for 24VDC systems.

The general wires connection scheme (between the external devices and the main electric box) is the following:

Voltage	**Automatic switch**	**Cable lenght**					
		up to 3 mts		3 - 7 mt.		7-10 mt.	
Volt	Ampere	**mm2**	**AWG**	**mm2**	**AWG**	**mm2**	**AWG**
12	**63**	**16**	**5**	**25**	**3**	**25**	**3**
24	**32**	**10**	**7**	**10**	**7**	**10**	**7**

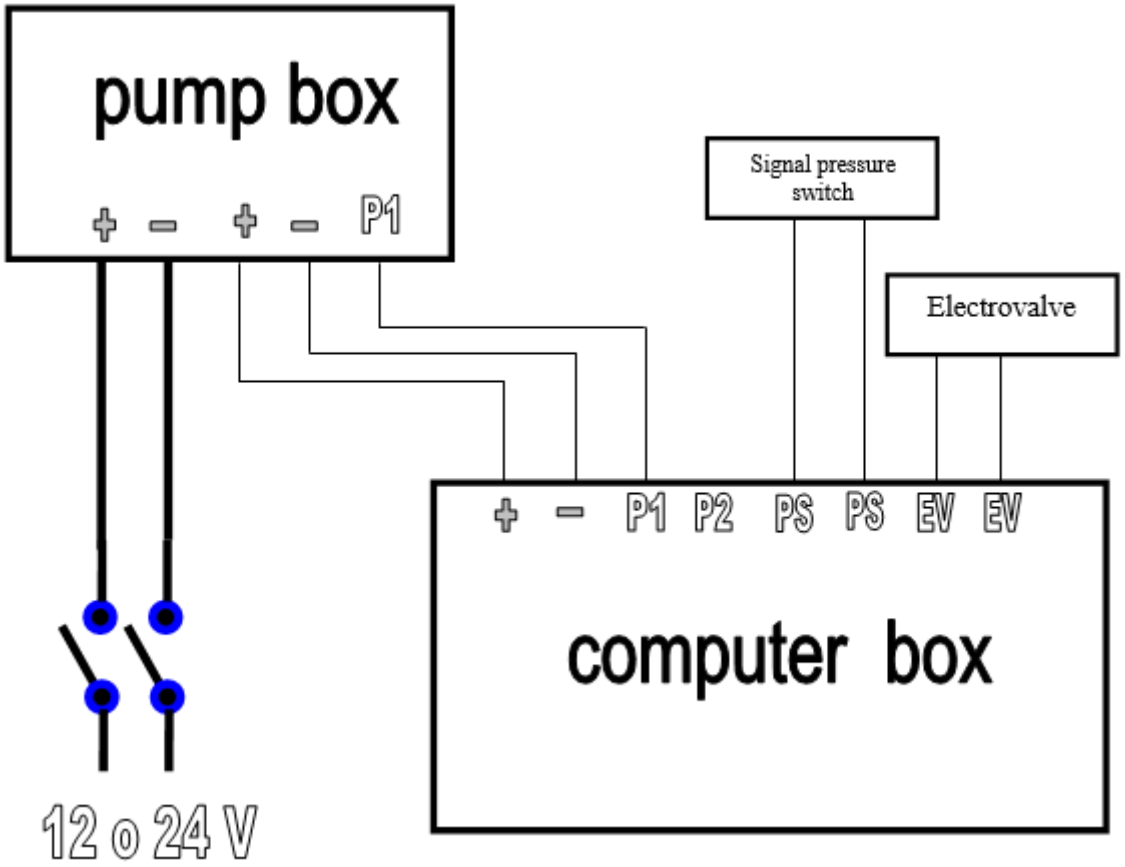
Electric cables and switches selection table

The connection general diagram is the following:

Clamp	*Position*	*connect to*	*cable section*
-	Pump box	negative battery	see table
+	Pump box	positive battery	see table
-	Pump box	Computer box	see table
+	Pump box	Computer box	see table
P1	Pump box	Computer box	2,5 mm2
PS	Computer box	Signal pressure switch	2,5 mm2
PS	Computer box	Signal pressure switch	2,5 mm2
EV	Computer box	electrovalve (on the AC filter)	2,5 mm2
EV	Computer box	electrovalve (on the AC filter)	2,5 mm2

Connection between the computer box and remote panel.

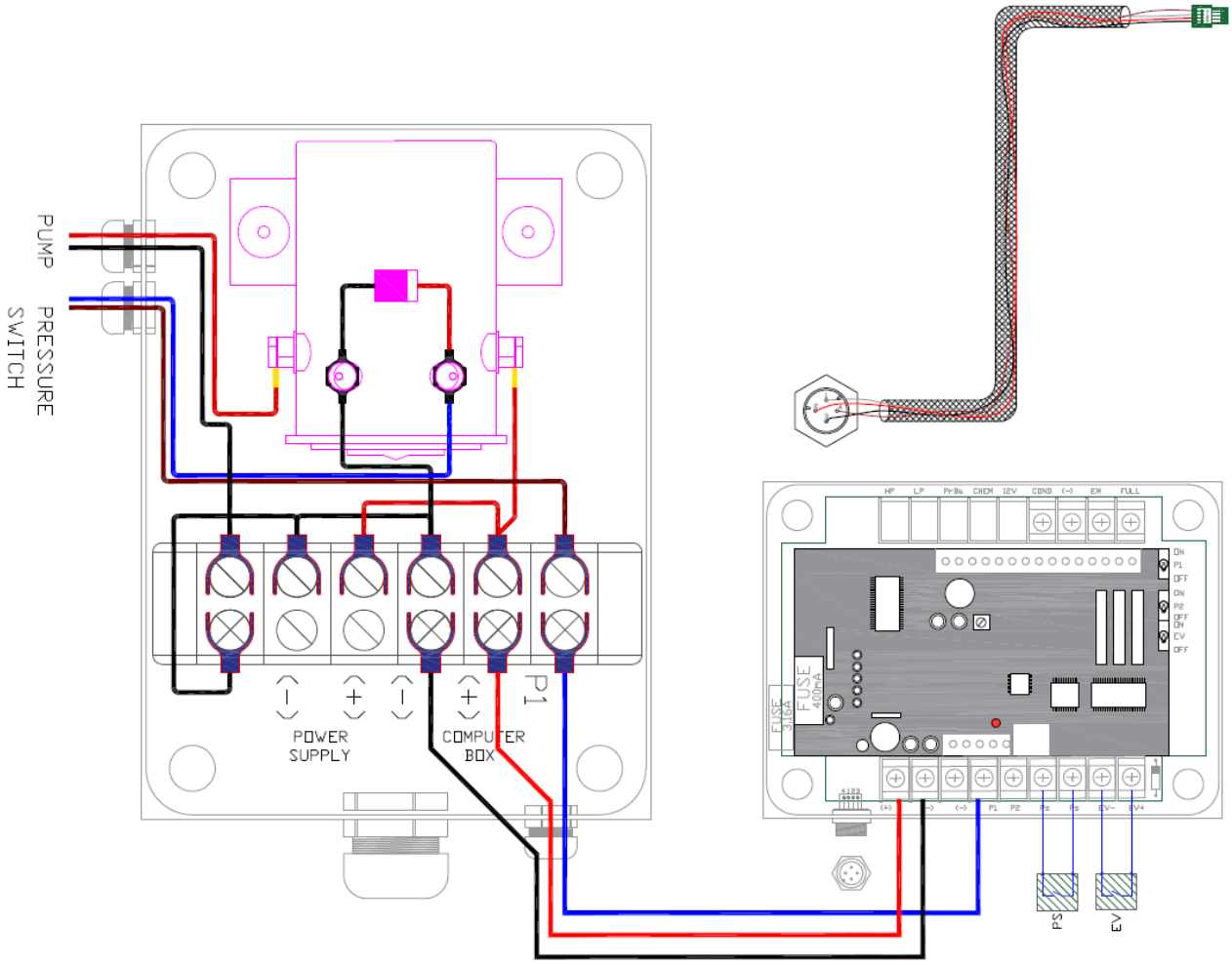
Connect the remote panel to the computer box using pre wired cable supplied (standard length 10 mts.)



WIRING LOGIC SCHEME12-24 VDC

FIG. 4-4

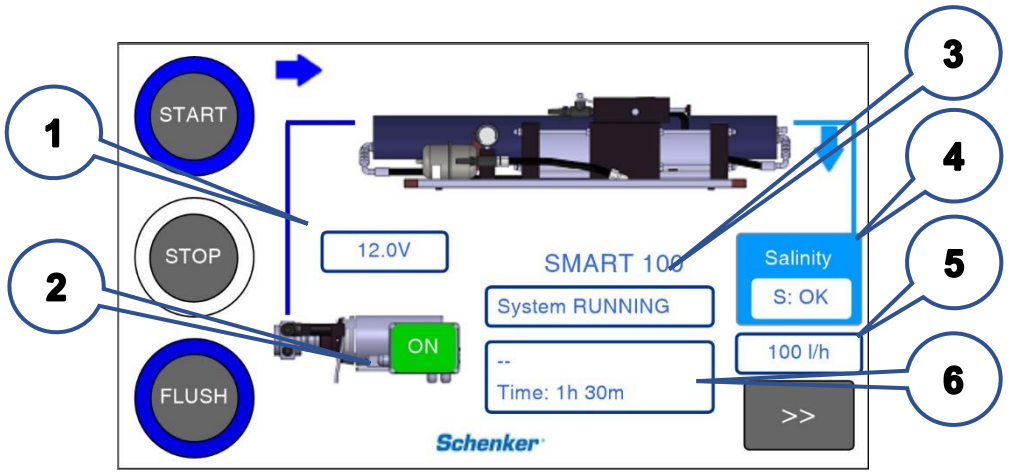
4.5.3 Electric layout scheme (12/24V DC)



ELECTRIC SCHEME SMART 100 12/24V DC
FIG. 4-5

5. FUNCTIONING AND USE

5.1 Command description



HOME PAGE – PAGE 1
FIG. 5.1

N°	Fuction	Possible options
1	Remote panel voltage	12 / 24 V
2	Pump status	ON / OFF
3	Info box	System status / Alarms
4	Salinity control (optional)	OK / MED / BAD /WAIT
5	Flow rate (optional)	Fresh water lit/hour
6	Timer	Working hours / total hours / total liters

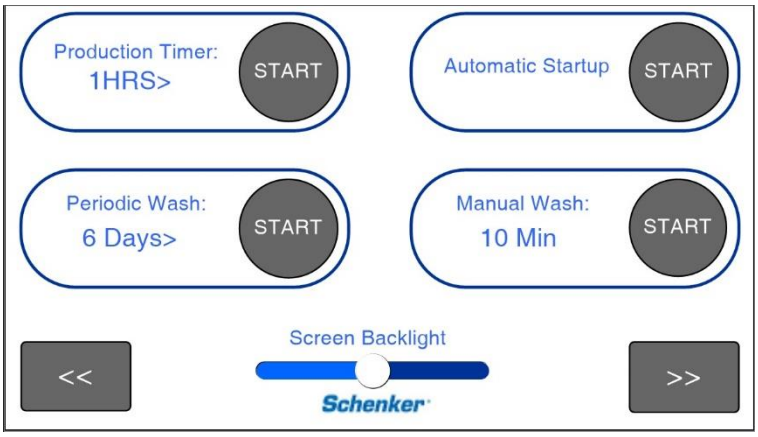
The touch screen remote panel has 3 pages. The display switches off after 3 minutes of not use. Touching in any point will light the display up again, without activate any other command.

In the home screen it is possible to check the status of the watermaker and perform the following functions:

START
Used to start the system; the unit runs indefinitely until STOP is pushed.

STOP
Used to stop the system. The system doesn't stop immediately but awaits the correct positioning of the internal valve (2-3 seconds), and then stops. If the automatic washing is activated the system performs the automatic washing (1 min) before stopping.
STOP is used as well for an emergency stop, by pressing it for 5 seconds: in this case the watermaker stops immediately.

FLUSH
The system gets ready to perform an automatic washing (1 minute long) once the system is stopped.



PAGE 2
FIG. 5.2

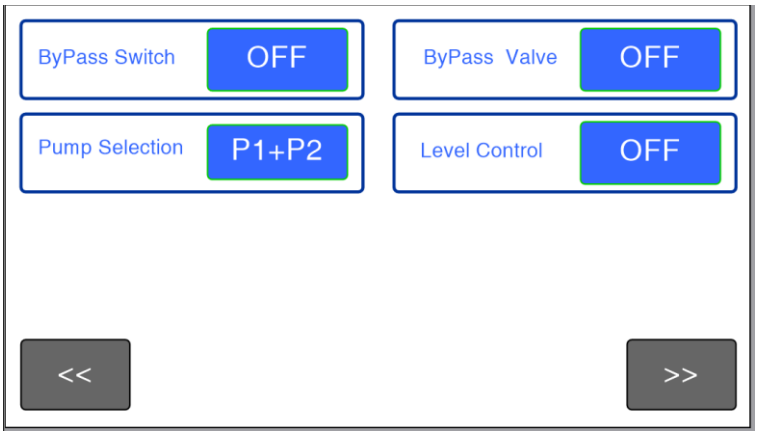
All commands in this page allow to start the watermaker with different options.

PRODUCTION TIMER
It allows to select the working time of the watermaker (1-6 hours) by pressing on the arrow "**>**".

AUTOMATIC STARTUP
This function activates automatically the first start up procedure. The procedure is necessary when a new machine is started for the first time, or after the filter cartridge replacement, or a general service. The procedure allows to purge completely the air from the system, and from the seawater and the washing fresh water hoses. The depressurization valve must be opened before start the procedure. The distinctive color is **YELLOW.**

PERIODIC WASH
This function allows a periodic automatic rinsing (every 6 up to 10 days) with fresh water. It can be used before long inactivity periods. The single washing operation will last about 1 minute. The consumed fresh water, for every washing, is about 20 liters. Therefore it is suggested to evaluate if the fresh water reservoir is enough for the programmed cycles. When this function is activated the FLUSH button is on and a count down appears in the Timer box.

MANUAL WASH
Used to start a 10-minute washing procedure. The system can be stopped at any time by pushing STOP.



PAGE 3
FIG. 5.3

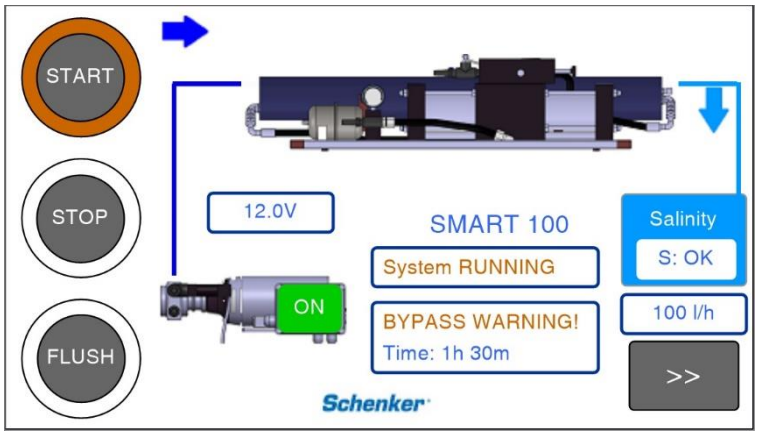
BYPASS SWITCH
It allows to exclude the sensor (signal pressure switch) that detects the correct cycling of the ERS. The operation with the by-pass is necessary only in case of malfunctioning of the signal pressure switch (in example if the system gets blocks, with the message " *SYSTEM BLOCKED*", not as consequence of a real hydraulic problem, but just as consequence of the malfunctioning of the probe).
The bypass is used also during special operation like the shut-down procedure (washing with chemicals). The bypass activation is automatically removed after one single production cycle. Don't activate the by-pass if not necessary.

BYPASS VALVE *
It allows to exclude the salinity probe that detects the water quality .In this case all the fresh water is diverted to the tank, regardless off its quality.

PUMP SELECTION **
There are 4 options available:
P1 the system works with pump1 only. In this case the production and the electric consumption will be halved
P2 the system works with pump2 only. I In this case the production and the electric consumption will be halved
P1&P2 the system works with one pump only, alternating P1 and P2 every 20 minutes in order to balance the wearing of the two pumps. In this case the production and the electric consumption will be halved
P1+P2 the system works with both pumps. In this case the production and the electric consumption will be the nominal values.

LEVEL CONTROL *
Allows to set a working procedure with an automatic control: in this case it is possible to install one or two level switches in the fresh water tank.

*Optional
**Not for the single pump watermakers



WARNINGS
FIG. 5.4

Messagges

SYSTEM RUNNING
It indicates that the system is properly running.
SYSTEM STOP
It indicates that the system is ready to be set and started.
TANK FULL / AUTO*
It indicates that the system is in standby because the fresh water tank is full. It starts automatically when the tank is empty.

Messages related to the salinity probe *:

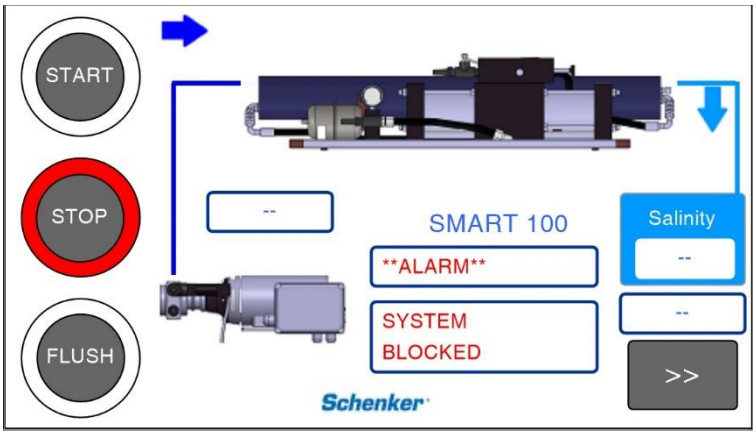
DIVERT TO DISCHARGE
For 1 minute the fresh water production is diverted to discharge.
S = wait This means that the salinity meter is still completing calculations.
S = OK Quality of the produced water is good.
S = MED Quality of the produced water is medium.
S = BAD Quality of the produced water is bad.

Warning messages

There are different warning massages: the unit still works but some controls are disabled. The distinctive color is **ORANGE.**

BYPASS WARNING
This message advices or remembers that the unit is working in bypass mode (then some safety functions are disabled).
DIV. VALVE BY-PASS*
This message advices or remembers that the unit is working without the salinity probe control (then all the produced water is diverted to the fresh water tank).

*Optional



ALARMS
FIG. 5.5

Alarm messages

There are different alarm massages: the unit stops immediately and has to be reset by pressing STOP.
The distinctive color is **RED.**

SYSTEM BLOCKED
This message means that a hydraulic block of the machine occurred, and then the pump has been switched off as safety procedure. In this case is suggested to perform a reset procedure and investigate on the possible hydraulic origins of the problem. If the origin of the problem is just a malfunctioning of the signal pressure switch, it is possible to start again the unit, activating the bypass
CONTROL CABLE
Check the continuity of connection between the remote panel and the computer box.
CHECK SALINY PROBE*
The salinity probe is faulty or disconnected from the circuit.
BAD WATER QUALITY*
When the measured salinity is too high for 15 seconds, the message “DIVERT TO DISCHARGE” is displayed and the fresh water production is diverted to discharge for 2:45 minutes. After these 3 minutes the unit goes into alarm state shutting off the pump group.

*Optional

5.2 Introduction – by pass mode

The by-pass mode disables the low pressure and the cycling controls . Then the watermaker can work but not in a safe condition, and has to be directly and continuously monitored.

The bypass mode has to be activated only in the following situations:

1. Chemical washing. The by-pass is necessary to avoid low pressure blocks.

2. Probe (signal pressure switch) fault. In this case the system gest an alarm (SYSTEM BLOCKED message) because the probe gives to the controller a false indication, not because a real problem is exsisting. The bypass mode allows the watermaker to by-pass the sensor and work.

CAUTION

Please, avoid to use the bypass mode if not strictly necessary. In this mode all the main electronic controls of the watermaker and automatic sensors are disabled.

5.3 First start-up procedure

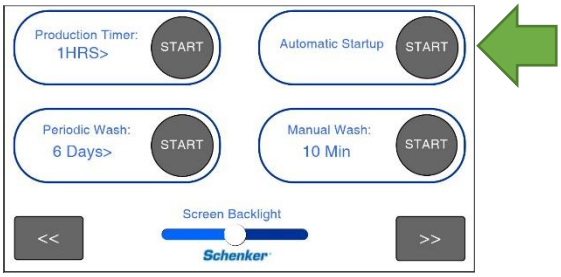
The first start-up procedure is necessary to start a new plant for the first time or to restart it after performed a chemical washing.
The purpose of the start-up procedure is to essentially purge the air contained in the system.

5.3.1 Preliminary checks before proceeding with the start-up procedure

Please, be sure to perform all the following checks before proceeding with the start-up procedure:

1. Verify that all plant components are connected correctly.
2. Verify the 5 micron is installed correctly.
3. Be sure the seawater inlet valve and salt water drain valve are opened (If existing).
4. Be sure the reset valve is closed (lever orthogonal to the body valve) and the positioner completely unscrewed.
5. Be sure the fresh water pressurizing pump of the vessel is on.
6. Be sure the valve on the active carbon filter is opened.
7. Be sure the fresh water tank is full enough (at least 100lt) to perform washing procedure.

5.3.2 Start-up

1. Open the depressurization valve (lever horizontal)	
2. Push for 20-30 sec the red button on the active carbon filter housing cup in order to purge the air from the system.	
3. Activate the start-up procedure through the function of the second page.	
4. Close the depressurization valve when the display shows the specific message and wait for the completion of the procedure.	

The procedure lasts about 3 minutes, and it can be stopped at any time pushing STOP. After completed the procedure the system is ready to start normally.

5.4 Normal operating procedure

Preliminary checks:

1. Reset valve closed (lever orthogonal to the body valve) and the positioner completely unscrewed.
2. Depressurization valve closed and grey valve on the active carbon filter open.

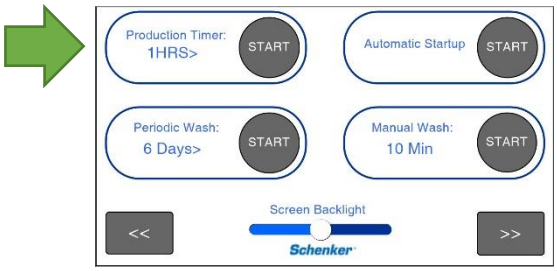
5.4.1 Normal operating procedure without final flushing

1. Press START to turn on the watermaker.
2. Press STOP to turn off the watermaker.

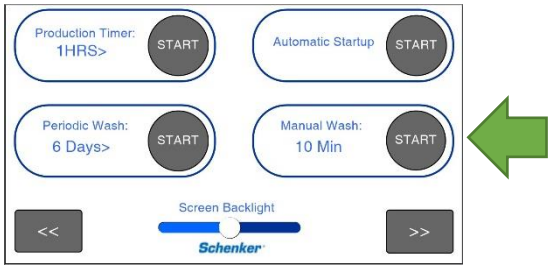
5.4.2 Normal operating procedure with final flushing (recommended procedure)

1. Press START to turn on the watermaker.
2. Press FLUSH to set the final flushing.
3. Press STOP to turn off the watermaker; FLUSH starts blinking. The fresh water consumed for the automatic washing is about 20 lt.
4. The system can be stopped at any time by pushing STOP.

5.4.3 Working cycle with timer

1. Select the working time of the watermaker (1-6 hours) by pressing on the arrow "**>**". 2. Press START in the function to turn on the watermaker 3. The unit can be stopped at any time by pressing STOP (without final flushing) or by pressing FLUSH then STOP(with final flushing).	

5.4.4 Long flushing procedure

1. Turn on the watermaker by pressing START in the MANUAL WASH function. A 10-minute flushing procedure starts 2. The unit can be stopped at any time by pressing STOP	

NOTE

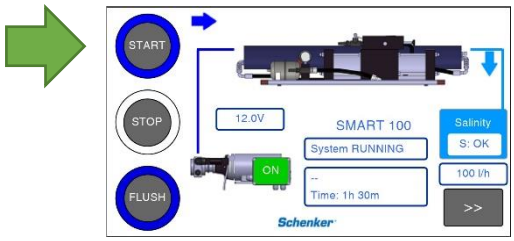
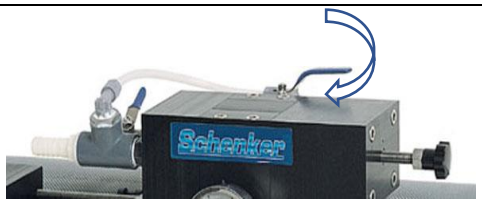
In case the power supply is removed, it is necessary to set again the parameter.

5.5 Reset procedure

If the watermaker gets air (or if some other problems occur), the automatic hydraulic valve may stop in a central position. This means that the working pressure goes up suddenly. After approx. 20 sec. the computer recognizes the problem, turn off the pumps, and the "SYSTEM BLOCKED" message starts flashing.

In this case is necessary to reset the valve with the following simple procedure:

1. Turn off the system 2. Open the reset valve (lever in horizontal position).	

3. Open the depressurization valve.	
4. Screw the positioner know clockwise until it can be moved no further. Normally 10 turns at least are needed.	
5. Unscrew the positioner knob counterclockwise up to the original position, until when it is blocked back.	
6. Close the reset valve (lever in vertical position).	
7. Restart the system.	
8. After some seconds close the depressurization valve.	

6. MAINTENANCE (ROUTINE AND SPECIAL)

6.1 Check filter cleanliness

It is very important to inspect filters condition periodically.
The following filters are present in the system:

1. Mesh filter (strainer)
2. Pump filter (5 micron cartridge filter)
3. Active carbon filter

follow the instructions given in the table below:

OPERATION	FREQUENCY	PROCEDURE
Check and cleaning of the strainer	Every 5 days	**Visual inspection and washing** 
Replacing of the 5 micron cartridge filters	It depends on the real working condition and the turbidity of the sea water. In average conditions the replacement of the cartridge is recommended every 100-120 working hours. Once replaced the filters it is necessary to purge the air from the system, opening for 2-3 minutes the depressurization valve.	**Unscrew the filter housing cup counter clockwise by using the specific key provided** 
Replace the active carbon fiber filter	Once per year	**Unscrew the filter housing cup counter clockwise by using the specific key provided** 

Purge air from the system periodically by opening for 2-3 minutes the depressurization valve.	Every 15-20 days	

6.2 Check the plant working pressure

It is necessary to read the pressure on the manometer located on the equipment front panel in order to perform this verification. The working pressure depends on many factors such as water temperature, salinity level of seawater, effective batteries voltage, membranes cleaning degree, typology of installation. The pressure, in normal working conditions, is approx. 7,5 – 8,5 Bars. There is a small pressure lost head, in the range of 0,4 bar, during the cycle.	

If the average pressure exceeds the above ranges it is necessary to check the membranes cleaning degree. It is necessary to perform the shutdown procedure if the membranes result dirty. If cleaning also results insufficient it could be necessary to perform an alkaline washing using the chemical product SCHENKER CLEANING 2 (SC2). It is recommended to contact a Schenker certified service centre.

6.3 Check for leaks

It is necessary to perform this verification at every plant start-up and however often, since possible leaks due to accidental causes (pipe bursting, pipe clamp loosening, equipment failure, etc.) may occur, even plentiful, with the consequence of possible damages.

6.4 Check for membranes replacement

The reverse osmosis membranes have a 7 years average working life. It is recommended therefore, after 5 years of operation, to verify the possible necessity of substitution and however to perform the substitution after 7 years.

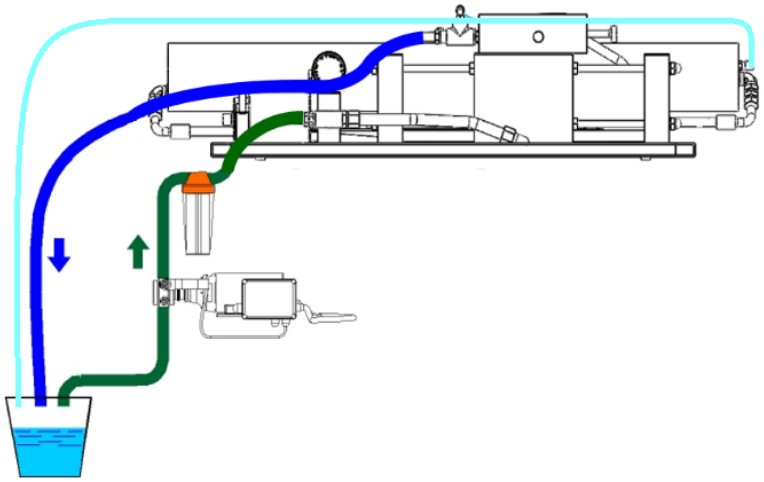
6.5 Shutdown procedure

It is necessary to perform the shutdown procedure before standstills longer than 3 months, for instance before the winter laying up.
The purpose of the shutdown is to flush the system from possible organic and inorganic sediments, and inhibit the growth of bacteria that could reduce the reverse osmosis membranes efficiency.

6.5.1 Necessary Equipment

The following equipment is necessary to perform the shutdown operation:

1. 1 tank of fill with at least 15 liters of fresh water
2. 3 pipes to be connected to:
   - inlet of the pre-pump
   - discharge of the watermaker
   - fresh water production of the watermaker.
3. A bottle of powder **SCHENKER CLEANING 1 (SC1)**. The solution must be prepared following the instruction indicated on the product label, and **using chlorine free water** (water produced by the system can be an option).
4. Tools for dismounting the system's pipes (screwdrivers, pliers, etc.)



HYDRAULIC SCHEME FOR SHUTDOWN PROCEDURE
FIG. 6-1

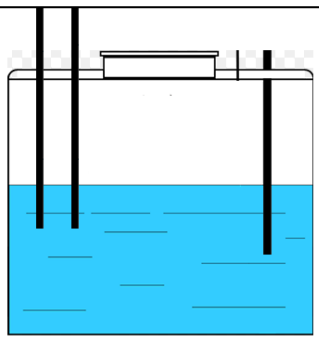
NOTE

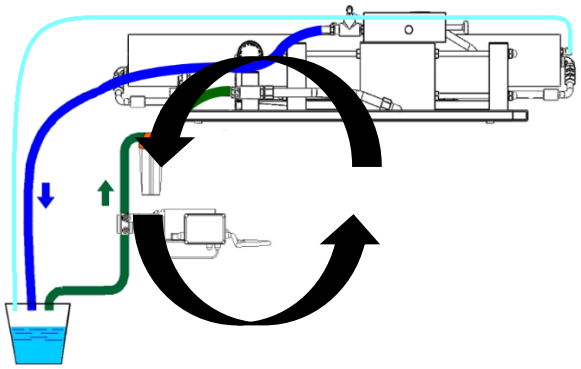
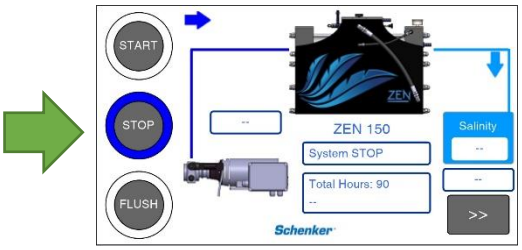
The available products for the shutdown procedure are the following:
1) SCHENKER CLANING 1 (SC1 – Acid product) to remove the inorganic components and preserve the watermaker during winter break
2) SCHENKER CLEANING 2 (SC2 – Alkaline product) to remove the organic components (mould and bacteria) when already deposited; in this case the system becomes stinky.
Whether the system needs acid or alkaline cleaning will depend on the type of foulant suspected. However, both are needed and it is recommended to start with the alkaline cleaning then follow with the acid cleaning after the system has been flushed.

NOTE

Normally only SC1 is required, but in case of strong smell it is recommended to use also the SC2.
The sequence in this case will be SC2 first, then a washing of the system. Finally the SC1, then again washing of the system.
It is advisable to replace the filters after performing shutdown procedure with new ones.

6.5.2 Shutdown operating procedure

1. Prepare the solution carefully mixing the bottle of SC1 in about 15 lit of unchlorinated water.	
2. Connect the 3 pipes to the pre-pump and watermaker as indicated above, and dip them in the solution.	
3. Check they are well dipped in the solution and don't inhale air.	**Pipes under the free water surface** 
4. Open the depressurization valve (turn counter clockwise).	

5. Start the watermaker with the by-pass activated.	
6. Leave the unit running for approx. 20 minutes, checking that the pipes are properly positioned in the recipient, so that to avoid inhaling air.	
7. Shut the plant off and connect the original pipes.	

CAUTION

It is necessary to perform the first start-up procedure when restarting the plant after a shutdown procedure, in order to purge the air and drain out board the chemicals in the systems.

6.6 Antifreeze procedure (Winterizing procedure in cold climate - under 5°C)

It is recommended to first perform the normal shutdown procedure by using SC1 in order to clean the system properly and prevent bacteria growth and inorganic material deposit.
After this operation, Then the system must be flushed and filled with an antifreeze.
The recommended antifreeze product is a solution of **propylene glycol and unchlorinated water**.
The ideal concentration of propylene glycol is

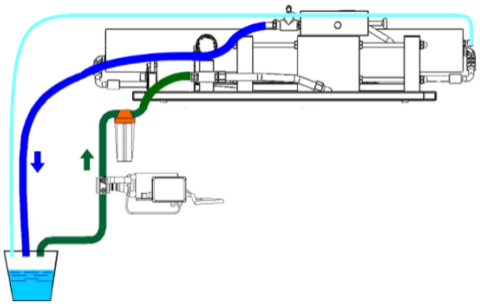
- 45% (for temperatures up to - 20°)
- 55% (for temperatures up to - 30°).

ATTENTION
Do not use ethylene glycol as this substance is toxic and non-degradable.

The total volume of the solution must be about 15 lit.

The procedure is similar to that used for chemical washing with SC1 and SC2 products:

1. Prepare the solution carefully mixing the propylene glycol with 15 lit of unchlorinated water by following the concentration suggested above.
2. Disconnect the drain pipe and the pumps suction pipe.
3. Connect two pipe pieces to the drain and to the pump suction.
4. Insert the end side of the pipes into the bucket, verifying that the pipes have been properly dipped in the solution and that they don't inhale air.
5. Open the depressurization valve.
6. Start the watermaker with the by-pass activated.
7. Leave the unit running for approx. 15/20 minutes, checking that the pipes are properly positioned in the recipient, so that to avoid inhaling air or spilling the liquid into the vessel.
8. Shut the plant off and connect the original pipes taking care of not empty the system daring out the solution.



HYDRAULIC SCHEME FOR WINTERIZING PROCEDURE
FIG. 6-2

ATTENTION
It is necessary to perform the first start-up procedure when restarting the plant after a shutdown procedure, in order to purge the air and drain out board the chemicals in the systems.

Before proceeding with any kind of service it is strongly recommended to read carefully the instruction contained in this manual.

6.7 Periodic maintenance

6.7.1 Membrane replacement

Reverse osmosis membranes have an average lifetime of about 7 years If correctly maintained. It is anyway recommended to check the efficiency of the membranes after 5 years of functioning and verify the needed of a replacement. Please, refer to a certified Schenker service centre for this operation.

6.8 Adjustments

Pump high pressure switch The main pump is equipped with a high pressure switch set at around 13 Bar. The pressure switch can be calibrated with a screwdriver. To calibrate the pressure switch pull out the plug, remove the security nut, and engage the small internal screw with a small screw driver. Turning clockwise the calibration of the pressure switch increases, while turning anticlockwise the calibration decreases.	
Accumulator It is a reservoir of air that has the function of damping the pressure oscillations during the commutations of the watermaker. The accumulator is factory loaded at a pressure of about 6 bar. The charge level must be periodically checked in order to guarantee a correct functioning to the watermaker. On latest version it is SS-made.	

7. TROUBLESHOOTING

7.1 Troubleshooting chart

Issue	Cause	Remedy
Pump doesn't start	Pump pressure switch disconnected or burned Electronic issue	Restore or replace the pump pressure switch Activate the by-pass
Pump starts but the system suddenly blocks in high pressure	Hydraulic block Dirty filters Obstruct membranes Commutation system block	Perform reset procedure Replace filters Perform washing procedure Contact a customer service
During operation, the pump temporarily switches off, giving rise to a start and stop phenomenon	Pump pressure switch not correctly set Dirty filters or membranes	Set pump pressure switch Clean or replace
Metal noise of the pump	Pump cavitation	Check the causes of the absence of water flow at the pre-pump inlet
Low production / normal or low pressure	Low battery Air within the system Loss of sealing systems	Check battery charge Purge the air out of the system Contact a customer service
Low production / high pressure (> 13 Bar)	Clogged filters Clogged membranes Cold inlet water	Replace filters Perform washing procedure Contact a customer service
Loss in the system	Loose fittings ERS leaks	Tighten fittings Contact a customer service

7.2 Electronic issues and their solution

- **Pressing the start button the system starts but goes into alarm after about 20-25 seconds.**

Check if the watermaker is in hydraulic block (pressure indicated by the pressure gauge above 9-10 bar and pump start/stop continuosly). In this case, carry out the reset procedure indicated in the manual and restart the system.

- If still the system does not start (it goes on the block after about 20 seconds), activate the system manually by inserting the bypass.
- If the system works correctly (normal pressure/normal output) it could be just a probe issue. In this case disconnect the 2 cables of the pressure switch from the PCB of the controller, then connect the 2 cables to a meter in ohm position. The pressure switch must give, under normal conditions, a closing signal followed by an opening signal, every 3-4 seconds. If the signal is always open or always closed, the pressure switch must be replaced.

8. SUGGESTED SPARE PARTS

8.1 Short term cruising

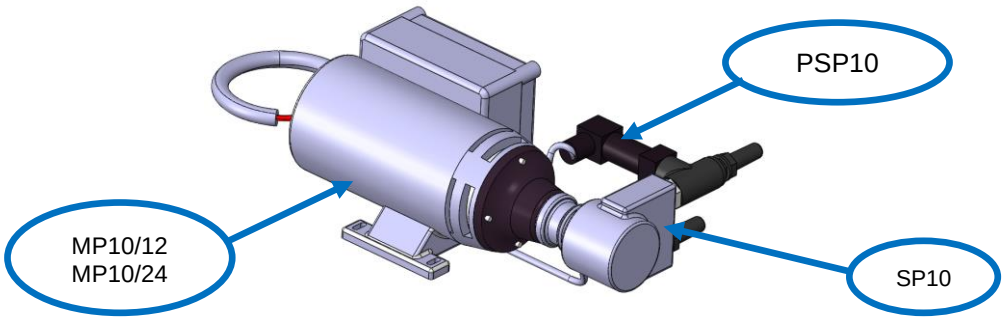
For short term cruising it is advisable to have onboard a cleaning kit (one SC1 and one SC2 cleaning product) as well as one 5 micron cartridge filter. Other additional spares are listed below with their codes:

Spare part name	Code
SC1 WASHING PRODUCT	SC1
SC2 WASHING PRODUCT	SC2
CLEANING KIT (SC1+SC2)	CK
5 MICRON CARTRIDGE 9 ¾''	F5
ACTIVE CARBON FILTER CARTRIDGE	CA

8.2 Long term cruising

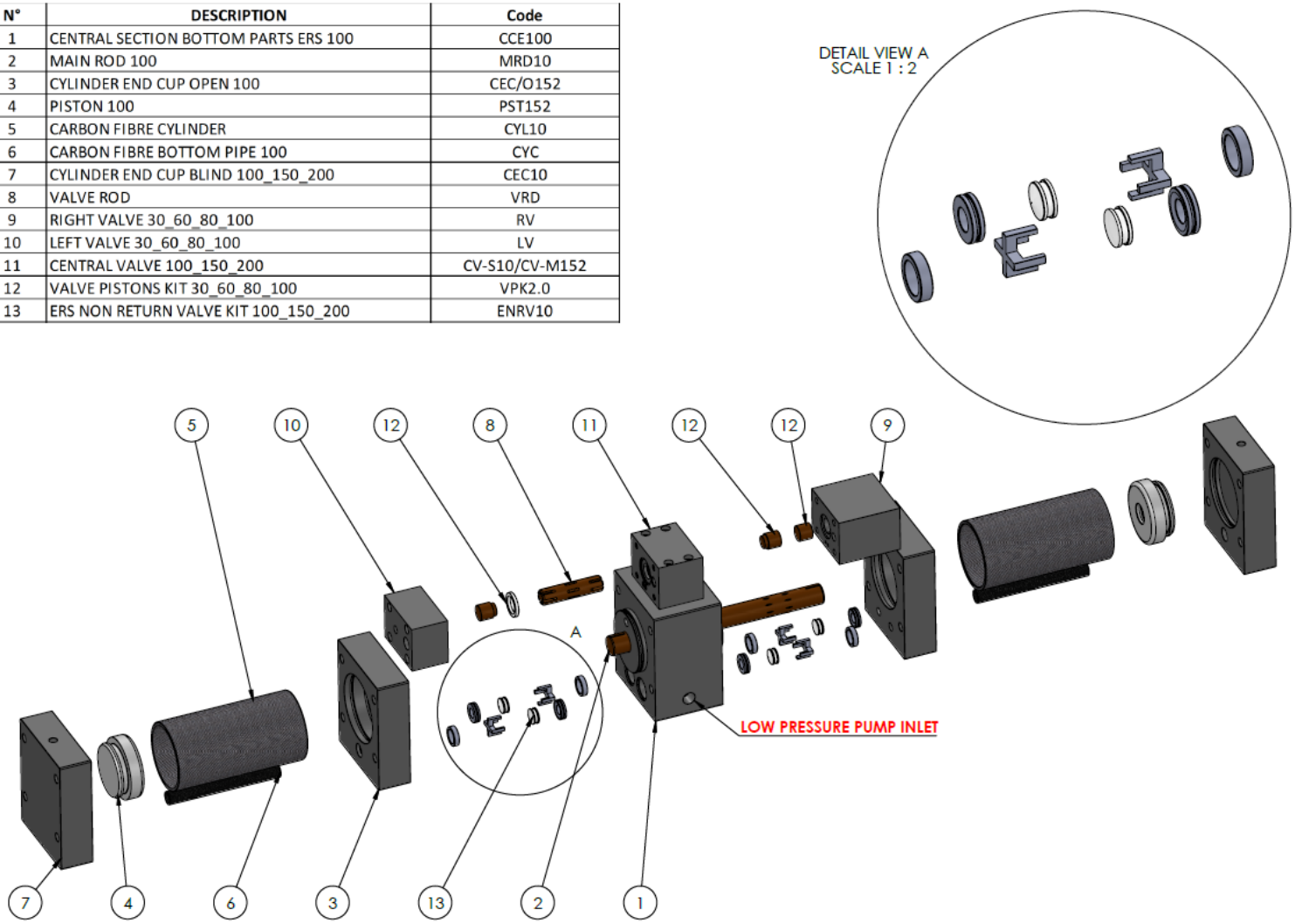
For long term cruising it is advisable to have onboard a cruising kit (three 5 micron cartridge filter, one active carbon filter, one cleaning kit) and a signal pressure switch. Other additional spares are listed below with their codes:

Spare part name	Code
SC1 WASHING PRODUCT	SC1
SC2 WASHING PRODUCT	SC2
CRUISING KIT	CRK136
PUMP HEAD 100/150 L	SP10
PUMP MOTOR 80/100 12V	MP10/12
PUMP MOTOR 80/100 24V	MP10/24
MEMBRANE 4040	M4040
PORTABLE SALINITY TESTER	PST
SIGNAL PRESSURE SWITCH SMART30/60/100	PSSS361
PUMP PRESSURE SWITCH 80/100	PSP10
SPARE SEALS KIT 2.0	SS100-2.0



8.3 ERS spare parts

N°	DESCRIPTION	Code
1	CENTRAL SECTION BOTTOM PARTS ERS 100	CCE100
2	MAIN ROD 100	MRD10
3	CYLINDER END CUP OPEN 100	CEC/O152
4	PISTON 100	PST152
5	CARBON FIBRE CYLINDER	CYL10
6	CARBON FIBRE BOTTOM PIPE 100	CYC
7	CYLINDER END CUP BLIND 100_150_200	CEC10
8	VALVE ROD	VRD
9	RIGHT VALVE 30_60_80_100	RV
10	LEFT VALVE 30_60_80_100	LV
11	CENTRAL VALVE 100_150_200	CV-S10/CV-M152
12	VALVE PISTONS KIT 30_60_80_100	VPK2.0
13	ERS NON RETURN VALVE KIT 100_150_200	ENRV10



8.4 Additional spares

For extraordinary maintenance intervention that might become necessary in order to ensure the normal operating condition of the watermaker, other common spares are listed below with relative images and codes:

Spare part name	Code
COUPLE HIGH PRESSURE PIPE SM 100/150/200	HPH2
END CUP VESSEL 4” SINGLE CONNECTION	EV4
END CUP VESSEL 4” DOUBLE CONNECTION	EV4-2
“C” END CUPS 4’’ CONNECTION FITTING	CEV4
MANOMETERS 0-16	M16B