Caution!
These Operating Instructions in pdf-format are for information only. They are not a replacement for the Operating Instructions supplied with the machine/device and options.
Important information on the Technical Manual

How to use the Technical Manual

**Identification**  
The document can be identified by the following information on the title page and on the labels, if any:  
- Edition of the technical document  
- Part number of the technical document

**Page identification**  
The page identification 1-3, for example, refers to: chapter 1, page 3.

**Editorial information**  
The editorial information 1/01.05, for example, refers to the 1st edition, January 2005.

**Changes**  
Changes to the Technical Manual will be released as new editions or supplements. In general: This manual is subject to change without notice.

**Significance of the safety precautions**  
Explanation of the Caution and Note symbols used:

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<td>☞</td>
<td>Note</td>
</tr>
<tr>
<td>🟡</td>
<td>Caution</td>
</tr>
</tbody>
</table>

**Note**  
Informs the operator that if the steps are not followed as described, a specific function will be executed incorrectly or will not be executed at all, or will not produce the desired effect.

**Caution**  
Advises the operator against certain procedures or actions that could cause damage to the equipment or may have adverse effects on operators and patients.
Important information on the system

Technician's qualification

Purpose
This Technical Manual is intended for service technicians and is to be used for first studies (to acquire a basic knowledge) and for reference purposes (for TSC, Maintenance and repair). The Technical Manual, however, does not replace the training courses offered by the manufacturer.

Requirements
Knowledge of the current Operating Instructions for the respective system. Background experience in mechanics, electrical and medical engineering.

Precautions for working on the system

Authorized persons
Assembly, extensions, adjustments, modifications or repairs may only be carried out by the manufacturer or persons authorized by him.

Test equipment and accessories
The activities described in this technical document require the availability of the necessary technical test equipment and accessories.

Specifications
For the specifications of the respective system, refer to the current Operating Instructions. Observe the information on the specifications.

Precautions
Before turning power on, repair any visible damage. Prior to opening the system and when working on the open system, the following precautions have to be observed:
– Protect the components against ingress of fluids.
– Do not touch live parts (e.g. connectors of the power cable or heater).
– Disconnect and connect all jacks, connectors and components only when the system is turned off.

ESD precautions
When repairing the system and replacing spare parts, observe the applicable ESD precautions.

Hygienic measures
The system and the consumables are generally considered to be contaminated and must therefore be sufficiently disinfected by the responsible organization as specified by the manufacturer.
Addresses

Please address any inquiries to:

**Manufacturer**
Fresenius Medical Care AG & Co. KGaA
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www.fmc-ag.com

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Fax: +49 (0)9721-678-130

**Local service**
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</table>

[Fig.: Flow diagram]
1.1 Description of the T1 test

1.1.1 T1 test flow diagram, serial program steps

START T1 TEST

MODULE T1

TEST BYPASS

TEST OK? no yes

TEST OPT. DETECTOR

TEST OK? no yes

TEST BLOOD SYSTEM

TEST OK? no yes

TEST VENOUS PRESSURE

TEST OK? no yes

TEST AIR DETECTOR

TEST OK? no yes

TEST DISPLAY

TEST OK? no yes

TEST ARTERIAL PRESSURE

TEST OK? no yes

TEST ACCUMULATOR

TEST OK? no yes

TEST BLOOD LEAK DETECTOR

TEST OK? no yes

TEST TEMPERATURE

TEST OK? no yes

NEG. PRESSURE HOLDING TEST

TEST OK? no yes

POS. PRESSURE HOLDING TEST

TEST OK? no yes

TEST UF-FUNCTION

TEST OK? no yes

TEST CONDUCTIVITY

TEST OK? no yes

TEST DIASAFE/HDF FILTER

TEST OK? no yes

TEST DIASAFE PLUS / ONLINE PLUS / HPU TEST

TEST OK? no yes

STORAGE ERROR NUMBER

STORAGE ERROR NUMBER

STORAGE ERROR NUMBER

STORAGE ERROR NUMBER

STORAGE ERROR NUMBER

STORAGE ERROR NUMBER

STORAGE ERROR NUMBER

STORAGE ERROR NUMBER

STORAGE ERROR NUMBER

STORAGE ERROR NUMBER

Basic hydraulics

Advanced hydraulics

1
T1 TEST UNSUCCESSFUL

- No
  - RETURN

- Yes
  - DIALYSIS START KEY
    - TEST OK
      - No
        - RETURN
      - Yes
        - ERROR DISPLAY
    - INCORRECT TEST STEP
      - TEST OK
        - No
          - RETURN
        - Yes
          - NEXT INCORRECT TEST STEP
    - INCORRECT TEST STEPS
      - No
        - RETURN
      - Yes
        - FURTHER INCORRECT TEST STEPS
          - No
            - RETURN
          - Yes
            - FURTHER INCORRECT TEST STEPS
1.1.2 T1 test flow diagram, parallel program steps
1

T1 TEST UNSUCCESSFUL

no

RETURN

yes

DIALYSIS START KEY

INCORRECT TEST STEP

TEST OK ?

no

ERROR DISPLAY

yes

FURTHER INCORRECT TEST STEPS

no

RETURN

yes

NEXT INCORRECT TEST STEP

RETURN
1.1.3 Description of the T1 test incl. error messages

- Prerequisites for starting and running the test

<table>
<thead>
<tr>
<th>Error message</th>
<th>Description</th>
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<td>Power failure</td>
<td>Power failure while the test is in progress</td>
</tr>
<tr>
<td>Dialines not conn</td>
<td>The dialysate lines are not in the interlock shunt.</td>
</tr>
<tr>
<td>Shunt Cover open</td>
<td>The interlock shunt is open.</td>
</tr>
<tr>
<td>Connect Conc.Line</td>
<td>The concentrate connector is in the rinse chamber, or concentrate is not connected at all. The error message depends on the central delivery system preselected in the setup menu.</td>
</tr>
<tr>
<td>Wrong conc. supply</td>
<td>The error message depends on the concentration supply system connected to the T1 test.</td>
</tr>
<tr>
<td>Blood Sensed by OD</td>
<td>The optical detector senses blood in the system.</td>
</tr>
<tr>
<td>Flow alarm</td>
<td>Line to or from the dialyzer kinked, malfunctions in the hydraulics.</td>
</tr>
<tr>
<td>Water alarm</td>
<td>Water supply interrupted.</td>
</tr>
<tr>
<td>XXX not calibrated</td>
<td>A valid calibration value is missing in the NOVRAM.</td>
</tr>
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</table>

- Overview of the individual test steps

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Online plus / Diasafe plus filter / HPU test ..................... 1-48
● Bypass test

Test description:

Check of the following functions:
- Heater relay
- Bypass (electric)
- Check of the temperature range changeover

Illustration:
Error description:

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<th>Error message</th>
<th>Description</th>
</tr>
</thead>
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<tr>
<td>F 01 Bypass</td>
<td>The heater relay is switched off.</td>
</tr>
<tr>
<td></td>
<td>-- Acknowledgement (H_REL_W, X639/A12) → X632/A10, 0 V are missing.</td>
</tr>
<tr>
<td>F 02 Bypass</td>
<td>The heater relay cannot be switched off by CPU2.</td>
</tr>
<tr>
<td></td>
<td>-- Acknowledgement (H_REL_W, X639/Y12) → X632/A10, 12 V are missing.</td>
</tr>
<tr>
<td></td>
<td>-- Control line (EM_H_OFF, X632/A9) → X639/A17, 12 V are missing.</td>
</tr>
<tr>
<td>F 03 Bypass</td>
<td>The temperature measurement range is set to hot rinse.</td>
</tr>
<tr>
<td></td>
<td>-- Control line (HOTRINSE, X634R/C24) → X639/A20, 0 V are missing.</td>
</tr>
<tr>
<td></td>
<td>-- Acknowledgement (HOTRINSE, X634R/C24) → X632/A26, 0 V are missing.</td>
</tr>
<tr>
<td>F 04 Bypass</td>
<td>The extended bypass cannot be correctly switched by CPU2 (V24 = off, V26 = on, V24B = off).</td>
</tr>
<tr>
<td></td>
<td>-- Acknowledgement (V24, X637/C1) → X632/A4, 24 V are missing.</td>
</tr>
<tr>
<td></td>
<td>-- Acknowledgement (V26, X637/C2) → X632/A6, 0 V are missing.</td>
</tr>
<tr>
<td></td>
<td>-- Acknowledgement (V24B, X637/C23) → X632/A5, 24 V are missing.</td>
</tr>
<tr>
<td>F 05 Bypass</td>
<td>The extended bypass cannot be correctly switched off by CPU2 (V24 = on, V26 = off, V24B = on).</td>
</tr>
<tr>
<td></td>
<td>-- Acknowledgement (V24, X637/C1) → X632/A4, 0 V are missing.</td>
</tr>
<tr>
<td></td>
<td>-- Acknowledgement (V26, X637/C2) → X632/A6, 24 V are missing.</td>
</tr>
<tr>
<td></td>
<td>-- Acknowledgement (V24B, X637/C23) → X632/A5, 0 V are missing.</td>
</tr>
<tr>
<td>F06 Bypass</td>
<td>CPU1 fails to set the temperature control to hot rinse.</td>
</tr>
<tr>
<td></td>
<td>-- Control line (HOTRINSE, X634R/C24) → X639/A20, 12 V are missing.</td>
</tr>
<tr>
<td></td>
<td>-- Acknowledgement (HOTRINSE, X634R/C24) → X632/A26, 12 V are missing.</td>
</tr>
<tr>
<td>F 07 Bypass</td>
<td>The extended bypass cannot be correctly switched by CPU1 (V24 = off, V26 = on, V24B = off).</td>
</tr>
<tr>
<td></td>
<td>-- Acknowledgement (V24, X637/C1) → X632/A4, 24 V are missing.</td>
</tr>
<tr>
<td></td>
<td>-- Acknowledgement (V26, X637/C2) → X632/A6, 0 V are missing.</td>
</tr>
<tr>
<td></td>
<td>-- Acknowledgement (V24B, X637/C23) → X632/A5, 24 V are missing.</td>
</tr>
<tr>
<td>F08 Bypass</td>
<td>CPU1 fails to reset the temperature control to dialysis.</td>
</tr>
<tr>
<td></td>
<td>-- Control line (HOTRINSE, X634R/C24) → X639/A20, 0 V are missing.</td>
</tr>
<tr>
<td></td>
<td>-- Acknowledgement (HOTRINSE, X634R/C24) → X632/A26, 0 V are missing.</td>
</tr>
<tr>
<td>F09 Bypass</td>
<td>The extended bypass cannot be correctly switched off by CPU1 (V24 = on, V26 = off, V24B = on).</td>
</tr>
<tr>
<td></td>
<td>-- Acknowledgement (V24, X637/C1) → X632/A4, 0 V are missing.</td>
</tr>
<tr>
<td></td>
<td>-- Acknowledgement (V26, X637/C2) → X632/A6, 24 V are missing.</td>
</tr>
<tr>
<td></td>
<td>-- Acknowledgement (V24B, X637/C23) → X632/A5, 0 V are missing.</td>
</tr>
<tr>
<td>F95 Bypass</td>
<td>System error</td>
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• Optical detector test

Test description:

Attenuation of the optical detector.
Check of the acknowledgement of the optical detector.

Illustration:
Error description:

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<th>Description</th>
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<tr>
<td>F01 opt. Detector</td>
<td>CPU1 interprets the optical detector in a different way than does CPU2. Acknowledgement (OD_OUT, X633L/C7) → X632/A30 and the digital input of P.C.B. LP 633 measure different levels.</td>
</tr>
<tr>
<td>F02 opt. Detector</td>
<td>CPU2 fails to recognize blood in the system. Acknowledgement (OD_OUT, X633L/C7) → X632/A30, 0 V are missing. Detuning (ODSA, X632/C15) → X351/7 not 12V.</td>
</tr>
<tr>
<td>F03 opt. Detector</td>
<td>CPU1 fails to recognize blood in the system. Acknowledgement (OD_OUT, X633L/C7) → digital input on P.C.B. LP 633. Detuning (ODSA, X632/C15) → X351/7 not 12V.</td>
</tr>
<tr>
<td>F04 opt. Detector</td>
<td>CPU2 recognizes that the optical detector senses opaque fluid (required because of the test in the cleaning program). Acknowledgement X632/A30 not 12V. AD28 defective.</td>
</tr>
<tr>
<td>F96 opt. Detector</td>
<td>System error.</td>
</tr>
</tbody>
</table>
● **Blood system test**

**Test description:**

Check of the following functions:
– Blood alarm acknowledgement
– Blood pump switch-off

**Illustration:**

[Diagram of blood system test components and connections]

- LP 632
- CPU 2
- LP 633
- Input board
- LP 634
- Output board
- LP 647
- (4008 E/B1)
- Display board
- LP 635
- (4008 E)
- LP 649
- (4008 B)
- LP 924
- (4008 H)
- LP 922
- (4008 S)
- Mother board
- LP 630
- (4008 E/B1)

Connections and signals are indicated with arrows and labels such as CLP_CTL, LDA2, BL_AL, BPSB_VEN, BPSB_ART, SN_ART.
Error description:

<table>
<thead>
<tr>
<th>Error message</th>
<th>Description</th>
</tr>
</thead>
</table>
| **F09 Bloodsystem** | Acknowledgement that CPU2 recognizes that the arterial blood pump is inactive (BP not running).  
- Acknowledgement (BPSB_ART, X348a/6) → X632/A11, 12 V missing.  
- Control line (BPSST_ART, X634L/B14) → X348a/1, 12 V missing or (BPST_ART, X634L/A14) → X348a/3, 12 V are missing. |
| **F10 Bloodsystem** | Acknowledgement that CPU1 recognizes that the arterial blood pump is inactive (BP not running).  
- Acknowledgement (BPSB_ART, X348a/6) → X633L/A11, 12 V are missing.  
- Control line (BPSTT_ART, X634L/B14) → X348a/1, 12 V missing or (BPST_ART, X634L/A14) → X348a/3, 12 V missing.  
- Level is raised during the T1 test. |
| **F11 Bloodsystem** | The arterial blood pump cannot be stopped by CPU1. CPU2 recognizes that the arterial blood pump remains active.  
- Control line (BPSST_ART, X634L/B14) → X348a/1, 0 V missing, as well as (BPST_ART, X634L/A14) → X348a/3, 0 V missing.  
- Acknowledgement (BPSB_ART, X348a/6) → X632/A11, 0 V are missing.  
- The level is raised during the T1 test, or the up/down key on the air detector is blocked and the level is constantly raised. |
| **F12 Bloodsystem** | The arterial blood pump cannot be stopped by CPU1. CPU1 recognizes that the arterial blood pump remains active.  
- Control line (BPSST_A, X634L/B14) → X348a/1, 0 V missing, as well as (BPST_ART, X634L/A14) → X348a/3, 0 V missing.  
- Acknowledgement (BPSB_ART, X348a/6) → X633L/A11, 0 V are missing. |
| **F13 Bloodsystem** | Applicable for SW 4.91/2.91 and higher if SN, ONLINE-HDF or 4008 HDF pump is connected (= ADKS active)  
Acknowledgement that CPU2 detects that the pump is inactive (pump is not running).  
- Acknowledgement (BPSB_VEN, X348V/6) → X632/ B11, 12V missing  
- Control line (BPSST_VEN, X634L/B15) → X348V/1, 12V missing or (BPST_VEN, X634L/A15) → X348V/3, 12V missing  
- Transistor T9 on P.C.B. LP 754 defective  
- IC5 on P.C.B. LP 632 defective  
- In 4008 HDF an HDF treatment was performed, followed by a cleaning program with the substituate pump running, then the T1 test has been re-started. The substituate pump must be switched off because otherwise the test step will fail to be passed (problem was corrected with SW 3.20 in 4008 H/S systems: the substituate pump will be switched off automatically on starting a cleaning program). |
F14 Bloodsystem

Applicable for SW 4.91/2.91 and higher if SN, ONLINE-HDF or 4008 HDF pump is connected (= ADKS active)

Acknowledgement that CPU1 detects that the pump is inactive (pump is not running).
- Acknowledgement (BPSB_VEN,X348V/6) → X633L/A13, 12V missing
- Control line (BPSST_VEN, X634L/B15) → X348V/1 not 12V or (BPST_VEN, X634L/A15) → X348V/3 not 12V
- IC16 on P.C.B. LP 633 defective
- P.C.B. LP 633 recognizes Single-Needle pump although it is not connected.

F15 Bloodsystem

Applicable for SW 4.91/2.91 and higher if SN, ONLINE-HDF or 4008 HDF pump is connected (= ADKS active)

CPU1 fails to stop the corresponding blood pump.
- Control line (BPSST_VEN, X634L/B15) → X348V/1, 0V missing as well as (BPST_VEN, X634L/A15) → X348V/3 not 0V
- Acknowledgement (BPSB_VEN, X348V/6) → X632/B11, 0V missing
- Transistor T9 on P.C.B. LP 754 defective
- IC5 on P.C.B. LP 632 defective
- During the test the lines are inserted on the corresponding pump using the Start/Stop key.
- P.C.B. LP 633 recognizes Single-Needle pump although it is not connected.

F16 Bloodsystem

Applicable for SW 4.91/2.91 and higher if SN, ONLINE-HDF or 4008 HDF pump is connected (= ADKS active)

CPU1 fails to stop the corresponding blood pump.
- Control line (BPSST_VEN, X634L/B15) → X348V/1 not 0V as well as (BPST_VEN, X634L/A15) → X348V/3 not 0V
- Acknowledgement (BPSB_VEN, X348V/6) → X633L/A13 not 0V
- IC16 on P.C.B. LP 633 defective
- P.C.B. LP 633 recognizes Single-Needle pump although it is not connected.

F17 Bloodsystem

Applicable for SW 4.91/2.91 and higher if SN, ONLINE-HDF or 4008 HDF pump is connected (= ADKS active)

Although the recognition of the venous blood pump (ADKS) is not acknowledged, the 24-V supply voltage of the pump can be switched off.
- Acknowledgement line (ADKS, X348V/7) → X633L/A10 not 12V
- Acknowledgement (BPSB_VEN, X348V/6) → X633L/A13 not 12V
- Acknowledgement (BPSB_VEN, X348V/6) → X632/B11 not 12V
- Online-HDF has already been switched on during the T1 test.
- IC16 on P.C.B. LP 633 defective.
**F18 Bloodsystem**

Applicable for SW 5.00/4.10 and higher, check of the BPUS signal (CPU, P.C.B. LP 632)

At the beginning of the test step a maximum of 40s may pass until rotation has stopped. If the blood pump is being activated, the rotation stop alarm must have been cleared.

- Acknowledgement line (BPUS, X348A/8) → X632/A13 not 0V
- Acknowledgement line (BPUS, X348A/8) → X632/A13 not 12V
- Blood pump speed is set to “0”: preset speed during the T1 test.

**F19 Bloodsystem**

Applicable for SW 5.00/4.10 and higher, check of the BPUS signal (CPU, P.C.B. LP 631 via LP 633)

At the beginning of the test step a maximum of 40s may pass until rotation has stopped. If the blood pump is being activated, the rotation stop alarm must have been cleared.

1. Acknowledgement line (BPUS, X348A/8) → X633L/A12 not 0V
2. Acknowledgement line (BPUS, X348A/8) → X633L/A12 not 12V

**F20 Bloodsystem**

Check of the actual arterial BP rate.

The actual rate of the arterial BP is not zero. The actual rate of the arterial BP does not increase.

If SN is installed: The actual rate of the venous BP is not zero. The actual rate of the venous BP does not increase.

- Acknowledgement line (BPR_ART, X348A/10) → X633L/B3 not 0V or acknowledgement line (BPR_ART, X348A/10) → X632/A14 not 0V
- Acknowledgement line (BPR_ART, X348A/10) → X633L/B3 no increase or acknowledgement line (BPR_ART, X348A/10) → X632/A14 no increase

If SN is installed:

- Acknowledgement line (BPR_VHDF, X348V/10) → X633L/B4 not 0V
- Acknowledgement line (BPR_VHDF, X348V/10) → X633L/B4 no increase

**F95 Bloodsystem**

System error.
• Venous pressure system test

Test description:

Verification of the lower limit by checking the venous zero point. The upper limit is tested by detuning the venous pressure unit in positive direction. (The venous line clamp is closed during the test.)

Illustration:
Error description

Error message | Description
---|---
F01 Venous | CPU1 (input board) shows a venous zero point deviation of more than ±12 mmHg (60 s).
- Control (VENT_VALVE, X634R/C18) → X351/1 of the vent valve in the LD is defective.
- Acknowledgement (P_VEN, X351/4) → X633L/B5 that the voltage value is outside the zero point tolerance.
- P-venous has not been calibrated.

F02 Venous | CPU2 shows a venous zero point deviation of more than ±12 mmHg (60 s).
- Control (VENT_VALVE, X634R/C18) → X351/1 of the vent valve in the LD is defective.
- Acknowledgement (P_VEN, X351/4) → X632/C17, the voltage value is outside the zero point tolerance.
- P-venous has not been calibrated.

F03 Venous | With detuning in positive direction, the achieved change in the venous display is less than 100 mmHg (7 s).
- The test detuning is defective (PV_DET, X632/C18) → X351/2.
- Acknowledgement (P_VEN, X351/4) → X633L/B5, the change in voltage is too low.
- P-venous has not been calibrated.

F04 Venous | The deviation in the measured value between CPU1 and CPU2 is higher than ±12 mmHg (if Pven > 100 mmHg).
- Acknowledgement (P_VEN, X351/4) → X633L/B5 and X632/C17 measure different voltage values.
- P-venous has not been calibrated.

F95 Venous | System error.
• Air detector test

Test description:
– Test of the air detector by checking the alarm state.
– Switch-off of the venous line clamp in the air detector module.

Illustration:
Error description:

<table>
<thead>
<tr>
<th>Error message</th>
<th>Description</th>
</tr>
</thead>
</table>
| F01 Airdetector | CPU1 interprets the air detector signal in a different way than does CPU2.  
  – Acknowledgements (LDA1, X351/14) → X632/C13 and X633L/C10 recognize different signal levels. |
| F02 Airdetector | The air detector alarm is not recognized by CPU2.  
  – Acknowledgement (LDA1, X351/14) → X632/C13, 0 V are missing.  
  – Transmission weakening (LDSA, X632/C16) → X351/10, 12 V are missing. |
| F03 Airdetector | Air detector clamps acknowledgement (CPU2) activated (clamp closed).  
  – Acknowledgement (LDA2, X351/6) → X632/C14, 24 V are missing.  
  – Clamp control (CLP_CTL, X634L/C14) → X351/8, 12 V are missing.  
  – Clamp control (CLP_CTL, X632/C10) → X351/8, 12 V are missing. |
| F04 Airdetector | Air detector clamps acknowledgement (CPU1) activated (clamp closed).  
  – Acknowledgement (LDA2, X351/6) → X633L/C13, 24 V are missing.  
  – Clamp control (CLP_CTL, X634L/C14) → X351/8, 12 V are missing.  
  – Clamp control (CLP_CTL, X632/C10) → X351/8, 12 V are missing. |
| F05 Airdetector | The blood alarm signal has not been cleared (indicates an alarm).  
  – Acknowledgement (BL_AL, X634L/C15) → X632/C21, 12 V are missing.  
  If the HDF option is used, this signal is not tested (special function). |
| F06 Airdetector | Closing of the air detector clamp via the CPU2 control line was not possible.  
  – Clamp control (CLP_CTL, X632/C10) → X351/8, 0 V are missing.  
  – Acknowledgement (LDA2, X351/6) → X632/C14, 0 V are missing. |
| F07 Airdetector | Opening of the air detector clamp via the CPU2 control line was not possible.  
  – Clamp control (CLP_CTL, X632/C10) → X351/8, 12 V are missing.  
  – Acknowledgement (LDA2, X351/6) → X632/C14, 24 V are missing. |
| F08 Airdetector | Closing of the air detector clamp via the CPU1 control line was not possible, or CPU2 acknowledgement is incorrect.  
  – Clamp control (CLP_CTL, X634L/C14) → X351/8, 0 V are missing.  
  – Acknowledgement (LDA2, X351/6) → X632/C14, 0 V are missing. |
F09 Airdetector  Closing of the air detector clamp via the CPU1 control line was not possible, or CPU1 acknowledgement is incorrect.
  – Clamp control (CLP_CTL, X634L/C14) → X351/8, 0 V are missing.
  – Acknowledgement (LDA2, X351/6) → X633L/C13, 0 V are missing.

F10 Airdetector  The blood alarm message is missing.
  – Acknowledgement (BL_AL, X634R/C15) → X632/C21, 0 V are missing.
      If the HDF option is used, this signal is not tested (special function).

F11 Airdetector  Air detector clamps acknowledgement (CPU2) activated (clamp closed).
  – Acknowledgement (LDA2, X351/6) → X632/C14, 24 V are missing.
  – Clamp control (CLP_CTL, X634L/C14) → X351/8, 12 V are missing.
  – Clamp control (CLP_CTL, X632/C10) → X351/8, 12 V are missing.

F12 Airdetector  Air detector clamps acknowledgement (CPU1) activated (clamp closed).
  – Acknowledgement (LDA2, X351/6) → X633L/C13, 24 V are missing.
  – Clamp control (CLP_CTL, X634L/C14) → X351/8, 12 V are missing.
  – Clamp control (CLP_CTL, X632/C10) → X351/8, 12 V are missing.

F13 Airdetector  The blood alarm signal has not been cleared (indicates alarm).
  – Acknowledgement (BL_AL, X634L/C15) → X632/C21, 12 V are missing.
      If the HDF option is used, this signal is not tested (special function).

F14 Airdetector  Raise level key on the air detector is constantly active.
  – Acknowledgement (LEVEL_UP, X351/3) → X632/C11 not 0V.

F15 Airdetector  Acknowledgement of the supply voltage for the ultrasonic output stage not between 6.5 and 13.5 V after 3 seconds.
  – Adapter board AD28 not connected
  – Acknowledgement (X351/11 → X633L/25A jumper to X633L/B7) not 12V.
  – Relay on AD28 failed to drop.

F16 Airdetector  Acknowledgement of the supply voltage for the ultrasound output stage not >14.5V after 3 seconds.
  – Adapter board AD28 not connected.
  – Acknowledgement (X351/11 → X633L/25A jumper to X633L/B7) not 16V/24V.
  – Relay on AD28 is not controlled.
  – No 10-Hz signal at ALARM_REST (X351/12)
F17 Airdetector  Acknowledgement of the supply voltage for the ultrasound output stage not between 6.5 and 13.5 V after 3 seconds.
- Adapter board AD28 not connected
- Acknowledgement (X351/11 → X633L/25A jumper to X633L/B7) not 12V
- Relay on AD28 failed to drop

F95 Airdetector  System error.
● **Display test**

**Test description:**

Check of all displays and indicators on the monitor front
- Display test
- Status LED
- Alarm LED
- Seven-segment display, all dark
- Seven-segment display, all 8888
- Bar graph
- CPU1/CPU2 alarm tone

**This display test must be monitored by the user!**

**Illustration:**

![Diagram showing the display test connections and components.](image-url)
<table>
<thead>
<tr>
<th>Error message</th>
<th>Description</th>
</tr>
</thead>
</table>
| F01 Display  | CPU1 failed to start the display test within 5 sec.  
|              | – The “test started” information transmitted via the serial interface is missing. |
| F02 Display  | CPU1 failed to complete the display test within 120 sec.  
|              | – The “test completed” information transmitted via the serial interface is missing. |
| F95 Display  | System error. |
- Arterial pressure system test

Test description:

Test of the arterial pressure unit by electronic detuning in positive or negative direction.

Illustration:
<table>
<thead>
<tr>
<th>Error description:</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Error message</strong></td>
<td><strong>Description</strong></td>
</tr>
<tr>
<td><strong>F01 Arterial</strong></td>
<td>With detuning in negative direction, the change achieved on the arterial display is less than 100 mmHg (2 sec).</td>
</tr>
<tr>
<td></td>
<td>– Acknowledgement (P_ART, X348A/7) → X633L/B12, insufficient voltage change.</td>
</tr>
<tr>
<td><strong>F02 Arterial</strong></td>
<td>With detuning in positive direction, the change achieved on the arterial display is less than 100 mmHg (2 sec).</td>
</tr>
<tr>
<td></td>
<td>– Acknowledgement (P_ART, X348A/7) → X633L/B12, insufficient voltage change.</td>
</tr>
<tr>
<td><strong>F95 Arterial</strong></td>
<td>System error.</td>
</tr>
</tbody>
</table>
• Battery test

Test description:

Check of the battery voltage under load.

Illustration:
<table>
<thead>
<tr>
<th>Error message</th>
<th>Description</th>
</tr>
</thead>
</table>
| **F01 Accumulator** | CPU1 failed to complete the battery test within 5 sec.  
– The “test completed” information transmitted via the serial interface is missing. |
| **F02 Accumulator** | The battery charge is insufficient for 15 min emergency operation (maybe no battery connected).  
– The battery voltage (U\_ACCU, ...) → X633L/B21 dropped below 17.6 V.  
– Acknowledgement (U\_ACCU, ...) → X633L/B21 of the battery voltage defective. |
| **F03 Accumulator** | The test circuit on P.C.B. LP 639 defective.  
– The test level is incorrect (TESTBATT, X634R/C23) → X639/A10, the 12-V pulse is missing (100 ms).  
– Power supply unit LP 639 SI5 or in 4008B/S systems fuse in the base defective.  
– R39 on P.C.B. LP 639 (4008E/H) or P.C.B. LP 647 (4008B/S) defective, possibly caused by flickering power supply unit. |
| **F95 Accumulator** | System error. |
• **Blood leak test**

**Test description:**

Test of the blood leak detector by lowering the capacity of the transmitting diode.

**Illustration:**
Error description:

Error message | Description  
--- | ---  
**F01 Bloodleak** | Blood leak channel and dimness not in alarm-free condition during the T1 test.  
- Dimness channel contaminated (calcium precipitate, etc.)  
- Acknowledgement (BLL, X637A/18) → X633L/B10 voltage value within the alarm tolerances (<3V).  
- Acknowledgement (BLL_DIM, X637A/21) → X633L/B11 voltage value within the alarm tolerances (<1.5V/ >8V).  
- DAC_BLL or DAC_DIM not within the tolerances (check calibration)  
**F02 Bloodleak** | The blood leak alarm/dimness alarm is not recognized during test detuning.  
- Acknowledgement (BLL, X637A/18) → X633L/B10 voltage value not within the alarm tolerances.  
- Acknowledgement (BLL_DIM, X637A/21) → X633L/B11 voltage value not within the alarm tolerances (<1.5V).  
- Test detuning (BLL_DET, X632/A25) → X633L/B27 not 5V  
- Calibration of DAC_BLL or DAC_DIM is too high  
- Detuning (DAC_DIM, X634R/A11) → X633L/C3 impossible  
- Dimness calibration is set to potentiometer calibration (BR6 from pos. 1/2 to 2/3).  
**F03 Bloodleak** | After test detuning, the blood leak channel and dimness fail to enter the alarm-free state.  
- Dimness channel contaminated (calcium precipitate, etc.)  
- Acknowledgement (BLL, X637A/18) → X633L/B10 voltage value within the alarm tolerances  
- Test detuning (BLL_DET, X632/A25) → X633L/B27 not 0V.  
- Acknowledgement (BLL_DIM, X637A/21) → X633L/B11 voltage value within the alarm tolerances (<1.5V/ >8V).  
- DAC_BLL or DAC_DIM not within the tolerances (check calibration)  
**F95 Bloodleak** | System error.
Temperature test

Test description:
Test of the upper alarm limit by electronically detuning the temperature display in positive direction.

Illustration:
<table>
<thead>
<tr>
<th>Error message</th>
<th>Description</th>
</tr>
</thead>
</table>
| **F01 Temperature** | The temperature measuring range is not set to hemodialysis.  
- Control line (HOTRINSE, X634R/C24) → X639/A20, 0 V are missing.  
- Acknowledgement (HOTRINSE, X634R/C24) → X632/A26, 0 V are missing. |
| **F02 Temperature** | The actual temperature is less than 35.0 °C (test running time > 15 minutes).  
- Calibrate the temperature.  
- The heater rod failed.  
- Acknowledgement (T_DIAL1, X633L/B16) → X632/A24, voltage got stuck. |
| **F03 Temperature** | The actual temperature is higher than 39.0 °C (test running time > 15 minutes).  
- Calibrate the temperature.  
- The regulating sensor (NTC-2) is defective.  
- Acknowledgement (T_DIAL1, X633L/B16) → X632/A24, voltage got stuck. |
| **F04 Temperature** | The temperature failed to stabilize within 15 minutes.  
- Acknowledgement (T_DIAL1, X633L/B16) → X632/A24 is steadily changing (change > 0.3 °C/15 sec). |
| **F05 Temperature** | Detuning in positive direction not higher than 3 °C (10 sec).  
- Acknowledgement (T_DIAL1, X633L/B16) → X632/A24, change in voltage insufficient.  
- Detuning (T_DETADJ, X632/A23) → X633R/C21 insufficient. |
| **F06 Temperature** | The monitor sensor indicates a constant value.  
- NTC-3 defective. |
| **F07 Temperature** | The test release is missing (max. test running time is 10 minutes).  
- Run-time problem (software). |
| **F08 Temperature** | CPU1 failed to transmit a Bibag status message within 3 sec.  
- Run-time problem (software). |
| **F09 Temperature** | Bibag NTC_BIB detuning not higher than 1 °C.  
- Acknowledgement (NTC_BIB, X633R/C15) → ADW on P.C.B. LP 633, change in voltage insufficient.  
- Detuning (BIBAG_TE, X634R/A13) → X633R/A20 insufficient. |
| **F10 Temperature** | Bibag temperature display outside of measuring range (15 to 45 °C).  
| **F95 Temperature** | System error. |
• Negative pressure holding test

Test description:

Within a specific time period, the actual value of the dialysate pressure transducer should change within certain limits only.

Illustration:
Error description:

<table>
<thead>
<tr>
<th>Error message</th>
<th>Description</th>
</tr>
</thead>
</table>
| **F01 neg. Pressure** | During the start phase a negative pressure of more than 450 mmHg has developed (max. test running time 120 sec),  
- the hydraulic system is contaminated,  
- the air separation pump started running. |
| **F02 neg. Pressure** | Setting the dialysate pressure to the test pressure (−300 mmHg to −450 mmHg) was not possible (max. test running time 120 sec). Upon repetition of measurement, the range was extended from −260 mmHg to 490 mmHg.  
- Leakage in the hydraulic system.  
- The UF pump is defective.  
- If the HDF filter test was skipped: Clamp the HDF filter. |
| **F03 neg. Pressure** | The working point (116 digits) of the differential amplifier cannot be set correctly (max. test running time 120 sec).  
- Pressure variations are too large.  
- The D-A converter (IC11) on P.C.B. LP 632 is defective.  
- The operational amplifier (IC1/IC3) on P.C.B. LP 632 is defective.  
- The acknowledgement (P_DIAL, X633L/B6) → X632/A29 is defective.  
- The CI signal is missing (LP 632 → X632/B22). |
| **F04 neg. Pressure** | Completion of pressure measurement was not possible (max. test running time 120 sec).  
- The D-A converter (IC11) on P.C.B. LP 632 is defective.  
- The operational amplifier (IC1/IC3) on P.C.B. LP 632 is defective.  
- The acknowledgement (P_DIAL, X633L/B6) → X632/A29 is defective. |
| **F05 neg. Pressure** | The air separation pump started running during the measurement phase.  
- Acknowledgement (ACKN_ASP, X634L/B10) → X632/A19, 0 V are missing.  
- ASP has been interrupted electrically. |
| **F06 neg. Pressure** | The negative pressure holding test failed to be passed. The dialysate pressure drop exceeds ±40 mmHg (related to ten balancing chamber switching).  
- Leakage in the hydraulic system. |
| **F07 neg. Pressure** | Current increasing pulses were not recognized (min. 2x).  
- 5-V balancing chamber pulses are missing (CI. X634R/A23) → X632/B22. |
| **F95 neg. Pressure** | System error. |

In systems with HDF option, the negative pressure holding test is performed internally only; i.e. V24, V24B are closed and V26 is open.
● Positive pressure holding test

Test description:

Valves V24, V24B and V26 are checked for proper function (mechanical).
Test of the TMP unit by detuning it electronically in positive direction.
With the dialysate flow turned off, positive pressure is applied to the balancing system. The actual value of the dialysate pressure transducer is now monitored for a defined period of time.
Test of the pump segment of P97.
<table>
<thead>
<tr>
<th>Error message</th>
<th>Description</th>
</tr>
</thead>
</table>
| F01 pos. Pressure | The mandatory filling program of CPU1 has not been completed (10 sec).  
– The solenoid valve V43 is not closed. |
| F24 pos. Pressure | V24 valve error.  
– Acknowledgement (V24, X637/C1) → X632/A4, 24 V are missing. |
| F25 pos. Pressure | No pressure increase above 150 mmHg (change in pressure) after valve switching.  
– Control signals of V24 and V24B mistaken for each other.  
– Leakage in the external system (shunt interlock, dialysate lines, etc.).  
– If the HDF filter test was skipped: Clamp the HDF filter. |
| F26 pos. Pressure | No pressure compensation after opening of V43 (−125 mmHg to 55 mmHg).  
– V24 got stuck (mechanically open).  
– V43 not open.  
– V26 leaking. |
| F27 pos. Pressure | No pressure compensation after opening of V43 (−125 mmHg to 55 mmHg).  
– V24 got stuck (mechanically open).  
– V43 not open.  
– V189 (retentate valve) leaking. |
| F02 pos. Pressure | The loading pressure cannot be measured via the solenoid valve V26 in the hydraulic system (P-Dial. < 600 mmHg, 15 sec).  
– Solenoid valve V26 mechanically not open.  
– Solenoid valve V43 mechanically not closed.  
The balancing chamber is switched to passage during this test sequence. V24, V24B and V43 are closed; V26 is open. |
| F03 pos. Pressure | The hydraulic system cannot be deaerated via the solenoid valve V43; the zero point of −125 to 55 mmHg has not been reached (15 sec).  
– Solenoid valve V26 mechanically not closed.  
– Solenoid valve V43 mechanically not open.  
– Zero point outside the −125 to 55 mmHg range.  
The balancing chamber is switched to passage during this test sequence. V24, V24B and V26 are closed; V43 is open. |
| F04 pos. Pressure | The first working point (220 digits) of the differential amplifier cannot be set.  
– Pressure variations are too large.  
– The D-A converter (IC11) on P.C.B. LP 632 is defective.  
– The operational amplifier (IC1/IC3) on P.C.B. LP 632 is defective.  
– The acknowledgement (P_DIAL, X633L/B6) → X632/A29 is defective. |
F05 pos. Pressure  Test detuning results in a change in the measuring range of more than 95 mmHg (60 sec).
− The operational amplifier (IC2) on P.C.B. LP 632 is defective.
− Acknowledgement (P_DIAL, X633L/B6) → X632/A29, change in voltage too large.
− Detuning defective (P_DETADJ, X632/C20) → X633R/C22.
− The balancing chamber valve V36 or V38 (waste water valve) is leaky.

F06 pos. Pressure  Test detuning results in a change in the measuring range of less than 85 mmHg (60 sec).
− The D-A converter (IC11) on P.C.B. LP 632 is defective.
− Acknowledgement (P_DIAL, X633L/B6) → X632/A29, change in voltage insufficient.
− Detuning defective (P_DETADJ, X632/C20) → X633R/C22.
− V26 is leaky.

F07 pos. Pressure  After detuning in the test there is a difference (P.diff > ±9 mmHg) between the display and the differential amplifier.
− The voltage divider R23/R9 or the operational amplifier IC2 is defective.
− The operational amplifier IC1/IC3 is defective.
− The balancing chamber valve V36 or V38 (waste water valve) is leaky.

F08 pos. Pressure  Test detuning results in a change in the measuring range of more than 400 mmHg (20 sec).
− The operational amplifier (IC2) on P.C.B. LP 632 is defective.
− Acknowledgement (P_DIAL, X633L/B6) → X632/A29, change in voltage too large.
− Detuning defective (P_DETADJ, X632/C20) → X633R/C22.

F09 pos. Pressure  Test detuning results in a change in the measuring range of less than 350 mmHg (20 sec).
− The D-A converter (IC11) on P.C.B. LP 632 is defective.
− Acknowledgement (P_DIAL, X633L/B6) → X632/A29, change in voltage insufficient.
− Detuning defective (DIAL_DET_ADJ, X632/C20) → X633R/C22.

F10 pos. Pressure  The second working point (116 digits) of the difference amplifier cannot be set correctly.
− The D-A converter (IC11) on P.C.B. LP 632 is defective.
− The operational amplifier (IC1/IC3) on P.C.B. LP 632 is defective.

F11 pos. Pressure  Change in the dialysate pressure after closing of the solenoid valve V43 (zero point change from -20 mmHg to +80 mmHg within 15 sec).
− The solenoid valve V24B is not closed.
− The balancing chamber valve V36 or V38 (waste water valve) is leaky.

The balancing chamber is switched to passage during this test sequence. V43, V24B and V26 are closed; V24 is open.
F12 pos. Pressure  
The loading pressure cannot be measured via the solenoid valves V24 and V24B in the hydraulic system (P-Dial. < 600 mmHg, 15 sec).  
– Solenoid valve V24 or V24B mechanically not open.  
The balancing chamber is switched to passage during this test sequence. V43 and V26 are closed; V24 and V24B are open.

F13 pos. Pressure  
The hydraulic system cannot be deaerated via the solenoid valve V43 (P-Dial. not equal to –125 to 55 mmHg, 20 sec).  
– The solenoid valve V24 is not closed.  
– V43 neither opens electrically nor mechanically.  
The balancing chamber is switched to passage during this test sequence. V24 and V26 are closed; V24B and V43 are open.

F14 pos. Pressure  
Zero point change after closing of solenoid valve V43 (20 sec).  
Standard: P-Dial. not equal to –125 to 55 mmHg.  
HDF option: P-Dial. not equal to –125 to 60 mmHg.  
– The solenoid valve V24 is not closed.  
The balancing chamber is switched to passage during this test sequence. V24, V26 and V43 are closed; V24B is open.

F15 pos. Pressure  
The loading pressure is below 780 mmHg ±30 mmHg (10 sec).  
– The loading pressure is too low.

F16 pos. Pressure  
During the start phase, the pressure dropped below 620 mmHg (measuring tolerance: ±30 mmHg, max. test running time 120 sec).  
– Major leakage in the hydraulic system.  
– The UF pump spring is defective.  
– The loading pressure is too low.  
– The air separation pump fails to occlude.  
– Relief valve (78) or V43 is leaky.

F17 pos. Pressure  
During the start phase, it was not possible to reduce the dialysate pressure to a value below 760 mmHg (measuring tolerance: ±30 mmHg, test running time 120 sec).  
– The loading pressure is too high.  
– The UF pump is defective.

F18 pos. Pressure  
The working point (116 digits) of the differential amplifier cannot be set correctly (test running time 120 sec).  
– The pressure variations in the system are too large.

F19 pos. Pressure  
Completion of the pressure measurement was not possible (max. test running time 120 sec).  
– The D-A converter (IC11) on P.C.B. LP 632 is defective.  
– The acknowledgement (P_DIAL, X633L/B6) → X632/A29 is defective.
**F20 pos. Pressure**

The positive pressure holding test failed to be passed. While the flow was off, a pressure drop of more than ±80 mmHg/min was detected in the hydraulic system.

- Leakage in the hydraulic system.
- The UF pump spring is defective.
- ASP fails to occlude.
- Relief valve leaking.
- V84 leaking.

**F21 pos. Pressure**

The dialysate pressure cannot be set to a value between 460 and 760 mmHg ±30 mmHg (10 sec).

- The heat exchanger is defective.
- Problem in the hydraulic system.

**F22 pos. Pressure**

The air separation pump is not running during the test phase (2 sec).

- Control line (AIR_SEP+, X634L/A22) → ASP/..., 24 V are missing.
- Control line (AIR_SEP−, X634L/C22) → ASP/..., 0 V are missing.
- Acknowledgement (ACKN_ASP, X634L/B10) → X632/A19, 12 V are missing.

**F23 pos. Pressure**

Pressure drop in the hydraulic system during the measurement phase (8 sec). Change more than +4 digits or more than −8 digits.

- Leakage in the pump segment of the air separation pump.
- Leakage in the heat exchanger.
- Acknowledgement (P_DIAL, X633L/B6) → X632/A29, change in voltage too large.

**F24 – F27**

See between F01 and F02

**F28 pos. Pressure**

ASP functional test (running and delivery test)

- ASP line segment is occluded
- ASP line segment has been incorrectly inserted (check direction of delivery)
- ASP is not running (electrically or mechanically)
- V87 electrically or mechanically closed

**F95 pos. Pressure**

System error.
- **UF function test**

**Test description:**

CPU1 activates the UF pump at a defined rate.
CPU2 checks the UF pump.
CPU2 blocks the control line of the UF pump and checks whether the UF pump stops.
Check of the UF counter.

The following is additionally applicable with built-in 4008 HDF option:
CPU1 activates the UF pump 2 at a defined rate.
CPU2 checks the hydraulic and the electric function of the UF pump 2.
CPU2 blocks the control line of the UF pump 2 and checks whether it stops.
Check of the UF2 counter.

**Illustration:**
Error description:

Error message | Description
--- | ---
F01 UF-Function | The pause between the strokes of the UF pump 1 was shorter than 220 ms. Correct volume delivery is not ensured due to too short a return.

- CPU1 issued too high a pump rate.

F02 UF-Function | The pulse time for the UF pump 1 is shorter than 180 ms. Correct volume delivery is not ensured due to too short an emission time.

- The monoflop on P.C.B. LP 634 is defective (IC42/R82/C47).

F03 UF-Function | The pulse time for the UF pump 1 is longer than 500 ms. A maximum rate of 5000 ml/h is not possible.

- The monoflop on P.C.B. LP 634 is defective (IC42/R82/C47).

F04 UF-Function | No activity of the UF pump 1 during the test (5 sec).

- Acknowledgement (UF_P1, X637/B23) → X632/A7, no LOW pulses.

- Control line (UF_P1, X634L/ABC23) → X637/B23, no LOW pulses.

F05 UF-Function | The UF pump 1 cannot be stopped by CPU2.

- Control line (UF_P_EN, X632/C28) → X634R/A22, 5 V are missing.

- The reset input at IC42/pin 3 on P.C.B. LP 634 is defective.

F06 UF-Function | The UF pump acknowledgement of CPU1 is defective.

- Acknowledgement (UF_P1, X637/B23) → X622L/C14, no LOW pulses.

F07 UF-Function | The change in pressure after a stroke is less than 20 mmHg.

- The UF pump 1 is mechanically defective.

- Control line (UF_P1_CTL, X632/C27) → X634R/A24, no LOW pulse.

F09 UF-Function | Dialysate pressure is outside the measuring range (15s).

- UF pressure transducer defective

- D/A converter (IC11) on P.C.B. LP 632 defective

- Operational amplifier (IC1/IC3) on P.C.B. LP 632 defective

F11 UF-Function | The pause between the strokes of the UF pump 2 was shorter than 220 ms. Correct volume delivery is not ensured due to too short a return.

- CPU1 issued too high a pump rate.

F12 UF-Function | The pulse time for the UF pump 2 is shorter than 180 ms. Correct volume delivery is not ensured due to too short an emission time.

- The monoflop on P.C.B. LP 634 is defective (IC42/R65/C45).
F13 UF-Function
The pulse time for the UF pump 2 is longer than 500 ms. A maximum rate of 5000 ml/h is not possible.
- The monoflop on P.C.B. LP 634 is defective (IC42/R65/C45).

F14 UF-Function
No activity of the UF pump 2 during the test (4 sec).
- Acknowledgement (UF_P2, X637/B26) → X632/C7, no LOW pulses.
- Control line (UF_P2, X634L/ABC24) → X637/B26, no LOW pulses.

F15 UF-Function
The UF pump 2 cannot be stopped by CPU2.
- Control line (UF_P_EN, X632/C28) → X634R/A22, 5 V are missing.
- The reset input at IC42/pin 13 on P.C.B. LP 634 is defective.

F16 UF-Function
The UF pump acknowledgement of CPU1 is defective.
- Acknowledgement (UF_P2, X637/B26) → X633L/C23, no LOW pulses.

F09 UF-Function
Dialysate pressure is outside the measuring range (15s).
- UF pressure transducer defective
- D/A converter (IC11) on P.C.B. LP 632 defective
- Operational amplifier (IC1/IC3) on P.C.B. LP 632 defective

F17 UF-Function
The change in pressure after a stroke of the UF pump 2 is less than 20 mmHg.
- The UF pump 2 is mechanically defective.
- Control line (UF_P2_CTL, X632/B24) → X634R/C11, no HIGH pulse.

F20 UF-Function
The difference in volume between UF pump 1 and UF pump 2 is higher than 25% (range of tolerance 15% to 35%).
- The stroke volume of UF pump 1 or UF pump 2 has been misadjusted.

F95 UF-Function
System error.
- **Conductivity test**

  **Test description:**

  Test of the alarm limits by electronically detuning the conductivity by +5% or by –5%.

  **Illustration:**

  ![Conductivity Test Diagram](image-url)
### Error description:

<table>
<thead>
<tr>
<th>Error message</th>
<th>Description</th>
</tr>
</thead>
</table>
| **F01 Conductivity** | The conductivity failed to be within the scale limits or to stabilize within 10 minutes (±0.1 mS/10 sec).  
  - Concentrate is not connected.  
  - Acknowledgement (COND_SIG, X633L/B8) → X632/A22, voltage outside the measuring range or unstable. |
| **F02 Conductivity** | Detuning in positive direction not more than 0.5 mS (10 sec).  
  - Acknowledgement (COND_SIG, X633L/B8) → X632/A22 insufficient.  
  - Detuning (COND_DET, X632/A21) → X633L/B31 insufficient. |
| **F03 Conductivity** | Detuning in negative direction not more than 0.5 mS (10 sec).  
  - Acknowledgement (COND_SIG, X633L/B8) → X632/A22 insufficient.  
  - Detuning (COND_DET, X632/A21) → X633L/B31 insufficient. |
| **F04 Conductivity** | The conductivity cell indicates a constant value.  
  - The CD cell is defective. |
| **F05 Conductivity** | CPU1 failed to transmit a Bibag status message within 3 sec.  
  - Run-time problem (software). |
| **F08 Conductivity** | CPU 1 fails to increase the working point (when the conductivity is <40mS/cm uncompensated) for the bibag conductivity by > 5 digits.  
  - Detuning (HOT_RINSE, X634R/C24 → X633R/A16) not 12V  
  - P.C.B. LP 633 T2 or IC26 defective |
| **F06 Conductivity** | The Bibag CD detuning is not more than 1 mS/cm.  
  - Acknowledgement (COND_SIGNAL3, X633R/A12) → MP TP3 on P.C.B. LP 633, change in voltage insufficient.  
  - Detuning (COND_DET, X632/A21) → X633L/B31 insufficient. |
| **F07 Conductivity** | The Bibag CD display is outside of the measuring range.  
  - Acknowledgement (COND_SIGNAL3, X633R/A12) → MP TP3 on P.C.B. LP 633.  
  - Conductivity outside the expected detuning range caused by wrong concentrate on the bicarbonate port or temperature too low. |
| **F95 Conductivity** | System error. |
● Diasafe/HDF filter test

Test description:

Test of the filters by testing the volume of the internal capillary and pressure holding test.

Illustration:
### Error description:

<table>
<thead>
<tr>
<th>Error message</th>
<th>Description</th>
</tr>
</thead>
</table>
| **F02 Diasafe** | The balancing chamber was not stopped by CPU1 (24 sec).  
- The message via the serial interface from CPU1 to CPU2 is missing.  
- The current rise pulse is missing (CI, X634R/A23) → X633L/C31, no 5-V pulse. |
| **F04 Diasafe** | CPU1 failed to complete one balancing chamber switching within 20 sec (30 ml fluid not removed?).  
- The message via the serial interface from CPU1 to CPU2 is missing.  
- The current rise pulse is missing (CI, 634R/A23) → 633L/C31, no 5-V pulse. |
| **F06 Diasafe** | During the pressure built-up phase, a negative pressure of less than –450 mHg has developed (24 sec).  
- Diasafe valve not open, control line (V\_DSAFE, X632/B5) → X637/C16, 0 V are missing. |
| **F07 Diasafe** | After the maximum fluid volume of 145 ml + 30 ml has been removed, the expected negative pressure of –300 mmHg to –450 mm Hg failed to build up.  
- Major leakage in the Diasafe filter membrane and/or filter housing.  
- Major leakage in the O-rings on filter holder/couplings.  
- V26 electrically or mechanically not closed. |
| **F08 Diasafe** | The negative test pressure of more than –300 mmHg has developed before the minimum fluid removal of 145 ml –30 ml has been achieved.  
- The Diasafe filter is contaminated.  
- The Diasafe filter was not correctly deaerated upon start of the test.  
- V112 electrically or mechanically not open. |
| **F09 Diasafe** | The zero point for pressure measurement cannot be set. The maximum test time has been exceeded (max. test time 5 min).  
- Leakage in the Diasafe filter membrane and/or filter housing.  
- Leakage in the O-rings on filter holder/couplings.  
- P.C.B. LP 632, IC3/pin 12 not in socket or IC defective (differential amplifier). |
| **F10 Diasafe** | The negative pressure to be achieved in the test failed to stabilize within the maximum test time of 5 minutes (change > ±16.7 mmHg/min).  
- Leakage in the Diasafe filter membrane and/or filter housing.  
- Leakage in the O-rings on filter holder/couplings.  
- Leakage in the hydraulic system.  
- V 26 electrically or mechanically not closed. |
| **F20 Diasafe** | It was not possible to prime (deaerate) the dialysate filter within 2 minutes.  
- Flow problems.  
- The priming program is permanently active (level sensor, osmosis water, or P.C.B. LP 633, IC36 defective). |
<p>| <strong>F95 Diasafe</strong> | System error. |</p>
<table>
<thead>
<tr>
<th>Error message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F01 HDF-Filter</td>
<td>The Diasafe option has not been set although ON-LINE HDF has been selected.</td>
</tr>
<tr>
<td></td>
<td>– CPU 2: DIP switch array 2, switch 1 not set to ON.</td>
</tr>
<tr>
<td>F02 HDF-Filter</td>
<td>CPU1 failed to stop the balancing chamber (24 sec).</td>
</tr>
<tr>
<td></td>
<td>– The message via the serial interface from CPU1 to CPU2 is missing.</td>
</tr>
<tr>
<td></td>
<td>– The current rise pulse is missing (Cl, X634/A23) → X633L/C31, no 5-V pulse.</td>
</tr>
<tr>
<td>F04 HDF-Filter</td>
<td>CPU1 failed to complete one balancing chamber switching within 20 sec (30 ml fluid not removed?).</td>
</tr>
<tr>
<td></td>
<td>– The message via the serial interface from CPU1 to CPU2 is missing.</td>
</tr>
<tr>
<td></td>
<td>– Verify the current rise pulse.</td>
</tr>
<tr>
<td>F06 HDF-Filter</td>
<td>During the pressure-buildup phase, a negative pressure of less than –370 mmHg has developed (24 sec).</td>
</tr>
<tr>
<td></td>
<td>– The HDF filter is clamped/clogged.</td>
</tr>
<tr>
<td></td>
<td>– The Diasafe valve is not open, control line (V_DSAFE, X632/B5) → X637/C16, 0 V are missing.</td>
</tr>
<tr>
<td>F07 HDF-Filter</td>
<td>After the maximum fluid volume of 255 ml +60 ml has been removed the expected negative pressure of –220 mmHg up to 370 mmHg failed to build up.</td>
</tr>
<tr>
<td></td>
<td>– Major leakage in the Diasafe/HDF filter membrane and/or filter housing.</td>
</tr>
<tr>
<td></td>
<td>– Major leakage in the O-rings on filter holder/couplings.</td>
</tr>
<tr>
<td></td>
<td>– V26 electrically or mechanically not closed.</td>
</tr>
<tr>
<td>F08 HDF-Filter</td>
<td>The negative test pressure of less than –220 mmHg has developed, before the minimum fluid removal of 255 ml –60 ml has been achieved.</td>
</tr>
<tr>
<td></td>
<td>– The Diasafe/HDF filters are contaminated.</td>
</tr>
<tr>
<td></td>
<td>– The Diasafe/HDF filters were not correctly deaerated upon start of the test.</td>
</tr>
<tr>
<td></td>
<td>– V112 electrically or mechanically not open.</td>
</tr>
<tr>
<td>F09 HDF-Filter</td>
<td>The zero point for pressure measurement cannot be set. The max. test time has been exceeded (10 min).</td>
</tr>
<tr>
<td></td>
<td>– Leakage in the Diasafe/HDF filter membrane and/or filter housing.</td>
</tr>
<tr>
<td></td>
<td>– Leakage in the O-rings on filter holder/couplings.</td>
</tr>
<tr>
<td>F10 HDF-Filter</td>
<td>The negative pressure to be achieved in the test failed to stabilize within the maximum test time of 10 minutes (change &gt; ±13.3 mmHg/min).</td>
</tr>
<tr>
<td></td>
<td>– Leakage in the Diasafe/HDF filter membrane and/or filter housing.</td>
</tr>
<tr>
<td></td>
<td>– Leakage in the O-rings on filter holder/couplings.</td>
</tr>
<tr>
<td></td>
<td>– Leakage in the hydraulic system.</td>
</tr>
<tr>
<td></td>
<td>– V26 electrically or mechanically not closed.</td>
</tr>
</tbody>
</table>
F20 HDF-Filter
It was not possible to prime (deaerate) the Diasafe filter within 2 minutes.
– Flow problems.
– The priming program is permanently active (level sensor, osmosis water, or P.C.B. LP 633, IC36 defective).

F21 HDF-Filter
It was not possible to correctly rinse/prime the HDF filter within 5 minutes (before the test).
– Flow problems.
– No conductivity.
– Conductivity at the upper or lower end of the scale range.
– The HDF pump is not running (e.g. open door).
– The delivery rate of the HDF pump is less than 380 ml/min.
– Line diameter not set to 8 mm.
– NTC6 permanently fails to detect fluid.
– Sieve on V43 clogged.

F22 HDF-Filter
It was not possible to correctly rinse/prime the HDF filter within 5 minutes (after the test).
– Flow problems.
– No conductivity.
– Conductivity at the upper or lower end of the scale range.
– Especially with biBag systems: check filter on V43
– The HDF pump is not running (e.g. open door).
– The delivery rate of the HDF pump is less than 380 ml/min.
– Line diameter not set to 8 mm.
– NTC6 permanently fails to detect fluid.
– Sieve on V43 clogged.

F95 HDF-Filter
System error.
• Online plus / Diasafe plus filter / HPU test

F01 ONLINE plus
F01 DIASAFE plus
F01 HPU
Present options and DIP switch settings do not match.
CPU1 system status (MST), HPU status and DIP switch/Array2 changed during the test running time.
  – **ONLINE plus:**
    - CPU 2: Array 2, DipSw2 not set to OFF
    - CPU 2: Array 2, DipSw3 not set to ON
  – **DIASAFE plus:**
    - CPU 2: Array 2, DipSw2 not set to OFF
    - CPU 2: Array 2, DipSw3 not set to OFF
    - MST transmitted by CPU1 not matching with the set DIP switch of array 2.
    - DIP switch/Array2 changed while the test was in progress.
    - HPU logged off.

F34 ONLINE plus
F34 DIASAFE plus
Pressure holding test not passed. Max. number of treatments exceeded?
  – Diasafe and HDF filter membranes leaking/worn.

F02 ONLINE plus
F02 DIASAFE plus
F02 HPU
Dialysate outlet pressure (DA1) outside the permissible range (10s).
DA1 test range: \(-125 \text{mmHg} \leq P_{dial} \leq 55 \text{mmHg}\)
  – Acknowledgement DA 1 (P_DIAL, X633L/B6) → X632/A29
  – Acknowledgement line DA 2 (see HPU diagram)

F03 ONLINE plus
F03 DIASAFE plus
F03 HPU
Cross comparison of both pressure transducers (DA1 / DA2) is outside the acceptable tolerance (10s).
P(DA2) == P(DA1) ±20mmHg
  – Acknowledgement DA 1 (P_DIAL, X633L/B6) → X632/A29
  – Acknowledgement DA 2 (see HPU diagram)

F41 ONLINE plus
F41 DIASAFE plus
F41 HPU
The test valve V183 is leaking. Pressure increase in the system of \(\Delta P(DA2) > 30 \text{mmHg}\) within 4s.
  – V183 open, contaminated, or mechanically defective
  – HPU, output stage etc. defective

F42 ONLINE plus
F42 DIASAFE plus
F42 HPU
No pressure increase of \(\Delta P(DA2) > 200 \text{mmHg}\) within 4s after opening the test valve V183 in the system.
  – V183 fails to open or mechanically defective.
  – Air pump defective, is not running
  – HPU, V183 and/or air pump output stage etc. defective
F43 ONLINE plus
F43 DIASAFE plus
F43 HPU
The lower pressure test range of $\Delta P(DA2) > 300$ mmHg failed to be achieved within 1s after closing the test valve V183.
- HPU, output stage etc. defective
- ONLINE filter leaking

F44 ONLINE plus
F44 DIASAFE plus
F44 HPU
The upper pressure test range of $\Delta P(DA2) 750$ mmHg was exceeded within 4s after closing of the test valve V183.
- HPU, output stage etc. defective

F04 ONLINE plus
F04 DIASAFE plus
The air pump is running although valve V43 is closed.
- HPU, output stage etc. defective

F05 ONLINE plus
The door on the Online Sys module is open during the rate test.
- Close module door.

F06 ONLINE plus
Port 1 is open during the first pressure build-up phase.
- Close port 1 (substitute port).

F07 ONLINE plus
Port 2 is open during the first pressure build-up phase.
- Close port 2 (rinse port).

F08 ONLINE plus
Failure to reach the test pressure PDIAL2 > 795 mmHg within 12s.
- Calibrate dialysate pressure.
- Replace DA 2 (re-calibration required)
- Air pump (185) or test valve (V183) defective
- Hydraulic system or valve ONL3 (191) leaking
- Air pump control (185) based on V43 status defective (HPU defective)

F09 ONLINE plus
The ONLINE system pump failed to comply with the first test rate of 100 ml/min ± 9 ml/min.
- ONLINE system pump control defective

F10 ONLINE plus
Monitoring unit (Hall sensor) of the pump rotor detects incorrect rotation of the rotor (desired rate 300 ml/min ± 25%).
- ONLINE system pump control defective (outside the tolerance of ±25%)
- Hall sensor /electronics defective

F11 ONLINE plus
The ONLINE system pump failed to comply with the second test rate of 300 ml/min ± 9 ml/min.
- ONLINE system pump control defective

F12 ONLINE plus
After the ONLINE system pump was switched off in the test, the monitoring unit (Hall sensor) detects that the rotor failed to stop correctly.
- Pump stop (output stage) defective
- Hall sensor /electronics defective
F13 ONLINE plus After the ONLINE system pump was switched off in the test, the actual rate of the module is > 0 ml/min.
- Pump stop (output stage) defective
- Synchro-transmitter electronics defective

F14 ONLINE plus After activation of the substitute pump the monitoring unit (Hall sensor) of the pump rotor detects incorrect rotation of the rotor (desired rate 300 ml/min).
- Pump control defective (outside the tolerance of ±25%)
- Hall sensor/electronics defective

F15 ONLINE plus After activation of the substitute pump the system pump failed to comply with the test rate of 300 ml/min ±9ml/min.
- Pump control defective

F16 ONLINE plus Port 1 open during ONL valve test sequence.
- Close port 1 (substitute port).

F17 ONLINE plus Port 2 open during ONL valve test sequence.
- Close port 2 (rinse port).

F18 ONLINE plus Acknowledgement of ONL1 (V193) differs from the desired state of the valve.
- Valve control in the ONLINE Sys module defective
- Valve acknowledgement in the ONLINE Sys module defective

F19 ONLINE plus Acknowledgement of ONL2 (V192) differs from the desired state of the valve.
- Valve control in the ONLINE Sys module defective
- Valve acknowledgement in the ONLINE Sys module defective

F20 ONLINE plus Acknowledgement of ONL3 (V191) differs from the desired state of the valve.
- Valve control in the ONLINE Sys module defective
- Valve acknowledgement in the ONLINE Sys module defective

F21 ONLINE plus Leakage test ONL3 (V191) failed to be passed.
The permitted pressure drop of $\Delta P < -10$ mmHg has been exceeded or the test pressure is $P \leq 710$ mmHg.
- Valve ONL3 (V191) in the ONLINE Sys module leaking
- Leaking system/tubing connections
- Port 1 or 2 in the ONLINE Sys module leaking

F22 ONLINE plus Leakage test ONL2 (V192) failed to be passed.
The permitted pressure drop of $\Delta P < -10$ mmHg has been exceeded or the test pressure is $P \leq 710$ mmHg.
- Valve ONL2 (V192) in the ONLINE Sys module leaking
- Leaky system/tubing connections
- Port 1 in the ONLINE Sys module leaking

F23 ONLINE plus Leakage test ONL1 (V193) failed to be passed.
The permitted pressure drop of $\Delta P < -10$ mmHg has been exceeded or the test pressure is $P \leq 710$ mmHg.
- Valve ONL1 (V193) in the ONLINE Sys module leaking
- Leaky system/tubing connections
F24 ONLINE plus
After the valves ONL1 to 3 opened, the pressure drop in the system was insufficient ($\Delta P < -100 \text{ mmHg}$).
- Valve ONL1/ONL2/ONL3 electrically or mechanically not open
- Kinked tubing
- HDF filter strongly contaminated

F25 ONLINE plus
No pressure change of $\Delta P > 40 \text{ mmHg}$ within 15s.
- HDF filter membrane leaking (major leakage)
- No HDF filter installed

F26 ONLINE plus
F26 DIASAFE plus
Insufficient test pressure ($P < 750 \text{ mmHg}$) in the system.
- HDF filter membrane leaking (major leakage)
- No HDF filter installed
- Hydraulics system leaking

F27 ONLINE plus
F27 DIASAFE plus
After the valve V189 opened, the pressure drop in the system was insufficient ($\Delta P < -70 \text{ mmHg}$).
- Valve V189 electrically or mechanically not open
- Diasafe filter strongly contaminated
- Filter before/after V43 strongly contaminated

F28 ONLINE plus
F28 DIASAFE plus
Pressure increase in the system fails to exceed $P > 760 \text{ mmHg}$.
- Diasafe filter membrane leaking (major leakage)
- No Diasafe filter installed

F29 ONLINE plus
F29 DIASAFE plus
Pressure holding test failed to be passed. Excess pressure drop within a measurement time of 30s ($\Delta P > -10 \text{ mmHg}$).
- Diasafe and/or HDF filter membrane leaking

F30 ONLINE plus
F30 DIASAFE plus
During the pressure holding test valve(s) ONL1, 2 or 3 and/or V189 was (were) closed (according to electronic acknowledgement).
- Valve control failed

F31 ONLINE plus
F31 DIASAFE plus
F31 HPU
Fill phase has been stopped.
Valve(s) V26 open and/or V24, V24b closed (according to electronic acknowledgement), or failure to perform 25 or 15 balancing chamber switchings within 120s.
- Valve control failed
- Balancing chamber switchings failed (e.g. only "Eigentakt")

F32 ONLINE plus
Valve(s) ONL1, 2 or 3 closed and/or V24 open or port 1 or 2 open during the rinse phase (according to electronic acknowledgement).
- Valve control failed
- Operator opened ports too early.
<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F33 ONLINE plus</td>
<td>Rinse phase has been aborted. Valve V189 open (according to electronic acknowledgement), or failure to perform 34 balancing chamber switchings within 240s.</td>
</tr>
<tr>
<td></td>
<td>- Valve control failed</td>
</tr>
<tr>
<td></td>
<td>- Failure to detect current rise pulse</td>
</tr>
<tr>
<td></td>
<td>- Conductivity not within the scale range</td>
</tr>
<tr>
<td></td>
<td>Possible cause: Concentrate and/or bicarbonate level sensor do not recognize CD, although present.</td>
</tr>
<tr>
<td>F34 ONLINE plus</td>
<td>See error message between F01 and F02 ONLINE plus /DIASAFE plus</td>
</tr>
<tr>
<td>F34 DIASAFE plus</td>
<td></td>
</tr>
<tr>
<td>F41 ONLINE plus</td>
<td>See error message between F01 and F02 ONLINE plus /DIASAFE plus</td>
</tr>
<tr>
<td>F41 DIASAFE plus</td>
<td></td>
</tr>
<tr>
<td>F42 ONLINE plus</td>
<td>See error message between F03 and F04 ONLINE plus /DIASAFE plus</td>
</tr>
<tr>
<td>F42 DIASAFE plus</td>
<td></td>
</tr>
<tr>
<td>F43 ONLINE plus</td>
<td>See error message between F03 and F04 ONLINE plus /DIASAFE plus</td>
</tr>
<tr>
<td>F43 DIASAFE plus</td>
<td></td>
</tr>
<tr>
<td>F44 ONLINE plus</td>
<td>See error message between F03 and F04 ONLINE plus /DIASAFE plus</td>
</tr>
<tr>
<td>F44 DIASAFE plus</td>
<td></td>
</tr>
<tr>
<td>F95 ONLINE plus</td>
<td>See error message between F03 and F04 ONLINE plus /DIASAFE plus</td>
</tr>
<tr>
<td>F95 DIASAFE plus</td>
<td></td>
</tr>
<tr>
<td>F95 HPU</td>
<td>System error</td>
</tr>
</tbody>
</table>
1.1.4 Description of system errors during the cleaning programs

• V84 monitoring

<table>
<thead>
<tr>
<th>Error message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rinse Failure F01</td>
<td>End of the rinse-free program in Dis I to V. Conductivity has been recognized via V84, although the valve is still closed. This error message can be acknowledged by pressing the Rinse key.</td>
</tr>
<tr>
<td>Rinse Failure F21</td>
<td>Disinfectant suction phase in Dis I – IV. Maximum permissible UF pump strokes (160) during the suction phase exceeded. Error message cannot be acknowledged. Turn the system off and on again.</td>
</tr>
<tr>
<td>Rinse Failure F02</td>
<td>Disinfectant suction phase in Dis I to IV. Conductivity has not been recognized via V84, and the “Disinfectant empty?” message has been acknowledged twice. This error message cannot be acknowledged. Switch the system off and on again. Program Dis V (only on systems with advanced hydraulics) No conductivity detected via concentrate level sensor, and “Disinfectant empty?” message acknowledged twice. Error message cannot be acknowledged. Turn the system off and on again.</td>
</tr>
<tr>
<td>Rinse Failure F03</td>
<td>End of the suction phase in Dis I to IV. Conductivity has been recognized via V84, although the valve is already closed. This error message can be acknowledged by pressing the Disinfection key.</td>
</tr>
<tr>
<td>Rinse Failure F04</td>
<td>End of the suction phase in Dis I to IV. The float switch does not recognize any fluid after the disinfectant has been drawn in. Aeration of the disinfectant container! This error message cannot be acknowledged. Turn the system off and on again.</td>
</tr>
</tbody>
</table>

F01, F02 and F03 cause the V84 monitoring flag to be set. I.e. after one of these error messages has occurred, Bergström or ISO-UF dialysis is no longer possible, since it is not possible to switch the flow off. The V84 malfunction can be eliminated by correctly performing Dis I to IV. The problem can also be corrected using the calibration program (by a service technician only), menu item NOVRAM (Reset V84).
• PSW (pressure switch) monitoring during free rinsing (only with systems with CDS)

The following requirements must be fulfilled to run the PSW test:
– DIP switch 8 Dip array 2 on P.C.B. LP631 must be set to ON.
– Rinse free followed by disinfection or heat disinfection (Dis. I–V) or Mandatory rinse as individual program
The pressure switches are designed as make contacts.

Specifications:
- Delta pressure switch: Switching point 700 mbar ±20 mbar
- Alcatel-SEL-pressure switch: Switching range 675 – 805 mbar
- Envec pressure switch: Switching range 700 mbar ±20 mbar

<table>
<thead>
<tr>
<th>Error message</th>
<th>Description</th>
</tr>
</thead>
</table>
| Rinse Failure F05 | Rinse-free program with following Dis or HDIS or mandatory rinse as individual program in Dis I to V. It was impossible to open the pressure switch for PSW_104 (S124) (bicarbonate).
| | - Pressure on distribution piping > 500 mbar (according to specification, the permissible pressure is max. 500 mbar) pressure peaks on distribution piping: Frequently occurs in distribution pipings with user points if e.g. several patients are disconnected simultaneously and disinfection is started. |
| | - Switching point of pressure switch too low: Desired value = 700 mbar ± 20 mbar |
| | - Check acknowledgement of pressure switch on P.C.B. LP 633: Bicarbonate: X633L/ A19 |
| Rinse Failure F06 | Rinse-free program with following Dis or HDIS or mandatory rinse as individual program in Dis I to V. It was impossible to open the pressure switch for PSW_102 (S123) (concentrate). |
| | - Pressure on distribution piping > 500 mbar (according to specification, the permissible pressure is max. 500 mbar) pressure peaks on distribution piping: Frequently occurs in distribution pipings with user points if e.g. several patients are disconnected simultaneously and disinfection is started. |
| | - Switching point of pressure switch too low: Desired value = 700 mbar ± 20 mbar |
| | - Check acknowledgement of pressure switch on P.C.B. LP 633: Concentrate: X633L/ A20 |
| Rinse Failure F07 | Rinse-free program, Dis, HDIS, or mandatory rinse in Dis I to V. Pressure drop during the monitoring phase on PSW_104 (S124) (bicarbonate) or pressure build-up impossible. |
| | - Check switching point of pressure switch |
| | - Check loading pressure (possibly splinter or contamination in orifice 151, remove tube and purge tube from both ends). |
| | - Check negative pressure and test orifice (89). **(For this purpose, remove and purge the tubing from both ends)** |
| | - Check check valve (118) and filter (120). |
| | - Check CDS valve (104). |
| | - Verify tightness of CDS path. |
| | - Check acknowledgement of pressure switch on P.C.B. LP 633: Bicarbonate: X633L/ A19 |
| | - Cartridge filter upstream of degassing pump clogged or wrong filter (filter for disinfectant container) installed. Filters can be distinguished by different adapters. |
Rinse Failure F08

Rinse-free program, Dis, HDIS, or mandatory rinse in Dis I to V.
Pressure drop during the monitoring phase on PSW_102 (S123) (concentrate) or pressure build-up impossible.
- Check switching point of pressure switch.
- Check loading pressure.
  (possibly splinter or contamination in orifice 151, remove tube and purge tube from both ends)
- Check negative pressure and orifice (89).
  (For this purpose, remove and purge the tubing from both ends)
- Check check valve (117) and filter (119).
- Check CDS valve (102).
- Verify tightness of CDS path.
- Check acknowledgement of pressure switch on P.C.B. LP 633:
  Concentrate: X633L/ A20
- Cartridge filter upstream of degassing pump clogged or wrong filter (filter for disinfectant container) installed. Filters can be distinguished by different adapters.

Rinse Failure F09

Five minutes before the end of the mandatory rinse in Dis I to V.
Pressure switch PSW_104 (S124) (bicarbonate) or PSW_102 (S123) (concentrate) did not open after pressure reduction.
See Rinse Failure F12.

Rinse Failure F12

Rinse-free program with following Dis or HDIS or mandatory rinse as individual program in Dis I to V.
The pressure switches for PSW_104 (S124) (bicarbonate) and for PSW_102 (S123) (concentrate) could not be opened.
- Membrane pumps fail to run.
- V 102 or 104 fails to open.
- Pressure on distribution piping > 500 mbar (according to specification, the permissible pressure is max. 500 mbar) pressure peaks on distribution piping: Frequently occurs in distribution pipings with user points if e.g. several patients are disconnected simultaneously and disinfection is started.
- Switching point of pressure switch too low:
  desired value = 700 mbar ± 20 mbar
- Check acknowledgement of pressure switch on P.C.B. LP 633:
  Bicarbonate: X633L/ A19
Rinse Failure F13

Rinse-free program with following Dis or HDIS or mandatory rinse as individual program in Dis I to V.
Pressure drop during the monitoring phase on PSW_104 (S124) (bicarbonate) or PSW_102 (S123) (concentrate) or pressure build-up impossible.

– Check switching point of pressure switch.
– Check loading pressure.
  (Possibly splinter or contamination in orifice 151; remove tube and blow through tube from both ends)
– Check negative pressure and orifice (89).
  (For this purpose, remove and purge the tubing from both ends)
– Check check valve (117/118) and filter (119/120).
– Check CDS valve (102/104).
– Verify tightness of CDS path.
– Check acknowledgement of pressure switch on P.C.B. LP 633:
  Bicarbonate: X633L/ A19
  Concentrate: X633L/ A20
– Cartridge filter upstream of degassing pump clogged or wrong filter (filter for disinfectant container) installed. Filters can be distinguished by different adapters.

In case of F07, F08 and F13, the “DO NOT SWITCH OFF!!” message can, in addition, be alternately displayed.
However, this message is displayed only if a mandatory rinse program is requested, since the concentrate and bicarbonate lines still have to be emptied before the system is switched off.
Hydraulics test (check of V91, V99, V100) in systems with central delivery system

- Mandatory rinse time ≤ 3 min
- V102 is opened for 900 ms. Pressure reduction with membrane pump (for two balancing chamber switch-overs)
- PSW 102 open
- Pressure build-up
  - PSW 102 V91/100/102 open for 900 ms V99/104 closed Concentrate and bicarbonate pump stopped
  - PSW 102 closed
  - Pressure reduction on PSW 102 V102/104 open for 900 ms V91/99/100 closed Pressure decreased with concentrate pump
  - V91/99/100/102 open for 900 ms V104 closed
  - PSW 102 open

- BiBag system?
- V91/100/102/130 are opened for 900 ms V99 closed
- Pressure reduction with membrane pump (for two balancing chamber switch-overs)
- PSW 102 open
- HPU (hydraulic processing unit) installed?
- V91/100/102/188 are opened for 900 ms V99 closed
- Message Error V130 System stopped
- Message Error V188 System stopped
- Normal mandatory rinse sequence
- Message Error V91/100 System stopped
- Message Error V99 System stopped
- Message Error V99 closed
<table>
<thead>
<tr>
<th>Error message</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Rinse Failure F11** | Three minutes before the end of the mandatory rinse in Dis I to V. The pressure switch PSW_102 (S123) (concentrate) did not open after pressure reduction.  
- Pressure on distribution piping > 500 mbar (according to specification, the permissible pressure is max. 500 mbar). Pressure peaks on distribution piping: Frequently occurs in distribution pipings with user points if e.g. several patients are disconnected simultaneously and disinfection is started.  
- Switching point of pressure switch too low: desired value = 700 mbar ± 20 mbar  
- Membrane pumps fail to run  
- V102 fails to open electrically or mechanically  
- Check acknowledgement of pressure switch on P.C.B. LP 633: X633L/A20 |
| **V91/V100 Failure** | Three minutes before the end of the mandatory rinse in Dis I to V. V91 or V100 cannot be opened.  
- V91 or V 100 fail to open electrically:  
  P.C.B. LP 634: V91 = X634L/A12; V100 = X634L/C13  
- V 91 or V 100 mechanically not open:  
  check sieve (148) upstream of V100, or valves clogged  
- V99 constantly open (electrically P.C.B. LP 634: X634L/B12 or mechanically)  
- V 102 not open  
- Pressure switch for PSW_102 (S 123) fails to switch |
| **V99 Failure** | Three minutes before the end of the mandatory rinse in Dis I to V. V99 cannot be opened.  
- V 99 fails to open electrically:  
  P.C.B. LP 634: X634L/ B12.  
- V 99 fails to open mechanically:  
  check sieve (149) before V99, or V99 clogged.  
- Pressure switch for PSW_102 (S 123) fails to open. |
| **V130 Failure** | Three minutes before the end of the mandatory rinse in Dis I to V. V130 cannot be opened (applicable to systems with BIBAG only).  
- V130 electrically defective:  
  P.C.B. LP 634: X634L/ A4  
- V130 mechanically defective or clogged  
- Pressure switch for PSW_102 (S 123) fails to open.  
- Check tubing for bicarbonate suction line and bibag block. |
| **V188 Failure** | V188 fails to open.  
- V188 electrically defective.  
- V188 mechanically defective or clogged  
- Pressure switch for PSW_102 (S123) fails to open. |
| **F14** | Shortly before the end of the mandatory rinse in Dis I to V (CDS: Dis I to IV). The hydraulics test has not been completed correctly, possibly caused by flow problems. |
- Hydraulics test (check of V91 and valve 98) in systems without central delivery system

<table>
<thead>
<tr>
<th>Error message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F14</td>
<td>Three minutes before the end of the mandatory rinse in Dis I to V. It was not possible to readjust the flow to 750 ml/min ±50 ml/min. V91 defective.</td>
</tr>
<tr>
<td>V91 Failure</td>
<td>Three minutes before the end of the mandatory rinse in Dis I to V. After V91 has opened, a flow &gt; 950 ml/min failed to develop. V91 or valve V98 defective.</td>
</tr>
<tr>
<td>F14</td>
<td>Shortly before the end of the mandatory rinse in Dis I to V. The hydraulics test has not been completed correctly, possibly caused by flow problems.</td>
</tr>
</tbody>
</table>
Hydraulics test (check of V91, V99, V100, V130) in systems with BIBAG and without central delivery system

The following requirements must be fulfilled to run the hydraulics test:

1. The test is run during the last 3 minutes of the mandatory rinse program only.
2. DIP switch 7 DIP array 2 on PCB LP 631 must be set to ON.
Rinse Failure F15 - Three minutes before the end of the mandatory rinse in Dis I to V. DS (BIBAG pressure switch 134) could not be opened at the beginning of the test.
- Check pressure switch: Switching point: desired value: 130 mbar + 30
- Suction error of bicarbonate pump
- V91 constantly electrically or mechanically open
- V99/100 constantly electrically or mechanically closed

V91 Failure - Three minutes before the end of the mandatory rinse in Dis I to V. It is impossible to build up pressure on DS (BIBAG pressure switch 134) via V91.
- Pressure switch fails to close mechanically: check switching point.
- V91 fails to open electrically: P.C.B. LP 634: X634L/A12.
- V91 fails to open mechanically (possibly clogged).
- V130 electrically not closed: P.C.B. LP 634: X634L/A4
- V130 fails to close mechanically (possibly clogged).
- Bibag connector leaking (check O rings)
- Sealing on the bicarbonate suction tube leaking.
- Check acknowledgement of pressure switch on P.C.B. LP 633: X633L/A8.
- V99 constantly electrically or mechanically open.

V100 Failure - Three minutes before the end of the mandatory rinse in Dis I to V. It is impossible to build up pressure on DS (BIBAG pressure switch 134) via V100.
- V100 fails to open mechanically (possibly clogged).
- V91 constantly electrically or mechanically open
- Concentrate pump fails to pump.
- Filter (148) clogged.
- Pressure switch fails to open.

Rinse Failure F16 - Three minutes before the end of the mandatory rinse in Dis I to V. DS (BIBAG pressure switch 134) cannot be closed. V99 or V130 is leaking.
- V91 fails to open electrically or mechanically.
- V99 constantly electrically or mechanically open
- V130 constantly electrically or mechanically open
- Sealing on the concentrate suction tube leaking.
- Pressure switch fails to close.

V99 Failure - Three minutes before the end of the mandatory rinse in Dis I to V. DS (BIBAG pressure switch 134) cannot be opened. V99 does not open.
- V99 fails to open electrically or mechanically.
- V100 fails to open electrically or mechanically.
- Pressure switch fails to open.
- V91 electrically or mechanically open
- Filter (149) upstream of V99 clogged.
Rinse Failure F17  Three minutes before the end of the mandatory rinse in Dis I to V. DS (BIBAG pressure switch 134) cannot be closed.
– V91 fails to open electrically or mechanically.
– V130 electrically or mechanically open
– V100 electrically or mechanically open
– Pressure switch fails to close.

V130 Failure  Three minutes before the end of the mandatory rinse in Dis I to V. DS (BIBAG pressure switch 134) cannot be opened.
– V130 fails to open electrically or mechanically.
– Pressure switch fails to open.
– Check tubing for bicarbonate suction line and bibag block.
– Bicarbonate line squeezed at strain relief.
– Narrowing in the reducer on the bibag connector

Rinse Failure F 20  Impossible to close the pressure switch (134) via V91/100.
– V91 fails to open electrically or mechanically.
– V130/V188 electrically or mechanically open.
– Pressure switch fails to close.

V188 Failure  The pressure on pressure switch (134) cannot be reduced via V188.
– V188 fails to open electrically or mechanically
– Pressure switch fails to open
– Check tubing for carbonate suction line and air separator block.
– Concentrate line squeezed at strain relief.

Rinse Failure F14  Shortly before the end of the mandatory rinse in Dis I to V. The hydraulics test has not been completed correctly, possibly caused by flow problems.
• V39 test

The following requirements must be fulfilled to run the V39 test:

1. The test is run during the last minute of the mandatory rinse program only.
2. DIP switch 5 DIP array 2 on PCB LP 632 must be set to OFF.

![Diagram of V39 test procedure]

- BiBag system?
  - yes
  - no
- Pressure increase?
  - yes
  - no
- DAC degas. pump = 200?
  - no
  - yes

**Test passed**
- Delete mandatory rinse
- Pressure compensation
- Evacuate rinse chambers

**Test failed**
- Pressure compensation
- "V39 Failure"

**Pressure increase?**
- (\(\text{dav}1 + 50\ \text{mmHg} < \text{dav}2\))
- no
- yes

**DAC degas. pump = 200?**
- no
- yes

**Mandatory rinse \(\leq 1\ \text{min}\)**

**DAC degas. pump = 200**

**open: V26, V91, V99, V100, V31, V33, V35, V37, V39 closed**

**Wait for 10 sec.**

**Measure for 5 sec.: Mean pressure value \(\text{dav}1\)**

**Open V39:**

**Wait for 5 sec.**

**Measure for 5 sec.: Mean pressure value \(\text{dav}2\)**
<table>
<thead>
<tr>
<th>Error message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>V39 Failure</strong></td>
<td>On opening V39 a difference in pressure (averaged value V39 open – averaged value V39 closed) is detected on the dialysate pressure transducer (182):</td>
</tr>
<tr>
<td></td>
<td>Standard system: &lt; 50 mmHg</td>
</tr>
<tr>
<td></td>
<td>bibag system: &lt; 20 mmHg</td>
</tr>
<tr>
<td></td>
<td>– V39 fails to open / close electrically or mechanically (possibly hydraulic processing unit defective).</td>
</tr>
<tr>
<td></td>
<td>– It is impossible to re-adjust the degassing pump (P.C.B. LP 634).</td>
</tr>
<tr>
<td></td>
<td>– V91, V99, V100 fail to open electrically or mechanically.</td>
</tr>
<tr>
<td></td>
<td>– Dialysate pressure transducer (182) defective or not calibrated (possibly HPU P.C.B. LP 941 defective)</td>
</tr>
<tr>
<td></td>
<td>– Filter 210 (upstream of degassing pump) clogged.</td>
</tr>
</tbody>
</table>
### Further messages which may be displayed before or during a cleaning program

<table>
<thead>
<tr>
<th>Error message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Sensed by OD</td>
<td>Start of a cleaning program in RI I to II, HR I to III, Dis I to V. The optical detector in the air detector module recognizes blood.</td>
</tr>
<tr>
<td>Shunt Cover open</td>
<td>Start of a cleaning program or during a cleaning program in RI I to II, HR I to III, Dis I to V. The shunt interlock is not closed.</td>
</tr>
<tr>
<td>Dialines not conn</td>
<td>Start of a cleaning program in RI I to II, HR I to III, Dis I to V. The dialysate couplings are not connected to the shunt interlock.</td>
</tr>
<tr>
<td>No LD alarm</td>
<td>Priming of the blood line system in RI I to II, HR I to III, Dis I to V. The drip chamber in the air detector module does not recognize any alarm.</td>
</tr>
<tr>
<td>Conc line not conn</td>
<td>Start of a cleaning program in RI I to II, HR I to III, Dis I to V, or end of the disinfectant suction phase in Dis V. The concentrate plug is not connected to the rinse chamber. Reconnect the concentrate plug to the rinse chamber.</td>
</tr>
<tr>
<td>Bic line not conn</td>
<td>Start of a cleaning program in RI I to II, HR I to III, Dis I to V, or end of the disinfectant suction phase in Dis V. The bicarbonate plug is not connected to the rinse chamber. Reconnect the bicarbonate plug to the rinse chamber.</td>
</tr>
<tr>
<td>Voltage Failure</td>
<td>During a cleaning program in RI I to II, HR I to III, Dis I to V. The 24-V/12-V supply voltages are drifting. This error can be acknowledged for 8 sec by pressing the respective program key.</td>
</tr>
<tr>
<td>CPU-II failed</td>
<td>During a cleaning program in RI I to II, HR I to III, Dis I to V. The watchdog relay has dropped. Communication (RxD or TxD) may be disturbed.</td>
</tr>
<tr>
<td>High temperature</td>
<td>During a cleaning program in RI I to II, HR I to III, Dis I to V. Temperature &gt; 41 °C; &gt; 90 °C during HR; &gt; 91 °C during IHR. The system continues to run. The alarm tone can be acknowledged. Upon error elimination, the message is automatically cleared.</td>
</tr>
<tr>
<td>Low temperature</td>
<td>During a cleaning program in RI I to II, HR I to III, Dis I to V. Temperature &lt; 33 °C; &lt; 78.5 °C during HR. The system continues to run. The alarm tone can be acknowledged. Upon error elimination, the message is automatically cleared.</td>
</tr>
</tbody>
</table>
**Water alarm**

During a cleaning program in RI I to II, HR I to III, Dis I to V.
The float switch transmits the "no water available" message for more than 10 seconds.
The balancing chamber has stopped; V41 is permanently open.
Upon error elimination, the message is automatically cleared.

**Water alarm**

During a cleaning program in RI I to II, HR I to III, Dis I to V.
For more than 30 seconds, the float switch fails to signal that water is required (not applicable to recirculation programs).
The system continues to run.
Upon error elimination, the message is automatically cleared.

**Flow alarm**

During a cleaning program in RI I to II, HR I to III, Dis I to V.
A current rise pulse is not recognized for more than 12 seconds.
The system continues to run at "Eigentakt" (10 seconds).
Upon error elimination, the message is automatically cleared.

**Upper Flow Alarm**

During a cleaning program in RI I to II, HR I to III, Dis I to V.
The cleaning flow increases to > 1000 ml/min. The program has stopped.
The error can be acknowledged by pressing the respective cleaning program key.

**UF-Pump failed**

During a cleaning program in RI I to II, HR I to III, Dis I to V.
The UF pump has stopped or the rate deviates (2800 ml/h < UFR < 6000 ml/h). The program has stopped.
The error can be acknowledged by pressing the respective cleaning program key.

**UF-Pump 2 failed**

During a cleaning program in RI I to II, HR I to III, Dis I to VI.
The UF2 pump has stopped (applicable only to systems with 4008 HDF).
The error can be acknowledged by pressing the respective cleaning program key.

**Dial. Valve failed**

During a cleaning program in RI I to II, HR I to III, Dis I to V.
V24 or V24B is closed although it should be open.
The program has stopped.
The error message can be acknowledged by pressing the respective program key.

**Bypass Valve failed**

During a cleaning program in RI I to II, HR I to III, Dis I to V.
V26 is closed although it should be open.
The program has stopped.
The error message can be acknowledged by pressing the respective program key.
**V102 Failure**

During a cleaning program in RI I to II, HR I to III, Dis I to V.

V102 has been opened electrically.
24 V are switched off.
The error cannot be acknowledged.

**V104 Failure**

During a cleaning program in RI I to II, HR I to III, Dis I to V.

V104 has been opened electrically.
24 V are switched off.
The error cannot be acknowledged.

**HDF-Pump failure**

During a cleaning program in RI I to II, HR I to III, Dis I to V.
The HDF pump has stopped, or the speed deviates (rated value: 400 ml/min, actual value: ≤ 300 ml/min; rated value: 150 ml/min, actual value: ≤ 100 ml/min).
The error message can be acknowledged for one complete cleaning program run by pressing the respective program key. The prompt: “Are you sure ?” is displayed.

**Float-Switch Failure**

During a disinfectant program in the suction phase in Dis I to V (CDS: Dis I to IV).
The lower switching point of the float switch is not reached within 20 sec.
The program has stopped.

**Connect Disinfectant**

Disinfectant suction phase in Dis V.
Request to connect the disinfectant.

**Press CONFIRM key**

Disinfectant suction phase in Dis V.
After the disinfectant has been connected, the Confirm key on the menu panel must be pressed to start the suction procedure.
The program has stopped.

**Please Wait**

Disinfectant suction phase in Dis V.
Disinfectant is drawn in via the concentrate pump.

**Disinfectant empty ?**

Disinfectant suction phase in Dis I to V.
Dis V: After the disinfectant has been drawn in, the float switch does not recognize any fluid.
Dis I to IV, Dis VI: The V84 monitoring unit does not recognize any conductivity.

**Disinf-Temp. too high**

Transition to disinfection in Dis I to V.
Temperature at the end of the rinse-free procedure > 40 °C.
Again and again, the rinse-free procedure is prolonged by 1 minute.
An audible warning is sounded after 4 minutes.
The message is automatically cleared, and it cannot be acknowledged.
Rinse required!  During stored mandatory rinse in Dis I to V.  The mandatory rinse has been interrupted (e.g. the system has been switched off).

Rinse after Disinf.  Selection of a cleaning program, although a mandatory rinse has been requested in HR.  A disinfection program has been stopped and subsequently a rinsing or hot rinsing program started.

Power Failure  During a cleaning program in RI I to II, HR I to III, Dis I to V.  Line voltage failed.

BIBAG connect. open  Upon start of a cleaning program in RI I to II, HR I to III, Dis I to V.  The BIBAG connector is not closed (cap not attached).

Heater error  During the CDS rinsing phase at the end of a hot rinsing program or a hot disinfection program in CDS: HR I to III, Dis II to IV.  The heater signal (P.C.B. LP 633: X633R/A26) is not changing for > 40 sec.

Accumulator empty!  Battery voltage <17.2 V ±2.5 %  Only in the event of a power failure during the cleaning programs.  If the voltage drops below 17 V, the system will switch off.
1.1.5 Error messages after turning power on

<table>
<thead>
<tr>
<th>Error message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPROM ERROR</td>
<td>System error. Check the plugs and the EPROM for proper connection. Replace the EPROM, if necessary.</td>
</tr>
<tr>
<td>BRAM_#_XXXX_XXXX_XXXX</td>
<td>System error. Switch the system off and on again. Check the plugs and the BRAM of P.C.B. LP 631 and P.C.B. LP 632 for proper connection. Replace the BRAM, if necessary. Then recalibrate.</td>
</tr>
<tr>
<td>RAM ERROR</td>
<td>System error. Switch the system off and on again. Check the plugs and the RAM for proper connection. Replace the RAM, if necessary.</td>
</tr>
<tr>
<td>Keyboard Error</td>
<td>Short-circuit on the keyboard. Switch the system off and on again. Check the plugs for proper connection. Possible short-circuit on the keys. Replace the front panel, if necessary.</td>
</tr>
<tr>
<td>Watchdog Error</td>
<td>This error message can only be displayed shortly after switch-on. Switch the system off and on again. Check the WD relay and components. Check CPU2/CPU1. Check the plug connectors on the monitor.</td>
</tr>
<tr>
<td>XX (not calibrated)</td>
<td>NOVRAM error upon test request. Switch the system off and on again. Recalibrate the function indicated. Replace the NOVRAM, if necessary.</td>
</tr>
<tr>
<td>NTC109 switched off</td>
<td>No valid value has been filed during start in the NOVRAM. The difference in temperature between NTC 109 and NTC 3 is too large. Switch off NTC 109 in the setup menu, or recalibrate the temperature.</td>
</tr>
</tbody>
</table>
### 1.1.6 Error messages during dialysis

<table>
<thead>
<tr>
<th>Error message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Voltage Failure</strong></td>
<td>The 24-V/12-V supply voltages are drifting.</td>
</tr>
<tr>
<td></td>
<td>The system enters the safe state and must be switched off/on.</td>
</tr>
<tr>
<td></td>
<td>– The 12-V or 24-V operating voltage is outside of the permissible range:</td>
</tr>
<tr>
<td></td>
<td>24 V: &gt; 26 V / &lt; 22.5 V</td>
</tr>
<tr>
<td></td>
<td>12 V: &gt; 13.5 to 15 V / &lt; 10.5 V</td>
</tr>
<tr>
<td></td>
<td>– Check the power supply unit.</td>
</tr>
<tr>
<td></td>
<td>– Power supply unit okay: Check the voltages applied to P.C.B. LP 633:</td>
</tr>
<tr>
<td></td>
<td>+12 V: X633R/A, C31</td>
</tr>
<tr>
<td></td>
<td>+24 V: 24V_EM: X633L/B20</td>
</tr>
<tr>
<td><strong>24 V Switched Off</strong></td>
<td>The 24-V supply voltage has fallen below 5 V.</td>
</tr>
<tr>
<td></td>
<td>The system enters the safe state and must be switched off/on.</td>
</tr>
<tr>
<td></td>
<td>– Check the power supply unit.</td>
</tr>
<tr>
<td></td>
<td>– Power supply unit okay: Check the voltages at P.C.B. LP 633:</td>
</tr>
<tr>
<td></td>
<td>+24V_EM: X633L/B20</td>
</tr>
<tr>
<td></td>
<td>– Remove all plug-in modules. As soon as the system is running: recombine each plug-in module individually with the system switched off; determine the defective module and repair it.</td>
</tr>
<tr>
<td></td>
<td>– Completely loosen the hydraulic compartment connections.</td>
</tr>
<tr>
<td></td>
<td><strong>Caution:</strong> J1 must now be fitted on P.C.B. LP 630 since, without it, the system would not be able to perform the watchdog test. Be absolutely sure to remove the jumper again for hemodialysis operation.</td>
</tr>
<tr>
<td></td>
<td>With the system running, check the short circuit in the hydraulic compartment for 24-V supply and the valves and pumps for short circuit.</td>
</tr>
<tr>
<td><strong>CPU-II failed</strong></td>
<td>CPU2 fails to communicate via the serial interface.</td>
</tr>
<tr>
<td></td>
<td>The system enters the safe state and must be switched off/on.</td>
</tr>
<tr>
<td></td>
<td>– The software versions of CPU1 and CPU2 are mismatching.</td>
</tr>
<tr>
<td></td>
<td>– Hardware defect on CPU2.</td>
</tr>
<tr>
<td><strong>Profile time diff.</strong></td>
<td>Deviation in time between CPU1 and CPU2.</td>
</tr>
<tr>
<td></td>
<td>The error message is emitted 60 seconds after the start of the profile.</td>
</tr>
<tr>
<td></td>
<td>– The clock module on CPU1 (IC14) is defective; or calibrate the time in case of layout &lt; D.</td>
</tr>
<tr>
<td><strong>Cyclical PHT F01</strong></td>
<td>Balancing error.</td>
</tr>
<tr>
<td></td>
<td>– System leakage.</td>
</tr>
<tr>
<td></td>
<td>– Applicable to Diasafe systems: On CPU II, the DIP switch array 2, switch 1, is not set to “ON”.</td>
</tr>
<tr>
<td><strong>Cyclical PHT F02</strong></td>
<td>Balancing error.</td>
</tr>
<tr>
<td></td>
<td>– System leakage.</td>
</tr>
<tr>
<td></td>
<td>– Applicable to Diasafe systems: On CPU II, the DIP switch array 2, switch 1, is not set to “ON”.</td>
</tr>
</tbody>
</table>
Cyclical PHT F03  
IC1 or IC3 on P.C.B. LP 632 is defective, or system leakage.

Cyclical PHT F04  
It was not possible to complete the test within a specific time interval.

V84 faultiness  
Conductivity is recognized at the V84 electrodes. 
This error message is emitted for the first time at the end of the T1 test. 
The error can be acknowledged for the duration of one hemodialysis procedure by pressing the Dialysis Start key. It is, however, not possible to switch off the flow (Bergström-/ISO-UF operating mode). Should the error occur during Flow OFF, the flow is switched on automatically.

– First of all, it must be verified whether a Rinse Failure F01, F02 or F03 occurred during the previous disinfection procedure (see listing of cleaning program errors). Should this be the case, a disinfection program I to IV (not Dis V) must be completed correctly. The problem can also be corrected using the calibration program, NOVRAM menu item (Reset V84).

– Should this not be possible, the error memory of the system can be read out.

– Should this neither be possible, the test described below can be performed:
  Remove the disinfectant.
  Switch the system off and on again.
  Perform or skip the T1 test.
  Should the error message be displayed again at the end of the test, it was generated by a Rinse Failure F01, F02 or F03 and can be cleared only by taking the measures described above.
  Should the message not be displayed again, a second test can be performed:
    Reconnect the disinfectant.
    Set the UF rate and switch on the UF unit.
    Should the error occur at this moment, there is a leakage on V84 (see listing of cleaning program errors).

Shunt Cover open  
– P.C.B. LP 633 C24 (100n) temporarily short-circuited.

(temporarily)  
– Shunt interlock defective (check switches).

Voltage Failure  
– P.C.B. LP 633 C84 (100n) temporarily short-circuited.

(temporarily)

UF1 volume - Error  
Failure to pass the test for an UF pump. The fill volume for the secondary air separator is outside the tolerance of 100 ml ±4 ml.

Possible cause:
– The affected UF pump fails to deliver correctly (not calibrated or mechanical defect)
– If the test result is >104 ml, the problem can also be caused by air coming from a poorly deaerated dialyzer.
F327 UF-failure  
Pause between two UF1 pump strokes less than 220 ms.  
Possible cause:  
– CPU-1 defective

F328 UF-failure  
Pulse time of one UF1 pump stroke less than 180 ms.  
Possible cause:  
– Controlling monoflop on LP 634 defective

F329 UF-failure  
Pulse time of one UF1 pump stroke exceeds 500 ms  
Possible cause:  
– Controlling monoflop on LP 634 defective.

F330 UF-failure  
Pick-up time of the UF1 pump exceeds 10 sec.  
Possible cause:  
– Controlling output stage on LP 634 defective.

F331 UF-failure  
Theoretical/actual rate of the UF1 pump deviates by more than ±10 %.  
Possible cause:  
– System error

F332 UF-failure  
UF1 pump stopped for more than the maximum time period.  
Possible cause:  
– Controlling output stage on LP 634 defective.  
– UF pump interruption  
– System error

F333 UF-failure  
Volume changes by more than 10 ml during prescribed standstill (only monitored if OD is dark).  
Possible cause:  
– System error

F334 UF-failure  
Pause between two UF2 pump strokes less than 220 ms.  
Possible cause:  
– CPU-1 defective

F335 UF-failure  
Pulse time of one UF2 pump stroke less than 180 ms.  
Possible cause:  
– Controlling monoflop on LP 634 defective.

F336 UF-failure  
Pulse time of one UF2 pump stroke exceeds 500 ms.  
Possible cause:  
– Controlling monoflop on LP 634 defective.

F337 UF-failure  
Starting time of the UF2 pump exceeds 10 sec.  
Possible cause:  
– Controlling output stage on LP 634 defective.

F338 UF-failure  
Desired/actual rate of the UF2 pump deviates by more than 10 %.  
Possible cause:  
– System error

F339 UF-failure  
UF2 pump stopped for more than the maximum time period.  
Possible cause:  
– Controlling output stage on LP 634 defective.  
– UF pump interruption  
– System error
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Possible Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>F340</td>
<td>UF2 volume change more than 10 ml although UF is switched off.</td>
<td>System error</td>
</tr>
<tr>
<td>F341</td>
<td>Mechanical UF1 pump failure.</td>
<td>Broken spring, Contaminated filter</td>
</tr>
<tr>
<td>F342</td>
<td>Mechanical UF2 pump failure.</td>
<td>Broken spring, Contaminated filter</td>
</tr>
<tr>
<td>F343</td>
<td>UF1/UF2 pump volume difference</td>
<td>Delivery volume altered</td>
</tr>
<tr>
<td>F350</td>
<td>A difference of more than 100 ml between the CPU1 and the CPU2 volume is detected during an UF data transfer after turning the UF unit on.</td>
<td>System error</td>
</tr>
<tr>
<td>F351</td>
<td>CPU2 could not detect plausibility of the CPU1 UF parameters.</td>
<td>System error</td>
</tr>
<tr>
<td>F352</td>
<td>CPU2 UF deviation compared to the theoretical UF target volume.</td>
<td>System error</td>
</tr>
<tr>
<td>F354</td>
<td>UF rate exceeds the maximum rate allowed.</td>
<td>System error</td>
</tr>
<tr>
<td>F361</td>
<td>CPU1 sent the UF parameter set to CPU2 and has not received a release from CPU2 after a timeout of 30 s.</td>
<td>System error</td>
</tr>
<tr>
<td>F363</td>
<td>CPU2 did repeatedly not receive a complete UF parameter set.</td>
<td>System error</td>
</tr>
<tr>
<td>F364</td>
<td>UF1 volume change although the UF goal has already been reached.</td>
<td>System error</td>
</tr>
<tr>
<td>F370</td>
<td>UF2 volume change although the UF goal has already been reached.</td>
<td>System error</td>
</tr>
<tr>
<td>Error message</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>-------------</td>
<td></td>
</tr>
</tbody>
</table>
| **HPU Error F00** | The HPU logs off with index STATUS_ER; no bit is set in the error bit field.  
  - Problem on P.C.B. LP 941  
  - Problem on CAN distributor board  
  - Problem on P.C.B. LP 763  
  - Problem on P.C.B. LP 630 |
| **HPU Error F01** | The cyclic communication has failed for more than 2 seconds.  
  - System error |
| **HPU Error F02** | The response to an event violated the time-out.  
  - System error |
| **HPU Error F03** | An error occurred in the program sequence.  
  - System error |
| **HPU Error F04** | Voltage drop (24V_SW) during HPU operation.  
  - 24V voltage supply on P.C.B. LP 941 failed (watchdog dropped). |
| **HPU Error F05** | Watchdog test failed to be passed.  
  - Watchdog circuit on P.C.B. LP 941 |
| **HPU Error F06** | Reference voltage monitoring detected an error.  
  - Reference voltage circuit on P.C.B. LP 941 is defective. |
| **HPU Error F07** | The HPU was logged off by the monitor. Will not be displayed since CPU1 has already stopped the communication.  
  - System error |
| **HPU Error F08** | General valve malfunction: may occur in HPU SW 2.01 or 3.00. (Software versions before evaluation of the HPU errors).  
  - System error |
| **HPU Error F09** | Malfunction of the compressor (185)  
  - MV43 defective or activated  
  - Compressor 185 defective or activated  
  - Error on P.C.B. LP 941 |
| **HPU Error F10** | Malfunction of valve MV39  
  - MV39 defective or activated  
  - Error on P.C.B. LP 941 |
| **HPU Error F11** | Malfunction of test valve (183)  
  - MV43 defective or activated  
  - MV183 defective or activated  
  - Error on P.C.B. LP 941 |
**HPU Error F12**  
Malfunction of evacuation valve (188)  
– MV188 defective or activated  
– Error on P.C.B. LP 941

**HPU Error F13**  
Malfunction of retentate valve (189)  
– MV189 defective or activated  
– Error on P.C.B. LP 941

**HPU Error F14**  
Defective component on P.C.B. LP 941  
– Error on P.C.B. LP 941

**HPU Error F15**  
Error in the HPU software. Valves are activated incorrectly.  
– System error

**HPU Error F98**  
Proceeding to the T1 test is not allowed after restart.  
– System error

**HPU Error F99**  
HPU fails without logging off.  
– Damaged cable or similar problem  
– HPU logged off by CPU1  
– CRC error in the transfer HPU → CPU1  
– BVM is connected via CAN and software <3.20 is installed in the BVM.  
– The VDE test was performed directly after turning the system on. Turn the system on at least 2 minutes before the test.
### ONLINE module errors

<table>
<thead>
<tr>
<th>Error message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ONL Error F00</td>
<td>Online module error</td>
</tr>
<tr>
<td>ONL Error F01</td>
<td>Watchdog error</td>
</tr>
<tr>
<td>ONL Error F02</td>
<td>Watchdog error</td>
</tr>
<tr>
<td>ONL Error F03</td>
<td>Watchdog error</td>
</tr>
<tr>
<td>ONL Error F04</td>
<td>Error in the program sequence</td>
</tr>
<tr>
<td>ONL Error F05</td>
<td>+24V_WD dropped to less than 17V or was switched off</td>
</tr>
<tr>
<td>ONL Error F06</td>
<td>Time-out of the communication watchdog exceeded</td>
</tr>
<tr>
<td>ONL Error F07</td>
<td>A transmission from the module was not confirmed by the dialysis system</td>
</tr>
<tr>
<td>ONL Error F08</td>
<td>General valve error</td>
</tr>
<tr>
<td>ONL Error F09</td>
<td>T1 test skipped</td>
</tr>
<tr>
<td>ONL Error F10</td>
<td>T1 test for ONLINEplus failed to be passed</td>
</tr>
<tr>
<td>ONL Error F11</td>
<td>Reference voltage is outside the tolerance</td>
</tr>
<tr>
<td>ONL Error F12</td>
<td>CRC error</td>
</tr>
<tr>
<td>ONL Error F13</td>
<td>EEPROM error</td>
</tr>
<tr>
<td>ONL Error F14</td>
<td>The monitor disabled the ONLINEplus module</td>
</tr>
<tr>
<td>ONL Error F16</td>
<td>Valve error ONL1</td>
</tr>
<tr>
<td>ONL Error F17</td>
<td>Valve error ONL2</td>
</tr>
<tr>
<td>ONL Error F18</td>
<td>Valve error ONL3</td>
</tr>
</tbody>
</table>
1.2 Functional description of the modules

1.2.1 Blood pump (arterial)

The blood pump ensures a sufficient blood flow in the extracorporeal blood circuit. It is absolutely necessary that sterility is maintained and that the blood is prevented from becoming contaminated.

The blood pump is designed as roller pump provided in an exchangeable plug-in module integrated in the hemodialysis system. The blood line is installed between a stator, which, with its rolling surface bent in a circle, represents a thrust bearing, and a rotor, which is provided with rollers and pivoted in the stator. The pressure of the rollers causes the development of a narrow or seal. If the rollers are moving in the direction of delivery, the blood is pushed in this direction.

A microprocessor controls the stepper motor with quartz accuracy, depending on the selected delivery rate, the set line diameter, and the monitor signals.

The pressure measuring equipment comprises a piezo-resistive pressure transducer. The pressure-proportional voltage is indicated on the monitor on a quasi-analog LED scale.

Functions of the blood pump:
- RAM and CRC test after turning power on,
- control and monitoring of the function by a dual processor system,
- emergency switchoff in case of an alarm: stop recognition (15 or 30 sec),
- setting of the speed to 180 ml/min during priming,
- measurement of the arterial pressure or the Single-Needle pressure (depending on the model concerned),
- semi-automatic loading and unloading of the line segment.

Error messages:
- E.01 Line diameter outside the permissible range
- E.02 Undefined hex switch position
- E.03 Uncalibrated arterial pressure transducer
- E.04 Run-time monitoring error during SN operation
- E.05 SN stroke volume outside the permissible range
- E.06 SN pressure thresholds outside the range of values of the A-D converter
- E.08 Stop alarm
- E.09 Error during A-D conversion
- E.12 Rotary monitoring error (Hall sensor)
- E.13 Monitoring error with regard to current sensing resistors
- E.14 Monitoring error with regard to current sensing resistors
- E.15 Speed monitoring error
1.2.2 Blood pump (Single-Needle), optional

Essentially, the blood pump (Single-Needle) is identical with the arterial blood pump. The difference lies in the Single-Needle control. During SN operation, the pressure outlet of the compliance vessel is connected to the pressure connector of the SN pump. The pressure transducer is protected by a hydrophobic filter both in the external and the internal tubing system.

The SN stroke volume can be set within a range from 10 ml to 50 ml in increments of 5 ml.

To adjust it, first press the Start/Stop key and the ▼ key simultaneously. Then change the value by using the ▲ and ▼ keys.

The lower changeover point is fixed to 75 mmHg.

The upper changeover point depends on the stroke volume:

<table>
<thead>
<tr>
<th>Stroke volume (ml)</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changeover point (mmHg) ± 7 mmHg</td>
<td>110</td>
<td>130</td>
<td>150</td>
<td>172</td>
<td>195</td>
<td>219</td>
<td>244</td>
<td>270</td>
<td>299</td>
</tr>
</tbody>
</table>
1.2.3 Heparin pump

Since the blood flows through an extracorporeal circuit during hemodialysis, coagulation would occur within a short time. The heparin pump allows continuous heparinization of the blood causing the coagulation time to be prolonged. Since the heparin volume required during hemodialysis depends on the respective patient concerned, it must be determined by the attending physician.

A syringe plunger is moved by a drive rod, which is connected to a threaded spindle via a sliding block. A microprocessor-controlled stepper motor causes the spindle to rotate. Depending on the type of activation, the plunger moves up or down. A Hall sensor indicates the upper end position of the plunger. The protective system of the pump comprises a speed monitoring unit (slotted disc with optical sensor) as well as a motor current monitoring unit.

The different syringe types can be selected by means of a coding switch:

0  20 ml B&D syringe
1  30 ml Fresenius syringe
2  50 ml Fresenius syringe
3  10 ml B&D syringe
4  30 ml B&D syringe
5  50 ml B&D syringe
6  20 ml Terumo syringe
7  30 ml Terumo syringe
8  50 ml Terumo syringe
9  20 ml JMS syringe
A  20 ml Nipro syringe
B–F not used

**Caution**

Do not change the coding switch position during operation.

Function of the heparin pump:
– RAM and CRC test after turning power on,
– delivery rate adjustable from 0.1 ml to 10 ml in increments of 0.1 ml,
– delivery time preselection (stopwatch) adjustable from 1 min to 9 h 59 min,
– bolus administration.
Error codes:

- **E01**: *Hardware error*, gate array defective
- **E02**: *Hardware error*, reset by spike or test alarm
- **E03**: Checksum error, data loss
- **E04**: First start-up
- **E05**: Incorrect hex switch position
- **E06**: Missing or incorrect data for the variable syringe
- **E07**: Selection of wrong syringe
- **E11 to E13**: *Step error*
- **E12**: Overdelivery during fast return
- **E14 to E15**: *Error in direction of rotation* (software not equal to hardware!)
- **E16**: *Software error*
- **E19**: *Optical sensor error* (stop of syringe holder or optical sensor defective)
- **E20**: *Error in direction of rotation*
- **E33**: *Step error* (impermissible range)
- **E37**: *Slotted disc error*
- **E40**: *Division error* (division by zero)
- **E41 to E42**: *Error in direction of rotation* (fast return)
- **E43 to E44**: *Error in direction of rotation* (slow return)
- **E45 to E46**: *Error in direction of rotation* (fast advance)
- **E47 to E48**: *Error in direction of rotation* (slow advance)
- **E49**: *Step error* (underdelivery during slow advance)
- **E50**: *Step error* (underdelivery during slow return)
- **E51**: *Step error* (overdelivery during fast advance)
- **E55**: *Error in step counting* (optical sensor defective or mechanics too sluggish; no pulses from the slotted disc)
- **E56**: *Error in step counting* (more than 8 pulses during transition of the slotted disc; the slotted disc is oscillating)
- **E90**: *Display error*
1.2.4 Air detector

The penetration of air into the patient's extracorporeal blood circuit may cause an air embolism. In order to catch limited amounts of air and to separate accompanying air bubbles, the venous blood line is expanded (venous drip chamber). A major task of the air detector is to monitor the filling level in the venous drip chamber.

Ultrasonic air detector

The protection system against air infusion uses the method of ultrasonic transmission. Ultrasonic converters are attached on either side of the venous bubble catcher. At periodic intervals of approx. 90 ms, a transmitting resonator generates attenuated ultrasonic vibrations at a natural resonance of approx. 90 kHz, which are absorbed by a receiving resonator. The amplitude of the signal received is dependent upon the medium between the converters. Its value is at its minimum with the bubble catcher empty (air) and at its maximum with bubble-free fluids. The amplitude decreases with increasing air content (foam). The signal path is fail-safe up to and including the receiving resonator, i.e. the failure of any component always leads to a smaller amplitude and, thus, to an alarm. Starting at the receiving resonator, the signal voltage is always sent onto two independent receiver paths. As soon as the signal is too weak, one of these receiver paths causes the blood pump to stop and the other the venous line clamp to close.

The ▲ and ▼ keys are used to both raise and lower the blood level in the venous bubble catcher. As long as the ▲ key is pressed, the venous line clamp closes. The vent valve in the air detector module opens, and the blood level rises. The blood pump runs at reduced speed (180 ml/min). As long as the ▼ key is pressed, the venous line clamp remains open. The vent valve in the air detector module opens, the ventilation pump is running, and the blood level sinks. The blood pump runs at the preselected speed.

Optical detector

The optical detector serves to detect if there is blood or saline solution or air in the venous return line downstream of the bubble catcher. In the hemodialysis system, the hemodialysis phase is defined by presence of a dark medium and the preparation phase by presence of a clear medium.

Venous pressure measurement

The venous pressure measuring equipment comprises a piezo-resistive pressure sensor provided on the P.C.B. with following operational amplifier. The pressure-proportional output voltage is supplied onto the logic P.C.B. in the monitor. There, the pressure is indicated on a quasi-analog LED scale, and the transmembrane pressure is computed by determining the difference between the dialysate pressure and the venous pressure.
1.3 Functional description of the hydraulic unit

*Fig.: Flow diagram*
1.3.1 Description of the hydraulic unit

As soon as the inlet valve (41) opens, the water flows through the pressure reducing valve (61) into the chamber (66a) of the heater block and across the heat exchanger (77) into the heater rod chamber (66b).

The concentrate pump (23) admixes concentrate to the inflowing water per balancing chamber phase.

The vent tubing prevents pressure from building up in chambers b and c. In the hot rinse mode, the developing vapor can escape through the vent tubing.

While it is rising, the fluid is warmed up to the preset temperature by the heater (54). The heater is controlled by the temperature sensor (2).

From chamber b, the dialysate flows into the chamber (66c). Incorporated in this chamber is a float switch (5), which controls the solenoid valve (41), thus ensuring the correct fluid level.

The degassing pump (29) draws in the dialysate via the degassing orifice (89). This generates a negative pressure of approx. 0.8 bar.

In the lines and the following chamber (88a), the dialysate is degassed to a level which is sufficient for hemodialysis.

Via the degassing pump (29), dialysate and released air are directed tangentially into the primary air separator (88c), where air bubbles and the airless dialysate are separated. The air accumulates at the top of the chamber (88c). Then, together with the recirculation flow and via the loading pressure valve (65) as well as the chamber (66c), the air escapes into the atmosphere.

Chamber 88c is provided with a separating disc (standard hydraulics only), which serves to prevent bicarbonate, if added, from being recirculated via the heater rod chamber (66b).

At the bottom of chamber 88c, the degassed dialysate is pressed out and into the balancing chamber (68) by means of the loading pressure.

Together with the eight solenoid valves (31 to 38), the balancing chamber (68) constitutes the balancing system. Each of the two sections of the balancing chamber comprises two compartments separated by an elastic membrane each. Hence, there are two chambers with four spaces:

- F1 and F2: fresh fluid
- A1 and A2: waste fluid (used)

As soon as one of the chambers (A1 or A2) is filled with dialysate, the solenoid valves are reversed in groups of four. The valves are reversed by the electronic evaluation of the current rise pulse of the drive motor of the pump (21), which receives this pulse upon membrane abutment. Within the filling phase, F1 or F2 is filled with fresh dialysate by means of the loading pressure. In order to obtain a continuous flow, a second chamber is switched parallel to the first chamber. The second chamber is operated at an inverse sequence.

Each time the chamber is changed over (maximum deflection of the membrane), all valves are closed for approx. 100 ms (dead time).

From the balancing chamber, the dialysate flows through the conductivity cell (7) with integrated temperature sensor (3). The measured conductivity values are indicated on the monitor in ms/cm, related to 25 °C.
The temperature sensor (3) has the following functions:
– temperature compensation of the conductivity display,
– indication of the dialysate temperature.

Should the actual values (temperature or conductivity) of the dialysate exceed or fall below the limit settings, the bypass valve (26) opens, and the dialyzer valve (24) is closed. The system is now in the bypass mode. The dialysate is discharged into the drain not via the dialyzer, but via the secondary air separator (88b) and the balancing chamber (68).

If the actual conductivity and temperature values of the dialysate are within the set limits, the dialyzer valve (24) opens. The valve (26) is closed. The dialysate flows to the dialyzer.

After the dialyzer, the dialysate which is now loaded with the substances usually eliminated with the urine flows into the secondary air separator (88b) via a filter (73), the valve (24b) and the blood leak detector (8). The secondary air separator (88b) comprises the pressure transducer (9) and the level sensor (6).

With a hematocrit of 0.25, blood losses of 0.5 ml per minute are recognized in the dialysate by the blood leak detector.

Together with the venous back pressure, the signal of the pressure transducer (9) is evaluated and indicated on the monitor as TMP. The fluid level in the secondary air separator (88b) is monitored by the level sensor (6). Due to the secondary air separator (88b), only airless dialysate is always delivered into the balancing chamber (68). Any presence of air bubbles in the balancing chamber (68) would cause balancing errors.

The dialysate is pressed into the balancing chamber (68) by the flow pump (21). As mentioned above, the balancing chamber valves are reversed by the current rise pulses of the drive motor of the flow pump. Using the speed of this pump, the dialysate flow can be adjusted in the dialysis program: 300, 500, and 800 ml/min. In the cleaning programs, the flow of the dialysate is fixed.

The relief valve (78) is used to limit the pressure of the flow pump before the balancing chamber to approx. 2 bar.

After the balancing chamber, the dialysate flows through the valve (30), the heat exchanger (77) and the valve (87) into the drain.

The valves (86) and (87) serve to recirculate fluid during the hot rinsing and disinfection programs.
1.3.2 Theory of operation of the balancing chamber

- (Standard program)

1st cycle:

2nd cycle:
1st cycle: Closed valves: 31, 34, 36, and 37
   F1  is filled with fresh dialysate.
   A1  used dialysate is discharged into the drain.
   F2  fresh dialysate is forced into the dialyzer.
   A2  is filled with used dialysate.

2nd cycle: Closed valves: 32, 33, 35, and 38
   F1  fresh solution is forced into the dialyzer.
   A1  is filled with used dialysate.
   F2  is filled with fresh dialysate.
   A2  used dialysate is discharged into the drain.

This system ensures that equal amounts of fluid enter and exit the dialyzer. This leads to an exact balancing of the dialysate and, in conjunction with the ultrafiltration pump (22), a controlled volumetric ultrafiltration.

- Secondary air purging by the air separation pump 97

As soon as the fluid level in the secondary air separator (88b) has dropped below the level sensor (6), this sensor activates the air separation pump (97). Should the fluid level not have reached the level sensor (6) within a given time period, the FILL PROGRAM is started.

Note
In order to recognize the fluid level, the level sensor (6) requires fluid with a certain minimum conductivity, which is definitely achieved in all dialysis programs. Separation of air is only required in the dialysis programs. In all other programs, the air separation pump (97) and the valve (43) are force-actuated.
● FILL PROGRAM: air separation by valve 43 at atmospheric pressure

1st cycle:

2nd cycle:
If not enough air was separated and the fluid level is still below the level sensor (6), the FILL PROGRAM is activated.

The pump (21) fills either chamber A1 or chamber A2. Valves (36), (38), and (30) are closed. The valve (43) opens. The air can escape into the drain.

1st cycle: Chamber F1 is filled. This forces the fluid from chamber A1 into chamber A2. The fluid is then forced into the secondary air separator (88b) by chamber A2 via the dialyzer.

2nd cycle: Chamber F2 is filled. This forces the fluid from chamber A2 into chamber A1. The fluid is then forced into the secondary air separator (88b) by chamber A1 via the dialyzer.

Filling is performed in this way to prevent a change in conductivity. As is the case in the standard program, here as well one stroke of the concentrate pump is still accomplished per balancing chamber cycle (30 ml).

A fill program is always activated at the beginning of hemodialysis (to fill the dialyzer). Should it be activated during the hemodialysis procedure (OD dark), this is shown on the display.

Note
Repeated activation of the fill program during treatment indicates a defect (leakages).
1.3.3 Central delivery system option

The central delivery system is connected to the connectors 121/122. The concentrate flows into the rinse chambers via the inlet filters and the valves 102/104. Through the connected concentrate suction tubes, the concentrate pumps deliver the concentrate to the mixing point.

During hemodialysis, the valves 91/99 and 100 are closed. Depending on the central delivery system, V102 and/or V104 are open.

During the cleaning programs, the valves 102 and 104 are closed. During the suction phase of concentrate pump and bicarbonate pump, the valves 91 and 99 open for 500 ms upon each balancing chamber changeover. Valve 100 is open.

In order to check the tightness of the valves 102 and 104, the pressure switch is tested during the rinse-clear phase with following disinfection or hot disinfection or a mandatory rinse. To perform this test, pressure is applied to the two lines between the check valves 117/118 and the valves 102/104. The pressure switches P123 and P124 are used to monitor the pressure. Three minutes before the mandatory rinse program is completed, a functional check of the valves 91/99 and 100 is performed.
1.3.4 Program sequences during the cleaning programs

*Fig.: Flow chart of cleaning programs – overview*

- **Explanation of the abbreviations used**

  - **PGM** Program
  - **R** Rinse
  - **R endless** Endless rinse
  - **F** Rinsing clear
  - **HR** Hot rinsing
  - **C** Cooling rinse
  - **D** Disinfection
  - **D(F)** Disinfection
  - **HDIS** Disinfectant drawn in from the front (concentrate suction tube).
  - **M** Mandatory rinse
  - **IHR** Integrated hot rinsing

- **Notes on program runs**

  At the end of the set program, the rinse chamber is evacuated for approx. 1 min.

  Any statements on time refer to the factory setting. Shorter or longer program times can be set at any time by means of the SETUP menu (see Technical Manual, chapter 6).
● Rinse

### PGM 1: –R–

<table>
<thead>
<tr>
<th>T/°C</th>
<th>t/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td></td>
</tr>
</tbody>
</table>

- **Rinse**
- Rinse chamber evacuation
- 10 strokes each
- Start (Rinse key)
- End
- 15 to 30 min (Setup) approx. 1 min

### PGM 2: –R– endless

<table>
<thead>
<tr>
<th>T/°C</th>
<th>t/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td></td>
</tr>
</tbody>
</table>

- **Rinse endless**
- Start (Rinse key)
- End (abortion of program)
- **Hot rinsing**

**PGM 1: –F–HR–C–**

- **Heating**
- **Rinsing clean**
- **Timing from 80 °C**
- **Cooling rinse down to 34.5 °C**
- **Rinse chamber evacuation** 10 strokes each

<table>
<thead>
<tr>
<th>t/min</th>
<th>Heating</th>
<th>Hot rinsing</th>
<th>Cooling rinse</th>
<th>Rinse chamber evacuation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>approx. 6 min (Setup)</td>
<td>approx. 4 min</td>
<td>approx. 1 min</td>
<td>approx. 1 min</td>
</tr>
</tbody>
</table>

- **Start** (Hot rinse key)

**T/°C**

- **37 ±t/mi**
- **80**

**PGM 2: –F–HR–**

- **Heating**
- **Rinsing clean**
- **Timing from 80 °C**
- **Rinse chamber evacuation** 10 strokes each

<table>
<thead>
<tr>
<th>t/min</th>
<th>Heating</th>
<th>Hot rinsing</th>
<th>Rinse chamber evacuation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>approx. 6 min (Setup)</td>
<td>approx. 4 min</td>
<td>approx. 1 min</td>
</tr>
</tbody>
</table>

- **Start** (Hot rinse key)

**T/°C**

- **37 ±t/mi**
- **80**
**PGM 3: –IHR–**

- Integrated hot rinsing
- Rinse chamber evacuation
- 10 strokes each
- approx. 1 min
- Start (Hot rinse key)
- approx. 15 min to 40 min (Setup)
- End

---

**PGM 3: –IHR–C–**

- Heating
- approx. 5 min
- Start (Hot rinse key)
- Integrated hot rinsing
- approx. 15 min to 40 min (Setup)
- Cooling rinse
- Temperature controlled
- approx. 1 min
- End

---

- Rinse chamber evacuation
- 10 strokes each
- approx. 1 min
- End
### Disinfection

**PGM 1: \(\text{–F–D–M–}\)**

<table>
<thead>
<tr>
<th>Rinsing clean</th>
<th>Prep.*</th>
<th>Disinfection</th>
<th>Mandatory rinse</th>
<th>Rinse chamber evacuation 30 strokes each</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 to 10 min (Setup)</td>
<td>approx. 1 min</td>
<td>10 to 20 min (Setup)</td>
<td>15 to 30 min (Setup)</td>
<td>approx. 1 min</td>
</tr>
</tbody>
</table>

Start (Disinfection key)

Mandatory rinse requested

End

*Prep.: preparation phase:
Heater off
Set the level of the float switch chamber below the lower switching point of the float switch by
1 balancing chamber changeover and
4 UF pump strokes.
Aspiration of disinfectant for 50 UF-pump strokes.

**PGM 2: \(\text{–F–HDIS–M–}\)**

<table>
<thead>
<tr>
<th>Rinsing clean</th>
<th>Prep.*</th>
<th>Hot disinfection</th>
<th>Mandatory rinse</th>
<th>Rinse chamber evacuation 10 strokes each</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 to 10 min (Setup)</td>
<td>approx. 1 min</td>
<td>approx. 4 min</td>
<td>15 to 30 min (Setup)</td>
<td>approx. 1 min</td>
</tr>
</tbody>
</table>

Start (Disinfection key)

Mandatory rinse requested

End

*Prep.: preparation phase:
Heater off
Set the level of the float switch chamber below the lower switching point of the float switch by
1 balancing chamber changeover and
4 UF pump strokes.
Aspiration of disinfectant for 50 UF-pump strokes.
Rinsing clean

Prep.*

Disinfection

Mandatory rinse

Heating

Hot rinsing

Rinse chamber evacuation
10 strokes each

Start

(Disinfection key)

Mandatory rinse requested

End

*Prep.: preparation phase:
Heater off
Set the level of the float switch chamber below the lower switching point of the float switch by
1. balancing chamber changeover and
4. UF pump strokes.
Aspiration of disinfectant for 50 UF-pump strokes.
**PGM 4: –F–HDIS–M–HR–**

- **Rinsing clean**
- **Prep.***
- **Heating**
- **Hot disinfection**
- **Mandatory rinse**
- **Heating**
- **Hot rinsing**
- **Rinse chamber evacuation 10 strokes each**

| Start  | Prep.: preparation phase:  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heater off</td>
</tr>
<tr>
<td></td>
<td>Set the level of the float switch chamber below the lower switching point of the float switch by</td>
</tr>
<tr>
<td></td>
<td>1 balancing chamber changeover and</td>
</tr>
<tr>
<td></td>
<td>4 UF pump strokes.</td>
</tr>
<tr>
<td></td>
<td>Aspiration of disinfectant for 50 UF-pump strokes.</td>
</tr>
</tbody>
</table>

**PGM 5: –F–D(F)–M–**

- **Rinsing clean**
- **Prep.***
- **Disinfection**
- **Mandatory rinse**
- **Rinse chamber evacuation 10 strokes each**

| Start  | Prep.: preparation phase:  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heater off</td>
</tr>
<tr>
<td></td>
<td>Set the level of the float switch chamber below the lower switching point of the float switch by</td>
</tr>
<tr>
<td></td>
<td>23 UF pump strokes.</td>
</tr>
<tr>
<td></td>
<td>Aspiration of disinfectant for 32 concentrate pump strokes à 330 steps.</td>
</tr>
</tbody>
</table>
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## 2 Technical Safety Checks / Maintenance

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</tr>
</tbody>
</table>
2.1 Technical Safety Checks and Maintenance for 4008 hemodialysis systems and options

2.1.1 Important notes

This chapter lists all necessary Technical Safety Checks (TSC) and Maintenance procedures (MA).

These checks must be performed every 24 months if all of the following requirements have been met:
- Unique assignment of the rotors to the appropriate line roller pumps
- Software:
  - 4008 E/B systems: from 4.951 to < 5.00 or with 5.201 or higher
  - 4008 H/S systems: from 2.951 to < 3.00 or with 4.311 or higher
- DIP switch P.C.B. LP 632 array 2 SW 5 set to OFF.
- DIP switch P.C.B. LP 631 array 2 SW 7 set to ON.
- DIP switch P.C.B. LP 631 array 2 SW 8 set to ON. (With CDS option only)
- Heater rod made of Titanium

If one of the requirements mentioned above has not been met, the checks have to be performed every 12 months.

Performance of the Technical Safety Checks must be recorded in the Medical Device Register.

Please refer to page 2-5 to page 2-14 for the description of the Technical Safety Checks and Maintenance.

Please refer to the pages 2-29 and 2-30 for the report for the Technical Safety Checks and Maintenance. Numbers not listed are not part of the TSC. These are part of the Maintenance procedures (MA).

Instructions to be observed when servicing the system

Assembly, extensions, adjustments, modifications or repairs may only be carried out by the manufacturer or persons authorized by him.

The activities described in the Technical Manual require the availability of the necessary technical test equipment and accessories.

When working on the open system, the following precautions must be respected:
- Protect the components against ingress of fluids.
- Do not touch live parts (e.g. connectors of the power cable or heater).

When repairing and when replacing spare parts, observe the applicable ESD precautions (e.g. EN 100 015-1).
These inspections must be carried out by persons who are qualified to properly perform the specified Technical Safety Checks owing to their educational background and training, their knowledge and experience gained in practice and who are not subject to any directions with regard to this inspection activity.

<table>
<thead>
<tr>
<th>TSC</th>
<th>MA</th>
<th>No.</th>
<th>Description</th>
<th>Expected value / function</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSC</td>
<td>1.1</td>
<td>Visual inspections</td>
<td>Fuses accessible from the outside</td>
<td>Must comply with the maximum permissible values.</td>
</tr>
<tr>
<td>TSC</td>
<td>1.2</td>
<td>Labels and identification</td>
<td>Must be present and legible.</td>
<td></td>
</tr>
<tr>
<td>TSC</td>
<td>1.3</td>
<td>Mechanical condition</td>
<td>Must permit further safe use.</td>
<td></td>
</tr>
<tr>
<td>TSC</td>
<td>1.4</td>
<td>Damage and contaminations</td>
<td>There must not be any detectable damage or contamination.</td>
<td></td>
</tr>
<tr>
<td>TSC</td>
<td>1.4.1</td>
<td>Rotors of the line roller pumps</td>
<td>The rotors show no signs of damage. Check the rotors of the line roller pumps.</td>
<td></td>
</tr>
<tr>
<td>TSC</td>
<td>1.5</td>
<td>Power cable</td>
<td>Must not be damaged.</td>
<td></td>
</tr>
</tbody>
</table>

Interval:
- 24 months
- 12 months (please check)

These checks must be performed every 24 months if all of the following requirements have been met:
- Unique assignment of the rotors to the appropriate line roller pumps
- Software:
  - 4008 E/B systems: from 4.951 to < 5.00 or with 5.201 or higher
  - 4008 H/S systems: from 2.951 to < 3.00 or with 4.311 or higher
- DIP switch P.C.B. LP 632 array 2 SW 5 set to OFF.
- DIP switch P.C.B. LP 631 array 2 SW 7 set to ON.
- DIP switch P.C.B. LP 631 array 2 SW 8 set to ON. (With CDS option only)
- Heater rod made of Titanium

If one of the requirements mentioned above has not been met, the checks have to be performed every 12 months.
Replace the sealing in the concentrate/bicarbonate suction tubes and lubricate with silicone paste. Replace the rivet in the suction tubes, if necessary.

Check the rubber in the rinse chambers for proper function.

Replace the filters of the suction tubes (71/72).

Retighten the rinse chamber (90a/90b) screws.

Replace the check valve (92).

When using CDS, replace the check valves (117/118) and the filters 119/120.

Replace the filter sieves; upstream of the UF pump (filter 74), downstream of MV43 (filter 76), between MV99 and rinse chamber (filter 149), between MV100 and rinse chamber (filter 148).

Replace the filter sieve in the dialyzer line; replace the complete filter (73), if necessary.

Replace the O-rings in the dialyzer couplings.

Check the line in the sampling valve (116) dialysate circuit for proper function, replace the complete valve, if necessary.

Clean or replace the fan filter in the monitor.

MV 84 must be replaced after 2 years.

Only if Puristeril is used.

Replace filter 210 (if present).

Replace the filter of the disinfectant suction tube.

Replace worn or dirty tubings.

### General checks

<table>
<thead>
<tr>
<th>TSC</th>
<th>No.</th>
<th>Description</th>
<th>Expected value / function</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSC</td>
<td>2.1</td>
<td>Power failure alarm</td>
<td>Dialysis mode; Continuous sound after removing the power plug. Text displayed: <strong>Emergency operation</strong> The extracorporeal blood circuit incl. all monitoring functions is maintained.</td>
</tr>
<tr>
<td>TSC</td>
<td>2.2</td>
<td>Check level sensor</td>
<td>Draw in air via the dialysate couplings. The air separation pump is activated. If more air is detected, the system will switch to the fill program, depending on the dialysate flow. Text displayed when the OD senses opaque fluid: <strong>Fillprogram</strong></td>
</tr>
<tr>
<td>TSC</td>
<td>2.3</td>
<td>Check DIP switches</td>
<td>P.C.B. LP 631 (CPU1) DIP switch array 2 SW7 is set to ON. With central delivery system: P.C.B. LP 631 (CPU1) DIP switch array 2 SW8 is set to ON.</td>
</tr>
</tbody>
</table>
### Check of the hydraulics

*Check all pressures with undamped pressure gauges!*

<table>
<thead>
<tr>
<th>TSC</th>
<th>MA No.</th>
<th>Description</th>
<th>Expected value / function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Check of the hydraulics</td>
</tr>
<tr>
<td>MA</td>
<td>3.1</td>
<td>Check the water inlet pressure (reduced) and correct, if necessary.</td>
<td>Connect a pressure gauge before MV41 to measuring point A in the hydraulic unit. With the valve MV41 closed the pressure should range between 0.9 and 1.4 bar.</td>
</tr>
<tr>
<td>MA</td>
<td>3.2</td>
<td>Check the balancing chamber loading pressure and correct, if necessary.</td>
<td>Connect a pressure gauge to the pressure side of the degassing pump (measuring point B in the hydraulic unit). The pressure should be between 1.2 and 1.3 bar. In case of the equipment codes 4008B - EC495 4008H - EC295 4008S - EC275 and higher, the pressure must be 1.45 bar ±0.05 bar.</td>
</tr>
<tr>
<td>MA</td>
<td>3.3</td>
<td>Check the negative degassing pump pressure</td>
<td>Connect a pressure gauge to the suction side of the degassing pump (measuring point D in the hydraulic unit). The negative pressure should be between 0.81 and 0.85 bar.</td>
</tr>
<tr>
<td>MA</td>
<td>3.4</td>
<td>Check the balancing chamber relief pressure at a flow of 800 ml/min (relief valve 78).</td>
<td>Connect a pressure gauge to the pressure side of the flow pump (measuring point C in the hydraulic unit). The relief pressure depends on the loading pressure set (MA 3.2): Loading pressure: Relief pressure: 1.2 to 1.3 bar 1.9 to 2.1 bar 1.45 ± 0.05 bar 2.2 ± 0.05 bar</td>
</tr>
</tbody>
</table>

### Ultrafiltration system and membrane pumps

<table>
<thead>
<tr>
<th>TSC</th>
<th>MA No.</th>
<th>Description</th>
<th>Expected value / function</th>
</tr>
</thead>
<tbody>
<tr>
<td>STK</td>
<td>4.1</td>
<td>Check the delivery volume of the UF pump.</td>
<td>In the dialysis mode collect 60 ml of dialysate in an appropriate graduated cylinder. 60 strokes = 60 ml ±0.5 ml. Correct the setting of the UF pump, if necessary.</td>
</tr>
<tr>
<td>WA</td>
<td>4.2</td>
<td>Check the balancing chamber volume.</td>
<td>Collect the volume of two consecutive balancing chamber switchings. The average volume must be 30 ml ±1 ml.</td>
</tr>
<tr>
<td>WA</td>
<td>4.3</td>
<td>Test the concentrate pump volume or compare it with an appropriate reference.</td>
<td>Adjust according to calibration instructions, if necessary.</td>
</tr>
<tr>
<td>WA</td>
<td>4.4</td>
<td>Test the bicarbonate pump volume or compare it with an appropriate reference.</td>
<td>Adjust according to calibration instructions, if necessary.</td>
</tr>
<tr>
<td>TSC</td>
<td>MA</td>
<td>No.</td>
<td>Description</td>
</tr>
<tr>
<td>-----</td>
<td>-----</td>
<td>------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td></td>
<td>MA</td>
<td>5.1</td>
<td>Temperature</td>
</tr>
<tr>
<td></td>
<td>MA</td>
<td>5.2</td>
<td>Temperature display</td>
</tr>
<tr>
<td></td>
<td>MA</td>
<td>5.3</td>
<td>Verify the dialysate flow 300/500/800 ml/min</td>
</tr>
<tr>
<td></td>
<td>MA</td>
<td>5.4</td>
<td>Dialysate pressure</td>
</tr>
<tr>
<td>TSC</td>
<td>MA</td>
<td>5.5</td>
<td>Verify the conductivity display</td>
</tr>
</tbody>
</table>
### Extracorporeal components

<table>
<thead>
<tr>
<th>TSC</th>
<th>MA</th>
<th>No.</th>
<th>Description</th>
<th>Expected value / function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>6.1</td>
<td>Arterial pressure transducer</td>
<td>Check the slope of the pressure transducer. After applying a pressure of approx. 200 mmHg to the pressure transducer the value displayed must agree with the reading shown on the external reference meter (tolerance ±10 mmHg). Correct any deviations with the calibration program.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.2</td>
<td>Venous pressure transducer</td>
<td>Check the slope of the pressure transducer. After applying a pressure of approx. 300 mmHg to the pressure transducer the value displayed on the system must agree with the reading shown on the external reference meter (tolerance ±10 mmHg). Correct any deviations with the calibration program.</td>
</tr>
<tr>
<td>TSC</td>
<td></td>
<td>6.3</td>
<td>Arterial and Single-Needle blood pump rate</td>
<td>Check the blood pump rate (calibration program: BP-Rate CHECK).</td>
</tr>
<tr>
<td>TSC</td>
<td></td>
<td>6.4</td>
<td>SN switching points</td>
<td>Check the switching points according to the table in the TM.</td>
</tr>
<tr>
<td>TSC</td>
<td></td>
<td>6.5</td>
<td>Check the blood pump stop alarm.</td>
<td>Opening the blood pump door will trigger the blood pump stop alarm after 30 s (factory setting).</td>
</tr>
<tr>
<td>TSC</td>
<td></td>
<td>6.6</td>
<td>Air detector</td>
<td>In the event of a blood alarm, the venous line clamp must close. Generate a pressure of about 2 bar in the venous bubble catcher. Ensure that the pressure does not drop by more than 0.1 bar within 3 minutes. (See chapter 3, Adjustment instructions.)</td>
</tr>
<tr>
<td>TSC</td>
<td></td>
<td>6.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TSC</td>
<td>MA</td>
<td>No.</td>
<td>Description</td>
<td>Expected value / function</td>
</tr>
<tr>
<td>-----</td>
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<td>--------------------------------------------------</td>
<td>-----------------------------------------------------------------</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>7.1</td>
<td>biolog®</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.1.1</td>
<td>biolog® connector</td>
<td>Replace the O-rings.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.1.2</td>
<td>PSW 134</td>
<td>Check the switching pressure. The maximum switching pressure is 130 mbar + 30 mbar.</td>
</tr>
<tr>
<td>7.2</td>
<td></td>
<td></td>
<td>DIASAFE</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.2.1</td>
<td>DIASAFE filter life</td>
<td>Check the filter life. Filter life: 12 weeks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.2.2</td>
<td>Hydrophobic filter 111</td>
<td>Replace the filter.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.2.3</td>
<td>O-rings in the dialysate couplings of the DIASAFE</td>
<td>Replace the O-rings.</td>
</tr>
<tr>
<td>7.3</td>
<td></td>
<td></td>
<td>DIASAFEplus</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.3.1</td>
<td>DIASAFEplus filter life</td>
<td>Check the filter life. Filter life: 12 weeks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.3.2</td>
<td>Hydrophobic filter 111</td>
<td>Replace the filter.</td>
</tr>
<tr>
<td>7.4</td>
<td></td>
<td></td>
<td>4008 HDF</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.4.1</td>
<td>Check the delivery rate of the 2nd UF pump.</td>
<td>Collect 60 ml of dialysate in the dialysis mode using an appropriate measuring cylinder. 60 strokes = 60 ml (±0.5 ml) If necessary, correct the value.</td>
</tr>
<tr>
<td>TSC</td>
<td>MA</td>
<td>No.</td>
<td>Description</td>
<td>Expected value / function</td>
</tr>
<tr>
<td>-----</td>
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<td>---------------------------</td>
</tr>
<tr>
<td>7.5</td>
<td>7.5.1</td>
<td>Filter life of DIASAFE and ON-LINE filter</td>
<td>Check the filter life. Filter life of the DIASAFE: 12 weeks Filter life of ON-LINE filter: 8 weeks or 50 treatments</td>
<td></td>
</tr>
<tr>
<td>7.5</td>
<td>7.5.2</td>
<td>Hydrophobic filter 111</td>
<td>Replace the filter.</td>
<td></td>
</tr>
<tr>
<td>7.5</td>
<td>7.5.3</td>
<td>O-rings in the dialysate couplings of the DIASAFE</td>
<td>Replace the O-rings.</td>
<td></td>
</tr>
<tr>
<td>7.5</td>
<td>7.5.4</td>
<td>HDF pump rotor</td>
<td>Check the rotor for smooth running and wear.</td>
<td></td>
</tr>
<tr>
<td>7.5</td>
<td>7.5.5</td>
<td>Fastening strap</td>
<td>Check the fastening strap for Luer-lock.</td>
<td></td>
</tr>
<tr>
<td>TSC</td>
<td>7.5.6</td>
<td>Substitute pump (part no. 672 521 1) with DC motor</td>
<td>Speed 150 ml/min To determine the delivery volume: the volume of fluid delivered must agree with the preset value (±10 %). To check the speed: with the above setting the blood pump rotor must turn at 13.5 rpm. (See Technical Manual ON-LINE-HDF, chapter 3).</td>
<td></td>
</tr>
<tr>
<td>TSC</td>
<td>7.5.7</td>
<td>Substitute pump stop</td>
<td>Stop the substitute pump by – triggering a blood alarm, – triggering the bypass function, – opening the blood pump door.</td>
<td></td>
</tr>
<tr>
<td>TSC</td>
<td>7.5.8</td>
<td>Substitute pump function – Rinse – Hot rinse – Disinfection</td>
<td>Start the rinse program; the pump will deliver at 400 ml/min. Start the hot rinse program; the pump will deliver at 150 ml/min. Start the disinfection program; the pump will deliver at 400 ml/min.</td>
<td></td>
</tr>
<tr>
<td>TSC</td>
<td>MA No.</td>
<td>Description</td>
<td>Expected value / function</td>
<td></td>
</tr>
<tr>
<td>-----</td>
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<td>-------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>7.6</td>
<td>ONLINE\textsubscript{plus}™ (and DIASAFE\textsuperscript{plus})</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA</td>
<td>7.6.1</td>
<td>Filter life of DIASAFE\textsuperscript{plus} and ONLINE\textsubscript{plus}™ filter</td>
<td>Check the filter life. Filter life of DIASAFE\textsuperscript{plus} and ONLINE\textsubscript{plus}™ filter: 12 weeks or 100 treatments</td>
<td></td>
</tr>
<tr>
<td>MA</td>
<td>7.6.2</td>
<td>Hydrophobic filters 111 and 184</td>
<td>Replace the filters.</td>
<td></td>
</tr>
<tr>
<td>MA</td>
<td>7.6.3</td>
<td>Substitute port (195) and rinse port (194)</td>
<td>Replace the O-rings.</td>
<td></td>
</tr>
<tr>
<td>TSC</td>
<td>7.6.4</td>
<td>Line pinch valve 193 (ONL1)</td>
<td>Replace the line.</td>
<td></td>
</tr>
<tr>
<td>TSC</td>
<td>7.6.5</td>
<td>Check DIP switch</td>
<td>With HPU (hydraulic processing unit) P.C.B. LP 632 (CPU2) DIP switch array 2 switch 5 is set to OFF.</td>
<td></td>
</tr>
</tbody>
</table>

7.7 OCM

<table>
<thead>
<tr>
<th>MA</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Perform OCM PULSE calibration.</td>
</tr>
<tr>
<td>TSC</td>
<td>MA</td>
</tr>
<tr>
<td>-----</td>
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<tr>
<td>7.8</td>
<td>BPM 4008</td>
</tr>
<tr>
<td>MA</td>
<td>7.8.1</td>
</tr>
<tr>
<td>MA</td>
<td>7.8.2</td>
</tr>
<tr>
<td>MA</td>
<td>7.8.2.1</td>
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<td>7.8.2.2</td>
</tr>
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<td>MA</td>
<td>7.8.2.3</td>
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<tr>
<td>MA</td>
<td>7.8.2.4</td>
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<td>7.8.2.5</td>
</tr>
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<td>TSC</td>
<td>7.8.3</td>
</tr>
<tr>
<td>TSC</td>
<td>7.8.4</td>
</tr>
<tr>
<td>TSC</td>
<td>7.8.5</td>
</tr>
<tr>
<td>TSC</td>
<td>7.8.6</td>
</tr>
<tr>
<td>7.9</td>
<td>BTM 4008</td>
</tr>
<tr>
<td>7.10</td>
<td>BVM 4008</td>
</tr>
<tr>
<td>TSC</td>
<td>MA No.</td>
</tr>
<tr>
<td>-----</td>
<td>--------</td>
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<tr>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

For measuring points, see 2.1.4 Notes – Check of the electrical safety.

<table>
<thead>
<tr>
<th>TSC</th>
<th>8.1</th>
<th>Visual inspections performed</th>
<th>see item 1 Visual inspections</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSC</td>
<td>8.2</td>
<td>Protective earth resistance</td>
<td>Max. 0.3 Ω (with power cable)</td>
</tr>
<tr>
<td>TSC</td>
<td>8.3</td>
<td>Measurement of the leakage current (device leakage current)</td>
<td>Differential current measurement according to fig. C.6</td>
</tr>
</tbody>
</table>

-or-

Direct measurement according to fig. C.5

Basic conditions:
- Measurement of the protective earth resistance has been completed.
- Perform the measurement with the system being at operating temperature in the Dialysis or Preparation operation mode.
- Dialysate:
  - Dialysate temperature ≥ 37°C
  - Dialysate flow ≥ 300 ml/min
  - Conductivity ≥ 13 mS/cm
- When performing a direct measurement, the following precautions must be observed:
  - The system must be installed under insulated conditions.
  - All external connections must have been removed from the system.
Documentation covers the line voltage during the measurement and the maximum device leakage current of both mains polarities scaled to the line voltage of the power supply. Maximum device leakage current: 500 μA

Example:
- Line voltage during measurement: 225 V
- Device leakage current for mains polarity 1: 180 μA
- for mains polarity 2: 120 μA
- Maximum value of both mains polarities: 180 μA
- Nominal voltage of the power supply: 230 V
- Scaled to nominal voltage: 184 μA
  \( (180 \mu A : 225 V \cdot 230 V = 184 \mu A) \)
- Device leakage current < 500 μA: OK

Additional conditions:
- If the device leakage current is higher than 90 % of the admissible alarm limit (450 μA), the last measured value or the first measured value must additionally be considered for the rating.
- If the device leakage current considerably increased since the last measurement or continuously increased since the first measurement (creeping deterioration of the insulation), or if the sum composed of the current value plus the difference since the last measurement is > 500 μA, the measurement has not been passed.

Example 1:
- Leakage current: 470 μA
- Last measured value: 450 μA
- \( 470 + (470 - 450) = 470 + 20 = 490 \) ➜ OK

Example 2:
- Leakage current: 470 μA
- Last measured value: 390 μA
- \( 470 + (470 - 390) = 470 + 80 = 550 \) ➜ not passed

9 Functional check

<table>
<thead>
<tr>
<th>TSC</th>
<th>MA</th>
<th>No.</th>
<th>Description</th>
<th>Expected value / function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>9.1</td>
<td>Perform the functional test</td>
<td>Press the Test key. The system must successfully pass the T1 test.</td>
</tr>
<tr>
<td>MA</td>
<td>9.2</td>
<td></td>
<td>Hot rinse / disinfection</td>
<td>Run a disinfection program.</td>
</tr>
</tbody>
</table>
2.1.3 Report – Technical Safety Checks and Maintenance

These checks must be performed every 24 months if all of the following requirements have been met:

- Unique assignment of the rotors to the appropriate line roller pumps
- Software:
  - 4008 E/B systems: from 4.951 to < 5.00 or with 5.201 or higher
  - 4008 H/S systems: from 2.951 to < 3.00 or with 4.311 or higher
- DIP switch P.C.B. LP 632 array 2 SW 5 set to OFF.
- DIP switch P.C.B. LP 631 array 2 SW 7 set to ON.
- DIP switch P.C.B. LP 631 array 2 SW 8 set to ON. (With CDS option only)
- Heater rod made of Titanium

If one of the requirements mentioned above has not been met, the checks have to be performed every 12 months.

<table>
<thead>
<tr>
<th>Customer/Customer no.</th>
<th>Service report no.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial no.:</td>
<td>Inventory no.:</td>
</tr>
<tr>
<td></td>
<td>Operating hours:</td>
</tr>
<tr>
<td>System type: 4008</td>
<td></td>
</tr>
<tr>
<td>4008 B</td>
<td></td>
</tr>
<tr>
<td>4008 H</td>
<td></td>
</tr>
<tr>
<td>4008 S</td>
<td></td>
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<tr>
<td>With option: SN</td>
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<tr>
<td>bibag®</td>
<td></td>
</tr>
<tr>
<td>4008 HDF</td>
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<tr>
<td>ON-LINE-HDF</td>
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<tr>
<td>ONLINEplus™</td>
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<tr>
<td>BPM</td>
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</tr>
<tr>
<td>BVM</td>
<td></td>
</tr>
<tr>
<td>DIASAFE</td>
<td></td>
</tr>
<tr>
<td>DIASAFE®plus</td>
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</tr>
<tr>
<td>OCM</td>
<td></td>
</tr>
</tbody>
</table>

1 Visual checks

TSC 1.1 Fuses accessible from the outside comply with the indicated values

TSC 1.2 Labels and identifications present and legible

TSC 1.3 Mechanical conditions permits further safe use

TSC 1.4 No damage or contaminations detectable

TSC 1.4.1 The rotors of the line roller pumps show no signs of damage

TSC 1.5 Power cable not damaged

1.6 Preventive Maintenance procedures

MA 1.6.1 Sealing in the suction tubes changed and lubricated, rivet replaced

MA 1.6.2 Rubber in rinse chambers checked for proper function

MA 1.6.3 Suction tube filters replaced

MA 1.6.4 Rinse chamber screws tight

MA 1.6.5 Check valve replaced

MA 1.6.6 Pre-UF pump filter, filter downstream of MV43, filter between rinse chambers, and on MV99, MV100, CDS and disinfectant port replaced

MA 1.6.7 Dialysate filter replaced or sieve changed

MA 1.6.8 O-rings in dialyzer couplings replaced

MA 1.6.9 Sampling valve functions properly

MA 1.6.10 Fan filter replaced

MA 1.6.11 Ribbon belt and line segment in air separation pump changed

MA 1.6.12 MV84, replaced after 2 years. (Only if Puristeril is used.)

MA 1.6.13 Connecting piece or equilibration chamber replaced.
(Only if ONLINE™plus or DIASAFE®plus option is not used.)

MA 1.6.14 Filter 210 replaced (if present)

MA 1.6.15 Filter of the disinfectant suction tube replaced

MA 1.6.16 No dirty or worn tubings
2 General checks
TSC 2.1 Power failure alarm – continuous sound – display: Emergency operation
TSC 2.2 Air separation by air separation pump activated; display if more air must be separated and OD senses opaque fluid: fill program
TSC 2.3 Check DIP switches
P.C.B. LP 631 (CPU1) DIP switch array 2 SW7 is set to ON.
With central delivery system:
P.C.B. LP 631 (CPU1) DIP switch array 2 SW8 is set to ON.

3 Check of the hydraulics
MA 3.1 Water inlet pressure (reduced) 0.9 bar to 1.4 bar
MA 3.2 Loading pressure 1.25 bar ±0.05 bar
With EC495 (4008B); EC295(4008H), EC 275 (4008S) and higher
Loading pressure 1.45 bar ±0.05 bar
MA 3.3 Negative degassing pump pressure 0.81 to 0.85 bar
MA 3.4 Balancing chamber relief pressure at 800 ml/min
Loading pressure: Relief pressure:
1.2 to 1.3 bar 1.9 to 2.1 bar
1.45 ± 0.05 bar 2.2 ± 0.05 bar

4 Ultrafiltration system and membrane pumps
TSC 4.1 UF pump, 1 stroke = 1 ml, 60 strokes = 60 ml ±0.5 ml
MA 4.2 Average balancing chamber volume 30 ± 1 ml
MA 4.3 Concentrate pump calibration volume removal / number of strokes
MA 4.4 Bicarbonate pump calibration volume removal / number of strokes

5 Dialysis mode
MA 5.1 Expected temperature 37 °C ± 0.5 °C
MA 5.2 Temperature display 37 °C ± 0.5 °C
MA 5.3 Dialysate flow check
800 ml/min (desired value: 765 to 837 ml/min)
500 ml/min (desired value: 471 to 528 ml/min)
300 ml/min (desired value: 279 to 321 ml/min)
MA 5.4 Dialysate pressure
– Check zero point with flow off
– Slope checked
TSC 5.5 Conductivity display checked with reference meter
If the biBag® option is used, connect a biBag®!
– CD system
– CD ref.

6 Extracorporeal components
MA 6.1 Arterial pressure displayed checked with reference meter
MA 6.2 Venous pressure displayed checked with reference meter
TSC 6.3 Blood pumps: blood pump rate checked (calibration program: BP-Rate CHECK)
TSC 6.4 SN switching pressure checked according to table in TM
TSC 6.5 Blood pump stop alarm checked
TSC 6.6 Venous line clamp closes after blood alarm
TSC 6.7 Pressure of about 2 bar in the venous bubble catcher
Pressure must not drop by more than 0.1 bar within 3 minutes.
7 Options

7.1 bi\textsuperscript{bag}\textsuperscript{®}

MA 7.1.1 bi\textsuperscript{bag}\textsuperscript{®} connector, O-rings replaced .................................................................

MA 7.1.2 Switching pressure of PSW134 checked,
130 mbar, + 30 mbar .................................................. Measured value:________

7.2 DIASAFE

MA 7.2.1 DIASAFE filter life checked .................................................................

MA 7.2.2 Hydrophobic filter 111 replaced .........................................................

MA 7.2.3 O-rings in the dialysate couplings of the DIASAFE replaced ..............

7.3 DIASAFE\textsuperscript{®} plus

MA 7.3.1 DIASAFE\textsuperscript{®} plus filter life checked .................................................................

MA 7.3.2 Hydrophobic filter 111 replaced .........................................................

7.4 4008 HDF

TSC 7.4.1 2\textsuperscript{nd} UF pump 1 stroke = 1 ml, 60 strokes = 60 ml ± 0.5 ml ...... Measured value:________

7.5 ON-LINE-HDF (and DIASAFE)

MA 7.5.1 Filter life of the DIASAFE and ON-LINE filter checked .................................................................

MA 7.5.2 Hydrophobic filter 111 replaced .........................................................

MA 7.5.3 O-rings in the dialysate couplings of the DIASAFE replaced ..............

MA 7.5.4 HDF pump rotor checked (smooth running, wear) ................................

MA 7.5.5 Fastening strap for Luer-lock checked ..............................................

TSC 7.5.6 Substitute pump .................................................................

\(\checkmark\) (part no. 672 521 1) with DC motor:
volume delivered by the pump checked .................................. desired/actual:\________/\________

or

\(\checkmark\) (part no. 674 982 1) with stepper motor:
pump rate checked (calibration program: HDF-P.-Rate CHECK)

TSC 7.5.7 Substitute pump stop

- after blood alarm .........................................................................................

- after triggering the bypass function ............................................................

- after opening the blood pump door ............................................................

TSC 7.5.8 Check substitute pump for proper function

- Rinse program, delivery rate: 400 ml/min ..................................................

- Hot rinse program, delivery rate: 150 ml/min .............................................

- Disinfection program, delivery rate: 400 ml/min ........................................

7.6 ONLINE\textsuperscript{TM} (and DIASAFE\textsuperscript{®} plus)

MA 7.6.1 Filter life of DIASAFE\textsuperscript{®} plus and ONLINE\textsuperscript{TM} checked .................................................................

MA 7.6.2 Hydrophobic filters 111 and 184 replaced ........................................

MA 7.6.3 O-rings in substitute port 195 and in rinse port 194 replaced .............

TSC 7.6.4 Line in the line pinch valve 193 (ONL1) replaced ................................

TSC 7.6.5 Check DIP switch

With HPU (hydraulic processing unit)
P.C.B. LP 632 (CPU2) DIP switch array 2 switch 5 is set to OFF. ........................

7.7 OCM

MA OCM PULSE calibration performed .............................................................

2-18 Fresenius Medical Care 4008 5/03.09 (TM)
7.8 BPM 4008
MA 7.8.1 Labels and indications are present and legible ................................................................. ❑
MA 7.8.2 Mechanical condition permits further safe use ................................................................. ❑
MA 7.8.2.1 Line connector is correctly fixed to the system ............................................................ ❑
MA 7.8.2.2 Internal blood pressure module, printed circuit boards, cable connections are correctly fixed .......................................................................................................................... ❑
MA 7.8.2.3 Damaged lines or cuffs have been replaced ................................................................. ❑
MA 7.8.2.4 Indicating elements checked .......................................................................................... ❑
MA 7.8.2.5 Touch panel checked ..................................................................................................... ❑
TSC 7.8.3 Leakage test: pressure leakage rate less than 6 mmHg/min ............................................ ❑
TSC 7.8.4 Calibration:

<table>
<thead>
<tr>
<th>Pressure values</th>
<th>Tolerance</th>
<th>Measured value:</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 mmHg</td>
<td>±5mmHg</td>
<td></td>
</tr>
<tr>
<td>200 mmHg</td>
<td>±5mmHg</td>
<td></td>
</tr>
<tr>
<td>150 mmHg</td>
<td>±3mmHg</td>
<td></td>
</tr>
<tr>
<td>100 mmHg</td>
<td>±3mmHg</td>
<td></td>
</tr>
<tr>
<td>50 mmHg</td>
<td>±3mmHg</td>
<td></td>
</tr>
</tbody>
</table>

TSC 7.8.5 Safety valve: discharge at 320 mmHg, ±10 mmHg .................................................. ❑
TSC 7.8.6 Blood pressure measured ............................................................................................. ❑

7.9 BTM 4008
No further Technical Safety Checks and Maintenance procedures must be performed.

7.10 BVM 4008
No further Technical Safety Checks and Maintenance procedures must be performed.

8 Check of the electrical safety
In other countries, observe the local regulations!
For measuring points, see 2.1.4 VDE check.
For 4008 HDF option, check additional measuring point!

TSC 8.1 Visual inspections performed according to item 1 ............................................................ ❑
TSC 8.2 Protective earth resistance max. 0.3 Ω (with power cable) ... Measured value: ... ❑
TSC 8.3 Measurement of the leakage current .............................................................................. ❑

q Differential current measurement according to fig. C.6
q Direct measurement according to fig. C.5

Nominal voltage of power supply ....................... Volt
Device leakage current mains polarity 1 ...... µA
for line voltage .............................................. Volt
scaled to nominal voltage (maximum 500 µA, see also Additional conditions) ....................... Measured value: ...

Device leakage current mains polarity 2 ...... µA
for line voltage .............................................. Volt
scaled to nominal voltage (maximum 500 µA, see also Additional conditions) ....................... Measured value: ...

Test equipment used: ........................................

9 Final checks
TSC 9.1 T1 test performed ............................................................................................................ ❑
MA 9.2 Hot rinse / disinfection performed .................................................................................... ❑
<table>
<thead>
<tr>
<th>Date:</th>
<th>Signature:</th>
<th>Stamp:</th>
</tr>
</thead>
</table>

The system has been released for further use

☐ Yes ☐ No

Remarks:

<table>
<thead>
<tr>
<th>Date:</th>
<th>Signature:</th>
<th>Stamp:</th>
</tr>
</thead>
</table>
2.1.4 Notes – Check of the electrical safety

- Test 4008 E, 4008 H

1. Protective earth resistance measuring points

Legend

1 Monitor rear panel (ports housing)
2 Hydraulic unit rear panel (plate on the push-on blade inside)
   **Caution:** The grounding cable must be connected.
3 Ground stud for potential equalization
4 Upper rear panel (screw)
5 Heat sink (power supply unit)
6 Monitor rear panel (plate)
7 Power supply plate
8 Heater rod housing (hydraulic unit open)
9 Dialyzer line ports (hydraulic unit open / earthing screw)

2. Use a meter (e.g. SECUTEST 0701) to check the leakage current.
Test 4008 B, 4008 S

1. Protective earth resistance measuring points

Legend

1. Ground stud for potential equalization
2. Upper rear panel (screw)
3. Heat sink (power supply unit)
4. Heater rod housing (hydraulic unit open)
5. Dialyzer line ports (adapters)

2. Use a meter (e.g. SECUTEST 0701) to check the leakage current.
• Test 4008 HDF (option)

1. Protective earth resistance measuring point

![Diagram showing protective earth resistance test measuring point]

2. Use a meter (e.g. SECUTEST 0701) to check the leakage current.

3. Measurement conditions

The measurements must be taken in the dialysis mode in the “ON phase” of the heater control system.
The scales must be moved out to such an extent that neither of the two end switches are actuated (middle position).
2.2 TSC report

These checks must be performed every **24 months** if all of the following requirements have been met:

- Unique assignment of the rotors to the appropriate line roller pumps
- Software:
  - 4008 E/B systems: from 4.951 to < 5.00 or with 5.201 or higher
  - 4008 H/S systems: from 2.951 to < 3.00 or with 4.311 or higher
- DIP switch P.C.B. LP 632 array 2 SW 5 set to OFF.
- DIP switch P.C.B. LP 631 array 2 SW 7 set to ON.
- DIP switch P.C.B. LP 631 array 2 SW 8 set to ON. (With CDS option only)
- Heater rod made of Titanium

If one of the requirements mentioned above has not been met, the checks have to be performed every **12 months**.

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Measured value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Visual inspections</strong></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Fuses accessible from the outside comply with the indicated values</td>
<td>– ✔</td>
</tr>
<tr>
<td>1.2</td>
<td>Labels and identifications are present and legible</td>
<td>– ✔</td>
</tr>
<tr>
<td>1.3</td>
<td>Mechanical condition permits further safe use</td>
<td>– ✔</td>
</tr>
<tr>
<td>1.4</td>
<td>No damage or contaminations detectable</td>
<td>– ✔</td>
</tr>
<tr>
<td>1.4.1</td>
<td>No signs of damage on the line roller pump rotors</td>
<td>– ✔</td>
</tr>
<tr>
<td>1.5</td>
<td>Power cable not damaged</td>
<td>– ✔</td>
</tr>
</tbody>
</table>

### General checks

2 | **Power failure alarm – continuous sound – text displayed: Emergency operation** | – ✔ |

### Air separation

2.2 | Air separation by air separation pump activated; text displayed if more air must be separated and OD senses opaque fluid: Fill program | – ✔ |

### System checks

2.3 | Check of DIP switches:
- P.C.B. LP 631 (CPU1) DIP switch array 2 SW 7 is set to ON.
- P.C.B. LP 631 (CPU1) DIP switch array 2 SW 8 is set to ON. (With CDS option only) | – ✔

### Ultrafiltration system and membrane pumps

4.1 | UF pump, 1 stroke = 1 ml, 60 strokes = 60 ml ± 0.5 ml | ........... ✔

### Dialysis mode

5.5 | Conductivity display checked using a reference meter (if the biog® option is used, connect a biog®): CD system/CD ref. | ....... / ....... ✔

### Extracorporeal components

6.3 | Blood pumps: check the blood pump rate (calibration program: BP-Rate CHECK) | – ✔

### Blood pump stop alarm checked

6.4 | SN switching pressure checked according to table in TM | – ✔

### Venous line clamp closes after blood alarm

6.6 | Pressure of approx. 2 bar in the venous bubble catcher. Pressure must not drop by more than 0.1 bar within 3 minutes. | – ✔

### Options

7.4 | 4008 HDF | – ✔

7.4.1 | Volume delivered by the 2nd UF pump checked: 60 strokes = 60 ml ± 0.5 ml | ........... ✔

7.5 | Online-HDF | – ✔

7.5.6 | Substitute pump (part no. 672 521 1) with DC motor: check volume delivered by the pump desired/actual | ....... / ....... ✔

- Substitute pump (part no. 674 982 1) with stepper motor: check the pump rate (calibration program: BP-Rate CHECK) | – ✔
<table>
<thead>
<tr>
<th>Nr.</th>
<th>Bezeichnung</th>
<th>Meßwert</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.5.7</td>
<td>Substitute pump stop:</td>
<td>✔</td>
</tr>
<tr>
<td>– after blood alarm</td>
<td>✗</td>
<td></td>
</tr>
<tr>
<td>– after triggering the bypass function</td>
<td>✗</td>
<td></td>
</tr>
<tr>
<td>– after opening the blood pump door</td>
<td>✗</td>
<td></td>
</tr>
<tr>
<td>7.5.8</td>
<td>Check substitute pump for proper function:</td>
<td>✔</td>
</tr>
<tr>
<td>– Rinse program, delivery rate: 400 ml/min</td>
<td>✗</td>
<td></td>
</tr>
<tr>
<td>– Hot rinse program, delivery rate: 150 ml/min</td>
<td>✗</td>
<td></td>
</tr>
<tr>
<td>– Disinfection program, delivery rate: 400 ml/min</td>
<td>✗</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Meßwert</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.6.4</td>
<td>Line in the line pinch valve 193 (ONL1) replaced</td>
</tr>
<tr>
<td>7.6.5</td>
<td>Check of DP switch</td>
</tr>
<tr>
<td>P.C.B. LP 632 (CPU2) DIP switch array 2 SW5 is set to OFF.</td>
<td>✗</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Meßwert</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.8.3</td>
<td>Leakage test: pressure leakage rate less than 6 mmHg/min</td>
</tr>
<tr>
<td>7.8.4</td>
<td>Calibration</td>
</tr>
<tr>
<td>250 mmHg ± 5 mmHg</td>
<td>✗</td>
</tr>
<tr>
<td>200 mmHg ± 5 mmHg</td>
<td>✗</td>
</tr>
<tr>
<td>150 mmHg ± 3 mmHg</td>
<td>✗</td>
</tr>
<tr>
<td>100 mmHg ± 3 mmHg</td>
<td>✗</td>
</tr>
<tr>
<td>50 mmHg ± 3 mmHg</td>
<td>✗</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Meßwert</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.8.5</td>
<td>Safety valve: discharge at 320 mmHg ± 10 mmHg</td>
</tr>
<tr>
<td>7.8.6</td>
<td>Blood pressure measured</td>
</tr>
</tbody>
</table>

8 Checking the electrical safety

In other countries, observe the local regulations!

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Meßwert</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.1</td>
<td>Visual inspection performed according to item 1.</td>
</tr>
<tr>
<td>8.2</td>
<td>Protective earth resistance maximum 0.3 ohms (with power cable)</td>
</tr>
<tr>
<td>8.3</td>
<td>Measurement of the leakage current (device leakage current)</td>
</tr>
<tr>
<td>Differential current measurement according to fig. C.6</td>
<td>✔</td>
</tr>
<tr>
<td>Direct measurement according to fig. C.5</td>
<td>✔</td>
</tr>
<tr>
<td>Nominal voltage of power supply:</td>
<td>✗</td>
</tr>
<tr>
<td>Device leakage current mains polarity 1</td>
<td>✗</td>
</tr>
<tr>
<td>for line voltage</td>
<td>✗</td>
</tr>
<tr>
<td>scaled to nominal voltage (maximum 500 μA, see also Additional conditions)</td>
<td>✗</td>
</tr>
<tr>
<td>Device leakage current mains polarity 2</td>
<td>✗</td>
</tr>
<tr>
<td>for line voltage</td>
<td>✗</td>
</tr>
<tr>
<td>scaled to nominal voltage (maximum 500 μA, see also Additional conditions)</td>
<td>✗</td>
</tr>
</tbody>
</table>

Test equipment used …………………………………………………………………………………………………

9 Functional test

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Meßwert</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.1</td>
<td>T1 test performed</td>
</tr>
</tbody>
</table>

Date: Signature: Stamp:

The system has been released for further use

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

Remarks:

Date: Signature: Stamp:
# Table of contents

## 3 Adjustment instructions

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<td>3-4</td>
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<tr>
<td>Fig.: Flow diagram hydraulics 4008 with advanced hydraulics</td>
<td>3-6</td>
</tr>
<tr>
<td>Fig.: P.C.B. overview</td>
<td>3-8</td>
</tr>
</tbody>
</table>

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Fig.: Measuring equipment
<table>
<thead>
<tr>
<th>Pos.</th>
<th>Measuring equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pressure gauge HMED with carrying case (set)</td>
</tr>
<tr>
<td>2</td>
<td>Universal measuring device UMED (set) (conductivity, pressure, temperature)</td>
</tr>
<tr>
<td>3</td>
<td>Secutest VDE tester (without printer module) Printer module (not ill.) Carrying case (not ill.)</td>
</tr>
<tr>
<td>4</td>
<td>Calibration kit for 22 mm AD</td>
</tr>
<tr>
<td>5</td>
<td>4008 Service Software set</td>
</tr>
<tr>
<td>6</td>
<td>Electronic pocket scales Test weight with spirit level and certificate</td>
</tr>
<tr>
<td>7</td>
<td>Measuring cylinder, 100 ml (not ill.)</td>
</tr>
<tr>
<td>8</td>
<td>Special tool for installation and removal of modules (not ill.)</td>
</tr>
<tr>
<td>9</td>
<td>ESD service kit</td>
</tr>
<tr>
<td>10</td>
<td>ESD work station kit</td>
</tr>
<tr>
<td>11</td>
<td>IC extraction tool</td>
</tr>
</tbody>
</table>

The current list of the measuring equipment with part numbers can be found in the electronic Spare Pars Catalog.
Fig.: Flow diagram hydraulics incl. DIASAFe® plus (Option) with basic hydraulics
### Legend

<table>
<thead>
<tr>
<th>Number</th>
<th>Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Temperature sensor</td>
</tr>
<tr>
<td>3</td>
<td>Temperature sensor</td>
</tr>
<tr>
<td>5</td>
<td>Float switch</td>
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<td>6</td>
<td>Level sensor</td>
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<tr>
<td>7</td>
<td>Conductivity cell</td>
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<tr>
<td>8</td>
<td>Blood leak detector</td>
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<td>9</td>
<td>Pressure transducer</td>
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<tr>
<td>10</td>
<td>Reed contact for concentrate</td>
</tr>
<tr>
<td>12</td>
<td>Reed contact for bicarbonate</td>
</tr>
<tr>
<td>21</td>
<td>Flow pump</td>
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<tr>
<td>22</td>
<td>UF pump</td>
</tr>
<tr>
<td>23</td>
<td>Concentrate pump</td>
</tr>
<tr>
<td>24</td>
<td>Dialyzer valve 1</td>
</tr>
<tr>
<td>24b</td>
<td>Dialyzer valve 2</td>
</tr>
<tr>
<td>25</td>
<td>Bicarbonate pump</td>
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<tr>
<td>26</td>
<td>Bypass valve</td>
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<tr>
<td>29</td>
<td>Degassing pump</td>
</tr>
<tr>
<td>30</td>
<td>Outlet valve</td>
</tr>
<tr>
<td>31</td>
<td>Balancing chamber valve 1</td>
</tr>
<tr>
<td>32</td>
<td>Balancing chamber valve 2</td>
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<td>Balancing chamber valve 3</td>
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<td>Balancing chamber valve 8</td>
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<td>41</td>
<td>Water inlet valve</td>
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<tr>
<td>43</td>
<td>Fill valve</td>
</tr>
<tr>
<td>54</td>
<td>Heater rod</td>
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<td>61</td>
<td>Pressure reducing valve</td>
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<td>63</td>
<td>Water inlet filter</td>
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<td>65</td>
<td>Loading pressure valve</td>
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<td>66</td>
<td>Heater block</td>
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<tr>
<td>66a</td>
<td>Water inflow chamber</td>
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<td>66b</td>
<td>Heater rod chamber</td>
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<tr>
<td>66c</td>
<td>Float chamber</td>
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<tr>
<td>68</td>
<td>Balancing chamber</td>
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<tr>
<td>71</td>
<td>Filter/concentrate</td>
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<tr>
<td>72</td>
<td>Filter/bicarbonate</td>
</tr>
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<td>73</td>
<td>Filter/dialysate ext.</td>
</tr>
<tr>
<td>74</td>
<td>Filter/UF</td>
</tr>
<tr>
<td>75</td>
<td>External flow indicator</td>
</tr>
<tr>
<td>76</td>
<td>Filter/fill valve</td>
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<tr>
<td>77</td>
<td>Heat exchanger</td>
</tr>
<tr>
<td>78</td>
<td>Relief valve</td>
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<tr>
<td>84</td>
<td>Disinfectant valve</td>
</tr>
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<td>85</td>
<td>Disinfectant connector</td>
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<td>86</td>
<td>Recirculation valve</td>
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<tr>
<td>87</td>
<td>Drain valve</td>
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<td>88</td>
<td>Multifunction block</td>
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<tr>
<td>88a</td>
<td>Degassing chamber</td>
</tr>
<tr>
<td>88b</td>
<td>Secondary air separator</td>
</tr>
<tr>
<td>88c</td>
<td>Primary air separator</td>
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<td>89</td>
<td>Degassing orifice</td>
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<td>Rinse chamber concentrate</td>
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<td>90b</td>
<td>Rinse chamber bicarbonate</td>
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<td>91</td>
<td>Rinse valve</td>
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<td>Vent valve</td>
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<td>94</td>
<td>Concentrate suction tube</td>
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<td>95</td>
<td>Bicarbonate suction tube</td>
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<td>97</td>
<td>Air separation pump</td>
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<td>99</td>
<td>Rinse valve</td>
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<td>100</td>
<td>Rinse valve</td>
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<tr>
<td>102</td>
<td>Central concentrate delivery valve</td>
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<tr>
<td>104</td>
<td>Central bicarbonate delivery valve</td>
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<td>Temperature sensor</td>
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<td>Hydrophobic filter</td>
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<td>112</td>
<td>Vent valve</td>
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<tr>
<td>114</td>
<td>Dialysate filter</td>
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<tr>
<td>115</td>
<td>Sensor disinfection valve</td>
</tr>
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<td>116</td>
<td>Sampling valve</td>
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<td>Filter/rinse valve 99</td>
</tr>
<tr>
<td>151</td>
<td>Orifice</td>
</tr>
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</table>

### Hydraulics measuring points

- **A** Reduced water inlet pressure
- **B** Balancing chamber loading pressure
- **C** Flow pump pressure
- **D** Degassing pump pressure
Fig.: Flow diagram hydraulics 4008 with advanced hydraulics
## Legend

<table>
<thead>
<tr>
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<td>Temperature sensor (OCM option)</td>
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<td>Reed contact for bicarbonate</td>
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<td>UF pump</td>
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<td>Pressure transducer 2 (advanced hydraulics)</td>
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<td>Rinse port (Online plus option)</td>
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<td>Substitute port (Online plus option)</td>
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<td>202</td>
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<td>203</td>
<td>Air separator</td>
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<tr>
<td>204</td>
<td>Level sensor</td>
</tr>
<tr>
<td>205</td>
<td>Concentrate / bicarbonate mixing point</td>
</tr>
<tr>
<td>210</td>
<td>Filter (degassing orifice)</td>
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</tbody>
</table>

## Hydraulics measuring points

- **A**: Reduced water inlet pressure
- **B**: Balancing chamber loading pressure
- **C**: Flow pump pressure
- **D**: Degassing pump pressure
**Fig.: P.C.B. overview**

Fresenius Medical Care 4008 5/03.09 (TM)

- **LP 630**: Motherboard
- **LP 631**: CPU 1 (operating system)
- **LP 632**: CPU 2 (safety system)
- **LP 633**: Input board
- **LP 634**: Output board
- **LP 635**: Display board
- **LP 636**: External connectors
- **LP 639**: Display board 4008 B
- **LP 649**: Display board 4008 H
- **LP 763**: Interface board
- **LP 922**: Display board 4008 S

**Rear Panel / Rückplatte**

- **LP 630**: Motherboard
- **LP 632**: CPU 2 (safety system)
- **LP 633**: Input board
- **LP 634**: Output board
- **LP 635**: Display board
- **LP 636**: External connectors
- **LP 649**: Display board 4008 B
- **LP 763**: Interface board
- **LP 922**: Display board 4008 S

**Alpha-Display (4008E/4008B)**

**Display board 4008E**: LP 635; 4008H: LP 924; 4008B: LP 649; 4008S: LP 922

**Front Panel / Mounting Plate / Frontplatte / Montagesplatte**

- **Current Increasing (LP 763) TMP-Gain TMP-Steilheit**

**P3**

Frontplatte / Montageplatte
3.1 Overview of the DIP switches in the 4008

3.1.1 P.C.B. LP 631 (CPU 1) DIP switch array 1

Note
Dip switch 6 is provided for service purposes/troubleshooting only and must be set to the OFF position for dialysis mode.

<table>
<thead>
<tr>
<th>Switch / Position</th>
<th>Function</th>
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<tr>
<td>max. UF rate</td>
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</tr>
<tr>
<td>SW 1     SW 2</td>
<td></td>
</tr>
<tr>
<td>ON       ON</td>
<td>1000 ml/h</td>
</tr>
<tr>
<td>OFF      ON</td>
<td>2000 ml/h</td>
</tr>
<tr>
<td>ON       OFF</td>
<td>3000 ml/h</td>
</tr>
<tr>
<td>OFF      OFF</td>
<td>4000 ml/h</td>
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</table>

<table>
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<th>Language 1</th>
<th>Language 2</th>
<th>Language 3</th>
<th>Language 4</th>
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<td>English</td>
<td>English</td>
<td>English</td>
<td>English</td>
</tr>
<tr>
<td>German</td>
<td>Finnish</td>
<td>Japanese</td>
<td>Hungarian</td>
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<td>Russian</td>
<td>Norwegian</td>
</tr>
<tr>
<td>Dutch</td>
<td>Polish</td>
<td>Slovakian</td>
<td>Ex-Yugoslav</td>
</tr>
</tbody>
</table>

The basic position upon delivery is shown in italics.
For “not used” the switch must be set to OFF.

* 4008 H/S only
## Switch / Position

<table>
<thead>
<tr>
<th>Switch / Position</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW 1</td>
<td>CAL mode</td>
</tr>
<tr>
<td><strong>ON</strong></td>
<td>Mode 0</td>
</tr>
<tr>
<td><strong>OFF</strong></td>
<td>Mode 1</td>
</tr>
<tr>
<td>SW 2</td>
<td>Ext. alarm input</td>
</tr>
<tr>
<td><strong>ON</strong></td>
<td>Invalid</td>
</tr>
<tr>
<td><strong>ON</strong></td>
<td>RO system</td>
</tr>
<tr>
<td><strong>OFF</strong></td>
<td>Patient bell</td>
</tr>
<tr>
<td><strong>OFF</strong></td>
<td>Ext. alarm</td>
</tr>
<tr>
<td>SW 3</td>
<td></td>
</tr>
<tr>
<td><strong>ON</strong></td>
<td></td>
</tr>
<tr>
<td><strong>OFF</strong></td>
<td></td>
</tr>
<tr>
<td>SW 4</td>
<td>Remote control</td>
</tr>
<tr>
<td><strong>ON</strong></td>
<td>System with remote control</td>
</tr>
<tr>
<td><strong>OFF</strong></td>
<td>System without remote control</td>
</tr>
<tr>
<td>SW 5</td>
<td>COMMCO LP 763 or LP 758 or LP 729</td>
</tr>
<tr>
<td><strong>ON</strong></td>
<td>Enabled</td>
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<tr>
<td><strong>OFF</strong></td>
<td>Disabled</td>
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<td>SW 6</td>
<td>COMMCO</td>
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<td>Standard record</td>
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<td>Hydraulics test (not CDS)</td>
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<tr>
<td><strong>ON</strong></td>
<td>Active</td>
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<tr>
<td><strong>OFF</strong></td>
<td>Inactive</td>
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<tr>
<td>SW 8</td>
<td>Central delivery system</td>
</tr>
<tr>
<td><strong>ON</strong></td>
<td>Installed</td>
</tr>
<tr>
<td><strong>OFF</strong></td>
<td>Not installed</td>
</tr>
</tbody>
</table>

*The basic position upon delivery is shown in italics.*

*For “not used” the switch must be set to OFF.*
3.1.3 P.C.B. LP 632 (CPU 2) DIP switch array 1

Note
DIP switches 3 and 8 permit to skip test steps which are requested by the system.
If the switches are set to the “can be skipped” position, it is important to know that the operator can then bypass the automatic test of the safety systems.
The person demanding this switch position shall be solely responsible for such a procedure.

<table>
<thead>
<tr>
<th>Switch / Position</th>
<th>Function</th>
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</thead>
<tbody>
<tr>
<td>SW 1</td>
<td>Not used</td>
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<tr>
<td>SW 2</td>
<td>T1 test</td>
</tr>
<tr>
<td></td>
<td>serial sequence</td>
</tr>
<tr>
<td></td>
<td>parallel sequence</td>
</tr>
<tr>
<td>SW 3</td>
<td>T1 test</td>
</tr>
<tr>
<td></td>
<td>skip</td>
</tr>
<tr>
<td>SW 4</td>
<td>Test service</td>
</tr>
<tr>
<td></td>
<td>“ON” (individual test steps can be selected, dialysis not possible)</td>
</tr>
<tr>
<td></td>
<td>“OFF” (automatic T1 test)</td>
</tr>
<tr>
<td>SW 5</td>
<td>Cyclic PHT</td>
</tr>
<tr>
<td></td>
<td>every 2 minutes and indication of the test result (service)</td>
</tr>
<tr>
<td></td>
<td>every 12.5 minutes, alarm emission only with cyclical PHT alarm</td>
</tr>
<tr>
<td>SW 6</td>
<td>Cyclic PHT</td>
</tr>
<tr>
<td></td>
<td>“ON”</td>
</tr>
<tr>
<td></td>
<td>“OFF”</td>
</tr>
<tr>
<td>SW 7</td>
<td>Air detector</td>
</tr>
<tr>
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<td>with PCB LP 450 without AD28</td>
</tr>
<tr>
<td></td>
<td>with PCB LP 450-2 or with AD28</td>
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<tr>
<td>SW 8</td>
<td>HDF test</td>
</tr>
<tr>
<td></td>
<td>can be skipped</td>
</tr>
<tr>
<td></td>
<td>mandatory</td>
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</table>

The basic position upon delivery is shown in italics.
For “not used” the switch must be set to OFF.
### 3.1.3 P.C.B. LP 632 (CPU 2) DIP switch array 2

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<th>Function</th>
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<td>SW 1 ON</td>
<td>DIASAFE / DIASAFE™&lt;sup&gt;plus&lt;/sup&gt;</td>
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<tr>
<td>SW 1 OFF</td>
<td>On</td>
</tr>
<tr>
<td></td>
<td>Off</td>
</tr>
<tr>
<td>SW 2 ON</td>
<td>ON-LINE-HDF</td>
</tr>
<tr>
<td>SW 2 OFF</td>
<td>On</td>
</tr>
<tr>
<td></td>
<td>Off</td>
</tr>
<tr>
<td>SW 3 ON</td>
<td>ONLINE&lt;sup&gt;plus™&lt;/sup&gt;</td>
</tr>
<tr>
<td>SW 3 OFF</td>
<td>On</td>
</tr>
<tr>
<td></td>
<td>Off</td>
</tr>
<tr>
<td>SW 4 ON</td>
<td>Hydraulics</td>
</tr>
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<td>SW 4 OFF</td>
<td>with WTR</td>
</tr>
<tr>
<td></td>
<td>without WTR</td>
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<td>SW 5 ON</td>
<td>V39 Test</td>
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<td>SW 5 OFF</td>
<td>On</td>
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<tr>
<td></td>
<td>Off</td>
</tr>
<tr>
<td>SW 6 ON</td>
<td>Fast heating HDIS</td>
</tr>
<tr>
<td>SW 6 OFF</td>
<td>deactivated</td>
</tr>
<tr>
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<td>activated</td>
</tr>
<tr>
<td>SW 7 ON</td>
<td>Not used</td>
</tr>
<tr>
<td>SW 7 OFF</td>
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<tr>
<td>SW 8 ON</td>
<td>Not used</td>
</tr>
<tr>
<td>SW 8 OFF</td>
<td></td>
</tr>
</tbody>
</table>

The basic position upon delivery is shown in italics. For “not used” the switch must be set to OFF.
3.2 Calibration mode

3.2.1 Basic conditions

- The hemodialysis system must be switched off.
- The service switch must be in the ON (up) position.
- Turn the hemodialysis system on.

Caution
If the Service switch is set to ON during the treatment or the cleaning program, the heater relay will be turned off.
3.2.2 Messages on the displays on the UF monitor (4008 E/B) or on the screen (4008 H/S)

- **4008/E/B**

  The values indicated on the display must be divided by the factor 10.
  Values in brackets: tolerances

  **Ultrafiltration**

  **Watchdog supply voltage**
  (4.5 V to 5.5 V)

  **12-V voltage** (11.5 V to 12.5 V)

  **24-V voltage** (23 V to 25 V)

  **Battery charging voltage** (> 20 V)

- **4008 H/S**

  **CALIBRATION**

  **Watchdog supply voltage** (4.5 V – 5.5 V)

  **12 V voltage** (11.5 V – 12.5 V)

  **24 V voltage** (23 V – 25 V)

  **Battery charging voltage** (> 20 V)
3.3 Hydraulics

Note
Measuring equipment for measurement points in the hydraulic unit:
UMED, HMED or pressure gauge with a measuring range of
−1 to +2.2 bar, min. quality class 1.6.
3.3.1 Reduced water inlet pressure

Measuring equipment: UMED, HMED or pressure gauge

Place of measurement: Hydraulics, measurement port A

Condition: Flow on

Check/adjustment:

- **Checking the reduced water inlet pressure**
  Connect the measuring equipment to measurement port A.
  Measure the water pressure with MV 41 closed.
  *Rated value of water inlet pressure: 0.90 to 1.40 bar*
  If it deviates from the rated value, the water inlet pressure must be adjusted.

- **Adjusting the reduced water inlet pressure**
  Pull back the knurled nut on the pressure reducing valve (16).
  Turn the knurled nut to set the water pressure to the desired value (clockwise: +, counter-clockwise: −).
  Push the knurled nut back in.
3.3.2 Degassing pump pressure

Measuring equipment: UMED, HMED or pressure gauge

Place of measurement: Hydraulics, measurement port D

Check/adjustment:
– Checking the pressure of the degassing pump
  Connect the measuring equipment to the measurement port D.
  Measure the pressure of the degassing pump.
  Rated value of degassing pump pressure: –0.81 to –0.85 bar
  If it deviates from the rated value, the pressure of the degassing pump must be adjusted.
– Adjusting the pressure of the degassing pump
  Enter the CALIBRATION menu, select and start the option CAL. DEGAS. PRESSURE
  (➜ Calibration, chapter 4, section 7).

Note
If the pressure of the degassing pump was changed, make sure to check the loading pressure and readjust, if necessary.

• Calibration of the negative degassing pressure on higher situated installation sites

If 4008 systems are operated on higher situated sites (observe sea level), the specified negative degassing pressure can not be reached. The calibration has to be performed as follows:
The setting for the degassing pump has to be increased in increments from a low speed until no significant increase of the negative pressure can be detected anymore.
This setting can also be stored.
3.3.3 Balancing chamber loading pressure

Measuring equipment: UMED, HMED or pressure gauge

Place of measurement: Hydraulics, measurement port B

Check/adjustment:
– Checking the loading pressure of the balancing chamber
  Connect the measuring equipment to the measurement port B. Measure the loading pressure of the balancing chamber.
  Rated value of the balancing chamber loading pressure: 1.2 to 1.3 bar
  With 4008 B EC495, 4008 H EC 295, 4008 S EC 275 or higher (change of the compression spring in the loading pressure valve): The loading pressure of the balancing chamber has been increased to 1.45 bar ± 0.05 bar.
  If it deviates from the rated value, the loading pressure of the balancing chamber must be adjusted.
– Adjusting the loading pressure of the balancing chamber
  Use the loading pressure valve (65) to adjust the loading pressure to the rated value.
  Turning the adjusting screw clockwise will increase the loading pressure.

Note
During the balancing chamber fill phase, the loading pressure drops to approx. 1.0 bar.

Note
If the loading pressure was changed, make sure to check the degassing pump pressure and readjust, if necessary.
3.3.4 Flow pump pressure

Measuring equipment: UMED, HMED or pressure gauge

Place of measurement: Hydraulics, measurement port C

Prerequisite: A dialysate flow of 800 ml/min must have been preselected.

Check/adjustment:
– Checking the pressure of the flow pump
   Connect the measuring equipment to the measurement port C.
   Turn the water supply off; water alarm; balancing chamber inactive.
   Measure the pressure of the flow pump.
   *The desired pressure value of the flow pump depends on the loading pressure set:
   Loading pressure: 1.2 to 1.3 bar  1.9 to 2.1 bar
   Flow pump pressure: 1.45 ± 0.05 bar  2.2 ± 0.05 bar
   If it deviates from the rated value, the pressure of the flow pump must be adjusted.
– Adjusting the pressure of the flow pump
   Use the relief valve (78) to adjust the rated value.
3.3.5 UF pump volume

Note
If scales are used for measuring, it must be ensured that no concentrate is connected.

Measuring equipment: Scales or measuring cylinder, tolerance ±0.5 %
Place of measurement: Hydraulic unit open
Condition: Calibration program selected

Check/adjustment:
- Checking the UF pump volume
  Remove the drain line of the UF pump from the T-piece (close the T-piece).
  Place the drain line in the measuring cylinder.
  Access the CALIBRATION menu, select and start the ADJ. UF-PUMP VOLUME option (Calibration, chapter 4, Part 6).
  Rated value: number of strokes in ml or g ±1%.
- Adjusting the UF pump
  Remove the protective cover.
  Unscrew the lock nut.
  Change the delivery volume, using the adjusting screw (turning the adjusting screw clockwise reduces, turning it counter-clockwise increases the stroke volume).
  Retighten the lock nut.
  Verify the delivery volume.
3.3.6 CDS pressure switch

Measuring equipment: Measurement setup according to diagram, UMED, HMED or pressure gauge (e.g. 0 to 1 bar, accuracy ±1 %), syringe

Place of measurement: Hydraulic unit open

Condition: The CDS connectors in position 121 and position 122 must be depresurized.
The pressure compensation port on the pressure switch must be open to air (atmospheric pressure).
The lines of the measuring equipment should be as short as possible.
The service mode must be selected.

Check/adjustment:
– Connect the measuring equipment as illustrated in the diagram.
– Select the DIAGNOSTICS menu:
  READ INPUTS
  READ DIGITAL INPUTS
  CPU1: RD DIGITAL INP
  I: CPU1_PSW_V102 or I: CPU1_PSW_104
– Activate the audible alarm by pressing the (Alarm) Tone Mute key (depressurized: alarm on).
– During these menu options, the solenoid valves MV102 and MV104 are closed.
– Use the syringe to create a pressure of 0.7 bar.
– Use forceps to clamp the line at point a, so that the pressure switch remains loaded with 0.7 bar.
– Verify the switching point by means of the audible alarm
  Rated values:
  Alcatel pressure switch (part no.: 674 322 1) (yellow): 0.68 – 0.80 bar
  Delta pressure switch, dark grey: 0.68 – 0.72 bar
  Envec pressure switch: 0.68 – 0.72 bar
  If the switching point deviates, adjust with the adjusting screw b (make sure there is no mechanical load on the pressure switch while adjusting).
– After completed adjustment, depressurize the measuring equipment and repeat the check. If necessary, repeat the adjustment procedure.

This adjustment procedure simultaneously checks the tightness of the check valves 117 and 118 and the solenoid valves 102 and 104.
### 3.3.7 bibag® pressure transducer calibration

#### General Notes on bibag® pressure transducer calibration

The calibration described below can be performed by means of a multimeter or the diagnostics program.

In order to read in the corresponding signal, the voltage of AD22 must be measured at pin 1 or the **E: CPU1_BIBAG_PSW** menu item must be selected in the diagnostics program.

The ALCATEL pressure switch is calibrated in the diagnostics program of the dialysis system.

The calibration of the Envec pressure switch is neither possible nor required. These pressure switches are set to a fixed position and can be checked in the diagnostics program.

The audible signal can be activated by pressing the **TONE MUTE** key.

#### Selection in the Diagnostics program

1. Turn the hemodialysis system off.
2. Set the Service switch to **ON** (up).
3. Turn the hemodialysis system on.
4. Use the ▲ and ▼ keys to select **READ INPUTS**.
5. Press the Confirm key.
6. Use the ▲ and ▼ keys to select **READ DIGITAL INPUTS**.
7. Press the Confirm key.
8. Use the ▲ and ▼ keys to select **CPU1: RD DIGITAL INP**.
9. Press the Confirm key.
10. Use the ▲ and ▼ keys to select **E: CPU1_BIBAG_PSW**.
11. Press the Confirm key.
The active levels **0000** or **1111** are shown on all UF displays or on the display of dialysis systems with a monitor.

- **Watchdog supply voltage** (4.5 V to 5.5 V)
- **12-V voltage** (11.5 V to 12.5 V)
- **24-V voltage** (23 V to 25 V)
- **Battery charging voltage** (> 20 V)

**Note**

In the menu items **E: CPU1_BIBAG_PSW**, the active level is identified by **1111**.

The active level of the circuit output is LOW (< 1 V).
Calibration of the ALCATEL pressure switch

Clamp the lines (X).
Connect the pressure gauge and the syringe and build up a pressure of 100 mbar + 10 mbar.

Turn the potentiometer (AD22 or directly on the pressure switch) until Low Level (< 1 V) (1111) is displayed on the UF displays.

Slowly turn the potentiometer into the opposite direction until the High level (> 10 V) (0000) is shown on the UF displays.

No pressure at the pressure transducer. 
UF displays must show High level (0000).

Clamp the lines (X).
Connect the pressure gauge and the syringe and build up a pressure of 160 mbar.

UF displays must show Low level (1111). 
Slowly reduce the pressure. UF displays must show High level (0000) at a minimum of 100 mbar.

If necessary, repeat calibration.

Pressure transducer calibration completed.
3.4 Air detector

**Caution**
For adjusting the air detector, the system must be in “Calibration” mode. The ambient temperature should range between 15 and 35 °C.

**Caution**
The calibration using the set for the air detector calibration is only valid for systems used together with Fresenius tubing systems. Observe the “use by” date!

- **Adjusting the air detector LD 22, using the set for the air detector calibration (see also adjustment instructions no. M36 067)**

  The system must be in Service mode and the bridge J1 / LP 450 in the calibration position.

  Fill the spherical hollow in the adjusting block with grease; remove excess grease with the spatula, so that only the hollows are filled to the brim with grease.

  Introduce the greased adjusting block into the drip chamber holder (the slant edges first). During this process, make sure that the ultrasonic sensors neatly engage into the spherical hollows of the normal. The normal must not touch the walls of the holder but hang freely between the sensors.

  Turn the potentiometer 1 and then the potentiometer 2 on LP 450 clockwise until LED D5 and LED D10 on LP 450 have turned dark.  
  Slowly (caution: time constant) turn back the potentiometer 1 / LP 450 until LED D5 on LP 450 is illuminated.  
  Slowly (caution: time constant) turn back the potentiometer 2 / LP 450 until LED D10 on LP 450 is illuminated.

  Plug bridge J1 / LP 450 to the ‘operating’ position.

  LED D5 and LED D10 must both be dark.

  Take the adjusting block out of the drip chamber and completely remove the grease from the drip chamber holder, using only lint-free cloth and permissible disinfectants.

**Check:**

Fill the spherical hollows of the checking block with grease and remove any excess grease with a spatula, so that only the hollows are filled to the brim with grease.

Insert the greased checking block into the drip chamber holder. During this process, make sure that the ultrasonic sensors neatly engage into the spherical hollows of the normal. The normal must not touch the walls of the holder but hang freely between the sensors.

Both LED D5 and LED D10 must be illuminated. If one or two of the LEDs is not illuminated, repeat the adjustment process.

Take the checking block out of the drip chamber and completely remove the grease from the drip chamber holder, using only lint-free cloth and permissible disinfectants.
Alternative: Adjusting the air detector without the set for the air detector calibration

Measuring equipment:
- Measurement setup according to diagram
- UMED, HMED or pressure gauge, bubble catcher, syringe filled with degassed water or saline solution

Place of measurement: Air detector

Check / adjustment:
- Adjusting the ultrasonic detector
  - Install the measurement set-up before checking / adjusting the air detector. Do not yet place the line in the occlusion clamp.
  - Jumper J1 / P.C.B. LP 450 set to calibration.
  - Fill the bubble catcher. The fluid level must be set to approx. 10 mm above the top edge of the sensor holder.
  - Turn potentiometer 1 and potentiometer 2 on P.C.B. LP 450 clockwise, until the LED DI5 and LED DI10 on P.C.B. LP 450 are dark.
  - Slowly (attention: time constant) turn potentiometer 1 on P.C.B. LP 450 counterclockwise, until the LED DI5 on P.C.B. LP 450 lights.
  - Slowly (attention: time constant) turn the potentiometer 2 on P.C.B. LP 450 counterclockwise, until the LED DI10 on P.C.B. LP 450 lights.
  - After completion of the calibration procedure, set the jumper J1 / P.C.B. LP 450 back to the operation position.

- Check
  - Lower the level in the bubble catcher: an alarm must be emitted.
  - Raise the level in the bubble catcher: it must be possible to clear the alarm; both LEDs must be off!

- Checking the venous line clamp (➡ Fig.)
  - Place the line in the venous line clamp.
  - Open the clamp and, using the syringe, generate a pressure of approx. 2 bar.
  - Close the clamp.
  - The pressure must not drop by more than 0.1 bar within 3 minutes.

- Adjusting the optical detector
  - Use the gray filter, double-laid, part no. 640 560 1.
  - Diagnostics menu; reading of digital inputs by CPU 1; item E: CPU1_OD_IN.
  - Install the gray filter, double-laid; close the hinged cover.
  - Slowly turn potentiometer P5 on P.C.B. LP 450 clockwise, until the UF display indicates 1111.
  - Slowly turn potentiometer P5 counterclockwise, until the display jumps to 0000. Continue to turn the potentiometer counterclockwise for half a turn.
  - Avoid incident light from external sources.
4 Calibration program

Adjustments made without display messages:

- Adjusting the blood pump stop alarm (blood pump or HDF pump) ........................................ 4-5
- Calibrating the Single-Needle blood pump ........................................................................... 4-11
- Adjusting the current rise pulse ......................................................................................... 4-15
- Adjusting the Hall sensor in the heparin pump ................................................................. 4-43

In the Calibration, Diagnostics, Setup and Miscellaneous program the function of the keys differs between 4008 E/B and 4008 H/S systems.

<table>
<thead>
<tr>
<th>Function</th>
<th>4008 E/B</th>
<th>4008 H/S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scrolling through menu options</td>
<td>▲▼</td>
<td>▲▼</td>
</tr>
<tr>
<td>Selecting a menu option</td>
<td>Confirm Conf</td>
<td></td>
</tr>
<tr>
<td>Changing values and functions in a menu</td>
<td>▲▼</td>
<td>+/-</td>
</tr>
<tr>
<td>Saving changes</td>
<td>Override Tone Mute</td>
<td></td>
</tr>
<tr>
<td>Exiting a menu without saving the data</td>
<td>Select</td>
<td>Esc</td>
</tr>
</tbody>
</table>

In the description of the steps, the differing keys to be used on 4008 H/S systems are shown in brackets.
Confirm key see Part 1

Confirm key see Part 2

Confirm key see Part 3

Confirm key see Part 4

Confirm key see Part 5

Confirm key see Part 6

Confirm key see Part 7

Confirm key see Part 8

Confirm key see Part 9

Confirm key see Part 10

Confirm key see Part 11

Confirm key see Part 12

Confirm key see Part 13

Confirm key see Part 14

Confirm key see Part 15

Confirm key see Part 16 (Option)

Confirm key see Part 17

Confirm key see Part 18

back to main menu ?

Note
Before calibrating the hydraulics, remove possibly existing precipitate by running an appropriate disinfection program.
Part 1: Calibrating the arterial pressure

Note: Pressure gauge accuracy: ±1 % of the measured value.
**Part 2: Calibrating the pressure in the arterial blood pump**

Set the hex switch in the module (P.C.B. LP 624, pos. 1) to position F. Should the error message E02 appear on the blood pump display, clear the message by pressing the **Start/Stop** key.

---

Return the hex switch to position 0.
- Without display messages: adjusting the blood pump stop alarm (blood pump or HDF pump)

Set the hex switch in the module (P.C.B. LP 624, pos. 1) to position B. Should the error message E02 appear on the blood pump display, clear the message by pressing the Start/Stop key.

![Diagram](image)

Change the preset value (15/30 sec) by pressing the ▲▼ keys on the blood pump module.

Acknowledged by pressing the Start/Stop key on the module.

![Diagram](image)

The stored value appears after 2 seconds.

Return the hex switch to position 0.

Automatic reset on the module.
Part 3: Calibrating the venous pressure

Note: If calibration of this function is not possible, the "CAL. VEN. P_MODULE" mode must first be performed in the air detector.

Note
Pressure gauge accuracy: ±1 % of the measured value.
**Part 4: Calibrating the venous pressure measurement in the air detector**

The venous pressure transducer is open to atmosphere (air detector module).

Readjust the zero-point potentiometer (P3/LP450) in the air detector until the display indicates ±0 mmHg.

Connect the syringe, which is connected to the external reference instrument, to the venous pressure transducer.

Apply ≥400 mmHg to the pressure transducer.

Use the slope potentiometer (P4/LP450) to set the value of the external reference instrument on the display.

Note:
Check zero point and slope; if necessary, repeat the procedure.

Note:
When adjusting the air detector, execute the CAL. VENOUS PRESSURE menu item.
Part 5: Calibrating the blood pump rates

- CALIB. (B)-PUMP-RATE
  - Confirm key
  - CALIB. ART. BP-RATE
    - Confirm key
    - CALIB. SN. BP-RATE
      - Confirm key
      - CALIB. HDF-PUMP-RATE
        - Confirm key
        - back to menu?

This function is possible only if ONLINE-HDF has been activated by means of the DIP switch.

- see Part 5.2
- see Part 5.3
- see Part 5.1
● Part 5.1: Calibrating the arterial blood pump

**Note:** Set the line diameter to 8 mm before starting the calibration procedure and press Start/Stop on the blood pump.

* The BP rate of 550 ml/min represents a default value. It can be changed using the ▲▼ (+/-) keys.

● Part 5.2: Calibrating the Single-Needle blood pump rate

**Note:** Set the line diameter to 8 mm before starting the calibration procedure and press Start/Stop on the blood pump.

* The BP rate of 550 ml/min represents a default value. It can be changed using the ▲▼ (+/-) keys.

---

**SN pump: lower switching point fixed to 75 mmHg**

<table>
<thead>
<tr>
<th>Stroke volume (ml)</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper switching point (mmHg) ± 7 mmHg</td>
<td>110</td>
<td>130</td>
<td>150</td>
<td>172</td>
<td>195</td>
<td>219</td>
<td>244</td>
<td>270</td>
<td>299</td>
</tr>
</tbody>
</table>

● Setting the Single-Needle stroke volume

Press the ▼ and the Start/Stop key simultaneously.
Use the ▲ and ▼ keys to adjust the stroke volume and the Start/Stop key to confirm the value.
Part 5.3: Calibrating the ONLINE-HDF pump (option)

Note: This function is possible only if ONLINE-HDF has been activated by means of the DIP switch.
• Without display messages: Calibrating the Single-Needle blood pump (SN pressure) (option)

Set the hex switch in the module (P.C.B. LP 624, pos. 1) to position F. Should the error message E02 appear on the blood pump display, clear the message by pressing the Start/Stop key.

The SN pressure transducer is open to atmosphere (SN blood pump).

Press the Start/Stop key on the SN blood pump.

Connect the syringe, which is connected to the external reference instrument, to the SN pressure transducer.

Apply exactly 250 mmHg to the pressure transducer.

Acknowledge by pressing the Start/Stop key on the SN blood pump.

The values are stored.

Finally return the hex switch to position 1. Then select SN.BP-Rate CHECK

Check the SN stroke volume.

Set stroke volume, e.g. 30 ml.

Using a syringe and the external reference instrument, check the lower (fixed to 75 mmHg) and the upper switching point. (Depending on the stroke volume selected, the upper switching point can be found in the table).

If the switching points are outside the tolerance range, repeat the calibration procedure.

SN pump: lower switching point fixed to 75 mmHg

<table>
<thead>
<tr>
<th>Stroke volume (ml)</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper switching point (mmHg) ± 7 mmHg</td>
<td>110</td>
<td>130</td>
<td>150</td>
<td>172</td>
<td>195</td>
<td>219</td>
<td>244</td>
<td>270</td>
<td>299</td>
</tr>
</tbody>
</table>

Note

It may be necessary to change the Single-Needle stroke volume: Press the ▼ and the Start/Stop key simultaneously. Use the ▲ and ▼ keys to adjust the stroke volume and the Start/Stop key to confirm the value.
Part 6: Adjusting the UF pump volume

Note:
Check the volume. If necessary, readjust the UF pump and repeat the procedure. (See 3.3.5)

Note
Graduated cylinder accuracy: ±0.5 %.

Note
If a scale is used as measurement instrument it must be ensured that no concentrate is connected.
• Part 7: Calibrating the degassing pressure

Connect a pressure gauge for the degassing pressure. Set the degassing pressure to –0.81 bar (to –0.85 bar) by pressing the ▲▼ (+/–) keys.

Override (Tone Mute) key

DATA STORED

approx. 3 sec

At this point, the following messages may appear:
– fill program active
– set flow on

See also 3.3.2 Degassing pump pressure
Part 8: 300 ml/min flow

Important:
If it is impossible to adjust the 300 – 500 – 800 flow volumes, or if problems caused by flow alarms occur after the “calibrate flow” message has appeared, this can be caused by the setting of the current rise pulse.

Note:
(only for systems with advanced hydraulics)
For the flow selected first, the message “DIASAFE-filling act.” is displayed for 17 balancing chamber switchings.
Adjusting the current rise pulse:

- Select “CAL.FLOW 300 ml/min”; display: flow (300) = XXX.
- The actual flow XXX must be approx. 300; if necessary, correct it using the ▲ and ▼ keys.
- Connect an oscilloscope to MP8 and MP1, and the ground MP7 to P.C.B. LP 634.
- Use P1 to set the current rise pulse as shown in the diagram below. Make sure that the actual flow (display XXX) remains at approx. 300; if necessary, correct it using the ▲ and ▼ keys.

![Diagram of MP1 and MP8 connections](image)

Alternative adjustment of the current rise (if an oscilloscope is not available):

- Select "calibrate flow 300 ml/min".
- There are two possibilities of reaction by the system:

1. The system runs with regular balancing chamber switching.
   - Display: flow (300) = XXX.
   - If necessary, correct the flow using the ▲ and ▼ keys, until the actual flow indicates approx. 300.
   - Turn the potentiometer P1 counterclockwise (wait for at least 10 sec after each rotation!), until the system switches to "Eigentakt".
   - Display: flow (300) = 147.
   - Now turn the potentiometer P1 clockwise (wait for at least 10 sec after each half-rotation!), until the actual flow again indicates approx. 300.
   - Turn the potentiometer P1 clockwise for another 2 rotations.

2. The system is in the "Eigentakt" mode.
   - Display: flow (300) = 147.
   - Turn the potentiometer P1 clockwise, until the system switches from "Eigentakt" to regular balancing chamber switching (wait for approx. 10 sec after each rotation!).
   - Display: flow (300) = XXX.
   - If necessary, correct the flow using the ▲ and ▼ keys, until the actual flow indicates approx. 300.
   - Turn the potentiometer P1 counterclockwise (wait for at least 10 sec after each rotation), until the system switches to "Eigentakt".
   - Display: flow (300) = 147.
   - Now turn the potentiometer P1 clockwise (wait for at least 10 sec after each half-rotation!), until the actual flow again indicates approx. 300.
   - Turn the potentiometer P1 clockwise for another 2 rotations.

After adjusting the current rise pulse, check and, if necessary, readjust the 300/500/800 flow settings.
• Part 9: Calibrating the 500 ml/min flow

Change the digits in the “UF Rate” window by pressing the ▲▼ (+/-) keys, until the actual value agrees with the specified value (500).

DATA STORED
approx. 3 sec

• Part 10: 800 ml/min flow

Change the digits in the “UF Rate” window by pressing the ▲▼ (+/-) keys, until the actual value agrees with the specified value (800).

DATA STORED
approx. 3 sec
Part 11: Calibrating the dialysate temperature

Note
Accuracy of the measuring instrument to be connected externally: ±0.2 °C.
● Part 11.1: Adjusting the dialysate temperature

Connect the external reference instrument. Connect the BIC suction tube to the BIC container or place it in water of room temperature.

Adjust the digital value in the "UF Rate" window by pressing the +/- keys.

Wait until the temperature on the external reference instrument indicates 37.0 °C.

Adjust the digital value in the "UF Rate" window by pressing the +/- keys.

Wait until the temperature on the external reference instrument indicates 37.0 °C.

OCM TEMP. - Adjust

System in bypass

Wait for the temperature to stabilize (37 °C) indicated in "UF rate" window by pressing the Tone Mute key.

DATA STORED

approx. 3 sec

OCM TEMP.-Adjust

System in bypass

Wait for the temperature to stabilize (37 °C) indicated in "UF rate" window by pressing the Tone Mute key.

DATA STORED

approx. 3 sec

① NTC3; 8 bit
② Control 8 bit
③ NTC3; 12 bit (with OCM option only)
④ NTC109; 8 bit, if NTC 109 is activated in SETUP

① NTC3; 8 bit (with OCM option: 12 bit)
② NTC3 temperature
③ NTC4; 12 bit (with OCM option only)
④ Dynamic measurement range switching
Part 11.2: Checking the dialysate temperature

Check TEMPERATURE

Confirm key

act temp = 37.0 °C

use ▲▼ to select the Temperature setting field

set temp = XXX.X °C

Specify a temperature by pressing the +/- keys.

Tone mute key

ACKNOWLEDGED

approx. 3 sec

ACT temp = XXX.X °C

Check whether the preselected temperature is achieved.

Check: reference instrument, display and 37.0 °C LED display correspond to 115-116 digits in the “UF Volume” window.

Tolerance: ±0.5 °C

Repeat the procedure with different values (e.g. 35/39 °C)

act. temp = 37.0 °C

1 XXXX ADC-digits

2

3 XXX.X °C

4 XXXX ADC-digits

Alpha display

Temperature adjustment

1 NTC3; 8 bit
2
3 NTC109; temperature
4 NTC109; 8 bit
Part 11.3: Checking the dialysate temperature for the OCM option

1. Open the shunt cover to switch the system to the bypass mode.
2. Use the +/- keys to select the Temperature setting field.
3. Specify a temperature by pressing the +/- keys.
4. Check whether the preselected temperature is achieved.
   - Display: 37.0 °C bargraph display
   - Tolerance of the displayed temperature in the UF rate field
   - and the UF time field:
     - ±0.2 °C
5. Specify a temperature by pressing the +/- keys.
6. ACT temp = XX.X °C
7. Check whether the preselected temperature is achieved.
   - Display: 37.0 °C bargraph display
   - Tolerance of the displayed temperature in the UF rate field
   - and the UF time field:
     - ±0.2 °C

Repeat the procedure with different values (e.g. 35/39 °C).

OCM Temp.-Check

1. XXXX ADC-digits
2. XX.XX °C
3. XXXX ADC-digits
4. XX.XX °C

Alpha display
Temperature adjustment

1. NTC3; 12 bit
2. NTC3; temperature
3. NTC4; 12 bit
4. NTC4; temperature
• Part 12: Calibrating the mixing system
**Part 12.1: Running-in of the membrane pumps**

The membrane pumps have to run-in so that the concentrate/bicarbonate pumps reach their operating temperatures before the pump volume is verified.

The concentrate suction tubes are in a container filled with water.

The membrane pumps are running; the display counts down.

---

* This message is only displayed on systems with advanced hydraulics.
Part 12.2: Determining the balancing chamber volume

Determine the balancing chamber volume. Pull off the drain line ?? am Gerät??.
Collect two consecutive pulses of fluid. Determine the volume and divide it by two.

Confirm key

Enter the balancing chamber volume determined above with the ▲▼ (+/-) keys.

(Tolerance ±1 ml)

Override (Tone Mute) key

DATA STORED

approx. 3 sec

Note
Accuracy of the measuring cylinder: ±0.5 %.

Note
If a scale is used as measurement instrument it must be ensured that no concentrate is connected.
Part 12.3: Calibrating the concentrate pump stroke

Note
Accuracy of the measuring cylinder: ±0.5 %.
Part 12.4: Determining the concentrate pump volume

The concentrate pump runs for 100 strokes. The display counts down. Then determine and record the volume removed by the pump.

Notes:

100 strokes are factory-set. This setting can be changed by pressing the ▲▼ (+/–) keys (depending on the graduated cylinder used). However, when returning to “CAL. MIXING-SYSTEM”, the display will indicate the factory setting again.

Check the volume and, if necessary, repeat the procedure.

Note
Accuracy of the measuring cylinder: ±0.5 %.

Note
If a scale is used as measurement instrument it must be ensured that no concentrate is connected.
Part 12.5: Calibrating the bicarbonate pump stroke

Enter the determined volume of one pump stroke by pressing the \(\text{▲▼} (+/–)\) keys.

DATA STORED
approx. 3 sec

Note
Accuracy of the measuring cylinder: ±0.5 %.

Note
If a scale is used as measurement instrument it must be ensured that no concentrate is connected.
Part 12.6: Determining the bicarbonate pump volume

The bicarbonate pump runs for 50 strokes. The display counts down. Then determine and record the volume removed by the pump.

Notes:
50 strokes are factory-set. This setting can be changed by pressing the \(\pm\) \((+/-)\) keys (depending on the graduated cylinder used). However, when returning to "CAL. MIXING-SYSTEM", the display will indicate the factory setting again.
Check the volume and, if necessary, repeat the procedure.

Note
Accuracy of the measuring cylinder: \(\pm 0.5\%\).

Note
If a scale is used as measurement instrument it must be ensured that no concentrate is connected.
Part 12.7: Checking the concentrate and/or bicarbonate volume

Check mixing ratio

Notes:

This test step permits verification of the concentrate or bicarbonate pump volumes in accordance with the parameters entered for the mixing system (mixing ratio, BC volume, conc. and bic. pump volume).

The pump whose concentrate suction tube is pulled off is activated.

50 strokes are factory-set. This setting can be changed by pressing the (+/–) keys (depending on the graduated cylinder used).

However, when returning to "CAL. MIXING-SYSTEM", the display will indicate the factory setting again.

Note

Accuracy of the measuring cylinder: ±0.5 %.

Note

If a scale is used as measurement instrument it must be ensured that no concentrate is connected.
Part 13: Calibrating the conductivity

The indicated values are examples.
Part 13.1: Setting the conductivity

- **CONDUCTIVITY Set**
  - Confirm key
  - Select (Esc) key

- **CD set: 12.80 mS/cm**
  - Conc key
  - Use ▲▼ (+/-) to move to the Concentrate setting field.
  - Conc. set = ± 0 %
  - Use ▲▼ (+/-) to reduce the concentrate pump volume to get to a CD in the lower display range.
  - Conc. set. = –X %
  - Override (Tone Mute) key
  - ACKNOWLEDGED
  - approx. 3 sec

- **CD set: 12.80 mS/cm**
  - Wait for the CD to stabilize.
  - Compare the CD with the external reference meter.
  - In case of a deviation, adjust the display by pressing the ▲▼ (+/-) keys.
  - Override (Tone Mute) key
  - ACKNOWLEDGED
  - approx. 3 sec

- **CD set: 15.70 mS/cm**
  - Use ▲▼ (+/-) to move to the Concentrate setting field.
  - Conc. set. = ±X %
  - Use ▲▼ (+/-) to raise the concentrate pump volume to get to a CD in the lower display range.
  - Conc. set. = +10 %
  - Override (Tone Mute) key
  - ACKNOWLEDGED
  - approx. 3 sec

- **Override (Tone Mute) key**
  - **DATA STORED**
  - approx. 3 sec

- **CD set: XX.X mS/cm**
  - Wait for the CD to stabilize.
  - Compare the CD with the external reference instrument.
  - In case of a deviation, adjust the display by pressing the ▲▼ (+/-) keys.
  - Override (Tone Mute) key
  - DATA STORED
  - approx. 3 sec

- CD cell 7: 12 bit / 8 bit alternating (with OCM option only)
- CD cell 110: 12 bit/8 bit alternating (with OCM option only)
Part 13.2: Setting the temperature/conductivity compensation (with OCM option only)

If the conductivity is outside these limits:
- Use /H17076 /H17075 to select the concentrate setting field.
- Use +/- to reduce/increase the concentrate pump volume until the conductivity is inside the alarm limits 13.9 – 14.5 mS/cm.

If no key is pressed for approx. 4 sec:
- Conc. set = ±0%

Verify that the conductivity of both measuring cells in the "UF rate" (②) and the "UF time" (③) window is identical and that it is within 13.9 to 14.5 mS/cm.

If the conductivity is outside these limits:
- Use +/- to select the concentrate setting field.

If no key is pressed for approx. 4 sec:
- Conc. set = ±X%

Verify that the preset temperature of 35 °C is achieved and that it has stabilized.
- Check: Display, LED bargraph display
- Alpha key

Verify that the conductivity of both measuring cells in the "UF rate" (②) and the "UF time" (③) window is identical and that it is within 13.9 to 14.5 mS/cm.

Verify that the conductivity of both measuring cells in the "UF rate" (②) and the "UF time" (③) window is identical and that it is within 13.9 to 14.5 mS/cm.

Verify that the conductivity of both measuring cells in the "UF rate" (②) and the "UF time" (③) window is identical and that it is within 13.9 to 14.5 mS/cm.
Part 13.3: Calibrating the OCM pulse (with OCM option only)

Verify that the conductivity is within 13.9 to 14.6 mS/cm and wait for the conductivity to stabilize.

Start PULSE calib.?

OCM PULSE calibr.

Tone Mute key

DATA STORED

Tone Mute key

approx. 3 sec

Start PULSE calib.? Esc key

OCM PULSE UP activ

Positive OCM pulse duration

Esc key

OCM PULSE DOWN activ

Negative OCM pulse duration

Esc key

OCM PULSE finished

approx. 3 sec

Tone mute LED is flashing. Info sound


Tolerance per pulse: ±25

Tone Mute key

DATA STORED

approx. 3 sec

Note

If the value is outside ±25, check the conductivity measuring system of the dialysis system.

1. Time elapsed since the pulse calibration was started
2. Counter
3. Concentrate setting
4. CD cell 7, compensated CD value
Part 13.4: Checking the conductivity

CONDUCTIVITY Check

Confirm key

act. cond: XX.X mS/cm

Use to select the Concentrate setting field

conc. set = ± 0%

Use the keys to reduce the concentrate pump volume e.g.: conc. set = -6 %

Tone Mute key

ACKNOWLEDGED

approx. 3 sec

act. cond: XX.X mS/cm

Verify the conductivity. Check:

Reference meter, display, LED bargraph display conc. set = ± 0%

Use the +/– keys to reduce the concentrate pump volume approx. 3 sec

act. cond: XX.X mS/cm

Repeat the procedure with different values

Esc key

① CD cell 7:
12 bit / 8 bit
alternating
(with OCM option only)

②

③

④ CD cell 110:
12 bit / 8 bit
alternating
(with OCM option only)
• Part 13.5: Checking the OCM conductivity (with OCM option only)

OCM Cond.-Check

Confirm key

OCM Cond.-Check

Use [ ▲ ] to select the concentrate setting field

conc. set = ± 0%

Use the +/- keys to reduce the concentrate pump volume.

e.g.:

conc. set = -6 %

Tone Mute key

ACKNOWLEDGED

approx. 3 sec

OCM Cond.-Check

Verify the conductivity.

Check:

Reference meter, display, LED bargraph display

Esc key

Repeat the procedure with different values

① CD cell 7; 12 bit
② CD cell 7
③ CD cell 110;12 bit
④ CD cell 110
Part 13.6: Temperature/conductivity compensation test (with OCM option only)

- The individual conductivities and their compensation factors are displayed in the fields (see 4008 H/S).
- The conductivity cells can be crosschecked by changing the concentration or temperature.

1. CD cell 7, compensated
2. CD cell 7, compensation factor
3. CD cell 110, compensated
4. CD cell 110, compensation factor
• Part 14: Calibrating the dialysate pressure (stainless steel pressure transducer)

Note
Measuring instrument accuracy: ±1% of the measured value.
Part 14.1: Dialysate pressure

- Open the dialysate circuit. Flow off / UF off. The dialysate pressure approaches "0".
- Set "0" mmHg on the display by pressing the ▲▼ (+/–) keys.
- Close the dialysate circuit.
- Switch on the flow.
- Switch on the UF pump by pressing the UF I/O key.
- Switch off the flow.
- Leave the UF pump running until approx. –500 mmHg are indicated by the external reference instrument.
- Use the potentiometer P3/LP 633 to set the value indicated by the external reference instrument on the alphanumeric display.
- Repeat the procedure until 0 and –500 mmHg correspond to the external comparison instrument.
- OK
- not OK
- Enter the value indicated by the external reference instrument by pressing the ▲▼ (+/–) keys.
- Override (Tone Mute) key
- DATA STORED
- approx. 3 sec
- OPEN SYSTEM
- Wait for OVERRIDE LED
- The Override LED is flashing.
- DATA STORED
- approx. 3 sec
Part 14.2: TMP check

Use the UF pump to build up various negative pressures (Flow on / UF off). Compare the values indicated on the display, the LED display and the external measuring instrument.

Select \((\text{Esc})\) key

approx. 3 sec

Note:
Observe the venous pressure!

Note:
Switch the flow on and off again once in a while, to maintain the operating temperature of the pressure transducer.

Part 14.3: PDIAL2 pressure check (for systems with advanced hydraulics only)

Use the UF pump to build up various negative pressures (Flow on / UF off). Compare the values indicated on the display, the LED display and the external measuring instrument.

Select \((\text{Esc})\) key

approx. 3 sec

Note:
Observe the venous pressure!

In 4008 H/S systems the temperature compensation function can also be checked: Press \(\leftarrow\rightarrow\) to select the field Flow setting. Adjust the flow by pressing \(+/-\). Confirm by pressing the Tone Mute key.
Part 15: Blood leak voltage

Set 5.0 V on the display by pressing the ▲▼(+/–) keys.

Tolerance for dimness voltage: 5 V ± 0.3 V.

Note: If values deviate check the glass burette for contamination.
Close the housing; temperature 37 °C; avoid incident light from an external source.
Part 16: Calibrating the BIBAG values (optional)

1. Connect the calibration resistor (10 kΩ) to connector X107 (with advanced hydraulics: X12).
2. Override (Tone Mute) key approx. 3 sec
3. Confirm key
4. Select (Esc) key

BIBAG Temp.-Adjust:
5. Connect the calibration resistor (104Ω) to connector X108 (with advanced hydraulics: X13).
6. Override (Tone Mute) key approx. 3 sec
7. Confirm key
8. Select (Esc) key

BIBAG Temp.-Check:
9. act temp = XX.X°C
10. Confirm key
11. Select (Esc) key

BIBAG Cond.-Adjust:
12. Connect the calibration resistor (56.2Ω) to connector X108 (with advanced hydraulics: X13).
13. Override (Tone Mute) key approx. 3 sec
14. Confirm key
15. Select (Esc) key

BIBAG Cond.-Check:
16. act. cond: XX.X mS/cm
17. Confirm key
18. Select (Esc) key

** with test plug: 25 °C
** without test plug: 45.7 mS/cm or 84.5 mS/cm

Refer also to the Technical Manual for the biBag
Part 17: Resetting the failure record

- Confirm key
- Override (Tone Mute) key
- Select (Esc) key
- Audible alarm
- Are you sure?
- Acknowledged
- Approx. 3 sec
Part 18: Initializing the NOVRAM, resetting the mandatory rinse, resetting the V84 malfunction

Note:
The "NOVRAM" menu option can be entered only if the DIP-Switch1/DIP-Sw.Array2/LP631 is activated in the calibration mode. To this end and depending on its initial position, the switch must be actuated once and then be reset to its initial position.
Without menu display: Adjusting the Hall sensor in the heparin pump

Adjustment of Hall sensor 1
- Remove plug connector from Hall sensor 2.
- Move the slide carriage down over Hall sensor 1.
- Move the slide carriage up to its fully open position.
- Move the slide carriage down again to the end of its travel.
- The free motion between the slide carriage and the housing should be approx. 0.5 mm. If necessary, change the position of Hall sensor 1 and repeat the procedure.

Adjustment of Hall sensor 2
- Reconnect plug connector for Hall sensor 2.
- Move the slide carriage down to approx. 2 cm before the end of its travel.
- Manually turn the threaded spindle approx. 2-3 rotations in delivery direction.
- Move the slide carriage down.
- The slide carriage must stop before the mechanical end of its travel. If necessary, change the position of Hall sensor 2 and repeat the procedure several times.
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## 5 Diagnostics program

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<td>5.13</td>
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</table>
5.1 General notes

The diagnostics program serves to activate all inputs and outputs of the hemodialysis system. Activation is related to CPU1 (P.C.B. LP 631), CPU2 (P.C.B. LP 632), as well as to the output board (P.C.B. LP 634) and the input board (P.C.B. LP 633).

Using this program, the technician is able to program his own settings for testing of error images.

The diagnostics program is divided into the following menus:
- READ INPUTS
  - READ ANALOG INPUTS
    - CPU1: RD ANALOG INP.
    - CPU2: RD ANALOG INP.
  - READ DIGITAL INPUTS
    - CPU1: RD DIGITAL INP
    - CPU2: RD DIGITAL INP
- WRITE OUTPUTS
  - WRITE ANALOG OUTPUTS
    - CPU1: WR ANALOG OUTP
    - CPU2: WR ANALOG OUTP
  - WRITE DIGITAL OUTPUTS
    - CPU1: WR DIGIT. OUTP
    - CPU2: WR DIGIT. OUTP
- INP/OUTP COMBINATION
  - CPU1: COMBINATION
- CAN–COMPONENTS
  - HPU
  - ONLINE–PLUS–MODUL

In order to indicate the corresponding levels, all UF-seven-segment displays as well as the status indicator (monitor), the external traffic light and the loudspeaker are used in the "READ DIGITAL INPUTS" menu.

The active signal state (which may correspond to both present and absent voltage) is indicated by 1111 on the UF displays, activated traffic light (status indicator) and audible signal. An audible signal can be deactivated by pressing the (Alarm) Tone Mute key. With the audible signal deactivated, the (Alarm) Tone Mute LED is flashing as a reminder.

The audible signal indication can be used to evaluate the state of the signal without having to look at the monitor. This may be advantageous in case measurements have to be made behind the system (e.g. hydraulic unit).
Note
In the diagnostics program, the signals are listed in the order of their electric connection, i.e. in latch groups of 8 signals each, according to the 8-bit data bus and according to the latch numbering on the circuit diagram (e.g. P.C.B. LP 633: CS_LATCH0 – CS_LATCH6).
The are not divided into groups of pertinency (e.g. all Bibag signals one after the other). The only exception here is the activation of the solenoid valves. These are listed in the menu in the order of their numbers. This facilitates finding each individual valve since, as a rule, several valves must be simultaneously activated for trouble shooting.
Since the signals are assigned to their respective connections (latch groups), it is possible at any time, by using the circuit diagram, to locate the respective signal in the menu, even if the signal name should have changed. Within one latch group, only one known signal suffices to find the renamed signal by counting through the menu.
Deviations of all voltage values indicated are possible due to tolerances and depending on the various systems.

The “CPU1: RD DIGITAL INP” menu item includes the “I:CPU1_KEY_TESTING” item, which serves to perform the key test.
The key actuated is indicated on the alphanumeric display.
The UP, DOWN, CONFIRM, SELECT and I/O keys have not been implemented, since their function can be tested by selecting the corresponding menu.
5.2 Menu structure

```
DIAGNOSTICS

READ INPUTS
  ▲▼
  WRITE OUTPUTS
  ▲▼
  INP/OUTP COMBINATION
  ▲▼
  CAN–COMPONENTS
  ▲▼
  BACK TO MAIN MENU?

READ ANALOG INPUTS
  ▲▼
  CPU1: RD ANALOG INP. → from page 5-7
  ▲▼
  CPU2: RD ANALOG INP. → from page 5-9
  ▲▼
  back to menu?

READ DIGITAL INPUTS
  ▲▼
  CPU1: RD DIGITAL INP → from page 5-10
  ▲▼
  CPU2: RD DIGITAL INP → from page 5-15
  ▲▼
  back to menu?

back to menu?
```

Confirm key
5.3 Reading the analog inputs of CPU I

Explanation:
UF Volume display: ADC value
Time Left display: Analog voltage (in 0.1 V), converted to the value at the input of P.C.B. LP 633

<table>
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<th>ADC1: RD ANALOG INP.</th>
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<td>Confirm key</td>
<td></td>
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<tr>
<td>I: CPU1_PWR_WD</td>
<td></td>
</tr>
<tr>
<td>Voltage for watchdog monitoring 5 V, IC 27/26, ACD 107 (4.5 to 5.5 V)</td>
<td></td>
</tr>
<tr>
<td>I: CPU1_P_CONC</td>
<td>Not used 0 V, IC 27/27, ACD 0</td>
</tr>
<tr>
<td>I: CPU1_P_VEN</td>
<td>Venous pressure 0 to 12 V, IC 27/28, ADC 0 to 255</td>
</tr>
<tr>
<td>I: CPU1_BPR_VEN</td>
<td>Venous blood pump rate 0 to 10 V, IC 27/1, ADC 0 to 215 (8 mm line diameter)</td>
</tr>
<tr>
<td>I: CPU1_PR_HDF</td>
<td>HDF blood pump rate 0 to 3.3 V, IC 27/1, ADC 0 to 72 (HDF switched on, 8 mm line diameter)</td>
</tr>
<tr>
<td>I: CPU1_BPR_ART</td>
<td>Arterial blood pump rate 0 to 10 V, IC 27/2, ADC 0 to 215 (8 mm line diameter)</td>
</tr>
</tbody>
</table>

- I: CPU1_VEN_BPR_SET
  Rated value specified for the venous blood pump rate 0 to 8 V, IC 27/3, ADC 0 to 171 (8 mm line diameter)

- I: CPU1_HDF_PR_SET
  Rated value specified for the HDF blood pump rate 0 to 2.7 V, IC 27/3, ADC 0 to 58 (HDF switched on, 8 mm line diameter)

- I: CPU1_ART_BPR_SET
  Rated value specified for the arterial blood pump rate 0 to 8 V, IC 27/4, ADC 0 to 171 (8 mm line diameter)

- I: CPU1_REF1
  Reference voltage AD 0 2.5 V, IC 27/5, ADC 128 (2.3 to 2.5 V)

- I: CPU1_U_ACCU
  Battery voltage e.g. 22 V, IC 28/26, ADC e.g. 184

- I: CPU1_P_BIC
  Not used 0 V, IC 28/27, ADC 0

- I: CPU1_24V_EM
  24V_EMERGENCY 24 V, IC 28/28, ADC 117 (22.5 to 26 V)
I: CPU1_BLL_DIM
Blood leak dimness voltage
5.0 V, IC 28/2, ADC 108

I: CPU1_BLL
Blood leak voltage
5.0 V, IC 28/3, ADC 108

I: CPU1_COND_SIGNAL1
CD display
0 to 10.8 V, IC 28/4, ADC 0 to 231

I: CPU1_REF2
Reference voltage AD1
2.5 V, IC 28/5, ADC 128
(2.3 V to 2.5 V)

I: CPU1_FREE1
Not used
0 V, IC 29/26, ADC 0

I: CPU1_TEMP_DIAL2
Temperature NTC 109
0 to 12 V, IC 29/27, ADC 0 to 255

I: CPU1_COND_SIGNAL3
CD cell (slot X108 / LP 747)
0 – 10.8 V, IC 29/2, ADC 0 – 231

I: CPU1_FREE2
Not used, open input
IC 29/3

I: CPU1_U_BATT_SW
Voltage for alarm tone, if battery relay is off
10.6 V, IC 29/4, ADC 110

I: CPU1_REF3
Reference voltage AD2
2.5 V, IC 29/5, ADC 128
(2.3 to 2.5 V)

back to menu ?
Confirm key
CPU1: RD ANALOG INP.
5.4 Reading the analog inputs of CPU II

Explanation:
UF Volume display: ADC value
Time Left display: Analog voltage (in 0.1 V), converted to the value at the input of P.C.B. LP 632

---

**CPU2: RD ANALOG INP.**

- Confirm key

**I: CPU2_BPR_ART**

Arterial blood pump
0 to 9.6 V, IC 12/20, ADC 0 to 223

**I: CPU2_P_ART**

Arterial pressure
0 to 10.6 V, IC 12/19, ADC 0 to 245

**I: CPU2_P_VEN**

Venous pressure
0 to 11 V, IC 12/18, ADC 0 to 255

**I: CPU2_P_DIAL**

Dialysate pressure
0 to 10 V, IC 12/17, ADC 0 to 231

**I: CPU2_COND_SIGNAL**

CD display
0 to 10.8 V, IC 12/16, ADC 0 to 251

**I: CPU2_TEMP_DIAL1**

Temperature display
0 to 10.8 V, IC 12/15, ADC 0 to 251

**I: CPU2_P_DIAL2**

Control voltage for higher resolution
Dialysate pressure
0 to 10.9 V, IC 12/14, ADC 0 to 252

**CPU2: RD ANALOG INP.**

**I: CPU2_BLL_DIM**

Blood leak dimness voltage
5.0 V, IC 12/13, ADC 116

**I: CPU2_BLL**

Blood leak voltage
5.0 V, IC 12/13, ADC 116

**I: CPU2_+10V**

Reference voltage, D-A converter/CPU II
10 V; 12/13, ADC 234

**I: CPU2_NC6**

Not used
0 V, IC 12/13, ADC 0

**back to menu ?**

Confirm key

---
5.5 Reading the digital inputs of CPU I

Explanation:
All UF displays show 0000; red, yellow, green traffic light off: low level at latch on P.C.B. LP 633
All UF displays show 1111; red, yellow, green traffic light on: high level at latch on P.C.B. LP 633
If high level is applied, an audible alarm is simultaneously sounded. This tone can be suppressed by pressing the Alarm Tone Mute key. In this case, the Alarm Tone Mute LED is illuminated.
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<th>Valve 24</th>
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<td>Check by opening/closing the valve</td>
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<td>Preparation: LD alarm-free and set CLAMP_CTRL (CPU1: WR DIGIT. OUTP) to 1</td>
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<td>Check: initiate an LD alarm</td>
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<th>CPU1_REED_BIC</th>
<th>Bicarbonate reed contact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IC 14/2</td>
</tr>
<tr>
<td></td>
<td>Actuate rinse chamber/bicarbonate reed contact</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CPU1_BIBAG</th>
<th>Microswitch 137 / connector</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IC 14/3</td>
</tr>
<tr>
<td></td>
<td>Check by connecting/removing the cap</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CPU1_REED_RINSE</th>
<th>Concentrate reed contact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IC 14/4</td>
</tr>
<tr>
<td></td>
<td>Actuate rinse chamber/concentrate reed contact</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CPU1_BIBAG_C</th>
<th>Microswitch 138 / connector</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IC 14/5</td>
</tr>
<tr>
<td></td>
<td>Check by connecting/removing the cap</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CPU1_PS_W_V102</th>
<th>Concentrate pressure switch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IC 14/6</td>
</tr>
<tr>
<td></td>
<td>Check by increasing/decreasing the pressure at the pressure switch</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CPU1_PS_W_V104</th>
<th>Bicarbonate pressure switch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IC 14/7</td>
</tr>
<tr>
<td></td>
<td>Check by increasing/decreasing the pressure at the pressure switch</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CPU1_PWR_OFF</th>
<th>Power off</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IC 14/8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CPU1_HEP_ON</th>
<th>Heparin pump on</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IC 14/9</td>
</tr>
<tr>
<td></td>
<td>Switch heparin pump on/off</td>
</tr>
</tbody>
</table>

| CPU1_LA32 | IC 15/2 |
I: CPU1_SW_ON_OFF
On/off key on system
IC 15/3
Brief key actuation

I: CPU1_PWR_FAIL
Power failure recognition
IC 15/4

I: CPU1_SHUNT_OUTP
Microswitch, interlock shunt
IC 15/5
Both lines in the interlock shunt and interlock shunt closed: 0

I: CPU1_SHUNT_INP
Microswitch, interlock shunt
IC 15/6
Red line only in the interlock shunt and interlock shunt closed: 0

I: CPU1_SHUNT
Microswitch, interlock shunt
IC 15/7
Open/close interlock shunt

I: CPU1_SERV_EN
Not used
IC 15/8

I: CPU1_LEV_SIGNAL
Level sensor (NTC 6 – replacement)
IC 15/9
Check by removing/short-circuiting the sensor pins

I: CPU1_SN
Single-Needle changeover
IC 16/2
Changeover pressure of SN blood pump reached: 0

I: CPU1_ADKS
Single-Needle blood pump recognition connected
IC 16/3
Connect/remove the blood pump (only with the system off)

I: CPU1_BPSB_ART
Arterial blood pump stop confirmation
IC 16/4
Actuation of Start/Stop key on the arterial blood pump

I: CPU1_BPUS_ART
Arterial blood pump revolution stop
IC 16/5
Arterial blood pump alarm field on: 0 (cleared by pressing the Start/Stop key on the blood pump)

I: CPU1_BPSB_VEN
Venous blood pump stop confirmation
IC 16/6
Actuation of the Start/Stop key on the venous blood pump

I: CPU1_BPUS_VEN
Venous blood pump revolution stop
IC 16/7
Preparation:
Set SNST (CPU1: WR DIGIT. OUTP) to 1 and wait for the alarm field.
Venous blood pump on.
Check: clearing of the alarm field by pressing the Start/Stop key on the venous blood pump
**E. CPU1_HEP_ALARM**

Heparin pump alarm
IC 16/8
Generate a heparin pump alarm
(e.g. by blocking the syringe slide)

**I: CPU1_BIB_LEVEL**

Level sensor 135
IC 16/9
Check by removing/shorting the sensor pins

**I: CPU1_EXT_ALARM**

External alarm
IC 20/2
Release of an external alarm

**I: CPU1_SERVICE_MODE**

Dialysis/calibration changeover
IC 20/3
Reset the service switch

**I: CPU1_LEVEL_UP**

Raise the LD level
IC 20/4
Press the "Raise level" key

**I: CPU1_LEVEL_DOWN**

Lower the LED level
IC 29/5
Preparation:
LD alarm-free, set CLAMP_CTRL
(CPU1: WR DIGIT. OUTP) to 1
Check: press the "Lower level" key

**I: CPU1_ADS_SN**

Not used
IC 20/6

**I: CPU1_ACKN_CONC**

Not used
IC 20/7

**I: CPU1_ACKN_BIC**

Not used
IC 20/8

**I: CPU1_BIBAG_PSW**

BIBAG pressure switch
IC 20/9
Check by increasing/decreasing pressure on the pressure switch

**I: CPU1_RA21**

Not used
IC 21/2

**I: CPU1_HDF_ON**

HDF on
IC 21/3
Actuation of HDF On/Off switch

**I: CPU1_V102**

Acknowledgement, valve 102
IC 21/4
Open/close the valve

**I: CPU1_V104**

Acknowledgement, valve 104
IC 21/5
Open/close the valve

**I: CPU1_CSS_REED**

IC 21/6
I: CPU1_HEAT_CLK
IC 21/7

I: CPU1_BYP_REQ
IC 21/8

I: CPU1_CLP_REQ
IC 21/9

I: CPU1_LATCH7_FREE1
Not used
IC 7/2

I: CPU1_LATCH7_FREE2
Not used
IC 7/3

I: CPU1_LATCH7_FREE3
Not used
IC 7/4

I: CPU1_LATCH7_FREE4
Not used
IC 7/5

I: CPU1_LATCH7_FREE5
Not used
IC 7/6

I: CPU1_LATCH7_FREE6
Not used
IC 7/7

I: CPU1_LATCH7_FREE7
Not used
IC 7/8

I: CPU1_LATCH7_FREE8
Not used
IC 7/9

I: CPU1_DIP1:00011100
DIP switch CPU I/array I
P.C.B. LP 631/IC 12/2 to 9
The position of the DIP switches is shown on the alphanumeric display (1: DIP switch „ON“)

I: CPU1_DIP2: 00000000
DIP switch CPU I/array II
P.C.B. LP 631/IC 13/2 to 9
The position of the DIP switches is shown on the alphanumeric display (1: DIP switch „ON“)

I: CPU1_KEY_TESTING
Touch panel test
P.C.B. LP 635/IC 73/2 to 6
The key pressed is shown on the alphanumerical display, the LED next to the key is illuminated.

I: CPU1_RCU_KEY_TEST
Touch panel test for the remote control RCU 4008.
The key pressed is shown on the alphanumerical display, the LED next to the key is illuminated.

back to menu?
Confirm key
CPU1: RD DIGITAL INP
5.6 Reading the digital inputs of CPU II

Explanation:
All UF displays show 0000; red, yellow, green traffic light off: low level at latch on P.C.B. LP 632
All UF displays show 1111; red, yellow, green traffic light on: high level at latch on P.C.B. LP 632
If high level is applied, an audible alarm is simultaneously sounded. This tone can be suppressed by pressing the Alarm Tone Mute key. In this case, the Alarm Tone Mute LED is illuminated.

CPU2: RD DIGITAL INP

Confirm key

I: CPU2_NC3
Not used
IC 4/2

I: CPU2_UF_P1
Acknowledgement, UF pump 1
IC 4/3

I: CPU2_ACKN_AIRSEP
Acknowledgement, air separation pump
IC 4/4

I: CPU2_UF_P2
Acknowledgement, UF pump 2
IC 4/5

I: CPU2_CI
Balancing chamber switching pulse
IC 4/6

I: CPU2_V24
Acknowledgement, valve 24
IC 4/7, open/close the valve

I: CPU2_V24b
Acknowledgement, valve 24b
IC 4/8, open/close the valve

I: CPU2_V26
Acknowledgement, valve 26
IC 4/9, open/close the valve

I: CPU2_V43
Acknowledgement, valve 43
IC 5/2, open/close the valve

I: CPU2_BL_ALARM
Blood pump rate changeover SN/HDF
IC 5/3

I: CPU2_PWR_OFF
Power off
IC 5/4

I: CPU2_FL_SWITCH+5V
Float switch
IC 5/5
Generate a water deficiency in the calibration mode = 0
Open V41 until water exits the vent tubing = 1

I: CPU2_LDA1
LD alarm, channel 1
IC 5/6, LD alarm/alarm-free
I: CPU2_LDA2
LD alarm, channel 2
IC 5/7
Preparation:
LD alarm-free and set CLAMP_CTRL
(CPU1: WR DIGIT. OUTP) to 1
Check: generate an LD alarm

I: CPU2_BPSB_VEN
Venous blood pump stop confirmation
IC 5/8
Actuation of the Start/Stop key on the
venous blood pump

I: CPU2_BPSB_ART
Arterial blood pump stop confirmation
IC 5/9
Actuation of the Start/Stop key on the
arterial blood pump

I: CPU2_V42
Not used
IC 6/2

I: CPU2_BPST_ART
Acknowledgement, special control of
the arterial blood pump
IC 6/3
Check by setting BPST_ART
(CPU1: WR DIGIT. OUTP) to 1/0

I: CPU2_BPST_VEN
Acknowledgement, special control of
the venous blood pump
IC 6/5
Check by setting BPST_VEN
(CPU1: WR DIGIT. OUTP) to 1/0

I: CPU2_BPSB_VEN
Venous blood pump stop confirmation
IC 6/6
Preparation:
Set SNST (CPU1: WR DIGIT. OUTP)
to 1 and wait for the alarm field of the
venous blood pump to turn on
Check: clear the alarm field by press-
ing the Start/Stop key on the venous
blood pump

I: CPU2_Adks
Single-Needle blood pump recognition
connected
IC 6/7
Connect/remove the blood pump (with
the system off only)

I: CPU2_LEVEL_UP
Raise LD level
IC 6/8, press the “Raise level” key

I: CPU2_LEVEL_DOWN
Lower LD level
IC 6/9
Preparation:
LD alarm-free, set CLAMP_CTRL
(CPU1: WR DIGIT. OUTP) to 1
Check: press the “Lower level” key

I: CPU2_RINSE
Concentrate reed contact
IC 7/2
Actuate rinse chamber/concentrate
reed contact
<table>
<thead>
<tr>
<th>Circuit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I: CPU2_V147</td>
<td>IC 7/3</td>
</tr>
<tr>
<td>I: CPU2_REED_BIC</td>
<td>Bicarbonate reed contact IC 7/4 Actuate rinse chamber/bicarbonate reed contact</td>
</tr>
<tr>
<td>I: CPU2_PSW_104</td>
<td>Bicarbonate pressure switch IC 7/5 Check by increasing/decreasing pressure at the pressure switch</td>
</tr>
<tr>
<td>I: CPU2_V145</td>
<td>IC 7/6</td>
</tr>
<tr>
<td>I: CPU2_SHUNT_OUTP</td>
<td>Microswitch, interlock shunt IC 7/7 Both lines in the interlock shunt and interlock shunt closed: 0</td>
</tr>
<tr>
<td>I: CPU2_SHUNT_INP</td>
<td>Microswitch, interlock shunt IC 7/8 Red line only in the interlock shunt and interlock shunt closed: 0</td>
</tr>
<tr>
<td>I: CPU2_SHUNT</td>
<td>Microswitch, interlock shunt IC 7/9, open/close the interlock shunt</td>
</tr>
<tr>
<td>I: CPU2_ABG_ON</td>
<td>Not used IC 8/2</td>
</tr>
<tr>
<td>I: CPU2_SERVICE_MODE</td>
<td>Changeover dialysis/calibration IC 8/3, reset the service switch</td>
</tr>
<tr>
<td>I: CPU2_HOT_RINSE</td>
<td>Changeover hot rinsing IC 8/4 Check by setting HOT_RINSE (CPU1: WR DIGIT. OUTP) to 0/1</td>
</tr>
<tr>
<td>I: CPU2_OD_OUT</td>
<td>LD optical detector IC 8/5, optical detector light/dark</td>
</tr>
<tr>
<td>I: CPU2_SNST</td>
<td>Single-Needle control IC 8/6</td>
</tr>
<tr>
<td>I: CPU2_24V_SW</td>
<td>24-V switch IC 8/7</td>
</tr>
<tr>
<td>I: CPU2_SN</td>
<td>Single-Needle changeover IC 8/8, SN switching pressure reached: 0</td>
</tr>
<tr>
<td>I: CPU2_HEAT_RL_WATCH</td>
<td>Acknowledgement, heater relay IC 8/9</td>
</tr>
<tr>
<td>I: CPU2_DIP1: 01100110</td>
<td>DIP switch CPU II/array I IC 9/2 to 9 DIP switch position shown on the alphanumeric display (1: DIP switch „ON“)</td>
</tr>
</tbody>
</table>
I: CPU2_DIP2: 11000001
DIP switch CPU II/array II
IC 10/2 to 9
DIP switch position shown on the
alphanumeric display
(1: DIP switch „ON“)

back to menu ?

Confirm
key

CPU2: RD DIGITAL INP
5.7 Writing the analog outputs of CPU I

Explanation:
UF Rate display: DAC value (can be changed with: 4008/E/B: ▲▼ UF Rate, 4008 H/S: +/-)
Time Left display: Analog voltage on P.C.B. LP 634, in 0.1 V

---

**CPU1: WR ANALOG OUTP**

- Confirm key

**O: CPU1_TEMP_SET**

Rated value specified for the temperature
IC 53/9
0 to 5 V (X634R/C20, 0.2 to 10 V)

**O: CPU1_DAC_DIM**

Calibration voltage, dimness
IC 53/8
0 to 5 V (C634R/A11, 0 to 5 V)

**O: CPU1_TEMP_ADJ**

Calibration voltage, temperature control
IC 53/7
0 to 5 V (X634R/C21, 0 to 5 V)

**O: CPU1_DAC_BLL**

Calibration voltage, blood leak
IC 53/6
0 to 5 V
(X634R/A12, 0 to 5 V)

**O: CPU1_BIBAG_TEMP_AJ**

Calibration voltage for temperature NTC
(slot X107 / LP 747)
IC 53/5
0 to 5 V (X634R/A13, 0 to 5 V)

---

**O: CPU1_DAC_X2**

Not used
IC 53/4
0 to 5 V (X634R/C13, 0 to 5 V)

**O: CPU1_STEUER_EP**

Speed setting, degassing pump
IC 53/3
0 to 4.4 V (X634L/ between A, B, C 27 and A, B, C 28, 0 to 21 V)

**O: CPU1_STEUER_FP**

Speed setting, flow pump
IC 53/2
0 to 4.4 V (X634L/ between A, B, C 29 and A, B, C 30, 0 to 21 V)

---

back to menu ?

Confirm key

---

CPU1: WR ANALOG OUTP
5.8 Writing the analog outputs of CPU II

Explanations:
UF Rate display: DAC value (can be changed with: 4008/E/B: ▲▼ UF Rate, 4008 H/S: +/-)
Time Left display: Analog voltage on P.C.B. LP 632, in 0.1 V

**CPU2: WR ANALOG OUTP**
- Confirm key

**O: CPU2_TEMP_DET_ADJ**
Detuning, temperature display
IC 11/2, 0 to 10 V (X632/A23, 0 to 10 V)

**CPU2: WR ANALOG OUTP**
- Confirm key

**O: CPU2_HIGHT_RES_OP**
OP control voltage for higher resolution of dialysate pressure
IC 11/20, 0 to 10 V

**CPU2: WR ANALOG OUTP**
- Confirm key

**O: CPU2_DIAL_DET_ADJ**
Detuning, dialysate pressure display
IC 11/1, 0 to 10 V (X632/C 20, 0 to 10 V)

**CPU2: WR ANALOG OUTP**
- Confirm key

**O: CPU2_P_ADS_DET**
Not used
IC 11/20, 0 to 10 V (X632/A 20, 0 to 10 V)

**CPU2: WR ANALOG OUTP**
- Confirm key

**O: CPU2_PV_DET**
Detuning, venous pressure
IC 11/20, 0 to 10 V (X632/C 18, 1 to 9 V)

**CPU2: WR ANALOG OUTP**
- Confirm key

**O: CPU2_PA_DET**
Detuning, arterial pressure
IC 11/19, 0 to 10 V (X632/A 17, 4 to 7 V)

**CPU2: WR ANALOG OUTP**
- Confirm key

**O: CPU2_COND_DET**
Detuning, CD display
IC 11/19, 0 to 10 V (X632/A 21, 0 to 10 V)
5.9 Writing the digital outputs of CPU I

Explanation:
UF Rate display:  
0000 = not active  
1111 = active (P.C.B. LP 634 level)  
(can be changed with: 4008/E/B: ▲▼ UF Rate, 4008 H/S: +/-)

- **CPU1: WR DIGIT. OUTP**
  - Confirm key
  - **O: CPU1_V24**  
    - Valve 24  
    - IC 10/19
  - ▲▼
  - **O: CPU1_V24b**  
    - Valve 24b  
    - IC 10/13
  - ▲▼
  - **O: CPU1_V26**  
    - Valve 26  
    - IC 10/18
  - ▲▼
  - **O: CPU1_V130**  
    - Valve 130  
    - IC 10/17
  - ▲▼
  - **O: CPU1_V30**  
    - Valve 30  
    - IC 7/16
  - ▲▼
  - **O: CPU1_V31**  
    - Valve 31  
    - IC 12/19
  - ▲▼
  - **O: CPU1_V32**  
    - Valve 32  
    - IC 12/18
  - ▲▼
  - **O: CPU1_V33**  
    - Valve 33  
    - IC 12/17
  - ▲▼
  - **O: CPU1_V34**  
    - Valve 34  
    - IC 12/16
  - ▲▼
  - **O: CPU1_V35**  
    - Valve 35  
    - IC 12/15
  - ▲▼
  - **O: CPU1_V36**  
    - Valve 36  
    - IC 12/14
  - ▲▼
  - **O: CPU1_V37**  
    - Valve 37  
    - IC 12/13
  - ▲▼
  - **O: CPU1_V38**  
    - Valve 38  
    - IC 12/12
  - ▲▼
  - **O: CPU1_V41**  
    - Valve 41  
    - IC 7/13  
    - (After a short time interval, the valve closes automatically, to prevent the water from overflowing.)
Valve 43
IC 7/15

Valve 84
IC 7/18
Note: After the valve V84 has been activated, rinsing is mandatory.

Valve 86
IC 7/17

Valve 87
IC 10/15

Valve 91
IC 10/14
Note: When exiting this menu option (return to „CPU1: WR DIGIT. OUTP") the valve will be closed.

Valve 99
IC 7/19
Note: When exiting this menu option (return to „CPU1: WR DIGIT. OUTP") the valve will be closed.

Valve 102
IC 10/12
(Activation of the valve is possible only if a mandatory rinse is not requested.)

Valve 104
IC 7/14
(Activation of the valve is possible only if a mandatory rinse is not requested.)

Not used

Not used

Not used

Not used

Air separation pump
IC 4/18, 19
(1111: clockwise)
Note: When exiting the menu option, the ASP stops
O: CPU1_STOP_EP
Stopping of the degassing pump
IC 4/16

O: CPU1_STOP_FP
Stopping of the flow pump
IC 4/15

O: CPU1_SET_UF1_ON
Activation of UF pump 1
IC 4/14
(0/1 jump = 1 stroke)

O: CPU1_SET_UF2_ON
Activation of UF pump 2
IC 4/13
(0/1 jump = 1 stroke)

O: CPU1_SET_EN_UF2
Not used
IC 4/12

O: CPU1_SET_FLOW_ON
Flow on
Dataword to Gal 23:
0000 0010 (active, V 32 open)
0000 0011 (inactive, V 31, 32 open)

O: CPU1_SET_FILL_PRG
Fill program
Dataword to Gal 23:
0000 1010 (V 32, 34 open)

O: CPU1_EMPTIING_PRG
Emptying program:
Dataword to Gal 23:
0001 0010 (V 32, 35 open)

O: CPU1_ALARM_SOUND
Alarm tone
IC 5/18, 19 set to 1: active

O: CPU1_WARN_SOUND
Warning tone
IC 5/18 set to 1, 19 to 0: active

O: CPU1_INFO_SOUND
Infosound
IC 5/18 set to 0, 19 to 1: active

O: CPU1_CLK_OVERLAP
Changeover of dead time of balancing chamber
IC 5/17 set to 0: 1 kHz; to 1: 2 Hz

O: CPU1_FILL_ONE_CHAM
Filling of a balancing chamber compartment
Dataword to Gal 23:
0100 0010 (V 32, 37 open)

O: CPU1_EMPTY_ONE_CHA
Emptying of a balancing chamber compartment
Dataword to Gal 23:
1100 0010 (V 32, 37, 38 open)

O: CPU1_CO:L:XXXXXXXX
Step number of concentrate pump
The dataword to IC 2 is indicated on the alphanumeric display and can be changed by pressing the UF Rate UP/DOWN keys.
Prerequisite: reed contact of concentrate connector open

O: CPU1_BI_L:XXXXXXXX
Step number of bicarbonate pump
Prerequisite: reed contact of bicarbonate connector open

O: CPU1_ALARM_SOUND
Alarm tone
IC 5/18, 19 set to 1: active

O: CPU1_WARN_SOUND
Warning tone
IC 5/18 set to 1, 19 to 0: active

O: CPU1_INFO_SOUND
Infosound
IC 5/18 set to 0, 19 to 1: active

O: CPU1_CLK_OVERLAP
Changeover of dead time of balancing chamber
IC 5/17 set to 0: 1 kHz; to 1: 2 Hz
**O: CPU1_EN_IN_PULSE**

Changeover, “Eigentakt”
IC 5/16 set to 0: “Eigentakt”; to 1:
changeover current rise

**O: CPU1_BC_PULSE**

Balancing chamber switching
IC 5/15

**O: CPU1_EN_STEP_PULS**

Gal changeover
IC 5/14

**O: CPU1_BC_FUNCTION**

Activation of balancing chamber gal
IC 5/13

**O: CPU1_STEPPER_PULS**

“Eigentakt”
IC 5/12

**O: CPU1_FL_SWITCH_EN**

V41 release
IC 7/12
Check:
Set level to 1 and float switch down:
V 41 open
Set level to 0 and float switch down:
V 41 closed

**O: CPU1_SNST**

Single-Needle control
IC 13/19
Preparation:
LD alarm-free and set CLAMP_CTRL
(CPU1: WR DIGIT. OUTP) to 1
Check:
SNST set to 1: as soon as the SN
changeover pressure is reached, the
venous blood pump is running

**O: CPU1_EN_PF_AT**

Release of audible power failure alarm
IC 13/17
Preparation: set WD_SET
(CPU2: WR DIGIT. OUTP)
Check: with EN_PF_AT set to 0/1, the
power failure alarm can be switched
on/off

**O: CPU1_PIC_RA3**

Not used
IC 13/16

**O: CPU1_PROG_LOG1**

Program logic 1, HDF pump
IC 13/14
(0: speed 200; 1: speed 400)

**O: CPU1_PROG_LOG2**

Program logic 2, HDF pump
IC 13/13
(0: speed 200; 1: speed 150)

**O: CPU1_VENT_VALVE**

LD vent valve
IC 13/12

**O: CPU1_CPU_OFF**

Automatic switchoff
IC 13/18
In position 1, the system switches off
O: CPU1_CLR_ALARM
Clearing of the alarm
IC 11/18
Check: generate a heparin pump alarm; by setting CLR_ALARM from 0 to 1, the alarm is cleared.

O: CPU1_HOT_RINSE
Changeover, hot rinsing
IC 11/17

O: CPU1_TEST_BATT
Battery test
IC 11/16

O: CPU1_CPU_AKKU
Battery relay
IC 11/15

O: CPU1_HEAT_OFF
Heater blocking
IC 11/14

O: CPU1_STAFF_CALL
Staff call
IC 11/13

O: CPU1_TL_RED
Traffic light red
IC 11/12
(The pertinent status indicator on the front panel lights simultaneously.)

O: CPU1_BPST_ART
Arterial blood pump system stop
IC 6/18

O: CPU1_CLAMP_CTRL
LD clamp control
IC 6/17
Preparation: LD in no alarm state

O: CPU1_BPST_VEN
Special control of the venous blood pump
IC 6/16

Venous blood pump system stop
IC 6/15
Preparation:
Set SNS (CPU1: WR DIGIT. OUTP) to 1
Check: apply pressure to the SN blood pump; with BPSST_VEN, the blood pump can be switched on/off.

O: CPU1_BL_ALARM
Changeover, blood pump rate
Single-Needle/HDF
IC 6/14

O: CPU1_TL_YELLOW
Traffic light yellow
IC 6/13
(The pertinent status indicator on the front panel lights simultaneously.)

O: CPU1_TL_GREEN
Traffic Light green
IC 6/12
The pertinent status indicator on the front panel lights simultaneously.
<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>O: CPU1_BP_FASTER</td>
<td>Increase blood pump rate +</td>
</tr>
<tr>
<td></td>
<td>(RCU 4008)</td>
</tr>
<tr>
<td></td>
<td>LP 649/X4.4; LP 635/X4.4;</td>
</tr>
<tr>
<td></td>
<td>LP 922/X5.4; LP 924/X6.4</td>
</tr>
<tr>
<td>O: CPU1_OVERLAP_VALUE</td>
<td>Charging of the dead time counter</td>
</tr>
<tr>
<td></td>
<td>IC 3/12 to 19</td>
</tr>
<tr>
<td></td>
<td>(DAC adjustable from 0 to 255)</td>
</tr>
<tr>
<td>O: CPU1_BP_SLOWER</td>
<td>Decrease blood pump rate –</td>
</tr>
<tr>
<td></td>
<td>(RCU 4008)</td>
</tr>
<tr>
<td></td>
<td>LP 649/X4.5; LP 635/X4.5;</td>
</tr>
<tr>
<td></td>
<td>LP 922/X5.5; LP 924/X6.5</td>
</tr>
<tr>
<td>O: CPU1_V_ADS</td>
<td>Not used</td>
</tr>
<tr>
<td>O: CPU1_NC_I</td>
<td>Not used</td>
</tr>
<tr>
<td>O: CPU1_NC_II</td>
<td>Not used</td>
</tr>
<tr>
<td>O: CPU1_NC_III</td>
<td>Not used</td>
</tr>
<tr>
<td>O: CPU1_ACKN_FLOW</td>
<td>Not used</td>
</tr>
<tr>
<td>O: CPU1_ACKN_BL_ALARM</td>
<td>All LED indicators are tested.</td>
</tr>
<tr>
<td></td>
<td>The display on the UF monitor counts from 1 to 0.</td>
</tr>
<tr>
<td>O: CPU1_DISPLAY_TEST</td>
<td>All LED indicators are tested.</td>
</tr>
<tr>
<td></td>
<td>The display on the UF monitor counts from 1 to 0.</td>
</tr>
<tr>
<td></td>
<td>back to menu?</td>
</tr>
<tr>
<td></td>
<td>Confirm key</td>
</tr>
<tr>
<td></td>
<td>CPU1: WR DIGIT. OUTP</td>
</tr>
<tr>
<td>O: CPU1_V_ADS</td>
<td>Not used</td>
</tr>
<tr>
<td>O: CPU1_NC_I</td>
<td>Not used</td>
</tr>
<tr>
<td>O: CPU1_NC_II</td>
<td>Not used</td>
</tr>
<tr>
<td>O: CPU1_NC_III</td>
<td>Not used</td>
</tr>
<tr>
<td>O: CPU1_ACKN_FLOW</td>
<td>Not used</td>
</tr>
</tbody>
</table>

**Note:**
- All commands not used in the current context.
5.10 Writing the digital outputs of CPU II

Explanation:
UF Rate display: 0000 = not active
1111 = active (P.C.B. LP 632 level)
(can be changed with: 4008/E/B: ▲▼ UF Rate, 4008 H/S: +/-)

**CPU2: WR DIGIT. OUTP**
- Confirm key

**O: CPU2_WD_RES**
Watchdog reset
IC 24/18
Preparation:
Set WD_SET (CPU2: WR DIGIT. OUTP) to 0, then to 1 again.
Check:
Briefly set WD_RES to 0; upon reset to 1, the WD relay is connected.

**CPU2: WR DIGIT. OUTP**

**△▼ O: CPU2_WD_SET**
Watchdog set
IC 24/17
Watchdog relay drops out, 24 V switched off, audible signal is sounded.
To clear the alarm, turn the system off and on again.
Otherwise calibration impossible.

**△▼ O: CPU2_V24_EN**
Release of V 24
IC 24/16
Preparation: V 24 Switch on (CPU1: WR DIGIT. OUTP).
Check: switch the valve on/off with V 24_EN.

**△▼ O: CPU2_V24B_EN**
Release of V24b
IC 24/15
Preparation: switch on V 24B (CPU1: WR DIGIT. OUTP).
Check: switch the valve on/off with V 24B_EN.

**△▼ O: CPU2_UF_P_CTRL**
Activation of UF pump
IC 24/14, 0/1 level change = 1 stroke
Preparation: set CPU2_UF_P_EN to 1.

**△▼ O: CPU2_UF_P_EN**
Release of UF pumps
IC 24/13

**△▼ O: CPU2_CPU2_ALARM**
Release of the alarm tone by CPU II
IC 24/12

**△▼ O: CPU2_UF_P2_CTRL**
Activation of UF-Pump 2
IC 24/11, 0/1 level change = 1 stroke
Preparation: set CPU2_UF_P_EN to 1.

**△▼ O: CPU2_4066_ENABLE_1**
Analog switch for P_ADS_DET
IC 20/13 (X632/A20)

**△▼ O: CPU2_4066_ENABLE_2**
Analog switch for +10-V reference voltage
IC 27/5

**△▼ O: CPU2_4066_ENABLE_3**
Analog switch for PV_DET
IC 20/6 (X632/C18)
O: CPU2_4066_ENABLE_4
Analog switch for PA_DET
IC 20/12 (X632/A17)

O: CPU2_4066_ENABLE_5
Analog switch, not used
IC 27/13

O: CPU2_4066_ENABLE_6
Analog switch for COND_DET
IC 20/5 (X632/A21)

O: CPU2_4066_ENABLE_7
Analog switch for BLL_DIM
IC 27/6

O: CPU2_4066_ENABLE_8
Analog switch for BLL
IC 27/12

O: CPU2_SN_ART
Single-Needle control, arterial
X632/A15

O: CPU2_LDSA
Attenuation of LD ultrasonic sensor
X632/C16
Preparation:
LD alarm-free and set CLAMP_CTRL
(CPU1: WR DIGIT. OUTP) to 1.
Check: by setting LDSA to 1, the
clamp at the LD closes.

O: CPU2_ODSA
Attenuation of LD optical sensor
X632/C15

O: CPU2_CLAMP_CTRL
Clamp control, air detector
X632/C10
Preparation: LD in no alarm state

O: CPU2_NC5
Not used
X632/B25

O: CPU2_NC7
Not used
X632/B10

O: CPU2_BLL_DET
Detuning of blood leak detector
X632/A25

O: CPU2_SN_EN
Release of Single-Needle
X632/C19

O: CPU2_NC10
Not used
X632/B4

O: CPU2_V26
Valve 26
X632/A6

O: CPU2_V42
Not used
X632/C4

O: CPU2_V43
Valve 43
X632/C5
- CPU2_VENT_DSAFE
  Vent valve, Diasafe
  X632/B5

- CPU2_EM.HEAT.OFF
  Heater relay
  X632/A9
  For safety reasons, the relay switches off again after having been activated.

- CPU2_NC8
  Not used
  X632/B9

- CPU2_NC9
  X632/C6
  IC 29/13

- CPU2_LED1
  P.C.B. LP 632, LED 1
  IC 21/19

- CPU2_LED2
  P.C.B. LP 632, LED 2
  IC 21/18

- CPU2_LED3
  P.C.B. LP 632, LED 3
  IC 21/17

- CPU2_LED4
  P.C.B. LP 632, LED 4
  IC 21/16

- CPU2_LED5
  P.C.B. LP 632, LED 5
  IC 21/15

- CPU2_EM.HEAT.OFF
  P.C.B. LP 632, LED 6
  IC 21/14

- CPU2_LED7
  P.C.B. LP 632, LED 7
  IC 21/13

- CPU2_LED8
  P.C.B. LP 632, LED 8
  IC 21/12

- back to menu? Confirm key

- CPU2: WR DIGIT. OUTP
5.11 Writing/Reading the digital outputs of CPU I

Explanation:
UF Volume display: Acknowledgement/input (in case of 1111, the three status LEDs of the traffic light are also illuminated)
UF Rate display: Activation/output (can be changed with: 4008/E/B: ▲▼ UF Rate, 4008 H/S: +/-)

CPU 1: COMBINATION

CPU 1_COMBI: V24
Valve 24
Activation, P.C.B. LP 634/IC 10/19
Acknowledgement, P.C.B. LP 633/IC 13/5

CPU 1_COMBI: V24b
Valve 24b
Activation, P.C.B. LP 634/IC 10/13
Acknowledgement, P.C.B. LP 633/IC 13/4

CPU 1_COMBI: V26
Valve 26
Activation, P.C.B. LP 634/IC 10/18
Acknowledgement, P.C.B. LP 633/IC 13/3

CPU 1_COMBI: V43
Valve 43
Activation, P.C.B. LP 634/IC 7/15
Acknowledgement, P.C.B. LP 633/IC 13/2

CPU 1_COMBI: V102
Valve 102
Activation, P.C.B. LP 634/IC 10/12
Acknowledgement, P.C.B. LP 633/IC 21/4
(Activation of the valve is possible only if a mandatory rinse is not requested)

CPU 1_COMBI: UF1_PUMP
UF pump 1
Activation, P.C.B. LP 634/IC 4/14
Acknowledgement, P.C.B. LP 633/IC 13/6
(when setting from 0 to 1 = 1 stroke; acknowledgement is a brief change to 1)

CPU 1_COMBI: AIR_SEP
Switching the ASP on/off

CPU 1_COMBI: V104
Valve 104
Activation, P.C.B. LP 634/IC 7/14
Acknowledgement, P.C.B. LP 633/IC 21/5
(Activation of the valve is possible only if a mandatory rinse is not requested)
5.12 ONLINEplus™ module

- ONLINE-PLUS-MODUL
  - Confirm key
  - READ INPUTS
    - Confirm key
  - WRITE OUTPUTS
    - Confirm key
    - back to menu?
      - Confirm key
  - WRITE ANALOG OUTPUTS
    - Confirm key
  - WRITE DIGITAL OUTPUTS
    - Confirm key
    - back to menu?
      - Confirm key

- READ ANALOG INPUTS
  - Confirm key

- READ DIGITAL INPUTS
  - Confirm key
  - back to menu?
    - Confirm key

- WRITE ANALOG OUTPUTS
  - Confirm key
  - not yet implemented

- WRITE DIGITAL OUTPUTS
  - Confirm key
  - A: ONL+_ONL1 (V193)
    - P.C.B. LP 785 X1/6a
      - valve Online 1 V193

  - A: ONL+_ONL2 (V192)
    - P.C.B. LP 785 X1/7a
      - valve Online 2 V192

  - A: ONL+_ONL3 (V191)
    - P.C.B. LP 785 X1/8a
      - valve Online 3 V191
  - back to menu?
    - Confirm key
5.13 HPU

READ ANALOG INPUTS
- Confirm key

READ DIGITAL INPUTS
- Confirm key

WRITE ANALOG OUTPUTS
- Confirm key

WRITE DIGITAL OUTPUTS
- Confirm key

back to menu?
- Confirm key

A: WTR_AIR_P
Compressor 185

A: WTR_TEST
Test valve V183

A: WTR_V39
Negative pressure valve V39

A: WTR_RETENT_V
Retentate valve V189

A: WTR_V_EVAC_INDI
not implemented

A: WTR_V_EVAC_SOD
Evacuation valve V188

back to menu?
- Confirm key
# Table of contents

## 6 Setup menu

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<td>Overview</td>
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<td>Main menu 4008 E/B</td>
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<tr>
<td>6.4</td>
<td>Main menu 4008 H/S</td>
<td>6-37</td>
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</tbody>
</table>
## 6.1 Overview Setup menu settings

<table>
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<th>Menu item</th>
<th>Submenu</th>
<th>Default value</th>
<th>Value range</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>SET ALARM/WARN TIME</td>
<td>Set ART-AL DELAYTIME</td>
<td>5 sec</td>
<td>0 – 5 sec</td>
<td>1 sec</td>
</tr>
<tr>
<td></td>
<td>Set VEN-AL DELAYTIME</td>
<td>5 sec</td>
<td>0 – 5 sec</td>
<td>1 sec</td>
</tr>
<tr>
<td></td>
<td>Set FLOW-OFF W-TIME</td>
<td>30 min</td>
<td>30 – 60 min</td>
<td>15 min</td>
</tr>
<tr>
<td></td>
<td>Set UF-WARNING-TIME</td>
<td>10 min</td>
<td>10/30 min</td>
<td>20 min</td>
</tr>
<tr>
<td></td>
<td>Set MUTE-TIME</td>
<td>1 min</td>
<td>1 – 2 min</td>
<td>1 min</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Menu item</th>
<th>Submenu</th>
<th>Default value</th>
<th>Value range</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>SETUP CLEANING PGM</td>
<td>Cleaning Times</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rinsing TIME</td>
<td>15 min</td>
<td>5 – 30 min</td>
<td>1 min</td>
</tr>
<tr>
<td></td>
<td>Hotrinse TIME</td>
<td>15 min</td>
<td>15 – 30 min</td>
<td>1 min</td>
</tr>
<tr>
<td></td>
<td>Disinfection TIME</td>
<td>10 min</td>
<td>10 – 20 min</td>
<td>1 min</td>
</tr>
<tr>
<td></td>
<td>Rinsing Free TIME</td>
<td>CPU1: DIP switch array 1, SW8 set to OFF (Test flow 800 ml/min) 3 min 3 – 10 min 1 min for CDS: 5 min 5 – 10 min 1 min</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CPU1: DIP switch array 1, SW8 set to ON (Test flow 500 ml/min) 4 min 4 – 10 min 1 min for CDS: 6 min 6 – 10 min 1 min</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hot-Disinf TIME</td>
<td>10 min</td>
<td>10 – 20 min</td>
<td>1 min</td>
</tr>
<tr>
<td></td>
<td>Mandatory Rinse TIME</td>
<td>CPU1: DIP switch array 1, SW8 set to OFF (Test flow 800 ml/min) 15 min 15 – 30 min 1 min for ON-LINE-HDF: 20 min 20 – 30 min 1 min for ONLINEplus™: 17 min 17 – 30 min 1 min</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CPU1: DIP switch array 1, SW8 set to ON (Test flow 500 ml/min) 15 min 15 – 30 min 1 min for ON-LINE-HDF: 20 min 20 – 30 min 1 min for ONLINEplus™: 20 min 20 – 30 min 1 min</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CITRO-Mandat-Ri-Time</td>
<td>CPU1: DIP switch array 1, SW8 set to OFF (Test flow 800 ml/min) 10 min 10 – 25 min 1 min for ON-LINE-HDF: 20 min 20 – 25 min 1 min for ONLINEplus™: 17 min 17 – 25 min 1 min</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CPU1: DIP switch array 1, SW8 set to ON (Test flow 500 ml/min) 10 min 10 – 25 min 1 min for ON-LINE-HDF: 20 min 20 – 25 min 1 min for ONLINEplus™: 20 min 20 – 25 min 1 min</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>INTEGRATED-HR Time</td>
<td>15 min</td>
<td>15 – 40 min</td>
<td>1 min</td>
</tr>
</tbody>
</table>

Continued on the next page
### Menu item: SETUP CLEANING PGM

<table>
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<tr>
<th>Submenu</th>
<th>Default value</th>
<th>Selectable options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PgM COMBINATION</strong></td>
<td>PGM 1: –R--</td>
<td>PGM 2: –R-- endless</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>RINSE Pgm</strong></td>
<td>PGM 1: –R--</td>
<td>PGM 2: –R-- endless</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>HOTRINSE Program</strong></td>
<td>PGM 1: –F--HR--C--</td>
<td>PGM 2: –F--HR--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PGM 3: –IHR--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PGM 4: –IHR--C--</td>
</tr>
<tr>
<td><strong>DISINFECTION Pgm</strong></td>
<td>PGM 2: –F--HDIS--M--</td>
<td>PGM 1: –F--D--M--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PGM 2: –F--HDIS--M--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PGM 3: –F--D--M--HR--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PGM 4: –F--HDIS--M--HR--</td>
</tr>
</tbody>
</table>

#### DEFAULT Cleaning Pgm

<table>
<thead>
<tr>
<th>Submenu</th>
<th>Default value</th>
<th>Selectable options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>only for 4008 E/B</strong></td>
<td>PGM 1: –R--</td>
<td>PGM 2: –R-- endless</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PGM 3: –IHR--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PGM 4: –IHR--C--</td>
</tr>
</tbody>
</table>

### Menu item: SETUP DILUTION

<table>
<thead>
<tr>
<th>Submenu</th>
<th>Default value</th>
<th>Selectable options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>canister</strong></td>
<td>canister 1+34</td>
<td>canister 1+34 C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>canister 1+44 C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>canister 1+44 ACF</td>
</tr>
</tbody>
</table>

#### CDS

<table>
<thead>
<tr>
<th>Submenu</th>
<th>Default value</th>
<th>Value range</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VARIABLE SETTING</strong></td>
<td>–</td>
<td>0.800 – 2.500</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>–</td>
<td>30.000 – 45.000</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>–</td>
<td>25 – 45</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>–</td>
<td>25 – 80</td>
<td>1</td>
</tr>
</tbody>
</table>

### Menu item: HDF-DILUTION

<table>
<thead>
<tr>
<th>Submenu</th>
<th>Default value</th>
<th>Selectable options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>only for ON-LINE-HDF</strong></td>
<td>HDF--PRE--dilution</td>
<td>HDF--PRE--dilution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HDF--POST--dilution</td>
</tr>
</tbody>
</table>

### Menu item: SET CONDUCT. LIMIT

<table>
<thead>
<tr>
<th>Submenu</th>
<th>Default value</th>
<th>Value range</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cd Limit</strong></td>
<td>12.8 mS/cm</td>
<td>12.8 – 14.0 mS/cm</td>
<td>0.1 mS/cm</td>
</tr>
</tbody>
</table>

### Menu item: INFO SOUND ( C-PGM )

<table>
<thead>
<tr>
<th>Submenu</th>
<th>Default value</th>
<th>Selectable options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Info-Sound</strong></td>
<td>Info-Sound: ON</td>
<td>Info-Sound: ON</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Info-Sound: OFF</td>
</tr>
<tr>
<td>Menu item</td>
<td>Submenu</td>
<td>Default value</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td><strong>SET DIAL PARAMETERS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SET Flow Parameter</td>
<td>Flow [ml/min]: 500</td>
<td>500 ml/min</td>
</tr>
<tr>
<td>SET Temp. Parameter</td>
<td>Temp. [°C]: 37.0</td>
<td>37 °C</td>
</tr>
<tr>
<td>SET Na/Bic Parameter</td>
<td>Base Na+ 135 mmol</td>
<td>135 mmol</td>
</tr>
<tr>
<td></td>
<td>Prescr. Na+ 135 mmol</td>
<td>135 mmol</td>
</tr>
<tr>
<td></td>
<td>Bicarbonate ±10 mmol</td>
<td>0 mmol</td>
</tr>
<tr>
<td></td>
<td>Limit Na/Base: 13 mmol only for 4008 H/S</td>
<td>13 mmol</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Menu item</th>
<th>Submenu</th>
<th>Default value</th>
<th>Selectable options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DIALYSIS TIME</strong></td>
<td></td>
<td></td>
<td>Effect. dialysis time</td>
</tr>
<tr>
<td>only for 4008 E/B</td>
<td></td>
<td></td>
<td>Effect. dialysis time</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>UF time</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Menu item</th>
<th>Submenu</th>
<th>Default value</th>
<th>Selectable options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CALC.CUMUL.BLOOD-VOL</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>only for BVM (option) and 4008</td>
<td></td>
<td></td>
<td>during seq DIAL: YES</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>during seq DIAL: YES</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>during seq DIAL: NO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Menu item</th>
<th>Submenu</th>
<th>Default value</th>
<th>Selectable options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HAEMOGLOBIN UNIT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>only for BVM (option) and 4008</td>
<td></td>
<td></td>
<td>g/dl</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>mmol/l</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Menu item</th>
<th>Submenu</th>
<th>Default value</th>
<th>Selectable options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OCM SETTINGS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>only for OCM (option) and 4008 H/S</td>
<td>OCM MEASUREMENT</td>
<td>OCM Measurement: OFF</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Default value</td>
<td>Value range</td>
<td>Resolution</td>
</tr>
<tr>
<td></td>
<td>OCM MEASURE DEL. TIME</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4008 H with advanced hydraulics:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15 sec</td>
<td>1 – 70 sec</td>
<td>1 sec</td>
</tr>
<tr>
<td></td>
<td>4008 H with ONLINEPlus™:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>65 sec</td>
<td>1 – 70 sec</td>
<td>1 sec</td>
</tr>
<tr>
<td></td>
<td>4008 S with advanced hydraulics:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>18 sec</td>
<td>1 – 70 sec</td>
<td>1 sec</td>
</tr>
<tr>
<td></td>
<td>4008 S with ONLINEPlus™:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>67 sec</td>
<td>1 – 70 sec</td>
<td>1 sec</td>
</tr>
<tr>
<td></td>
<td>OCM KT/V WARNLEVEL</td>
<td>85 %</td>
<td>0 – 99 %</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Menu item</th>
<th>Submenu</th>
<th>Default value</th>
<th>Selectable options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AUTOM. SN-START</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>autom. SN: OFF</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>autom. SN: OFF</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>autom. SN: ON</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Menu item</th>
<th>Submenu</th>
<th>Default value</th>
<th>Selectable options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACTIV. MONIT_NTC109</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>MONIT_NTC109: YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>MONIT_NTC109: NO</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>MONIT_NTC109: NO</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Menu item</th>
<th>Submenu</th>
<th>Default value</th>
<th>Selectable options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACTIV. STD UF-DATA</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>std UF-DATA: NO</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>std UF-DATA: NO</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>std UF-DATA: YES</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Menu item</th>
<th>Submenu</th>
<th>Default value</th>
<th>Value range</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SET STD. PRIME-TIME</strong></td>
<td></td>
<td>Prime-Time = 2 min</td>
<td>2 min</td>
<td>1 – 5 min</td>
</tr>
</tbody>
</table>
### Menu item Submenu Default value Selectable options

<table>
<thead>
<tr>
<th>Menu item</th>
<th>Submenu</th>
<th>Default value</th>
<th>Selectable options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SOUND I/O-SWITCH</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>I/O-Warnsound: ON</td>
<td>I/O-Warnsound: ON, I/O-Warnsound: OFF</td>
</tr>
<tr>
<td><strong>SET KEY-CCLICK</strong></td>
<td>only for 4008 H/S</td>
<td>key-click: ON</td>
<td>key-click: ON, key-click: OFF</td>
</tr>
<tr>
<td><strong>BPR/UFR-WARNING</strong></td>
<td></td>
<td>BPR/UFR-Warning: ON</td>
<td>BPR/UFR-Warning: ON, BPR/UFR-Warning: OFF</td>
</tr>
<tr>
<td><strong>SET RINSE-VOLUME</strong></td>
<td></td>
<td>Rinse-VOL: 1000 ml</td>
<td>Value range 0 – 5000 ml, Resolution 100 ml</td>
</tr>
<tr>
<td><strong>T1-TEST AUTOSTART</strong></td>
<td></td>
<td>T1-T. Autostart: OFF</td>
<td>T1-T. Autostart: OFF, T1-T. Autostart: ON</td>
</tr>
<tr>
<td><strong>ONLINE plus SETTINGS</strong></td>
<td>only for ONLINEplus™ (option)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONLINE plus HD</td>
<td>SET UF-Volume F/R</td>
<td>0 ml</td>
<td>Value range 0 – 1000 ml, Resolution 100 ml</td>
</tr>
<tr>
<td></td>
<td>SET Rinsing Volume</td>
<td>1000 ml</td>
<td>Value range 0 – 5000 ml, Resolution 100 ml</td>
</tr>
<tr>
<td>ONLINE plus HDF</td>
<td>SET UF-Volume F/R</td>
<td>500 ml</td>
<td>Value range 0 – 1000 ml, Resolution 100 ml</td>
</tr>
<tr>
<td></td>
<td>SET Rinsing Volume</td>
<td>1000 ml</td>
<td>Value range 0 – 5000 ml, Resolution 100 ml</td>
</tr>
<tr>
<td>ONLINE plus HF</td>
<td>SET UF-Volume F/R</td>
<td>1000 ml</td>
<td>Value range 0 – 5000 ml, Resolution 100 ml</td>
</tr>
<tr>
<td></td>
<td>SET Rinsing Volume</td>
<td>1000 ml</td>
<td>Value range 0 – 5000 ml, Resolution 100 ml</td>
</tr>
<tr>
<td>ONLINE plus MISC.</td>
<td>SET Reinf.-Volume</td>
<td>240 ml</td>
<td>Value range 90 – 480 ml, Resolution 30 ml</td>
</tr>
<tr>
<td><strong>SET CENTRAL-DELIVERY</strong></td>
<td></td>
<td>NO central-delivery</td>
<td>NO central-delivery, central Bic, central Acid, central Acid + Bic, centr acetate-supply</td>
</tr>
<tr>
<td><strong>AutoOFF after AutoON</strong></td>
<td></td>
<td>OFF</td>
<td>OFF, ON</td>
</tr>
<tr>
<td><strong>Init. CAMUS-baudrate</strong></td>
<td></td>
<td>2400 baud</td>
<td>2400 baud, 9600 baud</td>
</tr>
<tr>
<td><strong>STORE DEFAULT VALUES</strong></td>
<td></td>
<td></td>
<td>Press OVERRIDE only for 4008 E/B, Press ALARMTONE MUTE only for 4008 H/S</td>
</tr>
</tbody>
</table>

---

**Fresenius Medical Care 4008 5/03.09 (TM)**
6.2 Overview

CALIBRATION

▲▼

DIAGNOSTICS

▲▼

MISCELLANEOUS

▲▼

SETUP MENU

Confirm key

▲▼
6.3 Main menu 4008 E/B

SETUP MENU

- SET ALARM/WARN TIME
  - Confirm key
  - see Part 1

- SETUP CLEANING PGM
  - Confirm key
  - see Part 2

- SETUP DILUTION
  - Confirm key
  - see Part 3

- HDF-DILUTION
  - Confirm key
  - see Part 4 (optional)

- SET CONDUCT. LIMIT
  - Confirm key
  - see Part 5

- INFO SOUND (C-PGM)
  - Confirm key
  - see Part 6

- SET DIAL PARAMETERS
  - Confirm key
  - see Part 7

- DIALYSIS TIME
  - Confirm key
  - see Part 8

- CALC.CUMUL.BLOOD-VOL
  - Confirm key
  - see Part 9

- AUTOM. SN-START
  - Confirm key
  - see Part 10

- ACTIV. MONIT.NTC109
  - Confirm key
  - see Part 11

- ACTIV. STD UF-DATA
  - Confirm key
  - see Part 12

- SET STD. PRIME-TIME
  - Confirm key
  - see Part 13

- SOUND I/O-SWITCH
  - Confirm key
  - see Part 14

- BPR/UFR-WARNING
  - Confirm key
  - see Part 15

- SET RINSE-VOLUME
  - Confirm key
  - see Part 16

- T1-TEST AUTOSTART
  - Confirm key
  - see Part 17

- ONLINE plus SETTINGS
  - Confirm key
  - see Part 18 (optional)

- SET CENTRAL-DELIVERY
  - Confirm key
  - see Part 19

- AUTOFF after AUTOON
  - Confirm key
  - see Part 20

- Init. CAMUS-baudrate
  - Confirm key
  - see Part 21

- STORE DEFAULT VALUES
  - Confirm key
  - see Part 22

- BACK TO MAIN MENU ?
  - Confirm key
Part 1: Setting the alarm and warning time

1. SET ALARM/WARN TIME
   - Confirm key
   - Set ART-AL DELAYTIME
     - ▲▼
   - Set VEN-AL DELAYTIME
     - ▲▼
   - Set FLOW-OFF W-TIME
     - ▲▼
   - Set UF-WARNING-TIME
     - ▲▼
   - Set MUTE-TIME
     - ▲▼
   - back to menu ?

   Part 1.1: Setting the delay time of the arterial alarm
   - Set ART-AL DELAYTIME
     - Confirm key
     - Art Al Delay = 5s
     - Select key
     - Set the desired delay time (0 to 5 sec) by pressing the ▲▼ keys.
     - Override key
     - DATA STORED
     - After approx. 3 sec

   Part 1.2: Setting the delay time of the venous alarm
   - Set VEN-AL DELAYTIME
     - Confirm key
     - Ven Al Delay = 5s
     - Select key
     - Set the desired delay time (0 to 5 sec) by pressing the ▲▼ keys.
     - Override key
     - DATA STORED
     - After approx. 3 sec
• Part 1.3: Setting the flow-off warning time

Set FLOW-OFF W-TIME

Confirm key

Flow-Off-T = 30min

Select key

Set the desired warning time (30, 45, 60 min) by pressing the ▲▼ keys.

Override key

DATA STORED

After approx. 3 sec

• Part 1.4: Setting the UF warning time

Set UF-WARNING-TIME

Confirm key

UF-Warn-Time = 10min

Select key

Set the desired warning time (10, 30 min) by pressing the ▲▼ keys.

Override key

DATA STORED

After approx. 3 sec

• Part 1.5: Setting the mute time

Set MUTE-TIME

Confirm key

MUTE-Time = 1min

Select key

Set the desired time (1, 2 min) by pressing the ▲▼ keys.

Override key

DATA STORED

After approx. 3 sec
Part 2: Setting up the cleaning program

Part 2.1: Cleaning times

Note
The default values and the adjustable range for the cleaning times are not indicated, as they depend on the particular system options.
- **Part 2.1.1: Rinsing time**

Rinsing TIME

- Confirm key

Rinsing Time = xxmin

- Set the desired time by pressing the ▲▼ keys.
- Override key

DATA STORED

- After approx. 3 sec

- **Part 2.1.2: Hot rinsing time**

Hotrinse TIME

- Confirm key

H-Rinse Time = xxmin

- Set the desired time by pressing the ▲▼ keys.
- Override key

DATA STORED

- After approx. 3 sec

- **Part 2.1.3: Disinfection time**

Disinfection TIME

- Confirm key

Disinf. Time = xxmin

- Set the desired time by pressing the ▲▼ keys.
- Override key

DATA STORED

- After approx. 3 sec
• Part 2.1.4: Rinsing free time

Rinsing Free TIME

Confirm key

R.-Free Time = xmin

Select key

Override key

Set the desired time by pressing the ▲▼ keys.

DATA STORED

After approx. 3 sec

• Part 2.1.5: Hot disinfection time

Hot-Disinf TIME

Confirm key

H-Disinf Time = XXmin

Select key

Override key

Set the desired time by pressing the ▲▼ keys.

DATA STORED

After approx. 3 sec

• Part 2.1.6: Mandatory rinse time

Mandatory Rinse TIME

Confirm key

M-Rinse Time = XXmin

Select key

Override key

Set the desired time by pressing the ▲▼ keys.

DATA STORED

After approx. 3 sec
• Part 2.1.7: Citro mandatory rinse time

CITRO Mandat-Ri-Time

→ Confirm key

CITRO-MRTime = xxmin

→ Select key

→ Set the desired time by pressing the ▲▼ keys.

→ Override key

DATA STORED

→ After approx. 3 sec

• Part 2.1.8: Integrated hot rinse time

INTEGRATED-HR Time

→ Confirm key

INT. HR-Time = xxmin

→ Select key

→ Set the desired time by pressing the ▲▼ keys.

→ Override key

DATA STORED

→ After approx. 3 sec
• Part 2.2: Cleaning program combination
**Part 2.2.1: Rinse program**

Rinse Pgm

Confirm key

PGM 1: –R–

Override key

Select key

DATA STORED

After approx. 3 sec

PGM 2: –R– endless

Override key

Select key

DATA STORED

After approx. 3 sec

**Part 2.2.2: Hot rinse program**

HOTRINSE Program

Confirm key

PGM 1: –F–HR–C–

Override key

Select key

DATA STORED

After approx. 3 sec

PGM 2: –F–HR–

Override key

Select key

DATA STORED

After approx. 3 sec

PGM 3: –IHR–

Override key

Select key

DATA STORED

After approx. 3 sec

PGM 4: –IHR–C–

Override key

Select key

DATA STORED

After approx. 3 sec

**Part 2.2.3: Disinfection program**

DISINFECTION Pgm

Confirm key

PGM 2: –F–HDIS–M–

Override key

Select key

DATA STORED

After approx. 3 sec

PGM3: –F–D–M–HR–

Override key

Select key

DATA STORED

After approx. 3 sec

PGM4: –F–HDIS–M–HR–

Override key

Select key

DATA STORED

After approx. 3 sec

PGM1: –F–D–M–

Override key

Select key

DATA STORED

After approx. 3 sec
**Part 3: Mixing ratio with „NO central-delivery“, „central Bic“ (setting ➔ Part 19)**

**Setup Dilution**

- Confirm key
- Override key
- Select key
- DATA STORED After approx. 3 sec

1+34

1+35.83 (NaCl 20)

1+35.83 (NaCl 26)

1+35.83 (Belgium)

1+44 C

1+44 ACF

**Variable Setting**

- Confirm key
- see Part 3.1

**Part 3: Mixing ratio with „central Acid“, „central Acid + Bic“ (setting ➔ Part 19)**

**Setup Dilution**

- Confirm key
- Override key
- Select key
- DATA STORED After approx. 3 sec

Canister 1+34

CDS 1+34

1+35.83 (NaCl 20)

1+35.83 (NaCl 26)

1+35.83 (Belgium)

Canister 1+44 C

1+35.83 (NaCl 20)

1+35.83 (NaCl 26)

1+35.83 (Belgium)

Canister 1+44 ACF

CDS 1+44 ACF

CDS 1+44 C

**Variable Setting**

- Confirm key
- see Part 3.1
Part 3: Mixing ratio with „centr acetate-supply“ (setting ➔ Part 19)
● Part 3.1: Programmable mixing ratio (dilution)

**Caution**
The operator or technician is informed about his duty of care to enter the component parameters and settings correctly or to check them and to set the CD alarm window to the expected conductivity value. When using the programmable mixing ratio (dilution), make sure to use the right concentrate. Using a biog® in combination with the programmable mixing ratio (dilution) is not allowed. Only enter authorized, programmable mixing ratios (dilutions).
● Part 4: Setting the HDF dilution – only for ON-LINE-HDF (option)

![Diagram of HDF-DILUTION settings](image)

- HDF-DILUTION
  - Confirm key
  - HDF-PRE-dilution
    - Override key
    - Select key
    - DATA STORED
    - After approx. 3 sec
  - HDF-POST-dilution
    - Override key
    - Select key
    - DATA STORED
    - After approx. 3 sec

● Part 5: Setting the conductivity limit

![Diagram of SET CONDUCT. LIMIT settings](image)

- SET CONDUCT. LIMIT
  - Confirm key
  - Cd Limit: 12.8 mS/cm
    - Select key
    - Set the desired value (12.8 to 14.0 mS/cm)
      by pressing the ▲▼ keys.
    - Override key
    - DATA STORED
    - After approx. 3 sec

● Part 6: Infosound cleaning program

![Diagram of INFO SOUND (C-PGM) settings](image)

- INFO SOUND (C-PGM)
  - Confirm key
  - Info-Sound: ON
    - Override key
    - Select key
    - DATA STORED
    - After approx. 3 sec
  - Info-Sound: OFF
    - Override key
    - Select key
    - DATA STORED
    - After approx. 3 sec
• Part 7: Setting the dialysis parameters

SET DIAL PARAMETERS

- SET Flow Parameter
  - Confirm key
  - Flow [ml/min]: 500
    - Select key
    - Set the desired value (300, 500, 800) by pressing the ▲▼ keys.
      - OR
      - Value set in Dial.
    - Override key
    - DATA STORED
      - After approx. 3 sec

- SET Temp. Parameter
  - Confirm key
  - Temp. [°C]: 37.0
    - Select key
    - Set the desired value (35.0–39.0) by pressing the ▲▼ keys.
      - OR
      - Value set in Dial.
    - Override key
    - DATA STORED
      - After approx. 3 sec

- SET Na/Bic Parameter
  - Confirm key
  - back to menu?
    - Confirm key
● Part 7.3: Setting the Na/Bic

SET Na/Bic Parameter
Confirm key

Base Na\(^+\) 135mmol
Select key
Set the desired value (125 – 150)
by pressing the ▲▼ keys.
Value set in Dial.
Override key
ACKNOWLEDGED
After approx. 3 sec

Prescr. Na\(^+\) 135mmol
Select key
Set the desired value (125 – 145)
by pressing the ▲▼ keys.
Override key
ACKNOWLEDGED
After approx. 3 sec

Bicarbonate ±0mmol
Select key
Set the desired value (+8 bis –8)
by pressing the ▲▼ keys.
Value set in Dial.
Override key
DATA STORED
After approx. 3 sec
• Part 8: Dialysis time

- DIALYSIS TIME
  - Confirm key
  - Effect Dialysis Time
    - Override key
    - Select key
  - UF-Time
    - Override key
    - Select key
  - DATA STORED
    - After approx. 3 sec

• Part 9: Cumulated blood volume

- CALC.CUMUL.BLOOD-VOL
  - Confirm key
  - during seq DIAL: YES
    - Override key
    - Select key
  - during seq DIAL: NO
    - Override key
    - Select key
  - DATA STORED
    - After approx. 3 sec

• Part 10: Automatic Single-Needle start

- AUTOM. SN-START
  - Confirm key
  - autom. SN: OFF
    - Override key
    - Select key
  - autom. SN: ON
    - Override key
    - Select key
  - DATA STORED
    - After approx. 3 sec

• Part 11: Activation of Monit_NTC 109

- ACTIV. MONIT_NTC109
  - Confirm key
  - MONIT_NTC109: YES
    - Override key
    - Select key
  - MONIT_NTC109: NO
    - Override key
    - Select key
  - DATA STORED
    - After approx. 3 sec
Part 12: Activation of standard UF data

ACTIV. STD UF-DATA

- Confirm key
- std UF-DATA: NO
- Override key
- std UF-DATA: YES
- Override key
- DATA STORED
- After approx. 3 sec

UF-Rate: 750 ml/h
UF-Goal: 3000 ml
Time Left: 4 h

Part 13: Setting the priming time

SET STD. PRIME-TIME

- Confirm key
- Prime-Time = 2 min
- Select key
- DATA STORED
- After approx. 3 sec

Set the desired time (1 to 5 min) by pressing the ▲▼ keys.

Part 14: Warning sound I/O key

SOUND I/O SWITCH

- Confirm key
- I/O-Warnsound: ON
- Override key
- DATA STORED
- After approx. 3 sec
- Select key
- I/O-Warnsound: OFF
- Override key
- DATA STORED
- After approx. 3 sec
- Select key
- After approx. 3 sec
- **Part 15: Setting the BPR/UFR warning**

```
BPR/UFR–WARNING
  Confirm key
  BPR/UFR–Warning: ON
    Override key
    Select key
    DATA STORED
    After approx. 3 sec
  BPR/UFR–Warning: OFF
    Override key
    Select key
    DATA STORED
    After approx. 3 sec
```

- **Part 16: Setting the rinse volume**

```
SET RINSE-VOLUME
  Confirm key
  RINSE-VOL: 1000 ml
    Select key
    Set the desired value
    (0 – 5000
      in 100 ml increments)
    by pressing the ▲▼ keys.
    Override key
    DATA STORED
    After approx. 3 sec
```

- **Part 17: T1 test autostart**

```
T1-TEST AUTOSTART
  Confirm key
  T1-T. Autostart: OFF
    Override key
    Select key
    DATA STORED
    After approx. 3 sec
  T1-T. Autostart: ON
    Override key
    Select key
    DATA STORED
    After approx. 3 sec
```
Part 18: ONLINEplus™ settings – only for ONLINEplus™ (option)
- Part 18.1: ONLINEplus™ HD

- Part 18.1.1: Setting the UF volume (filling/rinsing)

- Part 18.1.2: Setting the rinse volume
● Part 18.2: ONLINEplus™ HDF

ONLINE plus HDF

SET UF-Volume F/R

▲▼

SET Rinsing Volume

▲▼

SET Substit.-Volume

▲▼

back to menu ?

● Part 18.2.1: Setting the UF volume (filling/rinsing)

SET UF-Volume F/R

Confirm key

Volume[ml]: 500

Select key

Set the desired value (0 – 1000) by pressing the ▲▼ keys.

Override key

DATA STORED

After approx. 3 sec

● Part 18.2.2: Setting the rinse volume

SET Rinsing Volume

Confirm key

Volume[ml]: 1000

Select key

Set the desired value (0 – 5000) by pressing the ▲▼ keys.

Override key

DATA STORED

After approx. 3 sec
Part 18.2.3: Setting the substitute volume

1. Press the **Confirm key**
2. Set the desired value (0 – 210) by pressing the ▲▼ keys.
3. Press the **Override key**
4. Press the **Select key**
5. After approx. 3 sec, the volume is stored.
Part 18.3: ONLINEplus™ HF

- **Part 18.3.1: Setting the UF volume (filling/rinsing)**

- **Part 18.3.2: Setting the rinse volume**
Part 18.3.3: Setting the substitute volume

- SET Substit.-Volume
  - Confirm key
  - Volume: 20
    - Select key
      - Set the desired value (0 – 210) by pressing the ▲▼ keys.
      - Override key
  - DATA STORED
    - After approx. 3 sec

After approx. 3 sec
Part 18.4: ONLINE plus™ miscellaneous

Part 18.4.1: Setting the reinfusion volume
- Part 19: Setting the parameters for central delivery system

- Part 20: AutoOFF after AutoON

- Part 21: CAMUS-baudrate
Part 22: Storing the default values

Store default values by pressing the Override key.

After approx. 3 sec
6.4 Main menu 4008 H/S
Part 1: Setting the alarm and warning time

- SET ALARM/WARN TIME
  - Confirm key
  - Set ART-AL DELAYTIME
  - Confirm key → see Part 1.1
  - ▲▼
  - Set VEN-AL DELAYTIME
  - Confirm key → see Part 1.2
  - ▲▼
  - Set FLOW-OFF W-TIME
  - Confirm key → see Part 1.3
  - ▲▼
  - Set UF-WARNING-TIME
  - Confirm key → see Part 1.4
  - ▲▼
  - Set MUTE-TIME
  - Confirm key → see Part 1.5
  - ▲▼
  - back to menu?
    - Confirm key

Part 1.1: Setting the delay time of the arterial alarm

- Set ART-AL DELAYTIME
  - Confirm key
  - Art Al Delay = 5s
  - Esc key
  - Set the desired delay time (0 to 5 sec) by pressing the +/- keys.
  - Tone Mute key
  - DATA STORED
    - After approx. 3 sec

Part 1.2: Setting the delay time of the venous alarm

- Set VEN-AL DELAYTIME
  - Confirm key
  - Ven Al Delay = 5s
  - Esc key
  - Set the desired delay time (0 to 5 sec) by pressing the +/- keys.
  - Tone Mute key
  - DATA STORED
    - After approx. 3 sec
● Part 1.3: Setting the flow-off warning time

Set FLOW-OFF W-TIME

Confirm key

Flow-Off-T = 30 min

Tone Mute key

DATA STORED

After approx. 3 sec

Set the desired warning time (30, 45, 60 min) by pressing the +/- keys.

● Part 1.4: Setting the UF warning time

Set UF-WARNING-TIME

Confirm key

UF-Warn-Time = 10 min

Tone Mute key

DATA STORED

After approx. 3 sec

Set the desired warning time (10, 30 min) by pressing the +/- keys.

● Part 1.5: Setting the mute time

Set MUTE-TIME

Confirm key

MUTE-Time = 1 min

Tone Mute key

DATA STORED

After approx. 3 sec

Set the desired time (1, 2 min) by pressing the +/- keys.
Part 2: Setting up the cleaning program

- Part 2.1: Cleaning times

Note
The default values and the adjustable range for the cleaning times are not indicated, as they depend on the particular system options.
● Part 2.1.1: Rinsing time

- Rinsing Time
  - Confirm key
  - Rinsing Time = xxmin
  - Set the desired time by pressing the +/- keys.
  - Tone Mute key
  - DATA STORED
  - After approx. 3 sec

- Esc key

● Part 2.1.2: Hot rinsing time

- Hotrinse Time
  - Confirm key
  - H-Rinse Time = xxmin
  - Set the desired time by pressing the +/- keys.
  - Tone Mute key
  - DATA STORED
  - After approx. 3 sec

- Esc key

● Part 2.1.3: Disinfection time

- Disinfection Time
  - Confirm key
  - Disinf. Time = xxmin
  - Set the desired time by pressing the +/- keys.
  - Tone Mute key
  - DATA STORED
  - After approx. 3 sec

- Esc key
• Part 2.1.4: Rinsing free time

Rinsing Free TIME

Confirm key

R.-Free Time = xmin

Set the desired time by pressing the +/– keys.

Tone Mute key

DATA STORED

After approx. 3 sec

• Part 2.1.5: Hot disinfection time

Hot-Disinf TIME

Confirm key

H-Disinf Time = xxmin

Set the desired time by pressing the +/– keys.

Tone Mute key

DATA STORED

After approx. 3 sec

• Part 2.1.6: Mandatory rinse time

Mandatory Rinse TIME

Confirm key

M-Rinse Time = xxmin

Set the desired time by pressing the +/– keys.

Tone Mute key

DATA STORED

After approx. 3 sec
• Part 2.1.7: Citro mandatory rinse time

- CITRO Mandat-Ri-Time
  - Confirm key
  - CITRO-MRTime = xxmin
  - Set the desired time by pressing the +/- keys.
  - Tone Mute key
  - DATA STORED
  - After approx. 3 sec

- CITRO-MRTime = xxmin
  - Esc key

• Part 2.1.8: Integrated hot rinsing time

- INTEGRATED-HR Time
  - Confirm key
  - INT. HR-Time = xxmin
  - Set the desired time by pressing the +/- keys.
  - Tone Mute key
  - DATA STORED
  - After approx. 3 sec
Part 2.2: Setting the default cleaning program

DEFAULT Cleaning Pgm

- Confirm key

PGM 1: –R–
  - Tone Mute key
  - Esc key

PGM 2: –R– endless
  - Tone Mute key
  - Esc key

PGM 1: –F–HR–C–
  - Tone Mute key
  - Esc key

PGM 2: –F–HR–
  - Tone Mute key
  - Esc key

PGM 3: –IHR–
  - Tone Mute key
  - Esc key

PGM 4: –IHR–C–
  - Tone Mute key
  - Esc key

PGM 1: –F–D–M–
  - Tone Mute key
  - Esc key

PGM 2: –F–HDIS–M–
  - Tone Mute key
  - Esc key

PGM 3: –F–D–M–HR–
  - Tone Mute key
  - Esc key

PGM 4: –F–HDIS–M–HR–
  - Tone Mute key
  - Esc key

DATA STORED After approx. 3 sec

Tone Mute key
Esc key
• Part 3: Mixing ratio with „NO central-delivery“, „central Bic“ (setting → Part 21)

![Diagram of setup dilution](image)

- **Setup Dilution**
  - Canister 1+34
    - Tone Mute key
    - Esc key
    - Data Stored
    - After approx. 3 sec
  - 1+35.83 (NaCl 20)
    - Tone Mute key
    - Esc key
    - Data Stored
    - After approx. 3 sec
  - 1+35.83 (NaCl 26)
    - Tone Mute key
    - Esc key
    - Data Stored
    - After approx. 3 sec
  - 1+35.83 (Belgium)
    - Tone Mute key
    - Esc key
    - Data Stored
    - After approx. 3 sec
  - Canister 1+44 C
    - Tone Mute key
    - Esc key
    - Data Stored
    - After approx. 3 sec
  - Canister 1+44 ACF
    - Tone Mute key
    - Esc key
    - Data Stored
    - After approx. 3 sec

- **Variable Setting**
  - confirm key
  - see Part 3.1

• Part 3: Mixing ratio with „central Acid“, „central Acid + Bic“ (setting → Part 21)

![Diagram of setup dilution](image)

- **Setup Dilution**
  - Canister 1+34
    - Tone Mute key
    - Esc key
    - ACKNOWLEDGED
    - CDS 1+34
      - +/−
      - CDS 1+44 C
        - +/−
        - CDS 1+44 ACF
          - +/−
          - Tone Mute key
          - Esc key
          - Data Stored
          - After approx. 3 sec
  - 1+35.83 (NaCl 20)
    - Tone Mute key
    - Esc key
    - ACKNOWLEDGED
    - CDS 1+34
      - +/−
      - CDS 1+44 C
        - +/−
        - CDS 1+44 ACF
          - +/−
          - Tone Mute key
          - Esc key
          - Data Stored
          - After approx. 3 sec
  - 1+35.83 (NaCl 26)
    - Tone Mute key
    - Esc key
    - ACKNOWLEDGED
    - CDS 1+34
      - +/−
      - CDS 1+44 C
        - +/−
        - CDS 1+44 ACF
          - +/−
          - Tone Mute key
          - Esc key
          - Data Stored
          - After approx. 3 sec
  - 1+35.83 (Belgium)
    - Tone Mute key
    - Esc key
    - ACKNOWLEDGED
    - CDS 1+34
      - +/−
      - CDS 1+44 C
        - +/−
        - CDS 1+44 ACF
          - +/−
          - Tone Mute key
          - Esc key
          - Data Stored
          - After approx. 3 sec
  - Canister 1+44 C
    - Tone Mute key
    - Esc key
    - ACKNOWLEDGED
    - CDS 1+34
      - +/−
      - CDS 1+44 C
        - +/−
        - CDS 1+44 ACF
          - +/−
          - Tone Mute key
          - Esc key
          - Data Stored
          - After approx. 3 sec
  - Canister 1+44 ACF
    - Tone Mute key
    - Esc key
    - ACKNOWLEDGED
    - CDS 1+34
      - +/−
      - CDS 1+44 C
        - +/−
        - CDS 1+44 ACF
          - +/−
          - Tone Mute key
          - Esc key
          - Data Stored
          - After approx. 3 sec

- **Variable Setting**
  - confirm key
  - see Part 3.1

---

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### Part 3: Mixing ratio with „centr acetate-supply“ (setting ➔ Part 21)

<table>
<thead>
<tr>
<th>Setup Dilution</th>
<th>Confirm Key</th>
<th>Tone Mute Key</th>
<th>CDS 1+34</th>
<th>Tone Mute Key</th>
<th>Esc Key</th>
<th>Data Stored</th>
<th>After approx. 3 sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canister 1+34</td>
<td></td>
<td></td>
<td></td>
<td>CDS 1+34</td>
<td></td>
<td>Data Stored</td>
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</tr>
<tr>
<td>1+35.83 (NaCl 20)</td>
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<td>CDS 1+34</td>
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<td>Data Stored</td>
<td></td>
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<tr>
<td>1+35.83 (Belgium)</td>
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<td></td>
<td></td>
<td>CDS 1+34</td>
<td></td>
<td>Data Stored</td>
<td></td>
</tr>
<tr>
<td>Canister 1+44 C</td>
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<td></td>
<td></td>
<td>CDS 1+34</td>
<td></td>
<td>Data Stored</td>
<td></td>
</tr>
<tr>
<td>Canister 1+44 ACF</td>
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<td></td>
<td></td>
<td>CDS 1+34</td>
<td></td>
<td>Data Stored</td>
<td></td>
</tr>
</tbody>
</table>

**VARIABLE SETTING**

Confirm Key

See Part 3.1
● Part 3.1: Programmable mixing ratio (dilution)

**Caution**
The operator or technician is informed about his duty of care to enter the component parameters and settings correctly or to check them and to set the CD alarm window to the expected conductivity value.
When using the programmable mixing ratio (dilution), make sure to use the right concentrate.
Using a bi*zag*® in combination with the programmable mixing ratio (dilution) is not allowed.
Only enter authorized, programmable mixing ratios (dilutions).
Part 4: Setting the HDF dilution – only for ON-LINE-HDF (option)

Part 5: Setting the conductivity limit

Part 6: Infosound cleaning program
Part 7: Setting the dialysis parameters

- SET DIAL PARAMETERS
  - SET Flow Parameter
    - Flow [ml/min]: 500
      - Set the desired value (300, 500, 800) by pressing the +/- keys.
      - OR
        - Value set in Dial
      - Tone Mute key
    - DATA STORED
      - After approx. 3 sec

- SET Temp. Parameter
  - Temp. [°C]: 37.0
    - Set the desired value (35.0 – 39.0) by pressing the +/- keys.
    - OR
      - Value set in Dial
    - Tone Mute key
  - DATA STORED
    - After approx. 3 sec

Part 7.1: Setting the dialysate flow

- SET Flow Parameter
  - Flow [ml/min]: 500
    - Set the desired value (300, 500, 800) by pressing the +/- keys.
    - OR
      - Value set in Dial
    - Tone Mute key
  - DATA STORED
    - After approx. 3 sec

Part 7.2: Setting the dialysate temperature
Part 7.3: Setting the Na/Bic

- **SET Na/Bic Parameter**
  - Confirm key
  - **Base Na+ 135mmol**
    - Set the desired value (125 – 150) by pressing the +/- keys.
      - OR Value set in Dial
    - Tone Mute key
  - **ACKNOWLEDGED**
  - After approx. 3 sec
  - **Esc key**

- **Prescr. Na+ 135mmol**
  - Set the desired value (125 – 148) by pressing the +/- keys.
    - Tone Mute key
  - **ACKNOWLEDGED**
  - After approx. 3 sec
  - **Esc key**

- **Bicarbonate ±0mmol**
  - Set the desired value (+8 to –8) by pressing the +/- keys.
    - OR Value set in Dial
  - Tone Mute key
  - **ACKNOWLEDGED**
  - After approx. 3 sec
  - **Esc key**

- **Limit Na/Base: 13 mmol**
  - Set the desired value (0 – 13) by pressing the +/- keys.
    - Tone Mute key
  - **DATA STORED**
  - After approx. 3 sec
• Part 8: Cumulated blood volume

CALC.CUMUL.BLOOD-VOL

Confirm key

Tone Mute key
Esc key

DATA STORED
After approx. 3 sec

during seq DIAL: YES

a/--

DATA STORED
After approx. 3 sec

during seq DIAL: NO

a/--

Tone Mute key
Esc key

DATA STORED
After approx. 3 sec

• Part 9: Haemoglobin unit – only for BVM (option)

HAEMOGLOBIN UNIT

Confirm key

Tone Mute key
Esc key

DATA STORED
After approx. 3 sec

g/dl

a/--

DATA STORED
After approx. 3 sec

mmol/l

a/--

DATA STORED
After approx. 3 sec
Part 10: OCM settings – only for OCM (option)
• Part 10.1: Activating the OCM measurement

![Diagram for activating the OCM measurement]

- **OCM MEASUREMENT**
- **Confirm key**
- **OCM Measurement: OFF** (default value: OFF)
- **Tone Mute key**
- **Esc key**
- **DATA STORED**
  - After approx. 3 sec

- **OCM Measurement: ON**
- **Tone Mute key**
- **Esc key**
- **DATA STORED**
  - After approx. 3 sec

• Part 10.2: Activating the OCM zero measurement

![Diagram for activating the OCM zero measurement]

- **OCM ZERO MEASUREMENT**
- **Confirm key**
- **OCM Zero Measure: ON** (default value: ON)
- **Tone Mute key**
- **Esc key**
- **DATA STORED**
  - After approx. 3 sec

- **OCM Zero Measure: OFF**
- **Tone Mute key**
- **Esc key**
- **DATA STORED**
  - After approx. 3 sec

**Note**
If the OCM zero measurement is set to “OFF”, the OCM option is deactivated. If the OCM option is reactivated (“ON”), an OCM pulse calibration must be performed.

• Part 10.3: Setting the OCM measurement delay time

![Diagram for setting the OCM measurement delay time]

- **OCM MEASURE DEL. TIME**
- **Confirm key**
- **Delaytime: XX s**
- **Esc key**
- **DATA STORED**
  - After approx. 3 sec

Press +/- to set the value indicated in the table on the right
(1 – 70 s)

**System**

<table>
<thead>
<tr>
<th>System</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>4008 H with advanced hydraulics</td>
<td>15 Sec</td>
</tr>
<tr>
<td>4008 H with ONLINE&lt;sup&gt;plus&lt;/sup&gt;™</td>
<td>65 Sec</td>
</tr>
<tr>
<td>4008 S with advanced hydraulics</td>
<td>18 Sec</td>
</tr>
<tr>
<td>4008 S with ONLINE&lt;sup&gt;plus&lt;/sup&gt;™</td>
<td>67 Sec</td>
</tr>
</tbody>
</table>
Part 10.4: Setting the OCM correction factor

Note
Do not change the default value.

Note
The 4008 H/S offers the theoretical possibility of defining a correction value for all clearance measurements. The intention is to be able to adapt the system to the latest state of technology resulting from the on-going scientific discussion. According to the current standard of knowledge, this correction value has to be set to “1” (factory setting) for Fresenius polysulfone membranes. The indicated accuracy specifications are valid only for Fresenius polysulfone membrane combined with this correction value setting of “1”.

Part 10.5: Setting the OCM baseline difference

Note
Do not change the default value.
**Part 10.6: Setting the OCM integral value**

Note
Do not change the default value.

**Part 10.7: Setting the OCM Kt/V warning level**
- **Part 11: Automatic Single-Needle start**

```
AUTOM. SN-START
    Confirm key
    Tone Mute key
    Esc key

autom. SN: OFF
    +/-
    DATA STORED
    After approx. 3 sec

autom. SN: ON
    +/-
    DATA STORED
    After approx. 3 sec
```

- **Part 12: Activation of Monit_NTC 109**

```
ACTIV. MONIT_NTC109
    Confirm key
    Tone Mute key
    Esc key

MONIT_NTC109: YES
    +/-
    DATA STORED
    After approx. 3 sec

MONIT_NTC109: NO
    +/-
    DATA STORED
    After approx. 3 sec
```

- **Part 13: Activation of standard UF data**

```
ACTIV. STD UF-DATA
    Confirm key
    Tone Mute key
    Esc key

std UF-DATA: NO
    +/-
    DATA STORED
    After approx. 3 sec

std UF-DATA: YES
    +/-
    DATA STORED
    After approx. 3 sec
```

- **Standard UF data**

```
UF-Rate: 750 ml/h
UF-Goal: 3000 ml
Time Left: 4 h
```

- **Part 14: Setting the priming time**

  SET STD. PRIME-TIME
  
  Confirm key
  
  Prime-Time = 2min
  
  Set the desired time (1 to 5 min) by pressing the +/- keys.
  
  Tone Mute key
  
  DATA STORED
  
  After approx. 3 sec

- **Part 15: Warning sound I/O key**

  SOUND I/O SWITCH
  
  Confirm key
  
  I/O-Warnsound: ON
  
  +/-
  
  Tone Mute key
  
  Esc key
  
  DATA STORED
  
  After approx. 3 sec
  
  I/O-Warnsound: OFF
  
  +/-
  
  Tone Mute key
  
  Esc key
  
  DATA STORED
  
  After approx. 3 sec

- **Part 16: Setting the key-click**

  SET KEY-CCLICK
  
  Confirm key
  
  key-click: ON
  
  +/-
  
  Tone Mute key
  
  Esc key
  
  DATA STORED
  
  After approx. 3 sec
  
  key-click: OFF
  
  +/-
  
  Tone Mute key
  
  Esc key
  
  DATA STORED
  
  After approx. 3 sec
**Part 17: Setting the BPR/UFR warning**

- **BPR/UFR-WARNING**
  - Confirm key
  - **BPR/UFR-Warning: ON**
    - Tone Mute key
    - Esc key
    - DATA STORED After approx. 3 sec
  - **BPR/UFR-Warning: OFF**
    - Tone Mute key
    - Esc key
    - DATA STORED After approx. 3 sec

**Part 18: Setting the rinse volume**

- **SET RINSE–VOLUME**
  - Confirm key
  - **RINSE-VOL.: 1000 ml**
    - Esc key
    - Set the desired rinse volume (0 to 5000 ml in 100 ml increments) by pressing the +/- keys.
    - Tone Mute key
    - DATA STORED After approx. 3 sec

**Part 19: T1-Test Autostart**

- **T1-TEST AUTOSTART**
  - Confirm key
  - **T1-T. Autostart: OFF**
    - Tone Mute key
    - Esc key
    - DATA STORED After approx. 3 sec
  - **T1-T. Autostart: ON**
    - Tone Mute key
    - Esc key
    - DATA STORED After approx. 3 sec
Part 20: ONLINE™ settings – only for ONLINE™ (option)
Part 20.1: ONLINEplus™ HD

- Part 20.1.1: Setting the UF volume (filling/rinsing)

- Part 20.1.2: Setting the rinse volume
Part 20.2: ONLINEplus™ HDF

- **Part 20.2.1: Setting the UF volume (filling/rinsing)**

  SET UF-Volume F/R
  
  Confirm key
  
  Volume [ml]: 500
  
  Set the desired value (0 – 1000) by pressing the +/- keys.
  
  Tone Mute key
  
  DATA STORED
  
  Esc key
  
  After approx. 3 sec

- **Part 20.2.2: Setting the rinse volume**

  SET Rinsing Volume
  
  Confirm key
  
  Volume [ml]: 1000
  
  Set the desired value (0 – 5000) by pressing the +/- keys.
  
  Tone Mute key
  
  DATA STORED
  
  Esc key
  
  After approx. 3 sec
● Part 20.2.3: Setting the substitute volume

Set the desired value (0 ~ 210) by pressing the +/- keys. After approx. 3 sec, DATA STORED.
Part 20.3: ONLINEplus™ HF

Part 20.3.1: Setting the UF volume (filling/rinsing)

Part 20.3.2: Setting the rinse volume
Part 20.3.3: Setting the substitute volume

- Confirm key
- Tone Mute key
- DATA STORED
- After approx. 3 sec

Set the desired value (0 – 210) by pressing the +/- keys.

Volume: 20

Set with the +/- keys.

Confirm key

Esc key
● Part 20.4: ONLINEplus™ miscellaneous

- ONLINE plus MISC.
  - Confirm key
  - SET Reinf.-Volume
    - ▲▼
    - back to menu?
      - ▲▼
      - Confirm key

- Set Reinf.-Volume
  - confirm key
  - Volume[ml]: 240
    - Esc key
    - Set the desired value (90 – 480) by pressing the +/- keys.
    - Tone Mute key
    - DATA STORED
      - After approx. 3 sec

● Part 20.4.1: Setting the reinfusion volume
Part 21: Setting the parameters for central delivery system

Note
Central delivery is not available for the 3mix option.

SET CENTRAL-DELIVERY

- No central-delivery
  - Tone Mute key
  - Esc key
  - SETUP DILUTION
  - After approx. 3 sec
  - DATA STORED
  - After approx. 3 sec

- Central Bic
  - Tone Mute key
  - Esc key
  - SETUP DILUTION
  - After approx. 3 sec
  - DATA STORED
  - After approx. 3 sec

- Central Acid
  - Tone Mute key
  - Esc key
  - SETUP DILUTION
  - After approx. 3 sec
  - DATA STORED
  - After approx. 3 sec

- Central Acid + Bic
  - Tone Mute key
  - Esc key
  - SETUP DILUTION
  - After approx. 3 sec
  - DATA STORED
  - After approx. 3 sec

- Centr acetate-supply
  - Tone Mute key
  - Esc key
  - SETUP DILUTION
  - After approx. 3 sec
  - DATA STORED
  - After approx. 3 sec

Part 22: AutoOFF after AutoON

- AutoOFF after AutoON
  - Confirm key
  - Auto OFF: OFF
    - Tone Mute key
    - Esc key
    - DATA STORED
    - After approx. 3 sec
  - Auto OFF: ON
    - Tone Mute key
    - Esc key
    - DATA STORED
    - After approx. 3 sec

Part 23: CAMUS-baudrate

- Init. CAMUS-baudrate
  - Confirm key
  - Baudrate: 2400 baud
    - Tone Mute key
    - Esc key
    - DATA STORED
    - After approx. 3 sec
  - Baudrate: 9600 baud
    - Tone Mute key
    - Esc key
    - DATA STORED
    - After approx. 3 sec
Part 24: Storing the default values

- Store the default values by pressing the Tone Mute key.
- After approx. 3 sec

Diagram:

STORE DEFAULT VALUES

Press ALARM/TONE MUTE

DATA STORED

Esc key

Confirm key
7 Miscellaneous

Main menu

- CALIBRATION
- DIAGNOSTICS
- MISCELLANEOUS
- SETUP MENU

Service switch to dialysis mode

SW-VERSION-NUMBER

BACK TO MAIN MENU

Confirm key

see Part 1

Confirm key

see Part 2

Confirm key
Part 1

SYSTEM CLOCK

- Press the ▲▼ (+/-) keys to set the flashing hours.
  - Confirm key
- Press the ▲▼ (+/-) keys to set the flashing minutes.
  - Confirm key
- Press the ▲▼ (+/-) keys to set the seconds, day, month, year in the same way.
  - Override (Tone Mute) key

DATA STORED

approx. 3 sec

Part 2

SW-VERSION-NUMBER

- Confirm key
- ▲▼ (+/-) keys

CPU_1-Ver-No.: X.XX
  - Select (Esc) key

CPU_2-Ver-No.: X.XX
  - Select (Esc) key

MDC-Ver-No.: X.XX
  - Select (Esc) key

HPU-Ver-No.: X.XX
  - Select (Esc) key

Online-Vers.: X.XX
  - Select (Esc) key

BVM-Ver-No.: X.XX
  - Select (Esc) key
# Table of contents

## 8 Circuit diagrams and circuit descriptions

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8.1 Block diagram 4008
8.2 Block diagram of voltage supply
8.3 Block diagram of screen 4008 H/S
8.4.1 Connection diagram CAN communication

MONITOR 4008

LP 631 OPERATING SYSTEM CPU 1

LP 763 CAN INTERFACE

LP 774 (4008H) 8 SLOTS
LP 928 (4008S) 6 SLOTS

CAN DISTRIBUTION BOARD

LP 785 ONLINE PLUS MODULE

LP 941 WASSERTEILRECHNER HYDRAULIC PROCESSING UNIT
8.5 P.C.B. LP 450-2 Level detector control (LD)

Fig.: Signal plan P.C.B. LP 450-2

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
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<tr>
<td>Niveau heben/senken Level up/down</td>
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<tr>
<td>Optischer Detektor Optical detector</td>
<td></td>
</tr>
<tr>
<td>Belüftungsventil Vent valve</td>
<td></td>
</tr>
<tr>
<td>Venöse Klemme Venous clamp</td>
<td></td>
</tr>
<tr>
<td>Membranpumpe Membrane pump</td>
<td></td>
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<tr>
<td>Potentialausgleich Ground</td>
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X153

X154

X155

X156

X351

X157

X158

X159

X160

X161

LP 450-2

20 - +24V
19 - +24V
18 - 0 (24V)
17 - 0 (24V)
16 - +12V
15 - 0 (12V)
14 - LDA1 = L
13 - Niveau senken / Level down = H
12 - Dialyse Start / Dialysis start = H
11 - n.c.
10 - LDSA = H
9 - Potentialausgleich / Ground
8 - Klemme zu, Clamp closed = L
7 - ODSA = H
6 - LDA2 = H
5 - OD: hell/light = dunkel/dark = L
4 - Pven 0 – 10 V
3 - Spiegel heben / Level up
2 - Pven-Verstimmung / Pven detune
1 - Belüftungsventil, auf / Vent valve, open = H
8.6  P.C.B. LP 493 Blood leak detector
8.7 P.C.B. LP 624 Control board (BP)
Fig.: Block diagram P.C.B. LP 631 CPU 1
= mit Haftklebepunkt isoliert (3x)
8.10 P.C.B. LP 632 CPU 2

Fig.: Block diagram P.C.B. LP 632 CPU 2

- **Reference voltage** 5 V / 10 V
- **DAC outputs**
- **8-bit ANALOG inputs**
- **16-bit DIGITAL inputs (DIRECT)**
- **24-bit DIGITAL inputs (BUFFER)**
- **Power outputs (BUFFER)**
- **8-bit Status LEDs**
- **8-bit DIGITAL outputs (DIRECT)**
- **Address decoder**
- **128 KByte EPROM**
- **2 KByte SRAM**
- **8 KByte NOVRAM**
- **Crystal-controlled oscillator 11 MHz**
- **80C535 Microcontroller**
- **Address bus**
- **Control bus**
- **Data bus**
- **2x8 DIP SWITCH**
- **Tx Rx serial interface**
- **POWER outputs (BUFFER)**
- **8x Status LEDs**
- **8x DIGITAL outputs (DIRECT)**
- **8x DIGITAL outputs (BUFFER)**
- **8x ANALOG inputs**
- **Address bus**
- **Control bus**
- **Data bus**
8.11 P.C.B. LP 633 Input board

Fig.: Block diagram P.C.B. LP 633
8.12 P.C.B. LP 634 Output board

Fig.: Block diagram P.C.B. LP 634 Output board
8.13 P.C.B. LP 635 Display board

Fig.: Block diagram P.C.B. LP 635 Display board
Pos.: C9,12,13,19,23 nicht bestückt / not fitted
1C 1 Wahlweise SMD oder Konventionell

Ansicht: Lötsseite "LS"
View: Solder side "LS"
8.15 P.C.B. LP 950 Control board (HEP)
8.17  P.C.B. LP 645 Position sensor membrane pump

Difference 671003 to 673362: length of Connecting cable + transmissive switches IC1/IC2
Unterschied 671003 zu 673362: Länge der Anschlußkabel + Gabellichtschranken IC1/IC2
8.18 P.C.B. LP 649-2 Display board (4008 B/S)

Fig.: Block diagram P.C.B. LP 649-2 Display board
8.19 P.C.B. LP 742 Interference filter
8.20  P.C.B. LP 748 Display board (BP)

HOEHE VON LD1, LD2; DP1-DP3, SH1-SH3: $8.8 \pm 0.2$ mm

HEIGHT OF LD1, LD2; DP1-DP3, SH1-SH3: $8.8 \pm 0.2$ mm

DISPLAY BOARD
LP748

672421

BP
8.21 P.C.B. LP 763 Multi interface board (COMMCO III)
8.22  P.C.B. LP 922 Display board (4008 S)
8.23  P.C.B. LP 923 Traffic light (4008 H/S)
8.24  P.C.B. LP 924 Display board (4008 H)
8.25  P.C.B. LP 941 Hydraulics processor
8.26  Heater board (power supply unit 4008)
8.27 Power board (power supply unit 4008)