

Mar Cor Purification

WRO 300/300 H

Service Manual



MAR COR[®]
PURIFICATION

A Cantel Medical Company

Important User Information

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Intended Use

MCP products are intended to be installed and used as described in this manual and other related MCP literature.

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Preface

This manual provides the information needed to carry out maintenance and to identify and remedy any fault that may occur on the WRO 300 water purification unit and the WRO 300 H water purification unit.

The complete model name *WRO 300 unit* or *WRO 300 H unit* is used only when the information is specific and only valid for one of the models. The *WRO unit* refers to information valid for both models.

Related Manuals

The list below shows manuals related to this *Service Manual*. Always specify the revision level when ordering the manual for your water purification machine.

Installation Guide, WRO 300/300 H	3027502
Operator's Manual WRO 300	3027435
Operator's Manual WRO 300 H	3027436

Safety Message Definitions



WARNING

Is used to alert the user/operator **not to take** a certain action, which if taken can cause a potential hazard and result in a serious adverse reaction, injury or death. A warning may also be used to alert the user/operator **to take** a certain action to avoid the potential hazard as above.



CAUTION

Is used to alert the user/operator **to take** a certain action to protect against a potential hazard which, if ignored, could have an adverse effect on the patient or the device. A caution may also be used to alert the user/operator **not to take** a certain action to avoid the potential hazard as above.

NOTE

A reminder to the user/operator on normal treatment activity and on what is a suitable action in a particular situation.

Safety Considerations



WARNING

Unauthorized installation, modifications, alterations or repair of the WRO unit may result in malfunctioning or have other serious consequences for the safe operation of the equipment.

**CAUTION**

- Dialysis machines that are supplied with water from the WRO unit, must comply with IEC 60601-2-16.
- The WRO unit should only be operated by persons trained in the use of this equipment and who have studied the instructions in the *Operator's Manual*. If the WRO unit does not perform as described in the *Operator's Manual*, it should not be used until the condition is rectified.
- The operator should pay attention to alarms and follow the instructions, warnings, cautions and notes given in the manual.
- The use of mobile telephones or communication equipment in the vicinity of the WRO unit could adversely influence the performance of the machine.
- The WRO unit needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided in the *Operator's and Service Manual* (refer to *Technical Data on page 115*).
- The WRO unit is not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.
- The WRO unit will perform as designed only if it is used and maintained in accordance with MCP's instructions. Any warranties made by MCP with respect to the WRO unit, are void if the equipment is not used in accordance with the instructions provided. MCP will not accept responsibility for any damage or injury resulting from improper use or maintenance or unauthorized repair.
- The user must verify the quality of the protective earth in the installation.
- U.S. Federal law restricts this device to sale by, or on the order of, a physician.

NOTE

- On delivery the WRO unit is filled with preservation and anti-freeze solution. This solution must be rinsed out before the WRO unit is put into operation.
- During transportation and storage the equipment must be kept in its original packing. If transportation or storage time is more than 15 weeks the environmental data relating to the operation must be fulfilled (refer to *Technical Data on page 115*).
- The WRO unit is intended for continuous operation.

List of Symbols

	Alternating current
	Protective earth (ground)
	Warning, consult accompanying documents
	Off (power, disconnection from the mains)
	On (power, connection to the mains)
	Type B, applied part
	Handle with care
	This way up
	Keep dry
	Separate collection for electrical and electronic equipment
	Year of manufacturing
IPX1	The WRO 300/300 H is protected against dripping water
 CB	Recycling symbol -General
	Reject water connection
	Feed water inlet connection
	Loop connections (Product water outlet and return)



ME equipment and ME systems that include RF transmitters or that intentionally apply RF electromagnetic energy for diagnosis or treatment shall be labeled with this symbol.

Certification Marks



The CSA(C-US) mark indicates that the WRO 300/300 H water purification units conform to the requirements related to safety of medical devices for the US and Canada. The C and the US adjacent to the CSA mark indicates that the WRO 300/300 H water purification units have been evaluated to the applicable ANSI/UL and CSA standards for use in the US and Canada.

IPR - Intellectual Property Rights

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1 Introduction

1.1 Intended Use

The MCP WRO 300/300 H Water Purification Unit is intended to be used as a dialysis accessory to produce water through reverse osmosis for one hemodialysis equipment.

The WRO 300/300 H can be connected to hemodialysis equipment used both in hospitals and in home environments, in conjunction with appropriate pre and post treatment units, as a part of a water treatment system designed to meet applicable regulations or standards for water for dialysis, for example current AAMI and Federal (U.S.) standards.



CAUTION

The water produced by the WRO unit should be analyzed at installation and on a regular basis to verify that it conforms to applicable regulations or standards for water for dialysis.

1.2 Reverse Osmosis

Reverse osmosis (RO) is a membrane process that is the most widely used technique for purification of water for dialysis. When the **feed water** is in contact with the semipermeable membrane (the most vital part of the system) and a high pressure is applied, water will flow through the membrane to the **product water** side. Most of the other constituents (dissolved salts, particles, bacteria and pyrogens) will remain on the feed water side of the membrane and be flushed to drain as **reject water**.

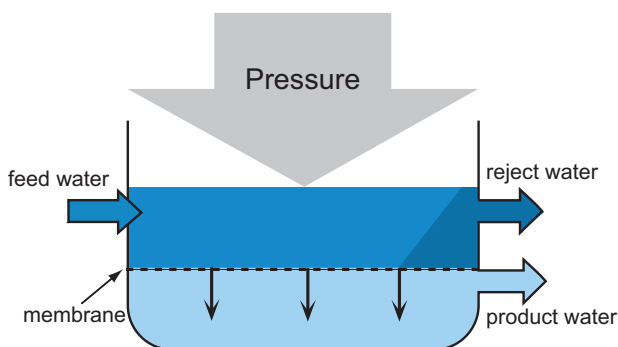


Fig. 1.1 — Principal of reverse osmosis

1.3 General Function

A high-pressure pump feeds water (usually pretreated water) into the RO module, containing the membrane. The **product water** leaves the RO module through the product water outlet into the product water loop, to which the dialysis machine is connected. The **reject water** leaves the WRO unit via the drain outlet.

1.4 Water Quality

1.4.1 Pretreatment

The quality of the incoming water varies from one place to another. Different pretreatment equipment may be required depending on the local water quality and regulations. An acceptable quality of the feed water is required, that is in accordance to *Technical Data on page 115*. As a minimum, 5 micron prefiltration must be applied. Additional pretreatment, such as carbon filters and softener, may be required depending on the feed water quality.



WARNING

This device does not remove chlorine and chloramines from the water. Carbon filtration to remove these substances is therefore required if the total chlorine concentration might exceed 0.1 mg/l (ppm). Severe patient injury may otherwise occur. Ensure by testing or by other means that the total chlorine concentration is below 0.1 mg/l (ppm) prior to initiating dialysis treatment.

1.4.2 Microbiology

The water quality is a very important factor in achieving and maintaining an adequate quality of the dialysis fluid. The microbiological quality of the product water depends not only on technical parameters such as retention rates of membranes, but also to a large extent on other factors:

- Feed water shall comply to relevant standards for drinking water.
- Handle taps and connectors in such a manner to avoid microbiological contamination (any pretreatment device, the WRO unit and the dialysis machine).
- Provide for **regular and pro-active** disinfection of the WRO unit.
- Set up air gap between the drain outlet and the drain to avoid microbiological contamination from the drainage system. Refer to the *Installation Guide* for the WRO unit.

1.4.3 Check Water Quality

The ions in the water effect the conductivity; the ability to conduct an electric current. To get an indication of the water quality from a chemical perspective, the WRO unit measures the conductivity of the feed water and the product water. The conductivity values ($\mu\text{S}/\text{cm}$) **indicate** the performance of the WRO unit. Further water tests are, however, necessary. Refer to *Water Testing on page 105*.

**CAUTION**

The conductivity value does not always indicate the suitability of the water for dialysis. For example, aluminium may be present in concentrations well exceeding recommended standards without affecting the conductivity. Therefore the quality of the product water, used for dialysis, should be verified by regular analysis of the water.

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2 Technical Description

2.1 Flow Diagrams

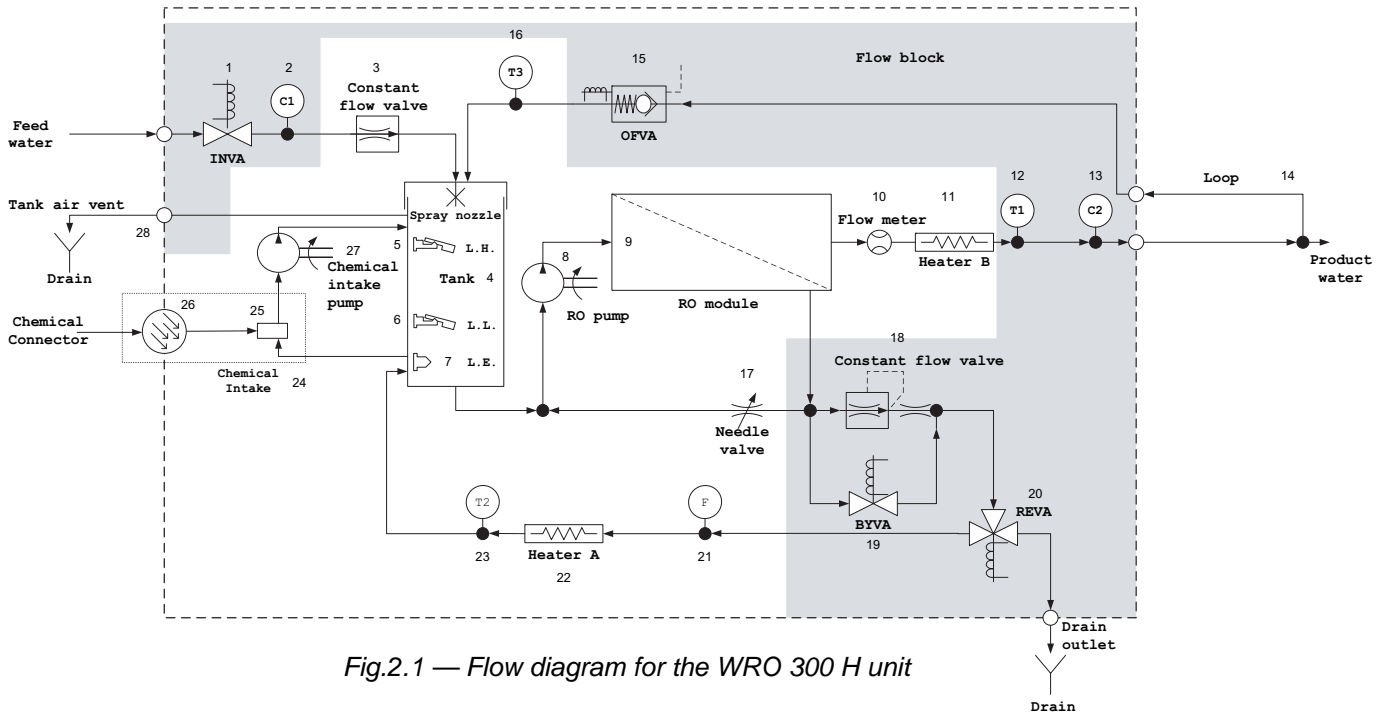


Fig.2.1 — Flow diagram for the WRO 300 H unit

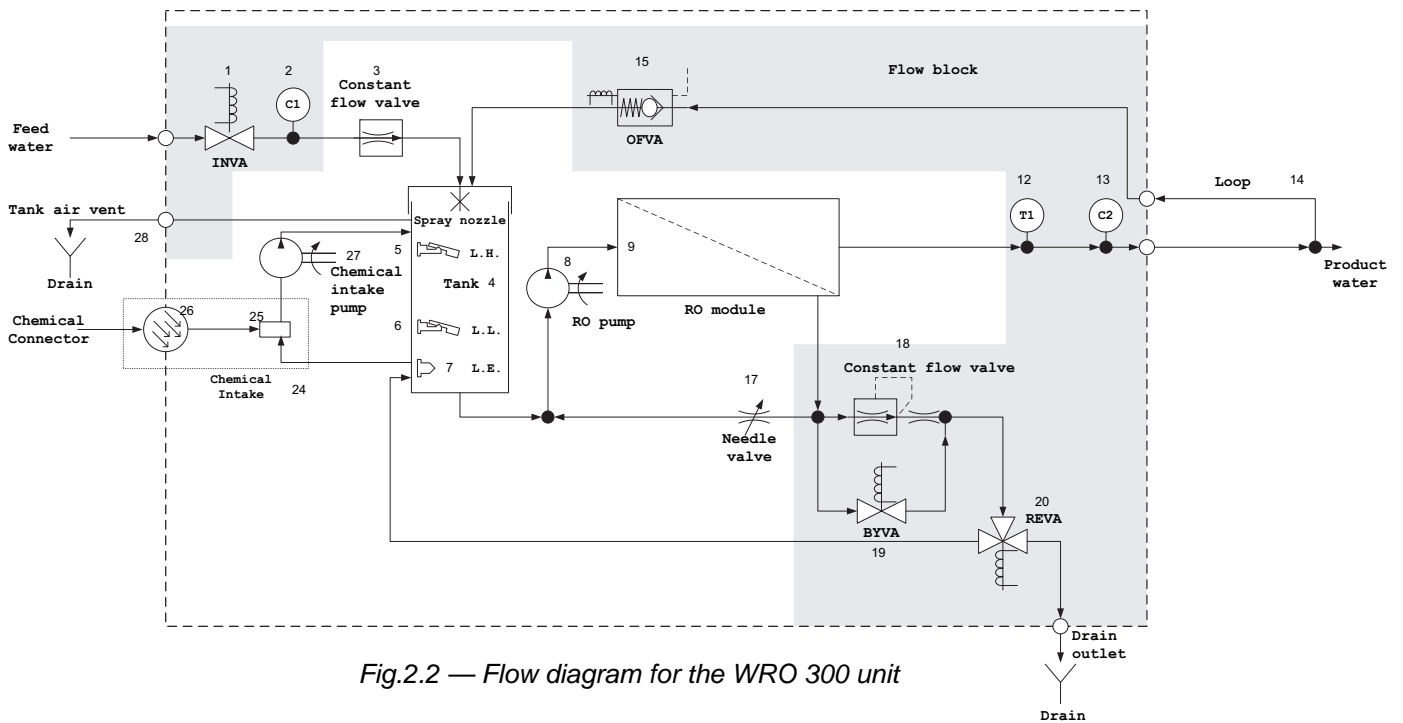


Fig.2.2 — Flow diagram for the WRO 300 unit

Components in the grey area in the illustrations above are mounted on the flow block.

2.2 Components in Flow Diagram

	Components	Additional Information	
1	Inlet valve (INVA)	Two-way solenoid valve	
2	Conductivity cell (C1)	Monitor feed water conductivity	
3	Constant flow valve	Approximately 4000 ml / minute	
4	Tank	Providing air gap	
5	High level sensor (LH)	Float level switch	
6	Low level sensor (LL)	Float level switch	
7	Empty level sensor (LE)	Optical sensor	
8	RO pump		
9	RO module	The WRO 300 unit and the WRO 300 H unit have different membranes and different pressure vessels.	
10	Flow meter	In product water line (Can also be installed in the WRO 300 unit, refer to separate Spare Part Instruction).	only in the WRO 300 H unit
11	Heater B	In product water line	only in the WRO 300 H unit
12	Temperature sensor (T1)	For product water	
13	Conductivity cell (C2)	Monitor product water conductivity	
14	Product water loop	To and from the dialysis machine	
15	Overflow valve (OFVA)	Two-way solenoid valve for product water return	
16	Temperature sensor (T3) product water return		only in the WRO 300 H unit
17	Needle valve	For reject recirculation	
18	Constant flow valve	1200 ml / minute when BYVA (19) is closed.	
19	Reject bypass valve (BYVA)	The two-way solenoid valve, when active (open), most of the reject water bypasses the constant flow valve (18) and the pressure in the WRO unit is minimized.	
20	Reject valve (REVA)	Three-way solenoid valve diverts reject water either to tank or to drain.	
21	Flow indicator	Recirculated reject water	only in the WRO 300 H unit
22	Heater A	Recirculated reject water	
23	Temperature sensor (T2)	Recirculated reject water	
24	Chemical intake		
25	Three-way valve	Manual operation	
26	Optical sensor	Detects the wand	
27	Chemical intake pump		

	Components	Additional Information
28	Tank air vent	Connects the tank to the atmosphere and is also used as overflow connection.

2.3 Flow Description

2.3.1 Run

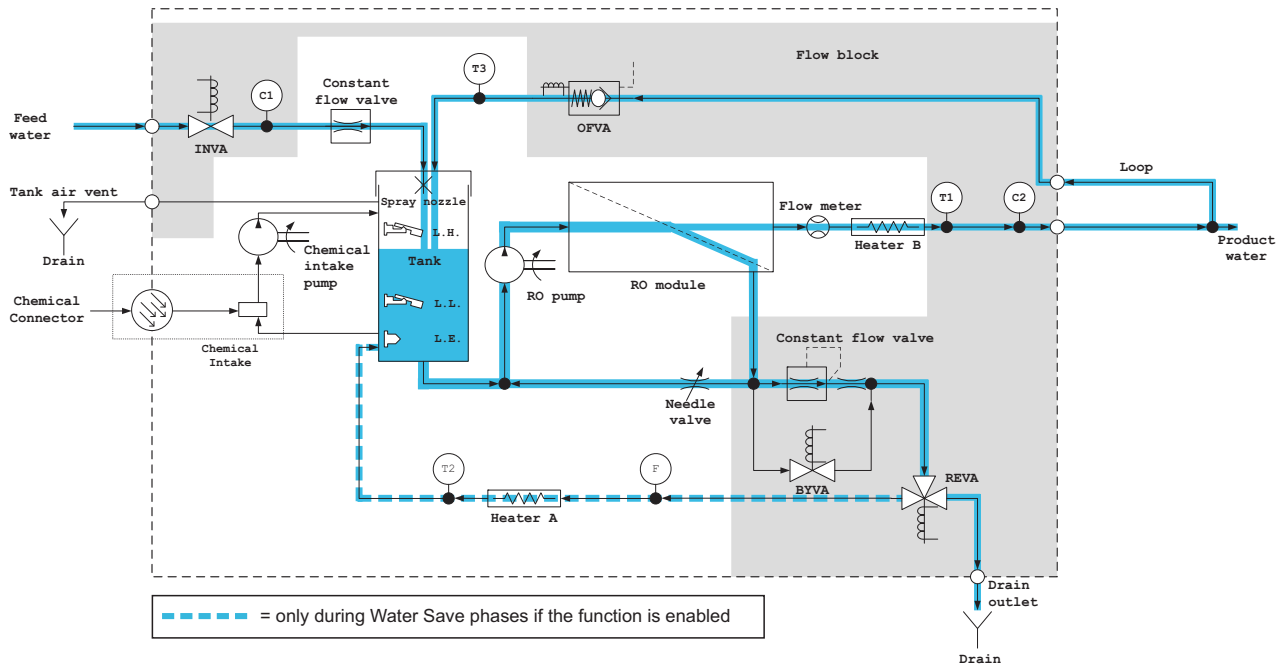


Fig.2.3 — Flow description

The **feed water** enters the WRO unit through the inlet solenoid valve INVA. The conductivity cell C1 monitors the feed water conductivity. The feed water passes the constant flow valve which regulates a steady flow of water into the tank, approximately 4 l/min, if the feed water pressure is above minimum pressure.

The low and high level **sensors** in the tank (LL and LH) detect the water level and the program controls the opening and closing of the inlet solenoid valve INVA. INVA is open during filling, and closes when the water level reaches LH. INVA opens again when the water level is below LL. If the water level in the tank gets too high, excess water is drained through the tank air vent (overflow connection). The RO pump stops when the empty level sensor LE detects air.

The RO-pump creates the **feed water flow** required for the reverse osmosis process. The pump speed ramps up during the initial two to three seconds. Higher pressure forces more water through the membrane. (The manually adjusted needle valve effects the water pressure in the RO module.).

NOTE
 High flow velocity over the RO membrane is important for proper function of the WRO unit. Part of the reject water is recirculated through the needle valve, while still maintaining low water consumption. Also, excess product water is recirculated to save water.

When the product water leaves the RO module in a WRO 300 H unit, it flows by the flow meter, the heater B, and the temperature sensor T1, (in a WRO 300 unit only T1). The conductivity cell C2 monitors the product water conductivity.

The product water leaves the WRO unit through the product water outlet and flows to the dialysis machine through the product water loop. Excess product water, not used by the dialysis machine, returns to the tank through the overflow solenoid valve OFVA (for functionality of the OFVA, refer to *page 26*). In a WRO 300 H unit, the water flows across the temperature sensor T3 before entering the tank.

The reject water leaves the RO module and flows through the constant flow valve which regulates a steady flow of reject water to the three-way solenoid valve REVA. The rest of the reject water goes back to the RO pump through the needle valve.

NOTE
 As the needle valve is closed, it creates higher pressure in the RO module and lower recirculation flow. Do not close the valve more than necessary to obtain the required product water flow and pressure. Otherwise, ions build up at the membrane surface and cause increased product water conductivity which may shorten the lifetime of the membrane.

REVA **diverts the reject water** either to the drain or back to the tank (if the water save function is enabled). In a WRO 300 H unit the water also passes the flow indicator F, the heater A and the temperature sensor T2 when recirculating to tank.

The tables below illustrate an example of the relationship of the water flow in the WRO unit during run, **when the total amount of water flow is 5.0 liters/minute.**

From	To	Type of water	Flow ¹ liter/min
RO module	product water loop	total product water	1.1
RO module	needle valve and constant flow valve	total reject water	3.9
constant flow valve	drain outlet	reject water, to drain	1.2
needle valve	RO pump	reject water, recirculated	2.6

From	To	Type of water	Flow ¹ liter/min
product water loop	tank	product water, recirculated	0.7
tap	tank	feed water	1.7
product water loop	dialysis machine	product water	0.5

1. In this example:

Sum of Flows to and from the RO module, (according to example above)	Flow liter/ minute
feed water to the WRO unit + product water (recirculated) + reject water (recirculation part) = total volume to RO module	1.7+ 0.7+ 2.6 = 5.0
total product water + total reject water = total volume from RO module	1.1+ 3.9 = 5.0

2.3.2 Chemical Disinfection and Cleaning

When the disinfection wand is connected to the chemical intake at the front of the WRO unit, the three-way valve in the chemical intake unit opens towards the chemical intake pump and the tank. The other end of the wand is inserted into an external container with cleaning or disinfection solution. The chemical intake pump feeds the solution through the wand into the tank. The optical sensor detects if the wand is connected or disconnected. When removed, the chemical intake pump stops and the three-way valve closes towards the chemical connector and instead allows for recirculation from tank through the chemical intake unit, back to the tank, (during chemical disinfection, cleaning or rinse). REVA also recirculates to the tank during some phases of chemical disinfection, cleaning or rinse.



CAUTION

The chemical container must be located below the chemical intake.



CAUTION

When requested by the WRO unit, remove the disinfection wand from the chemical intake. Failure to remove the disinfection wand can cause siphoning of the chemical solution from the bottle resulting in the tank overflowing chemical solution through the back of the machine.

2.4 Components

2.4.1 Overview

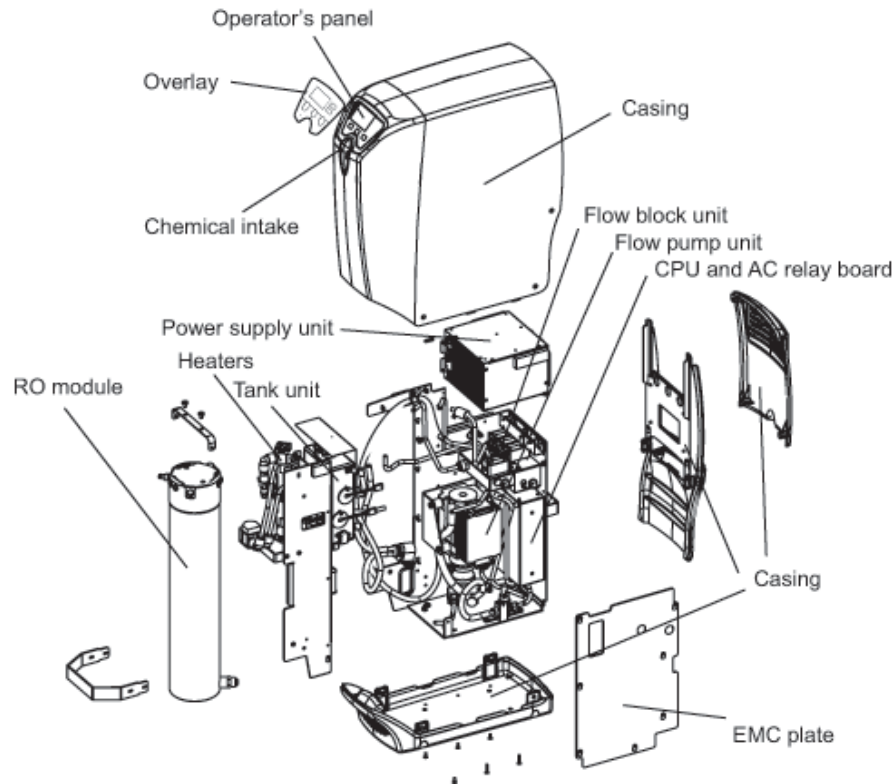


Fig.2.4 — The WRO 300 H unit overview

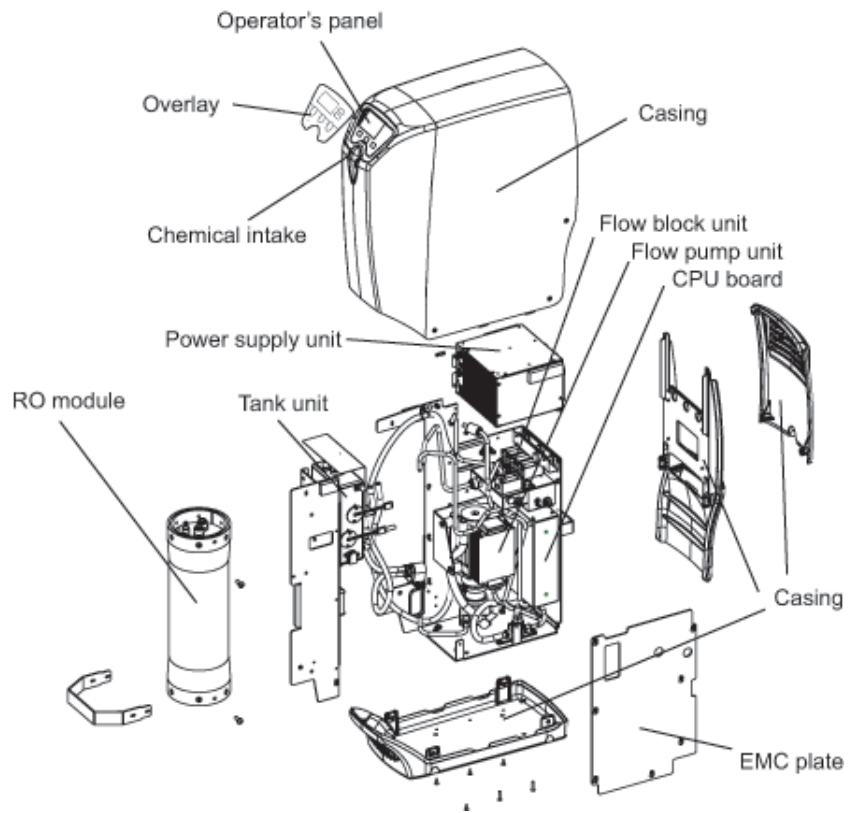


Fig.2.5 — The WRO 300 unit overview

2.4.2 Casing

The casing consists of four pieces as shown in the figure below.

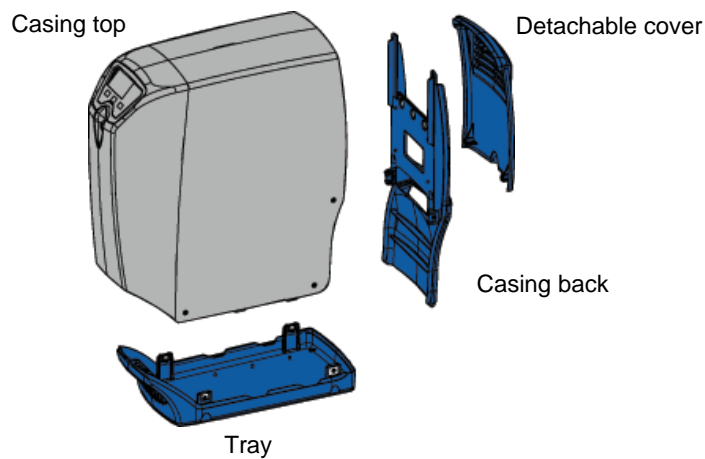


Fig.2.6 — Casing

2.4.3 Operator Panel

The circuit board with the display, buttons, buzzer and LCD screen is covered with an overlay. Overlay depends on model; WRO 300 unit or WRO 300 H unit.

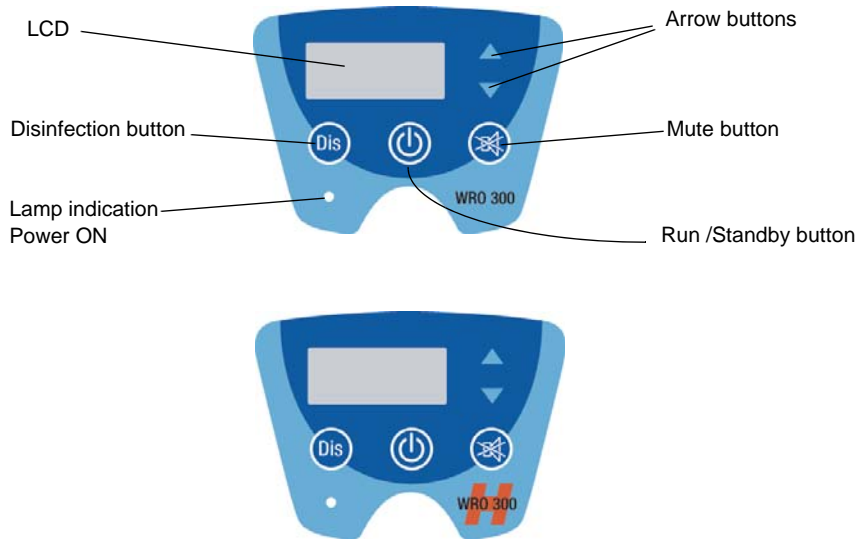


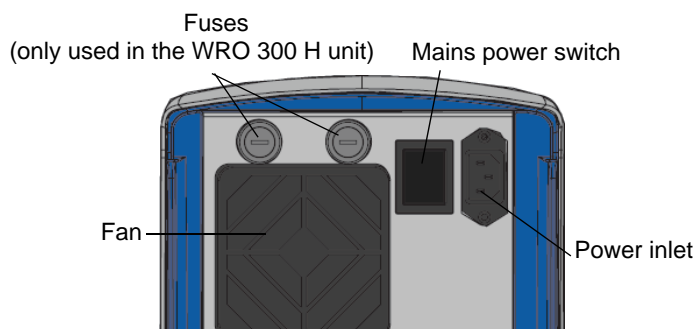
Fig.2.7 — Operator Panel

2.4.4 Power Supply Unit

The power supply unit adjusts automatically to the supplied voltage (100, 115 or 220 to 240 VAC with 50 or 60 Hz). The internal voltage supply is 24 VDC except for the heaters that are supplied with mains power voltage, refer to *Heat on page 87*.

2.4.5 Fan

The fan cools the power supply unit.



Fuses for the WRO 300 H unit

Voltage ¹	Fuse size	MCP Order Number
100 - 115 VAC	15 A SLO BLO	ME20165

1. Preset S32 must be changed, from GXP, to select the correct mains voltage.

2.4.6 Y Coupling and Product Water Loop

The product water loop consists of two hoses from the WRO unit connected to the parallel connections at the Y coupling. The hose from the third connection at the Y coupling is connected to the dialysis machine.

2.4.7 Tank

The tank is supplied with feed water from the feed water inlet and product return water and, if the water saving function is in use, also reject water from the reject valve (REVA). The water is distributed to the RO module or to the chemical intake pump (during disinfection).

2.4.7.1 Tank Air Vent

The tank air vent connects the tank to the atmosphere. If the water level reaches the tank air vent the excess water leaves the tank. To avoid back contamination of the feed water supply there is an air gap between the feed water at the top of the tank, above the tank air vent.

NOTE

The tank air vent outlet must be connected with an air gap to drain. If a hose is connected to the tank air vent the hose should have a constant slope.

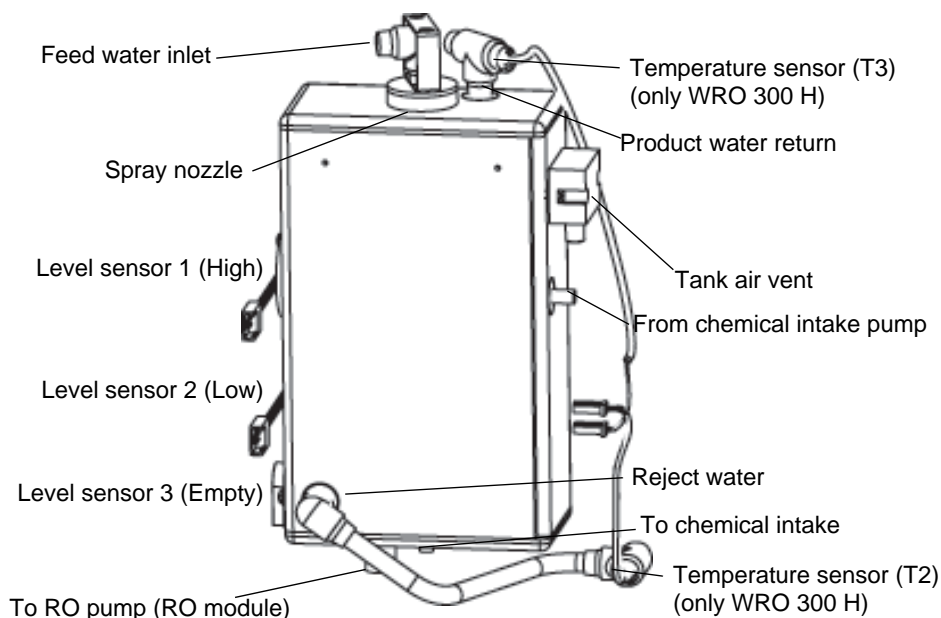


Fig.2.8 — Tank

2.4.7.2 Spray Nozzle

The feed water enters the tank unit through a spray nozzle to spray the walls of the tank.

2.4.7.3 Level Sensors

There are three level sensors in the tank to monitor the water level.

Level sensor	Description
Low	The high level sensor (LH) and the low level sensor (LL) are float level switches.
High	
Empty	The empty level sensor (EL) is an optical sensor.

NOTE

- Avoid touching the optical sensors detection area with fingers and do not expose it to dust. Optical sensors may be cleaned with a gentle detergent or soap. Substances containing alcohol must not be used.
- The float level switch can be permanently damaged if it is dropped on a hard surface.
- To be able to use float level switches the program version must be 4.0 or higher.

2.4.8 RO Modules

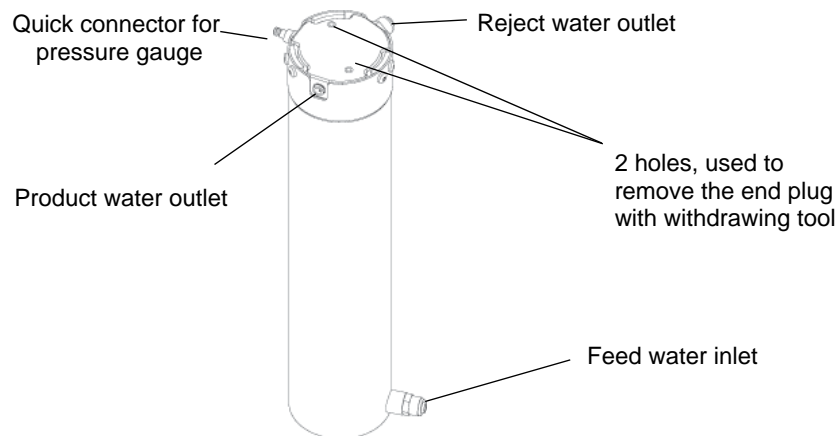


Fig.2.9 — RO module for the WRO 300 H unit

NOTE

- In a WRO 300 H unit, a new membrane element must be exposed to at least one heat cycle before the rejection rate is acceptable.
- The membrane element must not be exposed to a pressure exceeding 3 bar at temperatures above 45 °C.

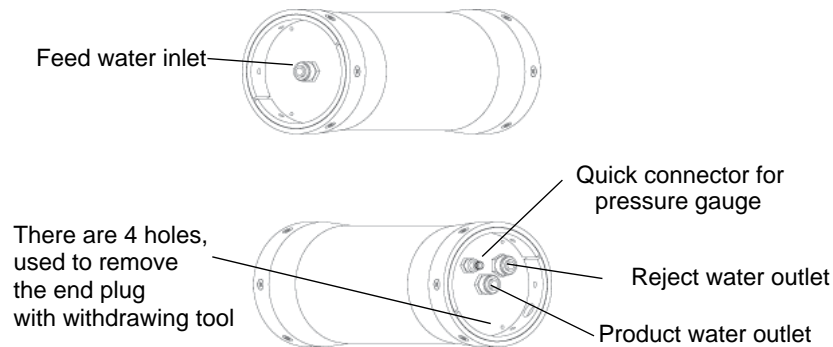


Fig.2.10 — RO module for the WRO 300 unit.

2.4.9 Motor and RO Pump Unit

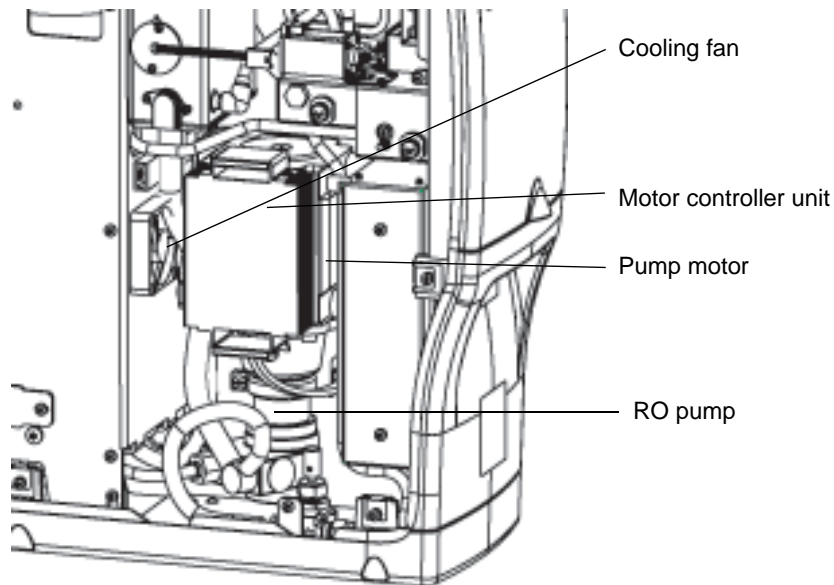


Fig.2.11 — RO pump

The RO pump creates the required pressure and flow for the reverse osmosis process and circulates the water in the WRO unit. It is driven by a 24 VDC brushless motor with a controller unit.

2.4.10 Cooling Fan

The pump motor and the motor controller unit are cooled by a separate, internal cooling fan.

2.4.11 Flow Block Complete

A number of the components required for the operation of the WRO unit are located in the flow block.

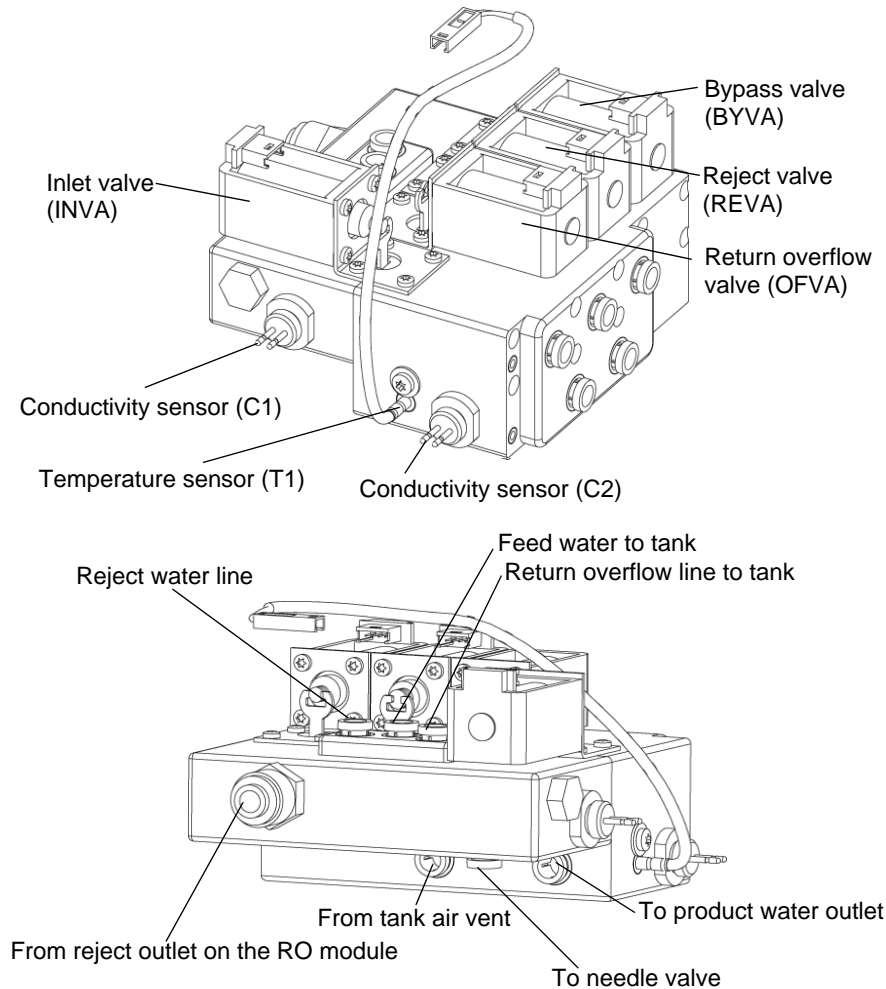
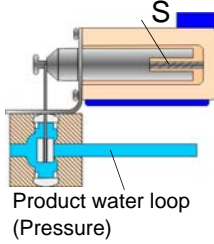


Fig.2.12 — Flow block

Sensors	Description
Conductivity sensors	C1 in the feed water line and C2 in the product water line measure the conductivity of the water.
Temperature sensor	T1 measures the temperature in the product water line.

Valves	Description
Reject valve (REVA)	Three way solenoid valve, either diverts to drain or tank.
Inlet valve (INVA)	Two way solenoid valve, opens and closes for feed water.
Bypass valve (BYVA)	Two way solenoid valve, when open (active) the flow bypasses the constant flow valve.

Valves	Description
Return overflow valve (OFVA) 	The spring-assisted solenoid valve (OFVA) has two functions: <ul style="list-style-type: none"> • To maintain pressure in the loop. When deactivated (run), the valve remains closed (= no flow) at pressures below 0.25 MPa (2.5 bar). When the pressure increases further, it gradually opens and lets water through. • To relieve the pressure in the loop during certain modes of operation. When activated, the valve opens to the inlet water tank. This will minimize the flow from the product water loop into the dialysis machine.
Constant Flow valve	This valve gives a steady flow of 1.2 ±0.1 l/min.

2.4.12 Needle Valve

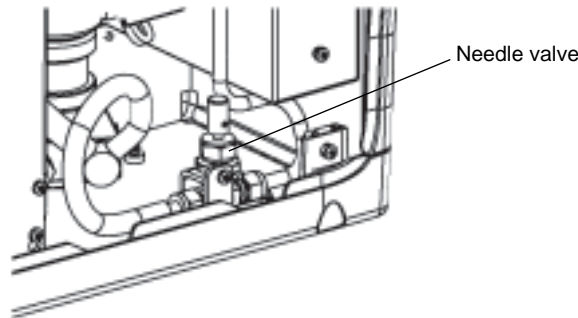


Fig.2.13 — Needle valve

The needle valve controls the desired product water consumption (1.1 l/min) at a loop pressure of 1.5 bar.

NOTE
 The setting of the needle valve affects the reject recirculation flow. Turning the needle valve clockwise towards closed position will reduce recirculation and increase module pressure.

2.4.13 Chemical Intake Unit

The chemical intake unit supplies the WRO unit with chemicals for disinfection or cleaning. The optical sensor detects if the disinfection wand connector is inserted in the chemical intake.

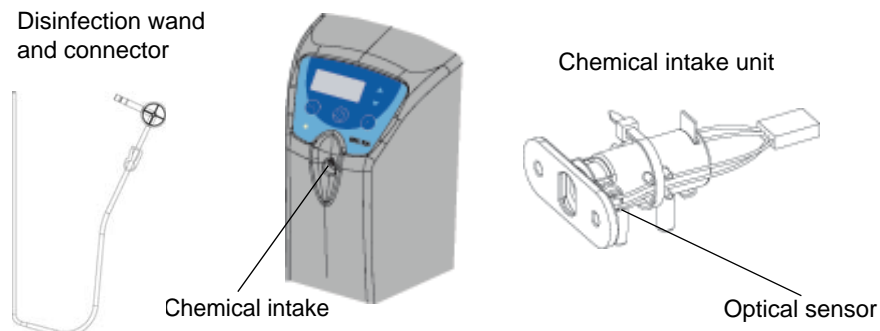


Fig.2.14 — Chemical intake

2.4.14 CPU Board

The CPU board contains most of the electronics that control the function of the WRO unit.

2.4.15 AC Relay Board (only WRO 300 H)

The AC relay board contains the electronics that control the heater rods.

2.4.16 External Communication Connections

At the rear side of the WRO unit there are three external communication connections. These are used for external communication, logging of data to a PC, and downloading upgraded software from a PC. The required cables are optional and may be ordered from MCP.



Connection	Function	Description
P500 Green ¹	External communication	Currently not used.
P501 Black	Software communication	Connection to PC.
P502 Yellow	External Signal/Remote Start	Currently not used.

1. Blue in older version of WRO unit.

NOTE

- Only cables specified by MCP must be used when connecting the WRO unit to external equipment.
- Be sure to use the correct cable type to the yellow connector when an external alarm is connected, refer to *Connection of External Equipment on page 118*.

2.4.17 Heaters (only WRO 300 H)

The WRO 300 H unit is equipped with two heaters with different properties. The electrical connections are therefore different and marked *REJECT* and *PRODUCT* on the AC relay board. Mount the reject water heater to the left and the product water heater to the right as seen in the figure below — if mounted incorrectly steam may come out from the tank air vent.



CAUTION

Ensure that the heaters are mounted in the correct position.

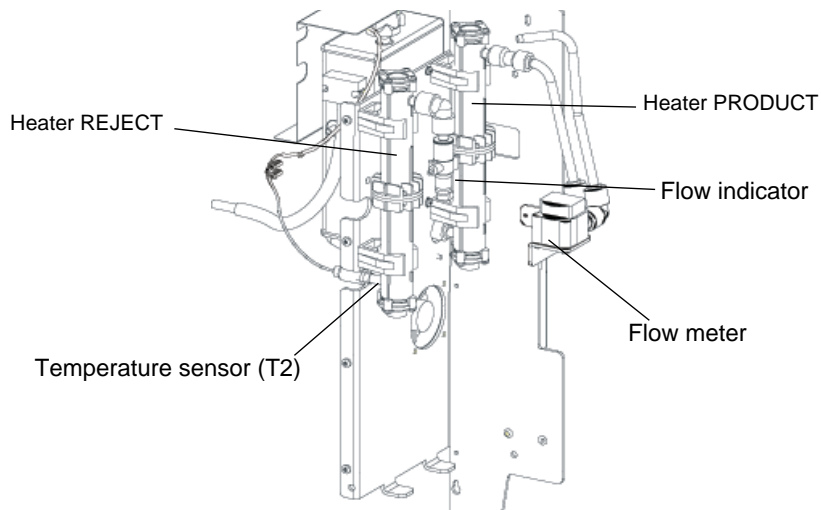


Fig.2.15 — Heaters

2.4.18 Mains Power Cable



Mains power cable is supplied with the RO and is a hospital grade, 15 Ampere rated capacity, detachable type cord.



2.5 Description of Indications



2.5.1 Light Indications

The light indications of the operator’s panel are described in the tables below.

Flash Indication	Time	
	On	Off
Slow flash	0.4 sec	2.0 sec
Medium flash	0.4 sec	0.4 sec
Fast flash	0.2 sec	0.2 sec

Indications			Description
	Green	General	Indicates that the WRO 300 is energized.
	Green	Steady light	Run mode, auto flush or manual flush in progress.
		Slow flash	The auto flush function is activated (only in standby mode).
		Fast flash	Insufficient feed water supply (only in run mode).

Indications			Description
	Yellow	Steady light	Chemical disinfection or cleaning is in progress.
		Medium flash	The disinfection wand connector is inserted into the chemical intake.
			During selection of procedure in SELECT or CHEM SELECT .
			The chemical intake phase is paused.
		Forced rinse is required (404 RINSE REQUIRED).	
	Red	Medium flash	Unconfirmed notification, info, alarm or stop conditions are present.
		Steady light	Notification, info, alarm or stop condition has been confirmed.

NOTE
 Medium flash of  or  alerts the user to push the flashing button.

2.5.2 Buzzer Sounds




The buzzer sounds of the Operator's panel are described in the table below.

Buzzer Sound	Description
Notification	— — — — —
Alarm	— — — — —
Stop	— — — — —


2.6 Operation Functions

2.6.1 Standby Mode

The actions in the table below are possible from standby mode.

Action	Additional information	Refer to
Change of presets from GXP	EXTERNAL PRESET displays when GXP is connected.	<i>Standby Mode</i> (this section)
Auto flush	Slow flash of  during standby indicates that the auto flush function is activated.	<i>Auto Flush on page 31</i>
Heat disinfection activated by time channel WRO 300 H only	Slow flash of  during standby indicates that automated heat disinfection by time channels is preset.	<i>Initiate Heat Disinfection on page 48</i>
Run activated by time channel	Slow flash of  during standby indicates that automated run by time channels is preset.	

2.6.2 Auto Flush

The auto flush function exchanges the water in the WRO unit during standby. During auto flush, indicated by steady light of , the water alternates between going to drain and going back to the tank. Auto flush will take place at preset intervals if enabled in preset S185; changeable from the internal service mode or the GXP software. Refer to *Auto Flush on page 31*.

Two time values for auto flush are preset; the time remaining in standby before initiating the flush, and the time that the flush will last;

S139 and S140 (only changeable from the GXP software, refer to *Auto Flush* on page 31).

NOTE


Auto flush mode has the same functionality as run mode but during a finite time period of maximum 100 minutes. The WRO 300 H unit performs a temperature test when initiating auto flush.

2.6.3 Run Mode

**WARNING**

This device does not remove chlorine and chloramines from the water. Carbon filtration to remove these substances is therefore required if the total chlorine concentration might exceed 0.1 mg/l (ppm). Severe patient injury may otherwise occur. Ensure by testing or by other means that the total chlorine concentration is below 0.1 mg/l (ppm) prior to initiating dialysis treatment.

2.6.3.1 Initiate Run

When the WRO unit is in standby mode, press  until light goes on (steady light).

A temperature check in the reject water line is always performed on a WRO 300 H unit before starting run mode. Active cool down is performed if a temperature of 40 °C or above is measured by the temperature sensor in the reject water line (T2). Refer to *Active Cool Down* on page 52.

When run is initiated a peak test is performed. Refer to *Peak Test* on page 34.

2.6.3.2 Flow

Refer to *Flow Description* on page 17.

NOTE


- As the needle valve is closed, it creates higher pressure in the RO module and lower recirculation flow. Therefore, do not close the valve more than necessary to obtain the required product water flow and pressure. Otherwise ions build up at the membrane surface and this causes increased product water conductivity and may shorten the lifetime of the membrane.
- If the water save function is active, the reject valve (REVA) alternates continuously between open to drain and open to tank. Refer to *Water Save Function* on page 53.

2.6.3.3 Water Level in Tank During Run

During run mode the inlet valve (INVA) opens when the level is below the low level sensor (LL) allowing water to enter the tank. The inlet valve closes again when the water reaches the high level sensor (LH).

A supervision function in the WRO unit controls the time for filling up the tank with water. The purpose is to limit the risk of excessive

amounts of water leaving the WRO unit through the air vent in case of a failure of level sensor LH. Alarm **104 INVALID WATER LEVEL** displays if the opening time for INVA exceeds the value for preset S233 (only changeable from GXP, refer to *Tank on page 23*).

The RO-pump stops if no water is indicated by empty level sensor (LE),  flashes fast and **204 INSUFFICIENT WATER SUPPLY** displays.

If the empty level sensor (LE) detects air at the same time as the low level sensor (LL) indicates water, the reject valve (REVA) diverts the reject water to the tank for five seconds. The water then flushes the empty level sensor (LE) to remove possible air bubbles from the optical sensor.

2.6.3.4 Conductivity Measurement

The product water conductivity is measured by the conductivity sensor (C2). The values from the conductivity sensors for feed water (C1) and for product water (C2) are used to calculate the rejection rate, refer to *Rejection Rate on page 34*.

The conductivity in water is affected by the temperature of the water. Therefore the conductivity measurements from both C1 and C2 are temperature compensated, using the product water temperature sensor (T1).

NOTE

The salt rejection ability of an RO membrane is a function of several factors, such as the conductivity and composition of the feed water, the water temperature and the pressure in the system. The product water conductivity and rejection rate should not be used as an absolute measure of the quality of the water but rather as an indicator of changes in performance over time.

2.6.3.5 Preset of Conductivity Limits

The three conductivity limits (notification/alarm/stop) can be changed from internal service or from GXP.

201 CONDUCTIVITY NOTIFICATION is issued when entering standby mode if the conductivity has exceeded the preset notification limit for more than 30 consecutive seconds during run. **202 CONDUCTIVITY ALARM** is issued during run if the product water conductivity has exceeded the preset alarm limit for more than 30 consecutive seconds. The buzzer can be muted and the WRO unit remains in run to allow finishing the dialysis treatment. **203 CONDUCTIVITY STOP** is issued and the WRO unit stops if the product water conductivity has exceeded the preset limit for *stop* for more than 30 consecutive seconds during run.

The conductivity limits should be set in relation to the feed water conductivity. Local regulation must be considered when determining the values of the limits.

NOTE

High product water conductivity value can be caused by several factors, such as fouling or degradation of the RO membrane or change in the feed water quality.

2.6.3.6 Peak Test

The intention of the conductivity peak test is to verify the function of the conductivity measuring circuit of the product water. During standby, salts will migrate from the feed water to the product water side of the membrane until the concentrations have equalized over the membrane. This process will start as soon as the WRO unit is stopped and the pressure is released.

The elevated conductivity of the product water will result in a momentary increase in the product water conductivity at next start up. Because of this, the conductivity supervision is disabled for 5 minutes during run mode start-up to avoid disturbing conductivity alarms. Supervision is disabled whether the Peak test is enabled or disabled (S186) except when the WRO unit is stopped by alarm **203 CONDUCTIVITY STOP**.

The peak test of the product water conductivity is performed during the start-up phase of run mode, if the WRO unit has been in standby for 10 minutes or more and if enabled in preset S186. Enabled from internal service mode or GXP software, refer to *Activate Functions on page 70* or *Rejection Rate and Peak Test on page 85*.

NOTE

If the WRO unit is stopped because of alarm **203 CONDUCTIVITY STOP**, supervision of product water conductivity is always performed when run is restarted.

When the peak test starts, the product water conductivity is measured (C2) and the value is saved by the program as a reference value. The duration of the peak test is for 5 minutes. During this period the product water conductivity must differ more than 5 $\mu\text{S}/\text{cm}$ from the reference value measured at the start of the Peak test. The difference can be both positive or negative, either way it proves that the conductivity sensor (C2) is working.

2.6.3.7 Rejection Rate

The rejection rate (percent) is the reduction of the conductivity of the water in a RO system. The rejection rate depends on a number of factors, such as conductivity, pH and temperature of the feed water, and may vary significantly from one location to another. The rejection rate should therefore not be considered as an absolute measure of the quality of the water, rather as an indicator that can help to detect

changes in performance of the WRO unit which may be caused by fouling or degradation of the RO membrane.


The rejection rate notification default setting of 90 percent (S149 changeable from GXP software or internal service mode, refer to *Rejection Rate and Peak Test on page 86* or *Alarm Limits on page 85*) is relevant for most inlet water supplies. It may need to be adjusted at installation to a lower value depending on local conditions, especially in cases of low feed water conductivity (<100 µS/cm). The limit should be set at least 5 percent units lower than the initial value at installation.

The rejection rate notification will be issued when the WRO unit enters standby if the rejection rate is below the notification limit, for more than 5 consecutive minutes during the run period.

The rejection rate is calculated by the formula below:

$$\text{Rejection rate} = \left(1 - \frac{\text{Conductivity in Product water line measured by C2}}{\text{Conductivity in Feed water line measured by C1}}\right) \times 100$$

2.7 Changing from Run to Standby Mode

The stop procedure below is performed when  is pressed during run mode until the light goes out and standby displays.

- Step 1 Bypass valve (BYVA) opens to release the pressure and the reject valve (REVA) is open to drain. The RO pump is on and the inlet valve (INVA) alternates between open and closed. It is open when the water level is between the low level sensor (LL) and the high level sensor (LH) and closed when the water level reaches the LH sensor.
- Step 2 The drain flow is increased to remove particles stuck on the feed water side of the membrane. This is to reduce the wear of the membrane and thereby prolong the lifetime of the membrane.
- Step 3 After ten seconds the inlet valve (INVA) closes and the tank is emptied until the water level is below the low level sensor.
- Step 4 The RO pump stops and the WRO unit enters standby mode.

2.7.1 Start After Power Loss


NOTE

As soon as a mode is entered, the software will store information, (in the serial E2PROM) to be used if the software has to be restarted because of a power loss.

The WRO unit cannot detect if the power loss is caused by the operator turning off the WRO unit with the mains power switch, or if a power failure occurred. The software will always perform a recovery after any

power loss (even if the WRO unit was in standby at the time of the power loss).

When the power returns after a power loss the recovery function in the WRO unit tries to bring the machine back to the mode it was in, at the time of the power loss. The program in the WRO unit will always start to check if chemicals are present. This is a safety precaution controlled by the setting of the CHEM FLAG. During modes when chemicals are present in the WRO unit the CHEM FLAG status is set to TRUE by the program.

If the CHEM FLAG status is TRUE the WRO unit will issue alarm **404 RINSE REQUIRED** when the power returns. The operator must initiate **RINSE** (pressing  until steady light goes on).

If the CHEM FLAG status is FALSE the software will check the mode at the time of the power loss and return to this mode. If no valid mode information is found the WRO unit will go to standby mode when the power returns.

NOTE

The start after power loss differentiates between run mode started by the operator (pressing the run button) and a remote run, started on request from the dialysis machine (remote cable connected between the two machines). The WRO unit will start automatically in run mode if the mode was started manually. The WRO unit will start in standby mode if it was a remote run. The dialysis machine will restart the WRO unit in run mode if the dialysis machine is still connected to the WRO unit.

2.8 Hygiene Functions

2.8.1 Manual Flush

The manual flush function is initiated by the operator when the WRO unit is in standby mode. Press **Dis** until **SELECT** displays. Use the arrow buttons to display **MANUAL FLUSH**. Press **Dis** to initiate. This gives a short flush of water in the WRO unit at elevated flow rate. The duration of the elevated flow rate is preset in S223 (changeable from GXP only, refer to *GXP — Preset on page 74*). The WRO unit then returns to standby mode.

2.8.2 Chemical Disinfection and Cleaning

The dialysis machine should be disconnected from the WRO unit before performing chemical disinfection or cleaning (this is not valid for *central chemical disinfection, refer to page 43*).



CAUTION

If the WRO unit is still connected to the dialysis machine during the chemical disinfection procedure, the test for residuals must be performed on the dialysis machine according to the dialysis machine operator manual of the when the chemical disinfection procedure is finished.

NOTE

Chemical disinfection cleaning is indicated by steady light of **Dis**.

Chemical disinfection and cleaning consist of three phases; Intake, dwell, and rinse.

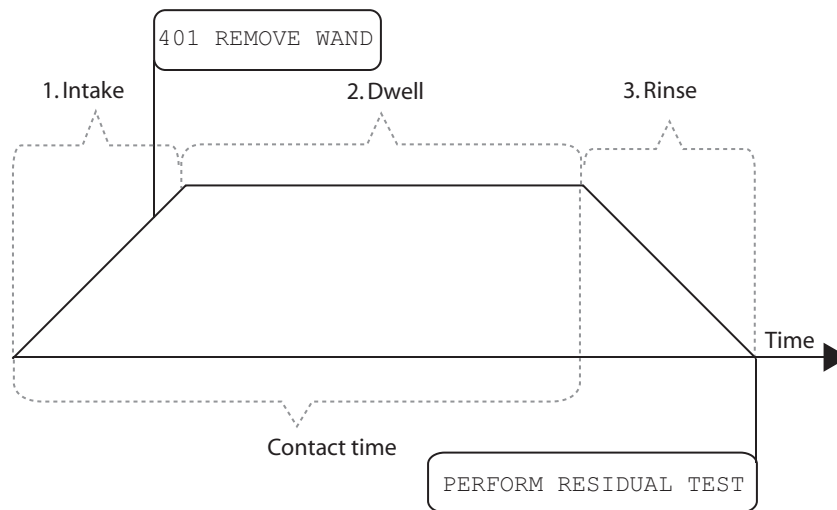


Fig.2.16 — Phases during chemical disinfection.

2.8.2.1 Intake Phase

The optical sensor detects when the disinfection wand is connected to the chemical intake. **CHEM SELECT** displays and **Dis** starts to flash. The other end of the disinfection wand should be inserted into an external container with cleaning or disinfection solution.

Press the **down** arrow button to enter a list of selectable protocols.¹ Use the arrow buttons to scroll the list. Press **Dis** until steady light goes on to start the selected protocol for chemical disinfection or cleaning. The preservation protocol (enabled by default) can also be selected from this menu. Refer to *Preservation Without Freeze Protection on page 48*.

NOTE

- The first disinfection protocol that displays when the disinfection wand is connected and the down arrow button is pressed, is defined in S138. It can only be changed from GXP, refer to *Disinfection Protocol Manager on page 90*.
- The protocol defined by S138 will only be shown once (at the start of scrolling through the visible protocols) if the actual protocol is set to invisible.
- Ten protocols, with 11 variables each, can be preset. Refer to *Disinfection Protocol Manager on page 90*. Protocol number 2, 4, 7, 8, and 9 are selectable by default settings (acid clean, Central Chem Phoenix®, MEMSTOR (preservative), Minncare® (disinfect), and Minnclean®).
- If protocols for preservation plus freeze, central chemical disinfection or alkaline cleaning are enabled, they are also selectable from the **CHEM SELECT** menu.

The **contact time**² is measured from when the Intake phase starts.

NOTE

When the contact time is reached, rinse is automatically performed (whether the Intake phase and the dwell phase are completed or not) to avoid extended exposure to disinfection chemicals.

When the intake phase starts, the **CHEM FLAG** status is set to **TRUE** by the program to indicate that chemicals are present in the WRO unit. The **CHEM FLAG** status will only change to **FALSE** when rinse has

1. S-numbers where the protocols can be set invisible; S37, S47, S57, S67, S77, S87, S97, S107, S127, changeable from the internal service mode or from GXP. Refer to *Protocol Enable on page 68* and Default setting of *Disinfection Protocol on page 92*.
 2. S-number; S40, S50, S60, S70, S80, S90, S100, S110, S120, S130, refer to *Disinfection Protocol Manager on page 90*.

been performed and the conductivity reading (C2) is below the notification limit for product water, S33, refer to *Alarm Limits on page 85*.

When the preset intake phase¹ has ended, both the RO pump and the chemical intake pump stop and **401 REMOVE WAND** displays until the disinfection wand is removed from the chemical intake. Thereafter dwell and then rinse are performed automatically. Refer to *Dwell and Rinse on page 44*.

If the disinfection wand is removed before the preset amount of solution has entered into the WRO unit, **Dis** flashes medium and the alarm **404 RINSE REQUIRED** displays. It is possible to restart the Intake phase by inserting the disinfection wand into the intake and then press **Dis**. The alarm **406 INSUFFICIENT INTAKE** will be issued if the preset limit² is not set to zero and not reached during the Intake phase. Remove the disinfection wand and insert it again to be able to restart the Intake phase. .



CAUTION

The chemical container must be located below the chemical intake.



CAUTION

When requested by the WRO unit, remove the disinfection wand from the chemical intake. Failure to remove the disinfection wand can cause siphoning of the chemical solution from the bottle resulting in the tank overflowing chemical solution through the back of the machine.

2.8.2.2 Power Failure

If a power failure occurs during chemical disinfection or cleaning the alarm **404 RINSE REQUIRED** will be issued when the power returns. When **Dis** is pressed until steady light goes on, **RINSE** is performed.

2.8.2.3 Intake Phase Pause

The chemical intake phase can be paused by pressing **Dis** until **Dis** flashes, (**Dis** flashes medium during paused Intake).

If the set dwell time is reached before the Intake phase is restarted (measured from start of the Intake phase before the pause), the WRO unit will automatically enter rinse.

When paused, the WRO unit stops all flows. The program remembers the amount of chemicals that have so far been added (calculated by the program based on time).

1. S-number; S41, S51, S61, S71, S81, S91, S101, S111, S121, S131, refer to *Disinfection Protocol Manager on page 90*.
2. S-number; S187, S188, S189, S190, S191, S192, S193, S194, S195, S196, refer to *Disinfection Protocol Manager on page 90*.

Press **Dis** again until steady light goes on to continue the Intake phase.

2.8.2.4 Intake Phase Restart

Remove the disinfection wand and reinsert it. **CHEM INTAKE RESTART** displays and **Dis** flashes. Press **Dis** until steady light goes on to restart the Intake phase.

NOTE

When the Intake phase is restarted the calculation for added chemicals is reset, but the contact time is not reset.

If the disinfection wand is not reinserted and **Dis** is pressed the WRO unit continues to the dwell period.

2.8.2.5 Days Since Last

For the operator to view **DAYS SINCE LAST** (heat disinfection¹/chemical disinfection/acid cleaning²/alkaline cleaning) the function has to be enabled in preset³.

-
1. Only in the WRO 300 H unit
 2. Warm Acid cleaning in the WRO 300 H unit
 3. S-number; S153, S154, S155, S156, refer to *Time Since Last on page 97*.

2.8.2.6 Disinfectant Concentration

Calculate the concentration of disinfectant in the WRO unit by using the variables described in the table below and the formula in the following table:

Value	Description	Unit
Vm	Internal water volume in the WRO unit (3500 ml) + Product water loop 2 x 1 m (100 ml)	ml
Km	The desired concentration of the solution in the WRO unit	%
Kc	The concentration of the disinfectant	%
Vc	Intake volume of the disinfectant	ml

Formula	Result of formula
$Km = Kc \times (Vc / Vm)$	Concentration of the solution in the WRO unit
$Vc = Km \times (Vm / Kc)$	Intake volume of disinfectant

Examples:

Calculated Intake volume of Dialox;
 when Vm = 3500 + 100 ml, Km = 3% and Kc = 100%
 $Vc = 3\% \times (3600 \text{ ml} / 100\%) = 108 \text{ ml}$

Calculated Intake volume of pre diluted chemical;
 when Vm = 3600 ml, Km = 3% and Kc = 75%
 $Vc = 3\% \times (3600 \text{ ml} / 75\%) = 144 \text{ ml}$

2.8.2.7 Chemical Disinfection Level

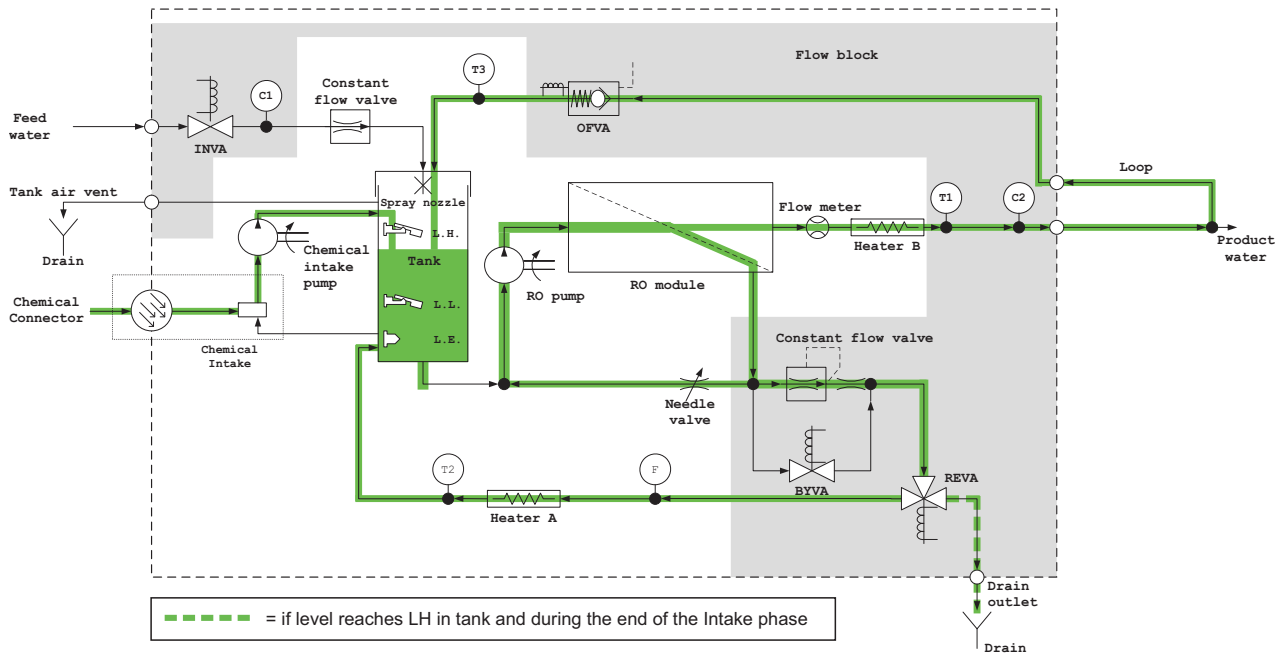


Fig.2.17 — Flow overview during chemical disinfection — during the Intake phase.

When chemical disinfection is initiated, the level in the tank is adjusted to a level just above the low level sensor (LL). The RO pump then

starts and runs until LL indicates air. The RO pump stops and the inlet valve (INVA) opens. It stays open until LL again senses water. When the disinfectant level in the tank reaches the high level sensor (HL), the reject valve (REVA) opens to drain.

The chemical intake pump runs until the preset amount of chemical solution has entered into the tank¹. The capacity of the chemical intake pump can be set between 60 and 180 ml/minute (changeable from GXP software only (S151), refer to *Chemical Disinfection on page 95*).

The RO pump circulates the fluid in the flow path during the chemical intake phase. At the end of the Intake phase the bypass valve (BYVA) opens and the reject valve (REVA) is activated to lower the water level in the tank to LL.

When the disinfection wand is removed and at least 10 seconds has elapsed since requesting the operator to remove the disinfection wand, the tank is filled up with water to the high level sensor (LH), BYVA closes and REVA is deactivated. The RO pump starts the circulation through the RO module, the chemical intake pump starts the circulation through the chemical intake unit and the return overflow valve (OFVA) opens. The circulation in the flow path will continue for three minutes. The alarm **406 INSUFFICIENT INTAKE** is issued if the product water conductivity is below the set intake limit (preset S187-S196).

The speed of the RO pump is then reduced, BYVA opens and REVA opens to drain. Both valves are deactivated and both pumps stop when the level is below the low level sensor (LL)..

NOTE
When BYVA is deactivated, the WRO unit is pressurised, allowing for disinfection of the product water loop.



CAUTION
The chemical container must be located below the chemical intake.



CAUTION
When requested by the WRO unit, remove the disinfection wand from the chemical intake. Failure to remove the disinfection wand can cause siphoning of the chemical solution from the bottle resulting in the tank overflowing chemical solution through the back of the machine.

1. S-number: S41, S51, S61, S71, S81, S91, S101, S111, S121, S131; refer to default setting in *Disinfection Protocol Manager on page 90*.

2.8.2.8 Central Chemical Disinfection

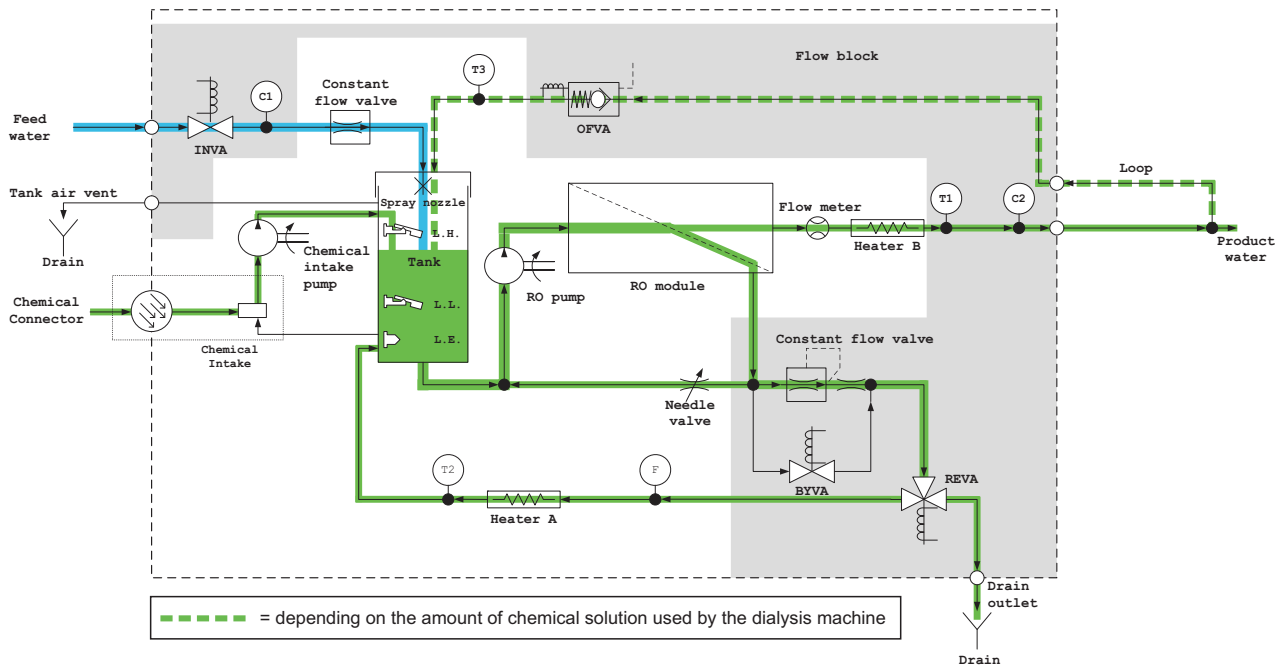


Fig.2.18 — Flow overview during central chemical disinfection.

The central chemical disinfection process disinfects the WRO unit and distributes disinfectant into the dialysis machine for chemical disinfection of the inlet parts of the dialysis machine.

The chemical intake pump starts when the product water conductivity reading is below the set low limit (preset S158). The chemical intake pump runs until the product water conductivity reading reaches the upper limit (preset S157). After that the chemical intake pump alternates between on and off. (Refer to *Chemical Disinfection on page 95*). The alarm **406 INSUFFICIENT INTAKE** will be issued if the product water conductivity reading has not reached the upper limit (preset S157) within five minutes.

The overflow valve (OFVA) stays open until the product water conductivity reading reaches the upper limit the first time (preset S157). It then closes to create a pressure in the product water loop and allow for the disinfection solution to enter the dialysis machine.

NOTE

OFVA stays active (open) until the preset conductivity limit is reached, minimizing the loop pressure and thereby preventing solution with insufficient concentration to enter the dialysis machine.

2.8.2.9 Acid Cleaning (only WRO 300)

For a description of the intake phase refer to *Chemical Disinfection and Cleaning on page 37*). During the intake phase and dwell of acid cleaning, the bypass valve BYVA is open when the RO pump is running. This minimizes the pressure and increases the flow rate over the

membrane, thus improving the effectiveness of the cleaning procedure.

When the intake phase is completed, **401 REMOVE WAND** displays until the disinfection wand is removed. Thereafter dwell and rinse are performed automatically. Refer to *Dwell and Rinse on page 44*.

2.8.2.10 Warm Acid Cleaning (only WRO 300 H)

For a description of the intake phase refer to *Intake Phase on page 38*). During the intake phase and dwell of warm acid cleaning, the bypass valve BYVA is open when the RO pump is running. This minimizes the pressure and increases the flow rate over the membrane, thus improving the effectiveness of the cleaning procedure.

When the intake phase is completed, **401 REMOVE WAND** displays until the disinfection wand is removed. Thereafter the heaters (A and B) are activated. The heaters alternate between on and off during the warm acid cleaning procedure, regulated by the program and the temperature of the water.

If the preset temperature value is not reached during warm acid clean the alarm **407 INSUFFICIENT TEMPERATURE** is activated.

2.8.2.11 Alkaline Cleaning

Refer to *Acid Cleaning (only WRO 300) on page 43*.

2.8.3 Dwell and Rinse

After a disinfection or cleaning program, the intake phase will automatically be followed by dwell and rinse.

2.8.3.1 Dwell Phase

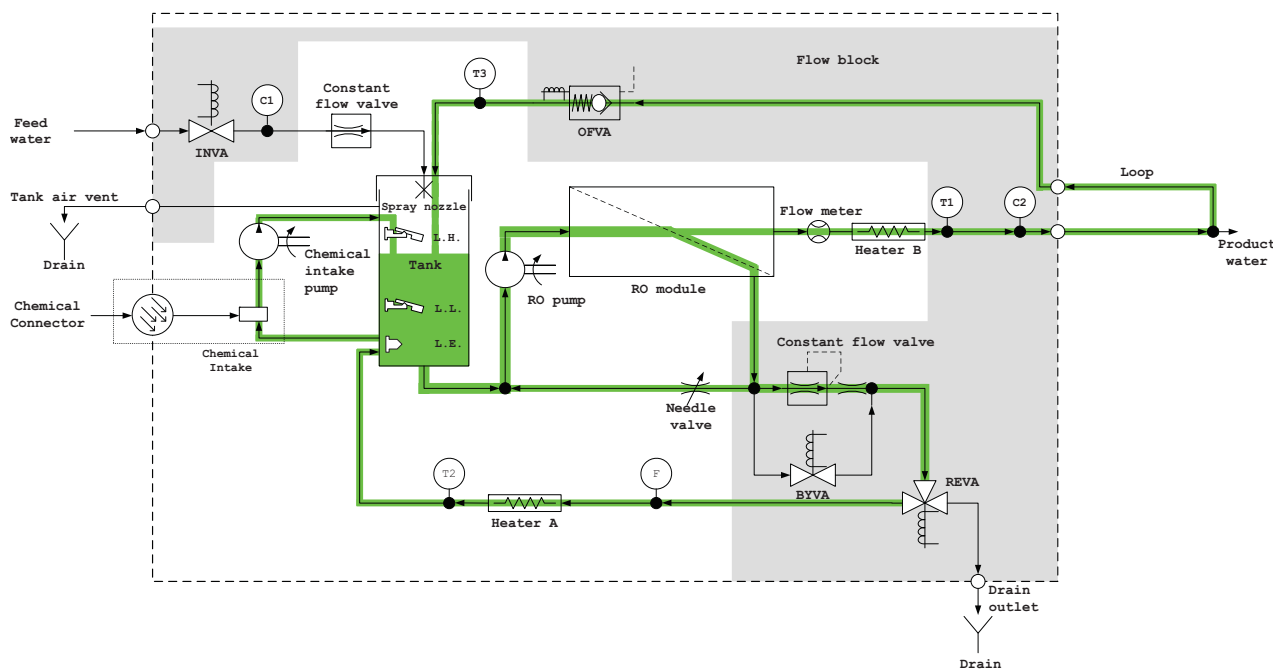



Fig.2.19 — Flow overview during dwell.

If the intermittent run is enabled in preset¹, circulation will be performed in the flow path during dwell. The RO pump will then operate according to the settings for circulation time² and stop time³. Refer to *Default Setting of Disinfection Protocol on page 94*.

A dwell period can be interrupted at any time by pressing . The WRO unit then switches to rinse.

NOTE



Intermittent run is enabled by default for protocol number; 2, 9, 10 (ACIDCLEAN for WRO 300, WARM ACID CLEAN for WRO 300 H, MINNCLEAN, ALKALICLEAN).

2.8.3.2 Rinse Phase and Residual Test

The rinse phase consists of three steps that are repeated for the preset rinse time (refer to *Default Setting of Disinfection Protocol on page 94*). The three steps are:

- Step 1 Bypass valve (BYVA) opens and reject valve (REVA) opens to drain. The RO pump starts at low speed. The RO pump stops and the valves close when the level is below low level sensor (LL). Then the inlet valve (INVA) is open until the water reaches the high level sensor (LH). Then this step is repeated seven times.
- Step 2 The RO-pump circulates the fluid in the WRO unit for two minutes with return overflow valve (OFVA) open and reject valve (REVA) open to drain followed by five seconds open to tank. The chemical intake pump also runs.
- Step 3 The WRO unit stops for one minute.
- Step 4 During the final five minutes of the rinse the conductivity value is checked in the product water line (C2). If the value is below the notification limit the rinse will be finished within the preset rinse time. The rinse will be extended until the conductivity goes below the limit or maximum 30 minutes. If the conductivity value is still above the notification limit after 30 minutes the alarm **403 HIGH CONDUCTIVITY RINSE** will be displayed.

2.8.3.3 Residual Test After Chemical Disinfection:

PERFORM RESIDUAL TEST displays when the rinse phase is completed.  will remain steady lit and  flashes medium. Verify the absence of chemicals or cleaning solution with approved methods. Refer to the *Operator's Manual* for the WRO 300 unit or the WRO 300 H unit.

-
- 1. S43, S53, S63, S73, S83, S93, S103, S113, S123, S133,
 - 2. S44, S54, S64, S74, S84, S94, S104, S114, S124, S134
 - 3. S45, S55, S65, S75, S85, S95, S105, S115, S125, S135

2.8.3.4 Residual Test After Central Chemical Disinfection:

After central chemical disinfection the WRO unit goes to standby, when the rinse phase is completed. There is no request from the WRO unit to perform residual test. This has to be performed on the dialysis machine after the dialysis machine's rinse, according to the *Operator's Manual* of the dialysis machine



CAUTION

The test for residuals has to be performed on the dialysis machine according to the *Operator's Manual* of the dialysis machine.

2.8.4 Preservation

If the WRO unit is to be disconnected from the water supply and taken out of service for more than one week, a chemical preservation has to be done.

NOTE

The preset contact time has no influence during preservation since the intake phase is not followed by dwell (preset S60 and S100 — refer to *Disinfection Protocol on page 92*). The default value is 0.

2.8.4.1 Preservation with Freeze Protection (glycerol)

The intake of the preservation solution is done through the feed water inlet. The WRO unit cannot generate a suction pressure for the feed water inlet — an external positive pressure must be generated. This can be done by placing the canister containing the preservation fluid higher than the WRO unit. The chemical intake is not used since the chemical intake pump cannot provide enough flow when adding glycerol.

When the disinfection wand is connected to the chemical intake unit the RO pump stops the circulation if the WRO unit is not already in standby mode. **CHEM SELECT** displays and **Dis** starts to flash. Use the arrow buttons to select the preservation protocol and press **Dis** until a steady light goes on.

NOTE

The disinfection wand is only connected to initiate the **CHEM SELECT**. The preservation solution enters through the feed water inlet.

The intake phase for preservation consists of the three phases below:

- 1 The inlet valve (INVA) is open until the water reaches the high level sensor (LH). The RO pump starts at low speed. Bypass valve (BYVA) opens and reject valve (REVA) opens to drain. The RO pump stops and INVA opens when the level is below the low level

sensor (LL). These steps are repeated eleven times and then 401 REMOVE WAND displays.

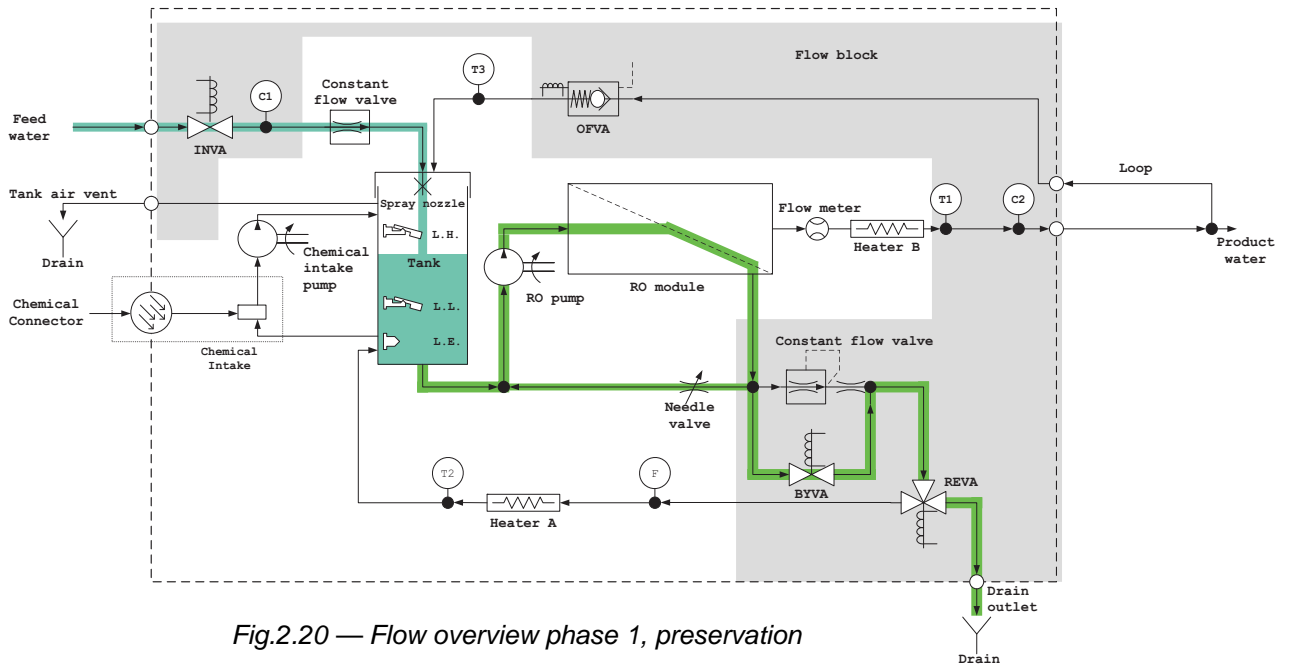


Fig.2.20 — Flow overview phase 1, preservation

- 2 When the disinfection wand is disconnected, the RO pump circulates the fluid in the WRO unit for five minutes with BYVA open, return overflow valve (OFVA) open and REVA open to tank. The chemical intake pump also runs.

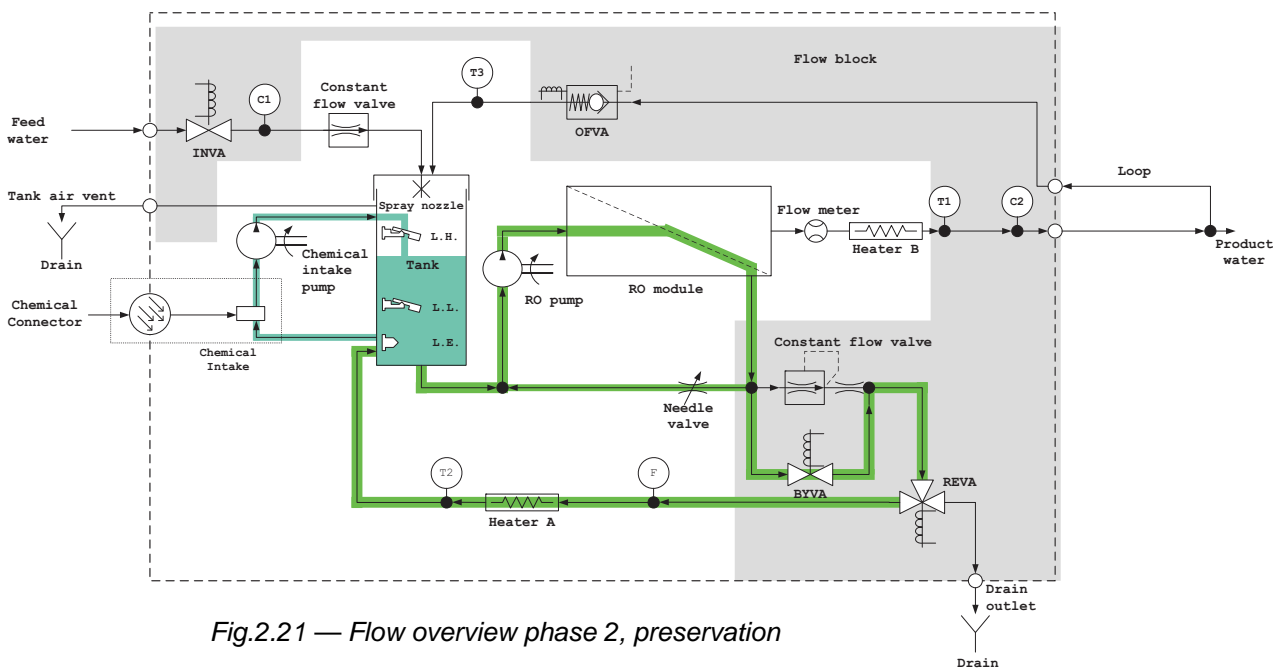






Fig.2.21 — Flow overview phase 2, preservation

- 3 When the circulation is completed, BYVA is still open and REVA opens to drain until the level in the tank is below Low level sensor (LL).




When the preservation procedure is completed, the alarm **404 RINSE REQUIRED** displays, the buzzer sounds,  and  flashes. Switch off power to the WRO unit using the mains power switch.

2.8.4.2 Preservation Without Freeze Protection

The intake phase is identical to the intake phase for the chemical disinfection and cleaning. Refer to *Intake Phase on page 38*.

When the preservation procedure is completed the alarm **404 RINSE REQUIRED** is issued and displayed. Buzzer sounds,  and  flashes. Switch off the WRO unit with the mains power switch.

2.8.4.3 Rinse After Preservation



Turn on the WRO unit with the mains power switch. **404 RINSE REQUIRED** displays,  and  flashes. Press  until light goes on to initiate rinse. Refer to *Rinse Phase and Residual Test on page 45*.

2.8.5 Heat Disinfection (only WRO 300 H)

If the WRO 300 H unit will not be used for an extended period of time, heat disinfection, either manually initiated or set by time channels, will maintain the microbiological quality of the product water.

The dialysis machine must not consume water during heat disinfection, since this would issue **304 INCORRECT WATER LEVEL** in the WRO 300 H unit.

2.8.5.1 Initiate Heat Disinfection

When the WRO 300 H unit is in standby mode, press  until light starts to flash and **SELECT** displays. Select the heat disinfection program **HEAT** with the arrow buttons and press  until steady light goes on. The heat disinfection procedure can also be initiated by time channels, refer to *Time Channels on page 55*.

If the water level in the tank is not above the low level sensor (LL) within a time period specified by the program, the alarm **302 INSUFFICIENT WATER SUPPLY** is issued.

2.8.5.2 Function Check

When the operator has initiated heat disinfection, the program performs the function checks described in this section. If the checks complete successfully, the WRO 300 H starts heating up the water.

First there is a function check of **temperature measurement**. The temperature sensor amplifiers are checked for range and offset errors. The temperature sensors are checked for short or open circuit. Refer to : *N INTERNAL ERROR on page 126*; 103:10 (T1), 103:11 (T2) and 103:15 (T1), 103:16 (T2) and 103:17 (T3).

Then there is a function check of **over heat protection**. The heater control and flow supervision circuits are checked to ensure that there is water flow through the heater before the heater rod is turned on. Nor-

mal test time is about one minute. If stable flow cannot be reached within five minutes an alarm is issued.

Initiation of any procedure (heat disinfection or low flow heat) in the WRO 300 H using the heater rods starts with functional tests to verify proper function of the following components (refer to Internal Error : *N INTERNAL ERROR on page 126*):

- Temperature sensors
- Flow switch and sensor including the corresponding safety relay
- The control relays

2.8.5.3 Temperature Sensor Test

- Step 1 The sensors are checked for disconnection. The output from the sensor measuring circuit indicates high temperature if the sensor is disconnected. The software checks that the measured temperature is lower than 105 °C. If not, internal error 103:15, 103:16 or 103:17 is issued, dependent of which sensor, and the selected procedure (**HEAT** or **LFH**) is stopped.
- Step 2 The sensors are checked for short circuit. The output from the sensor measuring circuit will indicate low temperature if the sensor is short circuited. The software checks that the signal input is higher than 3 °C. If not, internal error 103:15, 103:16 or 103:17 is issued and the selected procedure is stopped.
- Step 3 The electronic circuits on the CPU board are checked. The software checks that the reading through the A/D-system is able to measure temperatures up to 95 °C. This is done by replacing the temperature sensor with a fixed resistor in the measuring circuit. If the measured temperature is lower than the limit, the internal error 103:10 or 103:11 is issued. The test is only performed on the two sensors used for temperature feedback in the control loop. The alarm blocks the procedure.

2.8.5.4 Flow Switch and Sensor Test

- Step 1 A flow is generated by the RO-pump through the two heater rods. The status signals from both flow switch and flow sensor are then observed. The status shall indicate a continuous flow for 20 seconds. The observation period is 5 minutes. The internal error 103:8 is issued if any of the two sensor signals are not stable for 20 seconds. The alarm blocks the procedure.
- Step 2 Verification that the mains supply is not connected to the heaters when no flow is present. Otherwise, alarm 103:9 is issued and the procedure is blocked.

- Step 3 The control relays are switched on. The software verifies the presence of mains supply at the heater rods. If not, alarm 103:19 is issued and the procedure is blocked.
- Step 4 The RO pump is stopped. The software then verifies that the heater rods are disconnected from the mains supply. If not alarm 103:7 is issued. Also, alarm 103:6 is issued if the flow switch or the flow sensor still indicates flow. Both alarms stop the selected procedure.

NOTE

The over heat protection function has higher priority than the software. This is a safety precaution so that the WRO 300 H unit will never be able to turn the heater rods on if the water flow is insufficient.

2.8.5.5 Heat Disinfection Procedure

The RO pump starts with the bypass and return overflow valves (BYVA, OFVA) open to reduce the pressure in the system. The pressure must not exceed 3 bar, according to membrane specification, when the water temperature is above 45 °C. **Heater A** in the reject water line is activated. **Heater B** in the product water line is activated after a short while when the product water flow is above 200 ml/min. The chemical intake pump circulates the hot water in the chemical intake unit.

The default set temperature in reject and product water lines is 92 °C. Refer to *Heat Set Temperature on page 88*. The heating set temperature for the product water loop can be boosted. The preset S30 can be increased if the return temperature is not achieved. The software checks that correct temperature is reached at two different positions in the flow path. The first check verifies that the reject water temperature has reached the **heater A** set temperature. The second check verifies that the return temperature has reached the product water loop return temperature defined by the preset S225, refer to *Heat Set Temperature on page 88*. The heat disinfection temperature is achieved if both checks are satisfactory. The alarm **INTERNAL ERROR 103:21** is issued if the temperatures are still below the limits when the heat disinfection has been in progress for 60 minutes.

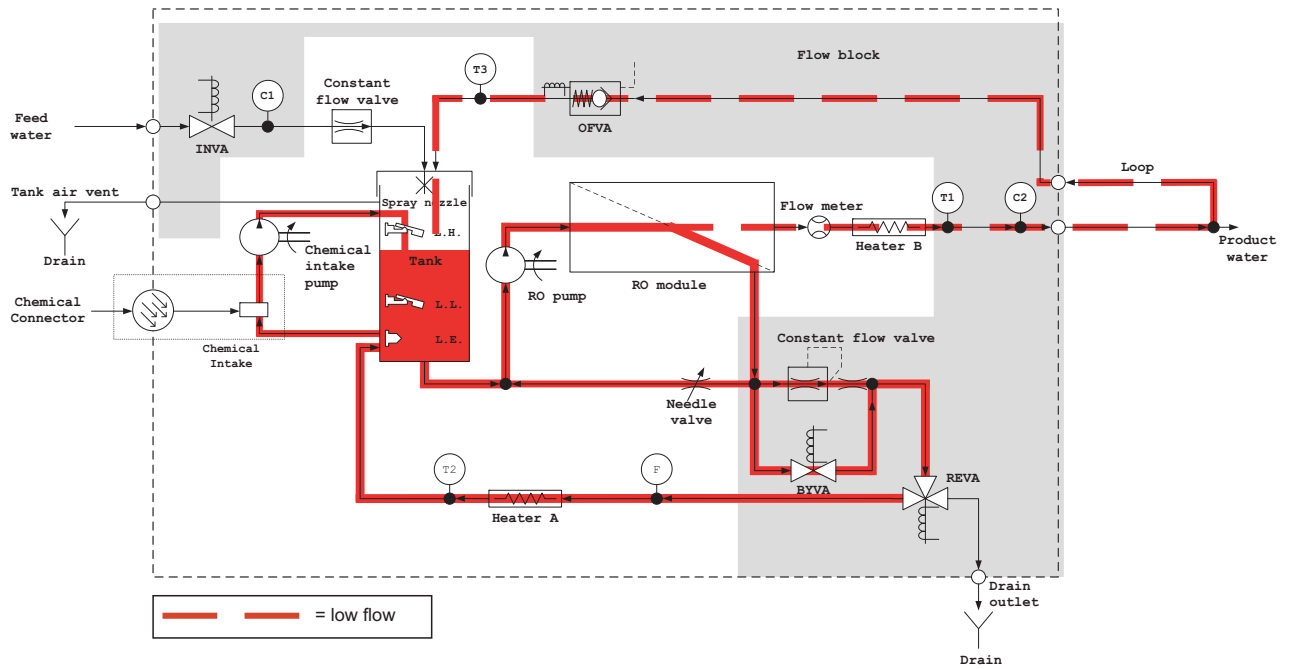


Fig.2.22 — Flow during start of Heat disinfection

During the heat disinfection the water level in the tank rises with increased temperature. If it reaches the high level sensor (LH), the reject valve (REVA) will open to drain for a few seconds to lower the level in the tank.

The product water flow increases with increased temperature of the water (up to approximate one liter/minute in the product water loop). During heat disinfection there must be no water consumption from the dialysis machine. If the water level in the tank goes below the low level sensor (LL) the alarm 304 **INCORRECT WATER LEVEL** is issued.

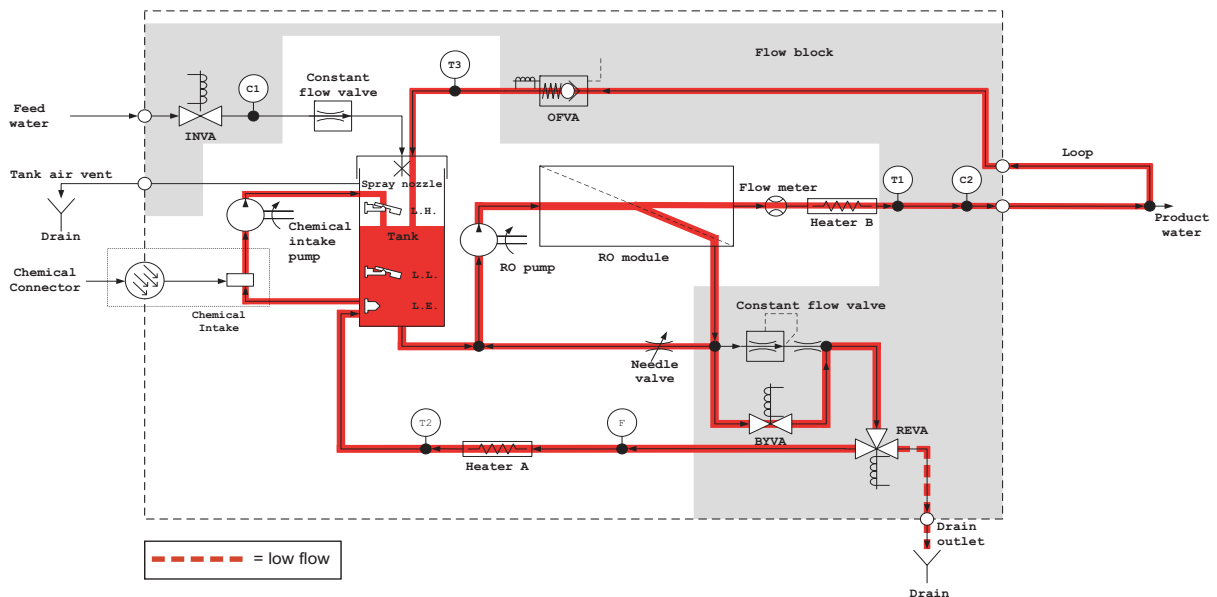


Fig.2.23 — Flow during heat disinfection

If a disinfection wand is connected to the chemical intake during heat disinfection, the alarm **401 REMOVE WAND** will be issued and the chemical intake pump will stop. The heat disinfection process will continue. The chemical intake pump will start again when the wand is removed.

2.8.5.6 Active Cool Down

The default preset is to run active cool down until the temperature is below 40 °C. The WRO 300 H unit will then enter standby mode. Without active cool down the internal water temperature in the WRO 300 H unit will remain elevated for several hours. Three different actions trigger active cool down (if preset to run active cool down, S142):


- Heat disinfection hold time has expired
- Heating interrupted by operator
- Power failure during heating

During active cool down the RO pump circulates the water and the reject valve (REVA) opens to drain for three seconds. Then the inlet valve (INVA) opens and remains open until the water reaches the high level sensor (LH). After 20 seconds the temperature is checked. This procedure is then repeated until the temperature is below 40 °C. The WRO 300 H unit then goes to standby mode.

2.8.5.7 Cool Down


If active cool down is disabled in the preset, the WRO 300 H unit goes to standby after termination of heat disinfection.

2.8.5.8 Stop During Heat Disinfection

To stop the heat disinfection press  until light goes on. An active cool down is then performed, if enabled. When the active cool down is finished the WRO unit goes to standby mode.

If active cool down is disabled in the preset, the WRO 300 H unit goes directly to standby mode.

2.8.5.9 Power Failure

If a power failure occurs during heat disinfection, alarm **301 INSUFFICIENT HEAT** displays when the power returns. The  button must be pressed. An active cool down is then started if enabled in the preset, otherwise standby is entered.

2.9 Features — Extra Functions

2.9.1 Water Save Function

The drain flow from the WRO unit is approximately 1.3 l/min when the WRO unit is in run mode. In situations where water is scarce or expensive, the water save function can be used in order to reduce the water consumption.

The function is enabled in preset S184 (changeable from Internal service mode, refer to *Sub menus for ACTIVATE FUNCTIONS on page 70* or GXP Software, refer to *Water Save on page 84*).

The water save function uses the three-way reject valve (REVA) to recirculate part of the reject water flow back to the inlet tank. The water save factor (equals the part of the time that the water is recirculated) is preset in S29, and is only changeable from GXP Software, refer to *Water Save on page 84*. The cycle time is 20 seconds. As an example, a preset of 5 percent gives one second ($= 0.05 \times 20$ seconds) flow to tank and 19 seconds ($= 0.95 \times 20$ seconds) to drain.

The water save function is disabled during the initial two minutes of run mode.

NOTE

- The water save function will not affect the flow conditions in the WRO unit, only the amount of water diverted to drain.
- The conductivity of the module feed water will increase with higher water save factor setting, which, in turn, will increase the product water conductivity.



CAUTION

Increasing the water save factor may affect the life expectancy and performance of the RO module.

The table below shows the recovery ratios (that is, the percentage of the feed water that is converted to product water) for the WRO unit that will be obtained at different water save factors and at different dialysis fluid flow rates.

				Dialysis fluid flow rate					
Water save factor	Drain flow	Water saved		0.3 l/min		0.5 l/min		0.7 l/min	
		l/min	During 5 h operation, liter	Total water consumption liter	Recovery ratio, %	Total water consumption liter	Recovery ratio, %	Total water consumption liter	Recovery ratio, %
0	1.3	-	-	480	19	540	28	600	35
10	1.17	0.13	39	441	20	501	30	561	37
20	1.04	0.26	78	402	22	462	33	522	40
30	0.91	0.39	117	363	25	423	35	483	43
40	0.78	0.52	156	324	28	384	39	444	47
50	0.65	0.65	195	285	32	345	43	405	52
60	0.52	0.78	234	246	37	306	49	366	57
70	0.39	0.91	273	207	43	267	56	327	64
80	0.26	1.04	312	168	54	228	66	288	73

Example: At 40% water save, the amount of water to drain will be reduced to 0.78 l/min. During a 5-hour treatment this corresponds to 156 liters less water used (0.52 l/min × 60 min × 5).




CAUTION

The shaded area in the table represents a recovery ratio above 50%. This area should only be entered if softened, non-fouling feed water is used.

2.9.2 Reminders

This function reminds the user about recurrent actions, (that is, change prefilter or perform acid cleaning). Five reminders may be active at the same time.




When a time period for a reminder has passed and standby is entered, the buzzer sounds,  flashes and the reminder text displays.



The time period is set from internal service mode, refer to *Sub Menus for Reminders on page 62*, while the text (of maximum 28 characters) is set from GXP, refer to *Reminders on page 99*.

NOTE

- The reminder will appear once for each time period.
- The time period is automatically reset when the reminder has occurred.
- Because of a limit of 14 characters in GXP, the text string for every recurrent notification is divided into two presets values.

2.9.3 Time Channels

Preset time for automatic start of heat disinfection and run is activated by time channels. When the WRO unit is in standby mode it will indicate automatic start of heat disinfection by slow flash of  and automatic start of run by slow flash of . The auto flush function will also be indicated by slow flash of .

Heat disinfection and run can be initiated automatically at a preset time through the time channels. A slow flash of  or  (in standby) will indicate that either of these functions have been selected.

NOTE

Auto flush is also indicated by a slow flash of .

Three different actions can be programmed in time channels (refer to presets for *Time Channels on page 98*).

- Automatic start of heat disinfection; the WRO 300 H unit must be in standby mode. If heat disinfection is not started when preset in a time channel, alarm 303 **OVERDUE HEAT** displays when entering standby.
- Automatic start of run; the WRO unit must be in standby mode.
- Automatic stop of run mode.

Time channels can be activated or changed either through internal service or by using GXP, refer to *Time Channels on page 55* or *Time Channels on page 98*.

NOTE

Preset of time channels should be performed in internal service mode. The time channels presets may be copied from one WRO unit to another using GXP software.

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3 Replacements

3.1 Replacement Matrix

After replacing components, MCP recommends performing the different actions in the table below in a specific order to verify the function of the WRO unit. The order of actions is set by numbers for each component in the matrix below.

		Component																					
		RO pump head	RO pump motor	Chemical intake pump	Chemical intake unit	Flow block complete	Temperature sensor	Conductivity cell	Needle valve	RO membrane (WRO 300)	RO membrane (WRO 300 H)	RO module	Level sensor/switch	Fan	AC/DC	CPU Board	Operator's panel	AC-relay board	Heater rod	Flow indicator	Flow meter		
Actions to be performed (The numbers in parentheses refer to sections in this manual)	Check/load program (4.3.5)															1							
	Set time and date (4.2.2.3)															2							
	Conductivity adjustment (6.5)					2	1									4							
	Temperature check					3	1									3							
	Load preset file (4.3.3)															5							
	Start RUN												1			6							
	Perform disinfection			1	1								2			7							
	Check Operator's panel (6.6)															8	1						
	PET-test (7.1)														1			1	1				
	ELT-test (7.2)														2			2	2				
	Flow/pressure adjustment (6.4)	1	1			1			1	1	3	2											2
	Check rejection rate (2.6.3.7)	2	2			5	2	2	2	2	4	3											
	Pre-adjust module pressure to 5 bar (6.4)										1												
	Heat disinfection (2.8.5)					6					2					9		3	3	1	1		
	Preservation rinse (2.8.4.3)											1											
	Verify water save (2.9.1)					4																	
Check cooling fan (2.4.5)													1	3	10								

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4 Internal Service

4.1 Changing Configuration Parameters

The internal configuration parameters used by the WRO unit during operation can be changed in three different ways:




- From internal service mode, see below.
- New program version downloaded. Refer to *GWD - Download on page 75*.
- From GXP. Refer to *GXP — Preset on page 74* and *Presets and Defaults on page 79*.

NOTE

- Some changes are possible both from the internal service mode and from GXP. Refer to *GXP — Preset on page 74*.
- Some changes can **only** be done from the internal service mode and other changes can **only** be done by the use of GXP.

4.2 Internal Service Mode


The operator panel is used to make changes in the internal service mode. The panel function is changed according to the table below.


Button	Function	Description in Internal Service
	OK	Press to confirm/select the displayed menu.
	CANCEL	Press to cancel and leave the displayed menu. In some sub menus the previous sub menu displays. In other sub menus the internal service list displays.
 up or down arrow buttons		Press to change a value.


The service code gives access to the internal service mode.

Service code	16	90	00
--------------	----	----	----

4.2.1 Enter Internal Service Mode


- Step 1 Use the arrow buttons to go up or down in the standard list.
- Step 2 When **INTERNAL SERVICE** displays, press **both arrow buttons at the same time**. Either release both buttons simultaneously or keep them pressed until (1) **ENTER SERVICE CODE** displays.
- Step 3 When (1) **ENTER SERVICE CODE** displays, use the arrow buttons to change the value to 16 and then press .

Step 4 When (2) **ENTER SERVICE CODE** displays, use the arrow buttons to change the value to 90 and then press .

Step 5 When (3) **ENTER SERVICE CODE** displays, use the arrow buttons to change the value to 00 and then press .

Step 6 The **INTERNAL SERVICE** list is entered.

NOTE


In internal service, the symbol  is visible.

4.2.2 Internal Service Loop

Use the arrow buttons to scroll the internal service list, containing the 14 menus in the table below:

1	SET REAL TIME
2	TIME CHANNELS
3	REMINDERS
4	CLEAR CHEM FLAG
5	SELECT LANGUAGE
6	CALIBRATE COND
7	SAFE MEM.
8	DEFAULT PRESETS
9	INIT DAYS SINCE LAST
10	PROTOCOL ENABLE
11	LOGGING
12	COND. ALARM LIMITS
13	ACTIVATE FUNCTIONS
14	REMOTE SIGNAL TEST

4.2.2.1 Exit Internal Service

Press  to leave the internal service list.

NOTE

Remember to turn off and on the WRO unit with the mains power switch to ensure changes are correctly used by the program.


4.2.2.2 Internal Service List Sub Menus



The sub menus are presented in this section, (one table for each menu in the internal service list).

NOTE


When the character / is used in this description, the sub menu can display either the text before or the text after /.




4.2.2.3 Set Real Time



When **SET REAL TIME** displays press  to enter the list of set real time.

Sub menus for SET REAL TIME	Information
SET YEAR <input type="text" value="X"/>	Use the arrow buttons to change the value displayed in the rectangle for each sub menu. Confirm the displayed value by pressing  , and the next sub menu is displays. Whenever  is pressed once SET REAL TIME in the internal service list is displays.
SET MONTH <input type="text" value="X"/>	
SET DAY <input type="text" value="X"/>	
SET HOUR <input type="text" value="X"/>	
SET MINUTE <input type="text" value="X"/>	
WEEKDAY <input type="text" value="XXXDAY"/>	WEEKDAY is displays, based on the values set in the sub menus above, to confirm the selected data.

4.2.2.4 Time Channels

When **TIME CHANNELS** displays press  to enter the list of set time channels. (for description of functionality refer to *Time Channels on page 55*, also changeable from GXP, refer to *Time Channels on page 98*).






Sub menus for TIME CHANNELS	Information
X¹. WEEKDAY HH:MM INACTIVE / STANDBY / RUN / HEAT	Use the arrow buttons to scroll the list of set time channels (maximum 21). Press  , and the first sub menu (for the selected time channel) displays. Use the arrow buttons to change the value. Confirm by pressing  , and the next sub menu displays. Whenever  is pressed once the list of set time channels displays.
SET WEEKDAY XXXDAY	
SET HOUR HH:MM	
SET MINUTE HH:MM	





Sub menus for TIME CHANNELS	Information
<p>SET TYPE INACTIVE / STANDBY / RUN / HEAT</p>	<p>Use the arrow buttons to change the type. Confirm by pressing . SAVING displays and followed by SET WEEKDAY (the first sub menu for the time channel).</p> <p>Press  to return to the list of set time channels.</p>

1. X represents a number (1-21).

4.2.2.5 Reminders

When **REMINDERS** displays, press  to enter the list of set reminders. (Refer to *Time Channels on page 55* for description of functionality.)

Sub Menus for Reminders	Information
<p>REMINDERX INACTIVE / Y Z DAYS</p>	<p>Use the arrow buttons to scroll the reminder list. If the reminder is active; Y displays the time period and Z displays the remaining days until the reminder will be issued.</p> <p>Press  to display the first sub menu (for the selected reminder).</p>
<p>SET DAYS INACTIVE / Y Z DAYS</p>	<p>To be able to activate (set the time period) or disable the reminder, press  to enter the next sub menu.</p> <p>If the reminder already has a time period (Y) and one of the arrow buttons is used, RESET displays. Choose a or b below:</p> <ol style="list-style-type: none"> 1 Press  and return to the reminder list, remaining days (Z) is not reset. 2 Press  and remaining days (Z) is reset (to same value as Y). <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Note</p> <p>If INACTIVE displays and the arrow buttons are used, RESET displays.</p> <p>Press  to return to the reminder list.</p> </div>

Sub Menus for Reminders	Information
SET DAYS INACTIVE / Y DAYS	<p>If INACTIVE displays use the arrow buttons to change to Y DAYS.</p> <p>If Y DAYS displays use the arrow buttons to change the time period Y (1-730 days).</p> <p>Confirm by pressing , and SAVING displays. If a time period was saved RESET displays. Choose a or b below:</p> <p>a. Press  and return to the reminder list without resetting remaining days (Z).</p> <p>b. Press  and the set value for remaining days (Z) is reset (to same value as Y). In both cases the reminder list displays.</p> <hr/> <p>Inactivate a reminder by selecting INACTIVE and press . SAVING displays followed by the reminder list.</p>

NOTE

The text for a reminder is set from GXP. Refer to *Reminders on page 99*.

4.2.2.6 Clear CHEM FLAG

When **CLEAR CHEM FLAG** displays in the internal service list, press




to enter the sub menu where the status can be changed.

**CAUTION**

When the **CHEM FLAG** is manually set to **FALSE** the technician is responsible for no chemicals being present in the WRO unit before operation (run mode).

Only change the **CHEM FLAG TO FALSE** in the following situations:


- To exclude the forced rinse, when the functionality of the chemical intake has been tested **using water instead of chemicals** during the Intake phase for the chosen disinfection cleaning mode.
- If the **CHEM FLAG=TRUE** displays because of a corrupt check sum in the program.
- If exchanging the CPU board.




Sub menus for CLEAR CHEM FLAG	Information
CHEM. FLAG <input type="checkbox"/> TRUE / <input type="checkbox"/> FALSE	Use the arrow buttons to change between TRUE and FALSE . Confirm by pressing  . SAVING displays, followed by CLEAR CHEM FLAG in the internal service list.

NOTE

The **CHEM FLAG** can only be manually changed from internal service mode.

4.2.2.7 Select Language


When **SELECT LANGUAGE** displays in the internal service list press  to enter the list where display text language is changed. Displayed text language in internal service is always English

Sub menus for SELECT LANGUAGE	Information
LANGUAGE	Use the arrow buttons to scroll the list of language versions of the display texts. Press  to choose the displayed language. SAVING displays, followed by the sub menu below.
VIEW CHOSEN LANGUAGE TXT?	Press  and a list with all display texts for the language version displays. Use the arrow buttons to scroll the list. Press  to return to the list of language selection.






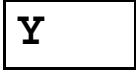


NOTE

The language can also be changed from GXP (S36). Refer to *User Interface Panel (LCD) on page 87*.


4.2.2.8 Calibrate Cond


When **CALIBRATE COND** displays in the internal service list press  to adjust the conductivity sensors C1 and C2.

NOTE
Only use **COEFF.** to adjust the conductivity sensors; for both the feed water FW (C1) and the product water PW (C2). Always set **OFFSET** to zero for both conductivity sensors.

Sub menus for CALIBRATE COND	Information
	Use the arrow buttons to move the rectangular marker to FW (feed water) or PW (product water). Press  to enter the sub menu.
FW OFFSET / PW OFFSET Naaa  Tbbb	<p>N is the non-temperature-compensated conductivity reading. T is the temperature-compensated conductivity reading.</p> <p>Use the arrow buttons to increase or decrease the value (X); so the conductivity value, displayed for the operator in operational data, will change with X μS from the value measured by the conductivity sensor.</p> <p>Confirm by pressing , SAVING displays followed by the next sub menu.</p> <p>Press  to return to the first sub menu.</p>
FW COEFF. / PW COEFF. Naaa  Tbbb	<p>N is the non-temperature-compensated conductivity reading. T is the temperature-compensated conductivity reading.</p> <p>Use the arrow buttons to increase or decrease the value (Y). A higher coefficient will result in a lower conductivity value and vice versa. The coefficient is used by the program to recalculate the conductivity value displayed for the operator in operational data.</p> <p>Confirm by pressing , SAVING displays followed by the next sub menu.</p> <p>Press  to return to the first sub menu.</p>

4.2.2.9 Safe Memory Area

When **SAFE MEM.** displays in the internal service list press  to enter the sub menu where all values in the safe memory area can be set to default values by choosing **TRUE**.

Sub menus for SAFE MEM.	Information
INIT SAFE MEM. <div style="border: 1px solid black; display: inline-block; padding: 2px;">FALSE</div> TRUE	Use the arrow buttons to move the rectangular marker from FALSE to TRUE . Press  to confirm, SAVING displays and all values in the safe memory area are set to default values. Thereafter SAFE MEM. in the internal service list displays.


The safe memory area includes the information below:





CAUTION
 Information will be lost when **INIT SAFE MEM.** is done. Important data must be recorded manually. It is not possible to reenter the data into the WRO unit.

Safe Memory Area	Default Values	Additional Information
LASTACID	0	Counter for days since last acid cleaning
LASTALK	0	Counter for days since last alkaline cleaning.
LASTHEAT	0	Counter for days since last heat disinfection.
LASTCHEM	0	Counter for days since last chemical disinfection.
ROPUMP	0	Counter for run time in hours. The run time displays in the operational data list as machine RUN TIME :
VISUAL-STATEMODE	E_COLD_START	Clear the recovery area and set the recovery memory to standby
CONDPULSS-TOPTIME	0	The last time when there was water flow is saved by the program, used for the peak test.
LASTUSED-CHEMPROT	0	0 = CHEMICAL disinfection (such as Dialox or Minncare)
CHEMFLAG	1	= TRUE (gives forced rinse)

4.2.2.10 Default Presets

When **DEFAULT PRESETS** displays in the internal service list press  to enter the sub menu where all values in the preset area can be set to default values by choosing **TRUE**.

Sub menus for DEFAULT PRESETS	Information
DEFAULT PRESETS  FALSE TRUE	Use the arrow buttons to move the rectangular marker from FALSE to TRUE . Press  to confirm, SAVING displays and all values in the preset area are set to default values. Thereafter DEFAULT PRESETS in the internal service list displays.


Refer to section *Presets and Defaults* on page 79 for default values.






CAUTION

Information will be lost when **DEFAULT PRESETS** is done. Important data must be recorded manually.

4.2.2.11 Init Days Since Last


When **INIT DAYS SINCE LAST** displays in the internal service list, press  to reach the sub menu where all counters for **TIME SINCE LAST** (heat disinfection, chemical disinfection, acid cleaning and alkaline cleaning) can be set to zero.

Sub menus for INIT DAYS SINCE LAST	Information
INIT TIME SINCE LAST  FALSE TRUE	Use the arrow buttons to move the rectangular marker from FALSE to TRUE . Press  to confirm, SAVING displays and the counters are reset (thereafter still in this menu). Press  to return to the internal service list.



NOTE

Disable or enable display of **DAYS SINCE LAST** in S153–156, refer to *Time Since Last* on page 97.

4.2.2.12 Protocol Enable

When **PROTOCOL ENABLE** displays in the internal service list press  to reach the sub menus where the visibility of disinfection protocols (for the operator) are set.

NOTE
The protocols are in a list and the only way to see the following protocols is to confirm the protocol displayed (**TRUE** or **FALSE**). Confirm all protocols to reach the last one.




Sub menus for PROTOCOL ENABLE	Information
<p>1. _____¹</p> <div style="border: 1px solid black; display: inline-block; padding: 2px;">FALSE</div> TRUE	<p>Use the arrow buttons to move the rectangular marker from FALSE to TRUE. Press  to confirm, and SAVING displays, followed by the sub menu for the next disinfection protocol.</p> <p>Whenever  is pressed one time PROTOCOL ENABLE in the internal service list displays.</p>

1. 10 protocols can be set, _____ is the first by default

NOTE

- The first disinfection protocol to display when the disinfection wand is connected and the down arrow button is pressed, is defined in S138. Refer to *First Protocol on page 90*.
- Protocol's are also changeable from GXP. Refer to *Default Setting of Disinfection Protocol on page 94*.


4.2.2.13 Logging



When **LOGGING** displays in the internal service list press  to reach the sub menus. The menus only provide information; values cannot be changed. Press  and the next sub menu displays. Press  from a sub menu to return to the internal service list and **LOGGING** displays.

Sub menus for LOGGING	Information
<p>RETURN TEMP. x °C</p>	<p>Temperature measured by T3. The reading is only valid in a WRO 300 H unit. (116 indicates that no temperature sensor is connected.)</p>

Sub menus for LOGGING	Information
SENSOR & VALVES ELH IW:WWA 10	<p>ELH = Empty low high level sensors in the tank. The 3 characters after the colon give information about what the 3 sensors currently detect, A for air and W for water.</p> <p>I represents the inlet valve (INVA). The first figure is the current state of INVA, where 1 is enabled/open/water to tank and 0 is disabled/closed</p> <p>W represents Water save (controlled by the reject valve REVA). The second figure is the current state of REVA, where 1 is enabled/open to drain and 0 is disabled/open to tank.</p> <p>NOTE In the given example: Empty and low level sensor detects water and High level sensor detects air. INVA is open and REVA is inactive. Both INVA and REVA give water to</p>
PUMP SPEED 0 RPM	Measured RO pump speed.
REJECT TEMP X °C	Temperature measured by T2. The reading is only valid in a WRO 300 H unit. (116 indicates that no temperature sensor is connected.)



4.2.2.14 Cond. Alarm Limits






When **COND. ALARM LIMITS** displays in the internal service list, press  to reach sub menus, to change the limits for the different conductivity alarms; notification, alarm, stop and rejection rate.

Sub menus for COND. ALARM LIMITS	Information
COND. NOTIFICATION LIMIT X MS/CM	Use the arrow buttons to change the value (X) for each limit. Confirm by pressing  , SAV-ING displays followed by the next sub menu. Whenever  is pressed once COND. ALARM LIMITS in the internal service list displays.
COND. ALARM LIMIT X MS/CM	
COND. STOP LIMIT X MS/CM	
COND. REJECTION RATE LIMIT X%	

NOTE
 The limits are also changeable from GXP, presets S33, S34, S35 and S149. Refer to *Alarm Limits on page 85* and *Rejection Rate and Peak Test on page 86*.

4.2.2.15 Activate Functions

When **ACTIVATE FUNCTIONS** displays in the internal service list press  to display the list of functions. Use the arrow buttons to scroll the list. Press  to enter the sub menu where the function can be enabled or disabled. (Also refer to *Features — Extra Functions on page 53*).



Sub menus for ACTIVATE FUNCTIONS	Information
WATER SAVE  DISABLED	Move the rectangular marker to select ENABLED to DISABLED . Confirm by pressing  , and SAVING displays followed by the list of functions. Press  to return to the internal service list and ACTIVATE FUNCTIONS displays.
PEAK TEST  DISABLED	
AUTO FLUSH  DISABLED	

NOTE
 The functions are also possible to activate from GXP; presets S184, S186 and S185. Refer to *Water Save on page 84*, *Rejection Rate and Peak Test on page 86* and *Auto Flush on page 97*.

4.2.2.16 Remote Signal Test

NOTE
 The **REMOTE SIGNAL TEST** with **REMOTE TEST ENABLED** is only to be used by manufacturing for final testing of Port500 (green¹).

1. Blue in older version

When **REMOTE SIGNAL TEST** displays in the internal service list, press  to reach the sub menu **REMOTE TEST ENABLED**. Press  to return to the internal service list and **REMOTE SIGNAL TEST** displays.

4.3 PC Support Software

4.3.1 USB Serial Driver Installation

NOTE

The WRO 300/300 H requires USB drivers.

NOTE

This installation instruction is applicable for Windows 2000 and Windows XP.

NOTE

This software along with GXP/GXL/GWD have only tested through Windows XP. Newer versions of Windows (Vista, Windows 7) are not yet supported.

NOTE

Do not insert the USB cable before installing the drivers!

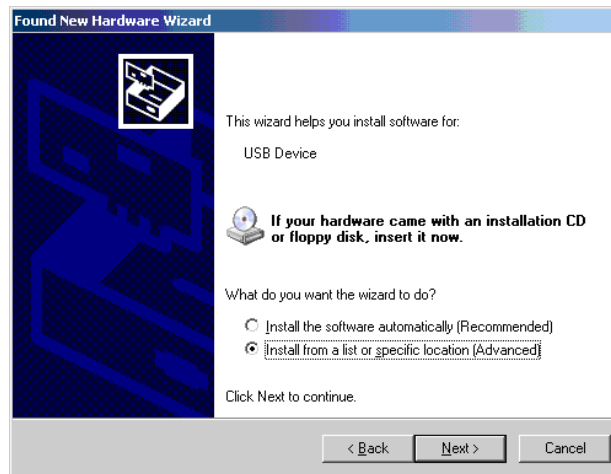
Install the USB to COM Driver (W405050) on a PC as follows.

- Step 1 Unzip **W405050.zip** to the desktop. Double click the **W405050.bat** file found in the extracted W405050 directory — this will install the driver.
- Step 2 Connect the USB cable from the WRO 300/300 H to an available USB port.
- Step 3 Windows will detect new hardware.

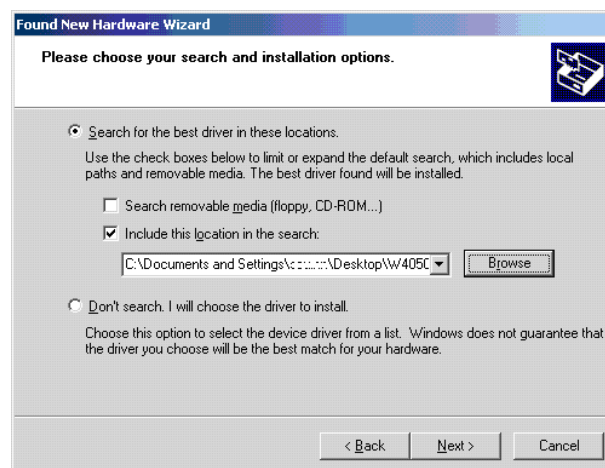


- Step 4 On the **Found New Hardware Wizard** dialog box, click **No, not this time** and click **Next**.

- Step 5 Click **Install from a list or specific location (Advanced)** and click **Next**

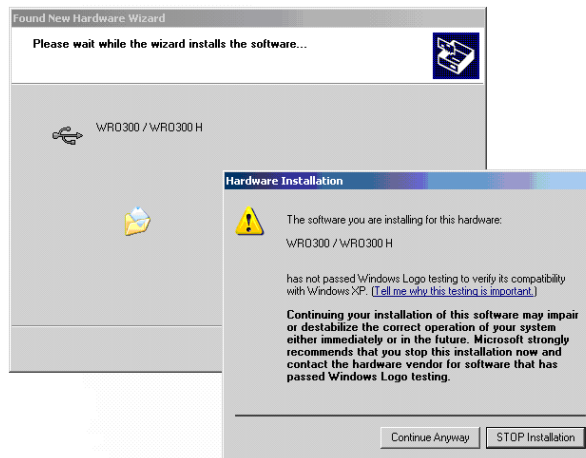


- Step 6 Click **Search for the best driver in these locations**, select **Include the location in the search** check box, click **Browse**, and select **GAMBRO_WRO300_Installer** (located in the extracted directory (Typically **W405050\GAMBRO_WRO300_INSTALLER**)). Click **Next**.



- Step 7 Windows installs the driver.

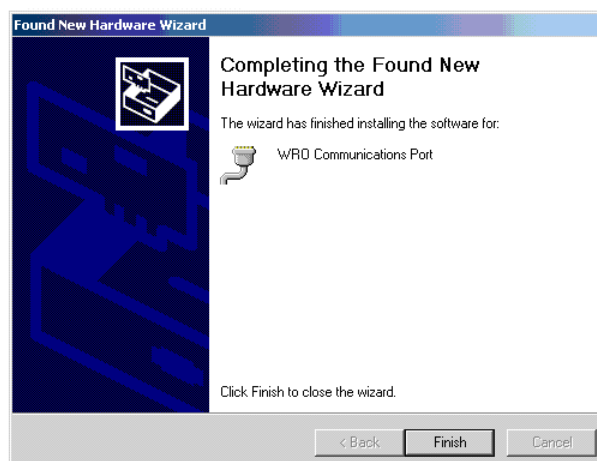
Step 8 If the window below displays, click **Continue Anyway**.



Step 9 On the **Completing the Found New Hardware Wizard** dialog box, click **Finish**.



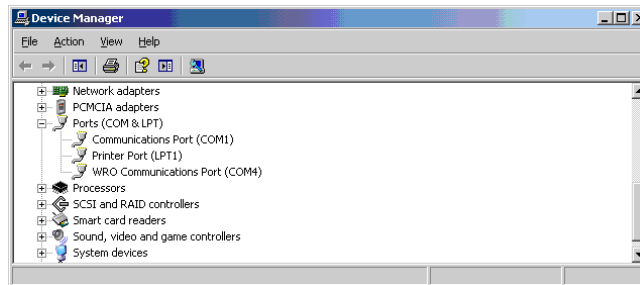
Step 10 On the dialog box shown below, click **Finish**.



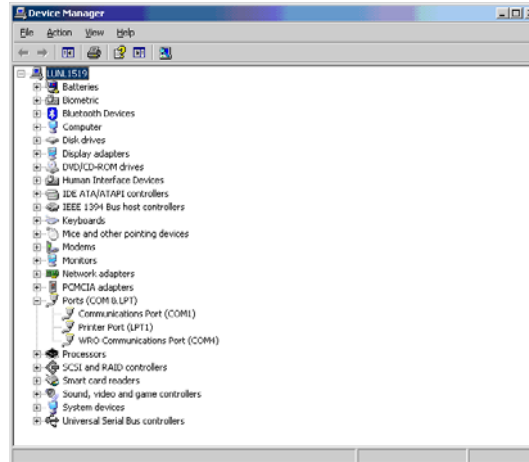
Step 11 Windows displays the message **Found New Hardware**.



Step 12 The **Device Manager** window displays with the COM port visible. The COM port number assigned will vary — the WRO software only recognizes ports 1–6. Please check what your installation resulted in.



Step 13 Repeat the installation for the next USB port on the computer if more ports are needed.



4.3.2 GXL — Logging

Logging of parameters like conductivity, flow, temp etc. is possible to do during operation by the use of GXL. For detailed information of the GXL software refer to the *GXL Operator's Manual*.

4.3.3 GXP — Preset


Preset values can be changed with the Gambro® service tool, GXP. The GXP runs on an ordinary PC communicating with the WRO unit through an USB interface. The technician starts the GXP session by:

Step 1 Put the WRO unit into standby mode.

- Step 2 Connect the WRO unit to the computer through the USB interface.
- Step 3 Choose **Online** in the GXP software and enter the access code (169000). **EXTERNAL PRESET** displays on the WRO unit when the WRO unit enters the preset mode.
- Step 4 Make changes from the GXP software and execute by choosing **WRITE**.
- Step 5 Verify that all changes are accepted by the WRO unit and that no other parameters are changed.
- Step 6 Turn the power off and on the WRO unit using the mains power switch to enter standby mode again. This will force the WRO unit to restart and all preset parameters will be re-read.

For detailed information of the GXP software refer to the *GXP Operator's Manual*. Descriptions of presets refer to *Presets and Defaults on page 79*.

4.3.4 Checksum Status

Press the  button and at the same time switch on the WRO unit using the mains power switch. The display shows four checksums.

Main	Display
1: aaaa ¹	1: bbbb ²
2: cccc ³	2: dddd ⁴

1. Main CPU board application code checksum
2. Display board application code checksum.
3. Main CPU board boot loader code checksum
4. Display board boot loader code checksum


Verify the values with the program documentation.

4.3.5 GWD - Download

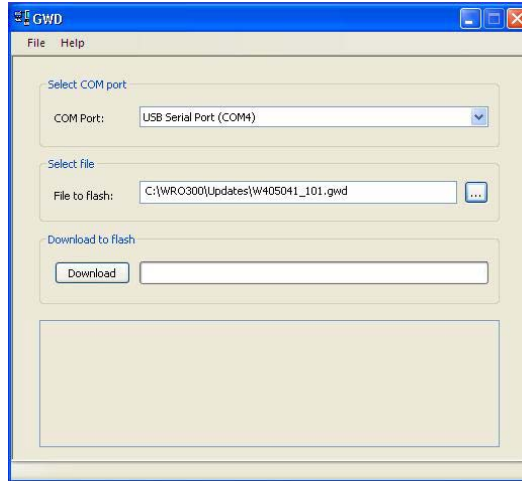
NOTE
Requires GWD version 2.

GWD is a tool to upgrade the software in a WRO 300/300 H using a connected PC.

4.3.6 Start the GWD

- Step 1 Press the  button and at the same time turn on power to the WRO unit using the mains power switch. Verify that the WRO unit enters boot mode (blank display).

Step 2 On the desktop, double click the **GWD** icon to start the program and display the **GWD** window.



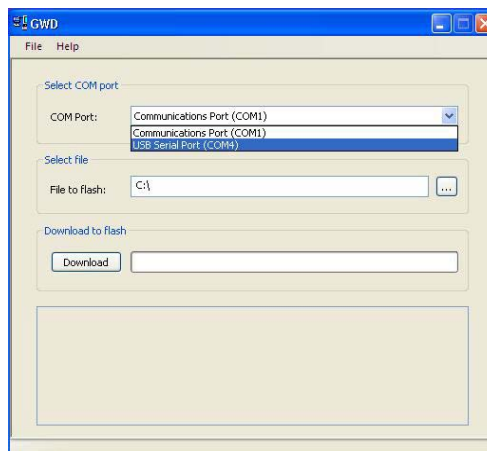
4.3.6.1 Menus



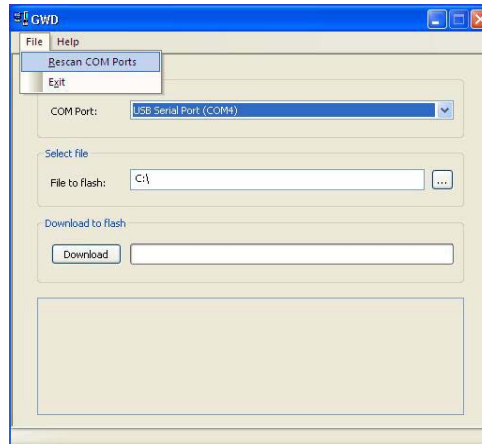
Menus	Description	
File	Re-scan COM Ports	GWD will update the list of COM ports.
	Exit	Ends the GWD program.
Help	About GWD...	Displays data about the program.


4.3.6.2 Download a New Program

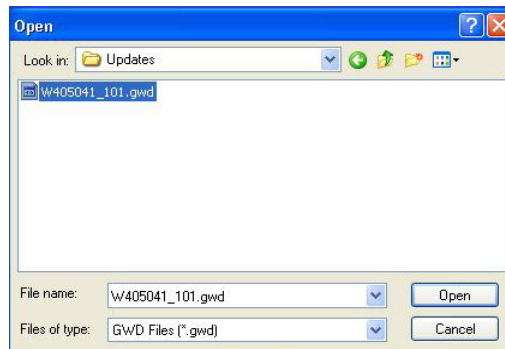
Step 1 On the **GWD** window, click in the **COM Port** list and select the appropriate **COM port**.



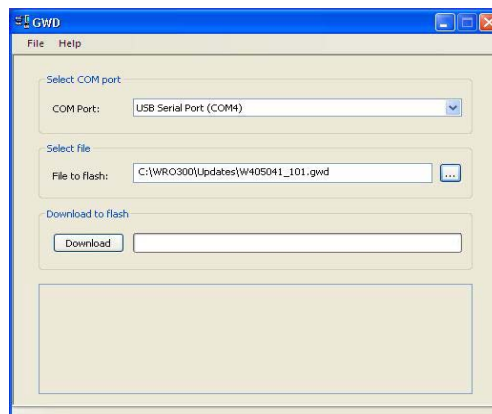
- Step 2 If the cable to the WRO 300/300 H is not connected when GWD is started, connect the cable and update the list with COM ports. To update the list point to **File** and click **Re-scan COM Ports**.



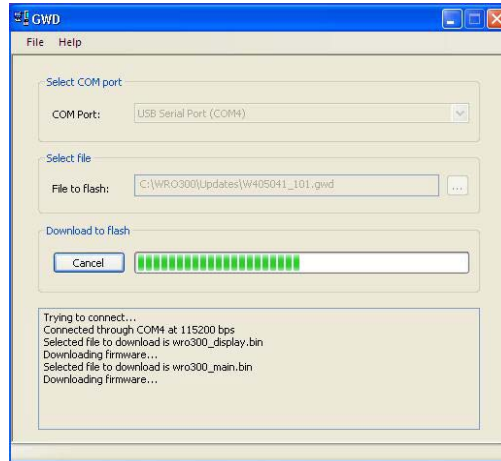
- Step 3 Click the **COM Port** list and select the software file by clicking , a browse window opens.



- Step 4 Select the upgrade file and click **Open**. The file will always have the file extension **.gwd**. The path shows in the **File to Flash** box.

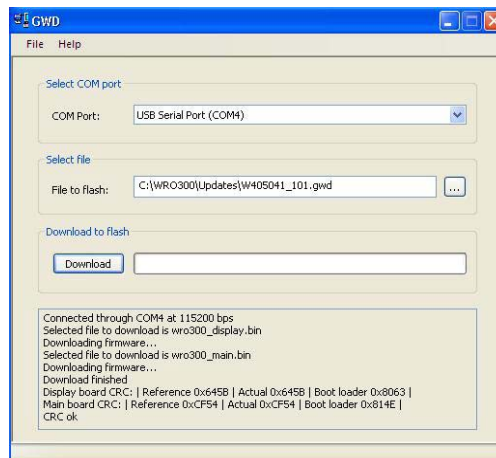


- Step 5 On the **GWD** window, Click **Download**.
- Step 6 The program will proceed with the download, displaying the status.



- Step 7 When the download finishes, the program calculates a check-sum (CRC) to verify that the software has been downloaded correctly.

- Step 8 The result of the verification is shown.



- Step 9 When ready, close the program and restart the WRO unit.

4.4 Presets and Defaults

Preset values in the non volatile memory are used to configure the behavior of the WRO unit. The presets can be changed by the use of GXP. Refer to *GXP — Preset on page 74* for instructions to start the GXP session.

NOTE

- Manufacturing setup of the preset may be different from the default values presented in this chapter.
- Some preset values are also changeable from the Internal service mode. Refer to *Internal Service Mode on page 59*.

When changing preset values using the GXP software, the two tables below assist in finding the section where the preset is described. The first table is sorted in alphabetical order of preset groups. The second table is sorted in numerical order of S-numbers.

Group	Number of presets within this group	Refer to
CHEM	3	<i>Chemical Intake Pump Capacity on page 95</i>
COND	5	<i>Alarm Limits on page 85</i>
		<i>Rejection Rate and Peak Test on page 86</i>
DISPROTMANAGER	110	<i>First Protocol on page 90</i>
	1	<i>Default Setting of Disinfection Protocol on page 94</i>
	1	<i>Manual Flush on page 96</i>
EXTERNAL RELAY	1	<i>External relay on page 101</i>
HEATING	8	<i>Heat Set Temperature on page 88</i>
		<i>Active Cooldown on page 89</i>
		<i>Low Flow Heat on page 89</i>
		<i>WRO 300 Flow Kit Installed on page 90</i>
LCD	3	<i>User Interface Panel (LCD) on page 87</i>

Group	Number of presets within this group	Refer to
REMINDERS	10	<i>Reminders on page 99</i>
REMOTE	2	<i>Remote on page 100</i>
RO PUMP	2	<i>RO Pump on page 83</i>
TANK CONTROL	2	<i>Tank Control on page 83</i>
TIME MANAGER	8	<i>Auto Flush on page 97</i>
		<i>Time Since Last on page 97</i>
TIME CHANNEL	21	<i>Time Channels on page 98</i>
WATER SAVE	2	<i>Water Save on page 84</i>

INDEX: S-Numbers				
S28, page 83	S70, page 94	S112, page 94	S154, page 97	S197, page 94
S29, page 84	S71, page 94	S113, page 94	S155, page 97	S198, page 94
S30, page 88	S72, page 94	S114, page 94	S156, page 97	S199, page 94
S31, page 88	S73, page 94	S115, page 94	S157, page 95	S200, page 94
S32, page 88	S74, page 94	-	S158, page 95	S201, page 94
S33, page 85	S75, page 94	S117, page 94	S159, page 98	S202, page 94
S34, page 85	-	S118, page 94	S160, page 98	S203, page 94
S35, page 85	S77, page 94	S119, page 94	S161, page 98	S204, page 94
S36, page 87	S78, page 94	S120, page 94	S162, page 98	S205, page 94
S37, page 94	S79, page 94	S121, page 94	S163, page 98	S206, page 94
S38, page 94	S80, page 94	S122, page 94	S164, page 98	S207, page 90
S39, page 94	S81, page 94	S123, page 94	S165, page 98	S208, page 100
S40, page 94	S82, page 94	S124, page 94	-	S209, page 98
S41, page 94	S83, page 94	S125, page 94	-	S210, page 98
S42, page 94	S84, page 94	-	-	S211, page 98
S43, page 94	S85, page 94	S127, page 94	-	S212, page 98
S44, page 94	-	S128, page 94	S171, page 99	S213, page 98
S45, page 94	S87, page 94	S129, page 94	S172, page 99	S214, page 98
-	S88, page 94	S130, page 94	S173, page 99	S215, page 98
S47, page 94	S89, page 94	S131, page 94	S174, page 99	S216, page 98
S48, page 94	S90, page 94	S132, page 94	S175, page 99	S217, page 98
S49, page 94	S91, page 94	S133, page 94	S176, page 99	S218, page 98
S50, page 94	S92, page 94	S134, page 94	S177, page 99	S219, page 98
S51, page 94	S93, page 94	S135, page 94	S178, page 99	S220, page 98
S52, page 94	S94, page 94	-	S179, page 99	S221, page 98
S53, page 94	S95, page 94	-	S180, page 99	S222, page 98
S54, page 94	-	S138, page 90	S181, page 89	S223, page 96
S55, page 94	S97, page 94	S139, page 97	S182, page 100	S224, page 83
-	S98, page 94	S140, page 97	S183, page 89	S225, page 88
S57, page 94	S99, page 94	S141, NOT USED ¹	S184, page 84	S226, page 100
S58, page 94	S100, page 94	S142, page 89	S185, page 97	S227, page 83
S59, page 94	S101, page 94	S143, page 87	S186, page 86	S228, -
S60, page 94	S102, page 94	S144, page 87	S187, page 94	S229, -
S61, page 94	S103, page 94	-	S188, page 94	S230, -
S62, page 94	S104, page 94	-	S189, page 94	S231, -
S63, page 94	S105, page 94	-	S190, page 94	S232, -
S64, page 94	-	-	S191, page 94	S233, page 83
S65, page 94	S107, page 94	S149, page 86	S192, page 94	S234, page 100
-	S108, page 94	-	S193, page 94	S235, page 95

INDEX: S-Numbers			
S67, page 94	S109, page 94	S151, page 95	S194, page 94
S68, page 94	S110, page 94	-	S195, page 94
S69, page 94	S111, page 94	S153, page 97	S196, page 94

1. Time channels replaces preset S141

NOTE
 Preset S228–S232 are prepared for remote start/stop of chemical disinfection from the dialysis machine. The remote start-stop feature is currently not used in any U.S. dialysis machines.

4.4.1 Change Presets for WRO 300 H

The WRO unit makes a **default preset** if any of the alarms 103:1-4 are issued. (Refer to *Alarms on page 125*). Then the default presets are fetched from the flash memory containing the software and restored in the non volatile memory. Any presets adjusted for the clinic are lost.

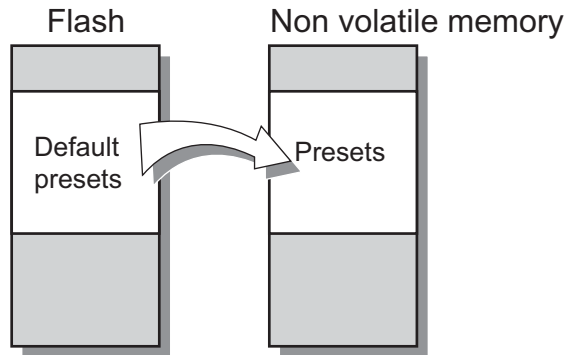


Fig.4.1 — Data from flash memory to non volatile memory.

The WRO 300 H setup reverts to WRO 300 basic settings. Values in the table below must be preset in a WRO 300 H unit for the machine to function as a WRO 300 H unit.

Parameter	Default Value	Value for the WRO 300 H Unit	Refer to
S28	35	40	<i>RO Pump on page 83</i>
S32	2	1 (220 - 240 VAC) 2 (115 VAC) 3 (100 VAC)	<i>Heat Supply Voltage on page 88</i> !CAUTION Correct mains voltage must be set in order to prevent malfunction of heat disinfection and low flow heat.

Parameter		Default Value	Value for the WRO 300 H Unit	Refer to
S48	Protocol number 2	8	8 WARMACID	<i>Default Setting of Disinfection Protocol on page 94</i>
S49		WARM ACID	WARM CITRIC	

4.4.2 RO Pump

Group: RO Pump		
Parameter	Settings	
Name	Run speed	Low product flow notification limit.
S No.	S28	S224
Description	Output duty cycle for RO pump during (run) operation.	If the product water flow is below the preset limit the notification 206 LOW PRODUCT FLOW is issued when entering standby mode.
Scale	1 %	1 ml / minute
Default	35/40 (Cold/Hot)	0
Low Limit	0	0
High Limit	46	1000

4.4.3 Tank Control

Group: Tank control		
Parameter	Settings	
Name	INLET VALVE MAX OPEN TIME	High sensor test on/off
S No.	S233	S227
Description	The time for Inlet valve (INVA) to be maximum open	Activates or deactivates the High level sensor test (LH) in the tank. This preset must only be changed if the Low level and High level sensors (position LL and LH) in the tank are exchanged from optical level sensors to float level switches. For detailed description refer to separate Spare Parts instruction.

Group: Tank control		
Parameter	Settings	
Scale	0 = Timer off 1 - 600 (seconds)	0 = MECHANICAL 1 = OPTICAL
Default	60	0
Low Limit	0	0
High Limit	600	1

NOTE

- In WRO units manufactured with program version 3.2 or earlier, all three level sensors are optical sensors.
- In WRO units manufactured with program version 4.0 or later, only the empty level (LE) sensor is optical and the sensors for low level (LL) and high level (LH) are float level switches.
- The preset S227 is only to be changed if the level sensors are to be replaced. Both the sensor for low level (LL) and high level (LH) must be changed on the same occasion and the software in the WRO unit must be program version 4.0 or later.

4.4.4 Water Save

Group: Water Save		
Parameter	Settings	
Name	Water save factor	Water save enable/disable
S No.	S29	S184
Description	Preset value for the time that the reject water is redirected back to the tank in order to reduce water consumption, during run.	Enables or disables the water save function, during run.
Scale	1% of time period where total time period is 20 seconds	0 = DISABLED 1 = ENABLED
Default	5	1
Low Limit	0	0
High Limit	80	1

NOTE
S184 is changeable from internal service mode.

4.4.5 Conductivity

The conductivity monitoring uses three limits: notification, alarm and stop, allowing for individual adaptation of alarm settings to local preferences and regulations.

NOTE

- For the operator to get an early warning of change in the product water conductivity; preset the notification limit to a value between the normal product water reading and the preset alarm limit.
- To stop operation in case of a conductivity alarm, preset the alarm and the stop limits at the same value.
- If, in case of a conductivity alarm, it is desired to allow for continued dialysis treatment in order to finish the ongoing dialysis treatment; preset the stop limit to a higher value than the preset alarm limit.

4.4.5.1 Alarm Limits

Group: Cond			
Parameter	Settings		
Name	Notification Limit	Alarm Limit	Stop Limit
S No.	S33	S34	S35
Description	<p>201 CONDUCTIVITY NOTIFICATION is issued when entering standby if the product water conductivity has exceeded the notification limit for more than 30 consecutive seconds during run. This notification limit is also used as a reference, during the last 5 minutes of a rinse cycle, to verify that the product water conductivity is below the notification limit. If not, the rinse is prolonged with a maximum of 30 minutes. If the conductivity reading is still not below preset notification limit within the 30 minutes the alarm 403 HIGH CONDUCTIVITY RINSE is issued.</p>	<p>202 CONDUCTIVITY ALARM is issued during operation (run) if the product water conductivity has exceeded the preset alarm limit for more than 30 consecutive seconds during run. The WRO unit continues in run to allow for finishing the dialysis treatment.</p>	<p>203 CONDUCTIVITY STOP is issued and the WRO unit stops if the product water conductivity has exceeded the preset limit for more than 30 consecutive seconds during operation (run).</p>

Group: Cond			
Parameter	Settings		
Scale	1 µS/cm	1 µS/cm	1 µS/cm
Default	20	30	60
Low Limit	0	0	0
High Limit	500	500	500

NOTE

- S33, S34, S35 are changeable from internal service mode.
- Factory settings of limits for notification, alarm and stop are all pre-set to 60 µS/cm. With these preset limits the WRO 300 unit will stop without any previous warning if the product water conductivity exceeds 60 µS/cm for more than 30 seconds (since the priority of the actions are in the order of stop, alarm and notification).
- If the feed water conductivity is known to vary significantly, the conductivity notification limit can be inactivated by setting it at the same value as the conductivity alarm.

4.4.5.2 Rejection Rate and Peak Test

Group: Cond		
Parameter	Settings	
Name	REJECTION_RATE_LIMIT	Cond Peak test enable/disable
S No.	S149	S186
Description	Rejection ratio notification limit. The notification 205 LOW REJECTION RATE will be issued when the WRO unit enters standby if the rejection rate is below the set limit for more than 5 consecutive minutes during the previous run period.	Enable or disable the peak test
Scale	1%	0 = DISABLED 1 = ENABLED
Default	90	1
Low Limit	0	0
High Limit	98	1

NOTE
S149 and S186 are changeable from internal service mode. Refer to *Cond. Alarm Limits* on page 69 and *Activate Functions* on page 70.

4.4.6 User Interface Panel (LCD)

Group: LCD			
Parameter	Settings		
Name	Language	Backlight Timeout	Loop Timeout
S Number.	S36	S143	S144
Description	Language for the texts displayed for the operator.	LCD backlight time out.	LCD list time out until the display reverts back to show mode.
Scale	0 = ENG (English) 1 = SWE (Swedish) 2 = GER (German) 3 = FRE (French) 4 = ITA (Italian) 5 = SPA (Spanish) 6 = DK (Danish) 7 = FI (Finnish) 8 = NL (Netherlands) 9 = PT (Portuguese) 10 = TR (Turkish) 11 = NR (Norwegian) 12 = CZE (Czech) 13 = PL (Polish) 14 = ET (Estonian) 15 = SK (Slovak) 16 = SL (Slovene) 17 = LV (Latvian) 18 = LT (Lithuanian)	-1 = no backlight 0 = backlight only when button pressed 1 - 60 = seconds	1 - 60 = seconds
Default	0	15	15
Low Limit	0	-1	1
High Limit	18	60	60

NOTE

S36 is changeable from internal service mode. Refer to *Select Language on page 64*.

4.4.7 Heat

The heaters consists of three windings and to obtain correct power a specific combination of those has to be activated. Different combinations are required depending on which power supply voltage is used.

4.4.7.1 Heat Supply Voltage

Group: Heating	
Parameter	Settings
Name	Supply voltage
S No.	S32
Preset group	Heating
Description	Mains supply voltage for the WRO unit's heater function.
Scale	0 = no heater function available 1 = 220 - 240 V AC 2 = 115 V AC 3 = 100 V AC
Default	0 (2 for WRO H)
Low Limit	0
High Limit	3

4.4.7.2 Heat Set Temperature

Group: Heating			
Parameter	Settings		
Name	Product Temp	Reject Temp	Return Temp Limit
S No.	S30	S31	S225
Description	Preset for the set temperature of heater B, measured by temperature sensor (T1) in the product water line.	Preset for the set temperature of heater A, measured by temperature sensor (T2) in the reject water line.	Preset for the temperature limit to be reached in the return overflow water line during heat, measured by temperature sensor (T3). The alarm INTERNAL ERROR (103:21) will be issued if the return temperature limit is not reached.
Scale	0.01 °C	0.01 °C	0.01 °C
Default	9200	9200	8000
Low Limit	0	0	0
High Limit	9500	9500	9500

4.4.7.3 Active Cooldown

Group: Heating	
Parameter	Settings
Name	Active cool down
S No.	S142
Preset group	Heating
Description	Enable Active cooldown
Scale	0 = DISABLED 1 = ENABLED
Default	1
Low Limit	0
High Limit	1

4.4.7.4 Low Flow Heat

Group: Heating		
Parameter	Settings	
Name	Low flow heat temp	LFH auto HEAT
S No.	S181	S183
Preset group	Heating	Heating
Description	Set temperature of heater B in low flow heat mode	Preset = TRUE automatically starts heat disinfection after a remote low flow heat initiated by the dialysis machine. The preset has no effect on low flow heat mode started from the SELECT menu in the WRO 300 H unit.
Scale	0.01 °C	0 = FALSE 1 = TRUE
Default	8300	1
Low Limit	0	0
High Limit	8500	1

NOTE

The WRO 300 H has a feature called low flow heat that is used in conjunction with certain dialysis machines. This feature is not approved in the US by the FDA or currently compatible with any U.S. dialysis machines.

4.4.7.5 WRO 300 Flow Kit Installed

NOTE	
<ul style="list-style-type: none"> • This preset must only be changed if a flow meter kit is installed in a WRO 300 unit. • For installation of the flow meter kit refer to separate spare parts instruction. 	

Group: Heating	
Parameter	Settings
Name	CHC_FLOW_KIT_INSTALLED
S No.	S207
Description	This preset must only be set to TRUE if a flow kit has been installed in a WRO 300 unit. Then the product water flow displays for operator and the notification for low product flow notification limit can be issued (refer to S224 <i>RO Pump on page 83</i>). The preset has no function in the WRO 300 H unit.
Scale	0 = FALSE 1 = TRUE
Default	0
Low Limit	0
High Limit	1

4.4.8 Disinfection Protocol Manager

The technician can preset up to ten different disinfection, cleaning, and preservation protocols for the WRO unit.

All parameters included in the setup for each protocol is changeable through the GXP program.

The internal service mode can also be used to change the parameter indicating if a particular protocol is to be visible (selectable) during the chemical select procedure. Refer to *Protocol Enable on page 68*.

4.4.8.1 First Protocol

Group: DisProtManager	
Parameter	Settings
Name	Default protocol
S No.	S138
Description	First protocol displayed in chemical select mode
Scale	1–10 (= Protocol number, refer to <i>Default Setting of Disinfection Protocol on page 94</i>)
Default	8 (= MINNCARE , refer to <i>Default Setting of Disinfection Protocol on page 94</i>)

Group: DisProtManager	
Parameter	Settings
Low Limit	1
High Limit	10

NOTE

- The first protocol to display when the disinfection wand is connected and the down arrow button is pressed, is defined in S138¹.
- The protocol defined by S138 will be shown whether the actual protocol is visible or invisible.
- The protocol defined by S138 will only be shown once (at the start of scrolling through the visible protocols) if the actual protocol is set to invisible².

1. Only changeable from GXP

2. S37, S47, S57, S67, S77, S87, S97, S107, S127, changeable from the internal service mode or from GXP refer to *Protocol Enable on page 68* and *Default Setting of Disinfection Protocol on page 94*.

4.4.8.2 Disinfection Protocol

The protocol parameters are described in table below. All S-numbers and default values for the protocols are presented on *page 94*.

Group: DisProtManager			LIMIT	
Name ¹	Scale	Further Description	Low	High
PROTX_VISIBLE	1 = visible 0 = invisible	Preset if the disinfection protocol is going to be selectable (displayed for the operator during chemical select mode) or not displayed.	0	1
PROTX_TYPE	0 = CHEM DIS (Chemical disinfection) 1 = CENTR CH (Central Chemical disinfection) 2 = PRES+FREEZE (Preservation + Freeze) 3 = ACID (Acid cleaning) 4 = ALKALI (Alkaline cleaning) (5 = MEM FLUSH (Membrane flush)) 6 = PRESERV (Preservation) 7 = REMOTE CENTR CH (Remote Central Chemical disinfection) 8 = WARM ACID CLEAN (Warm Acid cleaning)	Preset type of protocol. <div style="border: 1px solid black; padding: 5px; width: fit-content;">NOTE Do not use protocol type 5 (Membrane flush).</div>	0	8
PROTX_TITLE	Text string	Protocol name, displayed during chemical select mode.	-	-
PROTX_CONT_TIME	1 minute	Contact time, calculated from the start of the Chemical disinfection. Refer to page 95.	0	3000
PROX_CH_VL	1 ml <div style="border: 1px solid black; padding: 5px; width: fit-content;">NOTE If Central Chemical disinfection the scale is minutes.</div>	During the Intake phase of Chemical disinfection, Cleaning or Preservation, the program calculates the time for the Intake period, from the preset value for volume (ml).	0	2500
PROTX_RINSE_TIME	1 minute	Rinse time	6	1000
PROTX_INT_MIT_RUN_MODE	1 = TRUE 0 = FALSE	Preset if the WRO unit is going to intermittently circulate the fluids during the Dwell period or not.	0	1

Group: DisProtManager			LIMIT	
Name ¹	Scale	Further Description	Low	High
PROTX_INT_MIT_RUN_TIME	1 minute	The time for the RO pump to be on, if PROTX_INT_MIT_RUN_MODE is set to TRUE.	0	1000
PROTX_INT_MIT_STOP_TIME	1 minute	The time, for the RO pump to be off, if PROTX_INT_MIT_RUN_MODE is set to TRUE.	0	1000
CDM_PROTX_MIN_INTAKE_COND_LIM	µS/cm	The alarm 406 INSUFFICIENT INTAKE is issued at the end of the Intake phase, if the conductivity check indicates that no chemicals have been consumed. Set to zero will disable the Intake phase conductivity check. <div style="border: 1px solid black; padding: 5px; width: fit-content;"> NOTE The limit is not used during Central Chemical disinfection. </div>	0	1000
CDM_PROTX_TEMP	1 C°	Preset for the set temperature of Heater B, measured by temperature sensor (T1) in the product water line. Only valid if the protocol type is set to WARM ACID CLEAN (8)	0	4500

1. X in the Name represents a number (1-10) = protocol No.

4.4.8.3 Default Setting of Disinfection Protocol

Name	Protocol No.											
	1	2 Cold	2 Hot	3	4	5	6	7	8 Cold	8 Hot	9	10
PROTX_VISIBLE	S37	S47	S47	S57	S67	S77	S87	S97	S107	S107	S117	S127
	Invisible	Visible	Visible	Invisible	Visible	Invisible	Invisible	Visible	Visible	Invisible	Visible	Invisible
	0	1	1	0	1	0	0	1	1	0	1	0
PROTX_TYPE	S38	S48	S48	S58	S68	S78	S88	S98	S108	S108	S118	S128
	CHEM DIS	ACID	ACID WARM	PRES FREEZE	CENTR CH	CENTR CH	ACID	PRESERV	CHEM DIS	CHEM DIS	ACID	ALKALI
	0	3	8	2	1	1	3	6	0	0	3	4
PROTX_TITLE	S39	S49	S49	S59	S69	S79	S89	S99	S109	S109	S119	S129
	—	ACIDCLEAN	WARM CITRIC	PRESERV+FREEZE	CENTR_CH_PHX	CENTR_CH_200	CENTR_CH_200U	MEMSTOR	MINNCARE	MINNCARE	MINNCLEAN	ALKALICLEAN
PROTX_CONT_TIME	S40	S50	S50	S60	S70	S80	S90	S100	S110	S110	S120	S130
	30	30	30	0	30	30	30	0	30	30	30	30
PROX_CH_VL	S41	S51	S51	S61	S71	S81	S91	S101	S111	S111	S121	S131
	115	250	250	0	10	13	1100	2100	50	50	200	250
PROTX_RINSE_TIME	S42	S52	S52	S62	S72	S82	S92	S102	S112	S112	S122	S132
	60	30	30	60	60	60	30	60	60	60	30	30
PROTX_INT_MIT_RU N_MODE	S43	S53	S53	S63	S73	S83	S93	S103	S113	S113	S123	S133
	0	1	1	0	0	0	1	0	0	0	1	1
PROTX_INT_MIT_RU N_TIME	S44	S54	S54	S64	S74	S84	S94	S104	S114	S114	S124	S134
	2	5	5	0	0	0	5	0	0	0	5	5
PROTX_INT_MIT_ST OP_TIME	S45	S55	S55	S65	S75	S85	S95	S105	S115	S115	S125	S135
	10	5	5	0	0	0	5	0	0	0	5	5
CDM_PROTX_MIN_ INTAKE_COND_LIM	S187	S188	S188	S189	S190	S191	S192	S193	S194	S194	S195	S196
	250	0	0	0	0	0	0	100	280	280	0	0
CDM_PROTX_TEMP	S197	S198	S198	S199	S200	S201	S202	S203	S204	S204	S205	S206
	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500

4.4.9 Chemical Disinfection

4.4.9.1 Chemical Intake Pump Capacity

Group: Chem	
Parameter	Settings
Name	PUMP_CONSTANT_WATER
S No.	S151
Description	The value represents the pump capacity in terms of volume per second.
Scale	1/10 ml/second
Default	15
Low Limit	10
High Limit	100

4.4.9.2 Central Chemical Disinfection Limit

Group: Chem		
Parameter	Settings	
Name	Central chem upper limit	Central chem lower limit
S No.	S157	S158
Description	The chemical intake pump stops when the conductivity value of the product water reaches the set limit.	The chemical intake pump starts when conductivity value of the product water goes below the set limit.
Scale	1 μ S/cm	1 μ S/cm
Default	250	250
Low Limit	1	1
High Limit	1000	1000

4.4.9.3 Chemical Pump Motor Type

Group: Chem	
Parameter	Settings
Name	CCP_CHEM_PUMP_MOTOR_TYPE
S No.	S235
Description	The chemical pump motor type that is being used.
Scale	0 = AC 1 = DC
Default	0

Group: Chem	
Parameter	Settings
Low Limit	0
High Limit	1

4.4.9.4 Manual Flush

Group: DisProtManager	
Parameter	Settings
Name	CDM_MANUAL_FLUSH_TIME
S No.	S223
Description	The duration of manual flush mode.
Scale	1 minutes
Default	5
Low Limit	1
High Limit	1000

NOTE

Manual flush is initiated manually by the operator from the **SELECT** menu, when the WRO unit is in standby mode.

4.4.10 Time Manager

4.4.10.1 Auto Flush

Group: Time manager			
Parameter	Settings		
Name	Autoflush standby time	Autoflush run-time	Standby flush enable/disable
S No.	S139	S140	S 185
Description	Time in standby before an Auto flush starts	Duration of an Auto flush period	Enables or disables the Auto flush functionality
Scale	1 minutes	1 minutes	0 = DISABLED 1 = ENABLED
Default	240	5	1
LOW LIMIT	0	1	0
HIGH LIMIT	10000	100	1

NOTE

S185 is also changeable from internal service mode (refer to *Activate Functions on page 70*) This preset enables or disables S139 and S140.

4.4.10.2 Time Since Last

Group: Time manager				
Parameter	Settings			
Name	Time since last heat visible	Time since last chem visible	Time since last acid visible	Time since last alk. visible
S No.	S153	S154	S155	S156
Description	When preset visible, days since last heat disinfection ¹ displays (HEAT).	When preset visible, days since last chemical disinfection displays (CHEM). Protocol type 0, 1 or 7, refer to <i>Disinfection Protocol on page 92</i> .	When preset visible, days since last acid cleaning ² displays (ACID CLEAN). Protocol type 3 or 8 refer to <i>Disinfection Protocol on page 92</i> .	When preset visible, days since last alkaline cleaning displays (ALKALINE CLEAN). Protocol type 4 refer to <i>Disinfection Protocol on page 92</i> .
Scale	1 = Visible 0 = Invisible	1 = Visible 0 = Invisible	1 = Visible 0 = Invisible	1 = Visible 0 = Invisible

Group: Time manager				
Parameter	Settings			
Default	0 (1 if WRO 300H)	1	1	0
Low Limit	0	0	0	0
High Limit	1	1	1	1

1. Only in the WRO 300 H unit
2. Warm Acid cleaning in the WRO 300 H unit

NOTE

Days since last heat disinfection, chemical disinfection, acid cleaning, or alkaline cleaning displays in operational data. Refer to the *Operator's Manual*.

NOTE

Setting S153 to visible in a WRO 300 unit will enable the **TIME SINCE LAST HEAT** message in the information list. However, the value has no meaning to the operator.

4.4.11 Time Channels

Group: Time channel	
Parameter	Settings
Name	Time channel Program X ¹
S No.	S159–S165 S209–S222
Description	Preset time for automatic start of Heat disinfection or run, or automatic stop of run mode.
Scale	HH:MMWT HH = HOUR MM = MINUTE W= day of week (0 = Monday, 1 = Tuesday..., 7 = Sunday) T= Type (0 = No Type (inactive), 1 = Heat disinfection, 2 = RUN, 3 = STANDBY)
Default	00:0010 The default preset value above means that no time channel is enabled because the last number (representing type) is set to 0=NOTYPE.

Group: Time channel	
Parameter	Settings
Further Explanation	<p>Examples:</p> <p>08 : 0021 means that 08:00 o'clock on Wednesday a Heat disinfection will automatically be started.</p> <p>00 : 3512 means that 00:35 o'clock on Tuesday run will automatically be started.</p> <p>10 : 5073 means that 10:50 o'clock on Sunday the WRO unit will automatically go to standby.</p>

1. X represents a number (1-21) = Program number

NOTE

Preset of time channels is recommended to be done in internal service mode. The presets (S159 to S165 and S209 to S222) can thereafter be copied from one WRO unit to another using GXP software.

4.4.12 Reminders

A text string of maximum 28 characters can be set for each reminder. Due to the limit of 14 characters in the GXP program the text string for every recurring notification is divided on two presets.

NOTE

The time period is set from internal service mode, refer to *Sub Menus for Reminders on page 62*.

Group: Reminders			
Parameter		Settings	
Scale		Text string of 14 characters	
1	Name	Reminders_1	Reminders_12
	S No.	S171	S172
	Default	REPLACE	CARBON FILTER
2	Name	Reminders_2	Reminders_22
	S No.	S173	S174
	Default	DISINFECTION	REQUIRED
3	Name	Reminders_3	Reminders_32
	S No.	S175	S176
	Default	ACIDCLEAN	MEMBRANES

Group: Reminders			
Parameter		Settings	
4	Name	Reminders_4	Reminders_42
	S No.	S177	S178
	Default	REMI	NDER4
5	Name	Reminders_5	Reminders_52
	S No.	S179	S180
	Default	REMI	NDER5

4.4.13 Remote

Group: Remote			
Parameter		Settings	
Name	WRO 300 - AK protocol	CRC_RUN_SIGNAL_INVERSED_POLARITY	Enable/disable remote chem dis stop
S No.	S182	S208	S234
Description	Setting of serial or parallel communication	Preset to change the polarization of REMOTE START from the dialysis machine. This preset is only functioning if the S182 is set to parallel	Enables the possibility to remote stop of Chemical disinfection.
Scale	0 = PARALLEL 1 = SERIAL	0 = False; A closing of the current circuit will force the WRO unit to go to standby if in run. 1 = True; No current through the current circuit will force the WRO unit to go to run if in standby.	0=DISABLED 1=ENABLED
Default	0	0	0
Low Limit	0	0	0
High Limit	1	1	1

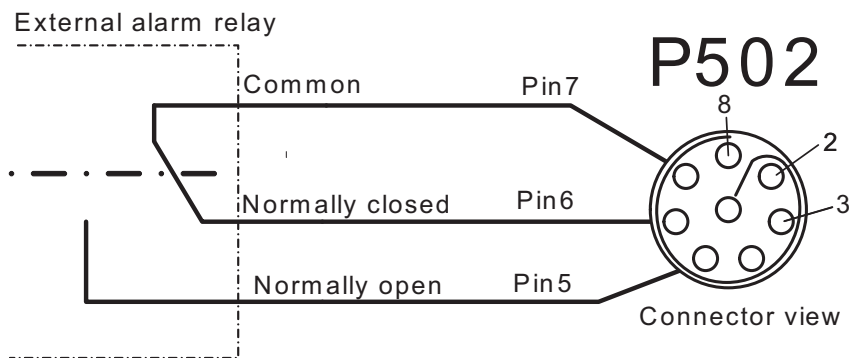
NOTE

It is recommended not to change the preset S208 and S234.

4.4.14 External relay

Group: External Relay	
Parameter	Settings
Name	External buzzer relay on/off
S No.	S226
Description	If enabled (TRUE), it is possible to use the external alarm output to control opening and closing of the external tap water valve. Makes it possible to activate run by Time channels and at the same time control the external tap.
Scale	0 = FALSE 1 = TRUE
Default	1
Low Limit	0
High Limit	1

The external water valve can be connected to connector P502. The output from the WRO unit is controlled by a relay. All three connection points (common, normally closed and normally open) are directly connected to the external connector P502. The maximum external voltage connected to the relay is 24 VDC and the maximum current is 100 mA.



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5 Wiring Diagram

5.1 WRO 300 H

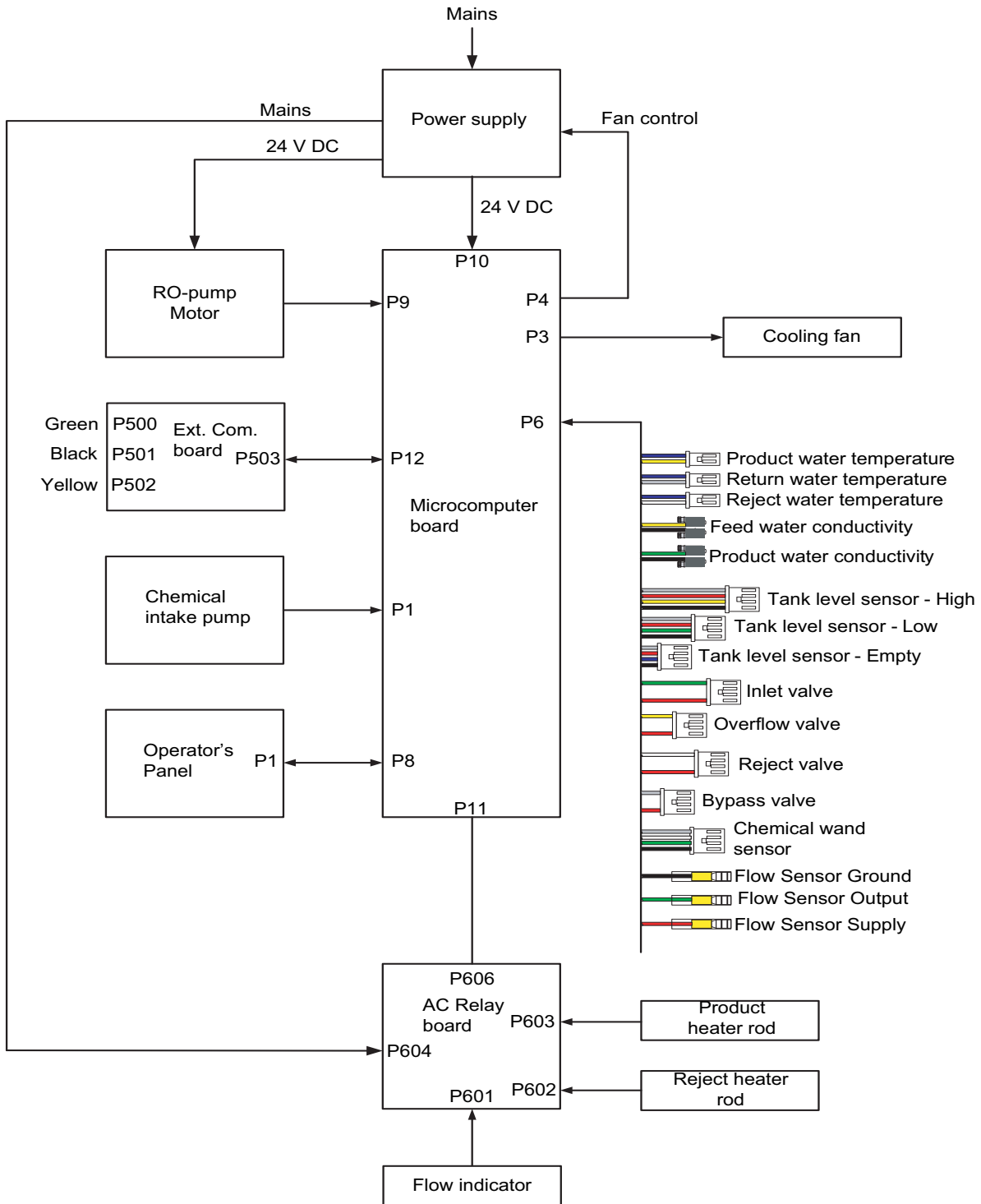


Fig.5.1 — Wiring diagram for the WRO 300 H unit

5.2 WRO 300

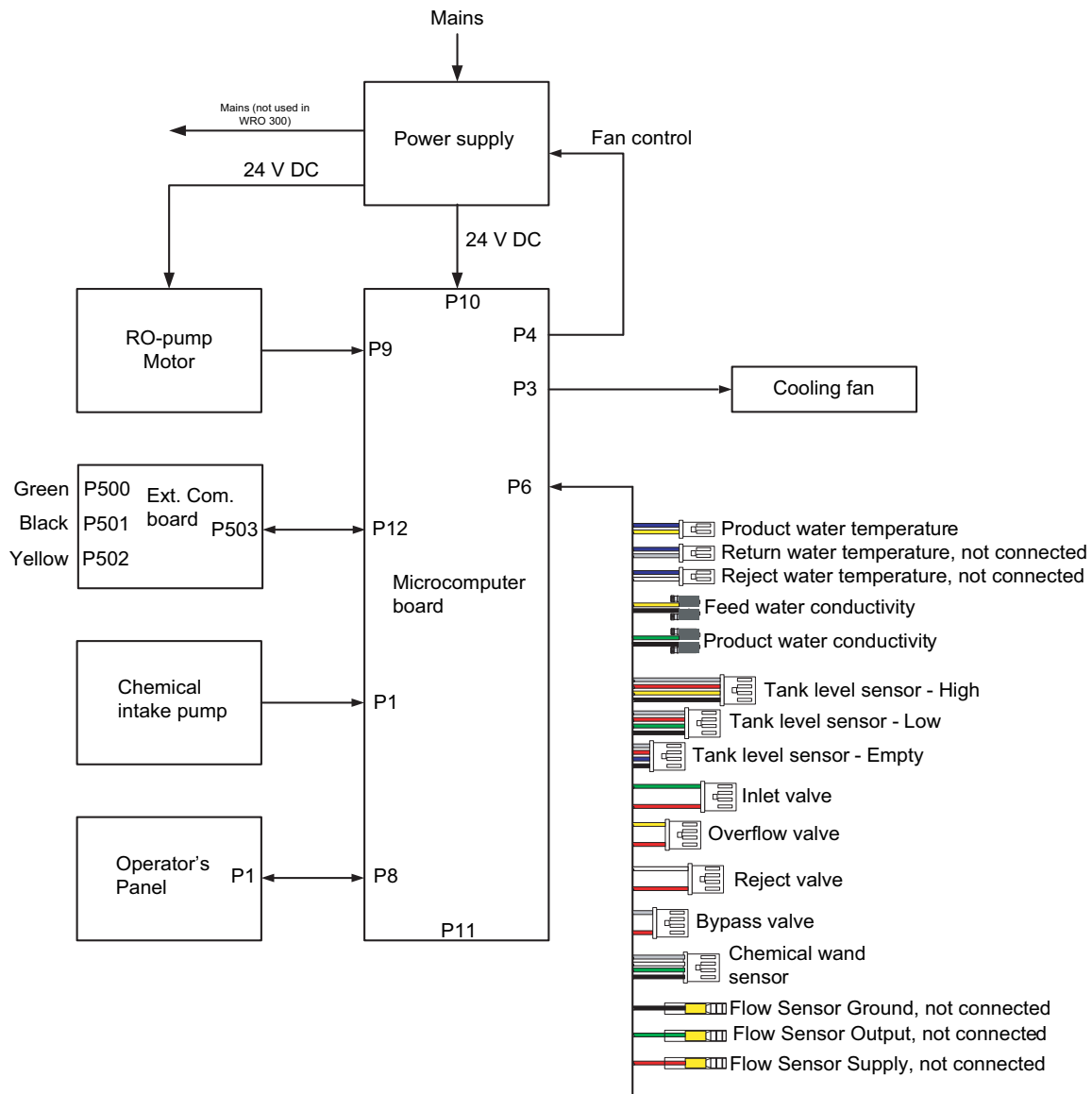


Fig.5.2 — Wiring diagram for the WRO 300 unit

6 Maintenance

6.1 Water Testing

Certain tests of the water are required to insure proper function of the WRO unit. The testing frequency depends on system setup and local conditions and regulations. The following tests are recommended.

6.1.1 Total Chlorine

**WARNING**

This device does not remove chlorine and chloramines from the water. Carbon filtration to remove these substances is therefore required if the total chlorine concentration might exceed 0.1 mg/liter (ppm). Severe patient injury may otherwise occur. Ensure by testing or by other means that the total chlorine concentration is below 0.1 mg/l (ppm) prior to initiating dialysis treatment.

Test kit example:

SteriChek Chlorine Sensitive, MCP order number 3027108.

6.1.2 Residual Hardness

If a softener is installed before the WRO unit, a test for residual hardness should be performed by the user on a regular basis to verify the performance of the softener. Refer to the operator's manual for the softener.

Example of test kit:

SteriChek Sensitive Low-Range Water Hardness, MCP order number WT821973.

6.1.3 Performance Tests

Chemical and microbiological tests of the product water for the WRO unit must be performed on a regular basis. Scope, methodology and frequency should be in accordance with local rules and regulations.

6.2 Changing Prefilter Cartridges

6.2.1 General

The prefiltration equipment to the WRO unit may vary in type, number and size depending on local conditions and feed water quality. Filtration to remove particles 5 micron and larger is always required. Carbon filtration must also be applied if the water contains or may contain chlorine or chloramines at any time but is also recommended as a general precaution in all installations. Filtration through two carbon filters in series is recommended.

Carbon block filters contain a carbon matrix that acts as a filtration medium itself and is therefore a good alternative as a combination fil-

ter. Different sizes and filtration rates are available to fit different requirements.

6.2.2 Replacing Carbon Block Filters

6.2.2.1 Frequency

The cartridge should be exchanged before the total chlorine concentration exceeds 0.1 mg/l. Proactive replacement on a regular basis should be done to avoid an excessive pressure drop over the filter.

6.2.2.2 Filter Change Procedure

- Step 1 Turn off the water supply.
- Step 2 Relieve any pressure in the prefilter housing.
- Step 3 Unscrew the prefilter housing and remove the old cartridge.
- Step 4 Clean the inner surface of the housing.
- Step 5 Insert a new cartridge and reinstall the housing.
- Step 6 Turn on the water supply and verify that there are no leaks.

6.3 Power Supply Unit

6.3.1 Air Filter

The air filter in the power supply unit protects it from dust. It has to be replaced on a regular basis to insure sufficient air flow through the unit. The filter should be exchanged at least annually. More frequent replacement may be required depending on environmental conditions.

6.3.2 Protective Earth (PE)

Verify the protective earth connection (earth ground) after service work and at regular intervals.

6.4 Adjusting Product Water Flow

6.4.1 Using Adjustment Tool 3027493



Fig.6.1 — Adjustment Tool 3027493

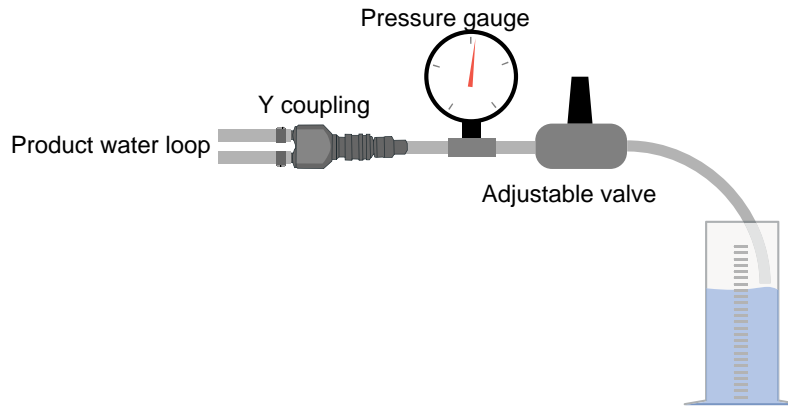
This tool will automatically result in a correct product water flow (1.1 – 1.2 l/min) when the loop pressure is set at 1.5 bar.

- Step 1 Mount a pressure gauge in the quick connector on the RO module.
- Step 2 Connect the service tool to the Y-coupling on the loop of a WRO 300 or WRO 300 H.
- Step 3 Connect a hose to the outlet of the tool and lead it to drain.
- Step 4 Start the WRO in Run.
- Step 5 Wait until the water temperature has stabilized.
- Step 6 Adjust the loop pressure with the internal needle valve¹ in the WRO until a stable pressure of 1.5 bar is obtained.
- Step 7 Stop the WRO and disconnect the tool from the Y-coupling.
- Step 8 Check the reject pressure at the pressure gauge on the RO module. The pressure should be below 13 bar. Otherwise, the membrane may need cleaning or be replaced.

1) Refer to Needle Valve on page 27.

6.4.2 Using Adjustment Tool WT100TEST

- Step 1 Attach a pressure gauge to the quick connector on the RO module.
- Step 2 Attach another pressure gauge and an adjustable valve after the Y coupling on the product water loop.



- Step 3 Start the WRO unit and let it run until the water temperature has stabilized.
- Step 4 Adjust the external adjustable valve until the pressure in the product water loop is 1.5 bar.
- Step 5 Measure the product water flow. It should be 1.1 (10 °C) to 1.2 (30 °C) l/min.
- Step 6 If the flow is lower, slightly close the internal needle valve¹. If higher, slightly open it.
- Step 7 Repeat steps 4 to 6 until flow and pressures are correct.
- Step 8 Check the reject pressure at the pressure gauge on the RO module. The pressure should be below 13 bar — the membrane may need to be cleaned or to be replaced.

NOTE

This tool is being replaced by tool P/N 3027493 because of its ease of use.

1) Refer to Needle valve on page 27.

6.5 Conductivity Adjustment


NOTE

The conductivity of a reverse osmosis unit is intended as an indication of the performance of the device. As such, there is no need for an absolute calibration. The procedure below, referred to as calibration in the Internal service menu, will only adjust the conductivity reading of the WRO unit to correspond to the reading of an external, temperature-compensated conductivity reference meter, designed for conductivity measurements in pure water.

NOTE

When using software version P3.2 or lower the conductivity reading in internal service mode will differ from the reading on the display of the WRO unit, as the value in internal service is not temperature compensated. Check the conductivity reading on the display of the WRO unit after making adjustments.

6.5.1 Adjustment Procedure¹

- Step 1 Start the WRO unit in run mode by pressing . Wait for 15 minutes for the conductivity to stabilize.
- Step 2 Create a product water consumption, about 0.5 l/min, by means of an adjustable valve or equal.

NOTE

The product water temperature sensor is also used for the temperature compensation calculation of the feed water conductivity. If the adjustment is to be made after a heat disinfection of a WRO 300 H unit, 30 extra minutes is required for the temperature equalization within the flow path.

6.5.1.1 Product Water (PW) Adjustment


- Step 1 Enter **INTERNAL SERVICE, CALIBRATE COND** and **PW**.
- Step 2 Check that **OFFSET** is set to 0. If not, change it to 0.
- Step 3 Use a conductivity reference meter to read the product water conductivity from the loop.
- Step 4 Use the up and down arrows to adjust the **COEFF** so that the **temperature compensated** value (°C) corresponds to the value of the reference meter (it takes a couple of seconds between each adjustment until the display value is updated). A higher coefficient will result in a lower conductivity value and vice versa.

1. Refer to *Internal Service* on page 59, *Calibrate Cond* on page 65.

Step 5 Press  to confirm.

NOTE

Remember to turn the WRO unit off and on with the mains power switch to ensure changes are correctly used by the program.

Step 6 Press  three times to exit the internal service mode and go back to normal display.

6.5.1.2 Feed Water Adjustment:

Step 1 Enter **INTERNAL SERVICE, CALIBRATE COND** and **FW**.

Step 2 Check that **OFFSET** is set to 0. If not, change it to 0.


Step 3 Use a conductivity reference meter to read the feed water conductivity at the tap.

Step 4 Use the up and down arrows to adjust the **COEFF** so that the **temperature compensated** value (**T**) corresponds to or is as close as possible to the value of the reference instrument (it takes a couple of seconds between each adjustment before the display value is updated). A higher coefficient will result in a lower conductivity value and vice versa.


Step 5 Press  to confirm.

NOTE

Remember to turn the WRO unit off and on with the mains power switch to ensure changes are correctly used by the program.

Step 6 Press  three times to exit the Internal Service mode and go back to normal display.

6.6 Checking Operator Panel





Step 1 Press the  button and at the same time switch on the WRO unit using the mains power switch.

Step 2 During approximate two seconds after start verify that a frame with the outermost pixels are activated (the overlay blocks the lower part of the display).

NOTE

The text **TEST WRO 300** will appear on the LCD after the time has expired.

Step 3 Press and hold  and verify that the button lights.

- Step 4 Release the button and verify that the button light is off.
- Step 5 Press and hold  and verify that the button lights and that all LCD pixels are activated, black (the overlay blocks the lower part of the display).
- Step 6 Release the button and verify that the button lights.
- Step 7 Press and hold  and verify that the button lights.
- Step 8 Release the button and verify that the button light is off.
- Step 9 Press and hold the  and verify that the LCD back-light flashes.
- Step 10 Release the button and verify that the back-light stops flashing.
- Step 11 Press and hold the  and verify that the loudspeaker is sounding.
- Step 12 Release the button and verify that the loudspeaker is silent.

6.7 Checking Chemical Intake O-rings

To avoid insufficient intake of chemicals because of air leakage, regularly check that the o-ring on the disinfection wand and the two o-rings in the chemical intake are intact. Change if any sign of damage.

6.8 Battery Replacement

6.8.1 WRO 300/300 H Battery

Description	Type	Location
Battery to real time clock, 3V Lithium	CR2025 (or equivalent)	On the CPU board

6.8.2 Battery and Electronic Waste Handling



Separate collection for electrical and electronic equipment

6.8.3 Waste Handling

Battery from WRO 300/300 H shall not be discarded in normal waste — instead separate and proper collection systems must be used. If improperly disposed, battery might contaminate the environment and risk the health of people.

NOTE

Follow local legislation applicable for Battery and electronic waste handling.

7 Electrical Safety

7.1 Protective Earth Test

7.1.1 Test Equipment for PET Test.

Digital multimeter:

Manufacturer: Fluke

Resistance: accuracy ± 0.5 percent

7.1.2 PET for WRO 300

- Step 1 Check that the resistance between the grounding clips of the mains plug and the exterior cover of the power supply is ≤ 0.3 Ohm.
- Step 2 Check that the resistance between the grounding clips of the mains plug and the chassis grounding screw is ≤ 0.3 Ohm.

7.1.3 PET for WRO 300 H

- Step 1 Check that the resistance between the grounding clips of the mains plug and the exterior cover of the power supply is ≤ 0.3 Ohm.
- Step 2 Check that the resistance between the grounding clips of the mains plug and the chassis grounding screw is ≤ 0.3 Ohm.
- Step 3 Check that the resistance between the grounding clips of the mains plug and the Heater A metal cover is ≤ 0.3 Ohm.
- Step 4 Check that the resistance between the grounding clips of the mains plug and the Heater B metal cover is ≤ 0.3 Ohm.

7.2 Electrical Leakage Test (ELT)

7.2.1 ELT Test Equipment

Safety tester:

According IEC 60601-1

Suggested Manufacturer: Metron, Rigel, Biotect


7.2.2 ELT General Conditions

- Ensure that the WRO unit is connected to both feed water and drain.
- Connect the WRO unit to the outlet supply of the safety tester. Use a mains plug adapter for respective mains plug.
- No other external equipment other than specified in this instruction should be connected to the machine.

- The protective earth of the WRO unit must not be in contact with any external protective earth (earth ground).
- The product water loop should be open to drain.

7.2.3 ELT WRO 300

Measure the earth leakage current with the safety tester:

- Step 1 Start the WRO unit by pressing  until light goes on (steady light).
- Step 2 Take the highest reading when the machine is running (test period 5 minutes).
- Step 3 Invert the mains phases. The WRO unit may restart.
- Step 4 Take the highest reading when the machine is running (test period 5 minutes).
- Step 5 Check that the highest measured readings don't exceed the earth leakage current limit for WRO 300 (see table below).

7.2.4 ELT WRO 300 H

Measure the earth leakage current with the safety tester:

- Step 1 Start the WRO unit in LFH from the SELECT menu.
- Step 2 Wait 10 minutes; verify that the WRO unit is still in LFH. Record the reading.
- Step 3 Invert the phases of the mains. The WRO unit might restart.
- Step 4 Wait 5 minutes; verify that the WRO unit is still in LFH. Record the reading.
- Step 5 Check that the highest measured readings don't exceed the earth leakage current limit for WRO 300 H, see table below.

7.2.5 Earth Current Limits

	Voltage	Current
Earth Leakage Current	220 – 240 VAC	Max. 250 μ A
	115 VAC	Max. 145 μ A
	100 VAC	Max. 140 μ A

8 Technical Data

8.1 Performance and Specification

		Values
Product water	Output flow	Minimum 1.1 l/min <ul style="list-style-type: none"> at +10 °C feed water temperature at 0.15 MPa (22 psi) pressure in the product water loop
	Product water loop	Maximum 2 metres (2 x 1 m) uninsulated Maximum 20 metres (2 x 10 m) insulated*
	*under the following conditions; <ul style="list-style-type: none"> MCP recommended insulation shall be used the minimum feed water temperature is +10 °C the minimum ambient temperature is +18 °C 	
	Product water pressure	0.12 to 0.6 MPa (17 to 87 PSI) during RUN mode (depending of the consumption from product water loop)
	Quality	Dependent on feed water quality. If potable water is used, the following rejection rates will be obtained: <ul style="list-style-type: none"> Total dissolved salts: >96% (based on conductivity); at +10 °C feed water temperature Bacteria and endotoxins: >99%

		Values
Water Supply	Input	Min. 3.0 l/min required
	Feed Water Pressure	During operation — there is an inlet flow of water into the WRO unit. 0.15 to 0.3 MPa (22 to 45 PSI)
		Maximum design pressure: 0.8 MPa (115 psi)
		If the feed water pressure exceeds 0.3 MPa (45 psi), a flow regulator, order number WTW522001001, should be installed.
	Feed Water Temperature	+5 to +30 °C
	Feed Water Quality	Potable water should be used.
		Particle filtration shall be used (<5 µm)
		Carbon filtration shall be used if water is chlorinated, see limits below.
		Membrane life expectancy might be reduced if the monitor is operated outside the following limits.
	Hardness	<0.3 °dH (6 ppm as CaCO ₃)
	Iron	<0.1 mg/l
	Manganese	<0.1 mg/l
	Turbidity	<1 JTU
	Total dissolved salts (TDS)	<1500 mg/l
Fouling index (silt density index)	<5	
Chlorine (total)	<0.1 mg/l	
Drain	Drain output flow during run mode	1.2 ±0.1 l/min
	Height difference between the drain hose outlet and the WRO 300 H drain outlet.	Maximum 1.0 m
	Drain (length of hose)	Maximum 5 m
	Drain flow capacity	Minimum 3.0 l/min required
	Max temperature	85 °C
Tank Air Vent	This outlet connects the tank to the atmosphere. This outlet must be connected with an air gap if plumbed to a drain. If a hose is connected to the Tank air vent, the hose shall have a constant slope.	
	NOTE Air will move back and forth in this line because of the variation of the level in the tank.	
Chemical intake	The machine is designed to bring in disinfectant-cleaning agent through the chemical intake. The maximum suction height from chemical intake is 600 mm.	

		Values	
Fluid Connections	Designed for flexible, reinforced tubing 8 mm x 2.5 mm (5/16 in. I.D.) The product water loop is designed for flexible, reinforced tubing 5 mm x 3 mm.		
Conductivity measurement (Temperature compensated)	Product water conductivity	Operating range	1–500 $\mu\text{S}/\text{cm}$
		Accuracy	$\pm 10\%$ or $\pm 10 \mu\text{S}/\text{cm}$ Whichever is greater
	Feed water conductivity	Operating range	10 - 2000 $\mu\text{S}/\text{cm}$
		Accuracy	$\pm 10\%$ or $\pm 10 \mu\text{S}/\text{cm}$ Whichever is greater
Temperature measurement	Operating range	0 to 105 °C	
	Accuracy	± 4 °C	
Reverse osmosis module	Membrane material	Polyamide, thin film composite	
	Membrane configuration	Spiral wound	
	Membrane pH tolerance	2 to 11	
Power supply	Mains Voltage	100 to 240 VAC (line voltage range 85 to 264 VAC)	
	Frequency	50 or 60 Hz (line frequency range 45 to 65 Hz)	
	Power Consumption Max	1500 W (100 VAC) 1380 W (115 VAC) 1850 W (220-240 VAC)	
	Appliance inlet	According to IEC 60320; C14	
	Cable	Cable with protective earth Conductor length max. 3.5 m minimum 1 mm ² (220-240 VAC) AWG 16 at 100 and 115 VAC	
	Mains plug	North America type—100 and 115 VAC, Hospital grade, earthed plug, type IEC 60 083; A5-15	
	Fuses	15 A slo blo (115 VAC) 15 A slo blo (100 VAC)	
	Earth Leakage Current	Max. 250 μA (220–240 VAC) Max. 145 μA (115 VAC) Max. 140 μA (100 VAC)	

		Values	
Connection of External Equipment	External connector 8 pins REDEL, yellow.		
	Not used.		
	External connector 8 pins REDEL, black. RS-232		
	Logging interface	Max input voltage	±15 VDC
		High level min output voltage	5.0 VDC
		Low level max output voltage	5.0 VDC
		Max Current	±5 mA DC
	External connector 8 pins REDEL, green.		
Not used.			
Sound	Sound power level	Less than 65 dBa during normal operation	

8.2 Chemical Disinfection

Disinfection	<p>The following disinfectants may be administered via the chemical intake:</p> <ul style="list-style-type: none"> • MINNCARE® Cold Sterilant • Other peracetic acid disinfectants, provided that they are approved by the manufacturer for disinfection of thin film composite reverse osmosis membranes made of modified polyamide. Follow the manufacturer instructions for use for the specific disinfectant.
Cleaning agents	<p>The following cleaning agents may be administered via the chemical intake:</p> <ul style="list-style-type: none"> • Citric acid • Minnclean® AC • Minnclean® TF • Acetic Acid (5%) • Other cleaning agents may also be used, provided that they are approved by the manufacturer for cleaning of thin film composite reverse osmosis membranes made of modified polyamide. Follow the manufacturer's instructions for use for the specific cleaning agent.
Preservation	<p>The following preservations may be administered via the chemical intake and feed water inlet:</p> <ul style="list-style-type: none"> • MEMSTOR • MEMSTOR in combination with 9% glycerol • Formalin
Exterior cleaning	<ul style="list-style-type: none"> • Ethanol (70%) • Isopropanol (60%) • Soapy water

8.3 Physical Data

Measurements	Values
Weight	33 kg (72.8 lb)
Height	563 mm (22.2 inch)
Depth	Max 520 mm (20.5 inch)
	Footprint 380 mm (15.0 inch)
Width	Max 205 mm (8.1 inch)
	Footprint 185 mm (7.3 inch)
Internal fluid volume	Approximately 3.5 liters excluding the product water loop

8.4 Materials Contacting Product Water


Type	Material
Polymers	PA (Polyamide) PEEK (Polyetheretherketone) PEI (Polyetherimide) PE (Polyethylene) PFA (Fluorocarbon) POM (Polyoxymethylene) PP (Polypropylene) PPS (Polyphenylsulphite) PVC (Polyvinylchloride) PVDF (Polyvinyliden fluoride)
Rubber	Q (Silicone)
Metals	Titanium Stainless steel
Others	Ceramic

8.5 Environmental Data

		Value
Operation	Ambient Temperature range	+10 to +40 °C
	Relative Humidity range	30 to 85% RH
	Air Pressure range	700 to 1060 hPa
Transportation and storage	Ambient Temperature range	-10 to +40 °C
	Relative Humidity range	10 to 95% RH
	Air Pressure range	500 to 1060 hPa
	For transportation and storage below the freezing point, the WRO 300 H must be filled with a preservation solution of 2% MEMSTOR, at least 9% glycerol and the remaining parts RO water.	
	During transportation and storage the equipment must be kept in its original packing. If transportation or storage time is more than 15 weeks, the environmental data relating to the operation must be followed.	
	If condensation occurs when moving the equipment between locations with different temperatures and high relative humidity (for example, outdoor and indoor locations), the inside of the equipment must be allowed to dry before switching on the equipment.	

8.6 Electromagnetic Environment

		Value	
The WRO 300 H is intended for use in the electromagnetic environment specified below. The customer or the user of the WRO 300 H should assure that it is used in such an environment.			
Emissions Test	Compliance	Electromagnetic Environment — Guidance	
RF emissions CISPR 11	Group 1	The WRO 300 H uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment	
RF emissions CISPR 11	Class B	The WRO 300 H is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes	
Harmonic emissions IEC 61000-3-2	Class A (Not applicable for 115 V version)		
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies (Not applicable for 115 V version)		
Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment — Guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV Air	±6 kV contact ±8 kV Air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Surge IEC 61000-4-5	±1 kV for differential mode ±2 kV for common mode	1 kV for differential mode ± 2kV for common mode	Mains power quality should be that of a typical commercial or hospital environment
Voltage dips, short interruptions and voltage variations on power supply input lines. IEC 61000-4-11	<5% U_T (>95% dip in U_T) for 0.5 cycle	<5% U_T (>95% dip in U_T) for 0.5 cycle	Mains power quality should be that of a typical commercial or hospital environment.
	40% U_T (60% dip in U_T) for 5 cycles	40% U_T (60% dip in U_T) for 5 cycles	
	70% U_T (30% dip in U_T) for 25 cycles	70% U_T (30% dip in U_T) for 25 cycles	
	<5% U_T (>95% dip in U_T) for 5 sec	<5% U_T (>95% dip in U_T) for 5 sec	
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.

		Value	
Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment — Guidance ²
Conducted RFIEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 V	Portable and mobile RF communications equipment should be used no closer to any part of the WRO 300 H, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance, $d = 1.2 \sqrt{P}$ where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m).
Radiated RFIEC 61000-4-3	3 V/m 80 MHz to 3.0 GHz	3 V/m	$d = 1.2 \sqrt{P}$ 80 to 800 MHz ³ $d = 2.3 \sqrt{P}$ 800 MHz to 2.5 GHz
Radiated RF mobile phones	-	30 V/m	Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey ⁴ , should be less than the compliance level in each frequency range ⁵ . Interference may occur in the vicinity of equipment marked with the following symbol: 

		Value		
Recommended separation distances between portable and mobile RF communications equipment and the WRO 300 H				
The WRO 300 H is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the WRO 300 H can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the WRO 300 H as recommended below, according to the maximum output power of the communications equipment.				
Rated maximum output power of transmitter W	Separation distance according to frequency of transmitter (m)			
	150 kHz to 80 MHz $d = \left[\frac{3.5}{3} \right] \sqrt{P}$	80 MHz to 800 MHz ⁶ $d = \left[\frac{3.5}{3} \right] \sqrt{P}$	800 MHz to 3 GHz $d = \left[\frac{7}{3} \right] \sqrt{P}$	
0,01	0.11	0.11	0.23	
0,1	0.37	0.37	0.74	
1	1.2	1.2	2.3	
10	3.7	3.7	7.4	
100	12	12	23	
Rated maximum output power of mobile phone	-	-		$d = \left[\frac{7}{30} \right] \sqrt{P}$
2W GSM/3G	-	-	0.33	
For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.				


- NOTE: UT is the AC mains voltage prior to application of the test level.
- NOTE: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.
- NOTE: At 80 MHz and 800 MHz, the higher frequency range applies.
- Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the WRO 300 H is used exceeds the applicable RF compliance level above, the WRO 300 H should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the WRO 300 H.
- Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.
- NOTE: At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

8.7 Safety

The machine complies with the following standards:
IEC 60601-1 General requirements for safety, Class I, type B, and IPX1.
IEC 60601-1-2 Electromagnetic compatibility.

9 Troubleshooting


9.1 Alarms



A message text is shown on the display when an alarm condition exists. If multiple alarm conditions are present, only the last generated alarm message displays. The others can be accessed by pressing  and then using the arrow buttons to scroll through the messages.

The following troubleshooting tables provide a reason and a list of recommended actions for each alarm message. If the first action does not clear the alarm, proceed to the second one and so on until the problem is fixed.

Descriptions of the different buzzer sounds are found in *Buzzer Sounds* on page 31

9.1.1 General

No	Alarm Message	Definition	
101	CONDUCTIVITY SENSOR FAILURE	WRO	Buzzer sounds with alarm sound,  , flashes, message text displays.
		Reason	The initial conductivity system check (peak test) has failed.
		Action	<ol style="list-style-type: none"> 1 False alarms may be issued if the feed water conductivity is very low (<50 $\mu\text{S}/\text{cm}$) or if the unit is operated on reverse osmosis feed water. If so, disable preset S186 to avoid these false alarms. 2 Verify the product water conductivity reading against an external conductivity reference instrument and calibrate if necessary. 3 If the product water conductivity cannot be calibrated, check the conductivity measurement system (probe and electrical connections). Replace the CPU board if required.

No	Alarm Message	Definition	
102	HIGH LEVEL SENSOR FAILURE	WRO	The WRO unit stops, buzzer sounds with stop sound,  flashes, message text displays.
		Reason	Failure of high level sensor in tank. NOTE This alarm relates to optical sensors only. As a general recommendation we advise changing to float level switches.
		Action	<ol style="list-style-type: none"> 1 If float level switches have been installed: Verify that preset S227 has been changed to MECHANICAL. 2 Check the connections to the high level sensor. 3 Remove the high level sensor and clean it with a mild soap solution if optical type. 4 If problem persists, change to float level switches.
103	: N INTERNAL ERROR	WRO	The WRO unit stops, buzzer sounds with stop sound,  flashes, message text displays.
		Reason	Control unit failure.
		Action	The number (N) displayed before the alarm text identifies which specific kind of alarm that has occurred. For description refer to the table below.

9.1.2 Internal Error (103:N)

103:N	Reason for Internal Error	Action
1-5	<p>The preset memory structure is verified at start-up. If the structure is changed in an uncontrolled way, an internal software error will be issued. The nature of the problem determines which error that will be issued. It is normal to get one or more of the internal errors when the software version is updated. Contact MCP for detailed information regarding which errors that could be expected.</p>	<ol style="list-style-type: none"> 1 Restart the WRO unit. Verify that the alarm is not re-issued and that the preset values are according to local settings using GXP. 2 Replace the CPU board if problem persists. Perform all necessary actions according to the replacement matrix, refer to <i>Replacements on page 57</i>.
6	<p>Heater startup test in heat disinfection or low flow heat.</p> <p>The RO pump is stopped. The reading from the flow indicator (located in the reject line) and from the flow meter (located in the product water line) are both verified. In this case, the indication should be that no flow is going through the flow path. The test expects stable output from both sensors during five seconds. The test period is thirty seconds. If the test fails the alarm is issued.</p>	<ol style="list-style-type: none"> 1 Use GXL and verify that the indication from both sensors corresponds to no flow. In case of wrong indication check cable connection and replace the fault component if needed. 2 Replace the CPU board if the reading from the flow meter is incorrect. 3 Replace the AC relay board if the reading from the flow indicator is incorrect.
7	<p>Heater start up test in heat disinfection or low flow heat.</p> <p>The RO pump is stopped. The system has detected that there is no flow through the system. It should not be possible to connect the mains supply to the heater rods when there is no flow through the system. The flow sensor/meter is verified for correct output. The output will hardware wise control the safety relay. The test aims to verify that the safety relay is able to switch off the heater rod mains supply.</p>	<p>Replace the AC relay board</p>


103:N	Reason for Internal Error	Action
8	<p>Heater start-up test in heat disinfection or low flow heat.</p> <p>The water level in the tank is verified to be above low level sensor (LL). The RO pump is started and there is no flow diverted to drain.</p> <p>The reading from the flow indicator (located in reject line) and from the flow meter (located in the Product water line) are both verified. There should be a constant indication for twenty seconds from both sensors that there is a flow through the system. If not, the alarm is issued.</p> <p>The test period is five minutes.</p>	<ol style="list-style-type: none"> 1 Verify that there are no water leaks and that there is no water consumption from the product water loop. 2 The alarm could be issued if the RO membrane is changed and the air in the RO module is not removed before the heating/low flow heat is started. Before re-start of the heating/low flow heat, start the WRO 300 H in RUN. Let the WRO unit remain in RUN for five minutes and then re-start the heat/low flow heat. 3 Use GXL and verify that the indication from both sensors corresponds to flow. In the case of wrong indication check cable connection and replace the fault component if needed. 4 Replace the CPU board if the reading from the flow meter is incorrect. 5 Replace the AC relay board if the reading from the flow indicator is incorrect.
9	<p>Heater start-up test in heat disinfection or low flow heat.</p> <p>The test of flow indicator and flow meter passed. There is no mains voltage connected to the heater rods when the control circuit is switched on.</p>	<p>Change the AC relay board.</p>
10	<p>Heater start-up test in heat disinfection or low flow heat.</p> <p>Product temperature (T1) circuit broken; too low or too high temperature detected.</p>	<p>Replace the CPU board if the problem persists.</p>
11	<p>Heater start-up test in heat disinfection or low flow heat.</p> <p>Reject temperature (T2) circuit broken; too low or too high temperature detected.</p>	<p>Replace the CPU board if the problem persists.</p>
12	<p>No valid safe-memory bank. New memory bank created; all values are set to default.</p>	<ol style="list-style-type: none"> 1 Restart the WRO unit and verify that the alarm is not re-issued. 2 Replace the CPU board if problem persists. Perform all necessary actions according to the replacement matrix, <i>Replacements on page 57.</i>

103:N	Reason for Internal Error	Action
13	Error when read old preset values moving to E2-prom.	<ol style="list-style-type: none"> 1 Restart the WRO unit and verify that the alarm is not re-issued. Replace the CPU board if problem persists. Perform all necessary actions according to the replacement matrix, <i>Replacements on page 57</i>. 2 Verify the conductivity measurement and calibrate the sensors if needed.
14	The memory storage area for the conductivity sensor calibration data is corrupted.	<ol style="list-style-type: none"> 1 Restart the WRO unit and verify that the alarm is not re-issued. Replace the CPU board if problem persists. Perform all necessary actions according to the replacement matrix, <i>Replacements on page 57</i>. 2 Verify the conductivity measurement and calibrate the sensors if needed.
15	Heater start-up test in heat disinfection or low flow heat. Product temperature sensor (T1) short circuit or not connected.	<ol style="list-style-type: none"> 1 Check the connection of the product water temperature sensor (T1). <ol style="list-style-type: none"> a. Change the temperature sensor if the reading is around 0 °C. b. Verify that the temperature sensor is properly connected to the CPU board. Temperature reading around 116 0 °C indicates problems with the connection. 2 Replace the CPU board if the problem persists.
16	Heater start-up test in heat disinfection or low flow heat. Reject temperature sensor (T2) short circuit or not connected.	<ol style="list-style-type: none"> 1 Check the connection of the reject water temperature sensor (T2). <ol style="list-style-type: none"> a. Change the temperature sensor if the reading is around 0 °C. b. Verify that the temperature sensor is properly connected to the CPU board. Temperature reading around 116 0 °C indicates problems with the connection. 2 Replace the CPU board if the problem persists.
17	Heater start-up test in heat disinfection or low flow heat. Return temperature sensor (T3) short circuit or not connected.	<ol style="list-style-type: none"> 1 Check the connection of the return water temperature sensor (T3). <ol style="list-style-type: none"> a. Change the temperature sensor if the reading is around 0 °C. b. Verify that the temperature sensor is properly connected to the CPU board. Temperature reading around 116 0 °C indicates problems with the connection. 2 Replace the CPU board if the problem persists.

103:N	Reason for Internal Error	Action
18	<p>Heater start-up test in heat disinfection or low flow heat.</p> <p>The control circuit on the AC relay board is verified to be turned off when the flow indicator and flow meter indicates flow. The alarm is issued if mains supply is detected to be connected to the heater rods.</p>	<p>Replace AC relay board.</p>
19	<p>Heater start-up test in heat disinfection or low flow heat.</p> <p>The heater mains supply is switched on when there is an identified stable flow through the system.</p> <p>The test is executed by connecting the mains power to the heater rods on the AC relay board when the flow is stable. It is then verified that there is mains supply connected to the heater rods.</p>	<ol style="list-style-type: none"> 1 Verify that the fuses located in the AC/DC are still OK. 2 Verify the connection between the AC/DC unit and the AC relay board. 3 Replace AC relay board. 4 Replace the CPU board. 5 Verify the AC output from the AC/DC unit. Change the unit if there is no AC output.
20	<p>Not used.</p>	<p>Not applicable.</p>
21	<p>The alarm is issued if the heat disinfection temperatures at the Heater A (reject water) and the product water loop return temperature is not reached within 60 minutes.</p>	<ol style="list-style-type: none"> 1 Re-start the Heating and verify that no alarms are issued. 2 Verify that both heater rods are connected to the AC relay board. 3 Verify that the preset, CHC_SUPPLY_VOLTAGE, is set to the correct mains supply voltage. 4 Replace the AC relay board. 5 Replace the CPU board. 6 Replace Heater A (reject water). 7 Replace Heater B (product water loop).
22	<p>The alarm is issued if the temperature in the product water (T1) is below the low flow heat limit for more than 15 minutes.</p>	<ol style="list-style-type: none"> 1 Re-start the Heating and verify that no alarms are issued. 2 Verify that both heater rods are connected to the AC relay board. 3 Verify that the preset, CHC_SUPPLY_VOLTAGE, is set to the correct mains supply voltage. 4 Replace the AC relay board. 5 Replace the CPU board. 6 Replace Heater B (product water loop).
23	<p>The alarm is issued if it is a new machine or if the run-time data is corrupted at program start-up. The run-time will be set to zero.</p>	<p>Replace the CPU board if the problem persists.</p>
24	<p>The alarm is issued the first time a new WRO unit is started or when the RTC (Real Time Clock) data is corrupted.</p>	<ol style="list-style-type: none"> 1 Use internal service and readjust the REAL TIME. 2 Replace the CPU board if the problem persists.


103:N	Reason for Internal Error	Action
25	The RO pump motor controller unit is supervised. It is verified that the motor is rotating when the motor is commanded to run. The measured motor rpm is used as feedback. The alarm is issued when the motor controller unit stops the RO pump motor. The reasons for stopping the motor could be high temperature in the motor control unit, high current consumption, low motor controller unit supply voltage, etc.	<ol style="list-style-type: none"> 1 Start the WRO unit in RUN mode. 2 If the alarm is issued, immediately continue as follows: 3 Verify that the connection between the motor controller unit and the CPU board is working properly. 4 Replace the RO pump if it is blocked. 5 Replace the RO pump motor including the controller unit. 6 Replace the CPU board. <p>If the alarm is issued after a while continue as follows:</p> <ol style="list-style-type: none"> 1 Perform pressure and flow adjustment according to the instructions in 6.5 Adjusting the flow and the pressure 2 Check the air-filter located at the AC/DC unit. 3 Verify that the ambient temperature where the WRO unit is located is in accordance with the specifications in <i>Technical Data</i>. 4 Replace the RO-pump motor including the controller unit.
26	The E2-prom read/write time-out limit is exceeded.	Replace the CPU board if the problem persists.



9.1.3 Internal Error (104)



104	INVALID WATER LEVEL	WRO	The WRO unit stops, buzzer sounds with alarm sound,  flashes, message text displays.
		Reason	During filling of the inlet water tank, the high level sensor has not detected water within the expected time period. The time is defined by preset S233.
		Action	<ol style="list-style-type: none"> 1 Replace optical level sensors to float level switches if not already done. 2 Start the WRO unit in RUN mode. Use logging in Internal service to verify proper function of the high level sensor. Replace the high level sensor if needed. 3 Adjust the preset S233 if the WRO unit is installed with poor water supply or water supply with large variations in flow. 4 If the alarm still remains, the overflow supervision system can be disabled by setting preset S233 to zero (0). <p>CAUTION This action will overrule the overflow supervision function.</p>





9.1.4 Operation


No	Alarm and Notifications	Definition	
201	CONDUCTIVITY NOTIFICATION	WRO	When entering STANDBY mode, buzzer sounds with notification sound,  flashes, message text displays.
		Reason	The conductivity value has exceeded the notification limit for more than 30 consecutive seconds during previous run period. The purpose of this notification is to give an early warning of elevated conductivity.
		Action	<ol style="list-style-type: none"> 1 Start the WRO unit and let it run for at least 15 minutes (to allow for equalization of the water temperature within the unit). Verify both feed and product water conductivity reading against an external conductivity reference instrument and calibrate if necessary. 2 If the feed water conductivity has increased compared to initial values, the product water conductivity will also increase. Adjust the conductivity notification limit to correspond to the new situation. 3 If the feed water temperature has increased significantly since the time of installation, this will have an effect on the salt rejection ability of the reverse osmosis membrane, leading to higher product water conductivity. Adjust the conductivity notification limit to correspond to the new situation. 4 If the product water conductivity has increased without a change in feed water conductivity: <ol style="list-style-type: none"> a. Verify that the WRO is correctly adjusted regarding pressure and flow conditions. b. Check that the reject flow to drain is in accordance with specifications (1.2 ±0.1 l/min). If it is too low, check the constant flow valve (18) for obstructions. Also check the function of the three-way valve REVA (20). Refer to component 18 and 20 in Flow diagrams on page 15. c. If the water save function is used, a too high setting may cause elevated conductivity. Readjust the water save factor to a lower setting. d. The RO membrane may be fouled. Perform cleaning according to the Operator's Manual (if not already done). Recheck pressure and flow. 5 If the problem is still not resolved, the RO module may have suffered damage due to improper feed water quality or pretreatment. Exchange the RO element or RO module.

No	Alarm and Notifications	Definition	
202	CONDUCTIVITY ALARM	WRO	Buzzer sounds with alarm sound,  flashes, message text displays
		Reason	The conductivity value has exceeded the alarm limit for more than 30 consecutive seconds.
			<p data-bbox="808 428 1364 751"> Action 1 Start the WRO unit and let it run for at least 15 minutes (to allow for equalization of the water temperature within the unit). Verify both feed and product water conductivity reading against an external conductivity reference instrument and calibrate if necessary. 2 If the feed water conductivity has increased compared to initial values, the product water conductivity will also increase. The conductivity alarm limit then has to be adjusted to correspond to the new situation. </p> <p data-bbox="808 758 1364 852"> CAUTION Changing the conductivity alarm limit may require approval from medical personnel. </p> <p data-bbox="808 858 1364 1062"> 3 If the feed water temperature has increased significantly since the time of installation, this will have an effect on the salt rejection ability of the reverse osmosis membrane, leading to higher product water conductivity. Adjust the conductivity alarm limit to correspond to the new situation. Refer to caution note above. </p> <p data-bbox="808 1068 1364 1467"> 4 If the product water conductivity has increased without a change in feed water conductivity: <ol data-bbox="846 1136 1364 1467" style="list-style-type: none"> Verify that the WRO is correctly adjusted regarding pressure and flow conditions. Check that the reject flow to drain is in accordance with specifications (1.2 ± 0.1 l/min). If the water save function is used, a too high setting may cause elevated conductivity. Readjust the water save factor to a lower setting. The RO membrane may be fouled. Perform cleaning according to the <i>Operator's Manual</i> (if not already done). Recheck pressure and flow. </p> <p data-bbox="808 1474 1364 1589"> 5 If the problem is still not resolved, the RO module may have suffered damage due to improper feed water quality and/or pretreatment. Exchange the RO element or RO module. </p>






No	Alarm and Notifications	Definition	
203	CONDUCTIVITY STOP	WRO	The WRO unit stops, buzzer sounds with alarm sound,  flashes, message text displays.
		Reason	The conductivity value has exceeded the stop limit for more than 30 consecutive seconds.
		Action	<ol style="list-style-type: none"> 1 Start the WRO unit and verify the fault condition. 2 Check that the reject flow to drain is in accordance with specifications (1.2 ± 0.1 l/min). If it is too low, check the constant flow valve (18) for obstructions. Also check the function of the three-way valve REVA (20). Refer to component 18 and 20 in <i>Flow diagram for the WRO 300 H unit on page 15</i> and <i>Flow diagram for the WRO 300 unit on page 15</i>. 3 Verify both feed and product water conductivity reading against an external conductivity reference instrument and calibrate if necessary. 4 If the product water conductivity cannot be calibrated, check the conductivity measurement system (probe and electrical connections). Replace the CPU board if necessary. 5 If the feed water conductivity has increased compared to initial values, the product water conductivity will also increase. The conductivity stop limit then has to be adjusted to correspond to the new situation. <div style="text-align: center;">  <p>CAUTION Changing the conductivity alarm limit may require approval from medical personnel.</p> </div> <ol style="list-style-type: none"> 6 If the feed water temperature has increased significantly since the time of installation, this will have an effect on the salt rejection ability of the reverse osmosis membrane, leading to higher product water conductivity. Adjust the conductivity alarm limit to correspond to the new situation. Refer to caution note above. 7 If the product water conductivity has increased without a change in feed water conductivity: <ol style="list-style-type: none"> a. Verify that the WRO is correctly adjusted regarding pressure and flow conditions. b. If the water save function is used, a too high setting may cause elevated conductivity. Readjust the water save factor to a lower setting. c. The RO membrane may be fouled. Perform cleaning according to the Operator's Manual (if not already done). Recheck pressure and flow.

No	Alarm and Notifications	Definition	
			<p>8 If the product water conductivity has increased without a change in feed water conductivity, perform cleaning according to the Operator's Manual (if not already done). Recheck pressure and flow.</p> <p>9 If the problem remains, the RO module may have suffered damage due to improper feed water quality and/or pretreatment. Exchange the RO element or RO module.</p>
204	INSUFFICIENT WATER SUPPLY	WRO	The WRO unit stops,  flashes fast, message text displays.
		Reason	The empty level sensor indicates that the inlet tank is empty.
		Action	<ol style="list-style-type: none"> 1 Check that the feed water supply is in accordance with Technical Data. If the message occurs intermittently the feed water pressure may be insufficient. 2 Check the function of the level sensors and the inlet valve via the Internal Service Menu. 3 Check the internal inlet constant flow valve for particles. Refer to component 3 in <i>Flow Diagrams on page 15</i>. 4 Check the external constant flow valve for particles (if applicable).




No	Alarm and Notifications	Definition	
205	LOW REJECTION RATE	WRO	When entering STANDBY mode, buzzer sounds with notification sound,  flashes, message text displays.
		Reason	The conductivity rejection rate has been below set limit for more than 5 consecutive minutes during previous Run period.
		Action	<ol style="list-style-type: none"> 1 Start the WRO unit and let it run for at least 15 minutes (to allow for equalization of the water temperature within the unit). Then verify both feed and product water conductivity reading against an external conductivity reference instrument and calibrate if necessary. 2 If the feed water temperature has increased significantly compared to the time of installation, this will have an effect on the salt rejection ability of the reverse osmosis membrane, leading to lower rejection rate. Adjust the notification limit to correspond to the new situation. 3 Verify that the WRO is correctly adjusted regarding pressure and flow conditions and make adjustments if needed. 4 If the product water conductivity has increased without a change in feed water conductivity, perform cleaning according to the <i>Operator's Manual</i> (if not already done). Recheck pressure and flow. 5 If no softener is included in the pretreatment, scaling may have occurred on the feed water conductivity sensor, resulting in too low reading. Unscrew the sensor and clean it with a citric acid solution. 6 If the problem remains, the RO module may have suffered damage due to improper feed water quality and/or pretreatment. Exchange the RO-element or RO module.








No	Alarm and Notifications	Definition	
206	LOW PRODUCT FLOW	WRO	When entering STANDBY mode, buzzer sounds with notification sound,  flashes, message text displays.
		Reason	<p>The purpose of this notification is to give an early warning of reduced product water output. The notification will be issued when the product water flow rate has been below the set limit for more than 5 consecutive minutes during the previous Run or Standby flush period. Default set limit is 0 ml/min (S224).</p> <div data-bbox="813 573 1360 720" style="border: 1px solid black; padding: 5px;"> <p>NOTE</p> <p>The lowest product water flow rate is obtained when there is no consumption of product water (Standby flush).</p> </div>
		Action	<ol style="list-style-type: none"> 1 Verify that the WRO is correctly adjusted regarding pressure and flow conditions and make adjustments if needed. 2 Perform cleaning according to the Operator's Manual and then recheck pressure and flow. 3 If no problem has been experienced with the supply of water to the dialysis machine, readjust the limit to a lower value. 4 Exchange the RO element or RO module if the situation remains.


9.1.5 Heat (only WRO 300 H)

No	Alarm and notifications	Definition	
301	INSUFFICIENT HEAT	WRO 300 H	The WRO 300 H unit stops, buzzer sounds with alarm sound,  flashes, message text displays.
		Reason	Power failure.
		Action	Re-start the heat disinfection cycle.
302	INSUFFICIENT WATER SUPPLY	WRO 300 H	The WRO 300 H unit stops, buzzer sounds with alarm sound,  flashes, message text displays.
		Reason	Lack of feed water.
		Action	<ol style="list-style-type: none"> 1 Check that the feed water supply is in accordance with Technical Data. If the message occurs intermittently the feed water pressure may be insufficient. 2 Check the function of the level sensors and the inlet valve via the Internal Service Menu. 3 Check the internal inlet constant flow valve for particles. Refer to component 3 in <i>Flow Diagrams on page 15</i>. 4 Check the external constant flow valve for particles (if applicable). 5 If the problem persists, change to float level switches.
303	OVERDUE HEAT	WRO 300 H	When entering STANDBY mode, buzzer sounds with Notification sound,  flashes, message text displays.
		Reason	Automatic start of heat disinfection is activated by Time channel settings but cannot start because the WRO 300 H is not in STANDBY mode.
		Action	Check Time channel settings.
304	INCORRECT WATER LEVEL	WRO 300 H	The WRO 300 H unit stops, buzzer sounds with alarm sound,  and  flashes, message text displays
		Reason	Water level in tank is lower than expected.
		Action	<ol style="list-style-type: none"> 1 Check that the dialysis machine is disconnected. 2 Check fluid connections and the WRO for leakage. 3 Check the empty level sensor and connection.

9.1.6 Chem/Rinse

No	Alarm and notifications	Definition	
401	REMOVE WAND	WRO	Buzzer sounds with alarm sound,  flashes, message text displays.
		Reason	The chemical intake sensor indicates that the wand is still in place.
		Action	<ol style="list-style-type: none"> 1 Check the connection cable to the chemical intake sensor. 2 Replace chemical intake sensor. 3 Replace CPU board.
402	INSUFFICIENT WATER SUPPLY	WRO	The WRO unit stops, buzzer sounds with alarm sound,  flashes, message text displays.
		Reason	Lack of feed water.
		Action	<ol style="list-style-type: none"> 1 Check that the feed water supply is in accordance with <i>Technical Data</i>. If the message occurs intermittently the feed water pressure may be insufficient. 2 Check the function of the level sensors and the inlet valve via the Internal Service Menu. 3 Check the internal inlet constant flow valve for particles. Refer to component 3 in <i>Flow Diagrams on page 15</i>. 4 Check the external constant flow valve for particles (if applicable). 5 If the problem persists, change to float level switches.
403	HIGH CONDUCTIVITY RINSE	WRO	Buzzer sounds with alarm sound,  flashes, message text displays.
		Reason	Conductivity value is above Conductivity Notification limit after a prolonged Rinse.
		Action	<ol style="list-style-type: none"> 1 Verify with a separate test that there are no residual chemicals in the product water. 2 Verify the product water conductivity reading against an external conductivity reference instrument and calibrate if necessary. 3 If the product water conductivity cannot be calibrated, check the conductivity measurement system (probe and electrical connections). Replace the CPU board if necessary.

No	Alarm and notifications	Definition	
404	RINSE REQUIRED	WRO	Buzzer sounds with alarm sound,  and  flashes, message text displays.
		Reason	The WRO is filled with chemicals.
		Action	If the alarm persists after a second Rinse cycle replace the CPU board.
405	INCORRECT WATER LEVEL	WRO	The WRO unit stops, buzzer sounds with alarm sound,  and  flashes, message text displays.
		Reason	The water level in the tank is lower than expected.
		Action	<ol style="list-style-type: none"> 1 Check that the dialysis machine is disconnected. 2 Check fluid connections and the WRO for leakage. 3 Check the empty level sensor and connection.
406	INSUFFICIENT INTAKE	WRO	Buzzer sounds with alarm sound,  and  flashes, message text displays.
		Reason	The product water conductivity is below the minimum intake conductivity limit.
		Action	<ol style="list-style-type: none"> 1 Verify that correct amount of disinfectant is consumed during the intake phase. 2 If the intake volume is correct, verify that the set alarm limit is correct. Adjust if required. 3 If the intake volume is too low, check the o-ring on the wand and replace if necessary. 4 Adjust the chemical intake pump capacity coefficient (S151) to correspond to the measured flow. 5 Exchange the chemical intake pump. Verify that the intake volume is correct.
407	INSUFFICIENT TEMPERATURE	WRO 300 H	Buzzer sounds with alarm sound,  flashes, message text displays.
		Reason	The temperature during Warm Acid cleaning has not reached above the preset limit.
		Action	Refer to alarm 103:21

No	Alarm and notifications	Definition	
408	INSERT WAND	WRO	The WRO unit stops, buzzer sounds with alarm sound,  flashes, message text displays.
		Reason	A Central Chemical disinfection has been initiated via the remote control and the disinfection wand is not inserted.
		Action	Insert the disinfection wand to continue the Central Chemical disinfection procedure.

9.2 Boot Loader

No	Alarm and notifications	Definition	
	LOAD APPLICATION FAILED	WRO	LOAD APPLICATION FAILED is shown on the display.
		Reason	Software malfunction.
		Action	<ol style="list-style-type: none"> 1 Download new program to the WRO. 2 If the LOAD APPLICATION FAILED persists, replace the CPU board.

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