

# Dialog<sup>+</sup> SW 9.xx

Service Manual

English  
Edition 1 -2010



**B | BRAUN**  
SHARING EXPERTISE



**Contact your Local  
B. Braun Representative  
for Service Support**



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Valid for the following machine type:

# Dialog<sup>+</sup>

For Software  $\geq$  9.xx

Dialog+: from serial no. 100000

Dialog+ HDF-Online: from serial no. 150000

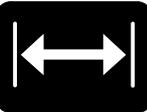
**Registration Number:**

Service Manuals with a registration number are included in the update service!

Copyright Commissioning and Service	This document is the property of B. Braun Avitum AG with all rights reserved. Only trained personnel must service the Dialog+, i.e. repair, maintenance, software installation, firmware update, retrofitting and commissioning of the Dialog+. Servicing must only be performed with proper tools, calibration equipment and be in accordance with the most recent revision of this service manual/technical information, which must be clearly and thoroughly understood.
Prevent Electrical Shock Hazard	Switch off the Dialog+ and disconnect unit from mains if you have to open the machine for servicing. Do not touch any exposed wiring or conductive surfaces while the Dialog+ is opened. The voltages present when electrical power is connected to the Dialog+ can cause serious injury or death.
 ESD Information High Voltage in TFT Monitor	Pay attention to ESD information, because electronic components are sensitive to electrostatic discharges.  If a battery option is present in the machine: High voltage can be present at the backlight inverter board BIB in the TFT monitor, even if the machine has been disconnected from mains. Pull out the battery compartment in the base platform and switch off the battery voltage before opening the machine.
Protective Conductor in TFT Housing	If the TFT housing had to be opened during a service job, the tight seat of the protective conductors in the TFT housing must be checked.
TSM Service Program	Only activate the TSM service program for service activities. It is prohibited to connect a patient to the Dialog+ and to run a therapy if the TSM service program is activated in the Dialog+. If the TSM service program is activated the complete alarm system is disabled. The TSM service program is started in the service mode: digital board, service switch S1, position 2.
Software	The software is installed in the software mode: digital board, service switch S1, position 3.
Therapy Mode	After completion of all procedures switch back to the therapy mode: digital board, service switch S1, position 0.
Calibration	Only perform a calibration after the Dialog+ has reached working temperature and the machine was disinfected and decalcified. Save the calibration data (CFC) before you exit the TSM service program: <i>TSM Main Menu, File Operations, Save Calibration Data</i> .
Tubing	Tubing must be replaced only by the same tubing type/length and identical installation manner. Make sure that the tubings in the machine are not kinked or twisted after servicing (e.g. if sub-racks are pulled out and inserted again). The tubing must not touch moving/rotating components (e.g. motors of gear pumps).
Wiring	Wiring must be replaced only by the same cable type/length and identical installation manner. The cables must not touch moving/rotating components (e.g. motors of gear pumps).
Prevent Chemical Burns and Scalding	During servicing on running machines: prevent chemical burns and scalding of the skin due to the penetration of disinfectant or hot liquid.
Contaminated Machines	Protective gear should be worn in case of servicing of assumed contaminated machines.
Cover in Rear Door	Servicing of mechanical assembly groups (components in contact with fluid): the cover for the switch mode power supply microcontroller SMPS-MC in the rear door must be assembled during servicing because it serves as a spray protection.
O-Rings Figures	Always check o-rings from disassembled groups/components and replace if necessary. The displayed figures can differ slightly from the machines on site, due to different hardware statuses.
Fuses	If fuses are replaced they must exactly match the type and rating specified by the manufacturer in the spare parts list/technical information. Where applicable: fuses must be approved by UL/CSA.
 Spare Parts Disposal and Taking Back of Spare Parts System Configuration	Only use original spare parts manufactured and sold by B. Braun Avitum AG. Dispose spare parts (e.g. boards or batteries) according to local disposal guidelines or send back to B. Braun Avitum AG free of charge (see chapter 7). The system configuration saved on a diskette must be downloaded to an other Dialog+ machine only if: <ul style="list-style-type: none"> <li>• the hardware matches and</li> <li>• the identical software version number is present.</li> </ul>
Function Check	Check the respective function of the assembly group/component after servicing. A complete function check must be performed after every service, according to the operating manual.

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## Conventions

Symbol	Description
	<b>Attention</b> The symbol gives information, which are safety relevant for the Dialog+ and must be observed.
	<b>Information</b> The symbol gives additional information, which should be observed.
	<b>Tips</b> The symbol gives additional hints, which can be helpful.
	<b>Handling</b> The symbol gives information for a handling at or in the machine, i.e. during a calibration, disassembly or assembly.
	<b>Calibration</b> The symbol appears for necessary calibration measures.
	<b>Calibration Equipment/Tools</b> The symbol gives remarks for necessary calibration equipment/tools, i.e. during a calibration, disassembly or assembly.

**Service Manual**

The edition of this service manual is for the maintenance and repair of the Dialog+ machine with a software  $\geq 9.01$ . The service manual is subject to amendments.

**Service Training**

A service training is essential to meet the B. Braun standard operating procedures for qualified service and support.

The user of this documentation should only use this documentation in combination with a participation in a B. Braun service training.

The user of this documentation should have the following qualifications and prerequisites:

1. Mechanics, digital/analogue techniques, optoelectronics, measurement and PC techniques.
2. Participation in a B. Braun service training to accomplish qualified maintenance, repair and service support.
3. Availability of approved and calibrated test equipment and tools given in this service manual.

Contact your local B. Braun representative or dealer for detailed information concerning training courses.

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**Technical Safety Inspection**

Perform regular technical safety inspections as described in chapter 5 of this service manual to ensure the safety of the machine.

**Instructions for Use**

An instructions for use can be ordered at your local B. Braun representative or dealer.

**ESD/EMC Information**

Please observe the ESD/EMC information (see appendix for additional information):

- ESD: electrostatic discharge
- EMC: electromagnetic compatibility

**Spare Parts**

Only original spare parts manufactured and sold by B. Braun are applicable. Please provide part number and description respectively when ordering any spare parts. Please order your spare parts at your local B. Braun representative or dealer.

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The main assembly groups are defined according to the spare parts list. The main assembly groups are especially:

- All pcb's (printed circuit boards)
- Pumps
- DF block
- Ultrafiltration
- Blood leak detector
- Safety air detector
- Heater

Tamper or repairs in these assembly groups are not permissible (due to calibration, ESD, multi-layer pcb's and the application of SMT (SMT = surface mounted technology)).

**Calibration Service**

All calibration devices must be approved and registered with an identification number. The calibration equipment is subject to the B. Braun calibration service and must be checked and recalibrated in regular intervals, to meet the B. Braun standard operating procedures SOPs. Only approved and registered calibration equipment must be applied for servicing.

Copyright

Commissioning and Service

Prevent Electrical Shock Hazard

ESD Information

High Voltage  
in TFT Monitor

Protective Conductor in TFT Housing

TSM Service Program

Software

Therapy Mode

Calibration

Prevent Chemical Burns and Scalding

Contaminated Machines

Cover in Rear Door

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Spare Parts

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Check Machine

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Electrical Installation

Mains Voltage Supply

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Water Installation

Water Quality

Central Hot Cleaning System

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Servicing must only be performed with proper tools, calibration equipment and be in accordance with the most recent revision of this service manual/technical information, which must be clearly and thoroughly understood.

Switch off the Dialog+ and disconnect unit from mains if you have to open the machine for servicing.

Do not touch any exposed wiring or conductive surfaces while the Dialog+ is opened. The voltages present when electrical power is connected to the Dialog+ can cause serious injury or death.

Pay attention to ESD information, because electronic components are sensitive to electrostatic discharges.

If a battery option is present in the machine:

High voltage can be present at the backlight inverter board BIB in the TFT monitor, even if the machine has been disconnected from mains. Pull out the battery compartment in the base platform and switch off the battery voltage (remove fuse) before opening the machine.

If the TFT housing had to be opened during a service job, the tight seat of the protective conductors in the TFT housing must be checked.

Only activate the TSM service program for service activities. It is prohibited to connect a patient to the Dialog+ and to run a therapy if the TSM service program is activated in the Dialog+. If the TSM service program is activated the complete alarm system is disabled. The TSM service program is started in the service mode: digital board, service switch S1, position 2.

The software is installed in the software mode: digital board, service switch S1, position 3.

After completion of all procedures switch back to the therapy mode: digital board, service switch S1, position 0.

Only perform a calibration after the Dialog+ has reached working temperature, and the machine was disinfected and decalcified. You should save the calibration data to the hard disk drive before you exit the TSM service program: *TSM Main Menu, File Operations, Save Calibration Data*.

During servicing on running machines: prevent chemical burns and scalding of the skin due to the penetration of disinfectant or hot liquid.

Protective gear should be worn in case of servicing of assumed contaminated machines.

Servicing of mechanical assembly groups (components in contact with fluid): the cover in the rear door must be assembled during servicing because it serves as a spray protection for the SMPS-MC.

Tubing must be replaced only by the same tubing type/length and identical installation manner.

Make sure that the tubings in the machine are not kinked or twisted after servicing (e.g. if sub-racks are pulled out and inserted again). The tubing must not touch moving/rotating components (e.g. motors of gear pumps).

Wiring must be replaced only by the same cable type/length and identical installation manner. The cables must not touch moving/rotating components (e.g. motors of gear pumps).

If fuses are replaced they must exactly match the type and rating specified by the manufacturer in the spare parts list/technical information. Where applicable: fuses must be approved by UL/CSA.

Only use original spare parts manufactured and sold by B. Braun Avitum AG.

Please pay attention to the information in the instructions for use

Check completeness of machine and transport damages after unpacking.

Do not start machine if a safe operation is not guaranteed.

The electrical installation must correspond with national regulations for initial operation of the unit (e.g. IEC publications). The machine must not be operated in hazardous locations or rooms. The potential equalisation must be in accordance with national requirements (e.g. IEC publications)

The mains voltage supply must correspond with the mains voltage on the unit type plate!

Before the Dialog+ is switched on the machine must have room temperature (see instructions for use, chapter 15).

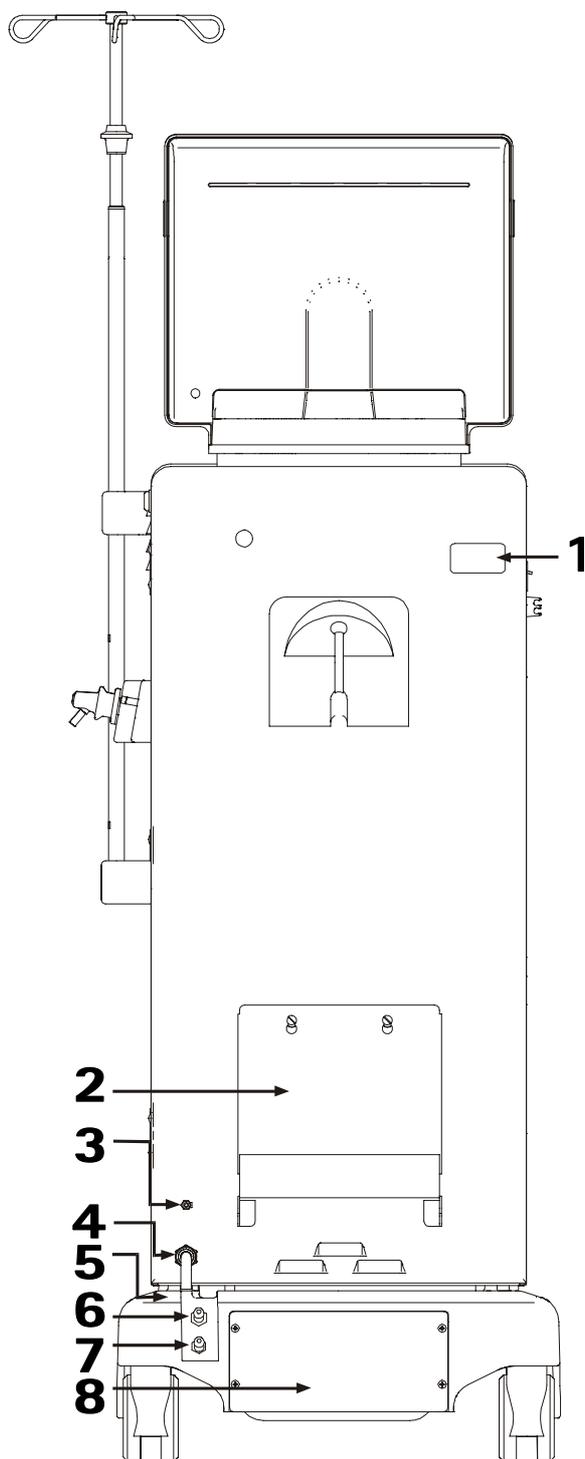
The installation must be in accordance with national regulations e.g. DVGW work sheet W503 for haemodialysis equipment and VDE 0753 (rules of application for haemodialysis equipment).

A pipe disconnecter is not necessary if a water softener or water softener with built-in reverse osmosis system is installed. A nonreturn valve and a bleed pipe are adequate. Please see DVGW work sheet W 503, section 4.4 and VDE 0753 part 4 (Rules of application for haemodialysis equipment).

Only water of the highest quality should be applied. Please consider the following, especially for bicarbonate dialysis:

- Inlet water shall be free of  $Mg^{++}$  and  $Ca^{++}$ .

If the machine is connected to a central hot cleaning system a high temperature tubing must be used for the water inlet.



### Legend

1. Type Plate
2. Canister Holder
3. Potential Equalisation Bolt
4. Main Cord
5. Central Concentrate Supply Option
6. Tubing Connection Water Inlet
  - PVC tubing 10 x 3 mm (red)  
(fasten with two single ear clamps 19.5)
  - Tubing length: approx. 3 m
- 6.1 Tubing Connection Water Inlet for Osmosis Device with Hot Disinfection of the Loop Line
  - Silicone tubing 8 x 3.2 mm (high temperature tubing, red)  
(fasten with two single ear clamps 19.5)
7. Tubing Connection Dialysate Outlet
  - PVC tubing 10 x 3 mm (black)  
(fasten with a single ear clamp 19.5 and a tubing clamp 12-20 mm)
  - Tubing length: approx. 3 m
  - Drain height: max. 80 cm
8. Emergency Power Supply/Battery Option

Fig.: Dialog+ Rear View

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## 1.1 Commissioning Check List

For Dialog+ SW 9.xx

The commissioning (putting into service) shall be performed and documented before the machine is handed over to the responsible organisation (user), according to the specified check list, with reference to the service manual and instructions for use.

REF {Type/Typ}: ..... SN {Serien-No./Nr.}: .....

Year of Purchase: ..... Responsible Organisation (User): .....

Operating Hours: ..... h Inventory No.: .....

SW Version: .....

Manufacturer:

B. Braun Avitum AG  
34209 Melsungen, Germany

### Check List

OK

Note: Text in { } brackets is information for the execution of the check list!

<b>1. Visual Inspection</b>		<input type="checkbox"/>	
1.1	{Machine: clean/complete; no damages/moisture influences or loose assemblies; no moveable parts touching tubings or wires; casters are moveable; type plate legible}		
1.2	{Check tight seat and damages of mains supply (power supply cord, strain relief), potential equalisation cable, staff call/data lines (if present) and connectors}		
<b>2. Protective Earth Resistance According to EN 62353</b>			
2.1	<b>Protective Earth Resistance:</b>  <div style="text-align: right;">&lt; 0.3 [Ω]      {note highest value}: .....</div> [Ω] {(Machine incl. power supply cord. Move the power supply cord during the check. Thus possible loose connections can be detected. Data lines and potential equalisation cable must not be connected during the check of the of the protective earth resistance (see figure 1)} {Measurement points: {Exterior: Potential equalisation bolt, rinsing bridge (dialyser inlet and outlet)} {Interior: Heater body (top), rear door (top left corner), frame (rear), housing cover (top left), front door (top left)} {Monitor: Monitor (one of the screws in the front panel/housing)}	<input type="checkbox"/>	
<b>3. Install Machine</b>		<input type="checkbox"/>	
3.1	{Connect water inlet to the metal tubing connector and fasten with single ear clamp. Connect dialysate outlet to plastic tubing connector and fasten with tubing clamp.}		
3.2	{Connect central supply for concentrate (central supply option) and deaerate tubings}		
3.3	{Assemble holder for disinfectant (if option present)}		
3.4	{Assemble dialyser holder}		
3.5	{Assemble filter holder. Insert DF filter (option)}		
3.6	{Assemble DF filter/HDF filter (if option present)}		
<b>4. Function Inspection</b>			
<b>{ Pay attention to the filling procedure of the machine to prevent dry run of the heater! }</b>			
4.1	<b>Switch on machine, fill and rinse:</b>	- {Switch machine in <i>Test 1.10 Degassing and Heating</i> menu and fill with water until water flows out of the dialysate outlet. Then rinse in disinfection (approx. 5 minutes).}	
4.2	<b>Automatic Blood Pressure Measurement ABPM</b>	Option present	no <input type="checkbox"/> yes <input type="checkbox"/>
4.2.1	<b>ABPM Option:</b>	- Measurement on a test person is plausible	
4.3	<b>Customer Specific System Setting:</b>	- {Switch machine in TSM Service Program: Execute <i>Treatment Support</i> (calibrate PE offset for altitudes > 1000 m)}	

Check List

OK

Note: Text in { } brackets is information for the execution of the check list!

SN {Serien-No./Nr.} .....

<b>5. Setting into Service According to Instructions for Use with Electrical Safety Check According to EN 62353/EN 60601-1</b>		
5.1	Applied Accessories/Disposables: - Applied line system: Name: .....	
5.2	Switch on machine: - Self-test passed {and 15 minutes therapy with UF safety check} - Ultrafiltration comparison measurement 15 minutes with UF rate 500 ml/h: ..... [ml] (125 ml UF volume ±15 ml)	<input type="checkbox"/> <input type="checkbox"/>
5.3	Temperature: - Comparison measurement {at dialyser coupling}, at 37 °C (-1.5; +0.5): ..... [°C]	<input type="checkbox"/>
5.4	Conductivity: - Comparison measurement {at dialyser coupling}, e.g. 14.3 mS/cm (±0.2): ..... [mS/cm]	<input type="checkbox"/>
5.5	Equipment Leakage Current: {All water connections and data lines must be connected during the check of the equipment leakage current (see figure 2)} ≤ 0.5 [mA] - During heat-up phase {change mains polarity and note highest value}: ..... [mA]	<input type="checkbox"/>
5.6	Patient Leakage Current: {All water connections and data lines must be connected during the check of the patient leakage current (see figure 3)} < 10 [µA] AC - Under normal conditions {at dialyser coupling}, conductivity at 13 – 15 mS/cm: ..... [µA]	<input type="checkbox"/>
5.7	Safety Air Detector (SAD): - Test alarm function (visual/audible) passed	<input type="checkbox"/>
5.8	Disinfection: - Start	<input type="checkbox"/>

Applied Measurement Equipment:

Electrical Safety: ..... \* ID/Serial No.: .....

Conductivity: ..... \* ID/Serial No.: .....

Temperature: ..... \* ID/Serial No.: .....

Pressure: ..... \* ID/Serial No.: .....

Balance: ..... \* ID/Serial No.: .....

Pressure Manometer: ..... \* ID/Serial No.: .....

Other Measurement Device: ..... \* ID/Serial No.: .....

..... \* ID/Serial No.: .....

\* If applicable, please enter the type and identification number of the equipment used.

Comments:

.....

.....

.....

Next Inspection Date: .....

The commissioning was performed and the machine was hand over to the responsible organisation (user).

Name Service Technician:

Name of Company:

.....

Date/Signature

.....

1.1.1 Measurement Circuits for Measurement of Electrical Safety  
According to IEC 62353/60601-1

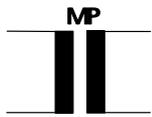
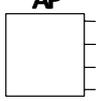
	Protective earth (ground)		
L, N	Supply mains terminals	PE	Protective earth terminal
	Mains part		Applied part
	Measuring device		Residual current meter with frequency response as MD
	Resistance measurement equipment		
	Part of enclosure not protectively earthed		Connection to accessible conductive parts

Table 1: Legend of Abbreviations and Symbols

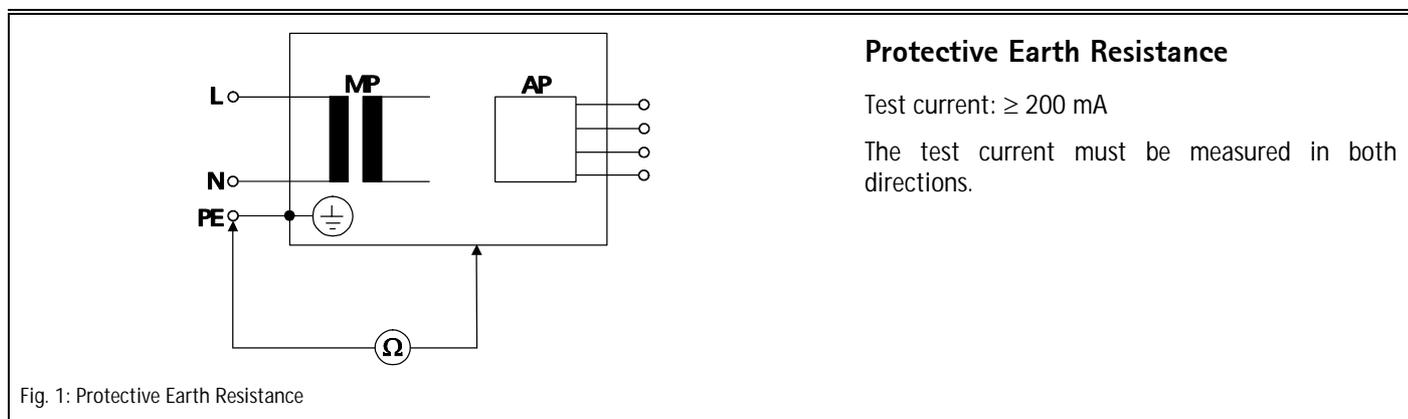


Fig. 1: Protective Earth Resistance

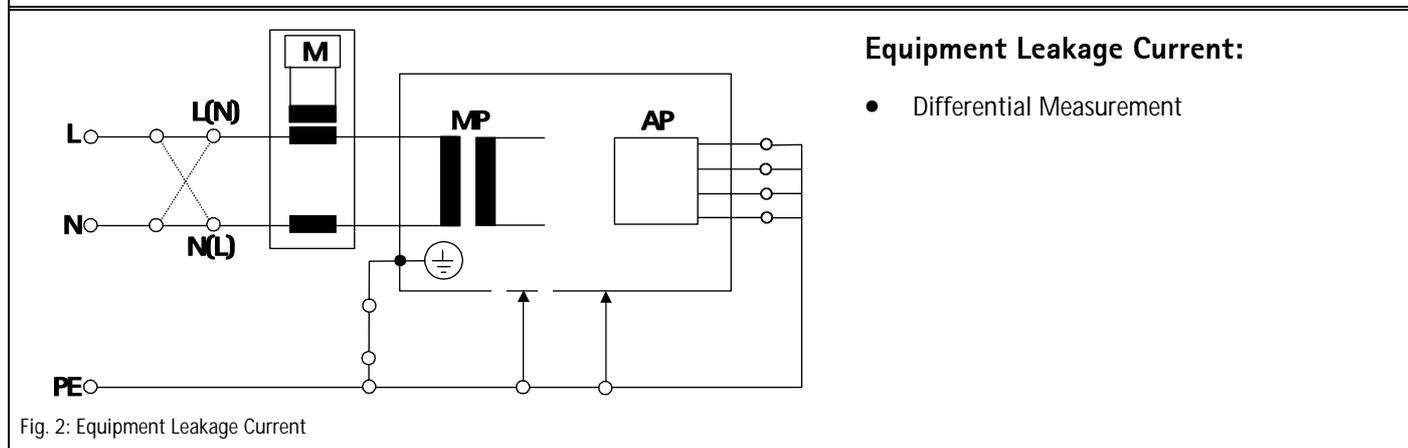


Fig. 2: Equipment Leakage Current

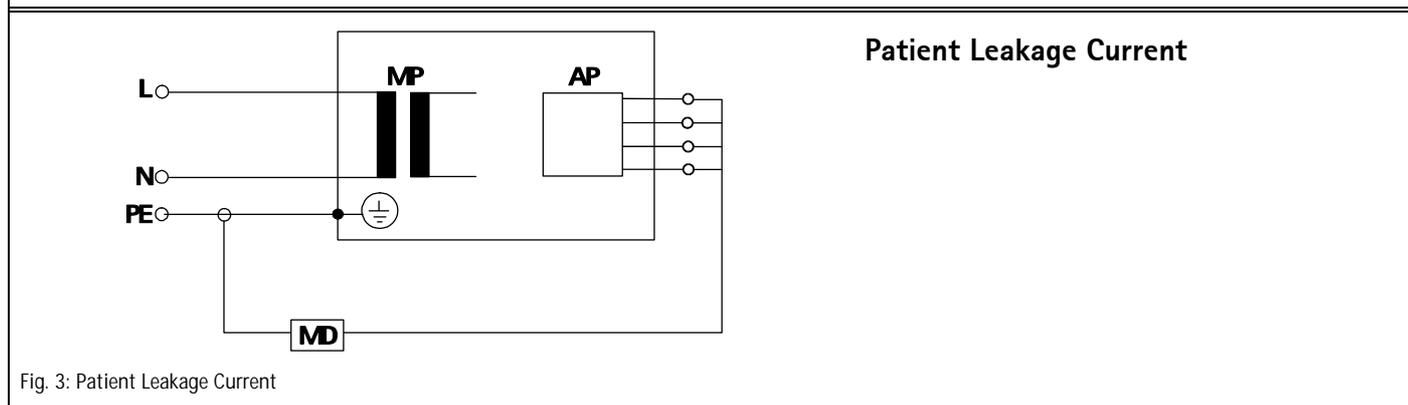


Fig. 3: Patient Leakage Current

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## General Information

Operation is accomplished via a touch screen (TFT monitor). Two microprocessor systems control and monitor the machine.

The hardware concept consists of the following systems:

- Top Level System
- Low Level System

### Top Level System

The top level system consists of the following components:

- Communication module
- Top level controller TLC (motherboard)
- Compact flash card CFC
- Options

The communication between the user and the machine is performed via the top level.

Example data exchange to communication module:

- Entry via input mask of the touch screen or keyboard
- Output via the output mask of the TFT monitor

Example data exchange to low level:

- Transmitting and receiving data from/to low level controller and supervisor on the digital board DB (LLD)

### Low Level System

The low level system consists of the following components:

- Digital board DB (LLD)
- Analog board AB (LLA)
- Power board motors PBM
- Power board valves PBV

The low level controls and monitors all functions.

Data exchange to top level controller (motherboard):

- Transmitting and receiving data from/to low level supervisor
- Transmitting and receiving data from/to low level controller

Data exchange between low level controller to supervisor:

- Transmitting and receiving messages, data and commands

All sensor data are sent separately, via two serial bus systems, to the supervisor and controller via the analog board to the digital board. The actuators, motors and valves are driven via the power board valves PBV and power board motors PBM.

# Dialog<sup>+</sup>

For Software  $\geq$  9.xx

2.1 Overview Sub-Racks

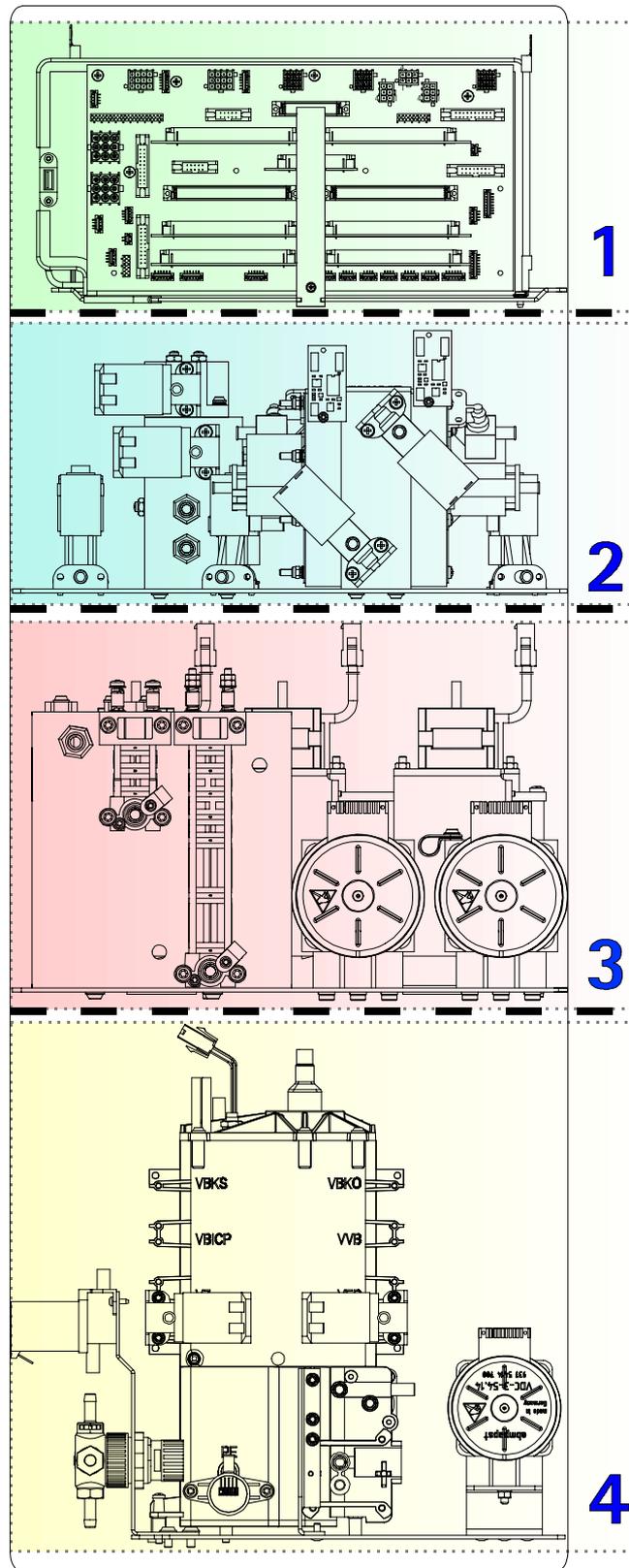


Fig. : Overview Sub-Racks Rear View Dialog+

2.1.1 Legend Overview Sub-Racks

- |   |                    |   |                |
|---|--------------------|---|----------------|
| 1 | Top Level Sub-Rack | 3 | DF Sub-Rack    |
| 2 | UF Sub-Rack        | 4 | Water Sub-Rack |

## 2.2 Top Level Sub-Rack

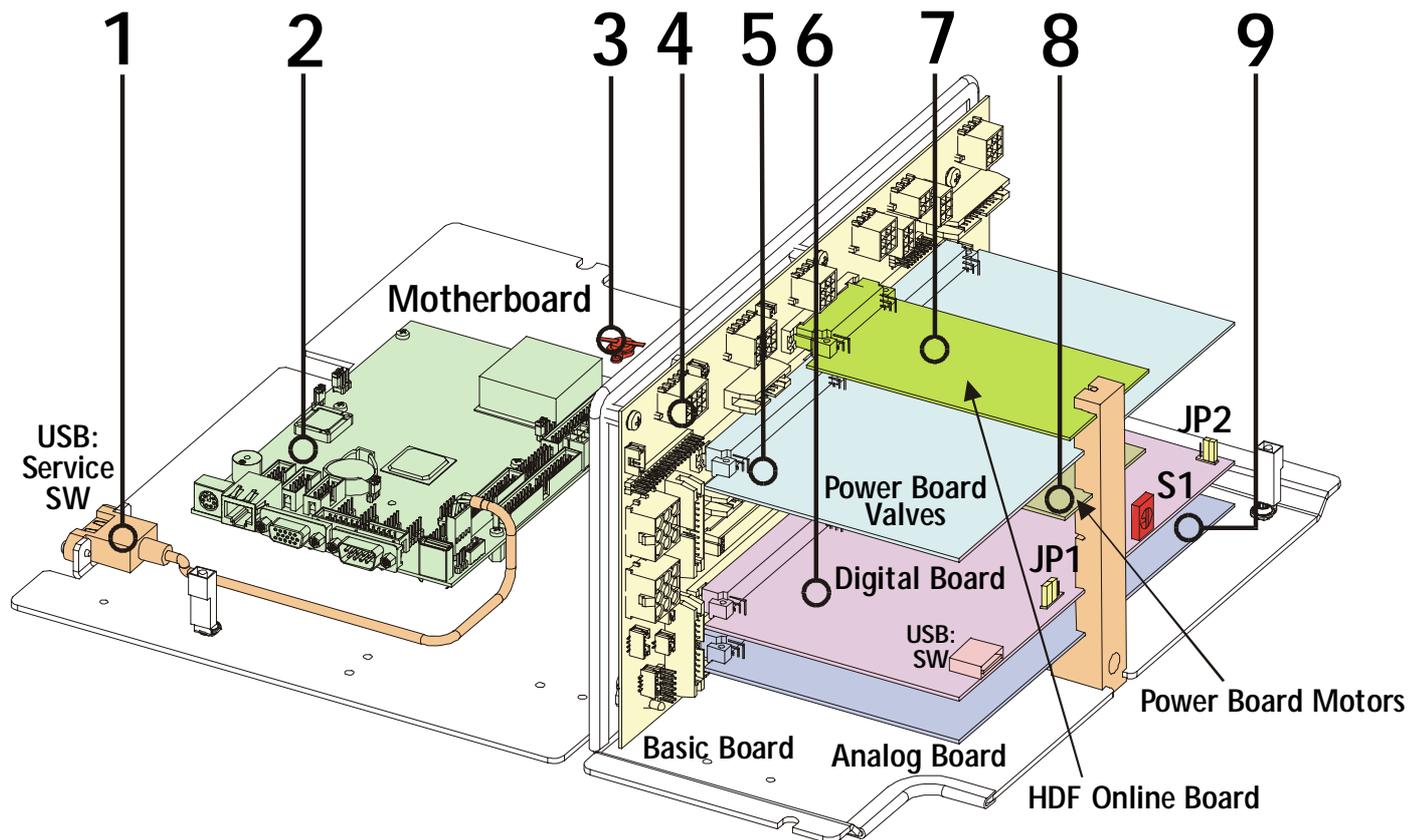


Fig. : Top Level Sub-Rack

## 2.2.1 Legend Top Level Sub-Rack

- 1 USB Port:  
Service (FSU)/Software Installation TLC
- 2 LX800 Motherboard
- 3 Temperature Switch TS (closes at  $50 \pm 3$  °C, opens at  $35 \pm 6$  °C)
- 4 Basis Board BB
- 5 Power Board Valves PBV
- 6 Digital Board DB (LLD):  
USB Port: Software Installation LLC/LLS; Service-Switch S1; Jumper JP1/JP2
- 7 HDF Online Board HOB
- 8 Power Board Motor PBM
- 9 Analog Board AB (LLA)

## 2.3 Basic Board BB

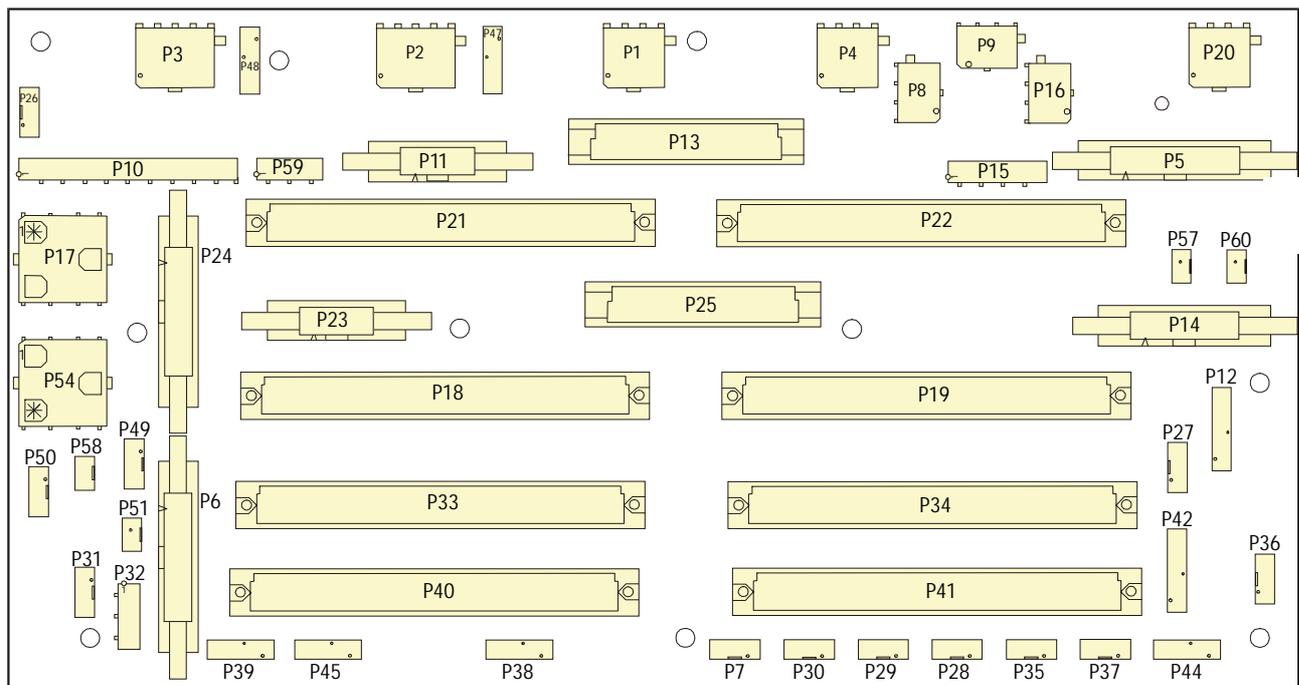


Fig. : Basic Board

## 2.3.1 Legend Basic Board

<b>P1</b>	Degassing Pump <b>EP</b>	<b>P27</b>	Membrane Position Sensors Balance Chamber <b>MSBK</b>
<b>P2</b>	Venous Blood Pump <b>BPV</b>	<b>P28</b>	Temperature Sensor Dialysate <b>TSD</b>
<b>P3</b>	Arterial Blood Pump <b>BPA</b>	<b>P29</b>	Temperature Sensor Heater Inlet <b>TSHE</b>
<b>P4</b>	Outlet Flow Pump <b>FPA</b>	<b>P30</b>	Degassing Temperature Sensor <b>TSE</b>
<b>P5</b>	Safety Air Detector <b>SAD</b>	<b>P31</b>	Level Sensor Upline Tank <b>NSVB</b>
<b>P6</b>	Heparin Pump <b>HP (HEP)</b>	<b>P32</b>	Blood Leak Detector <b>BL</b>
<b>P7</b>	Air Separator Level Sensor <b>LAFS</b>	<b>P33/P34</b>	Digital Board <b>DB</b>
<b>P8</b>	BIC Pump <b>BICP</b>	<b>P35</b>	Temperature Sensor BIC <b>TSBIC</b>
<b>P9</b>	Concentrate Pump <b>KP</b>	<b>P36</b>	Temperature Sensor Dialyser Inlet <b>TSDE</b>
<b>P10</b>	All Valves (+ Option BIC) <b>VALVES</b>	<b>P37</b>	Temperature Sensor Dialysate Supervisor <b>TSD-S</b>
<b>P11</b>	Level Regulation <b>LR</b>	<b>P38</b>	Pressure Sensor Dialysate Outlet <b>PDA</b>
<b>P12</b>	<b>DIABUS</b>	<b>P39</b>	Blood Side Pressure Sensor <b>PBLOOD</b>
<b>P13</b>	HDF Online Board <b>HOB</b>	<b>P40/P41</b>	Analog Board <b>AB (LLA)</b>
<b>P14</b>	Front Panel Board <b>FPB</b>	<b>P42</b>	END Conductivity Sensor (Controller/Supervisor) <b>ENDLF+S</b>
<b>P15</b>	Valves Balance Chamber <b>VCH</b>	<b>P44</b>	BIC Conductivity Sensor <b>BICLF</b>
<b>P16</b>	UF Pump <b>UFP</b>	<b>P45</b>	Pressure Sensor Degassing <b>PE</b>
<b>P17</b>	Power Supply 1 <b>PS1</b>	<b>P47</b>	Speed/Rotation Direction Venous Blood Pump <b>DZ/DR BPV</b>
<b>P18</b>	Not Applicable	<b>P48</b>	Speed/Rotation Direction Arterial Blood Pump <b>DZ/DR BPA</b>
<b>P19</b>	Not Applicable	<b>P49</b>	BIC and Concentrate Sensors for Suction Rods <b>BIC-K</b>
<b>P20</b>	Inlet Flow Pump <b>FPE</b>	<b>P50</b>	Rinsing Bridge Sensors <b>SBS</b>
<b>P21/P22</b>	Power Board Valves <b>PBV</b>	<b>P51</b>	BIC Cartridge Holder Sensor <b>BKUS</b>
<b>P23</b>	Staff Call <b>PERS-R</b>	<b>P54</b>	Power Supply 2 <b>PS2</b>
<b>P24</b>	Control <b>SMPS-MS (NT)</b>	<b>P57</b>	Power Supply Bedside Link <b>BSL-PWR</b>
<b>P25</b>	Power Board Motors <b>PBM</b>	<b>P58/P60</b>	Power Supply Hall Sensors
<b>P26</b>	Disinfection Valve <b>VD</b>		

## 2.4 Power Board Valves PBV

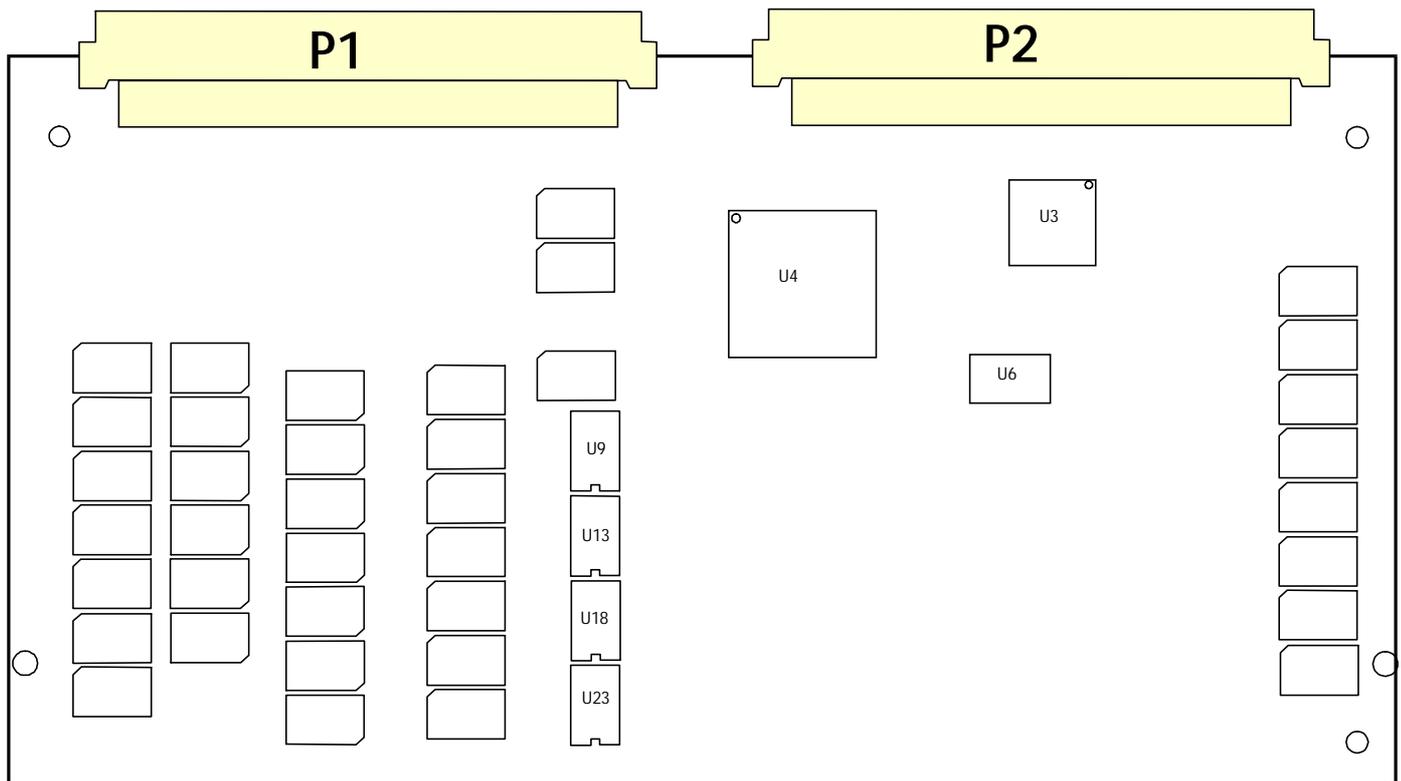


Fig. : Power Board Valves

## 2.4.1 Legend Power Board Valves

**P1 Valves:**

Inlet Upline Tank Valve **VVBE**  
 Degassing Inlet Valve **VEB**  
 Air Separator Valve Luftabscheider **VLA**  
 Dialyser Inlet Valve **VDE**  
 Dialyser Outlet Valve **VDA**  
 Bypass Valve **VBP**  
 Option BIC Cartridge Valves **VBICP, VBKS, VBKO, VVB**  
 Disinfection Valve **VD**  
 Circulation Valve **VZ**  
 Venous Tubing Clamp **SAKV**  
 Arterial Tubing Clamp **SAKA**

**P2 Valves:**

Valve Balance Chamber **VDEBK1/2, VDABK1/2, VEBK1/2, VABK1/2**  
 Valves Level Module **VBT, VPV, VPE, VPU, VPD, VPA**

## 2.5 Power Board Motors PBM

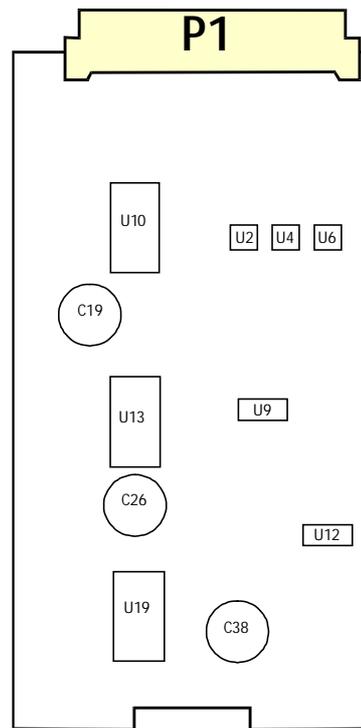


Fig. : Power Board Motors

### 2.5.1 Legend Power Board Motors

- P1** BIC Piston Pump **BICP**
- Concentrate Piston Pump **KP**
- UF Piston Pump **UFP**
- Level Regulation Pump (Diaphragm Pump) **LRP (PPR)**

2.6 Digital Board DB

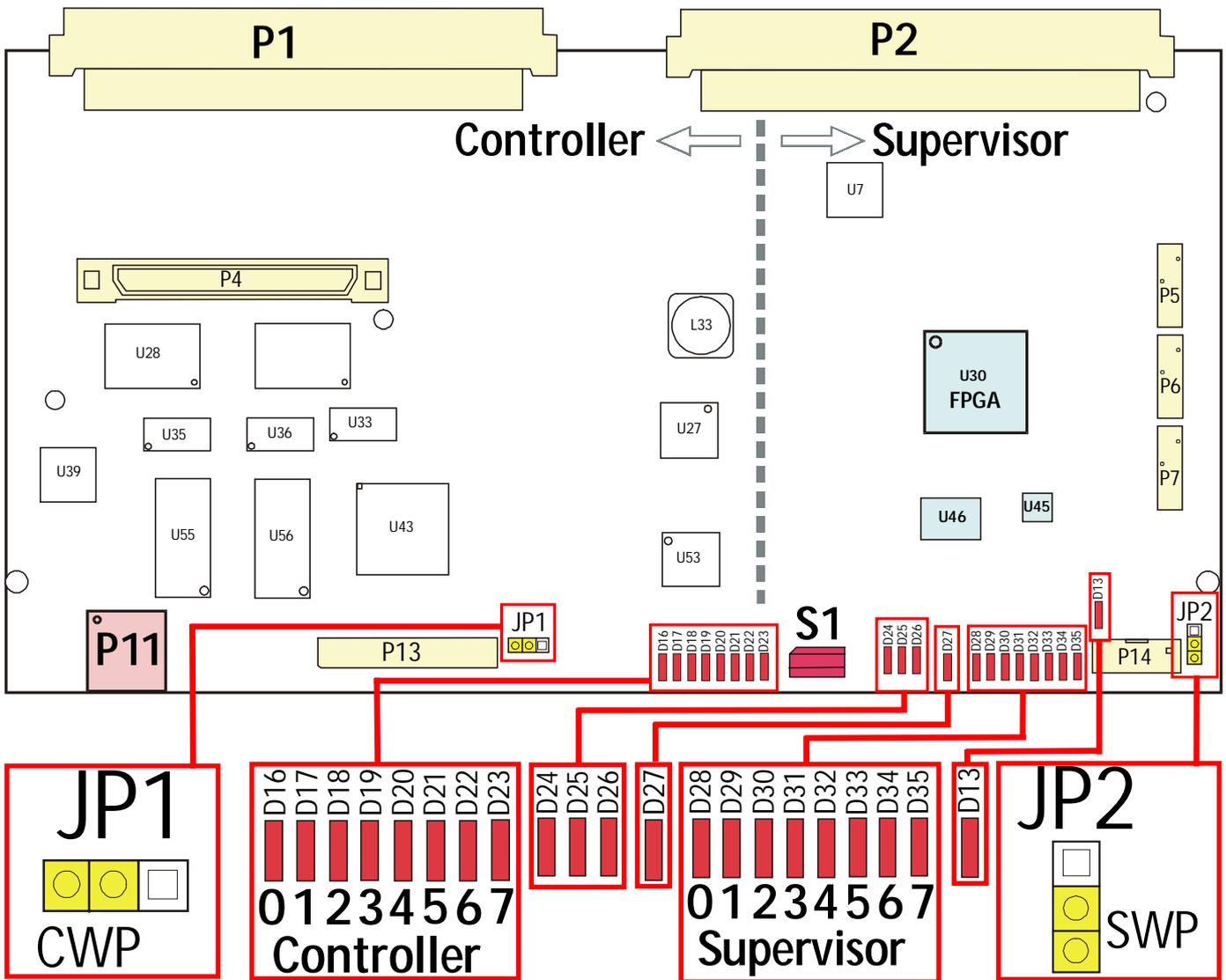


Fig. : Digital Board DB (LLD) with Controller and Supervisor

2.6.1 Legend Digital Board

**Calibration Data**

All calibration data are stored on the digital board. The calibration data must be stored additionally on the compact flash card CFC.

**12 Bit AD Converter**

Both supervisor and controller have a 12 bit AD converter with a range of 0 to 4095.

P4/P5/P6/P7/P13/P14: not applicable

P11 USB Type A for SW installation with USB stick

**Supervisor Sensors:**

BICPOS, KPPOS, UFPOS

**Controller/Supervisor Sensors:**

BKUS, SBS1, SBS2, BPS\_IMP, BPA\_DIR, BPV\_IMP, BPV\_DIR

**Pumps:**

BPA, BPV, EP, FPA, FPE

**Controller Sensors:**

NSVB, BICSS, KSS, MSBK1/2, RDV, SAD, BPADS, BPVDS, BL (Controller/Supervisor Sensor Analog Board)

**Jumper JP1:**

Default: Controller Write Protect CWP (for controller firmware)

**Controller LEDs D13 – D20:**

Status 0 – 7 for installation of LLC software

**FPGA LEDs V7 – V9:** always ON

Voltages for FPGA (U30) and periphery (FPGA: Field Programmable Gate Array – configurable logical circuit)

**LED V10:** flashes permanently

Cycle time, system is running

**Supervisor LEDs V11 – V18:**

Status 0 – 7 for installation of LLS software

**LED V5:** always ON after loading

The content of the memory (U45) is loaded to FPGA (U30) during switch-on. The therapy program and the service program is stored in the RAM (U45).

**Jumper JP2:**

Default: Supervisor Write Protect SWP (for supervisor firmware)

**S1 Service Switch:**

**Position 0:** Therapy Mode

**Position 2:** TSM Service Program Mode

**Position 3:** Software Installation/Update Mode

## 2.7 Analog Board AB

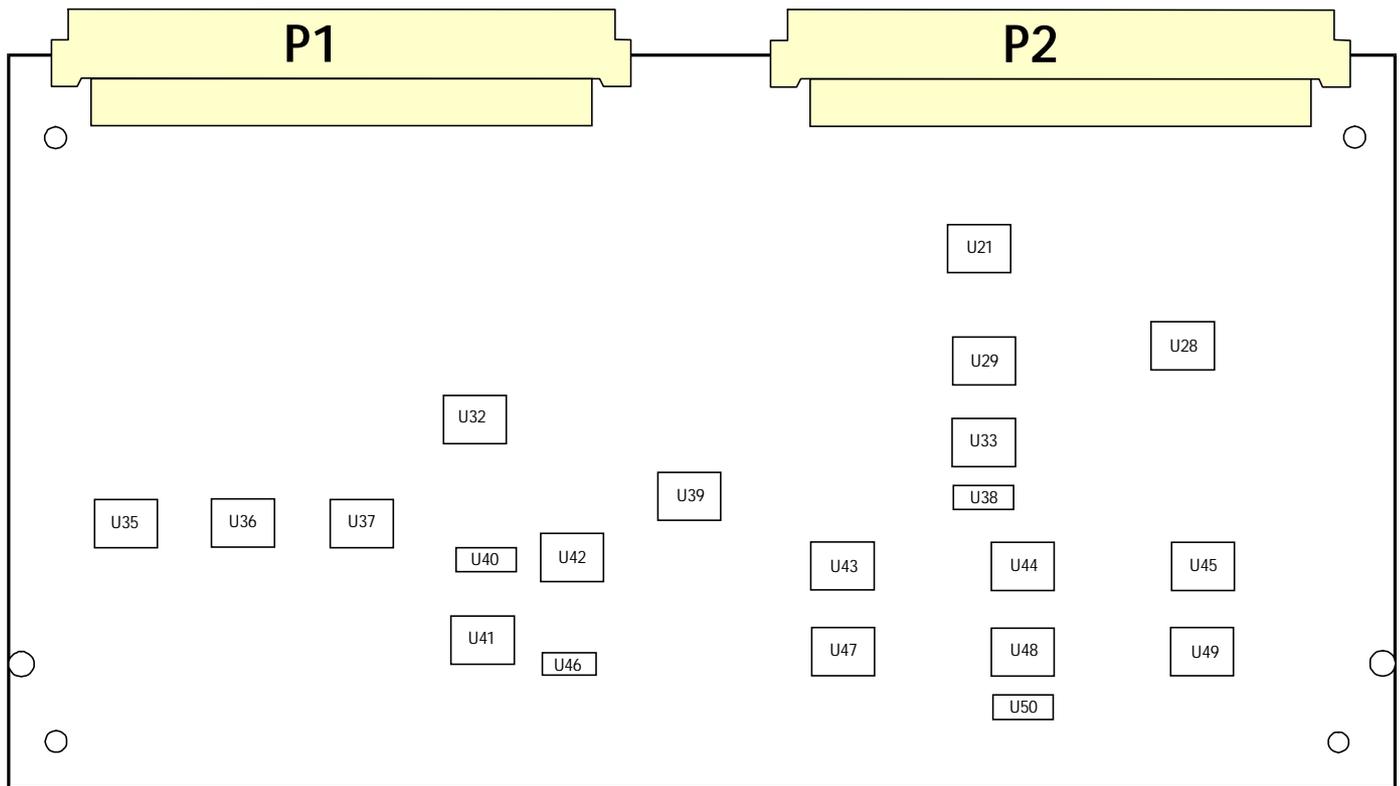


Fig. : Analog Board AB (LLA)

### 2.7.1 Legend Analog Board

#### P1/P2

##### Controller Sensors:

PBS, TSHE, TSE, TSBIC, TSD, TSDE, BICLF, ENDLF, PE, LAFS

##### Supervisor Sensors:

TSD-S, ENDLF-S

##### Controller/Supervisor Sensors:

BL, PBE, PA, PV, PDA

## 2.8 HDF Online Board HOB

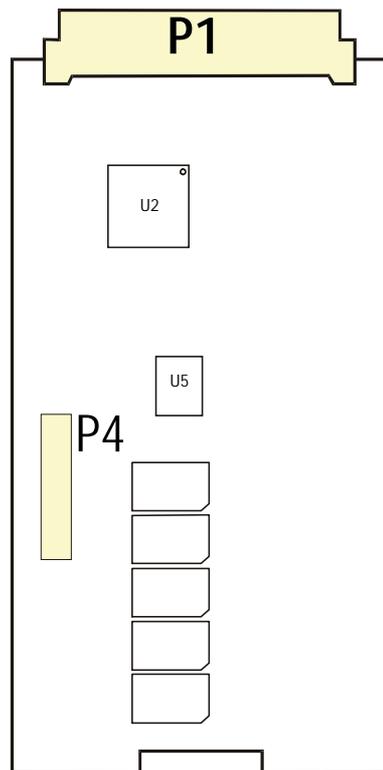


Fig. : HDF Online Board

### 2.8.1 Legend HDF Online Board

**P1:** Sensors: PSABFS, PSAUS, PSPOSS, FEHDFS, FEDFFS

**P4:** Valves VBE, VDFF, VSAA, VSAE, VSB

## 2.9 UF Sub-Rack

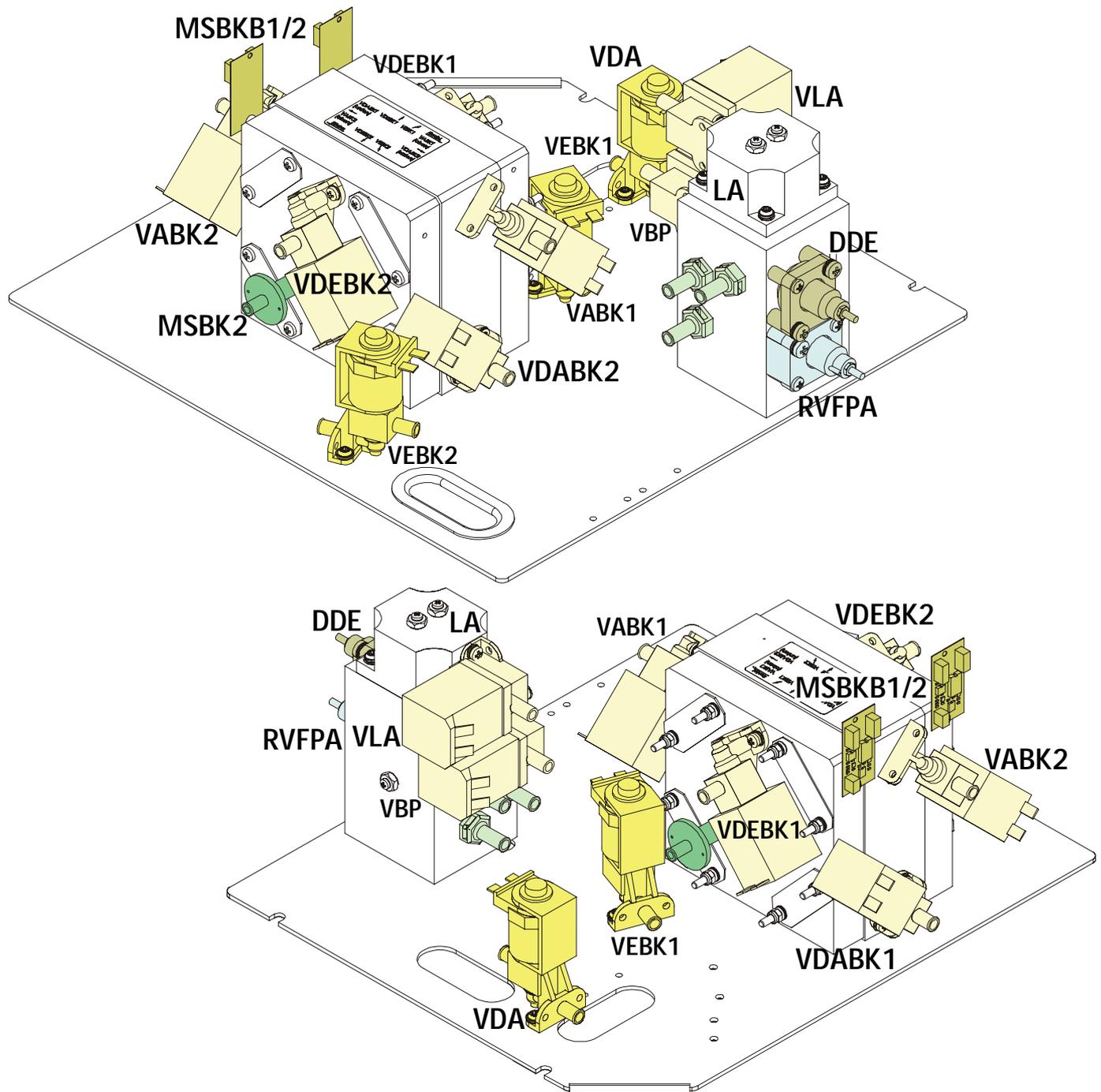


Fig. : UF Sub-Rack

## 2.9.1 Legend UF Sub-Rack

Balance Chamber **BK1/2**Bypass Valve **VBP**Throttle Dialyser Inlet **DDE**Air Separator **LA**Membrane Position Sensor Balance Chamber Board **MSBKB1/2**Membrane Position Sensor Balance Chamber **MSBK1/2**Non-Return Valve Outlet Flow Pump **RVFPA**Outlet Balance Chamber Valve **VABK1**Outlet Balance Chamber Valve **VABK2**Outlet Dialyser Balance Chamber Valve **VDABK1**Outlet Dialyser Balance Chamber Valve **VDABK2**Inlet Dialyser Balance Chamber Valve **VDEBK1**Inlet Dialyser Balance Chamber Valve **VDEBK2**Inlet Balance Chamber Valve **VEBK1**Inlet Balance Chamber Valve **VEBK2**Air Separator Valve **VLA**

## 2.10 UF Sub-Rack HDF Online

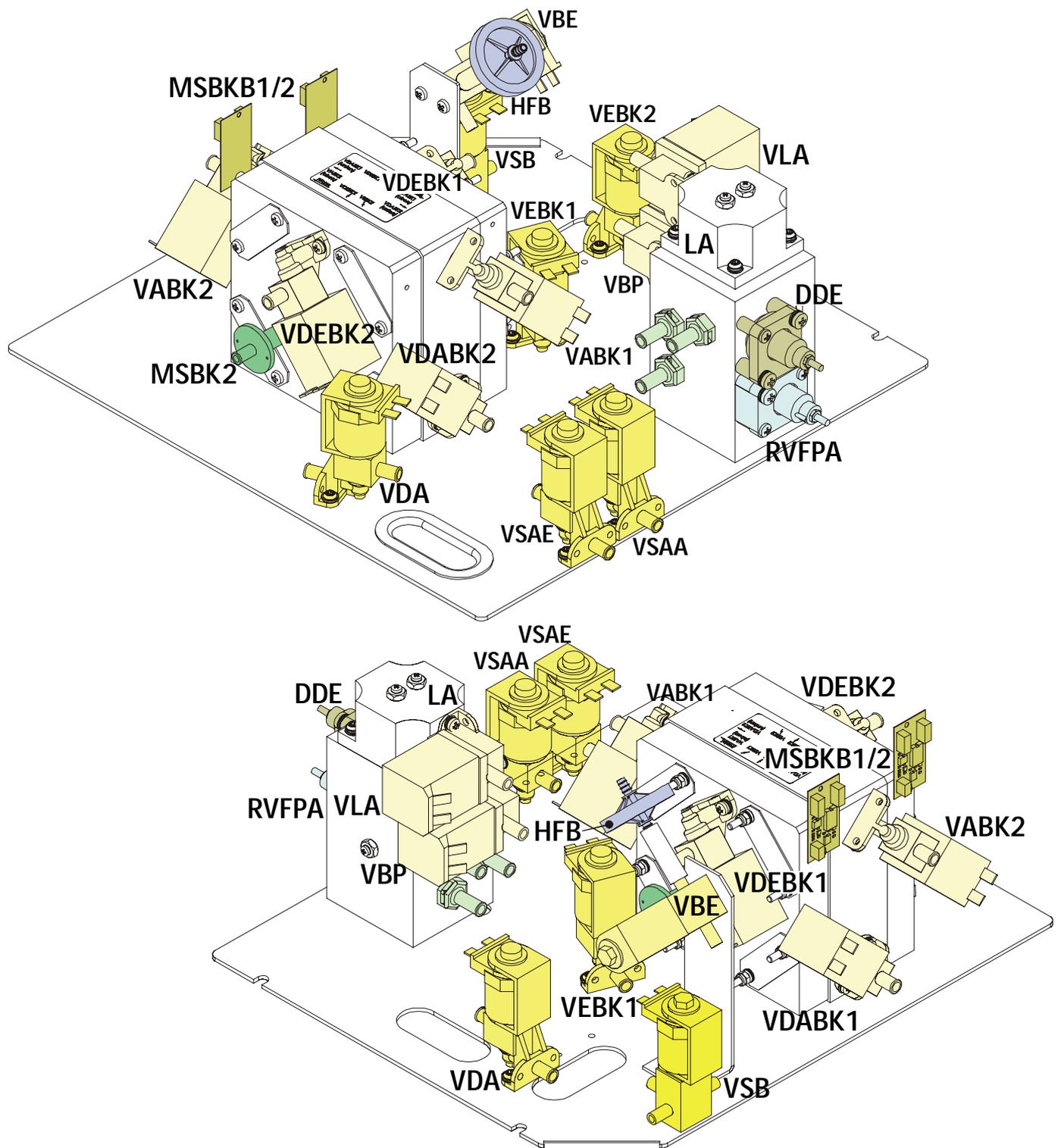


Fig. : UF Sub-Rack HDF Online

## 2.10.1 Legend UF Sub-Rack HDF Online

Balance Chamber **BK1/2**Bypass Valve **VBP**Throttle Dialyser Inlet **DDE**Hydrophobic Vent Filter **HFB**Air Separator **LA**Membrane Position Sensor Balance Chamber Board **MSBKB1/2**Membrane Position Sensor Balance Chamber **MSBK1/2**Non-Return Valve Outlet Flow Pump **RVFPA**Outlet Balance Chamber Valve **VABK1/2**Outlet Dialyser Balance Chamber Valve **VDABK1/2**Inlet Dialyser Balance Chamber Valve **VDEBK1/2**Inlet Balance Chamber Valve **VEBK1/2**Air Separator Valve **VLA****Additional Components for HDF Online:**Substitute Bypass Valve **VSB**Substitute Connection Outlet Valve **VSAA**Substitute Connection Inlet Valve **VSAE**Filter Vent Valve **VBE**

## 2.11 DF Sub-Rack

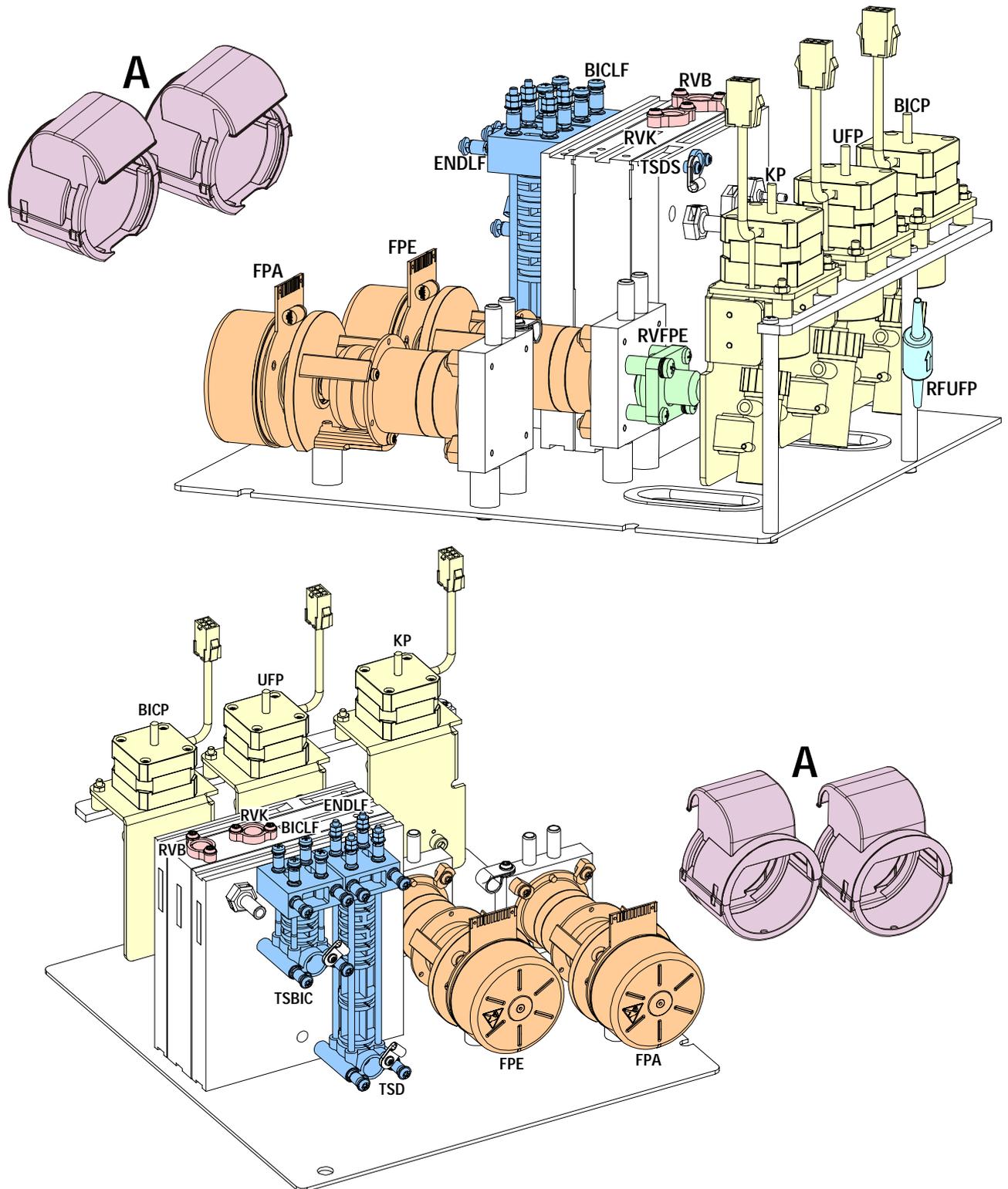


Fig. : DF Sub-Rack

## 2.11.1 Legend DF Sub-Rack

BIC Pump **BICP**Degassing Pressure Sensor **PE**END Conductivity/Supervisor **ENDLF/ENDLF-S**Outlet Flow Pump **FPA** (Motor Cover **A**)Inlet Flow Pump **FPE** (Motor Cover **A**)Concentrate Pump **KP**Bicarbonate Conductivity Sensor **BICLF**Bicarbonate Non-Return Valve **RVB**Non-Return Valve Flow Pump Inlet **RVFPE**Non-Return Valve Concentrate **RVK**Non-Return Valve UF Pump **RFUFP**Bicarbonate Temperature Sensor **TSBIC**Dialysate Temperature Sensor **TSD**Dialysate Supervisor Temperature Sensor **TSD-S**UF Pump **UFP**

2.12 Water Sub-Rack

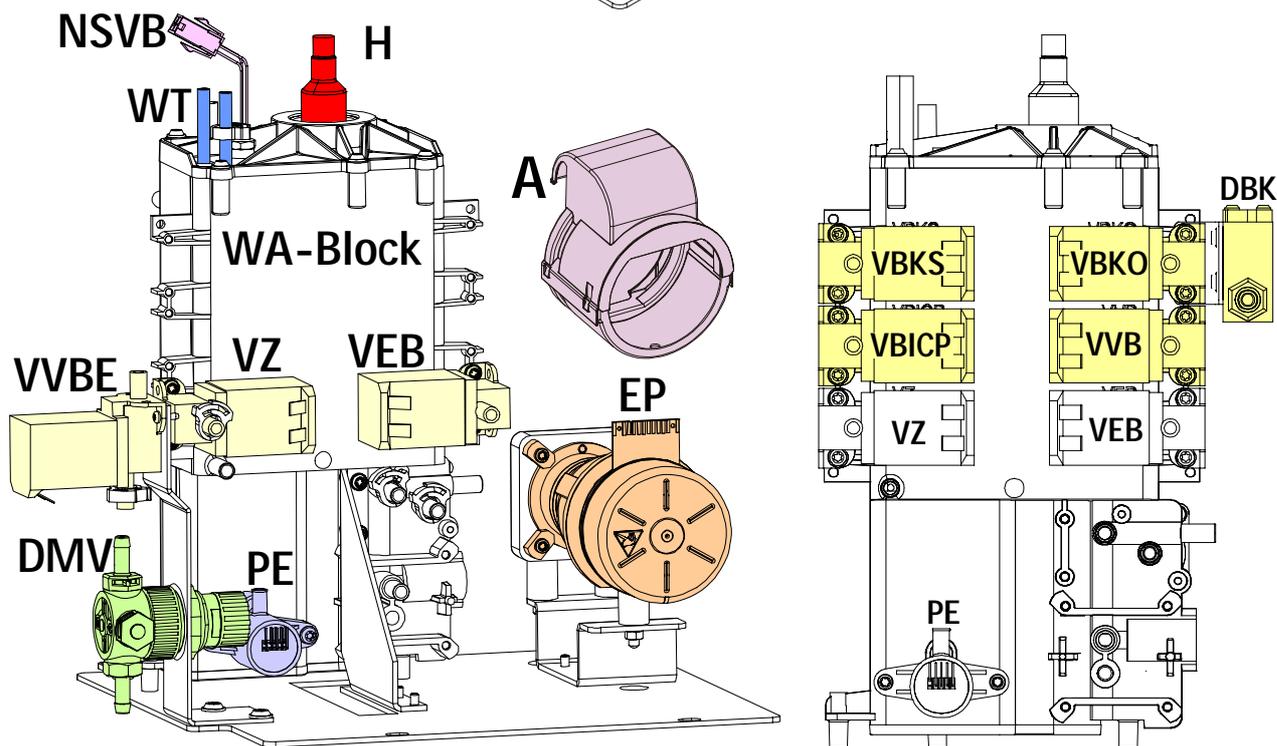
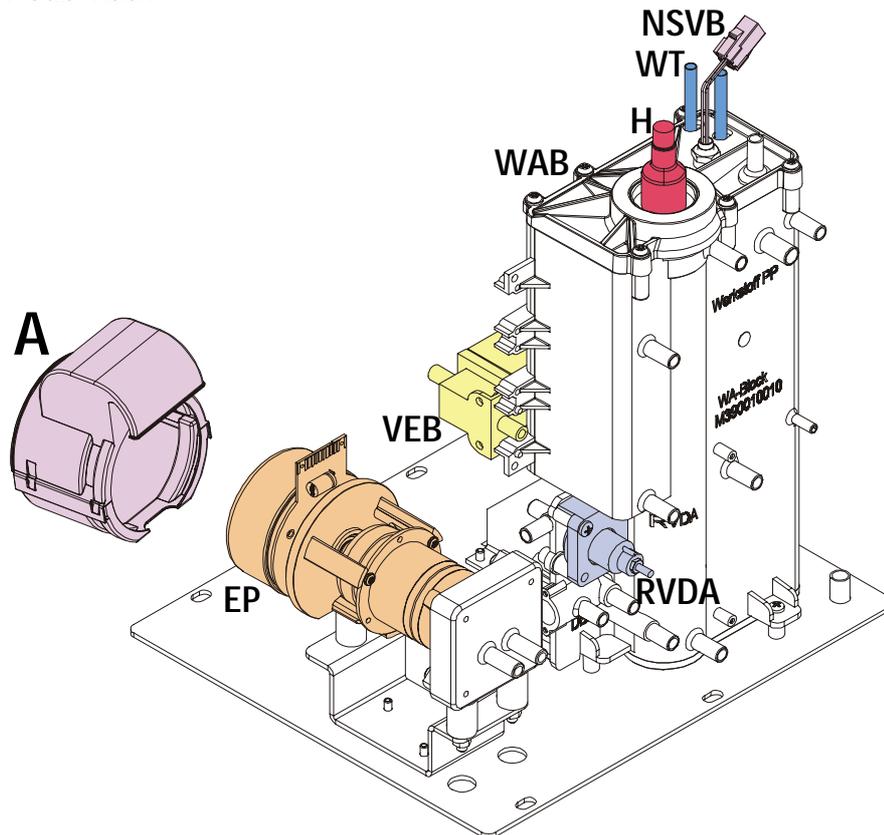


Fig. : Water Sub-Rack

Fig. : Water Block with Valves for BIC Option

2.12.1 Legend Water Sub-Rack

Water Block **WAB** (with integrated Degassing Chamber **EK**, Upline Tank **VB** and Heat Exchanger **WT**)  
 Pressure Reducer **DMV**  
 Degassing Pressure Sensor **PE**  
 Degassing Chamber **EK**  
 Degassing Pump **EP** (Motor Cover **A**)  
 Heater **H**  
 Degassing Temperature Sensor **TSE**  
 Heater Temperature Sensor **TSH**  
 Heater Inlet Temperature Sensor **TSHE**

Upline Tank Inlet Valve **VVBE**  
 Upline Tank **VB**

**Additional Components for Option BIC Cartridge:**  
 Throttle BIC Cartridge Holder **DBK**  
 BIC Concentrate Suction Rod Valve **VBKS**  
 Top BIC Cartridge Valve **VBKS**  
 BIC Pump Valve **VBICP**  
 Upline Tank Valve **VVB**

## 2.13 Rinsing Bridge

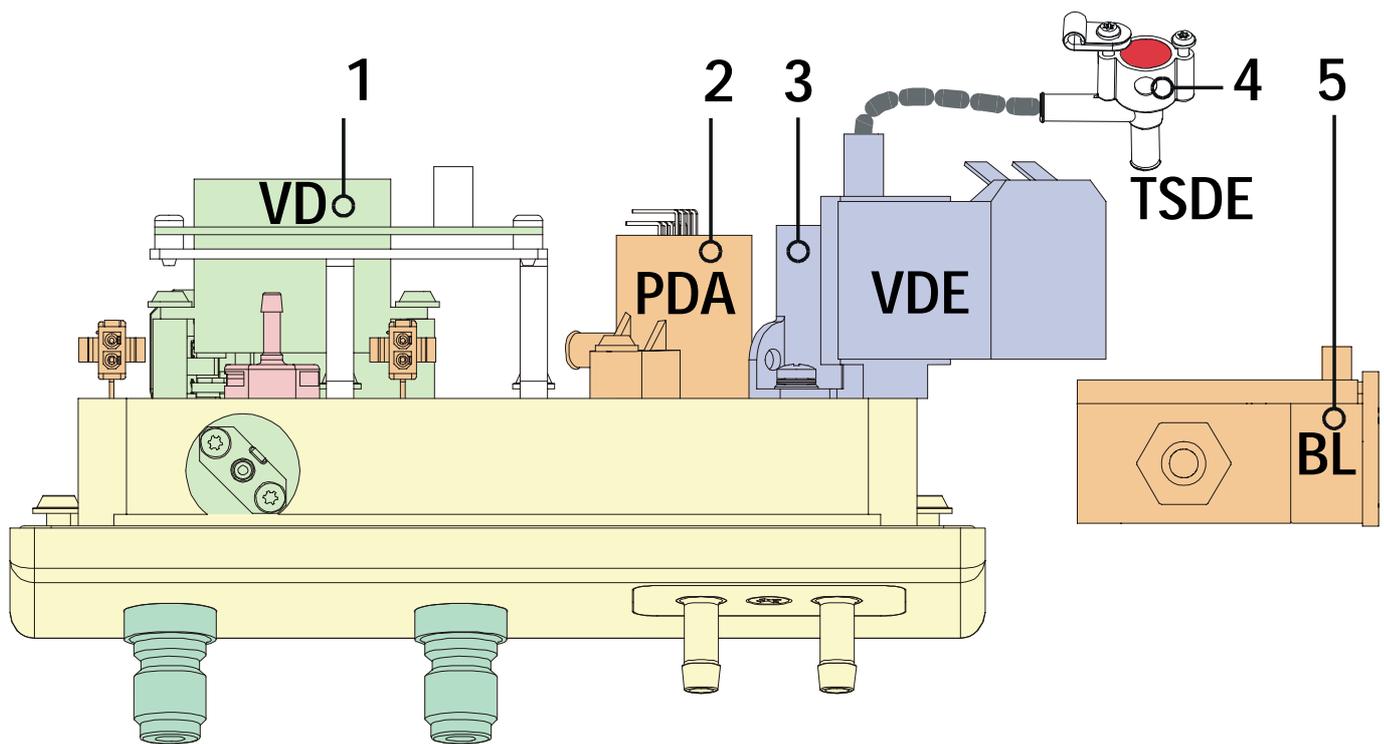


Fig. : Rinsing Bridge

## 2.13.1 Legend Rinsing Bridge

1 Disinfection Valve **VD**2 Pressure Sensor Dialysate Outlet **PDA**3 Dialyser Inlet Valve **VDE**4 Temperature Sensor Dialyser Inlet **TSDE**5 Blood Leak Detector **BL**

## 2.14 Rear Door

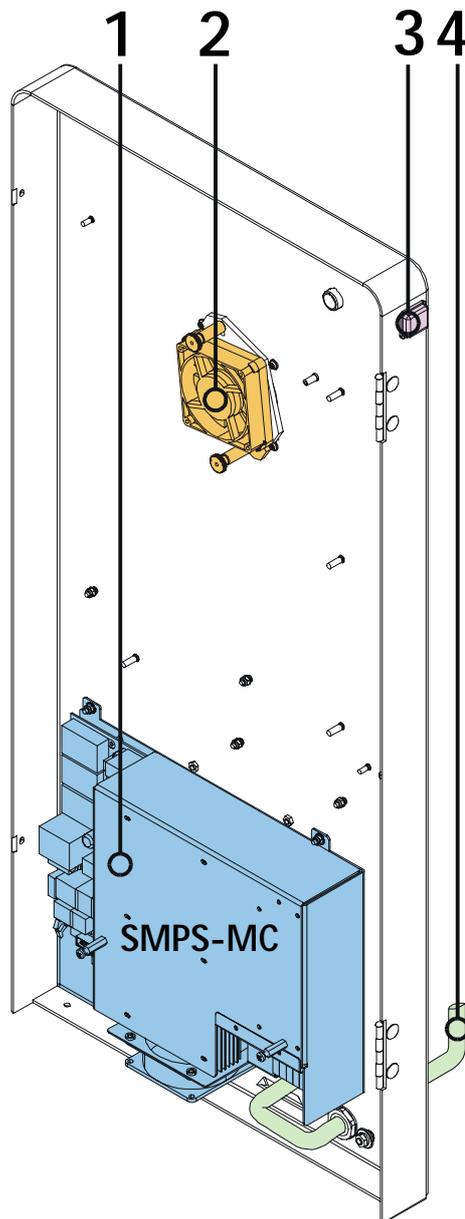


Fig. : Rear Door

## 2.14.1 Legend Rear Door

1. Switch Mode Power Supply Microcontroller **SMPS-MC**  
2. Fan

3. Mains Switch  
4. Mains Cord

## 2.15 Switch Mode Power Supply Microcontroller SMPS-MC

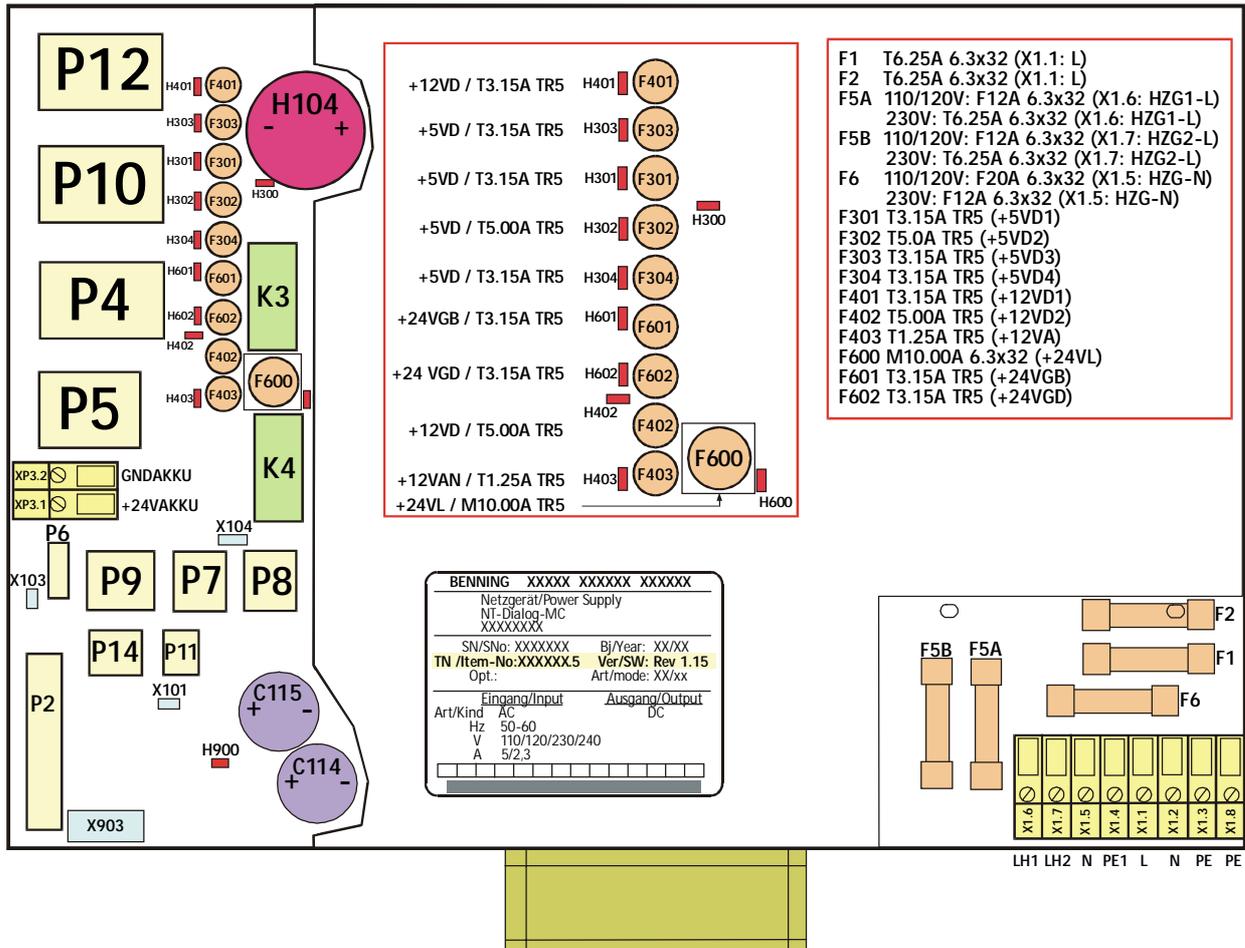


Fig. : Switch Mode Power Supply Microcontroller SMPS-MC

### 2.15.1 Legend Switch Mode Power Supply Microcontroller

X1.1	Mains Input L
X1.2	Mains Input N
X1.3	Mains Input PE
X1.4	Heater PE1
X1.5	Heater N
X1.6	Heater LH1
X1.7	Heater LH2
X1.8	PE
P2	Power Supply Control from Low Level Digital Board/Basic Board
XP3	Battery Connection (Screw Terminal)
P4	24 V Voltages
F1/F2	6.25 AT (6.3x32), Mains Input
F5A/F5B	12 AF (6.3x32), Heater 1800 W (110/120 V)
	6.25 AT (6.3x32), Heater 1800 W (230/240 V)
F6	20 AF (6.3x32), Heater 1800 W (110/120 V)
	12 AF (6.3x32), Heater 1800 W (230/240 V)
F301	3.15 AT (TR5), +5 VD
F302	5.00 AT (TR5), +5 VD

#### Type Plate SMPS-MC

TN/Item-No (Version Number SMPS-MC): e.g. XXXXXX.5

P5	12 V Voltages
P7	ABPM Option
P8	DSI Option
P9	Fan, Mains Switch
P10	Motherboard, Front Panel Board
P12	Options
P13	-
P14	EXT EIN
P101	Service Watchdog
X100	Fan

F303/F304	3.15 AT (TR5), +5 VD
F401	3.15 AT (TR5), +12 VD
F402	5.00 AT (TR5), +12 VD
F403	1.25 AT (TR5), +12 VAN
F600	10 AM (6.3x32), +24 VL
F601/F602	3.15 AT (TR5), +24 VGB

Ver/SW (SW Version): e.g. Rev. 1.15

2.16 TFT Monitor

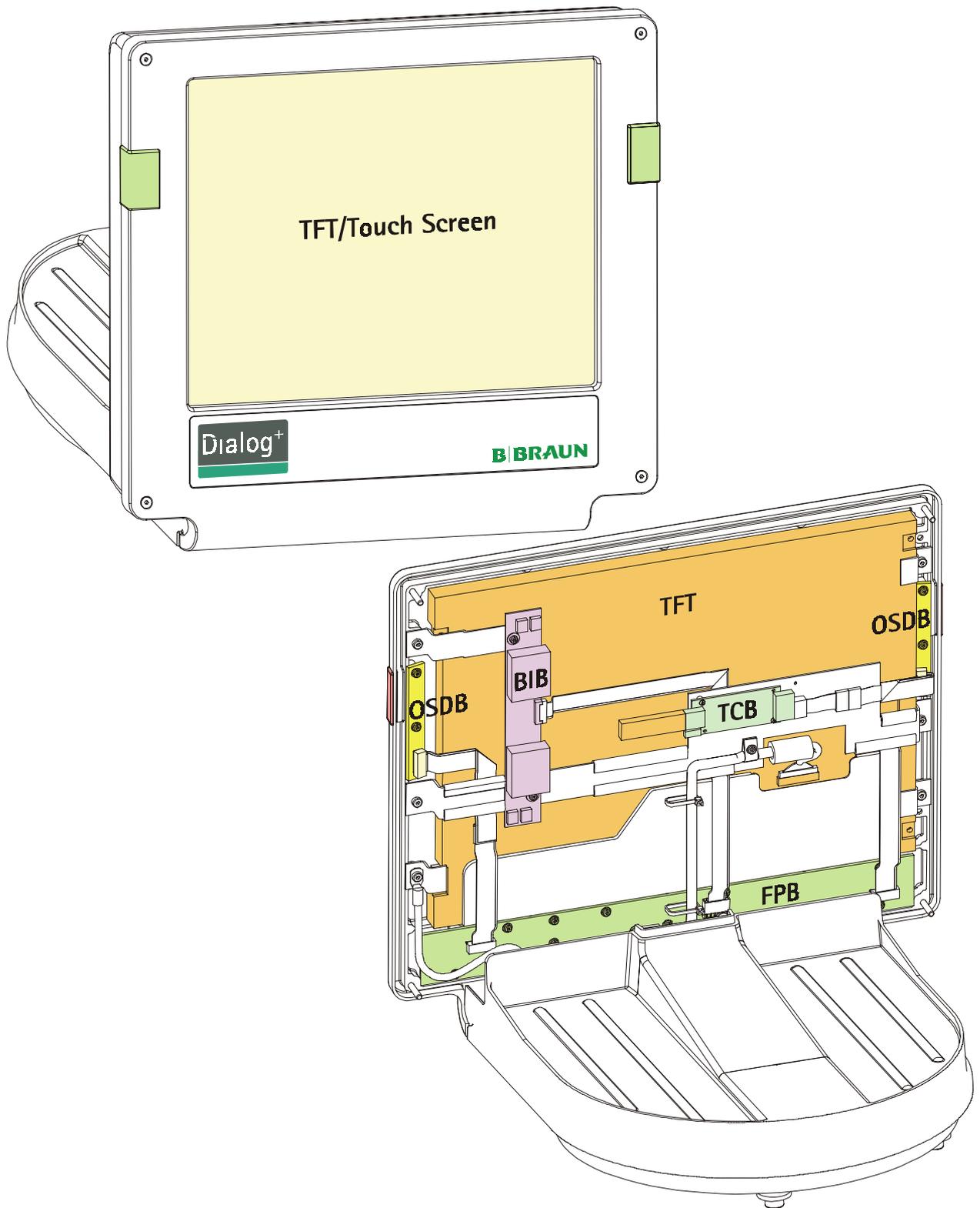


Fig. : TFT Monitor

2.16.1 Legend TFT Monitor

Backlight Inverter Board **BIB**  
 Front Panel Board **FPB**  
 TFT Monitor **TFT**

Optical Status Display Board **OSDB**  
 Touch Controller Board **TCB**  
 Touch Screen

2.17 Front Door

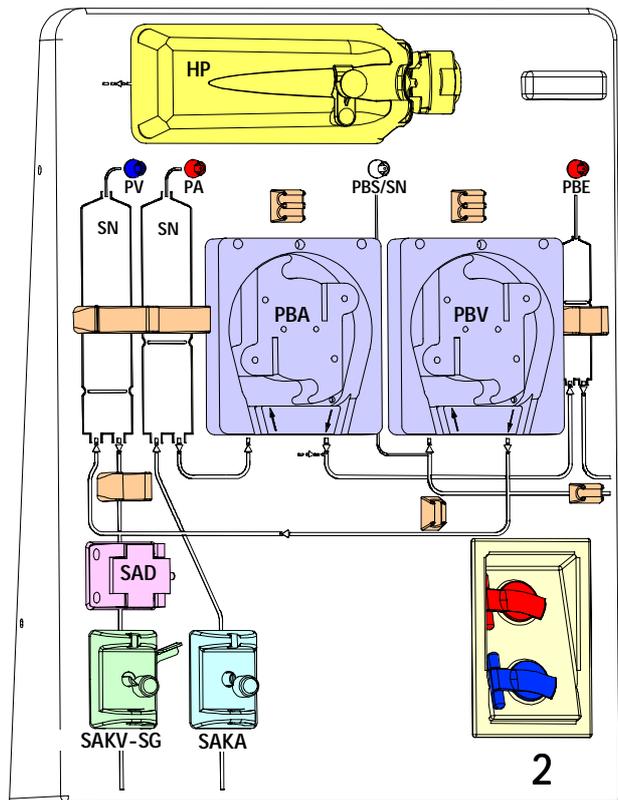


Fig. : Front Door with Double Pump

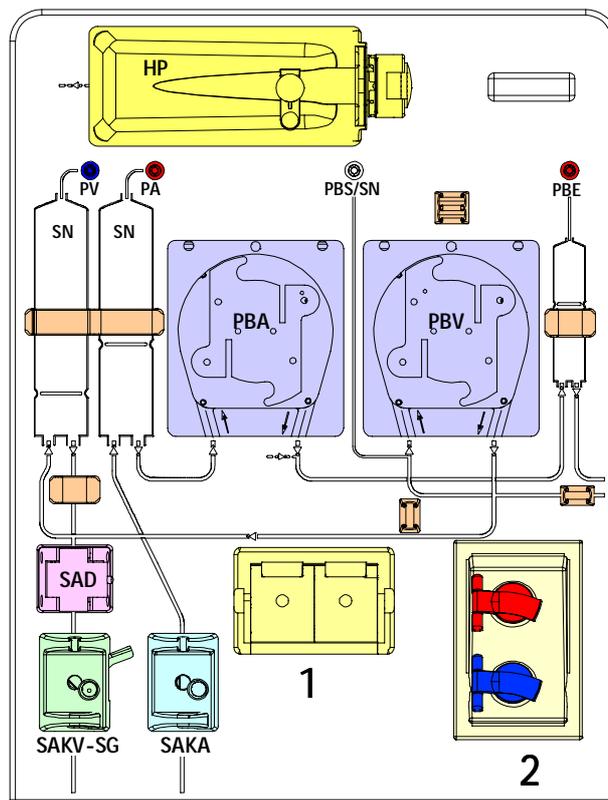


Fig. : Front Door for HDF Online

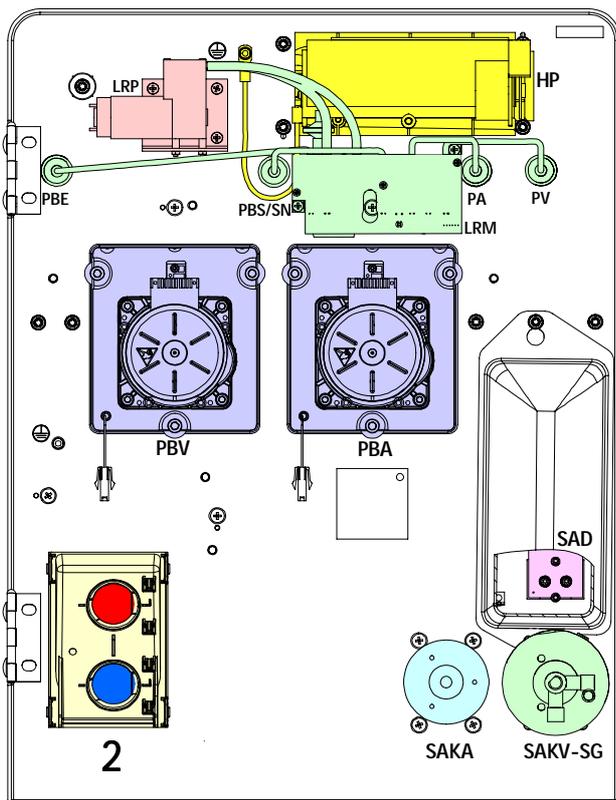


Fig. : Front Door (Inside) with Double Pump

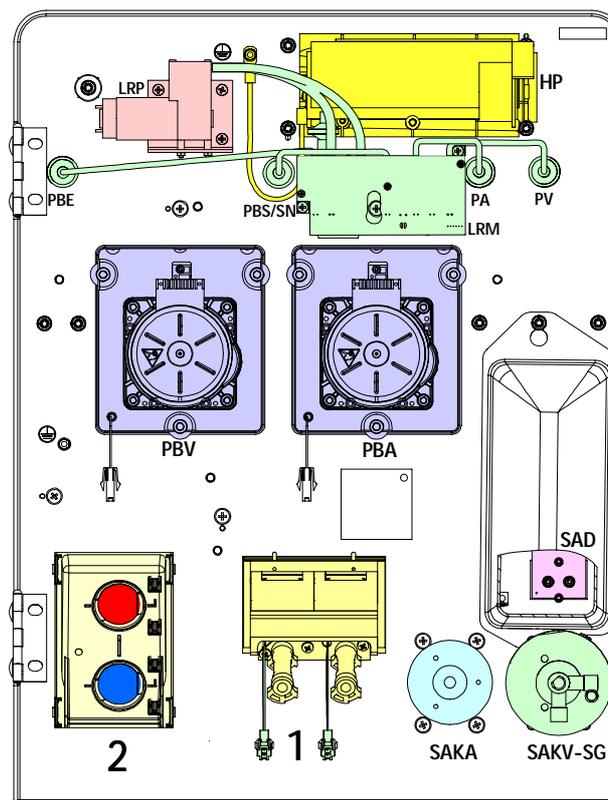


Fig. : Front Door (Inside) for HDF Online

2.17.1 Legend Front Door

- Cover for Suction Rods 2
- Arterial Blood Pump BPA
- Venous Blood Pump BPV
- Pressure Sensor PBE
- Pressure Sensor PBS/SN
- Arterial Pressure Sensor PA
- Venous Pressure Sensor PV

- Heparin Pump Compact HP
- Arterial Tubing Clamp SAKA
- Venous Tubing Clamp Current Closed SAKV-SG
- Safety Air Detector SAD/Venous Red Detector RDV
- Substitution Port 1
- Connection for concentrate Suction Rods 2

## 2.18 Level Regulation Module

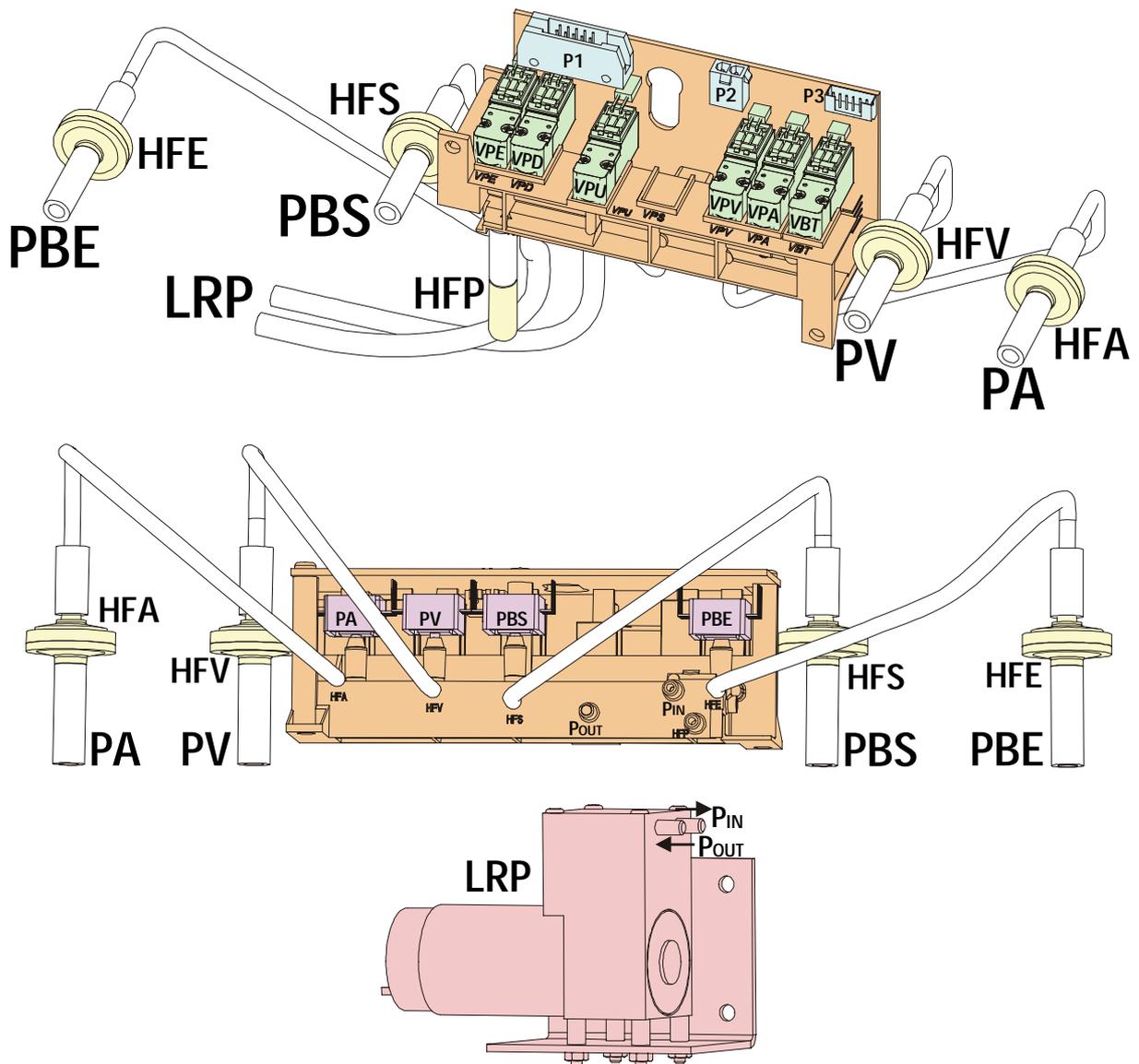


Fig. : Level Regulation Module and Level Regulation Pump

## 2.18.1 Legend Level Regulation Module

There are two level regulation modules with different assemblies, i.e. for machines with a single blood pump and with a double blood pump.

Inlet Pressure Sensor Valve **VPE**  
 Down Pressure Sensor Valve **VPD**  
 Up Pressure Sensor Valve **VPU**  
 Blood Control Pressure Sensor Valve **VPS** (Double Pump)  
 Venous Pressure Sensor Valve **VPV**  
 Arterial Pressure Sensor Valve **VPA**  
 Blood Side Test Pressure Sensor Valve **VBT**

Arterial Hydrophobic Filter **HFA**  
 Venous Hydrophobic Filter **HFV**  
 Blood Control Pressure Hydrophobic Filter **HFS**  
 (Double Pump)  
 Inlet Hydrophobic Filter **HFE**  
 Pump Hydrophobic Filter (Ceramic Filter) **HFP**

Level Regulation Pump **LRP**

## 2.18.2 Flow Diagram Level Regulation Module

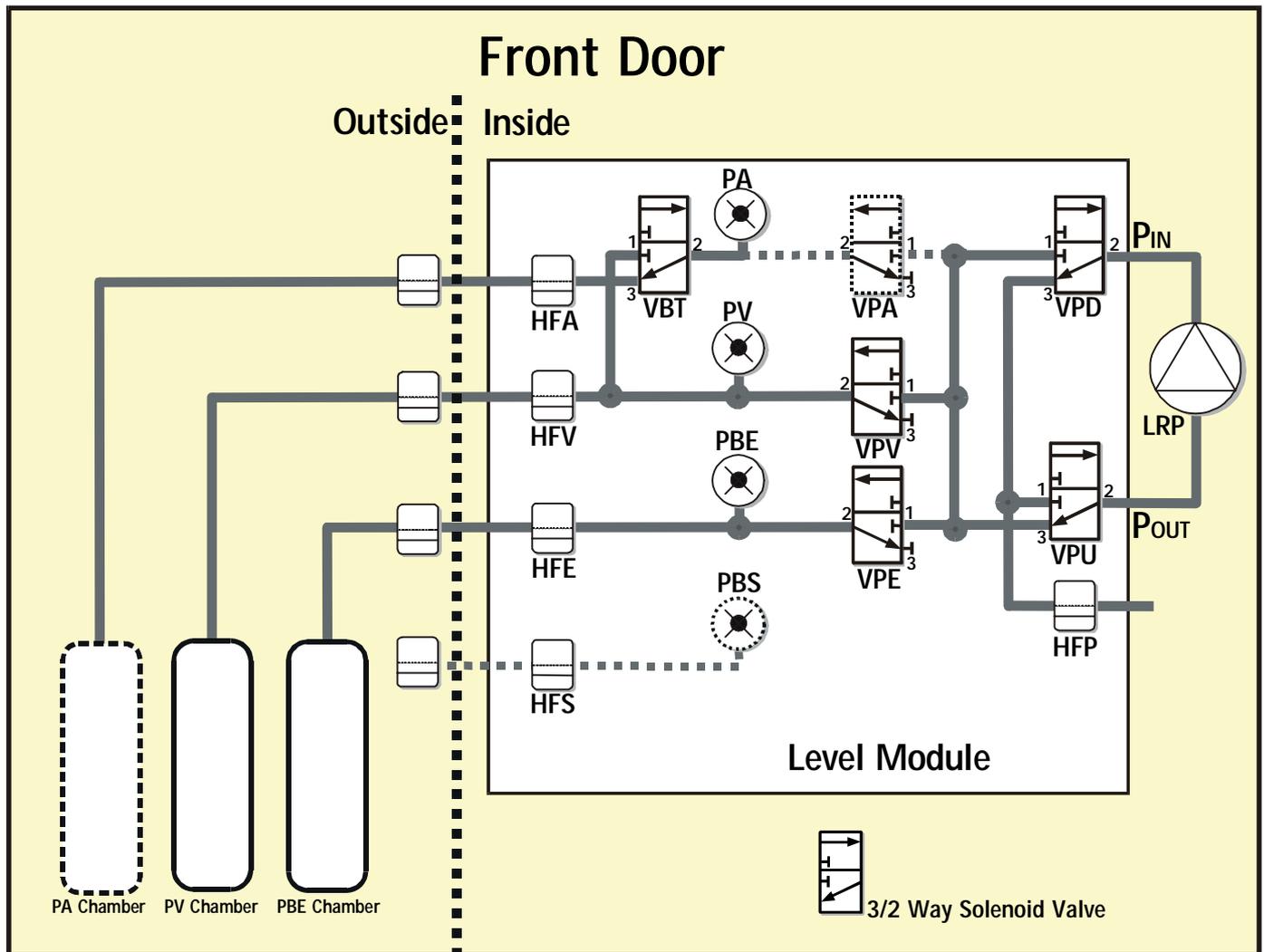


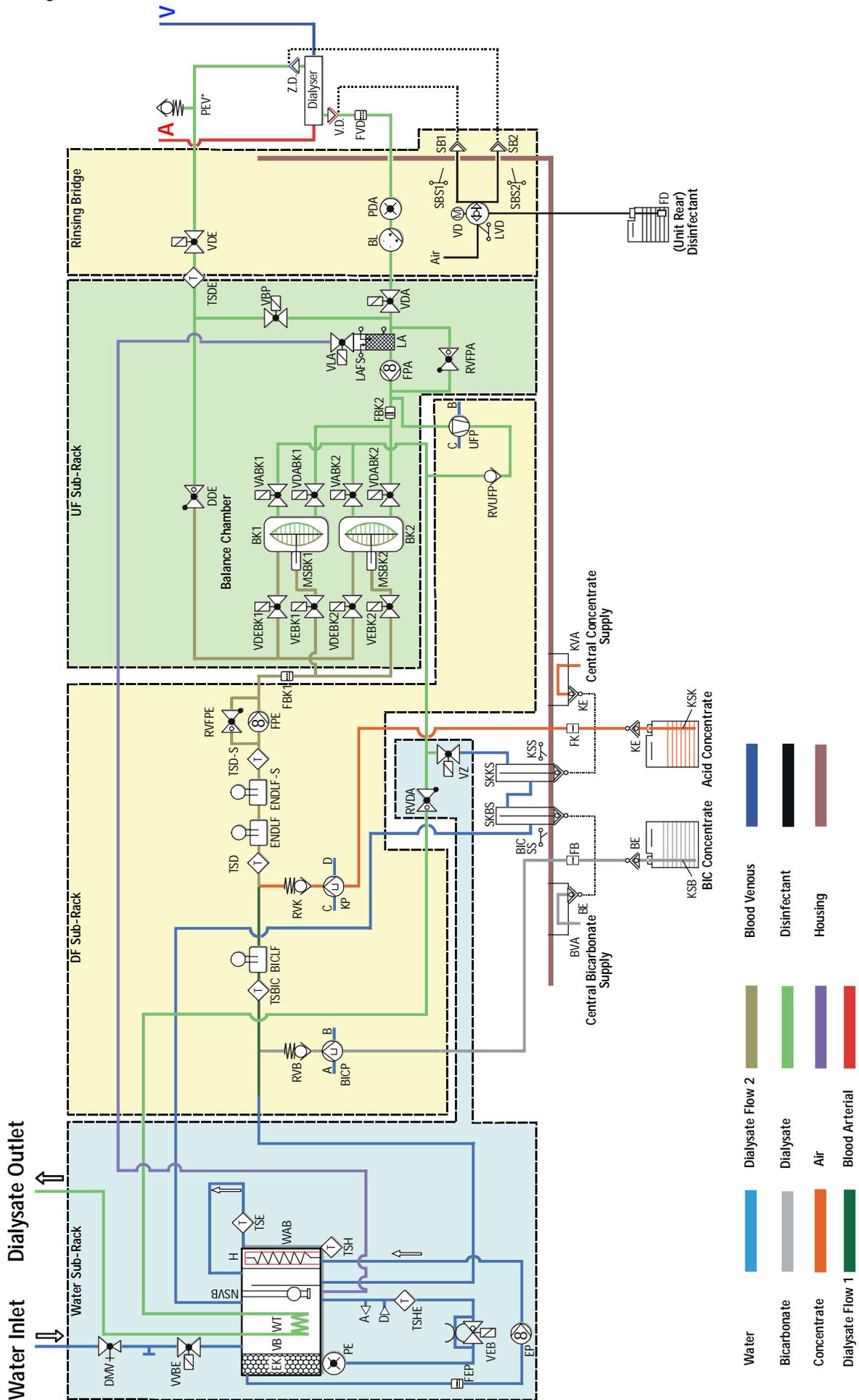
Fig. : Flow Diagram Level Regulation Module

There are two level regulation modules with different assemblies, i.e. for machines with a single blood pump and with a double blood pump. The level regulation module and the level regulation pump **LRP** are assembled on the inside of the rear door. The level regulation module and **LRP** have the following functions;

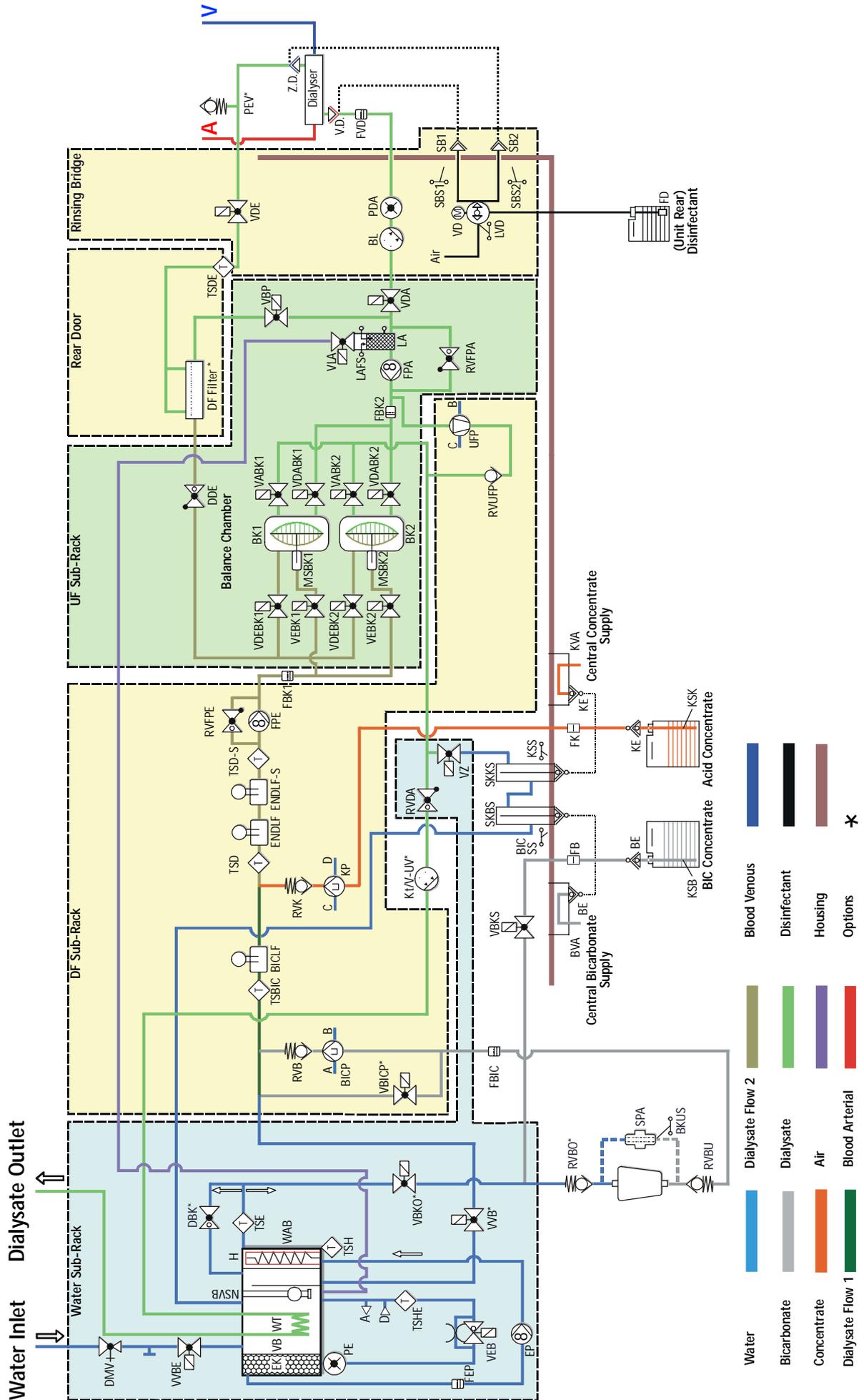
- Setting of the level in all blood side chambers (3/2 way solenoid valves **VPA**, **VPV**, **VPE**, **VPU**, **VPD** and diaphragm pump **LRP**)
- Monitoring of the blood side pressures (pressure sensors **PA**, **PV**, **PBE** and **PBS**)
- Test of the blood side pressure sensors in preparation (3/2 way solenoid valve **VBT**)

2.19 Flow Diagrams

2.19.1 Dialog+



2.19.2 Dialog+ with BIC Option and DF Filter Option





## 2.19.4 Legend Flow Diagram

Abbreviation	Description
BE	Bicarbonate Withdrawal
BICLF	Bicarbonate Conductivity
BICP	Bicarbonate Pump
BICSS	Bicarbonate Rinsing Connection Sensor
BK1	Balance Chamber 1
BK2	Balance Chamber 2
BL	Blood Leak Detector
BPA	Arterial Blood Pump
BPV	Venous Blood Pump
BVA	Bicarbonate Supply Connection (Central Supply)
DBK	Throttle Bicarbonate Cartridge Holder
DDE	Throttle Dialyser Inlet
DMV	Pressure Reducer Valve
EK	Degassing Chamber
ENDLF	END Conductivity
ENDLF-S	END Conductivity Supervisor
EP	Degassing Pump
FB	Filter Bicarbonate
FBIC	Filter Bicarbonate Cartridge
FBK1	Filter Balance Chamber 1
FBK2	Filter Balance Chamber 2
FEP	Filter Degassing Pump
FK	Filter Concentrate
FM	Flowmeter
FPA	Outlet Flow Pump
FPE	Inlet Flow Pump
FVD	Filter from Dialysate
H	Heater
HP	Heparin Syringe Pump
KE	Concentrate Withdrawal
KP	Concentrate Pump
KSB	Bicarbonate Rod
KSK	Concentrate Rod
KSS	Concentrate Rinsing Connector Sensor
KVA	Concentrate Supply Connector (Central Supply)
LA	Air Separator
LAFS	Air Separator Level Sensors
LVD	Light Barrier Disinfection Valve
MSBK1	Membrane Position Sensor Balance Chamber 1
MSBK2	Membrane Position Sensor Balance Chamber 2
NSVB	Level Sensor Upline Tank
PA	Arterial Pressure Sensor
PBE	Pressure Sensor Blood Inlet
PBS	Blood Pressure Control Sensor
PDA	Pressure Sensor Dialysate Outlet
PE	Degassing Pressure Sensor

PV	Venous Pressure Sensor
RDV	Venous Red Detector
RVB	Throttle Bicarbonate
RVDA	Throttle Dialysate Valve
RVFPA	Throttle Flow Pump Outlet
RVFPE	Throttle Flow Pump Inlet
RVK	Throttle Concentrate
RFUFP	Throttle Ultrafiltration Pump
SAD	Safety Air Detector
SAKA	Arterial Tubing Clamp
SAKV-SD	Venous Tubing Clamp Currentless Closed
SBS1	Rinsing Bridge Connector Sensor 1
SBS2	Rinsing Bridge Connector Sensor 2
TSBIC	Bicarbonate Temperature Sensor
TSD	Dialysate Temperature Sensor
TSDE	Dialyser Inlet Temperature Sensor
TSD-S	Dialysate Temperature Sensor Supervisor
TSE	Degassing Temperature Sensor
TSH	Thermal Fuse Heater Element
TSHE	Heater Inlet Temperature Sensor
UFP	Ultrafiltration Pump
VABK1	Outlet Valve Balance Chamber 1
VABK2	Outlet Valve Balance Chamber 2
VB	Upline Tank
VBICP	Bicarbonate Pump Valve
VBKO	Bicarbonate Cartridge Holder Top Valve
VBKS	Bicarbonate Cartridge Holder Concentrate Rod Valve
VBP	Bypass Valve
V.D.	Dialyser Coupling (from Dialysate)
VD	Disinfection Valve
VDA	Dialyser Outlet Valve
VDABK1	Dialyser Outlet Valve Balance Chamber 1
VDABK2	Dialyser Outlet Valve Balance Chamber 2
VDE	Dialyser Inlet Valve
VDEBK1	Dialyser Inlet Valve Balance Chamber 1
VDEBK2	Dialyser Inlet Valve Balance Chamber 2
VEB	Degassing Bypass Valve
VEBK1	Inlet Valve Balance Chamber 1
VEBK2	Inlet Valve Balance Chamber 2
VLA	Air Separator Valve
VVB	Upline Tank Valve
VVBE	Upline Tank Inlet Valve
VZ	Circulation Valve
WA	Water Block
WT	Heat Exchanger
Z.D.	Dialyser Coupling (to Dialysate)

2.20 Description Flow Diagram

The flow diagram can be divided into six sections:

- Water Inlet Section with Water Block
- Degassing Circuit with Temperature System
- Dialysate Processing
- Balance Chamber
- Ultrafiltration
- Rinsing Bridge

2.20.1 Water Inlet Section with Water Block

The water inlet section has the following components

- Pressure Reducer Valve **DMV**
- Upline Tank Inlet Valve **VVBE** (2/2 way valve)
- Water Block **WAB** with integrated Upline Tank **VB**, Level Sensors Water Block **NSVB**, Heat Exchanger **WT**, 2 double-stage Heater **H**, Degassing Chamber **EK**

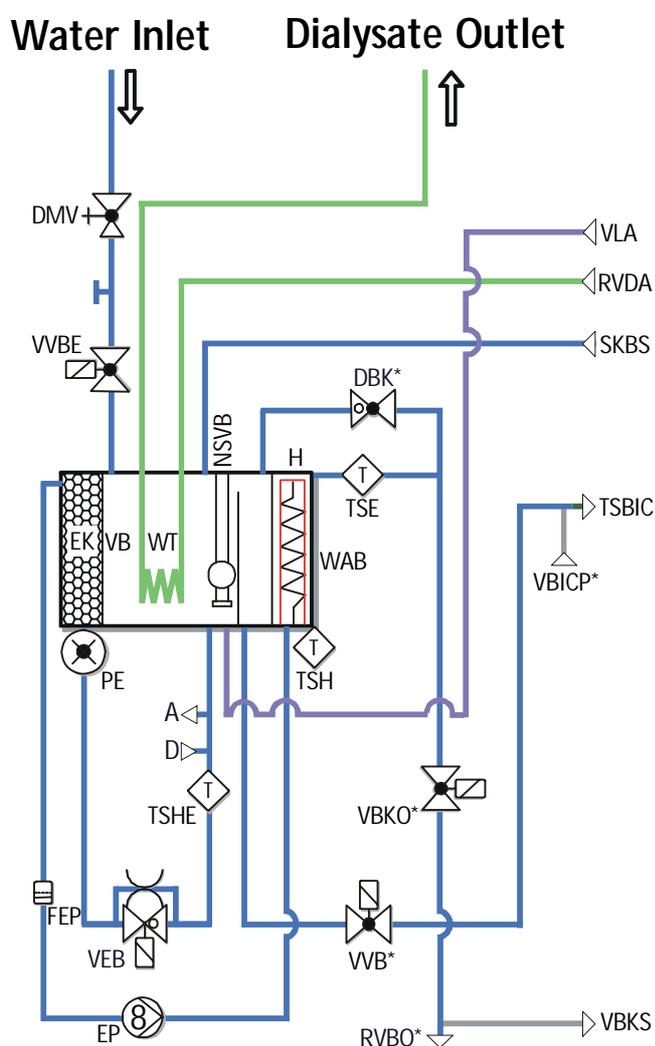


Fig. : Water Inlet with Water Block

**Pressure Reducer Valve DMV**

The pressure reducer valve DMV limits the pressure of the inlet water (e.g. osmosis water) to  $0.9 \pm 0.1$  bar.

**Upline Tank Inlet Valve VVBE**

The valve VVBE is time-delayed controlled via the level sensor NSVB (top) in the upline tank VB. The delay time depends on the dialysate flow.

**Level Sensors Upline Tank NSVB**

The level sensors are mounted in the upline tank VB.

**NSVB top:**

closed - VVBE is closed

**NSVB bottom (monitoring low water level):**

- closed (alarm) - Water inlet is disturbed
- Heater is switched off
- Pumps are stopped

**Heat Exchanger WT**

The cold inlet water is warmed up via the heat exchanger WT. Thereby the heat consumption to heat up the water is reduced.

### 2.20.2 Degassing Circuit with Temperature System

The degassing circuit with temperature system has the following components:

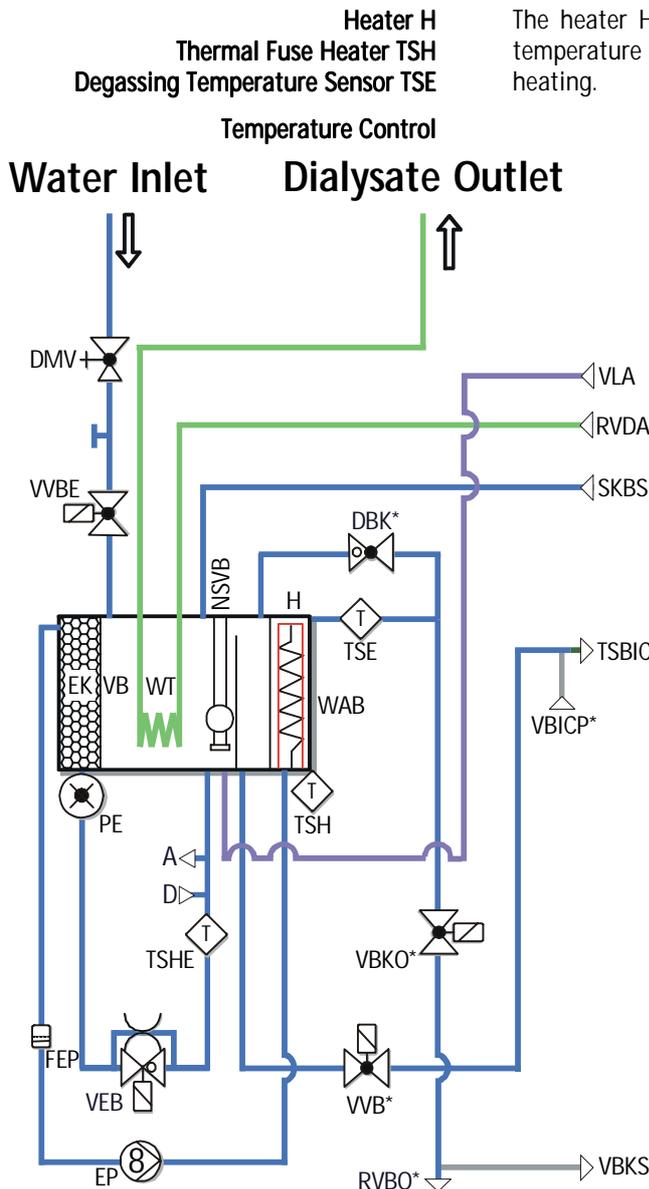
- Degassing Bypass Valve **VEB**
- Degassing Pressure Sensor **PE**
- Degassing Chamber **EK**
- Degassing Pump **EP**
- Thermal Fuse Heater **TSH**
- Temperature Sensor Heater Inlet **TSHE**
- Double-Stage Heater **H**
- Degassing Temperature Sensor **TSE**

Degassing Bypass Valve **VEB**  
 Degassing Pressure Sensor **PE**  
 Degassing Pump **EP**

The degassing bypass valve VEB, pressure sensor PE, degassing chamber EK and degassing pump EP produce and measure a negative pressure respectively. The negative pressure is produced to separate the dissolved gas from the water.

If the degassing bypass valve VEB is closed, the flow path is reduced by means of a bypass constriction (orifice, throttle principle) in the valve. VEB is opened during disinfection to avoid this constriction. The desired negative pressure is gained by controlling the degassing pump EP. The value of the negative pressure is approx. -500 mmHg and thus always higher than the lower pressure of the dialysate behind the dialyser. The degassing pump works with constant speed, which is determined by the dialysate flow, unless the negative pressure is insufficient. Then the speed of EP is increased.

The heater H has an integrated thermal fuse TSH as a thermal cut-off. The temperature sensor TSE measures the actual temperature at the outlet of the heating.



The required heat output is determined with the temperature sensors TSE and TSHE.

A detailed description for the double-stage heater control is described in the paragraph for the switch mode power supply microcontroller SMPS-MC.

Fig. : Degassing Circuit with Temperature System

## 2.20.3 Dialysate Processing

The dialysate processing has the following components:

- Bicarbonate Concentrate Pump **BICP**
- Bicarbonate Throttle **RVB**
- Bicarbonate Temperature Sensor **TSBIC**
- Bicarbonate Conductivity **BICLF**
- Concentrate Pump **KP**
- Concentrate Throttle **RVK**
- END Conductivity **ENDLF**
- END Conductivity Supervisor **ENDLFS**
- Dialysate Temperature Sensor **TSD**
- Dialysate Temperature Sensor Supervisor **TSDS**
- Inlet Flow Pump **FPE**
- Inlet Flow Pump Throttle **RVFPE**
- Dialyser Inlet Temperature Sensor **TSDE**

The main components of the dialysate preparation are the bicarbonate concentrate pump BICP and the concentrate pump KP, with the conductivity cells BICLF and ENDLF and a flow pump FPE. The flow pump FPE delivers the dialysate. The bicarbonate concentrate, which is added via the bicarbonate pump BICP, is measured by the conductivity measurement cell BICLF. Thereby the pump can control the given conductivity set-point value.

The concentrate or acid concentrate addition has the same working principle. The nonreturn valves RVB and RVK stabilise the dosage of the bicarbonate and concentrate.

The temperature sensors TSBIC, TSD and TSDE are responsible for:

- the temperature compensation of the conductivity measurement and
- the temperature measurement TSD after the addition of cold concentrate (second measurement sensor for temperature system) and
- the temperature measurement TSDE directly before the dialysate leaves the machine and thus for the compensation of the temperature loss.

The conductivity sensor ENDLFS is an independent monitoring unit (supervisor). The geometry of the ENDLFS sensor is different (but has the same cell constant) than the ENDLF sensor of the controller. Thereby a deposit on the sensor can be identified. The temperature compensation is carried out by the temperature sensor TSDE. The temperature sensor additionally monitors the dialysate flow temperature for the supervisor. The ENDLFS and TSDE sensors have no influence on the respective control.

The throttle RVFPE prevents a high pressure build-up and thus a bursting of tubing if the flow path is blocked behind FPE. If the set pressure is reached RVFPE is opened and the fluid can circulate.

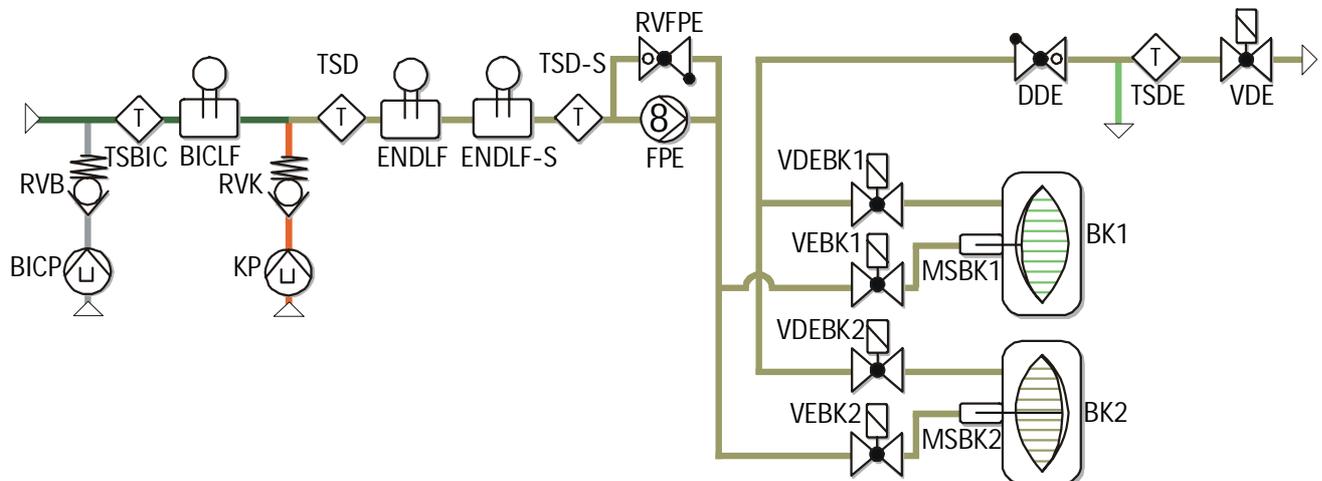


Fig. : Dialysate Processing

2.20.4 Central Bicarbonate and Concentrate Supply (Option)

A canister or central supply can be selected via the bicarbonate and concentrate supply connection BVA and KVA.

The flow pump FPE guarantees a continuous control of the desired dialysate flow into the balance chambers.

The flow rate is determined by the filling time of the balance chamber. The flow pump FPE is controlled via the predetermined volume of the chamber and a continuous detection of the position of the membrane.

2.20.5 BIC Cartridge Holder (Option)

- DBK Throttle Bicarbonate Cartridge Holder**  
DBK ensures a constant pressure (approx. 300 mmHg) during the filling of the bicarbonate cartridge.
- VBKO Bicarbonate Cartridge Holder Top Valve**  
The bicarbonate cartridge is filled to the limit pressure (300 mmHg) after VBKO opens.
- VBKS Bicarbonate Cartridge Holder Concentrate Rod Valve**  
The bicarbonate cartridge is vented during preparation and in therapy, i.e. VBKO closes and VBKS opens for a short time. This is repeated in regular intervals during therapy. VBKS is opened after the end of the therapy to empty the bicarbonate cartridge.
- VBICP Bicarbonate Pump Valve**  
VBICP opens shortly after the BIC cartridge was filled, to rinse away the initial bicarbonate. VBICP switches the BIC pump in bypass after the end of the therapy to empty the bicarbonate cartridge.
- VVB Upline Tank Valve**  
VVB cuts off the main flow after the end of the therapy to empty the bicarbonate cartridge via FPE (VBICP and VBKS are opened).

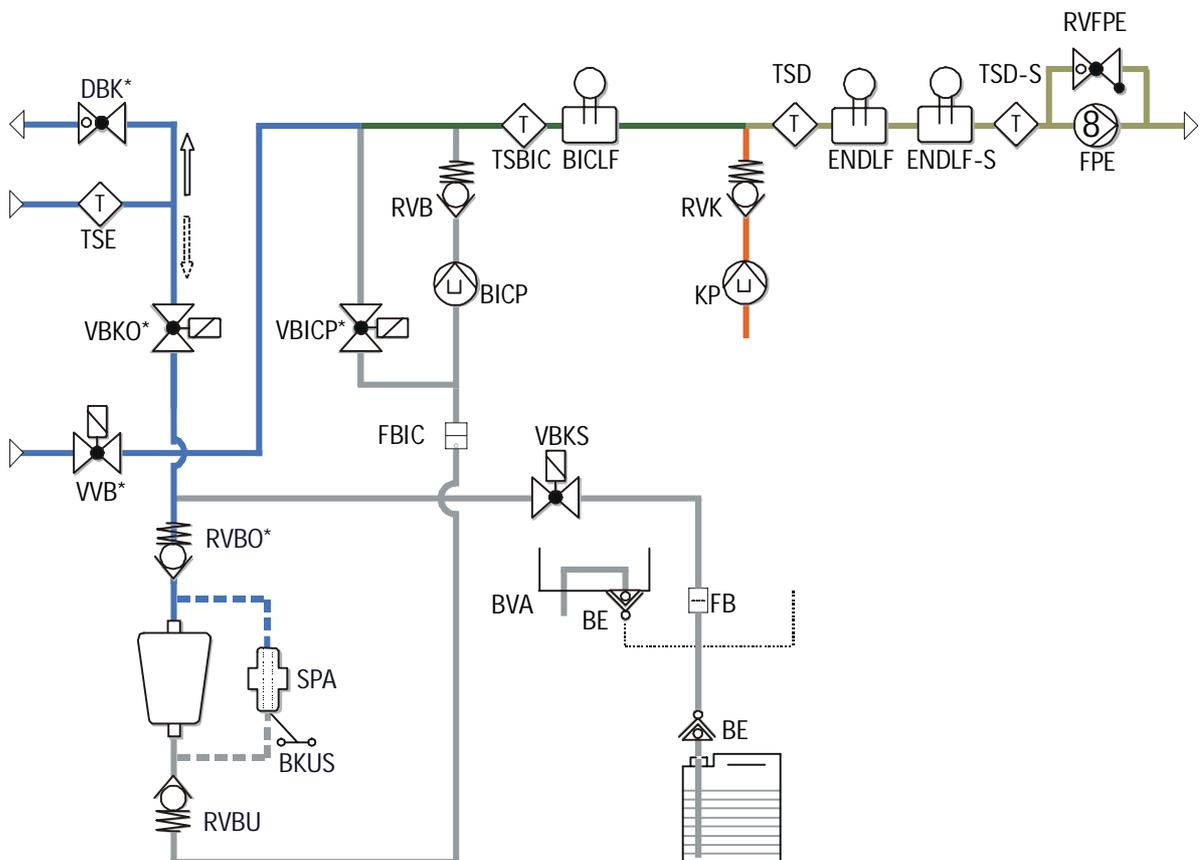


Fig. : BIC Cartridge Holder (Option)

## 2.20.6 Balance Chamber System

The balance chamber system has the following components:

- Balance Chamber **BK1**
- Balance Chamber **BK2**
- Balance Chamber Dialyser Inlet Valve **VDEBK1** and **VDEBK2**
- Balance Chamber Inlet Valve **VEBK1** and **VEBK2**
- Balance Chamber Membrane Position Sensor **MSBK1** and **MSBK2**
- Balance Chamber Dialyser Outlet Valve **VDABK1** and **VDABK2**
- Balance Chamber Outlet Valve **VABK1** and **VABK2**

The measurement and control of the ultrafiltration rate is accomplished by the double balance chamber system and the ultrafiltration pump UFP.

Both balance chambers BK1 and BK2 are identical. The chambers have flexible membranes, which can be moved to both sides. The membranes divide the chambers into two sub-compartments. The flow direction is defined by the membranes and the eight solenoid valves. The position of the membranes is measured by inductive membrane position sensors MSBK1 and MSBK2. The membrane position sensors (ferrites) are connected to the membranes and each move in a respective coil MSBK1 and MSBK2.

## 2.20.7 Working Principle Balance Chamber System

### Phase 1:

The balance chamber BK1 is filled with dialysate at the beginning of phase 1. The membrane is in right position. The valves VDEBK1 and VDABK1 are opened. The balance chamber BK1 is filled by the outlet flow pump FPA with used dialysate, via valve VDABK1. Simultaneously the fresh dialysate is removed from the balance chamber BK1 via valve VDEBK1. Phase 1 is completed and the membrane is in left position (see figure).

The balance chamber BK2 is filled with fresh dialysate during this period. The used dialysate from the previous phase 2 is drained (see description phase 2).

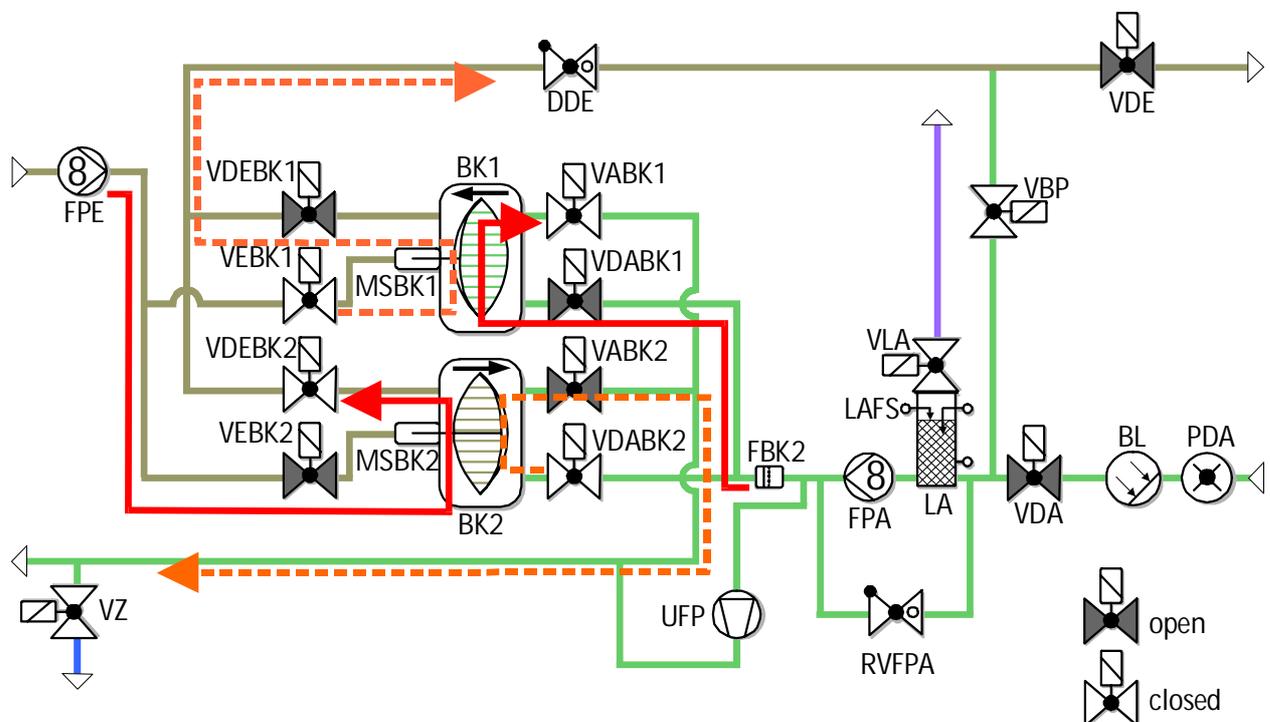


Fig. : Phase 1 Balance Chamber

**Phase 2:**

After phase 1 is completed there is an automatic switch to the filled balance chamber BK2 to obtain a constant flow in the dialyser. The complete cycle is repeated in phase 2, i.e. valves VDEBK2 and VDABK2 are opened. The balance chamber BK2 is filled via valve VDABK2. Simultaneously the dialysate is drained from the balance chamber BK2 via valve VDEBK2. Phase 2 is completed and the membrane is in left position (see figure).

Simultaneously the balance chamber BK1 is filled with fresh dialysate. Therefore valve VEBK1 is opened. Valve VABK1 is also opened, to initiate the flow path for the used dialysate to the drain. The membrane moves to the right position.

The outlet fluid volume is equal to the returned fluid volume, due to the closed balance chamber system

The fluid volume removed from the closed system via the ultrafiltration pump UFP is replaced from the blood in the dialyser and equals the precise ultrafiltration volume.

The system is initialised in preparation, i.e. the membrane sensors are automatically calibrated and the speed of the flow pumps FPE and FPA are determined. Thus a synchronisation of the membranes is guaranteed, and the pump speeds for the desired flow are determined.

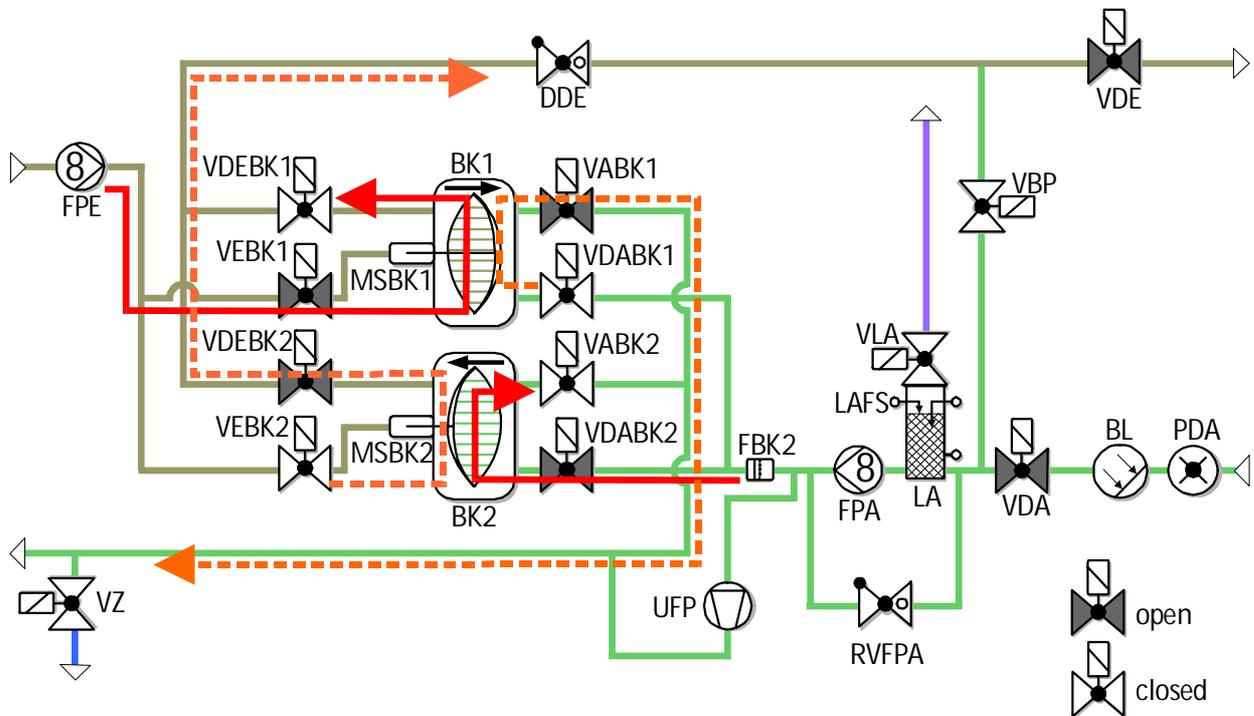


Fig. : Phase 2 Balance Chamber

## 2.20.8 Ultrafiltration and Rinsing Bridge

The main flow path and bypass have the following components:

- Dialyser Inlet Throttle **DDE**
- Dialyser Inlet Valve **VDE**
- Dialyser Outlet Valve **VDA**
- Bypass Valve **VBP**
- Outlet Flow Pump **FPA**

The flow path for the main flow and bypass are determined by the valves VDE, VDA and VBP. The built up flow from the flow pump FPA is stabilised by the throttle DDE. Valves VDE and VBP are closed for sequential therapy (ultrafiltration without dialysate fluid flow). The ultrafiltrate removal is carried out by the ultrafiltration pump UFP.

Further components are:

- Red sensitive blood leak detector BL
- Pressure sensor PDA which monitors the dialysate pressure (also used to calculate TMP)
- Air separator LA with built in level sensors LAFS and air separator valve VLA
- Throttle RVDA functions as a resistance to stabilise the flow of FPE

The throttle RVFPA prevents a high pressure build-up and thus a bursting of tubing if the flow path is blocked behind FPA. If the set pressure is reached RVFPA is opened and the fluid can circulate.

### Detection of Air in Air Separator LA

If air is detected in the air separator LA by the air separator level sensors LAFS, the balance chamber switches to free flow:

- VEBK1 and VDEBK2            opened
- VABK1/2 and VDABK1/2        closed

VLA is opened and air is removed with positive pressure from LA. VLA is closed once air is not detected anymore by LAFS. The balance chamber is switched to normal operation.





2.21 Block Diagram

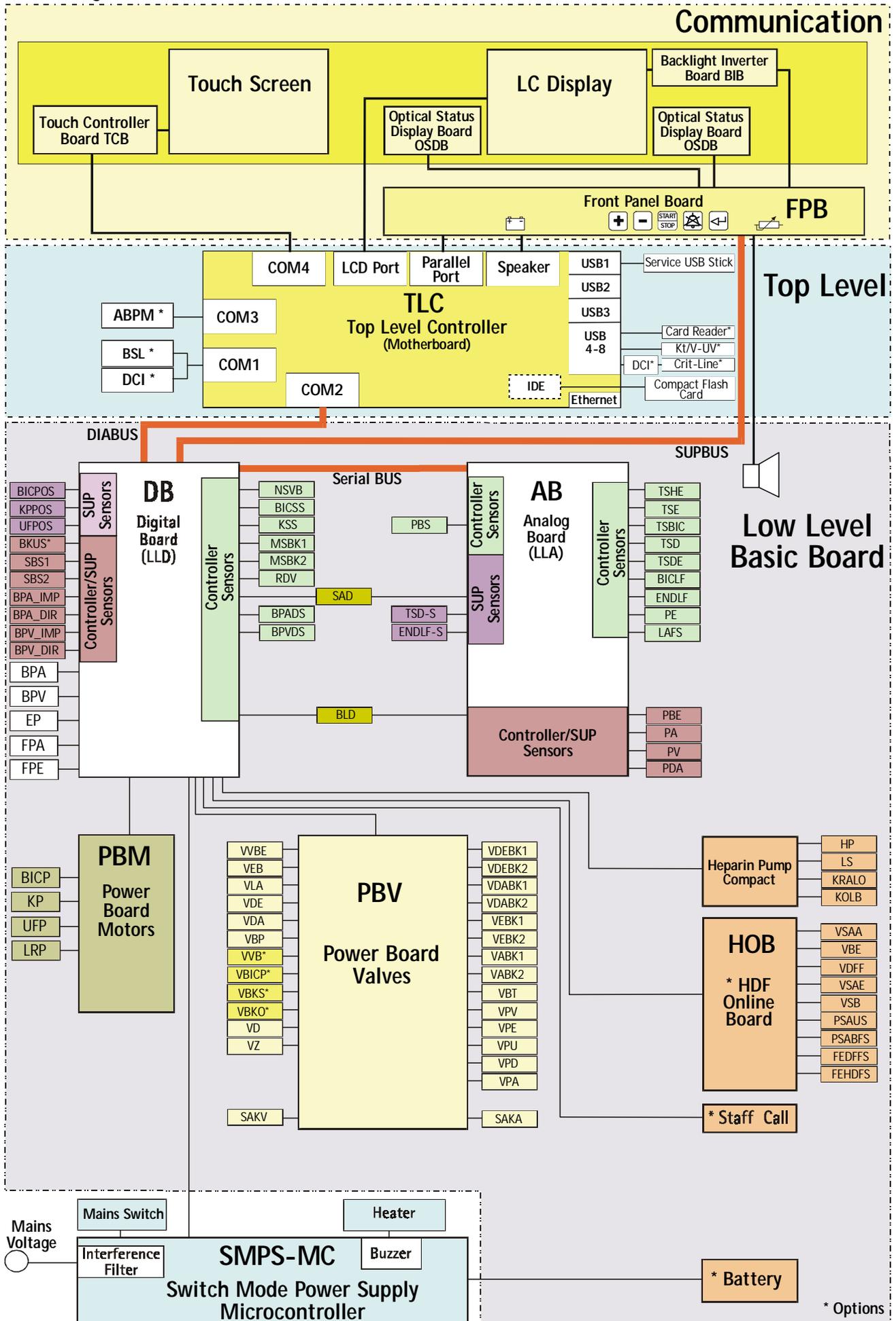


Fig. : Block Diagram

## 2.21.1 Legend Block Diagram

## Digital Board DB

<b>BPA</b>	Arterial Blood Pump
<b>BPV</b>	Venous Blood Pump
<b>EP</b>	Degassing Pump
<b>FPA</b>	Outlet Flow Pump
<b>FPE</b>	Inlet Flow Pump

## Supervisor

<b>BICOS</b>	Bicarbonate Pump Position Sensor
<b>KPPOS</b>	Concentrate Pump Position Sensor
<b>UPPOS</b>	UF Pump Position Sensor

## Controller/Supervisor

<b>BKUS</b>	Bottom Bicarbonate Cartridge Sensor
<b>SBS1</b>	Rinsing Bridge Connector Sensor 1
<b>SBS2</b>	Rinsing Bridge Connector Sensor 2
<b>BPA_IMP</b>	Arterial Blood Pump Motor Hall Sensor
<b>BPA_DIR</b>	Arterial Blood Pump Direction
<b>BPV_IMP</b>	Venous Blood Pump Motor Hall Sensor
<b>BPV_DIR</b>	Venous Blood Pump Direction

## Controller

<b>NSVB</b>	Level Sensor Upline Tank
<b>BICSS</b>	Bicarbonate Rinsing Connection Sensor
<b>KSS</b>	Concentrate Rinsing Connector Sensor
<b>MSBK1</b>	Membrane Position Sensor Balance Chamber 1
<b>MSBK2</b>	Membrane Position Sensor Balance Chamber 2
<b>RDV</b>	Venous Red Detector
<b>SAD</b>	Safety Air Detector
<b>BPADS</b>	Arterial Blood Pump Cover Switch
<b>BPVDS</b>	Venous Blood Pump Cover Switch

## Analog Board AB

## Controller

<b>PBS</b>	Pressure Single Needle
<b>TSHE</b>	Heater Inlet Temperature Sensor
<b>TSE</b>	Degassing Temperature Sensor
<b>TSBIC</b>	Bicarbonate Temperature Sensor
<b>TSD</b>	Dialysate Temperature Sensor
<b>TSDE</b>	Dialyser Inlet Temperature Sensor
<b>BICLF</b>	Bicarbonate Conductivity
<b>ENDLF</b>	END Conductivity
<b>PE</b>	Degassing Pressure Sensor
<b>LAFS</b>	Air Separator Level Sensors

## Supervisor

<b>TSD-S</b>	Dialysate Temperature Sensor Supervisor
<b>ENDLF-S</b>	END Conductivity Supervisor

**Controller/Supervisor**

<b>BLD</b>	Blood Leak Detector
<b>PBE</b>	Pressure Sensor
<b>PA</b>	Arterial Pressure Sensor
<b>PV</b>	Venous Pressure Sensor
<b>PDA</b>	Pressure Sensor Dialysate Outlet

**Power Board Motors PBM**

<b>BICP</b>	Bicarbonate Pump
<b>KP</b>	Concentrate Pump
<b>UFP</b>	Ultrafiltration Pump
<b>LRP</b>	Level Regulation Pump

**Power Board Valves PBV**

<b>VVBE</b>	Upline Tank Inlet Valve
<b>VEB</b>	Degassing Bypass Valve
<b>VLA</b>	Air Separator Valve
<b>VDE</b>	Dialyser Inlet Valve
<b>VDA</b>	Dialyser Outlet Valve
<b>VBP</b>	Bypass Valve
<b>VVB</b>	Upline Tank Valve
<b>VBICP</b>	BIC Pump Valve
<b>VBKS</b>	BIC Concentrate Suction Rod Valve
<b>VBKO</b>	Top BIC Cartridge Valve
<b>VD</b>	Disinfection Valve
<b>VZ</b>	Circulation Valve
<b>VDEBK1</b>	Dialyser Inlet Valve Balance Chamber 1
<b>VDEBK2</b>	Dialyser Inlet Valve Balance Chamber 2
<b>VDABK1</b>	Dialyser Outlet Valve Balance Chamber 1
<b>VDABK2</b>	Dialyser Outlet Valve Balance Chamber 2
<b>VEBK1</b>	Inlet Valve Balance Chamber 1
<b>VEBK2</b>	Inlet Valve Balance Chamber 2
<b>VABK1</b>	Outlet Valve Balance Chamber 1
<b>VABK2</b>	Outlet Valve Balance Chamber 2
<b>VBT</b>	Blood Side Test Pressure Sensor Valve
<b>VPV</b>	Venous Pressure Sensor Valve
<b>VPE</b>	Inlet Pressure Sensor Valve
<b>VPU</b>	Up Pressure Sensor Valve
<b>VPD</b>	Down Pressure Sensor Valve
<b>VPA</b>	Arterial Pressure Sensor Valve
<b>SAKV</b>	Venous Tubing Clamp
<b>SAKA</b>	Arterial Tubing Clamp

**Heparin Pump Compact**

<b>HP</b>	Heparin Pump Compact
<b>LS</b>	Light Barrier Speed Monitoring
<b>KRALO</b>	Interlocking Sensor
<b>KOLB</b>	Syringe Plunger Sensor

## HDF Online Board HOB

<b>VSAA</b>	Substitution Connection Outlet Valve (drain)
<b>VBE</b>	Filter Vent Valve
<b>VDF</b>	DF Filter Valve
<b>VSAE</b>	Substitution Connection Inlet Valve
<b>VSB</b>	Substitution Bypass Valve
<b>PSAUS</b>	Port Substitution Outlet Sensor
<b>PSABFS</b>	Port Substitution Drain Sensor
<b>FEDFFS</b>	DF Filter Detection Sensor
<b>FEHDFS</b>	HD Filter Detection Sensor

2.22 Switch Mode Power Supply Microcontroller SMPS-MC

2.22.1 Block Diagram SMPS-MC

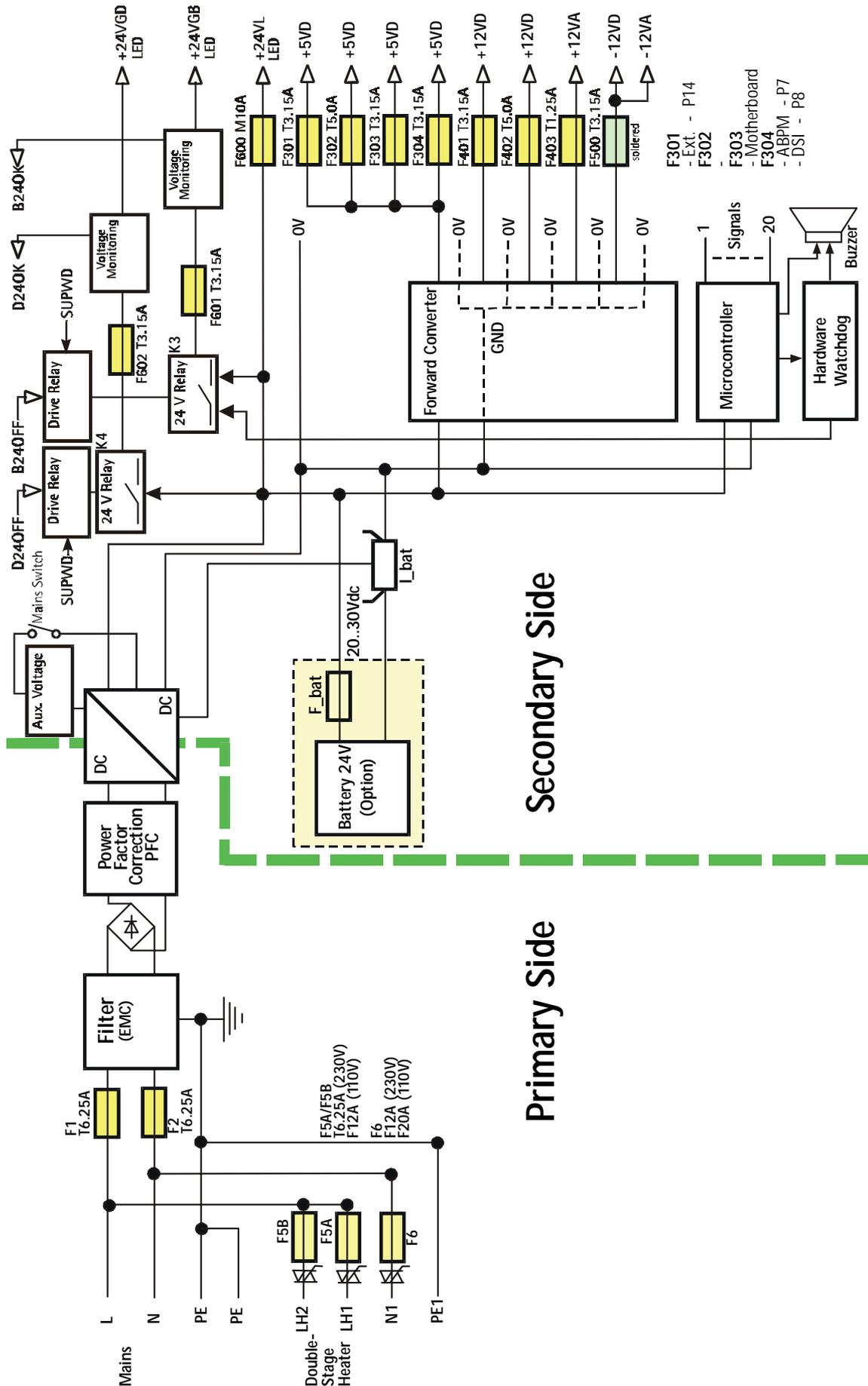


Fig. : Block Diagram Switch Mode Power Supply Microcontroller SMPS-MC



2.22.3 Component Layout SMPS-MC

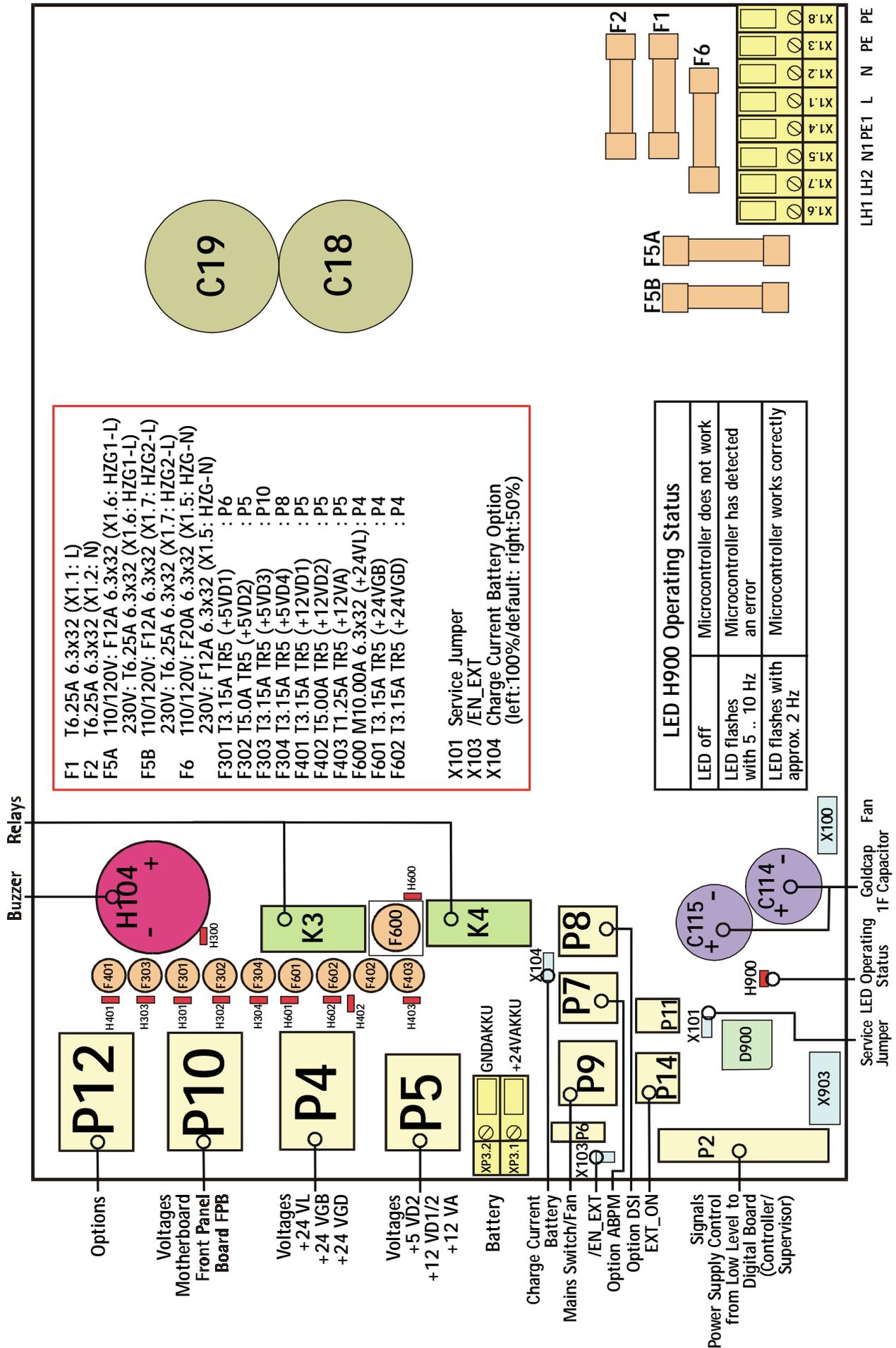


Fig. : Layout SMPS-MC

2.22.4 Wiring Diagram SMPS-MC with Battery Option

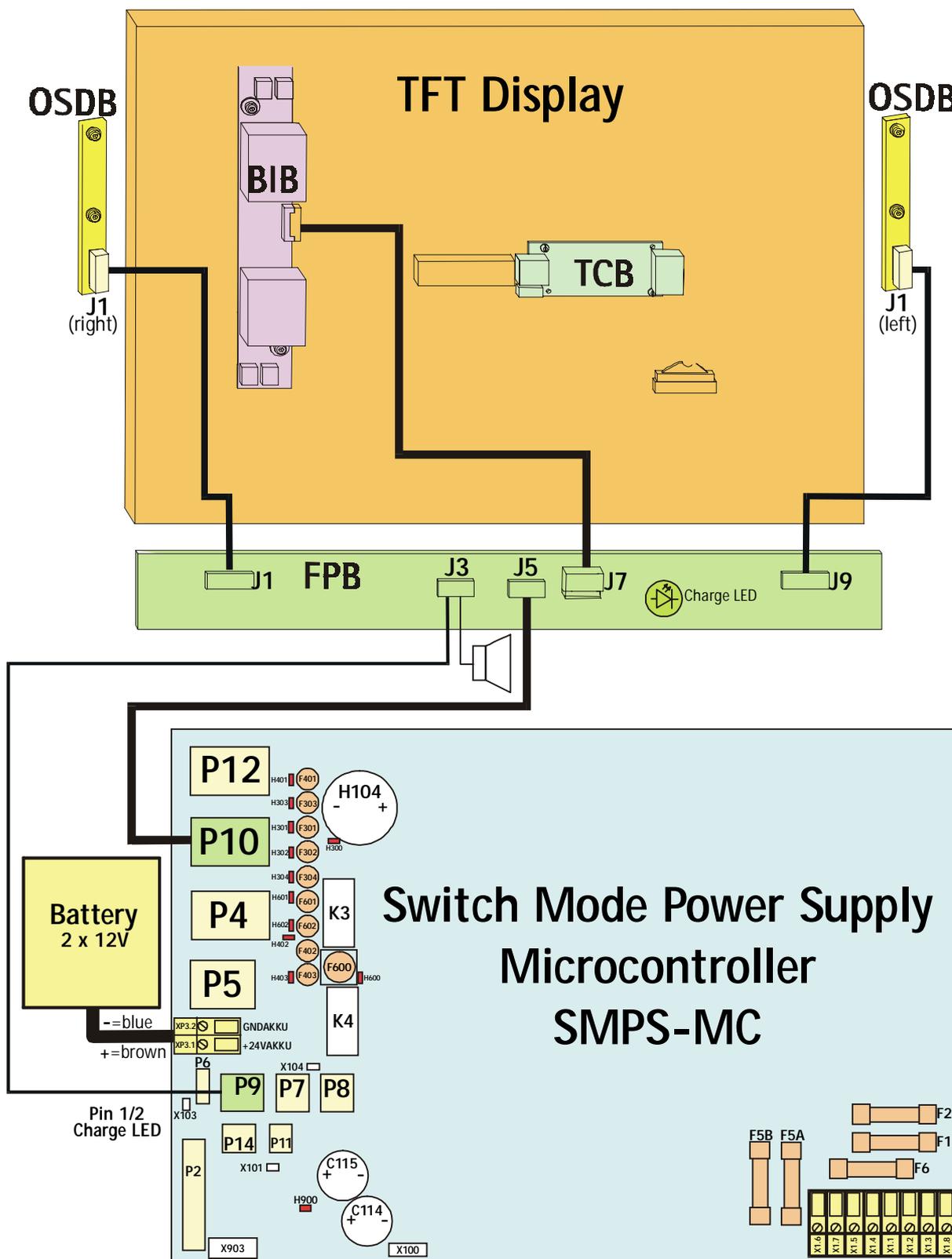
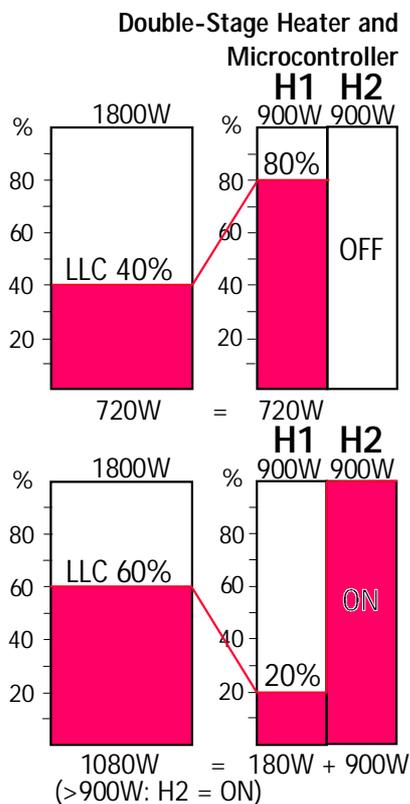


Fig. : Wiring Diagram SMPS-MC with Battery Option

<b>Battery</b>	2 x 12 V, 7 Ah
<b>Fuse for Battery</b>	10 AT (5x20), breaking capacity 1500 A, 150 Vdc
<b>Jumper X104</b>	Charge Current for Batteries Default: 50 % (right position)

## 2.22.5 Description SMPS-MC

	The switch mode power supply microcontroller SMPS-MC is used in Dialog+ machines with software $\geq 9.xx$ .																										
<b>Basic Components SMPS-MC</b>	<ul style="list-style-type: none"> <li>• Mains input, filter (EMC)</li> <li>• Bridge rectifier</li> <li>• PFC converter</li> <li>• DC/DC converter</li> <li>• Transformer</li> <li>• 24 VL output (protected via F 600)</li> <li>• 24 VGB output (switched via K3, protected via F601)</li> <li>• 24 VGD output (switched via K4, protected via F602)</li> <li>• DC/DC converter 24 V/+5 V (protected via F301/F302/F303/F304)</li> <li>• DC/DC converter 24 V/+12 V (protected via F401/F402/F403)</li> <li>• DC/DC converter 24 V/-12 V (electronically protected and via soldered fuse F500)</li> <li>• Heater power circuit triac V29/V30</li> <li>• Microcontroller (D900) for monitoring and heater control</li> <li>• Signal interface P2</li> <li>• Power connectors to the system components P4 ... P12</li> <li>• Battery screw terminal to 24 V P3</li> </ul>																										
<b>SMPS-MC</b>	<p>The SMPS-MC (<b>Switch Mode Power Supply MicroController</b>) is assembled in the rear door. The primary triggered switch mode power supply generates the following voltages on the secondary side: +5 V (5 V = 5.2 V); <math>\pm 12</math> V and 24 V (24 V = 21.5 ... 29.07 V). The primary side has a wide range input for 120/230/240 V <math>\pm 10</math> %.</p> <p>The SMPS-MC is not backwards compatible to the switch mode power supply SMPS.</p>																										
<b>Battery Option</b>	The battery option is available in the machine ex works and can also be retrofitted. The blood side functions in therapy can be maintained with a battery supply (option) in case of a power failure. The charging circuit is integrated in the SMPS-MC and includes a deep discharge protection.																										
<b>Mains Voltage</b>	120/230/240 V $\pm 10$ %, 50/60 Hz																										
<b>Mains Switch ON/OFF</b>	<p>If the Dialog+ is switched off via the <i>Automatic Switch-Off</i> function in therapy, the machine is in standby mode, e.g. the Dialog+ can be switched on and off via the disinfection program.</p> <p>The Dialog+ is only disconnected from mains if the mains plug is pulled out of the mains receptacle.</p> <p><b>Switch-off in Therapy</b> The buzzer is activated three times if the Dialog+ is switched off in therapy.</p> <p><b>Mains Failure</b> The Dialog+ (with SMPS-MC) can be switched off and on again in battery operation approx. 16 min after mains failure.</p>																										
<b>Voltages</b>	<table border="0"> <tr><td>+5 VC</td><td>Controller power supply</td></tr> <tr><td>+5 VD:</td><td>Digital</td></tr> <tr><td>+5 VG:</td><td>buffered (generated from +12 VH)</td></tr> <tr><td>+12 VH:</td><td>Aux. voltage</td></tr> <tr><td><math>\pm 12</math> VAN:</td><td>Analog</td></tr> <tr><td><math>\pm 12</math> VD:</td><td>Digital</td></tr> <tr><td>+24 VGB:</td><td>Switched blood side</td></tr> <tr><td>+24 VGD:</td><td>Switched dialysate side</td></tr> <tr><td>+24 VL:</td><td>Power (uncontrolled)</td></tr> <tr><td>GNDAN:</td><td>GND analog</td></tr> <tr><td>GNDD:</td><td>GND digital</td></tr> <tr><td>GNDH:</td><td>GND aux. voltage</td></tr> <tr><td>GNDL:</td><td>GND power</td></tr> </table>	+5 VC	Controller power supply	+5 VD:	Digital	+5 VG:	buffered (generated from +12 VH)	+12 VH:	Aux. voltage	$\pm 12$ VAN:	Analog	$\pm 12$ VD:	Digital	+24 VGB:	Switched blood side	+24 VGD:	Switched dialysate side	+24 VL:	Power (uncontrolled)	GNDAN:	GND analog	GNDD:	GND digital	GNDH:	GND aux. voltage	GNDL:	GND power
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GNDAN:	GND analog																										
GNDD:	GND digital																										
GNDH:	GND aux. voltage																										
GNDL:	GND power																										



**Hardware Watchdog**  
(see also LED H900)

**LED H900 Operating Status**

**24 V Outputs**

**Battery Management**

**+5 V Voltage**

**+12 V Voltage**

The SMPS-MC controls the double-stage heater **H1/H2** (2 x 900 W). The first heater circuit (heater **H1**, 900 W) is driven in 2 % steps. The second heater **H2** is switched with max. power (900 W) if 50% of **H1** is reached. **H1** is then controlled with half-wave-shapes, generated by the microcontroller **D900** from the SMPS-MC.

**Example:**

**Set value of LLC = 40 % (based on 1800 W)**

- H1 = 80 % (based on 900 W)
- H2 = switched off permanently

**Set value of LLC = 60 % (based on 1800 W)**

- H1 = 20 % (based on 900 W)
- H2 = switched on permanently

The microcontroller converts the predefined heater power from LLC into bit patterns (1 bit corresponds to a mains voltage half cycle) to control both heaters.

The hardware watchdog **HW-WD** switches the SMPS-MC in a safe condition if the microcontroller fails, i.e. the buzzer is activated, the heater and both voltages +24VGB/+24 VGD are switched off. The staff call is activated if present.

**3 Modes:**

- LED off : Microcontroller is not working
- LED flashes with 5 ... 10 Hz: Microcontroller has detected an error
- LED flashes with approx. 2 Hz: Microcontroller is working correctly

The 24 V of the main converter supplies the following circuits:

- 24 VL via fuse F600
- 24 VGB via fuse F601 and relay K3
- 24 VGD via fuse F602 and Relay K4

The SMPS-MC has a battery management, with the following components:

- Screw terminal XP3.1 (+) and XP3.2 (-) for batteries
- Protection against incorrect polarity
- Electronic connection
- Deep discharge protection TES
- Charging current regulator
- Battery full detection
- Shut-down circuit for the battery test
- Enable signal **AKKU\_EN**

All output voltages are maintained during a power failure if the signal **AKKU\_EN** was set prior to the power failure. The secondary auxiliary voltage is also present. The battery is charged if mains voltage is present. The charging is performed via a body diode even without **AKKU\_EN**. A comparator protects the battery from deep discharge by disconnecting the battery source from the circuit at a voltage < 22 V ±0.5 V via a MOSFET switch.

The 5 V DC/DC converter generates the 5 V voltage from the 24 V. The overvoltage protection circuit (crowbar) is triggered at 5.75 V ± 250 mV. A reset of the overvoltage protection circuit is possible only by switching the machine off and on again. The soldered fuse F300 disconnects the 24 V in case of a short circuit in the DC/DC converter.

A DC/DC converter generates the -12 V voltage from the 24 V. The soldered fuse F500 disconnects the 24 V in case of a short circuit in the DC/DC converter.

## 2.22.6 Fuses

Fuse	Voltage	Rated Fuse Value Fuse Type	Connector
F1	L (Mains Input)	6.25 A (6.3 x 32)	X1.1
F2	N (Mains Input)	6.25 A (6.3 x 32)	X1.2
F5A	L (Heater 1, 900 W)	12 A (110/120 V) 6.25 A (230 V) (6.3 x 32)	X1.6
F5B	L (Heater 2, 900 W)	12 A (110/120 V) 6.25 A (230 V) (6.3 x 32)	X1.7
F6	N (Heater)	20 A (110/120 V) 12 A (230 V) (6.3 x 32)	X1.5
F301	+5 VD1	3.15 A (TR5)	P4/1
			P4/4
			P6/1
			P11/1
			P12/1
F302	+5 VD2	5 A (TR5)	P14/6
F303	+5 VD3	3.15 A (TR5)	P5/10
			P10/1
			P10/4
F304	+5 VD4	3.15 A (TR5)	P10/7
			P7/1
F401	+12 VD1	3.15 A (TR5)	P8/1
			P12/2
F402	+12 VD2	5 A (TR5)	X100/1
			P5/4
			P7/4
			P8/4
			P9/5
			P9/6
			P10/10
			P10/14
F403	+12 VD3	1.25 A (TR5)	P11/2
			P4/7
			P5/1
			P7/7
F600	+24 VL	10 A (6.3 x 32)	P8/7
			P12/4
			P4/10
			P4/13
F601	+24 VGB	3.15 A (TR5)	P5/8
			P12/10
			P4/11
F602	+24 VGD	3.15 A (TR5)	P4/14
			P5/7
			P12/13
F602	+24 VGD	3.15 A (TR5)	P4/12
			P4/15
			P12/14

**Note:** Soldered fuses (e.g. F300 or F500) must not be changed if they are defective, i.e. the complete SMPS-MC must be exchanged.

## 2.22.7 Signals

<b>AKAL</b>	Audible alarm (LLC)
<b>AKAL_S</b>	Audible alarm (LLS)
<b>AKKU_EN</b>	Enable battery operation (possible in therapy mode only)
<b>AKKU_LADEN</b>	Signal for external LED (on front panel board) – charging of battery
<b>/AKKU_OK</b>	Load status of the battery
<b>B24OFF</b>	+24 VGB ON/OFF (LLS)
<b>B24OK</b>	+24VGB OK
<b>D24OFF</b>	+24 VGD ON/OFF (LLS)
<b>D24OK</b>	+24VGD OK
<b>/DIR_ON</b>	Jumper X101 – is used to switch on the power supply without using the <i>/REM</i> signal and deactivates the alarms. (The watchdog signal for the function of the heater ( <i>H_DIN</i> ) is still required to drive the heater.)
<b>/EXT_ON</b>	The machine can be switched on with this signal (see menu <i>1.26 Battery Option: external ON</i> ).
<b>EXT_STATE</b>	Status for external switch-on possibility (e.g. central disinfection), simultaneously input and output; the signal is looped through (connector P14/3 = input).
<b>H_DCLK</b>	Clock signal for heater data from LLC. The <i>H_DCLK</i> Signal is an open-collector signal and is generated by the LLC. The <i>H_DCLK</i> Signal is used to send the data at <i>H_DIN</i> to the microcontroller. <b>0, 1</b> Data clock
<b>H_DIN</b>	The <i>H_DIN</i> signal is an open-collector signal, is generated by the LLC and sent to the microcontroller (data to control the heater). <b>0</b> Half wave of mains voltage: heater switched off <b>1</b> Half wave of mains voltage: heater switched on
<b>/H_PROG</b>	Programming mode for heater data. The <i>/H_PROG</i> signal is an open-collector signal and is generated by the LLC. <b>0</b> Programming mode <b>1</b> No programming mode
<b>/MSWITCH</b>	Mains switch
<b>PERSR_N</b>	Staff call from SMPS-MC
<b>PF</b>	Power fail (power failure)
<b>/REM</b>	Remote signal of LLC (clock on digital board)
<b>WD_S</b>	Watchdog LLS

## 2.22.8 Internal Signals

<b>/PF</b>	Power fail for the power supply monitoring
<b>Watchdog</b>	A watchdog is integrated to prevent a permanent unintentional drive of the heater in case of an LLC reset. The watchdog is retriggered by the LLC with < 2 s. The <i>H_DIN</i> signal is used for triggering. The watchdog prevents a drive of the heater for t = 10 s after the switch-on of the switch mode power supply. The watchdog has no safety function and is therefore not tested before the therapy starts.

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## 3. Self Test SW 9.xx

## 3.1 Microprocessor Unit MPU Test from Controller/Supervisor

The microprocessor unit MPU of the controller and supervisor are checked. The function of the internal MPU registers, flags and stacks is tested.

**MPU Test Supervisor**

The MPU test is performed in therapy mode and service mode after switch-on prior to the RAM and ROM test.

**MPU Test Controller**

The MPU test is performed during the boot phase after the RAM and ROM test. The operating system is not active in this phase.

**Register Test**

The following tests are performed:

- Read-write capability of the registers
- Cross-talk between the single bits
- Address ability of the registers
- Crosstalk between single words

**Flag Test****Set and Reset Capability**

The test checks whether the flag can be set and reset correctly according to defined conditions.

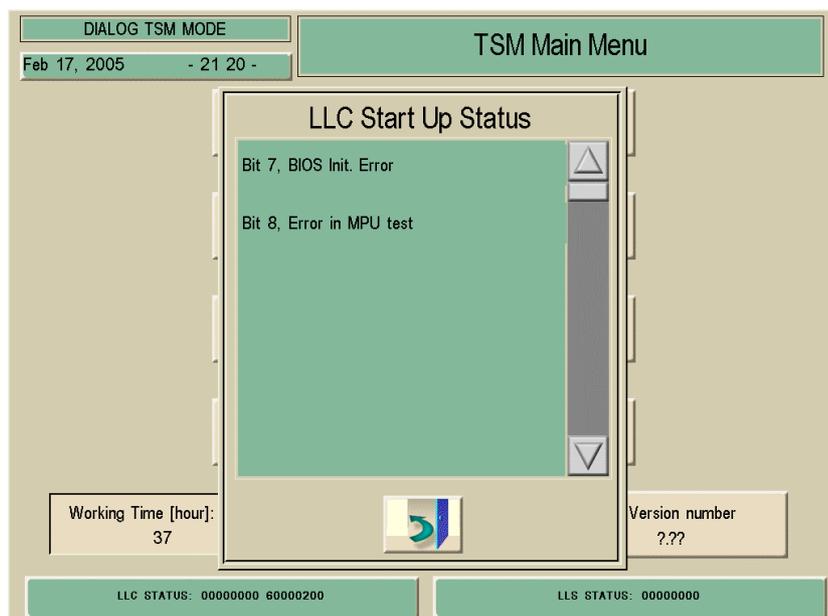
**Query Capability**

The test checks whether the correctly set flags can also be evaluated correctly .

**Stack Test**

The function of the stack is tested by storing and reloading/reading a test pattern.

### Reactions in Case of an Error of the MPU Test

**Controller**

If an error is detected during the MPU test the TLC terminates the start procedure – therapy can not be started. The error message is displayed in the TSM service program:

- Bit 7, BIOS init. error
- Bit 8, Error in MPU test

**Supervisor**

If an error is detected during the MPU test the following alarms are displayed:

**In Therapy – Therapy Selection:**

- *Hardware error RAM/ROM (SUP)*

**In TSM Service Program:**

- *Error in MPU test*

3.2. Status Self Test in Service Overview

Display LLC/LLS Test Codes in Status Self Test

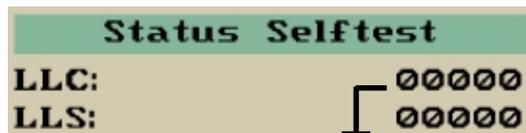
The test codes for the self test are displayed by LLC and LLS in the *Status Self Test* on the first page of the service overview (in therapy).

<b>Water Tank</b>	<b>Balance Chamber</b>	<b>Ultrafiltration</b>	<b>Blood Side (Pressure)</b>
VVBE: OPENED/CLOSED NSVB: HIGH/LOW	MSBK1: XXXXX MSBK2: XXXXX	UFP: XX rpm UFP_S: XX rpm	PA: XXX mmHg PA_S: XXX mmHg
<b>Degassing</b>	VEBK1_S: OPEN/CLOSED VABK1_S: OPEN/CLOSED	PDA: XXX mmHg PDA_S: XXX mmHg	PBE: XXX mmHg PV: XXX mmHg
EP: XXXX rpm VEB: OPEN/CLOSED PE: XXX mmHg	VDEBK2_S: OPEN/CLOSED VDABK2_S: OPEN/CLOSED	TMP: XXX mmHg	PV_S: XXX mmHg PBS: XXX mmHg
<b>Heater</b>	VEBK2_S: OPEN/CLOSED VABK2_S: OPEN/CLOSED	<b>BIC Cartridge Holder</b>	PBS_S: XXX mmHg
TSE: XX.X °C TSHE: XX.X °C	VDEBK1_S: OPEN/CLOSED VDABK1_S: OPEN/CLOSED	BKUS: OPEN/CLOSED BKUS_S: OPEN/CLOSED	<b>Blood Pumps</b>
<b>Air Separator</b>	<b>Flow (Dialysate Fluid)</b>	VVB: OPEN/CLOSED VBICP: OPEN/CLOSED	BPA: XXXX rpm BPA_S: XXXX rpm
LAFSO: NO AIR/AIR LAFSU: NO AIR/AIR	FPE: XXXX rpm FPA: XXXX rpm	VBKO: OPEN/CLOSED VBKS: OPEN/CLOSED	BPV: XXXX rpm BPV_S: XXXX rpm
VLA: OPEN/CLOSED	FMD: XXX ml/min FMD_S: XXX ml/min	<b>Valves Online</b>	<b>Tubing Clamps</b>
<b>Temperature</b>	<b>Valves (Bypass)</b>	VBE: OPEN/CLOSED VBE_S: OPEN/CLOSED	SAKA: OPEN/CLOSED SAKV: OPEN/CLOSED
TSE: XX.X °C TSBIC: XX.X °C	VBP: OPEN/CLOSED VBP_S: OPEN/CLOSED	VDF: OPEN/CLOSED VDF_S: OPEN/CLOSED	SAKV_S: OPEN/CLOSED
TSD: XX.X °C TSD_S: XX.X °C	VDE: OPEN/CLOSED VDE_S: OPEN/CLOSED	VSB: OPEN/CLOSED VSB_S: OPEN/CLOSED	<b>Air Detector</b>
TSDE: XX.X °C	VDA: OPEN/CLOSED VDA_S: OPEN/CLOSED	VSA: OPEN/CLOSED VSA_S: OPEN/CLOSED	SAD: NO AIR/AIR SAD_S: NO AIR/AIR
<b>Conductivity</b>	<b>Valves (Disinfection)</b>	VSAE: OPEN/CLOSED VSAE_S: OPEN/CLOSED	SAD TIME_S: OK SAD REF_S: XXXX mV
BICLF: X.X mS/cm ENDLF: XX.X mS/cm	VZ: OPEN/CLOSED VD: OPEN/CLOSED	<b>Pump Online</b>	SAD VOL: XXXX µl SAD VOL_S: XXXX µl
ENDLF_S: XX.X mS/cm	VD_S: OPEN/CLOSED	OPS: XXXX rpm OPS_S: XXXX rpm	<b>Heparin</b>
BICP: XX rpm BICP_S: XX rpm	<b>Blood Leak</b>	<b>Subst. Flow (Online)</b>	HP: STOP POSITION: XX XX mm
BIC-Ratio: XX.X BIC-Ratio_S: XX.X	BL: X.XX ‰ BL_S: X.XX ‰	FMS: XXX ml/min FMS_S: XXX ml/min	<b>Status Self Test</b>
KP: XX rpm KP_S: XX rpm			LLC: XXXXX LLS: XXXXX
END-Ratio: XX.X END-Ratio_S: XX.X			 

LLC/S & TLC Alarm Window

LLC Message Window

### 3.2.1 Set-Up Low Level Controller LLC Test Codes



Format of LLC Test Codes:

**T T S S x:**

**T T**

LLC test code to LLS

**S S**

Performed test step

**x**

Number of performed repeats

$0 \leq x < \text{repeats until error message}$

Examples

11102

Third blood leak detector test: send signal to blood leak detector task

33701

Second BS pressure test terminated, because during autopriming, e.g. an LF error occurred.

37991

VD test passed after the second time.

LLC Test Codes Before the  
Individual Tests

**T T 00 x**

Start test.

**T T 01 x**

Error: timeout (10 s) at "Before Test Start Wait for Test Code 0 from LLS".

**T T 02 x**

Test check prerequisites (if present, see respective tests).

**T T 03 x**

Error: Check timeout test prerequisites (if present, timeout time see respective tests).

**T T 04 x**

Wait for LLS test code from LLS.

**T T 05 x**

Error: timeout (10 s) at "Before Test Start Wait for LLS Test Code from LLS".

Test Codes of the Individual Tests

Range 10x .... 99x

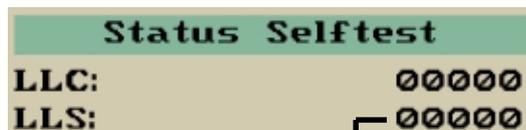
Not all test codes are displayed sequentially, due to the implementation.

A higher test code always includes all the finalised subcodes with lower priority.

In case of an error: The subcode always includes the subphase where the error occurred.

### 3.2.2 Set-Up Low Level Supervisor LLS Test Codes

The test code is displayed as a numerical value  $\geq 10000$ . If the value is  $< 9000$ , this is the required rinsing volume for the HDFO filter rinsing in ml. If the value is  $> 9000$  and  $< 10000$ , the last three digits display the required HDFO filter rinsing volume in ml through the valves VSAA and VSAE (VSB is closed).



Format of LLS Test Codes:

**T T S S S:**

(Value  $\geq 10000$ )

**T T**

LLS test code to LLC

**S S S**

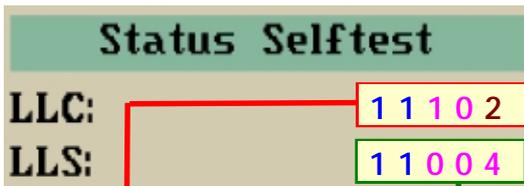
Performed test step

Example:

11104

Blood leak detector test: measure level for red and green

3.2.3 Example LLC/LLS Test Codes for Blood Leak Detector



LLC Test Code :

- 11 (TT) : Blood leak detector test
- 10 (SS) : Send signal to blood leak task
- 2 (x) : Third repetition (x = 0, 1, 2)

LLS Test Code :

- 11 (TT) : Blood leak detector test
- 004 (SS) : Measure level for red and green

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
1.	1102x	Prerequisites for Test: Upline tank must be filled Timeout 2 min		
2.		Test code = 11 to LLS	Test code = 11 back to LLC	
3.	1110x	EV_TESTE_BLUTLECK_EIN to BlutleckTaskID	Test initialisation (VGD ON) Single measurement of green, Single measurement of red, then comparison of: red ≥ green + 0.2 V no timeout	11000 – 11003 11004
4.			Acknowledge with switch-off of VGD	11005 –
5.	1120x	Wait for D24OFF (timeout 30 s)		11011
6.			VGD ON	11012
7.	1130x	Wait for D24ON (timeout 30 s)		
8.	1199x	Completed		

3.2.4 Overview Test Codes

- 0 0 No tests
- 1 1 Blood leak detector
- 1 2 DFS pressure test
- 1 5 Integrity test HDF online (only for Dialog+ HDF online)
- 1 6 Alarm system
- 1 7 Monitoring of analog voltage ± 12 V
- 2 0 UF pump
- 2 1 End conductivity
- 2 2 Temperature TSD
- 2 5 SMPS-MC EEPROM
- 2 6 SMPS-MC service mode
- 2 7 SMPS-MC battery
- 2 8 SMPS-MC buzzer
- 3 0 SAD: Level test
- 3 1 SAD: Counter test
- 3 2 Pressure sensors blood side: Equality test for blood side pressure sensors
- 3 3 Pressure sensors blood side: Blood side pressure test
- 3 7 Disinfection Valve VD
- 4 0 Pressure test substitution line S-Online HDF online

### 3.3 Self Test in Preparation SW 9.xx Switch Mode Power Supply Microcontroller SMPS-MC

#### 3.3.1 Service Mode (DIR\_ON)

<b>Configuration</b>	Switch mode power supply microcontroller SMPS-MC with and without battery
<b>Test Code</b>	26
<b>Repeats Until Error Message</b>	1
<b>ID Error Message</b>	1152: <i>Power supply service mode - no therapy</i>
<b>Reaction to the Test Result in Preparation</b>	Error: X101 connected (/DIR_ON = 0) <ul style="list-style-type: none"> <li>• <b>therapy not possible</b> because alarms deactivated, information text</li> </ul> OK: X101 open (/DIR_ON = 1) <ul style="list-style-type: none"> <li>• Therapy possible</li> </ul>

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
1.		<b>Prerequisites for Test:</b> none		
2.		Test code = 26 to LLS	Test code = 26 back to LLC	
3.	2610x		Switch-off of VGD and VGB	26001
4.		Wait for D24OFF and B24OFF (Timeout 15 s)		
5.		Set set point for heater to self test code #110		
6.	2620x	Wait for feedback of test result via BIOS (timeout 15 s)		
7.	2630x	Set set point of heater to 0		
8.	2699x	Completed	VGD ON VGB ON	

#### 3.3.2 Battery

<b>Configuration</b>	Switch mode power supply microcontroller SMPS-MC with and without battery
<b>Test Code</b>	27
<b>Repeats Until Error Message</b>	3
<b>ID Error Message</b>	1150: <i>Selftest error SMPS battery test</i>
<b>Reaction to the Test Result in Preparation</b>	Error: Battery not present or not loaded <ul style="list-style-type: none"> <li>• Information text and <b>therapy possible</b></li> </ul> OK: Battery present and loaded <ul style="list-style-type: none"> <li>• Therapy possible</li> </ul>

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
1.		<b>Prerequisites for Test:</b> none		
2.		Test code = 27 to LLS	Test code = 27 back to LLC	
3.	2710x		Switch-off of VGD and VGB	27001
4.		Wait for D24OFF and B24OFF (Timeout 15 s)		
5.		Set set point for heater to self test code #112		
6.	2720x	Wait for feedback of test result via BIOS (timeout 15 s)		
7.	2730x	Set set point of heater to 0		
8.	2799x	Completed	VGD ON VGB ON	

## 3.3.3 EEPROM

<b>Configuration</b>	Switch mode power supply microcontroller SMPS-MC with and without battery
<b>Test Code</b>	25
<b>Repeats Until Error Message</b>	1
<b>ID Error Message</b>	1154: <i>SMPS-EEPROM defective</i>
<b>Reaction to the Test Result in Preparation</b>	Test is not performed at present <ul style="list-style-type: none"> <li>Answer from SMPS-MC is <i>OK</i> because the EEPROM is not used at present</li> </ul>

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
1.		<b>Prerequisites for Test:</b>		
2.		Test code = 25 to LLS	Test code = 25 back to LLC	
3.	2510x		Switch-off of VGD and VGB	25001
4.		Wait for D24OFF and B24OFF (Timeout 15 s)		
5.		Set set point for heater to self test code #113		
6.	2520x	Wait for feedback of test result via BIOS (timeout 15 s)		
7.	2530x	Set set point of heater to 0		
8.	2599x	Completed	VGD ON VGB ON	

## 3.3.4 Buzzer Test via LLS

<b>Configuration</b>	Switch mode power supply microcontroller SMPS-MC with and without battery
<b>Test Code</b>	28
<b>Repeats Until Error Message</b>	3
<b>ID Error Message</b>	1145: <i>Self test error SMPS buzzer test</i>
<b>Reaction to the Test Result in Preparation</b>	Error: buzzer defective <ul style="list-style-type: none"> <li>Information text and <b>therapy possible</b></li> <li>OK: <ul style="list-style-type: none"> <li>Therapy possible</li> </ul> </li> </ul>

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
1.		<b>Prerequisites for Test:</b> none		
2.		Test code = 10 to LLS	Test code = 10 back to LLC	
3.	2810x		Switch-off of VGD and VGB	28001
4.		Wait for D24OFF and B24OFF (Timeout 15 s)		
5.		Set set point for heater to self test code #115		
6.			Activate buzzer after approx. 1 s for 250 ms	28003
7.	2820x	Wait for feedback of test result via BIOS (timeout 15 s)		
8.	2830x	Set set point of heater to 0		
9.	2899x	Completed	VGD ON VGB ON	

## 3.3.5 Alarm System

Test Code	16
Repeats Until Error Message	1
ID Error Message	1167: <i>Sound + LED test failed</i>
Actions after Error	None (test is repeated immediately)

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
	Code	LLC	LLS	Code
1.		<b>Prerequisites for Test:</b> No alarm activation		
2.		Test code = 16 to LLS	Test code = 16 back to LLC	
3.	1610x	<b>OSD LED OFF, Sound OFF</b>  No alarm activation  Timeout 60 s	<b>Start condition for the test:</b> 1. „OSD-LED OFF“ detected 2. „Sound OFF“ detected  Activation of the red OSD LED  Wait for feedback of the activation and switch-off of the LED  Wait for LED off	16001   16002  16003  16004
4.			Acknowledge with switch-off of the power supply trigger, i.e. switch-off of VGD and VGB	16005 – 16010
5.	1620x	Wait for D24OFF and B24OFF (timeout 60 s since start of code 100)		
6.			Trigger ON	16011
7.	1630x	Wait for D24ON and B24ON (timeout 10 s)		
8.	1630x	<b>D24ON and B24ON:</b> Alarm activation LLC/TLC  Activation test alarm with sound and OSD LED red (ID 1002)	<b>Condition for the test:</b> 1. „OSD LED red left and right ON“ detected 2. „Sound ON“ detected	16021
9.			Acknowledge with switch-off VGD	16022 – 16027
10.	1640x	Wait for D24OFF (timeout 60 s since start of code 200)		
11.			VGD ON	16028
12.	1650x	Wait for D24ON (timeout 10 s)		
13.	1699	Completed		

3.3.6 Monitoring of Analog Voltage  $\pm 12$  V

<b>Objective</b>	Check the monitoring of the analog voltage $\pm 12$ V.
<b>Test Code</b>	17
<b>Repeats Until Error Message</b>	1
<b>ID Error Message</b>	1155: $\pm 12$ V not passed
<b>Actions after Error</b>	None (test is repeated immediately)

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
1.		<b>Prerequisites for Test:</b> $\pm 12$ V voltage in limit range		
2.		Test code = 17 to LLS	Test code = 17 back to LLC	
3.			No test activation	17001 – 17003
4.	1710x	<b>Failure of voltage check</b> Timeout 15 s		
5.			Delete test activation for voltage 1: TEST1 set <i>low</i>	17011 – 17013
6.	1720x	<b>Voltage check OK</b> Timeout 15 s		
7.			Test activation for voltage 2: TEST2n set <i>low</i>	17021 – 17023
8.	1730x	<b>Failure of voltage check</b> Timeout 15 s		
9.			Delete test activation for voltage 2: TEST2n set <i>high</i>	17031
10.	1740x	<b>Voltage check OK</b> Timeout 15 s		
11.	1799	Completed		

## 3.3.7 Blood Leak Detector

<b>Objective</b>	The switch function between the LEDs and the PWM drive of the LEDs is tested.
<b>Test Code</b>	11
<b>Repeats Until Error Message</b>	3
<b>ID Error Message</b>	1156: <i>Blood leak test not OK</i>
<b>Actions after Error</b>	Rinse, repeat all tests

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
1.	1102x	<b>Prerequisites for Test:</b> Upline tank must be filled Timeout 2 min		
2.		Test code = 11 to LLS	Test code = 11 back to LLC	
3.	1110x	EV_TESTE_BLUTLECK_EIN to BlutleckTaskID	Test initialisation (VGD ON) Single measurement of green, Single measurement of red, then comparison of: red $\geq$ green + 0.2 V no timeout	11000 – 11003 11004
4.			Acknowledge with switch-off of VGD	11005 –
5.	1120x	Wait for D24OFF (timeout 30 s)		11011
6.			VGD ON	11012
7.	1130x	Wait for D24ON (timeout 30 s)		
8.	1199x	Completed		

## 3.3.8 DFS Pressure Test (Table)

<b>Objective</b>	Pressure test of the balance system and function test of the valves, drive of UFP for function test of speed detection.
<b>Test Code</b>	12
<b>Repeats until error message</b>	1
<b>ID Error Message</b>	1157: DF pressure test will be repeated
<b>Actions after error</b>	Rinse, repeat all tests.

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
1.		<b>Prerequisites for Test:</b> Upline tank must be filled		
2.		Test code = 12 to LLS	Test code = 12 back to LLC	
1.	1220x	<b>Membrane Movement VDABK</b> FPE = 1500 ml-/min FPA = 20 ml/min <b>Valve Status:</b> VEBK1/2, VDEBK1/2, VABK1/2 ----- opened VDABK1/2 ----- closed VBP, VDA, VDE ----- opened VLA ----- (5 s to vent) opened <b>Final Condition:</b> No further drop of the values for the balance chamber sensors or timeout 60 s	Wait until VLA is detected as opened	12000 12019
2	1221x	<b>Pressure build-up VDABK</b> FPE = 1500 ml-/min FPA = 20 ml/min <b>Valve Status:</b> VEBK1/2, VDEBK1/2, VABK1/2 -----opened VDABK1/2----- closed VDE, VDA, VBP ----- opened <b>Final Condition:</b> PDA ≥ +425 mmHg for 1 s or timeout 60 s	Wait until VLA is detected as closed	12020
3.	1230x	<b>Pressure reduction UFP</b> FPE = 500 ml/min FPA = 100 ml/min <b>Valve Status:</b> VEBK1/2, VABK1/2 -----opened VDABK1/2, VDEBK1/2 ----- closed VDE, VBP ----- opened VDA ----- closed PDA ≤ +380 mmHg or timeout 60 s		12021
4.	1235x	<b>VBP test</b> FPE = 800 ml/min FPA = 100 ml-/min <b>Valve Status:</b> VEBK1/2, VABK1/2, VDEBK1/2 -----opened VDABK1/2----- closed VDE, VBP ----- closed VDA ----- opened Test timeout 30 s or wait for inversion of LLS_SELFTESTBIT from LLS	<b>Start condition for the test (2,5 s):</b> 1. Correct valve position 2. UFP stopped (UF rate < 500 ml/h) 3. 300 mmHg < PDA < +450 mmHg  Test 5 s, max. deviation ΔPDA < 25 mmHg,  Acknowledge with inversion of LLS_SELFTESTBIT	12021 – 12026  12027 – 12036 12037  12038
5.	1240x	<b>VDE/VDA test</b> FPE = 800 ml/min FPA = 100 ml/min <b>Valve Status:</b> VEBK1/2, VDEBK1/2, VABK1/2 ----- opened VDABK1/2 ----- closed VBP ----- opened VDA, VDE ----- closed Test timeout 60 s or wait for inversion of LLS_SELFTESTBIT from LLS	<b>Start condition for the test (2,5 s):</b> 1. Correct valve position 2. UFP stopped (UF rate < 500 ml/h) 3. 300 mmHg < PDA < +450 mmHg  Test 5 s, max. deviation ΔPDA < 25 mmHg,  Acknowledge with inversion of LLS_SELFTESTBIT	12061 – 12066  12067 – 12076 12077  12078

6.	1245x	<b>Pressure build-up VDABK</b> FPE = 500 ml/min FPA = 100 ml/min <b>Valve Status:</b> VEBK1/2, VDEBK1/2, VABK1/2 ----- opened VDABK1/2 ----- closed VBP, VDA, VDE ----- opened PDA $\geq +425\text{ mmHg}$ for 1 s or timeout 60 s		12101
7.	1250x	<b>Pressure reduction with UFP</b> FPE = 800 ml/min FPA = 20 ml/min <b>Valve Status:</b> VEBK1/2, VDABK1/2 ----- opened VDEBK1/2, VABK1/2 ----- closed VBP, VDE ----- opened VDA ----- closed PDA $\leq +380\text{ mmHg}$ or timeout 60 s		12101
8.	1255x	<b>Membrane test</b> FPE = 800 ml/min FPA = 20 ml/min <b>Valve Status:</b> VEBK1/2, VDABK1/2 ----- opened VDEBK1/2, VABK1/2 ----- closed VBP, VDE, VDA ----- opened Test timeout 60 s or wait for inversion of LLS_SELFTESTBIT from LLS	<b>Start condition for the test (10 s):</b> 1. Correct valve position 2. UFP stopped (UF rate < 500 ml/h) 3. $+300\text{ mmHg} < \text{PDA} < +450\text{ mmHg}$  Test 10 s, max. deviation $\Delta\text{PDA} < 25\text{ mmHg}$ ,  Acknowledge with inversion of LLS_SELFTESTBIT	12101 – 12121  12122 – 12131 12132  12133
9.	1260x	<b>Pressure build-up VABK</b> FPE = 500 ml/min FPA = 500 ml/min <b>Valve Status:</b> VEBK1/2, VDEBK1/2, VDABK1/2 ----- opened VABK1/2 ----- closed VBP, VDA, VDE ----- opened PDA $\geq +425\text{ mmHg}$ for 1 s or timeout 60 s		12151
10.	1265x	<b>Membrane movement</b> FPE = 500 ml/min FPA = 1500 ml/min <b>Valve Status:</b> VEBK1/2, VABK1/2 ----- closed VDEBK1/2, VDABK1/2 ----- opened VBP, VDA, VDE ----- opened Test timeout 60 s or no increase of the values of the membrane position sensors		12151
11.	1270x	<b>Pressure reduction with UFP</b> FPE = 500 ml/min FPA = 500 ml/min <b>Valve Status:</b> VEBK1/2, VABK1/2 ----- closed VDEBK1/2, VDABK1/2 ----- opened VBP, VDE ----- opened VDA ----- closed PDA $\leq +380\text{ mmHg}$ or timeout 60 s		12151

12.	1275x	<b>VEBK test</b> FPE = 800 ml/min FPA = 500 ml/min <b>Valve Status:</b> VEBK1/2, VABK1/2 ----- closed VDEBK1/2, VDABK1/2 ----- opened VBP, VDE, VDA ----- opened Test timeout 60 s or wait for inversion of LLS_SELFTESTBIT from LLS	<b>Start condition for the test (5 s):</b> 1. Correct valve position 2. UFP stopped (UF rate < 500 ml/h) 3. +300 mmHg < PDA < +450 mmHg  Test 10 s, max. deviation $\Delta$ PDA < 25 mmHg,  Acknowledge with inversion of LLS_SELFTESTBIT	12151 – 12161  12162 – 12181 12182  12183
13.	1280x	<b>Pressure reduction</b> FPE = 500 ml/min FPA = 500 ml/min <b>Valve Status:</b> VEBK1/2, VDEBK1/2 ----- opened VABK1/2, VDABK1/2 ----- opened VBP, VDA, VDE ----- opened  Timeout 60 s		12000
14.	1299	Completed		

### 3.3.8.1 DFS Pressure Test

#### General Comments

The closing function of VLA is tested implicitly together with all tests that generate an overpressure at PDA, because the overpressure is not built up and not maintained when VLA is open. Therefore an explicit test of VLA is not required. DFS pressure test:

- A controlled membrane movement is performed to the outlet side prior to the phase *Pressure build-up VDABK*.
- The FPE and FPA pumps are set to 1500 ml/min in phases with membrane movement. Thus a fast movement of the membrane is achieved.
- UFP is activated during the pressure build-up phase and thus tested.
- The evaluation of the pressure changes in a test interval is performed via the pressure at the end of the test interval. (The pressure difference to the minimum and maximum sensor value is created in the test interval.)
- VLA is opened for 5 s at the beginning of the test to ensure that the air separator is completely filled with water. Simultaneously the function for the monitoring of the current is checked.
- UFP is started during the pressure build-up phase.
- The acknowledgement of the single test steps in the DFS pressure test is performed via a bit in the internal communication (between LLS and LLC).

3.3.8.2 Membrane Movement/Pressure Build-up VDABK

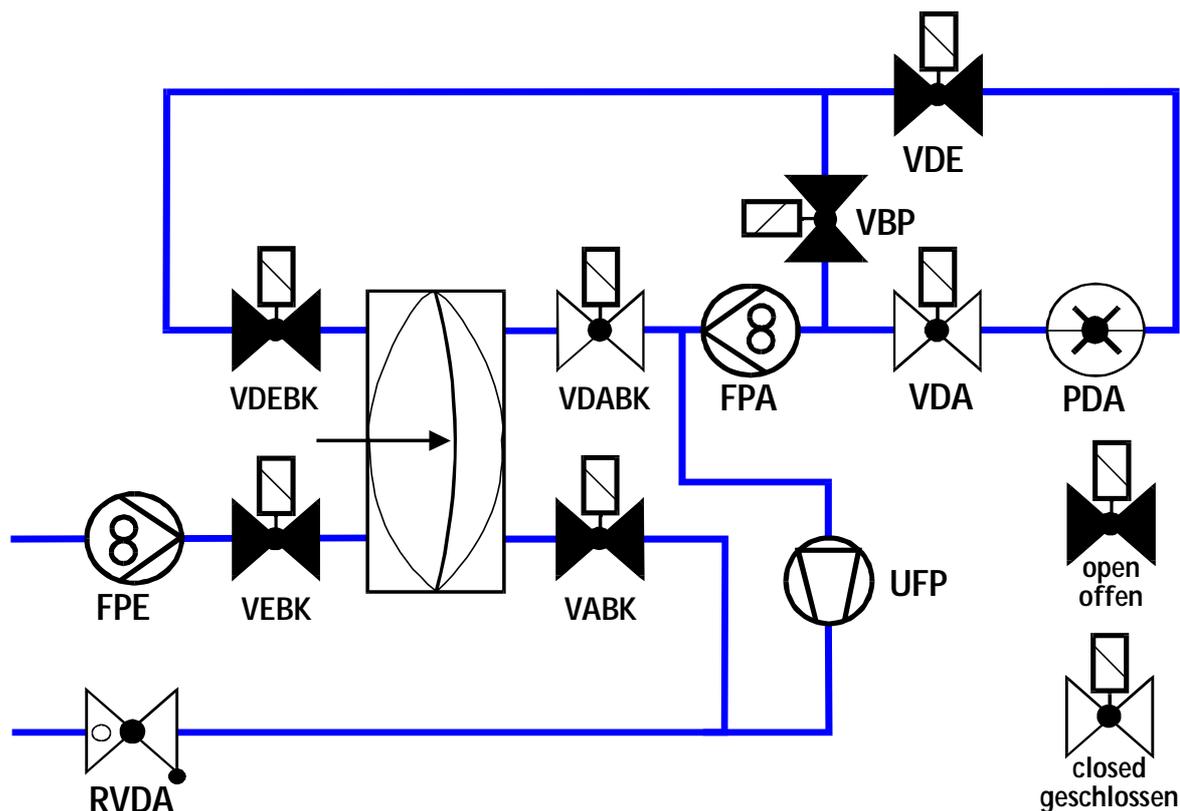


Fig. : Flow Diagram Membrane Movement/Pressure Build-up VDABK

The speed for FPE and FPA are slowly set in increments of 200 min<sup>-1</sup> to a maximum flow of 1500 ml/min and 10 ml/min respectively. The membrane movement with the resulting pressure build-up is terminated after no further drop of the values for the balance chamber sensors is detected. The membrane is moved to the outlet.

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
1.	1220x	<p><b>Membrane movement VDABK</b></p> <p>FPE = 1500 ml/min FPA = 20 ml/min</p> <p><b>Valve Status:</b> VEBK1/2, VDEBK1/2, VABK1/2 -----opened VDABK1/2----- closed VDE, VDA, VBP ----- opened VLA ----- open to vent for 5 s</p> <p><b>Final Condition:</b> No further drop of the values for the balance chamber sensors or timeout 60 s</p>	Wait until VLA is detected as opened	12000 12019
2.	1221x	<p><b>Pressure build-up VDABK</b></p> <p>FPE = 1500 ml./min FPA = 20 ml/min</p> <p><b>Valve Status:</b> VEBK1/2, VDEBK1/2, VABK1/2 -----opened VDABK1/2----- closed VDE, VDA, VBP ----- opened</p> <p><b>Final Condition:</b> PDA ≥ +425 mmHg for 1 s or timeout 60 s</p>	Wait until VLA is detected as closed	12020

3.3.8.3 Pressure Reduction VDABK with UFP

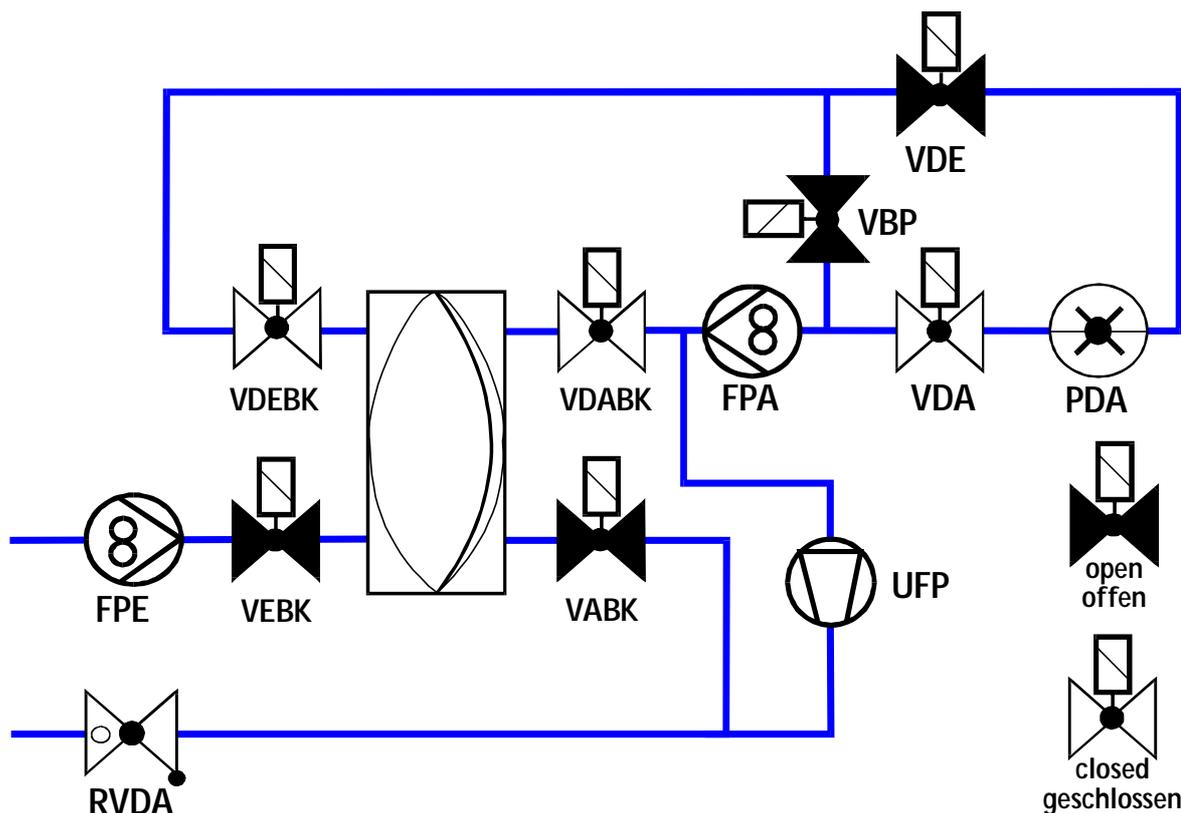


Fig. : Flow Diagram Pressure Reduction VDABK with UFP

The pressure at PDA is reduced built-up to  $\leq 380$  mmHg with the UF pump after the dialyser test circuit is closed. The UF pump is driven with 3000 ml/h. VDA is closed during this pressure reduction. Thus the UF pump strokes are damped via the extended flow path and no interferences are generated at PDA.

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
3.	1230x	<p><b>Pressure reduction UFP</b>                      FPE = 500 ml/min                      FPA = 100 ml/min  <b>Valve Status:</b>                      VEBK1/2, VABK1/2 -----opened                      VDABK1/2, VDEBK1/2 ----- closed                      VDE, VBP ----- opened                      VDA ----- closed  <b>Final Condition:</b>                      PDA <math>\leq +380</math> mmHg or timeout 60 s</p>		12021

3.3.8.4 VBP Test

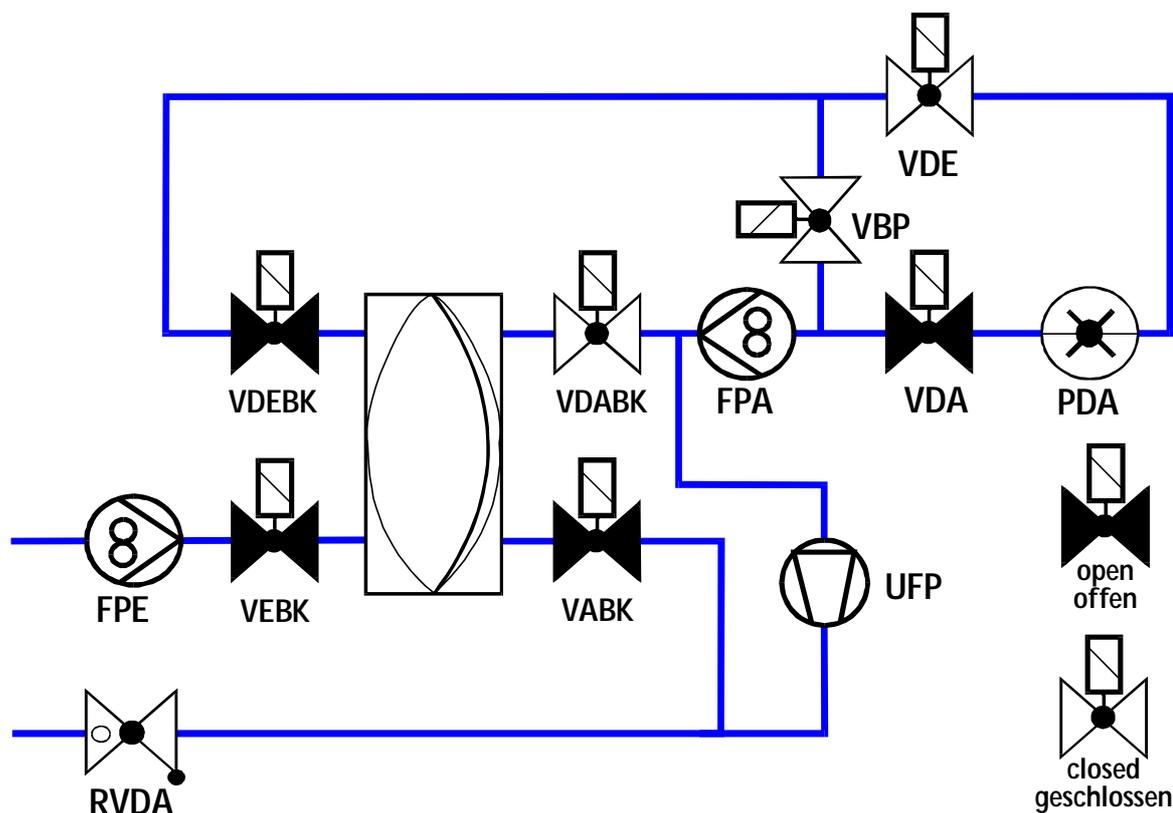


Fig. : Flow Diagram VBP Test

A pressure drop indicates a leakage at any component, e.g. rinse bridge, dialyser, UF pump, o-ring etc..

- Test VDE/VBP** A leakage of the valves leads to a pressure increase at PDA.
- Test VDABK** A leakage of the valve leads to a pressure increase at PDA.
- Timeout** 30 s

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
4.	1235x	<b>VBP test</b> FPE = 800 ml/min FPA = 100 ml/min <b>Valve Status:</b> VEBK1/2, VABK1/2, VDEBK1/2 -----opened VDABK1/2----- closed VDE, VBP ----- closed VDA ----- opened <b>Final Condition:</b> Test timeout 30 s or wait for inversion of LLS_SELFTESTBIT from LLS	<b>Start condition for the test (2.5 s):</b> 1. Correct valve position 2. UFP stopped (UF rate < 500 ml/h) 3. 300 mmHg < PDA < +450 mmHg  Test 5 s, max. deviation ΔPDA < 25 mmHg,  Acknowledge with inversion of LLS_SELFTESTBIT	12021 – 12026  12027 – 12036 12037  12038

3.3.8.5 VDE/VDA Test

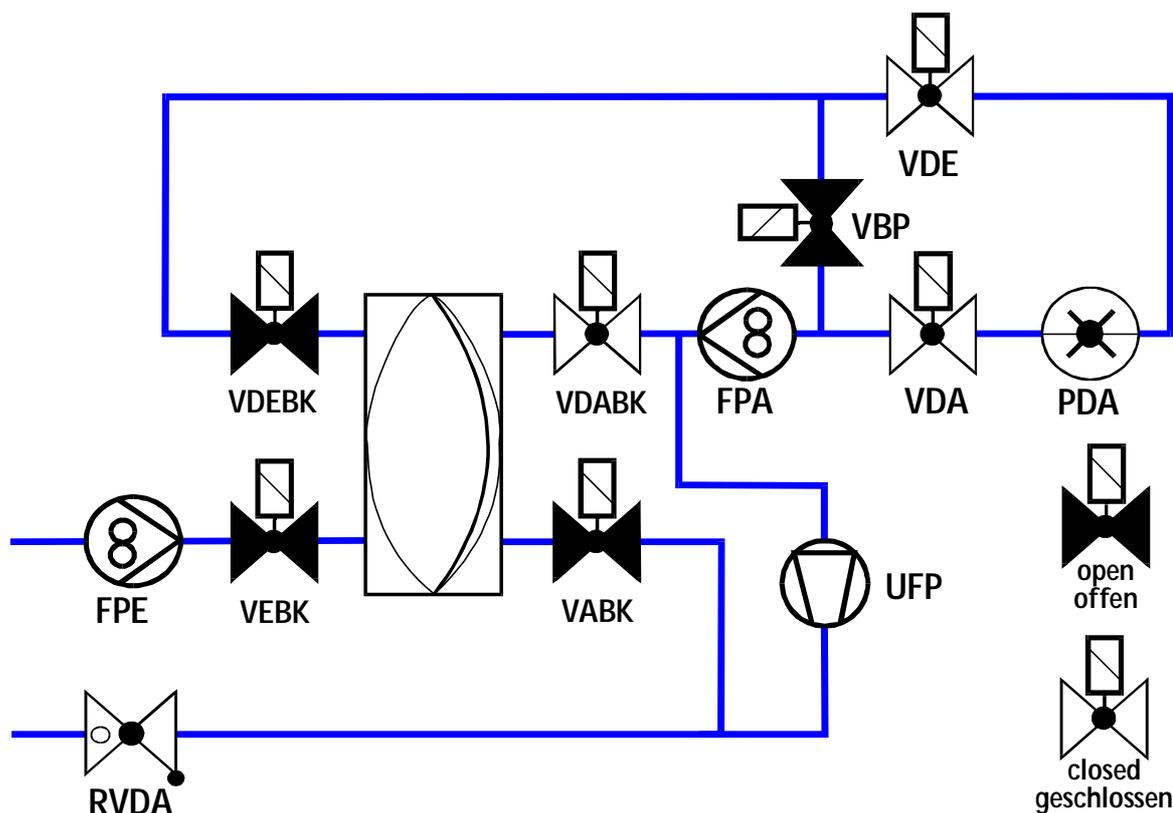


Fig. : Flow Diagram VDE/VDA Test

Test VDE/VDA

A leakage of the valves leads to a pressure increase at PDA.

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
5.	1240x	<p><b>VDE/VDA test</b>                      FPE = 800 ml/min                      FPA = 100 ml/min  <b>Valve Status:</b>                      VEBK1/2, VDEBK1/2, VABK1/2 ----- opened                      VDABK1/2 ----- closed                      VBP ----- opened                      VDA, VDE ----- closed  <b>Final Condition:</b>                      Test timeout 60 s or wait for inversion of LLS_SELFTESTBIT from LLS</p>	<p><b>Start condition for the test (2.5 s):</b>                      1. Correct valve position                      2. UFP stopped (UF rate &lt; 500 ml/h)                      3. 300 mmHg &lt; PDA &lt; +450 mmHg</p> <p>Test 5 s,                      max. deviation ΔPDA &lt; 25 mmHg,</p> <p>Acknowledge with inversion of LLS_SELFTESTBIT</p>	<p>12061 –                      12066</p> <p>12067 –                      12076                      12077</p> <p>12078</p>

3.3.8.6 Pressure Build-up VDABK

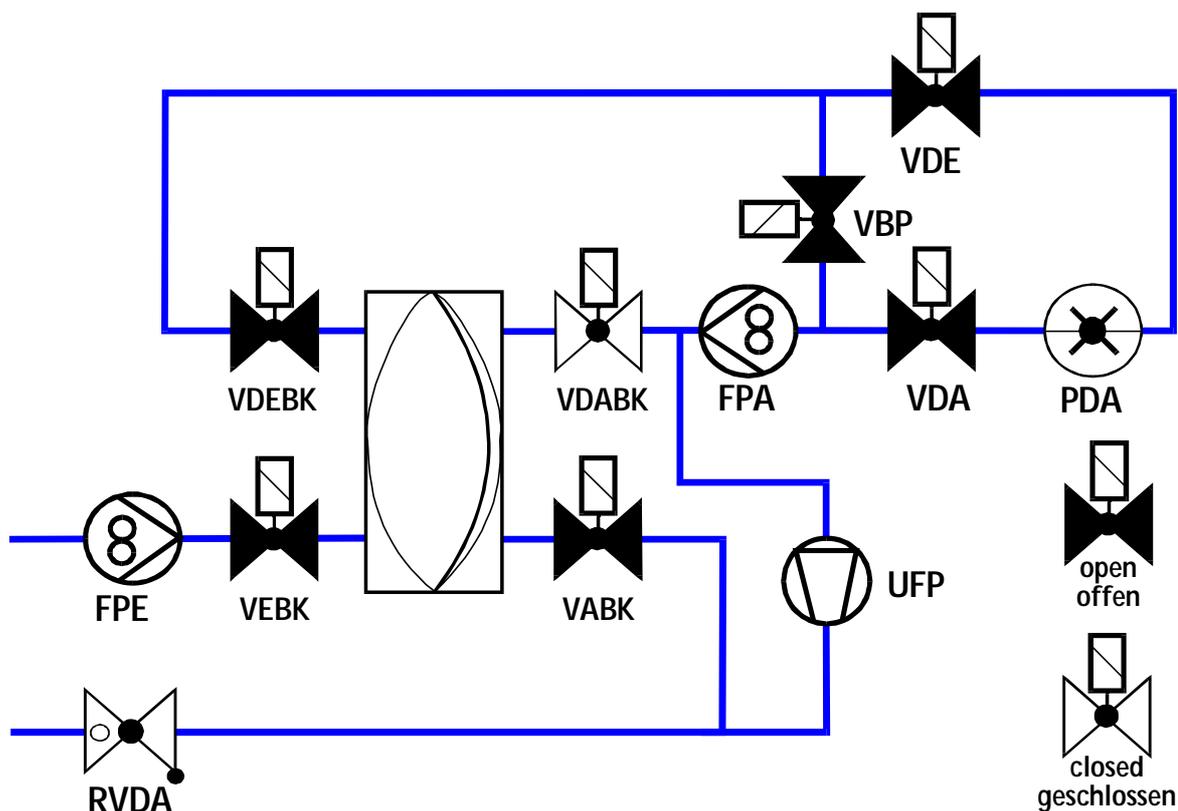


Fig. : Flow Diagram Pressure Build-up VDABK

If PDA < 425 mmHg: The speed for FPE and FPA is slowly set in increments of 200 min<sup>-1</sup> in 250 ms to a maximum flow of 500 ml/min and 100 ml/min respectively.

The pressure build-up is completed if PDA is ≥ 425 mmHg for more than 1 s.

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
6.	1245x	<p><b>Pressure build-up VDABK</b>                      FPE = 500 ml/min                      FPA = 100 ml/min  <b>Valve Status:</b>                      VEBK1/2, VDEBK1/2, VABK1/2 ----- opened                      VDABK1/2 ----- closed                      VBP, VDA, VDE ----- opened  <b>Final Condition:</b>                      PDA ≥ +425 mmHg for 1 s or timeout 60 s</p>		12101

3.3.8.7 Pressure Reduction Membrane  
Test with UFP

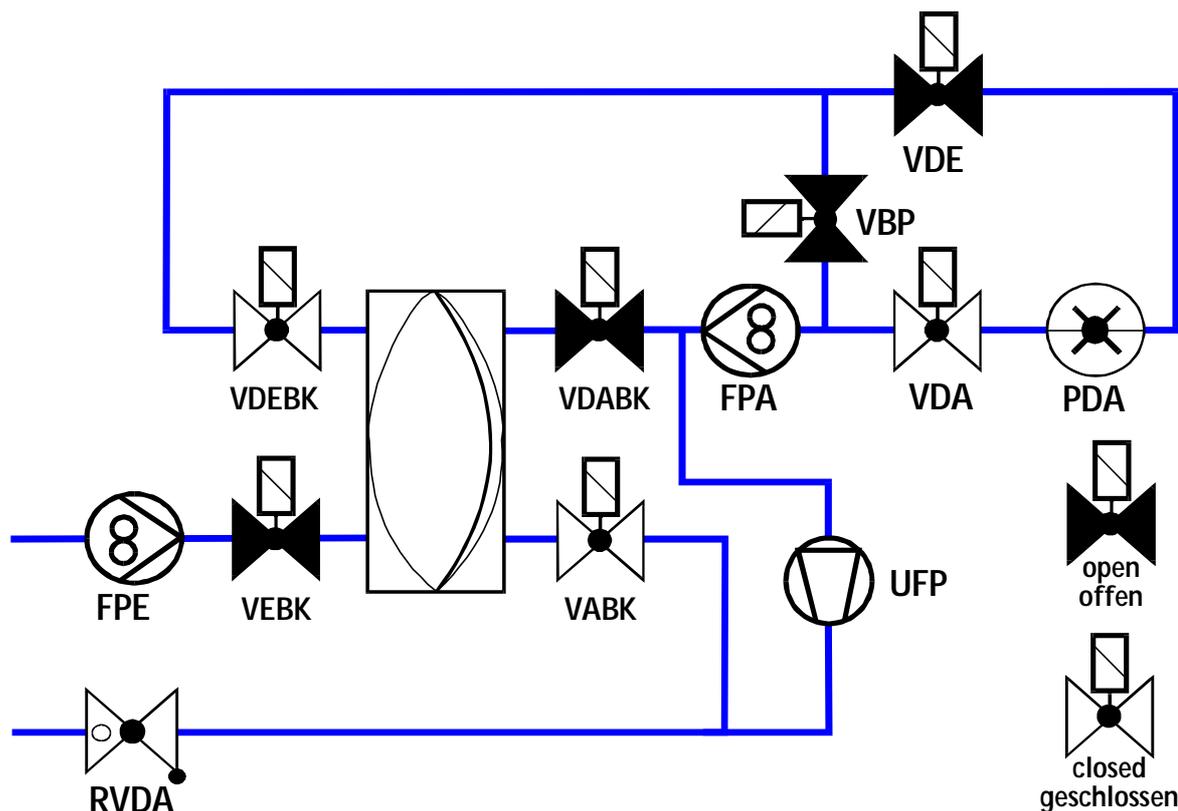


Fig. : Flow Diagram Pressure Reduction Membrane Test with UFP

The pressure at PDA is decreased to  $\leq 380$  mmHg with the UF pump after the dialyser test circuit is closed. The UF pump is driven with 3000 ml/h. VDA is closed during this pressure reduction. Thus the UF pump strokes are damped via the extended flow path and no interferences are generated at PDA.

During this pressure reduction the speeds for the following test are set to: FPE for a flow of 800 ml/min and FPA for 20 ml/min. Thus the membrane is pressed to the outlet side.

Timeout: 60 s

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
7.	1250x	<p><b>Pressure reduction with UFP</b>                      FPE = 800 ml/min                      FPA = 20 ml/min  <b>Valve Status:</b>                      VEBK1/2, VDABK1/2 ----- opened                      VDEBK1/2, VABK1/2 ----- closed                      VBP, VDE ----- opened                      VDA ----- closed  <b>Final Condition:</b>                      PDA <math>\leq +380</math> mmHg or timeout 60 s</p>		12101

3.3.8.8 Membrane Test

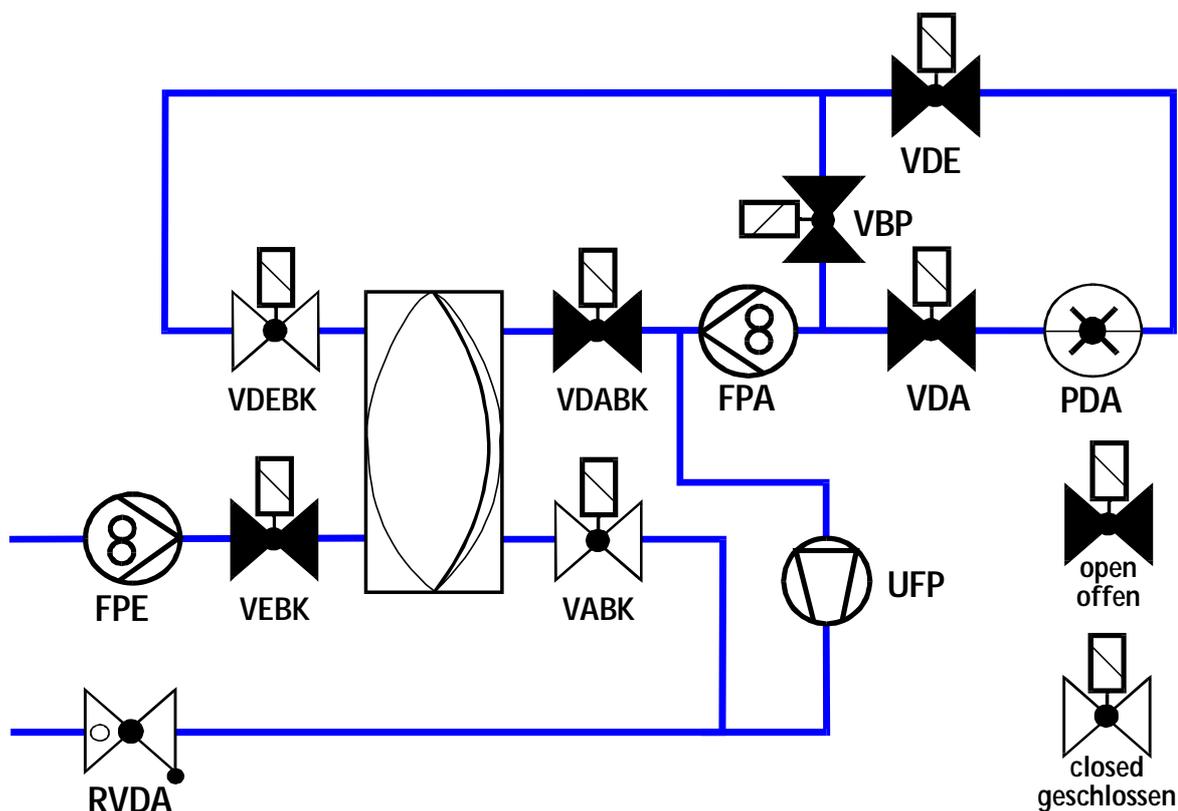


Fig. : Flow Diagram Membrane Test

**Test Membrane**

The membrane is loaded with a pressure of 1.3 bar due to the high speed of FPE with a flow of 800 ml/min. A leakage would cause a pressure increase at PDA. FPA runs with a slow speed during this test to prevent a back pressure.

**Test VDEBK**

A leakage of the valve leads to a pressure increase at PDA.

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
8.	1255x	<p><b>Membrane test</b>                      FPE = 800 ml/min                      FPA = 20 ml/min  <b>Valve Status:</b>                      VEBK1/2, VDABK1/2 ----- opened                      VDEBK1/2, VABK1/2 ----- closed                      VBP, VDE, VDA ----- opened  <b>Final Condition:</b>                      Test timeout 60 s or wait for inversion of LLS_SELFTESTBIT from LLS</p>	<p><b>Start condition for the test (10 s):</b>                      1. Correct valve position                      2. UFP stopped (UF rate &lt; 500 ml/h)                      3. +300 mmHg &lt; PDA &lt; +450 mmHg</p> <p>Test 10 s,                      max. deviation ΔPDA &lt; 25 mmHg,</p> <p>Acknowledge with inversion of LLS_SELFTESTBIT</p>	<p>12101 –                      12121</p> <p>12122 –                      12131                      12132                      12133</p>

3.3.8.9 Pressure Build-up VABK

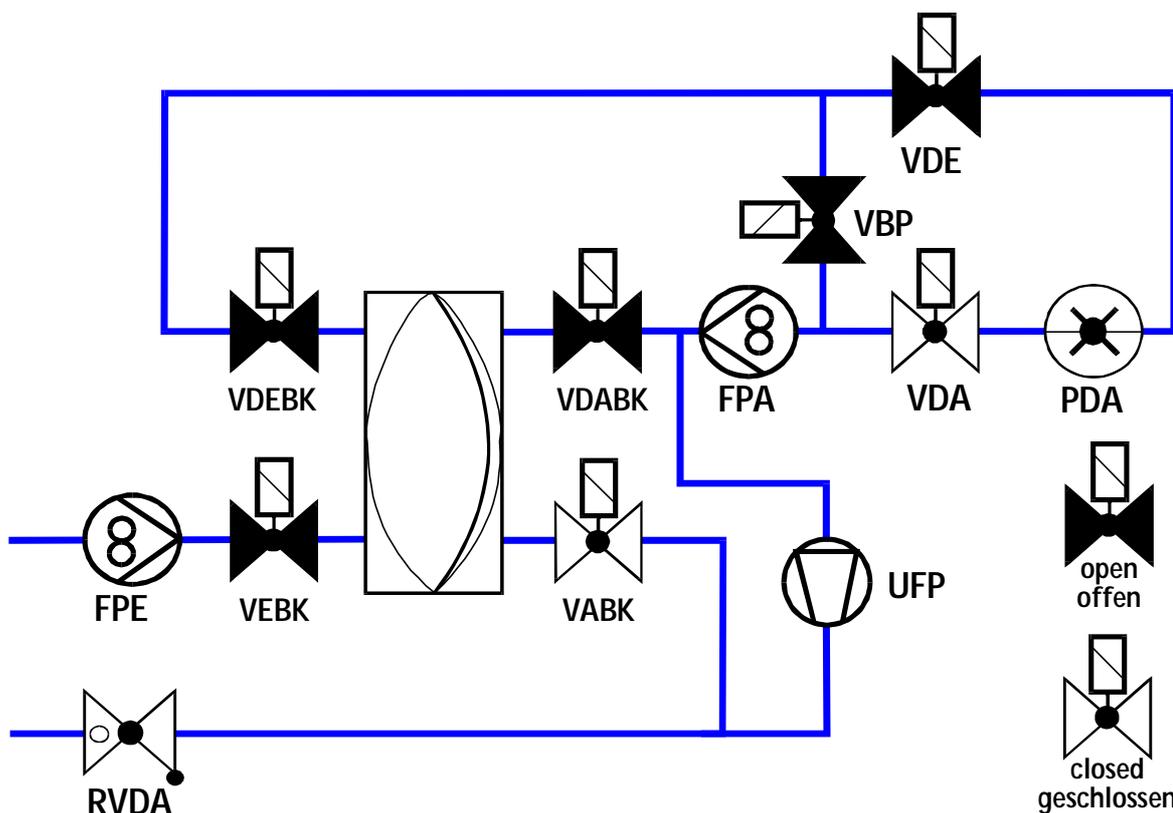


Fig. : Flow Diagram Pressure Build-up VABK

If PDA < 425 mmHg; the speed for FPE and FPA is slowly set in increments of 200 min<sup>-1</sup> to a maximum flow of 500 ml/min and 100 ml/min respectively. The pressure build-up is completed if PDA is ≥ 425 mmHg for more than 1 s.

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
9.	1260x	<p><b>Pressure build-up VABK</b>                      FPE = 500 ml/min                      FPA = 500 ml/min  <b>Valve Status:</b>                      VEBK1/2, VDEBK1/2, VDABK1/2 ----- opened                      VABK1/2 ----- closed                      VBP, VDA, VDE ----- opened  <b>Final Condition:</b>                      PDA ≥ +425 mmHg for 1 s or timeout 60 s</p>		12151

3.3.8.10 Membrane Movement to Inlet Side  
Side

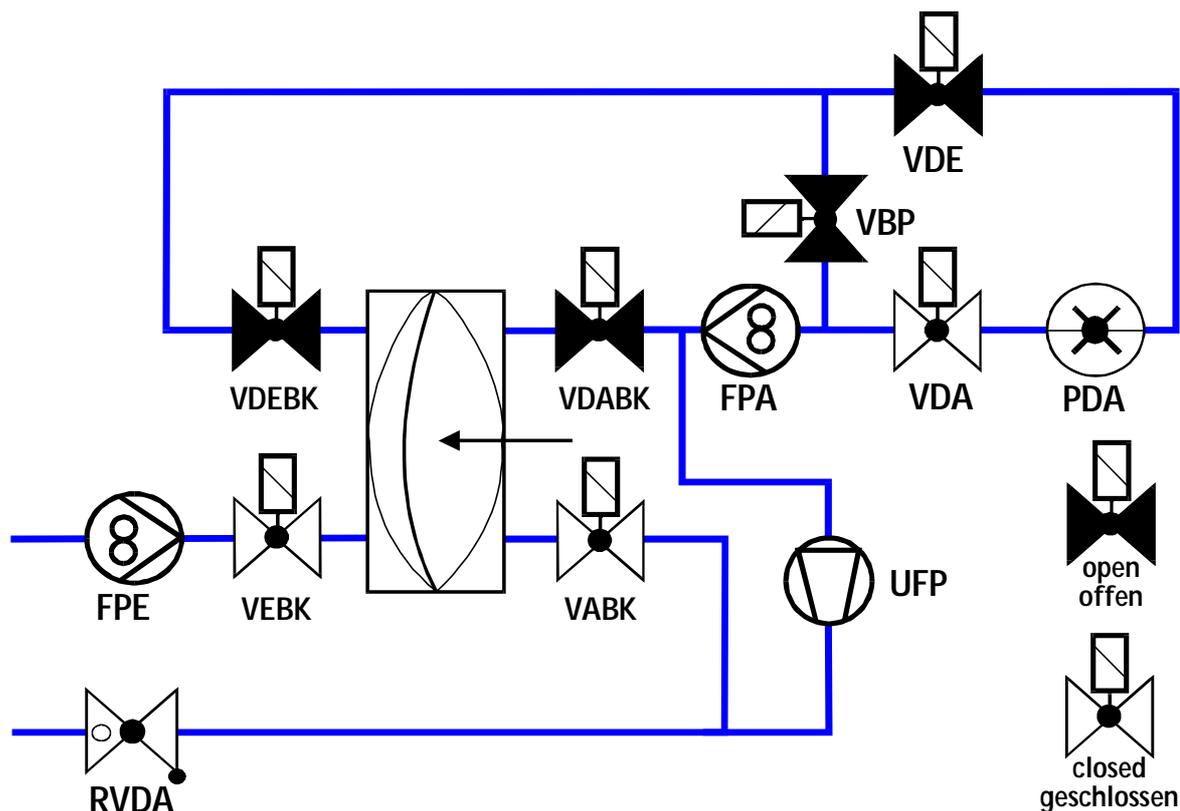


Fig. : Flow Diagram Membrane Movement to Inlet Side

The FPA pump is driven with 1500 ml/min and moves the membrane to the inlet side. Thus an overpressure is built up at the valves VABK1/2 for the next test step. If the membrane is not in end position: Only the pressure of the throttle DDE is built-up prior to the valves, due to the volume shift.

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
10.	1265x	<p><b>Membrane movement</b>                      FPE = 500 ml/min                      FPA = 1500 ml/min  <b>Valve Status:</b>                      VEBK1/2, VABK1/2 ----- closed                      VDEBK1/2, VDABK1/2 ----- opened                      VBP, VDA, VDE ----- opened  <b>Final Condition:</b>                      Test timeout 60 s or no increase of the values of the membrane position sensors</p>		12151



3.3.8.12 VEBK Test

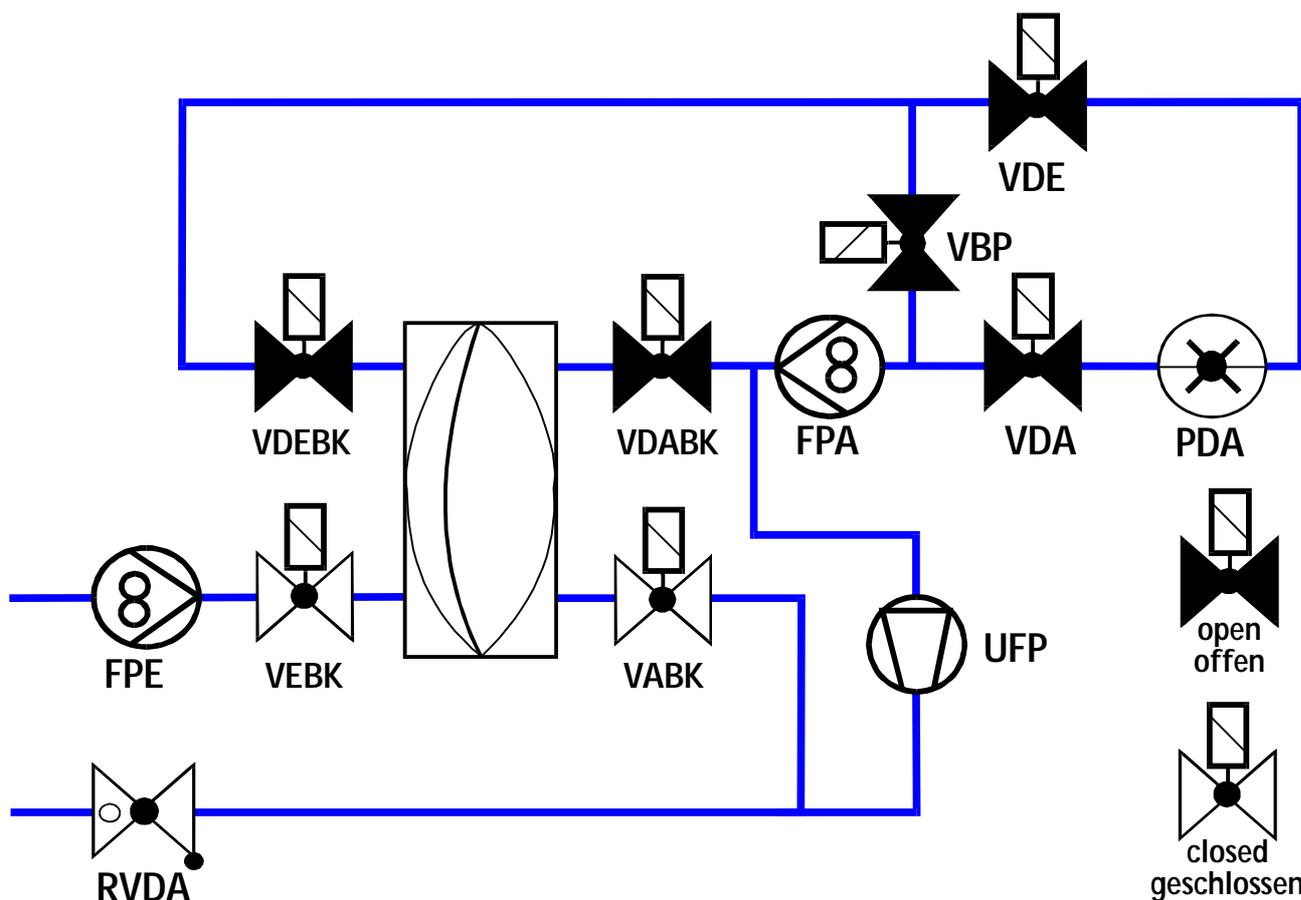


Fig. : Flow Diagram VEBK Test

- Test VEBK1/2** VEBK is charged by the maximum delivery pressure from FPE (set at RVFPE). A leakage of the valves leads to a pressure increase at PDA.
- Test VABK1/2** VABK is charged by the maximum delivery pressure from FPA (set at RVFPA). A leakage of the valves leads to a pressure increase at PDA.

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
12.	1275x	<p><b>VEBK test</b></p> <p>FPE = 800 ml/min FPA = 500 ml/min</p> <p><b>Valve Status:</b></p> <p>VEBK1/2, VABK1/2 ----- closed VDEBK1/2, VDABK1/2 ----- opened VBP, VDE, VDA ----- opened</p> <p><b>Final Condition:</b></p> <p>Test timeout 60 s or wait for inversion of LLS_SELFTESTBIT from LLS</p>	<p><b>Start condition for the test (5 s):</b></p> <ol style="list-style-type: none"> <li>1. Correct valve position</li> <li>2. UFP stopped (UF rate &lt; 500 ml/h)</li> <li>3. +300 mmHg &lt; PDA &lt; +450 mmHg</li> </ol> <p>Test 10 s, max. deviation ΔPDA &lt; 25 mmHg,</p> <p>Acknowledge with inversion of LLS_SELFTESTBIT</p>	<p>12151 – 12161</p> <p>12162 – 12181 12182</p> <p>12183</p>

3.3.8.13 Pressure Reduction

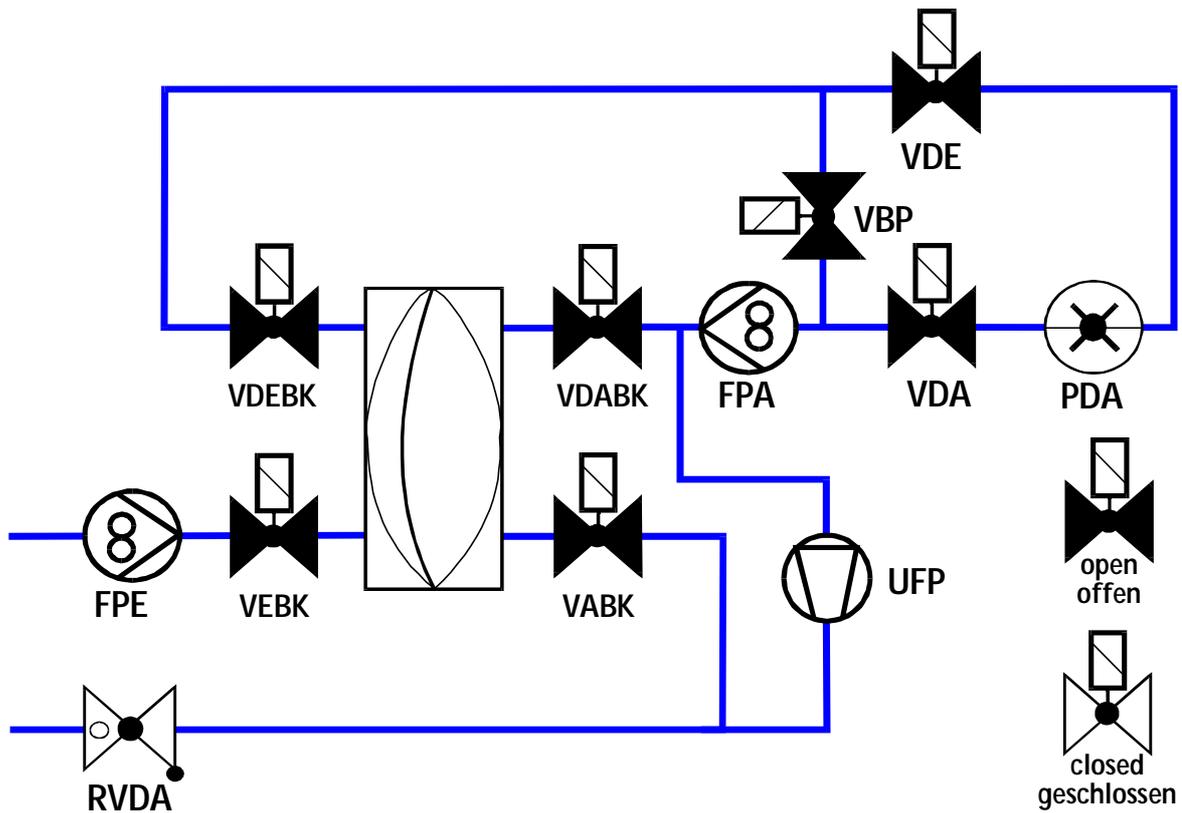


Fig. : Flow Diagram Pressure Reduction

A pressure level is set at PDA between -200 mmHg and +200 mmHg by opening all valves and driving the pumps accordingly.

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
13.	1280x	<p><b>VEBK test</b>                      FPE = 500 ml/min                      FPA = 500 ml/min  <b>Valve Status:</b>                      VEBK1/2, VDEBK1/2 ----- opened                      VABK1/2, VDABK1/2----- opened                      VBP, VDA, VDE ----- opened</p> <p>Timeout 60 s</p>		12000

## 3.3.9 Integrity Test HDF Online

Simultaneous pressure build-up of DF  
filter and HDF filter

## Objective

Detection of safety relevant ruptures, pressure test of the substitution system in the machine, pressure test of VBE/VSAE/VSAA.

Air can not pass the semipermeable filter membrane at negative pressure of > -500 mmHg. To detect ruptures: One side of the filter is filled with air; On the other side a negative pressure < -270 mmHg is built up. If the pressure drop is < 20 mmHg in 3 min, safety relevant ruptures are not present. The final opening of VBP must be detected by LLS via PDA. Thus it is guaranteed that the filters were filled with air and VBE was opened.

## Test code

15

## Repeats until error message

1

## ID error message

1151: *HDF online filter test failed!*

## Actions after error

Rinse, repeat all tests

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
1.	1502x	<b>Prerequisites for Test:</b> Upline tank must be filled, PSAUS, PSABF and BPV cover must be closed. Timeout 2 min		
2.		Test code = 15 to LLS	Test code = 15 back to LLC	
3.	1510x	<b>Pressure Reduction for VBE Test with FPA:</b> Pressure reduction with FPA until PDA < -300 mmHg <b>Valve Status:</b> VDEBK1/2, VEBK1/2 ----- closed VDABK1/2, VABK1/2----- opened VBE, VDFF, VDE, VSB----- closed VBP, VDA, VSAE, VSAA----- opened Timeout 1 min		
4.	1515x	<b>VBE Pressure Test</b> <b>Valve Status:</b> VDEBK1/2, VEBK1/2 ----- closed VDABK1/2, VABK1/2----- closed VBE, VDFF, VDE, VSB----- closed VBP, VDA, VSAE, VSAA----- opened  Test timeout 1 min or wait for switch-off VGD from LLS	<b>Start condition for the test (5 s):</b> 4. Correct valve position 5. UFP stopped (UF rate < 500 ml/h) 6. -450 mmHg < PDA < -150 mmHg  Test 10 s, max. deviation $\Delta$ PDA < 50 mmHg, PDA < -100 mmHg, Acknowledge with switch-off of VGD	15001 – 15010  15011  15012 – 15018
5.	1520x	<b>Pressure Reduction for VSAE Test with UFP:</b> Pressure reduction with UFP until PDA < -300 mmHg <b>Valve Status:</b> VDEBK1/2, VEBK1/2 ----- opened VDABK1/2, VABK1/2----- closed VBE, VDFF, VDE, VSB, VBP, VSAE----- closed VDA, VSAA----- opened Timeout 1 min		
6.	1525x	<b>VSAE Pressure Test and OSP Test</b> FPE = 1000 ml/min <b>Valve Status:</b> VDEBK1/2, VEBK1/2 ----- opened VDABK1/2, VABK1/2----- closed VBE, VDFF, VDE, VSB, VBP, VSAE----- closed VDA, VSAA----- opened  Test timeout 1 min or wait for switch-off VGD from LLS	<b>Start condition for the test (5 s):</b> 1. Correct valve position 2. UFP stopped (UF rate < 500 ml/h) 3. PDA < -150 mmHg  Test 10 s, max. deviation $\Delta$ PDA < 50 mmHg, PDA < -100 mmHg, Test delivery rate OSP at 200 $\pm$ 15 ml/min Acknowledge with switch-off of VGD	15021 – 15030  15031, 15032  15033 15034 – 15039

7.	1530x	<b>Pressure Reduction for VSAA Test with UFP:</b> Pressure reduction with UFP until PDA < -300 mmHg <b>Valve Status:</b> VDEBK1/2, VEBK1/2 ----- opened VDABK1/2, VABK1/2----- closed VBE, VDFF, VDE, VSB, VBP, VSAA ----- closed VDA, VSAE ----- opened Timeout 1 min		
8.	1535x	<b>VSAA Pressure Test</b> FPE = 1000 ml/min <b>Valve Status:</b> VDEBK1/2, VEBK1/2 ----- opened VDABK1/2, VABK1/2----- closed VBE, VDFF, VDE, VSB, VBP, VSAA ----- closed VDA, VSAE ----- opened  Test timeout 1 min or wait for switch-off VGD from LLS	<b>Start condition for the test (5 s):</b> 1. Correct valve position 2. UFP stopped (UF rate < 500 ml/h) 3. PDA < -150 mmHg  Test 10 s, max. deviation $\Delta$ PDA < 50 mmHg, PDA < -100 mmHg, Acknowledge with switch-off of VGD	15041 – 15050  15051  15052 – 15058
9.	1540x	<b>Pressure Equalisation for 60 s</b> <b>Valve Status:</b> VDEBK1/2, VEBK1/2 ----- opened VDABK1/2, VABK1/2----- closed VBE, VDE ----- closed VDFF, VBP, VSB, VDA, VSAE, VSAA ----- opened		
10.	1545x	<b>Filter Pressure Reduction with FPA:</b> Pressure reduction with FPA until PDA < -300 mmHg more than 4 s Opened VBE at PDA < -150 mmHg more than 2 s Close VBE at PDA > -150 mmHg <b>Valve Status:</b> VDEBK1/2 ----- closed VDABK1/2, VABK1/2----- opened VDE, VBP, VSAA ----- closed VDFF, VSB, VDA ----- opened Timeout 3 min		
11.	1550x	Wait 1 s		
12.	1555x	<b>Filter Pressure Reduction with UFP:</b> Control negative pressure with UFP (-320 mmHg) PDA < -150 mmHg: VBE opened PDA > -10 mmHg: VBE closed <b>Valve Status:</b> VDEBK1/2 ----- closed VDABK1/2 ----- closed VDE, VBP, VSAA ----- closed VDFF, VSB, VDA ----- opened Timeout 3 min		
13.	1560x	<b>Filter Pressure Test</b> <b>Valve Status:</b> VDEBK1/2 ----- closed VDABK1/2 ----- closed VDE, VBP, VSAA ----- closed VDFF, VSB, VDA, VBE ----- opened  Test timeout 1 min or wait for switch-off VGD from LLS	<b>Start condition for the test (5 s):</b> 1. Correct valve position 2. UFP stopped (UF rate < 500 ml/h) 3. VBE opened 4. PDA < -250 mmHg  Test 10 s, max. deviation $\Delta$ PDA < 50 mmHg, PDA < -200 mmHg, Acknowledge with switch-off of VGD	15101 – 15110  15111  15112 – 15118

14.	1565x	Opened VBP to acknowledge that air is really in the filter. Test timeout 1 min or wait for switch-off VGD from LLS	<b>Test Condition:</b> 1. Correct valve position 2. VBP, VBE opened 3. UFP stopped (UF rate < 500 ml/h) 4. PDA > -100 mmHg Acknowledge with switch-off of VGD	15120  15121 - 15127
15.	1580x	(Error) PSAUS and/or PSABF not closed		
16.	1599x	Completed		

The pressure reduction in the filters is first performed with FPA. The speed is controlled to build up a negative pressure of approx. -290 mmHg at PDA. If the pressure at PDA is < -300 mmHg the UF pump is switched on to reduce the pressure, and the balance chamber valves VDABK1/2 are closed.

#### Pressure reduction with FPA

PDA > -300 mmHg

100 ml/min ≤ FPA ≤ 1000 ml/min

#### Pressure reduction with UF pump

PDA > -300 mmHg

UF rate = 3000 ml/h

PDA > -320 mmHg

UF rate = 1000 ml/h

### 3.3.10 UF Pump

<b>Objective</b>	The function of the speed detection is tested.
<b>Test code</b>	20
<b>Repeats until error message</b>	1
<b>ID error message</b>	1158: <i>UF pump test will be repeated</i>
<b>Actions after error</b>	Repeat DFS pressure test and if necessary integrity test HDF online.

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
1.	2002x	<b>Prerequisites for Test:</b> Upline tank must be filled Timeout 2 min		
2.		Test code = 20 to LLS	Test code = 20 back to LLC	
3.	2010x	Set timeout timer	Test initialisation	20000 – 20004
4.			Since the start of the DFS pressure test more than 3 revolutions have been detected	20005
5.			Acknowledge with switch-off of VGD	20006 – 20011
6.	2020x	Wait for D24OFF (timeout 10 s)		
7.			VGD ON	20012
8.	2030x	Wait for D24ON (timeout 10 s)		
9.	2099x	Completed		

## 3.3.11 Conductivity

<b>Objective</b>	The function of the END-LF sensors is tested.
<b>Test code</b>	21
<b>Repeats until error message</b>	1
<b>ID error message</b>	1159: <i>Conductivity test not OK</i>
<b>Actions after error</b>	Rinse, repeat all tests.

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
1.		Test Prerequisites - None:		
2.		Test code = 21 to LLS	Test code = 21 back to LLC	
3.	2110x		Test initialisation	21000 – 21004
4.			Evaluation of the LF value test After passing the DFS pressure test ENDLF-S must reach the following value: - ENDLF-S > ENDLF-S <sub>DFS-Pressure Test</sub> + 5 mS/cm - ENDLF-S ≥ 11.4 mS/cm - ENDLF-S ≤ 17.85 mS/cm	21005
5.			Acknowledge with switch-off of VGD	21066 – 21011
6.	2120x	Wait for D24OFF (timeout 10 s)		
7.			VGD ON	21012
8.	2130x	Wait for D24ON (timeout 10 s)		
9.	2199x	Completed		

ENDLF-S<sub>DFS-Pressure Test</sub> is stored at the beginning of the DFS pressure tests

## 3.3.12 Temperature TSD

<b>Objective</b>	The function of the TSD sensors is tested.
<b>Test code</b>	22
<b>Repeats until error message</b>	1
<b>ID error message</b>	1160: <i>Temperature test not OK</i>
<b>Actions after error</b>	Rinse, repeat all tests.

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
1.	2202x	Prerequisites for Test: If test temperature was not yet reached: - Set warning 1102 - Wait for max. 3 min to reach the test temperature Test temperature reached or wait time exceeded: - Delete warning 1102 - Perform test.		
2.		Test code = 22 to LLS	Test code = 22 back to LLC	
3.	2210x	If test temperature (>41 °C) was not yet reached: Test not passed otherwise: timeout - set timer	Test initialisation	22000 – 22004
4.			After the start of the preparation: TSD-S must exceed 41 °C and be < 50 °C. The heater is switched off at TSD-S > 41 °C	22005
5.			Acknowledge with switch-off of VGD	22006 – 22011
6.	2220x	Wait for D24OFF (timeout 10 s)		
7.			VGD ON	22012
8.	2230x	Wait for D24ON (timeout 10 s)		
9.	2299x	Completed		

## 3.3.13 SAD Level Test

The level test measures the test threshold, which LLC generates to drive the SAD with a permanent test pulse. This is compared with the calibrated test threshold  $\pm 50$  mV. If the measured test threshold is in this limit LLS switches off the +24 V for 3 s. This is detected by LLC as "test passed".

Test code 30  
 Repeats until error message 3  
 ID error message 1161: SAD (Ref.) test not OK  
 Actions after error Return to window: Repeat blood line self test with  key.

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
1.	3002x	<b>Test Prerequisites:</b> Blood side must not be stopped by TLC or LLC. If stopped: Message 1140 is displayed. No timeout.		
2.		Test code = 30 to LLS	Test code = 30 back to LLC	
3.	3010x	Set wait timer	Test initialisation	30000
4.	3020x	After 3 s signal EV_DAUERTEST_SAD_EIN send to BIOS-SAD-Task		
5.			If deviation SAD-Ref $\leq 50$ mV then carry on	30001
6.			If deviation SAD-Ref $\leq 50$ mV then acknowledge with switch-off VGB	30002
7.			Acknowledge with switch-off VGB	30003 - 30008
8.	3030x	Wait for B24OFF (timeout 10 s) If B24OFF signal EV_DAUERTEST_SAD_AUS send to BIOS-SAD-Task		
9.			VGB ON	30009
10.	3040x	Wait for B24ON (timeout 10 s)		
11.	3099x	Completed		

## 3.3.14 SAD Counter Test

The counter test measures the time base of the counter for the TIMECONTR signal. LLC triggers and a low pulse of 1666  $\mu$ s is generated at the TIMECONTR signal, which is measured by LLS. If this pulse is in the range of 1666  $\mu$ s  $\pm 30$   $\mu$ s LLS switches off the +24 VB for 3 s. This is detected by LLC as "test passed".

Test code 31  
 Repeats until error message 3  
 ID error message 1162: SAD (Freq.) test not OK  
 Actions after error Return to window: Repeat blood line self test with  key.

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
1.	3102x	<b>Prerequisites for Test:</b> Blood side must not be stopped by TLC or LLC. If stopped: Message 1140 is displayed. No timeout.		
2.		Test code = 31 to LLS	Test code = 31 back to LLC	
3.	3110x	Send signal EV_COUNTER_TEST_SAD to BIOS-SAD-Task	Test initialisation	31000
4.			If measurement of TIMECONTR pulse length 1629 $\mu$ s $\leq t \leq 1689$ $\mu$ s, then acknowledge with switch-off VGB	31001
5.			Acknowledge with switch-off VGB	31002 - 31007
6.	3120x	Wait for B24OFF (timeout 10 s)		
7.			VGB ON	31008
8.	3130x	Wait for B24ON (timeout 10 s)		
9.	3199x	Completed		

### 3.3.15 Equality Test for Blood Side Pressure Sensors

The pressure sensors are connected together via the filled tubing system with bag and thus have the same pressure level. Additionally the feedback of the level regulation valves, the level regulation pump LRP (PPR) and the SAKA are checked.

**Objective**  
**Test code**  
**Repeats until error message**  
**ID error message**  
**Actions after error**

Test the equality of pressure sensors with opened tubing system.  
32  
3  
1163: *Blood side pressure sensor test not OK*  
Return to window: Repeat blood line self test with  key.

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
1.	3202x	<b>Prerequisites for Test:</b> a) Blood side must not be stopped by TLC or LLC. If stopped: Message 1140 is displayed. No timeout. b) If BS is not stopped HDFonline task must enable the start of the tests. A delay occurs only with autopriming (set pressure). Timeout 2 min		
2.		Test code = 32 to LLS	Test code = 32 back to LLC	
3.	3210x	LLC activates VBT, VPA, VPV, VPU and SAKA VPU must be activated to prevent a pressure equalisation to the environment and that the levels in the chambers do not change. VPE remains closed to prevent a pressure equalisation if PBE is not connected.	Test initialisation	32000
4.	3220x	Test timeout 60 s and wait for inversion of LLS_SELFTESTBIT from LLS	Check of current detection for VBT, VPA, VPV, VPE, VPD, SAKA and PPR  Acknowledge with inversion of LLS_SELFTESTBIT	32001
5.	3230x	LLC deactivates VBT, VPA, VPV, SAKA and activates VPE		
6.	3240x	Test timeout 60 s and wait for inversion of LLS_SELFTESTBIT from LLS	Check of current detection for VBT, VPA, VPV, VPE, VPD, SAKA and PPR  Acknowledge with inversion of LLS_SELFTESTBIT	32020
7.	3250x	LLC deactivates VBE and VPU VPD is activated PPR is activated with the PWM PPRLOW (PWM for line with small chamber, setting in TSM)		
8.		Initialise mean value storage for PA, PV, PBS and PBE	Check of current detection for VBT, VPA, VPV, VPE, VPD and PPR	32002
9.	3260x	Wait for inversion of LLS_SELFTESTBIT from LLS (timeout 15 s) Evaluate every 250 ms continuous mean value from the 4 values of PA, PV, PBS and PBE.	Save values from PA, PV, PBS, PBE and compare the pressure sensor PA, PV, PBE and PBS (if present):	32004
10.			PV – PA  must be ≤ 20 mmHg.  PV – PBE  must be ≤ 20 mmHg or  PBE  < 10 mmHg.	32005
11.			PV – PBS  must be ≤ 20 mmHg or  PBS  < 10 mmHg.	32006
12.			Acknowledge with inversion of LLS_SELFTESTBIT	32010
13.		Detected inversion of LLS_SELFTESTBIT Calculate mean value storage of PA, PV, PBS and PBE		
14.	3260x	(Error) received B24ON - mean value of PA and PV deviate more than ±40 mmHg.		
15.		(Error) the test prerequisites from HDFonline-Task are not given during one of the test steps (e.g. autopriming, HDF filter rinsing required after LF error).		
16.		Completed Close VPD		

### 3.3.16 Pressure Test Substitution Line S-Online HDF Online

If the substitution line s-online is connected at the beginning of the blood side self test and the filling of the tubing system is performed by the machine (autopriming): LLC performs a pressure test of the port connectors and the lines between the port and OSP. This tubing is connected with the pressure sensor PA via the arterial tubing adapter. The test is performed with positive pressure. The build-up is performed in the DFS system with FPE/FPA via a pressure drop at the throttle DDE and an opened VSAE. The pressure test is performed for s-online after the equality test of the pressure sensors in the blood side test block.

If autopriming is not performed s-online can not be tested. As an information LLS generates an alarm *Leakage Check S-Online* after the initial start of OSP in therapy. This information is generated even if the autopriming of the s-online test was not performed by LLC.

If the s-online is not connected during the pressure test this is not detected and a message to check the line is not generated after connection and the start of online.

<b>Test code</b>	40
<b>Repeats until error message</b>	1
<b>ID error message</b>	1166: <i>Self test substitution line failed</i>
<b>Actions after error</b>	Return to window: Repeat blood line self test with  key.

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
1.	4002x	<b>Prerequisites for Test:</b> Blood side must not be stopped by TLC or LLC. If stopped: Message 1140 is displayed. No timeout.		
2.		Test code = 40 to LLS	Test code = 40 back to LLC	
3.	4010x	Opened VSAE	Test initialisation	40000
4.	4020x	Pressure build-up with FPE/FPA in chamber flow through mode via DDE until PA > 270 mmHg (no pressure control for pressure sensor PA!) Valve Status: VDFF, VDE, VDA, VSB, VSAA -----closed VBP, VSAE -----opened Timeout 20 s		
5.		<b>S-online Pressure Test</b> <b>Valve Status:</b> VSAE closed, BPA and OSP stopped	<b>Start condition for the test (for 5 s):</b> 1. Correct valve position (VSAE closed) 2. PA > 250 mmHg 3- PA < 500 mmHg	40001 – 40010
6.			Test 10 s, Averaging MeanPA, Determine MinPA and MaxPA Check -500 mmHg < PA < 500 mmHg, max. deviation ΔPA < 50 mmHg, -450 mmHg < PA < 450 mmHg,	40011
7.			Check: - MaxPA - MeanPA < 50 mmHg, - MeanPA - MinPA < 50 mmHg  Acknowledge with switch-off VGB	40012  40013 – 40018
8.	4020x	Wait for B24OFF (timeout 30 s)		
9.			VGB ON	40019
10.	4030x	Wait for B24ON (timeout 15 s)		
11.	4070x	(Error) the test prerequisites from HDFonline task are not given during one of the test steps (e.g. autopriming, HDF filter rinsing required after LF error).		
12.	4099x	Completed		

### 3.3.17 Blood Side Pressure Retention Test

<b>Objective</b>	Pressure test of tubing system and control of the dynamics of the pressure sensors.
<b>Test code</b>	33
<b>Repeats until error message</b>	3
<b>ID error message</b>	1169: <i>Blood side leakage test not OK</i>
<b>Actions after error</b>	Return to window: Repeat blood line self test with  key.

	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
1.	3302x	<b>Prerequisites for Test:</b> a) Blood side must not be stopped by TLC or LLC. If stopped: Message 1140 is displayed. No timeout. b) If BS is not stopped HDFonline task must enable the start of the tests. A delay occurs only with autopriming (set pressure). Timeout 2 min		
2.		Test code = 33 to LLS	Test code = 33 back to LLC	
3.	3300x	Stop BPA	Test initialisation	33000
4.	3310x	Set BPA with ramp to delivery rate 200 ml/min, opened SAKV Timeout 90 s since subcode 100	Test SAKV opened	33001
5.			Test of BPA delivery rate at 185 ml/min < BPA < 215 ml/min Acknowledge by closing SAKV and saving PV	33013
6.			Test of BPA motor speed (Note: the motor pulses are used for alarm evaluation when detecting standstill.)	33014
7.	3330x	Wait for PV > +400 mmHg for 500 ms during the running of BPA. Pressure reached: - Stop BPA, close SAKV, open VBT - Initialise mean value storage for PA, PV, PBS and PBE Timeout 90 s since the start of subcode 100	Wait for PV > 390 mmHg no timeout	33015- 33023
8.	3340x	Evaluate every 250 ms continuous mean value from the 4 values of PA, PV, PBS and PBE. Evaluate after 2.5 s mean values of PBS and PBE: <b>PBE connected, if</b> PBE mean value is min. 100 mmHg higher (from BS pressure test) than PBE mean value (from BS equality test of pressure sensors) and PBE and PV mean value deviate less than ± 40 mmHg (from BS equality test). <b>PBS connected, if</b> PBS mean value is min. 100 mmHg higher (from BS pressure test) than PBS mean value (from BS equality test of pressure sensors) and PBS and PV mean value deviate less than ± 40 mmHg (from BS equality test). $ PA - PV  \leq 20$ mmHg	Opened SAKV	33024- 33025
9.			PBE present, if: $PBE \geq PBE + 100$ mmHg from test 32, step 4 PBS present, if: $PBS \geq PBE + 100$ mmHg from test 32, step 4 Terminate if PBS not present for SNCO $PV \geq PV + 100$ mmHg from test 32 step 20	33026
10.			Test SAKV closed, save PV	33027
11.			Test 10 s PV pressure drop < 20 mmHg and PV > 150 mmHg and $ PA - PV  \leq 20$ mmHg otherwise return to 54 Acknowledge with inversion of LLS_SELFTESTBIT	33028 - 33038
12.	3340x	Wait for inversion of LLS_SELFTESTBIT from LLS (Timeout 35 s since start of subcode 400)		
13.		Close VBT	Test VBT closed	33039
14.			$ PA - PV  \geq 200$ mmHg Acknowledge with inversion of LLS_SELFTESTBIT	33040
15.	3350x	Wait for inversion of LLS_SELFTESTBIT from LLS		

		(Timeout 10 s since start of subcode 400)	
16.	3360x	(Error) the test prerequisites from HDF online task are not given during one of the test steps (e.g. autopriming, HDF filter rinsing required after LF error).	
17.	3370x	(Error) during start up of BPA (subcode 200), PV > +400 mmHg	
18.	3399x	Completed	33041

### 3.3.18 Disinfection Valve VD

#### Objective

Function test of the detection of the actual value for LLS.

The disinfection valve VD is opened shortly ( $t < 3$  s) by LLC during the test. The opening must be detected by LLS.

The test is performed in *Preparation* if the dialyser couplings are not connected to the rinsing bridge anymore and the blood side pressure retention test was passed. If the test is not passed therapy is not possible.

#### Test code

37

#### Repeats until error message

3

#### ID error message

1165: *Self test VD failed*

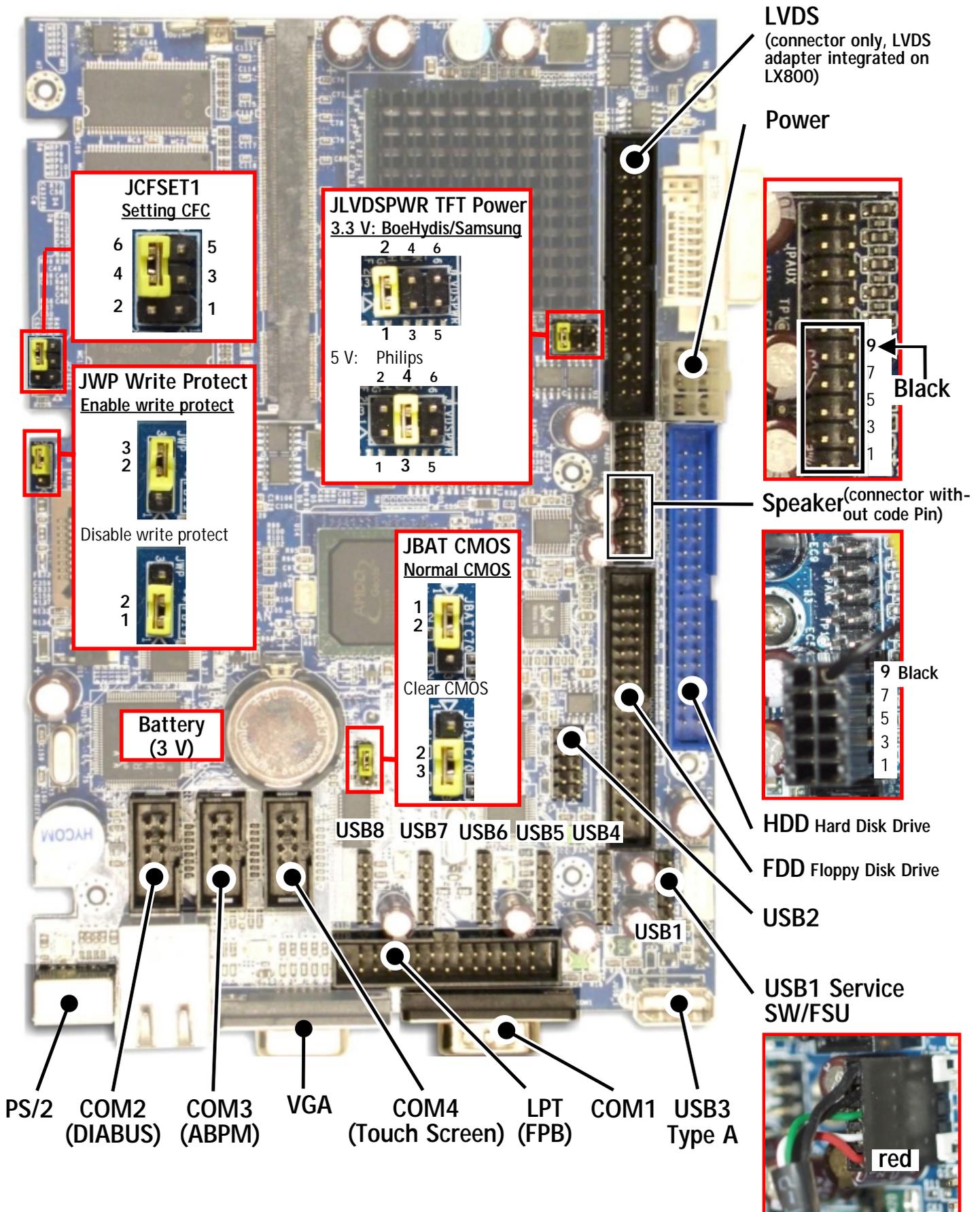
#### Actions after error

None (repeat test until passed).

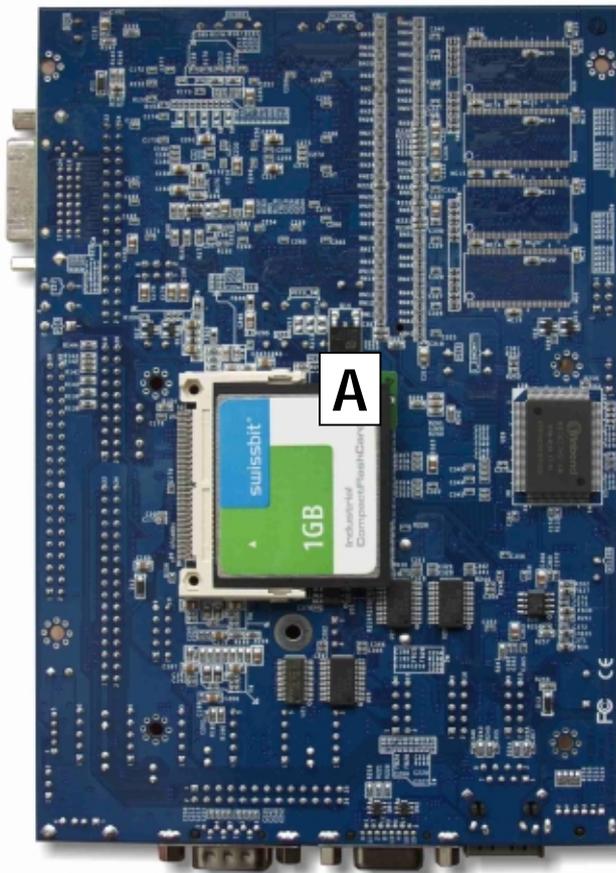
	LLC Test Code	LLC Test Steps	LLS Test Steps	LLS Test Code
1.		<b>Prerequisites for Test: None</b>		
2.		Test code = 37 to LLS	Test code = 37 back to LLC	
3.	3710x	Opened VD	Test initialisation	37000
4.			<b>Start condition for the test:</b>	
			1. BS pressure retention test is passed (test code 33)	37001
5.			Detection valve opened	37002
6.	3720x	Close VD after 750 ms		
7.			Detection valve closed. The detected opening is acknowledged by the switch-off of VGB.	37003 – 37009
8.	3730x	Wait for B24OFF (timeout 7.5 s)		
9.			VGB ON	37010
10.	3730x	Wait for B24ON (timeout 5 s)		
11.	3780x	(Error) at start of test one or both couplings connected to rinsing bridge.		
12.	3799x	Completed		

3.4 LX800 Motherboard

The Dialog+ (software 9.xx) uses the LX800 motherboard. A compact flash card CFC is connected to the motherboard. The BIOS is described in paragraph 3.3.5.



### 3.4.1 IDE Interface LX800 Motherboard

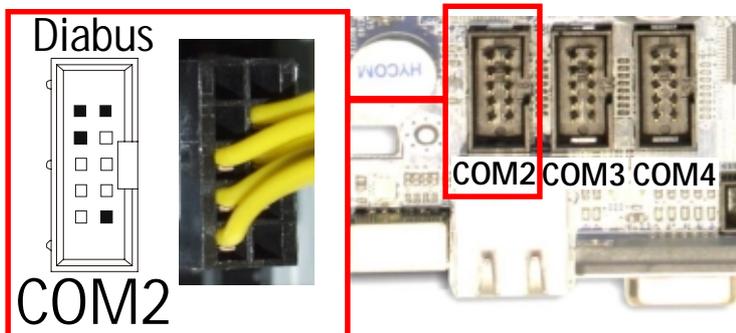


The compact flash card CFC **A** is assembled on the rear side of the LX800 motherboard. The assignment of the IDE interface is listed in the table. The BIOS settings are in paragraph 3.4.5.

LX800 Assignment IDE Interface	
	IDE
Compact Flash Card CFC	X

Fig.: LX800 Motherboard, Rear Side

### 3.4.2 COM Ports LX800 Motherboard

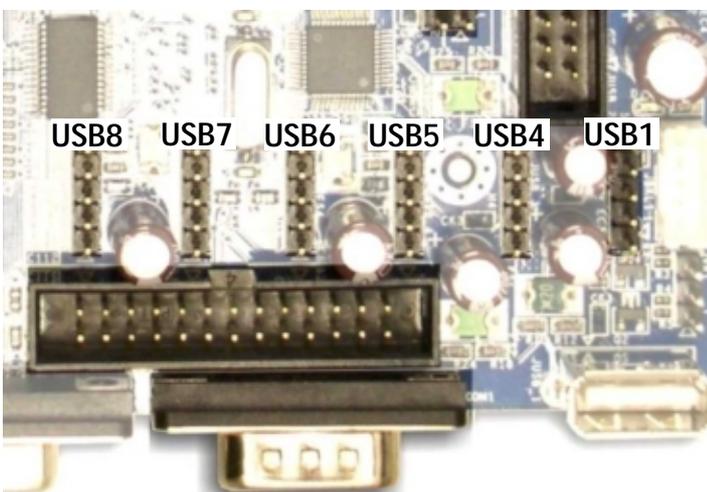


The assignment of the COM ports is listed in the table. The assignment of the Diabus is shown additionally (left figure). The BIOS settings are in paragraph 3.4.5.

LX800 Assignment COM Ports			
	COM2	COM3	COM4
DIABUS	X		
ABPM		X	
Touch Screen			X

Fig.: COM Ports

### 3.4.3 USB Ports LX800 Motherboard



The assignment of the USB ports is listed in the table. The USB ports 4 to 8 are freely selectable. The BIOS settings are in paragraph 3.4.5.

LX800 Assignment USB Ports				
	USB1	USB2	USB3	USB4-8
USB Service SW/FSU	X			
Card Reader				X
DSI (CritLine)				X
Adimea (Kt/V-UV)				X

Fig.: USB Ports

### 3.4.4 Detection/Boot Sequence from Bootable USB Sticks



Use only USB sticks supplied by B. Braun as tool for the installation of the software.



Fig.: Start Screen during Installation of Software with **Installation** Logo



Fig.: Start Screen during Installation of Software with **B | BRAUN** Logo

Dialog+ machines detect automatically connected bootable USB sticks. This is indicated by the red **Installation** text in start screen.

The following may occur during the installation of the TLC software:

- a bootable USB stick is not detected or
- a bootable USB stick is detected, but it is not booted from the USB stick.

If the installation of the software can not be performed from the USB stick, the **B | BRAUN** logo is displayed in both cases on the start screen.

- switch the machine off and on again
- if necessary check boot sequence in the BIOS

### 3.4.5 BIOS Settings for LX800 Motherboard

#### BIOS Menu

The LX800 motherboard is delivered with a special default setting - Dialog+ with software ≥ 9.xx and CFC.

These settings are displayed in the following BIOS lists.

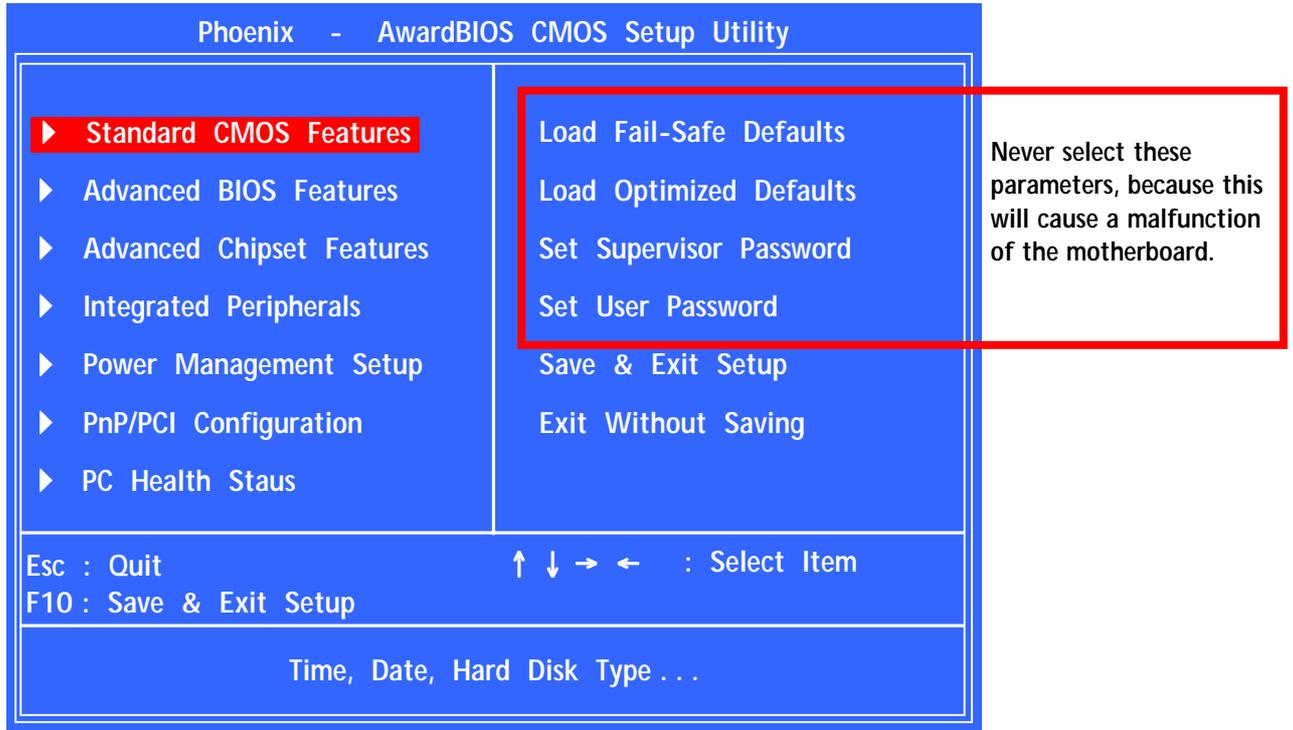
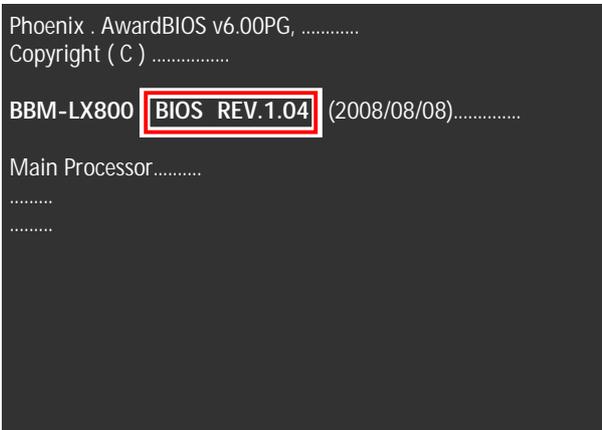


Fig.: Phoenix – AwardBIOS CMOS Setup Utility (Example)

#### BIOS Version Number



The BIOS version number can be displayed as follows:

1. Connect PC keyboard to motherboard.
2. Switch on machine.
3. Press the **TAB** key when the **B | BRAUN** logo is displayed.
4. Press the **Pause/Break** key to stop the boot routine. The BIOS version is displayed, e.g. **BIOS Revision 1.04**.



## 3.4.5.1 Standard CMOS Features

	Dialog+ SW 9.xx CFC/CR Compact Flash Card/Card-Reader (Default Setting)
Date (mm:dd:yy)	Sun, mm:dd:yy
Time (hh:mm:ss)	hh:mm:ss
IDE Primary Master	[xxx xxx]
IDE HDD Auto-Detection	[Press Enter]
IDE Primary Master	[Auto]
Access Mode	[Auto]
Capacity	-
Cylinder	-
Head	-
Precomp	-
Landing Zone	-
Sector	-
IDE Primary Slave	[None]
Drive A	[None]
Drive B	[None]
Video	[EGA/VGA]
Halt On	[All, But Disk/Key]
Base Memory	640K
Extended Memory	252672K
Total Memory	253440K

## 3.4.5.2 Advanced BIOS Features

Virus Warning	[Disabled]
CPU Internal Cache	[Enabled]
First Boot Device	<b>[USB-HDD]</b>
Second Boot Device	<b>[HDD-0]</b>
Third Boot Device	[Disabled]
Boot Other Drive	[Disabled]
Swap Floppy Drive	[Disabled]
Boot Up Floppy Seek	[Disabled]
Boot Up NumLock Seek	[On]
Gate A20 Option	[Fast]
Typematic Rate Setting	[Disabled]
x Typematic Rate (Chars/Sec)	6
x Typematic Delay (Msec)	250
Security Option	[Setup]
OS Select For DRAM > 64MB	[Non-OS2]
Full Screen LOGO Show	[Enabled]
Small Logo(EPA) Show	[Disabled]
Onboard Lan Boot ROM	[Disabled]

## 3.4.5.3 Advanced Chipset Features

CPU Frequency	[Auto]
x Memory Frequency	[Auto]
CAS Latency	[Auto]
Video Memory Size	[8 M]
Output Display	<b>[Panel &amp; CRT]</b>
Flat Panel Configuration	[Panel Enter]
Resolution	<b>[1024 x 768]</b>
Refresh Rate	[60 Hz]
HSYNC Polarity	[Normal High]
VSYNC Polarity Active	[Normal High]
SHFCLK Active Period	[Free Running]
LP Active Period	[Free Running]
Onboard Audio	[Disabled]
Onboard USB1.1	<b>[Enabled]</b>
Onboard USB2.0	<b>[Enabled]</b>
Onboard DIE	[Enabled]
Memory Hole At 15M-16M	[Disabled]

## 3.4.5.4 Integrated Peripherals

Dialog+ SW 9.xx  
CFC/CR  
Compact Flash Card/Card-Reader  
(Default Setting)

Master Drive PIO Mode	[Auto]
Slave Drive PIO Mode	[Auto]
IDE Primary Master UDMA	[Auto]
IDE Primary Slave UDMA	[Auto]
IDE DMA Transfer Access	[Enabled]
IDE HDD Block Mode	[Enabled]
Onboard FDC Controller	[Enabled]
Onboard Serial Port 1	[3F8/IRQ4]
Onboard Serial Port 2	[2F8/IRQ3]
UART Mode Select	[Normal]
x Rx/D, Tx/D Active	Hi, Lo
x IR Transmission Delay	Enabled
x UR2 Duplex Mode	Half
x Use IR Pins	IR-Rx2Tx2
Onboard Parallel Port	[378/IRQ7]
Parallel Port Mode	[SPP]
x EPP Mode Select	EPP1.7
x ECP Mode Use DMA	3
Watch Dog Timer Select	[Disabled]
Onboard Serial Port 3	[3E8]
Serial Port 3 Use IRQ	[IRQ9]
Onboard Serial Port 4	[2E8]
Serial Port 4 Use IRQ	[IRQ5]

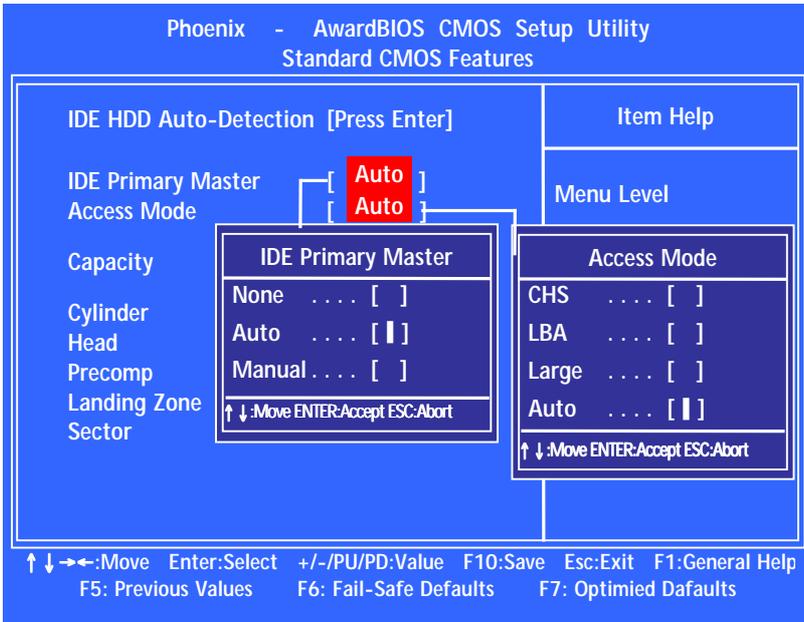
## 3.4.5.5 Power Management Setup

x ACPI Function	[Disabled]
Power Management	[Disabled]
** PM Timers **	
x Standby Mode	Disabled
x Suspend Mode	Disabled
HDD Power Down	[Disabled]
MODEM Use IRQ	[N/A]
PME Event Function	[Disabled]
Soft-Off by PWR-BTTN	[Instant-Off]
Power-On by Alarm	[Disabled]
x Time (hh:mm:ss) Alarm	0
IRQ Wakrup Events	[Press Enter]
IRQ1 (KeyBoard)	[OFF]
IRQ3 (COM 2)	[OFF]
IRQ4 (COM 1)	[OFF]
IRQ5 (LPT 2)	[OFF]
IRQ6 (Floppy Disk)	[OFF]
IRQ7 (LPT 1)	[OFF]
IRQ8 (RTC Alarm)	[OFF]
IRQ9 (IRQ2 Redir)	[OFF]
IRQ10 (Reserved)	[OFF]
IRQ11 (Reserverd)	[OFF]
IRQ12 (PS/2 Mouse)	[OFF]
IRQ13 (Coprocessor)	[OFF]
IRQ14 (Hard Disk)	[OFF]
IRQ15 (Reserved)	[OFF]

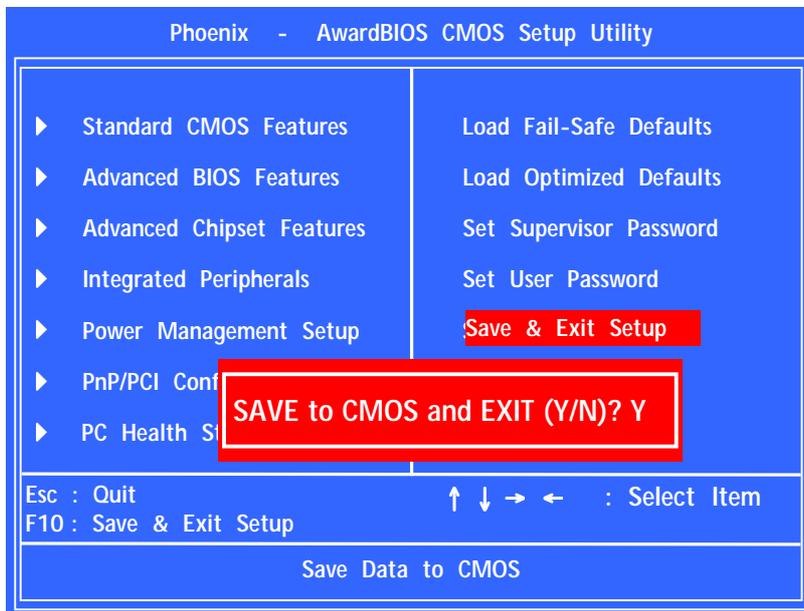
## 3.4.5.6 PnP/PCI Configuration

PNP OS Installed	[No]
Init Display First	[PCI Slot]
Reset Configuration Data	[Disabled]
Resources Controlled By	[Auto(ESCD)]
x IRQ Resources	Press Enter
x Memory Resources	Press Enter
PCI/VGA Palette Snoop	[Disabled]





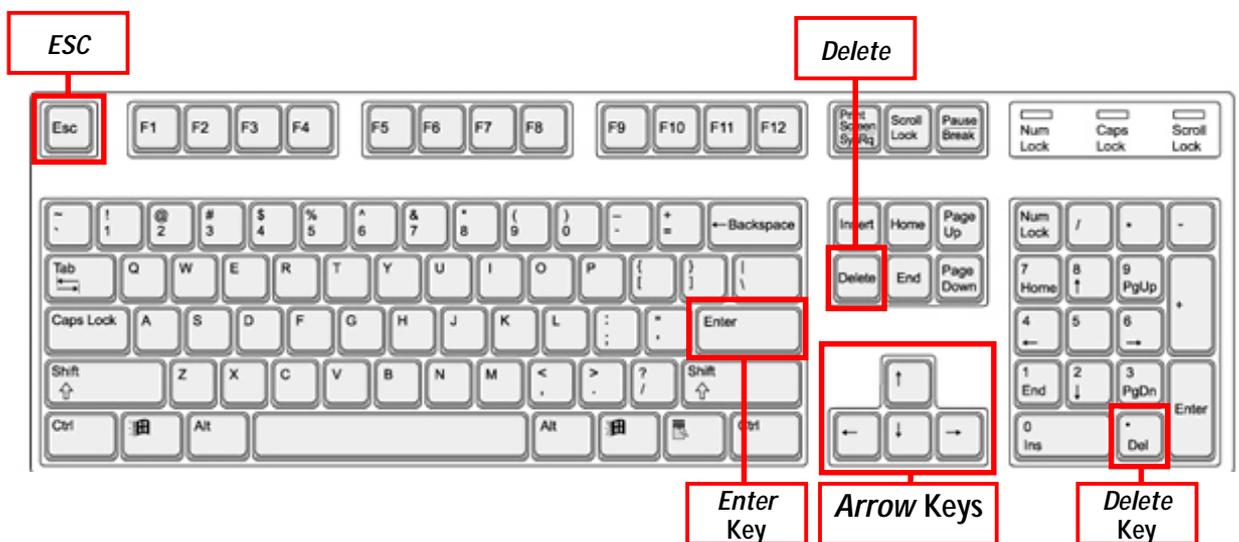
5. Press **Enter** key to open *IDE Primary Master* window.
6. Move down to *Auto* with the **Arrow** key.
7. Press **Enter** key to accept. The *IDE Primary Master* window closes.
8. Check the *Auto* setting in the *Access Mode*.



**Save and Exit BIOS**

9. Press **ESC** key to go back to the *CMOS Setup Utility* menu.
- Note:** In general you can use the **ESC** key to go back to the previous menu.
10. Select *Save & Exit Setup* menu with the **Arrow** keys.
11. Save changes and exit the *BIOS CMOS Setup* with **Enter** key.

The changes in the *Standard CMOS Features* menu are saved to the *BIOS CMOS*.



## 3.5 Installation Software 9.xx

**USB Stick for Treatment Support Settings**

The system configuration saved on a USB stick (FSU utility) must only be downloaded to an other Dialog+ machine (with software  $\geq$  9.xx) after a software update if:

- the hardware matches and
- the machine has the identical software version number.

**Activation of the Treatment Support Settings**

The settings are only activated after the Dialog+ is switched off and on again. Check the settings after the Dialog+ was switched on again.

**Service switch**

The software is installed in the software update mode: digital board, service switch S1, position 3.

After software installation: turn service switch S1 to TSM service program mode (position 2)

After completion of all procedures turn back service switch S1 to therapy mode (position 0).

**Default Table**

The default values for the parameters depend on the machine status (see Dialog+ default table for SW 9.xx for a detailed overview).

**Software Update**

The customer specific default values of the machine must be documented in the default table prior to the installation of a new software. These values must be entered again after installation.

## 3.5.1 Document Customer Specific Default Values

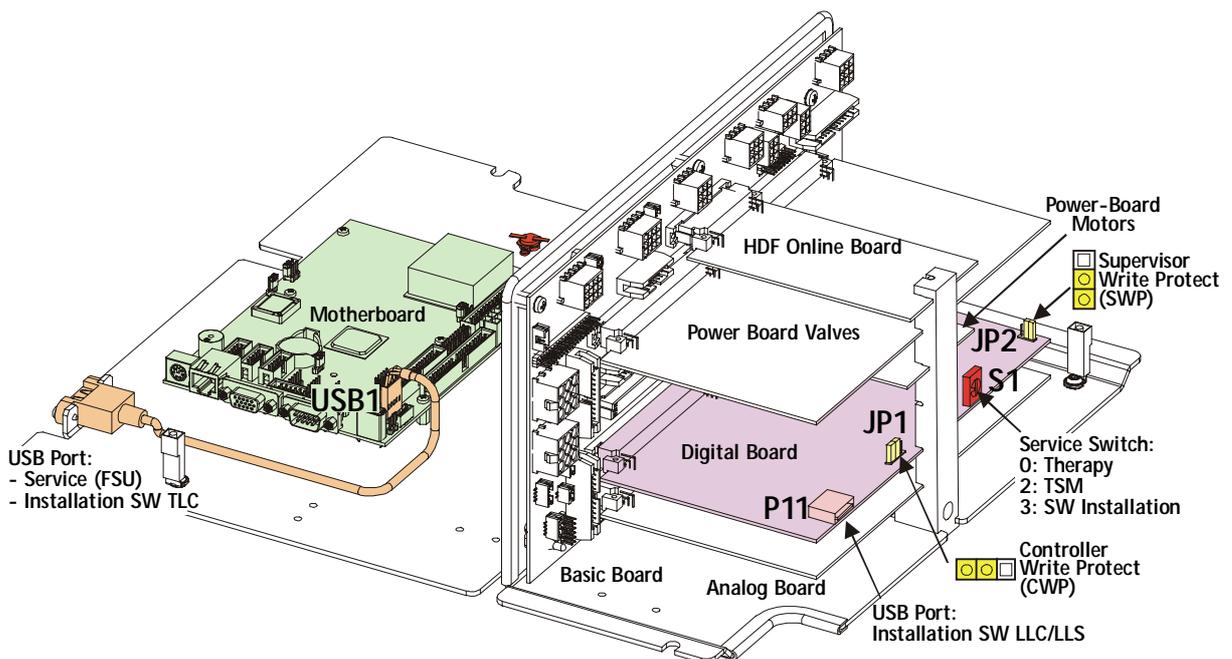


Fig. : Top Level Sub-Rack, Digital Board with Service Switch S1, USB Port P11 and Jumpers JP1/JP2



Enter the customer specific default values of the machine in the default table:

1. Open rear door.
2. Switch to TSM service program mode (on digital board DB, service switch S1 position 2).
3. Switch on Dialog+.
4. Document default values in default table.
5. Switch off Dialog+.

### 3.5.2 Installation Software LLC 9.xx and LLS 9.xx with USB Stick

The USB stick with the TLC/LLC/LLS software is required for the installation of the software LLC 9.xx and LLS 9.xx.



- Bootable USB stick with the TLC/LLC/LLS software

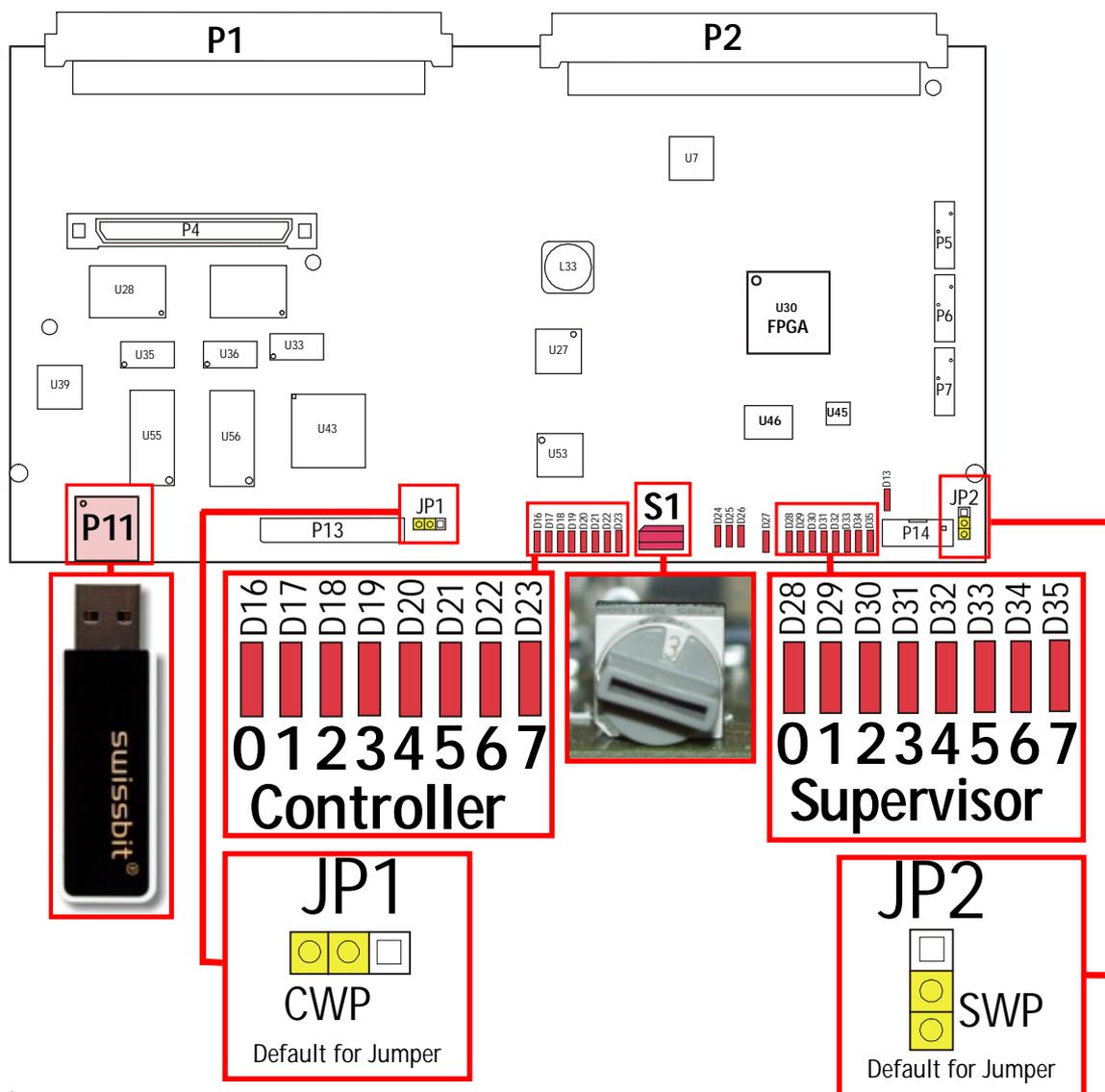
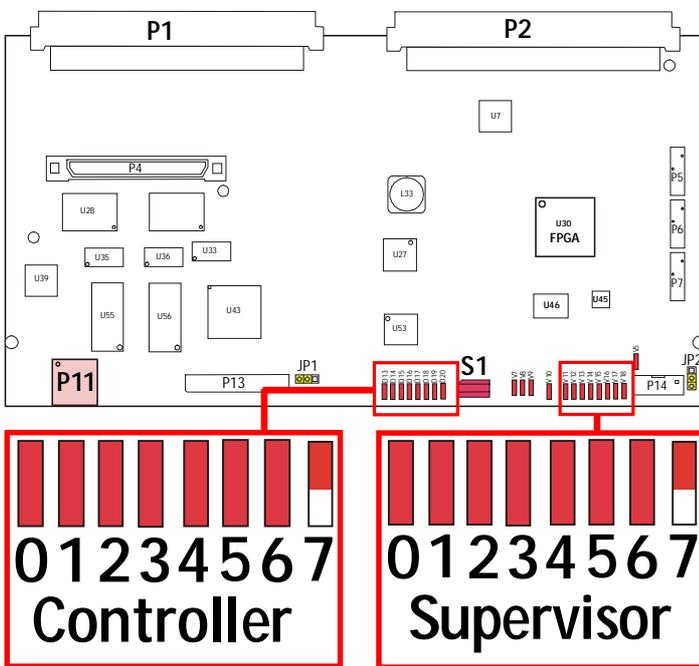
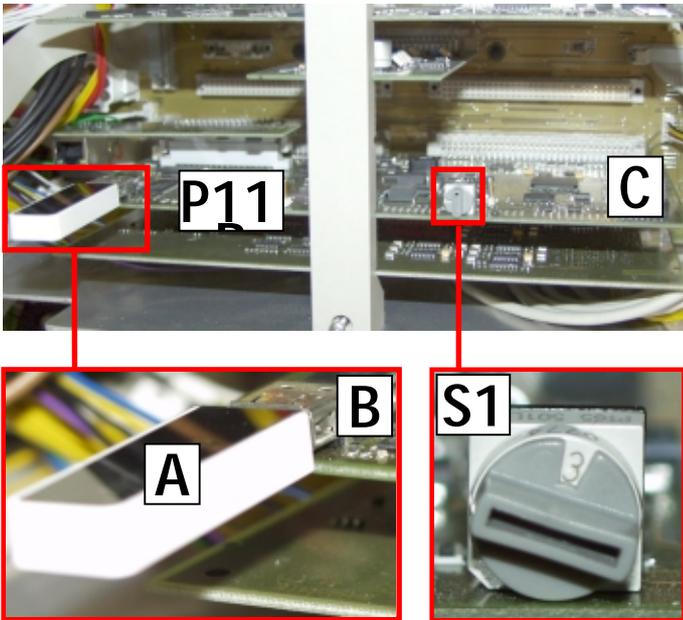


Fig. : Digital Board

- P11** USB Type A for Installation of LLC/LLS SW with USB Stick
- S1** **Service Switch:**  
 Position 0: Therapy Mode  
 Position 2: TSM Service Program Mode  
 Position 3: Software Installation/Update Mode

- Controller LEDs 0 to 7 (D16 – D23):**  
 Status 0 – 7 for Installation of LLC Software
- Jumper JP1 CWP:**  
 Controller Write Protect
- Supervisor LEDs 0 to 7 (D28 – D35):**  
 Status 0 – 7 for Installation of LLS Software
- Jumper JP2 SWP:**  
 Supervisor Write Protect

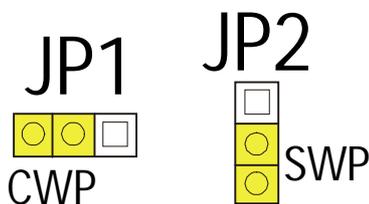


6. Connect USB stick **A** to USB port **B** (P11) on digital board **C**.
7. Turn service switch **S1** to position 3 – SW installation.
8. Switch on machine.
9. The USB stick is detected.

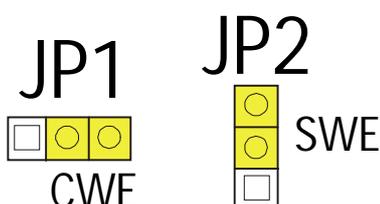
10. The LLC and LLS software is installed automatically.  
Both LLC/LLS LEDs show the installation progress:  
**LED 0**: Is off if firmware is not updated  
**LED 1**: Respective software is updated  
**LED 2**: Checksum and configuration files are loaded  
**LED 3**: USB stick consistency is verified  
**LED 4**: Binary files are loaded  
**LED 5**: Binary images are verified  
**LED 6**: Flash ROMs are programmed/under verification
11. A successful software installation is indicated by:
  - LEDs 7: flashing
  - short beep from the SMPS-MC
  - LED 0 : on (only if firmware is updated)
  - LEDs 1 to 6: on
12. Switch off machine.
13. Remove USB stick **A** from the USB port **B** on the digital board **C**.

Setting for Jumpers JP1 and JP2

Firmware Update not Possible (Protected)



Firmware Update Possible (Enabled)



The firmware for the controller and supervisor is protected by the jumpers JP1 and JP2. The position for both jumpers are set to CWP/SWP (controller/supervisor write protect). The jumpers must be in this position to protect the LLC and LLS firmware.

The installation of the firmware is normally not required during the installation of LLC and LLS.

If the firmware has to be installed additionally, it will be indicated in the installation instructions. JP1 and JP2 have to be set to this position (Default CWE and SWE: controller/supervisor write enabled). Set the jumpers back to the CWP/SWP setting after installation.

### 3.5.3 Installation Software TLC 9.xx with USB Stick

The USB stick with the TLC/LLC/LLS software is required for the installation of the software TLC 9.xx.



If the TLC software has to be installed only:

- Open rear door.
- Switch to TSM service program mode (on digital board DB, service switch S1 position 2).
- Proceed with point 14.
- Bootable USB stick with the TLC/LLC/LLS software



14. Open front door.
15. Connect USB stick **A** to USB port **B** on the TLC sub-rack **C**.
16. Switch on machine.

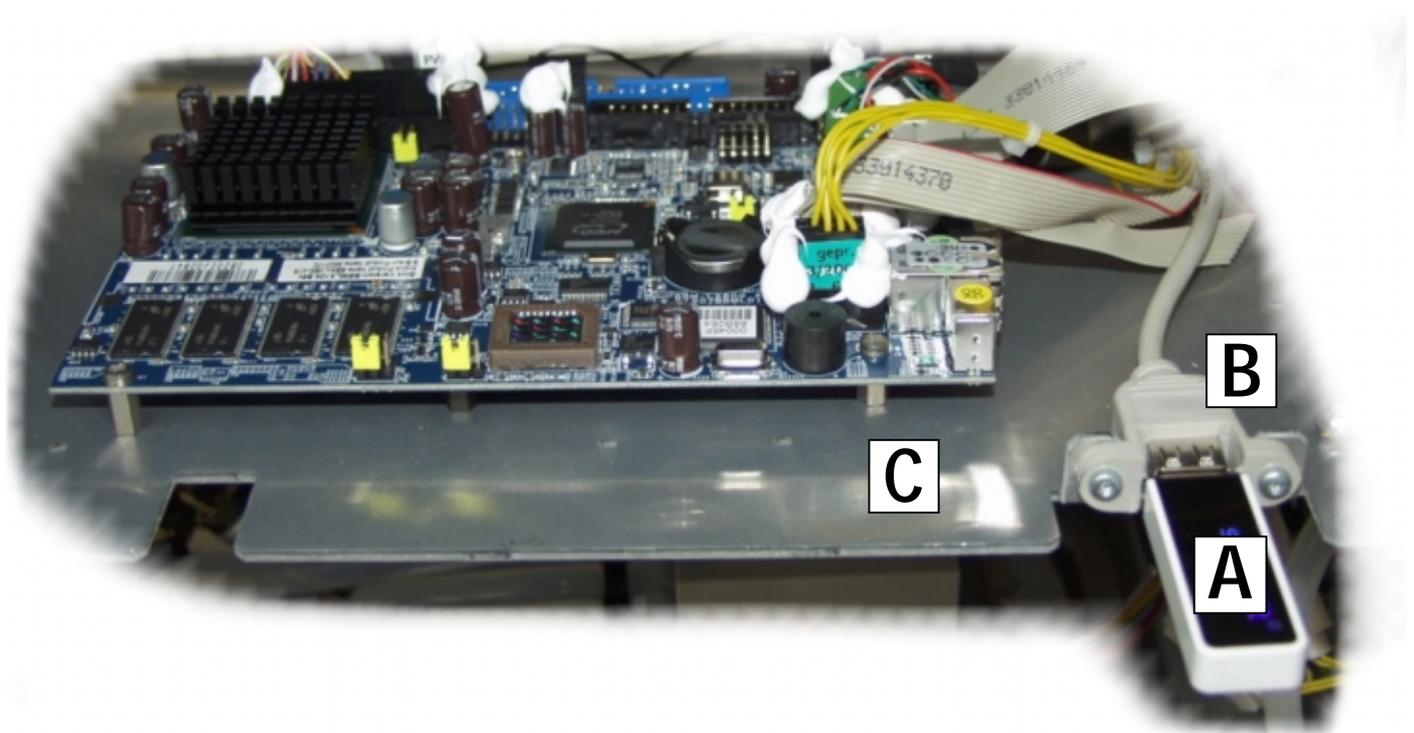
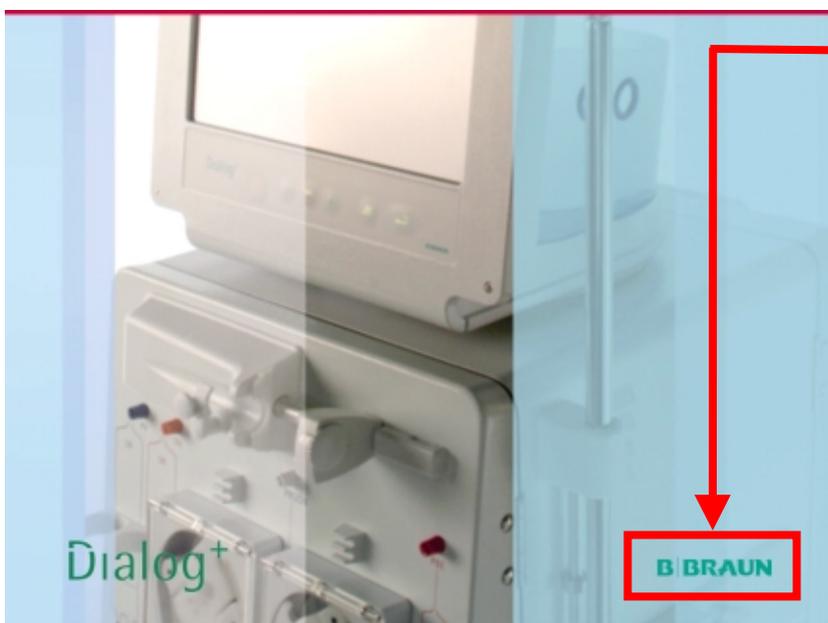


Fig.: Front View TLC Sub-Rack

**USB Stick Detected**

The system detects the bootable USB stick and boots from the USB stick (indicated by the red **Installation** text in the start screen).

**USB Stick not Detected**

The system does not detect the bootable USB stick (indicated by the green **B | BRAUN** logo in the start screen). If necessary disconnect the USB stick and reconnect.

17. Follow the software installation for TLC according to the information on the monitor:

⇒ Use hardware keys only: , or 

[AQ] (Alarm Acknowledgement) = NO = 

[EQ] (Enter) = YES = 

⇒ Do not connect and use a PC keyboard for the installation of the software.

\*\*\* You are about to install the Dialog/TLC V9.xx software. \*\*\*

If you want to **CONTINUE** the **Installation**,  
**LEAVE** the installation **USB stick** in the socket,  
 press **Y** or **y** and **<CR>** if keyboard is used  
 otherwise  
 press the **EQ** hardware key!

If you want to **SKIP** the **TLC** installation  
 press **N** or **n** and **<CR>** on keyboard or any **other** hardware key!

[EQ] Press  to confirm and proceed with the installation of the TLC software.

[AQ] Press  if you want to terminate the installation of the software.

#### LX800 Motherboard

\*\*\* Dialog V9.xx /TLC V9.xx installation \*\*\*  
 Installation/setup of the Dialog/TLC runtime system.

Does the machine have:

**LX800 (NIBP: COM3=IRQ9 ECG: COM4=IRQ5)** motherboard?

If **YES**, press **Y** or **y** and **<CR>** if keyboard is used  
 otherwise  
 press the **EQ** hardware key!

If **NO**, press **N** or **n** and **<CR>** on keyboard or any other hardware key!

[EQ] Press  to select the LX800 motherboard.

Selected motherboard: **LX800 (NIBP: COM3=IRQ9 ECG: COM4=IRQ5)**

**Are you sure ?**

If **YES**, press **Y** or **y** and **<CR>** if keyboard is used  
 otherwise  
 press the **EQ** hardware key!

If **NO**, press **N** or **n** and **<CR>** on keyboard or any other hardware key!

[EQ] Press  to confirm the selected LX800 motherboard.

#### Compact Flash Card CFC

Does the machine have:

**CF-Card\_Swissbit-SFCF1024H3BKZSA\_I-MO-513\_SID\_1.00GB (h=16 s=63) harddisk?**

If **YES**, press **Y** or **y** and **<CR>** if keyboard is used  
 otherwise  
 press the **EQ** hardware key!

If **NO**, press **N** or **n** and **<CR>** on keyboard or any other hardware key!

[EQ] Press  to select the CFC.

Selected harddisk: **CF-Card\_Swissbit-SFCF1024H3BKZSA\_I-MO-513\_SID\_1.00GB (h=16 s=63)**

**Are you sure ?**

If **YES**, press **Y** or **y** and **<CR>** if keyboard is used  
 otherwise  
 press the **EQ** hardware key!

If **NO**, press **N** or **n** and **<CR>** on keyboard or any other hardware key!

[EQ] Press  to confirm the selected CFC.

The following menu appears after the motherboard and the memory type were selected.

\*\*\* WARNING ! \*\*\*

If you have any important files, **SAVE** them before the installation!

**TRENDS** of previous treatments will be lost too, save them before the installation if they are needed in the future!

If you want to **CONTINUE** the **Installation**  
press **Y** or **y** and **<CR>** if keyboard is used  
otherwise  
press the **EQ** hardware key!

If you want to **CANCEL** the installation, press **N** or **n** and **<CR>**  
on keyboard or any **other** hardware key!

[EQ] Press  to confirm and proceed with the installation of the software.

[AQ] Press  if you want to terminate the installation of the software.

....

End of Dialog/TLC SW INSTALLATION.

**The Dialog/TLC SW INSTALLATION has been completed.**

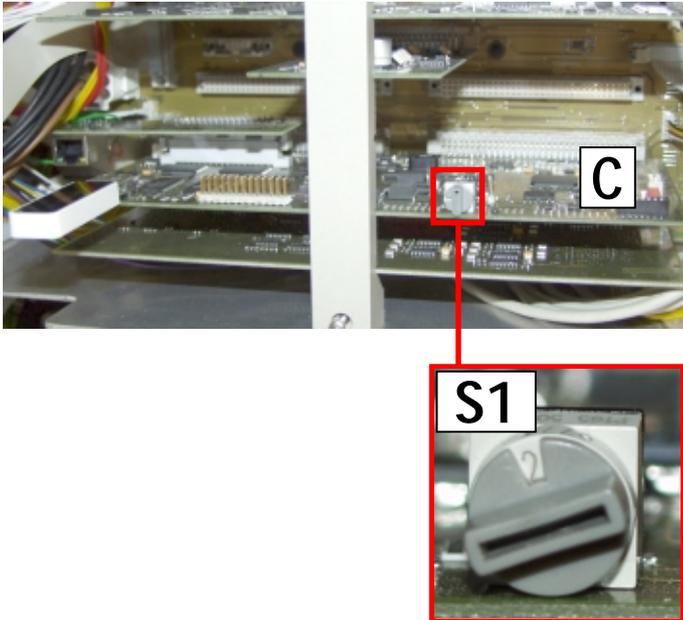
The Dialog/TLC uses.....

.....

Don't forget to set the operation mode switch to TSM mode (2) and check  
in TSM all subsystems' version number.

Switch the **power OFF** and **REMOVE** the **USB stick** before starting the Dialog...

**The TLC software was installed successfully.**



18. Switch off the machine after the successful installation of the TLC software.
19. Remove USB stick.
20. Turn service switch **S1** (on digital board **C**) to position 2 - TSM.

#### 3.5.4 Boot Machine /Check Version Number

21. Switch on machine.
22. Check whether machine boots correctly.
23. Open menu *Production Report, Version Number* and check the version numbers.

#### 3.5.5 Select Options



**All available options in TSM service program (*Production Report* and *Low Level Options*) must be selected again and saved with the OK button after the software installation.**

##### Low Level Options

24. Select and activate all present options in the *Low Level Options* with the  button. Thus, the data is saved when quitting the menu.

##### Production Report

25. If necessary enter the serial number (see type plate *SN*) in the *Production Report* menu.
26. Select and activate all present options in the *Production Report* with the  button. Thus, the data is saved when quitting the menu.

#### 3.5.6 Enter Customer Specific Default Values

The customer specific default values of the machine must be entered after the software installation.

27. Enter customer default values from default table and save

## 3.5.7 Enter Specific Parameters

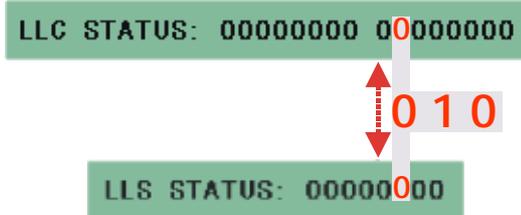


The specific parameters must be entered again in the TSM service program and saved with the OK button after the software installation.

28. Enter the tube constants in menu *Calibration 2.13 Flow of BPA and BPV Pump, 2.13.1 Tube Constants of BPA and BPV*.  
**BPA:** 12306 [µl/head rotation]  
**BPV:** 12306 [µl/head rotation]
29. Enter the stroke value in menu *Calibration 2.15 HDF Online Substitution Pump OSP*.  
**OSP:** 8300 [µl/head rotation]
30. Enter the absolute low limit for PA in menu *Calibration 2.12 PV Alarm Window, PA Low Limit* and save with the calibration button (see default table).
31. Select the limit for the blood leak detector in menu *Calibration 2.7 Blood Leak Detector, BL Limit* (standard limit or AAMI limit).
32. Save in menu *File Operation, Save Calibration Data* after entering all constants and calibration data.



Pay attention to the LLC and LLS status windows when saving the calibration data. The bit sequence **0 1 0** must be identical in the LLC and LLS status windows during the saving procedure. The calibration data is saved only after the bit sequence **0 1 0** (see figure).



If an error occurs select corresponding window: error message is displayed (eliminate cause of trouble).



#### FSU USB-Stick for Treatment Support Settings

The system configuration saved on a USB stick (FSU utility) must only be downloaded to an other Dialog+ SW 9.xx machine after a software update if:

- the hardware matches and
- the machine has the identical software version number.

33. Set system configuration (customer specific values) or if available use the FSU USB stick with the system configuration.
34. Save settings.
35. Switch off machine.

### 3.5.8 Self Test



1. Turn service switch **S1** to position 0 - Therapy.
2. Start machine (fully equipped) in dialysis mode.
3. Insert line system – see instructions for use.
4. The machine must run without errors up to the message *Connect Patient*.

### 3.5.9 Test Run

5. Assemble the blood lines, perform preparation (insert heparin syringe and select 2 ml/h and use BIC cartridge if present).
6. Perform self test – according to instructions for use.
7. Press the  icon to switch to therapy mode (*connect patient*). This icon is enabled after all self tests were performed successfully.
8. Insert the arterial and venous lines in the graduated cylinder.
9. Set the blood pump so that no blood side alarms are activated.
10. Start dialysis.
11. Check alarm function of SAD.  
(The ABPM function (if present) can be checked without a test run of the machine in preparation mode, without the concentrate pump.)
12. Terminate dialysis.
13. Perform disinfection/decalcification.
14. Remove blood lines, filter and heparin syringe.
15. Switch off Dialog+.

## 3.6 Field Service Utilities FSU

### General

The FSU utility can be used in any mode. Exception: if the Dialog+ was switched off during therapy or end of therapy and was switched on again within 15 minutes.

Most of the utilities have the following features:

- messages are displayed during execution
- an *End of <utility name>* message is displayed after completion of a utility

### 3.6.1 FSU Directories and Subdirectories



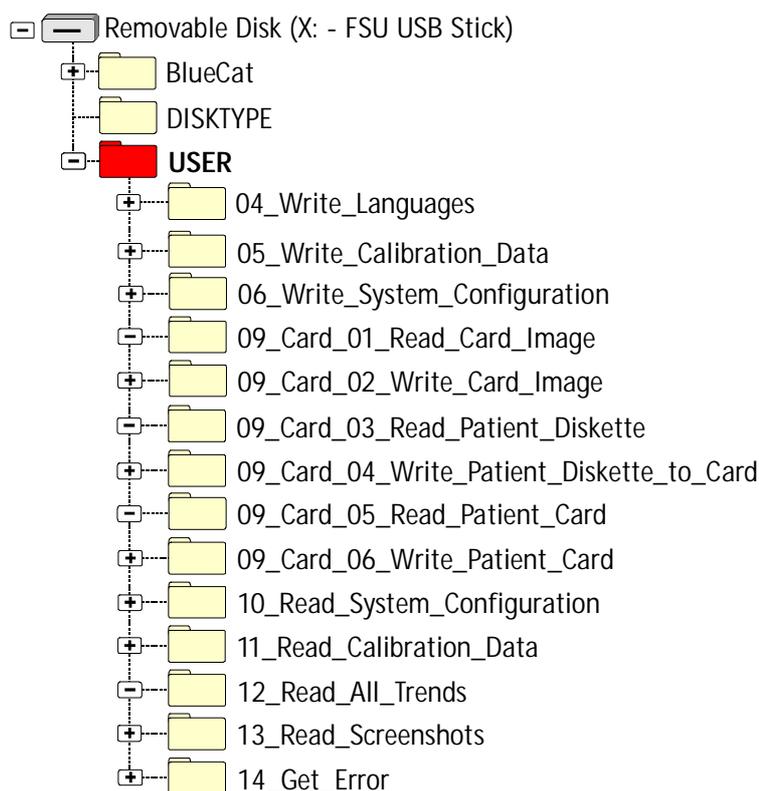
#### BlueCat and DISKTYPE Directories

The BlueCat and DISKTYPE directories are used by the system operation of the FSU program only. Do not use, modify or delete these directories.

#### USER Directory

The USER directory is required for service technicians only. All user specific data/files from and to the Dialog+ machines are written and read to/from this directory (subdirectories).

The field service utilities has the following directory structure (see left figure).



## 3.6.2 Start Field Service Utility FSU



TSM Service Mode  
Therapy Mode

Check of Initial Directories

Backup Copy of FSU  
USB Stick Directories

Self Test CRC

Prevent Corruption of USB Stick

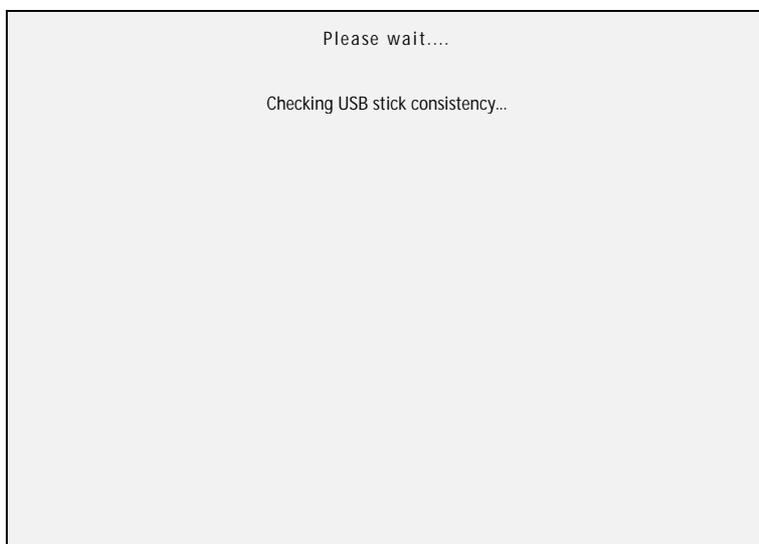
The service switch S1 on the digital board can be in position 0, 2 or 3. Turn back the service switch S1 to therapy mode (position 0) after terminating the field service utilities.

After switch-on the presence of the initial directories are checked. If one of these directories are not found (e.g. because they were accidentally deleted), an error window is displayed and the USB stick can not be used (use your backup copy).

Copy the BlueCat, DISKTYPE and USER directory from the USB stick to a PC as a backup copy in case directories can not be found (e.g. because they were deleted by mistake).

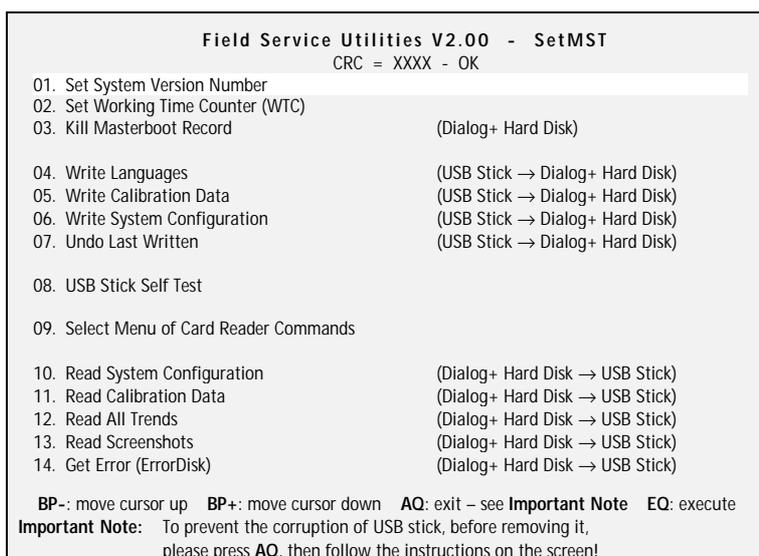
The FSU program stops automatically in case of a self test error. The FSU is terminated. The corrupted USB stick must be exchanged before you continue with the FSU program.

Do not disconnect the USB stick if the FSU menu is still active. Exit the FSU menu with the AQ  /BP  hardware keys before you disconnect the USB stick.



When the Dialog+ is switched on and the start window is displayed a self test is performed (a few seconds) for the USB stick.

1. Connect the USB stick to the USB port on the TLC sub-rack.
2. Switch on the Dialog+ in TSM service mode.
3. Wait for the consistency check of the FSU USB stick.



The main menu of the FSU is displayed. The following information is displayed in the header:

- Field service utilities Vn.nn" (n.nn is the version number)
- Set number of master (SetMST)
- CRC value with CRC status (CRC = XXXX – OK), i.e. CRC is OK

#### Hardware Keys

BP  : moves the cursor up

BP  : moves the cursor down

AQ  : exits the FSU menu

EQ  : executes a selected utility

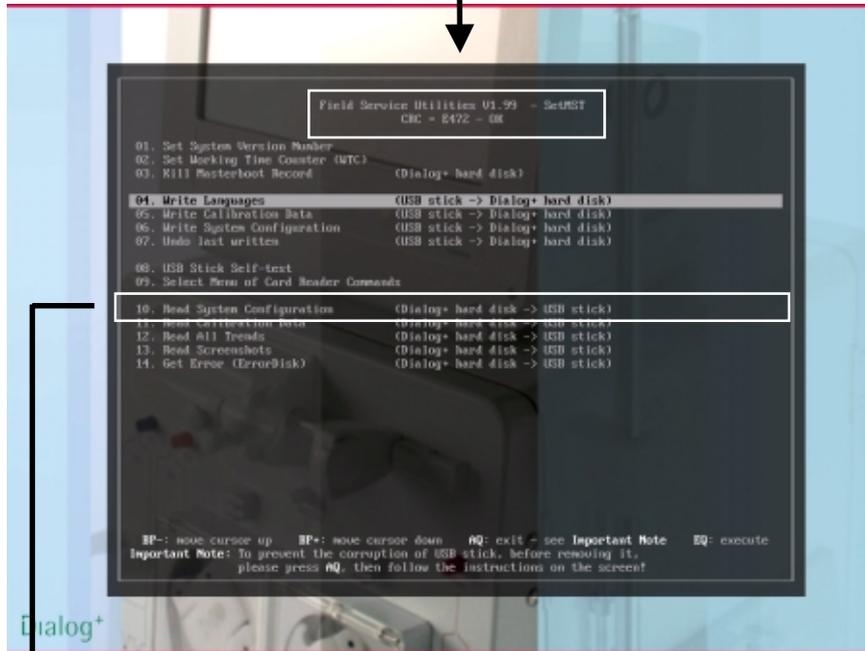
4. Press the EQ  hardware key to execute the utility.

5. Press the AQ  to exit the FSU program.

## 3.6.3 Set-Up FSU Main Menu

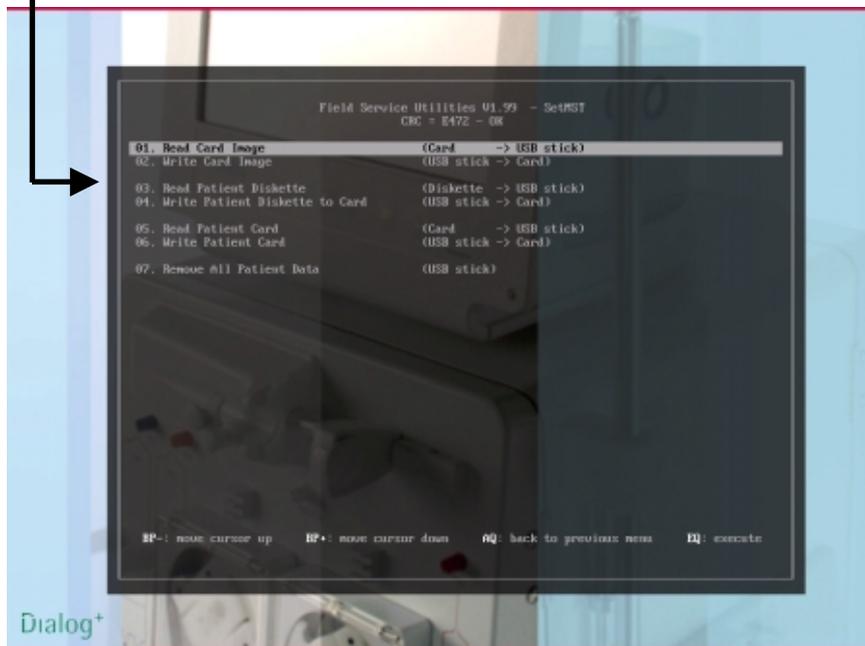
When the Dialog+ is switched on and the start window is displayed the self test for the USB stick is performed (a few seconds). In the start screen the *Field Service Utilities* menu appears after the CRC check (see header CRC=XXXX – OK).

There are standard utilities in the main menu: set, write and read. A sub-menu can be selected for the card reader with the utilities: read and write.



## Main Menu Field Service Utilities

1. Connect the USB stick (with the FSU) to the USB port on the TLC sub-rack.
2. Switch on Dialog+.

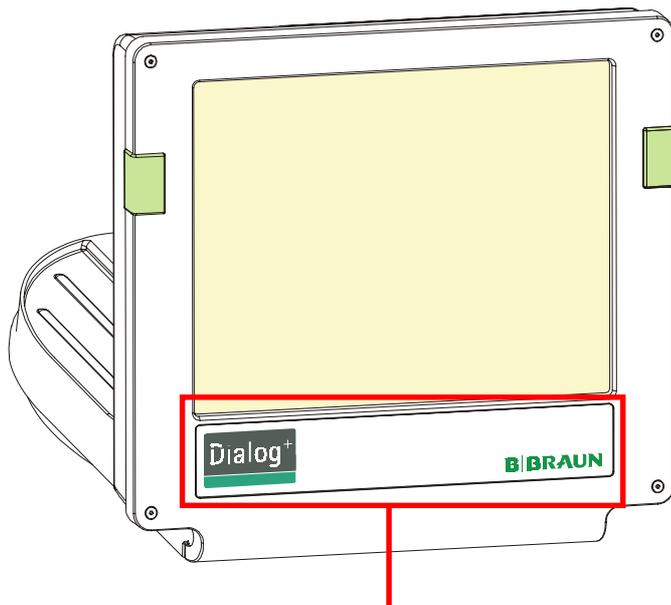


## Sub-Menu Card Reader

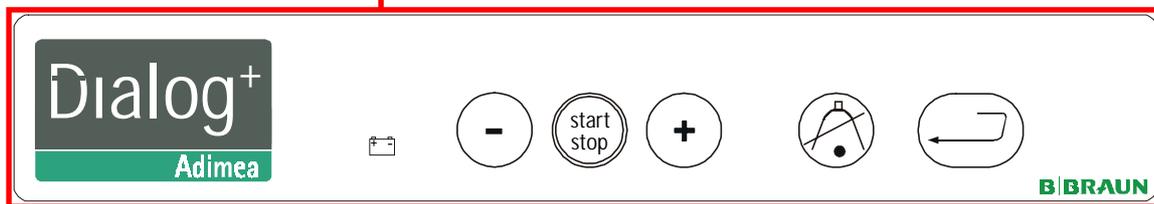
The following sub-menu appears if *09 Select Menu of Card Commands* is selected in the Field Service Utilities main menu.

1. Press the **BP +** hardware key and move the cursor down to *09 Select Menu of Card Commands* in the main menu.
2. Press the **EQ ↵** hardware key to execute the utility.
3. Press the **BP +** hardware key and move the cursor down to select a utility.

## 3.6.3.1 Hardware Keys for FSU



Use the hardware keys on the front panel of the TFT monitor to navigate through the FSU main menu/sub-menu. The general functions of the hardware keys are (may differ slightly in sub-menus):



Press the **BP**  hardware key to move the cursor up.



Press the **BP**  hardware key to select the next digit (e.g. during the setting of the working time counter).



Press the **BP**  hardware key to move the cursor down.



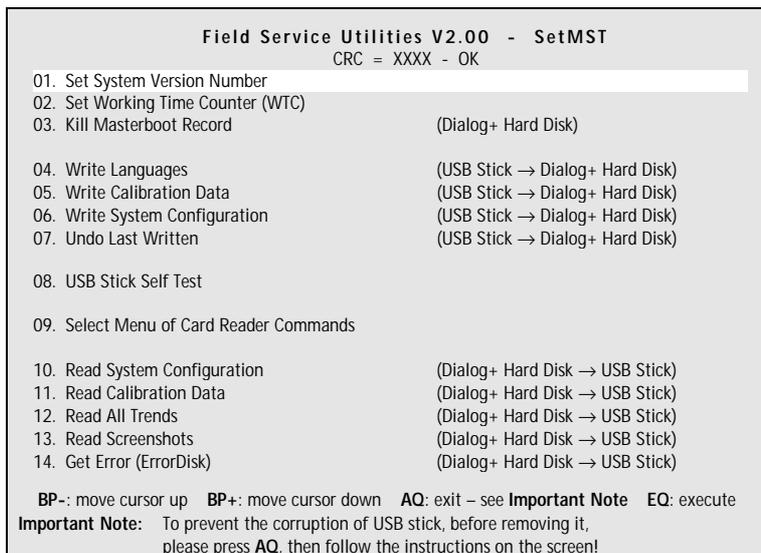
Press the **AQ**  hardware key to exit the FSU menu or to skip back to the previous menu.



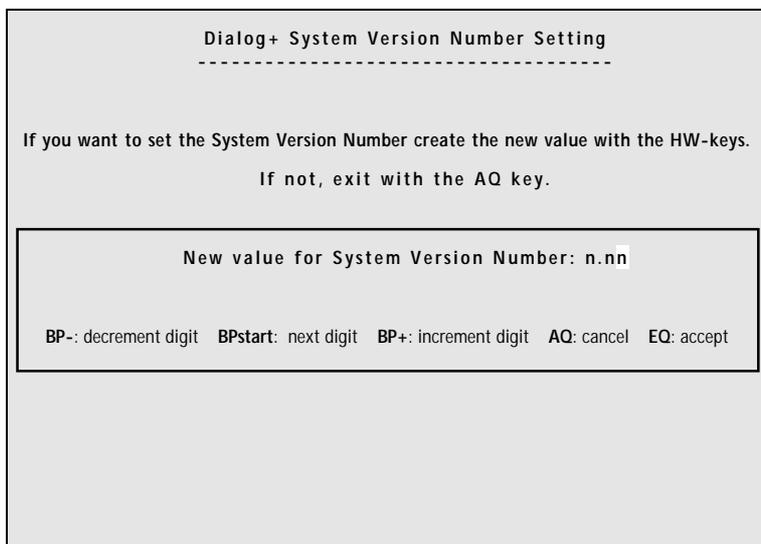
Press the **EQ**  hardware key to execute a selected utility.

### 3.6.4 Set System Version Number

The *System Version Number* for the Dialog+ can be set with this utility. The utility is typically used after updating the LLC software, because the TLC software can not be accessed during the installation of the LLC. There is no file exchange between the USB stick and Dialog+ hard disk drive (CFC).



1. Press EQ  to execute the utility.
2. Press AQ  to exit the FSU menu.



An input screen opens to set the new *System Version Number* with the following hardware keys:

- BP  : decrements the current digit
- BP  : increments the current digit
- BP  : selects the next digit (from right to left)
- AQ  : cancels the operation, system version number is not changed
- EQ  : sets the new system version number value

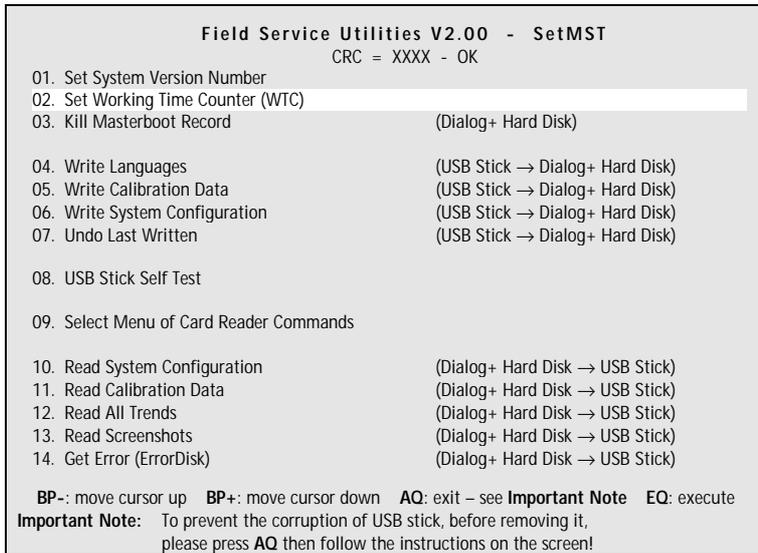
3. Set the new system version number with the BP , BP  and BP  hardware keys.

**Note:** (n.nn = the version number)

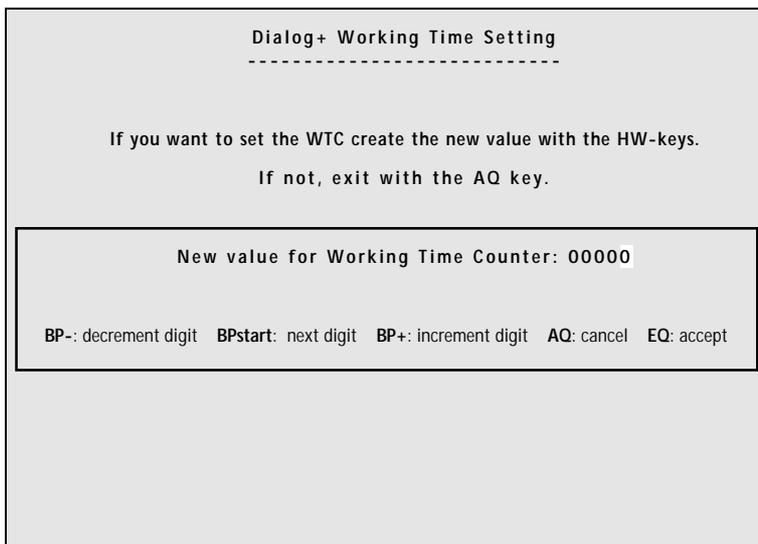
4. Press EQ  to accept the entered value.  
The main menu is displayed after a few seconds.

## 3.6.5 Set Working Time Counter (WTC)

The *Working Time Counter* for the Dialog+ can be set with this utility. The utility is typically used after replacing a hard disk drive (CFC). There is no file exchange between the USB stick and Dialog+ hard disk drive (CFC). In case of acceptance the new value is written to the Dialog+ hard disk drive (CFC) (TLC WTC files).



1. Press **BP +** and move the cursor down to select the utility.
2. Press **EQ** to execute the utility.

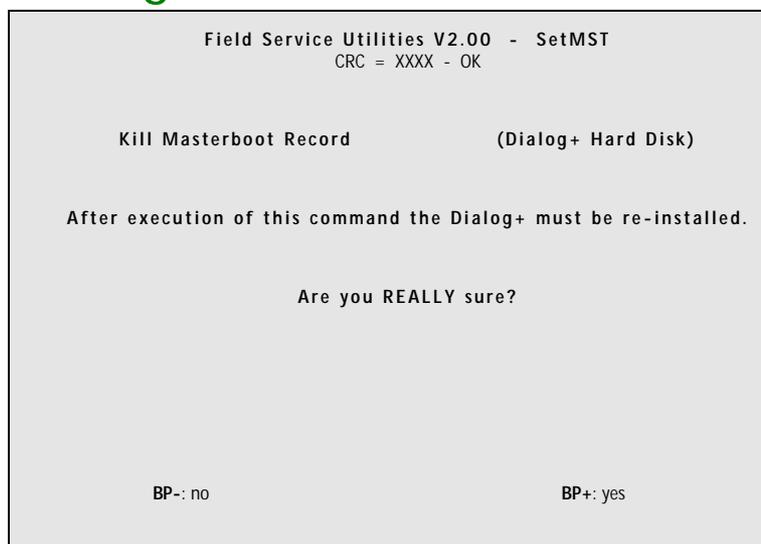


An input screen opens to set the new *Working Time Counter (WTC)* value with the following hardware keys:

- BP -** : decrements the current digit
- BP +** : increments the current digit
- BP** : selects the next digit (from right to left)
- AQ** : cancels the operation, WTC is not changed
- EQ** : sets the new WTC value

3. Set the new working time counter with the **BP -**, **BP +** and **BP** hardware keys.
4. Press **EQ** to accept the entered value.  
The main menu is displayed after a few seconds.





A second input screen opens to delete the MBR of the *Masterboot Record* with the following hardware keys:

**BP -** : NO, does not delete the MBR and the operation is cancelled

**BP +** : YES, deletes the MBR of the Dialog+ hard disk drive (CFC) (after second confirmation)

4. Press **BP +** if you are really sure. This will delete the masterboot record.

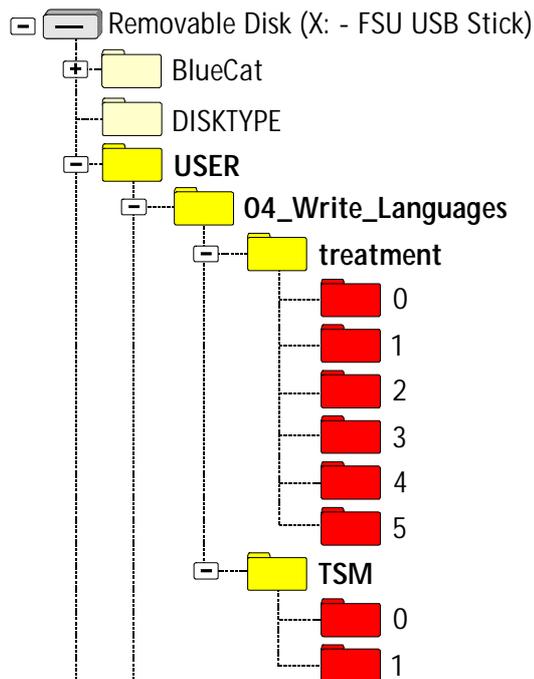
5. Press **BP -** to cancel the operation.

## 3.6.7 Write Utilities

The group of write utilities writes data files from the FSU USB stick to the Dialog+ hard disk drive (CFC). The following parameters can be written to the Dialog+ hard disk drive (CFC):

- Write Languages
- Write Calibration Data
- Write System Configuration
- Undo Last Written

## 3.6.7.1 Write Languages



The utility writes languages from the USB stick to the hard disk drive (CFC) of the Dialog+ machine.

**If language files are not on the FSU USB stick**

Languages have to be copied to the USB stick because by default the language directory is empty. Language files must be copied to the USER subdirectories of the USB stick from your PC.

**Note:** Do not mix up the places for the treatment language (0, 1, 2, 3, 4, 5) and the TSM language (0, 1).

**Write Treatment Language or TSM Language**

1. Connect the FSU USB stick to your PC.
2. Copy the required language files from the PC to the following directories:

**Treatment Language**

USB:\USER\04\_Write\_Languages\treatment\X\language.id

USB:\USER\04\_Write\_Languages\treatment\X\language.tar.gz

**TSM Language**

USB:\USER\04\_Write\_Languages\TSM\X\language.id

USB:\USER\04\_Write\_Languages\TSM\X\language.tar.gz

**Note:** The language files (*language.id* and *language.tar.gz*) are the outputs of the Windows Language Development Tool LDT.

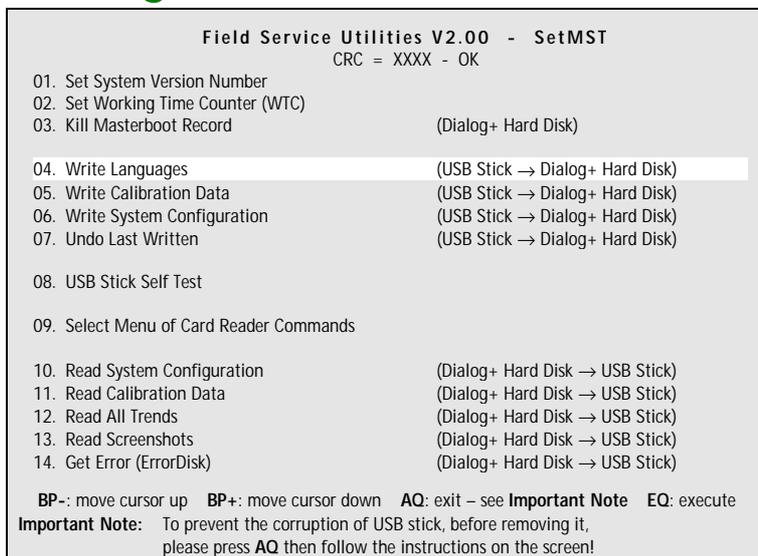
**Example Spanish Language ID**

The following information is included in the *language.id* file (open with text editor):

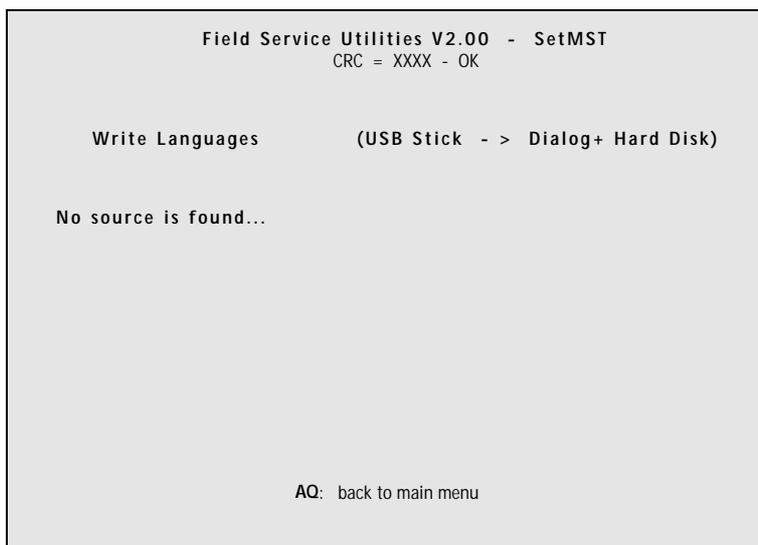
<b>Spanish:</b>	Spanish Language
<b>Treat:</b>	Treatment Language
<b>%M %02d, %04y:</b>	
<b>Spanish:</b>	Spanish Language
<b>034.07.17:</b>	<b>034</b> (country code), <b>07.17</b> (Dialog SW version number)



The last write procedure can be undone with the *07 Undo Last Written* utility. The Dialog+ can be switched off and on again between the write procedure and using the *07 Undo Last Written* utility.

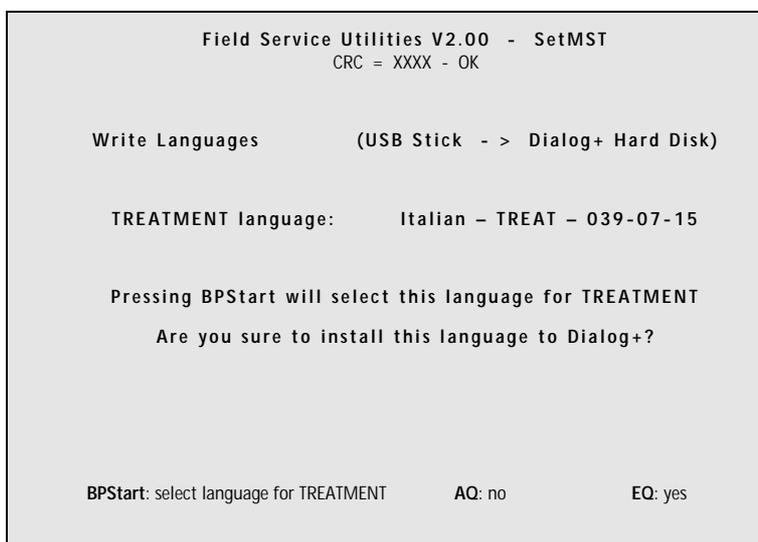


1. Press **BP**  and move the cursor down to select the utility.
2. Press **EQ**  to execute the utility.



An input screen can open with the following information (see left figure), i.e. no languages were found on the USB stick because the language subdirectories are empty. Languages must be copied to the USB stick before you can write languages to the Dialog+ hard disk drive (CFC). Use the following hardware key:

3. Press **AQ**  to go back to the main menu.



Languages must be downloaded to the USB stick before they can be written to the Dialog+ hard disk drive (CFC). An input screen opens to *Write Languages* (e.g. Italian) to the hard disk drive (CFC) with the following hardware keys:

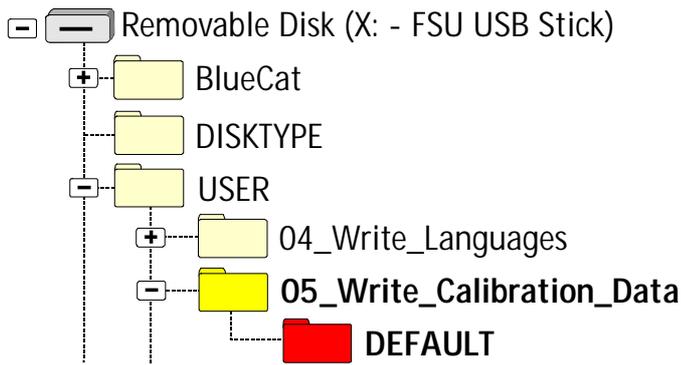
- BP**  : if pressed before pressing the **EQ** HW key, the selected *Treatment Language* is set after copying as the active language
- AQ**  : exit from the utility
- EQ**  : starts the execution of the language copying

After successfully copying the language to the CFC the version numbers of all languages available on the Dialog+ are displayed. The language selected for treatment is also marked.

4. Press **EQ**  to continue.

## 3.6.7.2 Write Calibration Data

The utility writes the *Calibration Data* from the USB stick to the hard disk drive (CFC) of the Dialog+ machine.

**If calibration data are not on the FSU USB stick**

The calibration data must be read to the USB stick with the *17 Read Calibration Data* utility, because by default the directory is empty.

**Write Calibration Data**

USB:\USER\05\_Write\_Calibration\_Data\DEFAULT\calib.dat.xxu

**Note:** The *Calibration Data* file can be copied back to the Dialog+ machine only, if the serial number and main version number, saved in the *Calibration Data* file, are equal with the serial number and main version number reported by the Dialog+ machine.

**Write and Read Calibration Data**

**Write (download) the calibration data from the FSU USB stick to the same Dialog+ machine only.**

The calibration data should be saved to the hard disk drive (CFC) in the TSM service program: *TSM Main Menu, File Operations, Save Calibration Data*.

You should read (download) the calibration data from the respective Dialog+ to the USB stick before you start servicing the machine with the *Read Calibration Data* utility in the FSU menu.

The last write procedure can be undone with the *07 Undo Last Written* utility.

**Field Service Utilities V2.00 - SetMST**  
CRC = XXXX - OK

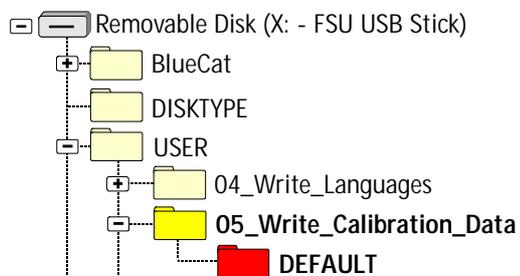
01. Set System Version Number	
02. Set Working Time Counter (WTC)	
03. Kill Masterboot Record	(Dialog+ Hard Disk)
04. Write Languages	(USB Stick → Dialog+ Hard Disk)
05. Write Calibration Data	(USB Stick → Dialog+ Hard Disk)
06. Write System Configuration	(USB Stick → Dialog+ Hard Disk)
07. Undo Last Written	(USB Stick → Dialog+ Hard Disk)
08. USB Stick Self Test	
09. Select Menu of Card Reader Commands	
10. Read System Configuration	(Dialog+ Hard Disk → USB Stick)
11. Read Calibration Data	(Dialog+ Hard Disk → USB Stick)
12. Read All Trends	(Dialog+ Hard Disk → USB Stick)
13. Read Screenshots	(Dialog+ Hard Disk → USB Stick)
14. Get Error (ErrorDisk)	(Dialog+ Hard Disk → USB Stick)

**BP-**: move cursor up   **BP+**: move cursor down   **AQ**: exit – see **Important Note**   **EQ**: execute

**Important Note:** To prevent the corruption of USB stick, before removing it, please press **AQ** then follow the instructions on the screen!

1. Press **BP +** and move the cursor down to select the utility.
2. Press **EQ** to execute the utility.





The utility searches for input in the *05\_Write\_Calibration\_Data*, *DEFAULT* subdirectory **and** in the results of the previously performed *11. Read Calibration Data* utility. If no file was found the following message is displayed:

*No source...*

If there are files (e.g. read from other Dialog+ machines) but there are no matching files, the following message is displayed:

*No selectable source is found...*

and the existing serial number/system version number pairs are displayed with the following message:

*(not selectable)*

If there is one matching file the following message is displayed:

*Are you sure?*

If there are more matching files (for the calibration data this is only possible if you read the calibration data with the *11. Read Calibration Data* utility and copy the result file manually to the *05\_Write\_Calibration\_Data*, *DEFAULT* subdirectory): all existing serial number/system version number pairs are displayed (*DEFAULT* is displayed instead of the serial number if the subdirectory contains a *calib.dat.xxu* file). The user can select from the matching pairs only.

The pairs that do not match are displayed with the following message:

*(not selectable)*

5. Press **EQ**  if you are sure. This will write the calibration data from the USB stick to the Dialog+ hard disk drive (CFC).

### 3.6.7.3 Write System Configuration



The utility writes the *System Configuration* from the USB stick to the hard disk drive (CFC) of the Dialog+ machine. The system configuration must be read to the USB stick with the *10 Read System Configuration* utility, because by default the directory is empty.

#### System Configuration

The system configuration saved on the FSU USB stick must be downloaded to an other Dialog+ machine only if:

- the hardware matches and
- the identical TLC software version number is present.

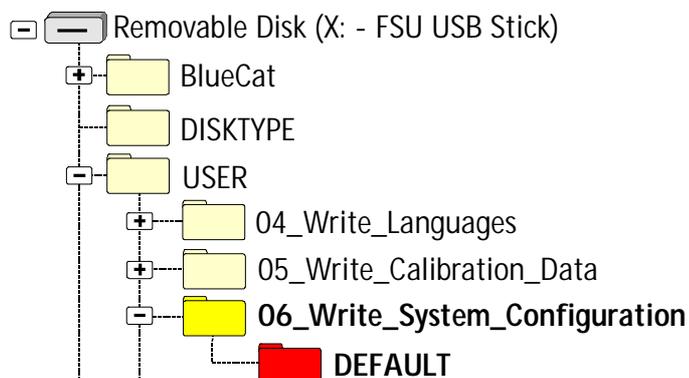
The last write procedure can be undone with the *07 Undo Last Written* utility.

#### USB Stick with Treatment Support Settings

Old treatment support settings must not be downloaded via a USB stick after a software update. If necessary download the new treatment support setting after an update.

#### Activation of the Treatment Support Settings

The settings are only activated after the Dialog+ is switched off and on again. Check the settings after the Dialog+ was switched on again.



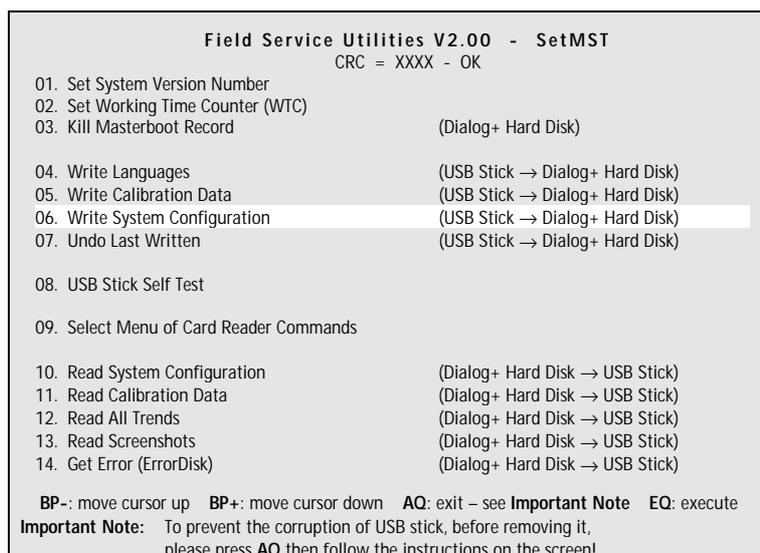
#### If system configuration is not on the FSU USB stick

The system configuration must be read to the USB stick with the *10 Read System Configuration* utility, because by default the directory is empty.

#### Write System Configuration

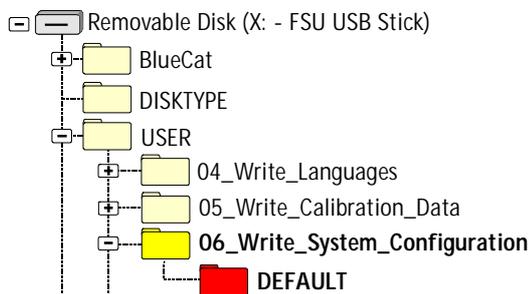
USB:\USER\06\_Write\_System\_Configuration\DEFAULT\config.xxu

**Note:** The *System Configuration* file can be copied back to the Dialog+ machine only, if the TLC version number, saved in the *System Configuration* file, is equal with the TLC version number reported by the Dialog+ machine.



1. Press the **BP +** hardware key and move the cursor down to select the utility.
2. Press the **EQ** hardware key to execute the utility.





### TLCver=90832/VX\_XX

The utility compares the top level controller version number (TLCver) stored in the system configuration file with the top level controller version number from the Dialog+. The system configuration file can be written only if they match.

#### Example

TLCver = V8\_20 (top level controller version number)

The utility searches for input in the *06\_Write\_System\_Configuration, DEFAULT* subdirectory **and** in the results of the previously performed *10. Read System Configuration* utility. If no file was found the following message is displayed:  
*No source...*

If there are files (e.g. read from other Dialog+ machines) but there are no matching files the following message is displayed:  
*No selectable source is found...*

and the existing serial number/top level controller version number pairs are displayed with the following message:  
*(not selectable)*

If there is one matching file the following message is displayed:  
*Are you sure?*

If there are more matching files (for the system configuration this is only possible if you read the system configuration data with the *10. Read System Configuration* utility and copy the result file manually to the *06\_Write\_System\_Configuration, DEFAULT* subdirectory): all existing serial number/top level controller version number pairs are displayed (*DEFAULT* is displayed instead of the serial number if the subdirectory contains a *config.xxu* file). The user can select from the matching pairs only.

The pairs that do not match are displayed with the following message:  
*(not selectable)*

5. Press **EQ**  if you are sure. This will write the system configuration data from the USB stick to the Dialog+ hard disk drive (CFC).

## 3.6.7.4 Undo Last Written

The content of the directory (directories) of the last write procedure is saved on the USB stick together with the serial number of the respective Dialog+ machine. The last write procedure can be undone (restored) with the *Undo Last Written* utility for the following write procedures:

- Write Languages
- Write Calibration Data
- Write System Configuration

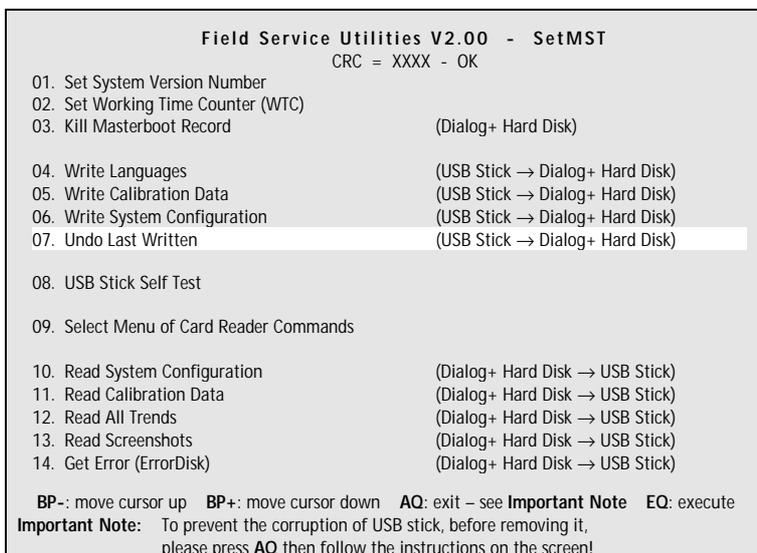


The *Undo Last Written* utility should be used immediately after a writing utility was performed by accident.

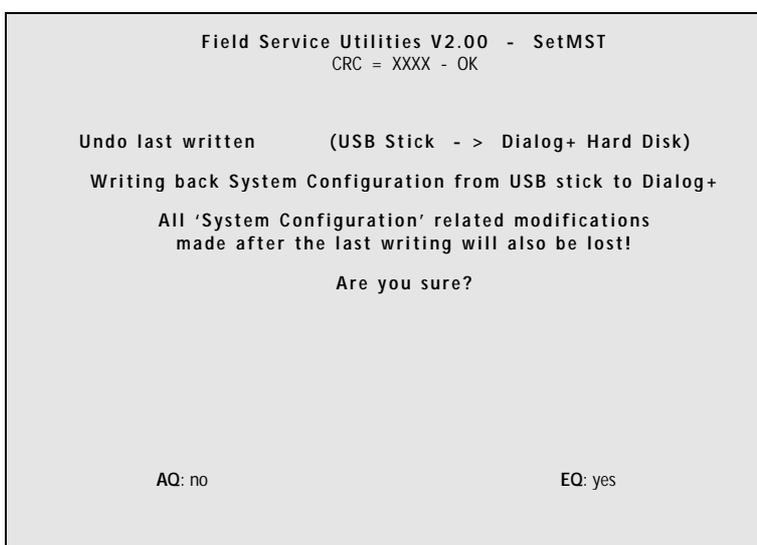
If the *Undo Last Written* utility is used after a *Write Calibration Data* or *Write System Configuration*: check and match not only the serial number but also the corresponding system version number or TLC version number.

If a *Write...* utility is executed two times in a row the last (saved) and the current status are identical, i.e. in case you would use the *Undo Last Written* utility now there would be no difference between both versions.

The *Undo Last Written* utility can be applied only to the result of the last *Write...* utility and if the saved and the current serial number of the Dialog+ match.



1. Press the **BP +** hardware key and move the cursor down to select the utility.
2. Press the **EQ ↵** hardware key to execute the utility.



The *Undo Last Written* utility will undo the last written utility. The menu on the left shows an example of the undo utility for the system configuration.

**AQ** : No, system configuration file is not undone, exit from the utility

**EQ** : Yes, system configuration file is undone

3. Press **EQ** if you are sure. This will undo the last written utility from the USB stick to the Dialog+ hard disk drive (CFC).

## 3.6.8 USB Stick Self Test

The *USB Stick Self Test* can be used to check the USB stick. The utility checks the consistency of the file systems.

**Self test OK**

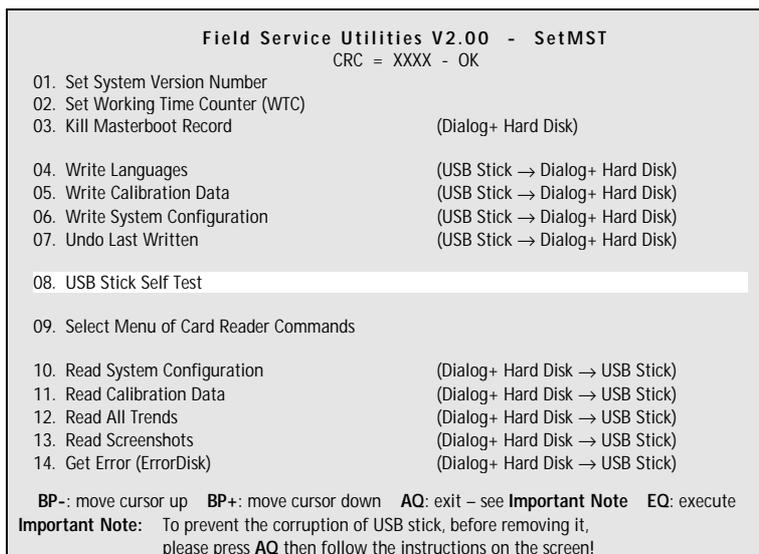
In case of successful execution the calculated and the reference CRC are displayed before returning to the main menu.

**Self test failed**

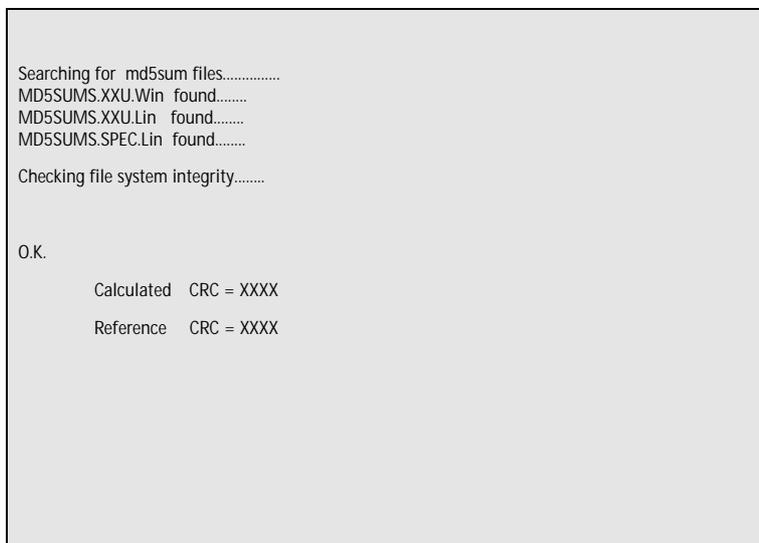
In case of any error the *Self test failed* message is displayed.

**Failed Self Test**

In case of a self test error the FSU stops automatically. Exit the program and exchange the damaged USB stick before you proceed with the FSU program.



1. Press the **BP +** hardware key and move the cursor down to select the utility.
2. Press the **EQ**  hardware key to execute the utility.



An input screen opens and the *USB Stick Self Test* is performed. The self test menu automatically returns to the main menu after the self test.

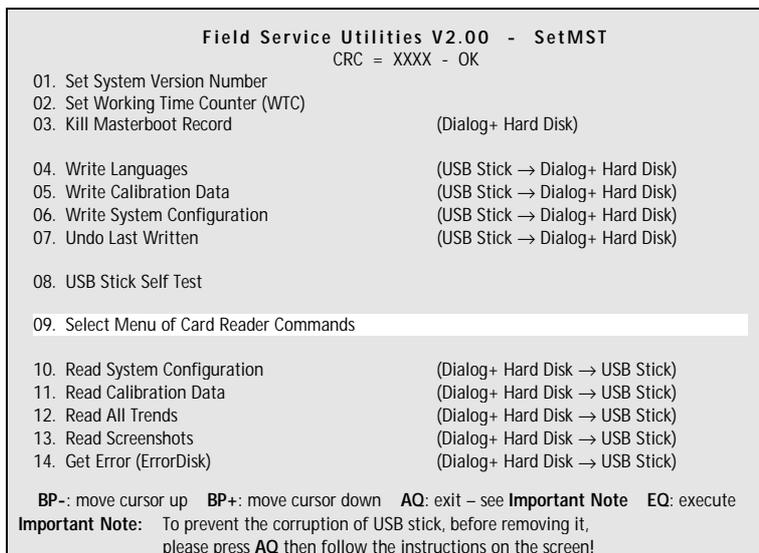
### 3.6.9 Card Reader Read/Write Utilities

The group of read and write utilities for the card reader is used:

- to read data from a card or diskette and to write them to a USB stick
- to read data from a USB stick and to write them to a card
- All card reader utilities are available in a sub-menu.

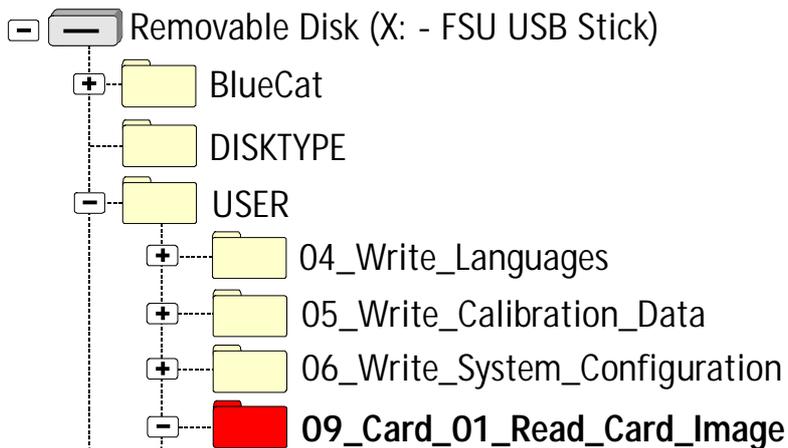
#### 3.6.9.1 Select Menu of Card Reader Commands

Select the *09. Select Menu of Card Reader Commands* to open the sub-menu for the card reader utilities.



1. Press the **BP**  hardware key and move the cursor down to select the utility:  
*09. Select Menu of Card Reader Commands.*
2. Press the **EQ**  hardware key to execute the utility.

## 3.6.9.2 Read Card Image



This utility reads card image from the card as a compressed *scard.img.zip* file to the FSU USB stick.

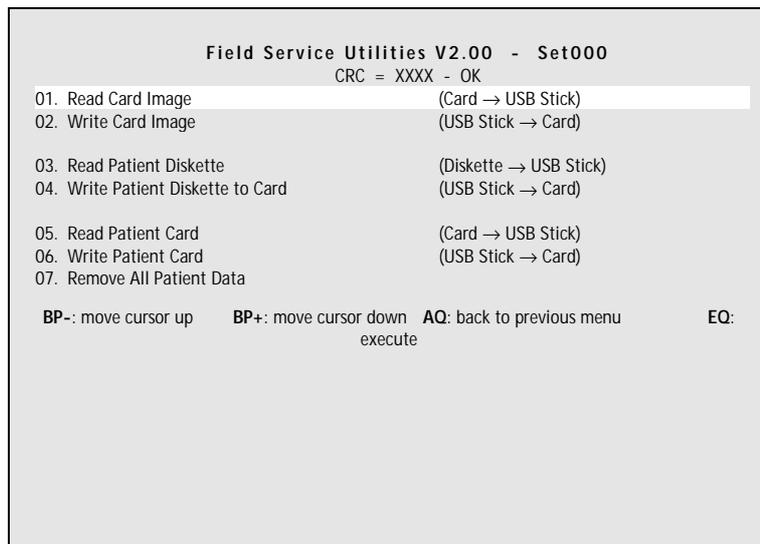
**Read Card Image**

USB:\USER\09\_Card\_01\_Read\_Card\_Image\{YYYY-MM-DD.hh.mm.ss}\scard.img.zip

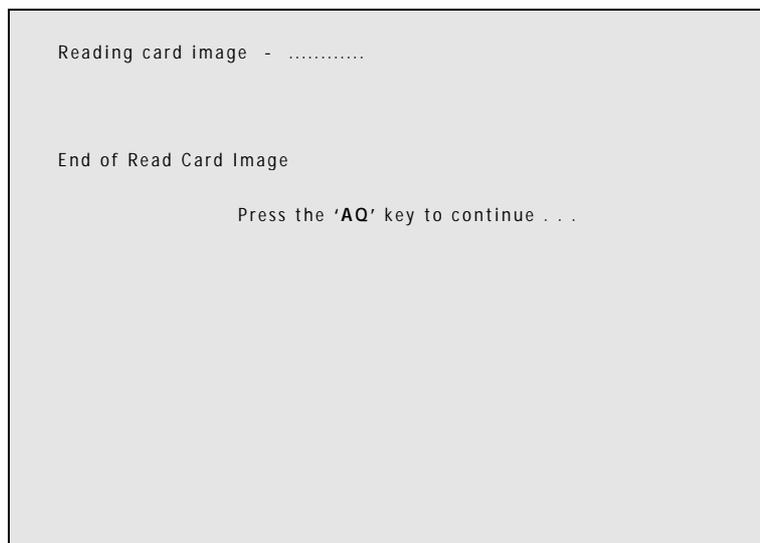
**Example:**

USB:\USER\09\_Card\_01\_Read\_Card\_Image\{2007-08-30.15.34.12}\scard.img.zip

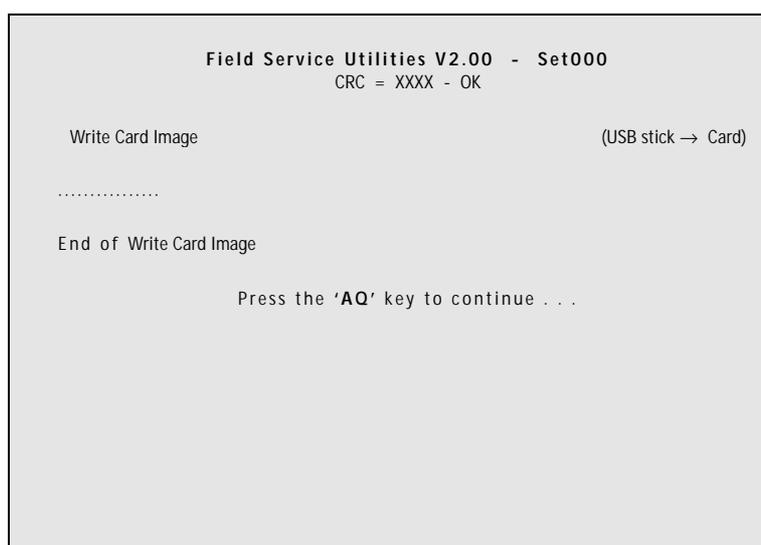
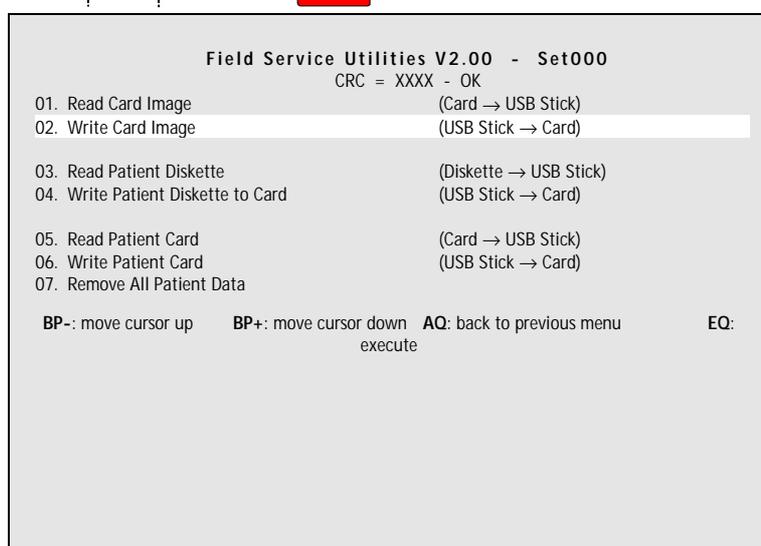
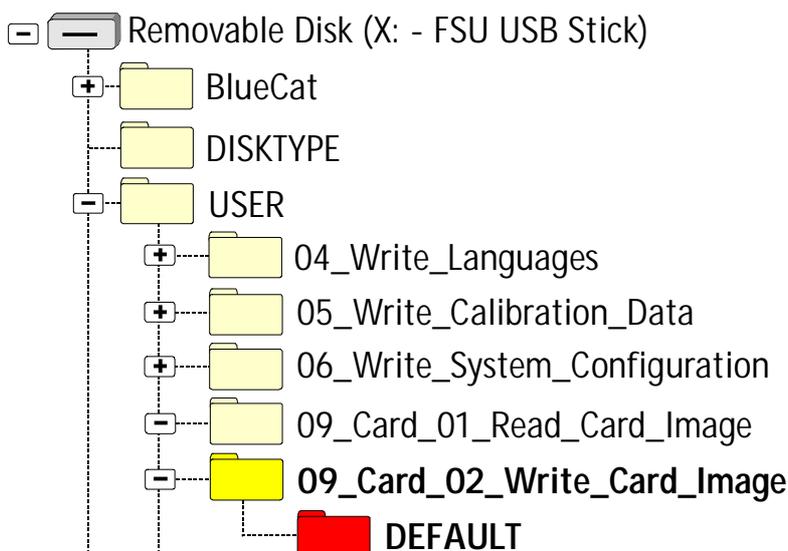
Y Y Y Y :      Year 2007  
M M :          08 month August  
D D :          30 Thursday  
h h :          15 hours  
m m :          34 minutes  
s s :          12 seconds



1. Press the **BP** hardware key, move cursor down and select *09. Select Menu of Card Reader Commands* in the main menu.
2. Press the **EQ** hardware key to execute the utility.
  - Yes, card image is written to USB stick
3. Press the **AQ** hardware key to skip to the previous menu.
  - No, card image is not written to USB stick



## 3.6.9.3 Write Card Image



This utility writes card images from the USB stick as a compressed *scard.img.zip* file to the card.

**If file is not on FSU USB stick**

Copy from the PC the compressed *scard.img.zip* file from the card image to the following USER subdirectory:

USB:\USER\09\_Card\_02\_Write\_Card\_Image\DEFAULT\*scard.img.zip*

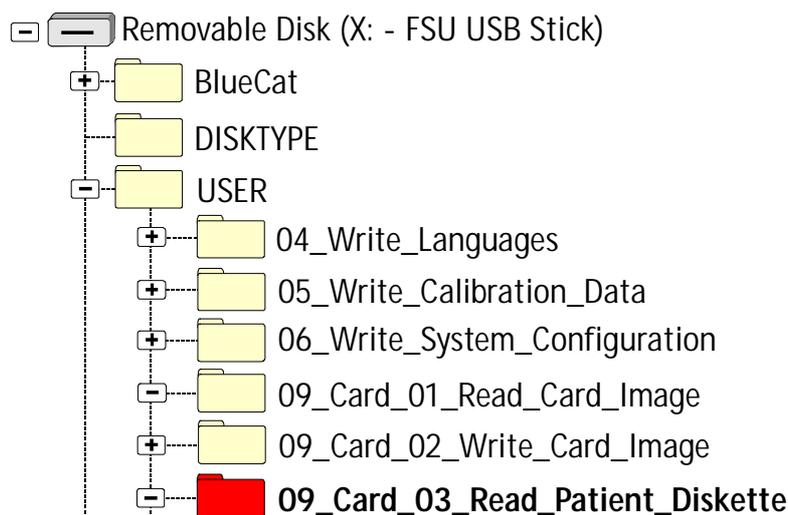
**Note:** This utility can not be used to copy the bioLogic RR activation card.

The process is aborted with the following message:

*ABPS (bioLogic RR) Activation Card Image can not be written to card.*

1. Press the **BP**  hardware key, move cursor down and select *09. Select Menu of Card Reader Commands* in the main menu.
2. Press the **BP**  hardware key and move the cursor down to select the utility.
3. Press the **EQ**  hardware key to execute the utility.
  - Yes, card image is written to card
4. Press the **AQ**  hardware key to skip to the previous menu.
  - No, card image is not written to card

## 3.6.9.4 Read Patient Diskette



This utility reads patient files from the patient diskette as a compressed *patdisk.zip* file to the FSU USB stick.

**Read Patient Diskette**

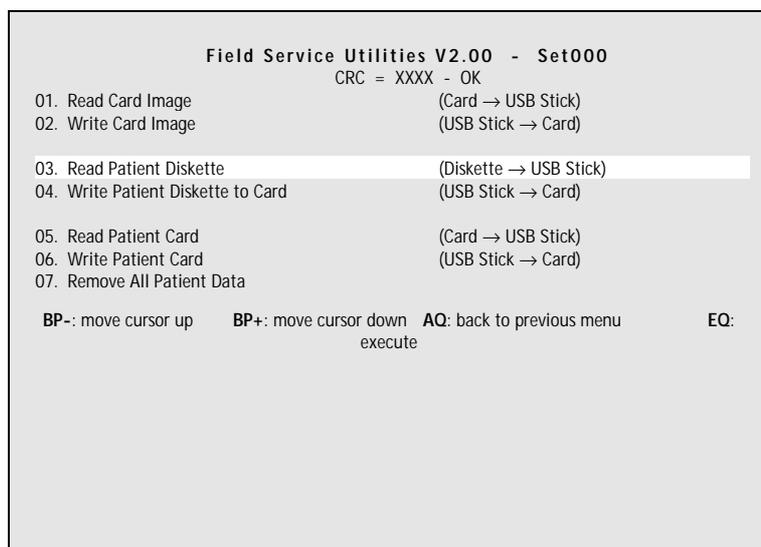
USB:\USER\09\_Card\_03\_Read\_Patient\_Diskette\  
{Patient\_Name}\patdisk.zip

**Example:**

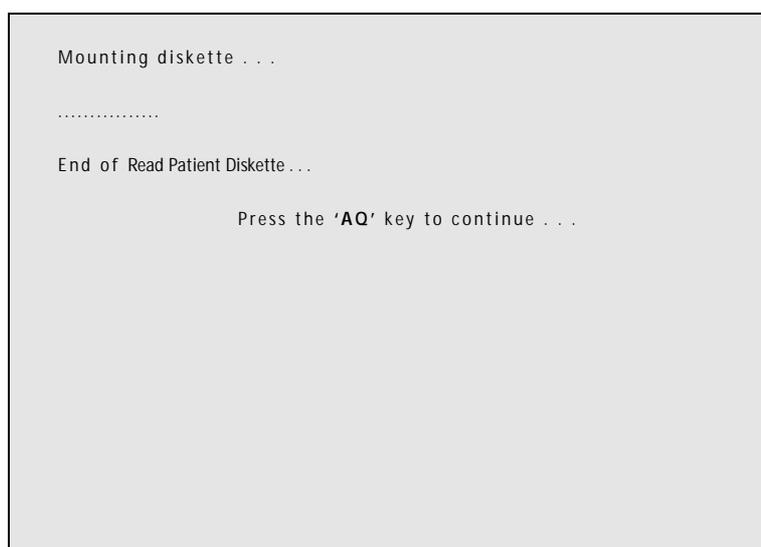
USB:\USER\09\_Card\_03\_Read\_Patient\_Diskette\  
Michael\_May\patdisk.zip

Patient\_Name: Michael\_May

**Note:** If the patient name is not found on the diskette, the *Unknown Patient* name is used.

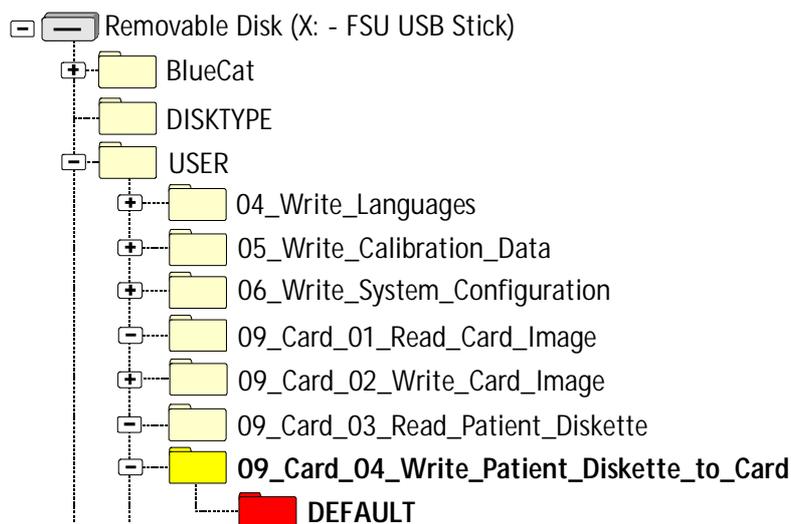


1. Press the **BP +** hardware key, move cursor down and select *09. Select Menu of Card Reader Commands* in the main menu.
2. Press the **BP +** hardware key and move the cursor down to select the utility.
3. Press the **EQ** hardware key to execute the utility.
  - Yes, patient diskette is read to USB stick
4. Press the **AQ** hardware key to skip to the previous menu.
  - No, patient diskette is not read to USB stick



**Remove all patient data from the FSU USB stick after service with the utility 07. Remove All Patient Data.** This will delete all patient data stored on the FSU USB stick.

## 3.6.9.5 Write Patient Diskette to Card

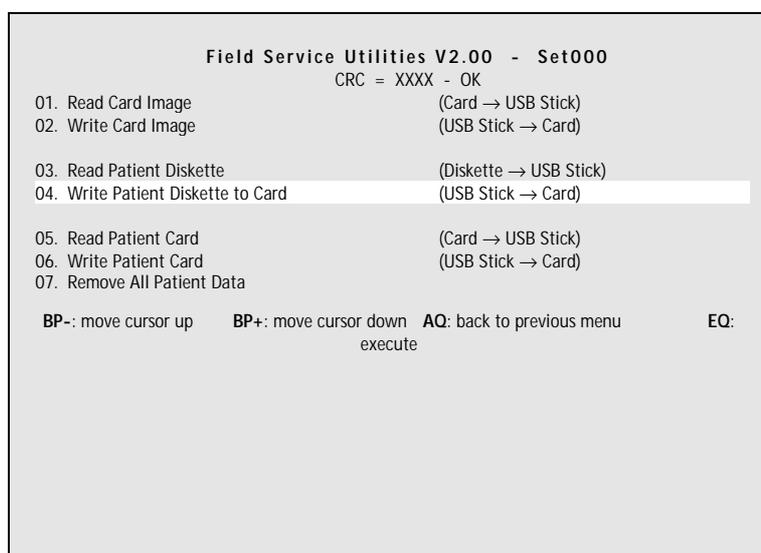


This utility writes the patient files from the USB stick as a compressed *patdisk.zip* file to the patient card, i.e. converts a patient diskette to a patient card.

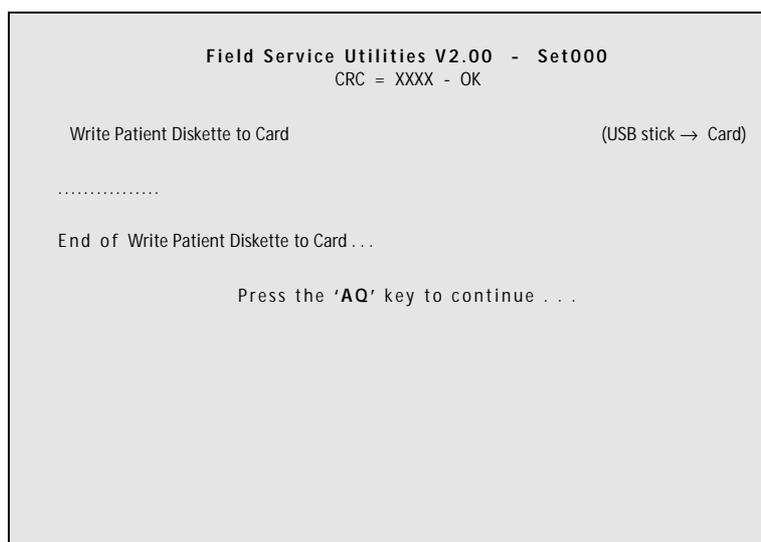
**If file is not on FSU USB stick**

Copy from the PC the compressed *patdisk.zip* file from the patient diskette to the following USER subdirectory:

USB:\USER\09\_Card\_04\_Write\_Patient\_Diskette\_to\_Card\DEFAULT\patdisk.zip

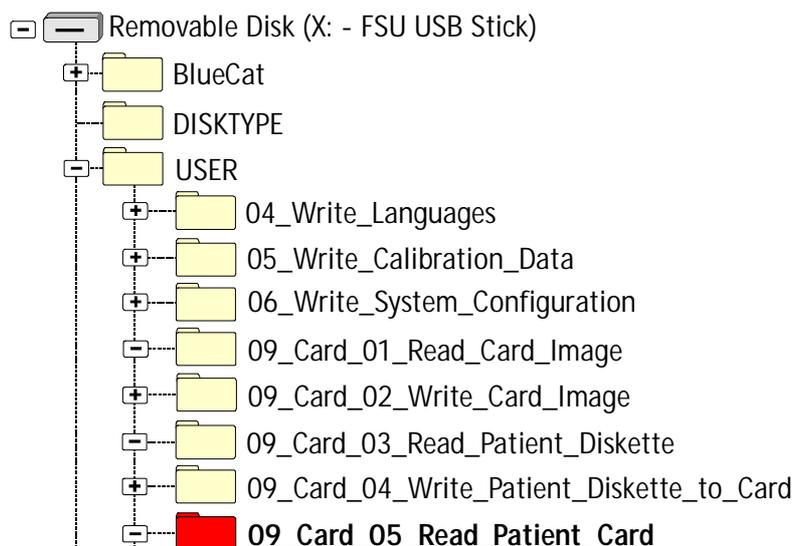


1. Press the **BP +** hardware key, move cursor down and select *09. Select Menu of Card Reader Commands* in the main menu.
2. Press the **BP +** hardware key and move the cursor down to select the utility.
3. Press the **EQ**  hardware key to execute the utility.
  - Yes, USB stick (patient diskette) is written to patient card
4. Press the **AQ**  hardware key to skip to the previous menu.
  - No, USB stick (patient diskette) is not written to patient card



**Remove all patient data from the FSU USB stick after service with the utility 07. Remove All Patient Data. This will delete all patient data stored on the FSU USB stick.**

## 3.6.9.6 Read Patient Card



This utility reads patient files from the patient card as a compressed *patcard.zip* file to the FSU USB stick.

**Read Patient Card**

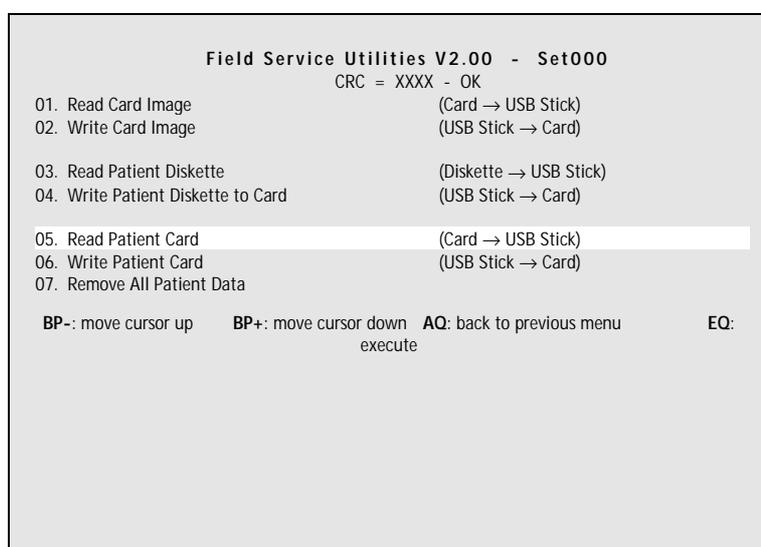
USB:\USER\09\_Card\_05\_Read\_Patient\_Card\{Patient\_Name}\patcard.zip

**Example:**

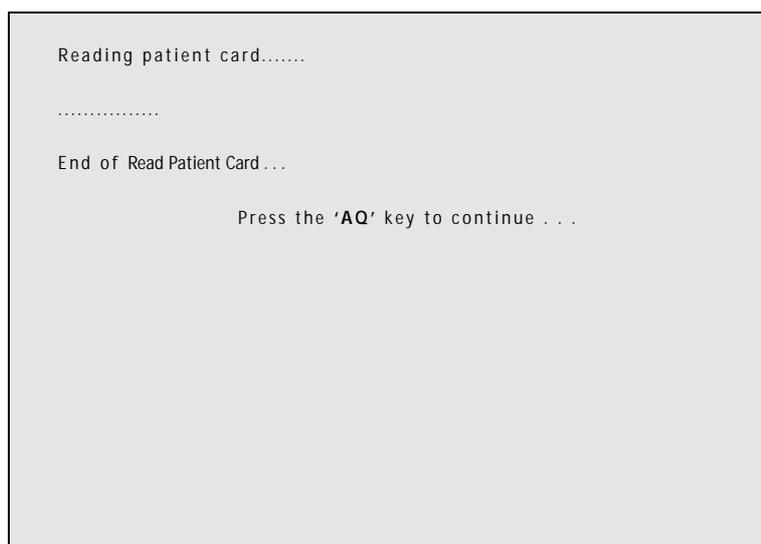
USB:\USER\09\_Card\_05\_Read\_Patient\_Card\Michael\_May\patcard.zip

Patient\_Name: Michael\_May

**Note:** If the patient name is not found on the card, the *Unknown Patient* name is used.

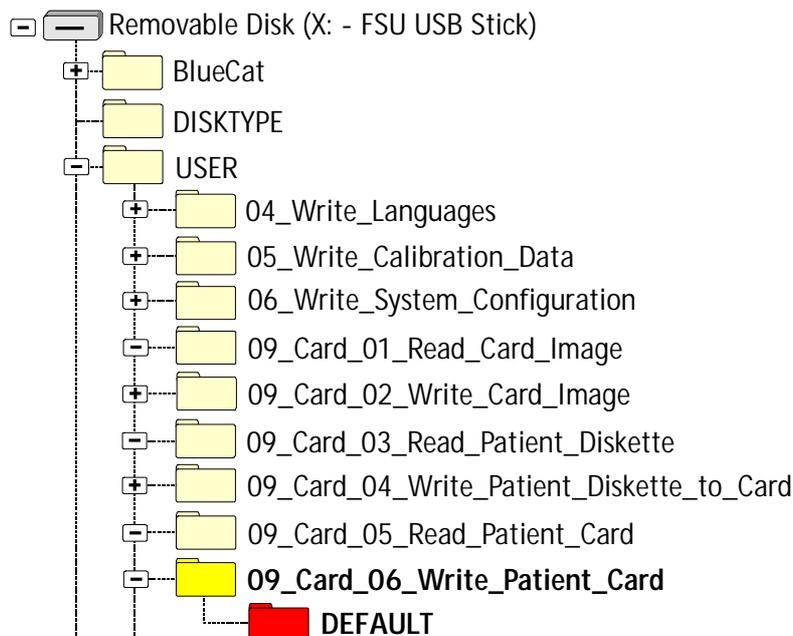


1. Press the **BP**  hardware key, move cursor down and select *09. Select Menu of Card Reader Commands* in the main menu.
2. Press the **BP**  hardware key and move the cursor down to select the utility.
3. Press the **EQ**  hardware key to execute the utility.
  - Yes, patient card is read to USB stick
4. Press the **AQ**  hardware key to skip to the previous menu.
  - No, patient card is not read to USB stick



**Remove all patient data from the FSU USB stick after service with the utility 07. Remove All Patient Data.** This will delete all patient data stored on the FSU USB stick.

## 3.6.9.7 Write Patient Card

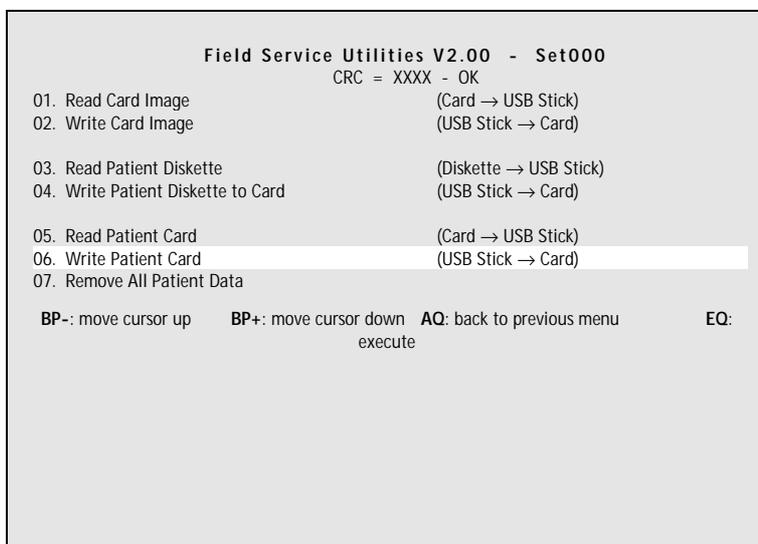


This utility writes patient files from the USB stick as a compressed *patcard.zip* file to the patient card.

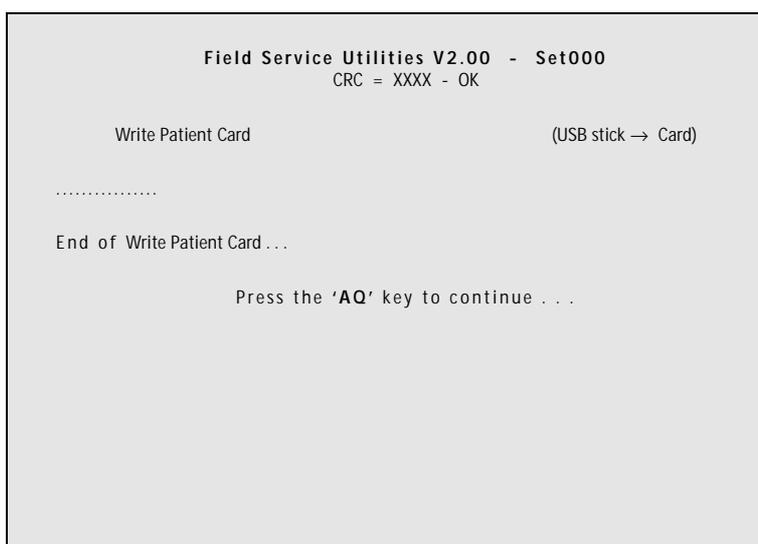
**If file is not on FSU USB stick**

Copy on the PC, the compressed *patcard.zip* from the patient card file to the following USER subdirectory:

USB:\USER\09\_Card\_06\_Write\_Patient\_Card\DEFAULT  
 \patcard.zip



1. Press the **BP +** hardware key, move cursor down and select **09. Select Menu of Card Reader Commands** in the main menu.
2. Press the **BP +** hardware key and move the cursor down to select the utility.
3. Press the **EQ**  hardware key to execute the utility.
  - Yes, USB stick is written to patient card
4. Press the **AQ**  hardware key to skip to the previous menu.
  - No, USB stick is not written to patient card



**Remove all patient data from the FSU USB stick after service with the utility 07. *Remove All Patient Data*. This will delete all patient data stored on the FSU USB stick.**

## 3.6.9.8 Remove All Patient Data



Remove all patient data from the FSU USB stick after service with the utility **07. Remove All Patient Data**. This will delete all patient data stored on the FSU USB stick.

The service technician can store patient data on the USB stick by reading them from patient cards and patient diskettes. Additionally patient data can be copied manually to the *09\_Write\_Patient\_Diskette\_to\_Card, DEFAULT* subdirectory and the *09\_Write\_Patient\_Card, DEFAULT* sub-directories. If the patient data are not required anymore the service technician can remove them from the USB stick in one step by using the **07 Remove All Patient Data** utility. The utility will remove all the patient data from the FSU USB stick, except the patient card images.

The utility requires two confirmations.

**First confirmation:**

*Are you sure?*

**AQ**  : exit from the utility

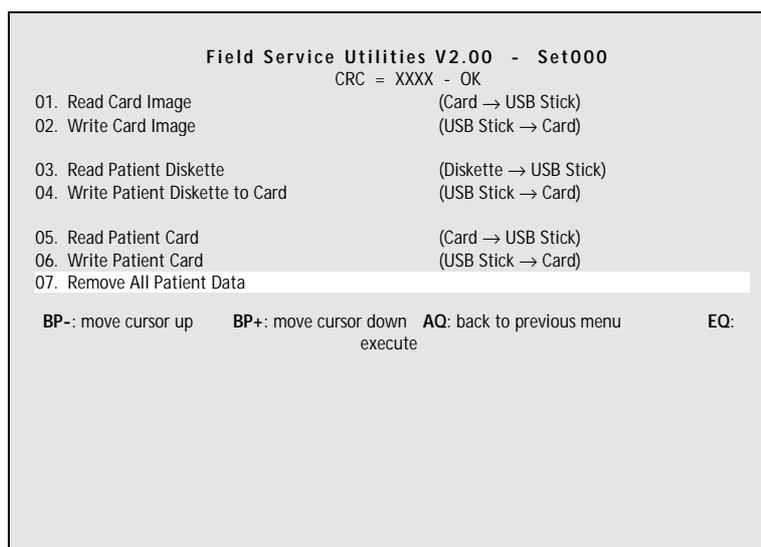
**EQ**  : renewed query for confirmation

**Second confirmation:**

*Are you REALLY sure?*

**BP**  : exit from the utility

**BP**  : all patient data are deleted from the FSU USB stick.



1. Press **EQ**  to execute the utility.

2. Press **AQ**  to skip to the previous menu.

Field Service Utilities V2.00 - Set000  
CRC = XXXX - OK

Remove All Patient Data  
(USB stick)

This command removes **ALL PATIENT DATA** from the USB stick

Are you sure?

AQ: no

EQ: yes

The *Remove All Patient Data* utility will delete all patient data from the FSU USB stick

AQ  : No, all patient data are not deleted, exit from the utility

EQ  : Yes, all patient data are deleted

3. Press EQ  if you are sure. This will delete all patient data from the FSU USB stick.

```
USER/09_Card_06_Write_Patient_Card.....  
USER/09_Card_05_Read_Patient_Card.....  
USER/09_Card_04_Write_Patient_Diskette_to_Card.....  
USER/09_Card_03_Read_Patient_Diskette.....  
End of Remove All Patient Data...
```

### 3.6.10 Read/Get Error Utilities

The group of read utilities reads data files from the Dialog+ hard disk drive (CFC) and writes them to the FSU USB stick.

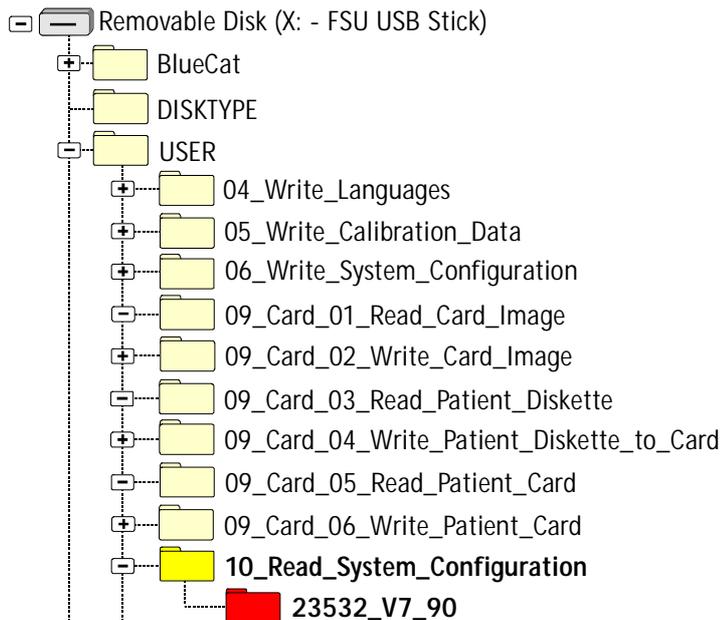
#### 3.6.10.1 Read System Configuration

The utility reads the system configuration from Dialog+ hard disk drive (CFC) and writes it to the USB stick. Files from different Dialog+ machines are placed in different subdirectories on the USB stick. The subdirectory name *USER/10\_Read\_System\_Configuration/ <SERNUM>\_<TLC Version>/* is created from the serial number and the TLC version number of the Dialog+ machine.



**<SERNUM>\_<TLC Version>**

The subdirectory name is created from the serial number **<SERNUM>** and the TLC version number of the Dialog+ machine. If the serial number is not set on the Dialog+ **<SERNUM>** is equal to '-----'.



See the results in the subdirectories with the following path for the *System Configuration* file *config.xxu*.

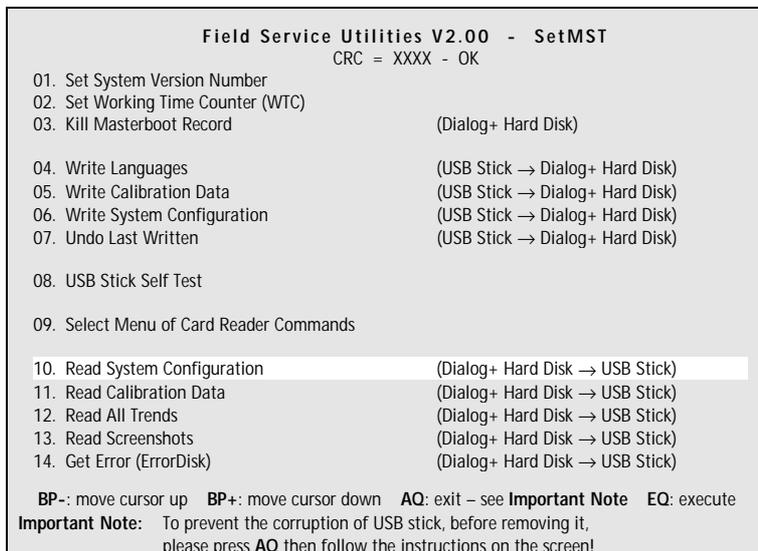
#### Read System Configuration

USB:\USER\10\_Read\_System\_Configuration\{Serial Number}\_{TLC Version}\*config.xxu*

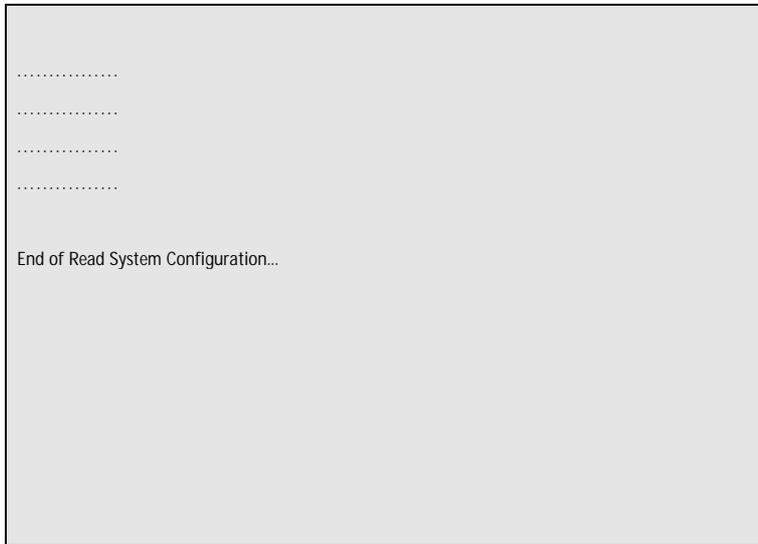
#### Example:

USB::\USER\10\_Read\_System\_Configuration\23532\_V7\_90\*config.xxu*

2 3 5 3 2 : Serial Number of the Dialog+ machine  
V 7 \_ 9 0 : TLC software version



1. Press **BP** and move the cursor down to select the utility.
2. Press **EQ** to execute the utility.



An input screen opens and the system configuration is read from the Dialog+ hard disk drive (CFC) to the USB stick. The *Read System Configuration* menu automatically returns (a few seconds) to the main menu after *End of Read System Configuration...* is displayed.

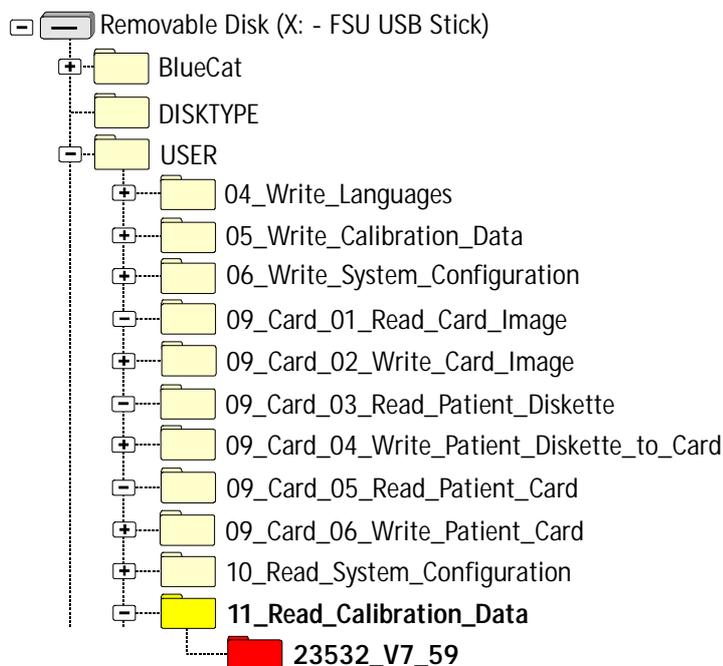
## 3.6.10.2 Read Calibration Data



The utility reads the calibration data from Dialog+ hard disk drive (CFC) and writes it to the USB stick. Files from different Dialog+ machines are placed in different subdirectories on the USB stick. The subdirectory name *USER/11\_Read\_Calibration\_Data/ <SERNUM>\_<Main Version>/* is created from the serial number and the main version number of the Dialog+ machine.

<SERNUM>

The subdirectory name is created from the serial number <SERNUM> and the main version number of the Dialog+. If the serial number is not set on the Dialog+ <SERNUM> is equal to '-----'.



See the results in the directories with the following path for the *Calibration Data* file *calib.dat.xxu*.

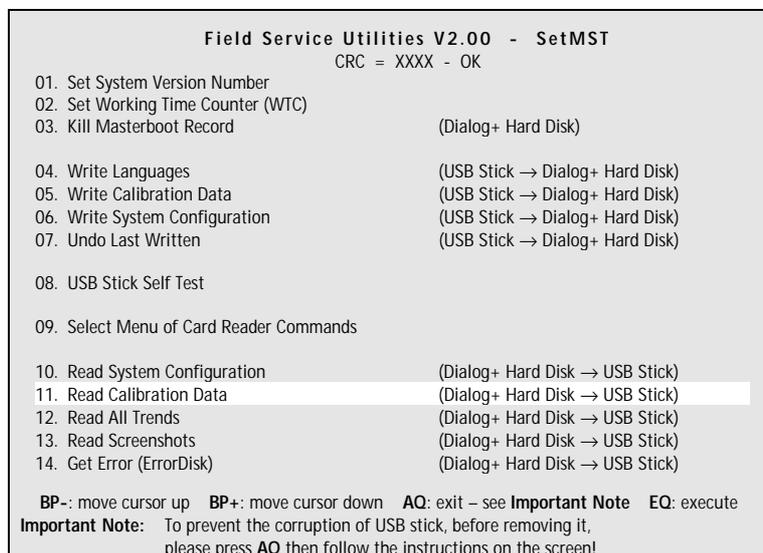
**Read Calibration Data**

USB:\USER\11\_Read\_Calibration\_Data\{Serial Number}\\_{Main Version}\calib.dat.xxu

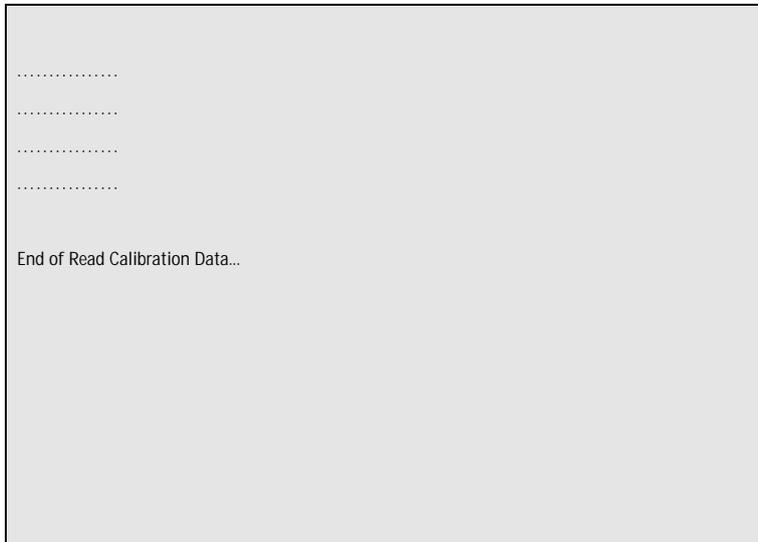
**Example:**

USB:\USER\11\_Read\_Calibration\_Data\23532\_V7\_59\  
*calib.dat.xxu*

2 3 5 3 2 : Serial Number of the Dialog machine  
V 7 \_ 5 9 : Dialog+ main software version



1. Press the **BP +** hardware key and move the cursor down to select the utility.
2. Press the **EQ** hardware key to execute the utility.



An input screen opens and the calibration data is read from the Dialog+ hard disk drive (CFC) to the USB stick. The *Read Calibration Data* menu automatically returns (a few seconds) to the main menu after *End of Read Calibration Data...* is displayed.

## 3.6.10.3 Read All Trends



A separate software program is required to analyse the trends, i.e. the Trend Viewer.

The utility reads all possible backup trend files on the Dialog+ hard disk drive (CFC) (max. 20 trends) and writes them to the USB stick. Files from different Dialog+ machines are placed in different subdirectories on the USB stick. The subdirectory name *USER/12\_Read\_All\_Trends/ <SERNUM>/* is created from the serial number of the Dialog+ machine. Files from the same machine are placed in different subdirectories where the subdirectory names are created from the trend creation dates *<DATE>*.



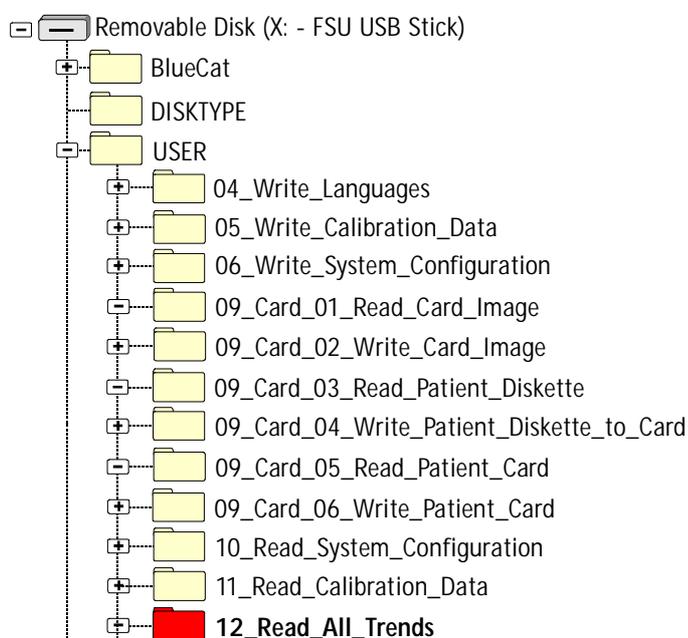
**<SERNUM>**

The subdirectory name is created from the serial number **<SERNUM>** of the Dialog+. If the serial number is not set on the Dialog+ **<SERNUM>** is equal to '-----'.

**<DATE>**

The subdirectory name is created from a date. Format: YYYY-MM-DD.hh.mm.

In case of TRENDS: the date is the date of the trend start.



See the results in the directories with the following path for the *Read All Trends* file *tbd1.zip*.

#### Read All Trends

USB:\USER\12\_Read\_All\_Trends\{Serial Number}\{YYYY-MM-DD.hh.mm}\tbd1.zip

#### Example:

USB:\USER\12\_Read\_All\_Trends\{Serial Number}\2007-09-12.14.25}\tbd1.zip

Y Y Y Y :	Year 2007
M M :	09 month September
D D :	12 Wednesday
h h :	14 hours
m m :	25 minutes



## 3.6.10.4 Read Screenshots

The utility reads the screenshots from Dialog+ hard disk drive (CFC) and writes them to the USB stick. Files from different Dialog+ machines are placed in different subdirectories on the USB stick. The subdirectory names `/USER/13_Read_Screenshots/ <SERNUM>/<DATE>/` are created from the serial numbers of the Dialog+ machines. Files from the same machine are placed in different subdirectories where the subdirectory names are created from the current date of reading `<DATE>`.

## Create Screenshots



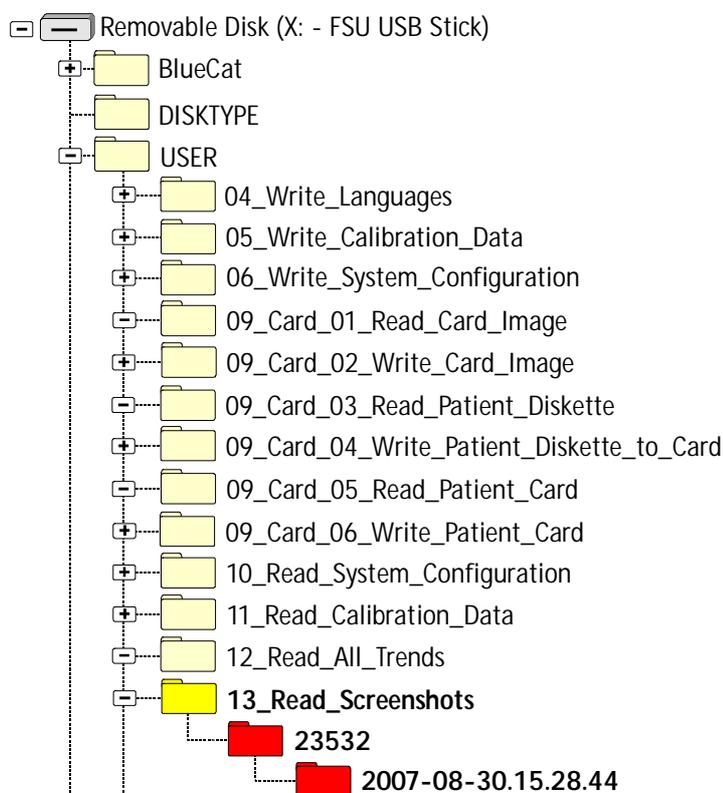
A keyboard is required to create screenshots. Connect a keyboard to the motherboard. Use the ALT + F5 key on the keyboard to take a screenshot.

`<SERNUM>`

The subdirectory name is created from the serial number `<SERNUM>` of the Dialog+. If the serial number is not set on the Dialog+ `<SERNUM>` is equal to '-----'.

`<DATE>`

The subdirectory name is created from a creation date. Format: YYYY-MM-DD.hh.mm.



See the results in the directories with the following path for the *Read Screenshots* files:

## Read Screenshots

USB:\USER\13\_Read\_Screenshots\{Serial Number}\{YYYY-MM-DD.hh.mm.ss}\{DEFAULT and other directories}

## Example:

USB:\USER\13\_Read\_Screenshots\23532\2007-08-30.15.28.44\{DEFAULT and other directories}

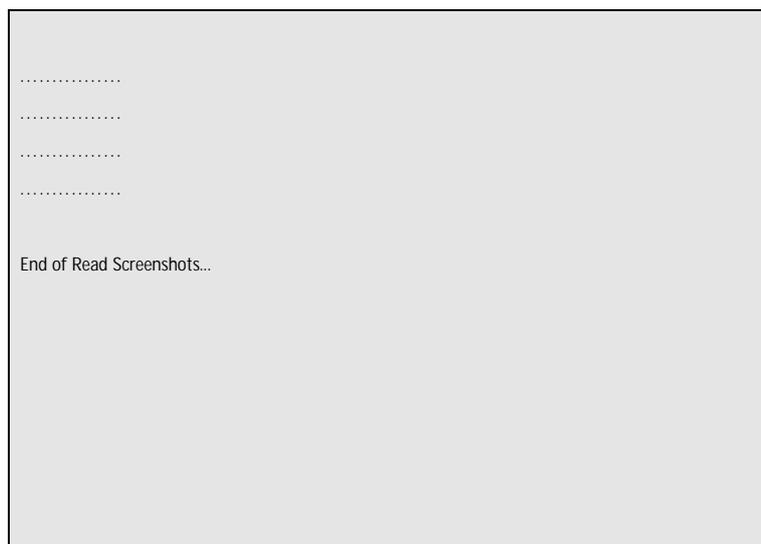
2 3 5 3 2 :	Serial Number of the Dialog machine
Y Y Y Y :	Year 2007
M M :	08 month August
D D :	30 Thursday
h h :	15 hours
m m :	28 minutes
s s :	44 seconds

The screenshots are stored in vga\*.zip files in the DEFAULT (and/or in other) subdirectories on the Dialog+. The vga\*.zip files copied to USB stick are deleted from the Dialog+ hard disk drive (CFC) (similarly to the log files) but the subdirectory structure on the Dialog+ hard disk drive (CFC) is left untouched.

Field Service Utilities V2.00 - SetMST	
CRC = XXXX - OK	
01. Set System Version Number	
02. Set Working Time Counter (WTC)	
03. Kill Masterboot Record	(Dialog+ Hard Disk)
04. Write Languages	(USB Stick → Dialog+ Hard Disk)
05. Write Calibration Data	(USB Stick → Dialog+ Hard Disk)
06. Write System Configuration	(USB Stick → Dialog+ Hard Disk)
07. Undo Last Written	(USB Stick → Dialog+ Hard Disk)
08. USB Stick Self Test	
09. Select Menu of Card Reader Commands	
10. Read System Configuration	(Dialog+ Hard Disk → USB Stick)
11. Read Calibration Data	(Dialog+ Hard Disk → USB Stick)
12. Read All Trends	(Dialog+ Hard Disk → USB Stick)
13. Read Screenshots	(Dialog+ Hard Disk → USB Stick)
14. Get Error (ErrorDisk)	(Dialog+ Hard Disk → USB Stick)

**BP-**: move cursor up    **BP+**: move cursor down    **AQ**: exit – see **Important Note**    **EQ**: execute  
**Important Note:** To prevent the corruption of USB stick, before removing it, please press **AQ** then follow the instructions on the screen!

1. Press the **BP +** hardware key and move the cursor down to select the utility.
2. Press the **EQ**  hardware key to execute the utility.



An input screen opens and all the screenshots are read from the Dialog+ hard disk drive (CFC) to the USB stick. The *Read Screenshots* menu automatically returns (a few seconds) to the main menu after *End of Read Screenshots...* is displayed.

## 3.6.10.5 Get Error (ErrorDisk)



The error files can only be analysed by qualified personnel of B. Braun Avitum (e.g. development department) and should be provided only on special request.

The utility gets error information and log files from Dialog+ hard disk drive (CFC) and writes them to the USB stick. Files from different Dialog+ machines are placed in different subdirectories on the USB stick (VFAT partition). The subdirectory names `/USER/14_Get Error/<SERNUM>/<DATE>/` are created from the serial numbers of the Dialog+ machines and from the current date of reading `<DATE>`.



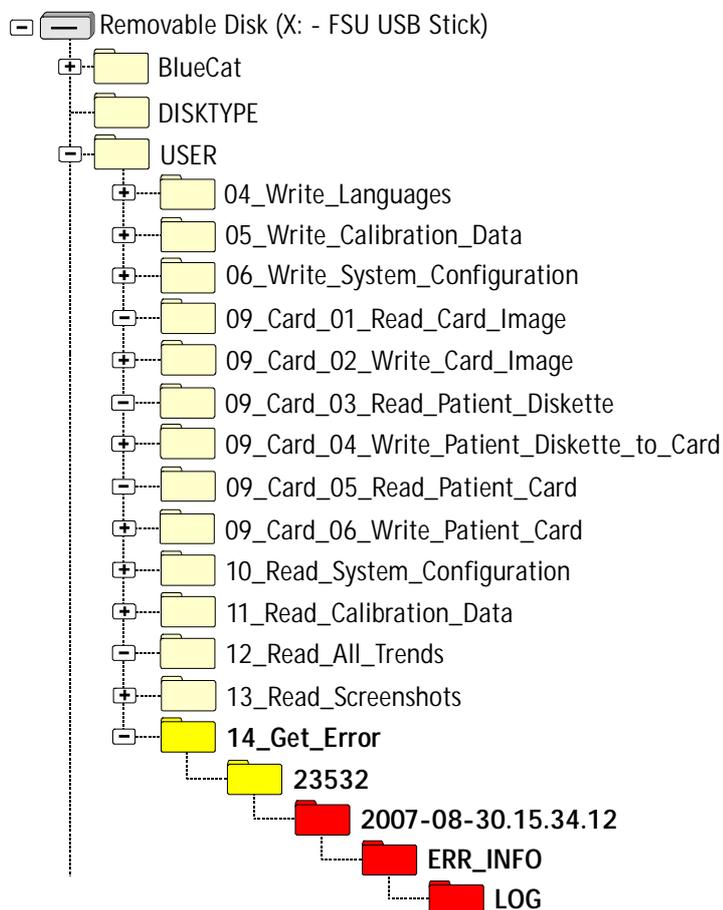
**<SERNUM>**

The subdirectory name is created from the serial number `<SERNUM>` of the Dialog+. If the serial number is not set on the Dialog+ `<SERNUM>` is equal to '-----'.

**<DATE>**

The subdirectory name is created from a date. Format: `YYYY-MM-DD.hh.mm.ss`.

In case of ERRDISK: the date is the date of the reading.



See the results in the directories with the following path:

#### Get Error

USB:\USER\14\_Get\_Error\{Serial Number}\{YYYY-MM-DD.hh.mm.ss}\ERR\_INFO

#### Example:

USB:\USER\14\_Get\_Error\23532\2007-08-30.15.34.12\ERR\_INFO

2 3 5 3 2 :	Serial Number of the Dialog machine
Y Y Y Y :	Year 2007
M M :	08 month August
D D :	30 Thursday
h h :	15 hours
m m :	34 minutes
s s :	12 seconds
ERR_INFO :	Error information
LOG :	Log

Field Service Utilities V2.00 - SetMST	
CRC = XXXX - OK	
01. Set System Version Number	
02. Set Working Time Counter (WTC)	
03. Kill Masterboot Record	(Dialog+ Hard Disk)
04. Write Languages	(USB Stick → Dialog+ Hard Disk)
05. Write Calibration Data	(USB Stick → Dialog+ Hard Disk)
06. Write System Configuration	(USB Stick → Dialog+ Hard Disk)
07. Undo Last Written	(USB Stick → Dialog+ Hard Disk)
08. USB Stick Self Test	
09. Select Menu of Card Reader Commands	
10. Read System Configuration	(Dialog+ Hard Disk → USB Stick)
11. Read Calibration Data	(Dialog+ Hard Disk → USB Stick)
12. Read All Trends	(Dialog+ Hard Disk → USB Stick)
13. Read Screenshots	(Dialog+ Hard Disk → USB Stick)
14. Get Error (ErrorDisk)	(Dialog+ Hard Disk → USB Stick)

**BP-**: move cursor up   **BP+**: move cursor down   **AQ**: exit – see **Important Note**   **EQ**: execute

**Important Note:** To prevent the corruption of USB stick, before removing it, please press **AQ** then follow the instructions on the screen!

1. Press the **BP +** hardware key and move the cursor down to select the utility.
2. Press the **EQ**  hardware key to execute the utility.



An input screen opens and all the log files are read from the Dialog+ hard disk drive (CFC) to the USB stick. The *Get Error (ErrorDisk)* menu automatically returns (a few seconds) to the main menu *End of Error Disk...* is displayed.

### 3.6.11 FSU Handling of Errors

All utilities have the same error handling procedure:

- In case of an error generally an error message is displayed
- An error or warning message is displayed if an error occurs during the execution of a utility. To return to the main menu the service technician should press AQ or EQ according to the instruction on the screen.
- An error message is displayed in red at the bottom of the main menu:

*ERROR: Function returned error code = N*

*N* can be a varied number, e.g.:

- 1:** Error during directory creation, file copying, general error
- 3:** Source files are not found
- 126:** Function exists but not executable
- 127:** Function is missing

- The error message refers to the highlighted utility in the menu
- The error message is cleared at the next user input

### 3.6.12 Examination of Results



#### Deletion of Subdirectories

The <SERNUM>, <DATE>, <Patient Name> subdirectories and their contents (including sub-subdirectories) can be deleted without any problem.

#### Initial Directories

**Do not delete the initial directories (that exist on the USB stick before the first use). Deletion makes the USB stick unusable. After the next switch-on a fatal error message is displayed (including the name of the missing directory). The missing directory must be restored to use the USB stick again.**

Data collected from the Dialog+ and stored on the FSU USB stick can be examined on a PC with the following features:

- Windows operating system
- USB connection

#### Examine Data

- connect the USB stick to USB connector of the PC
- wait until Windows detects the USB stick
- open *My computer*
- the VFAT partition of the XXU stick appears as *Removable Disk X:*
- open the disk
- the results are in the following subdirectories:

*USER/XX\_Read.....*

*USER/14\_Get\_Error*

These files can be copied to any location on the PC (e.g. to use them for local examination) or can be deleted from the FSU USB stick.

### 3.6.13 Troubleshooting USB Stick

#### 3.6.13.1 Field Service Utility Menu with Failed CRC Check



The FSU program stops automatically in case of a self test error. The corrupted USB stick must be exchanged before you continue with the FSU program.

The USB stick can be damaged permanently if the procedure to remove the USB stick is not observed.

```
Required CRC = XXXX  
*** Self=test ERROR – USB stick is not usable ***  
  
--- SWITCH OFF the Dialog+ ---
```

The following error message is displayed in case of a self test error.

Exchange the corrupted USB stick before you continue with the FSU program.

## 3.7 Default Table SW 9.xx

## System Configuration

	Unit	HD	HDF Online	US Default	Modified
<b>Dialysate Side Parameters</b>					
Na Concentration/Conductivity Measurement Unit	-	mS/cm	mS/cm	mS/cm	
Acetate Mode Disabled	-	NO	YES	YES	
Default Conductivity Mode	-	BIC	BIC	BIC	
Stand-by Function Available in Preparation	-	YES	YES	NO	
Stand-by after Self Test/Rinsing	-	YES	YES	NO	
Maximum Stand-by Time	h:min	1:00	1:00	5:00	
Selected Acetate	-	B.BRAUN CONCENTRATE 1	B.BRAUN CONCENTRATE 1	B.BRAUN CONCENTRATE 1	
Selected Bicarbonate	-	BIC without NaCl	BIC without NaCl	BIC without NaCl	
Selected Acid	-	B.BRAUN ACID 1	B.BRAUN ACID 1	B.BRAUN ACID 1	
Temperature Measurement Unit	-	°C	°C	°C	
Dialysate Flow	ml/min	500	500	600	
Dialysate Temperature	°C	37.0	37.0	37.0	
<b>Settings for Acetate Concentrate</b>					
1 <sup>st</sup> to 10 <sup>th</sup> Concentrate Name	-		B.Braun Concentrate 1 – 10		
Conversion Factor	mS/cm per mmol/l		0.10500		
Default Value	mS/cm		14.0		
<b>Settings for BIC</b>					
1 <sup>st</sup> Bicarbonate without NaCl	-		BIC without NaCl		
Conversion Factor	mS/cm per mmol/l		0.0950		
Default Value	mS/cm		3.0		
Acid Selection	-		B.Braun Acid 1		
<b>2<sup>nd</sup> Bicarbonate with NaCl</b>					
Conversion Factor	mS/cm per mmol/l		0.0950		
Default Value	mS/cm		5.8		
Acid Selection	-		B.Braun Acid 2		
<b>Setting for Acid</b>					
1 <sup>st</sup> to 20 <sup>th</sup> Concentrate Name	-		B.Braun Acid 1 – 20		
Conversion Factor	mS/cm per mmol/l		0.10500		
Default Value	mS/cm		14.3		
<b>Blood Side Parameters</b>					
BS Pressure Test with Equalisation of Pressure	-	NO	NO	YES	
Default Blood Flow at End of Therapy	ml/min	100	100	200	
AV Line without Chamber is Possible	-	NO	NO	NO	
AV Line with PBE Connector	-	YES	YES	NO	
<b>Min-Max Parameters</b>					
Delta PA min.	mmHg	70	70	70	
Delta PA max.	mmHg	70	70	70	
Limit Maximum PBE	mmHg	700	700	700	
Limit Delta PBE	mmHg	150	150	600	
Limit Maximum TMP	mmHg	350	350	500	
Limits Low/High TMP	-	active	active	active	
Low Limit TMP	%	40	40	40	
High Limit TMP	%	40	40	40	
Minimum TMP Alarm Window	mmHg	20	20	20	
Extended TMP Limit Range Button is Displayed in Treatment	-	NO	NO	NO	
Select Extended TMP Limit Range	-	inactive	inactive	inactive	
<b>Arterial Bolus Parameters</b>					
Arterial Bolus Volume	ml	100	100	100	
Arterial Bolus with SAKA Support	-	NO	NO	NO	

	Unit	HD	HDF Online	US Default	Modified
<b>Single Needle Parameters</b>					
Single Needle Valve					
Limit Min. PA	mmHg	-200	-200	-200	
Max. Control Min. PV	mmHg	150	150	150	
Control Min. PV	mmHg	100	100	100	
Control Max. PV	mmHg	350	350	390	
Single-Needle Cross-Over					
Control PA	mmHg	-180	-180	-180	
Control PV	mmHg	360	360	360	
<b>Heparin Parameters</b>					
Treatment without Heparin	-	NO	NO	NO	
Heparin Measurement Unit	-	ml/h	ml/h	ml/h	
Conversion Factor Heparin (IE/ml)	-	1000	1000	1000	
Heparin Rate	ml/h	3.0	3.0	3.0	
Heparin Bolus Volume	ml	0.0	0.0	0.0	
Therapy Beginning Bolus	-	NO	NO	NO	
Selected Syringe Type	-	Omnifix 30 ml	Omnifix 30 ml	B-D 10 ml	
<b>Syringe Table</b>					
<b>Heparin Pump Compact</b>		Syringe Sizes: 10 ml to 30 ml			
<b>Syringe Type</b>		<b>Inside Diameter [mm]</b>			
Braun OPS	20 ml	19.00			
Terumo	20/25 ml	20.10			
Terumo	30/35 ml	22.57			
B-D (for US)	10 ml	14.43			
B-D	20 ml	18.90			
B-D	30 ml	21.53			
Monoject	20 ml	19.83			
Dispomed	30 ml	22.17			
Fresenius HS	30 ml	22.20			
Omnifix	10 ml	16.05			
Omnifix	20 ml	19.80			
Omnifix	30 ml	22.00			
	Unit	HD	HDF Online	US Default	Modified
<b>Rinsing Parameters</b>					
Priming without Recirculation	-	NO	NO	NO	
Filling BP Rate	ml/min	100	100	100	
Filling BP Volume	ml	700	700	500	
Automatic Rinse Program after Self Tests	-	YES	YES	YES	
User Message for BS Filled?	-	YES	YES	YES	
Rinsing Blood Flow	ml/min	200	200	200	
Rinsing Dialysate Flow	ml/min	500	500	600	
Rinsing Time by UFP	h:min	00:59	00:59	00:10	
Rinsing Rate by UFP	ml/h	203	203	600	
Rinsing Volume by UFP	ml	200	200	100	
Rinsing Time by BPA or BPV	h:min	-	00:30	-	
Rinsing Rate by BPA or BPV	ml/h	-	6000	-	
Rinsing Volume by BPA or BPV	ml	-	3000	-	
Blood Flow for Connecting Patient	ml/min	100	100	100	
<b>UF Parameters</b>					
Minimal UF Rate	ml/h	50	50	50	
UF Rate Compensation?	-	YES	YES	YES	
Max. Value of Upper Limit UF Rate	ml/h	3000	3000	3000	
Default Value of Upper Limit UF Rate	ml/h	2000	2000	2000	
UF Volume	ml	2000	2000	2000	
Therapy Time	h:min	04:00	04:00	03:30	
Gross UF Rate vs. Blood Flow	-	inactive	inactive	inactive	
	%	40	40	40	
Gross UF Rate vs. Blood Flow	-	active	active	active	
	%	30	30	30	
UF Profile Editor					

	Unit	HD	HDF Online	US Default	Modified
<b>HDF/HF Online Parameters</b>					
HDF Substitution Flow	ml/min	-	60	-	
HF Substitution Flow	ml/min	-	100	-	
HDF Dialysate Flow for Postdilution	ml/min	-	600	-	
HDF Dialysate Flow for Predilution	ml/min	-	700	-	
HDF/HF Infusion Bolus Volume	ml	-	100	-	
Post-/Predilution Selection	-	-	inactive	-	
<b>Disinfection Parameters</b>					
Disinfection after each Therapy	-	NO	YES	NO	
Automatic Preparation Start after Disinfection	-	NO	NO	NO	
Thermal Disinfection	-	YES	NO	YES	
Chemical Disinfection	-	YES	YES	YES	
Chemical Disinfection, Short	-	YES	NO	NO	
Central Thermal Disinfection	-	NO	NO	NO	
Central Manual Chemical Disinfection	-	NO	NO	NO	
Central Automatic Chemical Disinfection	-	NO	NO	NO	
Rinsing	-	NO	NO	YES	
Automatic Switch-On with Rinsing - No Weekly Schedule	-	inactive	inactive	inactive	
Switch-On Time	h:min	06:30	06:30	06:30	
Automatic Switch-On by Weekly Schedule	-	active	active	active	
Weekly Schedule	(see Table)				
Start on Sunday	-	inactive	inactive	active	
Start on Monday	-	active	active	inactive	
Auto Switch-On without daily confirmation	-	NO	NO	NO	
Maximum Out of Action Time	-	inactive	inactive	active	
Days	Days	0	0	2	
Hours/Minutes	h:min	08:00	08:00	00:00	
Disinfection Configuration Data Table	-	Citric Acid 50%	Citric Acid 50%	Citric Thermal	
Central Thermal: Inlet Flow	ml/min	250	250	250	
Central Thermal: Time	h:min	00:30	00:30	00:30	
Central Manual Chemical: Inlet Flow	ml/min	250	250	250	
Central Manual Chemical: Inlet Time	h:min	00:05	00:05	00:05	
Central Manual Chemical: Rinsing Flow	ml/min	800	800	800	
Central Manual Chemical: Rinsing Time	h:min	00:30	00:30	00:30	
Central Automatic Chemical: Inlet Volume	ml	260	260	260	
Central Automatic Chemical: Switch off for Retention without Automatic Switch-On	-	NO	NO	NO	
Central Automatic Chemical: Retention Time	h:min	00:20	00:20	00:20	
Central Automatic Chemical: Rinsing Flow	ml/min	800	800	800	
Central Automatic Chemical: Rinsing Time	h:min	00:30	00:30	00:30	
Rinsing: Inlet Flow	ml/min	800	800	800	
Rinsing: Time	h:min	00:02	00:02	00:02	
<b>Filter Parameters</b>					
Name	-	Diacap-Ultra	Diacap-Ultra	Diacap-Ultra	
Therapy Number	-	150	150	150	
Filter Operation Time	h	900	900	900	
<b>Dialyser Parameters (Kt/V)</b>					
Urea Distribution Volume Formula	-	Watson	Watson	Watson	
Height Measurement Unit of Watson Formula	-	cm	cm	cm	
Default Target Kt/V	-	1.20	1.20	1.20	
Default Setting for Treatment Mode Warning of Kt/V Target Projected Deviation	-	Warning active	Warning active	Warning inactive	
Kt/V Table - Manual Input: Setting Clean/Total Blood [%]	-	YES	YES	YES	
Warning for Saving Kt/V Volume enabled	-	NO	NO	NO	
<b>Kt/V-UV</b>					
Default Target Kt/V	-	1.20	1.20	1.20	
Kt/V Correction Mode	-	Single Pool	Single Pool	Single Pool	
Default Setting for Treatment Mode: Warning of Kt/V Target-Projected Deviation	-	Warning active	Warning active	Warning inactive	
Warning for Saving Kt/V Table	-	NO	NO	NO	
<b>Timings</b>					
Parameter Setting Window Disappearing Time	s	500	500	600	
Screen Saver Appearance	-	NO	NO	NO	
Appearing Time	s	600	600	600	

	Unit	HD	HDF Online	US Default	Modified
<b>Language Selection</b>					
English	-	active	active	active	
German	-	inactive	inactive	inactive	
<b>Summer Time Setting (enter values accordingly)</b>					
Begin of Summer Time	D/M/Y	dd.mm.yyyy	dd.mm.yyyy	dd.mm.yyyy	
	h:min	xx:xx	xx:xx	xx:xx	
End of Summer Time	D/M/Y	dd.mm.yyyy	dd.mm.yyyy	dd.mm.yyyy	
	h:min	xx:xx	xx:xx	xx:xx	
Time Difference	h:min	xx:xx	xx:xx	xx:xx	
<b>ABPM</b>					
Delete Button for Data	-	YES	YES	YES	
Auto Start of Cyclic Reading (from Patient Identification Media)	-	NO	NO	NO	
ABPM Cyclic Reading Stop at Entering Disinfection	-	YES	YES	YES	
Taking Over Limits from Patient's Parameters	-	YES	YES	YES	
<b>biologic RR Comfort</b>					
Guide Line Mode	-	NO	NO	-	
Suggested SYS Lower Limit	-	NO	NO	-	
bioLogic RR Algorithm ID	-	100	100	-	
<b>Miscellaneous Parameters</b>					
Click Sound	-	NO	NO	YES	
Warning and Writing (Saving) Patient Parameters	-	NO	NO	YES	
* Skip Self Tests	-	NO	NO	NO	
* A skip of the self tests for servicing only!					
Automatic Preparation Start	-	YES	YES	NO	
Data Validation with	-	Touch	Touch	Enter Key	
UF Profile Editing in Treatment	-	YES	YES	NO	
Manual Bypass Confirmation Window Enabled	-	NO	NO	YES	
End of Therapy Sound Duration	-	100 %	100 %	100 %	
Chopped Alarm Sound	-	NO	NO	NO	
Suppression of Warning Sounds in Preparation	-	NO	NO	NO	
Automatic Reinfusion Start at Entering End of Therapy	-	YES	YES	NO	
<b>DCI</b>					
Dianet Address	-	1	1	1	
Data Set	-	MPI 0.12	MPI 0.12	MPI 0.12	
<b>DBI</b>					
Baud Rate	kBaud	38.4	38.4	38.4	
User Logout Time	min	15 - ON	15 - ON	15 - ON	
Message Warning Time	min	15 - OFF	15 - OFF	15 - OFF	
Data Set	DBI 1.61	-	inactive	inactive	inactive
	DBI 1.72	-	inactive	inactive	inactive
	DBI 2.00	-	active	active	active
	DBI 2.20	-	inactive	inactive	inactive
	DBI 2.21	-	inactive	inactive	inactive
DBI-WAN Interface – Network Name Configuration					
Pre-SN String is needed	-	-	-	d / YES	
SN String is needed	-	-	-	- / YES	
Post-SN String is needed	-	-	-	/ NO	
Network Name (max. 15 chars.)	-	-	-	d-	
<b>Preventive Maintenance</b>					
Warning for Preventive Maintenance Enabled	-	NO	NO	NO	
Load Interval	-	inactive	inactive	inactive	
Elapsed Month	-	inactive	inactive	inactive	
Setting Elapsed Month	months	12	12	12	
Elapsed Working Time Counter WTC	-	inactive	inactive	inactive	
Setting Elapsed WTC	hours	4000	4000	4000	

## Production Report

	HD	HDF Online	US Default	Modified
<b>Options</b>				
ABPM	inactive	inactive	active	
DCI	inactive	inactive	inactive	
bioLogic RR®	inactive	inactive	inactive	
Kt/V	inactive	inactive	inactive	
Kt/V UV	inactive	inactive	inactive	
Card Reader	inactive	inactive	active	
HCT Crit-Line	inactive	inactive	inactive	
Low Level Options:				
Double Pump	1)	1)	1)	
Holder for BIC Cartridge	1)	1)	1)	
DF Filter	1)	1)	1)	
HDF Online	1)	1)	1)	
Battery	1)	1)	1)	
Nexadia-BSL (DBI)	1)	1)	1)	
WAN-BSL (DBI)	1)	1)	1)	

1) Setting depends on the configuration of the machine.

## Blood Leak Detector Limit (2.7)

	HD	HDF Online	US Default	Modified
Standard Limit (0.5 ml/min at Haematocrite HK 0.45)	active	active	inactive	
AAMI Limit (0.35 ml/min at Haematocrite HK 0.25)	inactive	inactive	active	

## Position Setting for BICP, KP and UFP (2.8.2)

	Unit	Default	US Default	Modified
BICP Parking	-	180	180	
KP Parking	-	180	180	
UFP Parking	-	180	180	
UFP Positive Pressure Test	-	270	270	
UFP Negative Pressure Test	-	90	90	

## BICLF and ENDLF Ratio (2.10)

	Unit	Default	US Default	Modified
BICLF Ratio	-	25	25	
ENDLF Ratio	-	31	36	
BICLF Cart Ratio	-	35	35	

## PV Alarm Window, PA Low Limit (2.12)

	Unit	Default	US Default	Modified
PV Alarm Window	mmHg	100	100	
PV Low Limit Position	mmHg	35	35	
PV Absolute Low Limit	mmHg	20	20	
PA Absolute Low Limit	mmHg	-200	-300	

## Pump Head Selection (2.13)

	Unit	Default	US Default	Modified
Pump Head 8 x 12	-	active	active	
Pump Head 7 x 10	-	inactive	inactive	

## BPA and BPV (2.13.1)

	Unit	Default	US Default	Modified
BPA	µl/Head Revolution	12306	12306	
BPV	µl/Head Revolution	12306	12306	

## HDF Online Substitution Pump OSP (2.15)

	Unit	Default	US Default	Modified
OSP	µl/Head Revolution	8300	8300	

## Level Regulation (2.16)

	Unit	Default	US Default	Modified
LRP (PPR) Slow	%	60	60	
LRP (PPR) Fast	%	100	100	

**Weekly Disinfection Program**

	Time	Method	Disinfectant	Time	Method	Disinfectant
<b>Monday</b>						
Night	-	-	-			
Morning	06:30	Chemical Long	Citric Acid 50%			
<b>Tuesday</b>						
Night	-	-	-			
Morning	06:30	Chemical Long	Citric Acid 50%			
<b>Wednesday</b>						
Night	-	-	-			
Morning	06:30	Chemical Long	Citric Acid 50%			
<b>Thursday</b>						
Night	-	-	-			
Morning	06:30	Chemical Long	Citric Acid 50%			
<b>Friday</b>						
Night	-	-	-			
Morning	06:30	Chemical Long	Citric Acid 50%			
<b>Saturday</b>						
Night	-	-	-			
Morning	-	-	-			
<b>Sunday</b>						
Night	-	-	-			
Morning	-	-	-			

**US Weekly Disinfection Program**

	Time	Method	Disinfectant	Time	Method	Disinfectant
<b>Monday</b>						
Night	-	-	-			
Morning	06:30	Rinsing	-			
<b>Tuesday</b>						
Night	-	-	-			
Morning	06:30	Rinsing	-			
<b>Wednesday</b>						
Night	-	-	-			
Morning	06:30	Rinsing	-			
<b>Thursday</b>						
Night	-	-	-			
Morning	06:30	Rinsing	-			
<b>Friday</b>						
Night	-	-	-			
Morning	06:30	Rinsing	-			
<b>Saturday</b>						
Night	-	-	-			
Morning	-	-	-			
<b>Sunday</b>						
Night	-	-	-			
Morning	-	-	-			

### Disinfection Configuration Data (Standard Machine)

Chemical Disinfection (long or short)

Disinfectant		Reaction Time		Rinsing Time	Temperature	Conductivity min.
Name (max. 20 Characters)	Volume ml	Long h:min	Short h:min			
Citric Acid 50 %	120	0:15	0:05	0:05	83	2.2
Decalcification with Citric Acid 50 %	120	0:05	0:05	0:05	40	2
* Peracetic acid 1 to < 5 * Hydrogen peroxide 1 to < 35 * Acetic acid 1 to < 10 (composition of concentrate [%])	90	0:20	0:20	0:25	40	0.1
# Tiutol™ KF	90	0:15	0:05	0:25	60	10,5
* Puristeril® 340	90	0:20	0:05	0:25	40	0.1
Doxan™	160	0:20	0:05	0:25	40	0.2
Dialox™	160	0:20	0:05	0:25	40	0.2
Peresal™	110	0:20	0:05	0:25	40	0.1
Citrosteril™	120	0:15	0:05	0:20	83	2.0
Maranon H™	90	0:20	0:05	0:25	40	10
Diasteril	90	0:15	0:05	0:15	80	0.5

\* DF filter: a **max.** of 150 disinfections can be performed with Citric Acid 50 % or peracetic acid/hydrogen peroxide/acetic acid/Puristeril® 340

# DF filter: a **max.** of 2 disinfections can be performed with Tiutol™ KF during the service life time (service life, 150 treatments/900 h), i.e.:

- Default: citro-thermal disinfection (thermal disinfection) with citric acid 50% after every treatment
- Option: after 50, 100 and 150 treatments (150 treatment and prior to exchange of filter) with Tiutol™ KF and then citro-thermal disinfection (after exchange of filter)

### Disinfection Configuration Data (HDF Online Machine with Diacap Ultra)

Chemical Disinfection (long or short)

Disinfectant		Reaction Time		Rinsing Time	Temperature	Conductivity min.
Name (max. 20 Characters)	Volume ml	Long h:min	Short h:min			
Citric Acid 50 %	130	0:15	0:15	0:05	83	2.2
* Peracetic acid 1 to < 5 * Hydrogen peroxide 1 to < 35 * Acetic acid 1 to < 10 (composition of concentrate [%])	120	0:20	0:20	0:25	40	0.1
# Tiutol™ KF	120	0:30	0:30	0:30	60	10.5
* Puristeril® 340	120	0:20	0:20	0:25	40	0.1

\* DF filter: a **max.** of 150 disinfections can be performed with Citric Acid 50 % or peracetic acid/hydrogen peroxide/acetic acid/Puristeril® 340

# DF filter: a **max.** of 2 disinfections can be performed with Tiutol™ KF during the service life time (service life, 150 treatments/900 h), i.e.:

- Default: citro-thermal disinfection (thermal disinfection) with citric acid 50% after every treatment
- Option: after 50, 100 and 150 treatments (150 treatment and prior to exchange of filter) with Tiutol™ KF and then citro-thermal disinfection (after exchange of filter)

### US Disinfection Configuration Data

Chemical Disinfection (long or short)

Disinfectant		Reaction Time		Rinsing Time	Temperature	Conductivity min.
Name (max. 20 Characters)	Volume ml	Long h:min	Short h:min			
Citric Thermal	120	00:15	00:05	00:05	83	2.2
Decalcification Short	120	00:05	00:05	00:05	40	2.2
Bleach	90	00:15	00:05	00:25	30	5.0

Dialyser Filter Urea Clearance Data for Diacap<sup>®</sup>DF1, DF2: Dialysate Flow  
In ml/minBF1, BF2, .... BF8: Blood Flow  
In ml/min

Filter Name (Default Filter on green)	DF1	BF1	BF2	BF3	BF4	BF5	BF6
	DF2	100	200	300	400	500	600
Type	ml/min	ml/min					
Diacap LOPS 10	500	0	176	217	242	0	0
	800	0	0	0	0	0	0
Diacap LOPS 12	500	0	183	233	261	0	0
	800	0	0	0	0	0	0
Diacap LOPS 15	500	0	189	246	285	0	0
	800	0	0	0	0	0	0
Diacap LOPS 18	500	0	192	253	294	0	0
	800	0	0	0	0	0	0
Diacap LOPS 20	500	0	194	258	302	0	0
	800	0	0	0	0	0	0
Diacap HIPS 10	500	0	180	223	250	0	0
	800	0	0	0	0	0	0
Diacap HIPS 12	500	0	186	238	271	0	0
	800	0	0	0	0	0	0
Diacap HIPS 15	500	0	190	245	288	0	0
	800	0	0	0	0	0	0
Diacap HIPS 18	500	0	192	250	292	0	0
	800	0	0	0	0	0	0
Diacap HIPS 20	500	0	194	253	296	0	0
	800	0	0	0	0	0	0
Diacap HIFlo 18	500	0	0	257	298	0	0
	800	0	0	0	0	0	0
Diacap HIFlo 23	500	0	0	277	328	0	0
	800	0	0	0	0	0	0
xevonta Lo 10	500	0	184	236	276	0	0
	800	0	0	0	0	0	0
xevonta Lo 12	500	0	189	249	291	0	0
	800	0	0	0	0	0	0
xevonta Lo 15	500	0	194	267	311	0	0
	800	0	0	0	0	0	0
xevonta Lo 18	500	0	196	276	322	0	0
	800	0	0	0	0	0	0
xevonta Lo 20	500	0	198	281	329	0	0
	800	0	0	0	0	0	0
xevonta Lo 23	500	0	199	285	333	0	0
	800	0	0	0	0	0	0
xevonta Hi 10	500	0	186	241	290	0	0
	800	0	0	0	0	0	0
xevonta Hi 12	500	0	191	255	306	0	0
	800	0	0	0	0	0	0
xevonta Hi 15	500	0	197	272	329	0	0
	800	0	0	0	0	0	0
xevonta Hi 18	500	0	198	281	341	0	0
	800	0	0	0	0	0	0
xevonta Hi 20	500	0	199	287	349	0	0
	800	0	0	0	0	0	0
xevonta Hi 23	500	0	199	290	354	0	0
	800	0	0	0	0	0	0

3.8 Measures after Repair

3.8.1 Repair Matrix

Exchanged/Repaired/Assembled Components/Groups	Tests and Calibrations to be Executed (see Dialog+ Service Manual, Chapter 4 and 5)		Tests and Measures to be Executed		
	Test/Calibration	Component	Test/Measure	Component	
1. Automatic Blood Pressure Measurement: ABPM 2. Board, Analog: AB 3. Board, Basic: BB 4. Board, Digital: DB 5. Board, Front Panel: FPB 6. Board, HDF Online HOB 7. Board, Mother: TLC 8. Board, Optical Status Display: OSD 9. Board, Power Motors: PBM 10. Board, Power Valves: PBV 11. Compact Flash Card CFC 12. Coupling, Dialyser 13. Detector, Blood Leak: BL 14. Detector, Safety Air: SAD 15. Throttle: DBK 16. Throttle: DDE 17. Valve, Pressure Reducer: DMV 18. Chamber, Degassing: EK 19. Filter: FBK1; FBK2; FBK; FVD; FB; FK 20. Filter, Hydrophobic: HFB 21. Heater 22. Clamp, Tubing: SAKV; SAKA 23. Rods, Concentrate Suction: o-ring 24. Manometer Connection: Protection Filter; Tubing 25. Membranes, MSBK1/2 (Balance Chamber) 26. Monitor (IFT Display) 27. Drive Unit, Gear Pump 28. Cable, Mains, with Mains Plug 29. SMPS-MC Components: Relay, Buzzer, Capacitor 30. SMPS-MC 31. Option ABPM 32. Option Admea (KIV-UV) 33. Option Battery 34. Option Bedside-Link-Modul: BSL 35. Option BIC Cartridge Holder 36. Option DCI 37. Option DF-Filter 38. Option DSI (Crit-Line) 39. Option Card Reader 40. Option Staff Call 41. Level Regulation Module 42. Pump: BPA; BPV 43. Pump, Piston: BICP; KP 44. Pump, Piston: UFP 45. Pump, Heparin 46. Pump, Level Regulation: LRP (PPR) 47. Pump, Gear: EP; FPA; FPE 48. Nonreturn Valve: RVDA 49. Nonreturn Valve: RVFPA 50. Nonreturn Valve: RVFPE 51. Sensor, Pressure: PDA; PE 52. Sensor, Conductivity: BICLF; ENDLF 53. Sensor, Level, Upline Tank: NSVB 54. Sensor, Reed: BKUS 55. Sensor, Reed: PSAUS; PSABF; FEDDFS; FEDHDFS 56. Sensor, Reed SBS1, SBS2 57. Sensor, Temperature: TSBIC; TSD; TSD_S; TSDE 58. Sensor, Temperature: TSE; TSHE 59. Software, Installation/Update 60. Rinsing Bridge 61. Touch Screen 62. Valve: VEB; WBE 63. Valve: VBE; VDF; VSB; VSAE; VSAA 64. Valve: VBP; VDE; VDA; VZ; VLA 65. Valve: VD 66. Valve: VDEBK1; VEBK1; VEBK2; VDEBK2; VDABK1; VABK1; VABK2; VDABK2 67. Valve: VVB; VBICP; VBKO; VBKS; IBKUS	3.8.2.1 Install Software	◆	◆	◆	
		3.8.2.2 Check System Configuration, Production Report and Set if Necessary	◆	◆	◆
		3.8.2.3 Self Test	◆	◆	◆
		3.8.2.4 Conductivity Test Run, Temperature Comparison Measurement	◆	◆	◆
		3.8.2.5 Test Run UF Comparison Measurement	◆	◆	◆
		3.8.2.6 Test Run	◆	◆	◆
		3.8.2.7 Electrical Safety Check	◆	◆	◆
		3.8.2.8 Perform Disinfection after repair	◆	◆	◆
		4.9.1.1 Buttons, Lamps and Sounds		◆	◆
		4.9.1.3 Touch Screen Calibration		◆	◆
		4.9.1.8 DBI Test (BSL) or DSI Test (Crit-Line) or DCI Test		◆	◆
		4.9.2.1 Test 1.1 Staff Call, Alarms, Power Off		◆	◆
		4.9.2.5 Test 1.5 Tubing Clamps		◆	◆
		4.9.2.7 Test 1.7 Air Sensor SAD, Red Sensor		◆	◆
		4.9.2.8 Test 1.8 Coupling Detectors		◆	◆
		4.9.2.13 Test 1.13 Balance Chamber Valves		◆	◆
		4.9.2.14 Test 1.14 Bypass and Disinfection Valves		◆	◆
		4.9.2.23 Test 1.23 BIC Cartridge Valves and Coupling Detectors		◆	◆
		4.9.2.25 Test 1.25 HDF Online Valves and Detectors		◆	◆
		4.9.2.26 1.26 Option Battery		◆	◆
		4.9.4.1 Calibration Pressure Sensors Blood Side PA, PV, PBE and PBS	◆		
		4.9.4.3 Calibration Pressure Sensors of Water Side PE and PDA	◆		
		4.9.4.4 Calibration Degassing TSE/TSHE	◆		
		4.9.4.5 Calibration Dialysis Temperature Sensors TSBIC and TSD/TSD_S/TSDE	◆		
		4.9.4.6 Calibration Conductivity Sensors BICLF and ENDLF/ENDLF_S	◆		
		4.9.4.7 Calibration Blood Leak Detector Type 2	◆		
		4.9.4.8 Calibration of Flow Rate UFP, BICP and KP		◆	◆
		4.9.4.9 Calibration Safety Air Detector SAD Version Version 3		◆	◆
		4.9.4.10 Calibration BICLF and ENDLF Ratio		◆	◆
		4.9.4.13 Calibration Flow Rate of BPA and BPV/OSP		◆	◆
		4.9.4.16 Calibration Inlet Flow Pump Nonreturn Valve RVFPE		◆	◆
		4.9.4.17 Calibration Dialysate Nonreturn Valve RVDA		◆	◆
		4.9.4.18 Calibration Outlet Flow Pump Nonreturn Valve RVFPA		◆	◆
		4.9.4.19 Calibration Dialyser Inlet Throttle Valve DDE		◆	◆
		4.9.4.20 Calibration Pressure Reducer Valve DMV		◆	◆
		4.9.4.21 Gap SAKA and SAKV		◆	◆
		4.9.4.23 Setting Servomotor for Disinfection Valve VD		◆	◆
		5.1 Inspection Protocol for Automatic Blood Pressure Measurement ABPM	◆		

## 3.8.2 Tests and Measures to be Executed

It is recommended to use the repair matrix, the tests and measures and the execution protocol after servicing (e.g. repair, SW installation etc.).

All components are numbered alphabetically (from 1 to n) in the column *Points for Exchanged/Repaired Assembly Groups*. The respective calibrations, tests and measures in the matrix are assigned to each component (HW/SW) with a ◆ character. The executed measure can be documented in the execution protocol.



**Risk of a patient infection due to a contamination of the manometer protection filter of the blood line system!**

**If the manometer protection filter of the blood line system was contaminated with blood and blood has entered the machine: replace the internal manometer protection filter, the tubing (between the filter and the manometer connector) and the manometer connector.**



Tubing must be replaced only by the same tubing type/length and identical installation manner.

Make sure that the tubings in the machine are not kinked or twisted after servicing (e.g. if sub-racks are pulled out and inserted again). The tubing must not touch moving/rotating components (e.g. motors of gear pumps).

## 3.8.2.1 Install Software

1. The software must be installed according to the description in the service manual.

## 3.8.2.2 Check System Configuration, Production Report and Set if Necessary



The FSU USB stick with the system configuration can only be used if the hardware and software of the machine match.

## 1A System Configuration

- **System Configuration Present**  
Load the system configuration from the FSU USB stick and check all settings in the TSM service program.
- **Customer Specific System Configuration not Present**  
Check system configuration and set system configuration according to user default.

## 1B Production Report

- Select and save/activate present options.

## 1C Calibration Data

- **Replacement of CFC**  
Save calibration data.
- **Replacement of Sensors/Detectors**  
Calibration, save calibration data.
- **Replacement of Digital Board**  
Download calibration data.
- **Replacement of Analog Board**  
Calibration, save calibration data.

## 1D LLC Calibrations

Check and set ratio, tubing constants BPA/BPV, OSP tubing type, check/set PA/PV limit values.

## 1E Working Time Counter

- Set working time counter.

## 1F Motherboard

Check and set BIOS.

## 3.8.2.3 Self Test

1. Start machine (fully equipped) in dialysis mode.
2. Insert line system – see instructions for use.
3. The machine must run without errors up to the message *Connect Patient*.

## 3.8.2.4 Conductivity Test Run, Temperature Comparison Measurement

1. Assemble the line system, perform preparation and self test – according to instructions for use.
2. Loop in a dialysis measurement system in the dialyser line.
3. Set 14.3 mS/cm, 37 °C (or the equivalent temperature in Fahrenheit).
4. Run the machine in main flow and compare the values (pay attention to the tolerances).

## 3.8.2.5 Test Run UF Comparison Measurement



**Pay attention that the dialyser circuit is free of air.**

1. Assemble the line system, perform preparation (insert heparin syringe and select 2 ml and use BIC cartridge if present).
2. Perform self test – according to instructions for use.
3. Press the  icon to switch to therapy mode (*connect patient*). This icon is enabled after all self tests were performed successfully.

**Simulation of Patient:**

4. Fill a 250 ml graduated cylinder with water and document exact value (weight).
5. Set the UF volume to 125 ml and a therapy time to 00:15 h.
6. Insert the arterial and venous lines in the graduated cylinder.
7. Set the blood pump so that no blood side alarms are activated.
8. Start dialysis.
9. Check the UF volume after a dialysis time to > 0:15 h and compare the removed volume from the graduated cylinder with the displayed UF volume at the machine.  
(Permissible deviation: 3 % of the UF rate per hour. Example: corresponds to approx. ±4 ml at 125 ml UF volume after 15 minutes.)

## 3.8.2.6 Test Run

1. Assemble the line system, perform preparation (insert heparin syringe and select 2 ml/h and use BIC cartridge if present).
2. Perform self test – according to instructions for use.
3. Press the  icon to switch to therapy mode (*connect patient*). This icon is enabled after all self tests were performed successfully.
4. Insert the arterial and venous lines in the graduated cylinder.
5. Set the blood pump so that no blood side alarms are activated.
6. Start dialysis.
7. Check alarm function of SAD.  
(The ABPM function can be checked without a test run of the machine in preparation mode.)

### 3.8.2.7 Electrical Safety Check

1. Electrical safety check according to EN 62353/EN 60601-1:
  - Protective earth resistance, equipment leakage current, patient leakage current.

### 3.8.2.8 Perform Disinfection after Repair

1. Select disinfection program.
2. Select disinfection type and start disinfection (depends on applied process and procedure in the dialysis centres, see chapter disinfection in the instructions for use).

### 3.8.2.9 Document the Executed Activities

1. The measures were executed correctly. Fill in the execution protocol after service (e.g. exchange of a component) and after executing all necessary measures according to the repair matrix.

3.8.3 Execution Protocol

Execution Protocol			
Measures According to Repair Matrix	Measurement Values/ Executed Measures	NA	OK
3.8.2.1 Install Software	executed correctly	<input type="checkbox"/>	<input type="checkbox"/>
3.8.2.2 Check System Configuration, Production Report and Set if Necessary	executed correctly	<input type="checkbox"/>	<input type="checkbox"/>
3.8.2.3 Self Test	executed correctly	<input type="checkbox"/>	<input type="checkbox"/>
3.8.2.4 Conductivity Test Run, Temperature Comparison Measurement:	<ul style="list-style-type: none"> <li>Conductivity (14.3 ms/cm, ±0.2) ..... [mS/cm]</li> <li>Temperature (37 °C, -1.5 +0.5) ..... [°C]</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
3.8.2.5 Test Run UF Comparison Measurement:	<ul style="list-style-type: none"> <li>15 min at UF rate 500 ml/h (3% ≈ ±4 ml) ..... [ml]</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
3.8.2.6 Test Run	executed correctly	<input type="checkbox"/>	<input type="checkbox"/>
3.8.2.7 Electrical Safety Check: According to: IEC 62353/EN 60601-1/IEC 601-1	<ul style="list-style-type: none"> <li>Protective Earth Resistance &lt; 0.3 [Ω]: Potential equalization bolt Heater body (top) Rinsing bridge (dialyser inlet and outlet) Interior: front door (top left corner) Interior: rear door (top left corner) Interior: frame (rear) Interior: housing cover (top left) Monitor (one of the screws in the housing frame)</li> <li>Equipment Leakage Current ≤ 0.5 [mA]:</li> <li>Patient Leakage Current &lt; 10 [µA] AC:</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
3.8.2.8 Perform Disinfection after Repair	executed correctly	<input type="checkbox"/>	<input type="checkbox"/>
4. Tests and Calibrations According to Service Manual All text in { } brackets are general notes or execution information!	executed correctly	<input type="checkbox"/>	<input type="checkbox"/>
{4.9.1.1 Buttons, Lamps and Sounds}	Please use the repair matrix for the necessary tests and calibrations.		
{4.9.1.3 Touch Screen Calibration}			
{4.9.1.8 DBI Test or DSI Test or DCI Test}			
{4.9.2.1 Test 1.1 Staff Call, Alarms, Power Off}			
{4.9.2.5 1.5 Tubing Clamps}			
{4.9.2.7 Test 1.7 Air Sensor SAD, Red Sensor}			
{4.9.2.8 1.8 Coupling Detectors}			
{4.9.2.13 1.13 Balance Chamber Valves}			
{4.9.2.14 1.14 Bypass and Disinfection Valves}			
{4.9.2.19 1.19 Leak Test}			
{4.9.2.23 Test 1.23 BIC Cartridge Valves and Coupling Detectors}			
{4.9.2.25 1.25 HDF Online Valves and Detectors}			
{4.9.2.26 1.26 Option Battery}			
{4.9.4.1 Calibration Pressure Sensors Blood Side PA, PV, PBE and PBS}			
{4.9.4.3 Calibration Pressure Sensors of Water Side PE and PDA}			
{4.9.4.4 Calibration Degassing TSE/TSHE}			
{4.9.4.5 Calibration Dialysis Temperature Sensors TSBIC and TSD/TSD_S/TSDE}			
{4.9.4.6 Calibration Conductivity Sensors BICLF and ENDLF/ENDLF_S}			
{4.9.4.7 Calibration Blood Leak Detector Type 3}			
{4.9.4.8 Calibration of Flow Rate UFP, BICP and KP}			
{4.9.4.9 Calibration Safety Air Detector SAD Version 3}			
{4.9.4.10 Calibration BICLF and ENDLF Ratio}			
{4.9.4.13 Calibration Flow Rate of BPA and BPV/OSP}			
{4.9.4.16 Calibration Inlet Flow Pump Nonreturn Valve RVFPE}			
{4.9.4.17 Calibration Dialysate Nonreturn Valve RVDA}			
{4.9.4.18 Calibration Outlet Flow Pump Nonreturn Valve RVFPA}			
{4.9.4.19 Calibration Dialyser Inlet Throttle Valve DDE}			
{4.9.4.20 Calibration Pressure Reducer Valve DMV}			
{4.9.4.21 Gap SAKA and SAKV}			
{4.9.4.23 Setting Servomotor for Disinfection Valve VD}			
{5.1 Inspection Protocol for Automatic Blood Pressure Measurement ABPM}			
The respective measures were executed correctly after servicing according to the repair matrix.	Name Service Technician: ..... ..... Date / Signature		

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## 4.1 Start TSM Service Program

## TSM Service Program



Only activate the TSM service program for service activities. It is prohibited to connect a patient to the Dialog+ and to run a therapy if the TSM service program is activated in the Dialog+. If the TSM service program is activated the complete alarm system is disabled.

## Therapy Mode

After completion of all procedures switch back to the therapy mode: digital board, service switch S1, position 0.

The *TSM Main Menu* (TSM = Technical Support and Maintenance) is used for servicing the machine. The TSM service program (*TSM Main Menu*) is started as follows:



1. Switch off machine.
2. Open rear door.
3. On digital board DB: turn service switch S1 from position 0 to **position 2**.

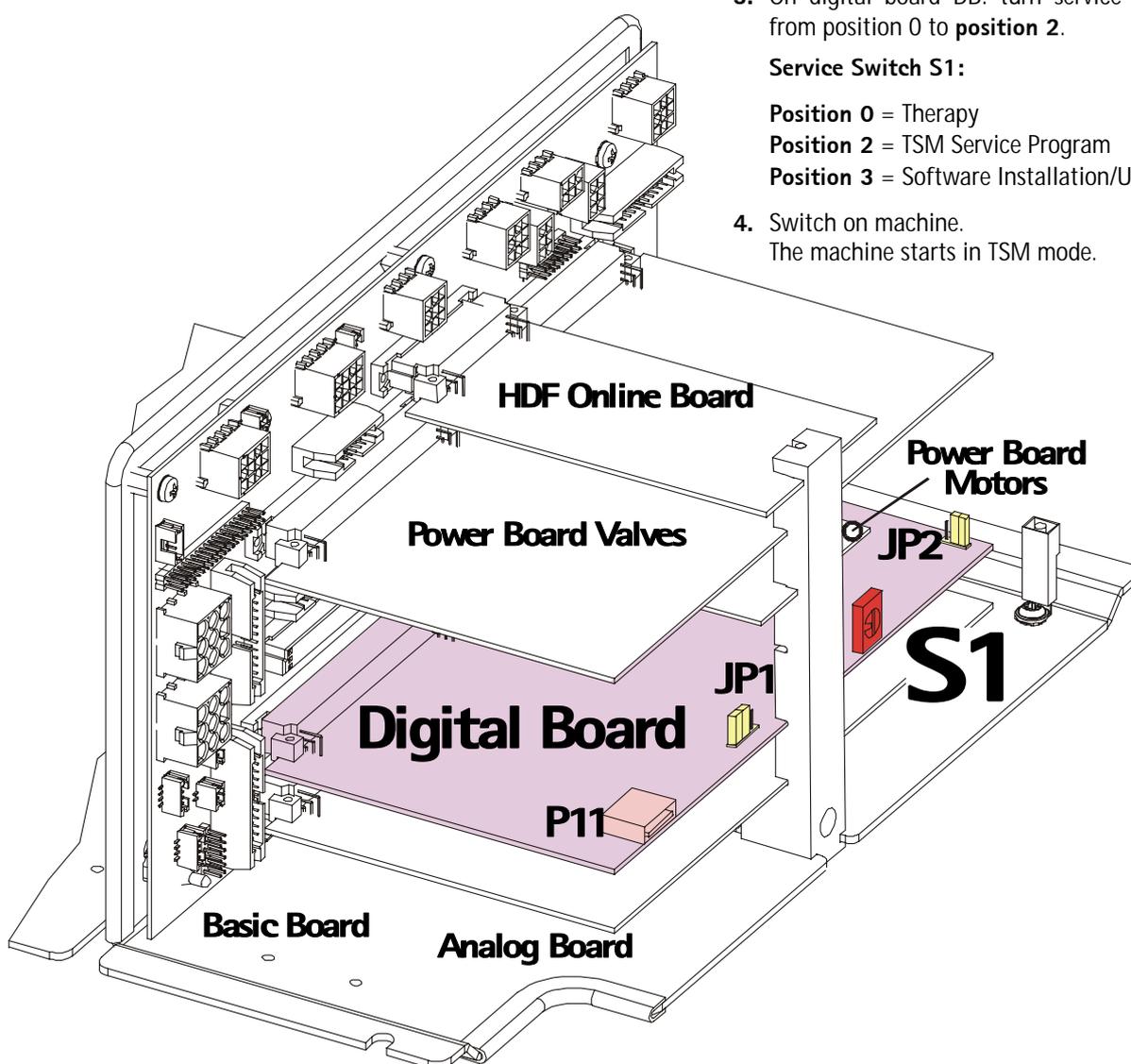
**Service Switch S1:**

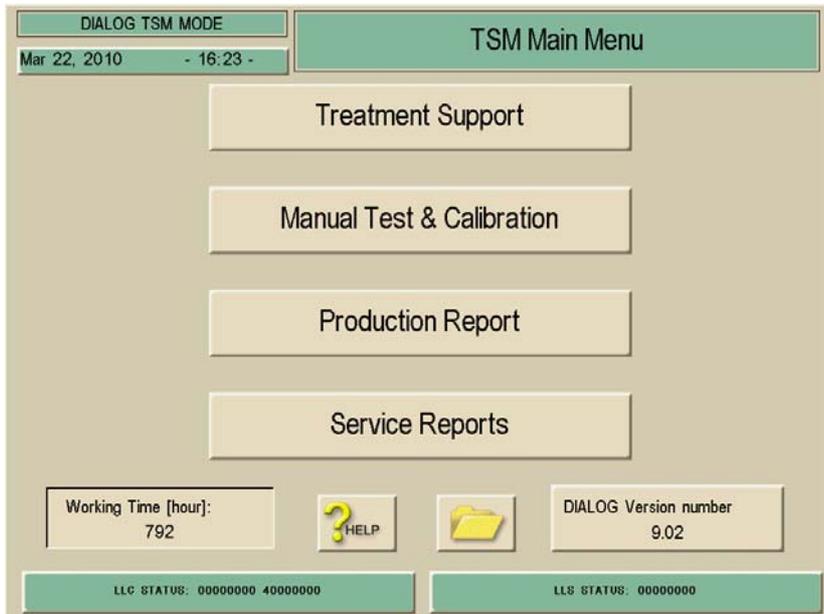
**Position 0** = Therapy

**Position 2** = TSM Service Program

**Position 3** = Software Installation/Update

4. Switch on machine.  
The machine starts in TSM mode.





The *TSM Main Menu* is displayed.

The date and time can be set in the *TSM Main Menu*.

The following four sub-menus can be selected:

- *Treatment Support*
- *Manual Test and Calibration*
- *Production Report*
- *Service Reports*

Mar 22, 2010 - 16:23 -

You can set the date and time of the machine by clicking on the field. The first click opens the *Minus/Plus* window for the *Date*; the second click opens the *Minus/Plus* window for the *Time*.

Treatment Support

All basic parameters can be set for the therapy mode in the *Treatment Support* menu.

Manual Test & Calibration

All manual tests and calibrations can be performed in the *Manual Test and Calibration* menu.

Production Report

All machine specific data and options are available in the *Production Report* menu.

Service Reports

The *Operation Mode Report* menu can be selected in the *Service Report* menu.

Working Time [hour]:  
792

The total working time of the machine is displayed in the *Working Time Counter* window. The total working time is stored on the compact flash card CFC.



- Activate additional information with the *HELP* icon.
  - Activate *HELP* icon
  - Select a sub-menu via touch screen.  
(A window with the help text is opened for the selected key.)



The *File Operations* menu can be activated with this icon.

DIALOG Version number  
9.02

The current software/firmware versions are displayed in the *Dialog Version Number* menu. This menu can also be selected in the *Production Report*.

## 4.2 Quit TSM Service Program

## TSM Service Program



Only activate the TSM service program for service activities. It is prohibited to connect a patient to the Dialog+ and to run a therapy if the TSM service program is activated in the Dialog+. If the TSM service program is activated the complete alarm system is disabled.

## Therapy Mode

After completion of all procedures switch back to the therapy mode: digital board, service switch S1, position 0.

The following steps must be taken to quit the service program and to re-enter the therapy mode:



1. Switch off machine.
2. On digital board DB: turn service switch S1 from position 2 to **position 0** therapy mode.

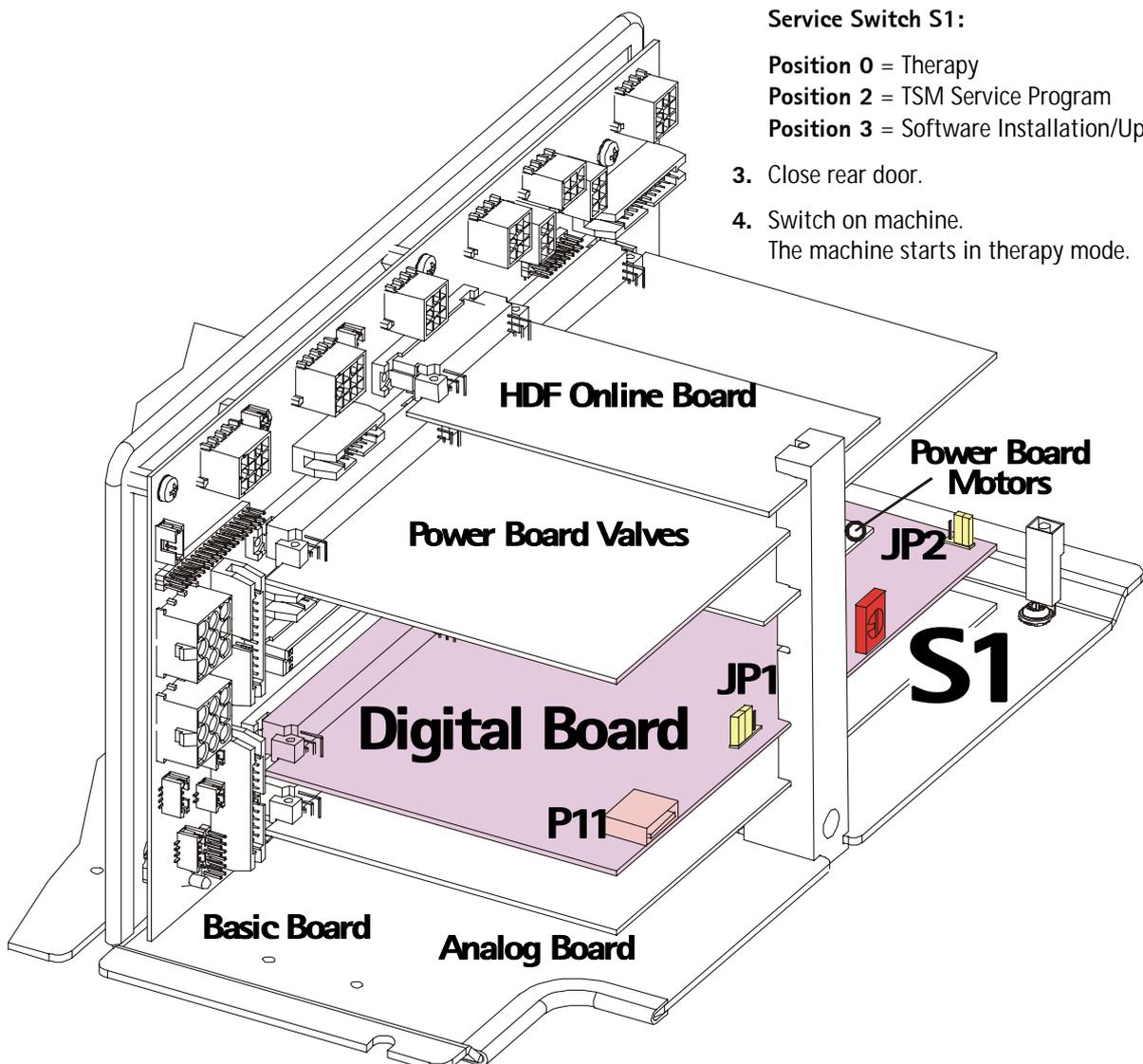
## Service Switch S1:

**Position 0** = Therapy

**Position 2** = TSM Service Program

**Position 3** = Software Installation/Update

3. Close rear door.
4. Switch on machine.  
The machine starts in therapy mode.



## 4.3 Structure of TSM Service Program

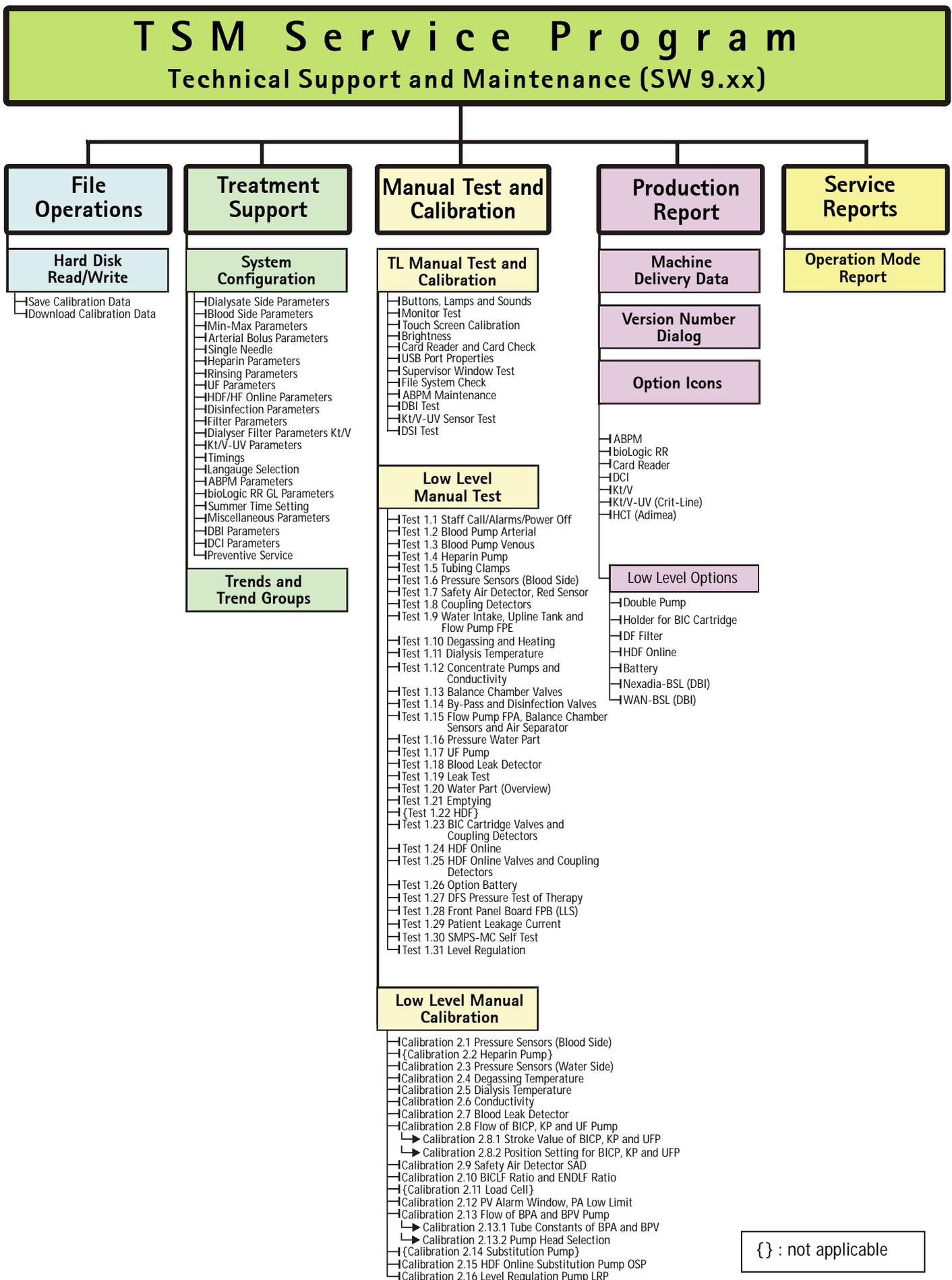


Fig. : TSM Service Program

## 4.4 Service Overview in Therapy



The service overview can be selected in therapy with the *Service Key* icon. The second and third page of the service overview can be selected with the *service key* icon.



Click the *Door* icon to jump back to the initial menu.

<b>Water Tank</b> VVBE: OPENED/CLOSED NSVB: HIGH/LOW	<b>Balance Chamber</b> MSBK1: XXXXX MSBK2: XXXXX	<b>Ultrafiltration</b> UFP: XX rpm UFP_S: XX rpm PDA: XXX mmHg PDA_S: XXX mmHg TMP: XXX mmHg	<b>Blood Side (Pressure)</b> PA: XXX mmHg PA_S: XXX mmHg PBE: XXX mmHg PV: XXX mmHg PV_S: XXX mmHg PBS: XXX mmHg PBS_S: XXX mmHg
<b>Degassing</b> EP: XXXX rpm VEB: OPEN/CLOSED PE: XXX mmHg TSE: XX.X °C TSHE: XX.X °C	VEBK1_S: OPEN/CLOSED VABK1_S: OPEN/CLOSED VDEBK2_S: OPEN/CLOSED VDABK2_S: OPEN/CLOSED VEBK2_S: OPEN/CLOSED VABK2_S: OPEN/CLOSED VDEBK1_S: OPEN/CLOSED VDABK1_S: OPEN/CLOSED	<b>BIC Cartridge Holder</b> BKUS: OPEN/CLOSED BKUS_S: OPEN/CLOSED VVB: OPEN/CLOSED VBICP: OPEN/CLOSED VBKO: OPEN/CLOSED VBKS: OPEN/CLOSED	<b>Blood Pumps</b> BPA: XXXX rpm BPA_S: XXXX rpm BPV: XXXX rpm BPV_S: XXXX rpm
<b>Heater</b> HEATER: XX.X %	<b>Flow (Dialysate Fluid)</b> FPE: XXXX rpm FPA: XXXX rpm FMD: XXX ml/min FMD_S: XXX ml/min	<b>Valves Online</b> VBE: OPEN/CLOSED VBE_S: OPEN/CLOSED VDFF: OPEN/CLOSED VDFF_S: OPEN/CLOSED VSB: OPEN/CLOSED VSB_S: OPEN/CLOSED VSAA: OPEN/CLOSED VSAA_S: OPEN/CLOSED VSAE: OPEN/CLOSED VSAE_S: OPEN/CLOSED	<b>Tubing Clamps</b> SAKA: OPEN/CLOSED SAKV: OPEN/CLOSED SAKV_S: OPEN/CLOSED
<b>Air Separator</b> LAFSO: NO AIR/AIR LAFSU: NO AIR/AIR VLA: OPEN/CLOSED	<b>Valves (Bypass)</b> VBP: OPEN/CLOSED VBP_S: OPEN/CLOSED VDE: OPEN/CLOSED VDE_S: OPEN/CLOSED VDA: OPEN/CLOSED VDA_S: OPEN/CLOSED	<b>Pump Online</b> OPS: XXXX rpm OPS_S: XXXX rpm	<b>Air Detector</b> SAD: NO AIR/AIR SAD_S: NO AIR/AIR SAD TIME_S: OK SAD REF_S: XXXX mV SAD VOL: XXXX µl SAD VOL_S: XXXX µl
<b>Temperature</b> TSE: XX.X °C TSBIC: XX.X °C TSD: XX.X °C TSD_S: XX.X °C TSDE: XX.X °C	<b>Valves (Disinfection)</b> VZ: OPEN/CLOSED VD: OPEN/CLOSED VD_S: OPEN/CLOSED	<b>Subst. Flow (Online)</b> FMS: XXX ml/min FMS_S: XXX ml/min	<b>Heparin</b> HP: STOP POSITION: XX.XX mm
<b>Conductivity</b> BICLF: XX mS/cm ENDLF: XX.X mS/cm ENDLF_S: XX.X mS/cm BICP: XX rpm BICP_S: XX rpm BIC-Ratio: XX.X BIC-Ratio_S: XX.X KP: XX rpm KP_S: XX rpm END-Ratio: XX.X END-Ratio_S: XX.X	<b>Blood Leak</b> BL: X.XX % BL_S: X.XX %		<b>Status Self Test</b> LLC: XXXXX LLS: XXXXX
<b>LLC/S &amp; TLC Alarm Window</b>		<b>LLC Message Window</b>	

Fig.: First Page Service Overview in Therapy

<b>Balance Chamber</b>	
<b>MSBK1:</b>	<b>32134</b>
<b>MSBK2:</b>	<b>32270</b>

#### Digit Range for MSBK1/2 in Therapy

MSBK1/2	
Min. Value:	10000
Max. Value:	35000
Differential Range:	min. 7500

Malfunctions in the balance chamber can occur if:

- the values are out of limits
- the minimal difference from the detected min. value was not reached



The second page of the service overview can be selected with the *Service Key* icon.



Click the *Door* icon to jump back to the initial menu.

Dialog - Basic	HDF Bag	HDF/HF Online	Others
<b>UF Volume</b>	<b>Substitution Volume</b>	<b>HDF/HF Volume</b>	<b>SMPS Battery</b>
UF NET: XXX ml UF GROSS: XXX ml UF GROSS_S: XXX ml	SUBST: X ml SUBST_S: X ml SUBST_WV_S: X ml SUM INF: X ml ACT INF_S: X ml INF LEAK_S: X ml	HDF/HF_V: X.X I HDF/HF_V_S: X.X I BOLUS_VOL: X ml BOLUS_VOL_S: X ml	Batt. enabled: YES/NO Self Test: NOT OK/OK
<b>Relay</b>	<b>Weight</b>	<b>Reed Sensor</b>	<b>bioLogic RR</b>
B24V_S: ON/OFF D24V_S: ON/OFF HEATER REL1_S: ON/OFF HEATER REL2_S: ON/OFF	BAG: X g BAG_S: X g	PSAUS: OPEN/CLOSED PSABF: OPEN/CLOSED FDfS: OPEN/CLOSED FHDFS: OPEN/CLOSED	Algorithm ID: X Algorithm SW: V X.XX GL Curves: X
<b>Couplings</b>	<b>Flow Detector</b>	<b>Remaining Filter Time</b>	<b>Crit-Line</b>
SBS1: COUPLED/UNCOUPLED SBS2: COUPLED/UNCOUPLED BIC_SS: COUPLED/UNCOUPLED K_SS: COUPLED/UNCOUPLED	UF_FLOW: FLOW/NO FLOW	DF: XXX h HDF: XXX h	Patient ID: X Station ID: X Start Date: XX X.XX, XXXXX Start Time: XX:XX:XX Actual Date: XX X.XX, XXXXX Actual Time: XX:XX:XX HCT Start: X.XX %
<b>Red Sensor</b>	<b>Air Detector</b>	<b>Remaining Dialysis</b>	<b>Preventive Service</b>
RDV: NO BLOOD/BLOOD	SUBAD: AIR/NO AIR	DF: XXX HDF: XXX	Warning Enabled: YES/NO Date of Last Service: NONE WTC of Last Service: NONE Status of Machine: XXX%
<b>OSD Red LED</b>	<b>Level Regulation</b>		<b>WTC</b>
RIGHT LED_S: ON/OFF LEFT LED_S: ON/OFF	<b>Pump (Level Regulation)</b>		WTC Actual: XXXXX h
<b>Loudspeaker</b>	<b>Valves (Level Regulation)</b>		
LS PULSE_S: ON/OFF LS CURRENTS_S: ON/OFF	VBT_S: OPEN/CLOSED VPA_S: OPEN/CLOSED VPV_S: OPEN/CLOSED VPE_S: OPEN/CLOSED VPD_S: OPEN/CLOSED		
<b>PD Read By</b>			
TLC VER: X.XX DBI VER: X.XX.X			
<b>PD Written By</b>			
TLC VER: DBI VER:			



<b>LLC ALARM:</b> 0000 0000 0000 0000 0000 0000	<b>MESSAGE:</b> 0000 0000 0000 0000 0000 0000
<b>LLS ALARM:</b> 0000 0000 0000 0000 0000 0000	<b>FREE M:</b> XXXX/XXX of XXXXX kB S: XX/XX MB

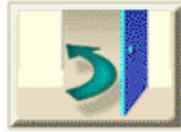
**LLC/S & TLC Alarm Window**

**LLC Message Window**

Fig.: Second Page Service Overview in Therapy



The third page of the service overview can be selected with the *Service Key* icon.



Click the *Door* icon to jump back to the initial menu.

<b>Network Name</b>	<b>Patient Card</b>	
BSL-WAN:	ID: XXXX XXX XXX	
<b>Configuration</b>	Card Status: X	
Serial No.: XXX	<b>Nurse Selection</b>	
DBI SW: X.XX.X	Enabled: YES/NO	
System SW: X.XX	<b>Pin Code AT</b>	
TLC SW: X.XX	Nurse Selection: YES/NO	
Actual Language: XXX.XX.XX	Configuration: YES/NO	
BSL Serial No.: NONE	<b>Time Setting</b>	
BSL FW: NONE	Server Date: NONE	
<b>Option Selection</b>	Server Time: NONE	
DBI: DBI-Nexadia	Dialog Date: NONE	
BSL: NONE	Dialog Time: NONE	
<b>Baud Rate</b>		
Baud Rate (kBaud): XX.X		
<b>DBI Status</b>		
DBI active/ DBI not active		
<b>Network Status</b>		
BSL Connection/ BSL no Connection		
		 

<b>LLC ALARM:</b>	0000 0000 0000 0000 0000 0000	<b>MESSAGE:</b>	0000 0000 0000 0000 0000 0000
<b>LLS ALARM:</b>	0000 0000 0000 0000 0000 0000	<b>FREE M:</b>	XXXX/XXX of XXXXX kB S: XX/XX MB

**LLC/S & TLC Alarm Window**

**LLC Message Window**

Fig.: Third Page Service Overview in Therapy

#### 4.4.1 Legend Service Overview in Therapy

<b>ACT INF_S:</b>	Actual infusion supervisor (not applicable)
<b>B24V_S:</b>	24 V cut-off blood side supervisor (HP, BPA, BPV)
<b>BAG:</b>	Bag weight (not applicable)
<b>BAG_S:</b>	Bag weight supervisor (not applicable)
<b>BIC_SS:</b>	Bicarbonate rinsing connector sensor
<b>BICLF:</b>	Bicarbonate conductivity
<b>BICP:</b>	Bicarbonate pump
<b>BICP_S:</b>	Bicarbonate pump supervisor
<b>BIC-RATIO:</b>	Bicarbonate ratio
<b>BIC-RATIO_S:</b>	Bicarbonate ratio supervisor
<b>BKUS:</b>	BIC cartridge holder lower switch
<b>BKUS_S:</b>	BIC cartridge holder lower switch supervisor
<b>BL:</b>	Blood leak detector
<b>BL_S:</b>	Blood leak detector supervisor
<b>BOLUS_VOL:</b>	Bolus volume
<b>BOLUS_VOL_S:</b>	Bolus volume supervisor
<b>BPA:</b>	Arterial blood pump
<b>BPA_S:</b>	Arterial blood pump supervisor
<b>BPV:</b>	Venous blood pump
<b>BPV_S:</b>	Venous blood pump supervisor
<b>DBI VER:</b>	DBI version
<b>D24V_S:</b>	24 V cut-off dialysate side supervisor (VDA, VDE)
<b>DF:</b>	Remaining time for DF
<b>ENDLF:</b>	End conductivity
<b>ENDLF_S:</b>	End conductivity supervisor
<b>END-RATIO:</b>	End ratio
<b>END-RATIO_S:</b>	End ratio supervisor
<b>EP:</b>	Degassing pump
<b>F(E)DFS:</b>	Filter recognition DF filter sensor
<b>F(E)HDFS:</b>	Filter recognition HD filter sensor
<b>FMS:</b>	Substitution flow measurement
<b>FMS_S:</b>	Substitution flow low measurement supervisor
<b>FPA:</b>	Outlet flow pump
<b>FPE:</b>	Inlet flow pump
<b>HDF/HF_V:</b>	HDF/HF volume
<b>HDF/HF_V_S:</b>	HDF/HF volume supervisor
<b>HDF:</b>	Remaining time for HDF
<b>HEATER REL1_S:</b>	Heater relay 1 supervisor (not applicable)
<b>HEATER REL2_S:</b>	Heater relay 2 supervisor (not applicable)
<b>HP:</b>	Heparin pump
<b>INF LEAK_S:</b>	Infusion leakage supervisor (not applicable)
<b>K_SS:</b>	Concentrate rinsing connector sensor
<b>KP:</b>	Concentrate pump
<b>KP_S:</b>	Concentrate pump supervisor
<b>LAFSO:</b>	Top air separator level sensor
<b>LAFSU:</b>	Bottom air separator level sensor
<b>LEFT LED_S:</b>	Left LED from OSD
<b>LLC:</b>	Low level controller
<b>LLS:</b>	Low level supervisor
<b>LS CURRENTS_S:</b>	Loudspeaker current supervisor
<b>LS PULSE_S:</b>	Loudspeaker pulse supervisor
<b>MSBK1:</b>	Membrane position sensor balance chamber 1
<b>MSBK2:</b>	Membrane position sensor balance chamber 2
<b>NSVB:</b>	Level sensors upline tank

OSP:	Online substitution pump
OSP_S:	Online substitution pump supervisor
PA:	Arterial pressure sensor
PA_S:	Arterial pressure sensor supervisor
PBS:	Blood control pressure sensor
PBS_S:	Blood control pressure sensor supervisor
PDA:	Dialysate outlet pressure sensor
PDA_S:	Dialysate outlet pressure sensor supervisor
PE:	Degassing pressure sensor
POSITION:	Drive position
PSABF(S):	Substitution port drain sensor
PSAUS(S):	Substitution port outlet sensor
PV:	Venous pressure sensor
PV_S:	Venous pressure sensor supervisor
RDV:	Venous red detector
RVE:	Degassing control valve
RIGHT_LED_S:	Right LED from OSD
SAD_REF_S:	Safety air detector reference voltage supervisor
SAD_TIME_S:	Safety air detector time control supervisor
SAD:	Safety air detector
SAD_S:	Safety air detector supervisor
SAKA:	Arterial tubing clamp
SAKV(-SG):	Venous tubing clamp currentless closed
SAKV(-SG)_S:	Venous tubing clamp currentless closed supervisor
SBS1:	Rinsing bridge connector sensor 1
SBS2:	Rinsing bridge connector sensor 2
SUBAD:	Substitution air detector (not applicable)
SUBST:	Substitution (not applicable)
SUBST_S:	Substitution supervisor (not applicable)
SUBST_WV_S:	Substitution weight volume supervisor (not applicable)
SUM_INF:	Sum infusion (not applicable)
TLC_VER:	TLC version
TMP:	Transmembrane pressure
TSBIC:	Bicarbonate temperature sensor
TSD:	Dialysate temperature sensor
TSD_S:	Dialysate temperature sensor supervisor
TSE:	Degassing temperature sensor
TSHE:	Heater inlet temperature sensor
TSDE:	Dialyser inlet temperature sensor
UF_Flow:	Ultrafiltration flow (not applicable)
UFP:	Ultrafiltration pump
UFP_S:	Ultrafiltration pump supervisor
VABK1_S:	Outlet valve balance chamber 1 supervisor
VABK2_S:	Outlet valve balance chamber 2 supervisor
VBE:	Vent filter valve
VBE_S:	Vent filter valve supervisor
VBICP:	BIC pump valve
VBKO:	BIC cartridge holder top Valve
VBKS:	BIC cartridge holder concentrate rod valve
VBP:	Bypass valve
VBP_S:	Bypass valve supervisor
VD:	Disinfection valve supervisor
VDA:	Dialyser outlet valve
VDABK1_S:	Dialyser outlet valve balance chamber 1 supervisor
VDABK2_S:	Dialyser outlet valve balance chamber 2 supervisor
VDA-S:	Dialyser outlet valve supervisor
VDE:	Dialyser inlet valve
VDEBK1_S:	Dialyser inlet valve balance chamber 1 supervisor
VDEBK2_S:	Dialyser inlet valve balance chamber 2 supervisor
VDE-S:	Dialyser inlet valve supervisor
VDFF:	DF filter valve

<b>VDFV_S:</b>	DF filter valve supervisor
<b>VEBK1_S:</b>	Inlet valve balance chamber 1 supervisor
<b>VEBK2_S:</b>	Inlet valve balance chamber 2 supervisor
<b>VLA:</b>	Air separator valve
<b>VSAA:</b>	Substitution outlet valve
<b>VSAA_S:</b>	Substitution outlet valve supervisor
<b>VSAE:</b>	Substitution inlet valve
<b>VSAE_S:</b>	Substitution inlet valve supervisor
<b>VSBB:</b>	Substitution bypass valve
<b>VSBB_S:</b>	Substitution bypass valve supervisor
<b>VVB:</b>	Upline tank valve
<b>VVBE:</b>	Upline tank inlet valve
<b>VZ:</b>	Circulation valve

**Working Time Counter** Working time counter (WTC)

**bioLogic RR** bioLogic RR Option

**LLC ALARM** The low level controller alarms are displayed in a hexadecimal format. The corresponding bit alarms are shown in the LLC alarm window.

**LLS ALARM** The low level supervisor alarms are displayed in a hexadecimal format. The corresponding bit alarms are shown in the LLS alarm window.

**LLC MESSAGE** The LLC messages are displayed in a hexadecimal format. The corresponding bit messages are shown in the message window.

**FREE MEMORY** Free RAM memory (DIMM/SIMM).

**LLC/S & TLC Alarm Window**

- Low level controller alarm text **Window** messages according to the LLC hex numbers from the LLC alarm window.
- Low level supervisor alarm text **Window** messages according to the LLS hex numbers from the LLS alarm window.
- Top level controller alarm messages **Window** according to the TLC hex numbers from the TLC alarm window.

**LLC Message Window** LLC text messages according to the LLC message hex numbers from LLC message window.

## 4.5 Service Overview in TSM Service Program



The service overview can be selected with the  key in the TSM service program.

Required Data to LLC		Actual Data from LLC							
<b>PUMP</b>		<b>VALVE</b>		<b>PUMP</b>		<b>PRESSURE</b>		<b>BALANCE CHAMBER</b>	
BICP:	X	RVE:	X	BPA:	X	PA:	X	MSBK1:	XXXXX
BPA:	X	VVBE:	OPEN/CLOSED	BPAIMP_S:	X	PA_S:	X	MSBK2:	XXXXX
BPV:	X	VABK1:	OPEN/CLOSED	BPA_FLOW:	X	PV:	X	VABK1_S:	OPEN/CLOSED
EP:	X	VDABK1:	OPEN/CLOSED	BPA_COVER:	OPEN/CLOSED	PV_S:	X	VDABK1_S:	OPEN/CLOSED
FPA:	X	VEBK1:	OPEN/CLOSED	BPV:	X	PBE:	X	VEBK1_S:	OPEN/CLOSED
FPE:	X	VDEBK1:	OPEN/CLOSED	BPVIMP_S:	X	PBS:	X	VDEBK1_S:	OPEN/CLOSED
KP:	X	VABK2:	OPEN/CLOSED	BPV_COVER:	OPEN/CLOSED	PBS_S:	X	VABK2_S:	OPEN/CLOSED
UFP:	X	VDABK2:	OPEN/CLOSED	EP:	X	PDA:	X	VDABK2_S:	OPEN/CLOSED
		VEBK2:	OPEN/CLOSED	FPE:	X	PDA_S:	X	VEBK2_S:	OPEN/CLOSED
		VDEBK2:	OPEN/CLOSED	FPA:	X	PE:	X	VDEBK2_S:	OPEN/CLOSED
		VBP:	OPEN/CLOSED	UFP_S:	X				
<b>HEATER</b>		VDE:	OPEN/CLOSED	UFP_FLOW:	X.X	<b>LEVEL</b>		<b>COUPLINGS</b>	
H:	X	VDA:	OPEN/CLOSED	UFP_FLOW_S:	X.X	NSVB:	HIGH/LOW	BIC_SS:	OPEN/CLOSED
		VD:	OPEN/CLOSED	BICP_S:	X	LAFS:	HIGH/MIDDLE/LOW	K_SS:	OPEN/CLOSED
<b>SAD</b>		VZ:	OPEN/CLOSED	BICP_FLOW:	X.X	<b>TEMPERATURE</b>		SBS1:	OPEN/CLOSED
SAD_LEVEL:	X	VLA:	OPEN/CLOSED	BICP_FLOW_S:	X.X	TSE:	XX.X	SBS2:	OPEN/CLOSED
		VDFF:	OPEN/CLOSED	KP_S:	X	TSHE:	XX.X	BKUS:	OPEN/CLOSED
<b>ACTIONS</b>		VSB:	OPEN/CLOSED	KP_FLOW:	X.X	TSBIC:	XX.X	BKUS_S:	OPEN/CLOSED
LEAKTEST:	ON/OFF	VBE:	OPEN/CLOSED	KP_FLOW_S:	X.X	TSD:	XX.X	<b>CONDUCTIVITY</b>	
EMPTYING:	ON/OFF	VSAE:	OPEN/CLOSED	HP_POS:	X.X	TSD_S:	XX.X	BICLF:	X.XX
BL_LAMP_T:	ON/OFF	VSAA:	OPEN/CLOSED	HPKOLB:	ON/OFF	TSDE:	XX.X	ENDLF:	X.XX
SAD_TEST:	ON/OFF			HPKRALLO:	OPEN/CLOSED			ENDLF_S:	X.XX
						<b>VALVE</b>			
						VBP_S:	OPEN/CLOSED		
						VDE_S:	OPEN/CLOSED	<b>STATUS</b>	
						VDA_S:	OPEN/CLOSED	RDV:	NO BLOOD/BLOOD
						VD_S:	OPEN/CLOSED	RDV_S:	NO BLOOD/BLOOD
						VZ_S:	OPEN/CLOSED		
						VLA_S:	OPEN/CLOSED		
						VDFF_S:	OPEN/CLOSED		
						VSB_S:	OPEN/CLOSED	<b>POWER</b>	
						VBE_S:	OPEN/CLOSED	B24VOFF:	ON/OFF
						VSAE_S:	OPEN/CLOSED	D24VOFF:	ON/OFF
						VSAA_S:	OPEN/CLOSED		
<b>AUTOMATIC TEST &amp; CALIBRATION</b>		<b>BLOOD LEAK</b>		<b>SAD</b>					
LF:	X.XX	PA:	XXX	BLCON:	X.XXX	SAD_LEVEL:	XX		
TSD:	X.X	PDA:	XXX	BLCON_S:	X.XXX	SAD_LEV_S:	X.XXX		
TSE:	X.X					SAD:	AIR/BLOOD		
						SAD_S:	AIR/BLOOD		
<b>WORKING TIME COUNTER</b>									
WTC:	XXXXX								
<b>FREE MEMORY (Mb)</b>									
XXXX of XXXXXX kB S: XX/XX MB									
<b>LLC STATUS: 00000000 00000000</b>					<b>LLS STATUS: 00000000</b>				

Fig.: Service Overview in TSM Service Program

### Balance Chamber

MSBK1: 32123  
MSBK2: 32253

#### Digit Range for MSBK1/2 in TSM

MSBK1/2  
Min. Value: 11000  
Max. Value: 34000  
Differential Range: min. 5500

Malfunctions in the balance chamber can occur if:

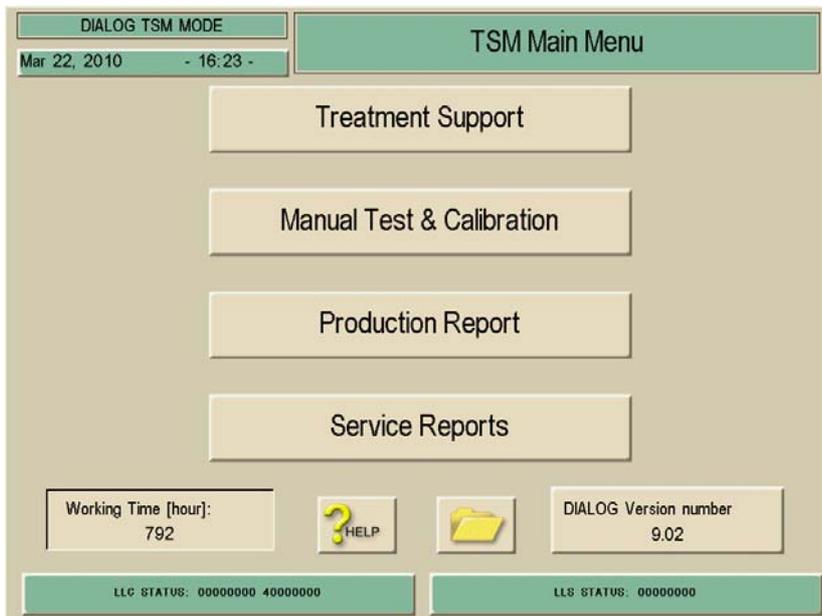
- the values are out of limits
- the minimal difference from the detected min. value was not reached

#### 4.5.1 Legend Service Overview in TSM Service Program

<b>B24VOFF:</b>	24 V cut-off blood side (HP, BPA, BPV)
<b>BIC_SS:</b>	Bicarbonate rinsing connector sensor
<b>BICLF:</b>	Bicarbonate conductivity
<b>BICP:</b>	Bicarbonate pump
<b>BICP_FLOW:</b>	Bicarbonate pump flow
<b>BICP_FLOW_S:</b>	Bicarbonate pump flow supervisor
<b>BICP_S:</b>	Bicarbonate pump supervisor
<b>BKUS:</b>	Bottom BIC holder sensor
<b>BKUS_S:</b>	Bottom BIC holder sensor supervisor
<b>BL_LAMP_T:</b>	Blood leak detector lamp test
<b>BLCON:</b>	Blood leak detector
<b>BLCON_S:</b>	Blood leak detector supervisor
<b>BPA:</b>	Arterial blood pump
<b>BPA_COVER:</b>	Arterial blood pump cover
<b>BPA_FLOW:</b>	Arterial blood pump flow
<b>BPAIMP_S:</b>	Arterial blood pump pulse supervisor
<b>BPV:</b>	Venous blood pump
<b>BPV_COVER:</b>	Venous blood pump cover
<b>BPVIMP_S:</b>	Venous blood pump pulse supervisor
<b>D24VOFF:</b>	24 V cut-off dialysate side (VDA, VDE)
<b>EMPTYING:</b>	Emptying
<b>ENDLF:</b>	End conductivity
<b>ENDLF_S:</b>	End conductivity supervisor
<b>EP:</b>	Degassing pump
<b>FPA:</b>	Outlet flow pump
<b>FPE:</b>	Inlet flow pump
<b>Free Memory:</b>	Free RAM memory (DIMM/SIMM)
<b>H:</b>	Heater
<b>HP_POS:</b>	Heparin pump drive position
<b>HPKOLB:</b>	Heparin pump plate sensor
<b>HPKRALLO:</b>	Heparin pump claws
<b>K_SS:</b>	Concentrate rinsing connector sensor
<b>KP:</b>	Concentrate pump
<b>KP_FLOW:</b>	Concentrate pump flow
<b>KP_FLOW_S:</b>	Concentrate pump flow supervisor
<b>KP_S:</b>	Concentrate pump supervisor
<b>LAFS:</b>	Air separator level sensors
<b>LEAKTEST:</b>	Leakage test
<b>LF:</b>	Conductivity sensor
<b>LLC STATUS:</b>	Alarm messages low level controller
<b>LLS STATUS:</b>	Alarm messages low level supervisor
<b>MSBK1:</b>	Membrane position sensor balance chamber 1
<b>MSBK2:</b>	Membrane position sensor balance chamber 2
<b>NSVB:</b>	Level sensor upline tank
<b>PA:</b>	Arterial pressure sensor
<b>PA_S:</b>	Arterial pressure sensor supervisor
<b>PBE:</b>	Blood inlet pressure sensor
<b>PBS:</b>	Blood control pressure sensor
<b>PBS_S:</b>	Blood control pressure sensor supervisor
<b>PDA:</b>	Dialysate outlet pressure sensor
<b>PDA_S:</b>	Dialysate outlet pressure sensor supervisor
<b>PE:</b>	Degassing pressure sensor
<b>PV:</b>	Venous pressure sensor
<b>PV_S:</b>	Venous pressure sensor supervisor
<b>RDV:</b>	Venous red detector
<b>RDV_S:</b>	Venous red detector supervisor
<b>RVE:</b>	Degassing control valve

<b>SAD:</b>	Safety air detector
<b>SAD_LEV_S:</b>	Safety air detector supervisor level (voltage)
<b>SAD_LEVEL:</b>	Safety air detector level
<b>SAD_S:</b>	Safety air detector supervisor
<b>SAD_TEST:</b>	Safety air detector test
<b>SBS1:</b>	Rinsing bridge connector sensor 1
<b>SBS2:</b>	Rinsing bridge connector sensor 2
<b>TSBIC:</b>	Bicarbonate temperature sensor
<b>TSD:</b>	Dialysate temperature sensor
<b>TSD_S:</b>	Dialysate temperature sensor supervisor
<b>TSE:</b>	Degassing temperature sensor
<b>TSHE:</b>	Heater inlet temperature sensor
<b>TSDE:</b>	Dialyser inlet temperature sensor
<b>UFP:</b>	Ultrafiltration pump
<b>UFP_FLOW:</b>	Ultrafiltration pump flow
<b>UFP_FLOW_S:</b>	Ultrafiltration pump flow supervisor
<b>UFP_S:</b>	Ultrafiltration pump supervisor
<b>VABK1:</b>	Outlet valve balance chamber 1
<b>VABK1_S:</b>	Outlet valve balance chamber 1 supervisor
<b>VABK2:</b>	Outlet valve balance chamber 2
<b>VABK2_S:</b>	Outlet valve balance chamber 2 supervisor
<b>VBE:</b>	Filter vent valve
<b>VBE_S:</b>	Vent filter valve supervisor
<b>VBP:</b>	By-pass valve
<b>VBP_S:</b>	By-pass valve supervisor
<b>VD:</b>	Disinfection valve
<b>VD_S:</b>	Disinfection valve supervisor
<b>VDA:</b>	Dialyser outlet valve
<b>VDABK1:</b>	Dialyser outlet valve balance chamber 1
<b>VDABK1_S:</b>	Dialyser outlet valve balance chamber 1 supervisor
<b>VDABK2:</b>	Dialyser outlet valve balance chamber 2
<b>VDABK2_S:</b>	Dialyser outlet valve balance chamber 2 supervisor
<b>VDA-S:</b>	Dialyser outlet valve supervisor
<b>VDE:</b>	Dialyser inlet valve
<b>VDEBK1:</b>	Dialyser inlet valve balance chamber 1
<b>VDEBK1_S:</b>	Dialyser inlet valve balance chamber 1 supervisor
<b>VDEBK2:</b>	Dialyser inlet valve balance chamber 2
<b>VDEBK2_S:</b>	Dialyser inlet valve balance chamber 2 supervisor
<b>VDE-S:</b>	Dialyser inlet valve supervisor
<b>VDF:</b>	DF filter valve
<b>VDF_S:</b>	DF filter valve supervisor
<b>VEBK1:</b>	Inlet valve balance chamber 1
<b>VEBK1_S:</b>	Inlet valve balance chamber 1 supervisor
<b>VEBK2:</b>	Inlet valve balance chamber 2
<b>VEBK2_S:</b>	Inlet valve balance chamber 2 supervisor
<b>VLA:</b>	Air separator valve
<b>VLA_S:</b>	Air separator valve supervisor
<b>VSAA:</b>	Substitution outlet valve
<b>VSAA_S:</b>	Substitution outlet valve supervisor
<b>VSAE:</b>	Substitution inlet valve
<b>VSAE_S:</b>	Substitution inlet valve supervisor
<b>VS:</b>	Substitution bypass valve
<b>VS_S:</b>	Substitution bypass valve supervisor
<b>VVBE:</b>	Upline tank inlet valve
<b>VZ:</b>	Circulation valve
<b>VZ_S:</b>	Circulation valve supervisor
<b>WTC:</b>	Working time counter

## 4.6 File Operations



The *File Operations* menu is selected with the *File* icon in *TSM Main Menu*.

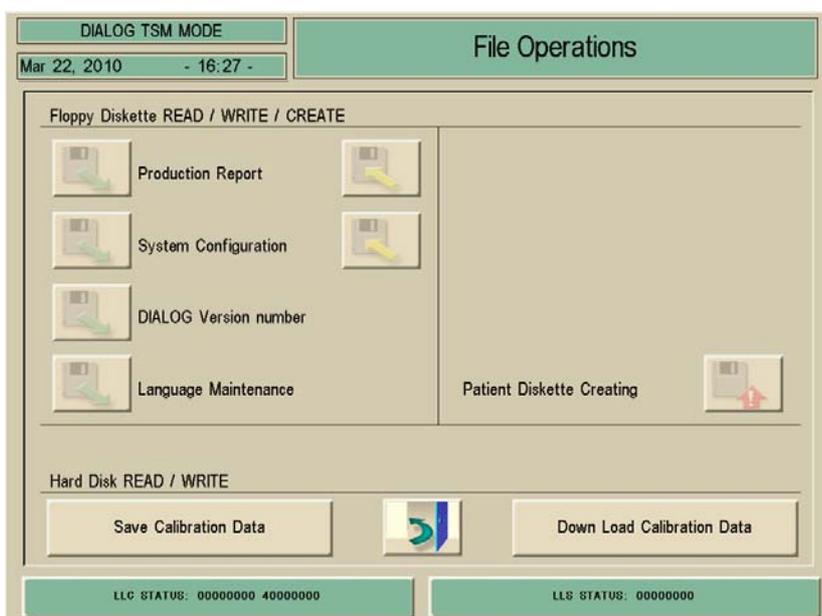
The following parameters can be selected:

**Floppy Diskette Read/Write/Create**

Not applicable.

**Hard Disk (Compact Flash Card) Read/Write**

- Save Calibration Data
- Down Load Calibration Data



The Field Service Utilities FSU can be used for all relevant service activities. Details can be found in chapter 2 repair instructions.

## 4.6.1 Hard Disk Read/Write

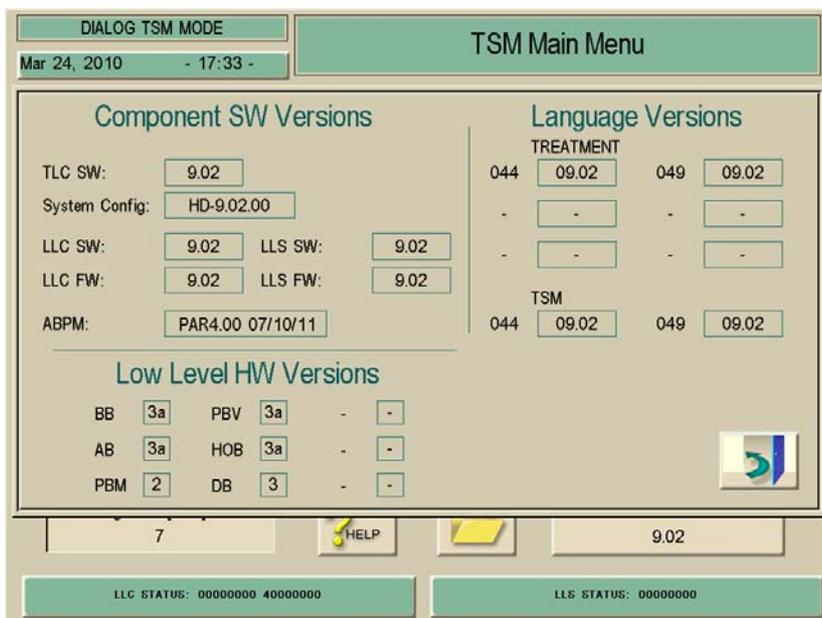
**Save Calibration Data**

The calibration data must be saved to the compact flash card CFC (hard disk drive) by LLC/LLS after every calibration.

**Down Load Calibration Data**

The calibration data can be downloaded from the compact flash card CFC (hard disk drive) to the exchanged digital board DB.

## 4.6.2 Dialog Version Number



The *Dialog Version Number* menu is selected with the *Dialog Version Number* window in *TSM Main Menu*. The current software/firmware versions are displayed. This menu can also be selected in the *Production Report*.

The following data can be checked:

**Component Software Versions**

The versions for the installed software/firmware are displayed.

- Top Level Controller Software TLC SW
- System Configuration (displays the system configuration version number for the haemodialysis machine)
- Low Level Controller Software LLC SW
- Low Level Controller Firmware LLC FW
- Low Level Supervisor Software LLS SW
- Low Level Supervisor Firmware LLS FW
- Automatic Blood Pressure Measurement ABPM (firmware for the ABPM module is displayed)

**Language Versions**

The installed languages are displayed.

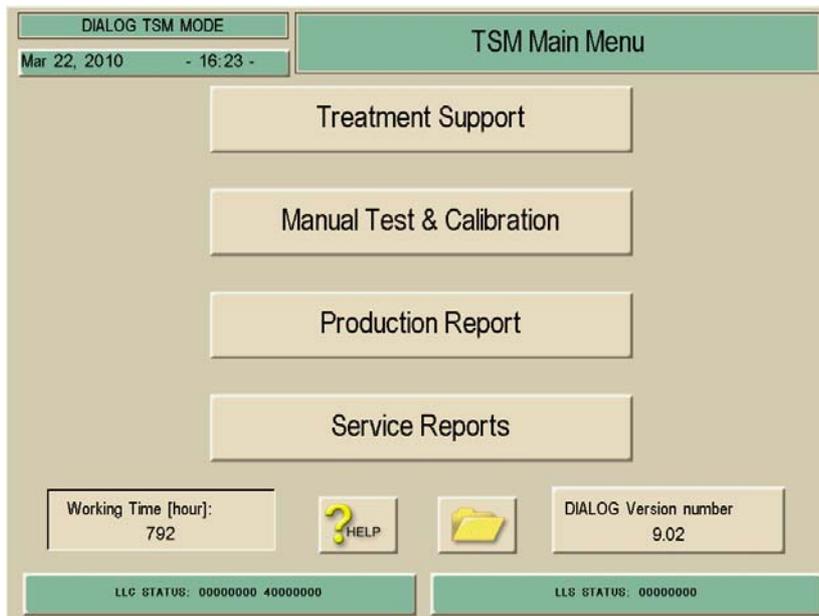
- Treatment
- TSM

**Low Level Hardware Versions**

The boards are displayed with the respective hardware versions, e.g. a HDF online machine. The displayed HW versions depend on the assembled boards in the machine.

- Basic Board **BB**
- Analog Board **AB**
- Power Board Motors **BPM**
- Power Board Valves **BPV**
- HDF Online Board **HOB**
- Digital Board **DB**

## 4.7 Treatment Support



1. Activate the *Treatment Support* menu with the *Treatment Support* key in menu *TSM Main Menu*. The following menu is opened.



Two sub-menus can be selected in the *Treatment Support* menu.

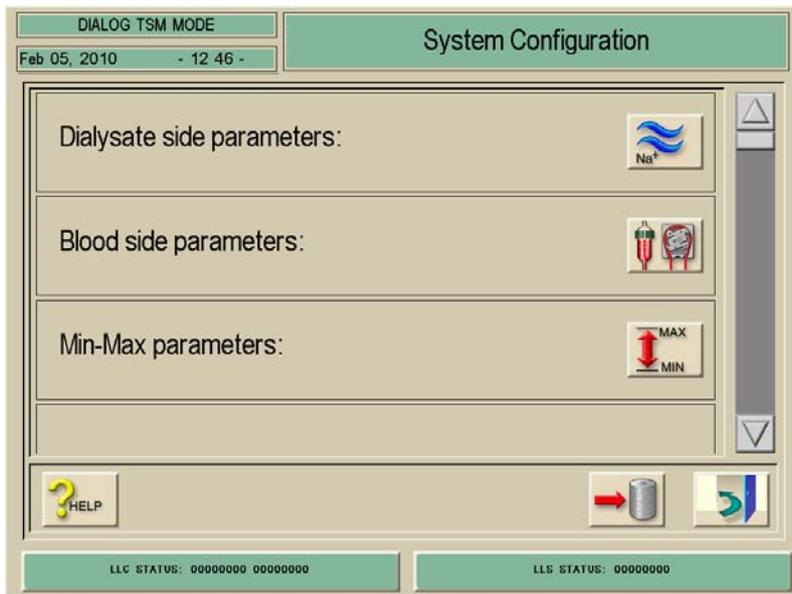
**System Configuration**

This is a special editor to set the configuration of the treatment mode (e.g. limits, default values). The new settings are valid after the restart of the machine.

**Trends and Trend Groups**

There are five trend groups, which can be selected for the treatment program. Every group has three treatment parameters.

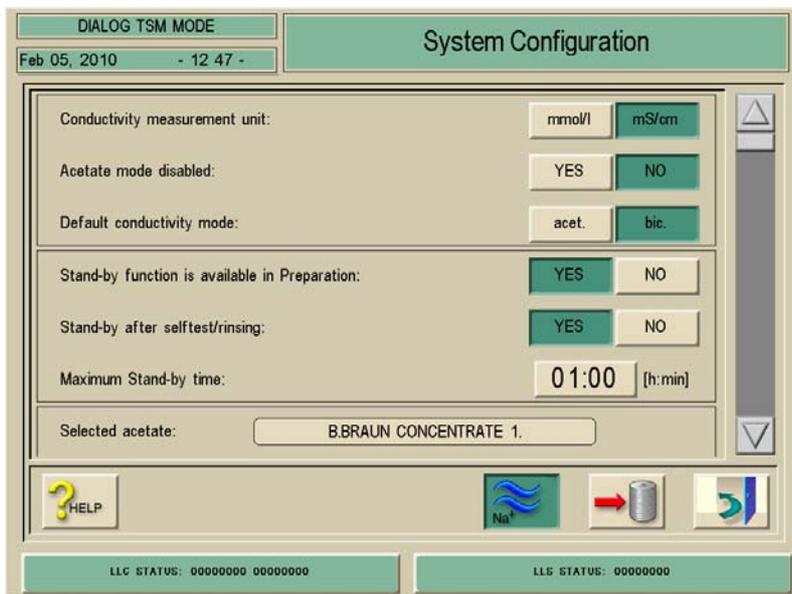
### 4.7.1 System Configuration



1. Activate the *System Configuration* menu with the *System Configuration* key in menu *Treatment Support*.  
The following menu is opened.

Scroll the various system configuration points up or down with the scroll bar. System configuration points can be selected (additional settings are activated if specific options are selected).

#### 4.7.1.1 Dialysate Side Parameters



The dialysate fluid parameters can be set in the *Dialysate Side Parameters* menu.

1. Activate the *Dialysate Side Parameters* menu with the *Dialysate Side Parameters* icon. The following menu is opened.

The following parameters can be set:

- Conductivity measurement unit
- Acetate Mode Disabled
- Default Conductivity Mode
- Stand-by Function is Available in Preparation
- Stand-by after Self Test
- Maximum Stand-by Time
- Selected Acetate (only necessary if mmol/l is selected)
- Selected Bicarbonate/Selected Acid (only necessary if mmol/l is selected)
- Temperature Measurement unit
- Dialysate Flow
- Dialysate Temperature

#### Conductivity Measurement Unit



**Make sure that the corresponding conversion factor is set and assigned correctly:**

- conversion factor for the conductivity unit mS/cm
- conversion factor for the concentration unit mmol/l.

You can either select conductivity [mS/cm] or sodium concentration [mmol/l] for the conductivity measurement unit. If sodium concentration [mmol/l] is selected a corresponding conversion factor must be entered. Activate the *ACET* or *BIC* icon to enter the corresponding conversion factor.

1. Click the *mmol/l* or *mS/cm* key to select a measurement unit.

#### Acetate Mode Disabled

The acetate mode can be disabled.

1. Click the *YES* key to disable the acetate mode.

**Default Conductivity Mode**

The bicarbonate dialysis is the standard factory setting. You can preselect either acetate or bicarbonate for the standard dialysis operation mode.

1. Click either the *Bic* or *Acet* key for the standard setting.

**Stand-by Function is Available in Preparation**

The stand-by function is available during preparation.

1. Click the *NO* key to disable the stand-by function in preparation.

**Stand-by after Self Test/Rinsing**

The function is activated after the self test/rinsing.

**Maximum Stand-by Time**

You can set the maximum duration of the stand-by state.

**Selected Acetate**

There are 10 acetate concentrate names and the conversion factors for the conversion of conductivity values for concentrate of sodium ions.

If necessary the name and the conversion factor [mS/cm per mmol/l] can be set, for the selected acetate type.

1. Click the ACET icon to activate the *Selected Acetate* menu.

The following menu is opened. You can activate a concentrate for therapy by pressing a free section of the window.

2. Click the *Concentrate* window if necessary to edit a concentrate name. This name is displayed in therapy mode.
3. Click the *Conversion* window if necessary to change the conversion factor [mS/cm per mmol/l].

**Conversion Factor:**

$$\frac{\text{Conductivity mS/cm (Standard Value)}}{\text{NaCl Concentration mmol/l (Measured Value)}} = \text{Conversion Factor}$$

4. Click the *Default Value* window if necessary to change the value [mS/cm].

## Selected Bicarbonate/Selected Acid

**DIALOG TSM MODE**  
Mar 23, 2010 - 15:29 -

**System Configuration**

Selected acetate: B.BRAUN CONCENTRATE 1. [Acet. icon]

Selected bicarbonate: BIC without NaCl. [BIC C icon]

Selected acid: B.BRAUN ACID 1. [Acid icon]

Temperature measurement unit: °C [F]

Dialysate flow: 500 [ml/min]

Dialysate temperature: 37.0 [°C]

[HELP icon] [Na<sup>+</sup> icon] [Red Arrow icon] [Blue Arrow icon]

LLC STATUS: 00000000 40000000      LLC STATUS: 00000000

There are 20 concentrate names and the conversion factors for the conversion of conductivity values.

If necessary the name and the conversion factor [mS/cm per mmol/l] can be set, for the selected bicarbonate type.

- Click the *BIC* icon to activate the menu for:
  - *BIC without NaCl*
  - *BIC with NaCl*.

## BIC without NaCl

**DIALOG TSM MODE**  
Mar 23, 2010 - 15:30 -

**System Configuration**

1. BIC without NaCl name: BIC without NaCl.  
Conversion factor (mS/cm per mmol/l): 0.09500  
Default value: 3.0 [mS/cm]  
Selected acid: B.BRAUN ACID 1. [Acid icon]

2. BIC with NaCl name: BIC with NaCl.  
Conversion factor (mS/cm per mmol/l): 0.09500  
Default value: 5.8 [mS/cm]  
Selected acid: B.BRAUN ACID 2. [Acid icon]

[HELP icon] [BIC C icon] [Red Arrow icon] [Blue Arrow icon]

LLC STATUS: 00000000 40000000      LLC STATUS: 00000000

The current bicarbonate type without NaCl can be selected:

- Bicarbonate without NaCl (2 - 4 mS/cm)

Activate *BIC without NaCl* by pressing a free section of the window.

- Click the *BIC without NaCl* window if necessary to edit the bicarbonate name.
- Click the *Conversion* window if necessary to change the conversion factor [mS/cm per mmol/l].
- Click the *Default Value* window if necessary to change the value [mS/cm].
- Click the *ACID* icon if necessary to edit the following parameters:
  - Acid Concentrate Name
  - Conversion Factor [mS/cm per mmol/l]
  - Default Value

**DIALOG TSM MODE**  
Mar 23, 2010 - 16:38 -

**System Configuration**

1. CONCENTRATE name: B.BRAUN ACID 1.  
Conversion factor (mS/cm per mmol/l): 0.10500  
Default value: 14.3 [mS/cm]

2. CONCENTRATE name: B.BRAUN ACID 2.  
Conversion factor (mS/cm per mmol/l): 0.10500  
Default value: 14.3 [mS/cm]

3. CONCENTRATE name: B.BRAUN ACID 3.  
Conversion factor (mS/cm per mmol/l): 0.10500  
Default value: 14.3 [mS/cm]

[HELP icon] [Acid icon] [Red Arrow icon] [Blue Arrow icon]

LLC STATUS: 00000000 40000000      LLC STATUS: 00000000

## BIC with NaCl

**Machines with a BIC Cartridge Option**

It is prohibited to use (select/activate) a bicarbonate concentrate with NaCl if the machine has a BIC cartridge holder.

The unit mmol/l (NaCl concentration) must not be used if bicarbonate concentrate with NaCl is applied.

You can select the current bicarbonate type with NaCl:

- Bicarbonate with NaCl (4 - 7 mS/cm)

The *BIC with NaCl* is activated by pressing a free section of the window.

The current acetate concentrate can be selected. The name and the conversion factor [mS/cm per mmol/l] can be entered if necessary for the different acetate concentrates.

1. Click the *BIC with NaCl* window if necessary to edit the bicarbonate name.
2. Click the *Conversion* window if necessary to change the conversion factor [mS/cm per mmol/l].
3. Click the *Default Value* window if necessary to change the value [mS/cm].
4. Click the ACID icon if necessary to edit the following parameters:
  - Acid Concentrate Name
  - Conversion Factor [mS/cm per mmol/l]
  - Default Value
5. Scroll down to the end to set further parameters.

**Temperature Measurement Unit**

You can set the temperature measurement unit between °C and F.

1. Click the *F* key to set to Fahrenheit.

**Dialysate Flow**

You can preset the dialysate flow for therapy.

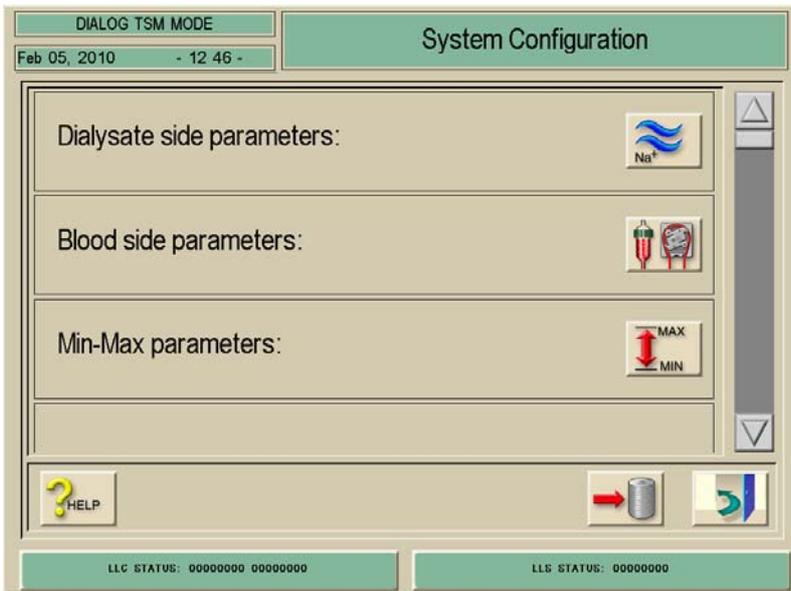
1. Click the *ml/min* key to set the dialysate flow.

**Dialysate Temperature**

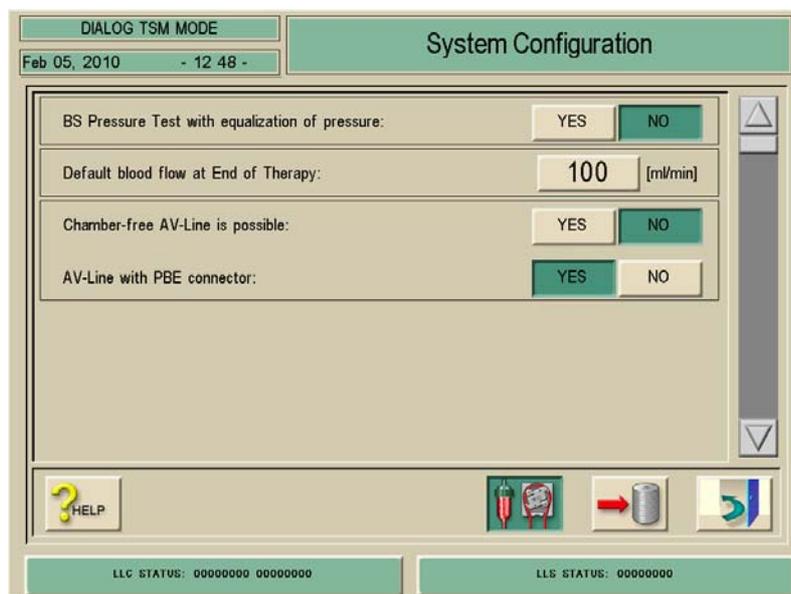
You can set the dialysate temperature for therapy.

1. Click the °C key to set the dialysate temperature.

## 4.7.1.2 Blood Side Parameters



1. Activate the *System Configuration* menu with the *System Configuration* key in menu *Treatment Support*. Use the scroll bar until the following menu appears.



2. Activate the *Blood Side Parameters* menu with the *Blood Side* icon. The following menu is opened.

The following parameters can be set:

- Blood Side BS Pressure Test with Equalisation of Pressure
- Default Blood Flow at End of Therapy
- Chamber-free AV Line is Possible
- AV Line with PBE Connector

#### Blood Side BS Pressure Test with Equalisation of Pressure

##### YES

If the *YES* key is pressed: The system performs a relief (equalisation) of the pressure at the end of the blood side BS pressure test via the main flow (dialyser).

##### NO

If the *NO* key is pressed: The system does not perform a relief (equalisation) of the pressure at the end of the blood side BS pressure test (venous tubing clamp SAKV opens and some fluid escapes from the venous line, as before).

#### Default Blood Flow at End of Therapy

You can preselect the blood flow which will be preset at the end of a therapy.

1. Click the *ml/min* key to set the default blood flow at the end of a therapy.

#### Chamber-free AV Line is Possible

##### YES

The chamber symbols can not be selected in the level regulation menu in therapy. The selected *Chamber-free AV Line* appears.

##### NO

The chamber symbols can be selected in the level regulation menu in therapy. The selected *Chamber-free AV Line* does not appear.

#### AV Line with PBE Connector

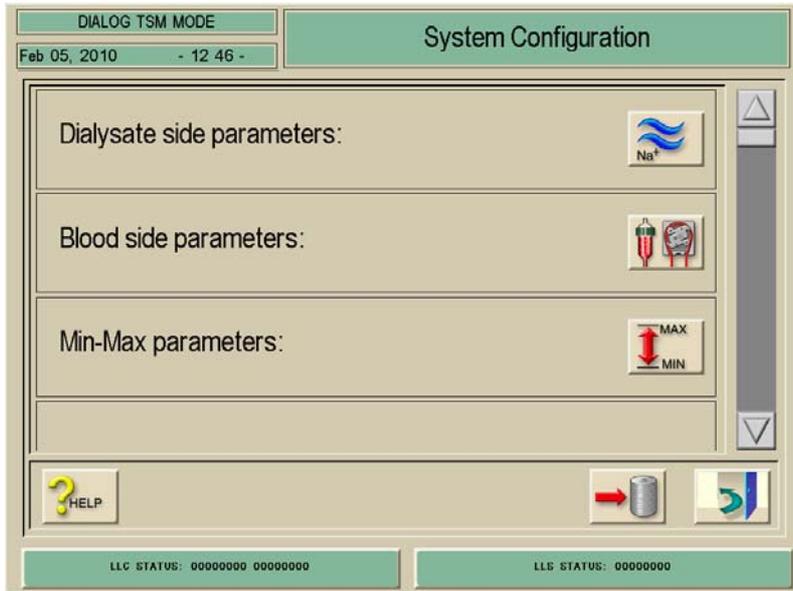
##### YES

Activate if AV lines with PBE pressure connection are used.

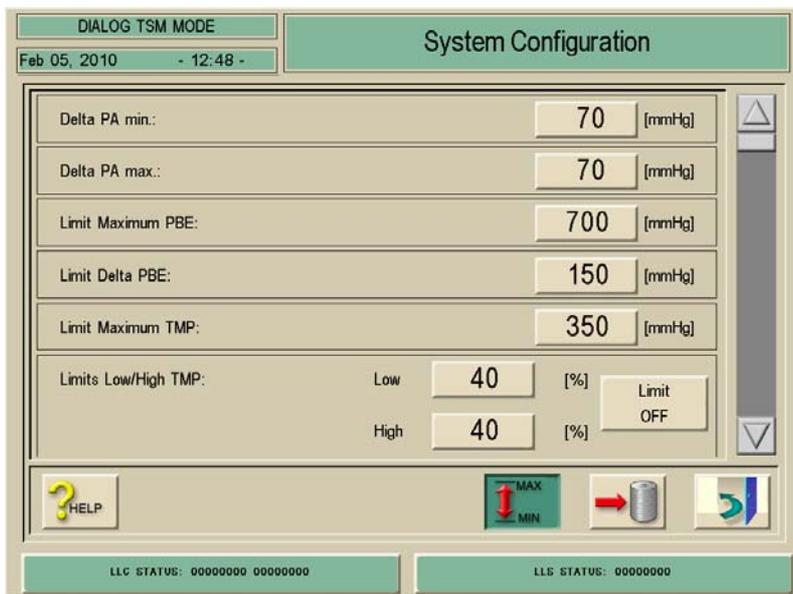
##### NO

Do not activate if AV lines without PBE pressure connection are used.

4.7.1.3 Min-Max Parameters



1. Activate the *System Configuration* menu with the *System Configuration* key in menu *Treatment Support*. Use the scroll bar until the following menu appears.



2. Activate the *Min-Max Parameters* menu with the *MIN-Max* icon. The following menu is opened.

The following parameters can be set in the *Min-Max Parameters* menu:

- Delta PA min.
- Delta PA max.
- Limit Maximum PBE
- Limit Delta PBE
- Limit Maximum TMP
- Limits Low/High TMP
- Extended TMP Limit Range Key is Displayed in Treatment
- Select Extended TMP Limit Range

**Delta PA min.** You can set the lower relative alarm limit for the PA limit window.

**Delta PA max.** You can set the upper relative alarm limit for the PA limit window.



Fig.: Limit Window for PA

- Limit Maximum PBE** The maximum limit for the monitoring of PBE in therapy can be set.
- Limit Delta PBE** The permissible changes for PBE during therapy can be set.
- Limit Maximum TMP** The maximum upper TMP limit for the monitoring in therapy can be set. This value is always active if no relative monitoring is active (see description for *Limits Low/High*).
- Limits Low/High TMP** The relative lower and upper limit can be set in % for TMP monitoring in therapy.

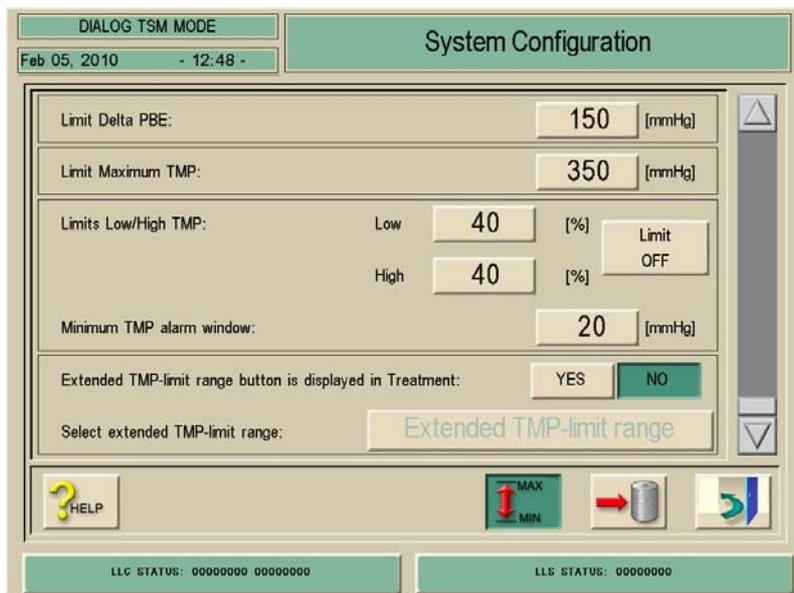
Limit OFF: Monitoring is not performed (activated)

Limit OFF: Monitoring is performed (deactivated)

#### Minimum TMP Alarm Window

The limit window is at least as large as predefined independent of the relative low and high limit. The default is 20 mmHg and can be changed in the limits of 20 to 100 mmHg.

- Use the scroll bar until the following menu appears.



#### Extended TMP Limit Range Key is Displayed in Treatment

The user can select the extended TMP range.

**NO** The *Extended TMP Limit Range* key can not be selected/enabled (shaded) if *NO* is selected.

**YES** The *Extended TMP Limit Range* key can be selected/enabled (highlighted) if *YES* is selected.

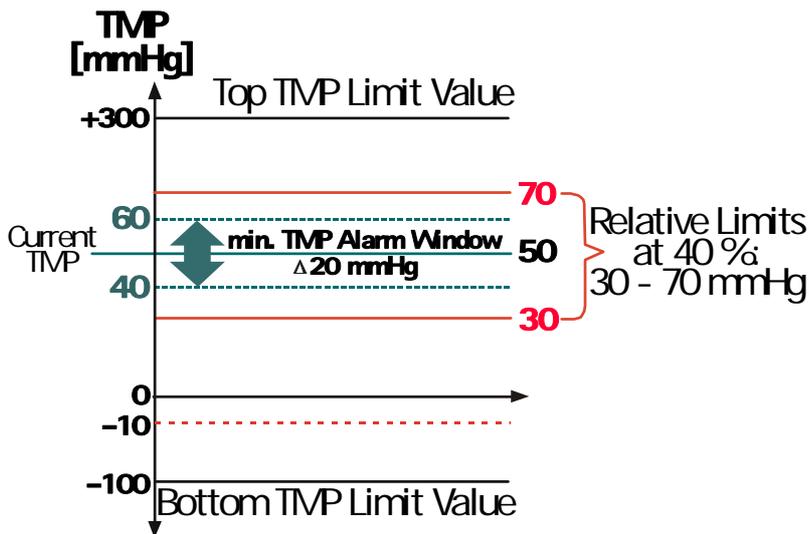
#### Select Extended TMP Limit Range

If the key was selected, the extended TMP limit range can be preselected during the start of the therapy via the *Extended TMP Limit Range*.

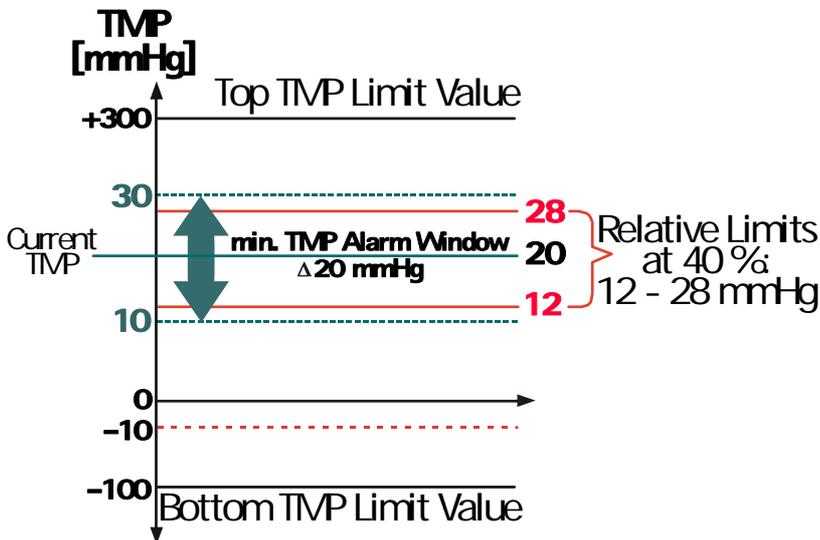
**If the key is not pressed** The TMP low limit range is set min. -10 mmHg.

**If the key is pressed** The TMP limit range is extended to -100 mmHg (absolute TMP value).

Standard TMP Limit Range

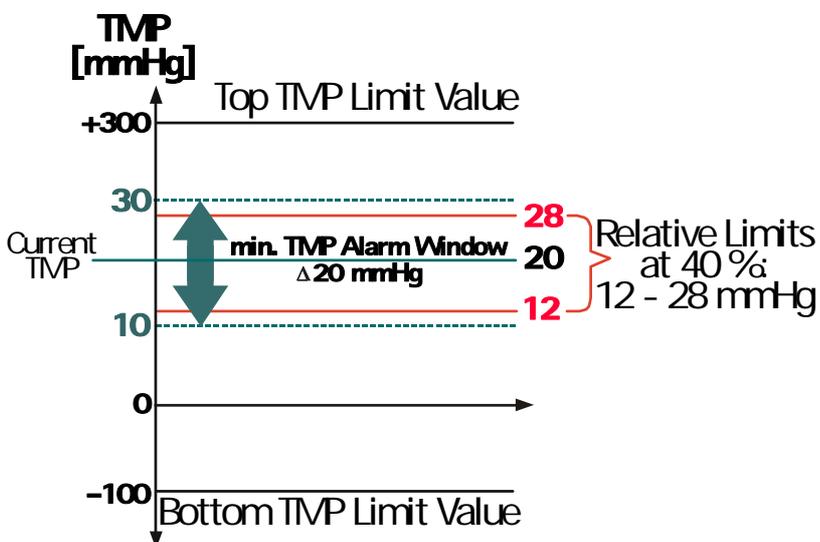


Example A



Example B

Extended TMP Limit Range



If the *Standard TMP Limit Range* key is not pressed:

- the TMP low limit range is set min. -10 mmHg.

If the normal window limits are reached:

- a warning message is displayed (in alarm window)
- a warning tone is activated.
- treatment is not interrupted

Once the TMP reaches -10 mmHg:

- a warning message is displayed (in alarm window)
- a warning tone is activated
- an additional information is displayed
- treatment is not interrupted

The absolute limit value is -100 mmHg.

Once the absolute TMP value is reached:

- an alarm is activated
- an alarm tone is activated
- treatment is interrupted
- machine is switched to bypass

In example **A** the min. TMP alarm window (40 to 60 mmHg) is smaller than the relative limits of 30 to 70 mmHg. Thus the relative limits are valid.

In example **B** the min. TMP alarm window (10 to 30 mmHg) is larger than the relative limits of 12 to 28 mmHg. Thus the limits of the min. TMP alarm window are valid.

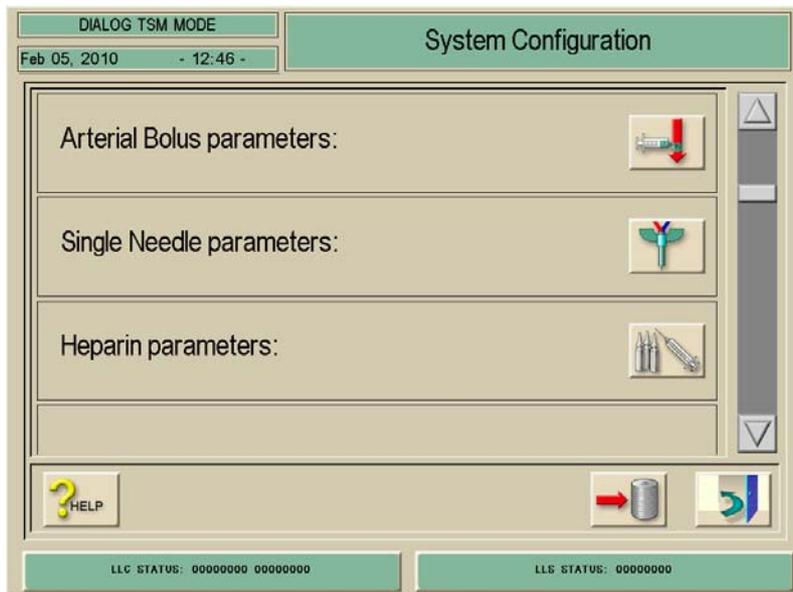
If the *Extended TMP Limit Range* key is pressed:

- the TMP limit range is extended to -100 mmHg (absolute TMP limit).

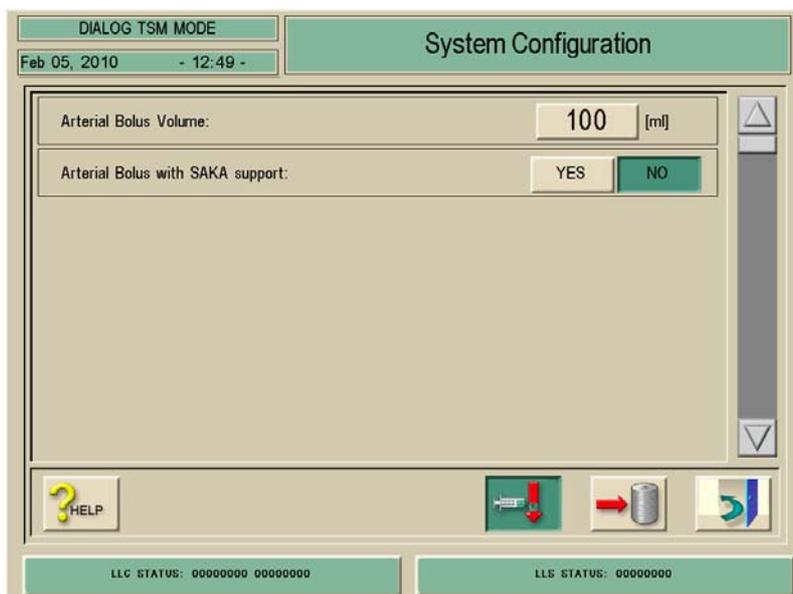
Once this absolute TMP limit is reached:

- an alarm is activated
- an alarm tone is activated
- a warning message is not displayed anymore
- treatment is interrupted
- machine is switched to bypass

## 4.7.1.4 Arterial Bolus Parameters



1. Activate the *System Configuration* menu with the *System Configuration* key in menu *Treatment Support*. Use the scroll bar until the following menu appears.



2. Activate the *Arterial Bolus Parameters* menu with the *Arterial Bolus* icon. The following menu is opened.

The following parameters can be set in the *Arterial Bolus Parameters* menu:

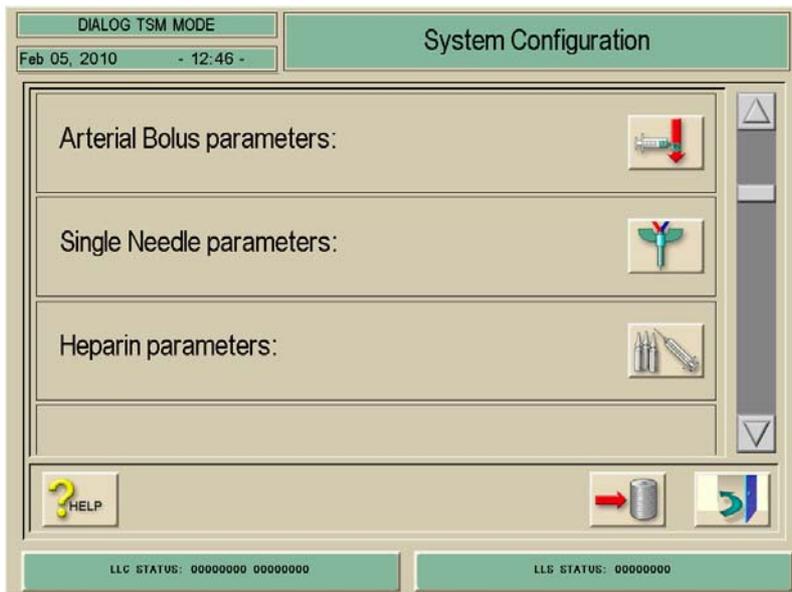
- Arterial Bolus Volume
- Arterial Bolus with SAKA Support

**Arterial Bolus Volume** The volume for an arterial bolus can be set.

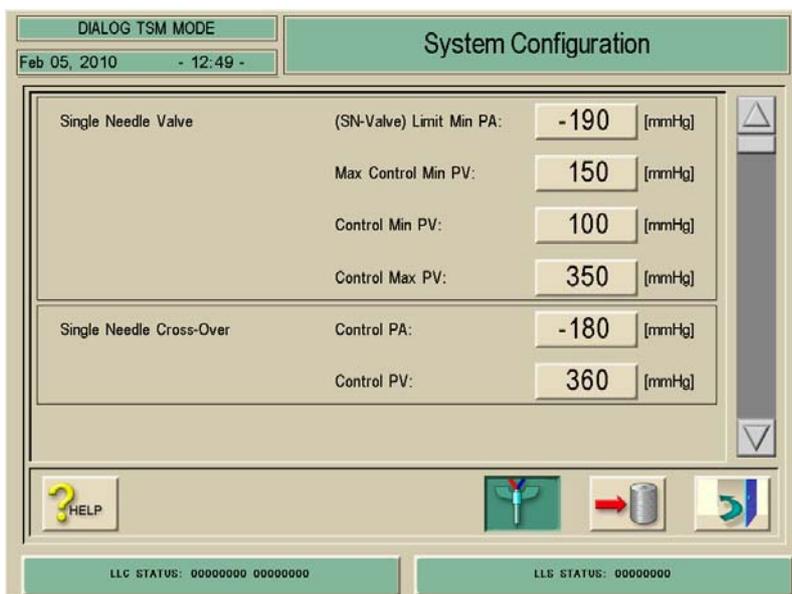
**Arterial Bolus with SAKA Support** The arterial tubing clamp SAKA can be used to support an arterial bolus in the *Arterial Bolus Parameters* menu. Prerequisites are:

- Arterial tubing clamp SAKA present
- An arterial line system with infusion access is present between the SAKA and blood pump

## 4.7.1.5 Single-Needle Parameters



1. Activate the *System Configuration* menu with the *System Configuration* key in menu *Treatment Support*. Use the scroll bar until the following menu appears.



2. Activate the *Single-Needle Parameters* menu with the *Single-Needle* icon.

The following parameters can be set:

#### Single-Needle Valve (Control Pressures)

- (Single-Needle SN Valve) Limit Min PA
- Max Control Min PV
- Control Min PV
- Control Max. PV

#### Single-Needle Cross-Over (Control Pressures)

- Control PA
- Control PV

#### Single-Needle Valve (Single-Needle SN Valve) Limit Minimum PA

The minimum limit of the arterial pressure PA can be set for the single-needle valve mode.

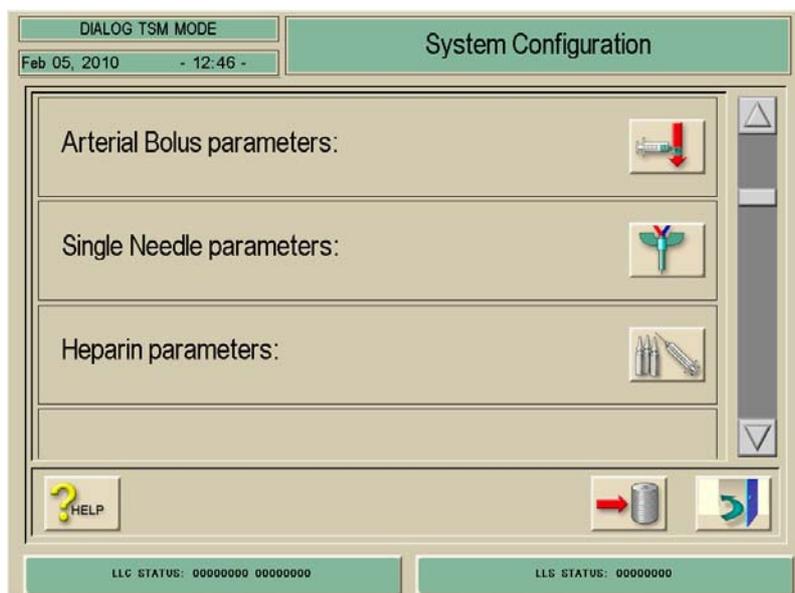
#### Maximum Control Minimum PV

The maximum lower venous control pressure can be set for the *Single-Needle Valve* option. For safety reasons it is necessary to limit the maximum value for the lower venous control pressure for the SN valve. The maximum setting is 150 mmHg (default setting).

Furthermore the control pressure PV can be set. Thereby the blood pump is started/stopped and the venous tubing clamp currentless closed SAKV-SG is opened/closed.

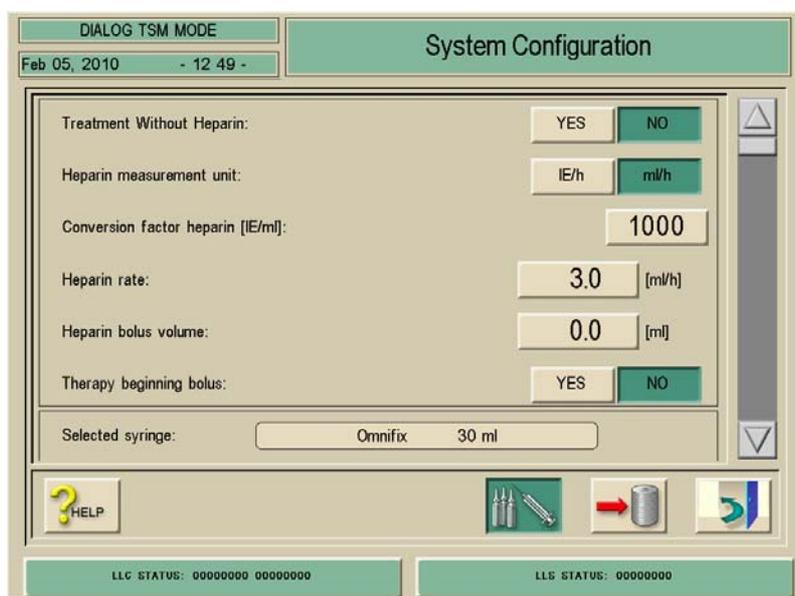
**Single-Needle Cross-Over** The control pressures for PA and PV can be set for single-needle cross-over.

## 4.7.1.6 Heparin Parameters



You can set the parameters in the Heparin Parameters menu and select a syringe type.

1. Activate the *System Configuration* menu with the *System Configuration* key in menu *Treatment Support*. The following menu is opened.



2. Activate the *Heparin Parameters* menu with the *Heparin Parameters* icon. The following menu is opened.

The following parameters can be set:

- Treatment without heparin
- Heparin measurement unit
- Conversion factor heparin [IE/ml]
- Heparin rate
- Heparin bolus volume
- Therapy beginning bolus
- Selected syringe

**Treatment Without Heparin****YES**

The treatment is not started with heparin if the YES key is selected, i.e. the default is set to treatment start without heparin. The heparin pump alarms are disabled.

**NO**

The treatment is started with heparin if the NO key is selected, i.e. the default is set to treatment start with heparin. The heparin pump alarms are enabled.

**Heparin Measurement Unit**

The measurement unit [IE/H] or [ml/h] can be selected for heparin.

**Conversion Factor Heparin [IE/ml]**

You can set the conversion factor ([IE/ML] depending on the mixing ratio, if the amount of heparin should be displayed in international units (IE). The conversion factor describes the quantity of IE in 1 ml solution, e.g. 1000 IE represent in 1 ml solution 1000 IE heparin.

**Heparin Rate**

The heparin rate can be set to [IE/h] or [ml/h], depending on the selected unit.

**Heparin Bolus Volume**

You can select the bolus volume for the heparin bolus.

**Therapy Beginning Bolus**

An automatic bolus can be administered at the beginning of a therapy. The heparin bolus is performed by the venous red detector RDV.

**Selected Syringe** The selected syringe type is used in therapy.

**Heparin Pump Compact** You can set the syringe name and the inner diameter of the syringe.

DIALOG TSM MODE

Mar 24, 2010 - 16:34 -

System Configuration

9. Syringe name & volume: Omnifix 30 ml

Inner diameter: 22.00 [mm]

10. Syringe name & volume: Omnifix 20 ml

Inner diameter: 19.80 [mm]

11. Syringe name & volume: Omnifix 10 ml

Inner diameter: 16.05 [mm]

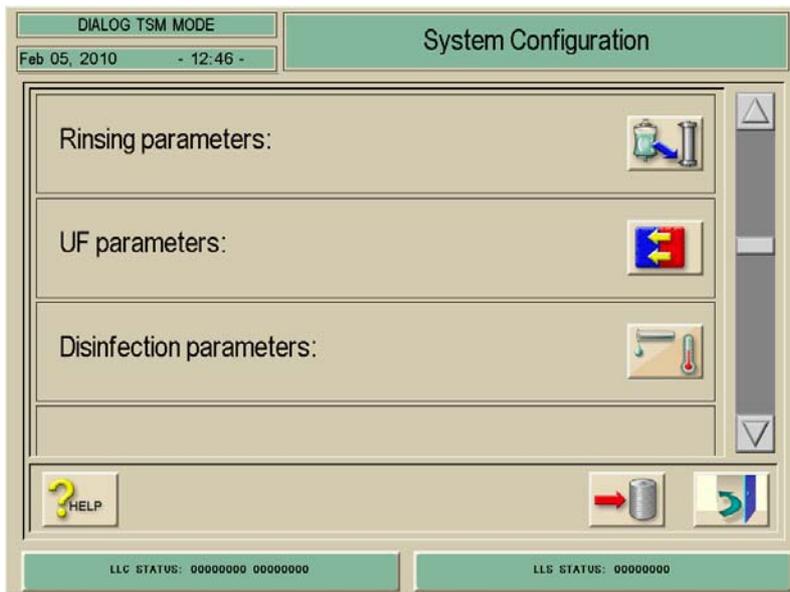
? HELP

LLC STATUS: 00000000 40000000

LLC STATUS: 00000000

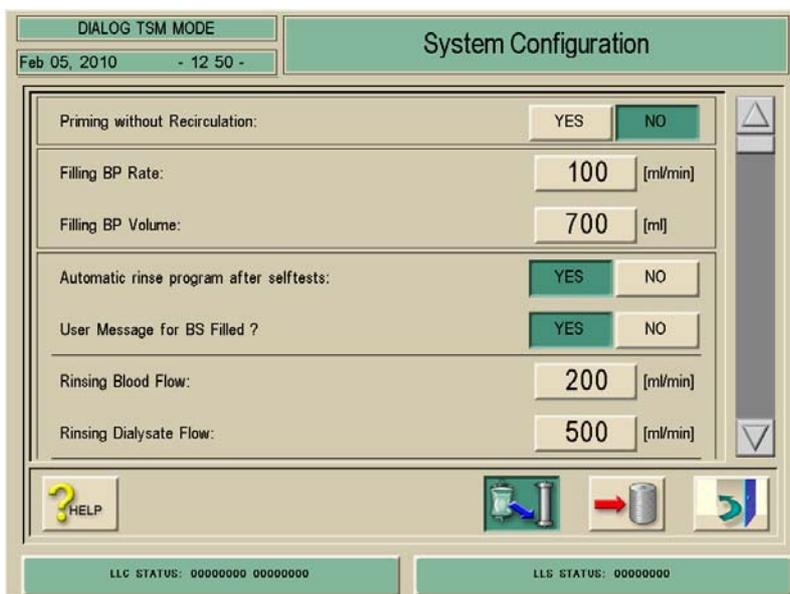
3. Activate the *Selected Syringe* menu with the *Selected Syringe* icon. The following menu is opened.

## 4.7.1.7 Rinsing Parameters



The *Rinsing Parameters* can be set in the *Rinsing Parameters* menu.

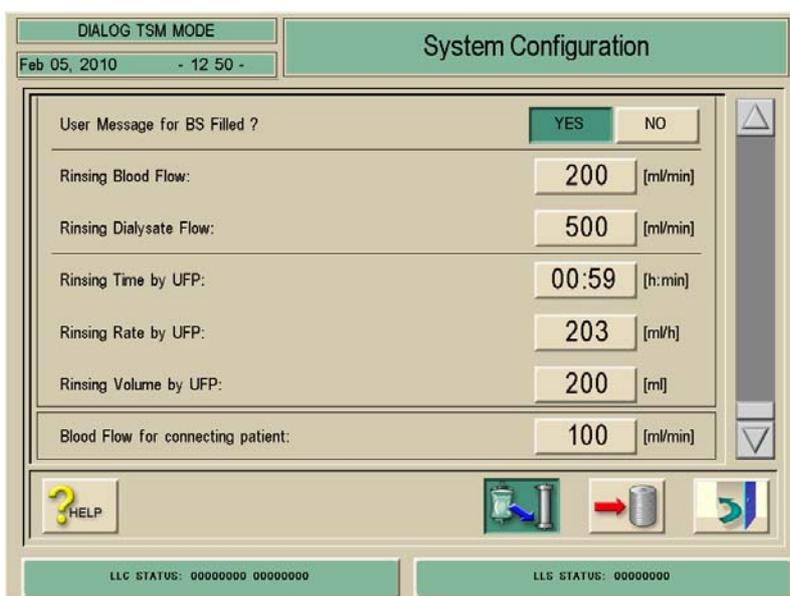
1. Activate the *System Configuration* menu with the *System Configuration* key in menu *Treatment Support*. The following menu is opened and displayed (scroll with scroll bar).



2. Activate the *Rinsing Parameters* menu with the *Rinsing Parameters* icon. The following menu is displayed.

The following parameters can be set:

- Priming without Recirculation
- Filling BP Rate
- Filling BP Volume
- Automatic Rinse Program after Self Tests
- User Message for BS Filled?
- Rinsing Blood Flow
- Rinsing Dialysate Flow
- Rinsing Time by UFP
- Rinsing Rate by UFP
- Rinsing Volume by UFP
- Blood Flow for Connecting Patient



**Priming without Recirculation** *If YES is activated*  
The blood pump stops 120 ml before the required filling volume. The 120 ml is used for the blood pump self test. A warning message is not activated. Thus a connection of the disposable for recirculation is not necessary after filling. An automatic start of the rinsing is prohibited.

**Filling BP Rate** You can set the BP rate to fill the blood line system (BS) for all rinsing modes.

**Filling BP Volume** You can set the filling/rinsing volume for the A/V system.

*With Rinsing Out of Machine*

The filling of the dialyser is started after the filling BP volume is reached (e.g. 500 ml; min. 500 ml/standard 700 ml).

*With Bag Rinsing*

The blood pump BPA is stopped after the filling BP volume is reached (e.g. 500 ml). This allows the changing from two bags to one bag.

**Automatic Rinse Program after Self Tests** *If YES is Activated*

The rinsing is automatically performed directly after the BS self tests.

*If NO is Activated*

The rinsing must be started manually after the BS self tests.

**User Message for BS Filled?** *If YES is Activated*

A user message is displayed after the rinsing of the machine:

The BS system is filled until the  key is pressed and the filling BP volume is completed. Thus the level can be set. Then the dialyser can be turned to fill the DF side.

*If NO is Activated*

The filling of the dialyser is automatically started after the *Filling BP Volume* is finished.

**Rinsing Blood Flow** You can set the blood flow for rinsing. After the self tests BPA delivers a longitudinal flow during rinsing. This depends on the rinsing mode.

**Longitudinal rinsing (along the dialyser):**

- Blood side inlet/outlet
- Water side inlet/outlet

**Cross rinsing (through the dialyser membrane):**

- Blood side to water side

**Note**

Interdependencies when changing parameters:

Change	Automatic Adaptation from
Rinsing Time	Rate
Rate	Rinsing Time
Rinsing Volume	Rate

**Rinsing Dialysate Flow** You can set the dialysate flow for the rinsing of the dialyser in preparation.

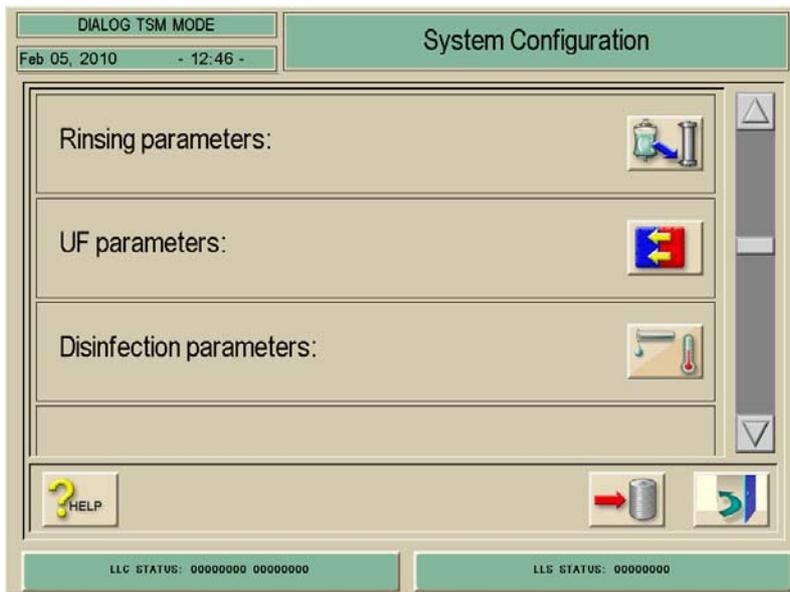
**Rinsing Time by UFP** You can set the rinsing time (for bag rinsing without substitution line (s-online)). Thus rinsing via the dialyser membrane is possible. After the termination of the rinsing time, rinsing is performed with min. UF.

**Rinsing Rate by UFP** You can set the rinsing rate for the UFP to reach the *Rinsing Volume by UFP*. The *Rinsing Time by UFP* is automatically recalculated.

**Rinsing Volume by UFP** You can set the rinsing volume (via the dialyser membrane) for the *Rinsing Time by UFP*. The *Rinsing Rate by UFP* is automatically recalculated.

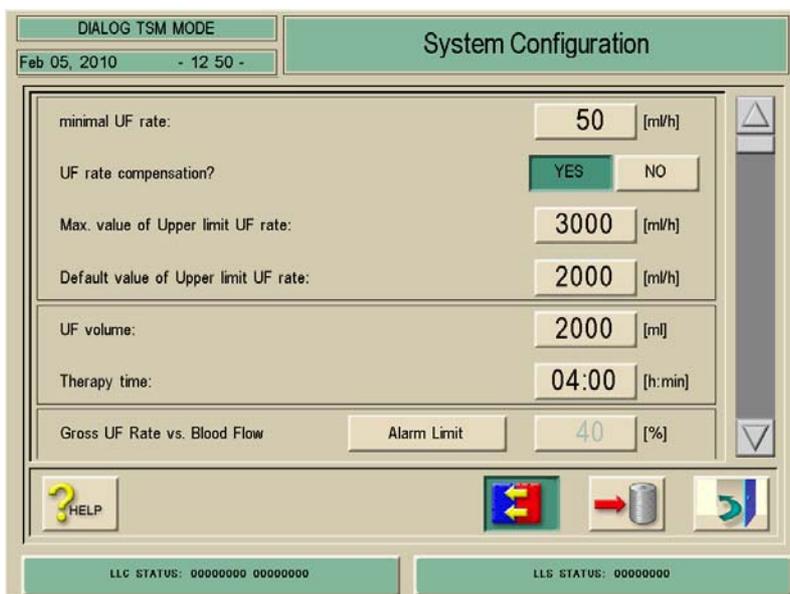
**Blood Flow for Connecting Patient** You can set the blood flow for connecting the patient (in therapy). The blood pump BPA is started with this rate when the therapy is started.

## 4.7.1.8 UF Parameters



The dialysate fluid parameters can be set in the *UF Parameters* menu.

1. Activate the *System Configuration* menu with the *System Configuration* key in menu *Treatment Support*. The following menu is opened and displayed (scroll with scroll bar).



2. Activate the *UF Parameters* menu with the *UF Parameters* icon. The following menu is opened.

The following parameters can be set:

- Minimal UF Rate
- UF Rate Compensation?
- Max. Value of Upper Limit UF Rate
- Default Value of Upper Limit UF Rate
- UF Volume
- Therapy Time
- Gross UF Rate vs. Blood Flow - Alarm Limit
- Gross UF Rate vs. Blood Flow - Warning Limit
- UF Profile Editor

**Minimal UF-Rate** You can set the minimal UF rate.

**UF Rate Compensation?** *If YES is Activated*  
If the *Minimal UF Rate* is active the UF rate is recalculated to reach the required UF volume.

**Max. Value of Upper Limit UF Rate** You can set the maximum value of the upper limit for the UF rate.

**Default Value of Upper Limit UF Rate** You can set the default value of the upper limit for the UF rate.

**UF Volume** You can set the UF volume.

**Therapy Time** You can set the therapy time.

**Gross UF Rate vs. Blood Flow - Alarm Limit** You can set and activate an alarm limit, i.e. an alarm (red) is activated if the limit is reached. The alarm limit can only be changed if the warning limit was changed in advance. The alarm can be acknowledged with the  key.

#### Setting Range

The alarm limit can not be set lower than the warning limit (even if the warning limit is deactivated).

**Gross UF Rate vs. Blood Flow – Warning Limit**

You can set and activate a warning limit, i.e. a warning (yellow) is activated if the limit is reached.

**Setting Range**

The alarm limit can not be set lower than the warning limit (even if the warning limit is deactivated).



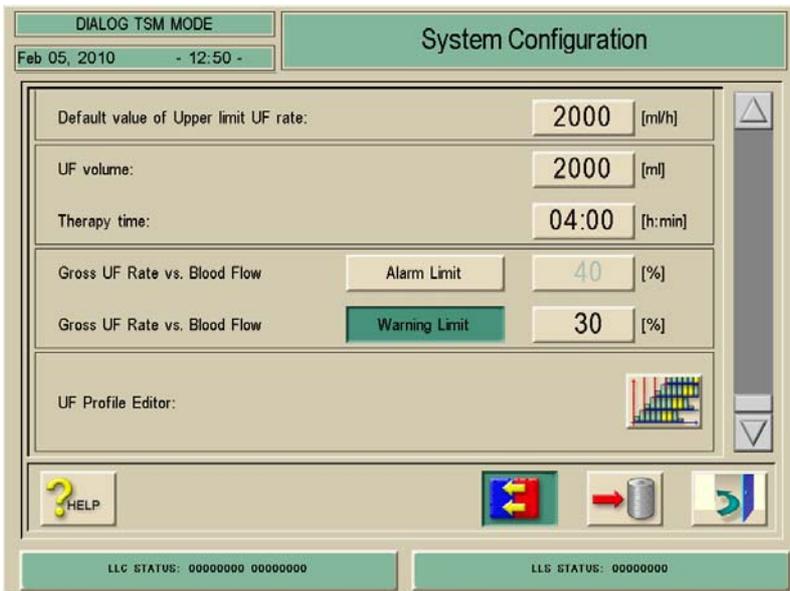
**There are no limit alarms for HDF machines in predilution.**

**Alarm Limit/Warning Limit**

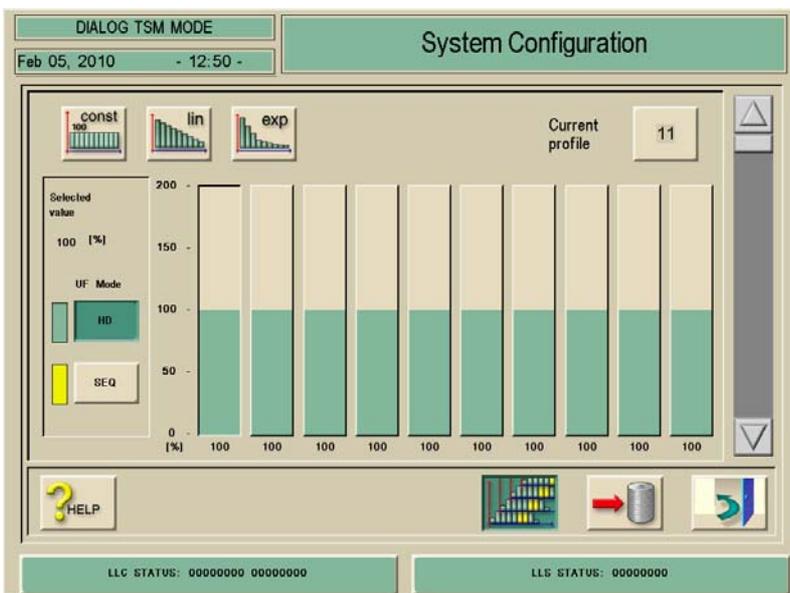
Alarm Limit	Warning Limit	
deactivated	deactivated	No alarm/no warning in therapy
deactivated	activated	Warning in therapy if limit is exceeded
activated	deactivated	Alarm in therapy if limit is exceeded
activated	activated	Alarm and warning in therapy if limit is exceeded

**UF Profile Editor**

The UF profile can be edited in the *UF Profile Editor*. Editing can be performed in the therapy mode and in the TSM service program.



Press the *UF Profile Editor* icon to open the *UF Profile Editor* menu.



*CONST (Constant)*

If this key is activated all intervals of the profile are set to 100%.

*LIN (Linear)*

If this key is activated only the first interval can be set. A linear adaptation is calculated for the remaining process.

*EXP (Exponential)*

If this key is activated only the first interval can be set. An exponential adaptation is calculated for the remaining process.

**Note** If both the *LIN* and *EXP* keys are not activated the response of the graph can be selected individually. If an interval is changed the remaining intervals are adapted accordingly. The last interval can not be modified, because this setting is calculated from the previous interval settings.

*Current Profile No.*

The profile selected with this key is displayed and can be modified. Additionally to 10 standard profiles 20 further profiles can be activated, displayed and modified.

*Profile No. 0*

This is a constant 100% profile.

*Profile No. 1 to 9*

These profiles are pre-defined.

*Profile No. 10*

A profile which was edited in therapy and stored to a chip card (card reader option).

*Profile No. 11 to 30*

These profiles can be edited in the TSM service program and stored under a number.

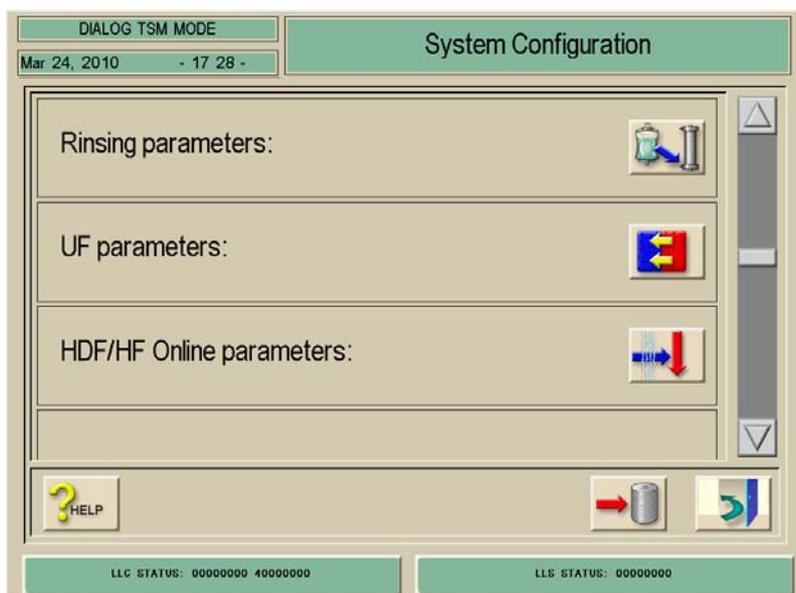
*UF Mode HD*

The UF process of the activated interval is set to HD with the *HD* key.

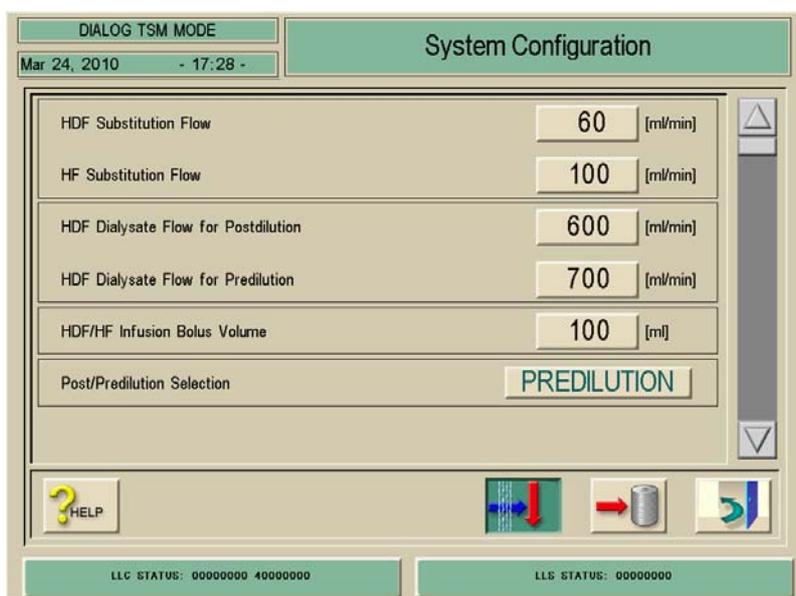
*UF Mode Sequential SEQ*

The UF process of the activated interval is set to sequential with the *SEQ* key.

## 4.7.1.9 HDF/HF Online Parameters



1. Activate the *System Configuration* menu with the *System Configuration* key in menu *Treatment Support*. Use the scroll bar until the following menu appears (only HDF online machines).



2. Activate the *HDF/HF Online Parameters* menu with the *HDF/HF Online Parameters* icon. The following menu is opened.

The following parameters can be set.

- HDF Substitution Volume
- HF Substitution Volume
- HDF Dialysate Flow for Postdilution
- HDF Dialysate Flow for Predilution
- HDF/HF infusion bolus volume
- Post/Predilution Selection

**HDF Substitution Volume** The HDF substitution volume can be set.

**HF Substitution Volume** The HF substitution volume can be set.

**HDF Dialysate Flow for Postdilution** The HDF dialysate flow for postdilution can be set.

**HDF Dialysate Flow for Predilution** The HDF dialysate flow for predilution can be set.

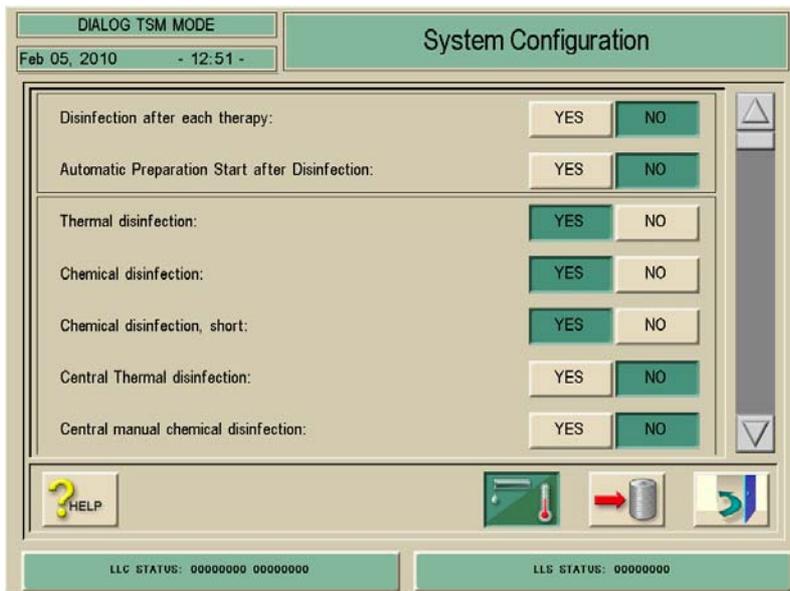
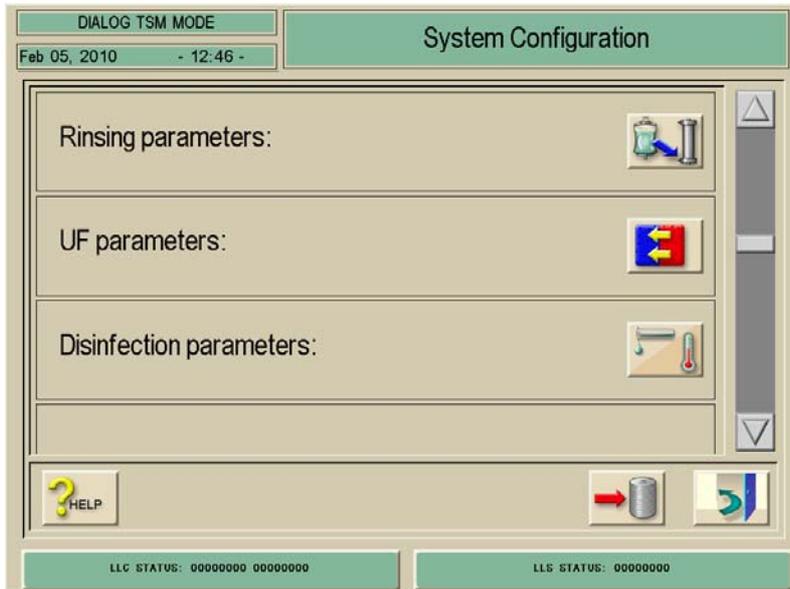
**HDF/HF Infusion Bolus Volume** The HDF/HF infusion bolus volume can be set.

**Post/Predilution Selection** You can set predilution for a HDF/HF online therapy by activating the *Predilution* key.

## 4.7.1.10 Disinfection Parameters

**Disinfection after servicing in TSM**

**Before disinfection: rinse the machine to remove residual dialysate or concentrate in the system.**



The disinfection parameters can be set in the *Disinfection Parameters* menu.

1. Activate the *System Configuration* menu with the *System Configuration* key in menu *Treatment Support*. The following menu is opened and displayed (scroll with scroll bar).

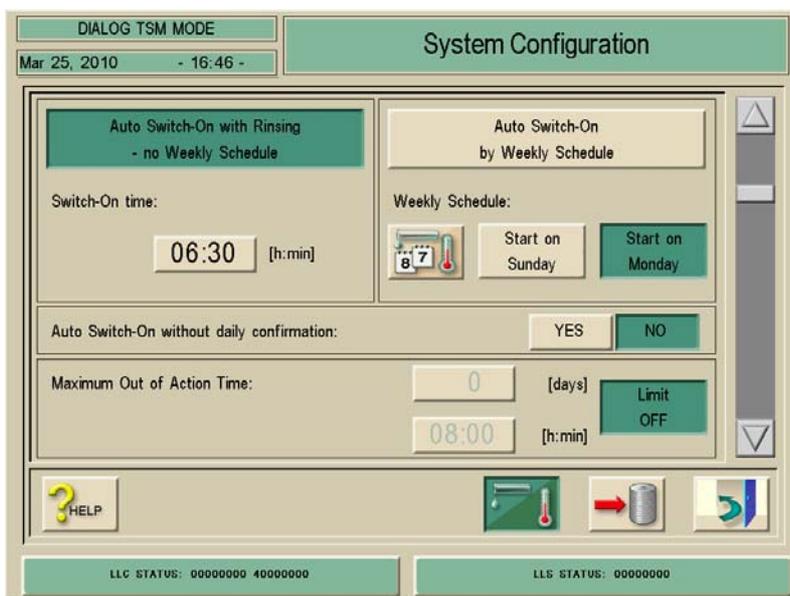
2. Activate the *Disinfection* menu with the *Disinfection Parameters* icon. The following menu is displayed.

3. Scroll the menu with the scroll bar.

The following parameters can be set:

- Disinfection after each Therapy
- Automatic Preparation Start after Disinfection
- Thermal Disinfection
- Chemical Disinfection
- Chemical Disinfection, Short
- Central Thermal Disinfection
- Central Manual Chemical Disinfection
- Central Automatic Chemical Disinfection
- Rinsing
- Auto Switch-On with Rinsing (No Weekly Schedule)
  - Switch-On Time
- Auto Switch-On by Weekly Schedule
  - Weekly Schedule
  - Start on Sunday/Start on Monday
- Auto Switch-On without Daily Confirmation
- Maximum Out of Action Time (Day/Hour/Minutes)
- Disinfection Configuration Data
  - Chemical (long), Chemical (short)
- Disinfection Configuration Data
  - Central Thermal, Central Chemical, Rinsing

- Disinfection after each Therapy** If the *YES* key is activated, a disinfection must be performed after every therapy.
- Automatic Preparation Start after Disinfection** *YES*  
After disinfection and rinsing the *Preparation* and the self tests are started.  
*NO*  
After disinfection and rinsing the disinfection method is terminated.
- Thermal Disinfection** You can enable the thermal disinfection with the *YES* key in the disinfection program or disable with the *NO* key. If you select the *NO* key the thermal disinfection icon is not displayed in the disinfection program.
- Chemical Disinfection** You can enable the chemical disinfection with the *YES* key in the disinfection program or disable with the *NO* key. If you select the *NO* key the chemical disinfection icon is not displayed in the disinfection program.
- Short Chemical Disinfection** You can enable the short chemical disinfection with the *YES* key in the disinfection program or disable with the *NO* key. If you select the *NO* key the short chemical disinfection icon is not displayed in the disinfection program.
- Central Thermal Disinfection** The inlet feed-line and the machine are disinfected with hot water, if the central facility loop-line is also disinfected with hot water (> 85°C).
- Central Chemical Disinfection** The inlet feed-lines are disinfected with chemical disinfectants, if the central facility loop-line is also disinfected with chemical disinfectants.
- Rinsing** Rinsing of disinfectant residues: e.g. a disinfection was performed in the evening and the residues are rinsed in the morning.
- Auto Switch-On with Rinsing - No Weekly Schedule**



The parameters for the switch-on without a weekly schedule can be set in the menu *Auto Switch-On with Rinsing - No Weekly Schedule*.

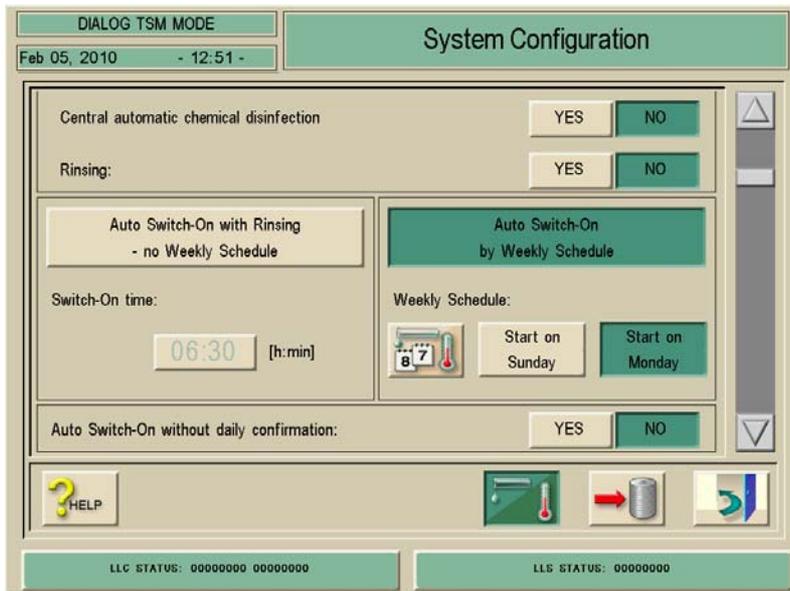
The keys for *Auto Switch-On with Rinsing - No Weekly Schedule* and *Auto Switch-On by Weekly Schedule* are interlocked.

The machine is rinsed after the preselected switch-on time. The key is only enabled if the function is selected.

#### Switch-On Time

The switch-on time can be set (without a weekly schedule).

### Auto Switch-On by Weekly Schedule

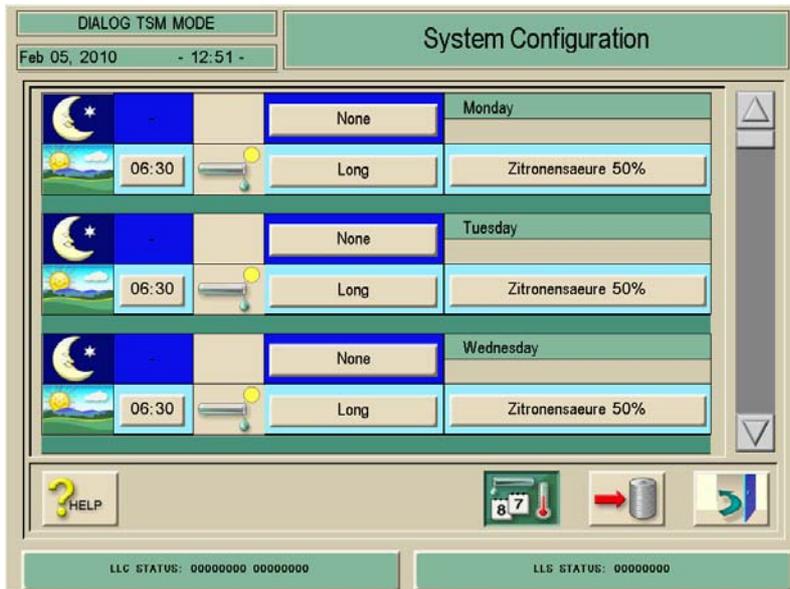


The parameters for the switch-on and the weekly schedule can be set in the menu *Auto Switch-On by Weekly Schedule*.

The keys for *Auto Switch-On with Rinsing - No Weekly Schedule* and *Auto Switch-On by Weekly Schedule* are interlocked.

#### Start on Sunday/Start on Monday

The table for the weekly schedule can either start with Sunday or Monday.



#### Weekly Schedule

The parameters for the weekly schedule can be set in the *Weekly Schedule* menu.

The selected disinfection method is performed according to the preselected *Weekday* and *Time* parameters:

- Monday, Tuesday ..... Sunday
- Night (Moon Symbol), Dialog switches off after disinfection is completed
- Day (Sun Symbol), Dialog does not switch off and remains in *Rinsing*
- Switch-On Time
- Disinfection Method
- Disinfectants

The table can also be modified by the user in the therapy/disinfection mode.

#### Auto Switch-On without Daily Confirmation *If YES is Activated*

No confirmation required for the automatic switch-on at the end of each disinfection.

#### *If NO is Activated*

A confirmation is required for the automatic switch-on at the end of each disinfection.

#### Maximum Out of Action Time *Limit OFF*

The function is activated if the *Limit OFF* key is not pressed.

The *Limit OFF* key is activated in the default setting, the parameter keys are disabled, i.e. parameter values can not be set.

### Disinfection Configuration Data Chemical (long), Chemical (short)

Disinfectant name	volume ml	Reaction time		Rinsing time h.min	Oper. temp. °C	Cond. min. mS/cm
		long h.min	short h.min			
Zitronensäure 50%	120	00:15	00:05	00:05	83	2.2
Puristeril 340	90	00:20	00:05	00:25	40	0.1
Tiutol KF	90	00:15	00:05	00:25	60	10.5
-	0	00:00	00:00	00:00	0	0.0

The parameters for the disinfectants are set in the *Disinfection Configuration Data, Chemical (Long), Chemical (Short)* table. The following parameters are available:

- Disinfectant Name, Type and Volume
- Reaction Time Long/Short
- Rinsing Time
- Operating Temperature
- Minimum Conductivity

Details can be found in Chapter 3 repair instructions.

### Disinfection Configuration Data Central Thermal, Central Chemical, Rinsing

Parameter	Value	Unit
Central Thermal Inlet Flow	250	[ml/min]
Central Thermal Time	00:30	[h:min]
Central manual chemical Inlet Flow	250	[ml/min]
Central manual chemical Inlet Time	00:05	[h:min]
Rinsing Flow	800	[ml/min]

The parameters for the water inlet system can be set in the menu *Disinfection Configuration Data, Central Thermal, Central Chemical, Rinsing*.

*Central Thermal:*

- Inlet Flow
- Time

*Central Manual Chemical:*

- Inlet Flow
- Inlet Time
- Rinsing Flow
- Rinsing Time

*Central Automatic Chemical:*

- Inlet Volume
- Switch-off for Retention without Automatic Switch-on
- Retention Time
- Rinsing Flow
- Rinsing Time

*Rinsing:*

- Inlet Flow
- Time

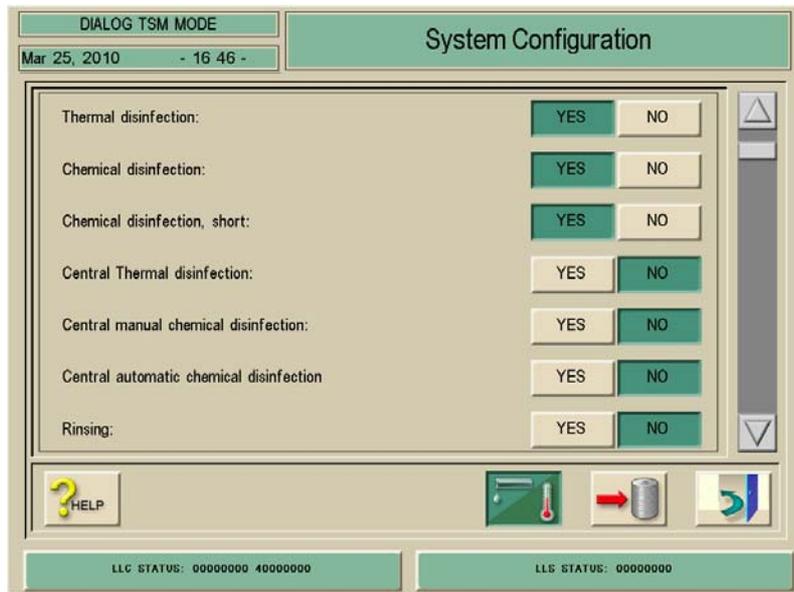
## Central Automatic Chemical Disinfection



The hypochlorite disinfectant Tiutol KF must be applied (mixing ratio maximum 65 ml Tiutol KF per litre).

The user is responsible to integrate the dialysis machine in the dialysis centre's central water loop system, if the *Central Automatic Chemical Disinfection* is used.

The retention time must be  $\leq 10$  hours if the retention is disabled, i.e. the *Retention Time* is set to **YES**, thus, no *Central Automatic Chemical Disinfection*.



This disinfection method can be used for the disinfection of the water inlet line in dialysis centres with central water loop systems.

A defined inlet volume (disinfectant) from the water loop line is sucked in as follows (see dotted lines in the flow diagram):

- **FPA/UFP** decrease the water level in the upline tank **VB** to the lower level sensor **NSVB**
- The upline tank **VB** (approx. 260 ml inlet volume) is filled with disinfectant to the upper level sensor **NSVB**, due to the water pressure at **VVBE** from
  - the central water loop system
- Filling is repeated until the preselected volume is reached
- Retention time (machine is switched off)
- Rinsing via **VB**, **RVE**, **VLA**, **LA** and **FPA** to the outlet

## Phase 1

- machine is filled and emptied 5 times, i.e. the disinfectant is volume controlled and sucked in and emptied by the central water loop line

## Phase 2

- cyclic rinsing (time controlled -- rinsing time and rinsing flow)

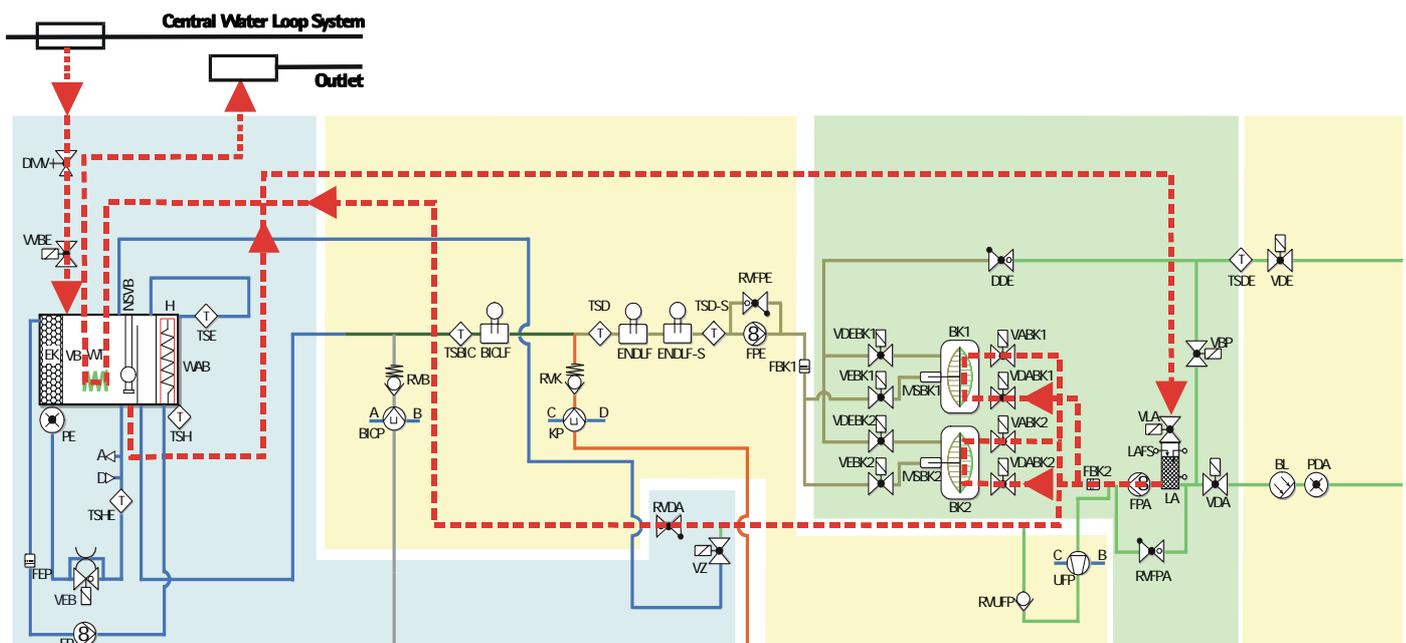
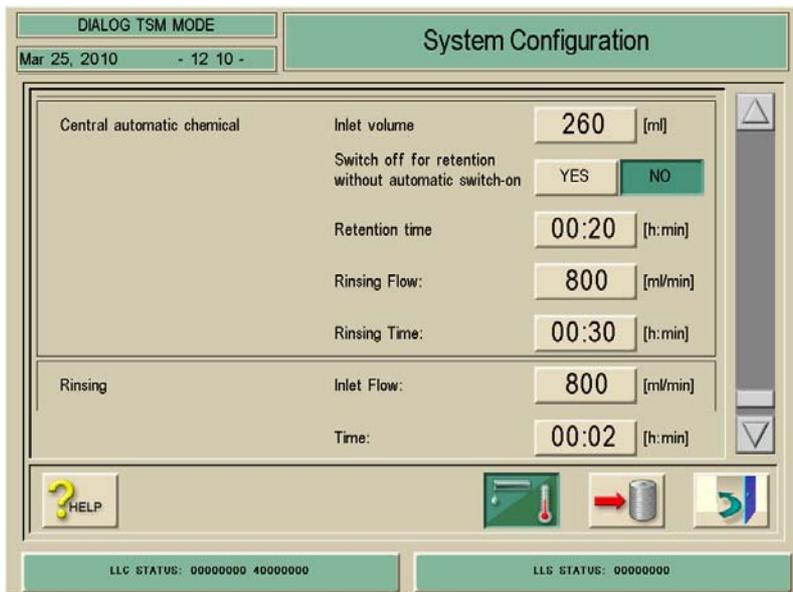


Fig.: Flow Diagram - Central Automatic Chemical Disinfection of Water Inlet



### Central Automatic Chemical

#### Inlet Volume

The inlet volume can be selected.

#### Switch-off for retention without automatic switch-on

*NO* – (i.e.: the automatic switch-on of the machine is performed)

The retention time of the disinfectant in the machine is according to the preset retention time.

*YES* – (i.e.: the automatic switch-on of the machine is not performed)

The retention time of the disinfectant in the machine depends on the switch-off time and from the manual switch-on of the machine by the user.

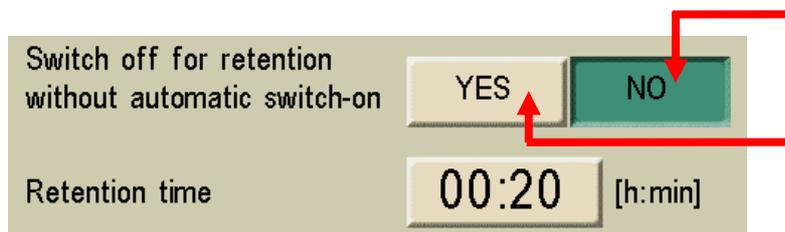
#### Retention Time

If *NO* was selected

The retention time is enabled and can be selected.

If *YES* was selected

The retention time is disabled and can not be selected. The retention time must be  $\leq 10$  hours for manual retention.



#### Rinsing Flow

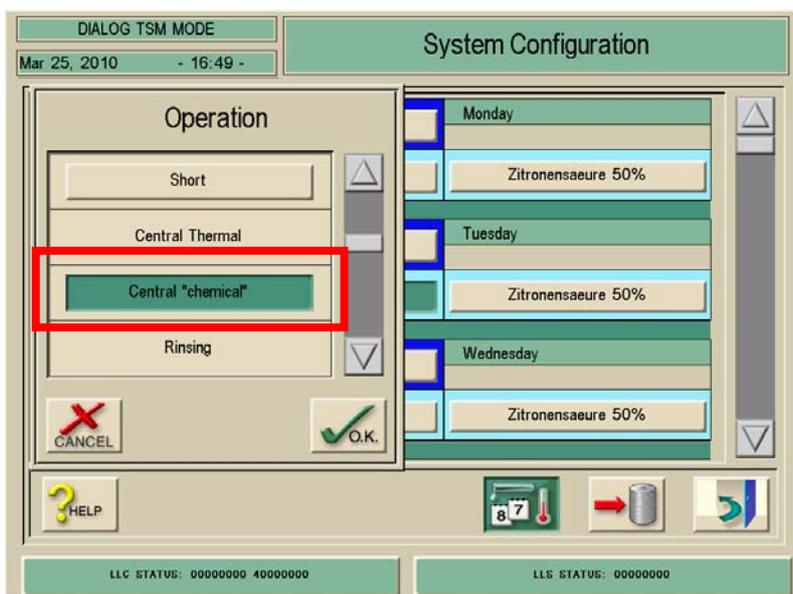
The rinsing flow can be selected.

#### Rinsing Time

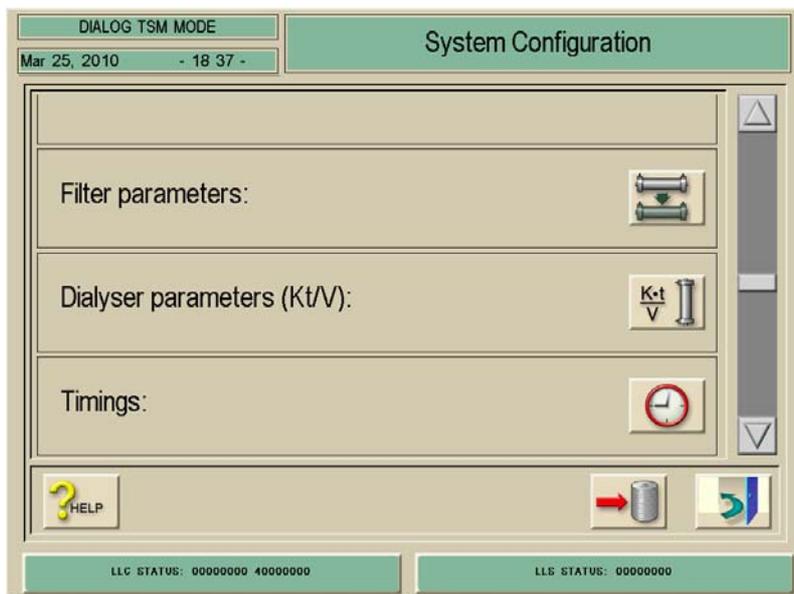
The rinsing time can be selected.

#### Central Chemical

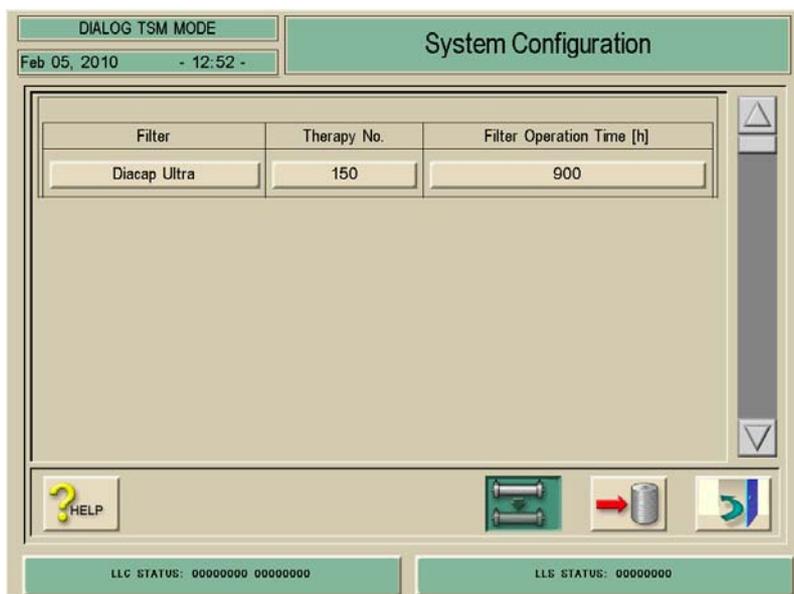
A central chemical mode can be selected for the automatic switch-on in the weekly schedule.



## 4.7.1.11 Filter Parameters



1. Activate the *System Configuration* menu with the *System Configuration* key in menu *Treatment Support*. Use the scroll bar until the following menu appears.



2. Activate the *Filter Parameters* menu with the *Filter* icon.

The following parameters can be set for HDF online and DF filters:

- Filter Type, e.g. Diacap-Ultra
- Therapy No. (number of therapies)
- Filter Operation Time [h]

**Filter** The filter type can be entered, e.g. Diacap-Ultra.

**Therapy Number** The number of therapies can be set for the DF/HDF filters.

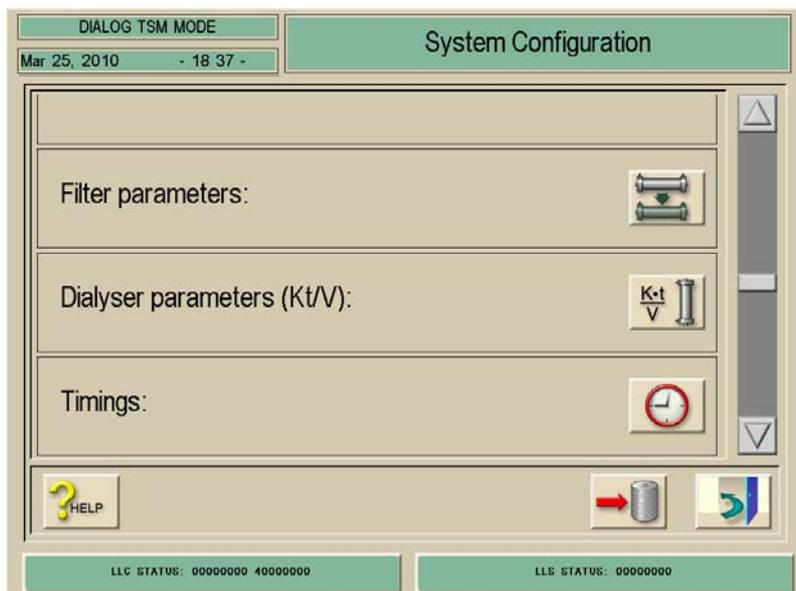
The following messages are displayed before *Preparation*, after the life-time data for therapy numbers/filter operation time is expired (one of the first three lines are selected/displayed depending on the filter/s which is/are expired):

<Check the DF Filter!> or  
 <Check the HDF Filter!> or  
 <Check the DF and HDF Filter!> or  
 <Check the life-time data on the service screen!>  
 <Do you want to continue with an expired filter?>

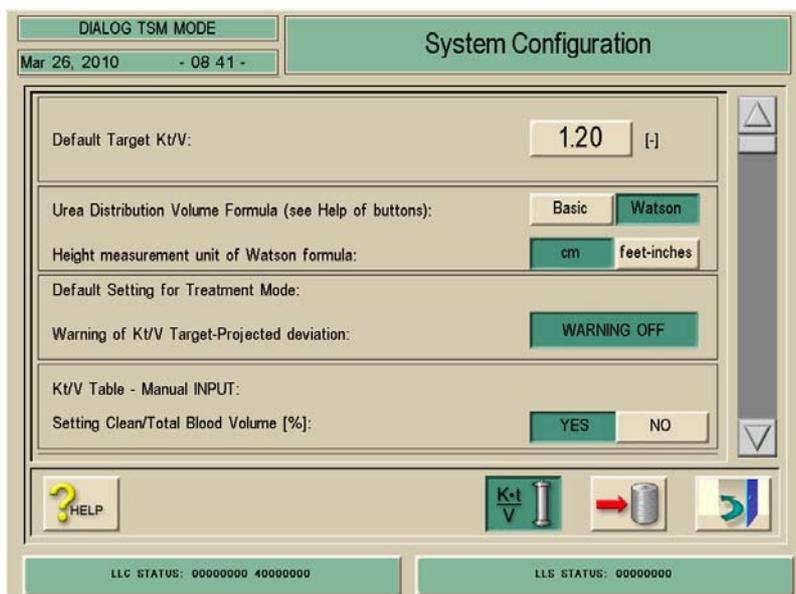
The message must be acknowledged with the  key.

**Filter Operation Time [h]** The operating hours can be set for the intended operation time of the DF/HDF filters. The operating hour counter is active when *DF Preparation* is active.

## 4.7.1.12 Dialyser Parameters (Kt/V)



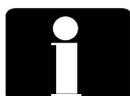
1. Activate the *System Configuration* menu with the *System Configuration* key in menu *Treatment Support*. Use the scroll bar until the following menu appears.



2. Activate the *Dialyser Parameters (Kt/V)* menu with the *Dialyser* icon.

The following parameters can be set.

- Default Target Kt/V
- Urea Distribution Volume Formula
- Height Measurement Unit of Watson Formula
- Default Setting for Treatment Mode: Warning of Kt/V Target Projected Deviation
- Kt/V Table - Manual INPUT: Setting Clean Blood Volume [%] Enabled
- Warning for Saving Kt/V Table
- Dialyser Filter Urea Clearance Data



#### If Nexadia-BSL is selected

Only the first parameter point *Default Target Kt/V* is displayed, but Kt/V is still active in Nexadia-BSL.

#### If WAN-BSL is selected

No display, Kt/V is not active in WAN-BSL, i.e. empty screen.

#### Default Target Kt/V

The target value is the Kt/V value at the end of a therapy. The target is set by the user.

#### Urea Distribution Volume Formula

Kt/V can be calculated with one of two different equations.

##### Urea Distribution Volume Formula (Basic)

The calculation is according to the following equation:

$$V \text{ (litres)} = 0.58 \times \text{Dry Weight (kg)}$$

##### Urea Distribution Volume Formula (Watson)

The calculation is according to the following Watson equation:

*Male:*

$$V \text{ (litres)} = 2.447 - 0.09516 \times \text{Age (years)} + 0.1074 \times \text{Height (cm or feet/inch)} + 0.3362 \times \text{Dry Weight (kg)}$$

*Female:*

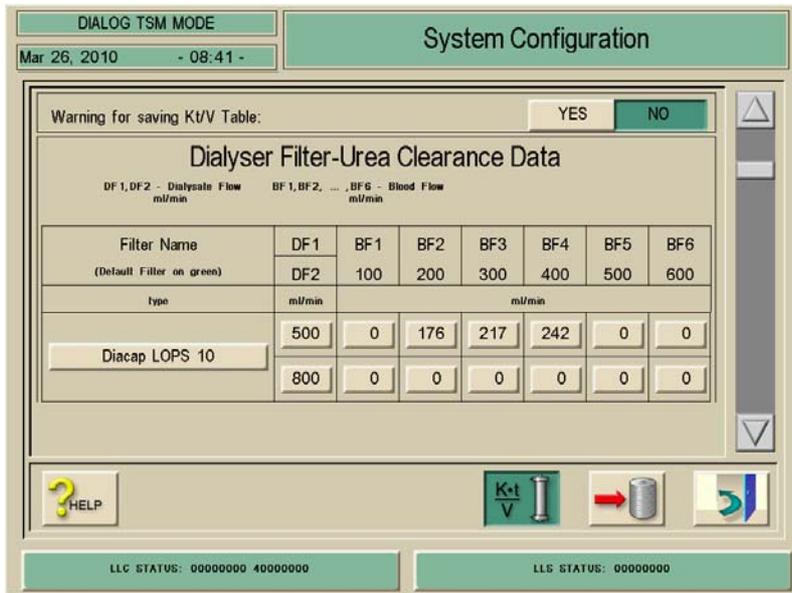
$$V \text{ (litres)} = -2.097 + 0.1069 \times \text{Height (cm or feet/inch)} + 0.2466 \times \text{Dry Weight (kg)}$$

**Height Measurement Unit of Watson Formula** The unit [cm] or [Feet/Inch] can be selected.

**Default Setting for Treatment Mode: Warning of Kt/V Target Projected Deviation** If the calculated Kt/V from the set parameters is smaller than the set target value a message is activated.

**Kt/V Table – Manual INPUT: Setting Clean Blood Volume [%] Enabled** If YES is Activated The ratio can be edited subsequently in therapy for adaptation to the calculated Kt/V value.

**Warning for Saving Kt/V Table** A warning message can be enabled for saving the Kt/V table.

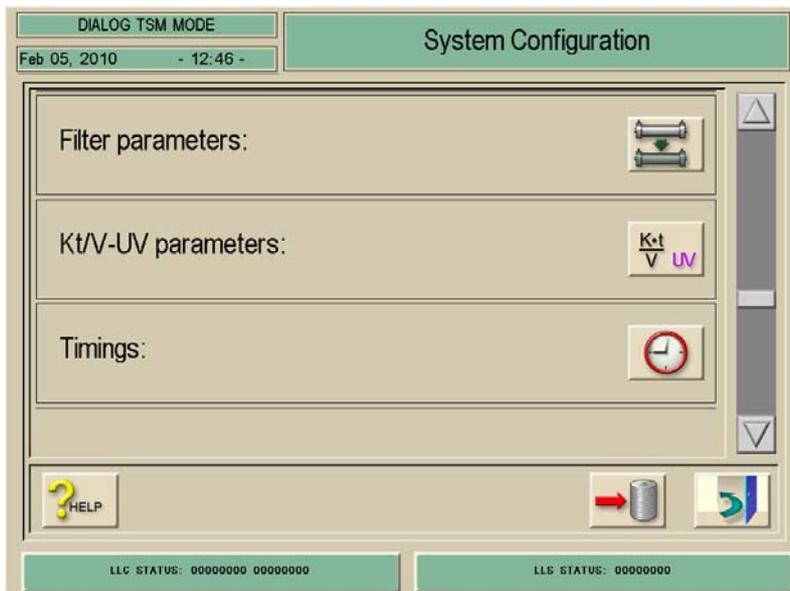


**Dialyser Filter Urea Clearance Data**

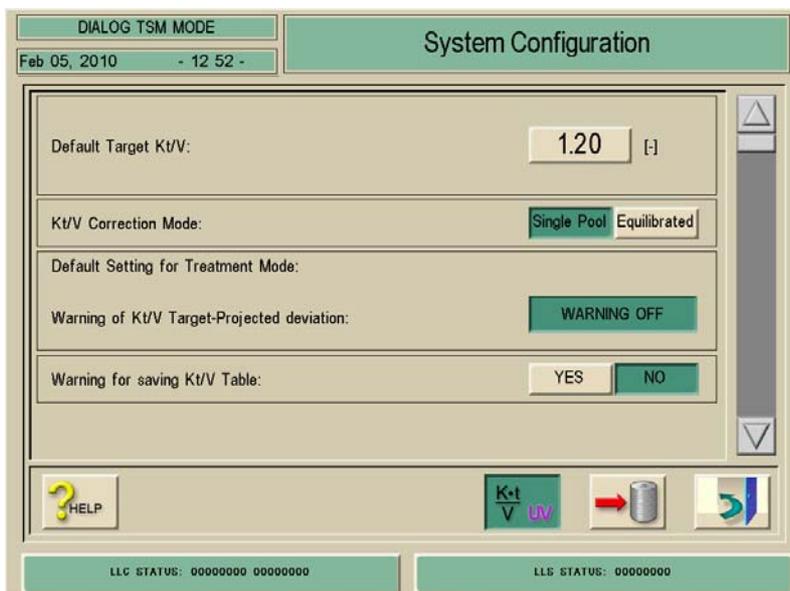
The Kt/V is approximately calculated via the *Dialyser Filter Urea Clearance Data* for the selected dialyser (see table, use scroll bar to see table).

Details can be found in Chapter 3 repair instructions.

## 4.7.1.13 Kt/V-UV Parameters



1. Activate the *System Configuration* menu with the *System Configuration* key in menu *Treatment Support*. Use the scroll bar until the following menu appears.



2. Activate the *Kt/V-UV Parameters* menu with the *Kt/V-UV* icon.

The following parameters can be set.

- Default Target Kt/V
- Kt/V Correction Mode
- Single Pool / Equilibrated
- Default Setting for Treatment Mode: Warning of Kt/V Target-Projected Deviation
- Warning for Saving Kt/V Table

**Default Target Kt/V**

The target value is the required Kt/V value at the end of a therapy. The target is set by the user.

**Kt/V Correction Mode**

For Kt/V-UV, i.e. Adimea option.

**Single Pool / Equilibrated**

The Single Pool parameter or the Equilibrated parameter can be selected according to the requirements of the physician/customer.

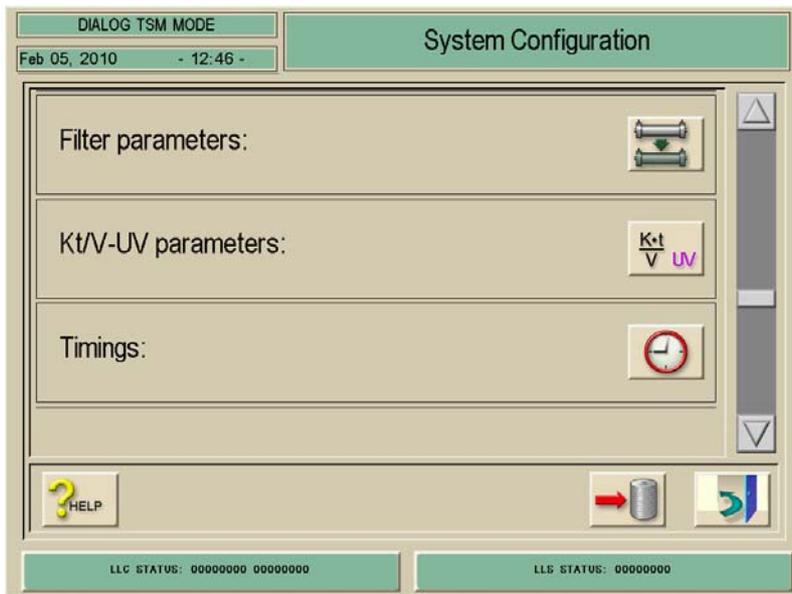
**Default Setting for Treatment Mode: Warning of Kt/V Target-Projected Deviation**

If the calculated Kt/V from the set parameters is smaller than the set target value, a message is activated.

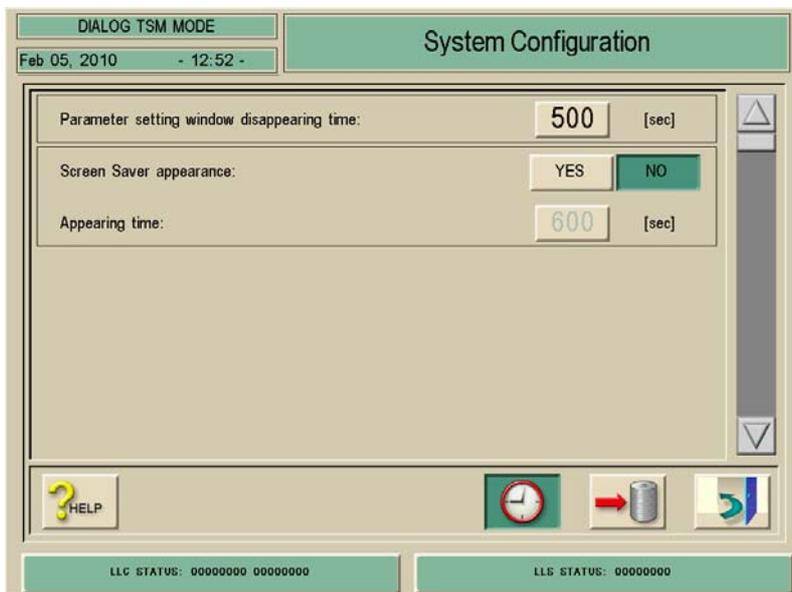
**Warning for Saving Kt/V Table**

A warning message can be enabled for saving the Kt/V table.

## 4.7.1.14 Timings



1. Activate the *System Configuration* menu with the *System Configuration* key in menu *Treatment Support*. The following menu is opened and displayed (scroll with scroll bar):



2. Activate the *Timings* menu with the *Timings* icon. The following menu is displayed.

The following parameters can be set:

- Parameter setting window disappearing time
- Screen saver appearance
- Appearing time

#### Parameter Setting Window Disappearing Time

You can set the automatic disappearing time for the *Parameter Setting Window* (lower screen in therapy).

#### Screen Saver Appearance

You can activate a screen saver with the *YES* key. The actual image on the screen is then replaced by the screen saver, according to the preset time. The original image appears in case of an alarm or if the screen is touched. The following screen savers are activated:

*Therapy selection:*

B.Braun logo, date, time

*Preparation:*

B.Braun logo, time, status line

*Therapy and end of therapy:*

Time cake, remaining time, status line

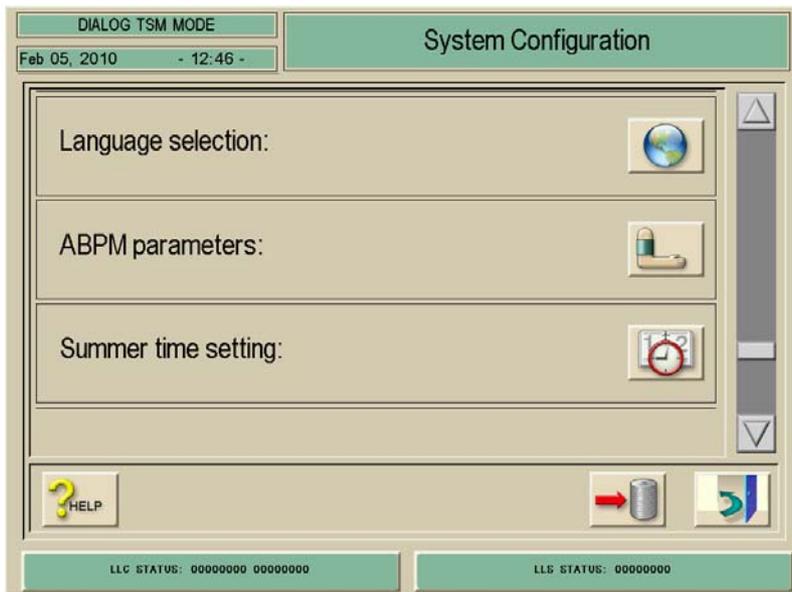
*Disinfection:*

Time cake, disinfection mode, phase

#### Appearing Time

You can set the appearance time of the Screen Saver.

## 4.7.1.15 Language Selection



1. Activate the *System Configuration* menu with the *System Configuration* key in menu *Treatment Support*. The following menu is opened and displayed (scroll with scroll bar).



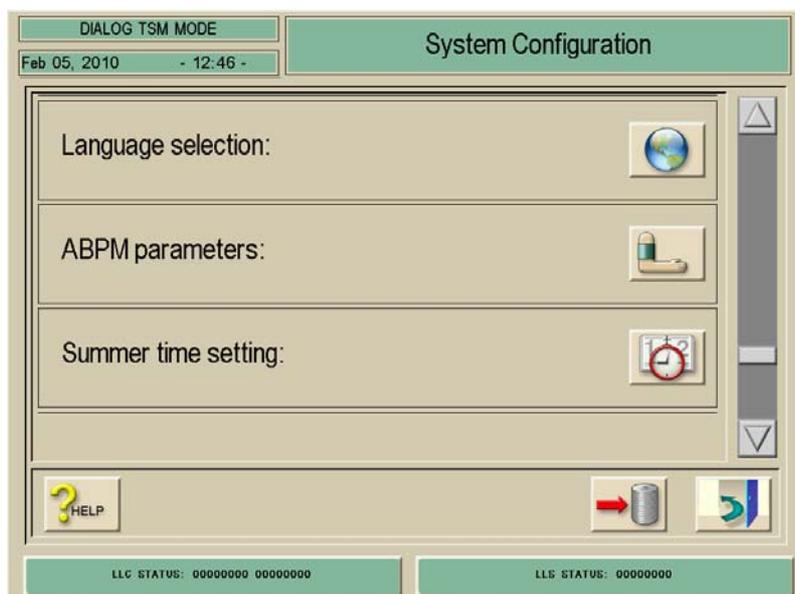
2. Activate the *Language Selection* menu with the *Language Selection* icon.

3. Select the *English* or *German* language or an additional available language.

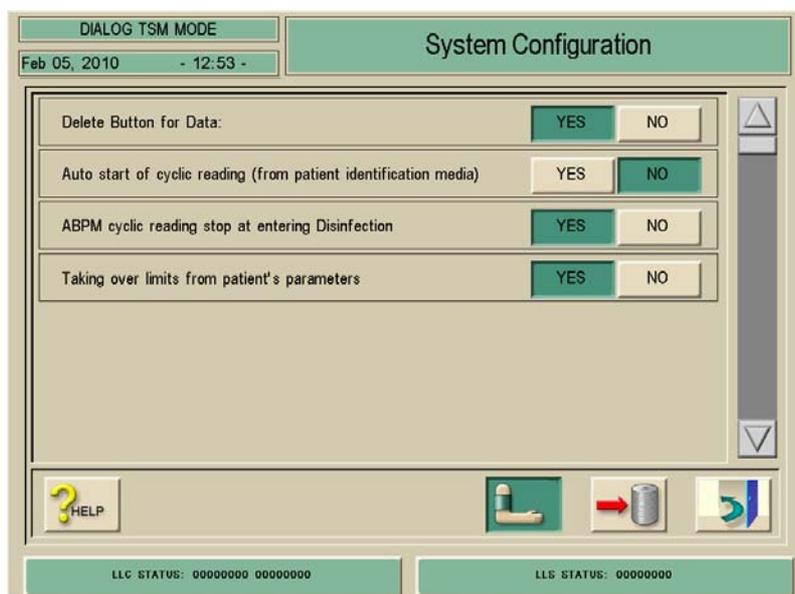
4. The following menu is displayed (or if available additional languages).

If English is selected the therapy and TSM language is English. If German is selected the therapy and TSM language is German. If an additional language is selected this language is used in therapy. The TSM language is English.

### 4.7.1.16 Automatic Blood Pressure Measurement ABPM



1. Activate the *System Configuration* menu with the *System Configuration* key in menu *Treatment Support*. The following menu is opened and displayed (scroll with scroll bar).



2. Activate the *ABPM Parameters* menu with the *ABPM Parameters* icon. The following menu is opened and displayed.

The following parameters can be set:

- Delete Key Data
- Auto Start of Cyclic Reading (from Patient Identification Media)
- ABPM Cyclic Reading Stop at Entering Disinfection
- Taking Over Limits from Patient's Parameters

#### Delete Key Data

*If YES is Activated*

In therapy a delete key is displayed in the ABPM menu. The measurement data can be deleted in the table.

*If NO is Deactivated*

The measurement data is saved in the table until the end of therapy and can not be deleted.

#### Auto Start of Cyclic Reading (from Patient Identification Media)

*NO*

The cyclic blood pressure measurement must always be selected manually.

*YES*

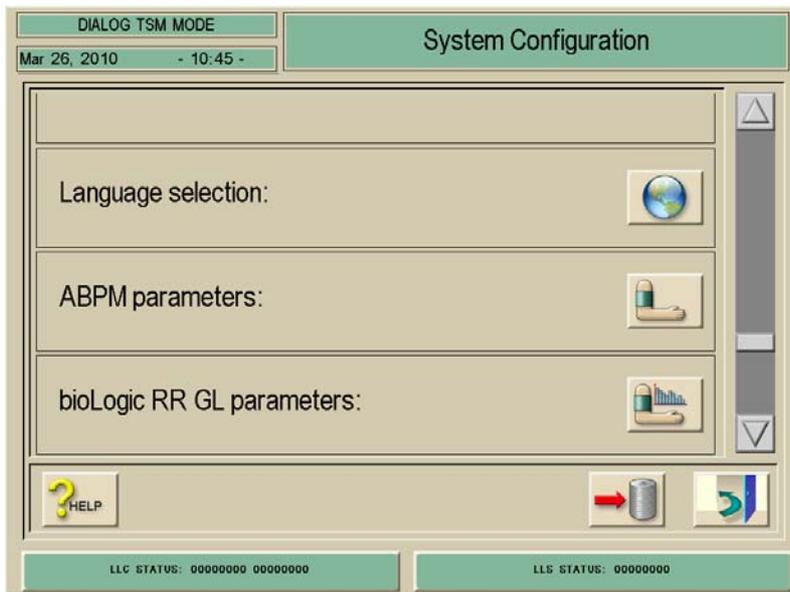
If the cyclic blood pressure measurement is on the patient chip card, ABPM is automatically activated at the beginning of a new therapy.

#### ABPM Cyclic Reading Stop at Entering Disinfection

The cyclic reading of the ABPM is stopped at entering the disinfection.

#### Taking Over Limits from Patient's Parameters

The limit values in therapy, e.g. for systole/diastole can be stored on a patient chip card. These limit values are taken over if the patient chip card is read.

4.7.1.17 bioLogic RR<sup>®</sup> GL Parameters

1. Activate the *System Configuration* menu with the *System Configuration* key in menu *Treatment Support*. The following menu is opened and displayed (scroll with scroll bar).
2. Activate the *bioLogic RR<sup>®</sup> Comfort* menu with the *bioLogic RR<sup>®</sup> Comfort* icon. The following menu is opened and displayed.

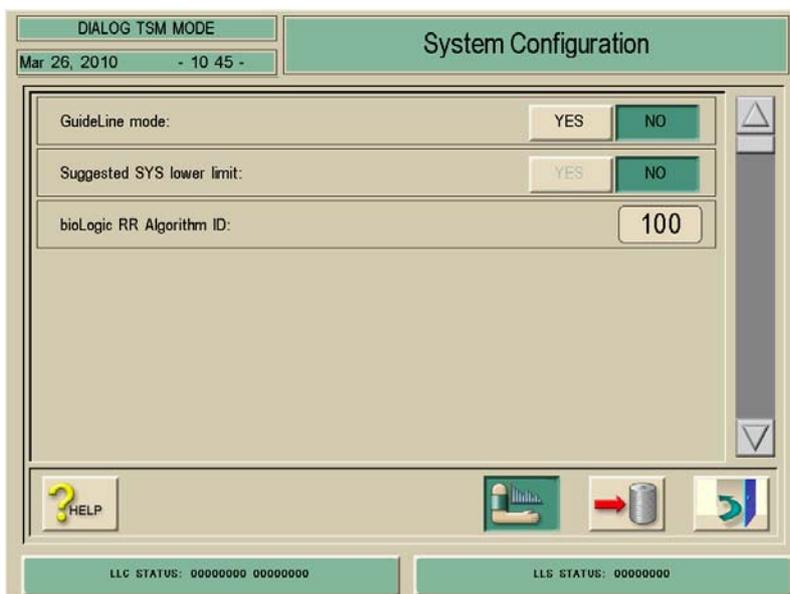
**bioLogic RR<sup>®</sup> GL** (GL: Guide-Line)

**Note:** bioLogic RR GL = bioLogic RR Comfort

The parameters for the bioLogic RR<sup>®</sup> Comfort can be set in the *System Configuration, bioLogic RR<sup>®</sup> Parameters* menu, if the option was already selected and activated in the *Production Report* menu.

The following parameters can be set:

- Guide Line Mode
- Suggested SYS (Systolic) Lower Limit
- bioLogic RR Algorithm ID



**Guide Line Mode**

Press *YES* key to enable the *Guide Line* (GL) mode of the bioLogic RR<sup>®</sup> Comfort option.

If *NO* is selected the bioLogic RR<sup>®</sup> Comfort option is used without the guide line (GL) mode.

**Suggested SYS (Systolic) Lower Limit**

If *Guide Line Mode: YES*

The suggested systolic lower limit can be selected. The suggested systolic lower limit can be used in therapy to set the SYS lower limit.

If *Guide Line Mode: NO*

The suggested systolic lower limit can not be selected (see bottom figure).

**bioLogic RR Algorithm ID**

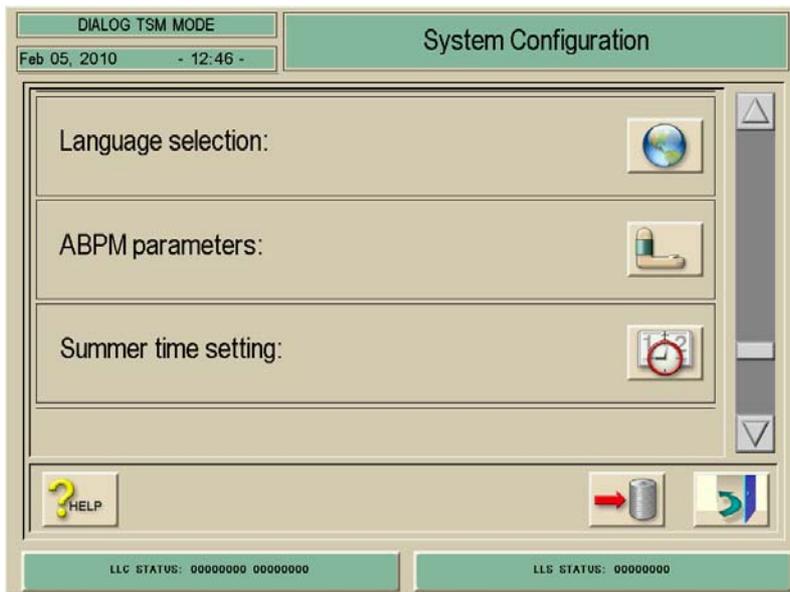
*ID Number 200*

The ID number 200 indicates that the *Guide Line Mode* is enabled and can be used in therapy.

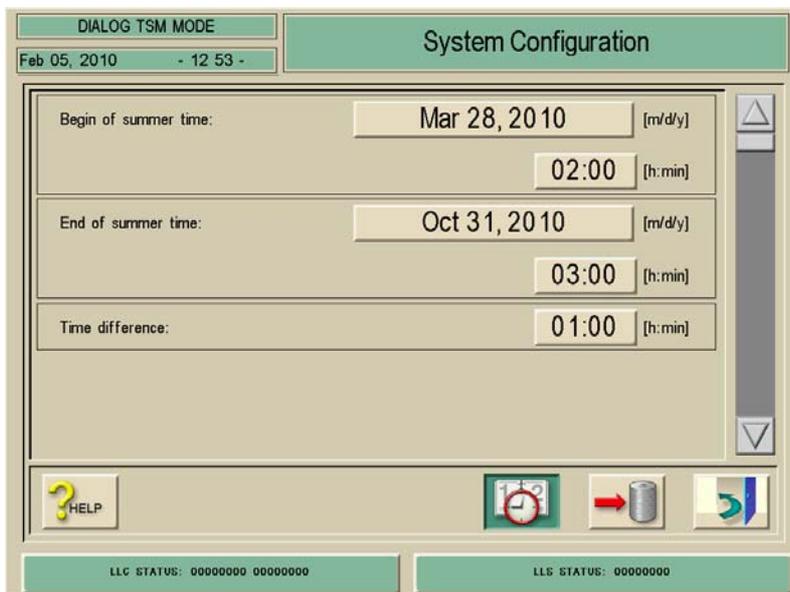
*ID Number 100*

The ID number 100 indicates that the *Guide Line Mode* is not enabled and can not be used in therapy.

## 4.7.1.18 Summer Time Setting



1. Activate the *System Configuration* menu with the *System Configuration* key in menu *Treatment Support*. The following menu is opened and displayed (scroll with scroll bar).



2. Activate the *Summer Time Setting* menu with the *Summer Time Setting* icon. The following menu is displayed.

The following parameters can be set:

- Begin of summer time
- End of summer time
- Time difference

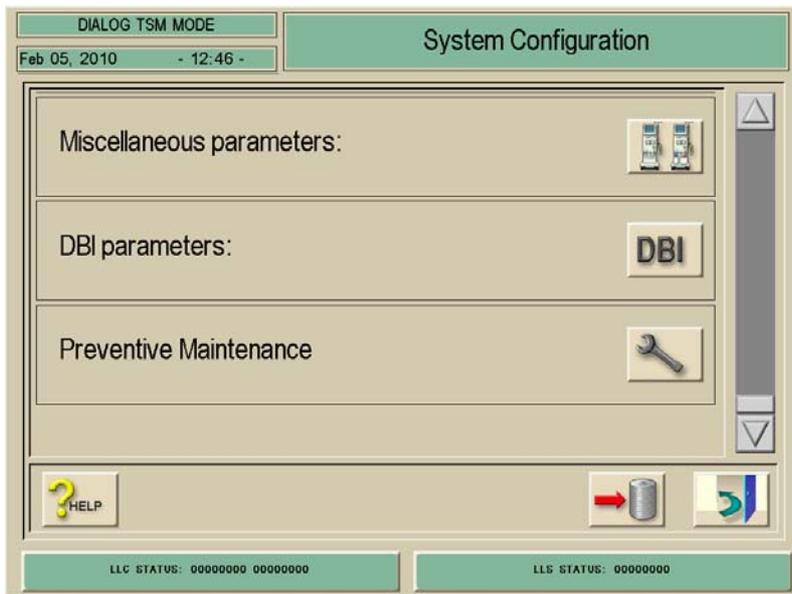
**Begin of Summer Time** If necessary you can set the start of the summer time (date and hour).

**End of Summer Time** If necessary you can set the end of the summer time (date and hour).

**Time Difference** If necessary you can set the time difference between summer and winter time.

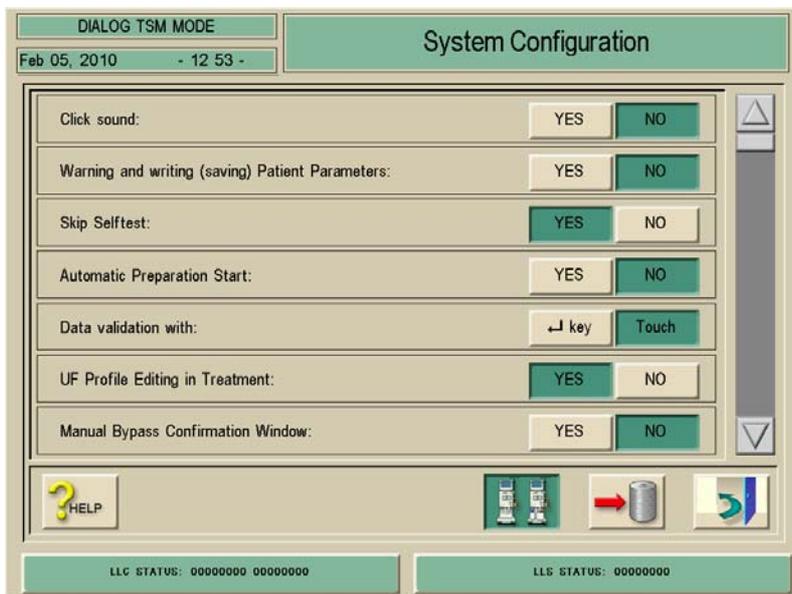
**Note:** The *Time Difference* should be set to 00:00 for countries where daylight saving time is not applicable.

## 4.7.1.19 Miscellaneous Parameters



Further parameters can be set in the *Miscellaneous Parameters* menu.

1. Activate the *System Configuration* menu with the *System Configuration* key in menu *Treatment Support*. The following menu is opened and displayed (scroll with scroll bar).



2. Activate the *Miscellaneous Parameters* menu with the *Miscellaneous Parameters* icon. The following menu is displayed.

The following parameters can be set:

- Click Sound
- Warning and Writing (Saving) Patient Parameters
- Skip Self Tests
- Automatic Preparation Start
- Data Validation with
- UF Profile Editing in Treatment
- Manual Bypass Confirmation Window
- End of Therapy Sound Duration
- Chopped Alarm Sound
- Suppression of Warning Sounds in Preparation
- Automatic Reinfusion Start at Entering End of Treatment

**Click Sound**

If you activate the *YES* key a click sound is activated if a key or the touch screen is pressed.

**Warning and Writing (Saving) Patient Parameters**

If you click the *YES* key you can generate a warning message to save the patient data in the following cases:

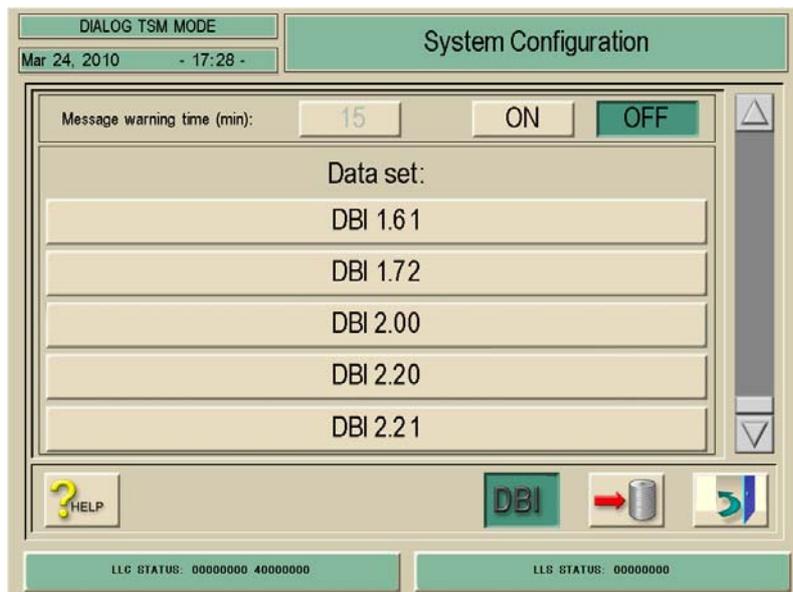
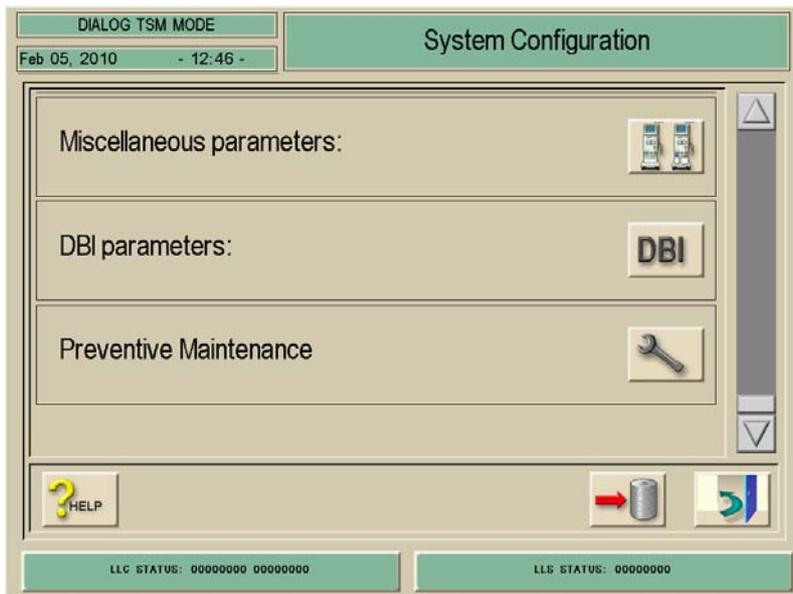
- The patient data was loaded from the data media
- The therapy was terminated without saving the patient data

**Skip Self Tests**

It is only permitted to activate the *Skip Self Test* function for servicing. It is prohibited to run a therapy with a patient if the *Skip Self Test* function is activated. The self test must be passed successfully prior to a therapy.

<b>Automatic Preparation Start</b>	Preparation is started after the machine is switched on, if the machine was in therapy selection mode when switched off.
<b>Data Validation with</b>	<b>Data validation with the  Key:</b> The confirmation of the data validation for the UF profiles is performed via the  key.
	<b>Data validation with the Touch:</b> The confirmation of the data validation for the UF profiles is performed via the  key (touch screen) in the menu.
<b>UF Profile Editing in Treatment</b>	The editing of the UF profiles can be performed in treatment.
<b>Manual Bypass Confirmation Window</b>	The confirmation window for bypass can be enabled with YES. Thus every bypass switching must be confirmed manually.
<b>End of Therapy Sound Duration</b>	The duration of the sound can be reduced at the end of a therapy.
<b>Chopped Alarm Sound</b>	Two different alarm tones can be selected. <b>NO</b> <ul style="list-style-type: none"><li>• Standard continuous alarm sound</li></ul> <b>YES</b> <ul style="list-style-type: none"><li>• Chopped alarm sound</li></ul>
<b>Suppression of Warning Sounds in Preparation</b>	Some warning sounds can be suppressed during preparation. See instructions for use (chapter 4.3) for details.
<b>Automatic Reinfusion Start at Entering End of Treatment</b>	A window is automatically opened at the end of therapy. This window must be confirmed at the end of the therapy for the reinfusion of the blood.

## 4.7.1.20 DBI Parameters



DBI parameters can be set in the *Dialog Bedside-Link Interface DBI Parameters* menu.

1. Activate the System Configuration menu with the System Configuration key in menu Treatment Support. The following menu is opened and displayed (scroll with scroll bar).

The DBI menu is present and can be opened if DBI Nexadia was selected in the Production Report, Low Level Options. Various DBI parameters can be selected in the DBI Parameters menu.

#### Baud Rate (kBaud)

The default for the Baud rate is 38.4 kBaud.

#### Automatic User Logout Time (min)

An automatic user logout time can be set and activated. After the automatic logout the user has to log in again before he is able to confirm any messages, medications or checklist entries.

#### Message Warning Time (min)

A message warning time can be set and activated. Thereby it is possible to inform users of any unconfirmed messages, medications or checklist entries, before the end of a therapy.

#### Note:

**The data set must be set according to the support of the Nexadia software.**

**Data Set DBI 1.61** (applicable for Nexadia)

**Data Set DBI 1.72** (not applicable)

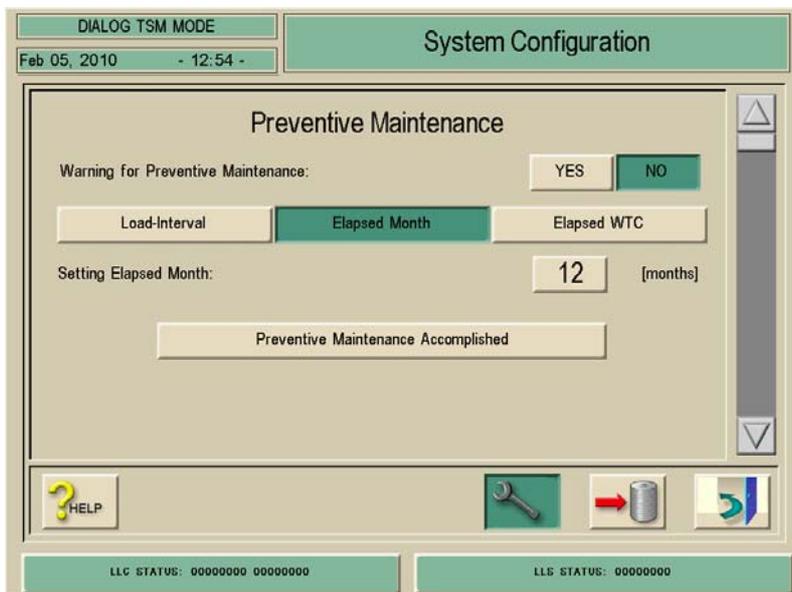
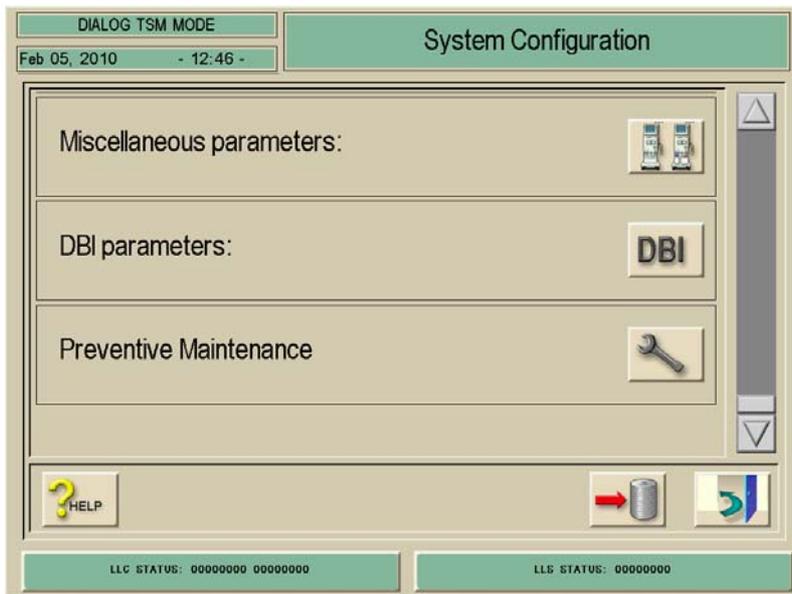
**Data Set DBI 2.00** (default)

**Data Set DBI 2.20** (not applicable)

**Data Set DBI 2.21**

The data set DBI 2.21 is required for the extension of the Nexadia functionality, e.g. support of the option bioLogic RR Comfort and Adimea; the mmol/l unit can be used. The Nexadia protocol must be supported by the host computer.

## 4.7.1.21 Preventive Maintenance



Preventive maintenance parameters can be set in the *Preventive Maintenance* menu.

1. Activate the System Configuration menu with the System Configuration key in menu Treatment Support. The following menu is opened and displayed (scroll with scroll bar).
2. Activate the *Preventive Maintenance* menu with the *Preventive Maintenance* icon. The following menu is displayed.

You can define an interval for a preventive maintenance PM. If this feature is selected (YES): the user is informed about the necessity of a preventive maintenance. A warning message is displayed in the transition phase end of treatment/start of disinfection. The message is displayed according to the following conditions:

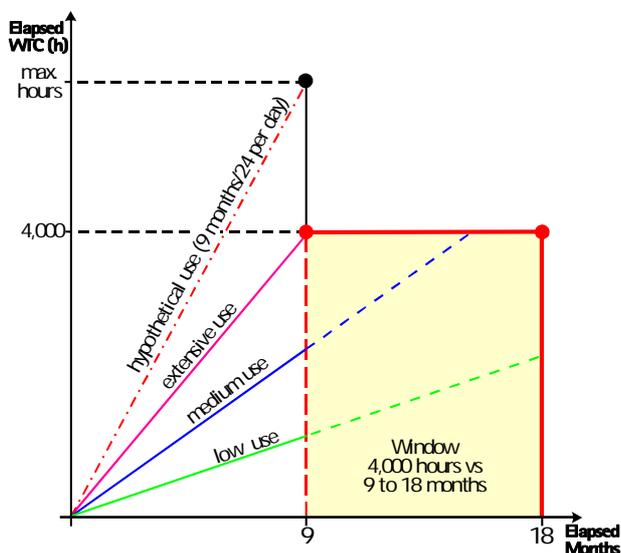
- once if status is  $\leq 5\%$  of set condition
- every time if set condition is expired

The following warning message is displayed:

*Preventive Maintenance Recommended  
The set preventive maintenance interval is expired.  
Please inform your service technician.*

One of three modes can be selected to calculate the next preventive service.

### Load-Interval



A warning message is enabled under the following defined conditions:

- YES is selected
- the user is never warned in the first 9 month period
- the user is always warned after a 18 month period
- the user is warned between a 9 to 18 month period if the working time is more than 4,000 hours after the last reset.

**Elapsed Months**

A warning message is enabled if *YES* is selected and the preselected period of months is expired.

**Note:** The manufacturer recommends an annual preventive maintenance and the replacement of the wear and tear parts from the preventive maintenance kit.

**Elapsed WTC  
(Working Time Counter)**

A warning message is enabled if *YES* is selected and the set working time is elapsed.

**Preventive Maintenance Accomplished**

Press the *Preventive Maintenance Accomplished* key and then the *Save* icon after the preventive maintenance was performed. Consequently a new preventive service period is started again after the machine is switched off and on.

## 4.7.2 Trends and Trend Groups



Six different trend groups can be selected for the treatment mode. Three treatment parameters can be configured individually for each group.

1. Activate the *Treatment Support* menu with the *Treatment Support* key in the *TSM Main Menu*. The following menu is opened.

The following settings can be selected:

- Cursor (left and right)
- Time display
- Selection of trend groups

**Cursor (left and right)**

The last treatment results can be displayed. You can shift the time base in one minute increments with the left or right cursor. The time is displayed in the *Time Display* window. A specific time can be selected in the graphics with the time base. Thus the corresponding events can be displayed.

**Time Display**

You can position the time base on a certain treatment time. The corresponding events can be displayed.

**Selection of Trend Groups**

You can select the *Trend Groups* menu. Six different graphic blocks can be selected. Three treatment parameters for each block can be configured individually.



2. Activate the *Trend and Trend Groups* menu with the *Trend and Trend Groups* key in the *Treatment Support* menu. The following menu is opened and displayed.

3. Activate the *Trend History* menu with the *Trend History* window.



Six trend groups are available. The trend group with the red arrow can be selected.

4. Activate the *Trend Groups* menu with the *Trend Groups* icon.



*Edit Key*

Three treatment parameters can be selected for one group from a parameter list.

5. Activate the *Edit* menu with the *Edit* icon.

6. The treatment parameters in the six trend groups can be modified.

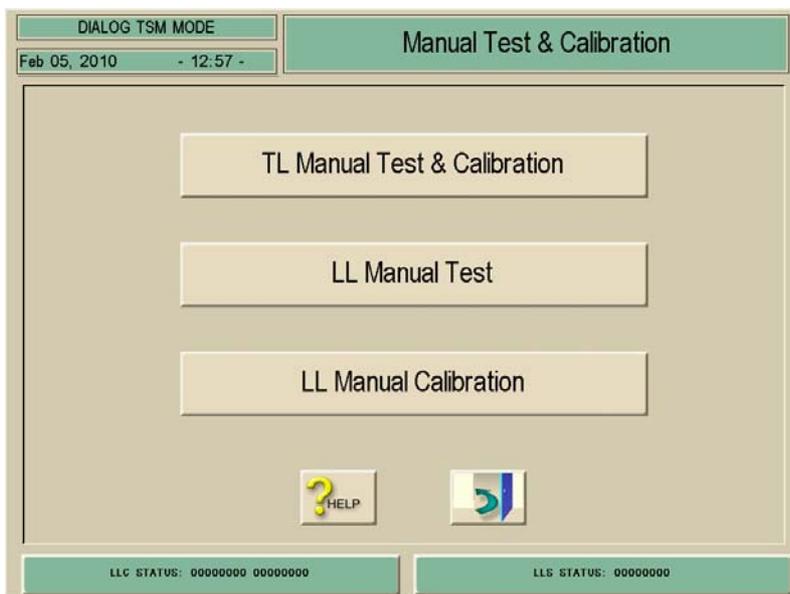
7. The default parameters can be reset with the *Set Defaults* window.

## 4.8 Manual Test and Calibration



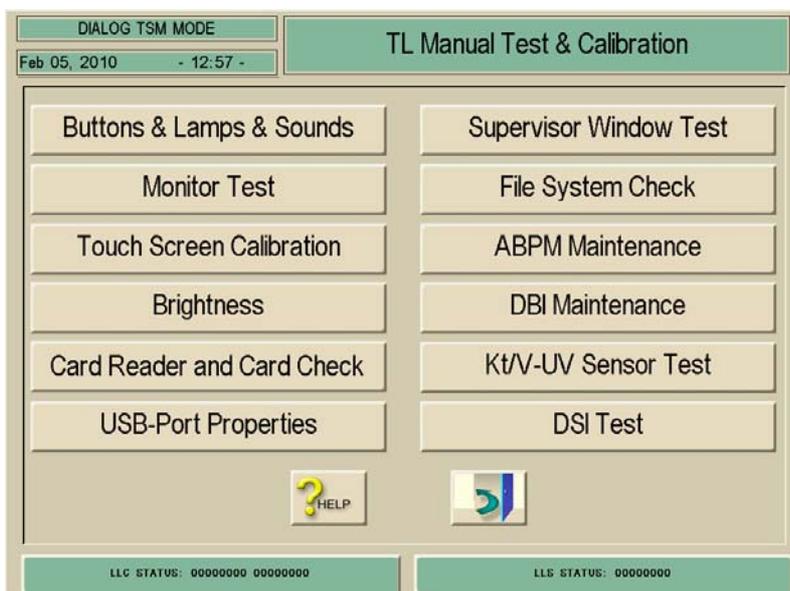
The menu contains test and calibration functions. The user can test all basic operations and calibrate components (e.g. sensors and pumps).

The *TSM Main Menu* appears after the machine is switched on.



1. Activate the *Manual Test and Calibration* menu with the *Manual Test and Calibration* key in the *TSM Main Menu*. The following menu is opened.

### 4.8.1 Top Level Manual Test and Calibration

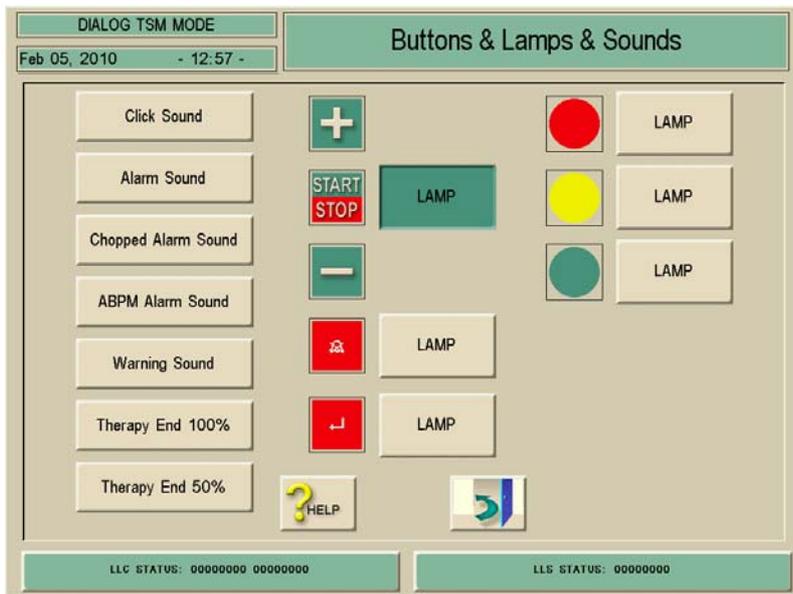


You can perform functional tests, a touch screen calibration, and the test of present options in the *Top Level Manual Test and Calibration* menu.

1. Activate the *TL Manual Test and Calibration* menu with the *TL Manual Test and Calibration* key.

- Buttons, Lamps and Sounds
- Monitor Test
- Touch Screen Calibration
- Brightness
- Card Reader and Card Check (Option Card Reader)
- USB Port Properties
- Supervisor Window Test
- File System Check
- ABPM Maintenance (Option ABPM)
- DBI Maintenance (Option Nexadia-BSL)
- Kt/V-UV Sensor Test (Option Adimea)
- DSI Test (Option Crit-Line)

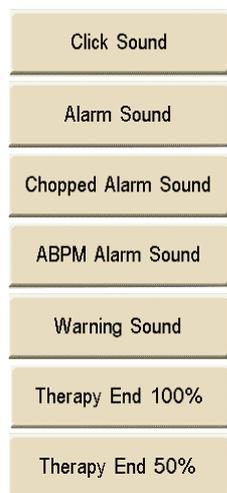
4.8.1.1 Buttons, Lamps and Sounds



1. Activate the *Buttons, Lamps and Sounds* menu with the *Buttons, Lamps and Sounds* key in the *TL Manual Test and Calibration* menu. The following menu is displayed.

In the *Buttons, Lamps and Sounds* menu the following functions can be tested:

- different sounds
- LEDs for  /  /  (on front panel board FPB)
- LEDs for signal lamps (on optical status display boards OSDs)



The *Click* sound can be checked.

The *Alarm* sound can be checked.

The *Chopped Alarm* sound can be checked.

The *ABPM Alarm* sound can be checked.

The *Warning* sound can be checked.

The *Therapy End 100 %* sound can be checked.

The *Therapy End 50 %* sound can be checked.



Check  key for blood pump.



Check  key/lamp for blood pump.



Check  key for blood pump.



Check alarm  (confirm) key and lamp (LED).



Check  (enter) key and lamp (LED).



Check red LED for signal lamp (on optical status display boards OSD).



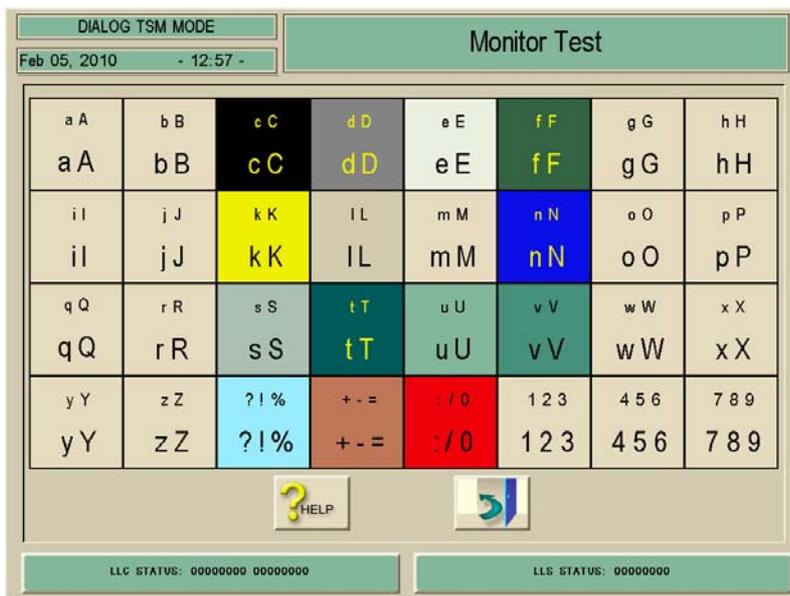
Check yellow LED for signal lamp (on optical status display boards OSD).



Check green LED for signal lamp (on optical status display boards OSD).

## 4.8.1.2 Monitor Test

A table appears with all colours. Every square contains an alphanumerical character with different character fonts. The brightness and the contrast of the monitor can be checked with this test image.



1. Activate the *Monitor Test* menu with the *Monitor Test* key in the *TL Manual Test and Calibration* menu. The following menu is displayed.

## 4.8.1.3 Touch Screen Calibration

The touch screen can be calibrated in the *Touch Screen Calibration* menu.

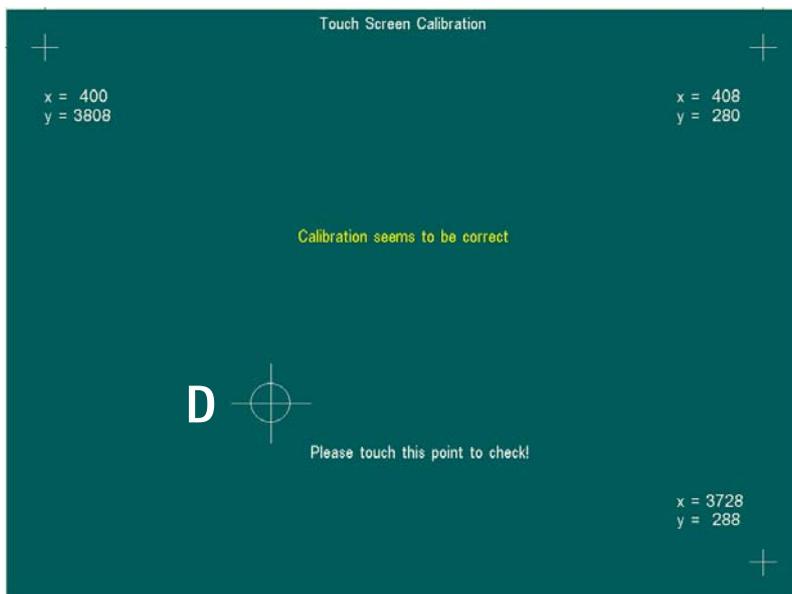


The active part of the touch screen is displayed in the figure. Four points are used (**A**, **B**, **C** and **D**) for the calibration. The touch area is defined by the calibration.

Tip on the cross wires to ensure an accurate setting during calibration.



1. Activate the *Touch Screen Calibration* menu with the *Touch Screen Calibration* key in the *TL Manual Test and Calibration* menu. The following menu is displayed.
2. Tip the cross wires **A** in the upper left corner. The first calibration point is defined.
3. Tip the cross wires **B**. The second calibration point is defined.
4. Tip the cross wires **C**. The third calibration point is defined.



The following message is displayed:  
*Calibration seems to be correct!*

5. Tip the cross wires **D** to check the calibration. The following message is displayed if the calibration was successful:  
*Calibration OK*  
The calibration data is stored. The *TL Manual Test and Calibration* menu is automatically displayed again.
6. Switch the Dialog+ off and on again. The new calibration data are loaded for the touch screen.
7. Check the touch screen.

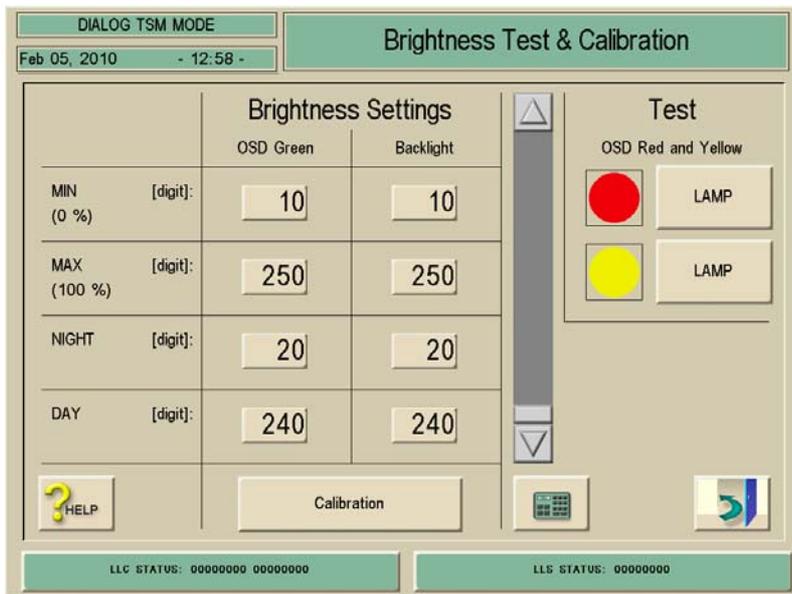
## Download Default Setting



If the touch screen is out of function (e.g. after a faulty calibration) the default setting for the touch screen can be downloaded.

1. Press the  key of the blood pump (on the keyboard membrane of the TFT housing) three times in the *TSM Main Menu*.
2. Switch machine off and on again. The old default setting is loaded.

## 4.8.1.4 Brightness Calibration



Parameters can be set and tests can be performed in the *Brightness and Test Calibration* menu.

1. Activate the *Brightness* menu with the *Brightness* key in the *TL Manual Test and Calibration* menu. The following menu is displayed.

If a button was pressed the field remains highlighted.

If a value is changed the *Calibration* button must be pressed to take over the new value.

If a *MIN* or *MAX* value was set the minimum and/or maximum limits for *NIGHT/DAY* are adapted.

### Brightness Settings

#### OSD Green Parameter (for green LED)

##### MIN (0%)

The minimum brightness (digits) for the green LEDs on the optical status display OSD boards can be set.

##### MAX (100%)

The maximum brightness (digits) for the green LEDs on the optical status display OSD boards can be set.

##### NIGHT

The night brightness (digits) for the green LEDs on the optical status display OSD boards can be set.

##### DAY

The day brightness (digits) for the green LEDs on the optical status display OSD boards can be set.

#### Backlight Parameter

##### MIN (0%)

The minimum brightness (digits) for the backlight can be set.

##### MAX (100%)

The maximum brightness (digits) for the backlight can be set.

##### NIGHT

The night brightness (digits) for the backlight set.

##### DAY

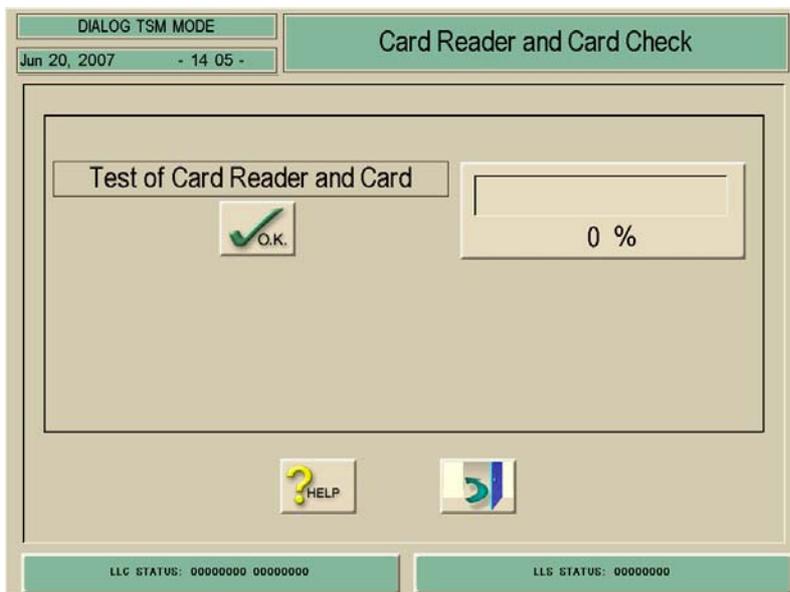
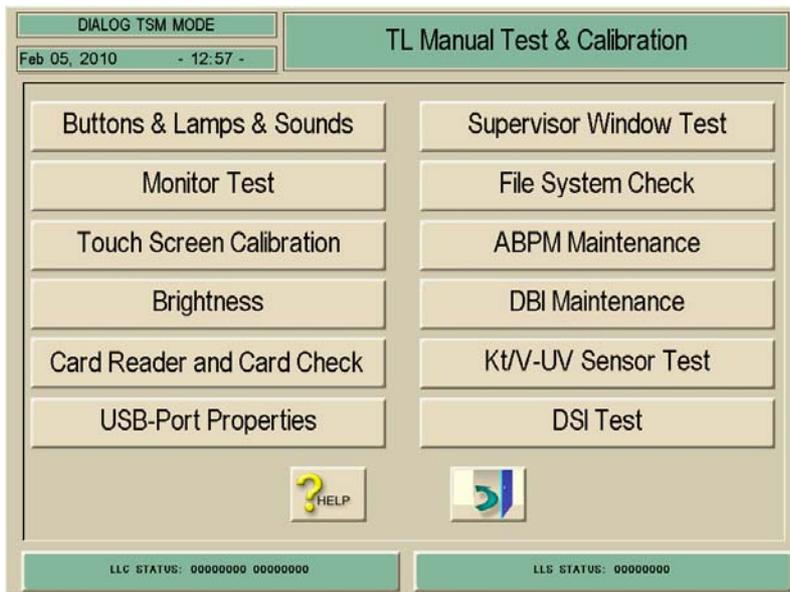
The day brightness (digits) for the backlight set.

#### Test

##### OSD Red and Yellow (for Signal Lamps)

The red and yellow LED of the optical status display OSD can be checked, i.e. switched ON and OFF.

## 4.8.1.5 Card Reader and Card Check



The card reader and the card can be checked in the *Card Reader and Card Check* menu.

The *Card Reader and Card Check* key is displayed in this menu if the card reader is present in the machine and the option was selected/activated in the *Production Report* menu.

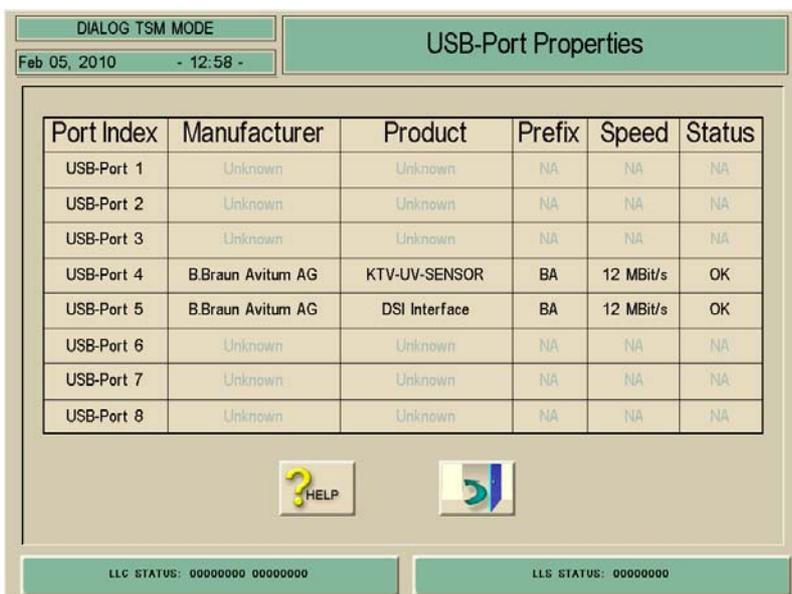
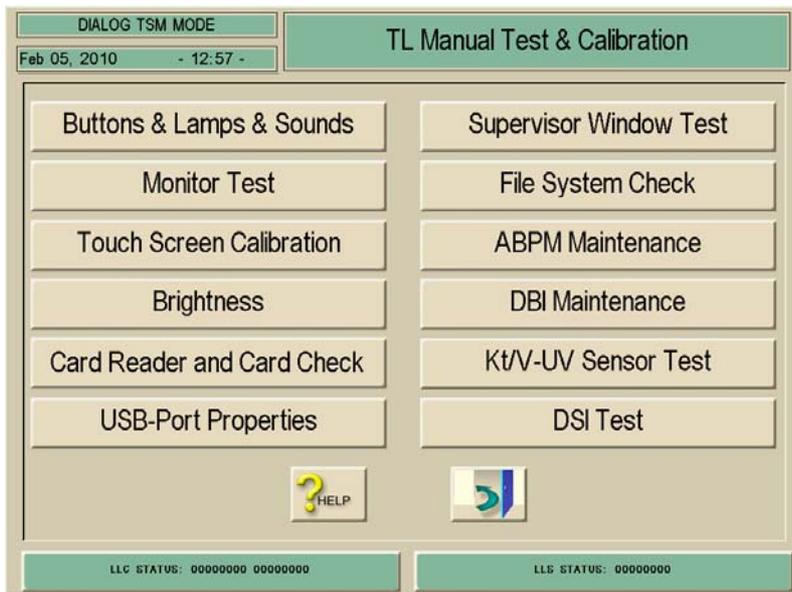
1. Activate the *Card Reader and Card Check* menu with the *Card Reader and Card Check* key in the *TL Manual Test and Calibration* menu. The following menu is displayed.

Both card reader and chip card can be checked if a chip card is inserted in the card reader and the test is started with the OK key. The chip card must be inserted with the contacts facing upwards.

**Note**

- Use an empty service chip card (art. no. 7703856) for the test and not a patient chip card.
- Do not remove the chip card from the card reader during the test.

## 4.8.1.6 USB-Port Properties



All devices connected to the motherboard can be checked in the *USB Port Properties* menu.

All devices connected to the USB ports of the motherboard are displayed in a table if the *USB Port Properties* key is pressed in the *TL Manual Test and Calibration* menu. There are two different tables depending on the type of motherboard connected.

1. Activate the *USB Port Properties* menu with the *USB Port Properties* key in the *TL Manual Test and Calibration* menu. The following menu is displayed.

#### Motherboard on Top Level Sub-Rack

The table displays all USB ports available on the motherboard with the corresponding USB port properties.

#### Port Index

The USB ports (1 through 8) on the motherboard.

- Ports 1 through 3 are internally assigned and can not be used for options
- Ports 4 through 8 can be chosen freely for options that are connected to a USB port

#### Manufacturer

The name of the USB device manufacturer.

#### Product

The name of the USB device product.

#### Prefix

The first two characters of the serial number of the USB device.

#### Speed

The maximum speed of the USB port.

#### Status

*OK*

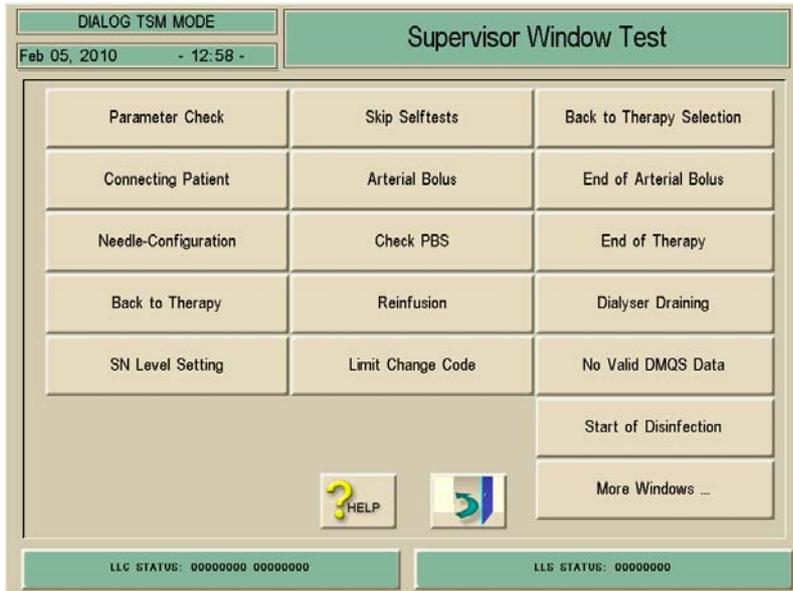
The connected USB device is in the valid USB device list.

*Not OK*

The connected USB device is not in the valid USB device list.

## 4.7.1.7 Supervisor Window Test

The position and data of the selected supervisor window is displayed. You can close the window with the *Cancel* key.



1. Activate the *Supervisor Window Test* menu with the *Supervisor Window Test* key in the *TL Manual Test and Calibration* menu. The following menu is displayed.

The following supervisor windows can be checked:

- Parameter Check
- Connecting Patient
- Needle Configuration
- Back to Therapy
- SN Level Setting
- Skip Self Tests
- Arterial Bolus
- Check PBS
- Reinfusion
- Limit Change Code
- Back to Therapy Selection
- End of Arterial Bolus
- End of Therapy
- Dialyser Draining
- No Valid DMQS Data
- Start of Disinfection

More Windows ...:

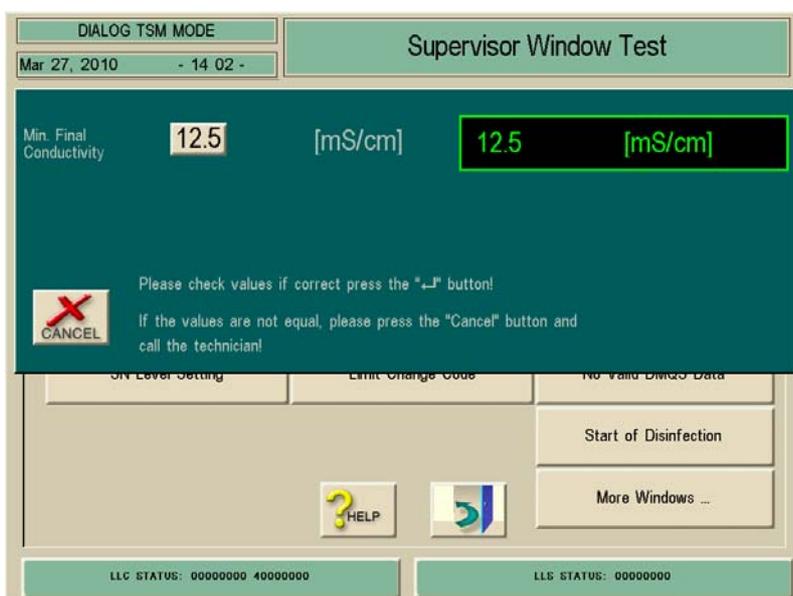
- Multi Window
- UF Volume and Max. UF Rate
- Multi Window MW with Substitution Volume
- Multi Window MW with Single Needle
- Min. Max. Final Conductivity

A parameter check is displayed as an example.

The supervisor window for the *Min. Max. Final Conductivity* is displayed. You

can either close the supervisor window with the  key or select and acknowledge the single parameters and close the supervisor window with the

 key.



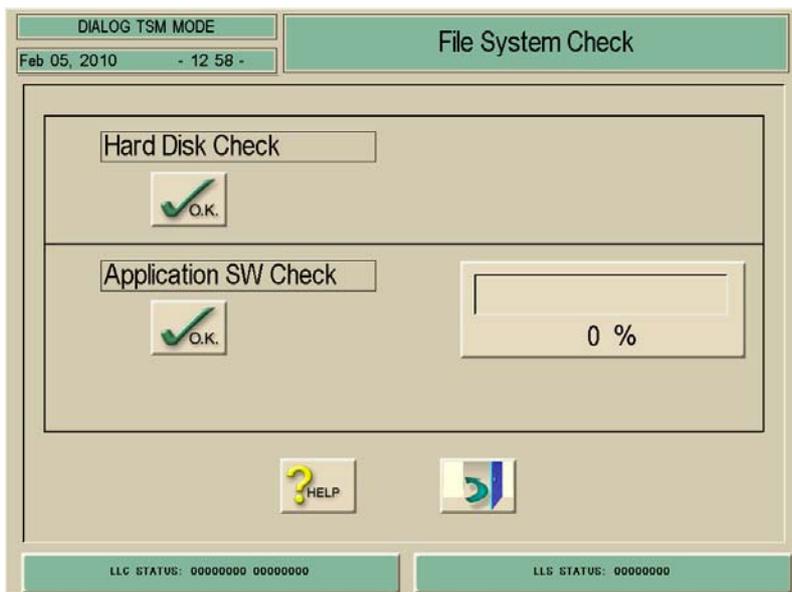
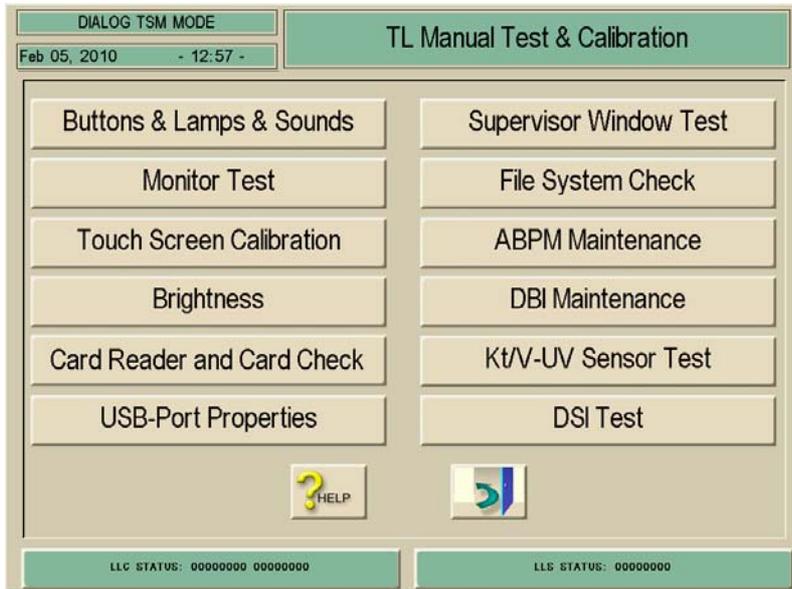
2. Activate the *Parameter Check* window with the *Parameter Check* key. The following menu is displayed.

3. Press the  key to close the supervisor window.

or

Press the  key to select and acknowledge the single parameters and close the supervisor window.

## 4.7.1.8 File System Check



Press the  key to start the check of the Dialog file system. This function reads all executable files and creates a check value. If it does not equal with the original check value a warning message is displayed.

1. Activate the *Test System Check* menu with the *Test System Check* key in the *TL Manual Test and Calibration* menu. The following menu is displayed.

2. Press the  key of the *Hard Disk Check* (for the compact flash card) to test the hard disk drive.

or

Press the  key of the *Application SW Check* to test the application software.

## 4.8.1.9 ABPM Maintenance

DIALOG TSM MODE		ABPM Maintenance	
Feb 05, 2010 - 12:58 -			
FW version:	PAR4.00 07/10/11		
SW version:	\$Revision: SYS - ABPM -- ABPM - V0.00 Exp \$		
1: Inflation Time [s]:	[0-250 mmHg] 0.0	[0-300 mmHg] 0.0	
2: Air Leakage [mmHg]:	Initial pr. 0	Final pr. 0	Leakage 0
<div style="display: flex; justify-content: space-around; margin-top: 20px;"> <span>p Test</span> <span>Test 1</span> <span>Test 2</span> </div>			
LLS STATUS: 00000000 00000000		LLS STATUS: 00000000	

1. Activate the *ABPM Maintenance* menu with the *ABPM Maintenance* key in the *TL Manual Test and Calibration* menu. The following menu is displayed.

The *ABPM Maintenance* menu is used for the function test of the Dialog automatic blood pressure measurement ABPM option. The cuff is replaced by a 500 ml measurement chamber.

The following functions can be tested:

- P Test Pressure Comparison Test
- Test 1 Inflation Time
- Test 2 Air Leakage

See chapter 5 technical safety inspection and preventive maintenance: inspection protocol for the automatic blood pressure measurement ABPM and the execution procedure for the measurement inspection.

## Pressure Comparison Test



The *P Test* key activates and deactivates the pressure comparison test of the ABPM. The *P Test* is used to compare the pressure value of the pressure sensor with a reference instrument. A reference instrument (accuracy  $\leq \pm 0.5$  mmHg) is required for the comparison test of the pressure sensor.

## Inflation Time [s]



The *Test 1* key activates and deactivates the inflation time. Thus the inflation time of the pump is tested up to 300 mmHg, i.e.:

- 0 - 250 mmHg
- 0 - 300 mmHg

1: Inflation Time [s]:	[0-250 mmHg] 0.0	[0-300 mmHg] 0.0
------------------------	---------------------	---------------------

The measurement chamber is connected to the ABPM system via the pressure tubing. A pressure is built up to 300 mmHg.

## Air Leakage [mmHg]

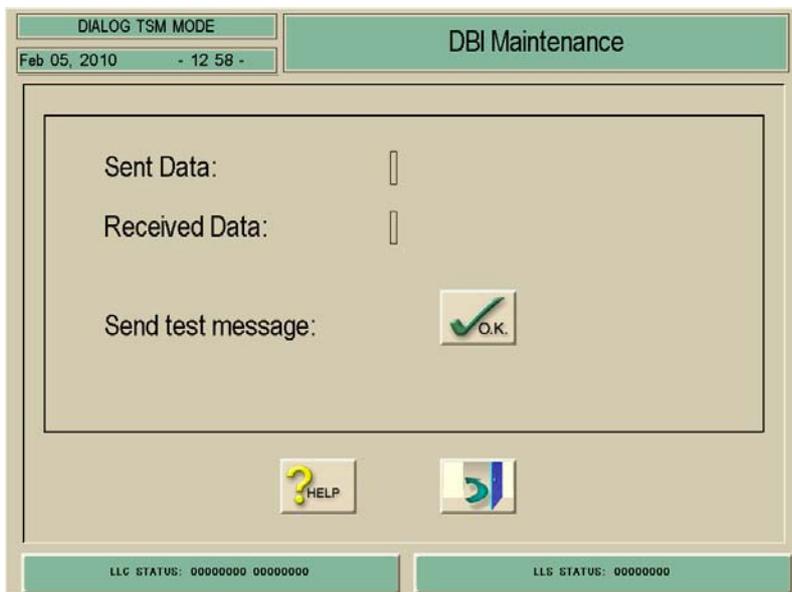
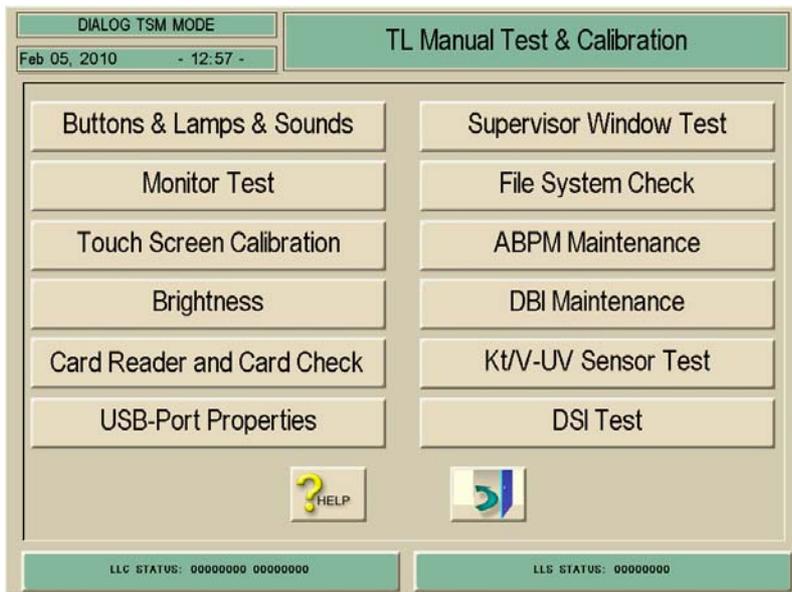


The *Test 4* key activates and deactivates the air leakage test (3 minutes). Thus the pneumatic integrity of the ABPM system is tested.

2: Air Leakage [mmHg]:	Initial pr. 0	Final pr. 0	Leakage 0
------------------------	------------------	----------------	--------------

The measurement chamber is connected to the ABPM system via the pressure tubing. A pressure is built up to 300 mmHg and is held for 3 minutes.

## 4.8.1.10 DBI Maintenance



If the DBI option (for Nexadia/WAN-BSL (Bedside Link) Network) was selected in the menu *Production Report/Low Level Options* the *Dialog Bedside-Link Interface DBI Maintenance* button is displayed.

The RS 232 port (COM1) on the motherboard can be tested (*Sent Data* and *Received Data*) in the *DBI Maintenance* menu. A test plug **A** (art. no. 7703473) is required to perform the DBI test.

1. Connect the test plug **A** to the RS 232 port (COM1) on the motherboard.
2. Switch on machine.
3. Open the *DBI Maintenance* menu with the *DBI Maintenance* key in the *TL Manual Test and Calibration* menu. The following menu is displayed.

4. Press the  key to start test.

**Note:** The DBI test can be repeated by

pressing the  key. If the DBI test is repeated the sent data pattern is different ( $\neq 1234567890$ ).

**Sent Data**

The sent data are displayed.

**Received Data**

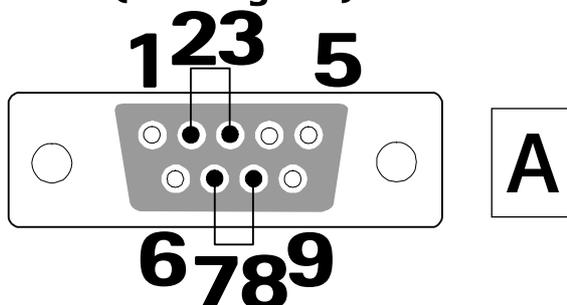
The received data are displayed.

**Comparison of Data**

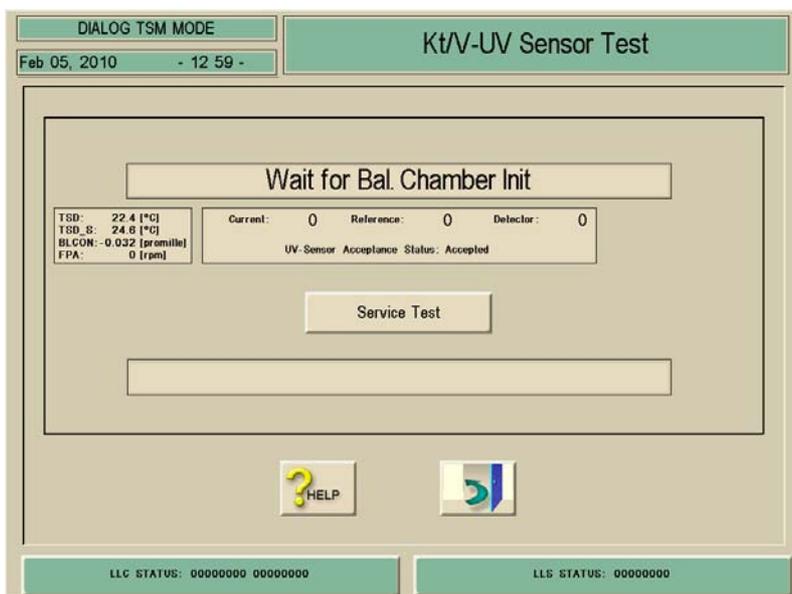
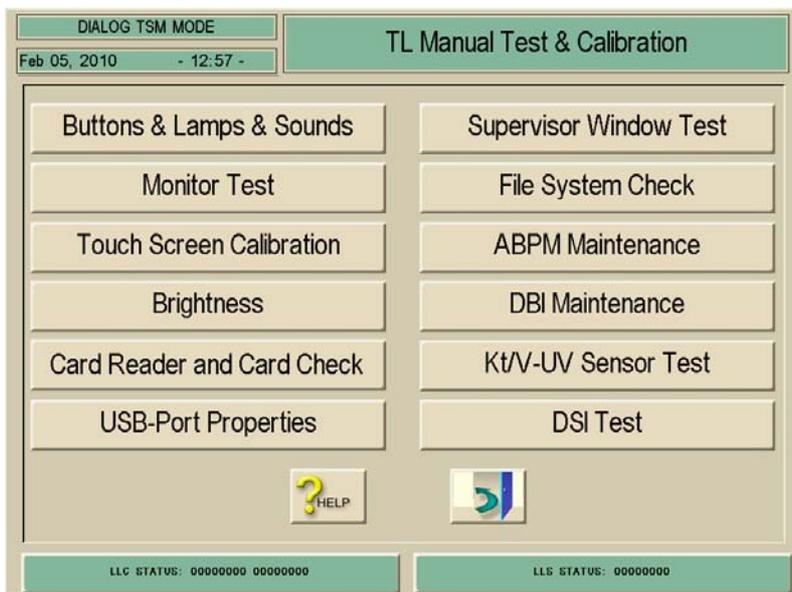
If the *Sent Data* and *Received Data* are identical, the test was successful.

5. Switch off machine after successful test.
6. Remove the test plug from the RS 232 port.

### Pin Assignment RS 232 Test Plug (Soldering Side)



## 4.8.1.11 Kt/V-UV Sensor Test



The Kt/V-UV sensor (option Adimea) can be checked and tested in the *Kt/V-UV Sensor Test* menu.

The *Kt/V-UV Sensor Test* key is displayed in this menu if the Kt/V-UV sensor is present in the machine and the option was selected/activated in the *Production Report* menu.

1. Activate the *Kt/V-UV Sensor Test* menu with the *Kt/V-UV Sensor Test* key in the *TL Manual Test and Calibration* menu. The following menu is displayed.

#### Kt/V-UV Sensor Test

The Kt/V-UV sensor can be tested in the Kt/V-UV Sensor Test menu.

The machine is prepared for the test after pressing the Kt/V-UV Sensor Test key. The following test steps are performed:

- Sensor Init
- TSD Sensor Calibration Check
- Wait for Bal. Chamber Init
- Balance Chamber Init
- Rinsing
- Temperature Check
- Bubble Free Check
- Stopping Dialysate Flow
- **Ready for Test**

#### Ready for Test

If the test was successful, *Ready for Test* is displayed.

#### Service Test

Press Service Test to start the test for the UV sensor. The single test steps are displayed in a window. The following test steps are performed:

- Checking Acceptance Status
- Cold sensor - <n>\*
- System Identification (100%) - <n>\*
- System Identification (75%) - <n>\*
- Calibration - <n>\*

(\* number of measurement cycles are indicated with <n>)

#### Test OK

*Test OK* is displayed if the test was successful.

#### Required Current

The LED requires a certain current for optimal working conditions. This current is automatically adapted to the LED. The current is displayed as digit value together with the corresponding reserve digits (residual digits). This value must be ≤4000 digits (maximum service life).

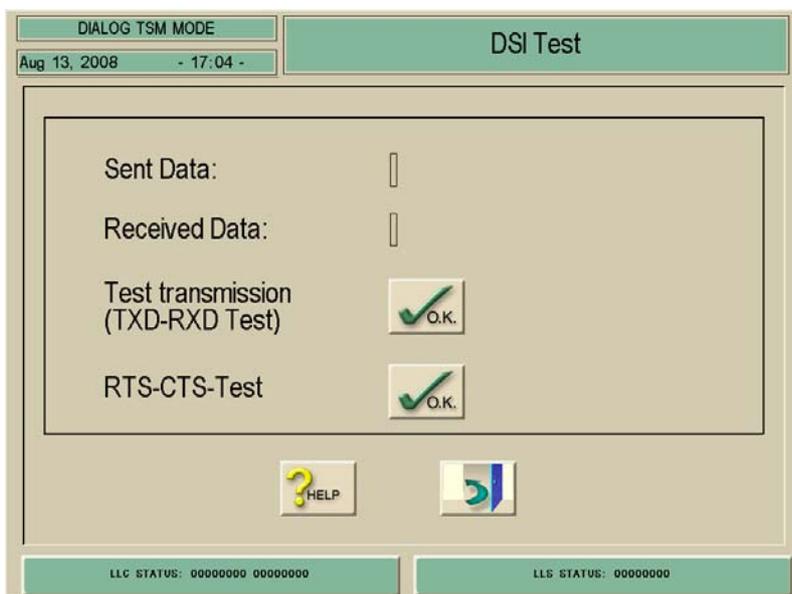
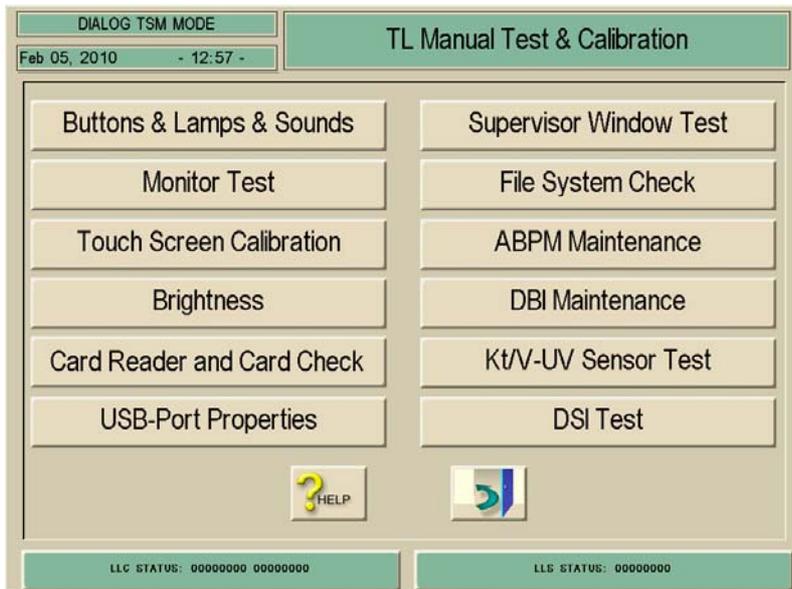
#### Example:

Required current: 1332 (digit)

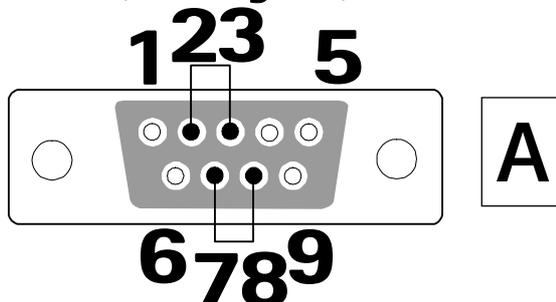
Reserve: 2668 (digit)

Total digits: 4000

## 4.8.1.12 Dialog Serial Interface DSI Test



### Pin Assignment RS 232 Test Plug (Soldering Side)



If the Crit-Line option (HCT) was selected in the menu *Production Report* and a DSI was detected at a USB port of the motherboard, the *Dialog Serial Interface DSI Test* button is displayed.

The DSI interface (RS 232) can be tested (*Sent Data* and *Received Data*) in the *DSI Test* menu. A test plug **A** (art. no. 7703473) is required to perform the DSI test.

#### Note

**The DSI test can be performed correctly only if a test plug is connected to the DSI interface (RS 232).**

1. Connect test plug **A** to the RS 232 socket of the DSI.
2. Switch on machine.
3. Activate the *DSI Test* menu with the *Dialog Serial Interface DSI* key in the *TL Manual Test and Calibration* menu. The following menu is displayed.

**Note:** The DSI test can be repeated by

pressing the  key. If the DBI test is repeated the sent data pattern is different ( $\neq 1234567890$ ).

#### Test Transmission (TXD-RXD Test)

(Transmit eXchange Data-Received eXchange Data)

The TXD-RXD test can be performed with the OK key. The sent data and the received data must match.

4. Press the  key to start *TXD-RXD Test*.

If the *Sent Data* and *Received Data* are identical, the test was successful.

#### RTS-CTS Test

(Request to Send - Clear to Send)

The RTS-CTS test can be performed with the OK key. The sent data and the received data must match.

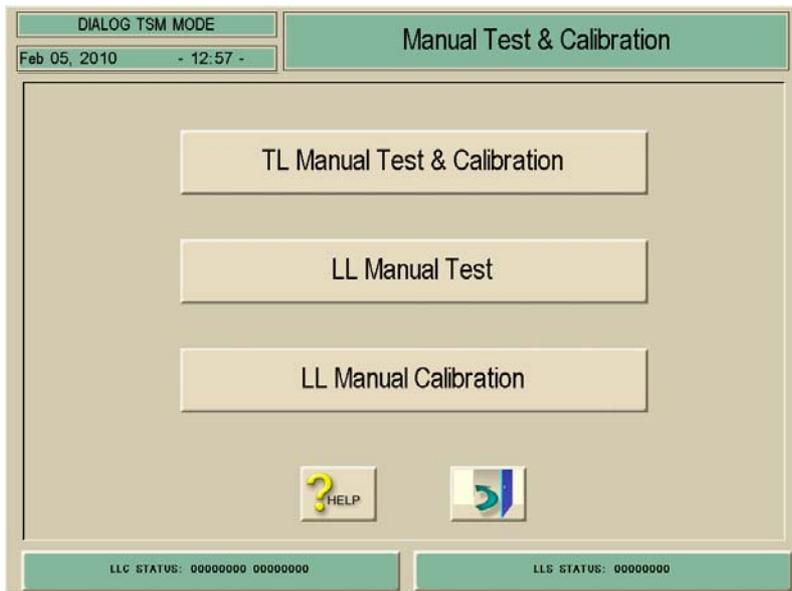
5. Press the  key to start *RTS-CTS Test*.

If the *Sent Data* and *Received Data* are identical, the test was successful.

6. Switch off machine after successful test.
7. Remove the test plug from the DSI interface.

## 4.8.2 Low Level Manual Test

You can test the function of the low level controller LLC sensors, pumps and valves. You can select a test menu and check a single (or where applicable combined) sensor, pump and valve. The components are displayed in graphics (position and corresponding value is displayed). Additionally you can directly skip to the *Low Level Calibration* menu with a *Calibration* key.



1. Activate the *Manual Test and Calibration* menu with the *Manual Test and Calibration* key in the *TSM Main Menu*. The following menu is displayed.
2. Activate the *LL Manual Test* menu with the *LL Manual Test* key in the *Manual Test and Calibration* menu. The following menu is displayed (if necessary use scroll bar).

The following tests can be selected:

- 1.1 Staff Call, Alarms, Power off
- 1.2 Blood Pump Arterial
- 1.3 Blood Pump Venous
- 1.4 Heparin Pump
- 1.5 Tubing Clamps
- 1.6 Pressure Sensors (Blood Side)
- 1.7 Air Sensor, Red Sensor
- 1.8 Coupling Detectors
- 1.9 Water Intake, Upline Tank and Flow Pump FPE
- 1.10 Degassing and Heating
- 1.11 Dialysis Temperature
- 1.12 Concentrate Pumps and Conductivity
- 1.13 Balance Chamber Valves
- 1.14 Bypass and Disinfection Valves
- 1.15 Flow Pump FPA, Balance Chamber and Air Separator
- 1.16 Pressure Water Part
- 1.17 UF Pump
- 1.18 Blood Leak
- 1.19 Leak Test
- 1.20 Water Part (Overview)
- 1.21 Emptying
- 1.22 HDF
- 1.23 BIC Cartridge Valve and Coupling Detectors
- 1.24 HDF Online
- 1.25 HDF Online Valves and Coupling Detectors
- 1.26 Option Battery
- 1.27 DFS Pressure Test of Therapy
- 1.28 Front Panel Board FPB (LLS)
- 1.29 Patient Leakage Current
- 1.30 SMPS-MC Self Tests
- 1.31 Level Regulation

## Function of the Software Keys and Icons

The function of the software keys and icons are as follows:



Press the *HELP* key to see the help information of the menu.



The menu can be closed with the *Exit Door* key.

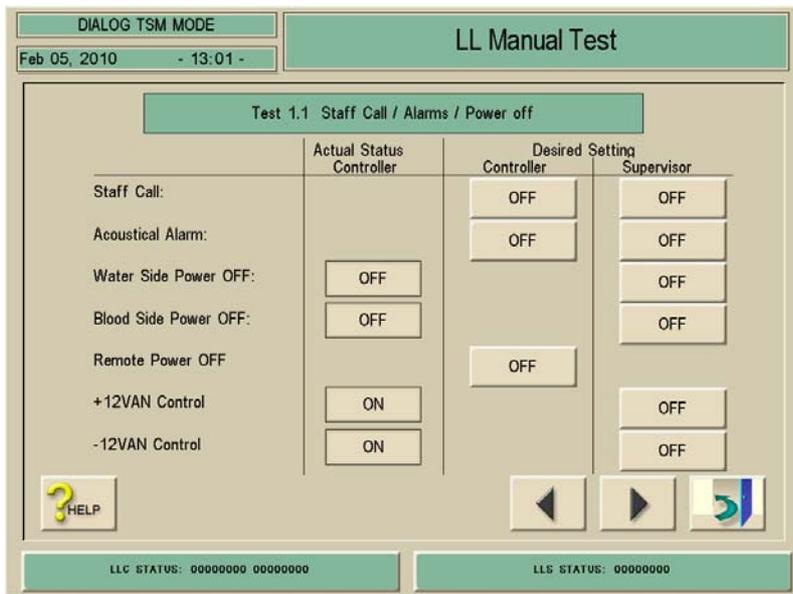


If required, the previous menu or the next menu can be selected with the *Previous* and *Next Arrow* keys.



If required, a corresponding calibration menu can be selected in certain *LL Manual Test* menus. The calibration procedures are described in paragraph 4.8.3 *Low Level Manual Calibration*.

4.8.2.1 Test 1.1 Staff Call, Alarms, Power Off



1. Activate the *Staff Call/Alarms/Power Off* menu with the *Staff Call/Alarms/Power Off* key in the *LL Manual Test* menu. The following menu is displayed.
2. Check the functions with the appropriate keys.
  - Staff Call/
  - Acoustical Alarm
  - Water Side Power OFF
  - Blood Side Power OFF
  - Remote Power OFF
  - +12 VAN Control
  - -12 VAN Control

**Staff Call/Acoustical Alarm**

The staff call can be activated with the *PRUF/PRUF-S* signal and the acoustical alarm can be switched separately with the *ACAL/ACAL-S* signal by the controller and supervisor.

**Water Side Power OFF**

The low level supervisor can test the power off for the 24 V supply voltage with the *D24OFF-S* signal for the dialysate side power off. The feedback to the controller (ON/OFF) shows whether the voltage was switched.

**Blood Side Power OFF**

The low level supervisor can test the power off for the 24 V supply voltage with the *B24OFF-S* signal for the blood side power off. The feedback to the controller (ON/OFF) shows whether the voltage was switched.

**Remote Power OFF**

The REMOTE signal for the remote power off can be activated by the controller. The machine is switched off by the internal real time clock RTC. The machine is switched on again after the shortest time period (approx. 64 s) has expired. The machine can be switched on immediately, if the machine is switched off and on again.

**±12 VAN Control**

The digital board has an integrated voltage monitoring for the analog ±12 VAN from the SMPS-MC. A self test for the ±12 VAN is performed during preparation. The ±12 VAN voltages are detuned during the test.

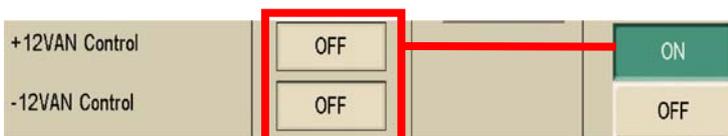
**Supervisor OFF**

±12 VAN for the controller are ON, i.e. voltages are present.

ON = Voltage OK

**+12 VAN Control / Supervisor ON**

ON = Test activated

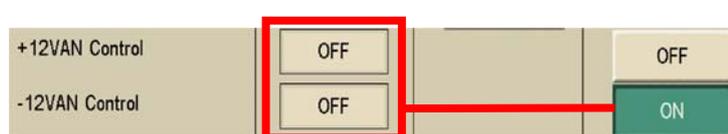


**±12 VAN Test:**

- +12 VAN > 13 V
- -12 VAN > -11 V

**-12 VAN Control / Supervisor ON**

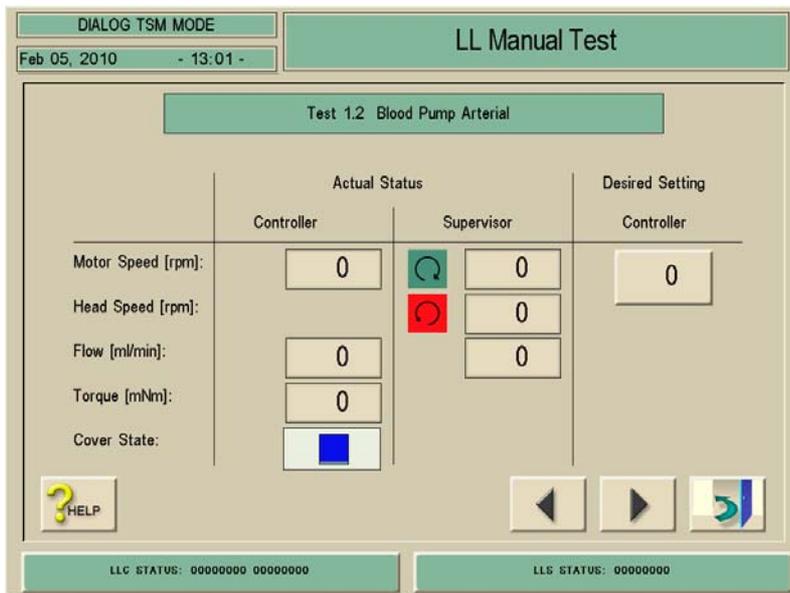
ON = Test activated



**±12 VAN Test:**

- +12 VAN < 11 V
- -12 VAN < -13 V

## 4.8.2.2 Test 1.2 Blood Pump Arterial



1. Activate the *Blood Pump Arterial* menu with the *Blood Pump Arterial* key in the *LL Manual Test* menu. The following menu is displayed.

2. Check the functions with the appropriate keys.

- Motor Speed
- Head Speed
- Flow
- Torque
- Cover State

**Motor Speed**

The motor speed is displayed by the controller and supervisor. The direction of rotation is displayed by a direction of rotation symbol:



Green: Correct direction of rotation



Red: Reverse direction of rotation

**Head Speed**

The head speed is displayed by the supervisor. The direction of rotation for the roller is displayed by a direction of rotation symbol:



Green: Correct direction of rotation



Red: Reverse direction of rotation

**Flow**

The controller and supervisor display the calculated flow rate, based on the pump speed and the tube constant.

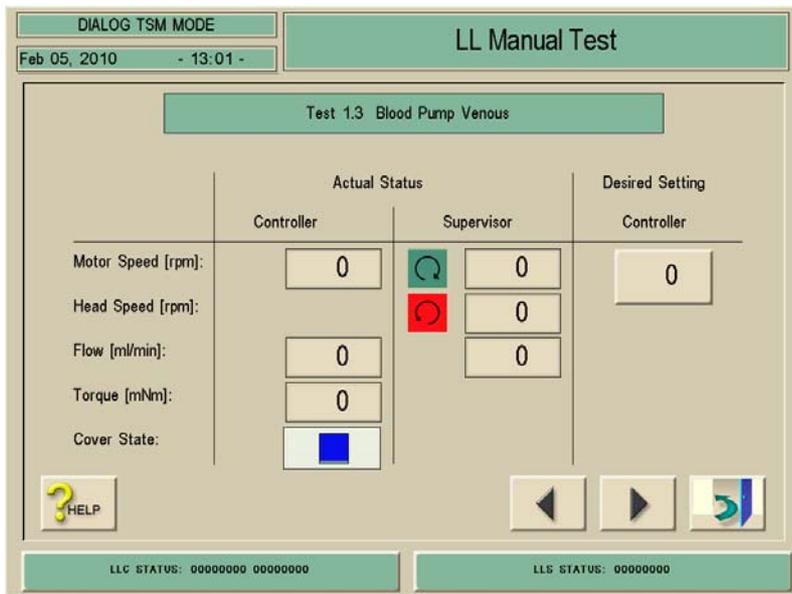
**Torque**

The motor torque is displayed by the controller.

**Cover State**

If the pump cover is opened the blood pump **BPA** is stopped. The controller detects and displays the opened pump cover.

## 4.8.2.3 Test 1.3 Blood Pump Venous



1. Activate the *Blood Pump Venous* menu with the *Blood Pump Venous* key in the *LL Manual Test* menu. The following menu is displayed.
2. Check the functions with the appropriate keys.

**Motor Speed**

The motor speed is displayed by the supervisor. The direction of rotation is displayed by a direction of rotation symbol:



Green: Correct direction of rotation



Red: Reverse direction of rotation

**Head Speed**

The head speed is displayed by the supervisor. The direction of rotation for the roller is displayed by a direction of rotation symbol:



Green: Correct direction of rotation



Red: Reverse direction of rotation

**Flow**

The controller and supervisor display the calculated flow rate, based on the pump speed and the tube constant.

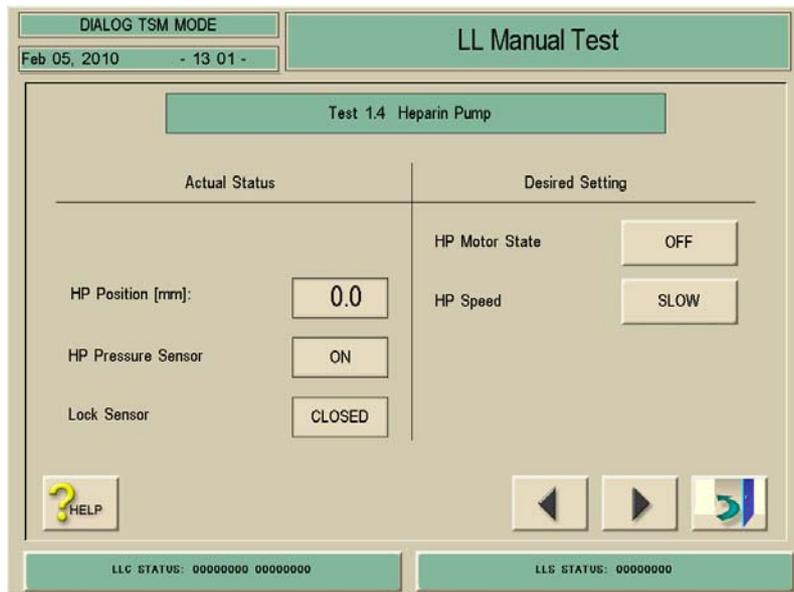
**Torque**

The motor torque is displayed by the controller.

**Cover State**

If the pump cover is opened the blood pump **BPV**/substitution pump is stopped immediately. The controller detects and displays the opened pump cover.

## 4.8.2.4 Test 1.4 Heparin Pump



1. Activate the *Heparin Pump* menu with the *Heparin Pump* key in the *LL Manual Test* menu. The following menu is displayed for the heparin pump Compact.
2. Check the functions with the appropriate keys.

**HP Position**

The forward feed distance is displayed in mm (only if the syringe is inserted and locked). The counter is reset if the lock sensor is opened. The distance is detected from the signal of the light barrier on the motor axle.

**HP Syringe Sensor**

The sensor for the sensor plate of the syringe detects an inserted syringe.

**Lock Sensor**

Sensor to open the clasp nut.  
(The clasp nut is assembled on the drive spindle and limits the max. pressure load of the heparin pump).

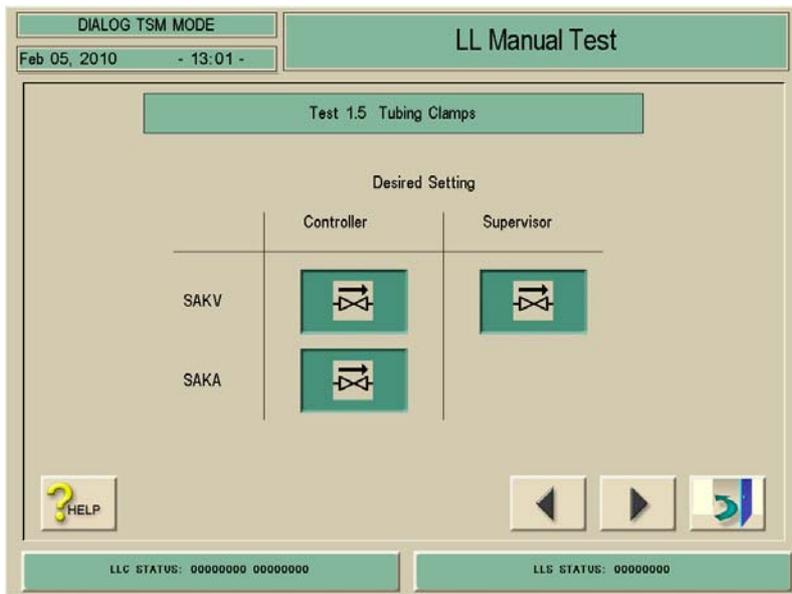
**HP Motor State**

Activates/switches off the heparin pump.

**HP Speed**

Selection between slow and fast forward feed.

## 4.8.2.5 Test 1.5 Tubing Clamps



1. Activate the *Tubing Clamps* menu with the *Tubing Clamps* key in the *LL Manual Test* menu. The following menu is displayed.
2. Check the functions with the appropriate keys.

**Tubing Clamps  
SAKV and SAKA**

The venous tubing clamp **SAKV** and arterial tubing clamp **SAKA** can be closed and opened. Thereby the switch function and leakage test (pressure - clamp gap, time) can be tested.

The closed clamp gap is set to 1.4 mm + 0.1 mm.

## 4.8.2.6 Test 1.6 Pressure Sensors (Blood Side)

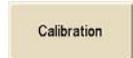
		Actual Status		Desired Setting	
		Controller	Supervisor		
PPR				Pressure negative	Pressure positive
PA	[mmHg]:	-16	-17		
PV	[mmHg]:	58	59		
PBE	[mmHg]:	60	59		
PBS	[mmHg]:	58	58		

LLC STATUS: 00000000 00000000      LLS STATUS: 00000000

1. Activate the *Pressure Sensors (Blood Side)* menu with the *Pressure Sensors (Blood Side)* key in the *LL Manual Test* menu. The following menu is displayed.
2. Check the functions with the appropriate keys.



You can skip directly to the calibration of the sensors by pressing the



key.

#### Level Regulation Pump LRP (PPR)



The pressure for the pressure sensors can be set with the *Pressure Negative* and *Pressure Positive* keys. The pressures are increased or decreased via the level regulation pump (diaphragm pump).

#### Pressure Sensors

The pressure sensors **PA**, **PV** and **PBE** are displayed.

#### PBS Value

##### Machine with Single Pump

The value for PBS is 0.

##### Machine with Double

*Double Pump* must be activated in *Production Report, Low Level Options*. A value for PBS is displayed.

## 4.8.2.7 Test 1.7 Air Sensor SAD, Red Sensor

	Actual Status		Desired Setting
	Controller	Supervisor	
SAD LEVEL	15	1.11 [V]	15
SAD TRIGGER OFF			ON
SAD TimeContr.		OFF	
SAD TEST	AIR	AIR	OFF
RDV	NO BLOOD	NO BLOOD	

LLC STATUS: 00000000 00000000      LLS STATUS: 00000000

1. Activate the *Air Sensor, Red Sensor* menu with the *Air Sensor, Red Sensor* key in the *LL Manual Test* menu. The following menu is displayed.
2. Check the functions with the appropriate keys.



You can skip directly to the calibration of the safety air detector **SAD** by pressing the  key.

**SAD Level**

The calibration level (example KS = 48) on the SAD is entered for the SAD (version 2) with a fixed alarm level. The alarm level is automatically set to 15 digits after the calibration value is entered. The test level is calculated by adding 5 digits to the calibration level (test level = KS + 5 digits). You can find the detailed description and procedure for the calibration of the SAD version 2 in the menu: *LL Manual Calibration, Calibration 2.9 Safety Air Detector SAD*.

**SAD Trigger OFF**

The cyclic measurement of the controller can be checked with the *SAD TRIGGER OFF* key.

**SAD Time Control**

The cyclic measurement is checked by the controller and must be detected by the supervisor with the *SAD Time Contr.*

**SAD Test**

Activate the internal test of the safety air detector **SAD** with the *SAD TEST* key (the switch level is automatically increased). The sensitivity can be changed to check the switching point.

**AIR**

**A tubing filled with air is inserted in the SAD**

If the *SAD TEST*  is activated *AIR* must be detected.

**NO AIR**

**A tubing filled with fluid is inserted in the SAD**

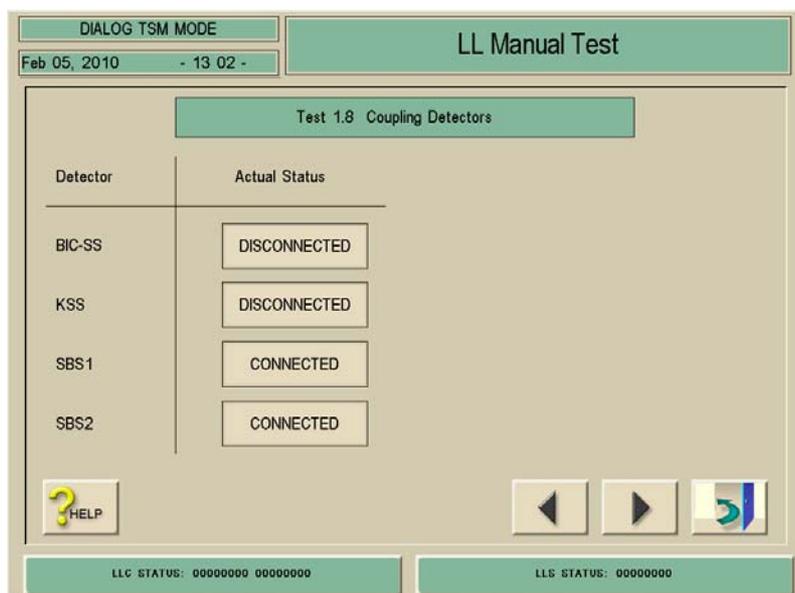
If the *SAD TEST*  is activated *NO AIR* must be detected.

**RDV**

**The light path is interrupted**

*NO BLOOD (Controller/Supervisor)* changes to *BLOOD (Controller/Supervisor)*.

## 4.8.2.8 Test 1.8 Coupling Detectors



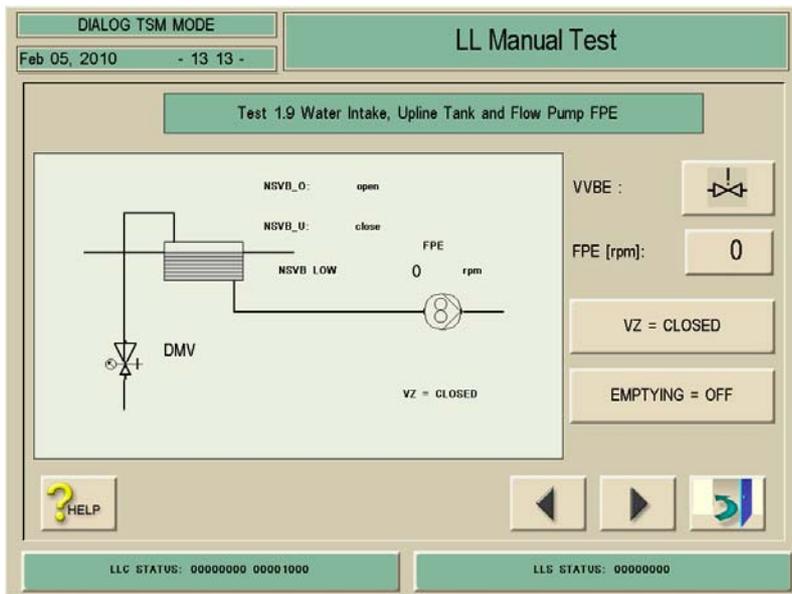
1. Activate the *Coupling Detectors* menu with the *Coupling* key in the *LL Manual Test* menu. The following menu is displayed.
2. Check the functions of the reed contacts with the appropriate couplings.

You can check the actual status of the reed sensors.

#### Detectors

<b>BICSS</b>	Bicarbonate rinsing connection sensor.
<b>KSS</b>	Concentrate rinsing connector sensor.
<b>SBS1</b>	Rinsing bridge connector sensor (dialyser coupling).
<b>SBS2</b>	Rinsing bridge connector sensor (dialyser coupling).

## 4.8.2.9 Test 1.9 Water Inlet, Upline Tank and Flow Pump FPE



1. Activate the *Water Inlet* menu with the *Water Inlet* key in the *LL Manual Test* menu. The following menu is displayed.
2. Check the functions with the appropriate keys.

**Valve VVBE**

You can set the flow of the upline tank control valve **VVBE**. **VVBE** must guarantee a flow of  $\geq 1200$  ml/min at a water inlet pressure of approx. 0.9 bar.

**Level Sensor NSVB**

The level of the upline tank **VB** is displayed on the screen by the level sensors (**NSVB\_O** high sensor and **NSVB\_U** low sensor).

**Flow Pump FPE**

If the upline tank is full the valve **VVBE** is closed automatically. If the flow pump **FPE** is activated **FPA** is also switched on, to allow an unrestricted flow through the balance chambers.

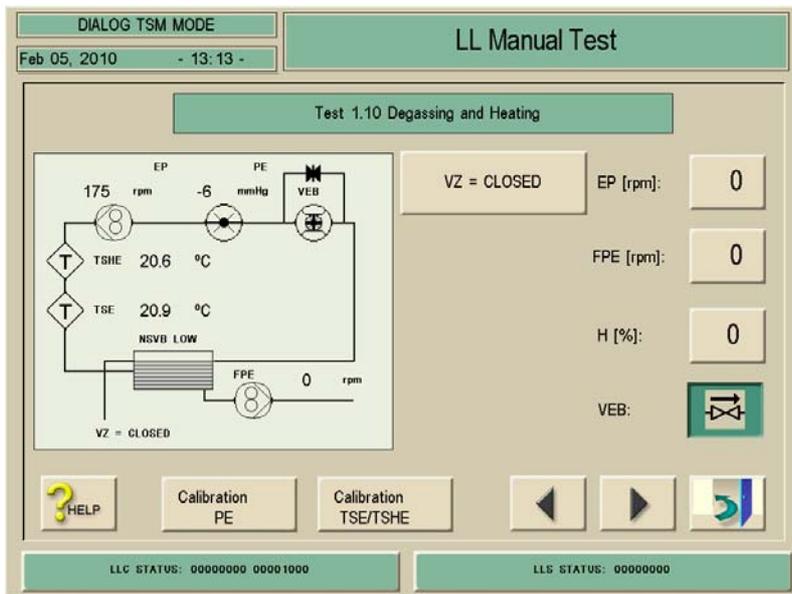
**Emptying**

The degassing pump **PE** is permanently switched on to allow a circulation in both compartments of the upline tank.

**VEB** is opened. If the emptying is activated to drain the machine the pumps are switched on for a short period and **VVBE** closed.

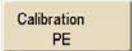
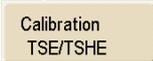
All balance chamber valves are opened and the outlet flow pump **FPA** works in main flow with the same speed as the inlet flow pump **FPE**. The degassing pump **EP** runs and the degassing bypass valve **VEB** is open.

## 4.8.2.10 Test 1.10 Degassing and Heating



1. Activate the *Degassing and Heating* menu with the *Degassing and Heating* key in the *LL Manual Test* menu. The following menu is displayed.
2. Check the functions with the appropriate keys.



You can skip directly to the calibration of the pressure sensor **PE** or the temperature sensor **TSHE/TSE** by pressing the appropriate  or  key. **TSHE** is calibrated together with **TSE**.

The components of the degassing and heating circuit can be tested step by step.

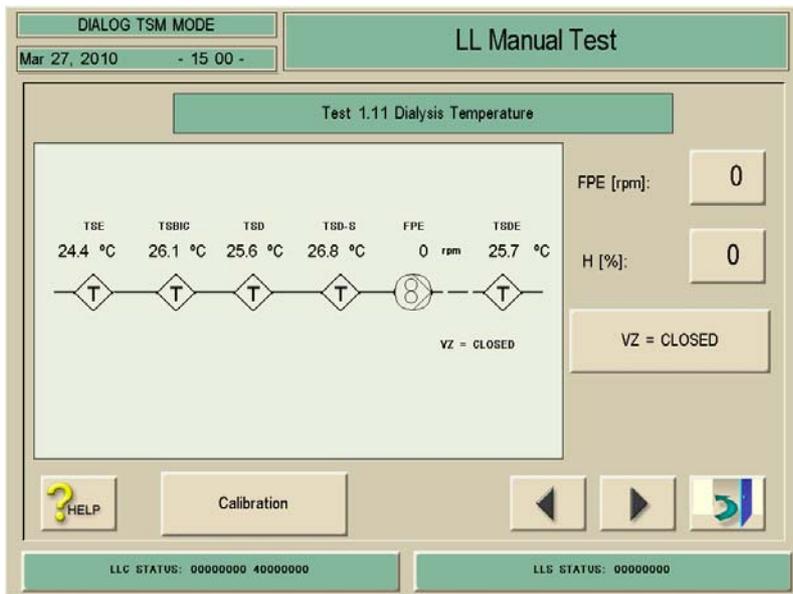
All balance chamber valves are switched so that one half of the balance chamber is open and the other side closed to position the membrane.

The flow pump **FPE** and **FPA** have the same speed and work in main flow. If the speed of **FPE** is set the degassing pump **EP** starts automatically with a higher speed.

The heater **H** is stopped if the degassing pump **EP** < 500 rpm, the degassing temperature sensor **TSE** > 89 °C or the upline tank **VB** is empty.

The degassing pump **EP** must be able to build up a flow of > 1200 ml/min at a negative pressure of - 500 mmHg.

## 4.8.2.11 Test 1.11 Dialysis Temperature



1. Activate the *Dialysis Temperature* menu with the *Dialysis Temperature* key in the *LL Manual Test* menu. The following menu is displayed.
2. Check the functions with the appropriate keys.



You can skip directly to the calibration of the temperature sensors **TSBIC**, **TSD**,

**TSD-S**, **TSDE** by pressing the  key.

The dialysate is heated up with the set heater power **H** %.

The flow pumps **FPE/FPA** work with the set speed. The balance chambers are opened and the machine works in main flow.

The temperature must be controlled by the heater to a stable set-point to test the temperature sensors.

If you open the circulation valve **VZ** a closed flow circuit is achieved (via the upline tank). Increase the speed [rpm] until the flow pump **FPE** has built up a flow of 750 ml/min.

The measurement range is as follows:

<b>TSE, TSD, TSBIC:</b>	0 to 100 °C
<b>TSD-S:</b>	30 to 55 °C
<b>TSDE:</b>	30 to 55 °C

## 4.8.2.12 Test 1.12 Concentrate Pumps and Conductivity

The screenshot shows the 'LL Manual Test' interface for 'Test 1.12 Concentrate Pumps and Conductivity'. It features a schematic diagram of the system with various sensors and pumps. The data is organized as follows:

TSBIC	BICLF	ENDLF	ENDLF-S	TSD	FPE
23.1 °C	0.00 mS/cm	0.00 mS/cm	0.00 mS/cm	22.7 °C	0 rpm

BICP-S		KP-S	
Head	Speed	Head	Speed
0	rpm	0	rpm
BICPFLOW	0.0 ml/min	KPFLOW	0.0 ml/min
BICFLOW_S	0.0 ml/min	KPFLOW_S	0.0 ml/min

Control parameters on the right:

- BICP [rpm]: 0
- KP [rpm]: 0
- FPE [rpm]: 0
- H [%]: 0

Buttons include: HELP, Calibration, VZ = CLOSED, and navigation arrows. Status bars at the bottom show LLC STATUS: 00000000 00001000 and LLS STATUS: 00000000.

1. Activate the *Concentrate Pumps and Conductivity* menu with the *Concentrate Pumps and Conductivity* key in the *LL Manual Test* menu. The following menu is displayed.
2. Check the functions with the appropriate keys.



You can skip directly to the calibration of the conductivity sensors **BICLF/ENDLF** by pressing the  key.

You can set the pumps **BICP/KP**, flow pump **FPE** and the heater power **H %**.

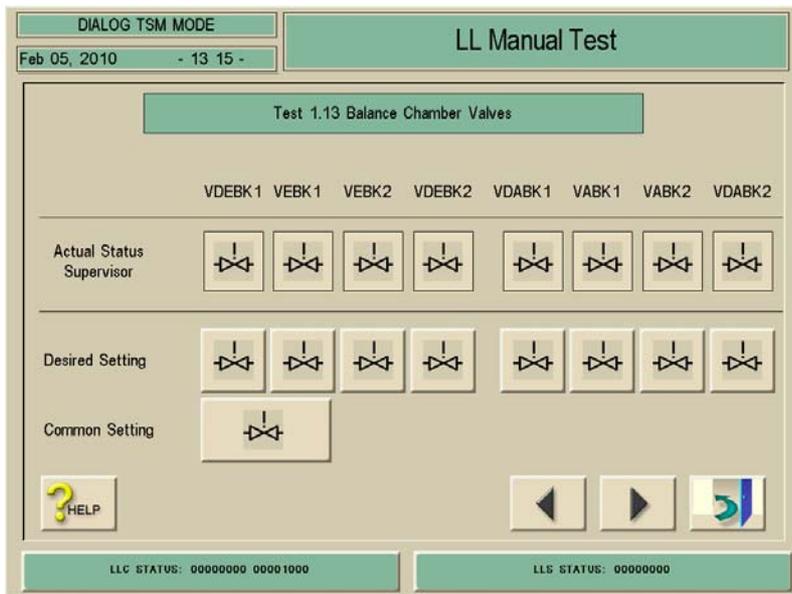
All balance chamber valves are open and the flow pump **FPA** works with the same speed as **FPE**.

The machine is in main flow. The machine can suck-in concentrate with the concentrate pumps **BICP/KP** for the preparation of the conductivity to test the conductivity sensors **BICLF/ENDLF/ENDLF-S**.

You can connect a measurement instrument at the dialyser couplings or between **FPE** and the balance chamber.

The supervisor displays the head speed **BICP-S/KP-S** of the concentrate pumps. Increase the speed [rpm] until the flow pump **FPE** has built up a flow of 750 ml/min. Thereby the pulsating flow of the pumps have no influence on the conductivity measurement.

## 4.8.2.13 Test 1.13 Balance Chamber Valves

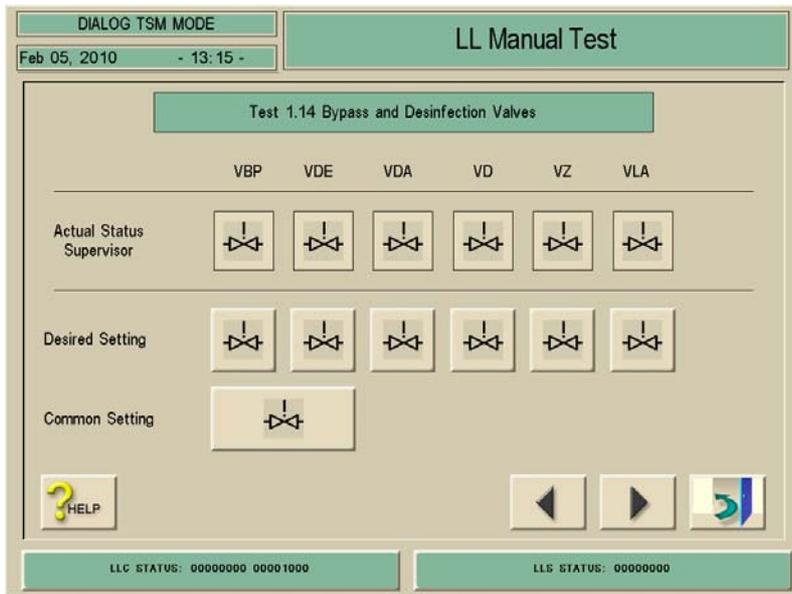


1. Activate the *Balance Chamber Valves* menu with the *Balance Chamber Valves* key in the *LL Manual Test* menu. The following menu is displayed.
2. Check the functions with the appropriate keys.

You can activate a single valve or combined setting via the controller. The actual condition is displayed by the supervisor. The following valves can be activated:

<b>Valves</b>	<b>VDEBK1/2</b>	Dialyser inlet valve 1/2 balance chamber
	<b>VEBK1/2</b>	Inlet valve 1/2 balance chamber
	<b>VDABK1/2</b>	Dialyser outlet valve 1/2 balance chamber
	<b>VABK1/2</b>	Outlet valve 1/2 balance chamber

## 4.8.2.14 Test 1.14 Bypass and Disinfection Valves

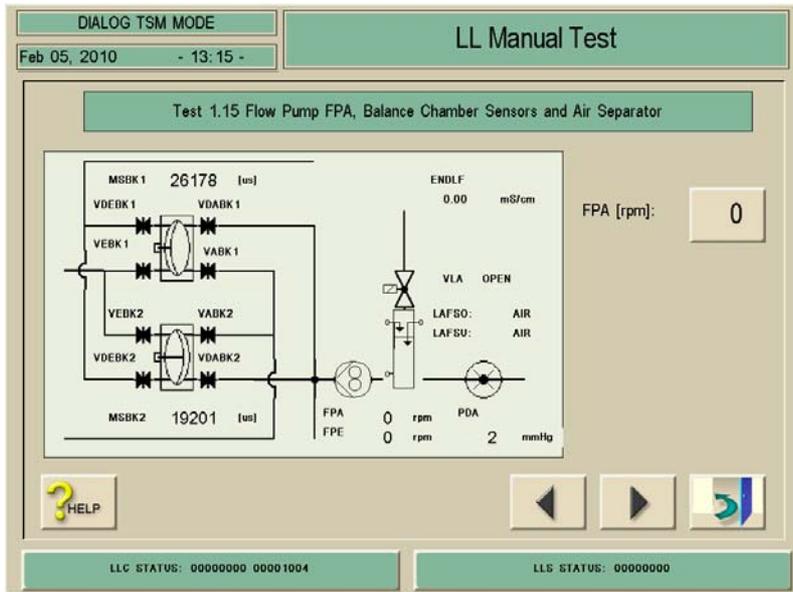


1. Activate the *Bypass and Disinfection Valves* menu with the *Bypass and Disinfection Valves* key in the *LL Manual Test* menu. The following menu is displayed.
2. Check the functions with the appropriate keys.

You can activate a single valve or combined setting via the controller. The actual condition is displayed by the supervisor. The following valves can be activated:

Valves	Code	Description
	VBP	Bypass valve
	VDE	Dialyser inlet valve
	VDA	Dialyser outlet valve
	VD	Disinfection valve
	VZ	Circulation valve
	VLA	Air separator valve

4.8.2.15 Test 1.15 Flow Pump FPA, Balance Chamber Sensors and Air Separator



1. Activate the *Flow Pump FPA, Balance Chamber Sensors and Air Separator* menu with the *Flow Pump FPA, Balance Chamber Sensors and Air Separator* key in the *LL Manual Test* menu. The following menu is displayed.
2. Check the functions with the appropriate keys.

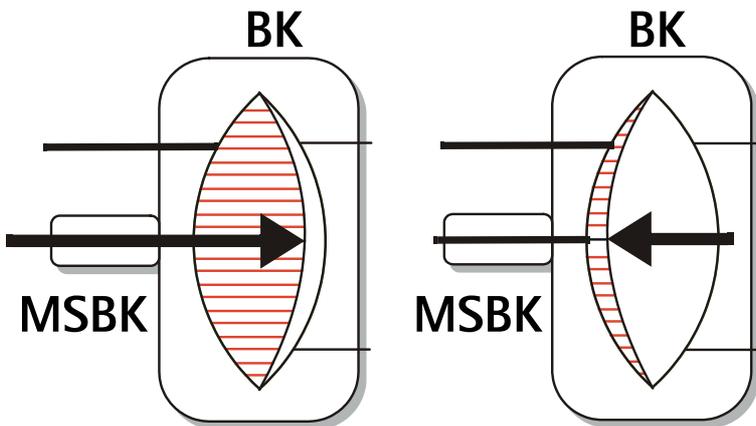


Fig. : Switch Point MSBK1/2

Phase 1

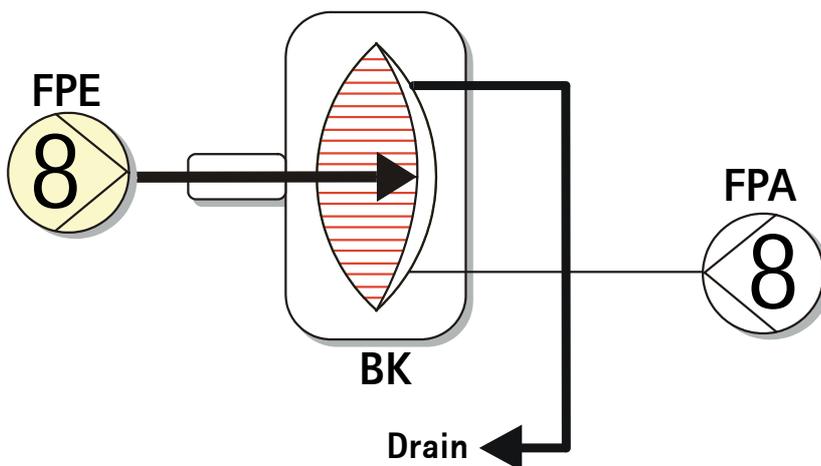


Fig. : Filling Cycle Balance Chamber Phase 1

If the test (initialisation) is started the switching point of the membrane position sensor balance chambers **MSBK1/2** are detected. If the maximum stroke of **MSBK1/2** is reached the balance chamber valves are automatically switched (see figure).

If you set the flow pump **FPA** the left side of one of the balance chambers is filled by the flow pump **FPE**. Simultaneously the fluid in the right side of the balance chamber is emptied to the drain.

## Phase 2

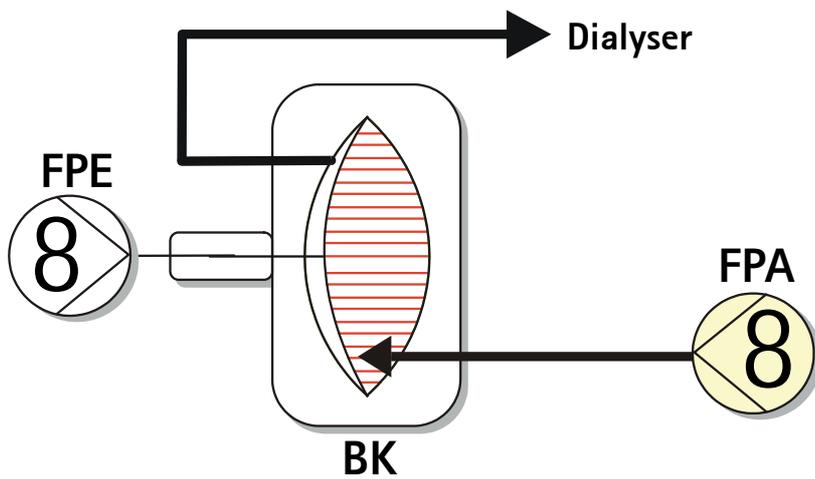


Fig. : Filling Cycle Balance Chamber Phase 2

The right side of the balance chamber is filled with the fluid from the dialyser by the flow pump **FPA**. Simultaneously the fresh fluid in the left side of the balance chamber is delivered into the dialyser circuit.

The concentrate pump **KP** is set to a fixed speed of 20 rpm during this test. Thereby a final conductivity **ENDLF** of > 0.5 mS/cm is obtained if concentrate is connected.

This conductivity is required to test the level sensors in the air separator **LA**. If the lower level sensor **LAFSU** is activated the air separator valve **VLA** is opened and the balance chamber valves are switched. Thereby **FPE** delivers fluid into the dialyser circuit. **VLA** is only closed and switched to normal operation if the top level sensor **LAFSO** detects fluid.

## 4.8.2.16 Test 1.16 Pressure Water Part

The screenshot shows the 'LL Manual Test' menu with the following data:

		Actual Status		Desired Setting
		Controller	Supervisor	
Dialysis Pressure	[mmHg]:	-2	-2	
Degassing Pressure	[mmHg]:	-3		
Degassing Pump	[rpm]:			0
Degassing Bypass Valve				

Buttons at the bottom include: HELP, Calibration, Pressure in mbar, and navigation arrows. Status bars at the bottom show LLC STATUS: 00000000 00001004 and LLS STATUS: 00000000.

1. Activate the *Pressure Water Part* menu with the *Pressure Water Part* key in the *LL Manual Test* menu. The following menu is displayed.
2. Check the functions with the appropriate keys.



You can skip directly to the calibration of the pressure sensors **PE** and **PDA** by pressing the  key.

The degassing pump **EP** can be set. The degassing bypass valve **VEB** can be opened/closed.

The pressure at the degassing pressure sensor **PE** can be set with the degassing pump **EP** and the degassing bypass valve **VEB**.

The pressure at the outlet dialysate pressure sensor **PDA** is set manually with a syringe at the dialyser couplings.

#### Pressure in mbar



The pressure can be displayed in mmHg or in mbar, depending on selection.

#### Conversion Factor mmHg to mbar

Conversion Factor = 1.3332

Example:

-100 mmHg      approx. -133 mbar  
 -400 mmHg      approx. -533 mbar

## 4.8.2.17 Test 1.17 UF Pump

		Actual Status		Desired Setting
		Controller	Supervisor	Controller
UFP	[rpm]	Motor Speed	Head Speed	
			0	0
Flow	[ml/min]	0.0	0.0	
Flow	[ml/h]	0	0	
Flow Detector			FLOW	Conductivity
PDA	[mmHg]	17		Stroke Value UFP
? HELP		◀ ▶		▶
LLC STATUS: 00000000 00001004		LLS STATUS: 00000000		

1. Activate the *UF Pump* menu with the *UF Pump* key in the *LL Manual Test* menu. The following menu is displayed.
2. Check the functions with the appropriate keys.

You can set the speed of the **UF** pump **UFP**. The head speed and the calculated flow are displayed. At the beginning of the test the balance chambers are initialised. The flow pumps **FPE/FPA** are activated to reach the inlet pressure for **UFP**, set by the value of the throttle **DDE**.

**Flow Detector**

Not applicable.

**Stroke Value UFP**

The *Stroke Value UFP* should not be used in a normal case, because **UFP** must be calibrated (see LL Manual calibration).

## 4.8.2.18 Test 1.18 Blood Leak

The screenshot shows the 'LL Manual Test' menu in Dialog+ TSM Mode. The date is Feb 05, 2010, and the time is 13:16. The main title is 'Test 1.18 Blood Leak'. The interface is divided into 'Actual Status' and 'Desired Setting' sections.

	Actual Status		Desired Setting
	Controller	Supervisor	
Blood Concentration [promille]:	-0.04	-0.03	
Outflow Pump Speed [rpm]:			0
TSD [°C]:	22.7		
LAMP TEST			OFF

At the bottom, there are buttons for 'HELP' and 'Calibration', and navigation arrows. The status bars at the bottom show 'LLC STATUS: 00000000 00001000' and 'LLS STATUS: 00000000'.

1. Activate the *Blood Leak Detector* menu with the *Blood Leak Detector* key in the *LL Manual Test* menu. The following menu is displayed.

2. Check the functions with the appropriate keys.

You can check the following functions of the blood leak detector:

- Red and green LED
- Receiver circuit
- Optical efficiency of the detector block



### Blood Leak Detector

You can skip directly to the calibration of the blood leak detector by pressing

the  key.

The blood leak detector performs an automatic calibration of the zero point with a reference diode.

The blood leak detector can be checked and calibrated. The rinsing block must have an even temperature for calibration. If both dialyser couplings are connected to the rinsing bridge the flow pumps **FPA/FPE** work in main flow.

If only one coupling is connected **FPE** is stopped. The test solution can be drawn in by the second coupling via **FPA**. The first calibration point must be performed with clean water from the water treatment system.



A function test and a calibration are performed for the blood leak detector.

If an actual value is out of limits during the function test, the blood leak detector has to be exchanged.

Check the blood leak detector after a citro-thermal disinfection (*LL Manual Test, Test 1.18 Blood Leak Detector*).

Close front and rear door for the function test to prevent light irradiation on the sensor.

### Leakages

Air and micro-bubbles can lead to false measurement values in the measurement line and can cause fluctuation of the actual value.

If air is visible check the complete system for leaks in menu 1.20 Test Water Part. After the initialisation phase rinse the blood leak detector approx. 1 min and then perform a leakage test of the system in menu 1.19 Leak Test.

## Check Blood Leak Detector



Exchange the blood leak detector if one of these three values is out of limits.

1. Connect both dialyser couplings to the rinsing bridge.
2. Select menu 1.18 in TSM to perform a function check of the blood leak detector.
3. Rinse the blood leak detector BL for approx. 1 min at the beginning of the rinsing time with outlet flow pump **FPA** (approx. 1400 rpm). Thereby possible air bubbles in the system are removed.
4. Rinse blood leak detector for approx. 15 to 30 min with **FPA**, approx. 1000 rpm to warm up the complete system to a temperature of approx. 40 °C.
5. The *LED Test* is activated with the *LED TEST OFF* key. The *OFF* key switches to the *RED* key as soon as the key is pressed.

The *red LED* is tested after 10 s. The controller value for the switched off *red LED* must be as follows (the supervisor value is uncritical):

red LED	Actual Status Controller
Blood Concentration	< 4.00

6. Press the *LED TEST RED* key to switch to the *green LED*. The *RED* key switches to the *GREEN* key.  
The *green LED* is tested. The controller value for the switched off *green LED* must be as follows (the supervisor value is uncritical):

green LED	Actual Status Controller
Blood Concentration	> 2.06

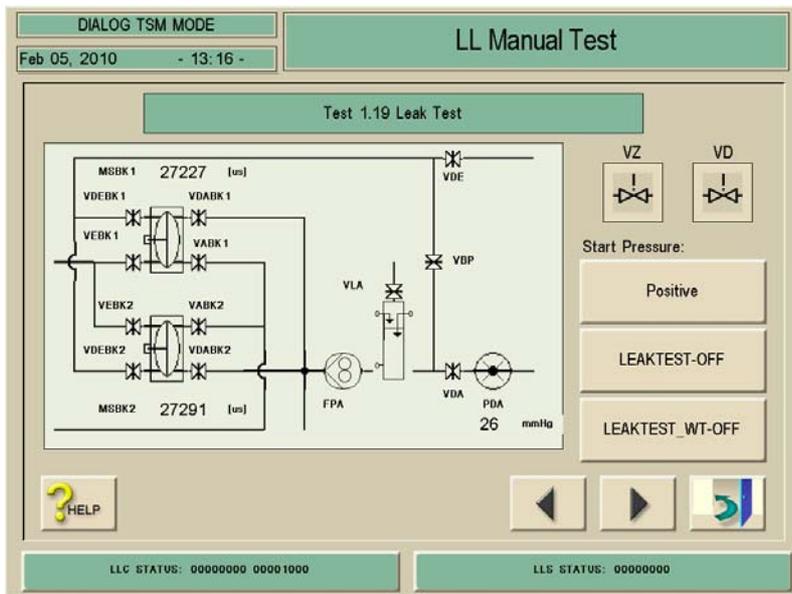
7. The actual controller values for the *red LED* and the *green LED* must be divided.

**Note:** The calculated value of **red LED** divided by **green LED** is displayed briefly after the key *LAMP TEST* is switched back to OFF.

The calculated value must be in the following limits (to the first decimal digit/round off):

red LED / green LED
1.15 - 1.44

## 4.8.2.19 Test 1.19 Leak Test



1. Activate the *Leak Test* menu with the *Leak Test* key in the *LL Manual Test* menu. The following menu is displayed.
2. Check the functions with the appropriate keys.

You can run a leakage test for the balance chamber system, the bypass valve **VBP** and the main flow valves **VDE/VDA**, the air separator valve **VLA** and the UF pump **UFP**. The leakage test can be started with a positive or negative pressure. The flow system must be filled with water prior to the leakage test (if necessary fill in menu 1.20 *Water Part Overview*).

**Leak Test**

The following components are tested:

Membrane position sensors:	<b>MSBK1/2</b>
Balance chamber valves:	<b>VDEBK1/2, VDABK1/2, VEBK1/2, VABK1/2</b>
Bypass valve:	<b>VBP</b>
Dialyser in/output valves:	<b>VDE, VDA</b>
Disinfection valve:	<b>VD</b>
Air separator valve:	<b>VLA</b>
* Membrane leak proof test:	<b>VDEBK/VABK (opened)</b> <b>VDABK/VEBK/VLA (closed)</b>

(\*If *Start Pressure Positive* was set: An additional membrane leak proof test is performed after the second test step.)

**Start Pressure Positive**

If the test is activated for the dialysate circuit an automatic leakage test is performed. The test is started with a positive test pressure and then followed by a negative test pressure.

If the test is started with a positive test pressure an additional test step is performed after the second test step. This additional step performs a leak proof test of the membranes. The valves have the following position during the test:

- **VDEBK/VABK:** opened
- **VDABK/VEBK/VLA:** closed

The test pressure is present in the inlet balance chamber during this test. The membrane seals the outlet of the test circuit. A defective membrane would cause a pressure drop.

**HDF Online**

HDF online machines: the two additional test steps **2a** and **2b** are performed after the membrane test. Thus the valves **VDFE, VSB, VSAE** and **VSAA** and the substitution port are checked.

**Start Pressure Negative**

If the test is activated for the dialysate circuit an automatic leakage test is performed. The test is started with a negative test pressure and then followed by a positive test pressure.

**LLC Alarm**

The leakage test consists of three test steps. If an error occurs an LLC alarm is activated (LLC Status 00020000).

**Test Procedure Positive Test Pressure**

- A positive pressure is built up with the FPE pump.
- The pump is stopped and the valves closed if the set-point pressure for PDA = +400 mmHg is reached.
- The PDA reference value is stored after a wait state of 5 s.
- This reference value is compared with the actual value after 30 s.
- If the deviation is < 10 mmHg the next test step is performed.

**Test Step 1** VLA, VEBK1/2, VABK1/2----- closed

**Test Step 2** VLA, VDEBK1/2, VDABK1/2 ----- closed

**Note**

**Only if start pressure was positive**

After the second test step a leak proof test of the membranes is performed. The valves have the following position:

VDEBK/VABK: ----- opened

VDABK/VEBK/VLA: ----- closed

**Test Step 2a** **Note**

**Test step 2a and 2b only for HDF online machines.**

VLA Air separator valve: ----- closed

VDFF DF filter valve: ----- closed

VSB Substitution bypass valve: ----- closed

VSAE Substitution connection inlet valve: - closed

**Test Step 2b**

VLA Air separator valve: ----- closed

VDFF DF filter valve : ----- closed

VSB Substitution bypass valve: ----- closed

VSAA Substitution connection outlet valve: closed

**Test Step 3**

VLA, VDE, VDA ----- closed

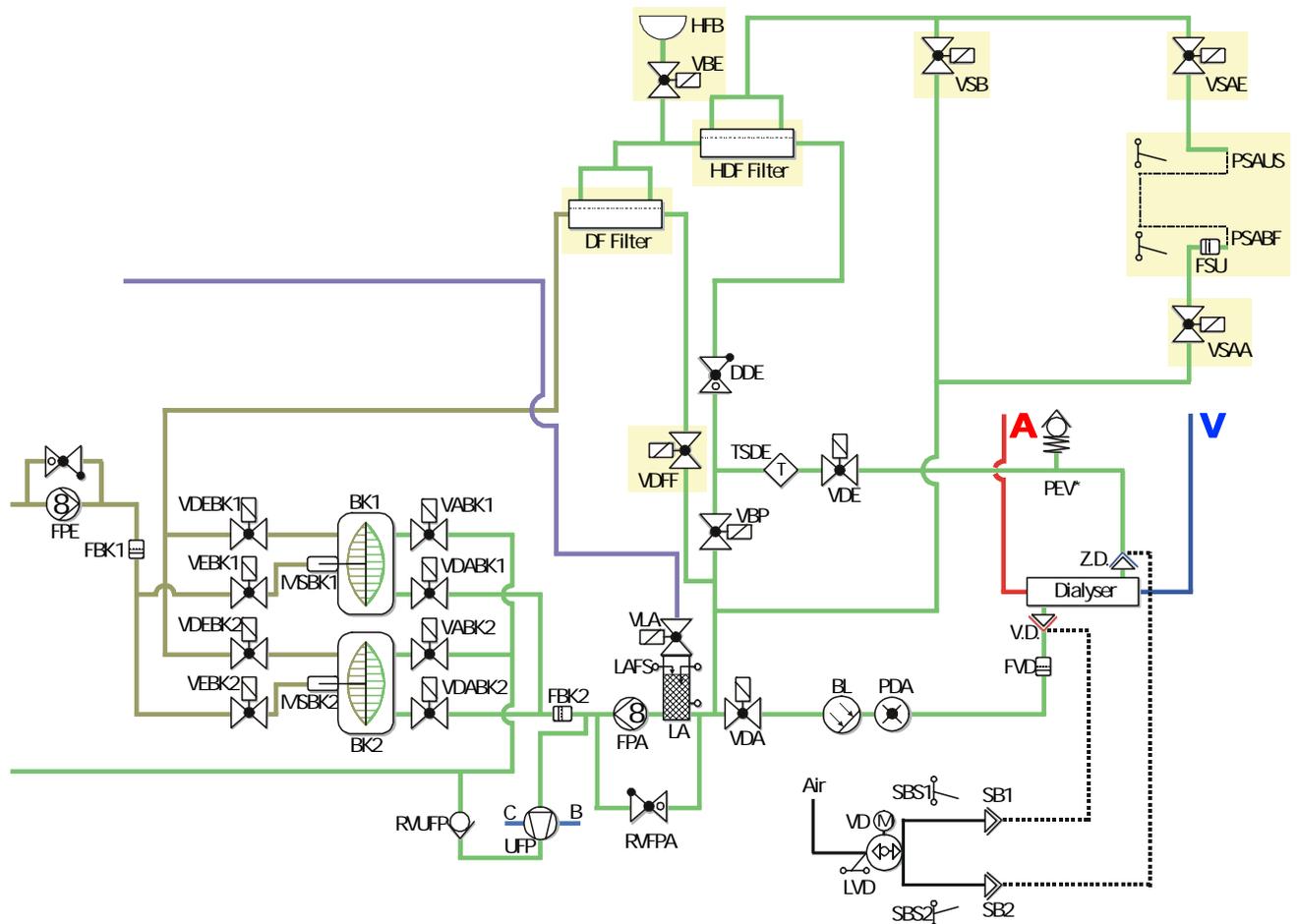


Fig.: Excerpt Flow Diagram for HDF Online

**Negative Test Pressure  
Test Steps 1 to 3**

The valve switching is identical with the above description.

- Negative pressure is built up with the UF pump after the third test step.
- The pump is stopped and the valves are closed if the set-point pressure for **PDA** = - 400 mmHg is reached.
- The **PDA** reference value is stored after a wait state of 5 s.
- This reference value is compared with the actual value after 30 s.
- If the deviation is < 10 mmHg the next test step is performed.

**Leak Test Heat Exchanger**

The following component is tested:

Heat Exchanger: **WT**

**Manual Leakage Test  
Heat Exchanger (WT)**

- a) Rinse the flow circuit with water prior to the leakage test, to prevent air bubbles in the test area.
- b) Close all valves in the Dialog (switch off machine).
- c) Connect a manometer and a syringe filled with water to the water outlet.
- d) Build up a test pressure 400 mmHg (+ 50 mmHg) with the syringe and close with tubing clamp.
- e) Check pressure drop. The pressure drop must be < 50 mmHg in 30 s.

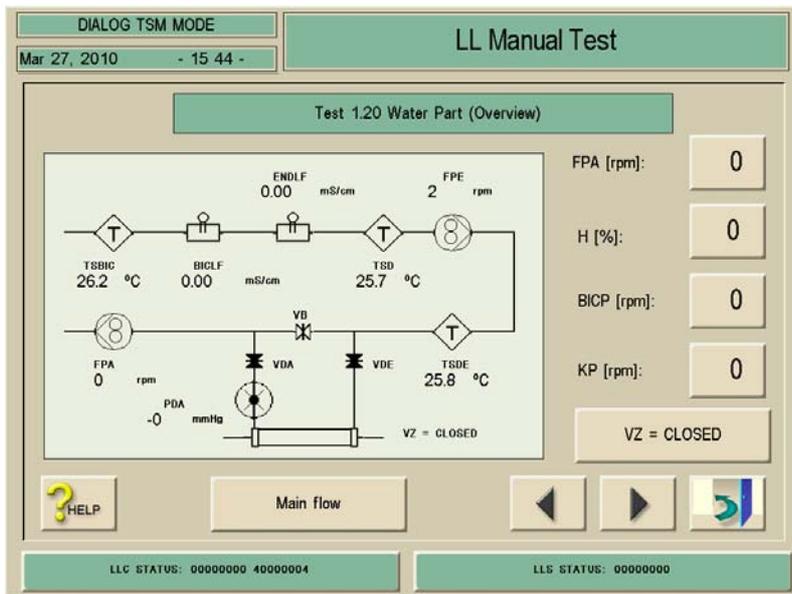
**Leak Test Heat Exchanger (WT)**

- a) Rinse water circuit to prevent air bubbles.
- b) Close the outlet.
- c) Activate test.

The **FPE** builds up a pressure.

- d) Check pressure drop. The pressure drop must be < 50 mmHg in 30 s.

## 4.8.2.20 Test 1.20 Water Part (Overview)



1. Activate the *Water Part (Overview)* menu with the *Water Part (Overview)* key in the *LL Manual Test* menu. The following menu is displayed.
2. Check the functions with the appropriate keys.

You can set the speed for the flow pump **FPE/FPA**. The heater power **H %** can be set in %. The speed of the concentrate pumps **BICP/KP** can be set manually. After starting this menu the balance chamber is initialised. Then the flow pump **FPE** is set to the same speed as **FPA**. The balance chamber valves are switched automatically.

**Main Flow**

The machine can be switched between main flow and bypass for servicing.

*Main Flow*

Valves **VDA/VDE** are open (valve symbols are black).

Valve **VBP** is closed (valve symbol is white).

*Bypass*

Valves **VDA/VDE** are closed (valve symbols are white).

Valve **VBP** is open (valve symbol is black).

## 4.8.2.21 Test 1.21 Emptying



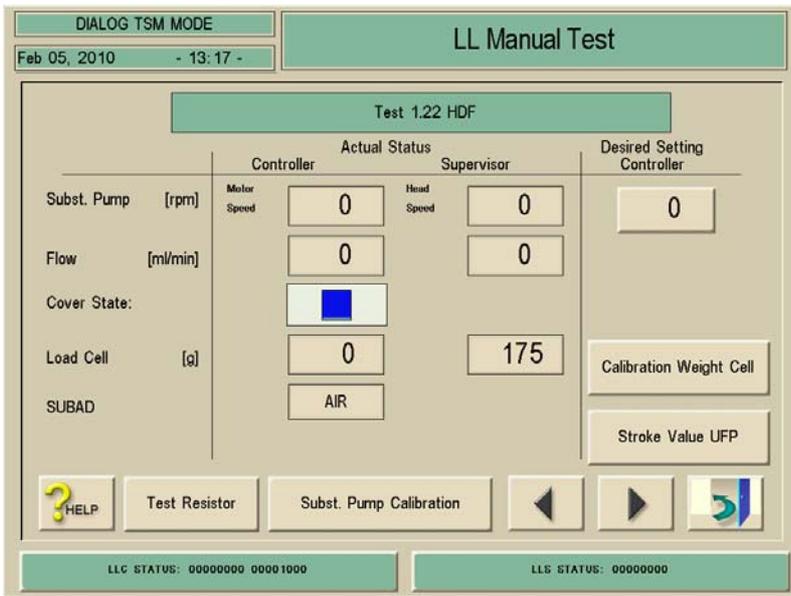
1. Activate the *Emptying* menu with the *Emptying* key in the *LL Manual Test* menu. The following menu is displayed.
2. Check the functions with the appropriate keys.

You can drain the system. After the emptying key is activated the drain procedure is started. The actual value, i.e. the fluid level of the upline tank **VB** is displayed by the level sensors **NSVB**.



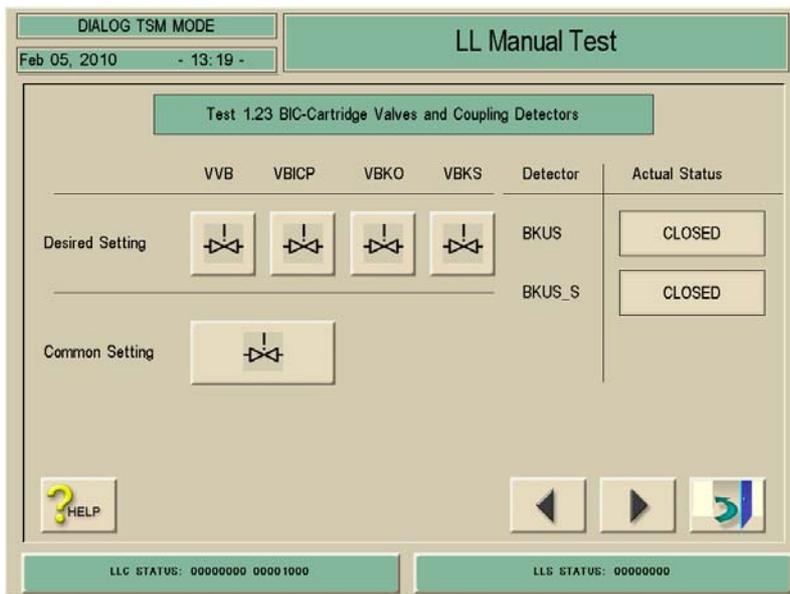
Start the *Emptying ON* at least three times and manually clamp the bypass (tubing) to ensure a sufficient emptying (for transportation).

4.8.2.22 Test 1.22 HDF



Not applicable.

## 4.8.2.23 Test 1.23 BIC Cartridge Valves and Coupling Detectors



1. Activate the *BIC Cartridge Valves and Coupling Detectors* menu with the *BIC Cartridge Valves and Coupling Detectors* key in the *LL Manual Test* menu. The following menu is displayed.
2. Check the functions with the appropriate keys.

**Valves VVB, VBICP, VBKO, VBKS**

The valves **VVB**, **VBICP**, **VBKO** and **VBKS** can be switched either separately or together.

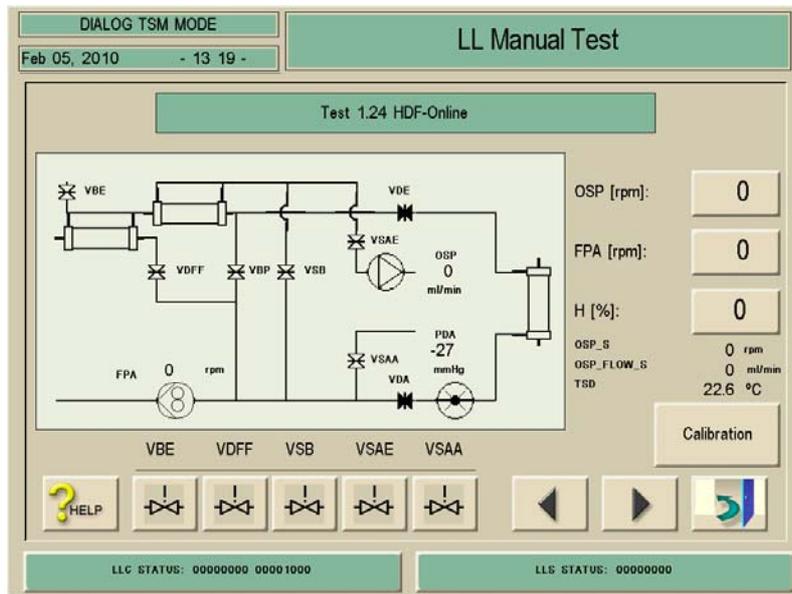
**Detectors BKUS, BKUS\_S**

The status of the reed sensor (*OPEN/CLOSED*) is displayed.

## 4.8.2.24 Test 1.24 HDF Online

**Exchange Intervals:**

The HFB filter must be exchanged on an annual basis.



1. Activate the *HDF Online* menu with the *HDF Online* key in the *LL Manual Test* menu. The following menu is displayed.
2. Check the functions with the appropriate keys.

### Online Substitution Pump OSP (BPV)

### Valves VBE, VDFF, VSB, VSAE, VSAA

You can check the function of the HDF online substitution pump *OSP (BPV)* and the additional valves.

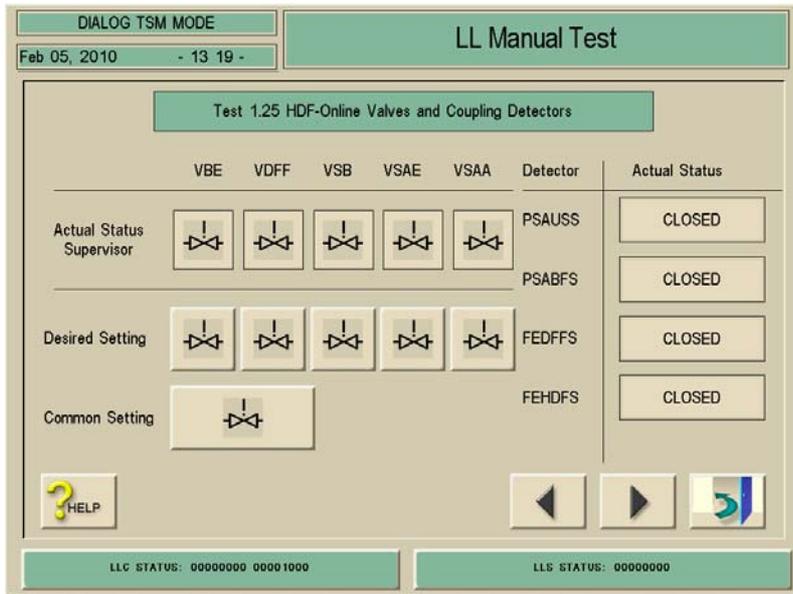
The function of the HDF online substitution pump *OSP (BPV)* can be checked.

The flow path through both filters (**DF** and **HDF**) can be set via the valves.

Before operation in main flow the DF filter inlet must be vented via **VDFF**, because the membranes of the **DF** filter and **HDF** filter are impermeable to air.

Valve **VBE** can only be opened if **PDA** < -100 mmHg to prevent fluid penetration.

4.8.2.25 Test 1.25 HDF Online Valves and Coupling Detectors



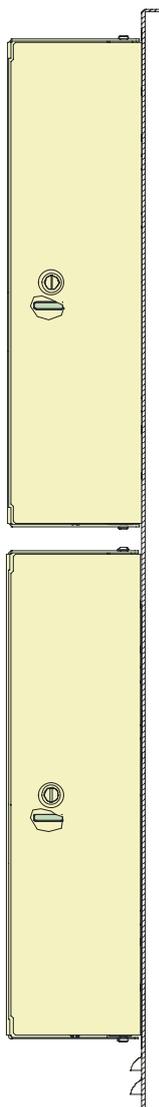
1. Activate the *HDF Online Valves and Coupling Detectors* menu with the *HDF Online Valves and Coupling Detectors* key in the *LL Manual Test* menu. The following menu is displayed.
2. Check the functions with the appropriate keys.

**Valves**  
VBE, VDFF, VSB, VSAE, VSAA

**Detectors**

FEHDFS

FEDFFS



You can activate and deactivate the HDF online valves.

You can either activate or deactivate a single valve with the *Desired Setting* icon or all valves **VBE, VDFF, VSB, VSAE, VSAA** with the *Common Setting* icon. Thus the feedback from the LLS can be checked.

*PSAUSS* (substitution port outlet sensor)

The status of the additional coupling sensor **PSAUS** can be checked.

*PSABFS* (substitution port drain sensor)

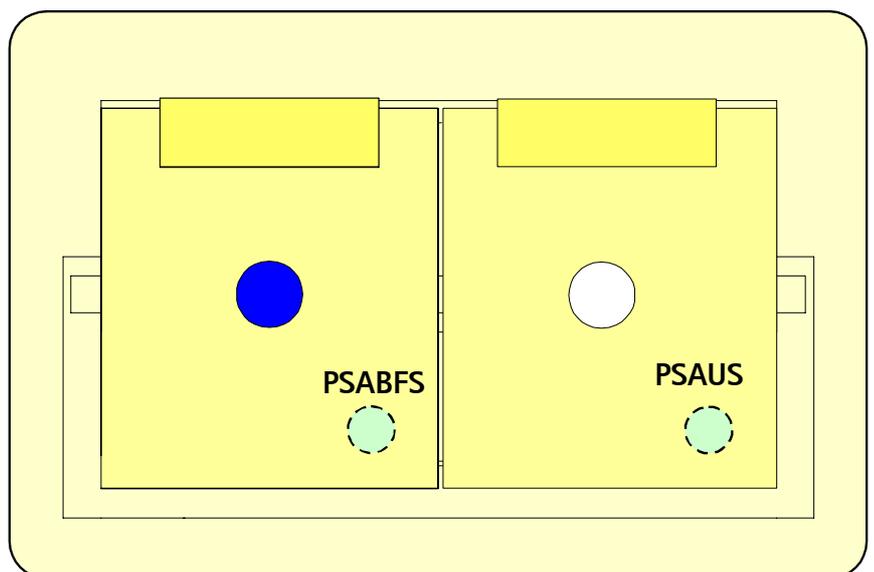
The status of the additional coupling sensor **PSABFS** can be checked.

*FEDFFS* (filter recognition DF filter)

The status of the additional coupling sensor **FEDFFS** can be checked.

*FEHDFS* (filter recognition HDF filter)

The status of the additional coupling sensor **FEHDFS** can be checked.



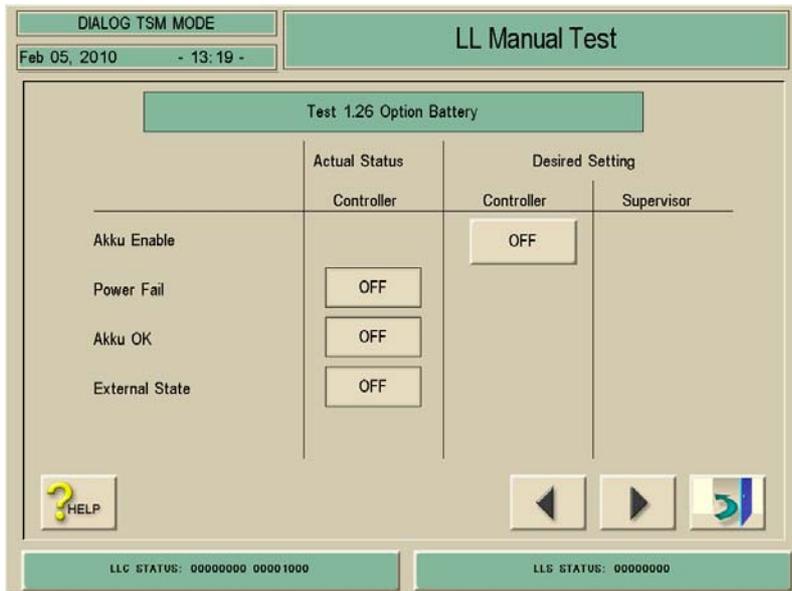
## 4.8.2.26 Test 1.26 Option Battery



## Charge Batteries

To guarantee battery operation the batteries may have to be charged for several hours if the Dialog was not connected to mains for a longer period.

If the batteries are empty the charge time is > 8 hours to guarantee a battery running time of at least 20 minutes.



1. Activate the *Option (Rechargeable) Battery* menu with the *Option (Rechargeable) Battery* key in the *LL Manual Test* menu. The following menu is displayed.

2. Check the functions with the appropriate keys.

The enable parameter can be set and the following parameters can be checked:

**Setting**

- *Akku Enable* (battery enable, *AKKU\_EN* signal)

**Check**

- *Power Fail* (PF signal)
- *Akku OK* (battery OK, *AKKU\_OK* signal)
- *External State* (*EXT\_STATE* signal)

**Akku Enable  
(Battery Enable)**

The enable signal is set to **ON** by the LLC in therapy. Thus indicating to the power supply that the battery operation can be enabled in the case of a power breakdown. In all other operating modes (with the exception of therapy) the *Akku Enable* (battery enable, *AKKU\_EN* signal) is set to **OFF**, i.e. the machine is switched off in case of a power breakdown.

1. Battery charged (charge LED off), i.e. *Akku OK* (battery OK) = *ON*
2. Set *Akku Enable* (battery enable) to *ON*.
3. Disconnect machine from mains with mains plug.

A three-tone signal is activated via the buzzer from the switch mode power supply to indicate that the machine is running in battery operation.

- Blood pump(s) run(s)
- Monitor is on
- Power Fail = *ON*
- *Akku OK* (battery OK) changes from *ON* to *OFF*

**Power Fail**

The switch mode power supply sends the signal to the LLC indicating a power failure.

- OFF** Mains voltage present (and in the tolerance limits)  
**ON** Mains voltage not present (or out of tolerance limits)

**Akku OK  
(Battery OK)**

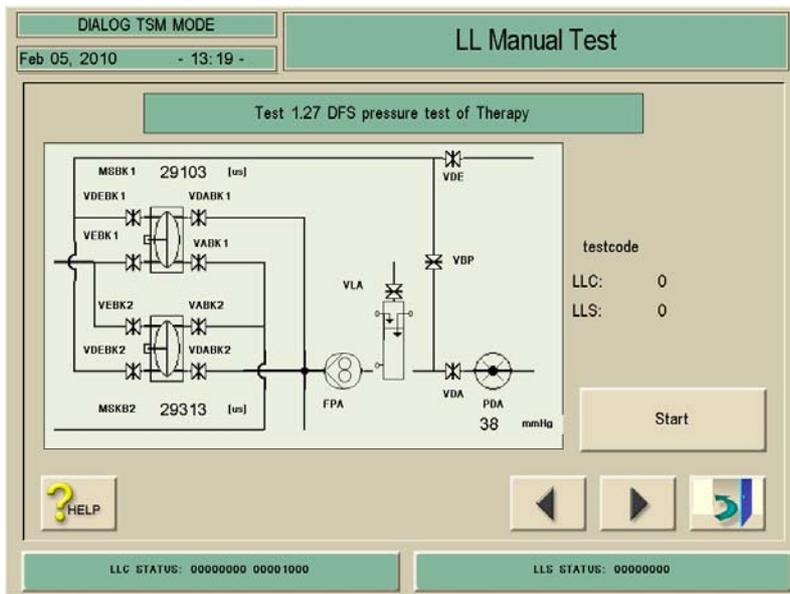
- ON** Battery capacity  $\geq$  required capacity for 20 minutes battery running time  
**OFF** Battery capacity < required capacity for 20 minutes battery running time

**External State**

Indicates if machine was switched on externally.

- ON** Machine was switched on externally

## 4.8.2.27 Test 1.27 DFS Pressure Test of Therapy



1. Activate the *DFS Pressure Test of Therapy* menu with the *DFS Pressure Test of Therapy* key in the *LL Manual Test* menu. The following menu is displayed.
2. Check the functions with the appropriate keys.

**Start Key**

You can activate the DFS pressure test with the *Start* key from the self test in *Preparation*.

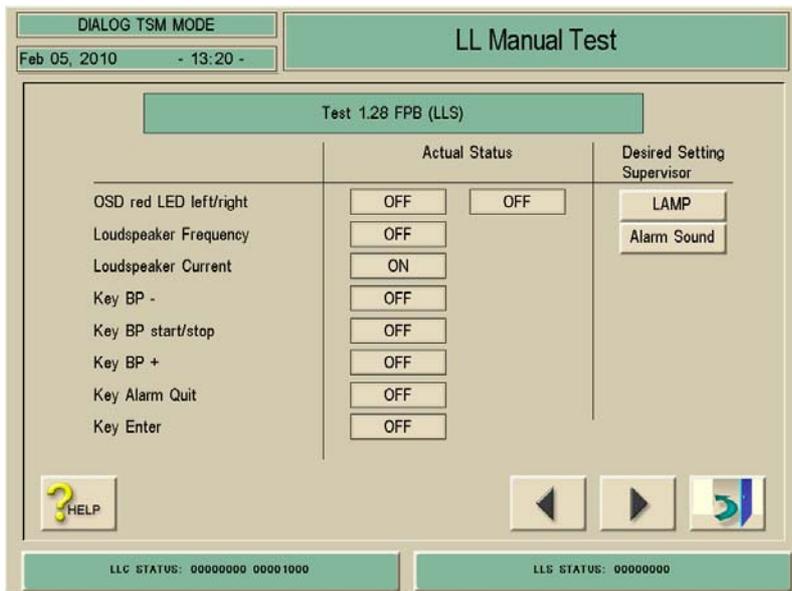
**Stop Key**

The test run can be terminated with the *Stop* key. The key jumps back to *Start* in case of an error or at the end of the pressure test.

**Test Code**

The test codes for LLC and LLS are displayed for all test phases. In case of an error the defective components can be determined with the help of the test description.

## 4.8.2.28 Test 1.28 Front Panel Board FPB (LLS)



1. Activate the *Front Panel Board FPB* menu with the *Front Panel Board FPB* key in the *LL Manual Test* menu. The following menu is displayed.

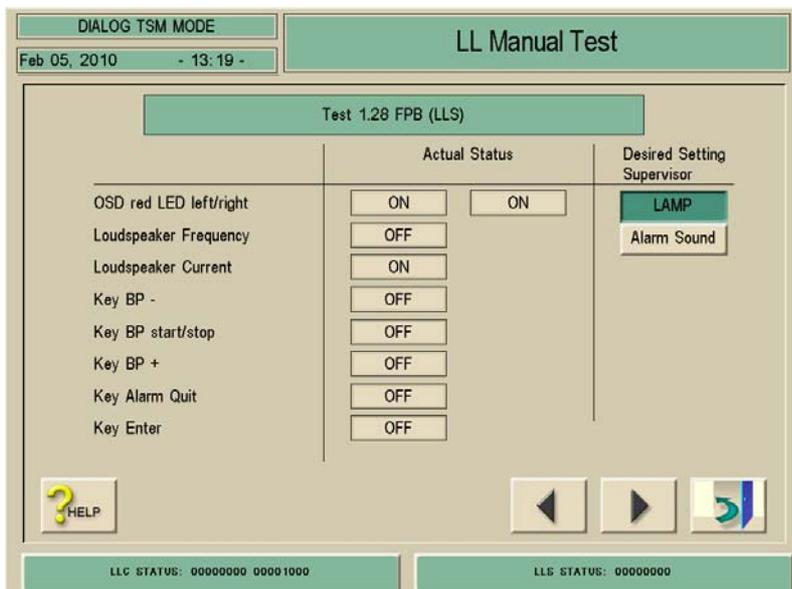
2. Check the functions with the appropriate keys.

You can check the LEDs and keys on the front panel board FPB via the supervisor LLS.

### Lamp

- OSD Red LED Left/Right

If you press the *Lamp* key the red LEDs on the OSD boards are switched on (*OFF/ON*) and checked with a feedback from the red LEDs to the supervisor LLS.



### Alarm Sound

- Loudspeaker Frequency

If you press the *Alarm Sound* key the loudspeaker is switched on and checked with a feedback (*Loudspeaker Frequency ON*) from the loudspeaker to the supervisor LLS.

If the loudspeaker is not connected the *Loudspeaker Frequency* stays *OFF*.

### Test Blood Pump Keys

- *Blood Pump - Key*

Press the  key on the front panel board FPB and wait for switching (*OFF/ON*).

- *Blood Pump START/STOP Key*

Press the  key on the front panel board FPB and wait for switching (*OFF/ON*).

- *Blood Pump + Key*

Press the  key on the front panel board FPB and wait for switching (*OFF/ON*).

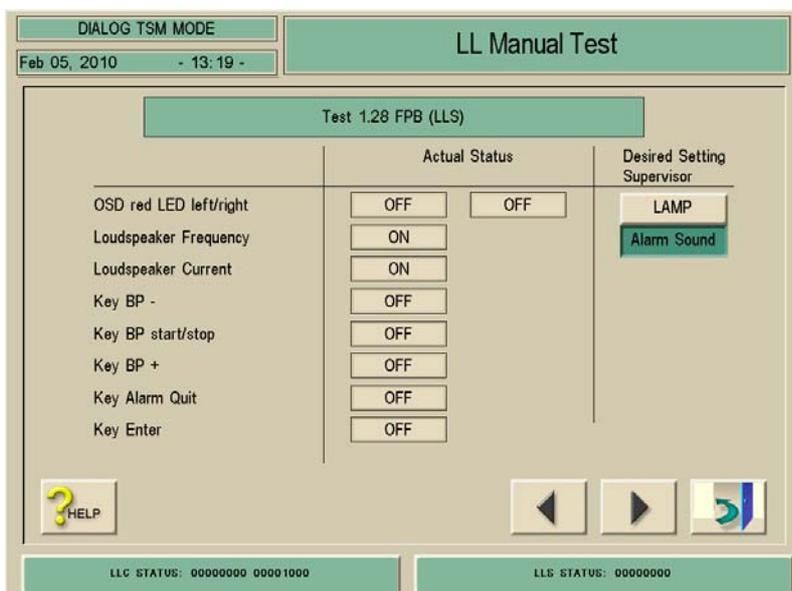
### Test Alarm Quit/Enter Key

- *Alarm Key*

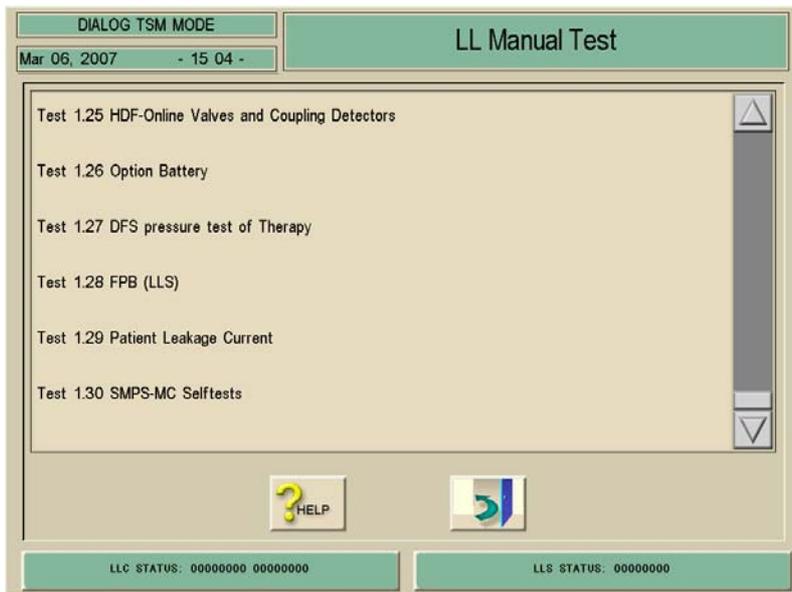
Press the  key on the front panel board FPB and wait for switching (*OFF/ON*).

- *Enter Key*

Press the  key on the front panel board FPB and wait for switching (*OFF/ON*).



## 4.8.2.29 Test 1.29 Patient Leakage Current



1. Activate the *Patient Leakage Current* menu with the *Patient Leakage Current* key in the *LL Manual Test* menu. The following menu is displayed.

2. Check the functions with the appropriate keys.

### Patient Leakage Current

You can set all required parameters for the measurement of the patient leakage current in the menu. The following parameters and functions are available:

- Automatic control of the conductivity after entering the set point value (default: max. conductivity setting).
- Heater can be switched on and off manually (automatic switch-off at 60 °C).
- Possibility to switch from Main Flow to Bypass (default: main flow).
- Set point can be set for the speed of the blood pump (default 0)
- Display of the conductivity and temperature
- DF flow between 500 – 600 ml/min depending on pump

### Conductivity

The conductivity can be activated for the measurement of the patient leakage current.

### Heater

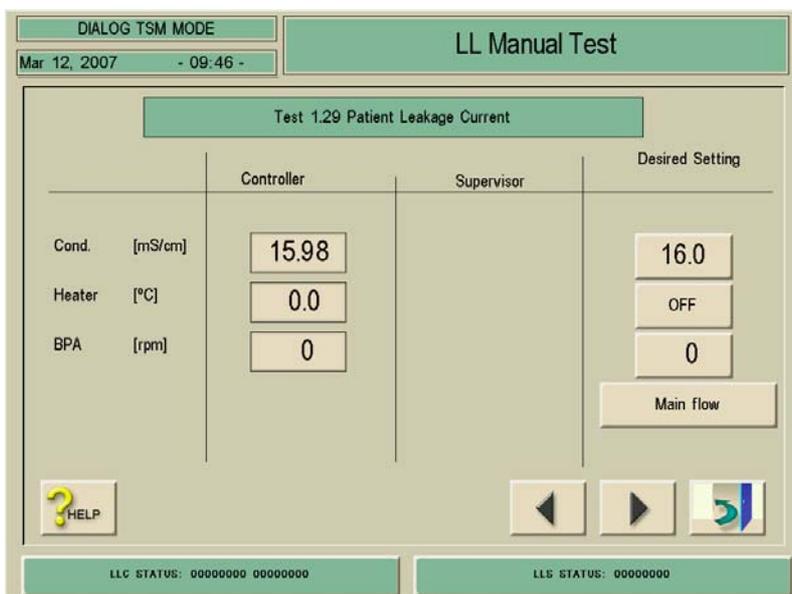
The heater can be switched on for the measurement of the patient leakage current. The heater is controlled with 100 % until it reaches 60 °C and is then switched off.

### BPA

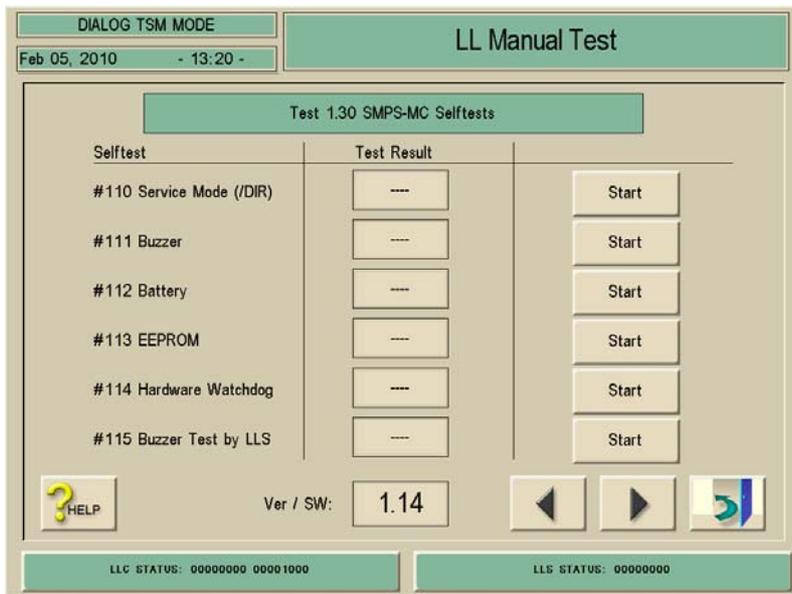
The blood pump can be activated additionally if the measurement is performed with tubing set (line).

### Main Flow

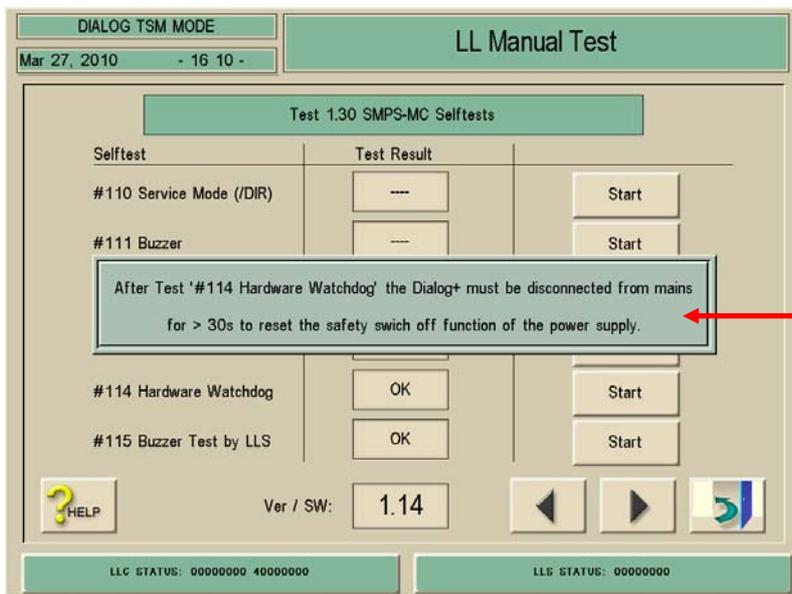
The machine can be switched between main flow and bypass.



## 4.8.2.30 Test 1.30 SMPS-MC Self Tests



1. Activate the *Test 1.30 SMPS-MC Self Tests* menu with the *SMPS-MC Self Tests* key in the *Low Level Manual Test* menu. The following menu is displayed.
2. Check the functions with the appropriate keys.



The switch mode power supply microcontroller SMPS-MC can be tested with the self test functions in this menu.

The relays K3/K4 are deactivated during all self tests.

The self tests are described in detail on the next page.

#110 Service Mode (/DIR)

#111 Buzzer

#112 Battery

**Note:** #112 Battery is performed only if the battery option is present.

#113 EEPROM

#114 Hardware Watchdog

**Note:** This window appears if the #Test 114 was performed. The safety switch-off of the SMPS-MC must be reset after the test, i.e. the machine must be disconnected from mains for > 30 s (disconnect mains plug from mains receptacle).

#115 Buzzer Test by LLS

#### Ver/SW

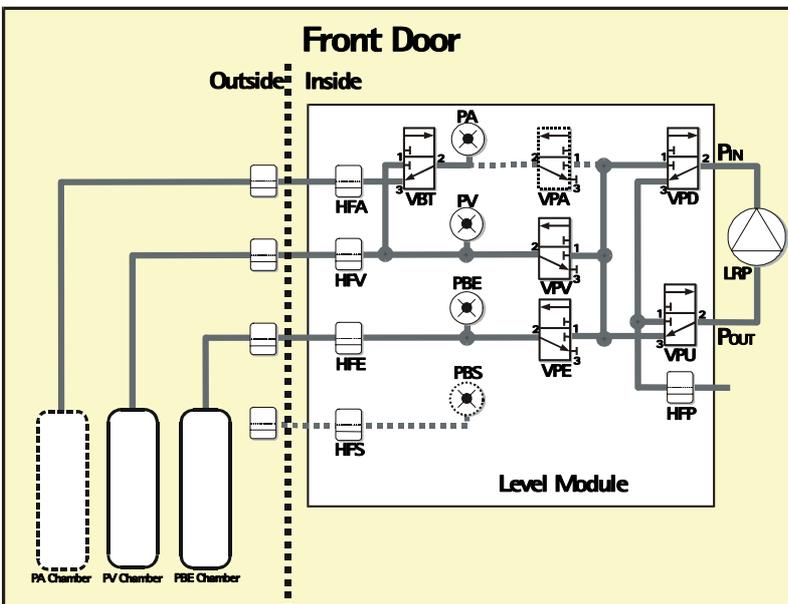
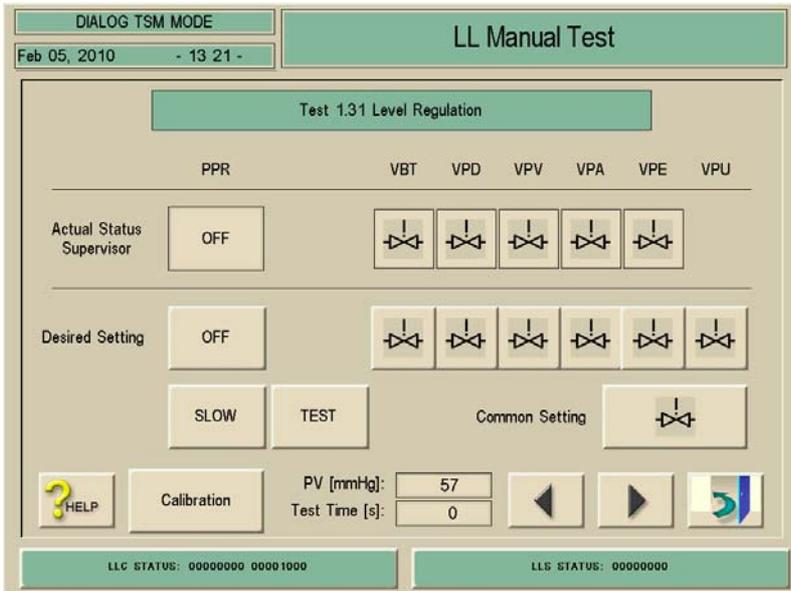
The software version of the SMPS-MC is displayed.

## 4.8.2.30.1 Self Tests SMPS-MC

Relays K3/K4 are deactivated during all self tests.

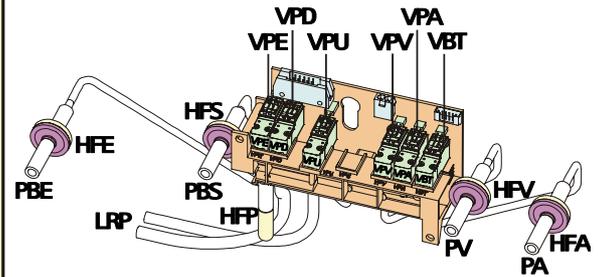
No.	Test	Description	Reaction SMPS-MC	Reaction Dialog+
-	Flash memory	Microcontroller of SMPS-MC checks the flash memory	Condition: <ul style="list-style-type: none"> <li>Machine connected to mains</li> </ul> Response: <ul style="list-style-type: none"> <li>Power-On reset + CRC</li> </ul> Condition: <ul style="list-style-type: none"> <li>Mains switch ON</li> </ul> Response: <ul style="list-style-type: none"> <li>Watchdog timer reset + CRC</li> </ul> Error in flash: <ul style="list-style-type: none"> <li>Switch-on not possible, quick flashing of the operating status LED H900 (5 .. 10 Hz)</li> </ul>	
110	Service mode (/DIR_ON)	Microcontroller of SMPS-MC checks the operating mode	Service jumper X101 connected <ul style="list-style-type: none"> <li>TSM mode (alarms deactivated)</li> </ul> Service jumper X101 not connected <ul style="list-style-type: none"> <li>Therapy mode (alarms activated)</li> </ul>	if /DIR_ON = 0 (service jumper X101 connected): <ul style="list-style-type: none"> <li>Therapy is rejected</li> <li>Error message is generated</li> </ul>
111	Buzzer test (the buzzer is tested via LLS in # 115)	Microcontroller of the SMPS-MC checks the function of the buzzer (without drive/activation from LLS)		
112	Battery test (is performed only if option is present)	Check whether battery is connected and if connected, check whether battery is charged sufficiently	OK: <ul style="list-style-type: none"> <li>Battery present and charged sufficiently</li> </ul> not OK: <ul style="list-style-type: none"> <li>Battery not present or not charged sufficiently</li> </ul>	if not OK: <ul style="list-style-type: none"> <li>Warning is generated</li> <li>Therapy still possible</li> </ul>
113	EEPROM	Microcontroller of the SMPS-MC checks the EEPROM memory (EEPROM currently not used)		
114	Hardware watchdog WD	In TSM service program only A simulated microcontroller failure tests the function of the hardware watchdog (the trigger signals for the hardware WD are switched off)	Condition: <ul style="list-style-type: none"> <li>Trigger HW-WD</li> </ul> Response: <ul style="list-style-type: none"> <li>Buzzer and staff call ON</li> <li>+24 VGX OFF</li> <li>Heater OFF</li> </ul> Only a reset of the microcontroller (enable voltage) deactivates the alarm (mains connector must be disconnected from the mains > 30 s)  <b>If switch-off time &lt; 30 s</b> Mains plug was connected again without waiting more than 30 s. LED H900 on SMPS-MC continues to flash - Remove fuse on battery rack -- LED H900 goes out. - Insert again the fuse.	
115	Buzzer test via LLS	Microcontroller of SMPS-MC checks the function of the buzzer	The +24 VGB and +24 VGD are always switched off during this test (a communication between LLS and SMPS-MC is not possible without this switch-off) <ul style="list-style-type: none"> <li>LLC informs LLS via DIABUS</li> <li>LLC sends #115 to SMPS-MC</li> <li>LLS must activate AKAL-S within 5 s</li> </ul> OK: <ul style="list-style-type: none"> <li>Buzzer OK.</li> </ul> not OK: <ul style="list-style-type: none"> <li>Buzzer not OK.</li> </ul>	if not OK: <ul style="list-style-type: none"> <li>Warning is generated</li> <li>Therapy still possible</li> </ul>

4.8.2.31 Test 1.31 Level Regulation



1. Activate the *Test 1.31 Level Regulation* menu with the *Level Regulation* key in the *Low Level Manual Test* menu. The following menu is displayed.
2. Check the functions with the appropriate keys.

The valves VPE, VPD, VPU, VPV, VPA, and VBT are all assembled on the level regulation module. All valves can be activated and tested. The manometer connectors must be opened for the test.



**Actual Status Supervisor**

**LRP (PPR) OFF/ON**

The supervisor must detect correctly the current status of the level regulation pump LRP (PPR).

**Desired Setting**

**OFF/ON**

The level regulation pump LRP (PPR) can be switched on and off.

**Slow/Fast**

The desired value for the LRP can be switched between a *Slow* and a *Fast* setting.

**Test**

The delivery of the LRP can be checked with the *Test* key. A measurement chamber must be connected to PV. LRP stops when 500 ml are reached and the required time for the pressure build-up is displayed.

## 4.8.3 Low Level Manual Calibration

## 4.8.3.1 General Calibration Information

## Specifications for Measurement Instruments



Measurement instruments (e.g. dialysis measurement instrument) used to calibrate Dialog machines are subject to regular inspections or if necessary calibration by the respective manufacturer or by a certified calibration lab.

<b>Pressure</b>	For ABPM <ul style="list-style-type: none"> <li>• Accuracy <math>\leq 0.8</math> mmHg</li> </ul>
<b>Pressure</b>	For PV, PA, PBS, PBE <ul style="list-style-type: none"> <li>• Accuracy <math>\leq \pm 1</math> mmHg</li> </ul>
<b>Temperature</b>	<ul style="list-style-type: none"> <li>• Temperature accuracy: <math>\leq \pm 0.2</math> °C</li> <li>• Temperature resolution minimum 0.1 °C</li> </ul>
<b>Conductivity</b>	<ul style="list-style-type: none"> <li>• Temperature coefficient <math>\alpha = 2.10</math> %/°C (set)</li> <li>• Reference temperature <math>T_{Ref} = 25</math> °C (set)</li> <li>• Correct cell constant (set)</li> <li>• Conductivity accuracy: <math>\leq \pm 0.1</math> mS/cm</li> <li>• Conductivity resolution 0.01 mS/cm</li> </ul>
<b>Balance</b>	<ul style="list-style-type: none"> <li>• Measurement range <math>&gt; 200</math> g, accuracy <math>&lt; 0.5</math> g</li> </ul>
<b>Manometer</b>	For PE and PDA: <ul style="list-style-type: none"> <li>• Accuracy Class <math>\leq 0.5</math></li> </ul> For DMV, RVFPA, RVFPE, DDE and RVDA: <ul style="list-style-type: none"> <li>• Accuracy Class <math>\leq 1.0</math></li> </ul>
<b>Flow Meter</b>	4 % of final value: <ul style="list-style-type: none"> <li>• 1.1 l/min, approx. <math>\pm 44</math> ml/min</li> </ul>

## Hardware Keys

Various keys (software keys and hardware keys) are used during calibration. The hardware keys (on the front panel board) can be used via the keyboard membrane (see figure). The function and significance of the hardware keys are as follows.

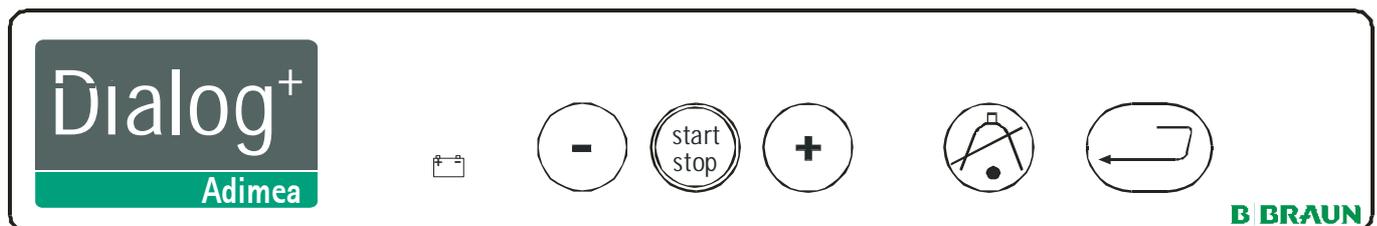


Fig. : Symbols of Hardware Keys on Keyboard Membrane of Monitor



Input values can be decreased in increments with the displayed hardware key as an alternative to the software key on the touch screen.

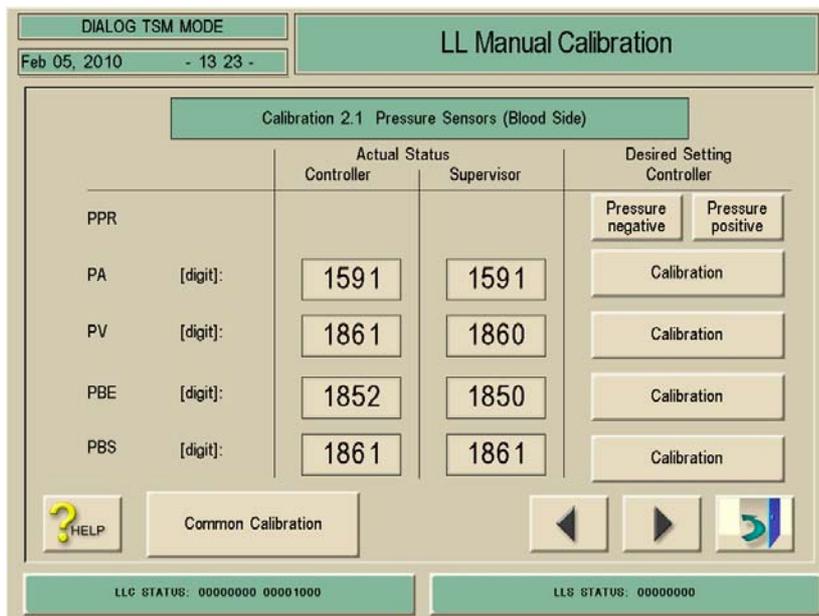


Input values can be increased in increments with the displayed hardware key as an alternative to the software key on the touch screen.



The service overview can be selected in the TSM with the hardware key.

## Software Keys and Icons



The software keys and icons are displayed in the respective menus of the TSM service program and can be used via the touch screen. The procedure for calibration of the sensors is similar in all *Low Level Manual Calibration* menus.

**Example**

Select the menu via the following menus:

- *TSM Main Menu*
- *Manual Test and Calibration*
- *Low Level Manual Calibration*
- *Calibration 2.1 Pressure Sensors (Blood Side)*

**Function of the Software Keys and Icons**

The function of the software keys and icons are as follows:



Press the *HELP* to see the help information of the menu.



A single sensor can be selected for calibration with the *Calibration* key. A lower calibration window is opened (see second figure).



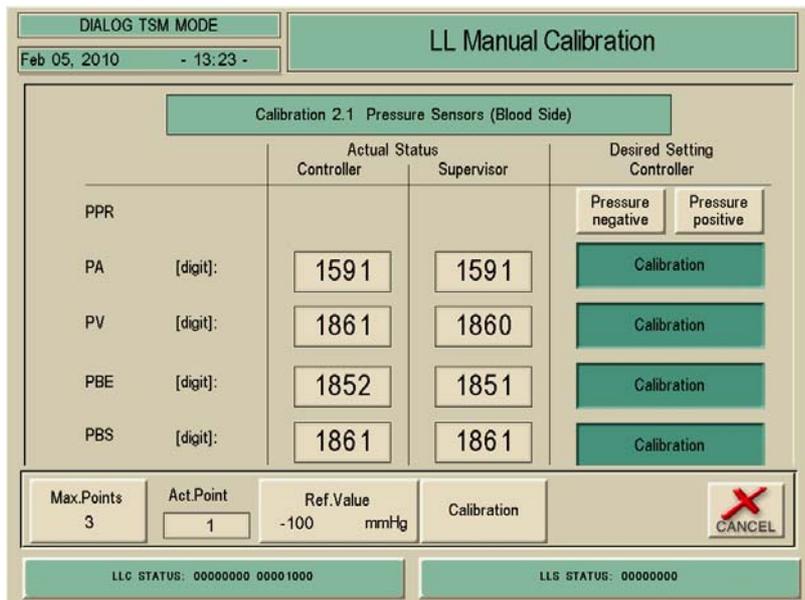
A combined sensor calibration can be selected with the *Common Calibration* key. A lower calibration window is opened (see second figure on next page).

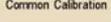


If required, the previous calibration menu or the next calibration menu can be selected with the *Previous* and *Next Arrow* keys.



The menu can be closed with the *Exit Door* key.



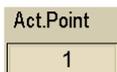
The  key was selected. A calibration window is opened (bottom section of the menu).

**Function of the Software Keys und Icons**

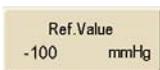
The function of the software keys und icons during calibration are as follows:



The max. number of calibration points is displayed, e.g. three calibration points. Click on key: the number of calibration points can be modified with the -/+ keys. We recommend keeping the suggested number or increasing only, do not decrease the number.



The actual calibration point is displayed, e.g. first calibration point.



The suggested reference value is displayed for the first calibration point.



If the reference value key is pressed, an input keypad is displayed. The value from the measurement instrument can be entered. The entered value must be in the permissible limits (e.g. -100 to 500 mmHg).

The entered value can be cancelled and the window is closed.

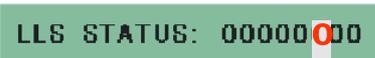
The entered value can be confirmed with the OK key and the window is closed.



The calibration point with the entered calibration value can be confirmed and the calibration value is saved. The sensor values must be checked in therapy mode (service overview) after calibration.



0 1 0



0 1 0

The calibration procedure is completed and the new calibration data are stored in the LLC and LLS.

**Note:** Pay attention to the LLC and LLS status windows. The bit sequence 0-1-0 must be identical in the LLC and LLS status windows during the saving procedure. The calibration data is saved only after the bit sequence 0-1-0 (see figure).

Save the calibration data to the compact flash card before exiting the TSM service program: *TSM Main Menu, File Operations, Save Calibration Data.*

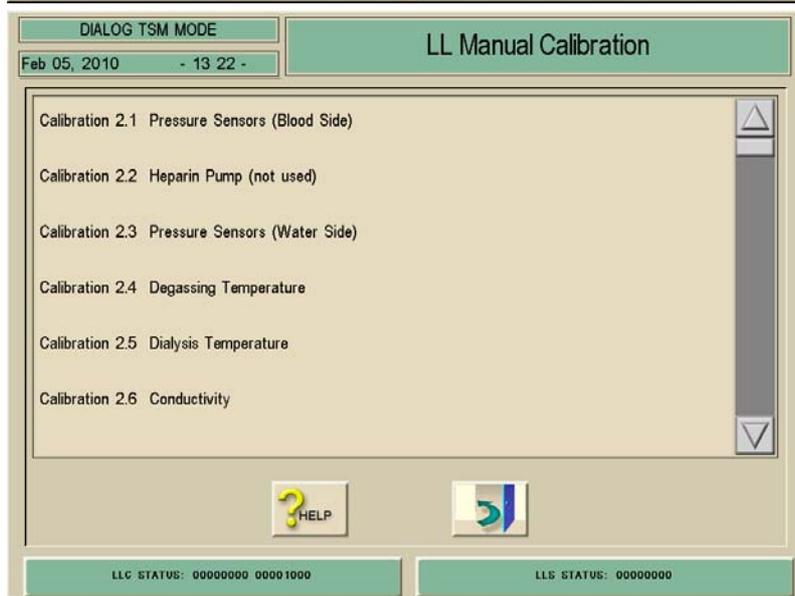
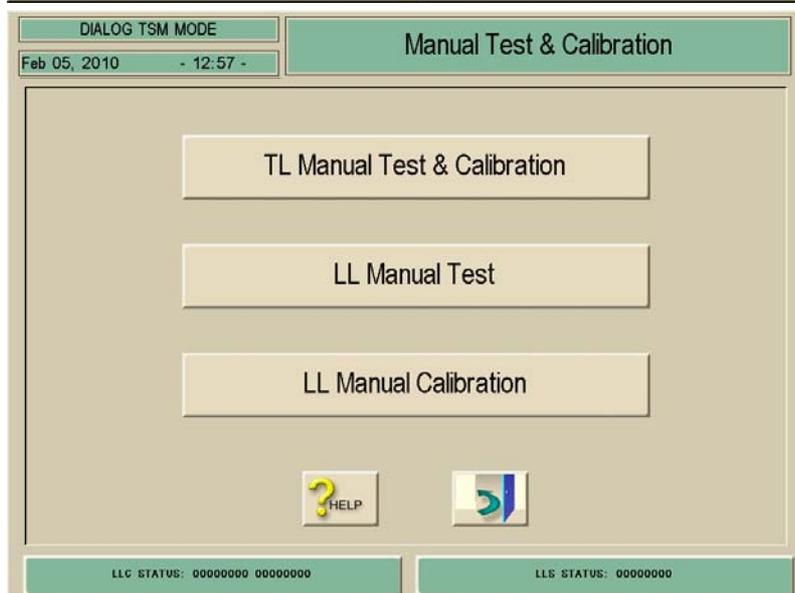
A calibration procedure can be terminated. The existing calibration data are maintained in the LLS and LLC.



**Conversion Table Voltage/Digits**

	Controller/Supervisor (12 bit)
Voltage	0 to 5 V
Digits	0 to 4095

## 4.8.3.2 Select Low Level Manual Calibration



You can calibrate all sensors in the *LL Manual Calibration* menu. The number of calibration points is preset.

Some sensors have the possibility to run a combined or a single calibration.

The *TSM Main Menu* is displayed after the machine is switched on (set service switch S1 to position 2, on digital board).

1. Activate the *Manual Test & Calibration* menu with the *Manual Test & Calibration* key in the *TSM Main Menu*. The following menu is displayed.

2. Activate the *LL Manual Calibration* menu with the *LL Manual Calibration* key in the *Manual Test and Calibration* menu. The following menu is displayed.

The following low level calibrations can be selected:

- 2.1 Pressure Sensors (Blood Side)
- 2.2 Heparin Pump (not applicable)
- 2.3 Pressure Sensors (Water Side)
- 2.4 Degassing Temperature
- 2.5 Dialysis Temperature
- 2.6 Conductivity
- 2.7 Blood Leak Detector
- 2.8 Flow of BICP, KP and UF
- 2.9 Safety Air Detector SAD
- 2.10 BICLF Ratio and ENDLF Ratio
- 2.11 Load Cell (not applicable)
- 2.12 PV Alarm Window, PA Low Limit
- 2.13 Flow of BPA and BPV Pump
- 2.14 Substitution Pump (not applicable)
- 2.15 HDF Online Substitution Pump OSP
- 2.16 Level Regulation

### 4.8.3.3 Calibration Pressure Sensors Blood Side PA, PV, PBE and PBS

#### Prior to Calibration

- Use calibrated measurement instrument
- Wait until Dialog has reached working temperature

You can calibrate the following pressure sensors of the blood side either separately or combined:

- **PA** arterial pressure sensor
- **PV** venous pressure sensor
- **PBE** blood inlet pressure sensor
- **PBS** blood control pressure sensor

After a calibration compare the pressure sensor values in the test menu. The sensor values are displayed in digits (see conversion table).

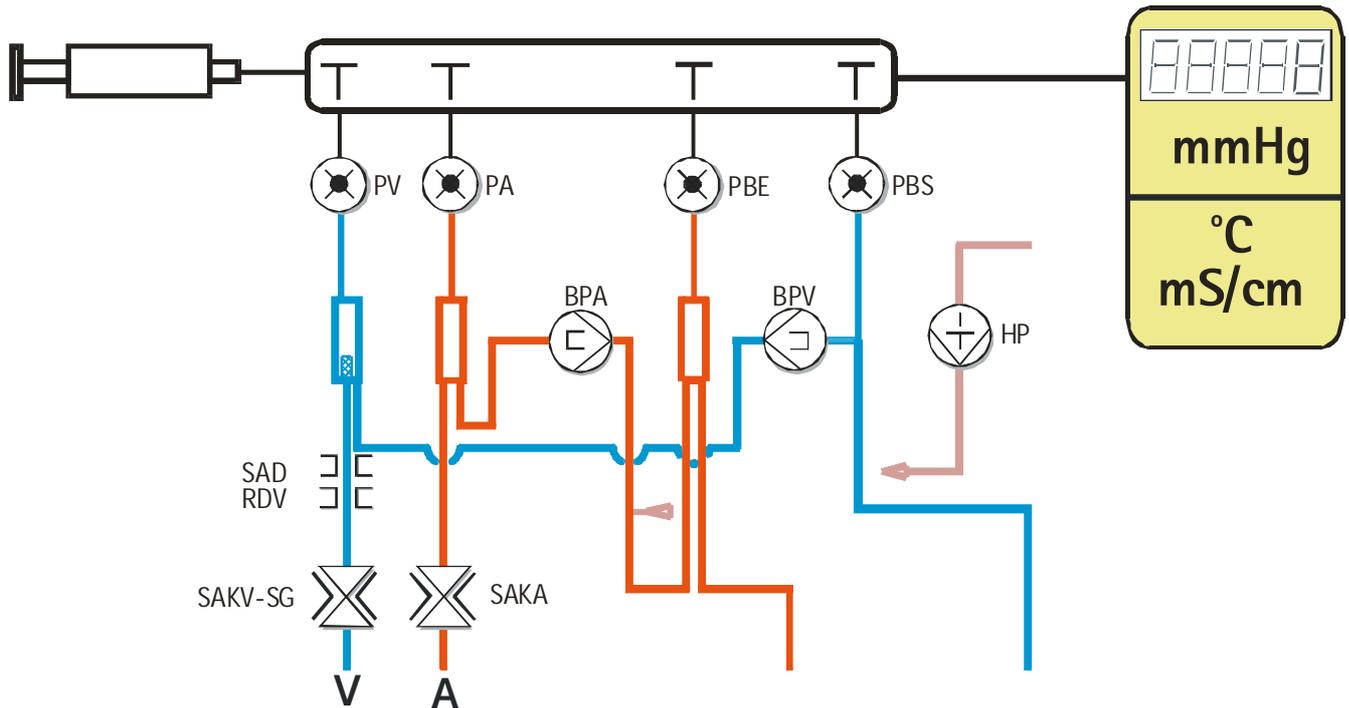
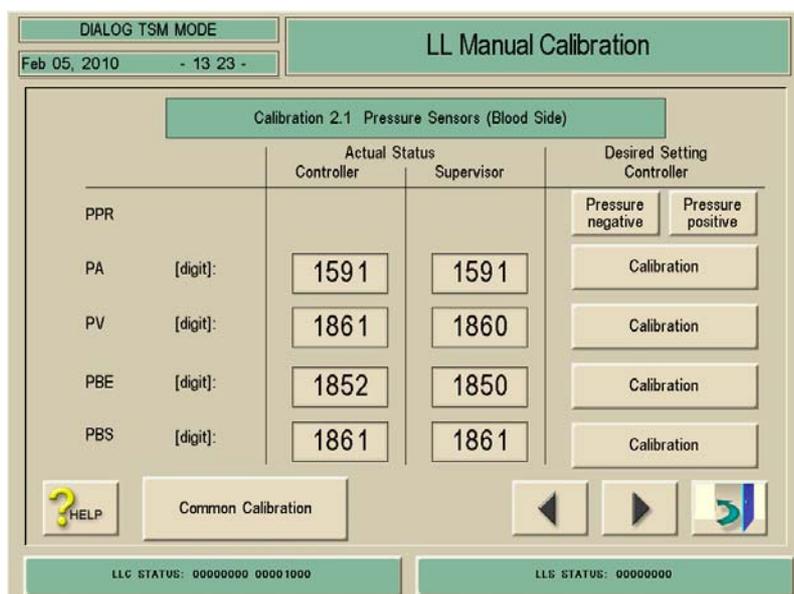


Fig. : Single Needle Version



1. Activate the LL Manual Calibration menu with the *LL Manual Calibration* key in the *Manual Test and Calibration* menu.
2. Activate the *Pressure Sensors Blood Side* menu by pressing on the line *Calibration 2.1 Pressure Sensors Blood Side*. The following menu is displayed.

	Actual Status		Desired Setting	
	Controller	Supervisor	Pressure negative	Pressure positive
PPR				
PA	[digit]: 1591	1591	Calibration	
PV	[digit]: 1861	1860	Calibration	
PBE	[digit]: 1852	1851	Calibration	
PBS	[digit]: 1861	1861	Calibration	

Max.Points: 3    Act.Point: 1    Ref.Value: -100 mmHg    Calibration    CANCEL

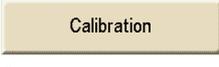
LLC STATUS: 00000000 00001000    LLS STATUS: 00000000

A common calibration or a single calibration can be performed for the pressure sensors.

### Common Calibration

Press the  key for a combined calibration of the pressure sensors **PA**, **PV**, **PBE** and **PBS**. A calibration window is opened if the key is selected. The common calibration of all blood pressure sensors is recommended. The menu shows the *Common Calibration*.

### Single Calibration

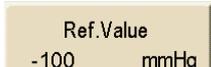
Press an individual  key for a single calibration of the pressure sensor **PA**, **PV**, **PBE** or **PBS**. A calibration window is opened if the key is selected.

Venous Pressure Ref. mmHg  
[-100.0 ... 500.0]

PPR									
PA	[digit]:	1	2	3	Calibration				
PV	[digit]:	4	5	6	Calibration				
PBE	[digit]:	7	8	9	Calibration				
PBS	[digit]:	0	C	+/-	.	Calibration			

Max.Points: 3    Act.Point: 1    CANCEL    O.K.    CANCEL

LLC STATUS: 00000000 00001000    LLS STATUS: 00000000

Press the  key to enter a reference value. A keypad is opened if the key is selected.



Pay attention to the negative or positive sign during the enter of the reference value.



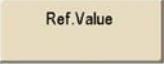
- Pressure measurement instrument (e.g. HDM 99 or equivalent)
- Syringe
- Stopcock system with lines (770203A) or tubing/tubing clamp



3. Connect the pressure measurement instrument, syringe and stopcock system.
4. Connect the tubing to the respective pressure sensors **PA**, **PV**, **PBE** and/or **PBS** (option).

### PA/PV/PBE/PBS Calibration Point -100 mmHg

5. Press  key.
6. Build up a pressure of -100 mmHg (+10 mmHg) with a syringe and clamp the tube.

7. Press  key.  
Wait until digits are stable.

8. Enter the stable value from the pressure measurement instrument as reference value.

9. Confirm with the  key.

**PA/PV/PBE/PBS Calibration Point  
0 mmHg**

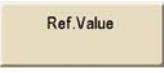
10. Remove syringe for the 0 mmHg calibration (open to atmosphere).  
Wait until digits are stable.

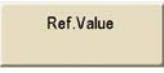
A rectangular button with a light beige background and a thin black border. The text "Calibration" is centered in a black sans-serif font.

11. Confirm the reference value 0 mmHg with the  key.

**PA/PV/PBE/PBS Calibration Point  
+500 mmHg**

12. Connect syringe and build up a pressure of +500 mmHg (-10 mmHg) and clamp the tube.

A rectangular button with a light beige background and a thin black border. The text "Ref. Value" is centered in a black sans-serif font.

13. Press  key.

14. Enter the stable value from the pressure measurement instrument as reference value.

Wait until digits are stable.

A rectangular button with a light beige background and a thin black border. The text "Calibration" is centered in a black sans-serif font.

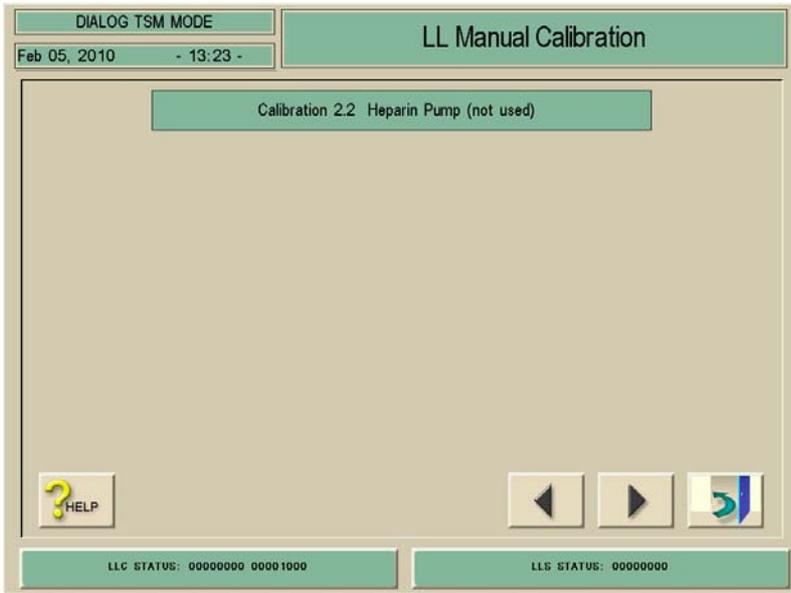
15. Confirm with the  key.

**Note:** The calibration data is saved only after the bit sequence 0-1-0 (for detailed information see 4.8.3.1 General Calibration Information).

16. Confirm and store completed calibration with  key.

17. Remove pressure measurement instrument, syringe and tubing.

4.8.3.4 Heparin Pump



Not applicable.



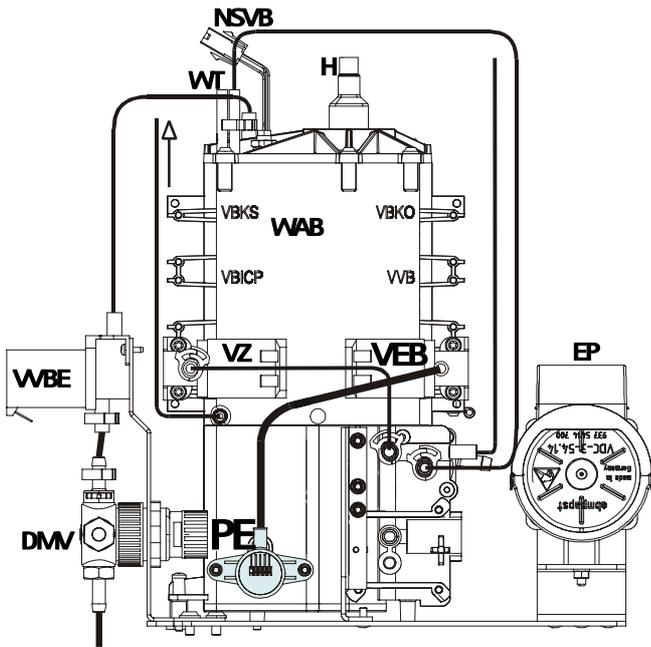


Fig.: Original Tubing Water Sub-Rack (rear view)

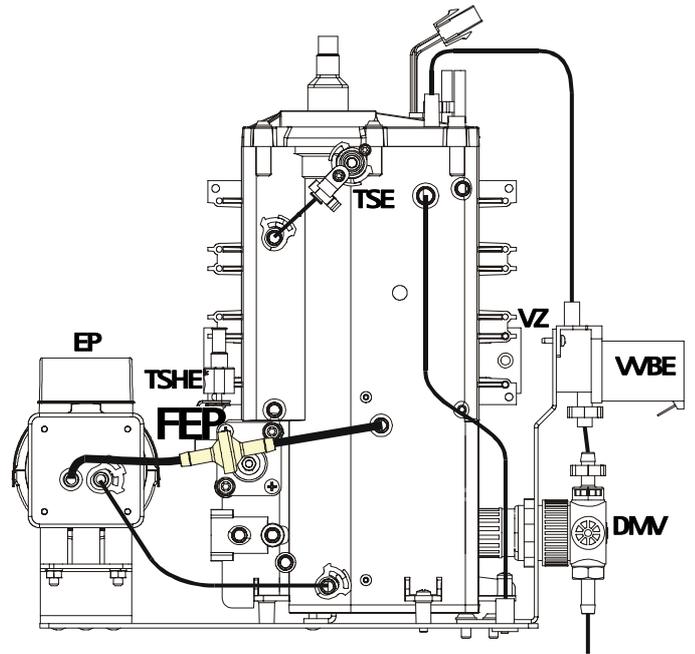


Fig.: Original Tubing Water Sub-Rack (front view)

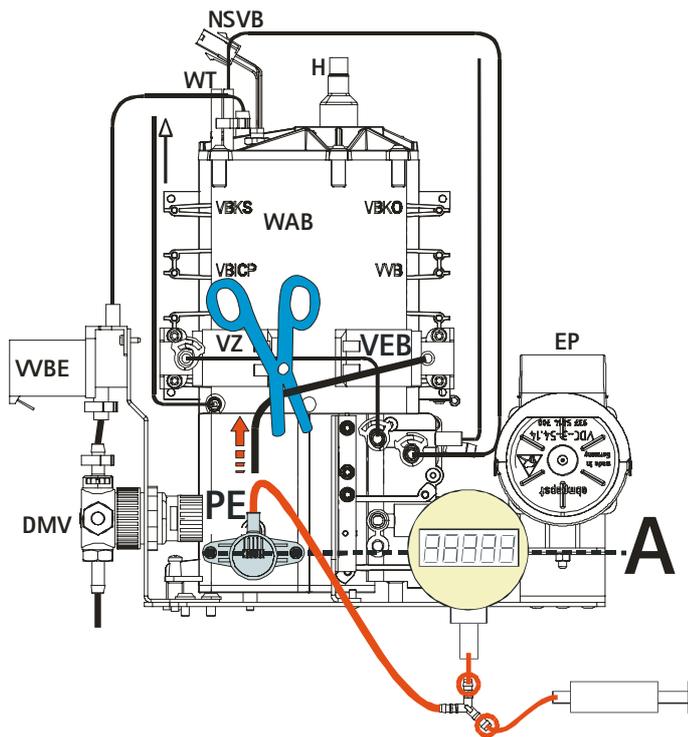


Fig.: Water Sub-Rack with Loop-In for Manometer at PE and Tubing Clamp at VEB (rear view)

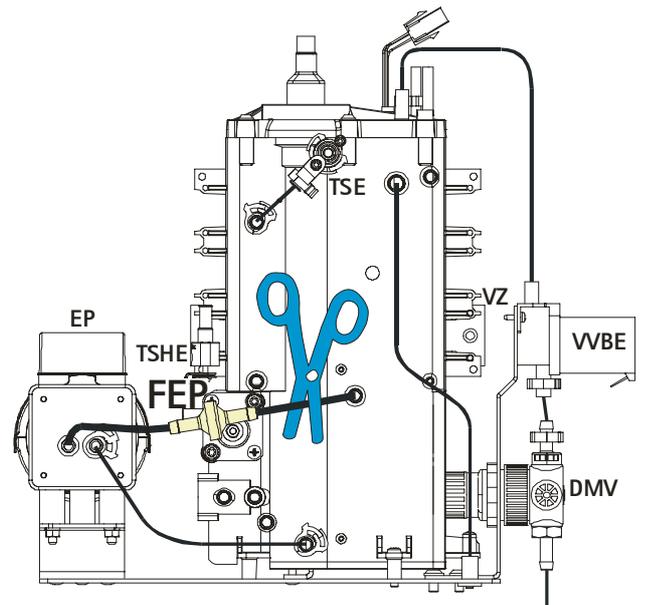


Fig.: Water Sub-Rack with Tubing Clamp between FEP and EP (front view)



The calibration for the degassing pressure sensor **PE** is performed with a two point calibration (-400 mmHg/-533 mbar and -100 mmHg/-133 mbar). The calibration can be performed either with a manometer or a pressure measurement instrument. The calibration is described with a manometer. The measurement unit *mmHg* or *mbar* can be selected for calibration.



**Conversion Factor mmHg to mbar**

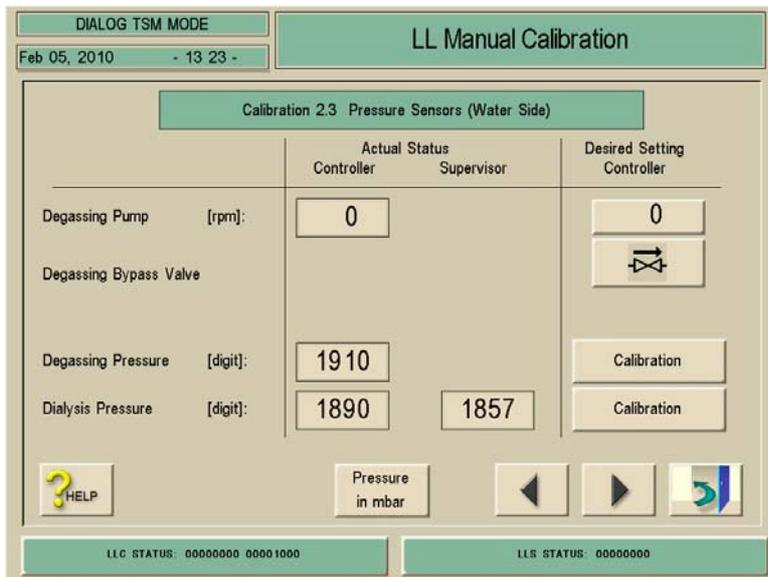
Conversion Factor = 1.3332

Example:

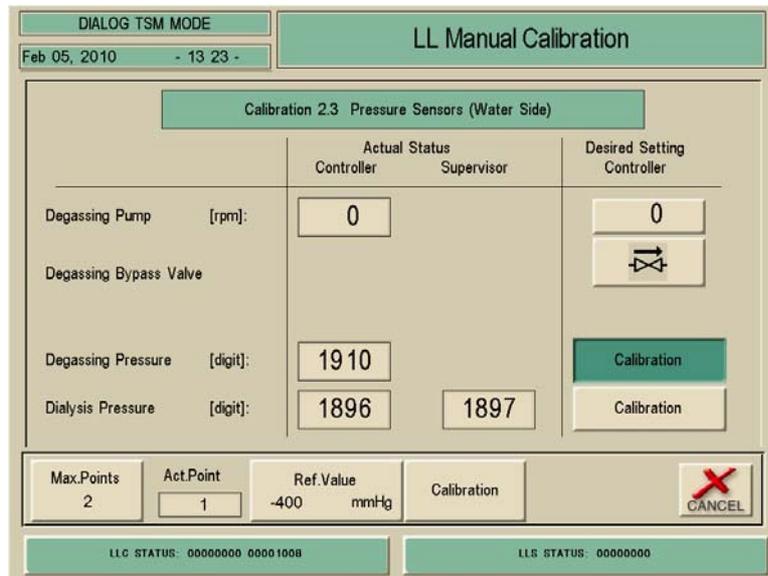
-100 mmHg      approx. -130 mbar  
 -400 mmHg     approx. -530 mbar



- Manometer or pressure measurement instrument
- Syringe
- Y piece
- Tubing and tubing clamps



1. Activate the *LL Manual Calibration* menu with the *LL Manual Calibration* key in the *Manual Test and Calibration* menu.
2. Activate the *Pressure Sensors (Water Side)* menu by pressing on the line *Calibration 2.3 Pressure Sensors (Water Side)*. The following menu is displayed.





Pay attention to the negative sign during the enter of the reference value.



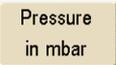
### Prevent offset during calibration

Pay attention that there is no fluid in the tubing to the manometer.



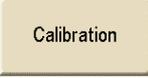
3. Clamp tubing at filter degassing pump **FEP** inlet.
4. Clamp tubing between degassing bypass valve **VEB** and degassing pressure sensor **PE** and pull off tubing from the degassing pressure sensor **PE**.
5. Connect a manometer and a syringe to the **PE** sensor, using a Y-piece and extra tubing.  
If required.

PE Calibration Point -400 mmHg  
-530 mbar

6. You can set the measurement unit to mbar with the  key if you want to perform a calibration in mbar.
7. Press *Degassing Pressure PE*  key.
8. Use a syringe to create a negative pressure of (reading on manometer display):
  - -400 mmHg ±10 mmHg
  - -530 mbar ±13 mbar

9. Press  key.
10. Enter the stable value from the manometer as reference value.  
Wait until digits are stable.

PE Calibration Point -100 mmHg  
-130 mbar

11. Confirm with  key.
12. Use syringe and create a negative pressure of (reading on manometer display):
  - -100 mmHg ±10 mmHg
  - -130 mbar ±13 mbar

13. Press  key.
14. Enter the stable value from the manometer as reference value.  
Wait until digits are stable.

15. Confirm with  key.

16. Confirm and store complete calibration procedure with  key.

**Note:** The calibration data is saved only after the bit sequence 0-1-0 (for detailed information see 4.8.3.1 General Calibration Information).

17. Remove calibration devices.
18. Reconnect tubings.
19. Check function in TSM menu *Test 1.16 Pressure Water Part*:
  - Open degassing bypass valve **VEB** and set speed of degassing pump **EP** to 1,500 rpm
  - **PE** should show a of approx. < -35 mmHg/-50 mbar
  - Close **VEB** and increase speed to 2,100 rpm
  - **PE** should show a value of approx. < -500 mmHg/-670 mbar

#### 4.8.3.5.1 Calibration Degassing Pressure Sensor PE for Machines at High Altitudes of >1,000 m



##### For calibration point -400 mmHg/-530 mbar

If the Dialog machine is used at high altitudes (>1,000 m above sea level), an offset of +75 mmHg/+100 mbar per 1000 m must be used for the calibration of the degassing pressure sensor PE.

##### Measurement unit mmHg

1,000 m altitude: -325 mmHg (-400 mmHg + 75 mmHg offset = -325 mmHg)

2,000 m altitude: -250 mmHg (-400 mmHg + 150 mmHg offset = -250 mmHg)

3,000 m altitude: -175 mmHg (-400 mmHg + 225 mmHg offset = -175 mmHg)

##### Measurement unit mbar

1,000 m altitude: -430 mbar (-530 mbar + 100 mbar offset = -430 mbar)

2,000 m altitude: -330 mbar (-530 mbar + 200 mbar offset = -330 mbar)

3,000 m altitude: -230 mbar (-530 mbar + 300 mbar offset = -230 mbar)

#### Example for Calibration at 1,000 m Altitude



1. Clamp tubing at filter degassing pump FEP.
2. Clamp tubing between degassing bypass valve VEB and degassing pressure sensor PE and pull off tubing from the degassing pressure sensor PE.
3. Connect a manometer and a syringe to the PE sensor, using a Y-piece and extra tubing.

#### PE Calibration Point -400 mmHg -530 mbar

4. Press the *Degassing Pressure PE*  key.
5. Use syringe and create a negative pressure, e.g. at 1,000 m altitude:
  - -325 mmHg ±10 mmHg (-400 mmHg plus offset +75 mmHg/1,000 m)
  - -430 mbar ±13 mbar (-530 mbar plus offset +100 mbar/1,000 m)

6. Press  key.

7. Enter the stable reference value:
  - -325 mmHg ±10 mmHg (-400 mmHg plus offset +75 mmHg/1,000 m)
  - -430 mbar ±13 mbar (-530 mbar plus offset +100 mbar/1,000 m)

Wait until digits are stable.

8. Confirm with  key.

#### PE Calibration Point 0 mmHg 0 mbar

11. Remove syringe (0 mmHg/0 mbar).

12. Press  key.

13. Enter 0 mmHg/0 mbar.

Wait until digits are stable.

14. Confirm with  key.

15. Confirm and store complete calibration procedure with  key.

**Note:** The calibration data is saved only after the bit sequence 0-1-0 (for detailed information see 4.8.3.1 General Calibration Information).

16. Remove calibration devices.

17. Reconnect tubings.

## 4.8.3.6 Calibration Dialysate Outlet Pressure Sensor PDA

**Prior to Calibration**

- Use calibrated manometer (or pressure measurement instrument)
- Position the manometer at the same level as the dialysate outlet pressure sensor **PDA** (see figure, **A**)
- Keep the extra tubings as short as possible for calibration
- Wait until Dialog has reached working temperature

You can calibrate the dialysate outlet pressure sensor **PDA**. Build up the negative or positive pressure in the dialysate circuit with a syringe. Pay attention to the position of **VDA**, it must be closed or the tubing must be clamped manually.

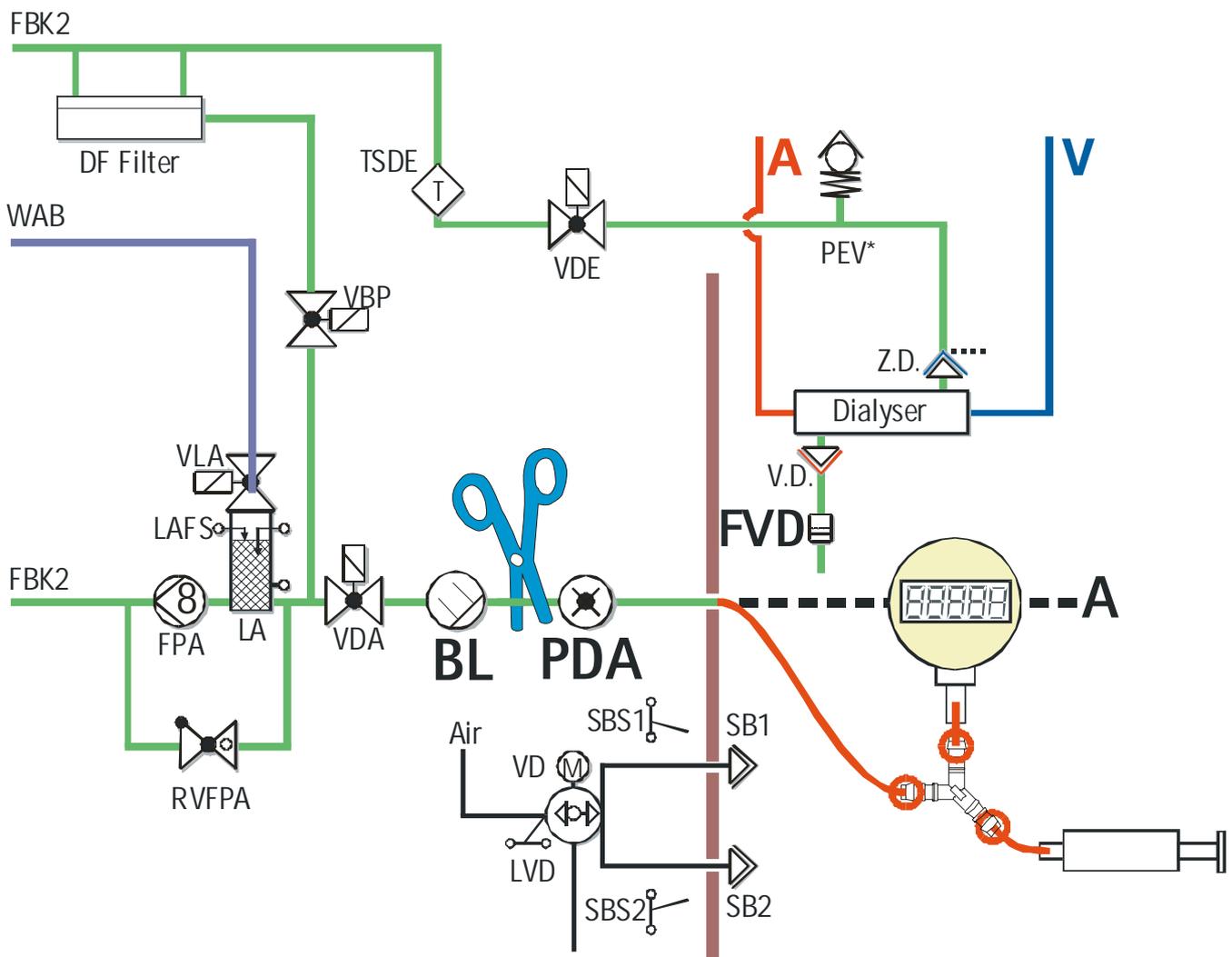


Fig.: Dialysate Circuit and PDA

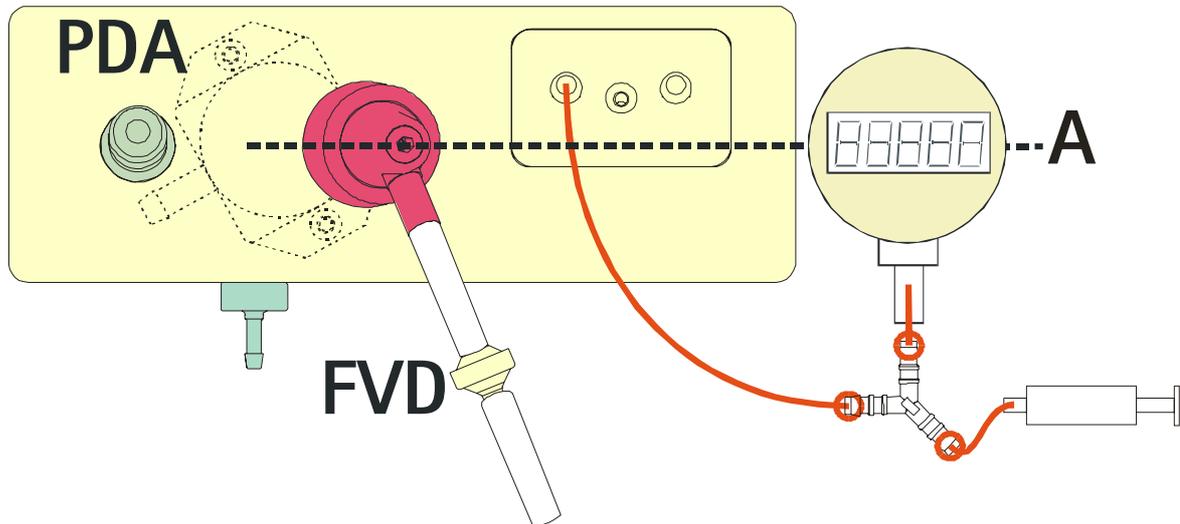


Fig.: Rinsing Bridge with Loop-In for Manometer/Syringe

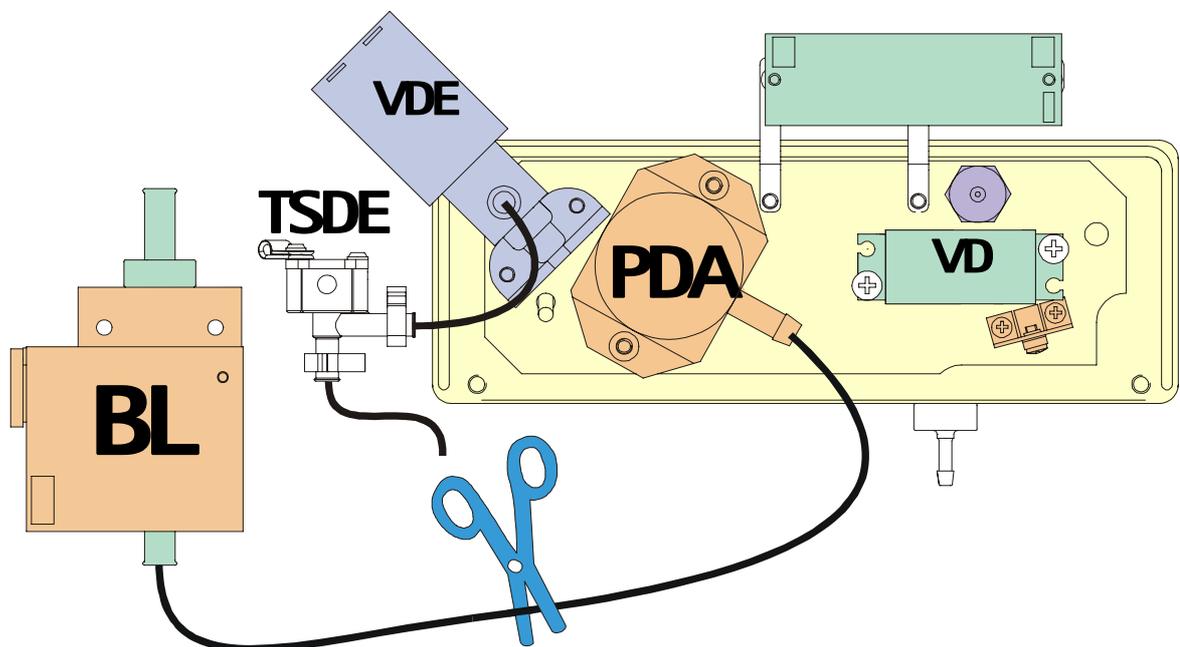


Fig.: Rinsing Bridge with Tubing Clamp between BL and PDA



Pay attention that there is no fluid in the tubing to the manometer. Ensure that the manometer and connection tubing are at the same level as the dialysate outlet pressure sensor **PDA**.

The calibration for the dialysate outlet pressure sensor **PDA** is performed with a three point calibration (-400 mmHg/-533 mbar, 0 mmHg/0 mbar and +400 mmHg/+533 mbar).

The calibration can be performed either with a manometer or a pressure measurement instrument. The calibration is described with a manometer. A measurement unit mmHg or mbar can be selected for calibration.



#### Conversion Factor mmHg to mbar

Conversion Factor = 1.3332

Example:

-400 mmHg	approx. -530 mbar
0 mmHg	0 mbar
+400 mmHg	approx. +530 mbar



- Manometer or pressure measurement instrument
- Syringe
- Y piece
- Tubing and tubing clamp

DIALOG TSM MODE  
Feb 05, 2010 - 13 23 -

### LL Manual Calibration

Calibration 2.3 Pressure Sensors (Water Side)

		Actual Status Controller	Supervisor	Desired Setting Controller
Degassing Pump	[rpm]:	0		0
Degassing Bypass Valve				
Degassing Pressure	[digit]:	1910		Calibration
Dialysis Pressure	[digit]:	1890	1857	Calibration

? HELP      Pressure in mbar      ◀ ▶ ▶

LLC STATUS: 00000000 00001000      LLS STATUS: 00000000

1. Activate the *LL Manual Calibration* menu with the *LL Manual Calibration* key in the *Manual Test and Calibration* menu.
2. Activate the *Pressure Sensors Water Side* menu by pressing on the line *Calibration 2.3 Pressure Sensors Water Side*. The following menu is displayed.

DIALOG TSM MODE  
Feb 05, 2010 - 13 23 -

### LL Manual Calibration

Calibration 2.3 Pressure Sensors (Water Side)

		Actual Status Controller	Supervisor	Desired Setting Controller
Degassing Pump	[rpm]:	0		0
Degassing Bypass Valve				
Degassing Pressure	[digit]:	1910		Calibration
Dialysis Pressure	[digit]:	1896	1897	Calibration

Max.Points 3	Act.Point 1	Ref.Value -400 mmHg	Calibration	
-----------------	----------------	------------------------	-------------	--

LLC STATUS: 00000000 00001008      LLS STATUS: 00000000



Pay attention to the negative or positive sign during the enter of the reference value.



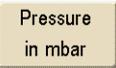
### Prevent offset during calibration

Pay attention that there is no fluid in the tubing to the manometer.



3. Disconnect tubing (to filter **FVD**) from rinsing bridge.
4. Connect manometer and a syringe to the left tubing connector outlet (red dialyser coupling) on rinsing bridge.
5. Clamp tubing between blood leak detector **BL** and dialysate outlet pressure sensor **PDA**.

**PDA Calibration Point -400 mmHg  
-530 mbar**

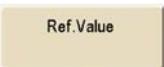
6. Set measurement unit to mbar with the  key if you want to perform a calibration in mbar.

7. Press *Dialysis Pressure PDA*  key.

8. Press  key and enter a third calibration point.

9. Use a syringe to create a negative pressure of (reading on manometer display):

- -400 mmHg  $\pm 10$  mmHg
- -530 mbar  $\pm 13$  mbar

10. Press  key.

11. Enter the stable value from the manometer as reference value.  
Wait until digits are stable.

12. Confirm with the  key.

**PDA Calibration Point 0 mmHg  
0 mbar**

13. Open syringe to atmosphere for 0 mmHg/0 mbar calibration.

14. Press  key.

15. Enter the value "0" from the manometer as reference value.  
Wait until digits are stable.

16. Confirm with the  key.

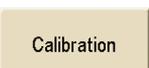
**PDA Calibration Point +400 mmHg  
+ 530 mbar**

17. Use the syringe to create a positive pressure of (reading on manometer display):

- +400 mmHg  $\pm 10$  mmHg
- +530 mbar  $\pm 13$  mbar

18. Press  key.

19. Enter the stable value from the manometer as reference value.  
Wait until digits are stable.

20. Confirm with  key.

21. Confirm and store complete calibration procedure with  key.

**Note:** The calibration data is saved only after the bit sequence 0-1-0 (for detailed information see 4.8.3.1 General Calibration Information).

22. Remove calibration devices.

23. Reconnect tubings.

### 4.8.3.7 Calibration Degassing Temperature Sensor TSE/ Heater Inlet Temperature Sensor TSHE

**Prior to Calibration**

- Position the heater inlet temperature sensor **TSHE** next to **TSE** (see figure redirect heater inlet temperature sensor **TSHE**, next page)
- Use calibrated measurement instrument
- Wait until Dialog has reached working temperature

The degassing temperature sensor **TSE** and the heater inlet temperature sensor **TSHE** are calibrated together. The following calibration points are used:  
**TSE / TSHE: 30 °C, 40 °C, 85 °C**

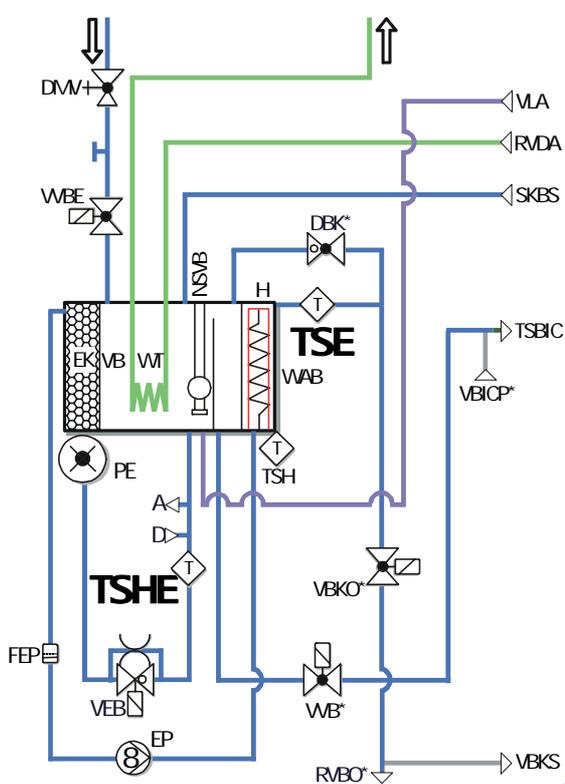


Fig.: Temperature Circulation

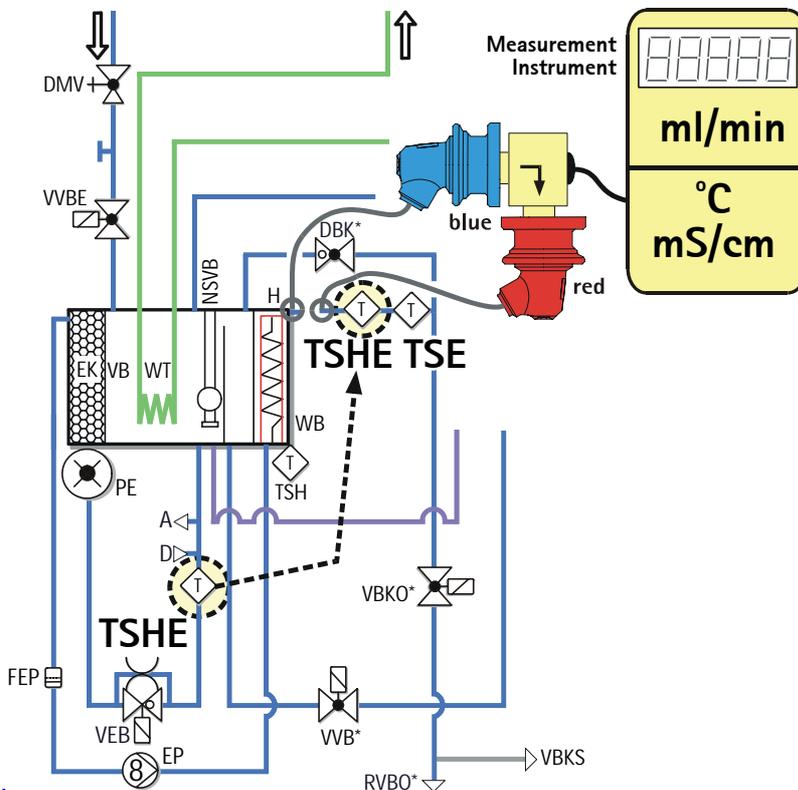


Fig.: Loop-In Point and TSHE in Line with TSE for Calibration

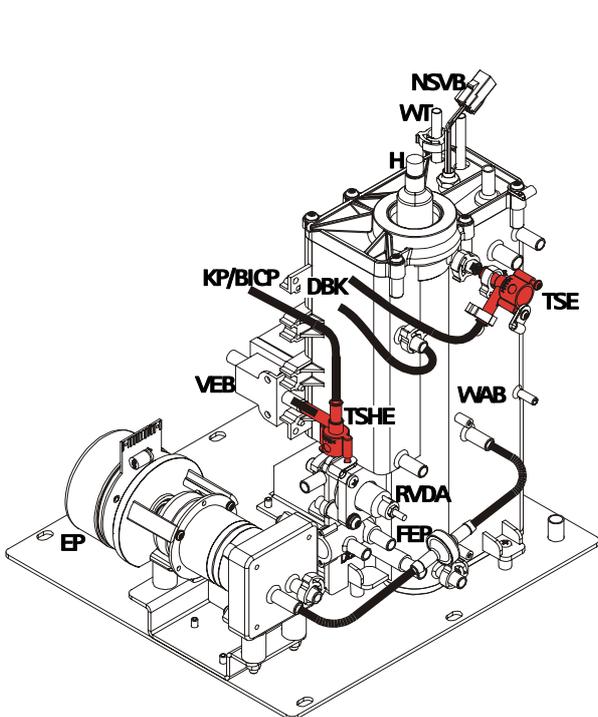


Fig.: Original Tubing Water Sub-Rack for TSE/TSHE

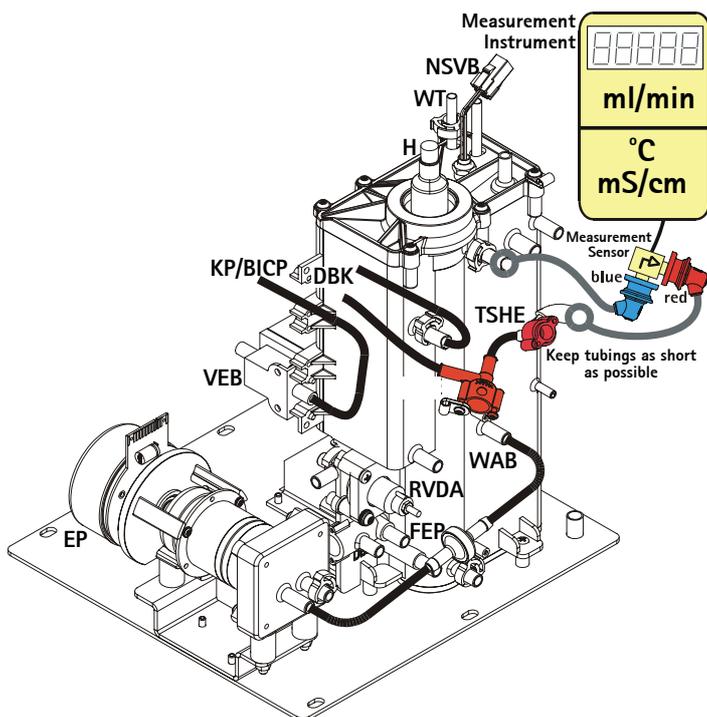
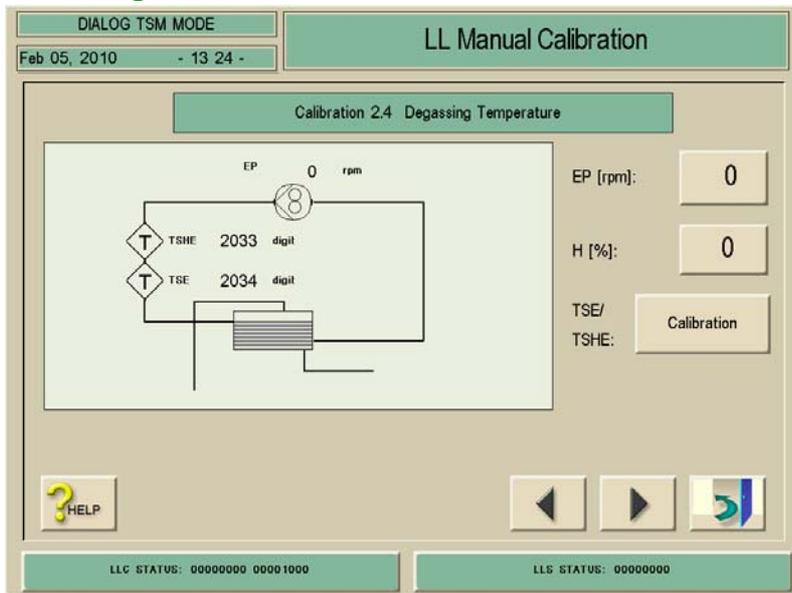
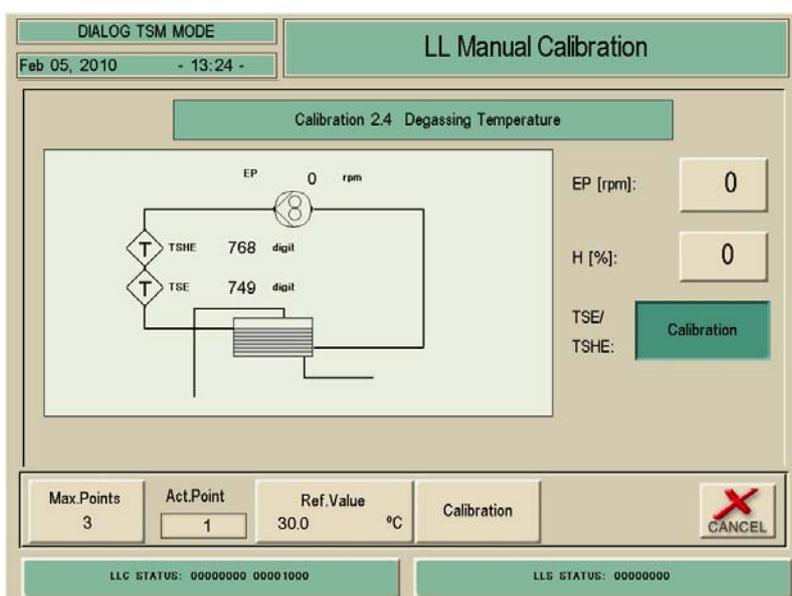


Fig.: Water Sub-Rack with TSHE in Line with TSE for Calibration

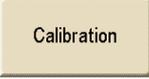


1. Activate the *LL Manual Calibration* menu with the *LL Manual Calibration* key in the *Manual Test and Calibration* menu.
2. Activate the *Degassing Temperature* menu by pressing on the line *Calibration 2.4 Degassing Temperature*. The following menu is displayed.



- Temperature measurement instrument (e.g. HDM 99 or equivalent)
  - Adapter set (coupling/tubing/dialyser couplings)
3. Position the heater inlet temperature sensor **TSHE** (on the water sub-rack) next to **TSE** (see previous page).
  4. Connect the adapter set between the heater inlet temperature sensor **TSHE** and water block **WAB**.  
**Note:** Pay attention to correct flow direction of temperature sensor **TSHE**.
  5. Connect temperature measurement instrument to adapter set.
  6. Set degassing pump **EP** to 1800 rpm.

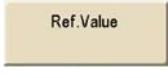
#### TSE/TSHE Calibration Point 30 °C

7. Press **TSE/TSHE**  key.
8. Increase heater power (in %) slowly, until a stable temperature value of 30 °C ( $\pm 2$  °C) is displayed at the temperature measurement instrument. Wait until temperature is stable, i.e. 0.1 °C for at least 10 s.
9. Press  key.
10. Enter the stable value from the temperature measurement instrument as reference value.

Wait until digits are stable.

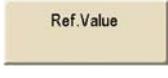
#### TSE/TSHE Calibration Point 40 °C

11. Confirm with the  key.
12. Increase heater power (in %) slowly, until a stable temperature value of 40 °C ( $\pm 2$  °C) is displayed at the temperature measurement instrument.
- Wait until temperature is stable, i.e. 0.1 °C for at least 10 s.

13. Press  key.
14. Enter the stable value from the measurement instrument as reference value.

#### TSE/TSHE Calibration Point 85 °C

15. Confirm with the  key.
16. Slowly increase heater power (in %), until a stable temperature value of 85 °C ( $\pm 2$  °C) is displayed at the temperature measurement instrument.
- Wait until temperature is stable, i.e. 0.1 °C for at least 10 s.

17. Press  key.
18. Enter the stable value from the temperature measurement instrument.

19. Confirm with the  key.
20. Confirm and store complete calibration procedure with  key.

**Note:** The calibration data is saved only after the bit sequence 0-1-0 (for detailed information see 4.8.3.1 General Calibration Information).

21. Set heater power to 0% and rinse briefly with flow pump **FPE** to cool down the water (menu 1.9, in *Low Level Manual Test*) and to prevent scalding.
22. Stop degassing pump **EP** and flow pump **FPE**, and disconnect adapter set.
23. Reassemble the heater inlet temperature sensor **TSHE** to the original position (see previous page).

**Note:** Pay attention to correct flow direction of temperature sensor **TSHE**.

4.8.3.8 Calibration Temperature Sensors  
TSBIC/TSD/TSD-S and TSDE



The conductivity sensors BICLF and ENDLF/ENDLF-S have to be calibrated after every calibration of the temperature sensors TSBIC/TSD/TSDS/TSDE (in menu (LL Manual Calibration, Calibration 2.6 Conductivity)).

Temperature Measurement Instrument  
(e.g. HDM 99 or equivalent)

Prior to Calibration

Technical Data:

- Temperature accuracy:  $\leq \pm 0.2 \text{ }^\circ\text{C}$
- Temperature resolution minimum  $0.1 \text{ }^\circ\text{C}$
- Use calibrated temperature measurement instrument
- Wait until Dialog has reached working temperature

The following calibration points are used:

- Calibration points TSBIC/TSD/TSD-S/TSDE:  $30 \text{ }^\circ\text{C}$ ,  $38 \text{ }^\circ\text{C}$ ,  $50 \text{ }^\circ\text{C}$
- Temperature oscillation range:  $\pm 1 \text{ digit}/0.1 \text{ }^\circ\text{C}$  (displayed value of Dialog) over 10 s, i.e. the temperature should be constant over a time period of 10 s to be considered stable.

Measurement of the Temperature and the Conductivity

The measurement sensor for temperature and conductivity of the measurement instrument is connected between FPE and the inlet to the balance chamber (see figure).

Measurement of the Flow

Connect the dialyser couplings to a flow sensor.

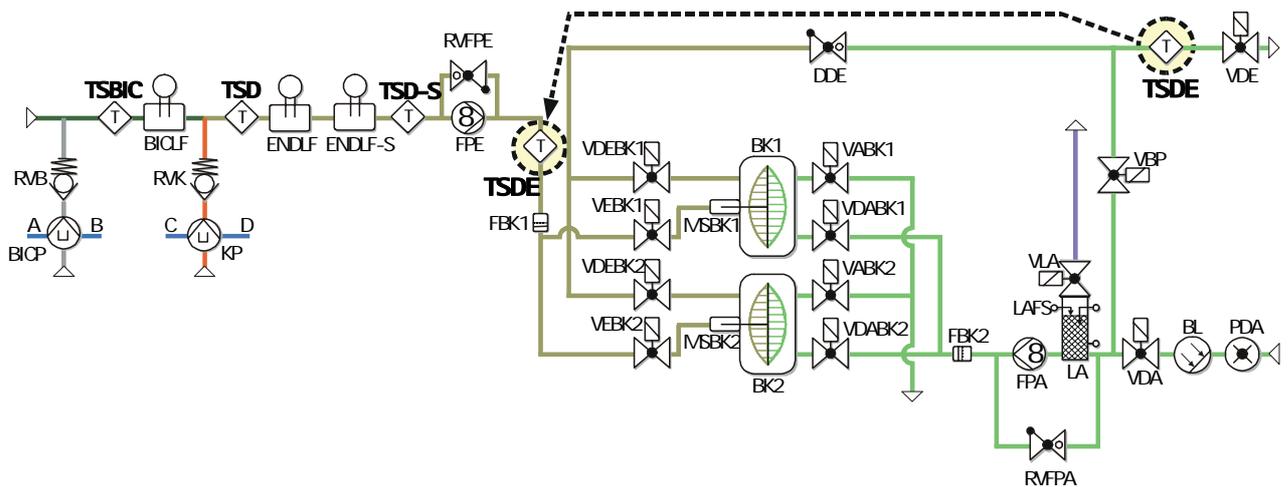


Fig.: Assemble TSDE from Rinsing Bridge to FBK1 on UF Sub-Rack

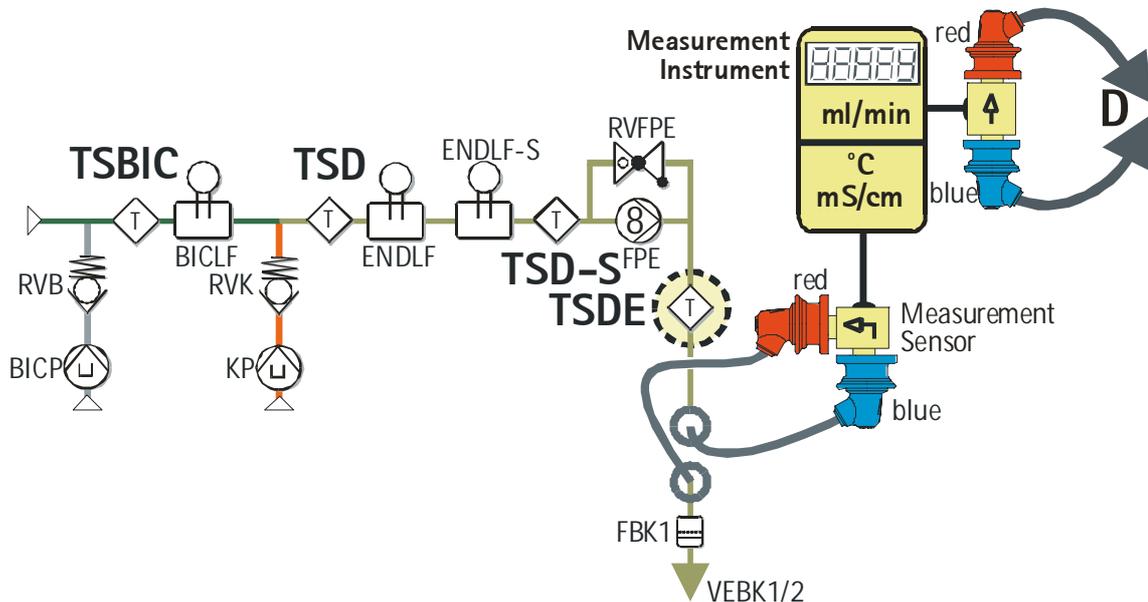


Fig.: Dialysate Preparation with Loop-In Point for TSBIC/TSD/TSD-S and TSDE Calibration

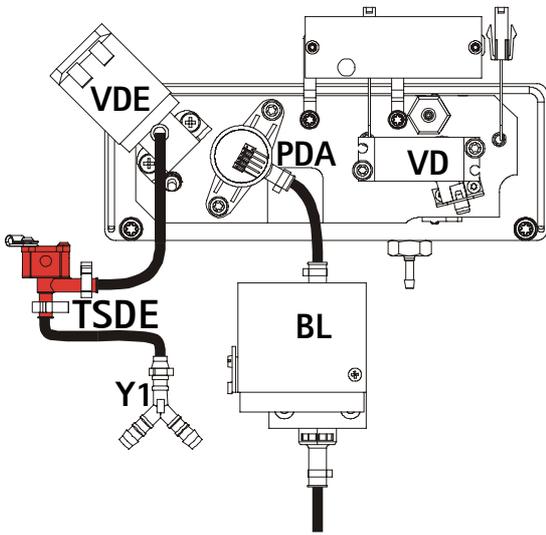


Fig.: Original Tubing Rinsing Bridge with TSDE

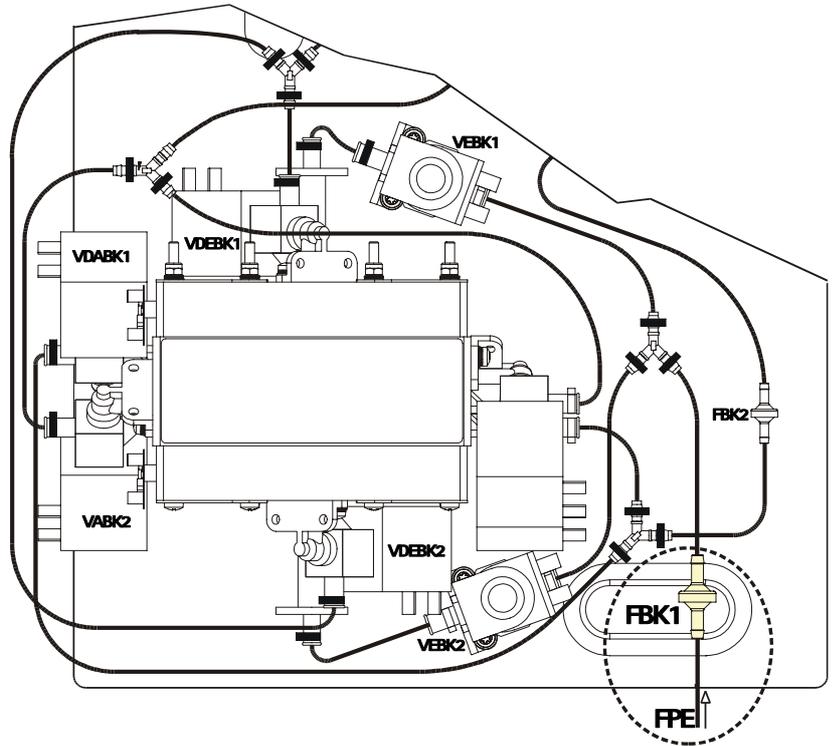


Fig.: Original Tubing UF Sub-Rack with FBK1

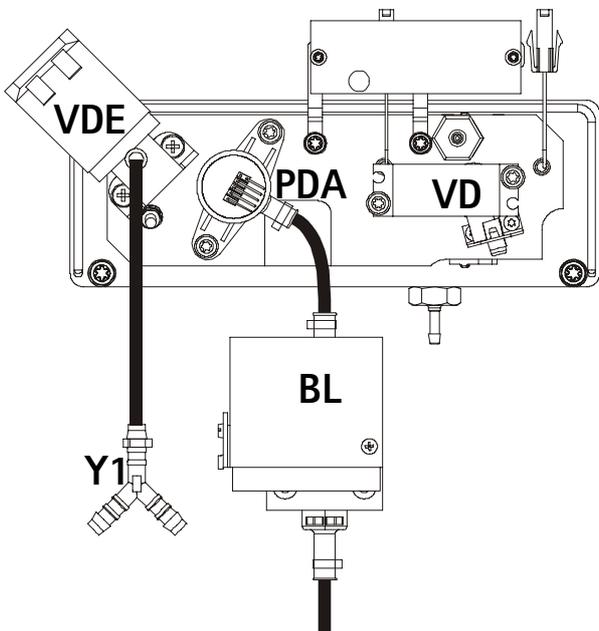


Fig.: Tubing Rinsing Bridge with Removed TSDE

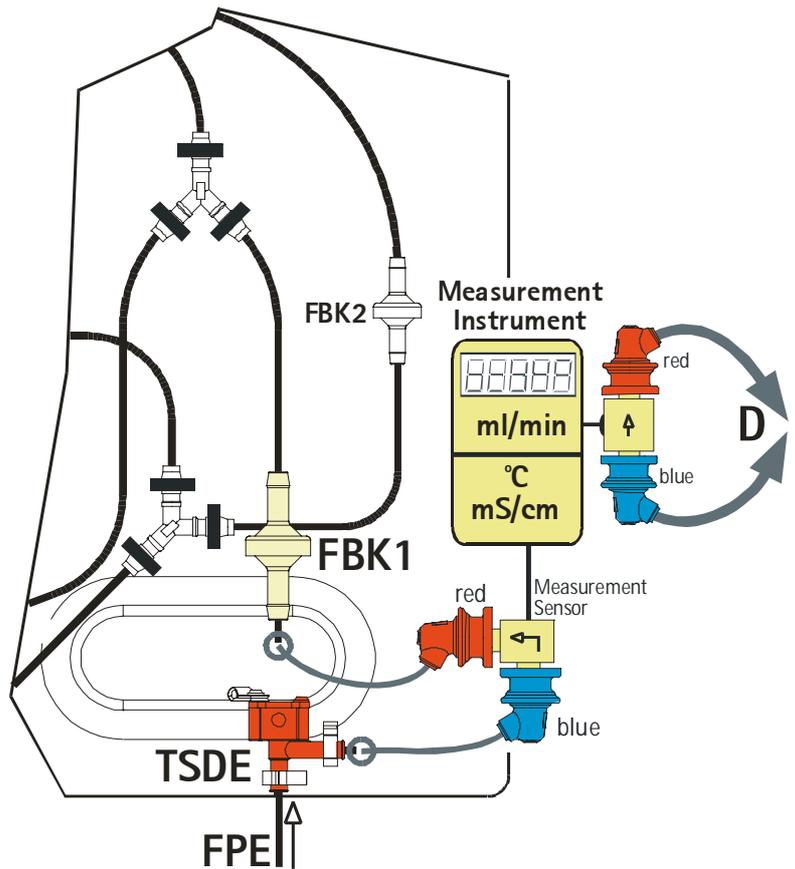
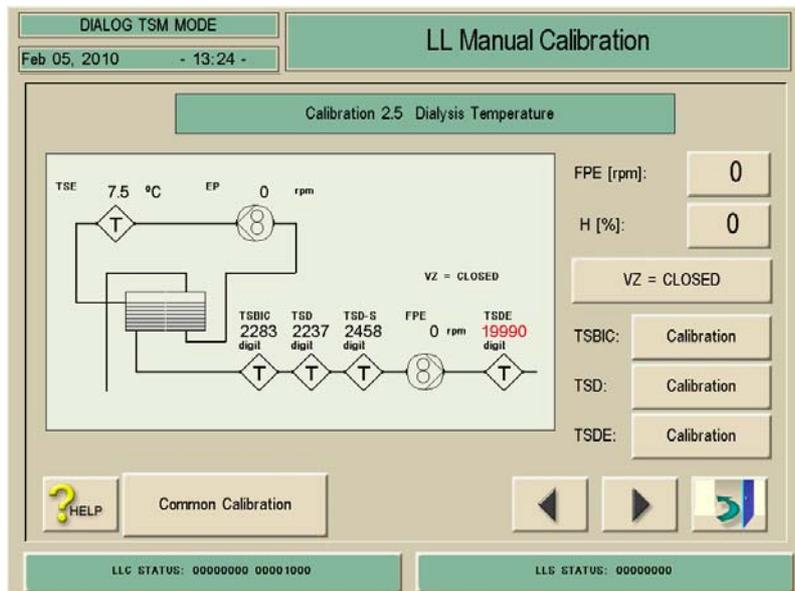
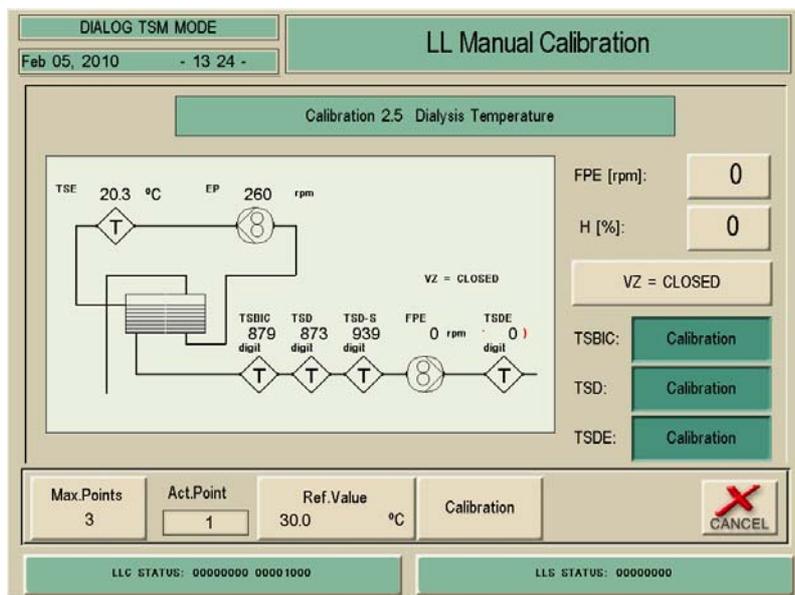


Fig.: UF Sub-Rack with TSDE in Line with TSBIC/TSD/TSD-S (on DF Sub-Rack) for Calibration



1. Activate the *LL Manual Calibration* menu with the *LL Manual Calibration* key in the *Manual Test and Calibration* menu.
2. Activate the *Dialysis Temperature* menu by pressing on the line *Calibration 2.5 Dialysis Temperature*. The following menu is displayed.



- Measurement instrument (e.g. HDM 99 or equivalent)
- Adapter set (coupling, tubing, dialyser couplings)



3. Remove **TSDE** from rinsing bridge and connect at the outlet of **FPE** (tubing going to **FBK1**).

**Note:** Pay attention to correct flow direction of temperature sensor **TSDE**.

4. Connect measurement instrument between **TSDE** and **FBK1**.
5. Connect dialyser couplings to flow meter.
6. Increase slowly the speed of **FPE**, until a flow of 750 ml/min  $\pm$ 50 ml/min is reached.

Common Calibration

7. Press **Common Calibration** key for a combined calibration of **TSBIC**, **TSD/TSD-S** and **TSDE** (The circulation valve **VZ** stays closed).

**Calibration Point 30 °C**

8. Increase slowly heater power (in %) until a stable temperature value of 30 °C  $\pm 2$  °C is displayed at the temperature measurement instrument.

**Note:** Pay attention to the maximum fluctuation of  $\pm 0.1$  °C over 10 s at the temperature measurement instrument.

9. Press  key.

Wait until digits are stable.

10. Enter the stable value from the temperature measurement instrument as reference value.

11. Confirm with  key.

**Calibration Point 38 °C**

12. Increase slowly heater power until a stable temperature value of 38 °C  $\pm 2$  °C is displayed at the temperature measurement instrument.

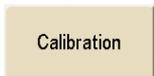
**Note:** Pay attention to the maximum fluctuation of  $\pm 0.1$  °C over 10 s at the temperature measurement instrument.

Write down the value of the heater power, because this value is required for the calibration of the conductivity.

13. Press  key.

Wait until digits are stable.

14. Enter the stable value from the temperature measurement instrument as reference value.

15. Confirm with  key.

**Calibration Point 50 °C**

16. Increase slowly heater power until a stable temperature value of 50 °C  $\pm 2$  °C is displayed at the temperature measurement instrument.

**Note:** Pay attention to the maximum fluctuation of  $\pm 0.1$  °C over 10 s at the temperature measurement instrument.

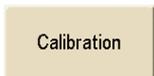


The flow can be reduced slightly if the heater power (100%) is insufficient for the last calibration point.

17. Press  key.

Wait until digits are stable.

18. Enter the stable value from the temperature measurement instrument as reference value.

19. Confirm with  key.

20. Confirm and save the completed calibration procedure with  key.

**Note:** The calibration data is saved only after the bit sequence 0-1-0 (for detailed information see 4.8.3.1 General Calibration Information).

21. Reassemble the heater inlet temperature sensor **TSDE** to the original position (see previous page).

**Note:** Pay attention to correct flow direction of temperature sensor **TSDE**.

### 4.8.3.9 Calibration Conductivity Sensors Bicarbonate BICLF and END Conductivity ENDLF/ENDLF-S

If the conductivity sensor BICLF or ENDLF/ENDLF-S is exchanged: the temperature sensors TSBIC, TSD/TSD-S must be calibrated prior to the calibration of the conductivity sensors BICLF/ENDLF/ENDLF-S.

#### Conductivity Measurement Instrument (e.g. HDM 99 or equivalent)

#### Prior to Calibration of BICLF/ENDLF/ENDLF-S

#### Test and Calibration Solution for BICLF

Table 1

#### Technical Data:

- Temperature coefficient  $\alpha = 2.10 \text{ \%}/^\circ\text{C}$  (set)
- Reference temperature  $T_{\text{Ref}} = 25 \text{ }^\circ\text{C}$  (set)
- Correct cell constant (set)
- Conductivity accuracy:  $\leq \pm 0.1 \text{ mS/cm}$
- Conductivity resolution  $0.01 \text{ mS/cm}$
- Use calibrated measurement instrument

- Perform a chemical disinfection with citric acid 50%
- Wait until Dialog has reached working temperature
- Calibrate temperature sensors TSBIC/TSD/TSD-S

The applied acid concentrate used as test and calibration solution (if not available use acetate) must be diluted according to the prerequisites with deionised water. The components of the acid concentrate are listed in table 1.

Nominal Composition of Ready for Use Dialysate According to Data on Canister (1 l Acid Concentrate + 1.225 BIC + 32.775 l Deionised Water)		
Component	Concentration [mmol/l]	Max. Oscillation Range
Sodium	138	0
Potassium	2	2
Calcium	1.5	0.5
Magnesium	0.5	0.5
Chlorine	109	3
Acetate	3	1
Bicarbonate	32	1
Glucose	0 g/l	1 g/l
Osmolarity	292 mOsm/l	5 mOsm/l

The following B. Braun acid concentrates can be used:

e.g. SW376A, SW163A, SW 196A, SW127A, SW93A, SW102A, SW380A, SW95A, SW139A, SW381A, SW178A, SW393A, SW195A

If acid concentrates are not available the following B. Braun acetate concentrates can be used as an alternative:

e.g. SW44 and SW 174

If acid concentrate from B. Braun is not available acid concentrate from a second source can be used. The composition is listed in table 1.

#### Composition of Calibration Solution for BICLF

#### Composition of Calibration Solution for ENDLF/ENDLF-S

#### Calibration Points for BICLF and ENDLF/ENDLF-S

Acid concentrate is diluted with deionised water with a ratio of 1:4 (or 1:4.5 with acetate) to calibrate the BICLF sensor, i.e. bicarbonate concentrate is not used.

The undiluted acid concentrate (if not available use acetate) is used to calibrate the ENDLF/ENDLF-S sensors (see table 1).

The following calibration points are used:

- Calibration points **BICLF**: 0 mS/cm, 3 mS/cm, 5.8 mS/cm
- Calibration points **ENDLF/ENDLF-S**: 0 mS/cm, 14.0 mS/cm
- Conductivity calibration point deviation: 0.2 mS/cm
- Conductivity oscillation range:  $\pm 1$  digit/0.1 mS/cm (displayed value of Dialog) over 10 s, i.e. the conductivity should be constant over a time period of 10 s.
- Reference temperature:  $38 \text{ }^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$

**Calibration Temperature Sensors**

The temperature sensors **TSBIC/TSD/TSD-S** must be calibrated prior to the calibration of the conductivity sensors **BICLF/ENDLF/ENDLF-S** (in menu *LL Manual Calibration, Calibration 2.5 Dialysis Temperature*).

**Measurement of the Temperature and the Conductivity**

The measurement sensor for temperature and conductivity of the measurement instrument is connected between **FPE** and the inlet to the balance chamber at **FBK1** (see figure).

**Measurement of the Flow**

Connect the dialyser couplings to the flow sensor.

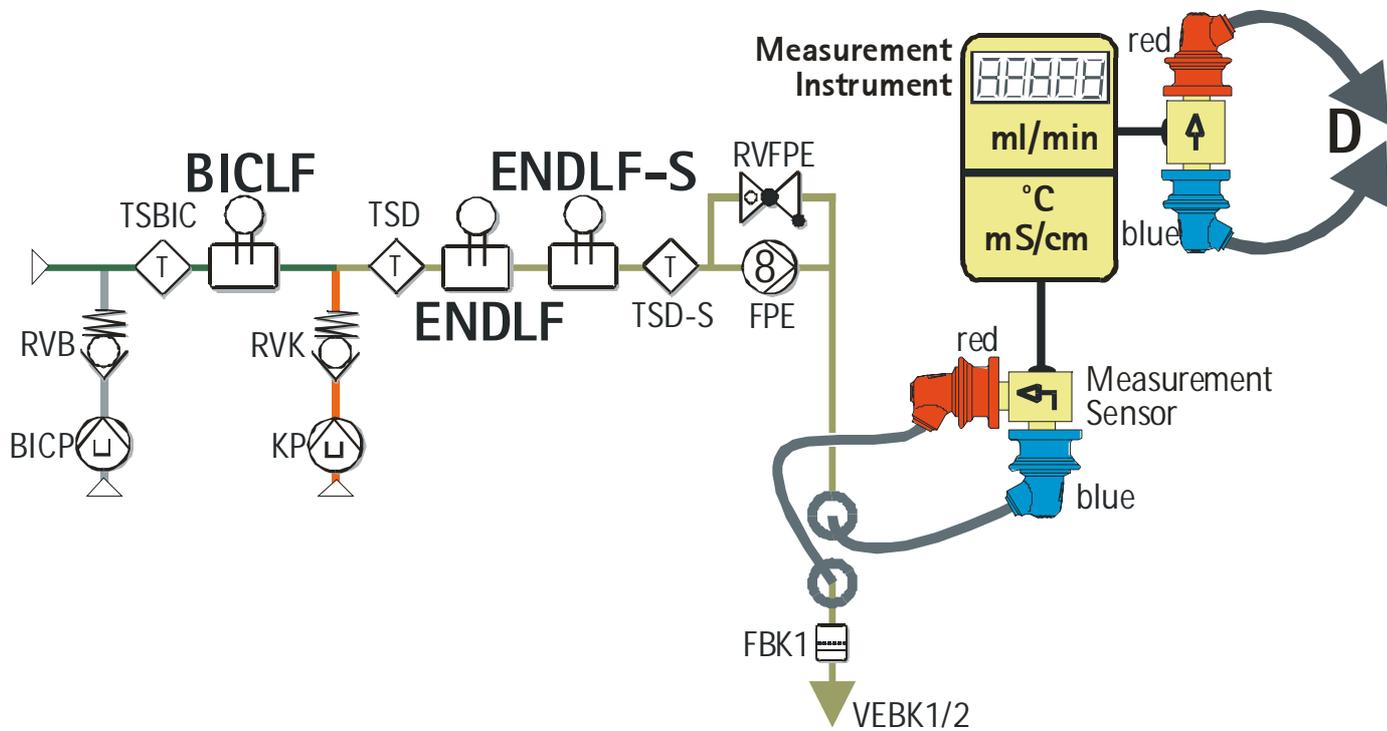


Fig.: Dialysate Preparation

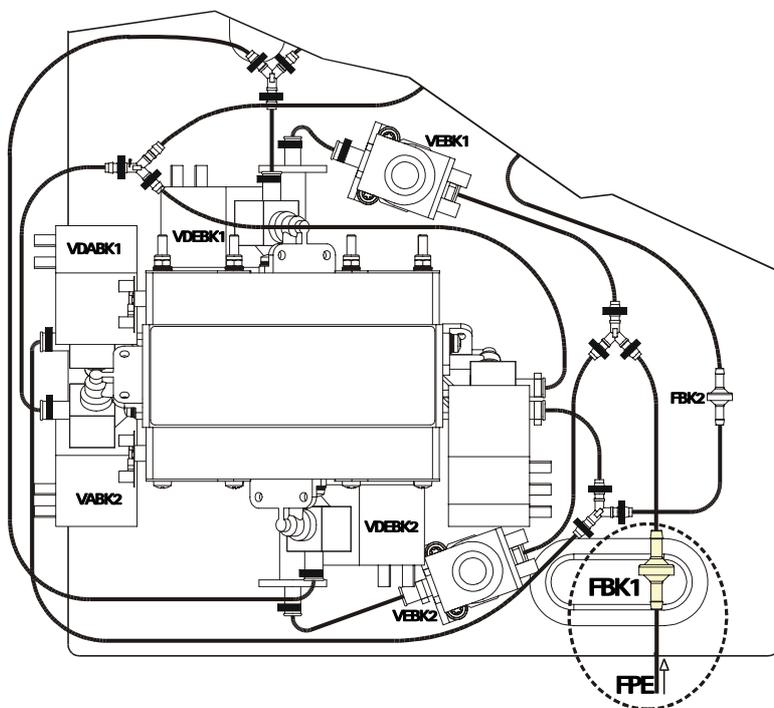


Fig.: Original Tubing UF Sub-Rack with FBK1

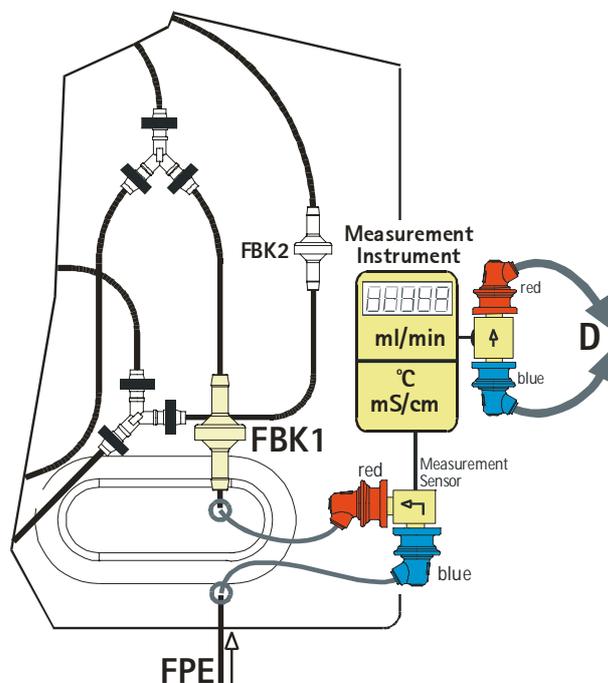
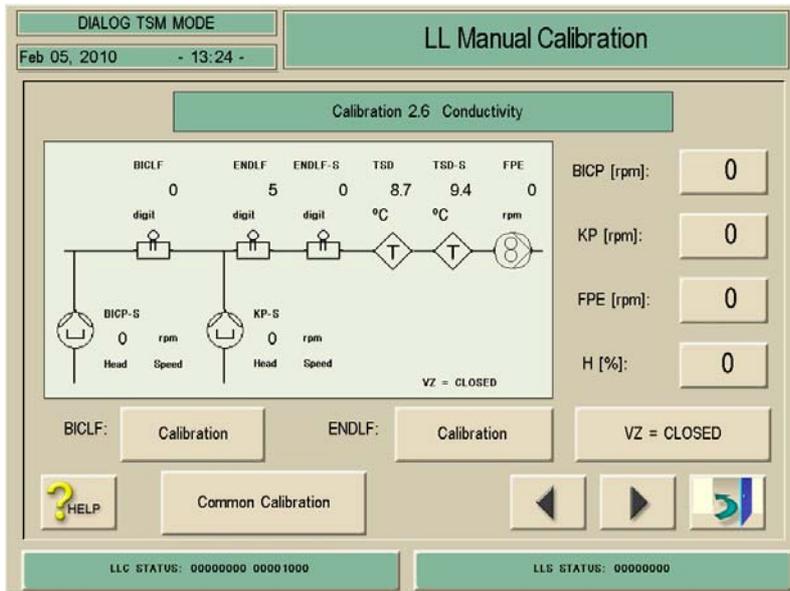
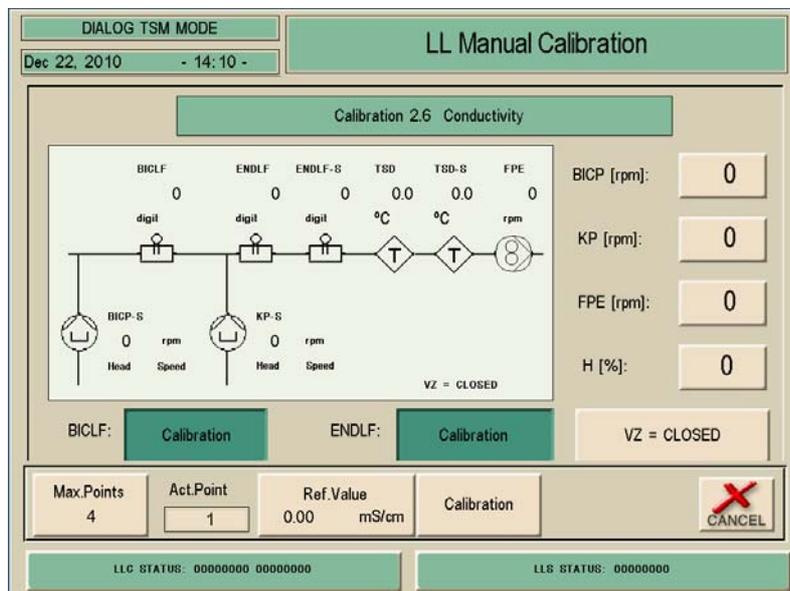


Fig.: UF Sub-Rack with Loop-In Point for BICLF, ENDLF and ENDLF-S Calibration



1. Activate the *LL Manual Calibration* menu with the *LL Manual Calibration* key in the *Manual Test and Calibration* menu.
2. Activate the *Calibration Conductivity* menu by pressing on the line *Calibration 2.6 Conductivity*. The following menu is displayed.
3. Press the  key to calibrate the conductivity sensors BICLF, ENDLF and ENDLF-S together.



The following menu is displayed.



#### Composition of the calibration solution for BICLF:

To calibrate the BICLF sensor deionised water is mixed with the respective acid concentrate, i.e. real bicarbonate concentrate is not used (see table 1).



There is no cyclic switching of the balance chambers during the conductivity calibration. Thus a continuous flow is accomplished which is necessary for the calibration. The following valves are opened **VEBK2/VDEBK2** and **VABK1/VDABK1**.

Pay attention that air bubbles do not build up in the reference sensor during calibration.



- Measurement instrument (e.g. HDM 99 or equivalent)
- Calibration solution: diluted and undiluted acid concentrate
- Adapter set (coupling, tubing, dialyser couplings)



4. Connect measurement instrument between **FPE** and balance chamber.
5. Connect dialyser couplings to flow meter.
6. Increase slowly the speed of **FPE**, until a flow of 750 ml/min  $\pm$ 50 ml/min is reached.

**BICLF/ENDLF/ENDLF-S Calibration Point  
0 mS/cm**

7. Change slowly heater power, until a stable temperature value of 38 °C ±2 °C is displayed at the measurement instrument.  
**Note:** Use the heater power value noted during the calibration of **TSBIC/TSD/TSDS/TSDE** at temperature of 38 °C.
8. Speed **BICP**: 0 rpm  
Speed **KP**: 0 rpm

9. Press  key.

Wait until digits are stable.

10. Enter the stable value from the measurement instrument as reference value.

11. Confirm with  key.

**Note:** Do not simply confirm the set value as 0.00 mS/cm but by all means enter the actual reference value, e.g. 0.01 mS/cm. Pay attention to the deviation range for the conductivity and the temperature at the measurement instrument.



A calibration solution with a ratio of approx. 1:4 is necessary for the 3 mS/cm and 5.8 mS/cm calibration, i.e. 1 l acid concentrate + 4 l RO (reverse osmosis) water.

If acid concentrate is not available a calibration solution with acetate can be used. The ratio is approx. 1:4.5, i.e. 1 l acetate + 4.5 l RO (reverse osmosis) water.

**BICLF Calibration Point 3 mS/cm**

12. Connect blue suction rod to the diluted acid concentrate (calibration solution).

Do not change by mistake the suction rods and the pumps **BICP/KP**.

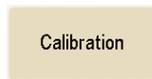
13. Increase slowly the speed (approx. 110 – 120 rpm) of the bicarbonate pump **BICP**, until a stable conductivity value of 3.0 mS/cm ±0.2 mS/cm is displayed at the measurement instrument.

**Note:** Pay attention to the deviation range for the conductivity and the temperature at the measurement instrument.

14. Press  key.

Wait until digits are stable.

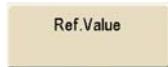
15. Enter the stable value from the measurement instrument as reference value.

16. Confirm with  key.

**BICLF Calibration Point 5.8 mS/cm**

17. Increase slowly the speed (approx. 220 - 230 rpm) of the bicarbonate pump BICP, until a stable conductivity value of 5.8 mS/cm ±0.2 mS/cm is displayed at the measurement instrument.

**Note:** Pay attention to the deviation range for the conductivity and the temperature at the measurement instrument.



18. Press **Ref.Value** key.

Wait until digits are stable.

19. Enter the stable value from the measurement instrument as reference value.



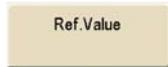
20. Confirm with **Calibration** key.

**ENDLF Calibration Point 14.0 mS/cm**

21. Connect the blue suction rod to the undiluted acid concentrate.

22. Change the speed of the bicarbonate pump BICP (approx. 115 - 120 rpm), until a stable conductivity value of 14.0 mS/cm ±0.2 mS/cm is displayed at the measurement instrument.

**Note:** Pay attention to the deviation range for the conductivity and the temperature at the measurement instrument.



23. Press **Ref.Value** key.

Wait until digits are stable.

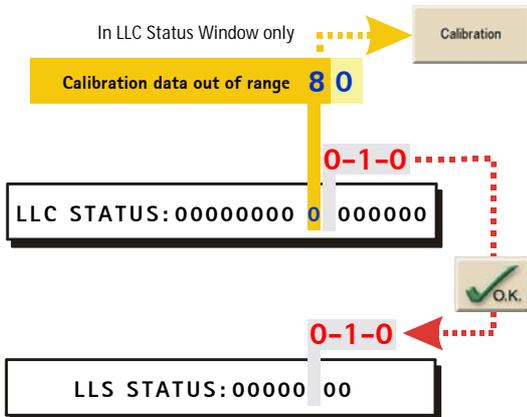
24. Enter the stable value from the measurement instrument as reference value.



25. Confirm with **Calibration** key.

**Note:** Pay attention to the *LLC Status* window. The calibration data are only valid if the following digit value is displayed in the *LLC Status* window: **0 X X X X X X X** (see figure).

If the calibration value for **ENDLF** is at the limit range the calibration data could be invalid. Thus the following digit value is displayed in the *LLC Status* window **8 X X X X X X X** (see figure). Repeat calibration procedure.



26. Confirm completed calibration procedure with  key (calibration data are saved).

**Note:** The calibration data is saved only after the bit sequence 0-1-0 (for detailed information see 4.8.3.1 General Calibration Information).

27. Stop **FPE** and **BICP** and remove measurement instrument.

4.8.3.10 Calibration Blood Leak Detector

You can check and calibrate the blood leak detector **BL**. The rinsing block must have an even temperature for the calibration. If both dialyser couplings are connected to the rinsing bridge the flow pumps **FPA/FPE** work in main flow. If only one coupling is connected **FPE** is stopped. The reference solution can be drawn in by the red coupling via **FPA**.

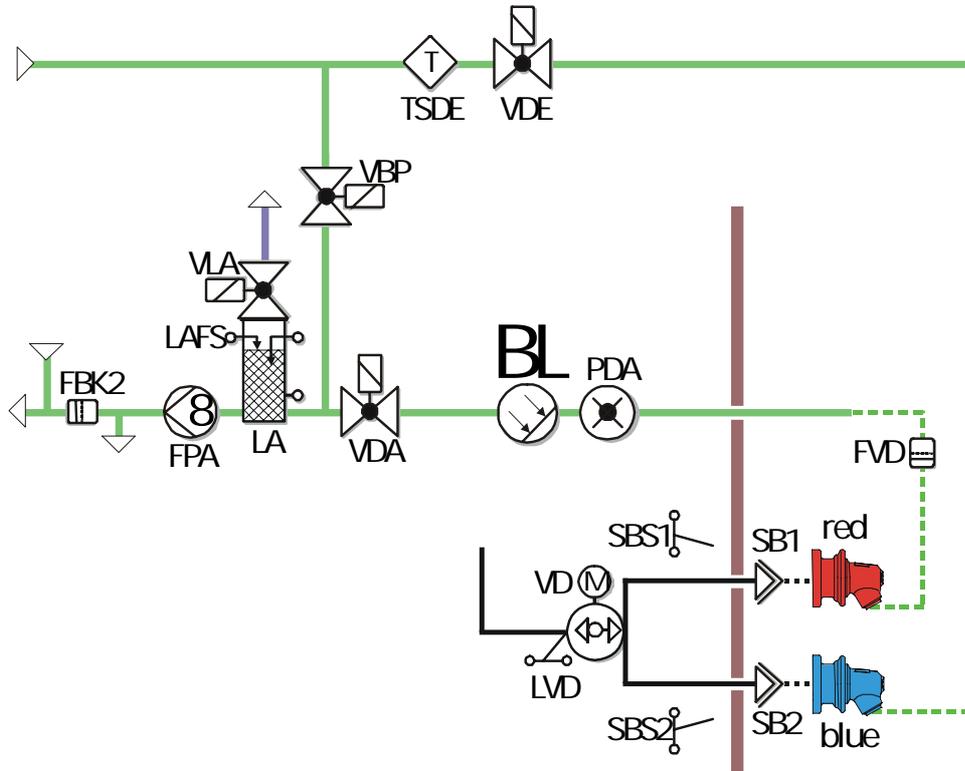


Fig.: Rinsing Bridge with Blood Leak Detector BL

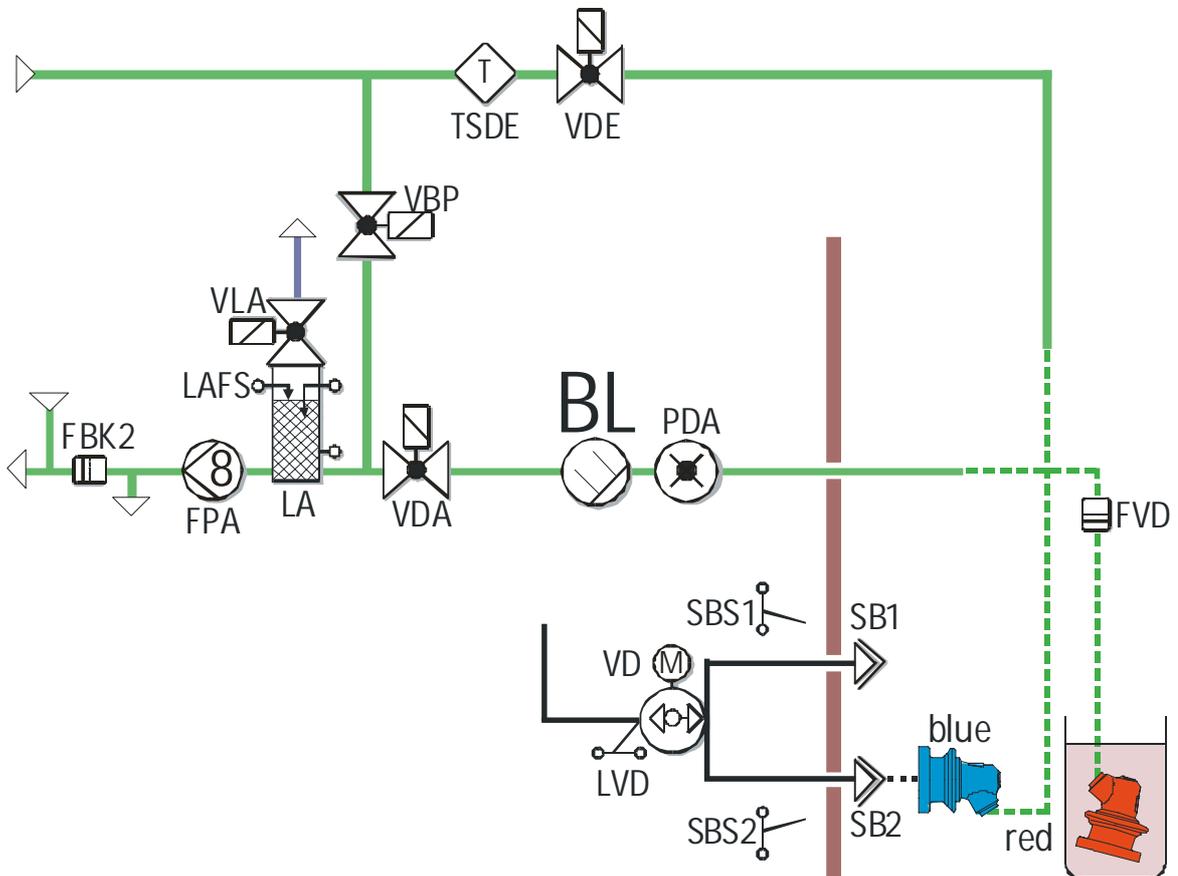


Fig.: Rinsing Bridge with Red Coupling Immersed in Reference Solution for BL Calibration

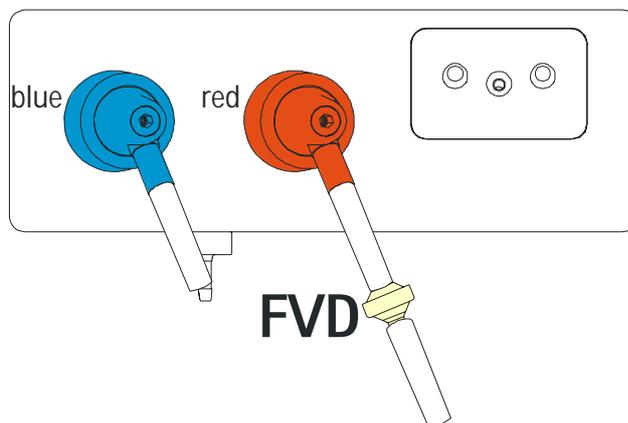


Fig.: Red and Blue Couplings Connected to Rinsing Bridge

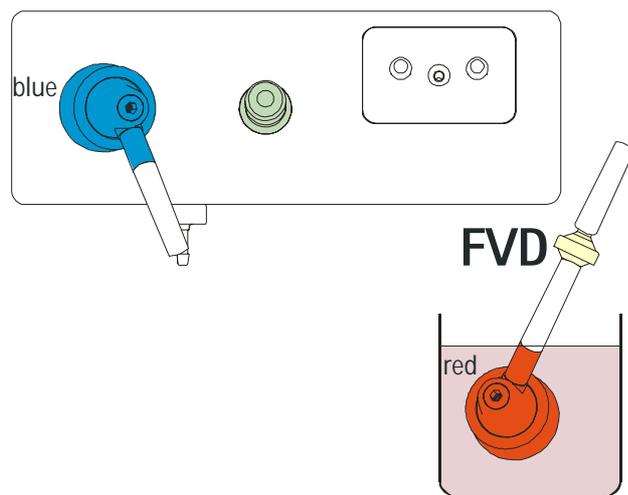


Fig.: Rinsing Bridge with Red Coupling Immersed in Reference Solution for BL Calibration

DIALOG TSM MODE		LL Manual Calibration		
Feb 05, 2010 - 13:25 -				
Calibration 2.7 Blood Leak				
		Actual Status		Desired Setting
		Controller	Supervisor	Controller
Outflow Pump Speed	[rpm]:	0		0
TSD	[°C]:	22.4		
Blood Concentration	[digit]:	-4	3506	Calibration
Max.Points	Act.Point	Ref.Value	Calibration	CANCEL
2	1	0.00 promille		
LLC STATUS: 00000000 00001028		LLS STATUS: 00000000		

1. You can activate the *LL Manual Calibration* menu with the *LL Manual Calibration* key in the *Manual Test and Calibration* menu.
2. Activate the *Blood Leak* menu by pressing on the line *Calibration 2.7 Blood Leak*. The following menu is displayed.



Close front and rear door for the function test and calibration to prevent light irradiation on the sensor.

#### Leakages

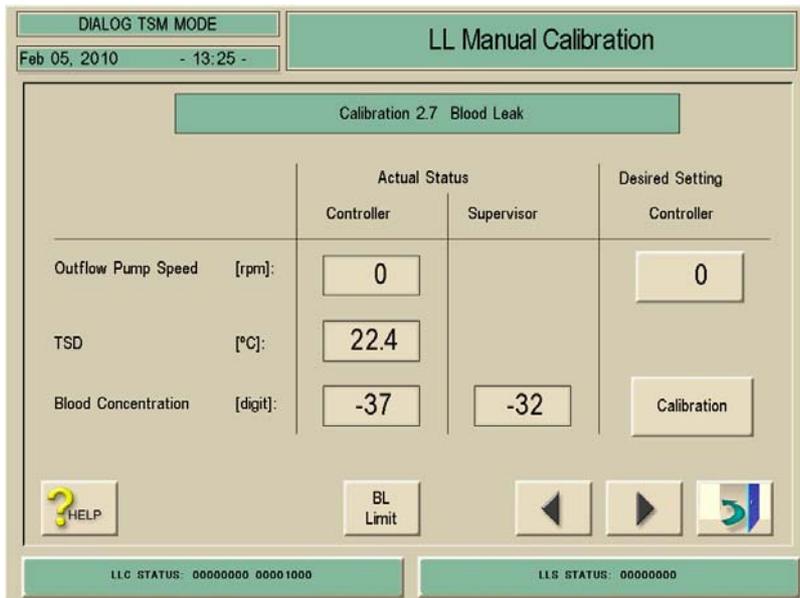
Air and micro-bubbles can lead to incorrect measurement values in the measurement line and can cause fluctuation of the current value.

If air is visible check the complete system for leaks in menu *1.20 Test Water Part*. After the initialisation phase rinse the blood leak detector approx. 1 min and then perform a leakage test of the system in menu *1.19 Leak Test*.

#### Chemical Disinfection with Citric Acid 50%

A decalcification must be performed before initial calibration.

4.8.3.10.1 Blood Leak Detector Limit



You can select the limit value for the alarm activation of the blood leak detector in the *Calibration 2.7 Blood Leak Detector, BL Limit* menu.

**BL Limit**

**Standard Limit (0.5 ml/min at haematocrite HK 0.45)**

The alarm limit is set to 0.5 ml/min at a haematocrite of 0.45, i.e. a blood leak detector alarm is activated if the alarm limit is exceeded.

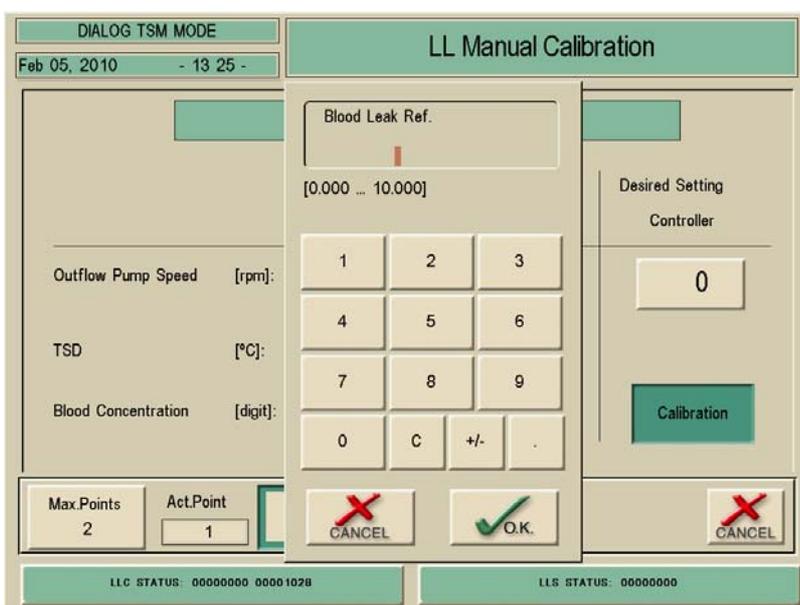
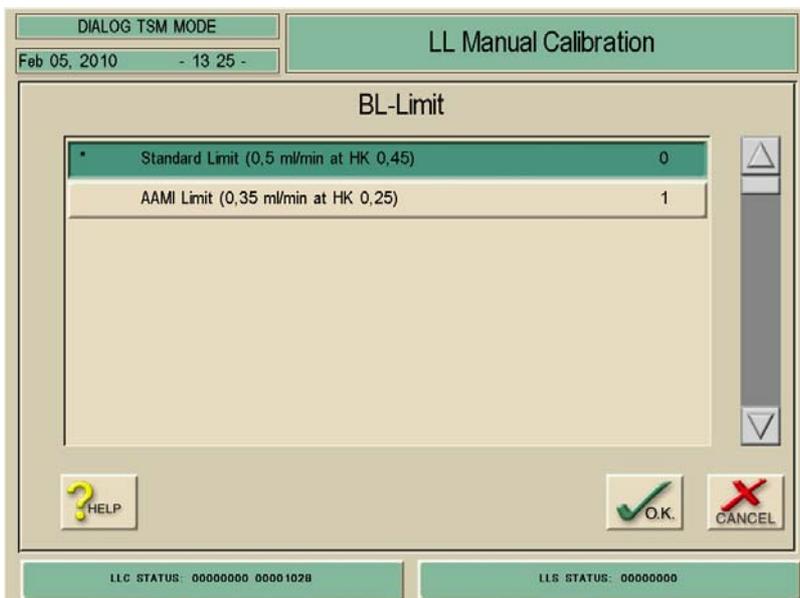
**AAMI Limit (0.35 ml/min at haematocrite HK 0.25)**

The alarm limit is set to 0.35 ml/min at a haematocrite of 0.25 (AAMI standard), i.e. a blood leak detector alarm is activated if the alarm limit is exceeded.

**Please Note**

The same blood leak detector is used for both settings:

- The calibration procedure is identical, but with different tolerance ranges
- The test procedure is identical



## 4.8.3.10.2 Check Blood Leak Detector

	Actual Status		Desired Setting
	Controller	Supervisor	Controller
Blood Concentration [promille]:	-0.04	-0.03	
Outflow Pump Speed [rpm]:			0
TSD [°C]:		22.7	
LAMP TEST			OFF

LLC STATUS: 00000000 00001000      LLS STATUS: 00000000

1. Connect both dialyser couplings to the rinsing bridge.
2. Select menu *Test 1.18 Blood Leak* in TSM to perform a function check of the blood leak detector.
3. Rinse the blood leak detector for approx. 1 min at the beginning of the rinsing time with flow pump outlet **FPA** (approx. 1400 rpm). Thereby possible air bubbles in the system are removed.
4. Rinse blood leak detector for approx. 15 to 30 min with **FPA** (approx. 1000 rpm) to warm up the complete system to a temperature of approx. 40 °C.



Exchange the blood leak detector if one of these three values is out of limits.

5. The *LED test* is activated with the *LAMP TEST OFF* key. The *OFF* key switches to the *RED* key as soon as the key is pressed.

The *red LED* is tested after 10 s. The controller value for the switched off *red LED* must be as follows (the supervisor value is uncritical):

red LED	Actual Status Controller
<b>Blood Concentration</b>	< 4.00

6. Press the *LAMP TEST RED* key to switch to the *green LED*. The *RED* key switches to the *GREEN* key.

The *green LED* is tested. The controller value for the switched off *green LED* must be as follows (the supervisor value is uncritical):

green LED	Actual Status Controller
<b>Blood Concentration</b>	> 2.06

7. The actual controller values for the *red LED* and the *green LED* must be divided.

**Note:** The calculated value of **red LED** divided by **green LED** is displayed briefly after the key *LAMP TEST* is switched back to OFF.

The calculated value must be in the following limits (to the first decimal digit/round off):

red LED / green LED
1.15 - 1.44

## 4.8.3.10.3 Calibration Blood Leak Detector



Close front and rear door for the calibration to prevent light irradiation on the sensor. Air and micro-bubbles must not be present prior or during the calibration of the blood leak detector (if necessary rinse, see information 4.8.3.10).

The blood leak detector must be clean.

**FPA** must be switched off to prevent a flow during the calibration procedure.

The calibration of the blood leak detector type 2 is performed in two steps:

- Turbidity calibration
- Calibration with reference solution



You can skip directly from the test menu to the calibration menu of the blood leak detector by pressing the  key.

The calibration procedure may take some time and requires stable values. Slight fluctuations due to air bubbles inside the blood leak detector during the calibration process can lead to an abortion of the calibration.

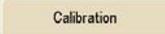


- Reference solution (red dye, art. no. 7700911)
- Graduated cylinder 2 litre



1. Both dialyser couplings are connected to the rinsing bridge.
2. Prepare 1 ‰ reference solution, i.e.:  
Dilute the flask of 2 ml of red dye with 2 litre deionised/RO water. The water should have at least 30 °C for an accurate calibration. Mix the reference solution thoroughly.

## 4.8.3.10.3.1 Turbidity Calibration with Water

3. Press  key. The calibration window is opened.
4. Set **FPA** slowly to zero.
5. Press the  key to activate the first calibration point of the automatic calibration.

The values must be in the following limits:

	Actual Status Controller	Actual Status Supervisor
<b>Blood Concentration [‰]</b>	-50 to +50 digits	205 to 230 digits

After the calibration of the first point the second calibration point is automatically displayed.

## 4.8.3.10.3.2 Calibration with Reference Solution (Red Dye)

6. Carefully pull off the red dialyser coupling from the rinse bridge to prevent any loss of fluid/air-intake and immerse it into the container with reference solution.
7. Set **FPA** slowly to 1000 rpm and draw-in approx. 1 l reference solution.
8. Set the **FPA** slowly to zero. If the displayed actual blood concentration value of the controller is stable, press the  key to confirm.

The displayed actual blood concentration value must be in the following limit, to ensure a sufficient resolution:

	Actual Status Controller
<b>Blood Concentration [‰]</b>	> 200

9. Confirm and store completed calibration procedure with  key.

#### 4.8.3.10.4 Actual Value Check Blood Leak Detector

10. Select menu 1.18 in TSM to check the actual value of the blood leak detector.

##### 4.8.3.10.4.1 Check 0 ‰ Blood Concentration

11. Connect red dialyser coupling to rinsing bridge.
12. Set **FPA** slowly to 1000 rpm and rinse.
13. Check blood concentration of the controller and supervisor.

The values for the controller and supervisor must be in the following limits:

	Actual Status Controller	Actual Status Supervisor
<b>Blood Concentration [‰]</b>	-0.1 to 0.1	-0.1 to 0.1

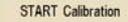
##### 4.8.3.10.4.2 Check 1 ‰ Blood Concentration

14. Set **FPA** slowly to zero.
15. Carefully disconnect red dialyser coupling.
16. Carefully immerse red dialyser coupling into reference solution.
17. Set **FPA** slowly to 1000 rpm and draw-in remaining reference solution.
18. Set **FPA** slowly to zero.
19. Check blood concentration of the controller and supervisor.

The blood concentration values for the controller and supervisor must be in the following limits:

	Actual Status Controller	Actual Status Supervisor
<b>Blood Concentration [‰]</b>	0.90 to 1.1	0.90 to 1.1

### 4.8.3.11 Calibration of Delivery Rate UFP, BICP and KP

You can calibrate the ultrafiltration pump **UFP**, the bicarbonate pump **BICP** and the concentrate pump **KP**. The **BICP** and **KP** can be calibrated either with a volumetric flask/graduated cylinder or a balance. The calibration with a balance is mandatory for **UFP**. Prior to calibration the balance chamber initialisation must be completed. The respective pump runs for approximately 2 minutes after pressing the  key and stops after a certain number of revolutions are reached.

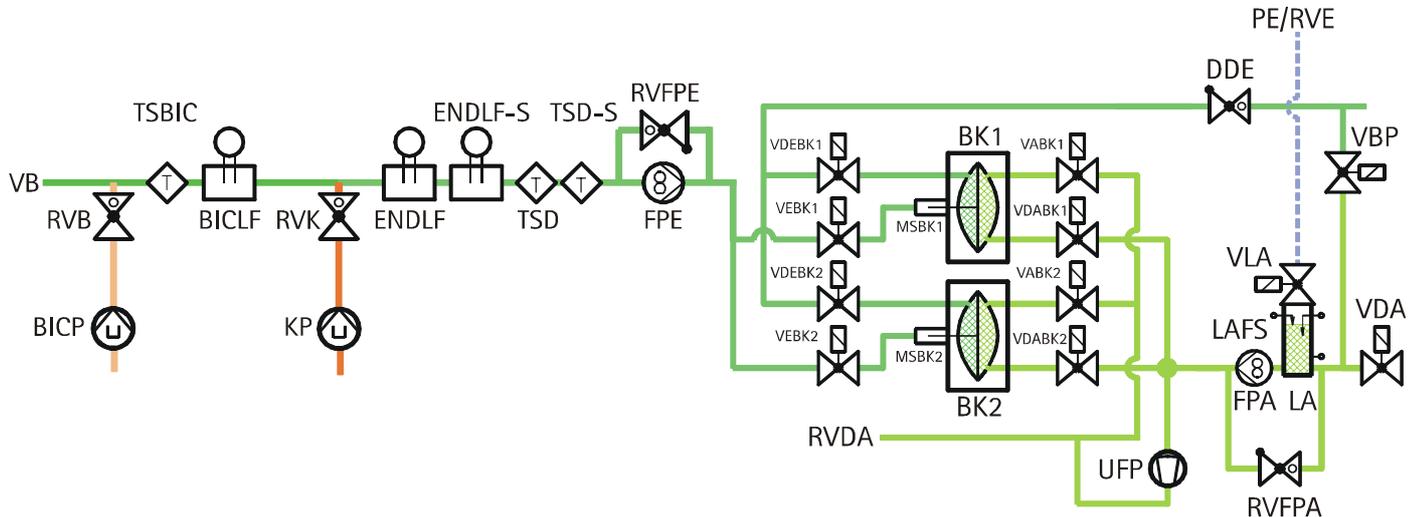
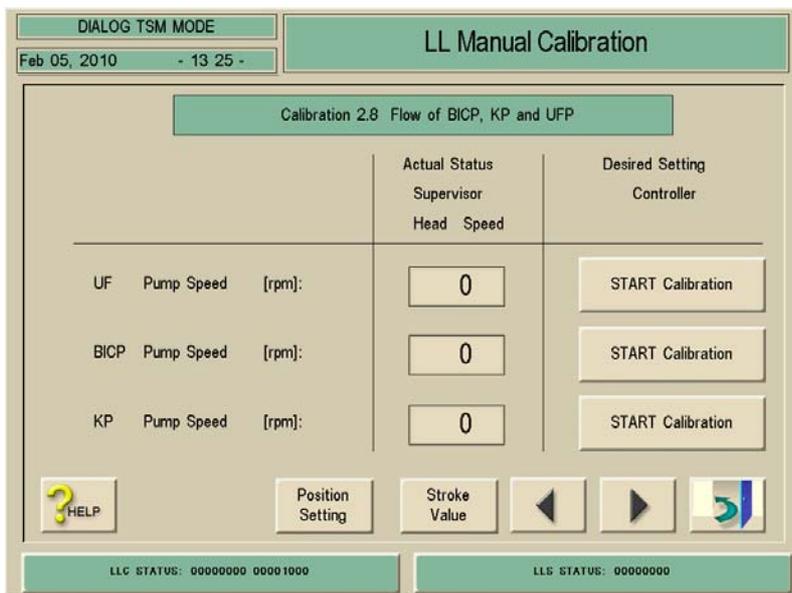


Fig.: Bicarbonate Pump BICP, Concentrate Pump KP and Ultrafiltration Pump UFP



During the selection of the menu:

- the balance chamber is initialised and
- the **UFP** is set to a defined initial position (reed sensor/hall sensor position).

Thus the accuracy during the calibration of **UFP** is improved, because **UFP** runs back to the initial position at the end of calibration. Thus complete revolutions are counted.

1. Activate the *LL Manual Calibration* menu with the *LL Manual Calibration* key in the *Manual Test and Calibration* menu.
2. Activate the *Flow of BICP, KP and UF Pump* menu by pressing on the line *Calibration 2.8 Flow of BICP, KP and UF Pump*. The following menu is displayed.

#### 4.8.3.11.1 Calibration BICP and KP Pump



Prior to calibration the initialisation of the balance chamber must be completed. The initialisation is completed, if the *LLC Status* window changes from *000000004* to *000000000*.

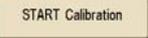
The system must be free of air for calibration. Thus an accurate calibration is guaranteed.



- Balance or graduated cylinder
- Tubing clamp



1. Fill graduated cylinder with 200 ml water.
2. Remove respective concentrate suction rod from rinsing chamber and immerse into graduated cylinder.

3. Press the *BICP Pump* or *KP Pump*  key again to start a pump calibration.  
The piston pump runs two minutes and stops.
  4. Press the  key, which appears automatically after 2 minutes.
  5. Enter the suction delivery volume (200 ml – residual volume = delivery volume) as reference value.
  6. Press  key to confirm.
  7. Confirm and store completed calibration procedure with  key.
- Note:** Generally, follow the instruction for **UFP** calibration if using a balance.

#### 4.8.3.11.2 Calibration UF Pump with Balance

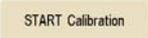
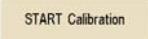
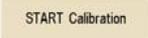
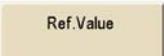
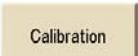


The accuracy of the **UFP** calibration is essential for the precise weight reduction of a patient during dialysis.

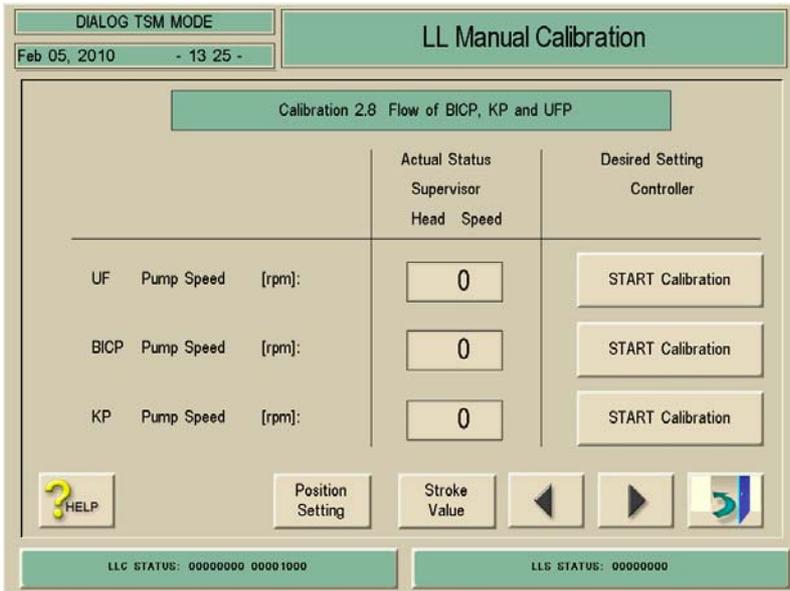


- Balance
- Tubing clamp



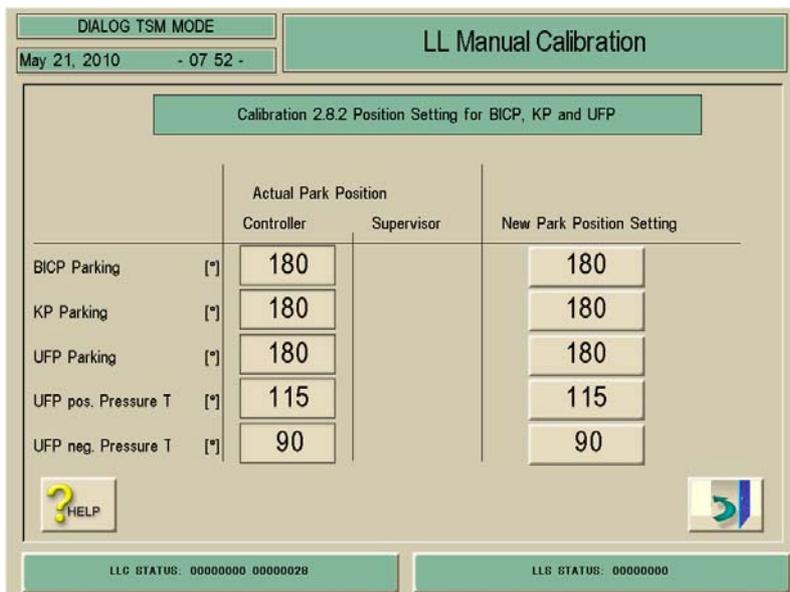
1. Clamp and remove inlet tubing from **UFP**. Connect another tubing to the **UFP** and immerse tubing into a container with approx. 200 ml demineralised water.
  2. Press the *UF Pump*  key to prime the tubings.  
Wait a few seconds to fully prime the tubings.
  3. Press again the *UF Pump*  key to stop the **UFP**.  
The **UFP** will rotate back into its initial position.
  4. Press  key.
  5. Remove the filled tubing carefully from the measuring cylinder, measure the weight and note value.
  6. Replace the tubing carefully in the measuring cylinder.
  7. Press the *UF Pump*  key to start the calibration procedure.  
The **UFP** runs approx. two minutes and stops. It will rotate back into its initial position.
  8. After the UF pump has stopped, remove the tubing carefully from the measuring cylinder, measure the weight and note value.
  9. Press  key.
  10. Enter the calculated delivery volume as reference value.  
First measurement – second measurement = delivery volume
  11. Press  key to confirm.
  12. Confirm and store completed calibration procedure with  key.
- Note:** The calibration data is saved only after the bit sequence 0-1-0 (for detailed information see 4.8.3.1 General Calibration Information).

4.8.3.11.3 Position Setting for BICP, KP and UFP



The sub-menu *2.8.2 Position Setting for BICP, KP and UFP* can be selected with the *Position Setting* key.

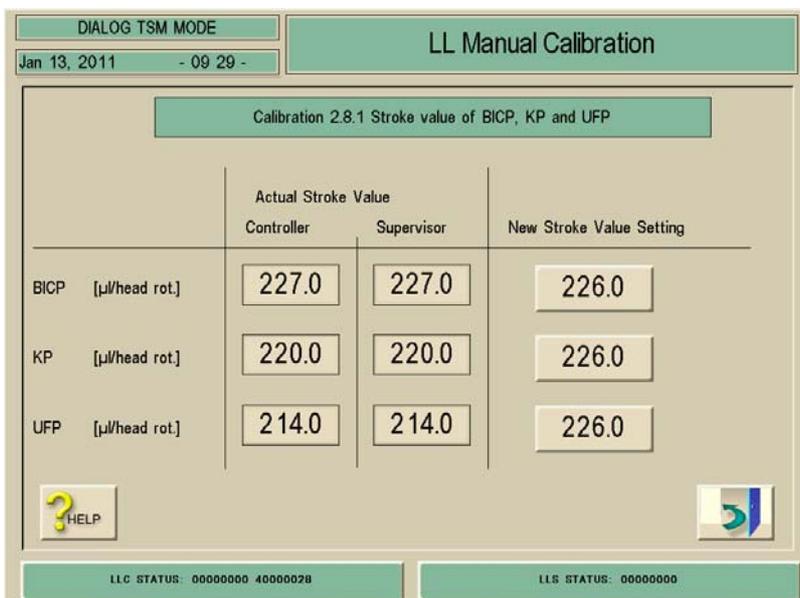
The sub-menu *2.8.1 Stroke Value of BICP, KP and UFP* can be selected with the *Stroke Value* key.



The following settings are required:

- BICP Parking: 180 °
- KP Parking: 180 °
- UFP Parking: 180 °
- UFP Positive Pressure Test: 115 °  
(used for DFS pressure test)
- UFP Negative Pressure Test: 90 °

4.8.3.11.4 Stroke Value of BICP, KP and UFP



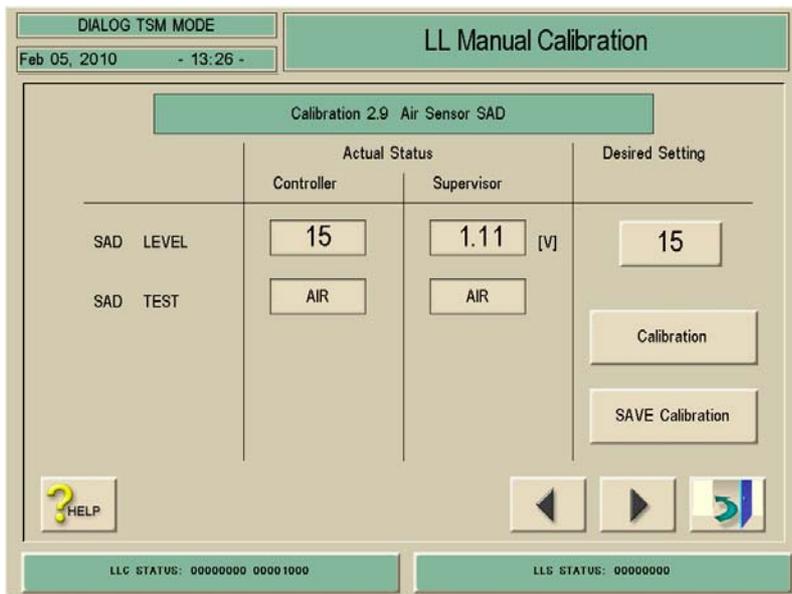
The sub-menu *2.8.1 Stroke Value of BICP, KP and UFP* can be selected from the menus *1.17 UF Pump*, or *2.8 Calibration Flow of BICP, KP and UFP*.

The stroke values (µl/head rotation) can be entered directly if the exact values are known for the bicarbonate pump *BICP* and the concentrate pump. The stroke value for the ultrafiltration pump *UFP* should not be changed, because it is determined by the calibration of the pump with a balance.

It is recommended to calibrate the UFP with the procedure described (with balance) because the accuracy of the stroke value might be insufficient for a proper UF control of the system.

## 4.8.3.12 Calibration Safety Air Detector SAD

- Calibration Level** The value for the calibration level is marked on the SAD (example calibration level KS = 49) and was determined individually for every SAD ex works.
- Test Level** The test level is the value used to check the function of the SAD in the cyclic self test. The test level is 5 digits higher than the calibration level:
- Test level TS = Calibration Level KS + 5 Digits
- Alarm Level** The safety air detector SAD has a fixed alarm level (15 Digits). The alarm level is displayed after the test level is entered.



1. Activate the *LL Manual Calibration* menu with the *LL Manual Calibration* key in the *Manual Test and Calibration* menu.
2. Activate the *Safety Air Detector SAD* menu by pressing on the line *Calibration 2.9 Safety Air Detector SAD*. The following menu is displayed.

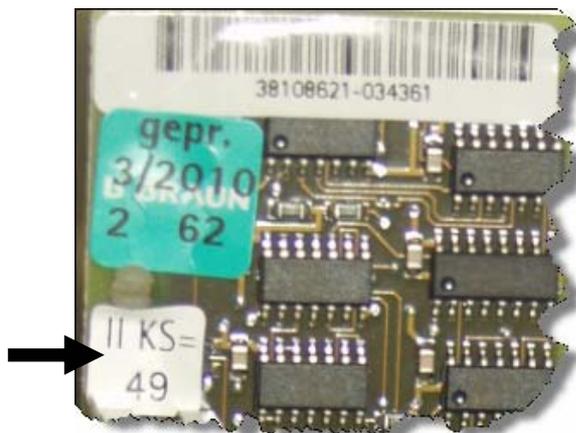
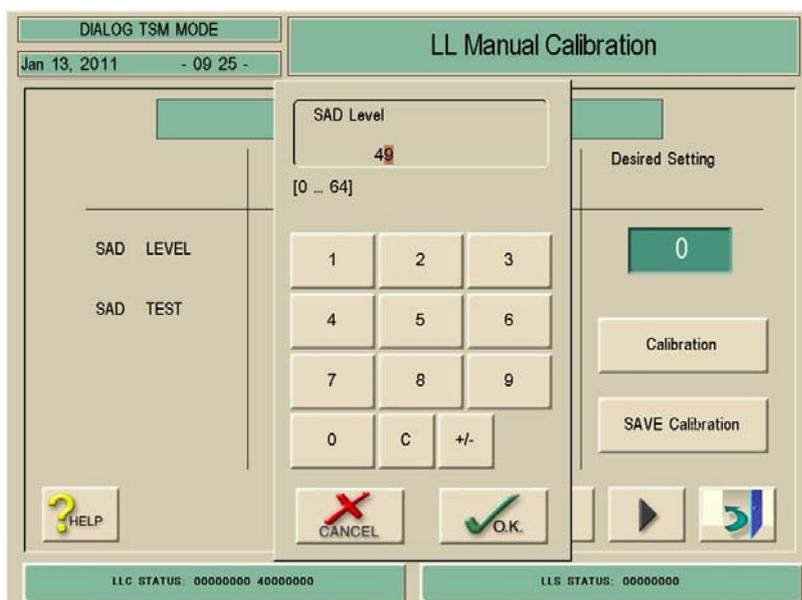


Fig.: Excerpt from SAD Board with KS Label (e.g. KS = 49)



The value for the calibration level is marked on the SAD board (example calibration level KS = 49, see left figure SAD board).



3. Take the value for the calibration level (KS) on the SAD and enter the value in the *Desired Setting* window.
4. Press **Calibration** key and wait until the **Calibration** key switches back again. The calibration procedure is completed.
5. Press the **SAVE Calibration** key to store the calibration.

**Note:** The calibration data is saved only after the bit sequence 0-1-0 (for detailed information see 4.8.3.1 General Calibration Information).

## 4.8.3.12.1 SAD Test after Calibration

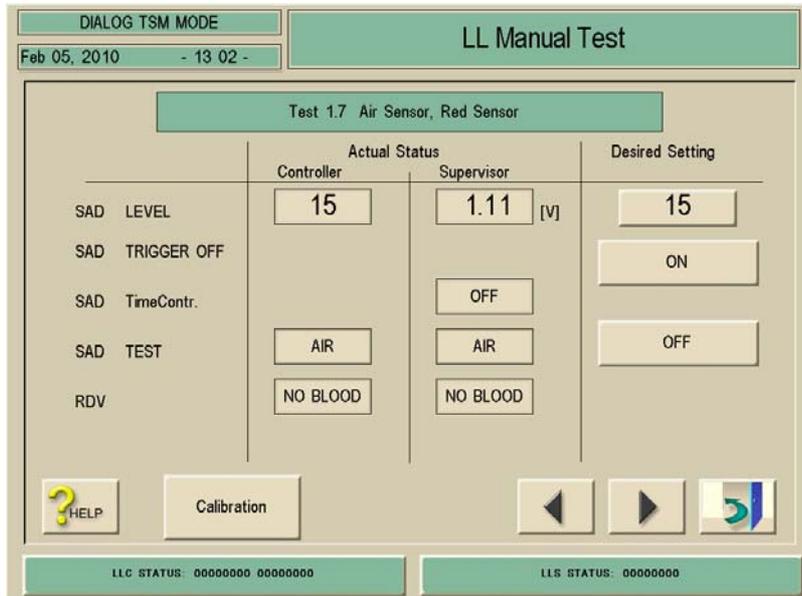
**SAD Test**

*AIR* must be displayed if the *SAD TEST* is activated, even if a tubing filled with fluid is inserted in the SAD.

The displayed result with *SAD TEST OFF* depends on the tubing inserted in the SAD:

*AIR*: must be detected if a tubing filled with air is inserted.

*NO AIR*: must be detected if a tubing filled with fluid is inserted.



1. Activate the menu *Test 1.7 Air Sensor, Red Sensor* in the *LL Manual Test* menu.
2. Insert a tubing filled with water in the SAD and close cover.  
The following settings must be displayed:  
*SAD LEVEL*: **15** (*Desired Setting*)  
*SAD TEST*: **NO AIR** (*Controller/Supervisor*)  
*RDV*: **NO BLOOD** (*Controller/Supervisor*)
3. Press *SAD TEST*  key (*Desired Setting*).  
The following settings must be displayed:  
*SAD LEVEL*: **KS+5** (*Desired Setting*, see previous page)  
*SAD TEST*: **TEST** (*Desired Setting*)  
*SAD TEST*: **AIR** (*Controller/Supervisor*)
4. Press the *SAD TEST*  key (*Desired Setting*) to terminate the test.  
The following setting must be displayed:  
*SAD TEST*: **OFF** (*Desired Setting*)
5. Press the *SAD TRIGGER OFF*  key (*Desired Setting*) to activate the *SAD TimeContr.*  
The following settings must be displayed:  
*SAD TimeContr.:* **OFF** (*Supervisor*)  
after approx. 1 second:  
*SAD TimeContr.:* **ON** (*Supervisor*)
6. Remove the tubing from the SAD.
7. Interrupt the light path in the SAD with a piece of paper.  
The following settings must be displayed:  
*RDV*: **NO BLOOD** (*Controller/Supervisor*)  
changes to  
*RDV*: **BLOOD** (*Controller/Supervisor*)

4.8.3.13 Calibration BICLF and ENDLF Ratio

You can set the expected values for the **BICLF** and **ENDLF** ratio. Thus the mixing ratio is monitored to prevent the use of false concentrates.

- **BICLF**: The mixing ratio between H<sub>2</sub>O and bicarbonate
- **ENDLF**: The mixing ratio between H<sub>2</sub>O and acid

The ratio between bicarbonate, acid/acetate and water is monitored during dialysis. The mixing ratio is monitored and dialysis with false concentrates can be prevented.

All concentrates applied by the user must be checked, during commissioning. If necessary the limit ratio value for bicarbonate and acid/acetate respectively, must be adapted to each machine to meet the customer specific requirements.



**ENDLF Ratio for Acid Concentrate with Ratio 1:44**

The **ENDLF ratio** should be set to 38 if an acid concentrate is used with a ratio of 1:44.

The acetate dialysis must be disabled, because an acetate dialysis is not possible with this setting: *Treatment Support, System Configuration, Dialysate Side Parameters, Acetate Mode Disabled (YES)*.

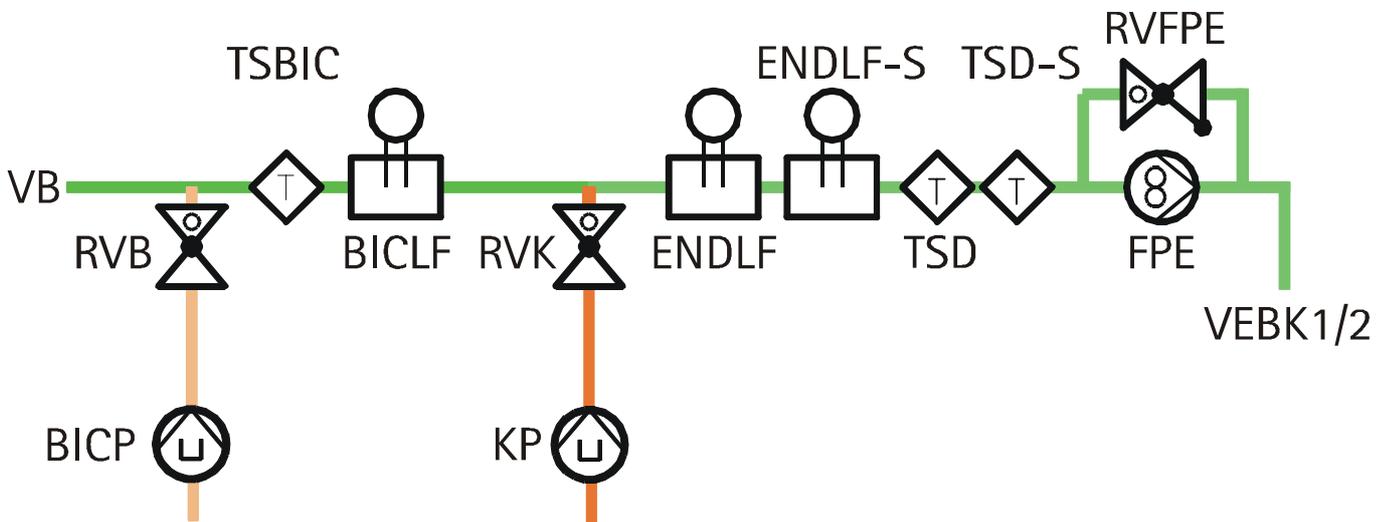
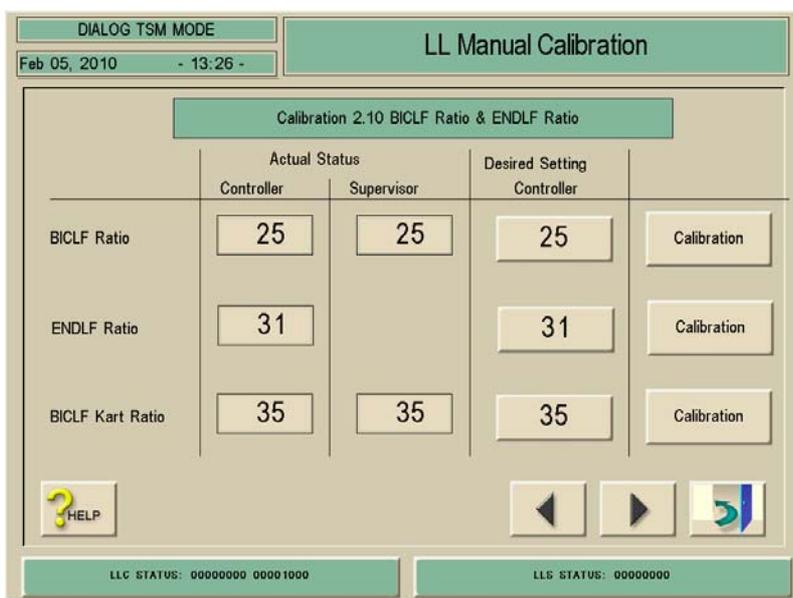


Fig.: BICLF and ENDLF Conductivity Sensors



1. Activate the *LL Manual Calibration* menu with the *LL Manual Calibration* key in the *Manual Test and Calibration* menu.
2. Activate the *BICLF and ENDLF Ratio* menu by pressing on the line *Calibration 2.10 BICLF and ENDLF Ratio*. The following menu is displayed.

The *BICLF Cart Ratio* is only displayed if the bicarbonate cartridge holder option is activated in the *Production Report, LLC Options, Holder for BIC Cartridge*.

You can determine the limit of the **ENDLF ratio** (measured at the end conductivity sensor **ENDLF**).

**Ratio Values (Factory Settings)**

BICLF Ratio: 25 (ratio water/bicarbonate for canister operation)

ENDLF Ratio: 31 (bicarbonate mode=ratio water/acid  
(acetate mode=ratio water/acetate))

BIC Cart Ratio: 35 (ratio water/bicarbonate for cartridge operation)

**Bicarbonate Therapy**The **ENDLF ratio** limit value 31 (factory setting, can be modified) must not be exceeded. An alarm is activated if this **ENDLF ratio** limit is exceeded.

B i c a r b o n a t e   M o d e		
Upper Limit ENDLF Ratio:	< 31	
Default Value BICLF Ratio:	25 ± 7 (canister)	
Default Value BICLF Ratio:	35 ± 10 (cartridge)	
	Setting Range (ENDLF Ratio 14 mS/cm)	Setting Range (BICLF Ratio 3 mS/cm)
Acid	10 to 50	-
Bicarbonate	-	10 to 50 (canister) 25 to 50 (cartridge)
Concentrate Pump KP:	Suction Rod (red)	
Bicarbonate Pump BICP:	Suction Rod (blue)	

**Acetate Therapy**The **ENDLF ratio** limit value must not fall below 31 (factory setting, can be modified). An alarm is activated if this **ENDLF ratio** limit is lower than 31.

A c e t a t e   M o d e		
Lower Limit ENDLF RATIO:	> 31	
	Setting Range (ENDLF Ratio 14 mS/cm)	Setting Range (BICLF Ratio 3 mS/cm)
Acetate	10 to 50	-
Concentrate Pump KP:	Suction Rod (red)	
BICP:	is deactivated in acetate mode	

The **BICLF Ratio** and **ENDLF ratio** limits can be modified in the given limits. These limits were determined and set to meet the general requirements. The Dialog is delivered with a standard factory setting. Concentrates, which are individually composed and applied in dialysis centres, can differ from these standard values.

The delivery rates of **KP** and **BICP** must be calibrated correctly prior to determining the actual ratio.**1. Check Bicarbonate**Check the conductivity of all concentrates in the therapy main menu, according to the prerequisites of the customer (setting of **ENDLF ratio** and **BICLF ratio**). If necessary change **END/BICLF ratio**.

1. Select the *Haemodialysis* key in *Therapy Selection*. Machine switches to *Preparation*.
2. Select the *Parameter* key, a parameter window is opened.
3. Select *Bicarbonate* key and activate bicarbonate mode.
4. Connect the respective concentrate (bicarbonate/acid) after the request.
5. Select service overview to display the current RATIO values. Wait till stable ratio values are reached. Use the mean value if there are slight deviations.

6. Connect and check all concentrates in succession and note the **BICLF ratio** and **ENDLF ratio** values.
7. Change the treatment mode to Acetate and connect only acetate concentrates if Acetate mode is performed in that dialysis centre.
8. Wait for the conductivity to be stabilized and read the actual ENDLF ratio from the service overview.
9. Switch off the Dialog and set service switch S1 to *position 2* TSM service program.
10. Switch on Dialog.
11. Select the *Manual Test & Calibration* key.
12. Select *LL Manual Calibration* key and activate *2.10 BICLF Ratio & ENDLF Ratio*.

For bicarbonate therapy with **BICLF ratio** values near the limits or out of the default setting of  $25 \pm 7$ .

11. If necessary enter the value for **BICLF ratio** (mean value of all bicarbonates) in *BICLF Ratio Desired Setting Controller 25* key (default value 25).
12. Confirm and save the entered value with the *Calibration* key.



To prevent alarms during therapy in bicarbonate mode the value of the **ENDLF Ratio** must be less than the set **ENDLF Ratio** e.g. <31.

To prevent alarms during therapy in acetate mode the value of the **ENDLF Ratio** must be more than the set **ENDLF Ratio**, e.g. >31.

13. If necessary select *ENDLF Ratio - Desired Setting Controller - 31* (limit Value 31) and enter the value for the **ENDLF ratio** (between highest value for all acidic concentrates and lowest value for all acetate concentrates).
14. Save the entered limit value.
15. Switch off Dialog and set service switch S1 to *position 0* therapy.

## 2. Bicarbonate Cartridge Holder Option

The option must be activated, set and checked in the TSM service program. After the activation a ratio value must be set for the *BICLF Cart Ratio*. Check the ratio value in therapy (service overview) and adjust if necessary.

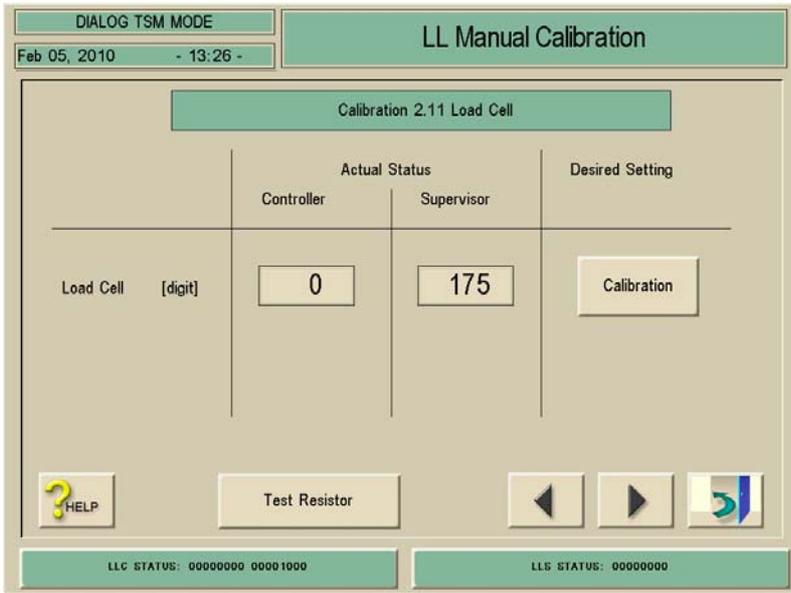
Setting Range: 25 to 50

Limits: Setting  $\pm 10$



1. Enter 35 in *Desired Setting Controller* for the *BICLF Cart Ratio*.
2. Save the entered value with the *Calibration* key.
3. Check the bicarbonate ratio value in therapy.

4.8.3.14 Calibration Load Cell



Not applicable.

### 4.8.3.15 Calibration PV Alarm Window, PA Low Limit Low Limit

DIALOG TSM MODE		LL Manual Calibration		
Feb 05, 2010 - 13:26 -		Calibration 2.12 PV Alarm Window, PA Low Limit		
	Actual Status Controller	Supervisor	Desired Setting Controller	
PV Alarm Window	100	100	100	Calibration
PV low limit Pos.	35	35	35	Calibration
PV abs. low limit	20	20	20	Calibration
PA abs. low limit	-200	-200	-200	Calibration

LLC STATUS: 00000000 00001000      LLS STATUS: 00000000

1. Activate the *LL Manual Calibration* menu with the *LL Manual Calibration* key in the *Manual Test and Calibration* menu.
2. Activate the *PV Alarm Window, PA Low Limit* menu by pressing on the line *Calibration 2.12 PV Alarm Window, PA Low Limit*. The following menu is displayed.

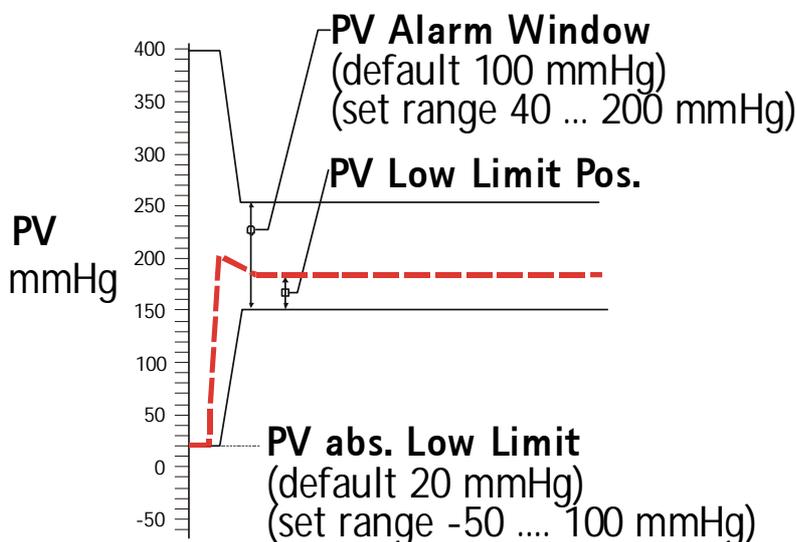


Fig.: PV Settings

For all Limit Settings (PA and PV)

PV Absolute Low Limit



If any setting values are changed these must be in agreement with the user, because any value can be used as a possible indication for "bleeding" (e.g. if the venous access to the patient is disconnected). Furthermore please note that the LLS limit value is 10 mmHg under the *PV Abs. Low Limit* (protection system).

You can set the absolute low limit for **PV** and the window values for the alarm size and position of the **PV** monitoring for therapy.

The supervisor uses a tolerance of 10 mmHg for monitoring the **PV** limit values to prevent double alarms.

PA Absolute Low Limit

The set *PA Absolute Low Limit* value (-200 mmHg) is used as limit in therapy and TSM service program/system configuration.

## 4.8.3.16 Calibration Flow Rate of BPA and BPV/OSP

The tube constants can be directly entered or calculated via a comparison measurement. **BPA** and **BPV/OSP** (option HDF online substitution pump) can be activated with the *START Calibration* key. The delivered volume is measured in ml and entered as reference value. The pressure conditions for the tube system during measurement must be identical with the pressure conditions in therapy.

	Actual Status		Desired Setting
	Controller	Supervisor	
BPA	0	0	START Calibration
BPV	0	0	START Calibration

1. Activate the *LL Manual Calibration* menu with the *LL Manual Calibration* key in the *Manual Test and Calibration* menu.
2. Activate the *Flow of BPA and BPV/OSP* menu by pressing on the line *Calibration 2.13 Flow of BPA and BPV/OSP*. The following menu is displayed.

	Actual Tube Constant	New Tube Constant Setting	
		Controller	Supervisor
BPA [µl/head rot.]	12306	12306	0
BPV [µl/head rot.]	12306	12306	0

**Tube Constant**

1. Press the *Tube Constant* key to activate the menu *Calibration 2.13.1 Tube Constants of BPA and BPV*. The following menu is displayed.

The following tube constants must be entered for the applied tubing system.

**8 x 12 Tubing System**

**BPA:** 12306 µl/head rotation  
**BPV:** 12306 µl/head rotation

**7 x 10 Tubing System**

**BPA:** 9293 µl/head rotation  
**BPV:** 9296 µl/head rotation

Pump Head Selection	Value
* Pump Head 8x12	0
Pump Head 7x10	1

**Pump Head**

1. Press the *Pump Head* key to activate the menu *Pump Head Selection*. The following menu is displayed.

You can select the pump head roller type used in the blood pumps.

- Pump head 8 x 12
- Pump head 7 x 10 (option)

## 4.8.3.17 Infusion Density Substitution Pump

DIALOG TSM MODE		LL Manual Calibration		
Feb 05, 2010 - 13:27 -				
Calibration 2.14 Substitution Pump				
Actual Value				
	Controller	Supervisor	New Value Setting	
Infusion density [g/l]	1006	1006	1006	
Actual Tube Constant				
	Controller	Supervisor	New Tube Constant Setting	
Subst. Pump [µl/head rot.]	3372	3372	3372	
				
LLC STATUS: 00000000 00001000		LLS STATUS: 00000000		

Not applicable.

## 4.8.3.18 Stroke Value HDF Online Substitution Pump OSP

	Actual Stroke Value		New Stroke Value Setting
	Controller	Supervisor	
OSP [µl/head rot.]	8300	8300	8300

LLC STATUS: 00000000 00001000      LLS STATUS: 00000000

1. Activate the *LL Manual Calibration* menu with the *LL Manual Calibration* key in the *Manual Test and Calibration* menu.
2. Activate the *HDF Online Substitution Pump OSP* menu by pressing on the line *Calibration 2.15 HDF Online Substitution Pump OSP*. The following menu is displayed.

**Stroke Value  
HDF Online Substitution Pump OSP**

The stroke value must be set to 8300 (for pump head 8 x 12).

## 4.8.3.19 Level Regulation

The screenshot shows the 'LL Manual Calibration' menu in Dialog+ TSM MODE. The date is Feb 05, 2010, and the time is 13:28. The menu title is 'LL Manual Calibration'. Below it, a sub-menu 'Calibration 2.16 Level Regulation' is active. The main area is a table with columns for 'saved PWM' (Controller, Supervisor) and 'new PWM'. The rows are 'PPR slow [%]' and 'PPR fast [%]'. The 'saved PWM' values are 60 and 100, and the 'new PWM' values are 60 and 100. There are navigation buttons (left, right, and a blue arrow) and a 'HELP' button. At the bottom, there are two status bars: 'LLC STATUS: 00000000 00001000' and 'LLS STATUS: 00000000'.

	saved PWM			new PWM
	Controller	Supervisor		
PPR slow [%]	60			60
PPR fast [%]	100			100

1. Activate the *LL Manual Calibration* menu with the *LL Manual Calibration* key in the *Manual Test and Calibration* menu.
2. Activate the *Level Regulation* menu by pressing on the line *Calibration 2.16 Level regulation*. The following menu is displayed.

**Level Regulation**

The speed of the level regulation pump (LRP = PPR) can be set for the slow mode and for the fast mode.

The settings are (see default table in chapter 3):

- 60 % for the slow mode
- 100 % for the fast mode

The default settings should not be changed, unless instructed otherwise.

### 4.8.3.20 Calibration Inlet Flow Pump Nonreturn Valve RVFPE

You can calibrate the inlet flow pump nonreturn valve **RVFPE**.

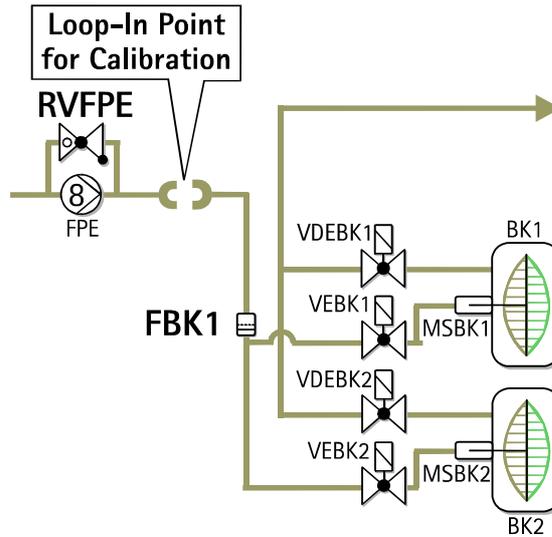


Fig.: Calibration RVFPE/Loop-In Point

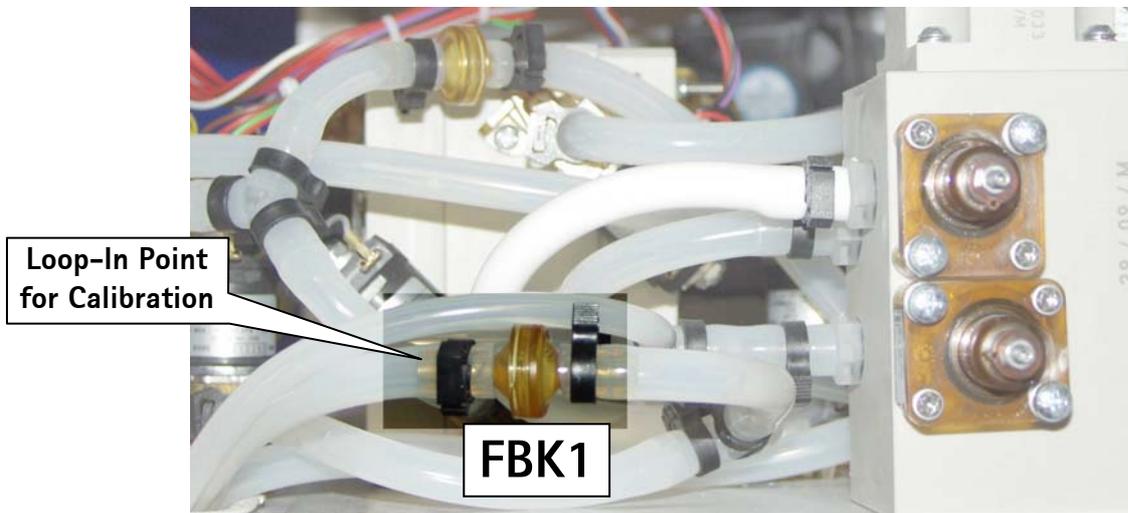


Fig.: UF Sub-Rack with FBK1

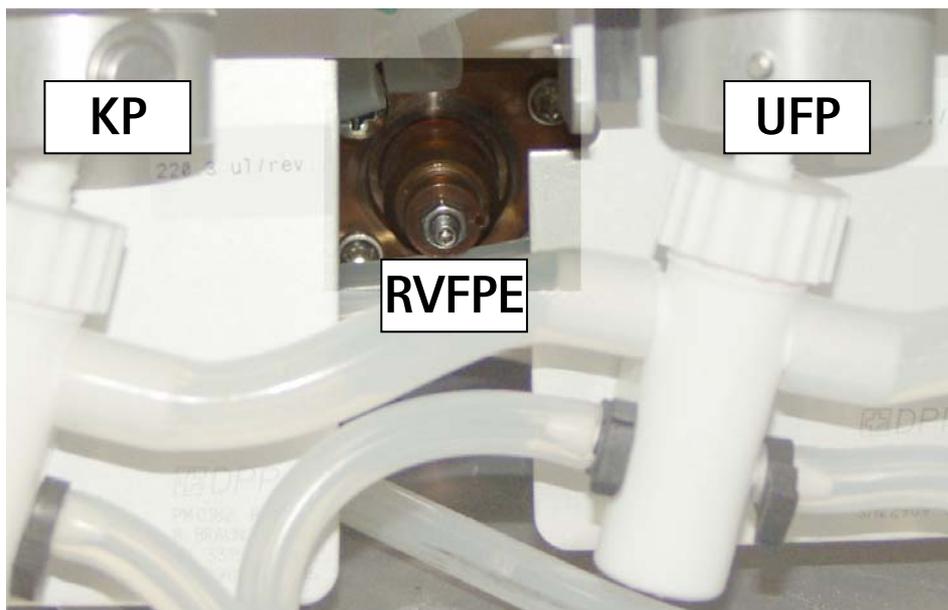


Fig.: DF Sub-Rack with RVFPE



- Manometer 0 to 4 bar (art. no. 7701357 or equivalent)
- Flow meter (art. no. 770085A or equivalent)
- Allen key 3 mm
- Size 7 spanner



**Please ensure that the manometer and connection tubing are at the same level as the nonreturn valve during calibration.**



1. Connect manometer and flow meter between flow pump **FPE** and **FBK1**.
2. Select *Test 1.20 Water Part (Overview)* in TSM.
3. Increase slowly the speed of **FPA**, until a flow of 500 ml/min is reached.
4. Set temperature **TSD** to 37 °C and wait until temperature is reached.
5. Clamp tubing between manometer and **FBK1**.
6. Loosen lock nut on **RVFPE** adjustment screw.
7. Set a pressure of 975 mmHg (1300 mbar) with the adjustment screw of **RVFPE**.
  - 975 mmHg ±37 mmHg
  - 1300 mbar ±50 mbar
8. Tighten lock nut again.
9. Remove manometer and flow meter.

4.8.3.21 Calibration Dialysate Nonreturn Valve RVDA

You can calibrate the dialysate nonreturn valve **RVDA**.

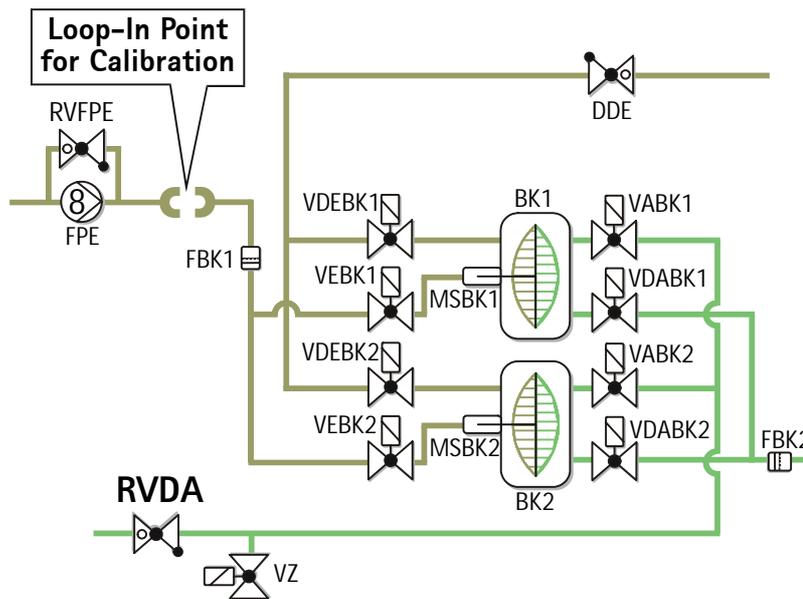


Fig.: Calibration RVDA/Loop-In Point

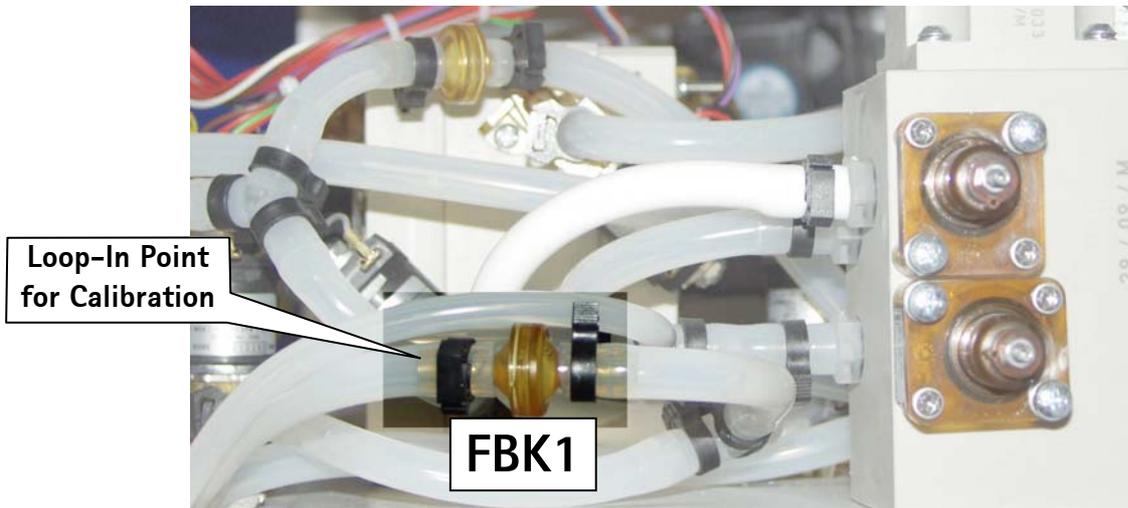


Fig.: UF Sub-Rack with FBK1

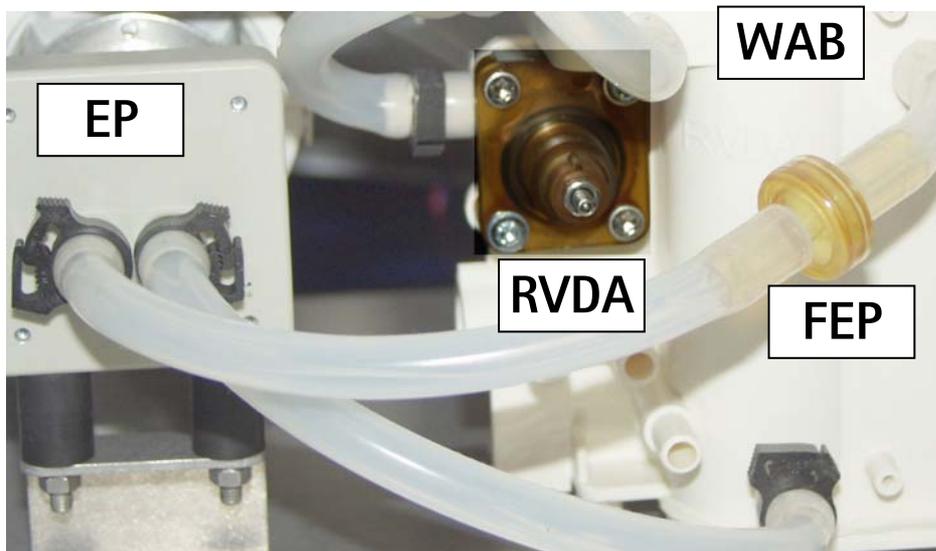


Fig.: Water Sub-Rack with RVDA



- Manometer 0 to 4 bar (art. no. 7701357 or equivalent)
- Flow meter (art. no. 770085A or equivalent)
- Allen key 3 mm



**Please ensure that the manometer and connection tubing are at the same level as the balance chamber/rinsing bridge and dialyser during calibration.**



1. Remove lower front cover.
  2. Connect manometer and flow meter between flow pump **FPE** and **FBK1**.
  3. Select *Test 1.20 Water Part (Overview)* in TSM.
  4. Increase slowly the speed of **FPA**, until a flow of 500 ml/min is reached.
  5. Set temperature **TSD** to 37 °C and wait until temperature is reached.
  6. Loosen lock nut on **RVDA** adjustment screw.
  7. Set a pressure of 300 mmHg/400 mbar (HDF online 375 mmHg/500 mbar) with the adjustment screw of **RVDA**.
    - 300 mmHg ±37 mmHg
    - 400 mbar ±50 mbar
- HDF Online**
- 375 mmHg ±37 mmHg
  - 500 mbar ±50 mbar
8. Tighten lock nut again.
  9. Remove manometer and flow meter.

### 4.8.3.22 Calibration Outlet Flow Pump Nonreturn Valve RVFPA

You can calibrate the outlet flow pump nonreturn valve **RVFPA**.

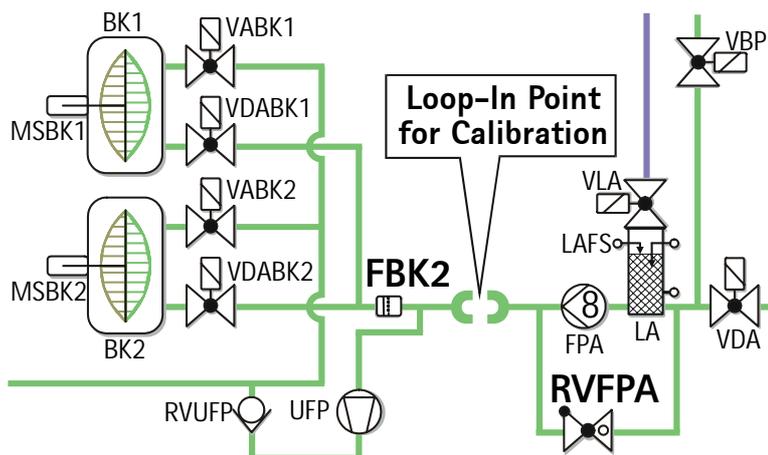


Fig.: Calibration RVFPA/Loop-In Point

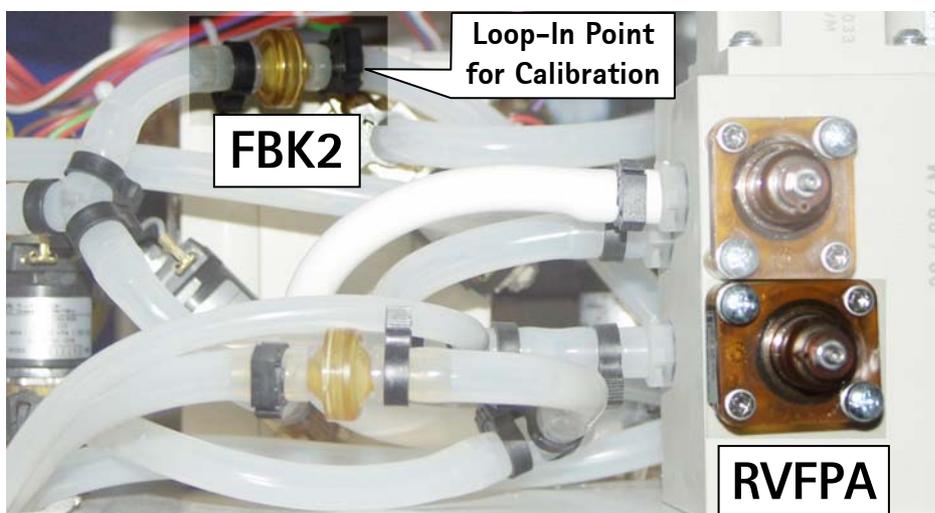


Fig.: UF Sub-Rack with FBK2 and RVFPA



- Manometer 0 to 4 bar (art. no. 7701357)
- Flow meter (art. no. 770085A or equivalent)
- Allen key 3 mm
- Size 7 spanner



**Please ensure that the manometer and connection tubing are at the same level as the nonreturn valve during calibration.**



1. Connect manometer and flow meter between flow pump **FPA** and **FBK2**.
2. Immerse both dialyser couplings into a vessel filled with warm water (30 to 40 °C). Thus uncontrolled pressure conditions are prevented.
3. Select *Test 1.20 Water Part (Overview)* in TSM.
4. Increase slowly the speed of **FPA**, until a flow of 500 ml/min is reached.
5. Set temperature **TSD** to 37 °C and wait for the temperature reached.
6. Clamp tubing between manometer and **FBK2**.
7. Loosen lock nut on **RVFPA** adjustment screw.
8. Set a pressure of 975 mmHg (1300 mbar) with the adjustment screw of **RVFPA**.
  - 975 mmHg ±37 mmHg
  - 1300 mbar ±50 mbar
9. Tighten lock nut again.
10. Remove manometer and flow meter.

4.8.3.23 Calibration Dialyser Inlet Throttle Valve DDE

You can calibrate the dialyser inlet throttle valve **DDE**.

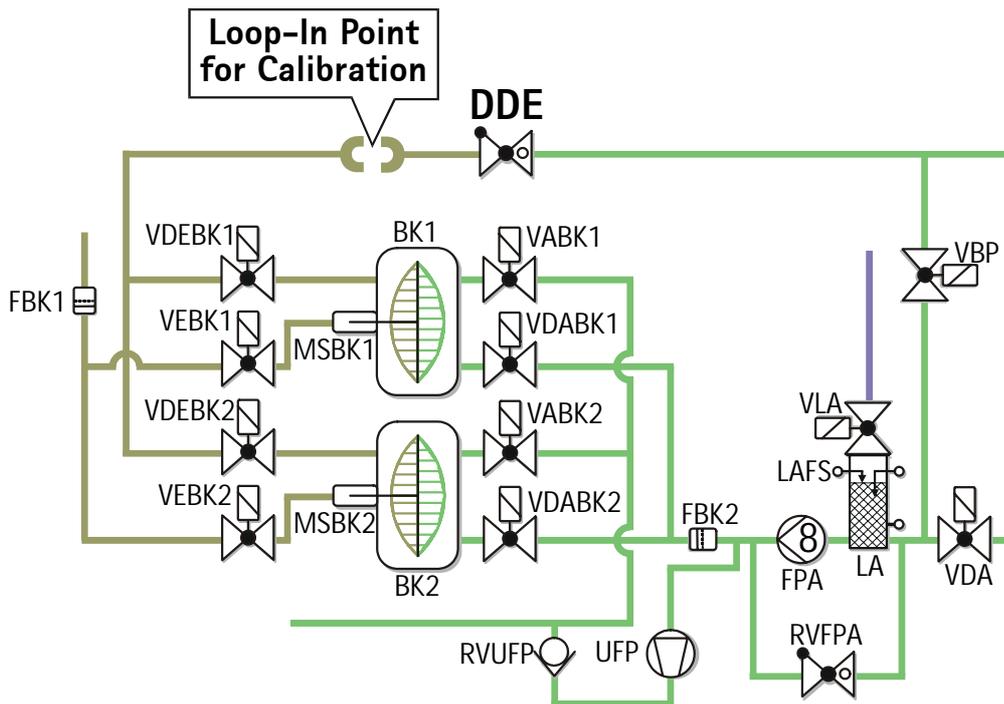


Fig.: Calibration DDE/Loop-In Point

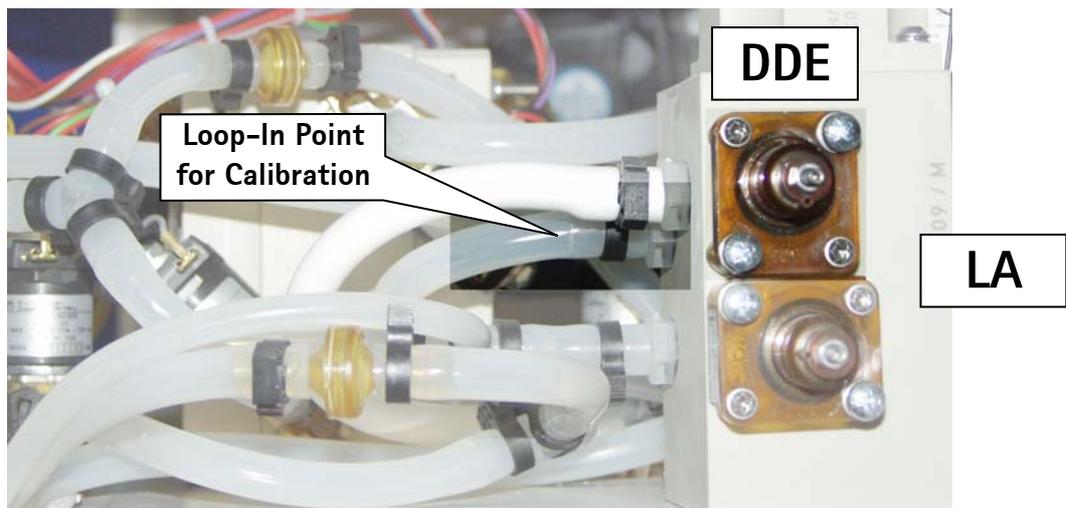


Fig.: UF Sub-Rack with DDE



- Manometer 0 to 4 bar (art. no. 770135A or equivalent)
- Flow meter (art. no. 7700857 or equivalent)
- Allen key 3 mm
- Size 7 spanner



**Please ensure that the manometer and connection tubing are at the same level as the throttle during calibration.**



1. Connect manometer and flow meter between **VDEBK1/2** and dialysate inlet throttle **DDE**.
2. Immerse both dialysate couplings into a vessel filled with water warm water (30 to 40 °C). Thus uncontrolled pressure conditions are prevented.
3. Select *Test 1.20 Water Part (Overview)* in TSM.
4. Increase slowly the speed of **FPA**, until a flow of 500 ml/min is reached.

5. Set temperature **TSD** to 37°C and wait for the temperature reached.



**Note for machines equipped with DF filter:**

The **DF** filter and the tubings going to the **DF** filter must be free of air before the **DDE** can be adjusted. Therefore the machine must be switched into Bypass for a few minutes to purge the air. Switch off the bypass for the calibration of **DDE** as it has to be done in mainflow.

6. Loosen lock nut on **DDE** adjustment screw.
7. Set a pressure of 300 mmHg/400 mbar with the adjustment screw of **DDE**.
  - 300 mmHg  $\pm$ 37 mmHg
  - 400 mbar  $\pm$ 50 mbar
8. Tighten lock nut again.
9. Remove manometer and flow meter.

4.8.3.24 Calibration Pressure Reducer Valve DMV

You can calibrate the pressure reducer valve **DMV**.

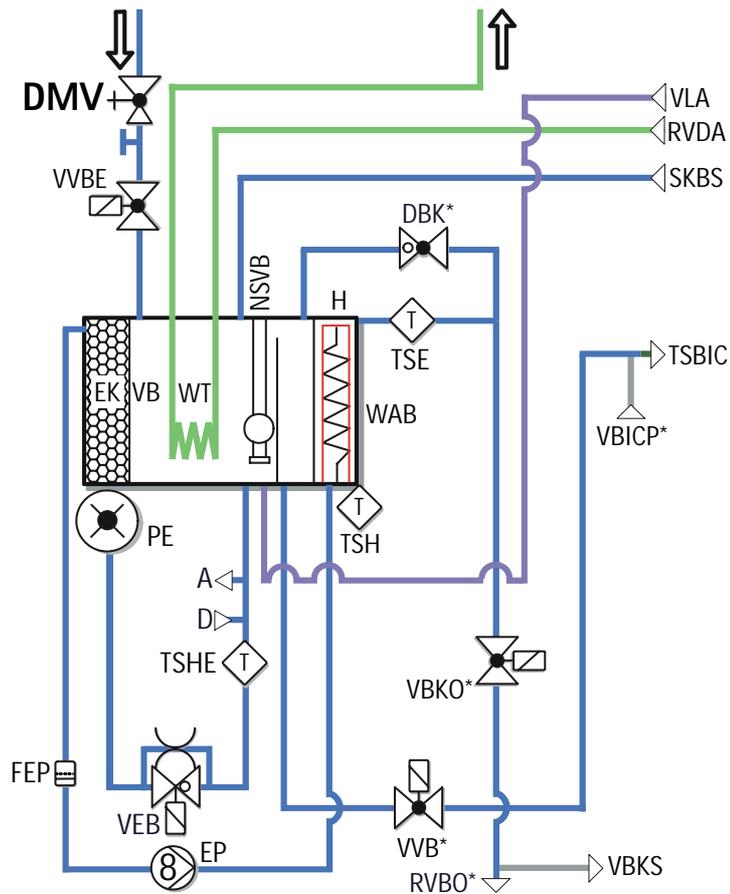


Fig.: Calibration DMV

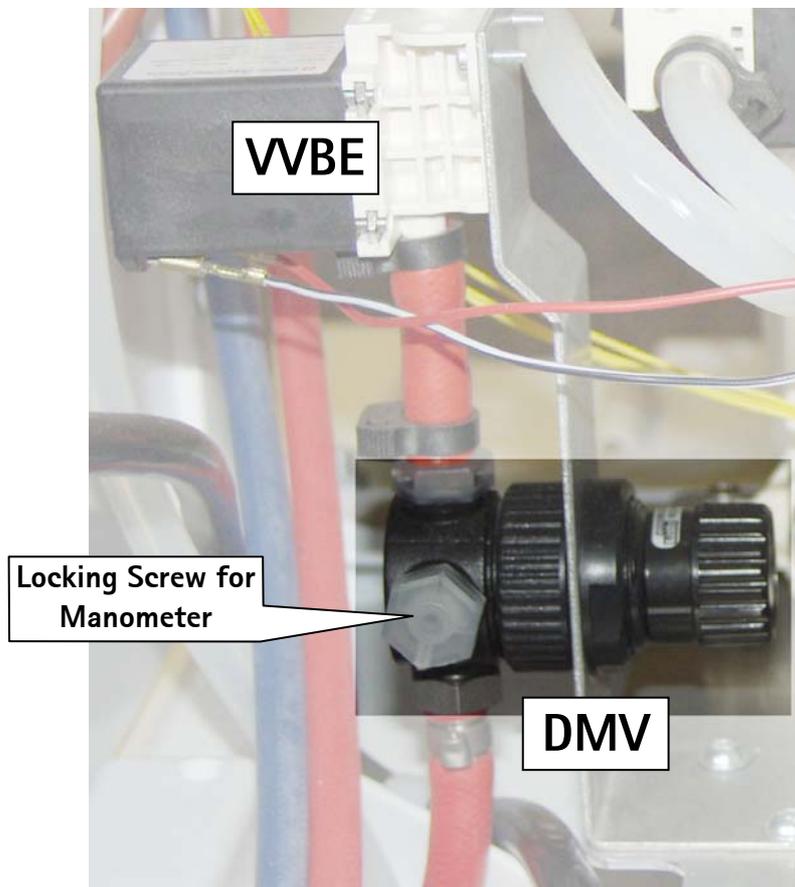


Fig.: Water Sub-Rack with DMV



- Manometer 0 to 2.5 bar (art. no. 34511571 or equivalent)



The calibration of **DMV** is performed in the dynamic operating mode (**FPE** running, level in the upline tank is controlled).



1. Disconnect water inlet hose from wall connection (close water tap if necessary).
2. Start briefly the unit to achieve a pressure free condition in the water inlet part to avoid water spraying.
3. Remove locking screw from **DMV** and screw in the manometer (if necessary use teflon tape to prevent leakages).
4. Connect water tubing and open the water tap.
5. Open the following menus in the TSM service program: *Manual Test and Calibration, LL Manual Test* and *1.9 Water Inlet, Upline Tank and Flow Pump FPE*.
6. Set **FPE** to approx. 1400 rpm (approx. 1200 ml/min) and open **VVBE** (the level in the upline tank must be controlled between medium and high level).
7. Pull up the adjustment knob to unlock pressure reducer valve **DMV** and set pressure to approx.  $0.9 \pm 0.1$  bar with the adjustment knob.
8. Close water tap.
9. Press down the adjustment knob to lock pressure reducer valve **DMV**.
10. Switch off Dialog.
11. Disassemble manometer.
12. Reassemble locking screw.

### 4.8.3.25 Gap Arterial Tubing Clamp SAKA/Venous Tubing Clamp Currentless Closed SAKV-SG

You can calibrate the gap for the arterial tubing clamp **SAKA** and the venous tubing clamp currentless closed **SAKV-SG**.



- Calibration template 1.4/1.5 (art. no. 7702493)



1. Remove cap **C** (e.g. use a sharp knife to lift out).
2. Close the respective tubing clamp in *Manual Test and Calibration*, *LL Manual Test*, *Test 1.5 Tubing Clamps*.

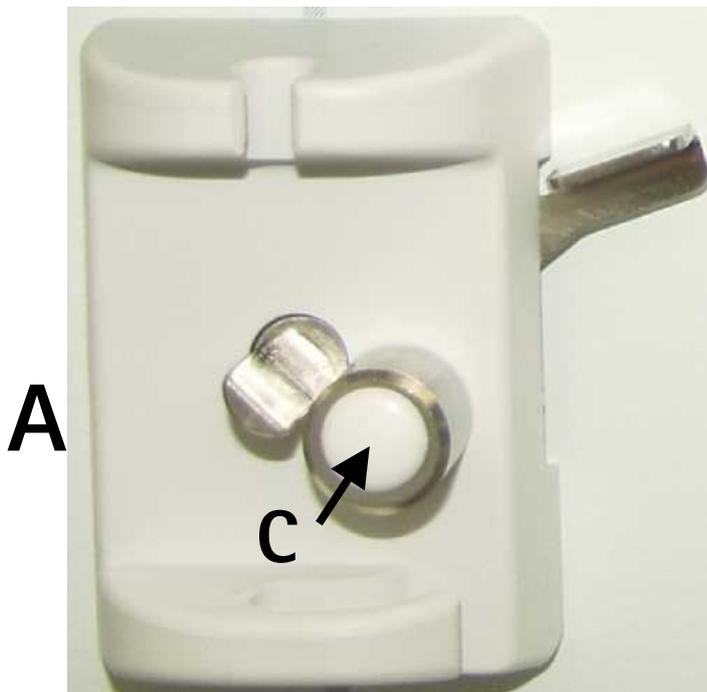


Fig.: Tubing Clamp SAKV-SG

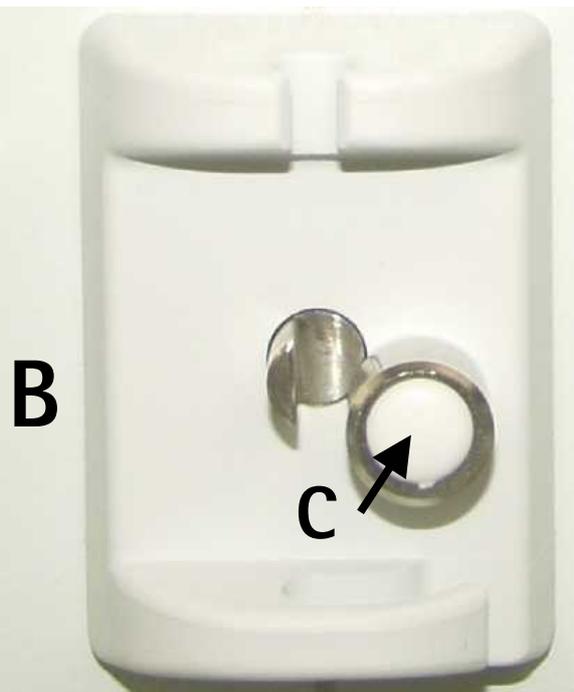
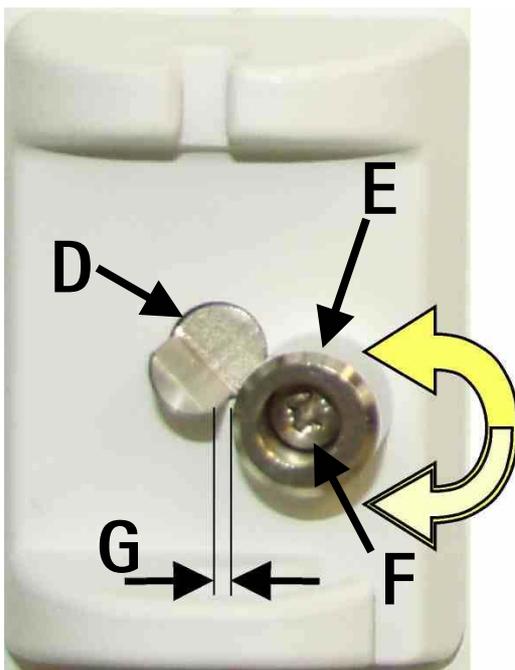


Fig.: Tubing Clamp SAKA



Set gap **G** to 1.4 mm with 1.4 mm template.

3. Loosen screw **F**.
4. Push 1.4 mm template between clamp **D** and eccentric cam **E**.
5. Rotate eccentric cam **E** until 1.4 mm is set.
6. Tighten again screw **F**

**Note**

The 1.4 mm template fits through the gap.

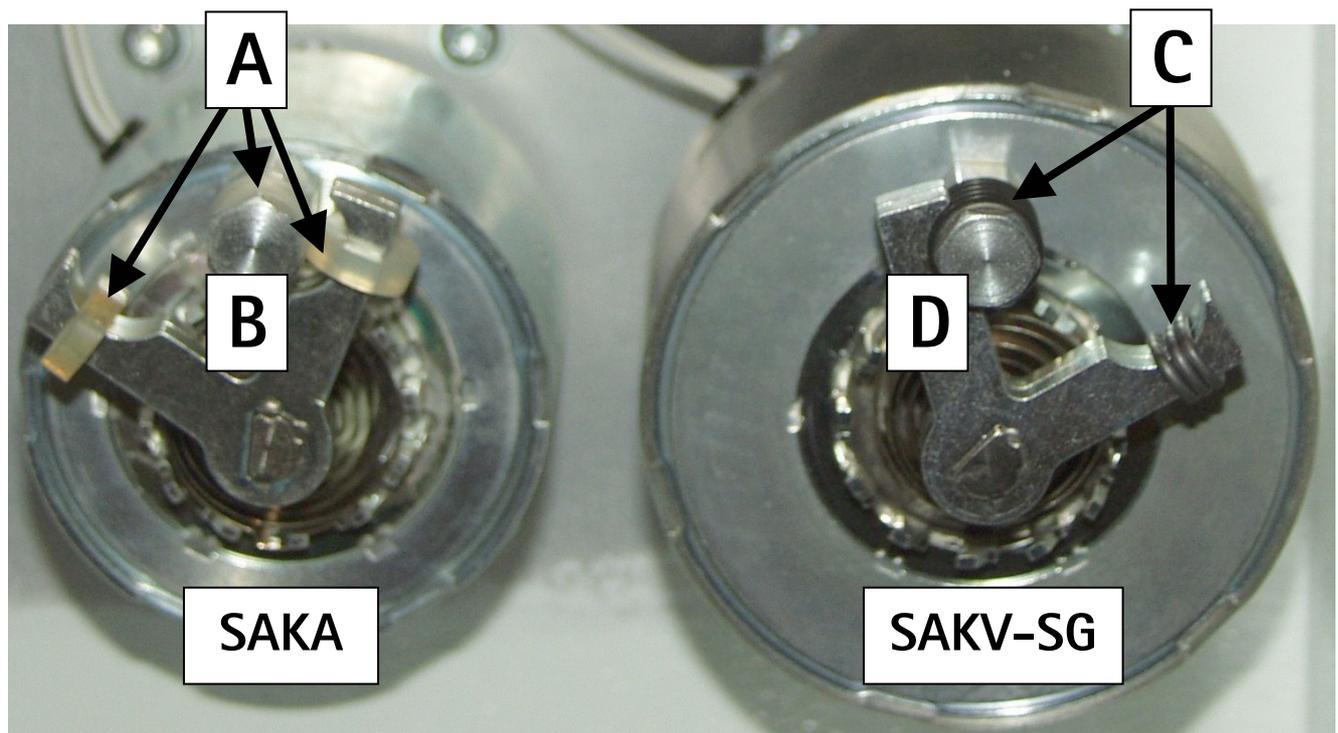
7. Check with the 1.5 mm template.

**Note**

The 1.5 mm template must not fit through the gap.

8. Reassemble cap **C**.

### 4.8.3.26 Arterial Tubing Clamp SAKA/Venous Tubing Clamp Currentless Closed SAKV-SG



#### SAKA

You can check the soft stoppers **A** on the V-stopper/stopper **B** of the arterial tubing clamp **SAKA**.



- Soft stoppers art. no. 34570675



1. Open front door.
2. Check the soft stoppers **A** on the V-stopper/stopper **B**.

Replace if soft stoppers show any damages (tears/ruptures/brittleness).

#### SAKV-SG

You can check the o-rings **C** on the V-stopper/stopper **D** of the venous tubing clamp currentless closed **SAKV-SG**.



- O-ring 7 x 1.5 art. no. 34570624



3. Check the o-rings **C** on the V-stopper/stopper **D**

Replace if o-rings show any damages (tears/ruptures/brittleness).

4. Close front door.

### 4.8.3.27 Setting Servomotor for Disinfection Valve VD

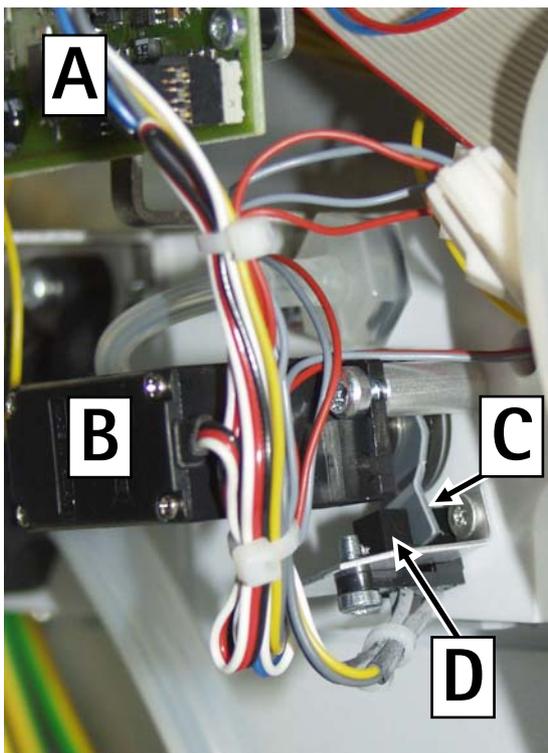


Fig.: Disinfection Valve VD/Rinsing Bridge



#### Basic Position Disinfection Valve VD

The servomotor and the servomotor board must only be replaced together, because they are a calibrated unit.

The position tag **C** of the servomotor **B** must be seated in the light barrier **D** when assembled (see figure).

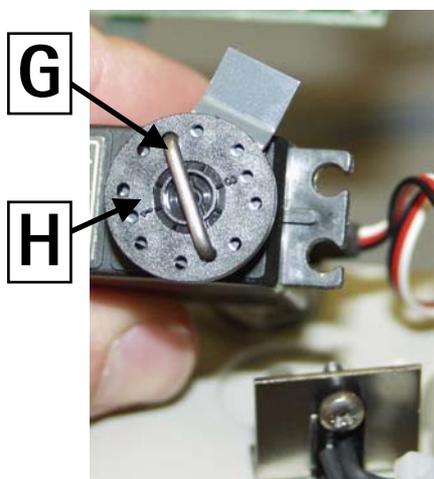
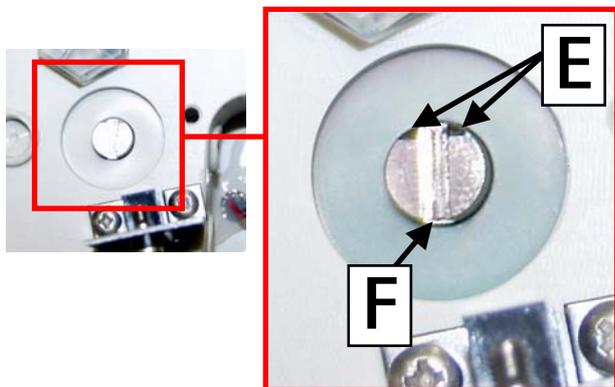
This basic position must be guaranteed if the servomotor is disassembled and assembled again on the disinfection valve (rinsing bridge). Thus the correct operation of **VD** is guaranteed, i.e. switching from the air line to the disinfection line.

In basic position the disinfection valve **VD**:

- is open to the air line, i.e. disinfectants can not be drawn in.

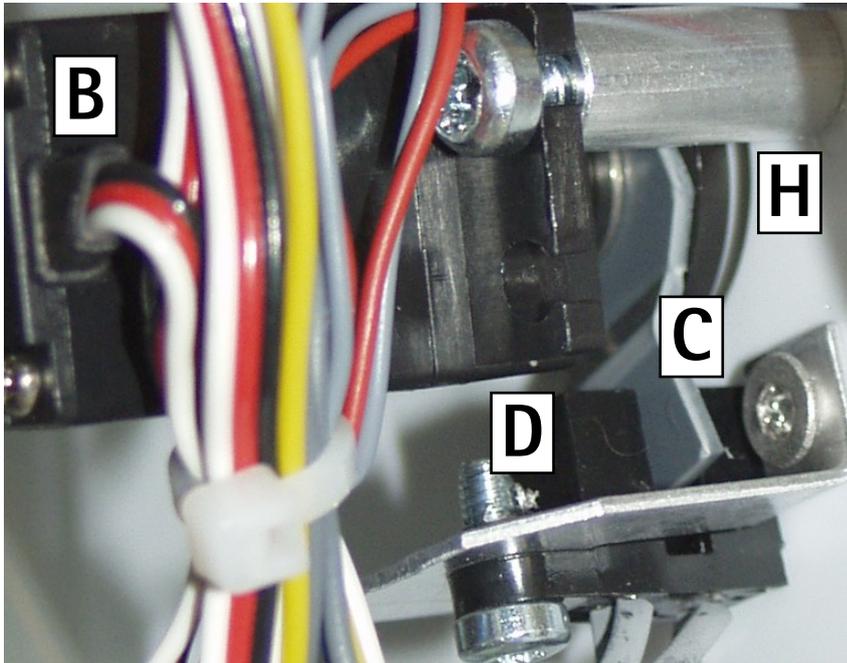


1. Open front door of Dialog.
2. Pull off the connector **A** from the disinfection valve board.
3. Disassemble servomotor **B**.
4. Prior to the assembly of the new servomotor **B**: pay attention to the position of the bevel **E** on the eccentric axle. The bevel **E** must be in upper position (see figure).



Do not pull off the bow **G** from the control disc **H**, because its position is set ex works.

5. The bow **G** on the control disc **H** must be seated in the groove **F** of the eccentric axle.

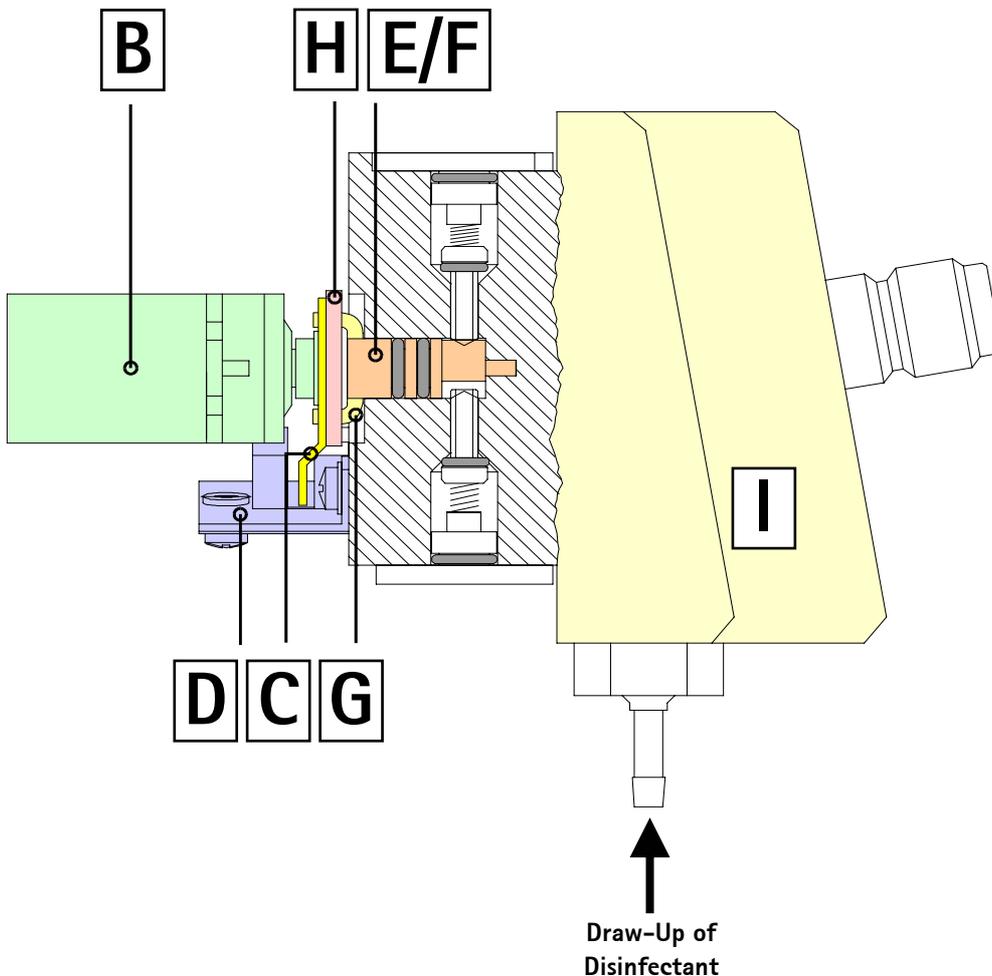


6. Assemble servomotor **B**.

The position tag **C** of the servomotor **B** is seated in the light barrier **D**. The bow **G** (not visible) is seated in the groove **F** of the eccentric axle.

7. Plug in connector to disinfection valve board matching with the motor.

8. Check function of the disinfection valve (position tag **C** in light barrier **D**).



- B** Servomotor
- C** Position tag
- D** Light barrier
- E** Bevel on eccentric axle
- F** groove
- G** Bow (only partly visible, is seated in the eccentric groove)
- H** Control disc
- I** Rinsing bridge

## 4.9 Production Report

Dialog <sup>+</sup>		Hersteller / B.Braun Avitum AG 34209 Melsungen, Germany
SN	10xxxx	
VA	2500	
REF	710xxx	
V	230~	
Hz	50/60	
IP	21	CE 0123
		Not to be used in presence of flammable anaesthetic gases

Fig.: Type Plate on Rear Door

The delivery data of the Dialog are displayed in the menu, i.e. must be entered during the commissioning of the machine, e.g.:

- Type = REF (see type plate)
- Ser-No. = SN (see type plate)

Options can be activated in the following menus:

**Icons**

For example: bioLogic RR, card reader or K\*t/V-UV (Adimea)

**Low Level Options (see 4.9.2)**

For example: Double pump or BIC cartridge holder

DIALOG TSM MODE		Production Report	
Mar 25, 2010 - 11:44 -			
Type (Typ):	710201G	Ser-No. (Nr.):	00005
Machine Description:	D i a l o g +		
Production Date:	150909	Date of Commissioning:	180909
User/Location:	-		
Order Number:	-	Version number	Oper. Sys.
		DIALOG 9.02	-
		Low Level Options	
LLC STATUS: 00000000 40000000		LLS STATUS: 00000000	

Activate the *Production Report* menu with the *Production Report* key in *TSM Main Menu*.

Options assembled in the machine must be activated. Further options present in the Dialog must also be activated in this menu or in the *Low Level Options* menu (see 4.9.2).

The following options can be activated:

- ABPM
- bioLogic RR (icon available if installed)
- Low Level Options
- Card reader
- DCI (Data Communication Interface)
- K\*t/V
- K\*t/V-UV (Adimea)
- HCT (Crit-Line interface)

**ABPM Automatic Blood Pressure Measurement**

If the ABPM option is assembled in the machine or the option is retrofitted it must be selected and saved to activate the option.

**bioLogic RR Automatic Blood Pressure Stabilisation**

The bioLogic RR icon is displayed after the installation software was installed for the bioLogic RR option. The bioLogic RR must be selected and saved to activate the option.

**Card Reader**

If the card reader option is present in the machine, it must be selected and saved to activate the option.

**DCI Data Communication Interface**

The DCI option communicates with the Dialog machine via an RS 232 interface. The communication is performed via a DIANET protocol.

**K\*t/V**

The *Kt/V* option must be selected and saved to activate the option.

**Adimea (K\*t/V-UV)  
(Accurate dialysis measurement)**

If an Adimea option is present in the machine, it must be selected and saved to activate the option.

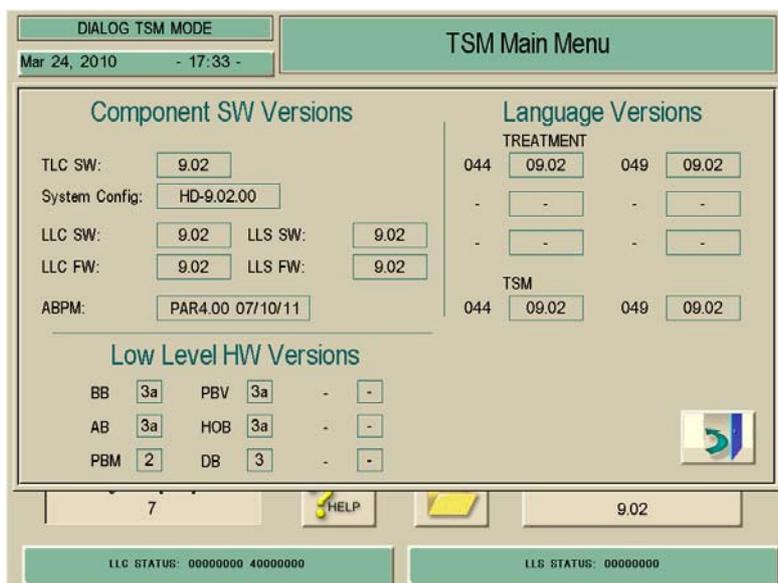
**HCT Crit-Line**

If a Dialog Serial Interface DSI is present in the machine, it must be selected and saved to activate the option.

**Note**

- The activation of the HCT Crit-Line option enables a window in therapy. This window allows the data exchange and display of measurement values to a connected HemaMetrics™ Crit-Line device.

## 4.9.1 Dialog Version Number



The *Dialog Version Number* menu is selected with the *Dialog Version Number* window in *Production Report*. The current software/firmware versions and hardware versions are displayed. This menu can also be selected in the *TSM Main Menu*.

The various software versions for top level, controller, supervisor, etc. are displayed and can be checked. These versions depend on the installed Dialog software version. The following software and hardware statuses can be checked:

#### Component SW Versions

The versions for the installed software/firmware are displayed.

- Top Level Controller Software TLC SW
- System Configuration (displays the system configuration version number for the haemodialysis machine)
- Low Level Controller Software LLC SW
- Low Level Controller Firmware LLC FW
- Low Level Supervisor Software LLS SW
- Low Level Supervisor Firmware LLS FW
- Automatic Blood Pressure Measurement ABPM (firmware for the ABPM module is displayed)

#### Language Versions

The installed languages are displayed.

#### Treatment

- 044 - English
- 049 - German
- or further therapy languages

#### TSM

- 044 – English
- 049 – German

#### Low Level Hardware Versions

The boards are displayed with the respective hardware versions, e.g. a HDF online machine. The displayed HW versions depend on the assembled boards in the machine.

- Basic Board **BB**
- Analog Board **AB**
- Power Board Motors **BPM**
- Power Board Valves **BPV**
- HDF Online Board **HOB**
- Digital Board **DB**

## 4.9.2 Low Level Options

Low Level  
Options

Press the *Low Level Options* key in the *Production Report* menu to open the *Low Level Options* menu.



Options assembled in the machine must be activated. Further options present in the Dialog must also be activated in this menu or in the *Production Report* menu (see 4.9).

The following options can be activated:

**Low Level Options**

- Double Pump
- Holder for BIC Cartridge
- DF Filter
- HDF Online
- Battery (Emergency Supply)
- Nexadia-BSL (DBI)
- WAN-BSL (DBI)

**Double Pump**

If *Double Pump* is selected and saved, cross-over and the PBS pressure sensor are automatically activated.

**Holder for BIC Cartridge**

If the option BIC cartridge holder is assembled or the option is retrofitted, it must be selected and saved to activate the option.

**DF Filter**

If the option *DF Filter* (dialysate fluid filter) is assembled or the option is retrofitted, it must be selected and saved to activate the option.

**HDF Online**

*HDF Online* must be selected and saved for HDF online machines.

**Battery**

If the emergency supply (battery) option is assembled or the option is retrofitted, it must be selected and saved to activate the option.

**Networking****Note**

Enter the serial number (see SN on type plate) in the menu *Production Report*, if the Dialog is networked. This serial number is required and used (query) as the identification number (ID) of the machine if networked (e.g. Nexadia network).

- Ser-No. = SN (see type plate)

Detailed information for networking (DBI) with Dialog machines are available in the technical information for Nexadia-BSL/WAN-BSL networks.

The Dialog can be integrated in a computer network with a Nexadia-BSL module. If the option is assembled or the option is retrofitted, it must be selected and saved to activate the option.

The Dialog can be integrated in a computer network with a WAN-BSL module. If the option is assembled or the option is retrofitted, it must be selected and saved to activate the option.

Dialog <sup>+</sup>		Hersteller / <b>B.Braun Avitum AG</b> 34209 Melsungen, Germany
SN	10xxxx	
VA	2500	
REF	710xxx	
V	230~	
Hz	50/60	
IP	21	CE 0123
Not to be used in presence of flammable anaesthetic gases		

**Nexadia-BSL (DBI)**

BSL = Bedside Link

DBI = Dialog Bedside Link Interface

**WAN-BSL (DBI)**

WAN = Wide Area Network

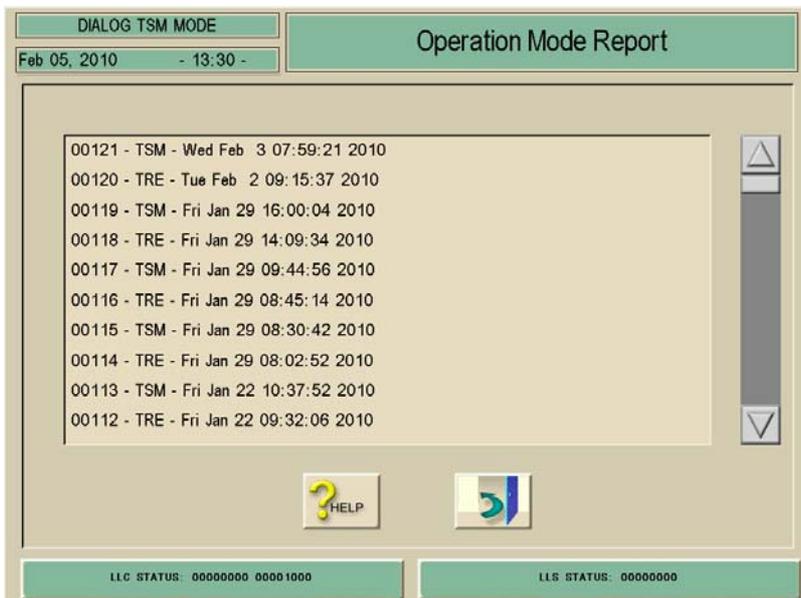
BSL = Bedside Link

DBI = Dialog Bedside Link Interface

## 4.10 Service Reports



The *Operation Mode Report* can be selected in the *Service Reports* menu.

**Operation Mode Report**

The switching from therapy mode to TSM mode and back to the therapy mode is documented with date and time.

Copyright		This document is the property of B. Braun Avitum AG with all rights reserved.
Service		Only trained personnel must service the Dialog+, i.e. repair, maintenance, software installation, firmware update, retrofitting and commissioning of the Dialog+. Servicing must only be performed with proper tools, calibration equipment and be in accordance with the most recent revision of this service manual/technical information, which must be clearly and thoroughly understood.
Prevent Electrical Shock Hazard		Switch off the Dialog+ and disconnect unit from mains if you have to open the machine for servicing. Do not touch any exposed wiring or conductive surfaces while the Dialog+ is opened. The voltages present when electrical power is connected to the Dialog+ can cause serious injury or death.
ESD Information		Pay attention to ESD information, because electronic components are sensitive to electrostatic discharges.
High Voltage in TFT Monitor	 	If a battery option is present in the machine: High voltage can be present at the backlight inverter board BIB in the TFT monitor, even if the machine has been disconnected from mains. Pull out the battery compartment in the base platform and switch off the battery voltage (remove fuse) before opening the machine.
Protective Conductor in TFT Housing		If the TFT housing had to be opened during a service job, the tight seat of the protective conductors in the TFT housing must be checked.
TSM Service Program		Only activate the TSM service program for service activities. It is prohibited to connect a patient to the Dialog+ and to run a therapy if the TSM service program is activated in the Dialog+. If the TSM service program is activated the complete alarm system is disabled. The TSM service program is started in the service mode: digital board, service switch S1, position 2.
Software		The software is installed in the software mode: digital board, service switch S1, position 3.
Therapy Mode		After completion of all procedures switch back to the therapy mode: digital board, service switch S1, position 0.
Calibration		Only perform a calibration after the Dialog+ has reached working temperature, and the machine was disinfected and decalcified. You should save the calibration data to the hard disk drive before you exit the TSM service program: <i>TSM Main Menu, File Operations, Save Calibration Data</i> .
Connection and Operation Service Board		The service board must only be operated in the TSM service program. If the service board is connected to the Dialog+ it is prohibited to connect a patient to the Dialog+ and to run a therapy.
Prevent Chemical Burns and Scalding		During servicing on running machines: prevent chemical burns and scalding of the skin due to the penetration of disinfectant or hot liquid.
Contaminated Machines		Protective gear should be worn in case of servicing of assumed contaminated machines.
Cover in Rear Door		Servicing of mechanical assembly groups (components in contact with fluid): the cover in the rear door must be assembled during servicing because it serves as a spray protection for the assembled SMPS-MC.
Tubing		Tubing must be replaced only by the same tubing type/length and identical installation manner. Make sure that the tubings in the machine are not kinked or twisted after servicing (e.g. if sub-racks are pulled out and inserted again). The tubing must not touch moving/rotating components (e.g. motors of gear pumps).
Wiring		Wiring must be replaced only by the same cable type/length and identical installation manner. The cables must not touch moving/rotating components (e.g. motors of gear pumps).
Fuses		If fuses are replaced they must exactly match the type and rating specified by the manufacturer in the spare parts list/technical information. Where applicable: fuses must be approved by UL/CSA.
Spare Parts		Only use original spare parts manufactured and sold by B. Braun Avitum AG.
Ambient Temperature		Before the Dialog+ is switched on the machine must have room temperature (see operating manual, chapter 15).

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## 5.1 Check List for Technical Safety Inspection and Preventive Maintenance

For Dialog+ SW 9.xx

The technical safety inspection shall be performed and documented every 12 months, according to the specified check list and with reference to the service manual and instructions for use.  
The preventive maintenance is recommended every 12 months, according to the specified check list and with reference to the service manual and instructions for use and shall be documented.

REF {Type/Typ}: ..... SN {Serien-No./Nr.}: .....

Year of Purchase: ..... Responsible Organisation (User): .....

.....

Operating Hours: ..... h Inventory No.: .....

SW Version: .....

Manufacturer:

B. Braun Avitum AG  
34209 Melsungen, Germany

S	M	Check List (S = Technical Safety Inspection Points; M = Preventive Maintenance Points)	NO	YES	OK
<b>Technical Safety Inspection</b> Note: Text in { } brackets is information for the execution of the check list!					<input type="checkbox"/>
<b>Technical Safety Inspection with Preventive Maintenance</b>					<input type="checkbox"/>
	M	1. Disinfection/decalcification was performed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		2. Visual Inspection with Maintenance Procedures			
S		2.1 Visual Inspection {Machine: clean/complete; no damages/moisture influences (protection covers) or loose assemblies; no moveable parts touching tubings or wires; casters are moveable; type plate legible}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	M	2.2 Clean interior space and exterior surfaces	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	M	2.3 Suction tubing for disinfection and concentrate exchanged ❶	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	M	2.4 O-rings at suction rod exchanged ❶	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	M	2.5 Balance chamber – no visible leakages	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
S		2.6 Check tight seat and damages of mains supply (power supply cord, strain relief), potential equalisation cable, staff call/data lines (if present) and connectors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	M	2.7 Tubing connectors, clamps and couplings (internal/external) are assembled correctly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	M	2.8 Membranes, o-rings and tubings at the dialyser couplings exchanged ❶	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	M	2.9 HDF Online <span style="float: right;">Option present</span>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		2.9.1 O-rings {12.37 x 2.62} and membranes {for HDF filter with couplings} exchanged ❷	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		2.9.2 Hydrophobic filter HFB exchanged ❷	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		2.9.3 Filter FSU {between PSABF and VSAA} exchanged ❷	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	M	2.10 DF Filter <span style="float: right;">Option present</span>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		2.10.1 Membranes exchanged ❶	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	M	2.11 Tight seat of boards and connectors (incl. mains connection in switch mode power supply)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		2.12 Exchange dust filter of fan (rear door) ❶	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	M	2.13 Filter (FVD, FB, FK, FBK1/2, FBIC, FEP) exchanged ❶	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	M	2.14 Filter level regulation module (HFA, HFV, HFE (HFS if present)) exchanged ❶	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	M	2.15 BIC Cartridge Holder <span style="float: right;">Option present</span>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		2.15.1 O-rings exchanged ❶	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	M	2.16 Battery on PC motherboard exchanged (after operating period of 4 years) {Battery is not included in the maintenance kit, if necessary order separately.}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	M	2.17 Monitor: no restriction of motion of rotation; touch membrane/keyboard membrane not damaged	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	M	2.18 Check non-return valve RVDA (400 mbar ±50 mbar or 300 mmHg ±37 mmHg) and set if necessary (for HDF Online: 500 mbar ±50 mbar or 375 mmHg ±37 mmHg)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	M	2.19 Check non-return valve DDE (400 mbar ±50 mbar or 300 mmHg ±37 mmHg) and set if necessary	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	M	2.20 Check non-return valve RVFPE (1,300 mbar ±50 mbar or 975 mmHg ±37 mmHg) and set if necessary	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	M	2.21 Check non-return valve RVFPA (1,300 mbar ±50 mbar or 975 mmHg ±37 mmHg) and set if necessary	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

S		M		Check List (S = Technical Safety Inspection Points; M = Preventive Maintenance Points)			NO	YES	OK
Note: Text in { } brackets is information for the execution of the check list!									
M	2.22	Conductivity Sensors							
	2.22.1	ENDLF sensor: Visual inspection			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	2.22.2	BICLF sensor: Visual inspection			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
M	2.23	Piston Pumps							
	2.23.1	BIC piston pump: Visual inspection			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	2.23.2	KP piston pump: Visual inspection			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
M	2.23.3	UF piston pump: Visual inspection			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
M	2.24	Blood leak detector (BLD) test passed			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	2.24.1	Check blood leak detector and calibrate if necessary ①			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
M	2.25	Degassing Pressure Sensor PE (permissible tolerance $\pm 13$ [mbar])							
		- Comparison measurement (at approx. -530): Measurement instrument: ..... Display on machine: ..... [mbar]			<input type="checkbox"/>				
		- Comparison measurement (at approx. -130): Measurement instrument: ..... Display on machine: ..... [mbar]			<input type="checkbox"/>				
M	2.26	Dialysate Outlet Pressure Sensor PDA (permissible tolerance $\pm 13$ [mbar])							
		- Comparison measurement (at approx. -530): Measurement instrument: ..... Display on machine: ..... [mbar]			<input type="checkbox"/>				
		- Comparison measurement (at approx. 0): Measurement instrument: ..... Display on machine: ..... [mbar]			<input type="checkbox"/>				
		- Comparison measurement (at approx. +530): Measurement instrument: ..... Display on machine: ..... [mbar]			<input type="checkbox"/>				
M	2.27	Heparin Pump							
	2.27.1	Position (80 mm $\pm$ 15 mm) {Drive fast forward to end position with 30 ml syringe. Check display position in mm.} ..... [mm]			<input type="checkbox"/>				
M	2.28	Set summer/winter time {TSM, Treatment Support, System Configuration, if applicable in this country}			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		<b>3. Function Inspection (Document Measurement Values)</b>							
S	3.1	<b>Blood Pump:</b> - Check function, moveability, noise rating						<input type="checkbox"/>	
	3.1.1	- Check roller/one-way bearing: clean and lubricate shaft slightly if necessary						<input type="checkbox"/>	
	3.1.2	- Alarm cover switch						<input type="checkbox"/>	
S	3.2	<b>Single-Needle Pump:</b> Option present			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	3.2.1	- Check function, moveability, noise rating						<input type="checkbox"/>	
	3.2.2	- Check roller/one-way bearing: clean and lubricate shaft slightly if necessary						<input type="checkbox"/>	
	3.2.3	- Alarm cover switch						<input type="checkbox"/>	
S	3.3	<b>Venous Tubing Clamp SAKV:</b> - Function/gap checked, set gap 1.4 (+0.1 mm) if necessary						<input type="checkbox"/>	
S	3.4	<b>Arterial Tubing Clamp SAKA:</b> Option present			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	3.4.1	- Function/gap checked, set gap 1.4 (+0.1 mm) if necessary						<input type="checkbox"/>	
S	3.5	<b>Arterial Pressure PA:</b> (permissible. tolerance $\pm 10$ [mmHg])							
		Comparison measurement (at approx. -400): Measurement instrument: ..... Display on machine: ..... [mmHg]			<input type="checkbox"/>				
		Comparison measurement (at approx. 0): Measurement instrument: ..... Display on machine: ..... [mmHg]			<input type="checkbox"/>				
S	3.6	<b>Inlet Pressure PBE:</b> (permissible. tolerance $\pm 10$ [mmHg])							
		Comparison measurement (at approx. 0): Measurement instrument: ..... Display on machine: ..... [mmHg]			<input type="checkbox"/>				
		Comparison measurement (at approx. +400): Measurement instrument: ..... Display on machine: ..... [mmHg]			<input type="checkbox"/>				
S	3.7	<b>Venous Pressure PV:</b> (permissible. tolerance $\pm 10$ [mmHg])							
		- Comparison measurement (at approx. 0): Measurement instrument: ..... Display on machine: ..... [mmHg]			<input type="checkbox"/>				
		Comparison measurement (at approx. +400): Measurement instrument: ..... Display on machine: ..... [mmHg]			<input type="checkbox"/>				
S	3.8	<b>Single-Needle Pressure PBS:</b> (permissible. tolerance $\pm 10$ [mmHg]) Option present			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		- Comparison measurement (at approx. 0): Measurement instrument: ..... Display on machine: ..... [mmHg]			<input type="checkbox"/>				
		- Comparison measurement (at approx. +400): Measurement instrument: ..... Display on machine: ..... [mmHg]			<input type="checkbox"/>				

S		M		Check List (S = Technical Safety Inspection Points; M = Preventive Maintenance Points)		NO	YES	OK
Note: Text in { } brackets is information for the execution of the check list!								
S	3.9	<b>Staff Call:</b>	Option present	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	3.9.1	- Function or contact continuity passed		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
S	3.10	<b>Automatic Blood Pressure Measurement ABPM:</b>	Option present	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	3.10.1	- ABPM inspection protocol performed {see separate ABPM inspection protocol, paragraph 5.2}		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
<b>4. Electrical Safety Check According to EN 62353/EN 60601-1</b>								
S	4.1	<b>Protective Earth Resistance:</b> < 0.3 [ $\Omega$ ] {note highest value}: ..... [ $\Omega$ ] {(Machine incl. power supply cord. Move the power supply cord during the check. Thus possible loose connections can be detected. Data lines and potential equalisation cable must not be connected during the check of the protective earth resistance (see figure 1)} {Measurement points:} {Exterior: Potential equalisation bolt, rinsing bridge (dialyser inlet and outlet)} {Interior: Heater body (top), rear door (top left corner), frame (rear), housing cover (top left), front door (top left)} {Monitor: Monitor (one of the screws in the front panel/housing)}		<input type="checkbox"/>				
S	4.2	<b>Equipment Leakage Current:</b> {All water connections and data lines must be connected during the check (see figure 2) of the equipment leakage current.}  $\leq 0.5$ [mA]: - During heat-up phase {change mains polarity and note highest value}: ..... [mA]		<input type="checkbox"/>				
S	4.3	<b>Patient Leakage Current:</b> {All water connections and data lines must be connected during the check (see figure 3) of the patient leakage current.}  $\leq 10$ [ $\mu$ A] DC: - Under normal conditions {at dialyser coupling}, conductivity at 13 - 15 mS/cm: ..... [ $\mu$ A] $\leq 10$ [ $\mu$ A] AC: - Under normal conditions {at dialyser coupling}, conductivity at 13 - 15 mS/cm: ..... [ $\mu$ A]		<input type="checkbox"/>				
<b>5. Setting into Service According to Instructions for Use</b>								
S	5.1	<b>Applied Accessories/Disposables:</b>	Applied line system: Name: .....					
S	5.2	<b>Switch on machine:</b>	- Self-test passed					<input type="checkbox"/>
S	5.3	<b>Power Fail Function:</b> {Activate buzzer in power supply, i.e. switch on machine for approx. 5 minutes and then disconnect mains plug.} - Check function, duration of a constant audible alarm > 1 minute						<input type="checkbox"/>
S	5.4	<b>Temperature:</b>	- Comparison measurement {at dialyser coupling}, at 37 °C (-1.5; +0.5): ..... [°C]					<input type="checkbox"/>
S	5.5	<b>Conductivity:</b>	- Comparison measurement {at dialyser coupling, e.g. 14.3 mS/cm ( $\pm 0.2$ ): ..... [mS/cm]					<input type="checkbox"/>
S	5.6	<b>Safety Air Detector (SAD):</b>	- Test alarm function (visual/audible) passed					<input type="checkbox"/>
S	5.7	<b>Monitor</b>						
	5.7.1	Function of the keys, display illumination, OSDs (for Dialog+) and touch screen OK						<input type="checkbox"/>
	5.7.2	Image display OK						<input type="checkbox"/>
S	5.8	<b>Ultrafiltration:</b> {see chapter 3 Measures after Repair, paragraph 3.8.2.5 Test Run UF Comparison Measurement} - Comparison measurement at 15 min with UF rate 500 ml/h (125 ml UF volume $\pm 15$ ml) :  Display on machine: ..... Meas. instrument: ..... [ml]						<input type="checkbox"/>
S	5.9	<b>Battery Option:</b>	Option present	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	5.9.1	- Activate audible alarm {The machine must be in therapy mode. Disconnect mains plug: The buzzer from the SMPS-MC gives three signalling tones as an indication that the machine is running in battery mode.}		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
M	5.10	<b>Disinfection:</b>	- Perform by responsible organisation {user} {inform responsible organisation}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
			- Performed by service technician	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		

S   M	<b>Check List (S = Technical Safety Inspection Points; M = Preventive Maintenance Points)</b> Note: Text in { } brackets is information for the execution of the check list!	NO	YES	OK
-------	---	----	-----	----

<b>Applied Measurement Equipment:</b>	Electrical Safety: .....	* ID/Serial No.: .....
	Conductivity: .....	* ID/Serial No.: .....
	Temperature: .....	* ID/Serial No.: .....
	Pressure: .....	* ID/Serial No.: .....
	Flow: .....	* ID/Serial No.: .....
	Balance: .....	* ID/Serial No.: .....
	Pressure Manometer: .....	* ID/Serial No.: .....
	Template 1.4/1.5: .....	* ID/Serial No.: .....
	Other Measurement Device: .....	* ID/Serial No.: .....
	.....	* ID/Serial No.: .....
	* If applicable, please enter the type and identification number of the equipment used	

<b>CHECK RESULTS:</b>			
Customer specific parts or information on the machine (e.g. stickers/labels) were removed during the technical safety inspection/preventive maintenance or repair:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
New labelling must be performed by responsible organisation (user):	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Results of Test and Evaluation:</b>	<b>2</b> <input type="checkbox"/>	<b>1</b> <input type="checkbox"/>	<b>0</b> <input type="checkbox"/>
0 = no deficiencies; 1 = minor deficiencies; 2 = deficiencies requiring repair			

**Comments:**

.....

.....

.....

The technical safety inspection/technical safety inspection with preventive maintenance was passed:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
---	--------------------------	--------------------------	--------------------------

**Next Inspection Date:** .....

<b>The technical safety inspection/technical safety inspection with preventive maintenance was performed correctly.</b>	Name Service Technician/Company: .....
	.....
	Date / Signature .....

**{ 1 Maintenance Kit }**

{A maintenance kit can be ordered for the technical safety inspection with preventive maintenance of a Dialog machine. All parts are included which are recommended for exchange during a preventive maintenance.}

{ Art. No. }	{ Description }
{3451893D}	Maintenance Kit }

**{ 2 Maintenance Kit/Supplement HDF Online }**

{A second maintenance kit can be ordered for the technical safety inspection with preventive maintenance. As a supplement this kit includes all parts recommended for exchange during a preventive maintenance of a HDF online machine.}

{ Art. No. }	{ Description }
{34560686}	Maintenance Kit/Supplement HDF Online }

5.1.1 Measurement Circuits for Measurement of Electrical Safety According to IEC 62353/60601-1

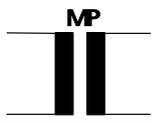
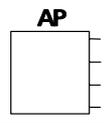
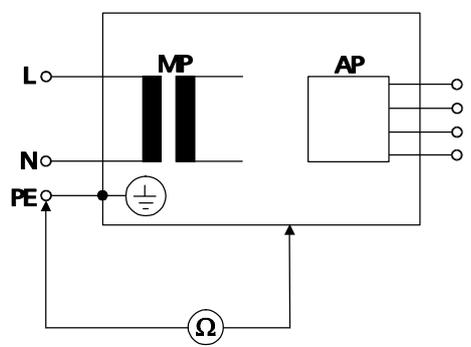
	Protective earth (ground)		
L, N	Supply mains terminals	PE	Protective earth terminal
	Mains part		Applied part
	Measuring device		Residual current meter with frequency response as MD
	Resistance measurement equipment		
	Part of enclosure not protectively earthed		Connection to accessible conductive parts

Table 1: Legend of Abbreviations and Symbols

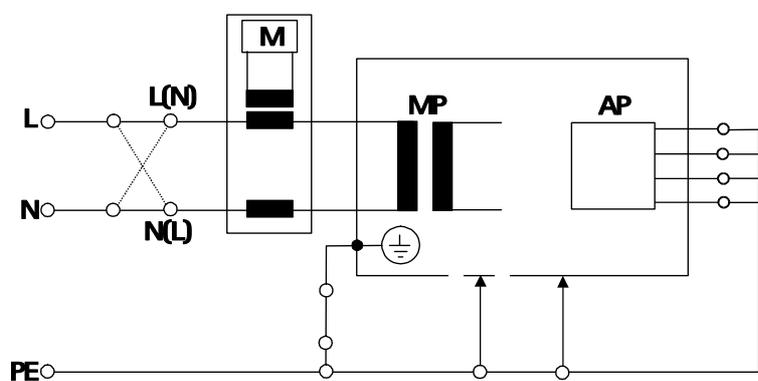


### Protective Earth Resistance

Test current:  $\geq 200$  mA

The test current must be measured in both directions.

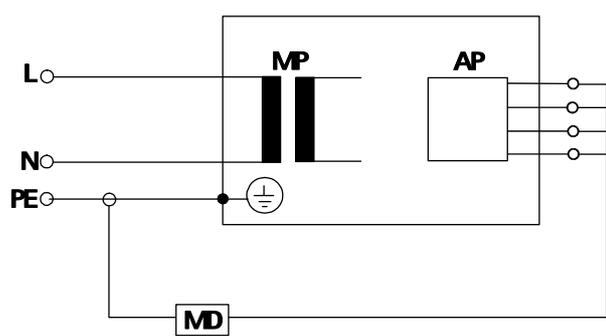
Fig. 1: Protective Earth Resistance



### Equipment Leakage Current:

- Differential Measurement

Fig. 2: Equipment Leakage Current



### Patient Leakage Current

Fig. 3: Patient Leakage Current

**5.2 Inspection Protocol for Automatic Blood Pressure Measurement ABPM**

**Measurement Inspection** The measurement inspection is recommended every **12 months** and should be documented. The measuring methods are described in the execution procedures.

**Dialysis Machine Dialog** REF {Type/Typ}: ..... SN {Serien-No./Nr.} .....  
**Automatic Blood Pressure Measurement ABPM** ABPM Module M2009/2010

**Manufacturer** B. Braun Avitum AG, 34209 Melsungen, Germany

**Responsible Organisation (User)** Address: .....  
 .....  
 .....

**1. Visual Inspection** - Tight seat of all connectors : ----- **OK**   
 - No damages which could affect the function or the safety (incl. tubing and cuff): ----- **OK**

**2. Limits of Error of the Pressure Indication** Admit a static pressure to the machine.

Pressure [mmHg]	Measurement Values		Deviation [mmHg]
	Dialog	Reference	
290			
200			
100			
50			
0			

The permissible tolerance for each measurement is:  
 ABPM Module: ----- ± 3 mmHg: **OK**

**3. Air Leakage**

Initial Pressure [mmHg]	Final Pressure [mmHg]	Air Leakage [mmHg]

Pressure drop ABPM Module: ----- ≤ 18 mmHg in 3 min: **OK**

**4. Rapid Exhaust** - Time for pressure reduction from >260 mmHg to <15 mmHg max. 10 s: ..... s **OK**   
 - Trigger of rapid exhaust between 300 mmHg and 330 mmHg: ----- **OK**

**5. Function Inspection** The results of a measurement on a test person are plausible ----- **OK**

**6. Result of Inspection** The blood pressure measurement module has passed the measurement inspection: ----- **No**  **Yes**

Comments: .....  
 .....

**The measurement inspection was performed correctly.** Name Service Technician: .....

.....  
 Date / Signature

## 5.2.1 Execution Procedure for Measurement Inspection ABPM



- Reference pressure instrument (accuracy  $\leq 0.8$  mmHg)
- Measurement chamber with 500 ml volume (rigid metal vessel, e.g. art. no. 7703090)
- Syringe 50 ml (for pressure build-up)
- Stopcock system incl. tubing (e.g. art. no. 770203A)
- Pressure tubing

DIALOG TSM MODE  
Feb 05, 2010 - 12:58 -

ABPM Maintenance

FW version: PAR4.00 07/10/11  
SW version: \$Revision: SYS - ABPM - ABPM - V0.00 Exp \$

1: Inflation Time [s]:	[0-250 mmHg] 0.0	[0-300 mmHg] 0.0	
2: Air Leakage [mmHg]:	Initial pr. 0	Final pr. 0	Leakage 0

p Test Test 1 Test 2

LLC STATUS: 00000000 00000000 LLC STATUS: 00000000

Activate the *ABPM Maintenance* menu with the *ABPM Maintenance* key in *TSM Service Program*, *TL Manual Test and Calibration*.

The *ABPM Maintenance* menu is used for the function test of the Dialog automatic blood pressure measurement ABPM option.

### To Point 2: Limits of Error of the Pressure Indication

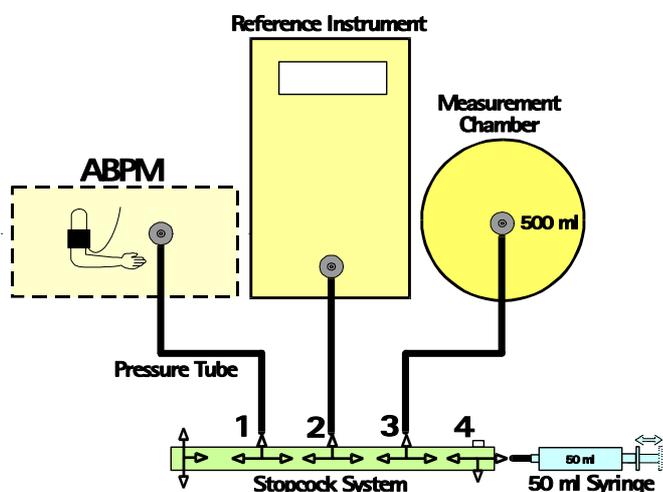


Fig.: Inspection Set-up for Compliance of Error Limits of the Measurement Display

Measurement according to EN 1060-1:1995 and EN 1060-3:1997.

1. Connect all components according to figure (set stopcock system according to figure).
2. Switch on Dialog in TSM service program.
3. Select in TSM *Manual Test and Calibration*, *TTL Manual Test and Calibration* and then *ABPM Maintenance*.

4. Press  button.

Wait until a pressure build-up of approx. 170 mmHg (start of pressure retention phase).

5. Increase the test pressure to 290 mmHg ( $\pm 10$  mmHg) with the syringe. Read the value displayed on the Dialog and close stopcock 4 immediately. Now read the value on the reference instrument and enter in table.
6. Decrease pressure according to test points and enter values in table.
7. Enter deviations in table.

## To Point 3: Air Leakage

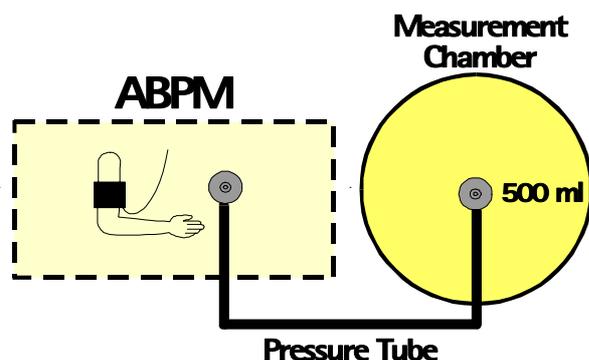


Fig.: Inspection Set-up for Inspection of Air Leakage

1. Set-up and connect ABPM according to figure.

Test 2

2. Press **Test 2** button.  
A test pressure of approx. 200 mmHg is automatically built up (test duration 4 minutes).
3. Enter values in table after test is expired.  
The values are displayed after the time has elapsed:  
The *Initial Pressure*, *Final Pressure* and *Leakage* are displayed in the *ABPM Maintenance* menu point 4.

Pressure drop ABPM module:----- ≤ 18 mmHg

## To Point 4: Rapid Exhaust

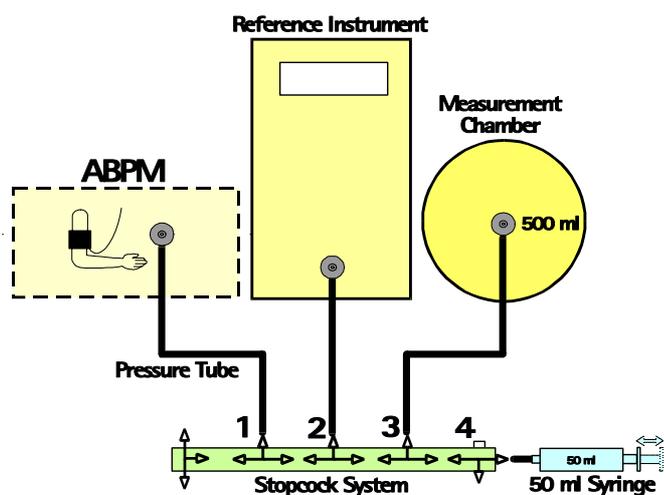


Fig.: Inspection Set-up for Rapid Exhaust

Test 2

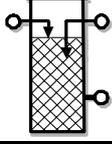
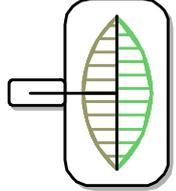
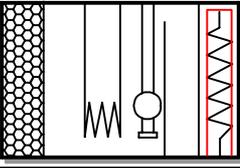
1. Press **Test 2** button.  
Wait until a pressure build-up of approx. 290 mmHg (start of pressure retention phase).
2. Increase slowly pressure to > 300 mmHg with the syringe until valve opens for rapid exhaust.
3. The valve for rapid exhaust must open between 300 and 330 mmHg. The indicated time for the pressure drop must not be exceeded.

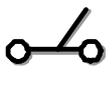
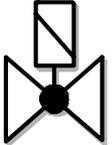
Pressure reduction from >260 mmHg to <15 mmHg: ---- max. 10 s

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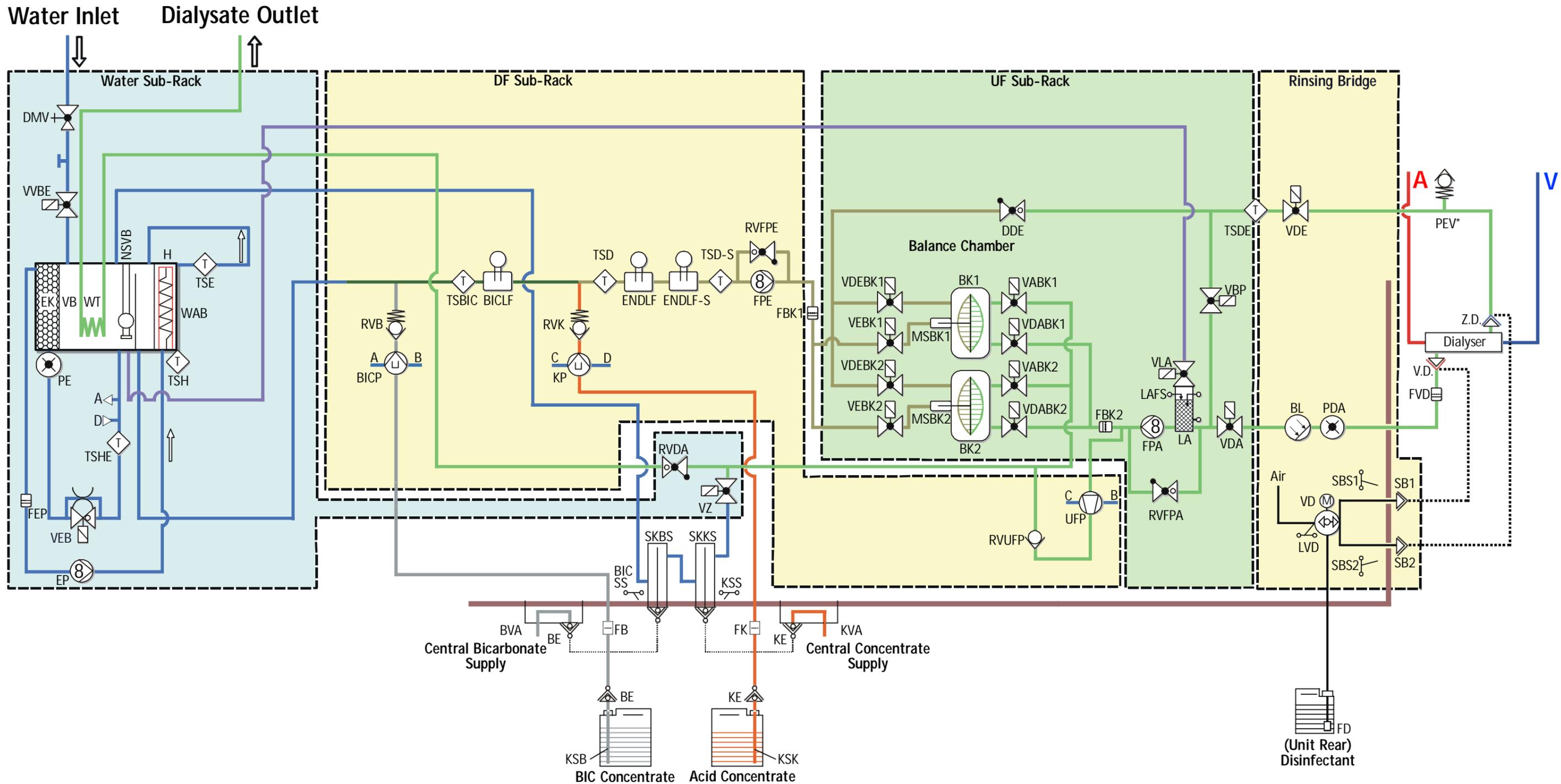
## 6.1 Flow Diagrams

## 6.1.1 Legend Flow Diagrams

Symbol	Abbreviation	Description
	BICLF ENDLF ENDLF-S	Bicarbonate conductivity sensor End conductivity sensor End conductivity sensor supervisor
	BICP KP UFP BPA BPV	Bicarbonate pump Concentrate pump Ultrafiltration pump Arterial blood pump Venous blood pump
	LA LAFS	Air separator Air separator level sensors
	BL	Blood leak detector
	DDE RVDA RVFPA RVFPE	Dialyser Inlet throttle Dialysate nonreturn valve Flow pump outlet nonreturn valve Flow pump inlet nonreturn valve
	RVB RVK DBK	Bicarbonate nonreturn valve Concentrate nonreturn valve Throttle BIC cartridge
	BVA KVA	Bicarbonate supply connection Concentrate supply connection
	EP FPA FPE	Degassing pump Outlet flow pump Inlet flow pump
	BK1 BK2 MSBK1 MSBK2	Balance chamber 1 Balance chamber 2 Membrane position sensor balance chamber 1 Membrane position sensor balance chamber 2
	FBK1 FBK2 FVD FB FK	Filter balance chamber (inlet) Filter balance chamber (outlet) Filter from dialysate Filter bicarbonate Filter concentrate
	KtV-UV	KtV-UV sensor (option Adimea)
	WAB	Water block with degassing chamber, upline tank, heat exchanger, level sensor, double-stage heater

	DMV	Pressure reducer valve
	VD ZD	Dialyser coupling (from dialysate) Dialyser coupling (to dialysate)
	BICSS KSS LVD SBS1 SBS2	Bicarbonate rinsing connection sensor Concentrate rinsing connection sensor Light barrier valve disinfection Rinsing connection sensor 1 Rinsing connection sensor 2
	VABK1 VABK2 VBP VD VDA VDABK1 VDABK2 VDE VDEBK1 VDEBK2 VEBK1 VEBK2 VLA VVBE VZ	Outlet balance chamber valve 1 Outlet balance chamber valve 2 Bypass valve Disinfection valve Dialyser outlet valve Dialyser outlet balance chamber valve 1 Dialyser outlet balance chamber valve 2 Dialyser inlet valve Dialyser inlet balance chamber valve 1 Dialyser inlet balance chamber valve 2 Inlet balance chamber valve 1 Inlet balance chamber valve 2 Air separator valve Upline tank inlet valve Circulation valve
	VEB	Degassing bypass valve
	SPA	Rinsing adapter
	RVB RVBO RVBU PEV	BIC nonreturn valve Top BIC nonreturn valve Bottom BIC nonreturn valve Sample valve
	PA PBE PBS PDA PE PV	Arterial pressure sensor Blood inlet pressure sensor Blood control pressure sensor Dialysate outlet pressure sensor Degassing pressure sensor Venous pressure sensor
	TSBIC TSD TSD-S TSE TSH TSHE TSDE	Bicarbonate temperature sensor Dialysate temperature sensor Dialysate temperature sensor supervisor Degassing temperature sensor Heater temperature sensor Heater inlet temperature sensor Dialyser inlet temperature sensor
	UFP	Ultrafiltration pump
	RVUFP	Ultrafiltration pump nonreturn valve

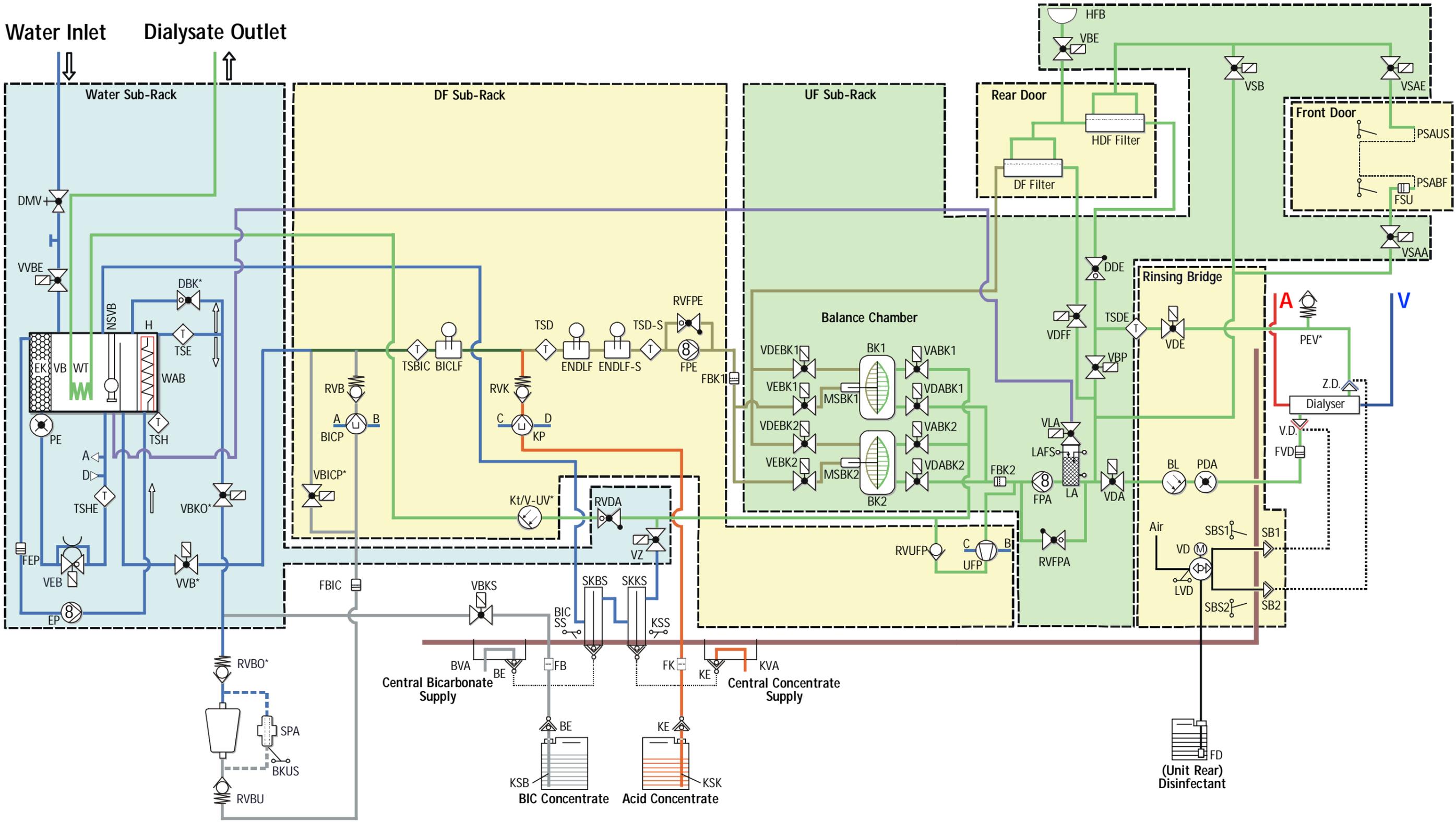
6.1.2 Flow Diagram Dialog+



Water		Dialysate Flow 2		Blood Venous	
Bicarbonate		Dialysate		Disinfectant	
Concentrate		Air		Housing	
Dialysate Flow 1		Blood Arterial			



6.1.4 Flow Diagram Dialog+ HDF-Online



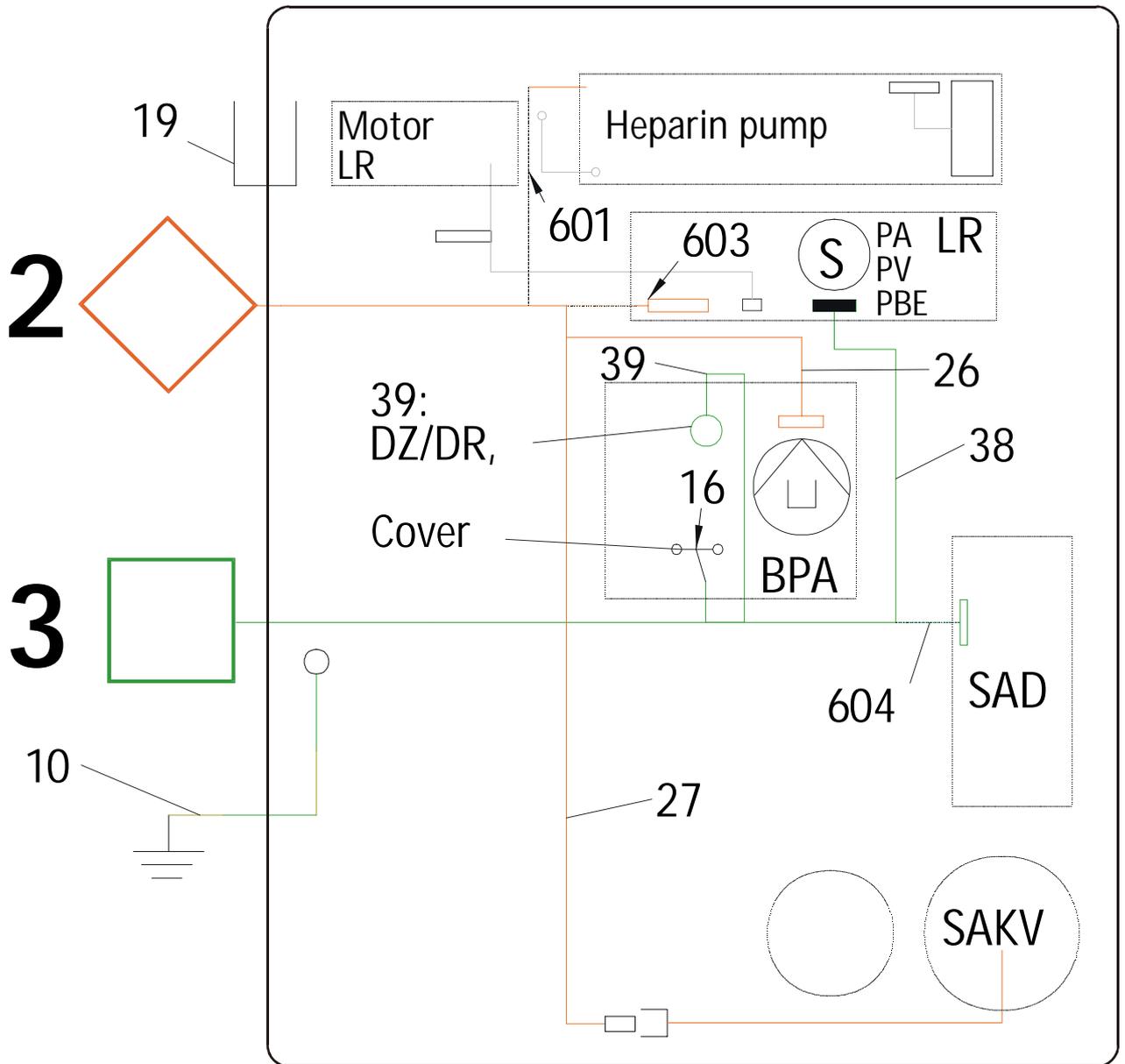
Water		Dialysate Flow 2		Blood Venous	
Bicarbonate		Dialysate		Disinfectant	
Concentrate		Air		Housing	
Dialysate Flow 1		Blood Arterial		Options	

## 6.2 Wiring Diagrams Dialog+

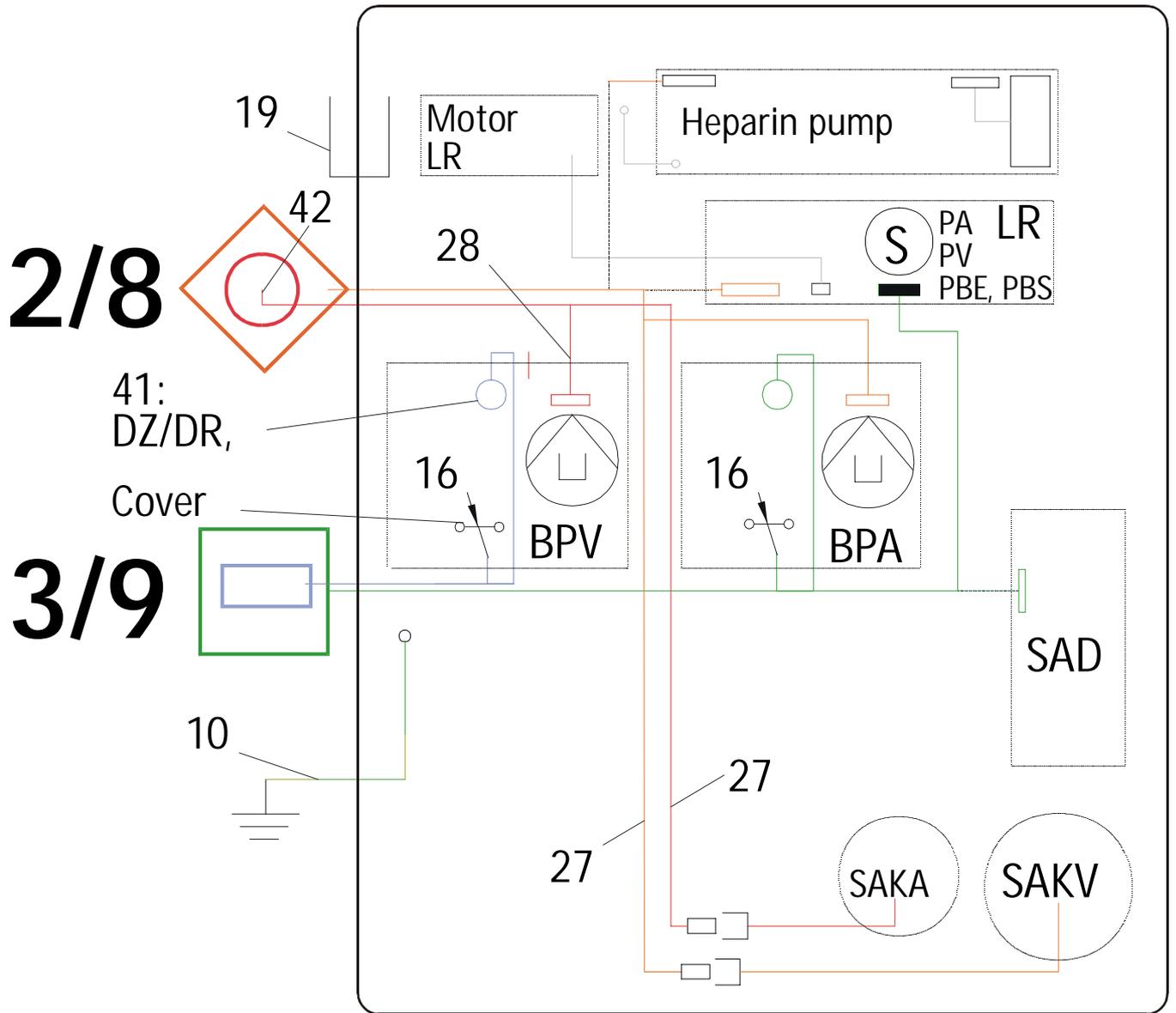
## 6.2.1 Legend Wiring Diagram

Symbol	Description
2 	Cable connection from basic board to front door: - Single pump - Double pump - HDF online
3 	Cable connection from basic board to front door: - Single pump - Double pump - HDF online
8 	Cable connection from basic board to front door: - Double pump - HDF online
9 	Cable connection from basic board to front door: - Double pump - HDF online

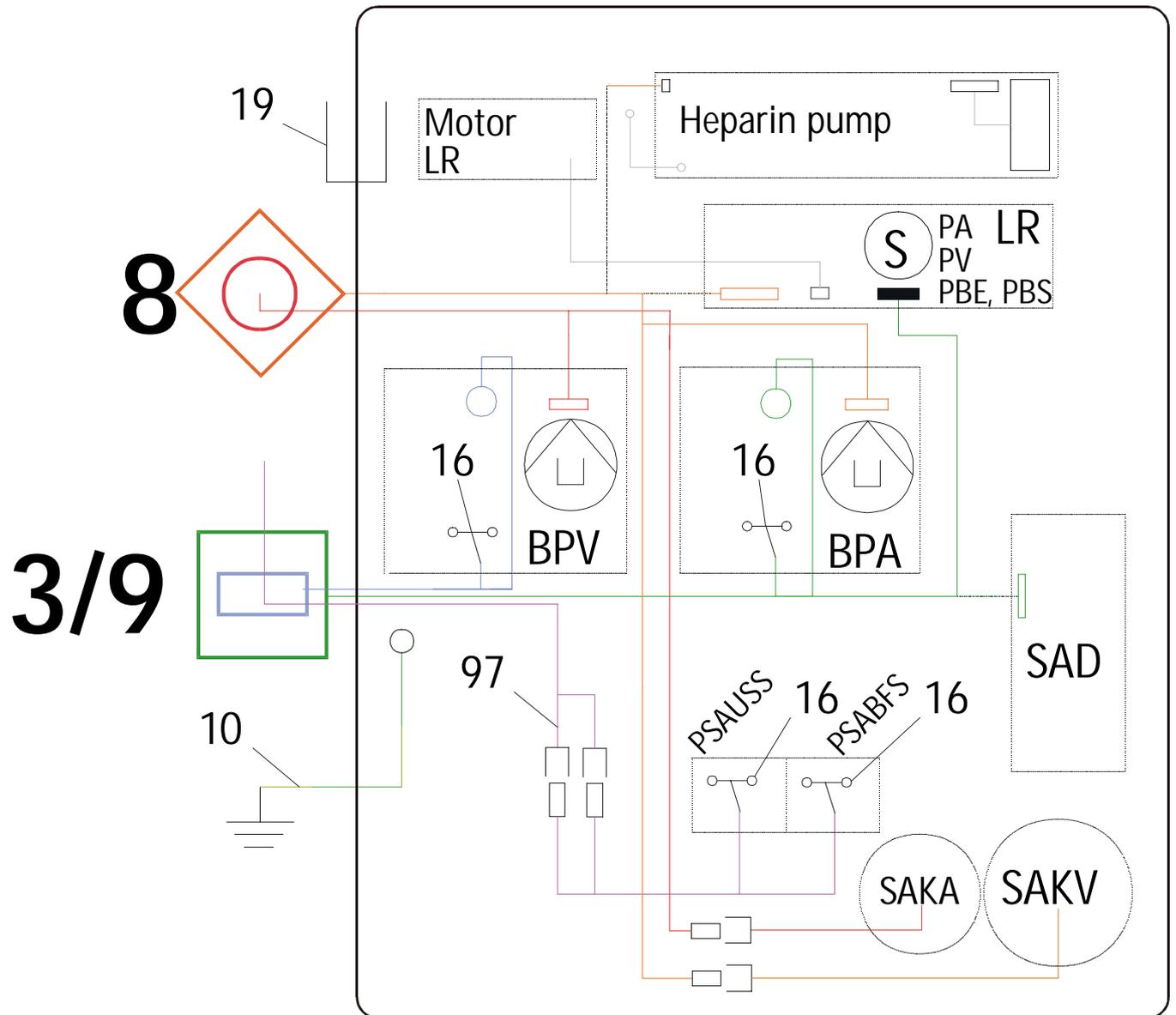
6.2.2 Wiring Diagram Front Door Single Pump



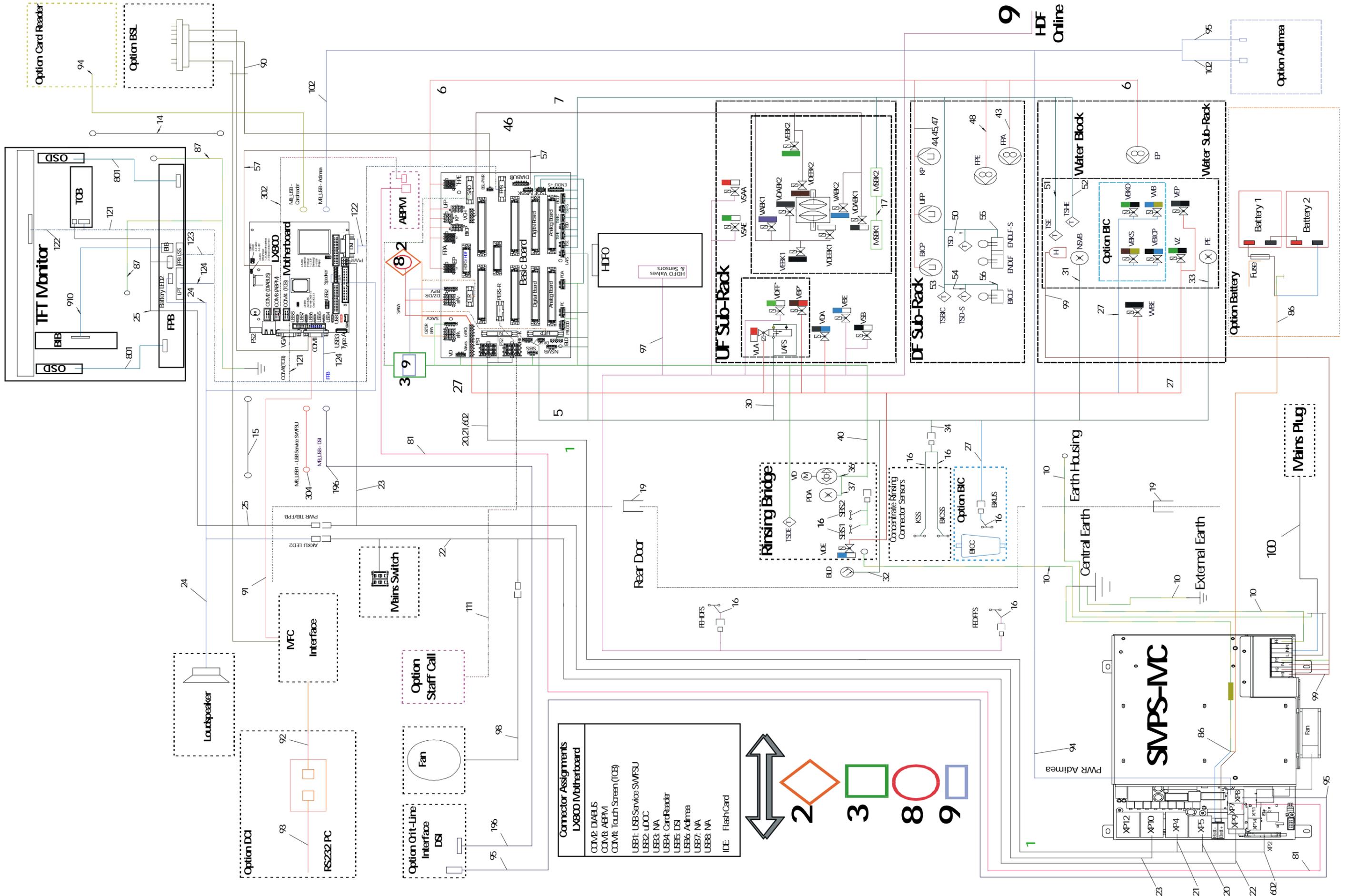
6.2.3 Wiring Diagram Front Door Double Pump



6.2.4 Wiring Diagram Front Door HDF Online

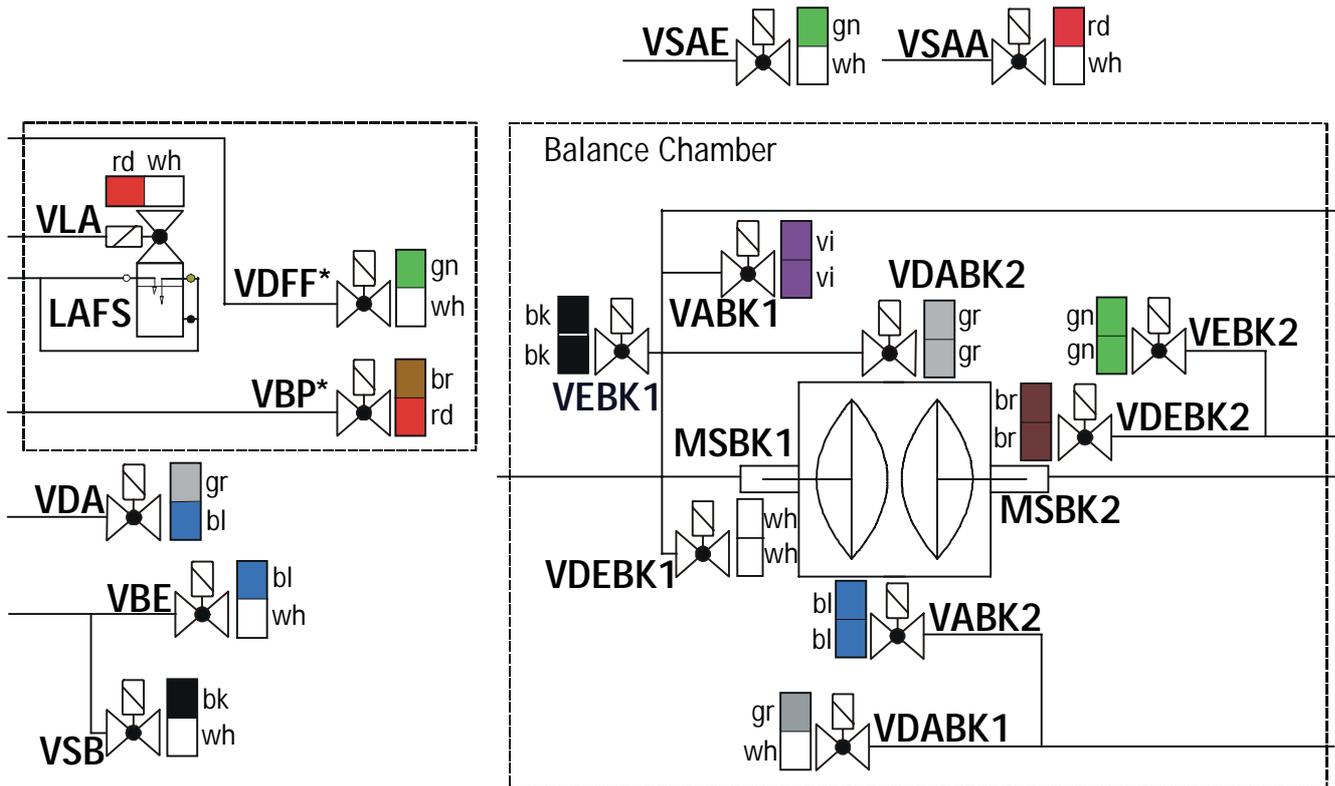


6.2.5 Wiring Diagram Housing

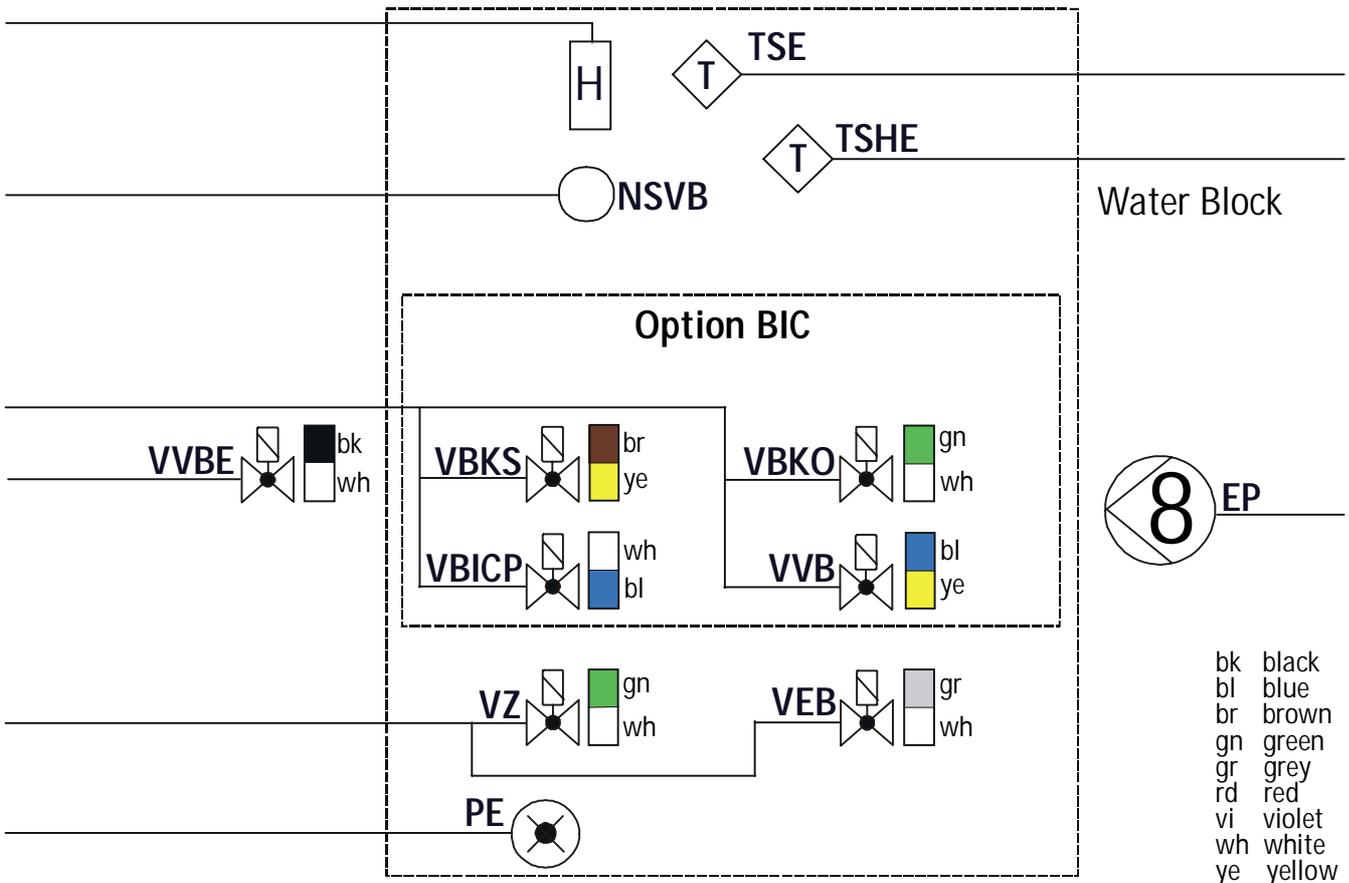


6.2.3 Colour Coding Solenoid Valves

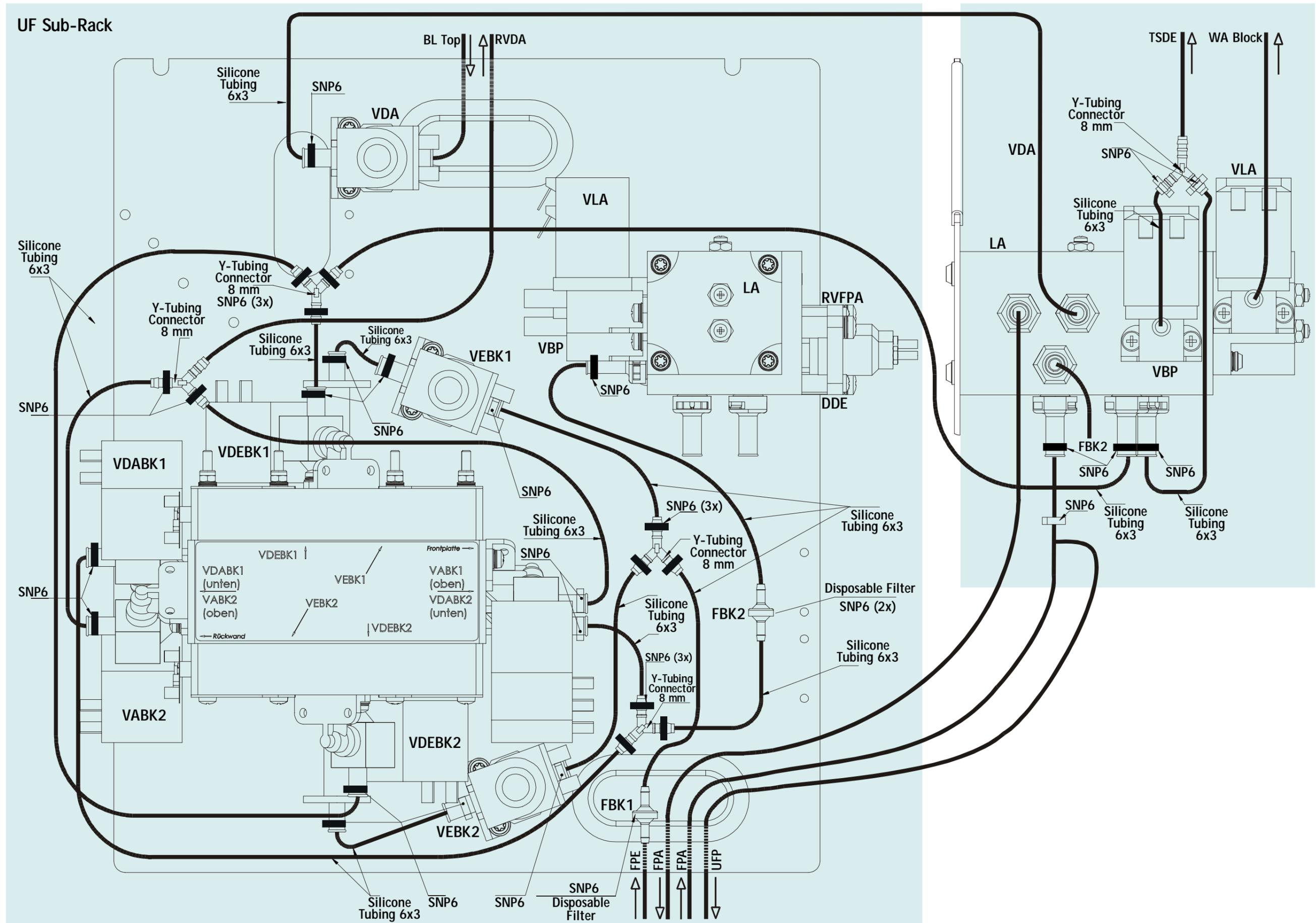
6.2.3.1 Solenoid Valves UF Sub-Rack

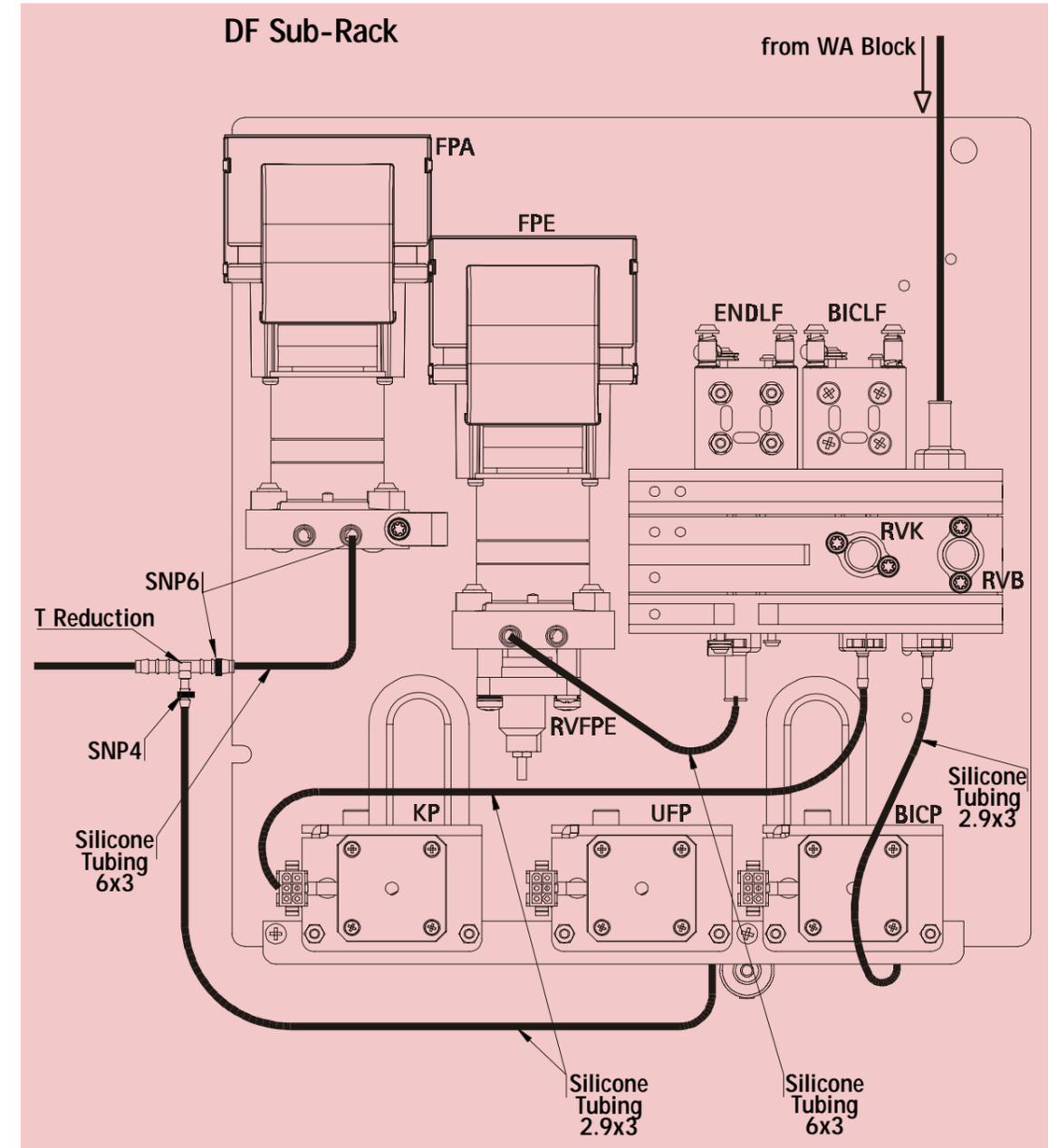
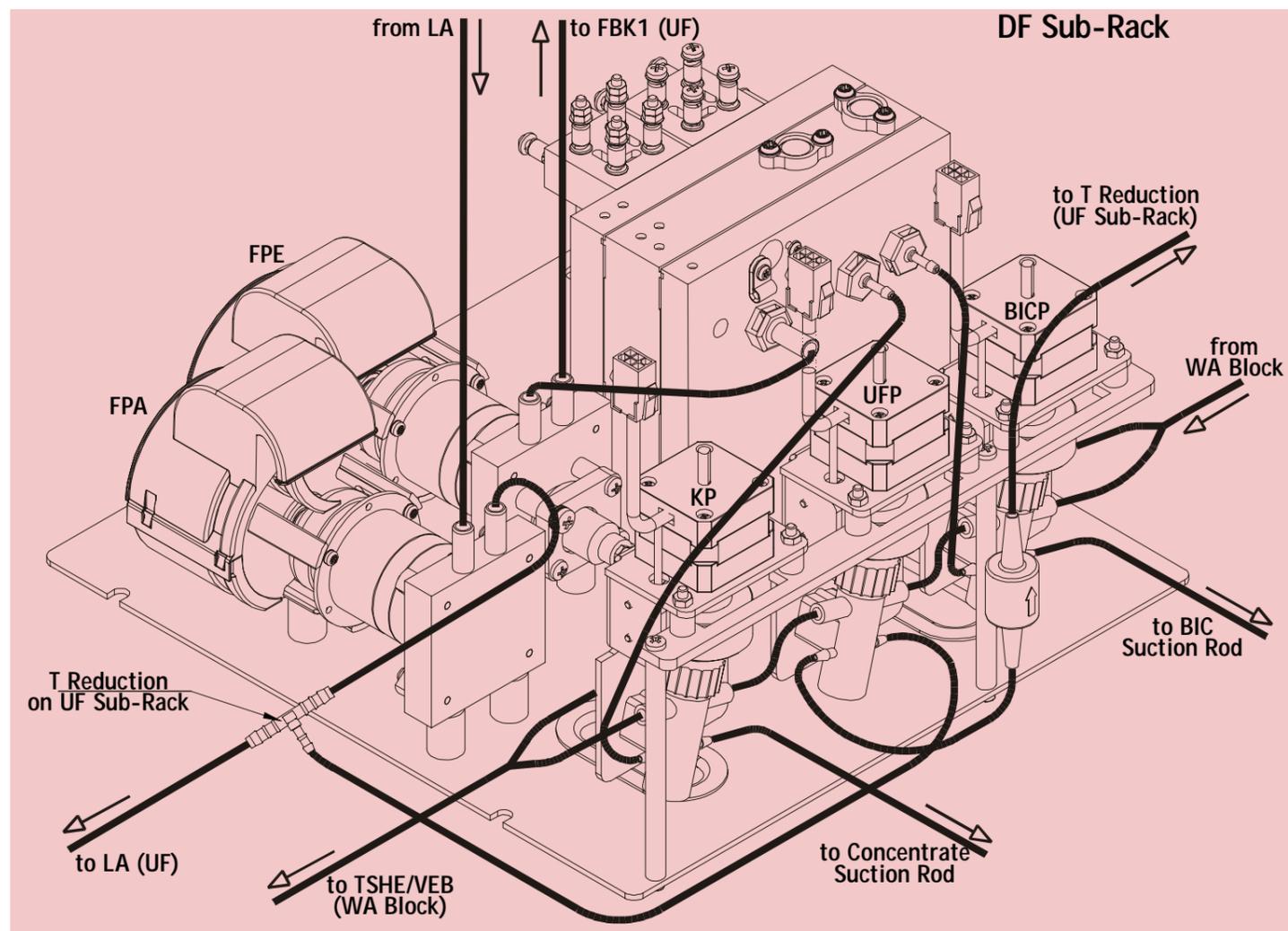
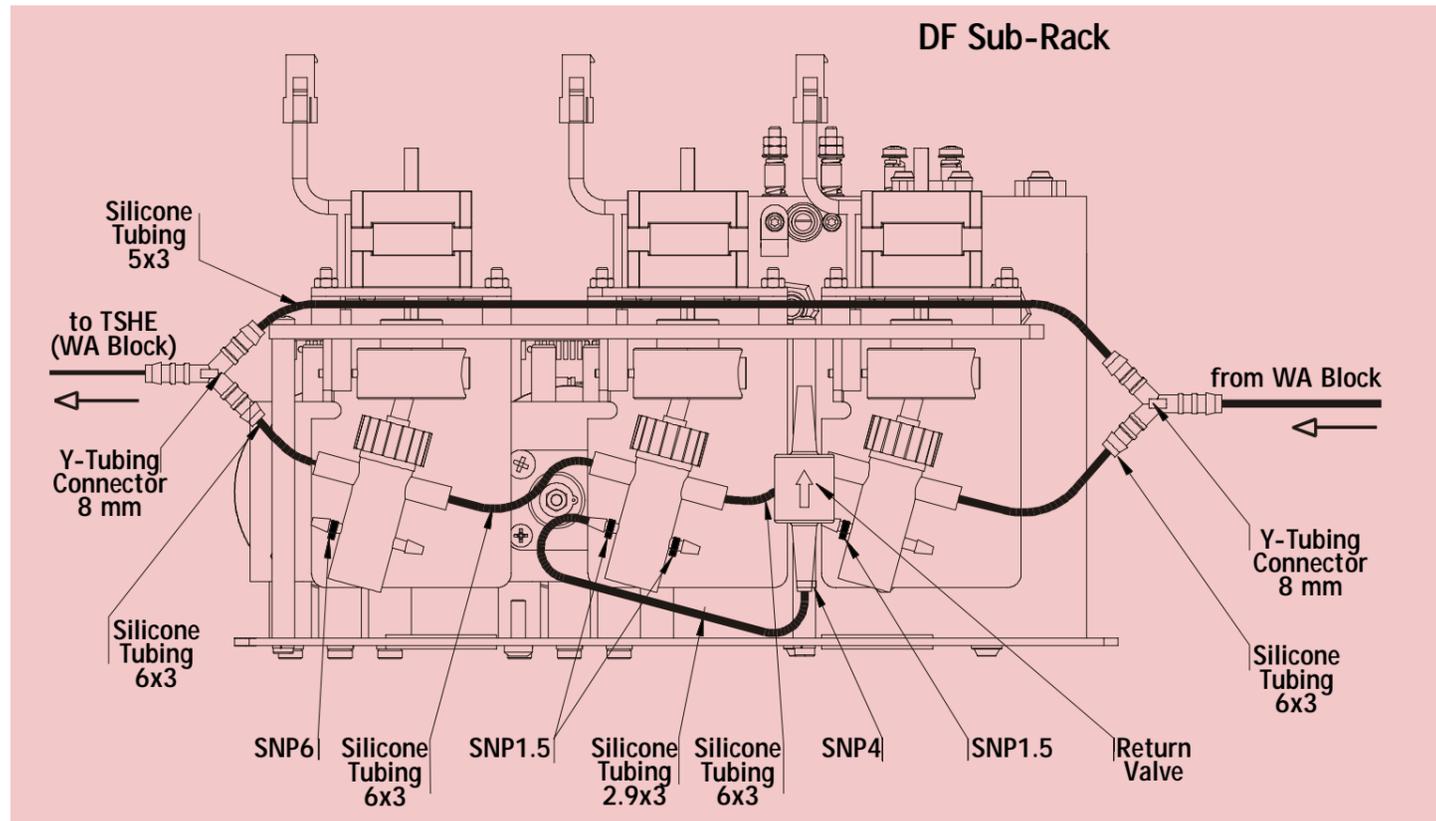


6.2.3.2 Solenoid Valves Water Sub-Rack





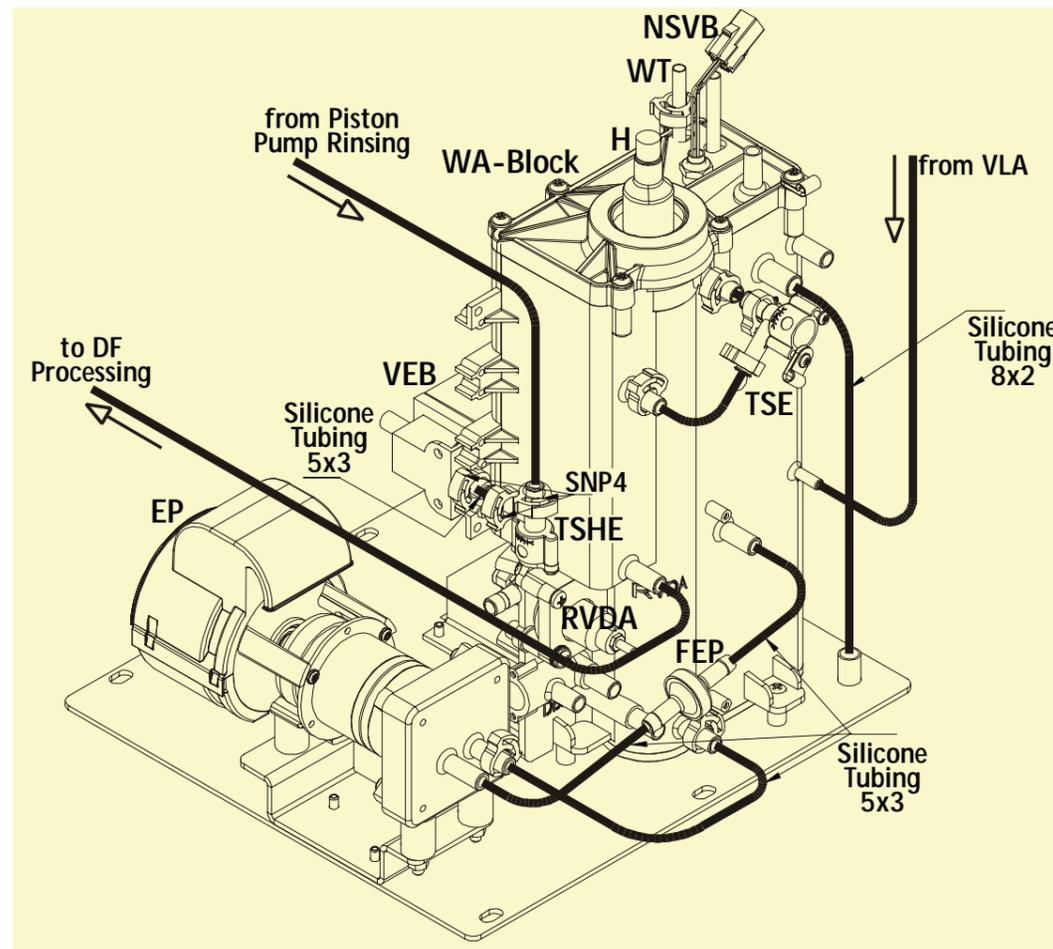
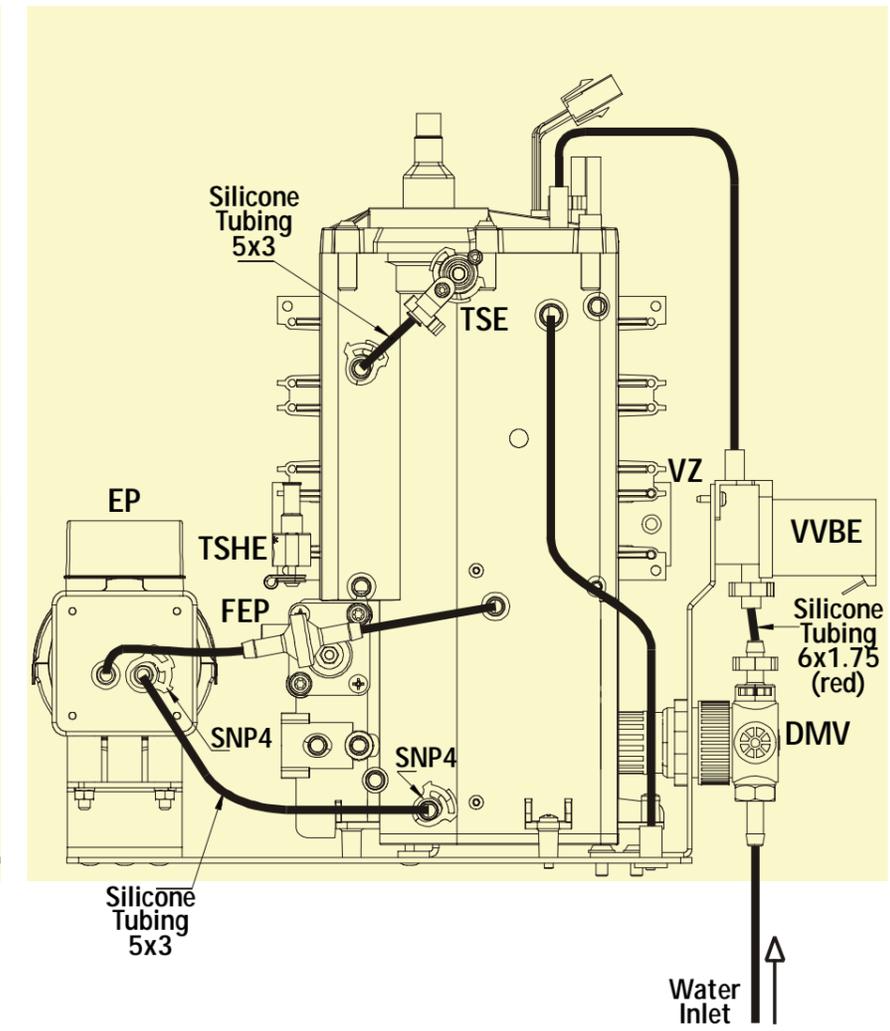
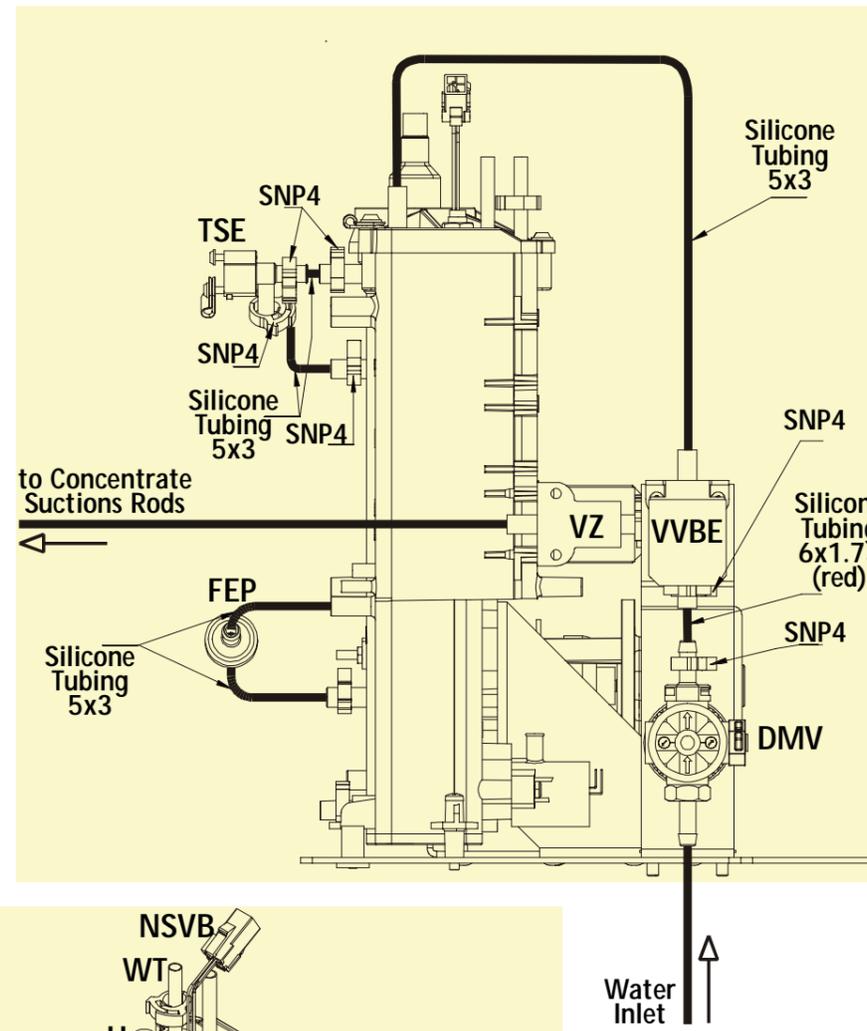
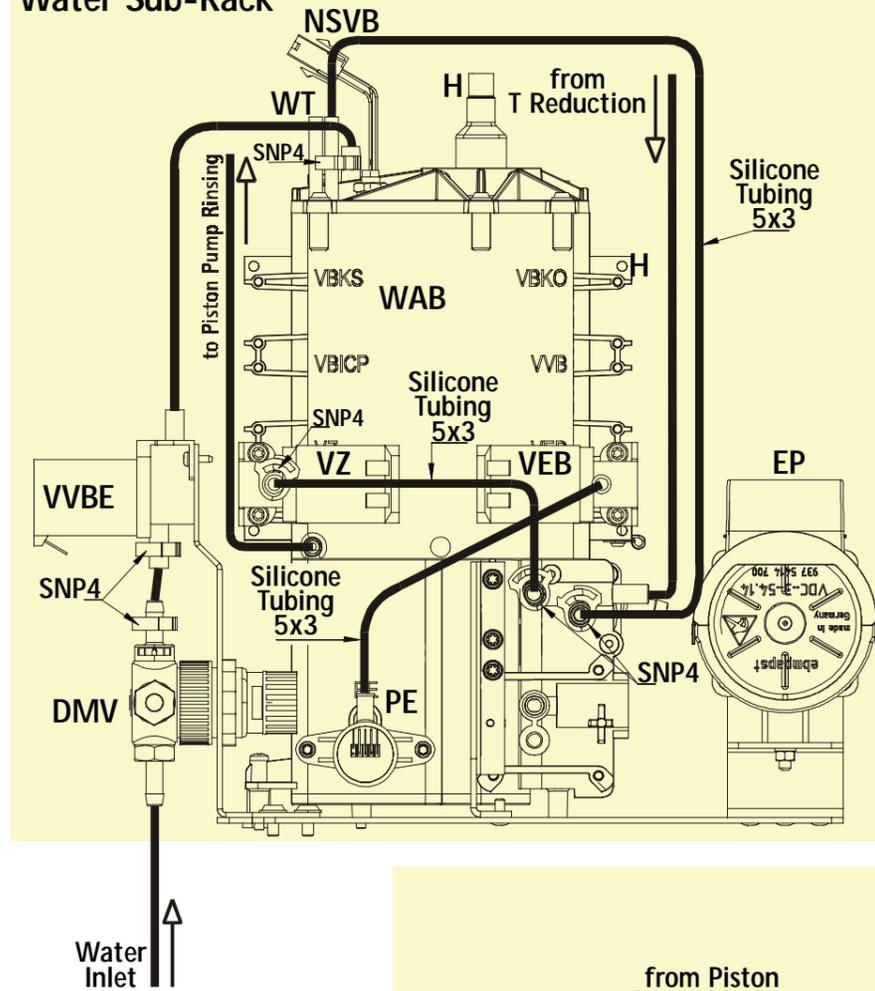




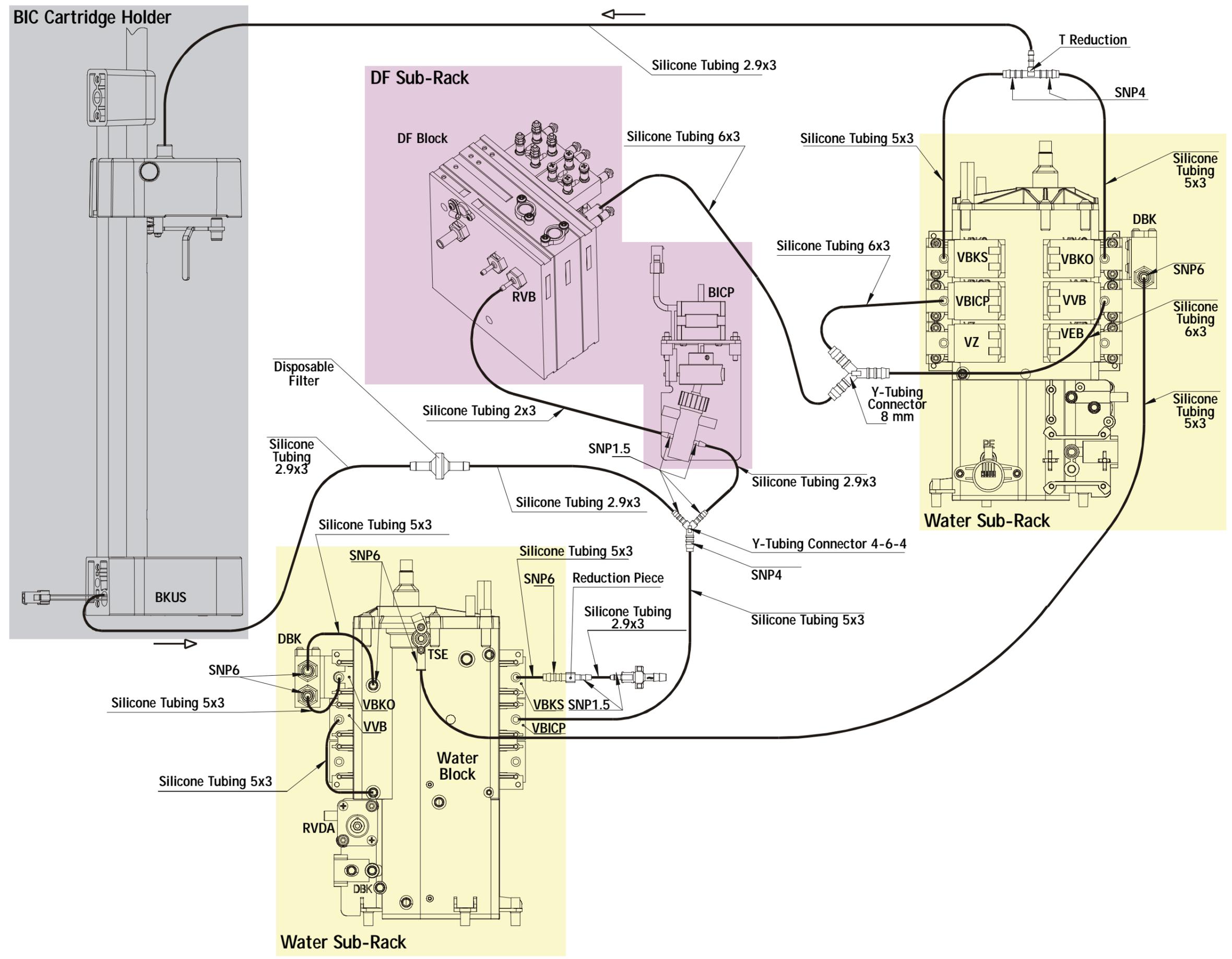
6.3.4

Tubing Diagram Water Sub-Rack

Water Sub-Rack

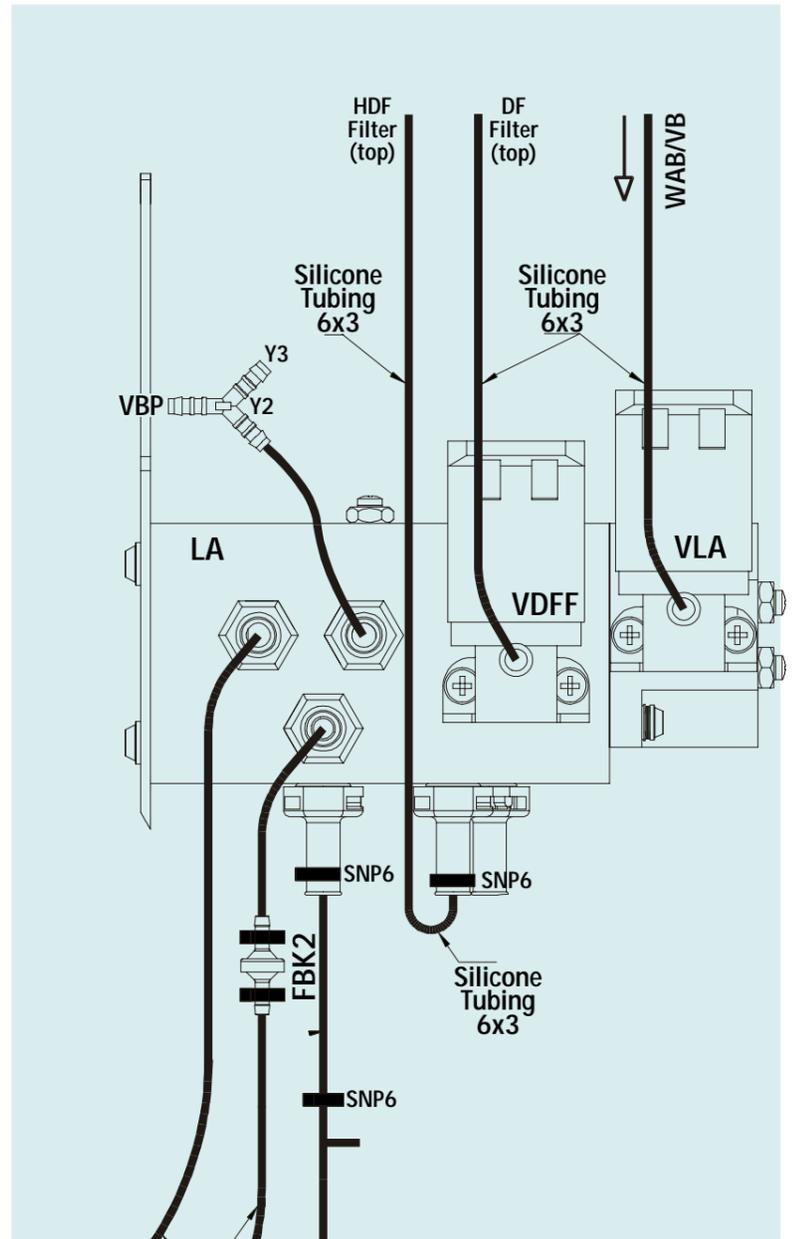
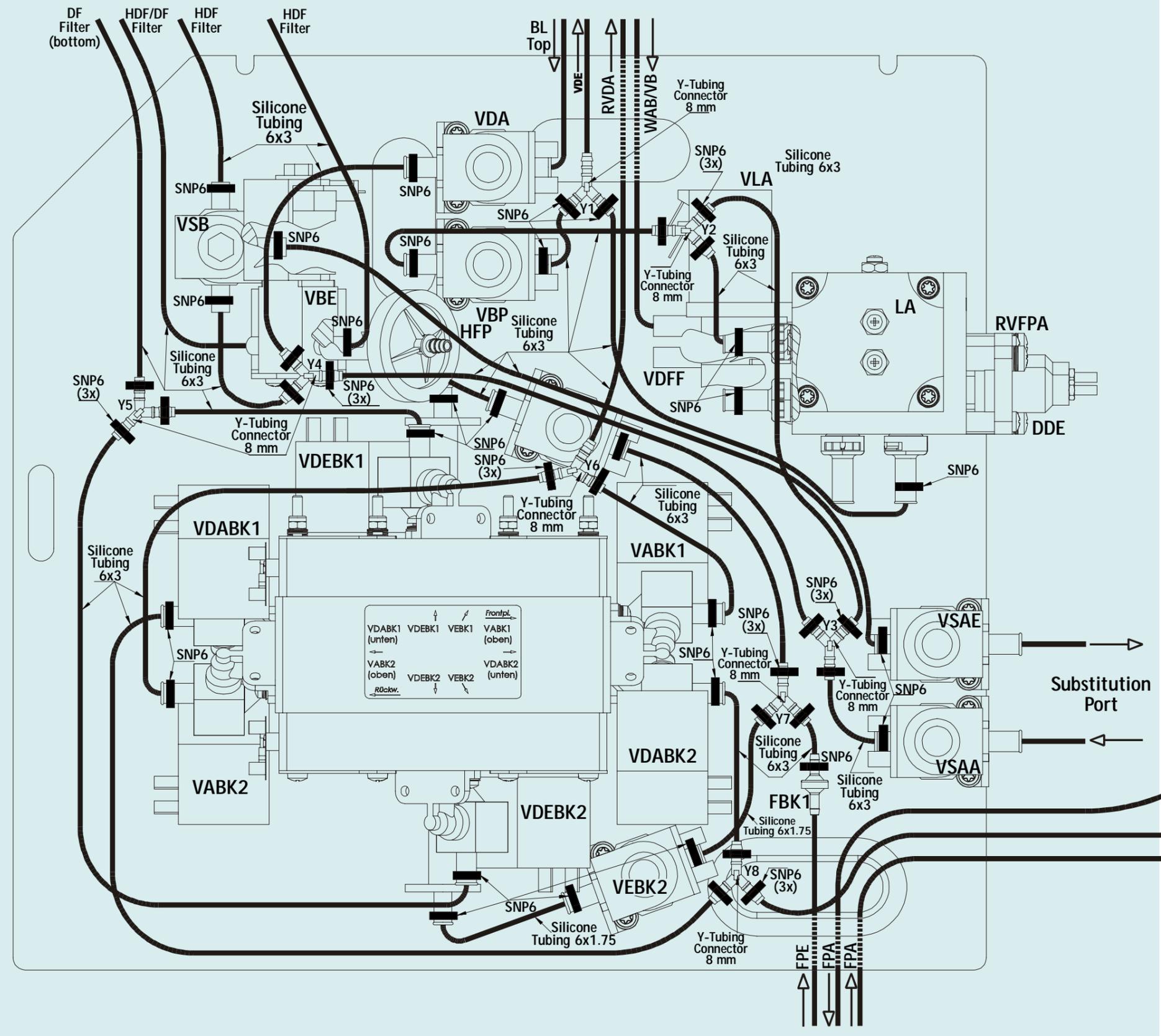


6.3.5 Tubing Diagram BIC Cartridge Holder

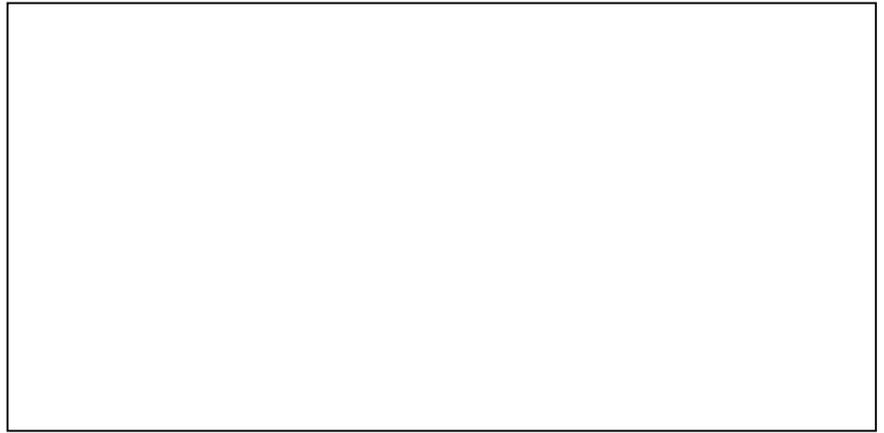




### UF Sub-Rack HDF Online



Contact your Local  
B. Braun Representative  
for Service Support



### Spare Parts List

The spare parts list (edition 1-2010, edition date March 2010) is valid with immediate effect.

### Refurbished Spare Parts

Conditions for Delivery of Refurbished Spare Parts (depending on availability):

Defective spare parts must be sent back with the accompanying documents (Material Return Form) to B. Braun Avitum AG via the representative of the respective country for the ability to supply refurbished spare parts. The condition and the version of the defective spare parts must allow a qualified refurbishment.

### Backward Compatibility of Spare Parts

New spare parts always have article numbers with numeric characters and are backward compatible unless otherwise specified in the spare parts list. If a spare part is modified the last digit of the article number changes to an alphabetic character with the initial index A. These spare parts are in principle backward compatible to the previous article number (numeric or alphanumeric - with or without an index).

**B. Braun Avitum AG**  
**34209 Melsungen**  
**Germany**

Tel. No.: +49 5661 713662  
E-Mail: Heike.Sinning@bbraun.com

## Material Return Form

B. Braun Avitum AG  
 Wareneingang - Service  
 Schwarzenberger Weg 73-79  
 D-34212 Melsungen  
 Germany

Reason for returning the part (please tick ):

- Warranty return (replacement to be ordered separately) -----
- Defective part for refurbishment -----
- Wrong shipment -----
- Complaint sample (use complaint form for details) -----
- Spare part returned for investigation -----
- Spare part returned for disposal by B. Braun Avitum AG -----

**Sender:** Name of Company: .....

.....

..... City: .....

Country: ..... Name of responsible person: .....

Customer number: ..... Telephone/e-mail: .....

**Returned part:** Article number: ..... Part serial number: .....

Part description: .....

Description of the defect: .....

**From machine type:** ..... Serial number: ..... Working hours: .....

Software Version: ..... Description of the problem on the machine: .....

**The described defect appears:** Intermittently  Permanently  (please tick )

**Cleaned/disinfected:** Cleaned  yes Disinfected  yes (please tick )

**Disinfectant:** .....



**Disposal and Taking Back of Spare Parts**

Dispose spare parts (e.g. boards or batteries) according to local disposal guidelines or send back to B. Braun Avitum AG free of charge.

**Cleaning and Disinfection of Spare Parts Used in Dialog Machines**

All spare parts sent by the customer to the B. Braun representative for repair, complaint, refurbishment, technical analysis or warranty must be cleaned and disinfected (exception: boards). Spare parts considerably contaminated, damaged or not disinfected are scrapped.

**Packaging Notice**

**Each returned part must be properly packed to prevent any damage during transportation due to mechanical impact or due to electrostatic discharge. The safest way to prevent damage is by using the packaging material from the new spare part and by packing the returned part exactly in the same way.**

Returned parts containing electronic components (electrostatic sensitive devices) must be packed in special ESD packaging material. Only shielded bags or antistatic bags may be used. Unprotected electronic parts (e.g. wrapped in normal plastic bags or parts padded with Styrofoam) are assumed to be damaged by electrostatic discharge and will be scrapped.

This form must be attached to every spare part sent back to your B. Braun representative!

Spare parts without this form are scrapped.

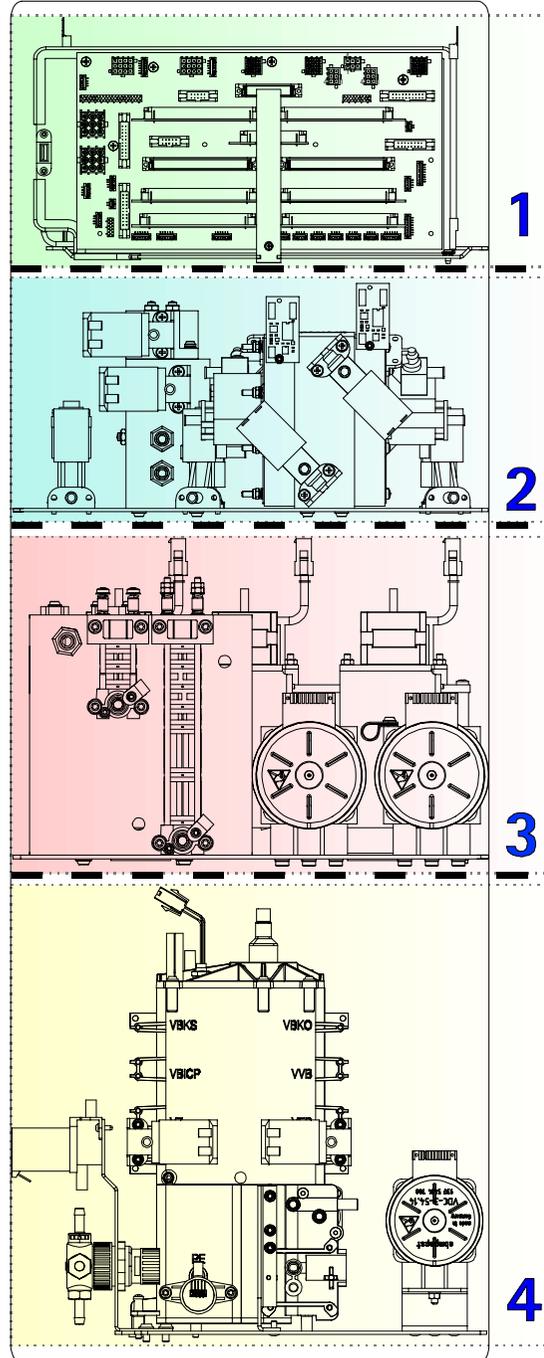
Please Copy!

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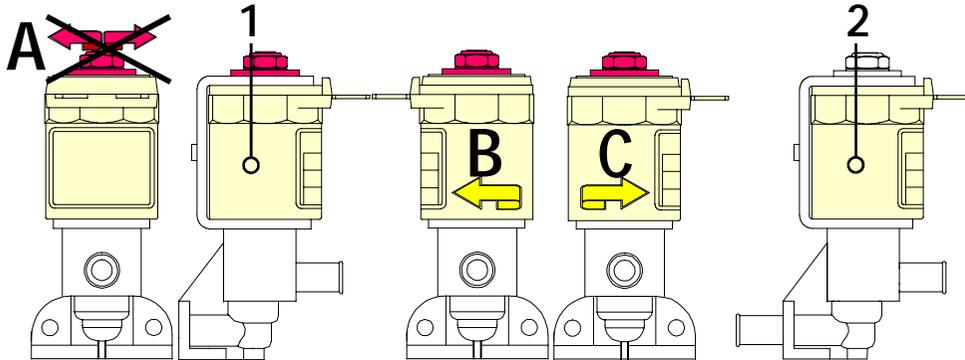
7.1 Sub-Racks



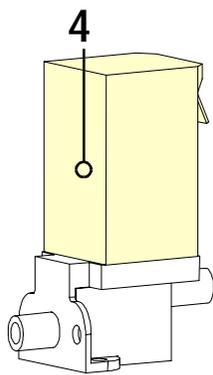
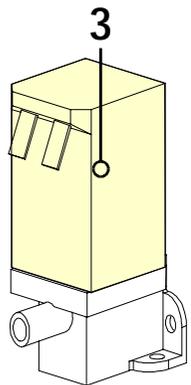
Pos.	Art. No.	Qty.	Description	Comments
1 -			Top level sub-rack	see paragraph 7.6 for single parts
2 -			UF sub-rack	see paragraph 7.5 for single parts
3 -			DF sub-rack	see paragraph 7.4 for single parts
4 -			Water sub-rack	see paragraph 7.3 for single parts

Pos.	Art. No.	Qty.	Description	Comments
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7.2 Solenoid Valves



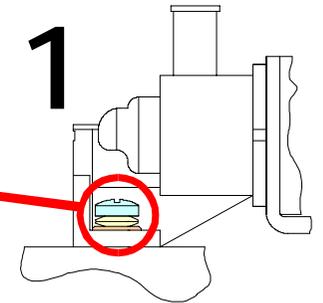
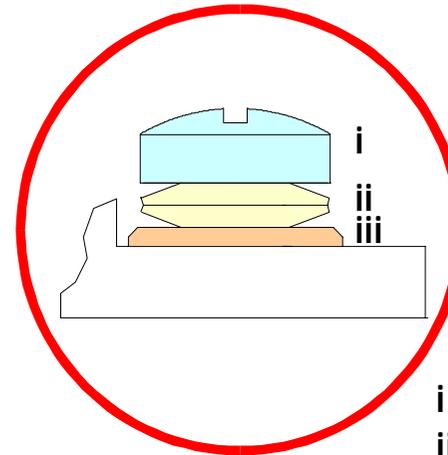
1	3451902C	1	Solenoid valve 2/2 way	connector/flange (AKM) (pay attention to bottom notes)
2	3451906C	1	Solenoid valve 2/2 way	connector/connector (AKM)
3	34560270	1	Solenoid valve 2/2 way	connector/flange (DPP)
4	34560289	1	Solenoid valve 2/2 way	connector/connector (DPP)



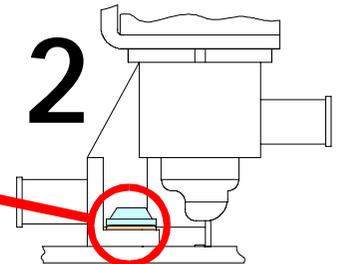
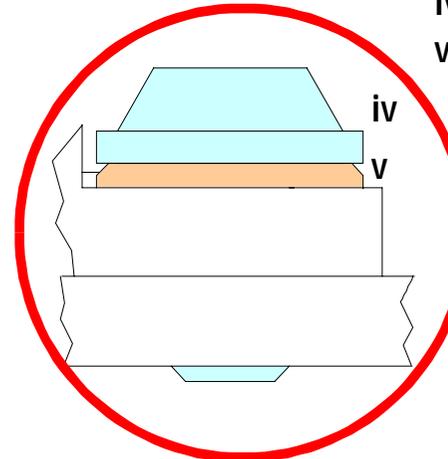
**Notes for Solenoid Valve 3451902C**

**Self-Locking Nut A**  
Do not readjust the self-locking nut A, because the nut is assembled with a defined torque (1.3 Nm ± 10 %).

The position of the magnet coil can be adapted to the assembly location, i.e. the coil can be carefully turned (B or C) without loosening the self-locking nut A. The procedure is only permissible if the coil can be turned without much effort.

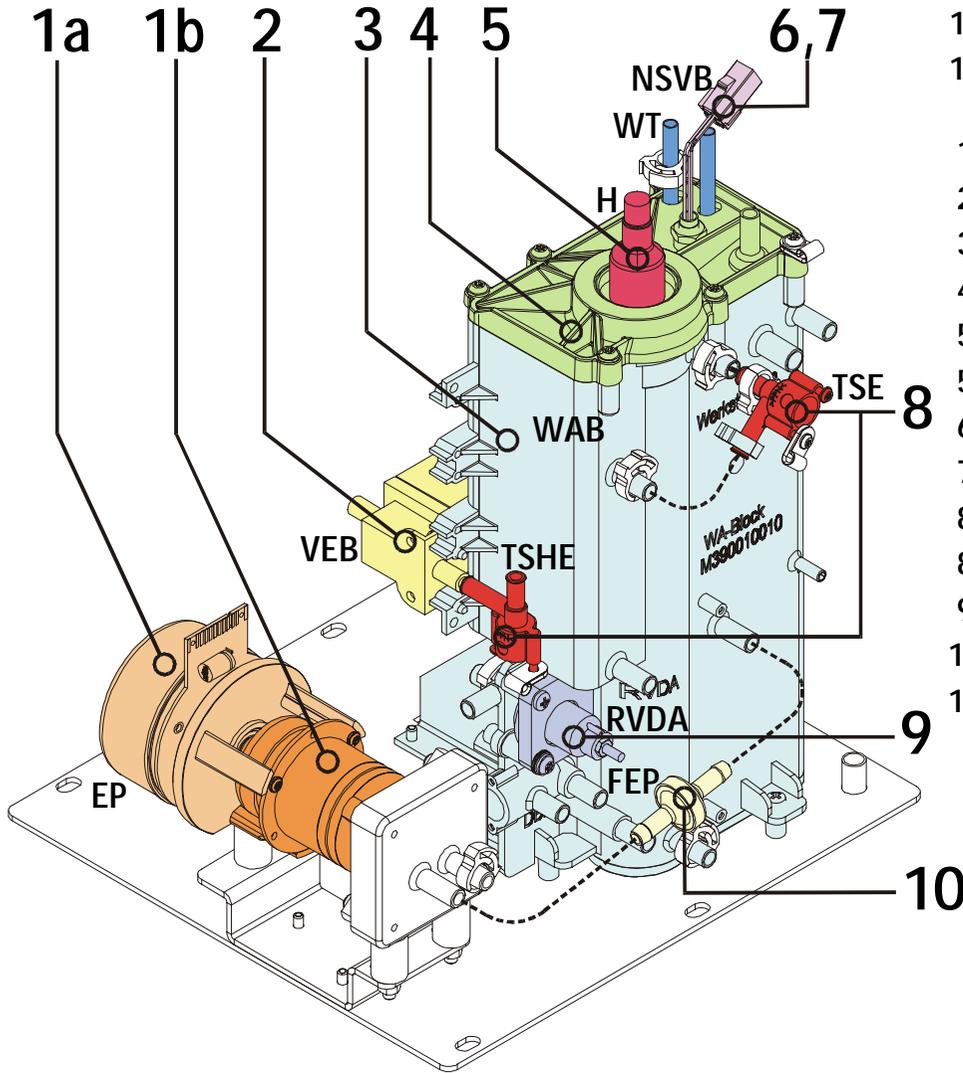


- i 1 x Screw M4
- ii 2 x Spring Washer 4.2
- iii 1 x Washer 4.2

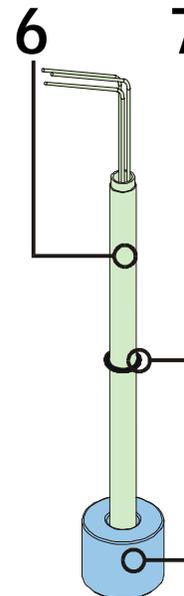


- iv 1 x Screw 40x10
- v 1 x Washer 4.2

7.3 Water Sub-Rack

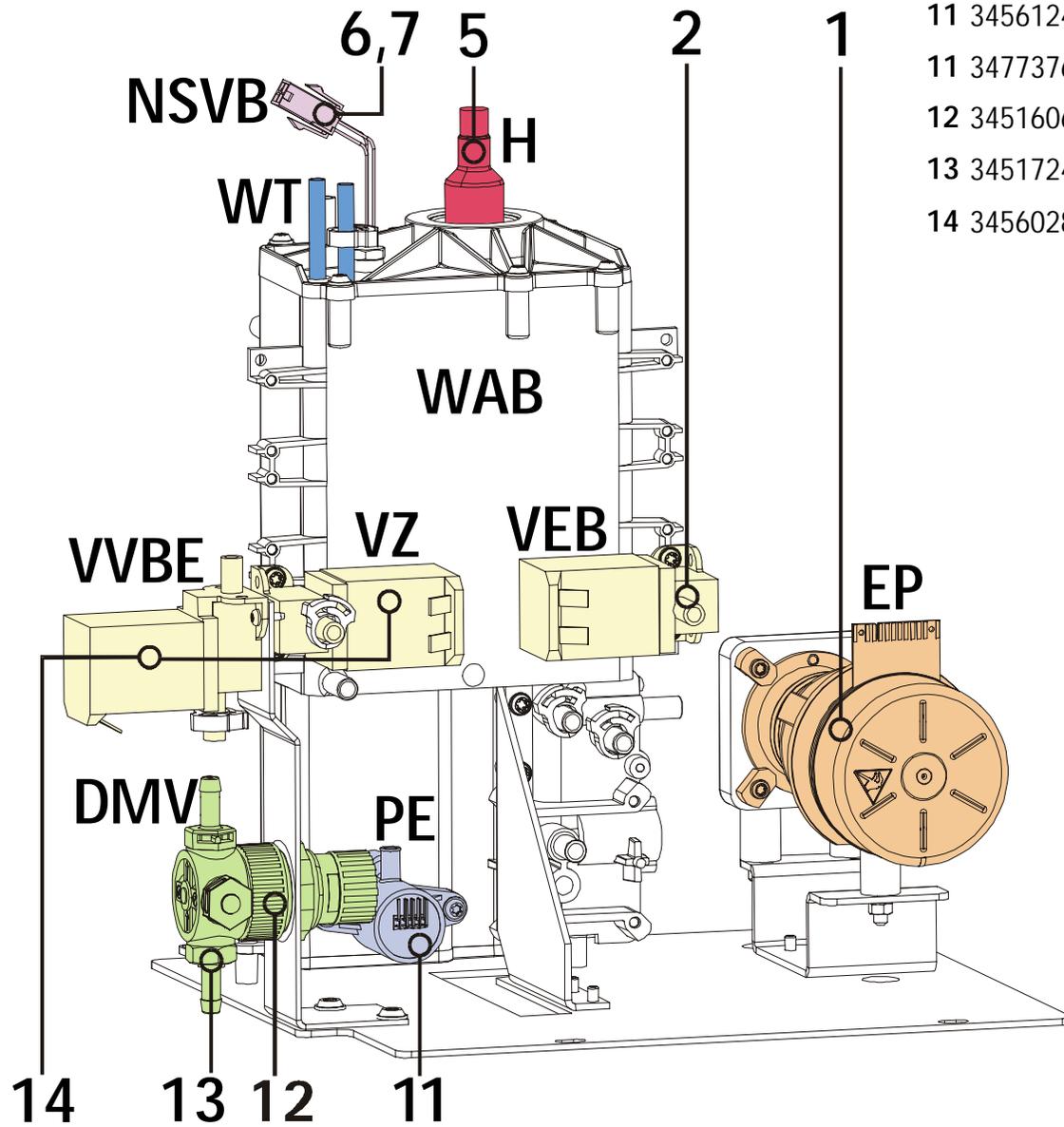


Pos.	Art. No.	Qty.	Description	Comments
1a	34560718	1	Motor for gear pump (SW 1.7.4)	see separate figure
1b	34560319	1	Gear pump (Micropump version 2) with magnet, without motor	version 2 for EP only is shown without motor cover
1	34770950	20	O-ring 8.0 x 1.6	
2	34560386	1	Solenoid valve 2/2 way with bypass	
3	34561315	1	Water block without lid	
4	34561323	1	Lid for waterblock	
5	3456021A	1	Heater element 120 V/2x900 W	incl. two seals
5	3456020A	1	Heater element 240 V/2x900 W	incl. two seals
6	34560459	1	Level sensor complete	with float ball
7	34560246	1	Float ball incl. o-ring	
8	3451614B	1	Temperature sensor	without connector
8	34570730	1	Housing complete for temperature sensor	
9	3451727B	1	Throttle 0.4 bar	
10	3451664B	1	Throttle 1.3 bar	für HDF-Online
11	34517782	5	Disposable filter	



Water Sub-Rack

Pos.	Art. No.	Qty.	Description	Comments
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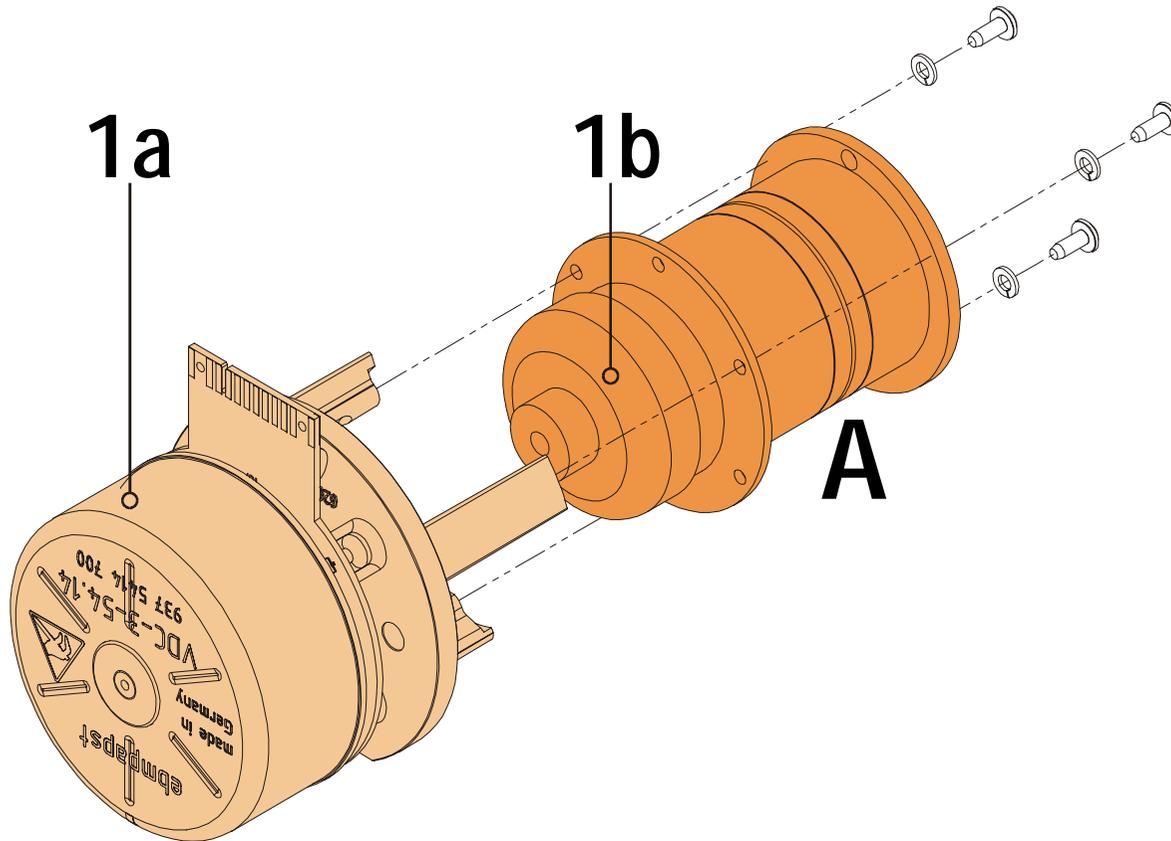
11	34561242	1	Pressure sensor	
11	34773762	10	O-ring 9.25 x 1.78	
12	34516069	1	Throttle 0 - 4 bar	
13	34517243	1	Tubing connector $\varnothing$ 7 x 1/8"	stainless steel
14	34560289	1	Solenoid valve 2/2 way	connector/connector (DPP)

Pos.	Art. No.	Qty.	Description	Comments
------	----------	------	-------------	----------

7.3.1 Gear Pump for EP

1a	34560718	1	Motor for gear pump (SW 1.7.4)	
1b	34560319	1	Gear pump (Micropump version 2) with magnet, without motor	

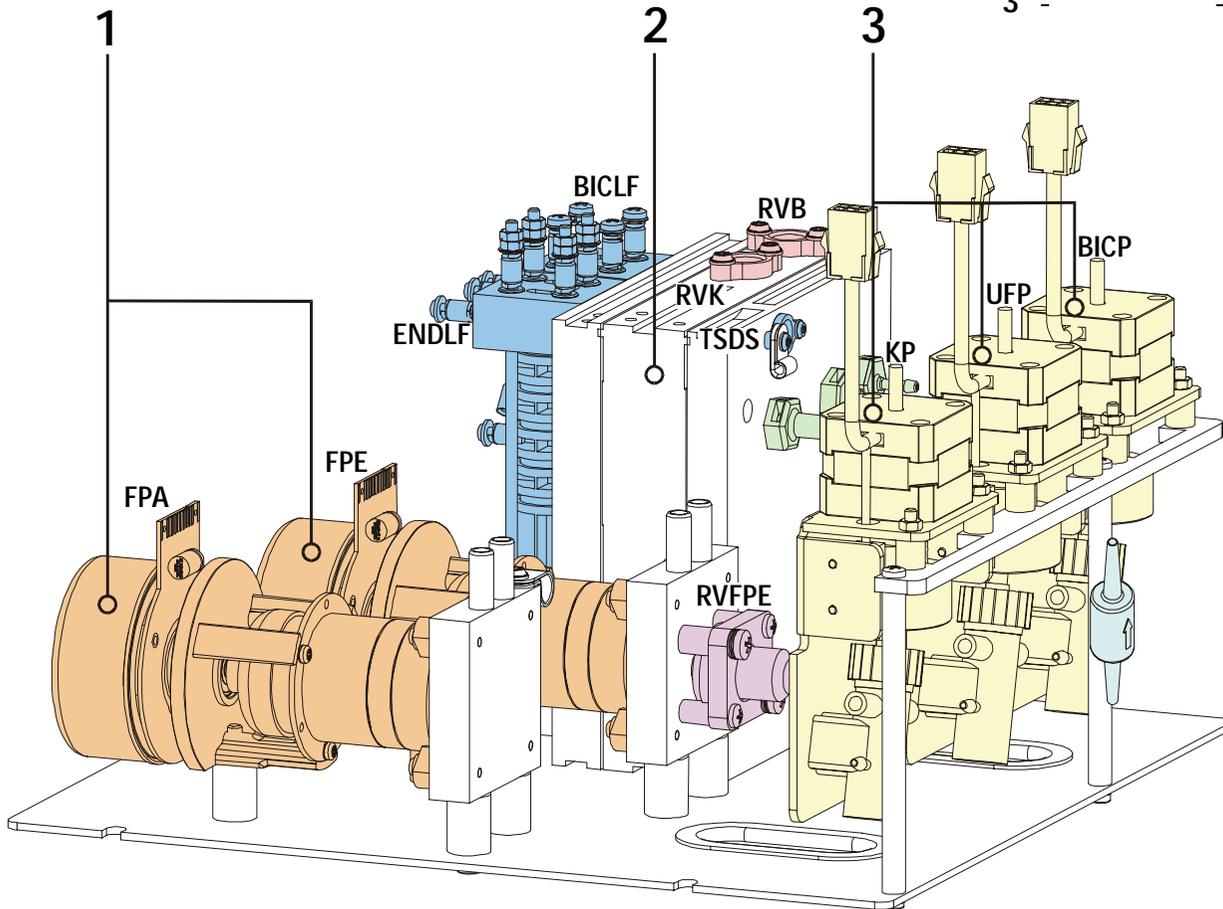
Micropump Version 2 for EP only  
(see A in figure)



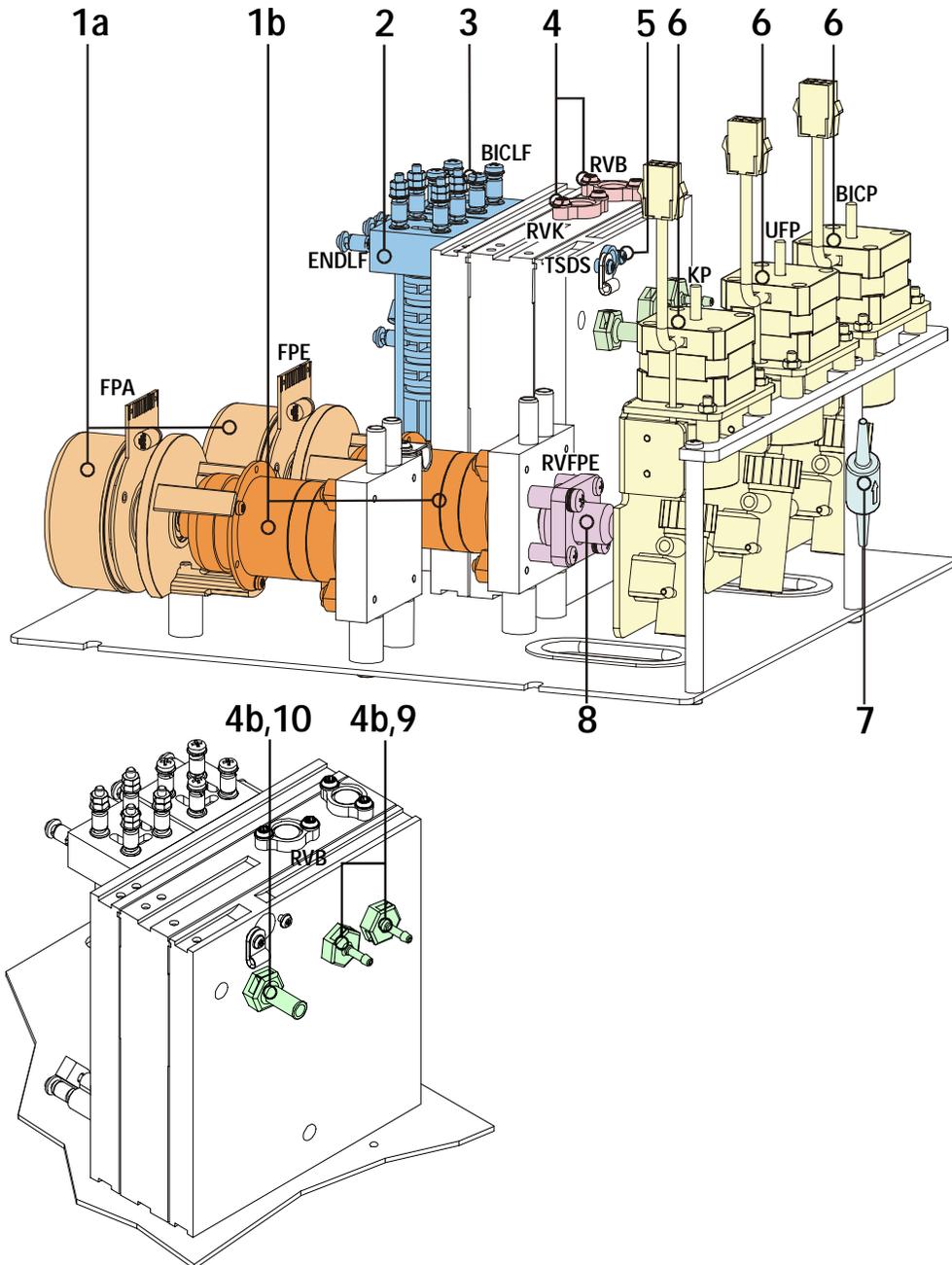
7.4 DF Sub-Rack

Pos.	Art. No.	Qty.	Description	Comments
------	----------	------	-------------	----------

1	-	-	Gear pumps	see separate figure for single parts, paragraph 7.4.1
2	-	-	DF block	see separate figure for single parts, paragraph 7.4.1
3	-	-	Piston pumps	see separate figure for single parts, paragraph 7.4.2



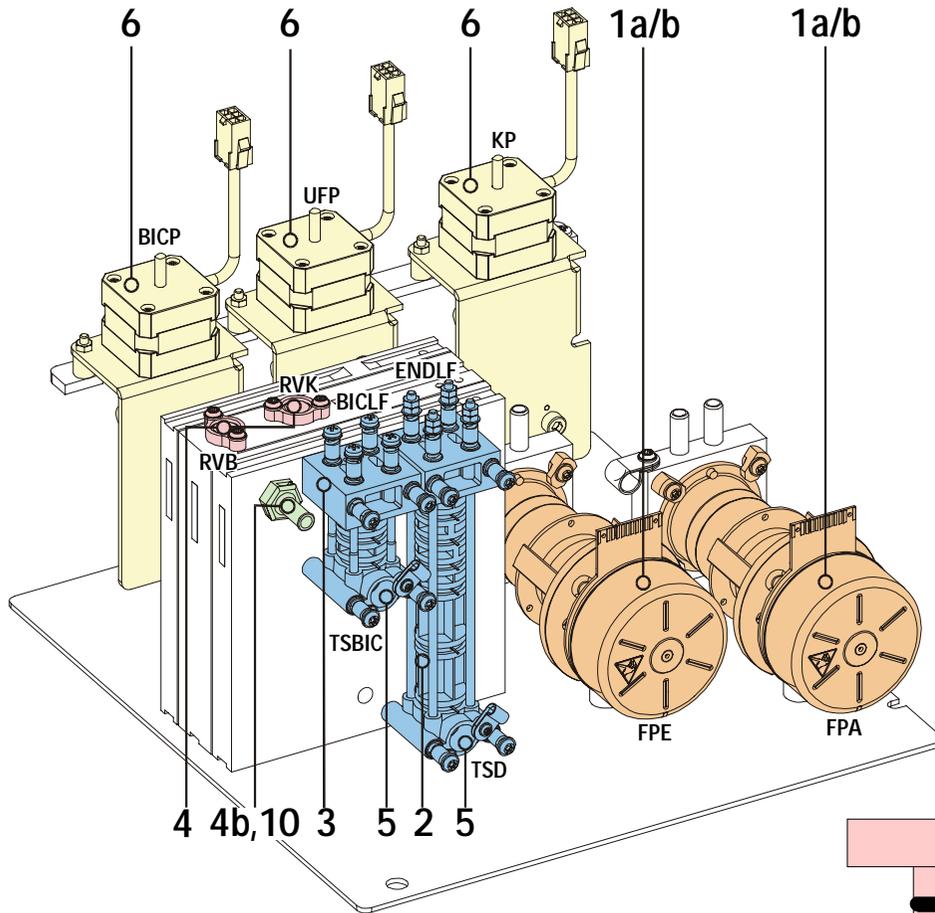
7.4.1 DF Block



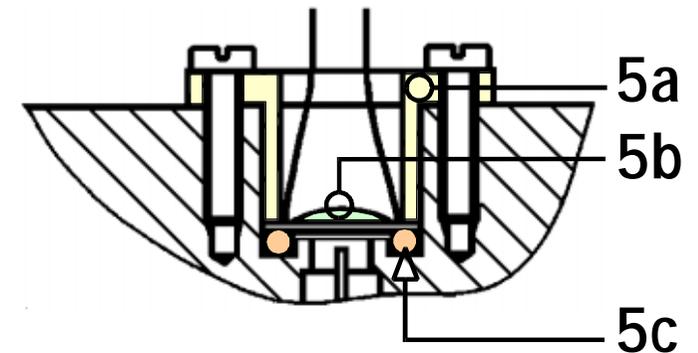
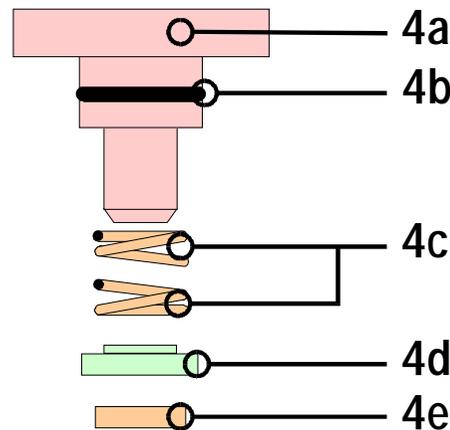
Pos.	Art. No.	Qty.	Description	Comments
1a	34560718	1	Motor for gear pump (SW 1.7.4)	see separate figure
1b	34515330	1	Gear pump (Micropump version 1) with magnet, without motor	version 1 for FPA/FPE only is shown without motor cover
1	34770950	20	O-ring 8.0 x 1.6	
1	34771140	20	O-ring 3.1 x 1.6	
2	34561030	1	END conductivity sensor version 2	with temperature sensor
3	34561021	1	Bicarbonate conductivity sensor version 2	with temperature sensor
4a	34770925	5	Plug	
4b	34770852	5	O-ring 11.1 x 1.6	
4c	34771050	10	Pressure spring 500 mmHg	
4d	34772928	3	Centre disc	
4e	34771085	5	Seal	
5a	34570373	10	Plug (long)	
5b	3451614B	1	Temperature sensor	without connector
5c	3477104A	10	O-ring 8.3 x 2.4	
6	-	-	Piston pumps	see paragraph 7.4.2
7	34514988	1	Return valve, incl. 2 x tubing clamps, 2 x cable ties	return valve RV necessary for standard UFP
8	3451664B	1	Druckregler 1,3 bar	
8	34570683	10	O-Ring 4,47 x 1,78	
9	3477103A	2	Tubing connector Ø 3.5 x 1/8"	plastic
10	3451916A	5	Tubing connector Ø 8 x 1/8"	plastic

Pos.	Art. No.	Qty.	Description	Comments
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DF Block

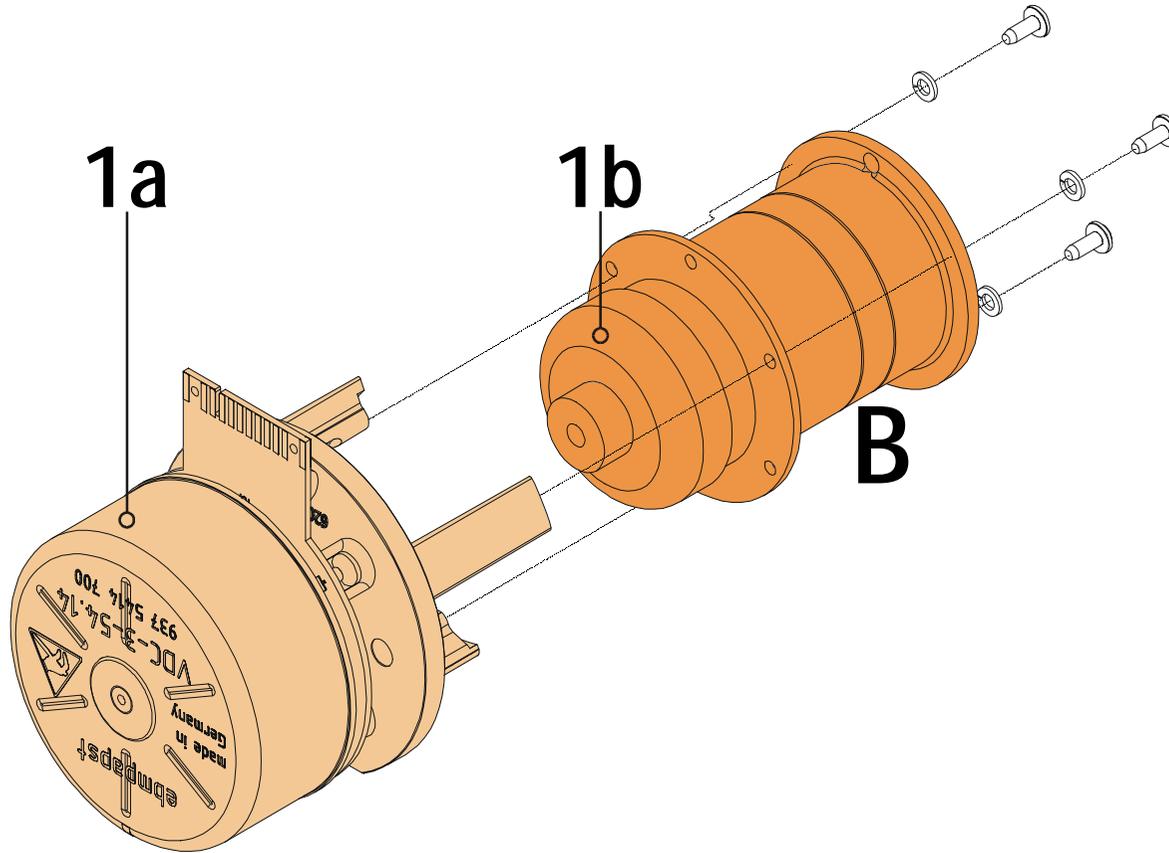


4a	34770925	5	Plug	
4b	34770852	5	O-ring 11.1 x 1.6	
4c	34771050	10	Pressure spring 500 mmHg	
4d	34772928	3	Centre disc	
4e	34771085	5	Seal	
5a	34570373	10	Plug (long)	
5b	3451614B	1	Temperature sensor	without connector
5c	3477104A	10	O-ring 8.3 x 2.4	



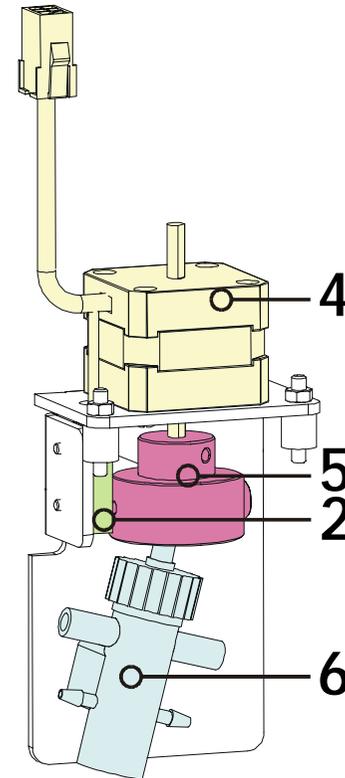
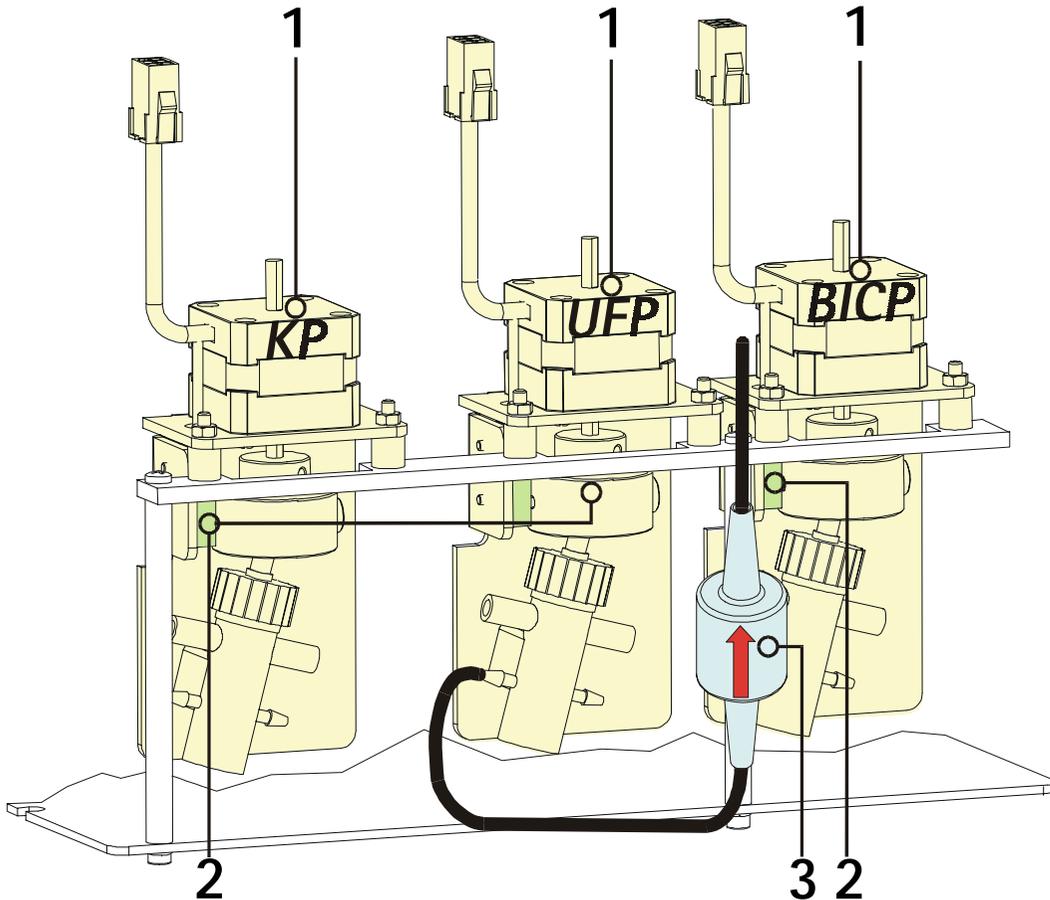
Pos.	Art. No.	Qty.	Description	Comments
1a	34560718	1	Motor for gear pump (SW 1.7.4)	
1b	34515330	1	Gear pump (Micropump version 1) with magnet, without motor	Micropump Version 2 for FPA/FPE only (see B in figure)

7.4.1.1 Gear Pump for FPE/FPA



7.4.2 Piston Pumps

Pos.	Art. No.	Qty.	Description	Comments
1	3451749E	1	Piston pump	for UF/BICP/KP piston pump. Return valve additionally necessary for standard UF piston pump.
2	34519246	1	Reed sensor complete	
3	34514988	1	Return valve, incl. 2 x tubing clamps, 2 x cable ties	return valve RV necessary for standard UFP
4	34560556	1	Motor for piston pump	
5	34560572	1	Bell joint for piston pump	
6	34560602	1	Pump body for piston pump	
-	7703848	1	Assembly jig (motor piston pump)	required for motor assembly

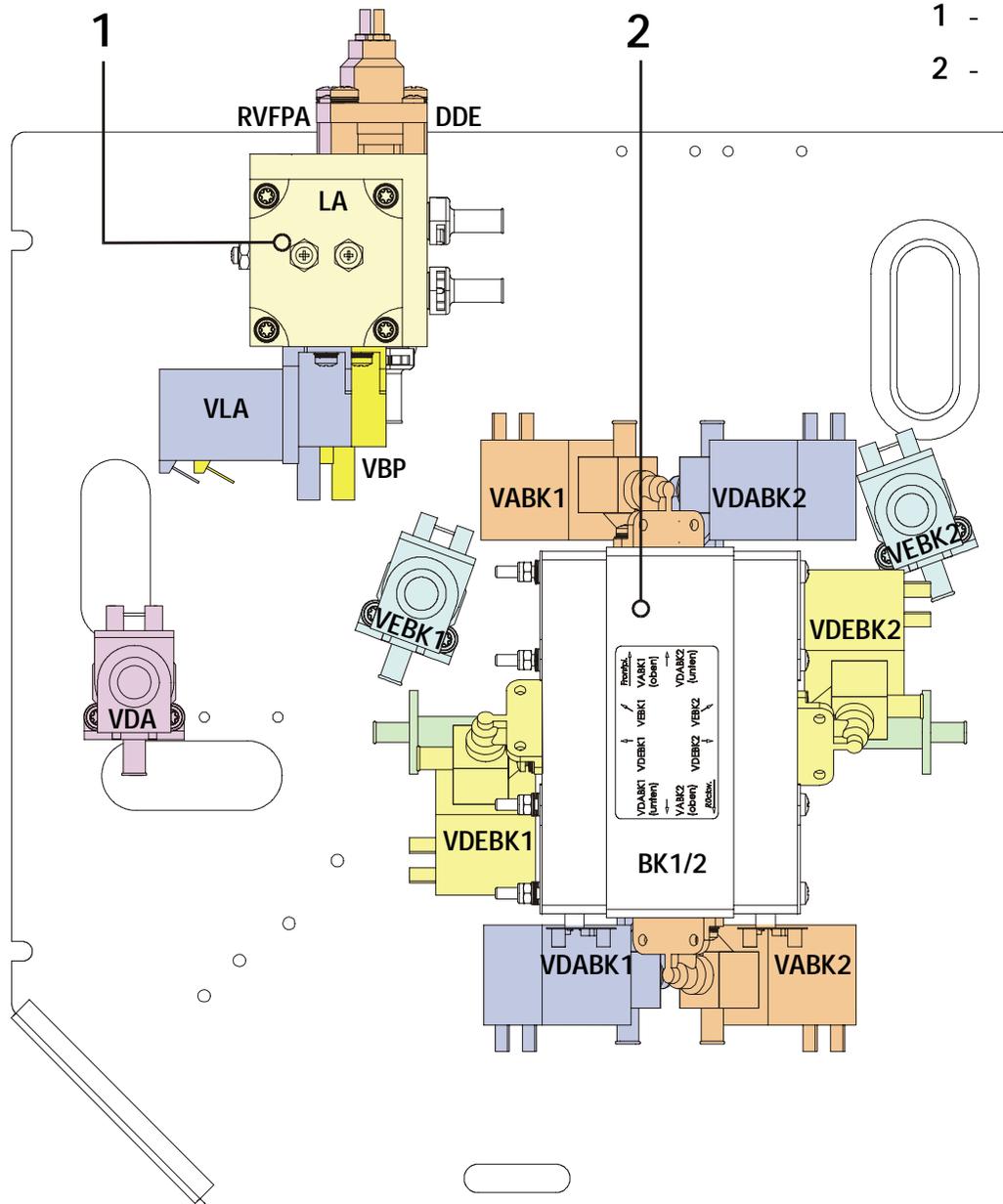


Pos. Art. No. Qty.

Description

Comments

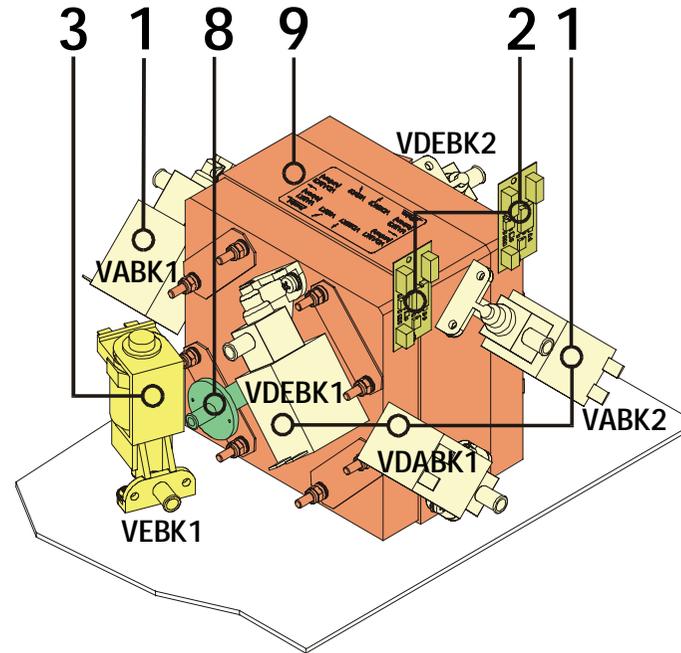
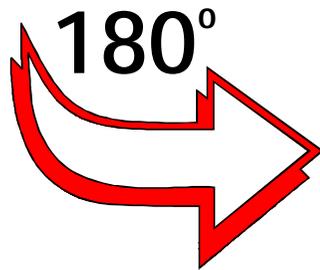
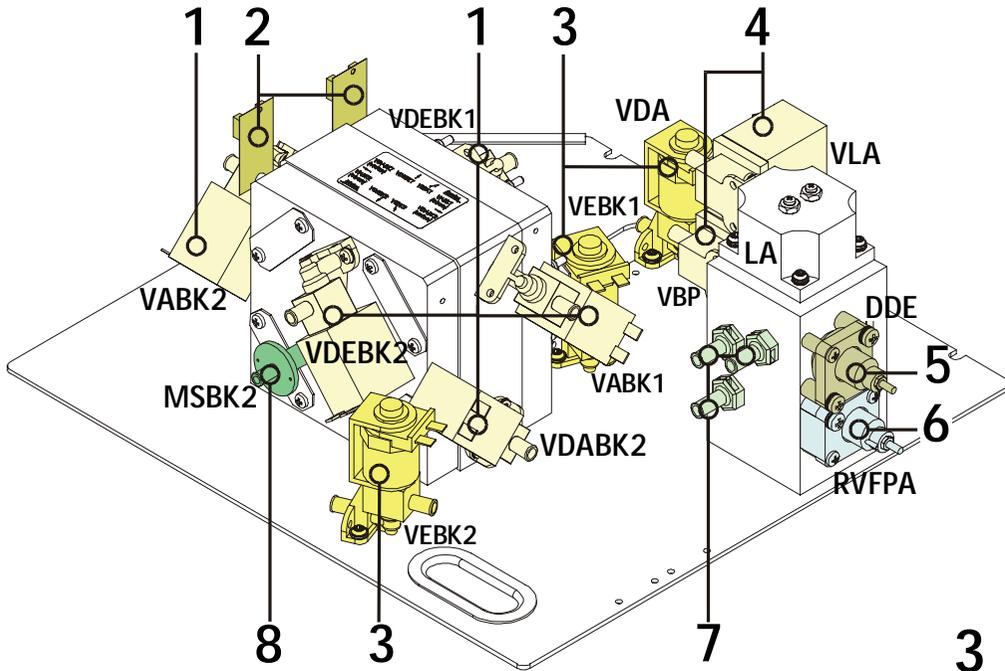
7.5 UF Sub-Rack



- |     |   |                        |                     |
|-----|---|------------------------|---------------------|
| 1 - | - | Air separator complete | see separate figure |
| 2 - | - | Balance chamber 2      | see separate figure |

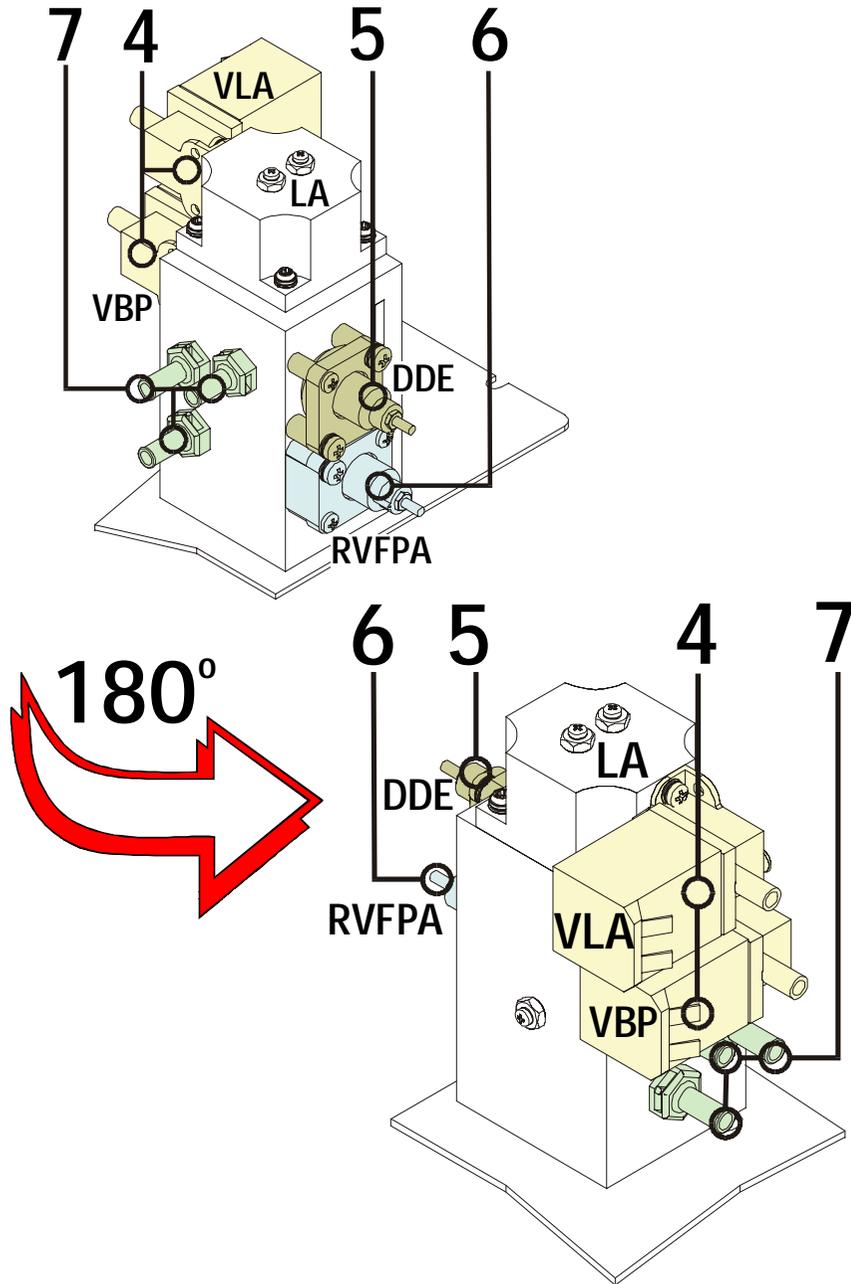
7.5.1 Balance Chamber 2

Pos.	Art. No.	Qty.	Description	Comments
1	3451902C	1	Solenoid valve 2/2 way	manuf. AKM only, connector/flange
1	34770852	5	O-ring 11.1 x 1.6	
2	3451665A	2	Membrane position sensor board	exchange as pair only
3	3451906C	1	Solenoid valve 2/2 way	manuf. AKM only, connector/connector
4	34560270	1	Solenoid valve 2/2 way	connector/flange (DPP)
5/6/7	-	-	-	see next page
8	3451909A	1	Coil	
8	34770976	10	O-ring 15.6 x 1.78	
9	3451897A	1	Repair kit balance chamber	for complete replacement of both membranes, incl. all o-rings/assembly parts (self-locking nuts, screws, springs etc.)
9	3451615A	2	Membrane for balance chamber	
-	34570195	20	Tubing clamp SNP-1.5 Ø 7-8 mm	plastic
-	34570209	20	Tubing clamp SNP-4 Ø 10-11 mm	plastic

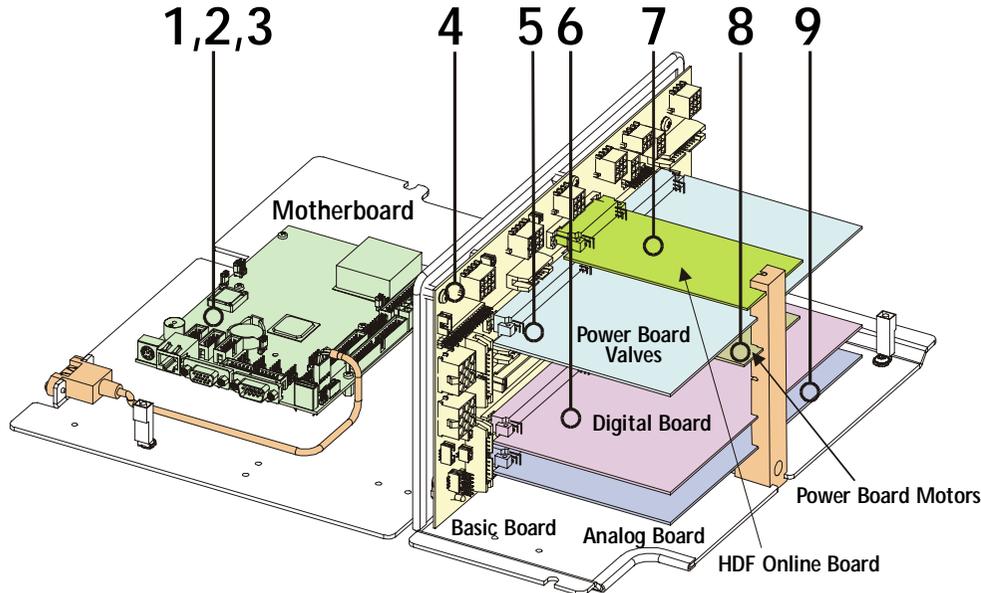


7.5.2 Air Separator Assembly Group

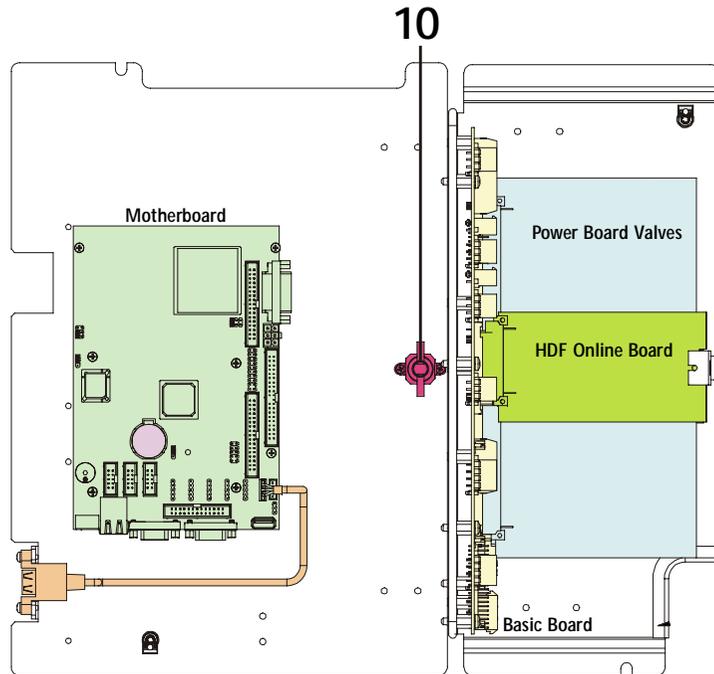
Pos.	Art. No.	Qty.	Description	Comments
4	34560270	1	Solenoid valve 2/2 way	connector/flange (DPP)
4/7	34770852	5	O-ring 11.1 x 1.6	
5	3451727B	1	Throttle 0.4 bar	
5/6	34570683	10	O-ring 4.47 x 1.78	
6	3451664B	1	Throttle 1.3 bar	
7	3451916A	5	Tubing connector $\varnothing$ 8 x 1/8"	plastic



7.6 Top Level Sub-Rack



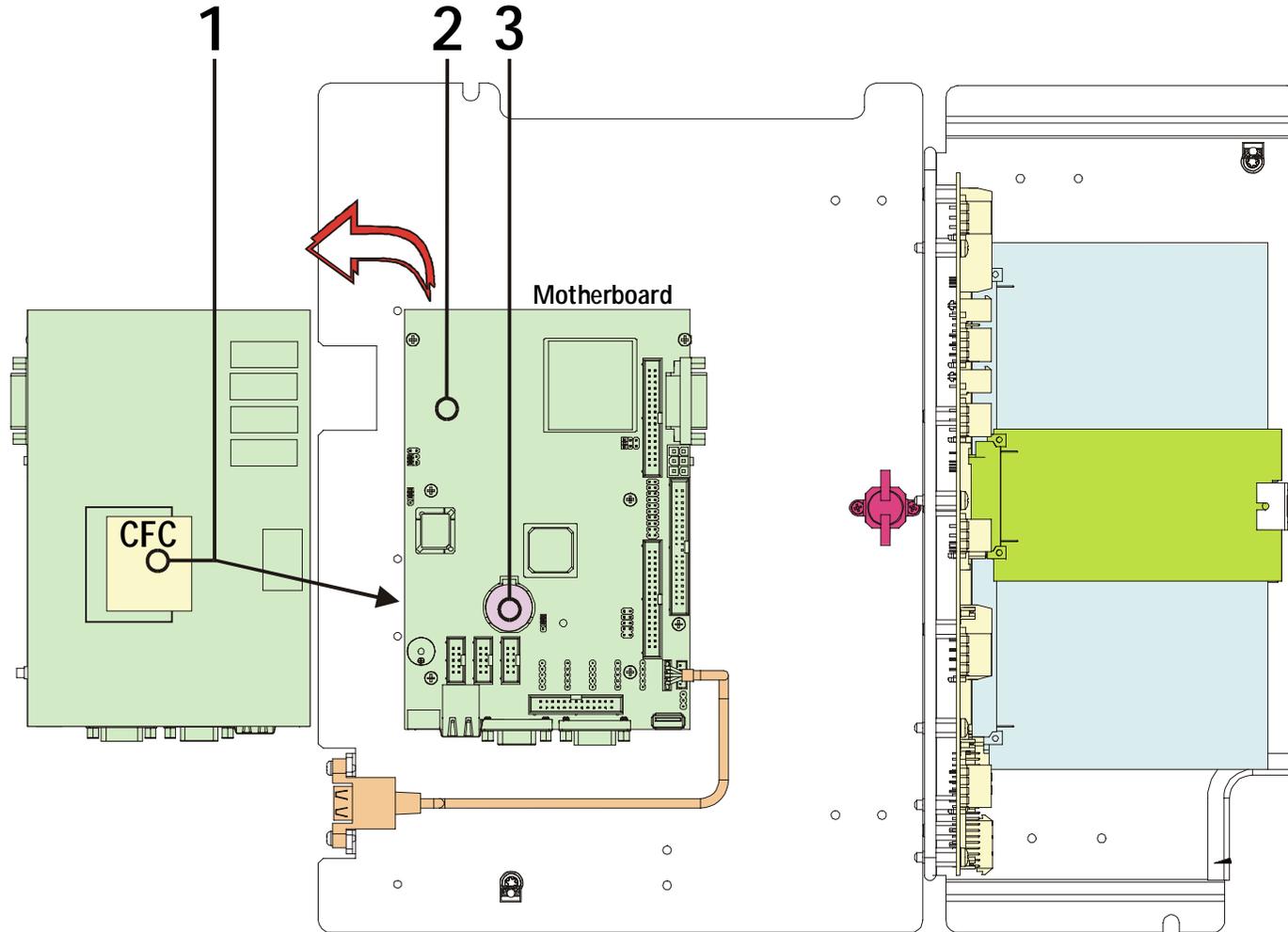
Pos.	Art. No.	Qty.	Description	Comments
1	34560610	1	LX800 motherboard	see 7.6.1
2	34519327	1	Battery BR2032, 3V	see 7.6.1
3	34560882	1	Compact flash card 1 GB	see 7.6.1
4	34560726	1	Basic board	
5	34560769	1	Power board (valves)	
6	34560740	1	Digital board	
7	34560866	1	HDF online board	
8	34560750	1	Power board (Motors)	
9	34560734	1	Analog board	
10	34561277	1	Temperature switch	assemble temperature switch on TL sub-rack with heat sink paste



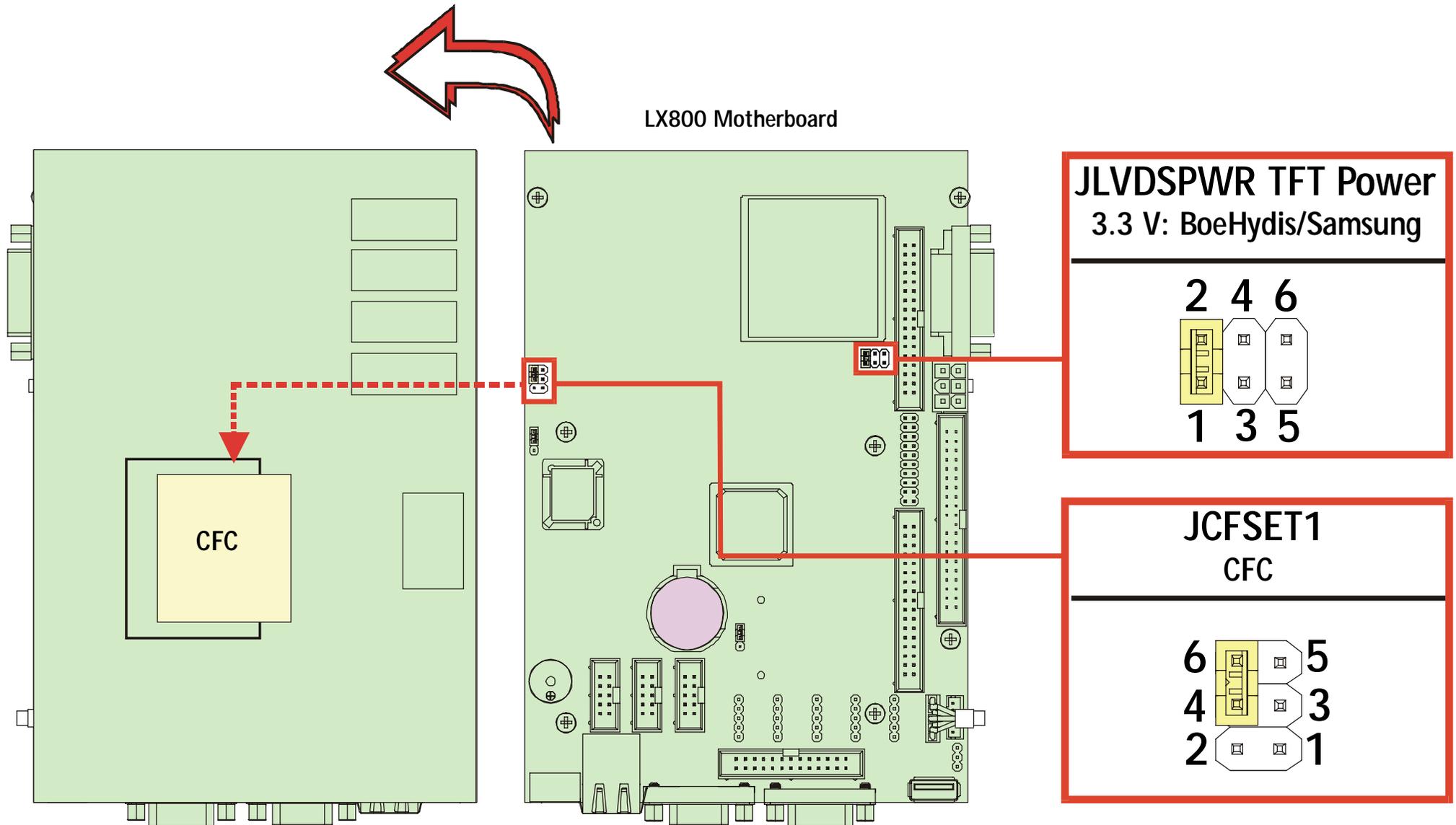
Pos.	Art. No.	Qty.	Description	Comments
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7.6.1 LX800 Motherboard

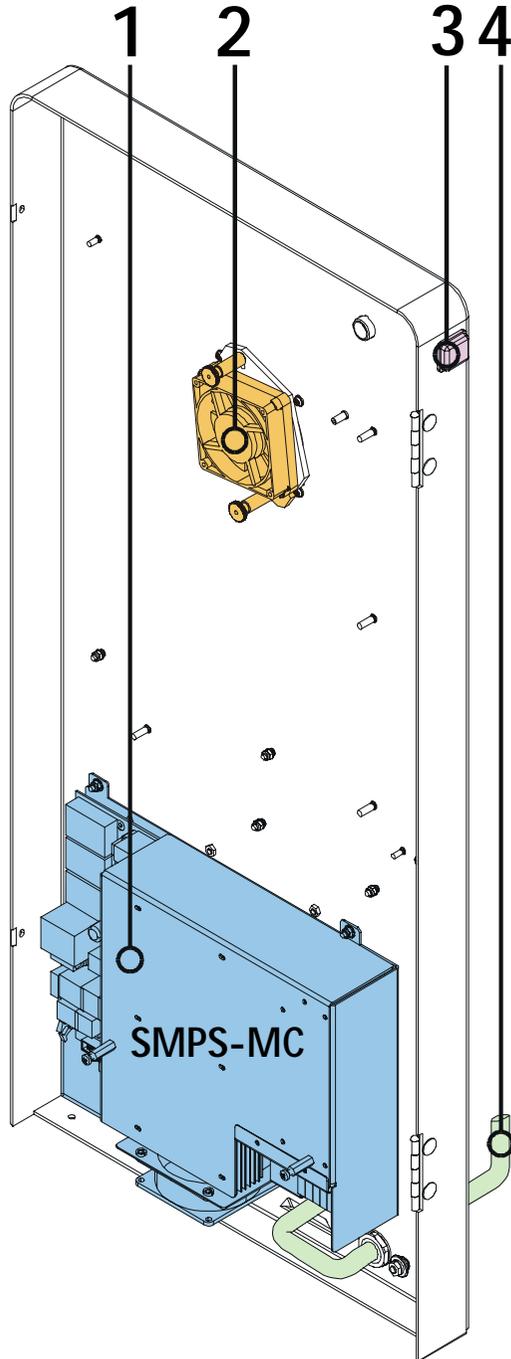
1	34560882	1	Compact flash card 1 GB	The SW for the machine has to be installed again after replacing the CFC.
2	34560610	1	LX800 Motherboard	
3	34519327	1	Battery BR2032, 3V	



7.6.2 Settings for TFT Display/CFC

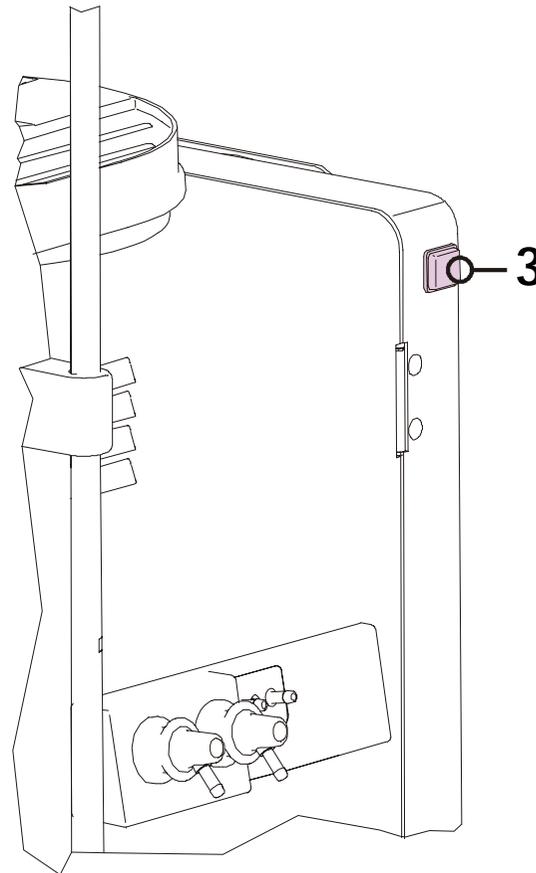


7.7 Rear Door



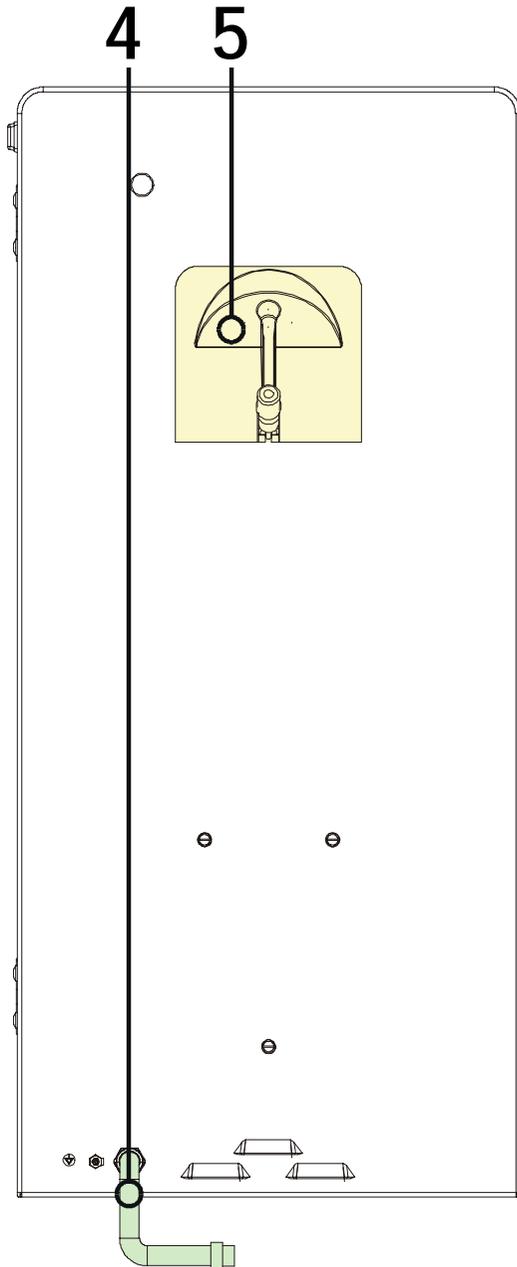
Pos.	Art. No.	Qty.	Description
1	34560220	1	Switch mode power supply microcontroller SMPS-MC, 110/240V, version 5
2	34561307	1	Fan 92 x 92 mm with connector
2	34570284	5	Dust filter
3	3451059A	1	Mains switch
3	34770003	5	Protection cap for mains switch
4	-	-	Mains cord

see separate figure (paragraph 7.7.1)

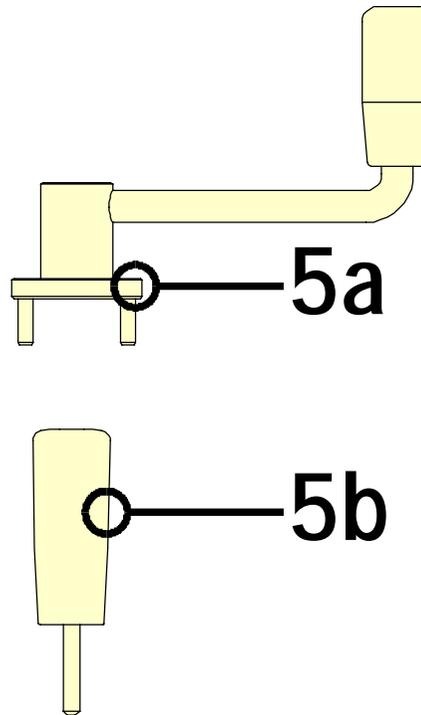


Rear Door

Pos.	Art. No.	Qty.	Description	Comments
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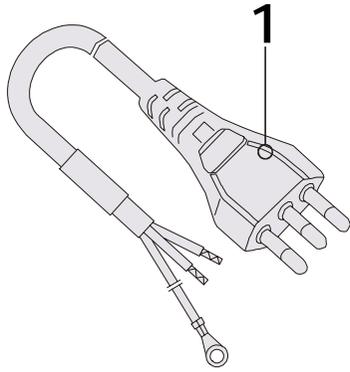


4	34518029	1	Strain relief	
5	3451441A	1	Tubing holder/fan cover	compatible to crank 5a/5b
5a	34518355	1	Crank for blood pump	
5b	34560157	1	Crank for blood pump	

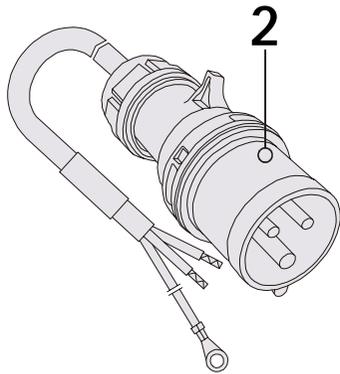


7.7.1 Mains Cord

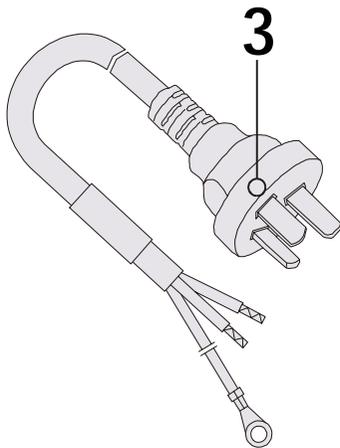
Pos.	Art. No.	Qty.	Description	Comments
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1	34561218	1	Mains cord (Brazil)	mains cord with mains plug
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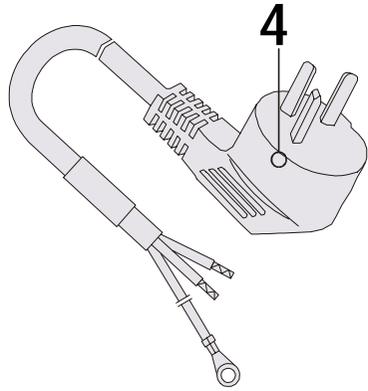


2	34561145	1	Mains cord (Cekon)	mains cord with mains plug
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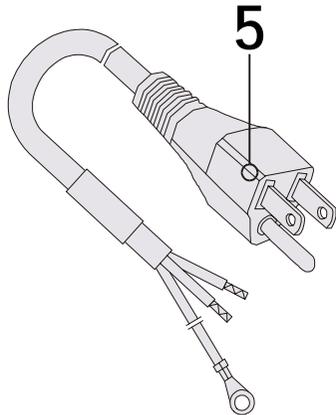


3	34561226	1	Mains cord (China)	mains cord with mains plug
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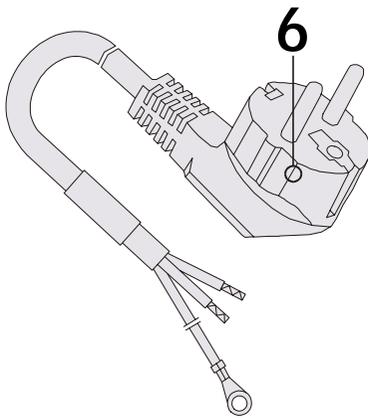
Pos.	Art. No.	Qty.	Description	Comments
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4	34561200	1	Mains cord (Israel)	mains cord with mains plug
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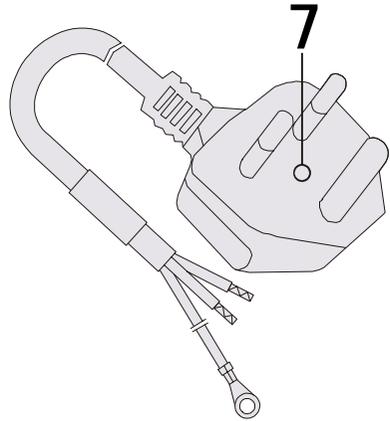


5	34561170	1	Mains cord (Philippines)	mains cord with mains plug
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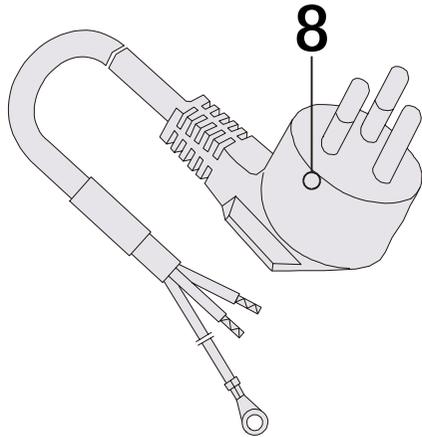


6	34561153	1	Mains cord (Schuko)	mains cord with mains plug
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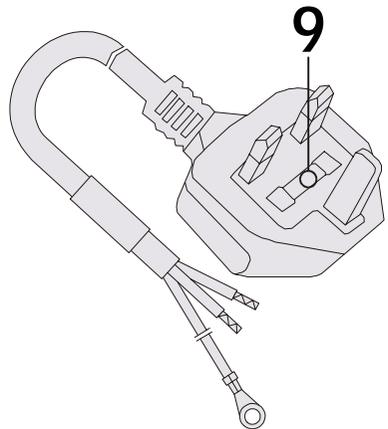
Pos.	Art. No.	Qty.	Description	Comments
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7	34561196	1	Mains cord (South Africa/India)	mains cord with mains plug
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8	34561234	1	Mains cord (Thailand)	mains cord with mains plug
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9	34561188	1	Mains cord (UK)	mains cord with mains plug
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Pos. Art. No. Qty.

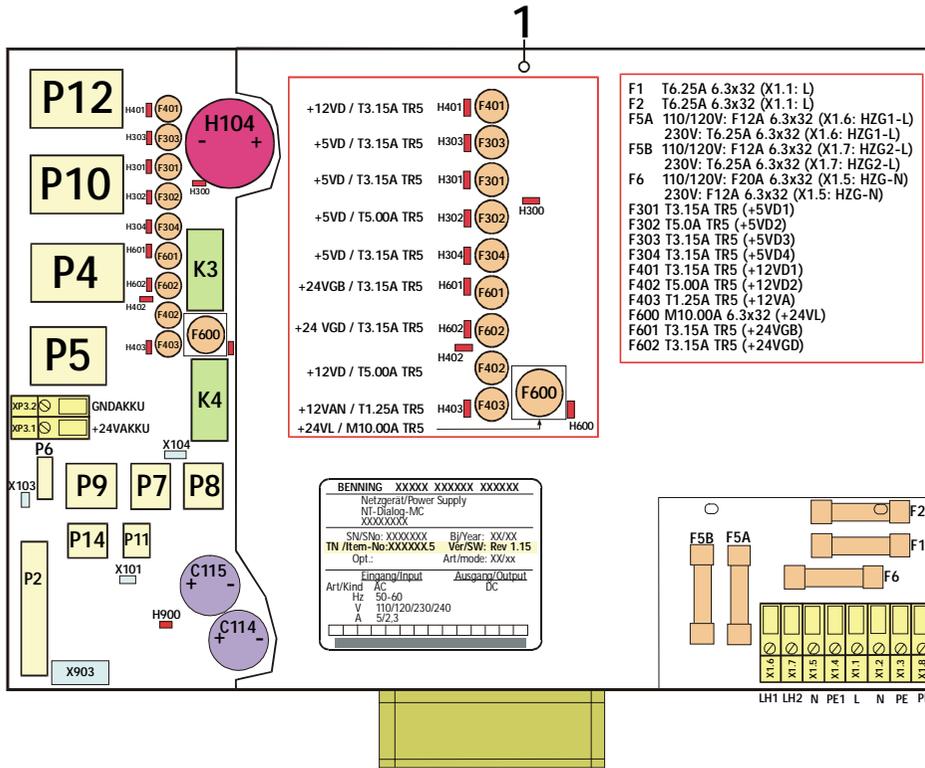
Description

Comments

## 7.7.2 Compatibility Table for Boards

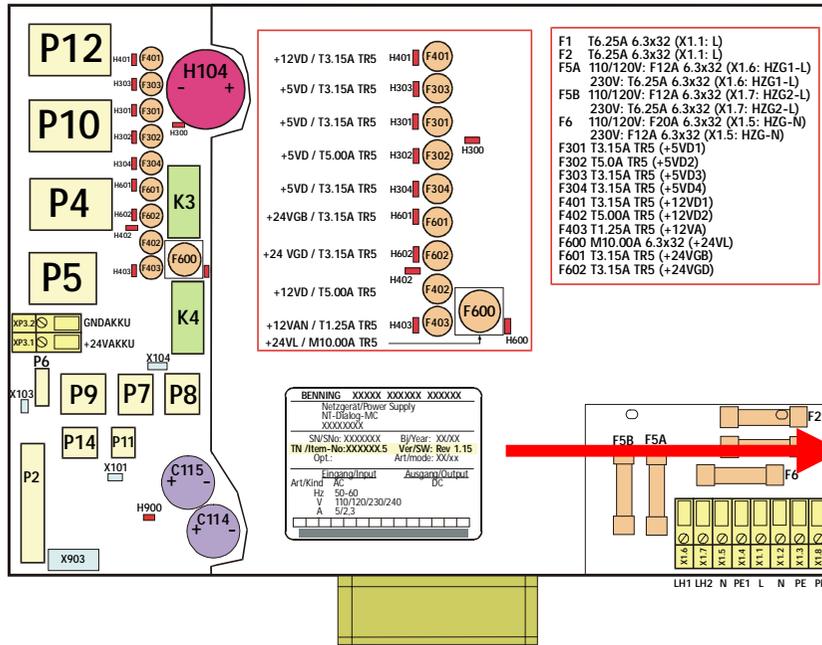
	Art. No.	Dialog+ SW 9.xx SMPS-MC	Dialog+ SW 9.xx SMPS-MC HDF Online
<b>Power Board Valves BPV</b>	34560769 (38108644)	X	X
<b>Power Board Motors BPM</b>	34560750 (38108643)	X	X
<b>Basic Board BB</b>	34560726 (38108640)	X	X
<b>Digital Board DB</b> After the replacement of a digital board: the LLS and LLC software must be reinstalled if the LLS or LLC software does not match with the software version in the machine. The digital board is always delivered with the latest LLS/LLC software versions!	34560740 (38108642)	X	X
<b>Analog Board AB</b>	34560734 (38108641)	X	X
<b>HDF Online Board HOB</b>	34560866 (38108647)	-	X
<b>MSBK Board</b>	3451665A (3810671X)	X	X

7.7.3 Switch Mode Power Supply Microcontroller SMPS-MC



Pos.	Art. No.	Qty.	Description	Comments
1	34560220	1	Switch mode power supply microcontroller SMPS-MC, 110/240V, version 5	see table 7.7.3.1
F1/F2	34570462	10	Fuse T6.25 A (6.3 x 32 mm)	
F5/F6	34771328	10	Fuse F12 A (6.3 x 32 mm)	for 230 V
F5/F6	34570187	10	Fuse M20 A (6.3 x 32 mm)	for 110/120 V
F301	34570160	10	Fuse T3.15 A (TR5)	
F302	34570470	10	Fuse T5 A (TR5)	
F303	34570160	10	Fuse T3.15 A (TR5)	
F304	34570160	10	Fuse T3.15 A (TR5)	
F401	34570160	10	Fuse T3.15 A (TR5)	
F402	34570470	10	Fuse T5 A (TR5)	
F403	34518819	10	Fuse T1.25 A (TR5)	
F600	34570179	10	Fuse M10 A (6.3 x 32 mm)	
F601	34570160	10	Fuse T3.15 A (TR5)	
F602	34570160	10	Fuse T3.15 A (TR5)	
K3/K4	34514775	2	Relay (12 V)	for 24 V
C114/C115	34519912	2	Capacitor 1F	
H104	34560580	1	Buzzer	
-	34560416	10	Plug for buzzer	

Switch Mode Power Supply Microcontroller SMPS-MC

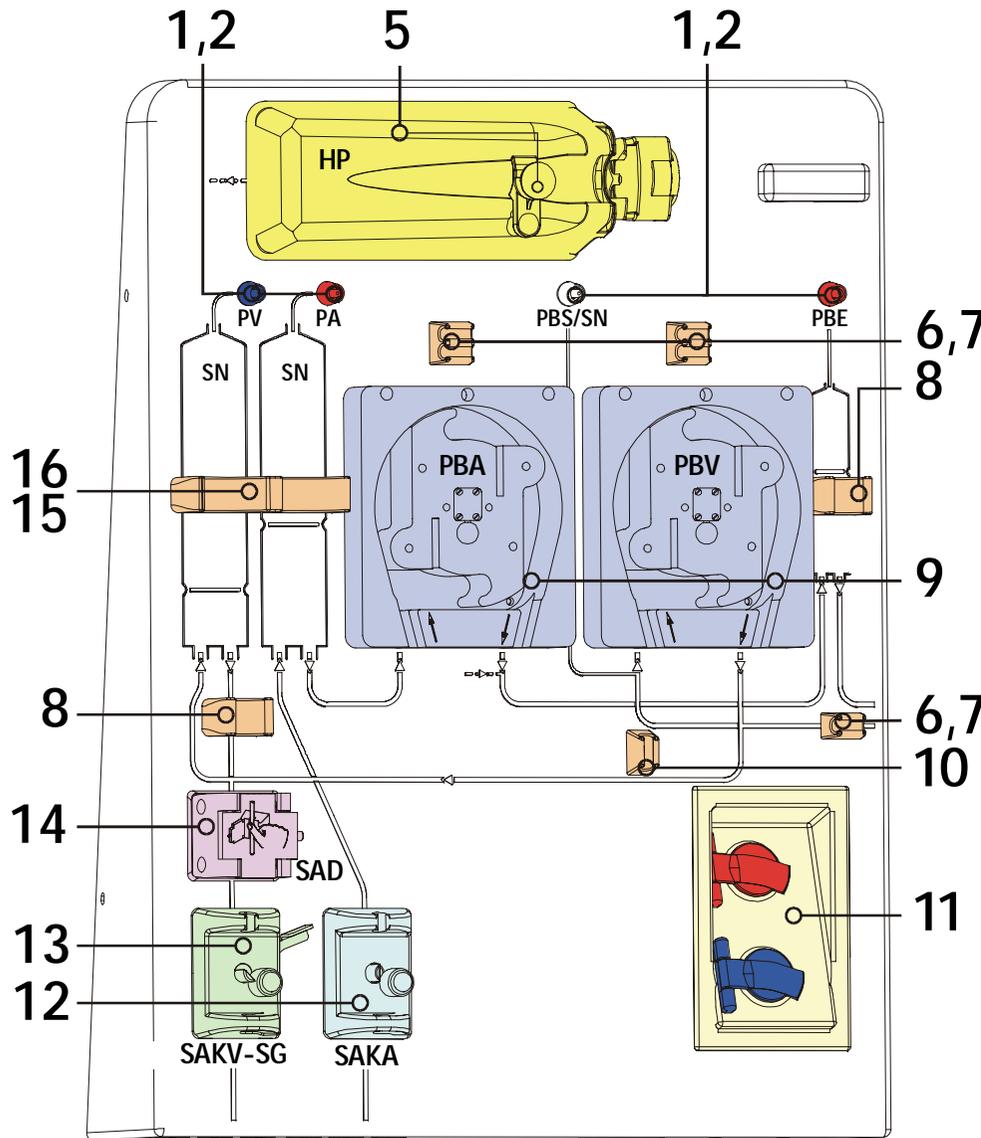


BENNING XXXXX XXXXXX XXXXXX	
Netzgerät/Power Supply	
NT-Dialog-MC	
XXXXXXXXXX	
SN/SNo: XXXXXXXX	Bj/Year: XX/XX
TN /Item-No: XXXXXX.5	Ver/SW: Rev 1.15
Opt.:	Art/mode: XX/xx
Eingang/Input	
Ausgang/Output	
Art/Kind	AC
Hz	50-60
V	110/120/230/240
A	5/2,3
DC	

7.7.3.1 Compatibility Table SMPS-MC  
SMPS-MC Type Plate

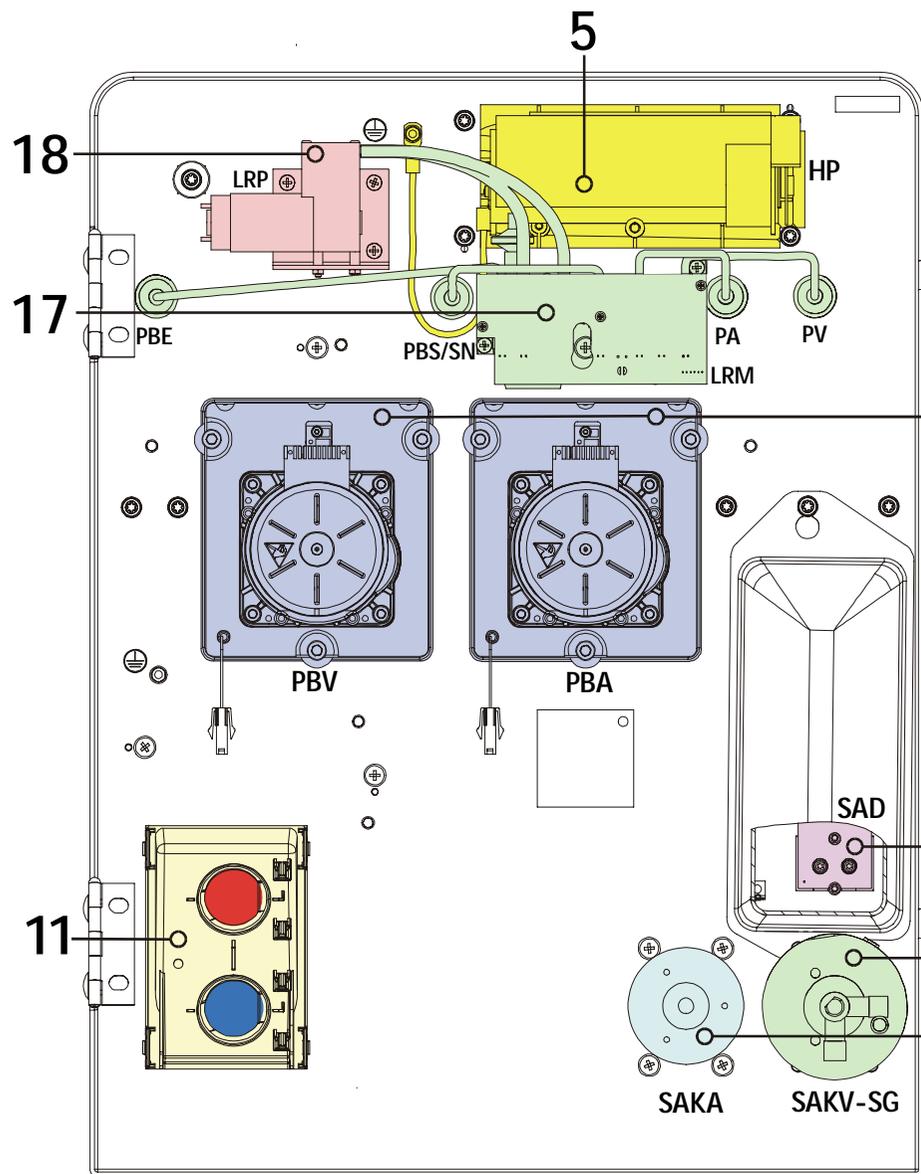
Version Number SMPS-MC (TN/Item-No)	SW Version (Ver/SW)	Dialog+ SW 9.xx
34560220 (version 5)	XXXXXX.5	Rev. 1.15
		X ex works

7.8 Front Door

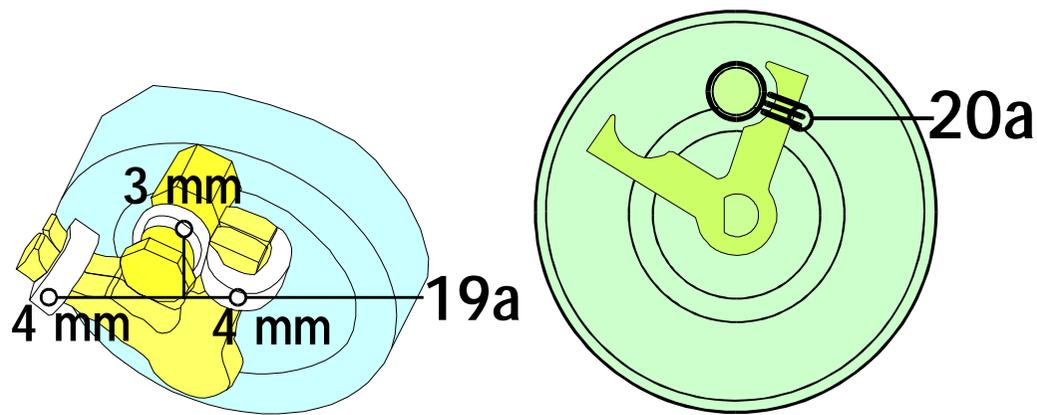


Pos.	Art. No.	Qty.	Description	Comments
1	34516352	1	Pressure sensor	see also position 24
2	3457058A	5	Manometer connection (white), for PBS/SN	with plastic nut A and
2	3451833A	5	Manometer connection (red), for PA/PBE	safety disc B (pay attention to
2	3451884A	5	Manometer connection (blue), for PV	correct assembly, see left figure)
5	3451432B	1	Heparin pump Compact	
5	34560785	1	Housing with seal	
5	34514732	1	Syringe holder	
5	34570640	5	Dummy plug	
5	34570667	1	Clamp	
5	34570659	1	Unlocking lever set	
6	34570535	1	Single tubing holder	∅ 6.8 mm
7	34570543	1	Double tubing holder	∅ 6.8 mm
8	34570527	1	Single holder, small	
9	34560793	1	Blood pump without roller	see separate figure
9	34561331	1	Pump head with cover	
9	34560947	1	Drive unit for blood pump (SW 1.7.4)	
9	34560807	1	Roller 8x12 for blood pump	
9	34570616	5	Latch	
9	3451669E	1	Cover for blood pump	without hinge pin (see separate figure)
9	34560025	1	Magnet ∅ 5 mm	for cover
9	34560033	1	Metal disc ∅ 10 mm	for cover
9	34519823	1	Hinge pin with interior thread	hinge pin
9	34516670	1	Seal for blood pump	

Front Door

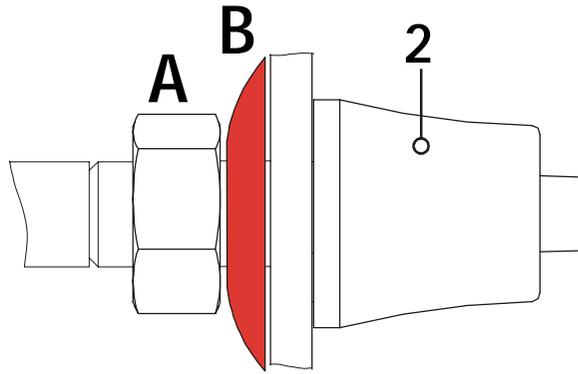


Pos.	Art. No.	Qty.	Description	Comments
10	34570560	1	Single tubing holder	∅ 6 mm
11	3451415A	1	Cover complete	
12	3456000A	1	Rotary magnet	for SAKA
12	34570578	1	Cover with tubing holder	for SAKA
12a	34570675	10	Soft stopper	for SAKA, set for 10 rotary magnets, with 20 x 4 mm, 10 x 3 mm
13	34514107	1	Rotary magnet (currentless closed)	for SAKV-SG
13	34514317	1	Cover with tubing holder	for SAKV-SG
13a	34570624	9	O-ring 7.0 x 1.5	for SAKV-SG
14	3456005C	1	SAD version 3 with red detector	see separate figure (paragraph 7.8.4)
9	15	1	Double holder, big	
16	34570519	1	Single holder, big	
17	34560815	1	Valve block level regulation (single pump)	see separate figure (paragraph 7.8.5)
17	34560831	1	Valve block level regulation (double pump)	see separate figure (paragraph 7.8.5)
18	34560823	1	Diaphragm pump	with assembly elbow



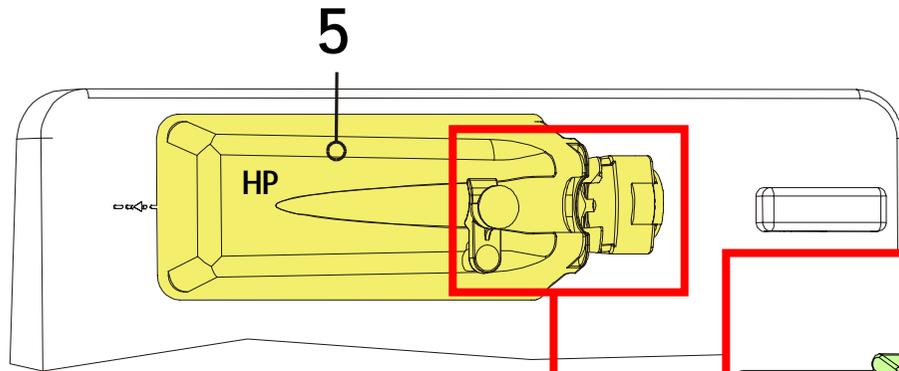
Pos.	Art. No.	Qty.	Description	Comments
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7.8.1 Manometer Connection

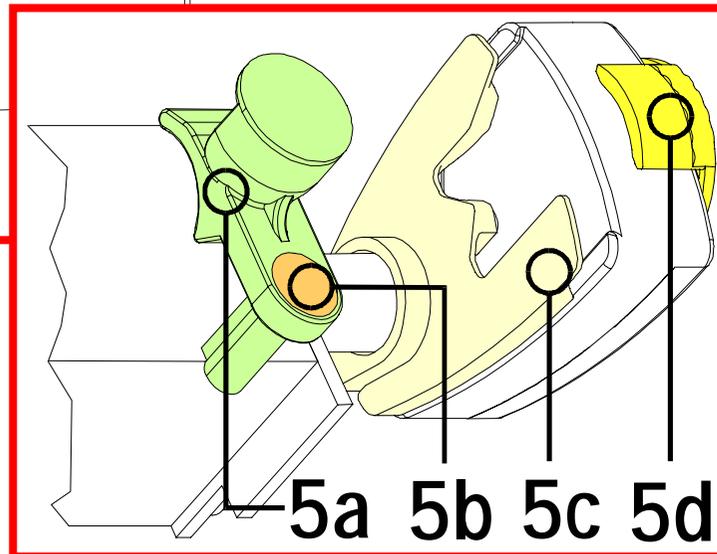


2	3457058A	5	Manometer connection (white), for PBS/SN	with plastic nut A and
2	3451833A	5	Manometer connection (red), for PA/PBE	safety disc B (pay attention to
2	3451884A	5	Manometer connection (blue), for PV	correct assembly, see left figure)

7.8.2 Heparin Pump

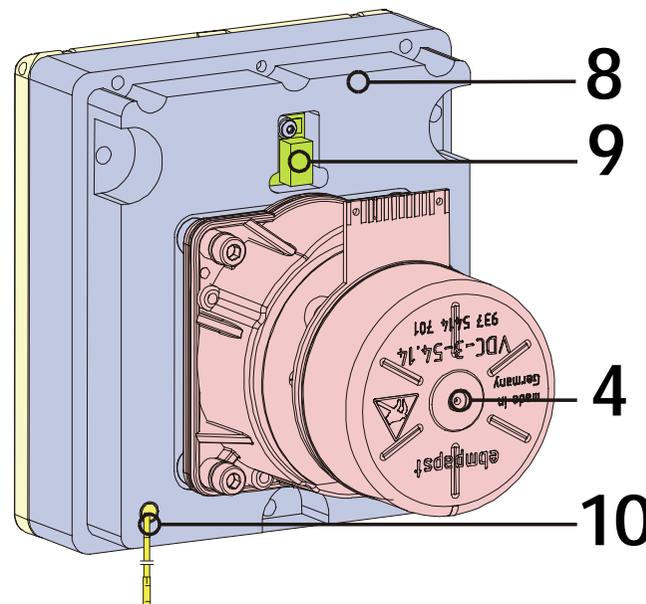
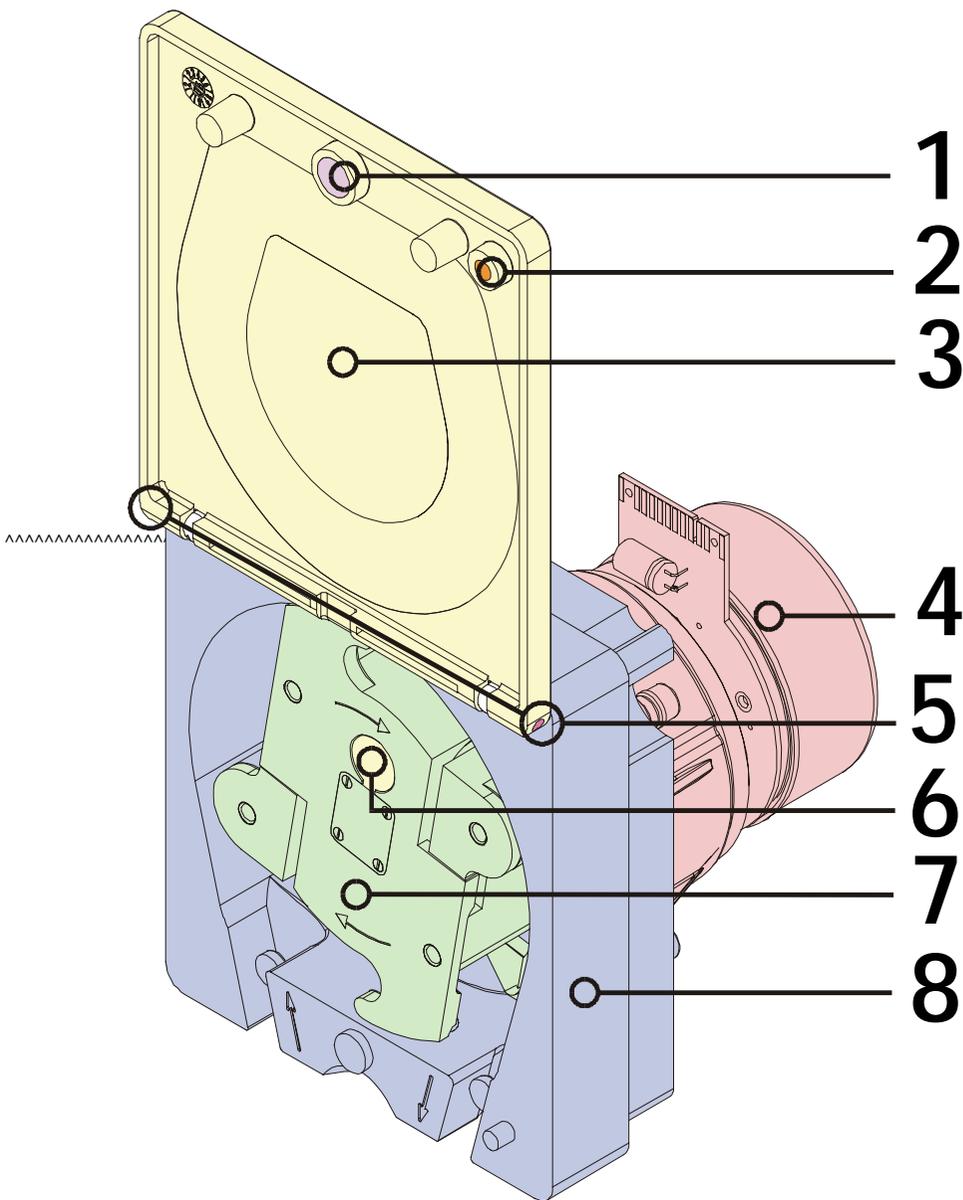


5	3451432B	1	Heparin pump Compact
5	34560785	1	Housing with seal
5a	34514732	1	Syringe holder
5b	34570640	5	Dummy plug
5c	34570667	1	Clamp
5d	34570659	1	Unlocking lever set



7.8.3 Blood Pump

Pos.	Art. No.	Qty.	Description	Comments
1	34560033	1	Metal disc Ø 10 mm	for cover, use Loctite 406
2	34560025	1	Magnet Ø 5 mm	for cover, use Loctite 406
3	3451669E	1	Cover for blood pump	without hinge pin (see separate figure)
4	34560947	1	Drive unit for blood pump (SW 1.7.4)	
5	34519823	1	Hinge pin with interior thread	hinge pin
6	34570616	5	Latch	
7	34560807	1	Roller 8x12 for blood pump	
8	34561331	1	Pump head with cover	without drive unit
8	34560793	1	Blood pump without roller	complete with drive unit and cover
9	34561358	1	Direction of rotation board for blood pump	
10	34517138	1	Reed sensor with contacts and o-ring 3.68 x 1.78	
-	34516670	1	Seal for blood pump	
-	7703708	1	Grease SKD 4002	100 g tube (to lubricate the shaft of the blood pump)

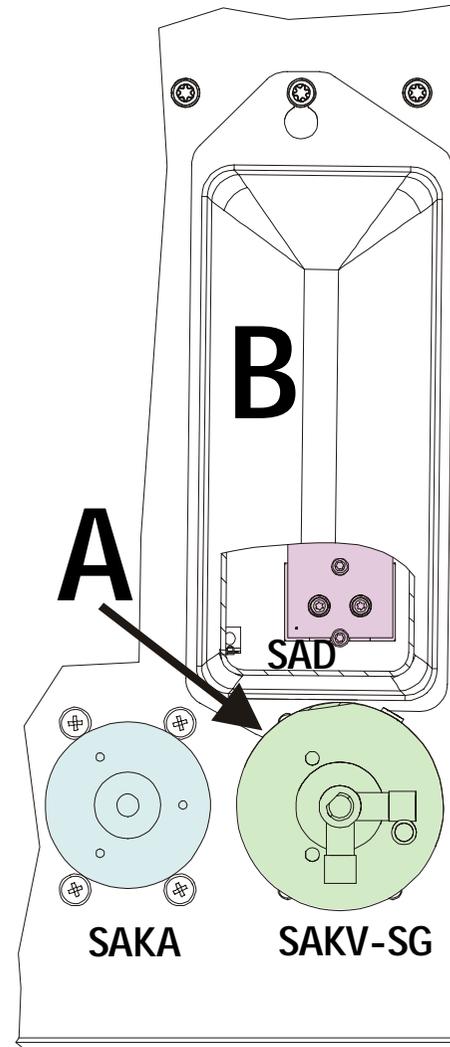
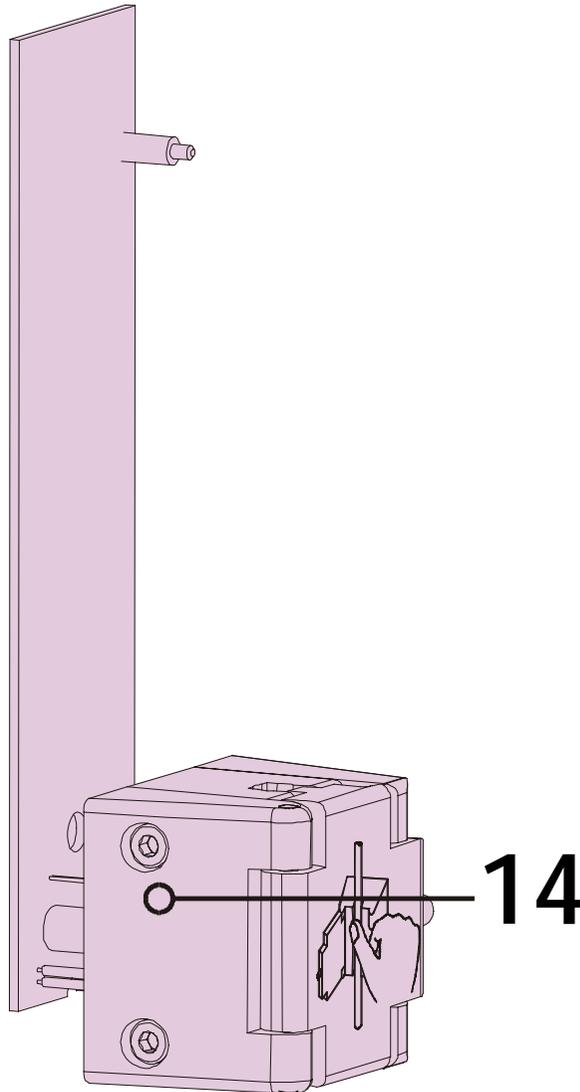


Pos.	Art. No.	Qty.	Description	Comments
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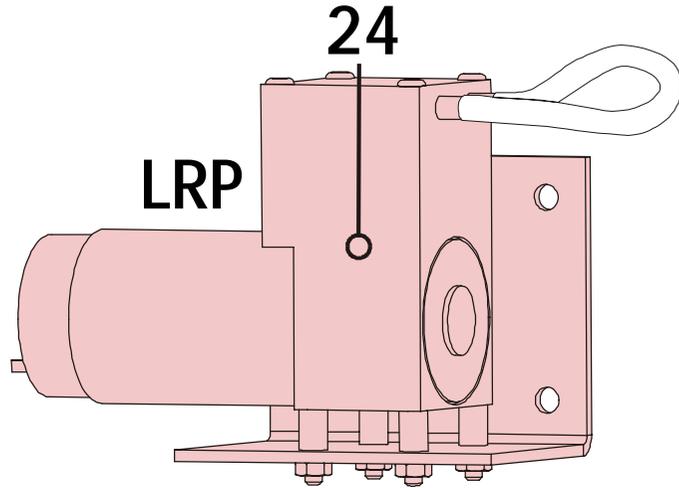
7.8.4 Safety Air Detector SAD

14	3456005C	1	SAD version 3 with red detector	
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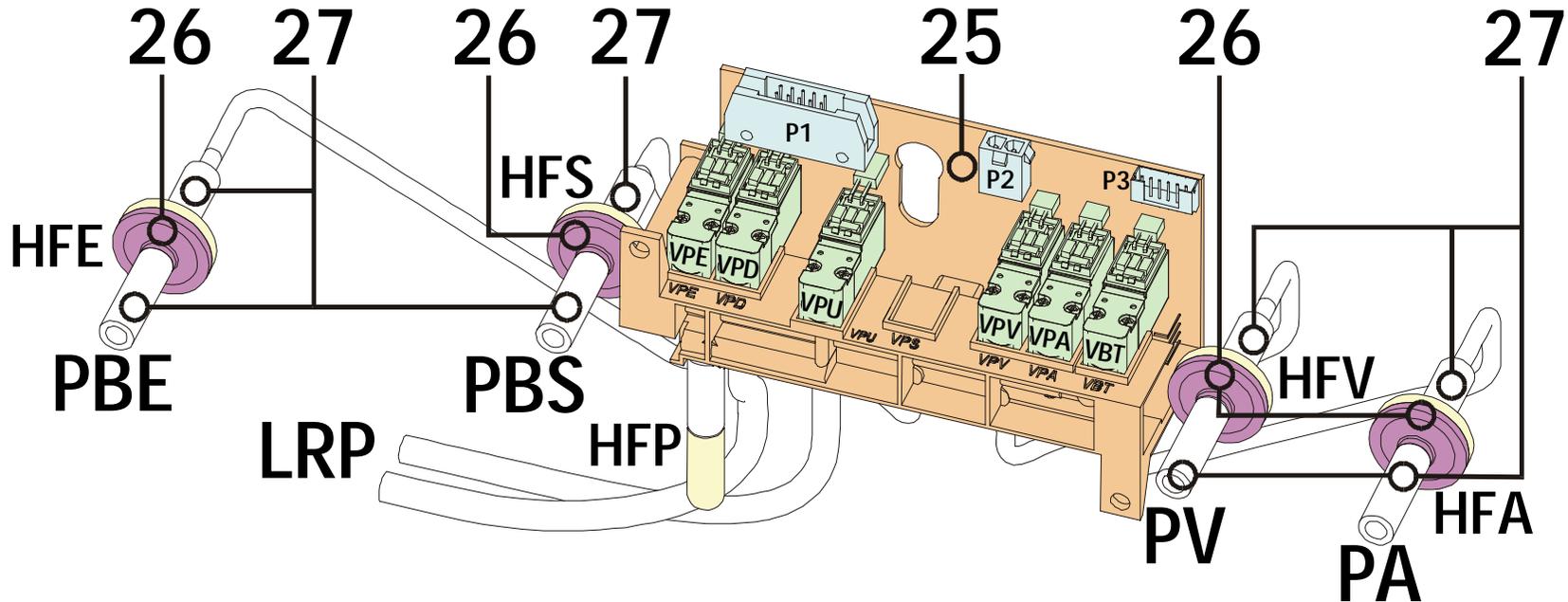
SAD with board; do not tamper, exchange only complete  
 If cover for SAD is present: a ball head allen key 2.5/3 is required for bottom screw behind rotary magnet.



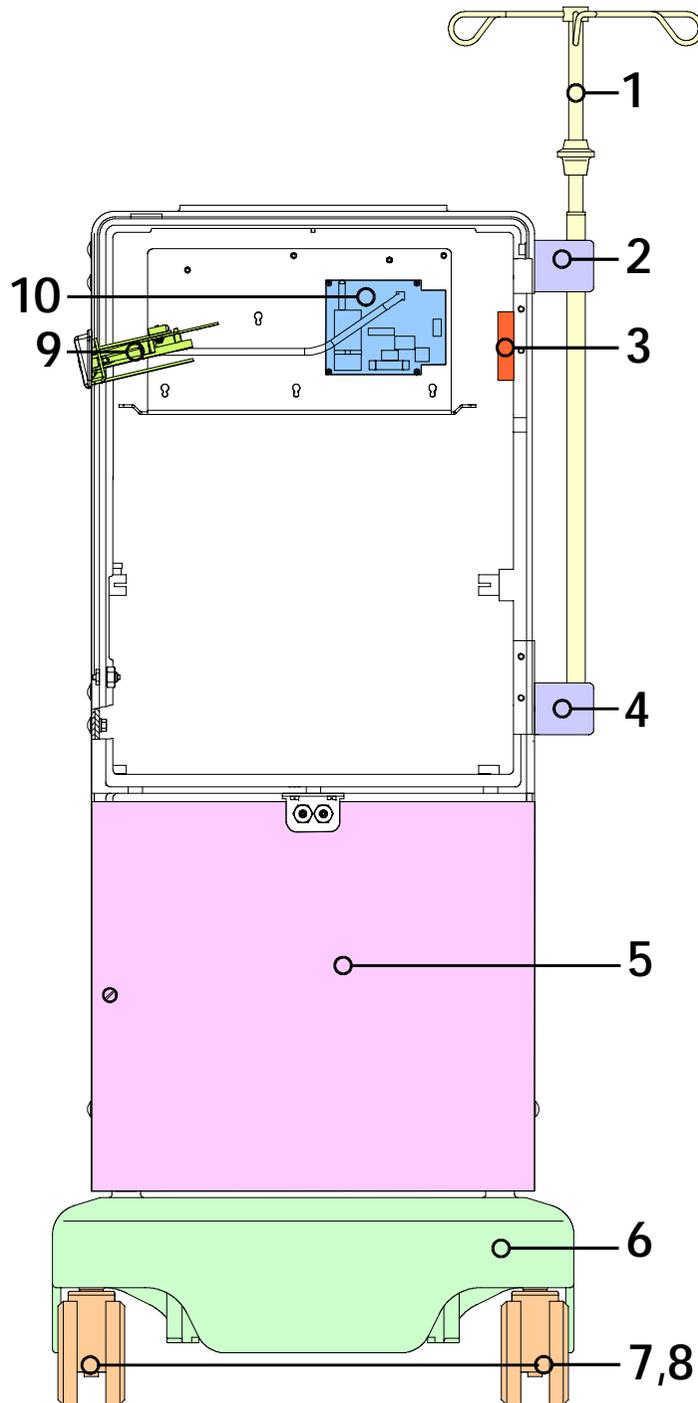
7.8.5 Level Regulation Module



Pos.	Art. No.	Qty.	Description	Comments
24	34560823	1	Diaphragm pump	LRP with assembly elbow
25	34560815	1	Valve block level regulation (single pump)	complete with 3 pressure sensors (for PA, PV, PBE), 6 valves, incl. filter and tubing
25	34560831	1	Valve block level regulation (double pump)	complete with 4 pressure sensors (for PA, PV, PBE, PBS), 6 valves, incl. filter and tubing
26	34516409	1	Filter	pay attention to the assembly position of the filter: transparent side towards the block
27	34565205	5m	PUR tubing 3.6 x 1.1 (5 m)	for manometer connection (filter)



7.9 Basic Housing

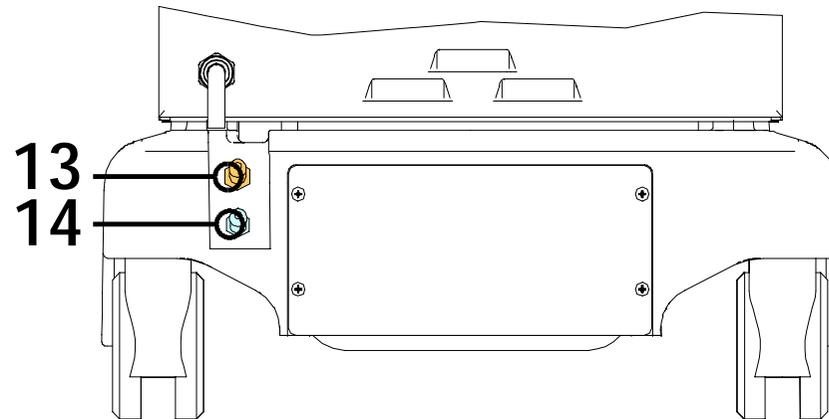
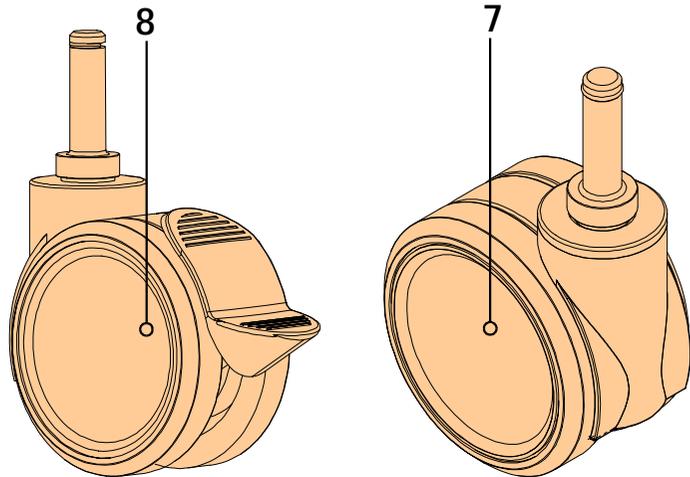
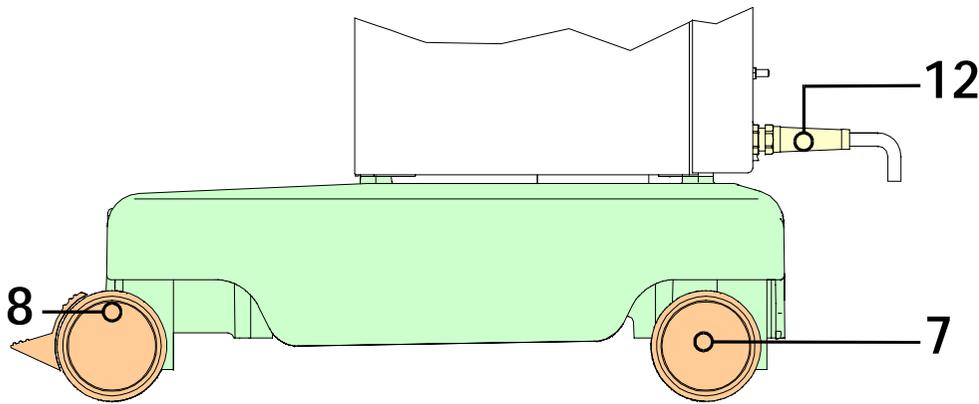


Pos.	Art. No.	Qty.	Description	Comments
1	3451962A	1	IV pole version 2	height adjustable
2	3451439A	1	Holder, top	
3	34514929	1	Loudspeaker	
4	3451438A	1	Holder, bottom	
5	34517804	1	Front panel, bottom	
6	34561269	1	Base platform	
6	34519564	1	Silicone profile	
7	3451489A	1	Swivel caster	
8	3451490A	1	Swivel caster with brake	
9	34560548	1	Card-Reader-Board	see 7.22 for details
10	3451487C	1	ABPM module M2009 with filter	see 7.19 for details

Basic Housing

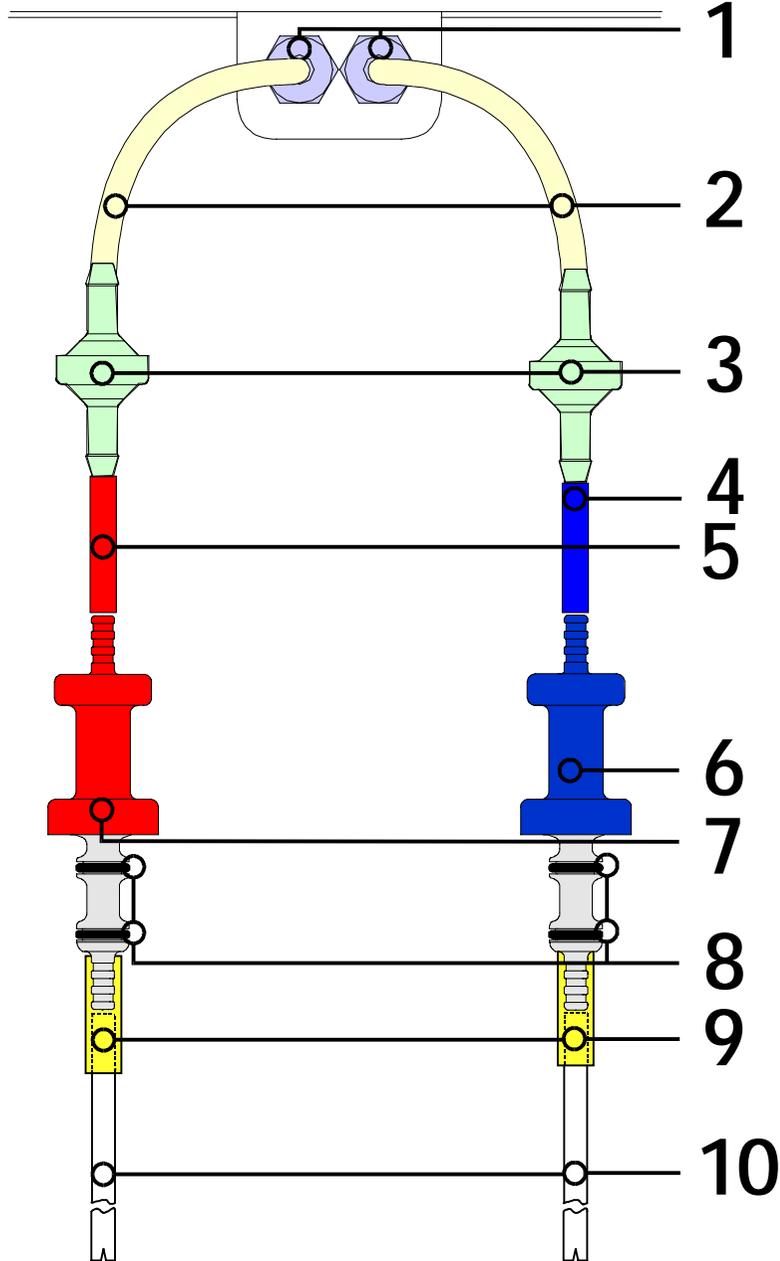
Pos.	Art. No.	Qty.	Description	Comments
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7	3451489A	1	Swivel caster	
8	3451490A	1	Swivel caster with brake	
12	34518029	1	Strain relief	
13	34560122	1	Double tubing connector 11xM12	stainless steel, for water inlet
14	34560130	1	Double tubing connector 11xM12	plastic, for dialysate outlet
-	34770852	5	O-ring 11.1 x 1.6	
-	34771271	10	Tubing clamp 15/9	
-	39234126	1	Tubing clamp 12-20 mm	
-	34565140	50m	PVC tubing 10 x 3, red	for water inlet
-	3456517A	1	PVC tubing 10 x 3 / red (3 m), with two single ear clamps 19.5	for water inlet
-	34565159	50m	PVC tubing 10 x 3, black	for dialysate outlet
-	3456518A	1	PVC tubing 10 x 3 / black (3 m), with a single ear clamps 19.5 and a tubing clamp 12-20 mm	for dialysate outlet
-	34565167	3m	Silicone tubing 8 x 3.2 / red (3 m), with two single ear clamps 17.5	external high temperature tubing
-	39224538	1	Single ear clamp 17.5	for external high temperature tubing



Pos.	Art. No.	Qty.	Description	Comments
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7.9.1 Concentrate Suction Rods



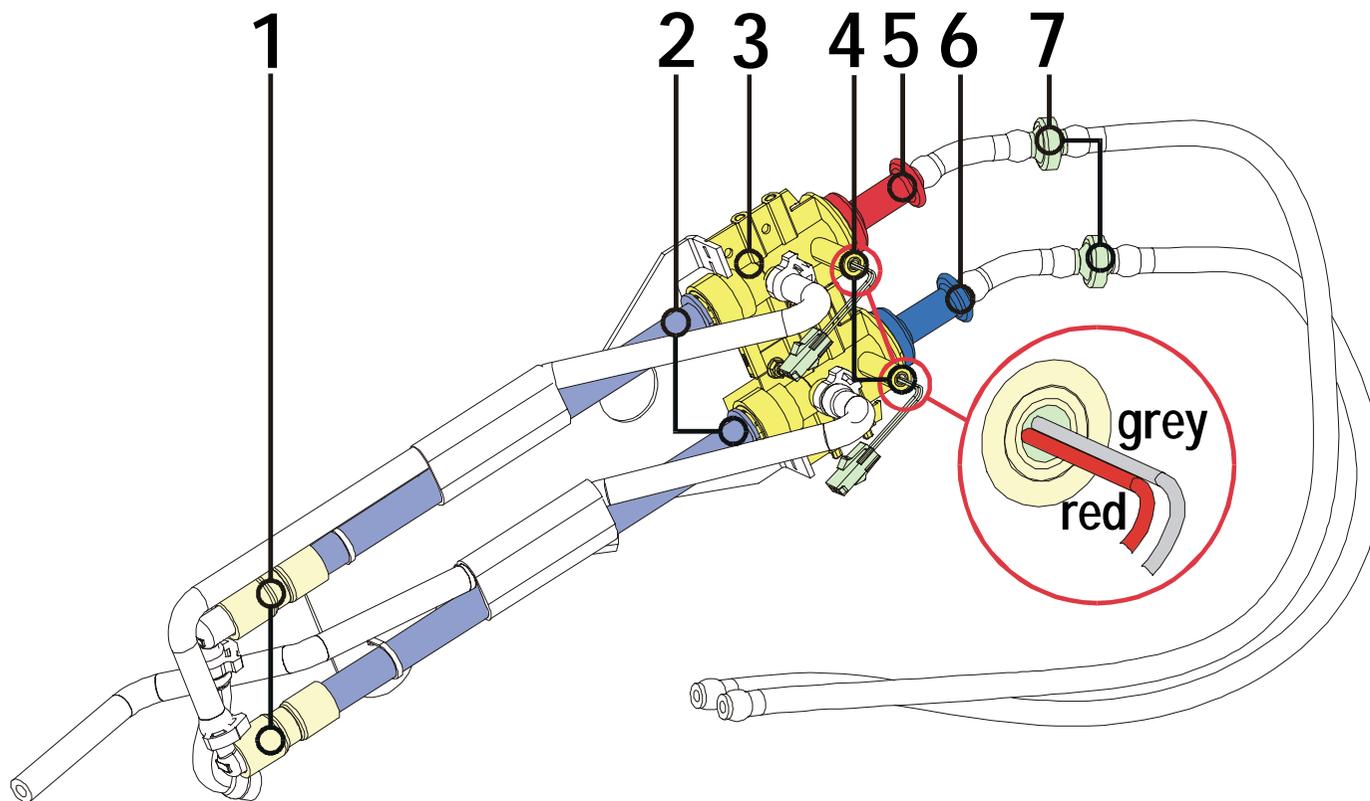
1	3451726A	1	Feed-through connector	
2	34565213	10m	Silicone tubing 2.9 x 3 (10 m)	
3	34517782	5	Disposable filter	
4	34565248	10m	Silicone tubing 5 x 1.5 / blue (10 m)	
5	34565230	10m	Silicone tubing 5 x 1.5 / red (10 m)	
6	3451475A	1	Male connector (blue) with o-rings	
7	3451476A	1	Male connector (red) with o-rings	
8	34570004	5	O-ring 9.3 x 2.4	
9	34565280	3m	Silicone tubing 3.2 x 1.6 (3 m)	
10	3451728A	1	PE tube 4 x 1	

with silicone tubing

Pos. Art. No. Qty. Description Comments

7.9.2 Rinsing Chambers for Concentrate Suction Rods

1	34565345	1m	Silicone tubing 12 x 2.5 (1 m)	
2	34560777	1	Retainer tubes (blue) for suction rods	1 x 260 mm and 1 x 280 mm
3	34514120	1	Retainer for suction rods	
4	34517138	1	Reed sensor with contacts and o-ring 3.68 x 1.78	Pay attention to the assembly position of the reed sensors (red left/grey right)
5	3451476A	1	Male connector (red) with o-rings	
6	3451475A	1	Male connector (blue) with o-rings	
7	34517782	5	Disposable filter	

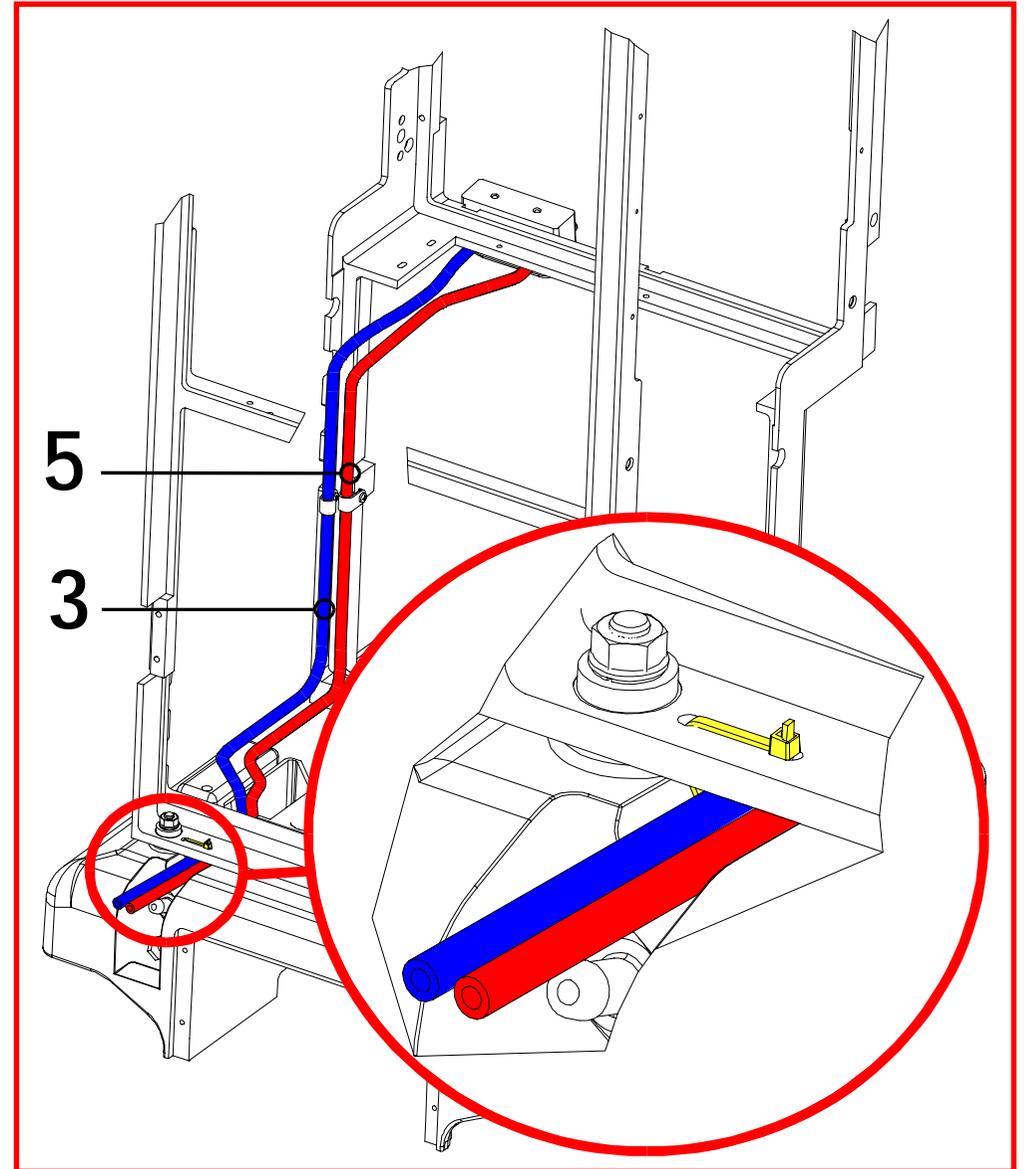
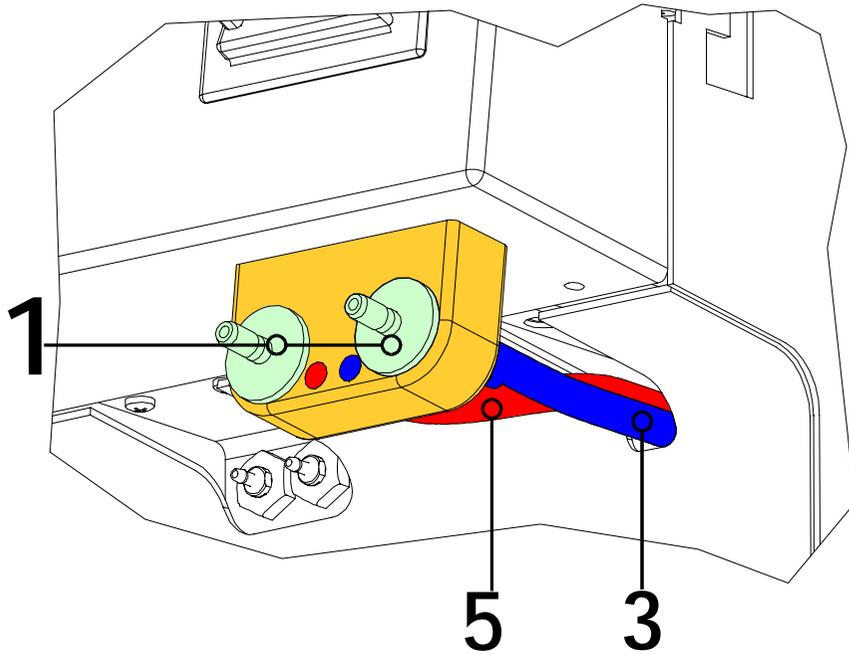




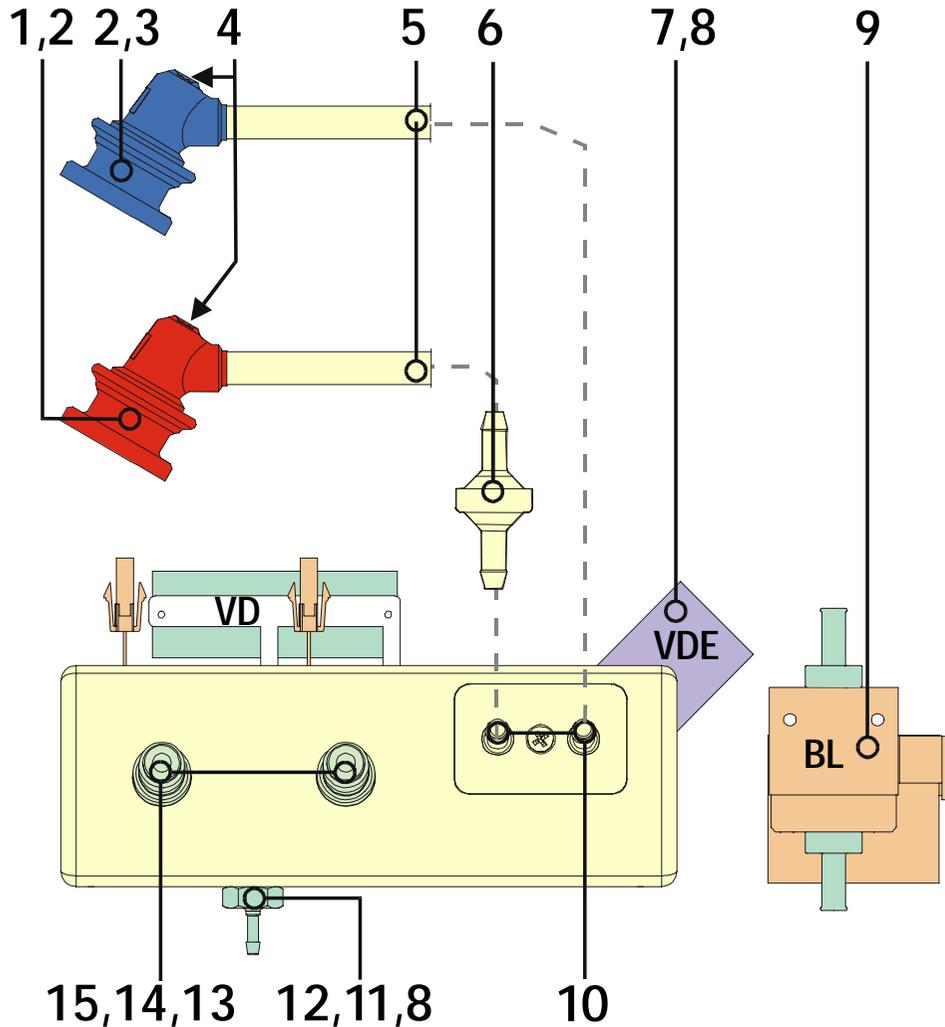
Pos.	Art. No.	Qty.	Description	Comments
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Central Concentrate Supply (Option)

3	34565248	10m	Silicone tubing 5 x 1.5 / blue (10 m)	
5	34565230	10m	Silicone tubing 5 x 1.5 / red (10 m)	



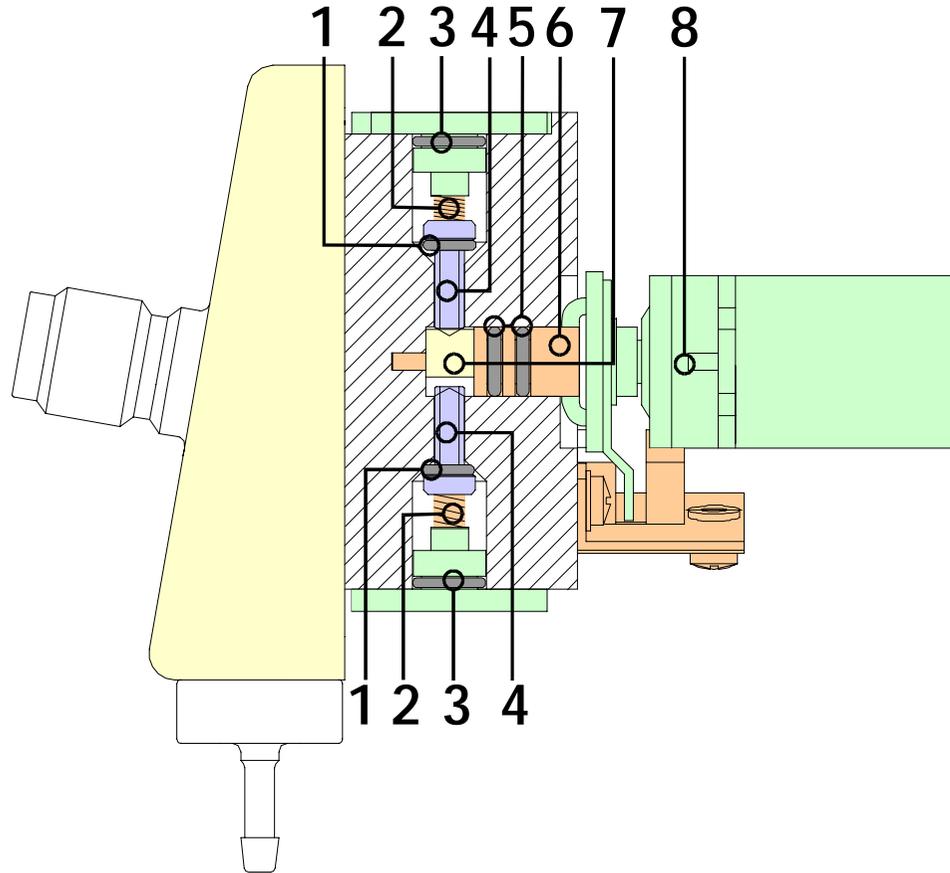
7.9.4 Rinsing Bridge 4



Pos.	Art. No.	Qty.	Description	Comments
1	3451445A	1	Dialyser coupling, red	
2	34990445	5	O-ring 12.37 x 2.62	for dialyser coupling
3	3451446A	1	Dialyser coupling, blue	
4	34773550	20	Membrane for dialyser coupling	
5	34565191	10m	Silicone tubing 5 x 3 (10 m)	
6	34517782	5	Disposable filter	
7	34560270	1	Solenoid valve 2/2 way	connector/flange (DPP)
8	34770852	5	O-ring 11.1 x 1.6	
9	3451908C	1	Blood leak detector 3	replaces version 2
10	34773762	10	O-ring 9.25 x 1.78	
11	34517251	1	Tubing connector Ø 3.5 x 1/8"	stainless steel
12	34517294	1	Suction set with tubing, suction port and black lid	for disinfection
12	34514562	1	Suction set with tubing, suction port and yellow lid	for disinfection
12	34565272	10m	PVC tubing 3.5 x 1 (10 m)	for disinfection
12	34512675	1	Suction port	for suction tubing
13	34511792	1	Tubing coupling	
14	34517138	1	Reed sensor with contacts and o-ring 3.68 x 1.78	
15	34771255	20	O-ring 14 x 1.5	

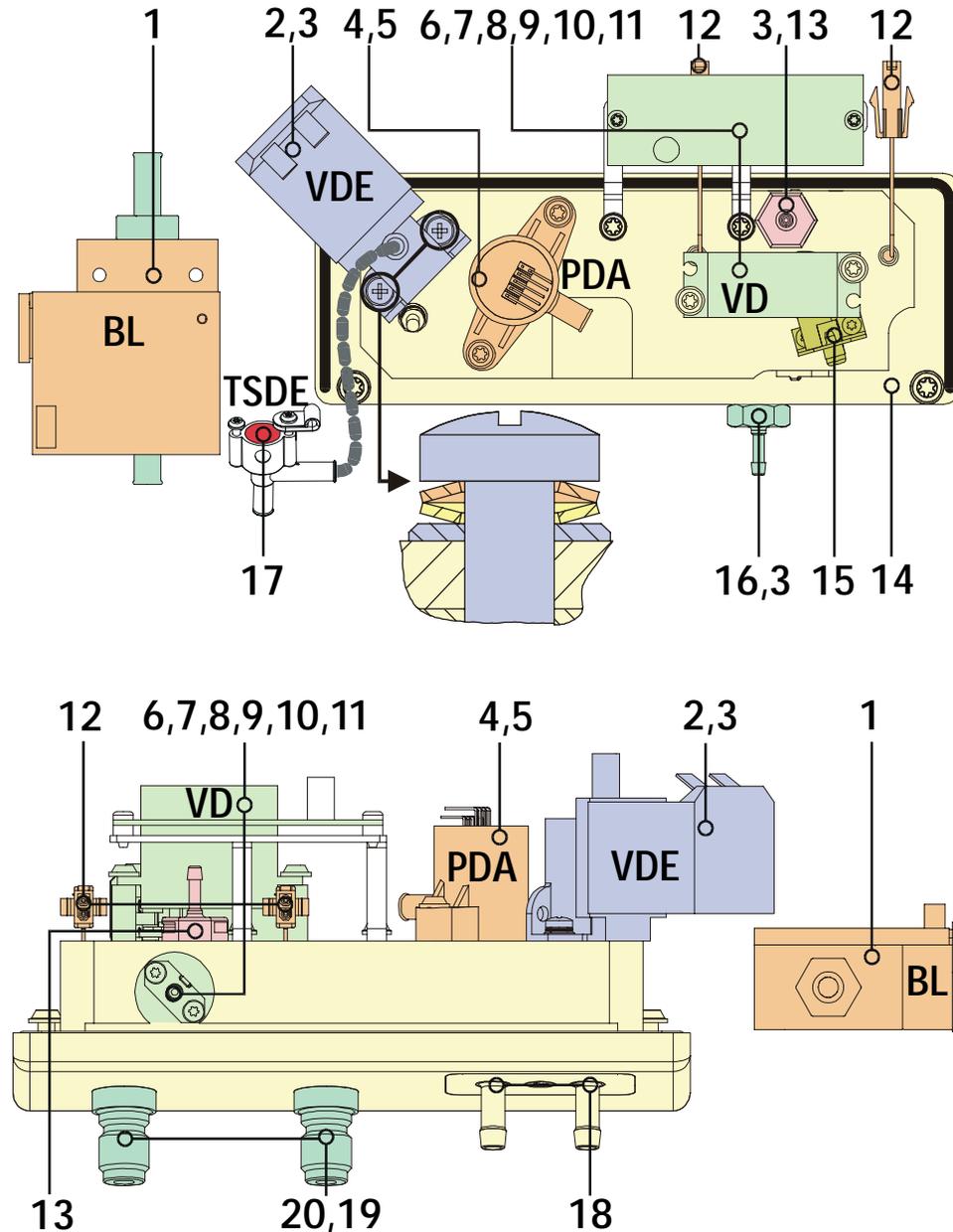
Rinsing Bridge 4

Pos.	Art. No.	Qty.	Description	Comments
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-	3451898B	1	Repair kit disinfection valve consisting of: 2 x O-ring 2.7 x 1.5 2 x O-ring 5 x 1.6 3 x O-ring 6.4 x 1.3 2 x Cover 4 x Countersunk screw M3x8 2 x Valve tappet 2 x Pressure spring 1 x Eccentric roller 1 x Eccentric shaft	for the complete replacement of all small parts in the disinfection valve
1	34570012	10	O-ring 2.7 x 1.5	for valve tappet
2	34517332	2	Pressure spring	for valve tappet
3	3477106A	5	O-ring 6.4 x 1.3	for cover valve tappet
4	34517324	2	Valve tappet	for VD
5	34570457	10	O-ring 5.0 x 1.6	for eccentric shaft
6	34560858	1	Eccentric roller	
7	34560840	1	Eccentric shaft	
8	3451659D	1	Servomotor with board	for VD, servomotor and board must be exchanged together

Rinsing Bridge 4

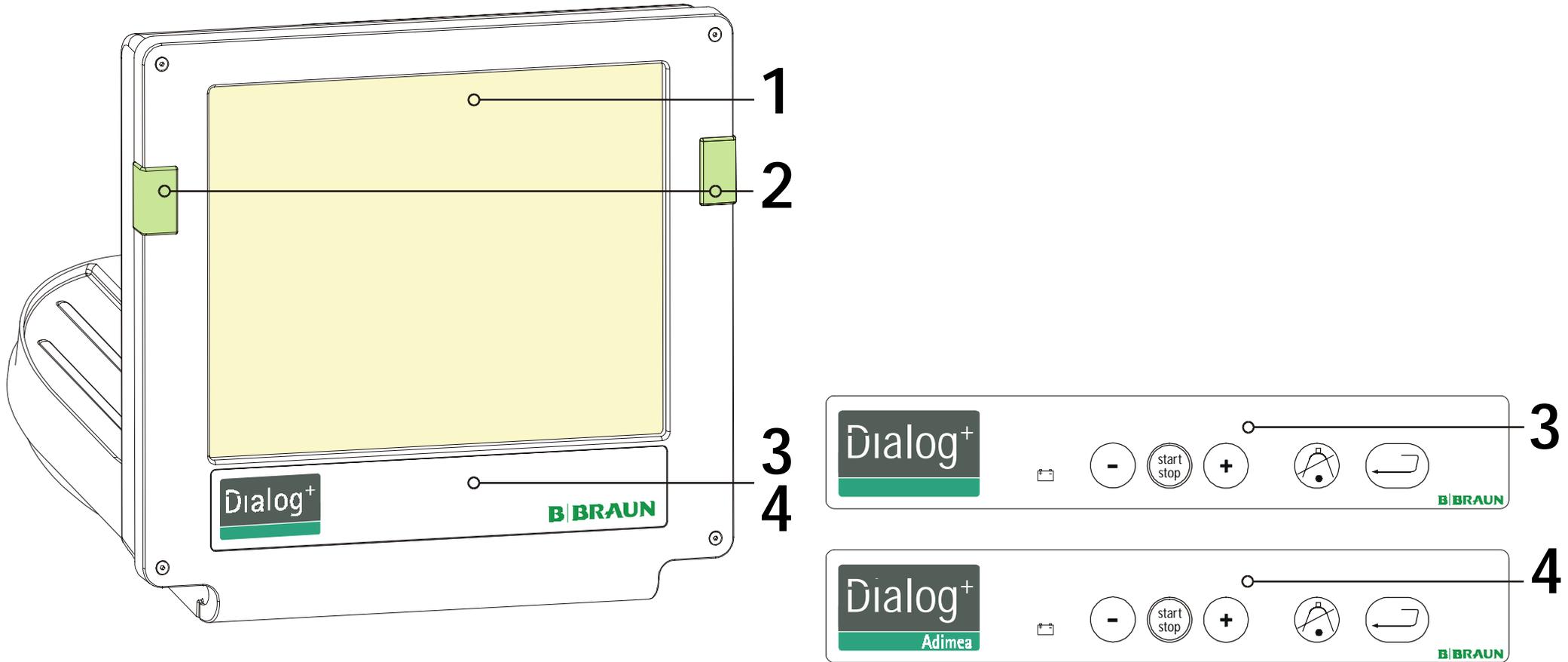


Pos.	Art. No.	Qty.	Description	Comments
1	3451908C	1	Blood leak detector 3	replaces version 2
2	34560270	1	Solenoid valve 2/2 way	connector/flange (DPP)
3	34770852	5	O-ring 11.1 x 1.6	
4	34561242	1	Pressure sensor	
5	34773762	10	O-ring 9.25 x 1.78	
6	34570012	10	O-ring 2.7 x 1.5	for valve tappet
7	34517332	2	Pressure spring	for valve tappet
8	3477106A	5	O-ring 6.4 x 1.3	for cover valve tappet
9	34517324	2	Valve tappet	for VD
10	34570457	10	O-ring 5.0 x 1.6	for eccentric shaft
11	3451659D	1	Servomotor with board	for VD
12	34517138	1	Reed sensor with contacts and o-ring 3.68 x 1.78	without housing
13	3477103A	2	Tubing connector Ø 3.5 x 1/8"	
14	34514627	1	Rinsing bridge housing, version 4	
15	34516603	1	Fork light barrier for servomotor	
16	34517251	1	Tubing connector Ø 3.5 x 1/8"	
17	3451614B	1	Temperature sensor	with shrinking tube, without connector/housing
17	34570730	1	Housing complete for temperature sensor	
18	34773762	10	O-ring 9.25 x 1.78	
19	34511792	1	Tubing coupling	
20	34771255	20	O-ring 14 x 1.5	

Pos.	Art. No.	Qty.	Description	Comments
------	----------	------	-------------	----------

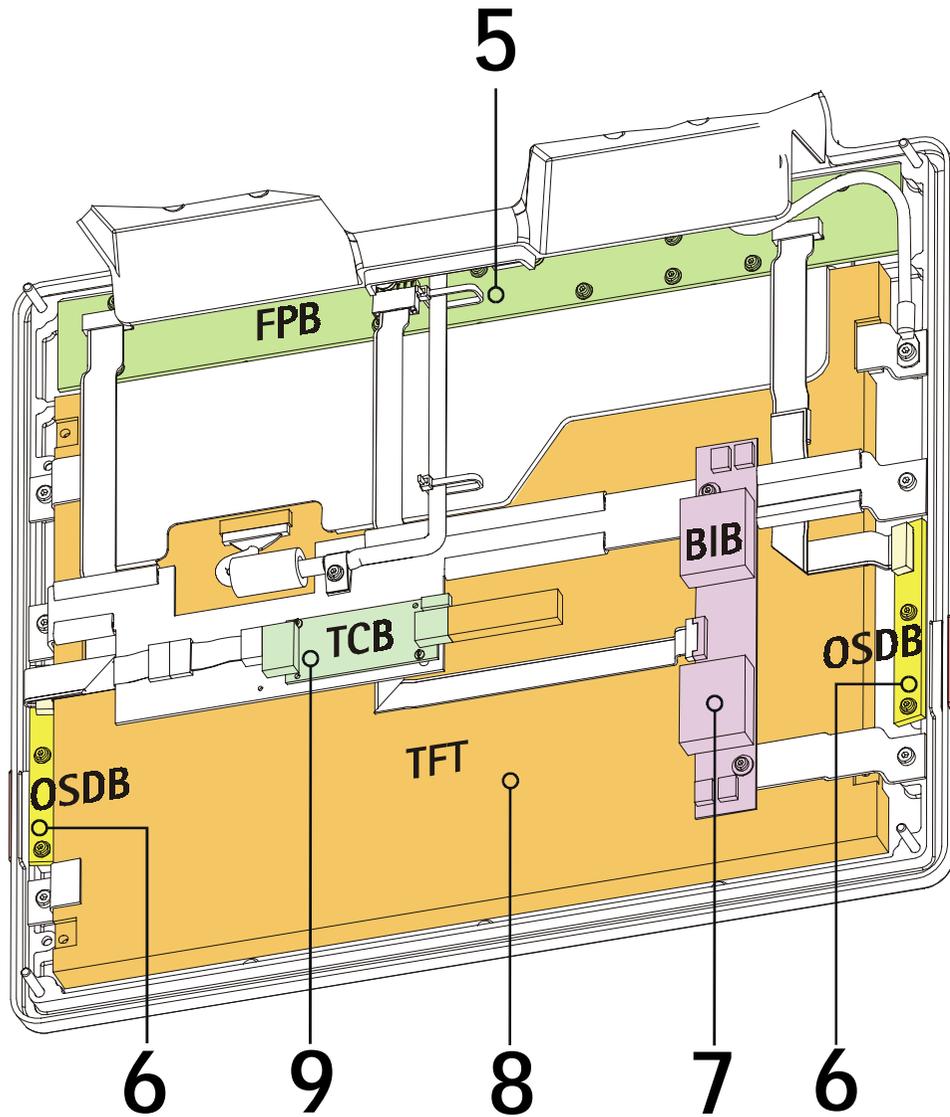
7.10 TFT Monitor

1	34514260	1	Touch screen for TFT	
2	34570691	2	OSD cover	complete with seal and screws
3	34561285	1	Membrane	
4	34561366	1	Membrane for Adimea option	



TFT Monitor

Pos.	Art. No.	Qty.	Description	Comments
------	----------	------	-------------	----------



5	3451428A	1	Front panel board FPB	
6	3451429A	1	Optical status display board OSD	
7	34514686	1	Backlight inverter board BIB for Boe Hydis TFT	
8	3451463B	1	TFT display 15" (Boe Hydis or Samsung)	
9	3451460A	1	Touch controller board TCB version 3	
-	34560912	1	Ribbon cable 12 pin FPB - OSD	
-	34560971	1	Ribbon cable FPB - BIB	

Pos.	Art. No.	Qty.	Description	Comments
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## 7.11 Test and Calibration Equipment and Tools

**Inspection for Calibration Equipment**

# Calibration equipment is subject to inspection and must be checked and calibrated in regular intervals.

#	7701357	1	Manometer 0-4 bar	
#	34511571	1	Manometer 2.5 bar	
-	770085A	1	Flow meter 1.1 l/min	
-	7700911	1	Reference solution (red)	for calibration blood leak detector
#	7702493	1	Template 1.4/1.5	for tubing clamp
#	-	*	Dialysis measurement instrument HDM 99XP For example manufacturer: IBP Instruments GmbH Internet: www.ibpmt.com	for temperature, conductivity, flow and pressure measurement  for details contact manufacturer directly
-	-	-	Crossover cable RS 232	for HDM 99 RS 232 interface for details contact IBP directly
#	-	*	SecuLife ST For example manufacturer: GMC Instruments Group Internet: www.gossenmetrawatt.com	for electrical safety check according to IEC 62353/EN 60601-1/IEC 601-1  for details contact manufacturer directly
-	-	*	Balance (e.g. Pocket Balance) For example manufacturer: Kern & Sohn GmbH Internet: www.kern-sohn.com	for calibration of UFP, BICP and KP  for details contact manufacturer directly

\* not in the product range of B. Braun Avitum AG

## Test and Calibration Equipment and Tools

Pos.	Art. No.	Qty.	Description	Comments
-	7701756	1	Extraction tool set (AMP)	
-	770203A	1	Stopcock system with five stopcocks, incl. lines	for the combined calibration of the pressure sensors (5 x original Perfusor lines 50 cm)
-	7703090	1	Measurement chamber 500 ml	for function test ABPM module and LRP
-	7701497	1	Special socket spanner Ø 18 mm	for assembly of MFC socket
-	7703589	1	Crossover cable RJ45	for network
-	7703597	1	Coupling (female/female) RJ45	for network
-	7703635	1	Extension cable D-sub 9 pin (male/female)	for network
-	7703643	1	Chip card for BSL-Nexadia	for network
-	7703473	1	Test plug RS 232	for network
-	7703856	1	Chip card for card reader	
-	7703805	1	Male to male connector	Adapter to connect both dialyser couplings for the measurement of the patient leakage current
-	770284A	1	DCI cable, external	
-	7703848	1	Assembly jig (motor for piston pump)	required for motor assembly

7.12 Service Kits

Pos.	Art. No.	Qty.	Description	Comments
-	3451897A	1	Repair kit balance chamber	for the complete replacement of both membranes, incl. all o-rings and assembly parts (self-locking nuts, screws, springs etc.)

## 7.13 Software

Pos.	Art. No.	Qty.	Description	Comments
-	770902	1	Software 9.02	USB-Stick with TLC/LLS/LLC
-	7703554	1	CD Remote Bedside Link List ReBeLL, version 1.5.13	for network
-	7703562	1	CD WAN-BSL, firmware version 1.0.4.8	for WAN-BSL only
-	7703864	1	Field service utility FSU, version 2.00	

Pos. Art. No. Qty.

Description

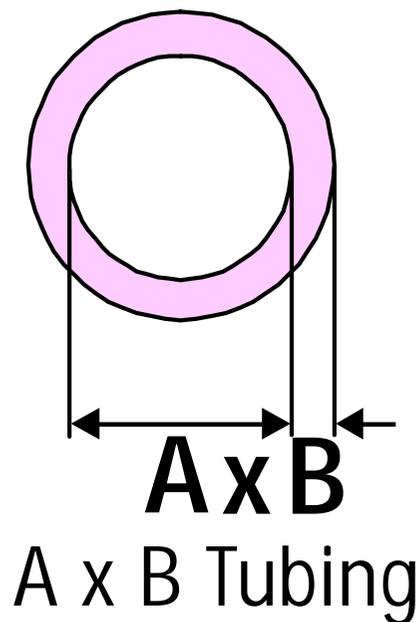
Comments

## 7.13.1 Software Compatibility Table

Software (ex Works)	BIOS	Dialog		Dialog Advanced		Dialog Advanced GX1LCD (ex Works)	Dialog+ ≤SW 8.XX *GX1LCD # LX800	Dialog+ SW 9.XX LX800
		POS-460	GX1LCD	POS-460	GX1LCD			
Software 3.46 (QNX2)	-	X	-	-	-	-	-	-
Software 3.48 (QNX2)	1.8	-	X	-	-	-	-	-
Software 5.35 (QNX2)	-	-	-	X	-	-	-	-
Software 5.36 (QNX2)	1.8	-	-	-	X	-	-	-
Software 6.XX (QNX4)	1.8	-	-	-	-	X	-	-
Software 7.21 bis 7.53 (QNX4)		-	-	-	-	-	X	-
Software-Update 7.53 (Linux) Diskettes with TLC/LLS SW only if SW 7.52 is present	*1.8/1.9 #1.01/ 1.04	-	-	-	-	-	X	-
Software 7.58 (Linux)		-	-	-	-	-	X	-
Software 7.59 (Linux)		-	-	-	-	-	X	-
Software-Update 7.59 (Linux) USB Stick with TLC/LLS SW only if SW 7.52 is present	*1.9 #1.01/ 1.04	-	-	-	-	-	X	-
Software ≥ 8.20 (Linux)		-	-	-	-	-	X	-
Software 9.02 (Linux)	1.04	-	-	-	-	-	-	X

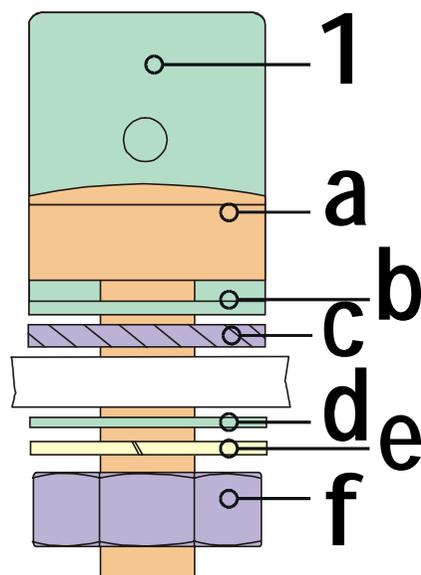
7.14 Miscellaneous

**Note:** See also chapter 6 (Tubing Diagrams)



Pos.	Art. No.	Qty.	Description	Comments
-	34565329	1m	Tubing 12 x 2 / RAL 9001 (1 m)	
-	34565337	2m	Silicone tubing 8 x 2 (2 m)	
-	34565221	10m	Silicone tubing 6 x 3 (10 m)	
-	34565256	2m	Silicone tubing 6 x 1.75 / red (2m)	internal high temperature tubing
-	39238032	1	Single ear clamp 13.3	for internal high temperature tubing
-	34565167	1	Silicone tubing 8 x 3,2 / red (3 m), with two single ear clamps 17.5	external high temperature tubing
-	39224538	1	Single ear clamp 17.5	for external high temperature tubing
-	34565264	2m	Silicone tubing 6 x 1.75 (2 m)	
-	34565191	10m	Silicone tubing 5 x 3 (10 m)	
-	34565248	10m	Silicone tubing 5 x 1.5 / blue (10 m)	
-	34565230	10m	Silicone tubing 5 x 1.5 / red (10 m)	
-	34565205	5m	PUR tubing 3.6 x 1.1 (5 m)	
-	34565272	10m	PVC tubing 3.5 x 1 (10 m)	
-	34565213	10m	Silicone tubing 2.9 x 3 (10 m)	
-	34565280	3m	Silicone tubing 3.2 1.6 (3 m)	
-	34565299	3m	Silicone tubing 2 x 3 (3 m)	transparent
-	34565302	5m	Silicone tubing 2 x 1.5 (5 m)	
-	34565140	50m	PVC tubing 10 x 3 / red (50 m)	for water inlet
-	3456517A	1	PVC tubing 10 x 3 / red (3 m), with two single ear clamps 19.5	for water inlet
-	34565159	50m	PVC tubing 10 x 3 / black (50 m)	for dialysate outlet
-	3456518A	1	PVC tubing 10 x 3 / black, (3 m), with a single ear clamp 19.5 and a tubing clamp 12-20 mm	for dialysate outlet
-	39234126	1	Tubing clamp 12-20 mm	
-	34565345	1m	Silicone tubing 12 x 2.5 (1 m)	

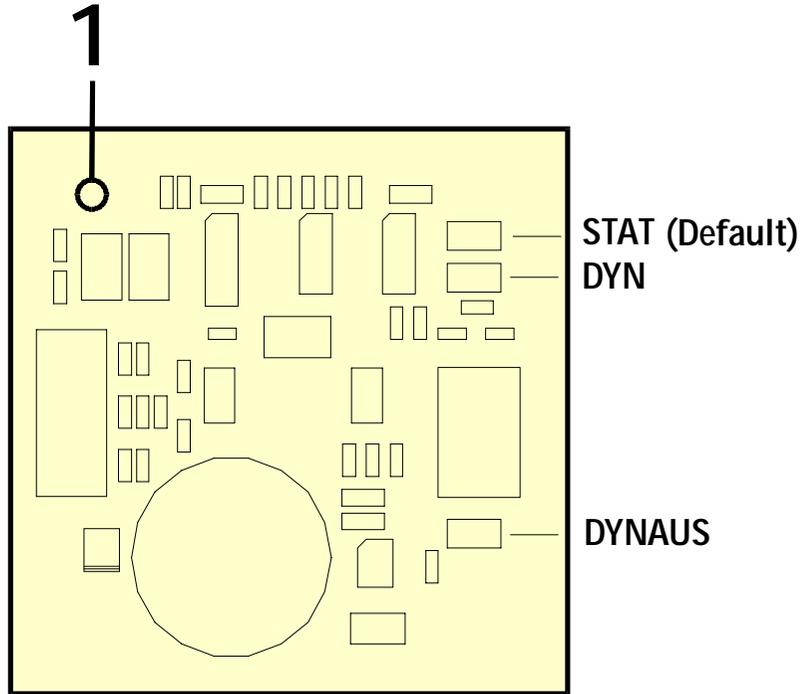
Pos.	Art. No.	Qty.	Description	Comments
-	34570195	20	Tubing clamp SNP-1.5 Ø 7-8 mm	plastic
-	34570209	20	Tubing clamp SNP-4 Ø 10-11 mm	plastic
-	34570365	20	Tubing clamp SNP-6 Ø 11.4-13 mm	plastic
-	34517766	10	Canister lid, red	with retainer for suction rod
-	34517774	10	Canister lid, blue	with retainer for suction rod
-	3399 0492	m	Spiral band	per meter
-	34773770	5	Y-Tubing connector 6 mm	
-	34570705	5	Y-Tubing connector 8 mm	
-	7703619	1	Touch-up pen pale green	
-	7703627	1	Touch-up pen light grey	
-	7702345	1	Silicone grease 410	(Renolit) 100 g tube
-	7702353	1	Silicone rubber adhesive (white) RTV 162	
-	7702388	1	Silicone rubber adhesive (transparent) RTV 118	must no be used for electronic components
1	34570322	10	Grounding for sub-racks consisting of: screw a, terminal b, tooth lock washer c, washer d, spring washer e, nut f	pay attention to correct assembly sequence!
-	7703708	1	Grease SKD 4002	100 g tube (to lubricate the shaft of the blood pump)



Pos.	Art. No.	Qty.	Description	Comments
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7.16 Staff Call (Option)

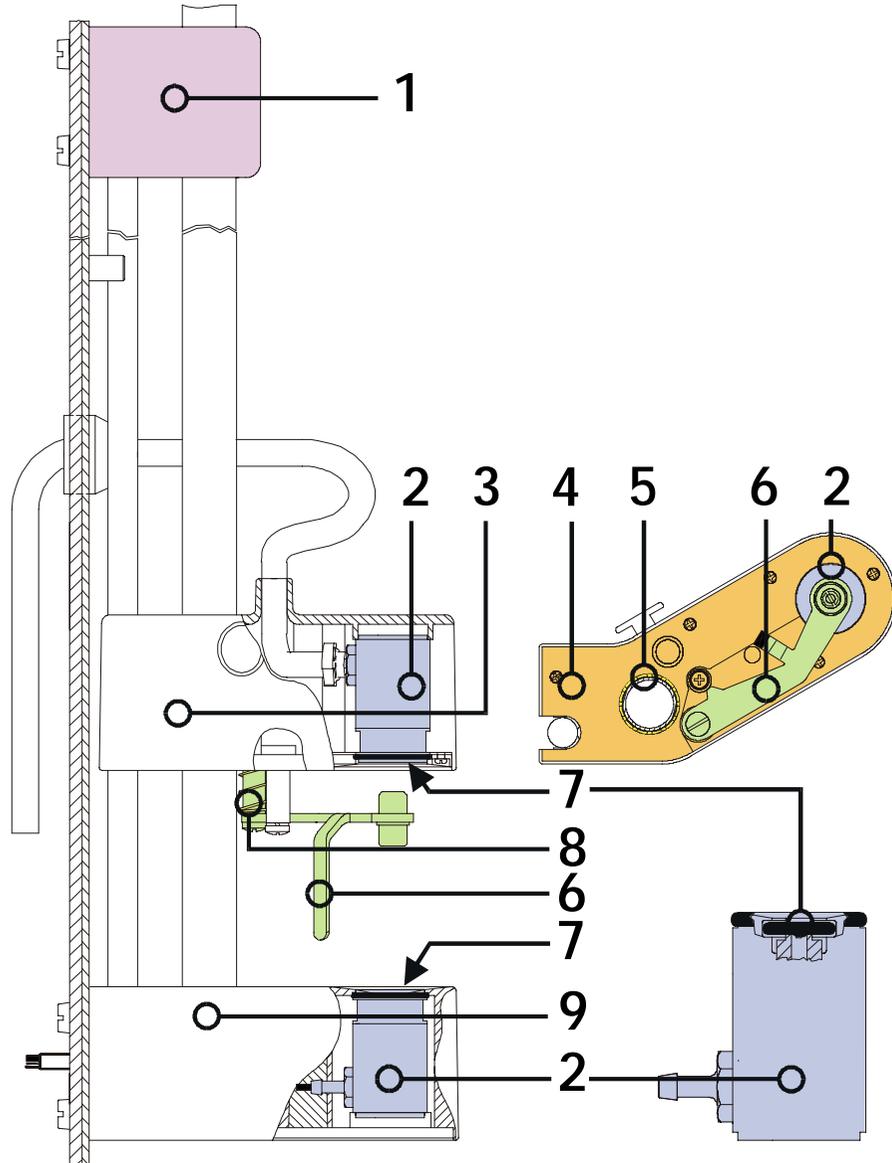
1	34517685	1	Staff call board	
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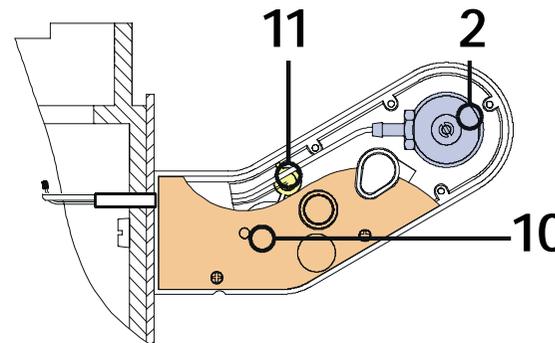
7.17 Bicarbonate Cartridge Holder (Option)

7.17.1 Bicarbonate Cartridge Holder

Pos.	Art. No.	Qty.	Description	Comments
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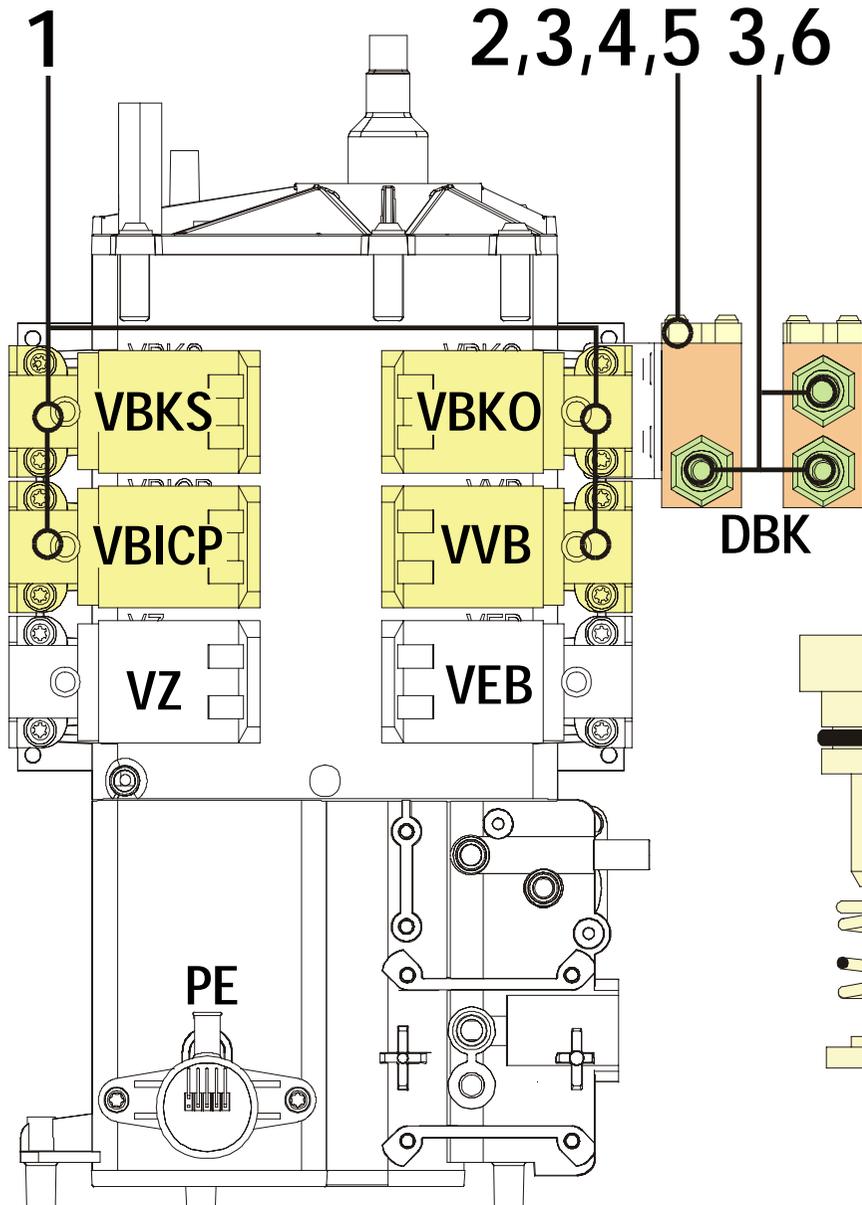


1	3451439A	1	Holder, top	
2	3456008A	1	Valve with piercing spike version 2 complete with o-ring	
3	3451437A	1	Housing, top	incl. thread forming screws 22 x 12
4	34514422	1	Cover for top housing	incl. thread forming screws 22 x 12
5	34519866	1	Slide ring	
6	34560092	1	Swivel arm version 2	
7	34570594	10	O-ring 9.2 x 2.7	
7	34570241	5	O-ring 9.19 x 2.62	alternative
8	34570420	5	Rotary spring	
9	34514430	1	Housing, bottom	incl. thread forming screws 22 x 12
10	34514449	1	Cover for bottom housing	incl. thread forming screws 22 x 12
11	34517138	1	Reed sensor with contacts and o-ring 3.68 x 1.78	bottom BIC cartridge holder
-	34517782	5	Disposable filter	filter FBIC

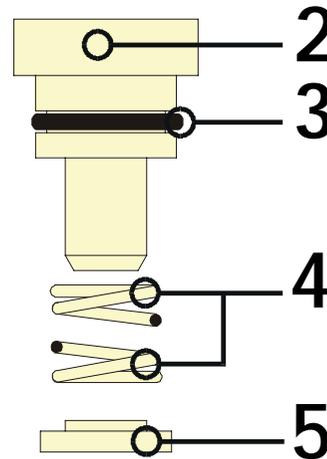


Pos.	Art. No.	Qty.	Description	Comments
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7.17.2 Solenoid Valves and Throttle

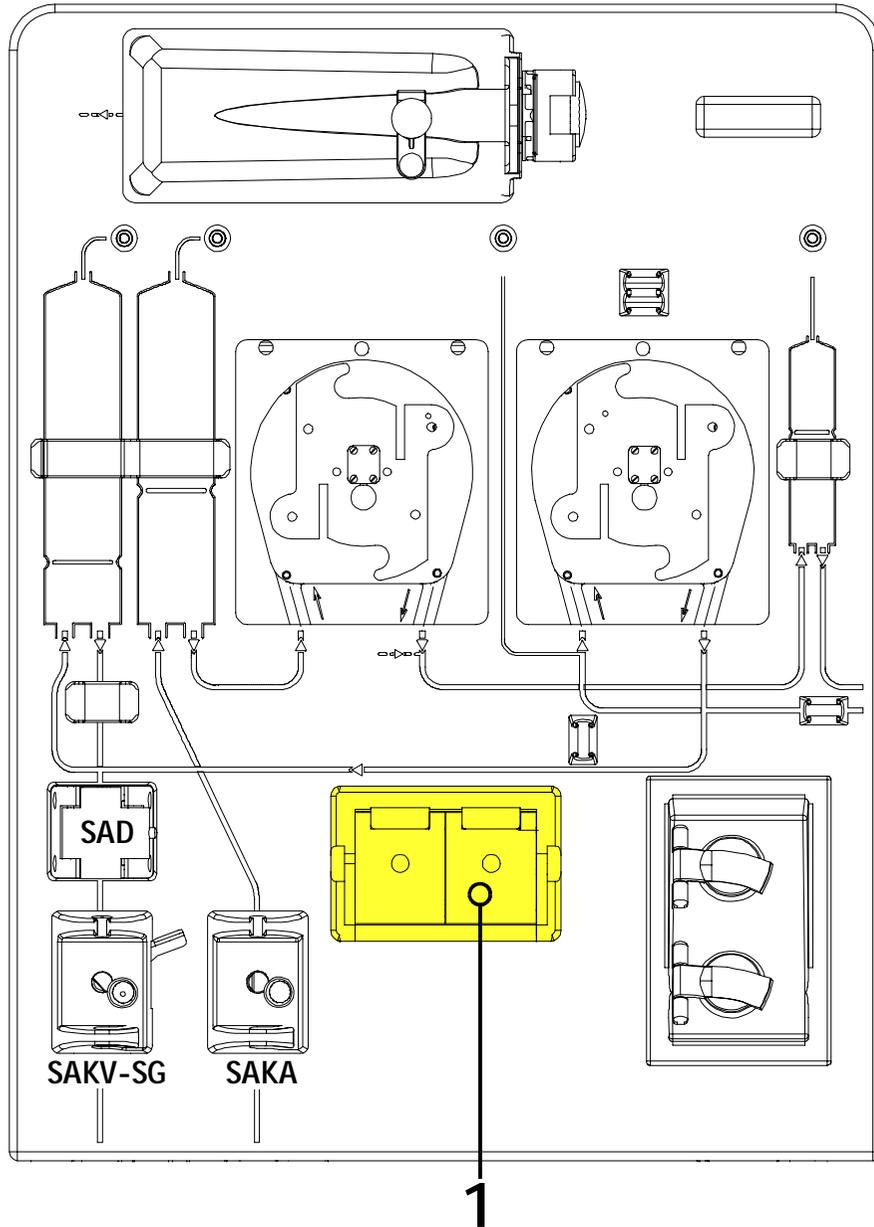


1	34560289	1	Solenoid valve 2/2 way	connector/connector (DPP)
2	34770925	5	Plug	
3	34770852	5	O-ring 11.1 x 1.6	
4	34771050	10	Pressure spring 500 mmHg	
5	34771352	3	Centre disc	
6	3451916A	5	Tubing connector Ø 8 x 1/8"	plastic



7.18 HDF Online (Option)

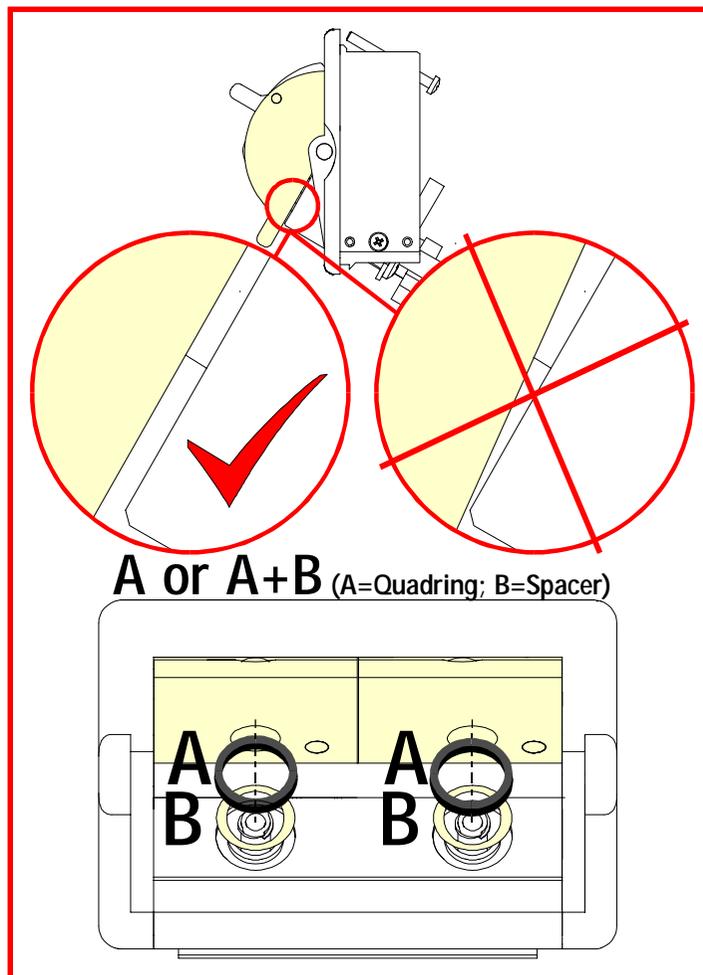
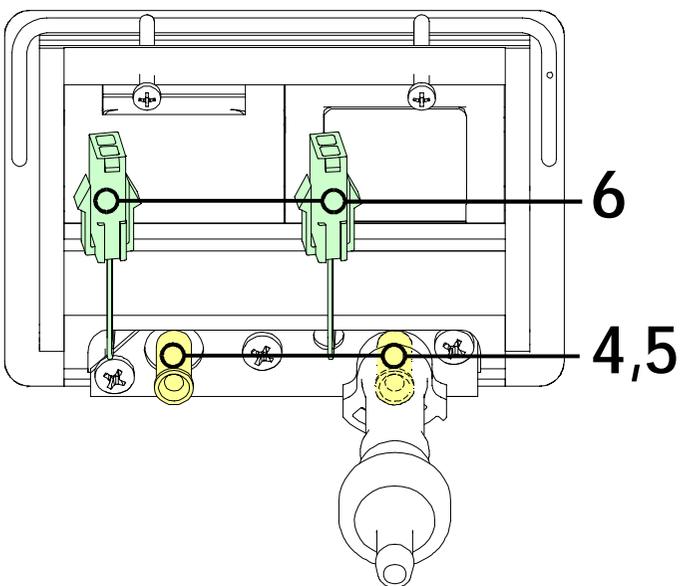
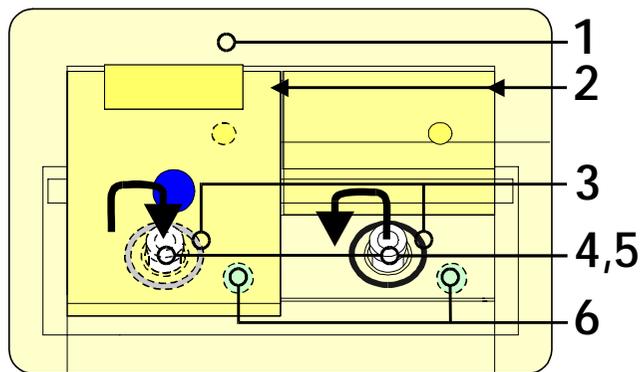
Pos.	Art. No.	Qty.	Description	Comments
------	----------	------	-------------	----------



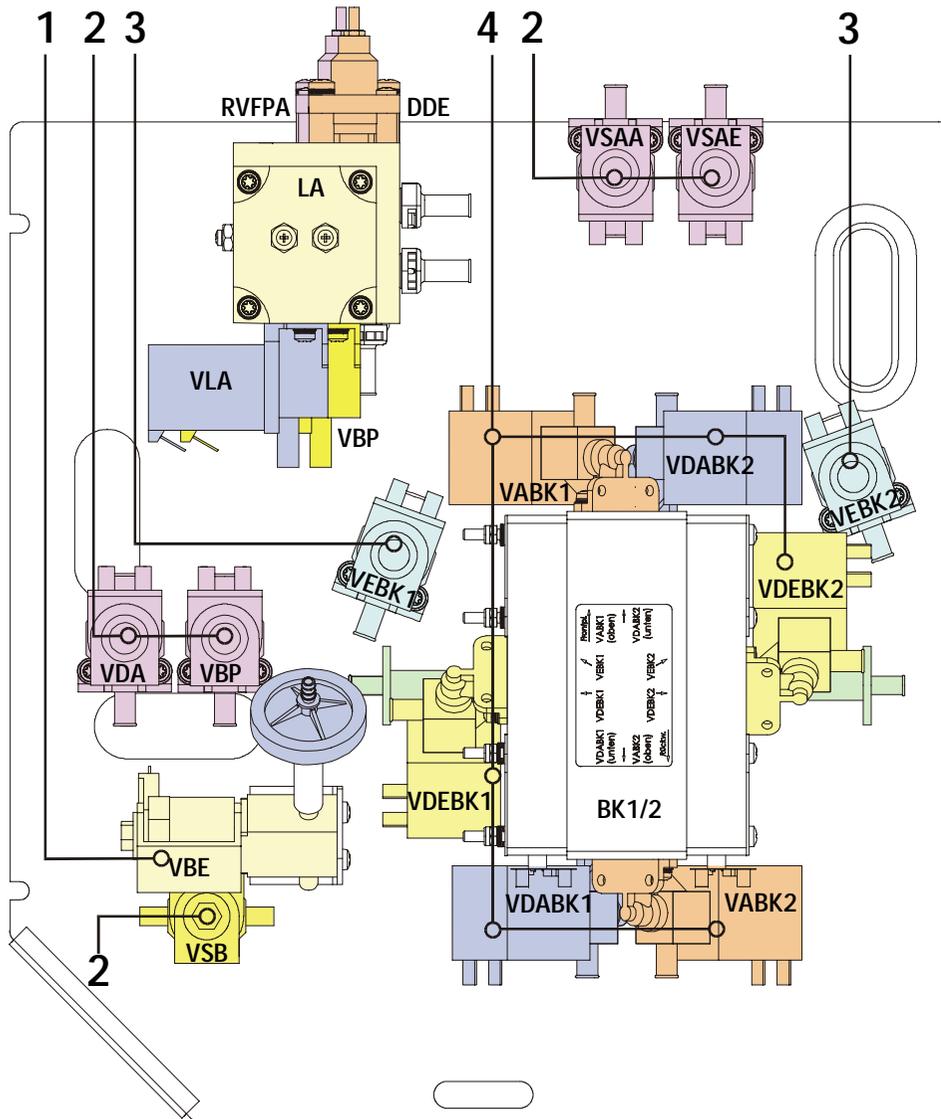
1	-	-	Substitution port	see separate figure
-	-	-	UF sub-rack	see separate figure

7.18.1 Substitution Port

Pos.	Art. No.	Qty.	Description	Comments
1	3451448A	1	Substitution port complete	
2	34570349	5	Pressure spring $\varnothing$ 4.6 x 14 mm	
3	3457035A	2	Quadring 12.37 x 2.62 incl. spacer	
4	34560017	1	Substitution connector	stainless steel, without o-ring
5	3477106A	5	O-ring 6.4 x 1.3	
6	34517138	1	Reed sensor with contacts and o-ring 3.68 x 1.78	



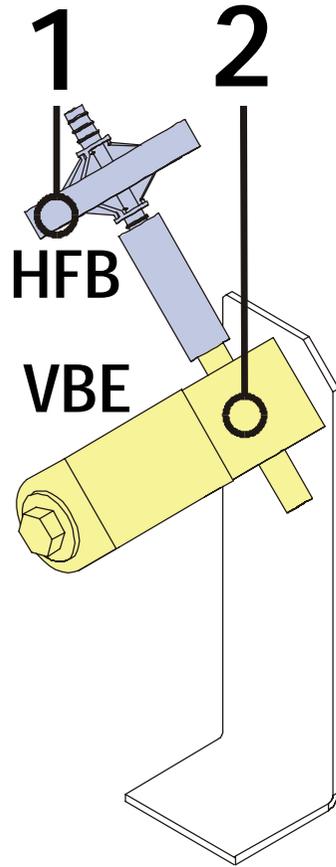
7.18.2 UF Sub-Rack HDF Online



1	-	-	Valve block	see separate figure
2	34560289	1	Solenoid valve 2/2 way	connector/connector (DPP)
3	3451906C	1	Solenoid valve 2/2 way	manuf. AKM only, connector/connector
4	3451902C	1	Solenoid valve 2/2 way	manuf. AKM only, connector/flange
4	34770852	5	O-ring 11.1 x 1.6	

Pos.	Art. No.	Qty.	Description	Comments
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7.18.3 Valve Block HDF Online



1	34560661	1	Hydrophobic filter	with tubing adapter
2	3451900A	1	Solenoid valve 3/2 way	

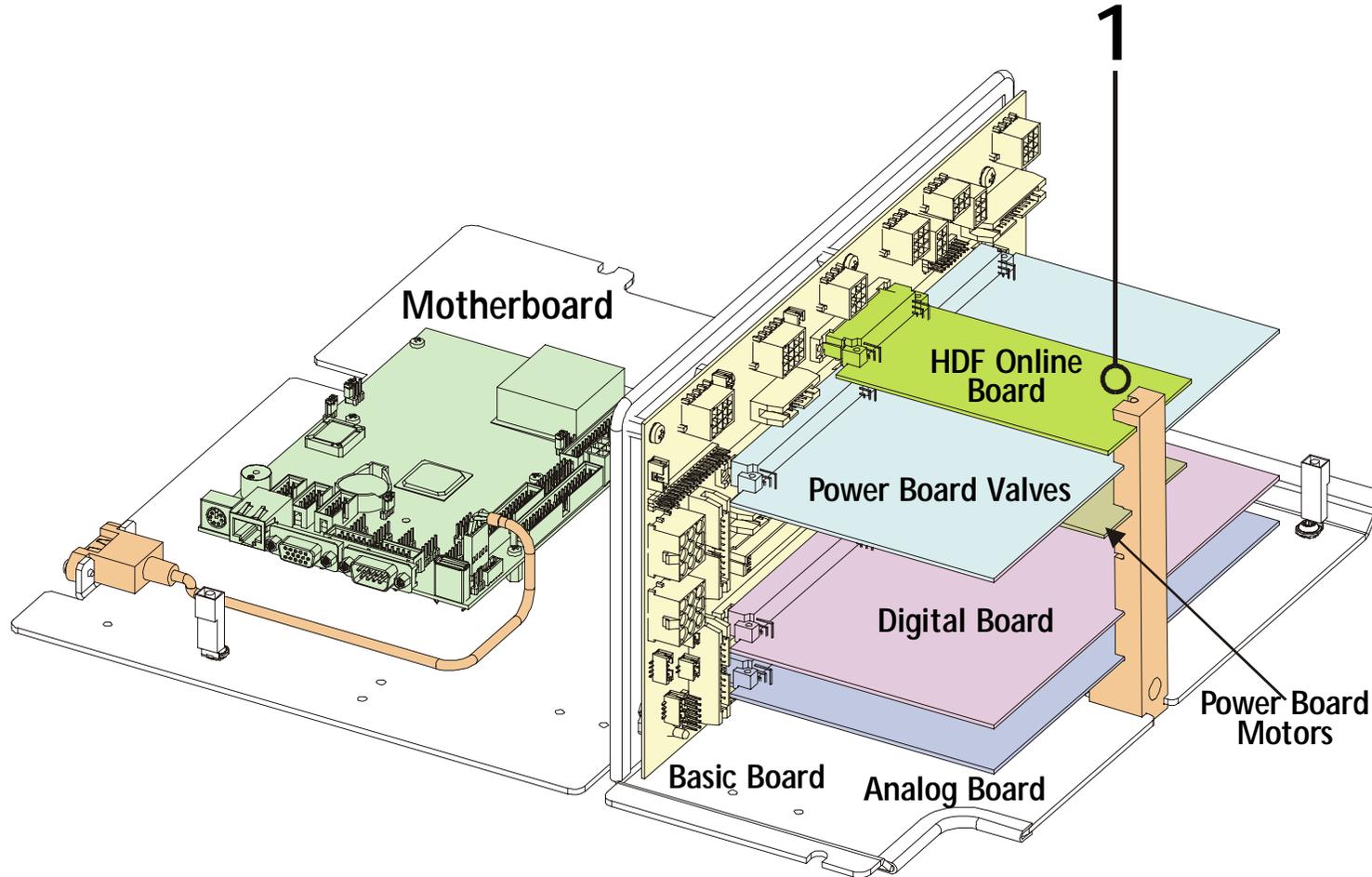
Pos. Art. No. Qty.

Description

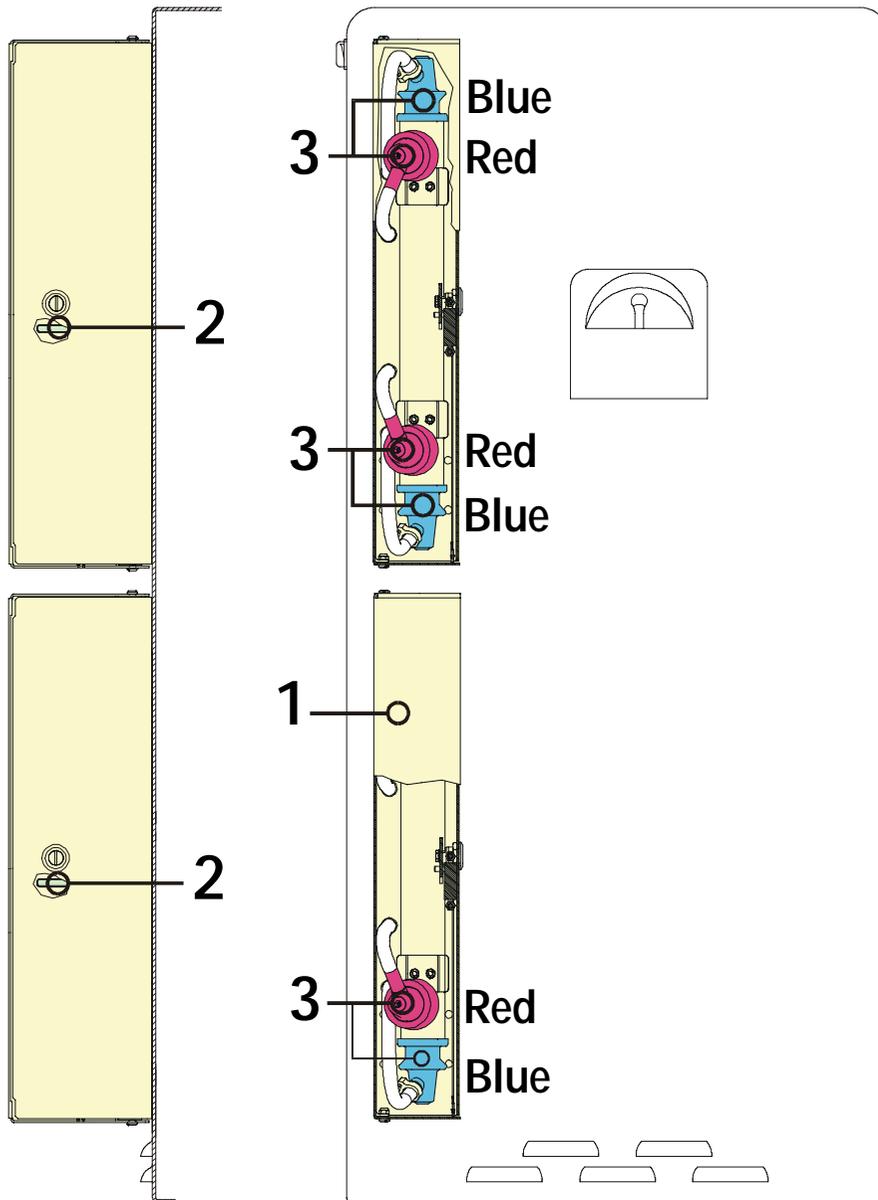
Comments

7.18.4 Board HDF Online

1 34560866 1 HDF online board



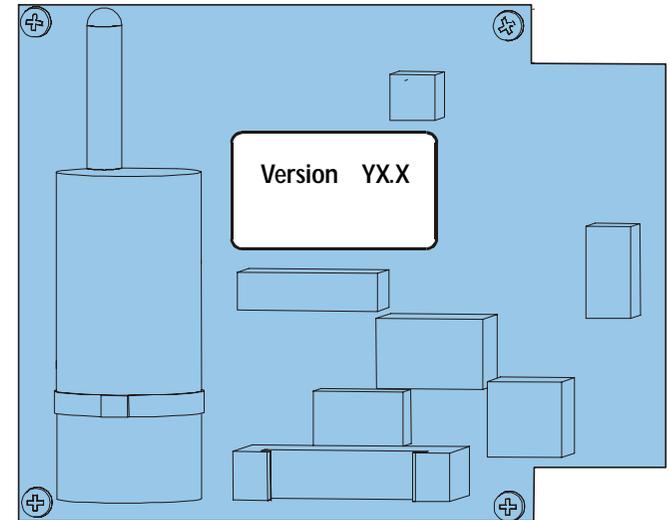
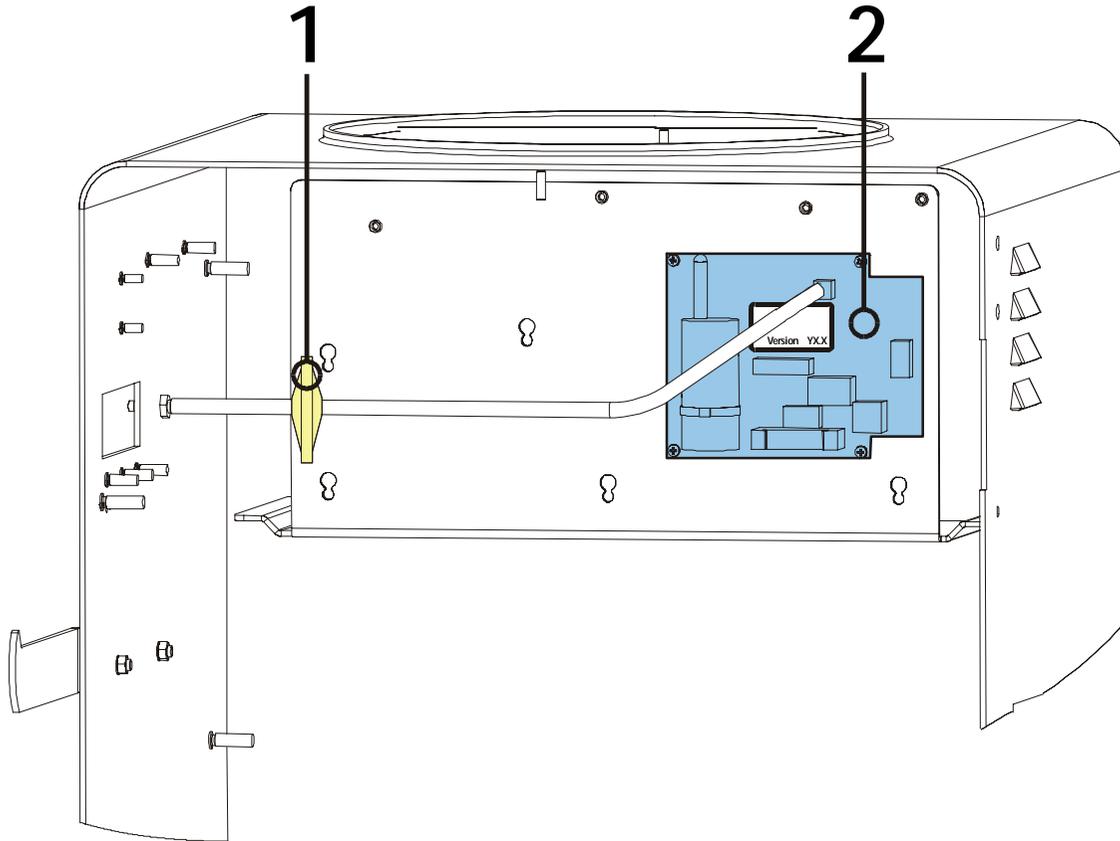
7.18.5 DF/HDF Filter Holder HDF Online



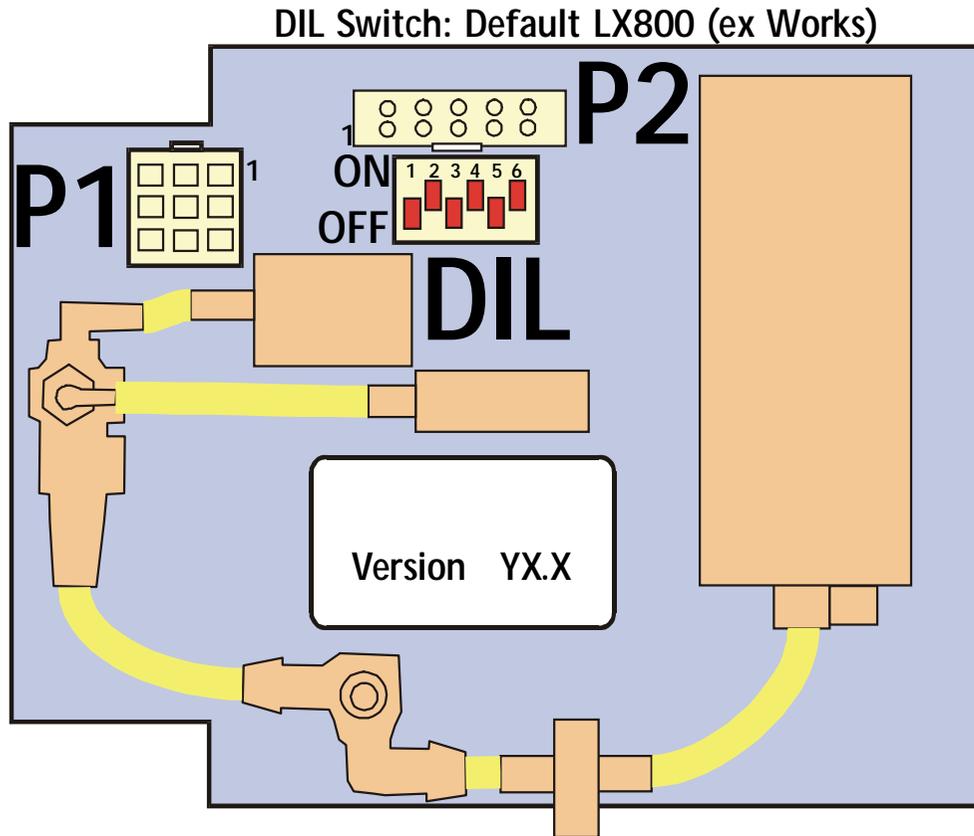
1	3456004A	1	Filter holder complete version 2	
2	34517138	1	Reed sensor with contacts and o-ring 3.68 x 1.78	
3	3451445A	1	Dialyser coupling (red)	
3	3451446A	1	Dialyser coupling (blue)	
3	34990445	5	O-ring 12.37 x 2.62	
3	34773550	20	Membrane for dialyser coupling	

Pos.	Art. No.	Qty.	Description	Comments
1	34560955	1	Filter (ABPM module M2009)	
2	3451487C	1	ABPM module M2009 with filter	firmware version of ABPM module on sticker: Version Y (FW):X.X

7.19 Automatic Blood Pressure Measurement ABPM Module M2009

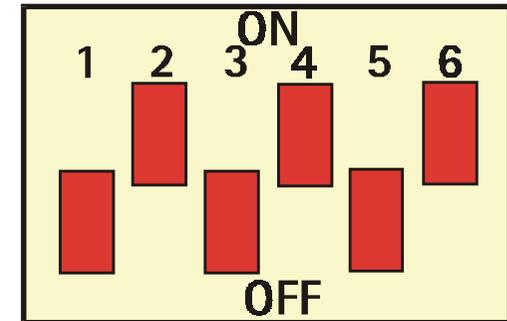


7.19.1 Compatibility Table ABPM Module M2009



DIL Switch

Position of DIL Switch for LX800 Motherboard



	DIL Switch					
	1	2	3	4	5	6
<b>LX800</b> (default)	OFF	ON	OFF	ON	OFF	ON

Pos. Art. No. Qty.

Description

Comments

## 7.20 Emergency Power Supply (Option)



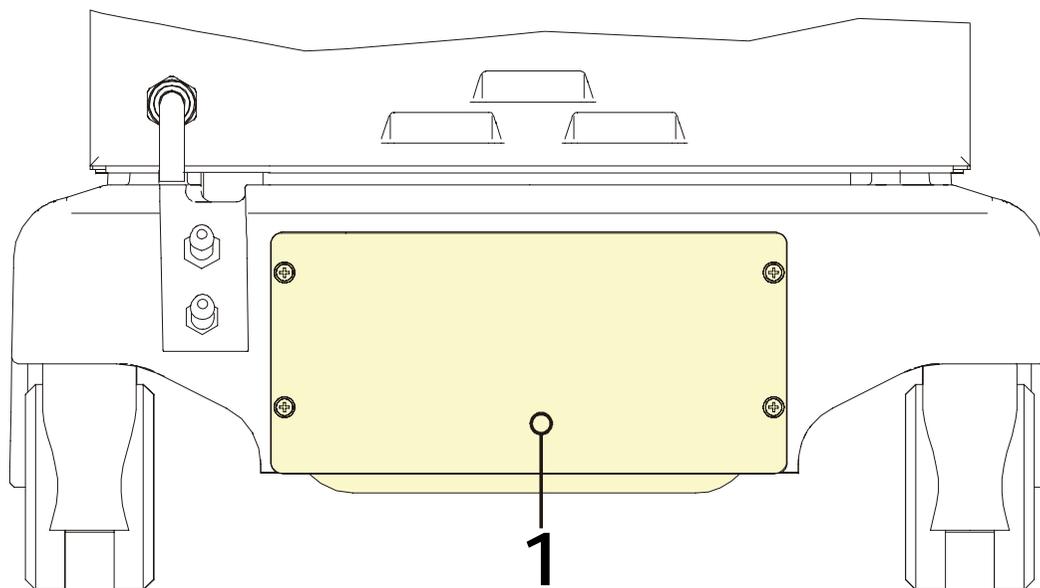
The battery (rechargeable) contains diluted sulfuric acid, a very toxic substance. If the battery leaks and the liquid inside spills on the skin or clothing, immediately wash it off with plenty of clean water.

If the liquid splashes into the eyes, immediately flush the eyes with plenty of clean water and consult a doctor. Sulfuric acid in the eyes may cause loss of eyesight and acid on the skin will cause burns.

**Pay attention to the included documentation of the battery supplier!**

1 - - Battery sub-rack

see separate figure

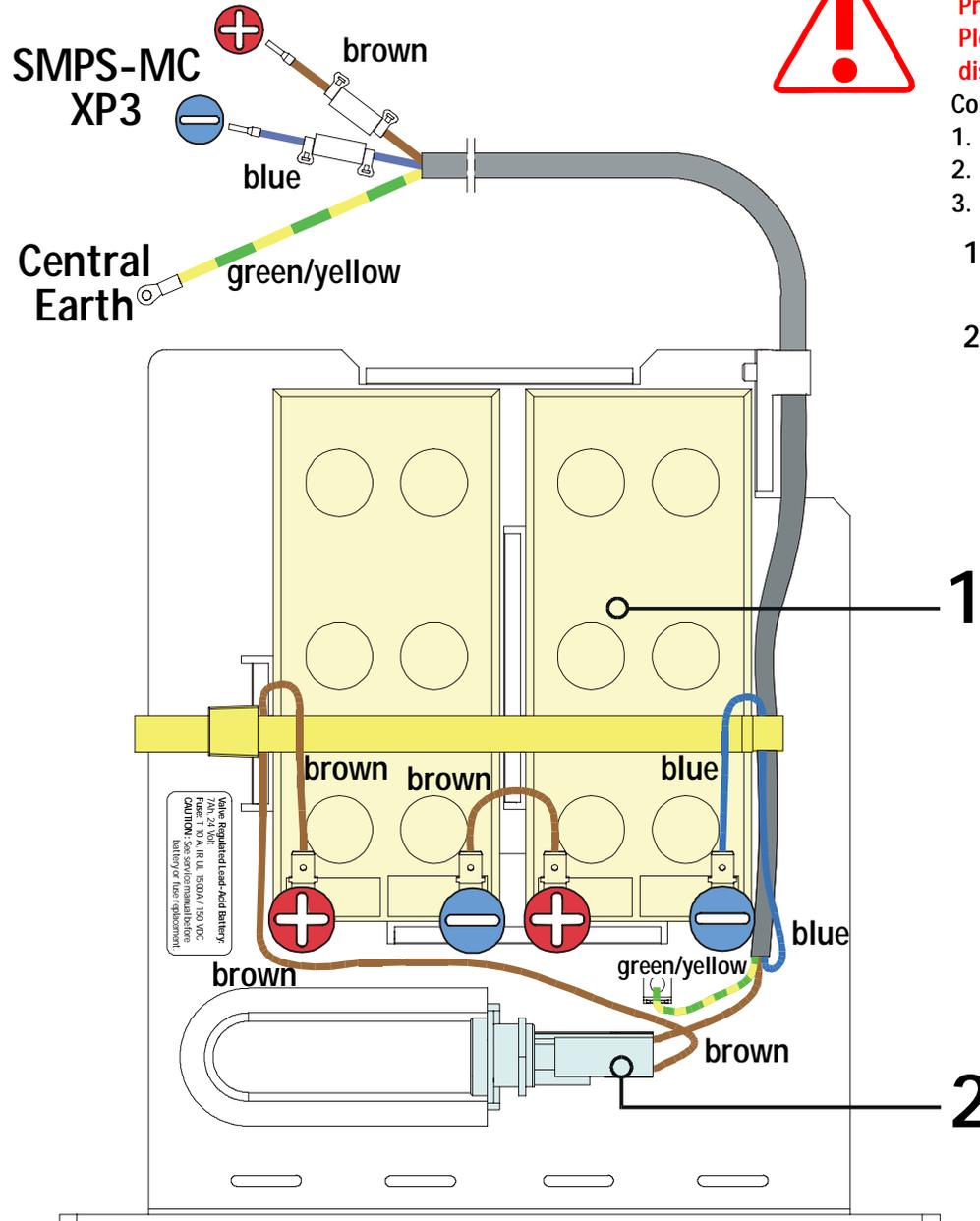


Pos. Art. No. Qty.

Description

Comments

7.20.1 Battery Sub-Rack



If a battery must be replaced exchange the complete battery set!  
 Prevent shorts in the battery compartment during disassembly and assembly:  
 Please pay attention to the correct disassembly/assembly sequence during the connection and disconnection of the batteries.

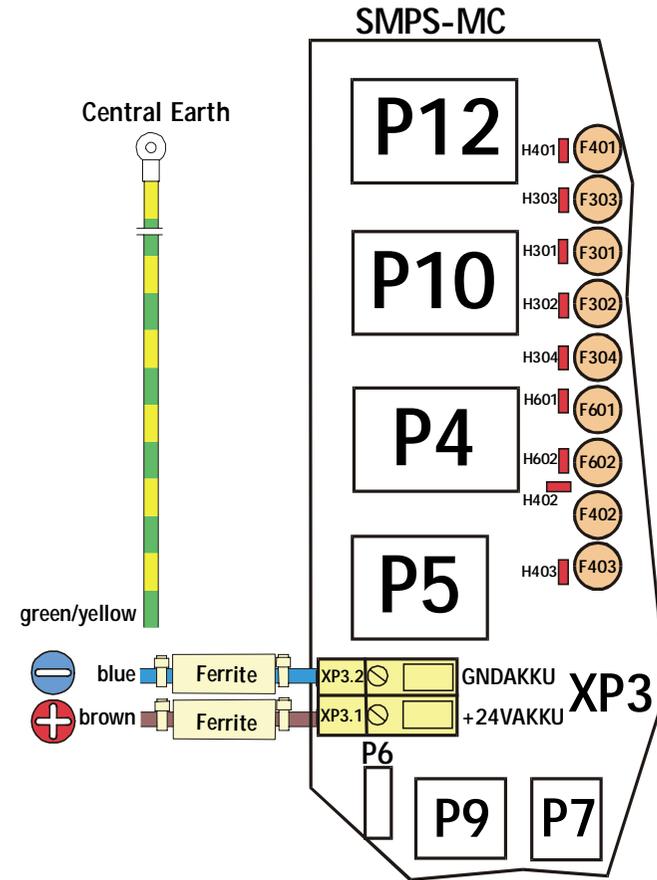
Connection

1. Connect (+) terminal (brown).
2. Connect (-) terminal (blau).
3. Connect ground terminal (green/yellow).

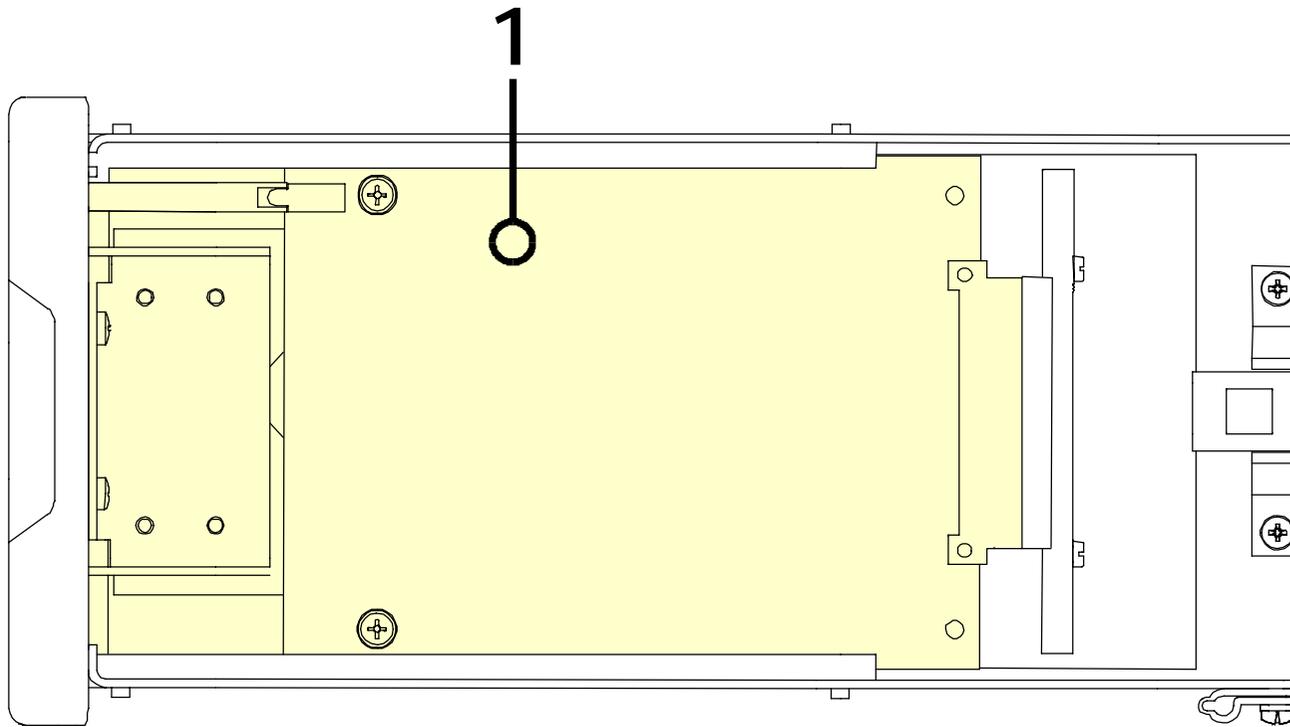
Disconnection

1. Disconnect (-) terminal (blue) abziehen.
2. Disconnect ground terminal (green/yellow).
3. Disconnect (+) terminal (brown).

1	34561250	1	Battery (rechargeable) set 12 V/7 Ah, incl. cable ties	2 x battery (rechargeable) 12 V/7 Ah
2	34570721	10	Fuse T10 A (5 x 20 mm)	



	Pos.	Art. No.	Qty.	Description	Comments
7.21 Nexadia®-BSL/WAN-BSL (Option)					
	1	34514554	1	Bedside link board (BSL board)	without firmware

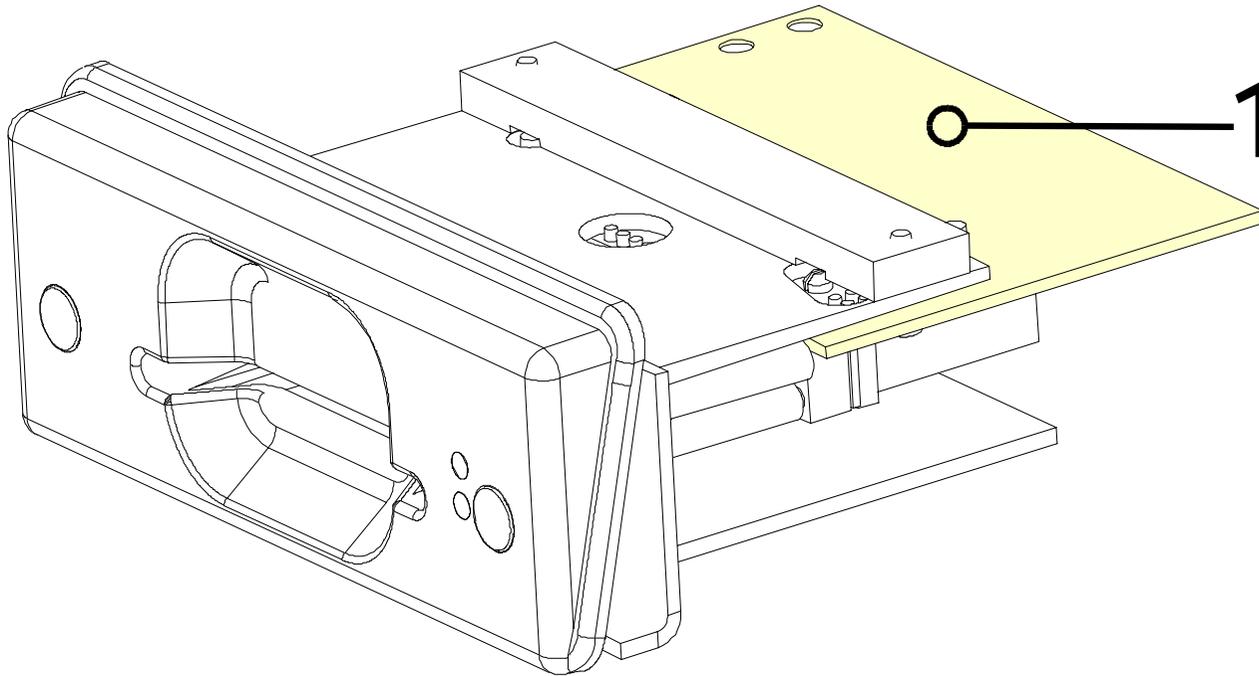


Art. No. Qty.

Description

## 7.22 Card Reader (Option)

1 34560548 1 Card reader board

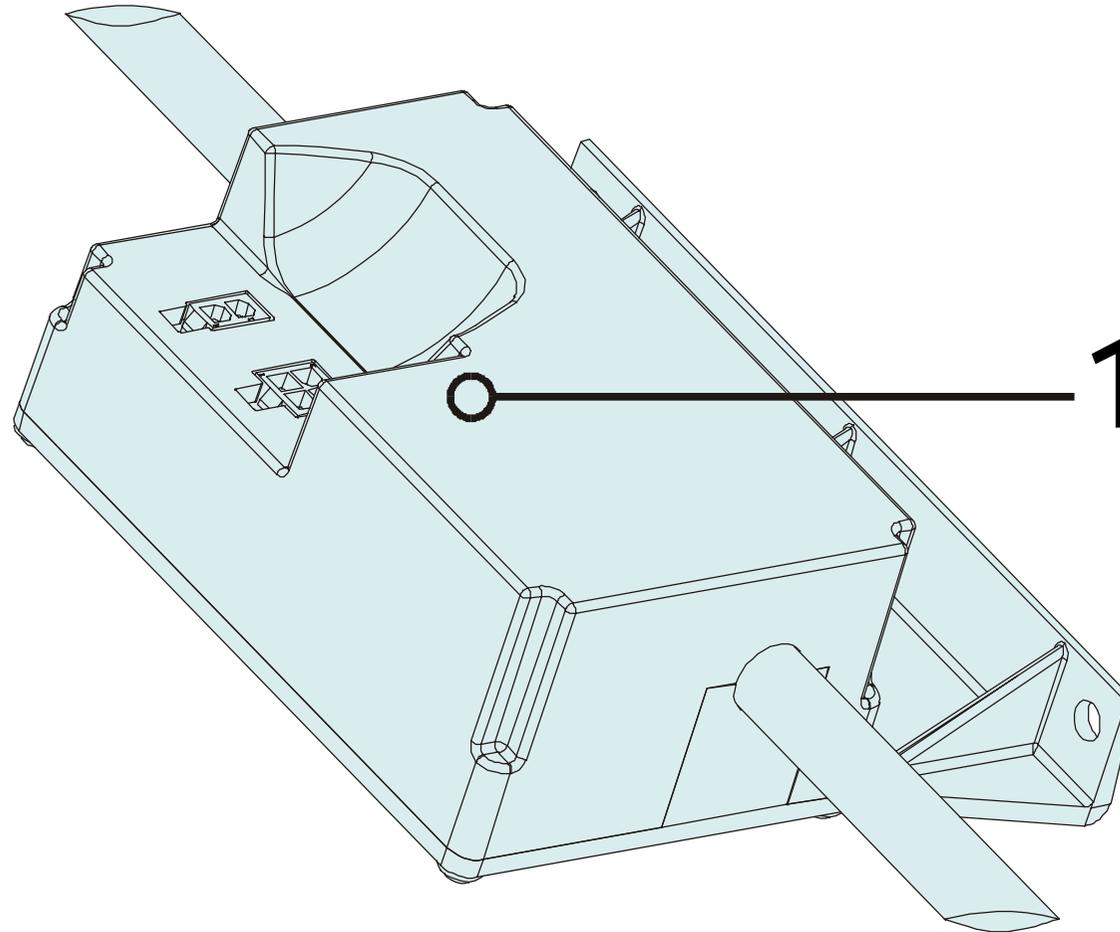


Art. No. Qty. Description

7.23 Adimea Option

1 3456063A 1 Kt/V-UV board

with housing and tubing



<b>8.1</b>	<b>ESD/EMC Information</b>	<b>8-2</b>
<b>8.1.1</b>	<b>Electrostatic Discharge ESD</b>	<b>8-2</b>
<b>8.1.2</b>	<b>Electromagnetic Compatibility EMC</b>	<b>8-4</b>
<b>8.2</b>	<b>Technical Information TI</b>	<b>-</b>
-		-
-		-
<b>8.3</b>	<b>Assembly Instructions AI</b>	<b>-</b>
-		-
-		-
<b>8.4</b>	<b>Field Service Information FSI</b>	<b>-</b>
-		-
-		-
<b>8.5</b>	<b>Instruction Leaflets IL</b>	<b>-</b>
-		-
-		-

## 8.1 ESD/EMC Information

## 8.1.1 Electrostatic Discharge ESD



ESD

## ESD Protection

## ESD Service Workstations

## ESD Service Kit



Fig. : ESD Service Kit

## Mat Material

**Prevent a direct contact of body parts with ground potential!  
Electrical shock hazard - do not touch any live components!**

Electrostatic discharge ESD is a static energy, which causes a sudden flow of electricity between two objects at different electrical potentials. ESD is the primary cause for damage or failure of integrated circuits.

The following information should help service technicians to prevent static discharge during servicing.

Precautions must be made when working on internal components of a system to prevent accidental static discharges to the components.

At any time the human body can hold a large static voltage charge that can easily damage components in a system. If this charge suddenly flows from one device to another through logic circuits these components can be damaged.

Service workstations should be adequately equipped with ESD devices to establish an area which meets static charge requirements to prevent damage of electronic components on pcb's.

Each service workstation should have a work surface with a conductive/dissipative material. The work surface and soldering iron should be connected to ground potential via protective resistors.

Personnel should wear a conducting wristband connected to the work surface, via a protective resistor cable. If possible personnel should wear cotton clothing to prevent static charging. Shoes should also be antistatic.

If applicable chairs, floors and mats in this area should be antistatic.

Use ESD service kits to equalize charges between you and any of the system components. Portable service kits are designed to prevent static charge of electronic systems during field service.

In general these service kits contain a wrist band and mat, with ground bonding cable for attachment to the system frame or an earth bonding point mains plug.

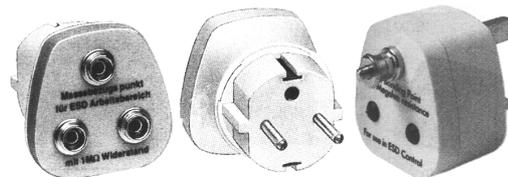


Fig. : Mains Plugs with Earth Bonding Point

In general the mats are made of sturdy two layer material and have reinforced edges and corners. The work surface is static dissipative ( $> 100 \text{ M}\Omega$ ), the other side is conductive ( $> 100 \text{ k}\Omega$ ).

### Wrist Bands

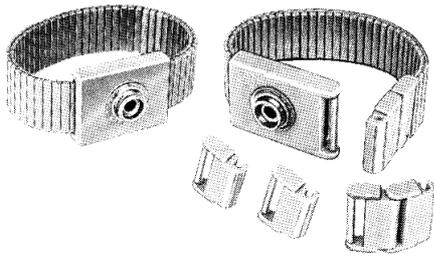


Abb. : Handgelenkband

In general the wrist band is a stainless steel expandable link style band. The outer coating and edges are insulated. The wrist bands are available in different sizes. Adjustable wrist bands with clip-on links are also available. The ground bonding cable for the wrist band is coiled. The cable incorporates a high-value resistance ( $> 1 \text{ M}\Omega$ ).

### Earth Cable

The common point straight earth cable has a snap fastener and a crocodile clip. The cable incorporates a high-value resistor ( $> 1 \text{ M}\Omega$ ).

### Storage, Transport and Delivery of Boards and Assembly Groups

The storage, transport and delivery of pcb's and assembly groups sensitive to static charge should only be carried out in original packaging. Only use correct packaging material, i.e. conductive bags, conductive bubble bags, shielding bags, pcb cartons with low density conductive foam. The original packaging is specially designed to meet the following specifications:

- provides physical and static protection
- prevents electrostatic charging
- prevents static induced damages
- prevents discharging of batteries equipped on pcb's

Do not send any boards or assembly groups sensitive to static charge in packaging material unfit for shipment, e.g. normal plastic bags, bubble bags, cartons, etc..

### Packaging Notice

Each returned part must be properly packed to prevent any damage during transportation due to mechanical impact or due to electrostatic discharge. The safest way to prevent damage is by using the packaging material from the new spare part and by packing the returned part exactly in the same way.

Returned parts containing electronic components (electrostatic sensitive devices) must be packed in special ESD packaging material. Only shielded bags or antistatic bags may be used. Unprotected electronic parts (e.g. wrapped in normal plastic film or parts padded with foam material) are assumed to be damaged by electrostatic discharge and will be scrapped.

## 8.1.2 Electromagnetic Compatibility EMC

**EMC** Electromagnetic compatibility EMC means that medical electrical equipment has the capability to work satisfactory in an electromagnetic environment, without causing electromagnetic emissions, which would be unacceptable for all other medical electrical equipment in this environment.

The following tables 201, 202 and 204 are guidelines from the IEC 60601-1-2 and must be observed.

Electromagnetic Emissions, Table 201

Guidance and manufacturer's declaration – electromagnetic emissions		
The Dialog <sup>+</sup> machine is intended for use in the electromagnetic environment specified below. The customer or the user of the Dialog <sup>+</sup> machine should assure that it is used in such an environment.		
Emissions test	Compliance	Electromagnetic environment – guidance
RF emissions acc. to CISPR 11	Group 1	The Dialog <sup>+</sup> machine 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 acc. to CISPR 11	Class B	The Dialog <sup>+</sup> machine 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 acc. to IEC 61000-3-2	Class A	The Dialog <sup>+</sup> machine 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.
Voltage fluctuations/flicker emissions acc. to IEC 61000-3-11 and DIN EN 60601-1-2:1993	Complies	The Dialog <sup>+</sup> machine 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. If the network impedance of the supply network has a max. impedance of $Z = (0.250 + j 0.150) \Omega$ or the machine is connected to a public low-voltage power supply network with a rated power supply of 230 V, measured between line L and neutral N, connected to a one or three phase public power supply with a constant current load of the power supply $\geq 100$ A per phase, then it is also valid for the Dialog <sup>+</sup> machine with the switch mode power supply microcontroller SMPS-MC.

Electromagnetic Immunity, Table 202

Guidance and manufacturer's declaration – electromagnetic immunity			
The Dialog <sup>+</sup> machine is intended for use in the electromagnetic environment specified below. The customer or the user of the Dialog <sup>+</sup> machine should assure that it is used in such an environment.			
Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment – guidance
Electrostatic discharge (ESD) acc. to 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 %.
Electrical fast transient/burst acc. to IEC 61000-4-4	± 2 kV for power supply lines ± 1 kV for input/output for lines	± 2 kV for power supply lines ± 1 kV for input/output for lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge acc. to IEC 61000-4-5	± 1 kV line(s) to line(s) ± 2 kV line(s) to earth	± 1 kV differential mode ± 2 kV 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 acc. to IEC 61000-4-11	< 5 % $U_T$ (> 95 % dip in $U_T$ ) for 0.5 cycle) 40 % $U_T$ (60 % dip in $U_T$ ) for 5 cycles 70 % $U_T$ (30% dip in $U_T$ ) for 25 cycles < 5 % $U_T$ (>95 % dip in $U_T$ ) for 5 s	< 5 % $U_T$ (> 95 % dip in $U_T$ ) for 0.5 cycle) 40 % $U_T$ (60 % dip in $U_T$ ) for 5 cycles 70% $U_T$ (30% dip in $U_T$ ) for 25 cycles < 5 % $U_T$ (>95 % dip in $U_T$ ) for 5 s	Mains power quality should be that of a typical commercial or hospital environment. If the user of the Dialog <sup>+</sup> machine requires continued operation during power mains interruptions, it is recommended that the Dialog <sup>+</sup> machine be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 Hz) magnetic field acc. to IEC 61000-4-8	3 A/m	3 A/m	The power frequency magnetic field should be measured in the intended installation location to assure that it is sufficiently low.
NOTE $U_T$ is the a.c. mains voltage prior to application of the test level.			

Electromagnetic Immunity, Table 204

Guidance and manufacturer's declaration – electromagnetic immunity			
The Dialog+ machine is intended for use in the electromagnetic environment specified below. The customer or the user of the Dialog+ machine should assure that it is used in such an electromagnetic environment.			
Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment – guidance
			Portable and mobile RF communications equipment should be used no closer to any part of the Dialog+ machine, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. 1.2 <b>Recommended separation distance:</b>
Conducted RF acc. to IEC 61000-4-6	3 V <sub>eff</sub> 150 kHz to 80 MHz	3 V <sub>eff</sub>	$d = 1.2\sqrt{P}$
Radiated RF acc. to IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz 3 V/m 80 MHz to 2.5 GHz	3 V/m	$d = 1.2\sqrt{P}$ for 80 MHz to 800 MHz
			$d = 2.33\sqrt{P}$ for 800 MHz to 2.5 GHz
			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 metres (m).  Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, <sup>a</sup> should be less than the compliance level in each frequency range. <sup>b</sup>  Interference may occur in the vicinity of equipment marked with the following symbol:  
NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies.			
NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			
a 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 Dialog+ machine is used exceeds the applicable RF compliance level above, the Dialog+ machine should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the Dialog+ machine.			
b Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.			

8.2 Technical Information TI

8.3 Assembly Instructions AI

8.4 Field Service Information FSI

8.5 Instruction Leaflets IL

Edition Number	Updates Edition/Chapter/Paragraph	Page	Date (yyyy-mm-dd)
0.1/2009	FAT Edition Dialog+ SW 9.xx Service Manual (English)		2009-09-09
1/2010	First Edition for Series, Dialog+ SW 9.xx Service Manual (English)		2010-03-29
1-1_1/2010	Revision Chapter 1 Commissioning		2011-03-01
4-1-1_1/2010	Revision Chapter 4 TSM Service Program		2011-03-01
4-2-1_1/2010			
4-3-1_1/2010			
5-1_1/2010	Revision Chapter 5 Technical Safety Inspection and Preventive Maintenance		2011-03-01
9-1_1/2010	Revision Chapter 9 Edition/Updates		2011-03-01