Hemodialysis System
DBB-EXA™

Reducing costs
Automation
Kind to patients
Useful features

Innovations for Human Care.
Concept

User-friendly and cost efficient dialysis monitor providing safe and adequate hemodialysis.

DBB-EXA has been developed for the value-oriented dialysis providers who are committed to high quality and safety standards, looking for a monitor to deliver standard HD treatments and advanced therapies as well.

DBB-EXA is a compact, user-friendly and cost efficient dialysis monitor providing a safe and adequate hemodialysis.

With a variety of configurations and options, DBB-EXA meets the needs of the modern dialysis facility.

Inherited reliability
Reducing costs

For the administrator who manages the dialysis facility, and is seeking a way to reduce the treatment cost, DBB-EXA is the dialysis machine that can reduce the total cost of ownership.

Automation

For the healthcare professional who requires more time for the patient, DBB-EXA is the dialysis machine that can provide more time for patient care by reducing routine dialysis tasks.

Kind to patients

For the dialysis patient, DBB-EXA is the dialysis machine that provides a comfortable treatment environment thanks to its smart, quiet and compact design.

Useful features

For the nephrologist who wants to deliver a safe and effective treatment, DBB-EXA is the dialysis machine that provides accurate and safe monitoring as well as flexible treatment modes.

Reducing costs

Nowadays dialysis facilities face a reduction in reimbursement. In order to reduce the treatment cost, DBB-EXA is designed to minimize the consumption of consumables. With inherited reliability and time-proven mechanical components of the DBB series, DBB-EXA can minimize maintenance costs with simple preventive maintenance and long MTBF.

- Priming, wash back and emergency bolus can be performed with dialysis fluid to save on saline cost.
- Online priming, wash back and emergency bolus can be performed without substitution line or special adapter, eliminating extra cost.
- Online priming solution and substitution fluid is purified using the integrated reusable double stage endotoxin retentive filter cascade.
- Priming fluid from the extracorporeal circuit can be drained through the drain port to eliminate the need for a drain bag. The drain port can be utilized in priming for both dialysis fluid and saline.
- BVM can be measured with Nikkiso standard bloodline set. No need for extra consumable for BVM.
- Screen motion sensor enabling automatic switch-off/on of screen.

Automation

D-FAS

Dialysis Fully-Automated System

Healthcare professionals in the dialysis facility have many tasks to complete such as lining, priming, entering prescribed treatment data, blood filling and wash back besides the primary role of patient care. Dialysis Fully-Automated System (D-FAS) can simplify and automate user operations. As a result, it may be possible that operator errors and/or the risk of contamination can be significantly reduced.

<table>
<thead>
<tr>
<th>Preparation</th>
<th>Blood filling</th>
<th>Treatment</th>
<th>Wash back</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Set patient card and confirm prescription data</td>
<td>• Connect patient access</td>
<td>Time for patient care</td>
<td>• Disconnect patient access</td>
</tr>
<tr>
<td>• Set dialyzer and bloodline set</td>
<td>• Touch Blood filling start key</td>
<td>D-FAS</td>
<td>D-FAS</td>
</tr>
<tr>
<td>• Touch Priming start key</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Bringing nursing staff back to patient care.

Advantages

• Reducing standard operational tasks between treatments such as preparation, connecting and disconnecting patients.
• Minimizing the number of times the operator has to interact with DBB-EXA.
• Simplifying and automating the tasks to reduce operator errors and risks of contamination.
• Dialysis facility can select automatic priming, wash back and emergency bolus utilizing dialysis fluid or saline (based on the facilities policy).
• Automatic wash back solution can be switched from dialysis fluid to saline. The operator can keep the standard wash back procedure even if the power supply is interrupted.
• D-FAS blood filling removes the priming solution automatically through the dialyzer. Patient UF removal can be minimized.
D-FAS priming
The operator installs the bloodline set and dialyzer, and then starts **D-FAS priming**. D-FAS automatically primes the extracorporeal circuit without operator intervention.

D-FAS blood filling
The operator simply connects the arterial and venous patient access and starts **D-FAS blood filling**. D-FAS blood filling can remove the priming solution automatically through the dialyzer, therefore the patients’ UF removal can be minimized.

D-FAS wash back
After the completion of the treatment, **D-FAS wash back** returns the blood in the extracorporeal circuit automatically through the arterial and venous patient access without any operator intervention. All the operator needs to do is simply disconnect the patient.

D-FAS emergency bolus
The operator can start the emergency bolus without handling the bloodline set. **D-FAS emergency bolus** can deliver automatically a defined volume of substitution fluid to the patient.
Patient card

Patient prescription and treatment data of the last 3 sessions can be stored on the patient card. The operator places the patient card on the machine before preparation and the prescription data is uploaded. Patient treatment data of the last 3 sessions can be recalled at any time. After treatment completion the treatment data is stored on the patient card automatically.

By utilizing the patient card, the dialysis facility can operate like an automated dialysis system without having the expense of a network being installed.

If the dialysis facility is equipped with a dialysis network system, the patient prescription can be downloaded, and treatment data can be uploaded between DBB-EXA and the dialysis network.*

* Under development
User-friendly interface

The user-friendly interface has operational guidance with intuitive graphical instructions. The interface is designed to simplify the operation. Using D-FAS and patient card, the number of screens and key strokes is minimized. Displayed information can be customized individually to fulfill all dialysis facilities requirements.
**Kind to patients**

**Smart design**

The patient is located in the immediate vicinity of the dialysis machine whilst on treatment. DBG-EXA provides a comfortable treatment environment for the patient through its smart and compact design.

- A curved appearance softens its mechanical impression and is easily integrated into a modern dialysis facility.
- External dimensions which are decreased in depth softens the appearance to the patients.
- Integrated BVM, online port and drain port gives the machine a neat appearance.
- Contactless patient card makes card reader surface smooth.
15 inch flat touch screen with wide viewing angle. 4 colored status display on the top of screen visible from any angle.

Smooth curved surfaces allowing for easy cleaning.

Integrated document holder keeping patients area neat and tidy.

The blood pressure monitor cuff holder with detachable flap for ease of cleaning.

A well laid-out extracorporeal circuit minimizes patient extracorporeal blood volume and makes it easy to install the bloodline set.

Simple and easy brake pedal, enabling locking of all 4 wheels.

Grip handle with integrated cable hook for ease of maneuverability.
Useful features

Monitoring patient blood pressure and blood volume

Common complications during hemodialysis are hypotension (20-30% of dialysis sessions), cramps (5-20%), nausea and vomiting (5-15%). Hypotension is relative to the plasma volume that is removed during an average dialysis session. Cramps, nausea and vomiting are considered as associated with hypotension [1]. Fluid management becomes a key clinical objective.

Body water distribution in the human body

Total body water is distributed between the intracellular fluid (ICF) compartment (2/3) and the extracellular fluid (ECF) compartment (1/3). The ECF compartment is further subdivided into interstitial fluid (3/4 of ECF) and plasma (1/4 of ECF) [2].

UF rate and Plasma refilling rate

UF rate during treatment is exclusively from blood plasma. Fluid volume reduction of blood initiates plasma refilling from other compartments to recover fluid volume. This refilling rate is called plasma refilling rate (PRR). If UF rate is equal or less than PRR, blood volume is kept the same or recovered. If UF rate is more than PRR, blood volume is reduced. Undesired reduction in blood volume results in a blood pressure drop [3].

Blood Pressure Monitor (BPM) with UF reduction

DBB-EXA can measure the blood pressure with the integrated BPM. Measurement timing can be selected from manual, auto measurement or continuous. Results are displayed in graphical form and the UF rate can be reduced automatically when it reaches a preset limit.

Advantages of BPM and Haemo-Master

- Integrated, easy to handle
- No additional costs for disposables
- BPM with automatic UF reduction
- Continuous Blood Volume Monitoring
- Automatic regulation of the UF rate and dialysis fluid conductivity
**Haemo-Master**

**Blood Volume Monitor (BVM) and Plasma Refilling Rate (PRR)**

BVM module transmits near-infrared light through the bloodline and measures the reflected light. A wavelength of near-infrared light is adsorbed and reflected by the red blood cells. Patient blood volume and blood cell concentration in the arterial bloodline are correlated. Haemo-Master observes the change of reflected light during the treatment and a change of patient blood volume (dBV) can be monitored continuously. Blood volume measurement is considered as a useful tool to help improve tolerance and the hemodynamic response [3]. Estimated patient PRR is calculated from UF rate and dBV trend. Nephrologists can refer to the PRR to help estimate adequate UF rate to stabilize the dBV. The monitored dBV and PRR are displayed in graphical form and clinicians can observe the patient fluid status visually.

**BV-UFC and BV-COC**

For each patient an individual curve for the ideal blood volume change is established. DBB-DXA continuously measures dBV during the dialysis treatment. This is the basis for automatic regulation of the UF rate (BV-UFC) and dialysis fluid conductivity (BV-COC) so that patient dBV follows the ideal curve. Some studies show that automatic regulation of the UF rate and dialysis fluid conductivity reduces incidences of hypotensive episodes and the frequency of symptoms during the treatment [4-6].
**Useful features**

**DDM**

**Dialysis Dose Monitor**

Positive long-term prognosis & higher quality of life for your patients!

Several studies have proven that a positive long-term prognosis and improved quality of life (QOL) of patients depends on the actual delivery of dialysis dose. Adequate dialysis dose may improve QOL [7-9].

Insufficient clearance performance can have various reasons:

- No countercurrent flow of blood and dialysis fluid due to incorrect connection
- Vascular access recirculation
- Secondary membrane formation and/or dialyzer clotting
- Frequent alarms of dialysis machine which shortens effective treatment time
- Reduced effective blood flow etc.

**Advantages of the Dialysis Dose Monitor**

- Real-time monitoring
- Recognize treatment inconsistencies
- Easy handling
- No additional costs for disposables

Measurement principle of the DDM

A sensor located directly in the spent dialysis fluid measures the absorbance at a wavelength which directly correlates with patient blood urea nitrogen (BUN) concentration.

The continuously measured values are inserted in the formulas for single pool Kt/V (spKt/V) and urea reduction ratio (URR) and the results are immediately displayed.
Reaching treatment goals

Reaching the individual treatment goals for your patients can only be achieved by always knowing the actual status. At the same time, necessary adaption of treatment parameters must be considered. By using the Dialysis Dose Monitor, measured $Kt/V$ is displayed in graphic form with a projection line. You can see deviations from the treatment goal at an early stage, and react accordingly.
Online HDF

Hemodialfiltration (HDF) has an improved clearance of low molecular weight protein compared with hemodialysis (HD), and is considered as a treatment mode with higher dialysis efficiency. Recently, several prospective studies which compare HDF with HD have been conducted in large scale [10-13]. The ESKID study reported that post-dilution online HDF with high convection volume reduces all-cause mortality [14].

DBB-EXA is a flexible dialysis machine which can perform different treatment methods such as post or pre-dilution HDF, HIF, HD and isolated UF. DBB-EXA can optimize substitution rate based on the set ratio with blood flow rate. Also substitution rate can be controlled automatically within set TMP limits to help prevent high blood concentration and TMP alarms.

Hygiene

Dialysis fluid and substitution fluid is purified using the integrated reusable double stage endotoxin retentive filter cascade. Dialyzer clean couplings and online port are designed so that all dialysis fluid contact areas are disinfected to help prevent contamination.

REFERENCES

### Specifications

#### General data

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>161 x 43 x 46 (H x W x D in cm) Base: 51 x 73 (W x D in cm)</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 90 kg (incl. all options)</td>
</tr>
<tr>
<td>Water supply</td>
<td>Pressure: 1 to 7 bar at minimum 800 mL/min at maximum 3000 mL/min Temp.: 5 to 30 ºC</td>
</tr>
<tr>
<td>Drain</td>
<td>Minimum drain capacity: 800 mL/min average Height: 50 cm maximum Temp.: 90 ºC maximum</td>
</tr>
<tr>
<td>Concentrate supply</td>
<td>Pressure: 0 to 0.5 bar 2 central acid concentrates</td>
</tr>
<tr>
<td>Power supply</td>
<td>220 to 240 VAC ±10 %, 50 to 60 Hz ±1 Hz ±10A</td>
</tr>
<tr>
<td>Battery</td>
<td>Ni-MH battery 24 V/3200 mAh</td>
</tr>
<tr>
<td>External connection port</td>
<td>External output (Staff call) External input 1 External input 2 Nurse call switch LAN/Network (RL-45) Serial interface (RS-232) BPM start switch USB 8F card type I</td>
</tr>
<tr>
<td>Monitor</td>
<td>15 inch LCD</td>
</tr>
</tbody>
</table>

#### Hydraulic circuit

<table>
<thead>
<tr>
<th>Hydraulic parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dialysis fluid flow rate</td>
<td>Setting range: Single ERY 300 to 800 mL/min Double ERY 300 to 700 mL/min</td>
</tr>
<tr>
<td>Dialysis fluid temperature</td>
<td>Setting range: 34.0 to 40.0 ºC</td>
</tr>
<tr>
<td>Dialysis fluid conductivity</td>
<td>Bicarbonate dialysis Bicarbonate conductivity setting range: 2.3 to 7.0 mS/cm Accuracy: ±0.1 mS/cm Total conductivity setting range: 12.7 to 15.2 mS/cm Accuracy: ±0.2 mS/cm Acetate dialysis Total conductivity setting range: 12.7 to 15.2 mS/cm Accuracy: ±0.2 mS/cm</td>
</tr>
<tr>
<td>Transmembrane pressure (TMP)</td>
<td>Measurement range: 100 to +500 mmHg Measurement accuracy: ±10 mmHg</td>
</tr>
<tr>
<td>Blood leak detector</td>
<td>Method: Optical Sensitivity: 0.3 mL Blood / 1 L Dialysis fluid (Blood: Hematocrit: ±2 %; Dialysis fluid temperature: 37 ºC)</td>
</tr>
<tr>
<td>Ultrafiltration</td>
<td>UF rate: 0.00; 0.10 to 4.00 L/h UF accuracy (Balance): ±30 mL/h UF dialysis fluid flow rate: 300 to 500 mL/min ±0.1 % of the dialysis fluid flow rate (At dialysis fluid flow rate 501 to 800 mL/min)</td>
</tr>
<tr>
<td>Dialysis Dose Monitor</td>
<td>Measurement principle: Absorptiometry Applicable Treatment mode: HD, On-line HDF Applicable Kt/V range: 0 to 3.0 Kt/V monitoring accuracy: ±10 % (Kt/V 0 to 1) ±5 % (Kt/V 1 to 2) Applicable URR range: 0 % to 100 % URR monitoring accuracy: ±5 %</td>
</tr>
<tr>
<td>Endotoxin retentive filter</td>
<td>EF-02D</td>
</tr>
</tbody>
</table>

#### Extracorporeal circuit

<table>
<thead>
<tr>
<th>Circuit parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arterial pressure monitoring</td>
<td>Measurement range: -300 to +600 mmHg Measurement accuracy: ±10 mmHg</td>
</tr>
<tr>
<td>Venous pressure monitoring</td>
<td>Measurement range: -300 to +600 mmHg Measurement accuracy: ±10 mmHg</td>
</tr>
<tr>
<td>Dialyzer inlet blood pressure monitoring</td>
<td>Measurement range: -300 to +725 mmHg Measurement accuracy: ±10 mmHg</td>
</tr>
<tr>
<td>Single needle pressure</td>
<td>Measurement range: -200 to +400 mmHg Measurement accuracy: ±10 mmHg</td>
</tr>
<tr>
<td>Air detector</td>
<td>Method: Ultrasonic waves Sensitivity: 0.02 mL (Normal air bubbles) (At Blood flow rate: 250 mL/min) 0.003 mL (microbubbles; blood-air mixture) (At Blood flow rate: 250 mL/min)</td>
</tr>
<tr>
<td>Arterial blood pump (PUMP1)</td>
<td>Setting range: 40 to 600 mL/min Flow rate accuracy: Set value ±10 % Inlet Pressure: 150 mmHg Hg ±150 mmHg Set value: 20 to 0 % (Inlet Pressure: 200 mmHg ±P &lt; -150 mmHg)</td>
</tr>
<tr>
<td>Heparin pump</td>
<td>Setting range: 0.0 to 9.9 mL/h Output rate accuracy: Set value ±10 % Syringe type: 30 mL or 20 mL, 20 mL or 10 mL, 10 mL or 9.9 mL</td>
</tr>
<tr>
<td>Venous blood pump / Substitution fluid pump (PUMP2)</td>
<td>Setting range: 40 to 600 mL/min Flow rate accuracy: Set value ±10 % (Inlet Pressure: 150 mmHg ±P &lt; 150 mmHg) Set value: 20 to 0 % (Inlet Pressure: 200 mmHg ±P &lt; -150 mmHg)</td>
</tr>
<tr>
<td>Blood Pressure Monitor (BPM)</td>
<td>Pressure display range: 10 to 300 mmHg Pressure display accuracy: Less than ±3 mmHg Measurement range (adults): Systolic blood pressure (SYS): 60 to 250 mmHg Mean arterial pressure (MAP): 45 to 235 mmHg Diastolic blood pressure (DIA): 40 to 250 mmHg Pulse rate: 40 to 200 beats per minute</td>
</tr>
<tr>
<td>Blood Volume Monitor (BVM)</td>
<td>Measurement principle: Near-infrared reflection method Applicable blood flow rate range: 40 to 600 mL/min Applicable hematocrit range: 15 to 50 % Accuracy: ±2.3 dBV % (Double needle)</td>
</tr>
</tbody>
</table>

#### Treatment options

<table>
<thead>
<tr>
<th>Option</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online HDF/HF</td>
<td>Substitution flow setting range: 0.00; 0.10 to 18.00 L/h (Online HDF) 0.00; 0.10 to 30.00 L/h (Online HF) Flow rate accuracy: ±10 % of set value</td>
</tr>
<tr>
<td>Single needle treatment</td>
<td>Single needle single pump treatment Single needle double pump treatment SN control pressure: Upper limit: +400 mmHg Lower limit: 0 mmHg</td>
</tr>
<tr>
<td>UF profiles</td>
<td>9 programmable profiles available</td>
</tr>
<tr>
<td>Conductivity profiles</td>
<td>9 programmable profiles available</td>
</tr>
</tbody>
</table>

#### Cleaning program

<table>
<thead>
<tr>
<th>Option</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disinfection and decalcification</td>
<td>50 % Citric acid DIALOX (Ferric acid)</td>
</tr>
<tr>
<td>Disinfection and degreasing</td>
<td>Sodium hypochlorite solution (Maximum 10 %)</td>
</tr>
<tr>
<td>Decalcification</td>
<td>30 % Acetic acid</td>
</tr>
</tbody>
</table>

#### Accessories

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hook for Concentrate bags</td>
<td>Max. load 10 kg</td>
</tr>
<tr>
<td>Patient card</td>
<td>MIFARE Class 4K Capacity: 4096 byte</td>
</tr>
<tr>
<td>Nurse call switch</td>
<td></td>
</tr>
</tbody>
</table>

* Those specifications may differ depending on the DBS-EXA type (A, B or C).
Always close to you

**Competent partners**

For all questions concerning dialysis and our products, please contact us or our local partner:

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