eXero-dr Product Specifications

Full-body, high-speed digital radiology with low emission and scatter radiation
These specifications are current and subject to change. Lodex Systems reserves the right to revise these specifications to ensure a well engineered product.

Diagram 1:
- a) AP Position (0°)
- b) Length

Diagram 2:
- a) Lateral Position (90°)
- b) Width

Diagram 3 illustrates the fixed, non-adjustable positions of the X-ray tube and the charged coupled device detector that is located at either ends of the C-arm. The X-ray tube and detector are positioned perpendicular with a fixed source image distance (SID) of 1302 mm.
eXero-dr Product Specifications

Diagram 4: User Interface (UI)

Diagram 5:
- a) Operating Console (OC)
- b) Width
- c) Length

Diagram 6:
- a) High Voltage Generator (HVG)
- b) Front
- c) Back
eXero-dr Product Specifications

**IMAGE QUALITY**

Contrast resolution: > 16 000 grey levels (14 bits) - After log compression
Fundamental pixel size: 60 μm (1x1 binning)
Maximum size: 1 800 mm x 680 mm (70.9” x 26.8”) (full body size, measured at lowest table height on table top)

<table>
<thead>
<tr>
<th>Resolution</th>
<th>Resolution (lp/mm)</th>
<th>Binning</th>
<th>Pixel size (μm)</th>
<th>Contrast (Grey levels)</th>
<th>Max Symmetrical Rad Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultra resolution</td>
<td>5.0</td>
<td>1x1</td>
<td>60</td>
<td>6 000</td>
<td>560 mm x 680 mm</td>
</tr>
<tr>
<td>Very high resolution</td>
<td>4.2</td>
<td>2x2</td>
<td>120</td>
<td>12 000</td>
<td>1120 mm x 680 mm</td>
</tr>
<tr>
<td>High resolution</td>
<td>2.1</td>
<td>4x4</td>
<td>240</td>
<td>24 000</td>
<td>1 800 mm x 680 mm</td>
</tr>
<tr>
<td>Standard resolution</td>
<td>1.4</td>
<td>6x6</td>
<td>360</td>
<td>36 000</td>
<td>1 800 mm x 680 mm</td>
</tr>
<tr>
<td>Base resolution</td>
<td>1.1</td>
<td>8x8</td>
<td>480</td>
<td>48 000</td>
<td>1 800 mm x 680 mm</td>
</tr>
</tbody>
</table>

Table 1: Spatial Resolution Mode

**SCANNER THROUGHPUT**

Linear scanning rate or speed (3 settings): 35 mm/s, 70 mm/s, and 140 mm/s
Beam width (FWHM @ 1000mm from focal spot): 1.4 – 2.8 mm
Instantaneous frame rate (X-ray exposure duration at any one point): 22 - 88 milliseconds small slit
Full field scan time (AP): <13 seconds (nominally 12.98 s at normal speed)
Time from “end-of-scan” until a diagnostic image becomes available on the DVS screen: <15 seconds (normal resolution image on a stand-alone 100 Mbits/s ethernet base-T network)
Best case time between two successive X-rays on the same body: 28 seconds (provided heat capacity of X-ray tube < 20%)

**IMAGE FLEXIBILITY**

Radial angles: 0 to 90 degrees. The supine or prone body can be X-rayed in any radial angle from AP (or PA) to the supine lateral positions.
Caudal-cranial / Cranio-caudal angles: 0 to 10 degrees. Projections can easily be accomplished by angling imaging transversely tabletop as needed.
Longitudinal angles: The trolley (gurney) top height can be adjusted vertically by 802.5 to 1 142.5 mm. Adjusting only one side of the trolley gives Trendelenburg angles up to ± 10 degrees.

**MACHINE DIMENSIONS**

Weight: 1 500 kg / 3 307 lbs
Maximum dimensions: L x W x H: 2 810 mm x 2 276 mm x 2 271 mm (110.6” x 89.6” x 89.4”)
Room height requirement: 2 450 mm (96.5”)
Operation envelope: L x W x H: 2 834 mm x 2 322 mm x 2 322 mm (111.6” x 91.4” x 91.4”)
Ideal room area: L x W 6 000 mm x 3 000 mm (236.2” x 118.1”)

**DIGITAL VIEWING STATION (DVS)**

Monitor: High luminance (>250 Cd/m²); high contrast (1 000:1); 1 920 x 1 080 pixels; size of 23”
DICOM Compliant LCD: Luminance 800 Cd/m² (Typ), DICOM calibrated luminance 500 Cd/m², contrast 400:1 (typ); 2 048 x 1 536 pixels, size of 23”
Type: DVS software is functionally integrated into the operator’s workstation. Imaging software allowing image recall, database access, zoom, pan, rotate, lucid/image enhancement, anatomical measurement capability and window/level control. (Optional standalone viewing workstations can be installed at convenient viewing locations)
Image storage: 500 GB Hard disk (minimum), includes a standard DVD writer
Image backup: 1 TB Hard disk (minimum), configurable

**DETECTOR SYSTEM**

Detector: Proprietary ultra-low noise TDI CCD detector
X-ray to light conversion: Gadox = GdOS; Tb

**SMART TROLLEY**

Dimensions: L x W x H: 2 448 mm x 704 mm x 803 mm (96.4” x 27.7” x 31.6”)
Weight capacity & positioning: 300 kg (660 lbs).
Height can be adjusted from 802.5 to 1 142.5 mm. Allows Trendelenburg angles ±10 degrees.
Automatically rises and lowers to accommodate C-arm movement when shifting from AP to lateral orientation.
Body loading / unloading: Brake function - lock trolley in desired position.
Tabletop attenuation (aluminium equivalence): Bariatric (300 kg): 1.5 mm (max)

**NETWORK**

Network data rate: 100 Mbps (minimum)
Network cables: CAT 5e

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**RADIATION SCATTER**

- Lodox LSSR scanning system is a unique technology employing proprietary X-ray beam controlling mechanism, and linear scanning technique.
- The Lodox X-ray beam is highly collimated by a narrow slit and a fan-width adjustment collimator into a laser-like fan beam of primary X-ray photons which spreads out in only one direction (i.e. width).
- The narrow beam and high-quality primary photons reduce the number of X-rays scattered by the body, so no post-patient anti-scatter grid is required.
- In addition, the detector is fitted into a scatter-absorbing housing, which is designed to eliminate almost all remaining scatter before detection, increasing the signal to noise ratio in the detected image.
- The inherently higher quality image means that a significantly lower patient exposure is required to achieve diagnostic-quality images.
- The lower exposure and collimated, narrow fan-beam also significantly reduce scattered radiation throughout the room.
- The X-ray tube, X-ray fan beam, collimating slit and detector all move together along a linear scanning path, collecting X-ray information to produce X-ray images of 100 mm x 100 mm (3.9" x 3.9") up to 1 000 mm x 680 mm (70.9" x 26.8").

When X-rays are generated, they produce a spectrum of varying energy and flux. In many applications, particularly in general radiography, the lower end of the spectrum does not add any information to the X-ray image. In fact, these X-rays with lower energy are the ones that are blocked by the body, resulting in dose being deposited in the body without providing any imaging benefit.

Ideally, the lower end of the spectrum should be eliminated from the X-ray spectrum that is used to image the patient. This is done by adding a filter to the beam as it emerges from the X-ray source. Various metals of various thicknesses have different effects on the beam. However, they will all attenuate the X-ray beam and they will also block (filter out) some of the lower energy X-rays. This process of filtering the X-ray spectrum to remove low-energy X-rays is called beam hardening.

Typically, aluminium is used to harden the beam. A certain thickness of aluminium is already used in every eXero-dr to eliminate some of the low-energy X-rays. In addition, a very thin copper filter (0.1 mm) is installed in each machine and is used for exposures above 110 kVp.

**OUTPUT**

- **Radiation type:** This equipment emits ionising radiation through an adjustable narrow slit collimator, thereby producing fan-beam scanning across the body. The slit is set to 0.4 mm (typically) or 1 mm (large bodies).
- **Typical entrance dose:** Chest AP ± 0.115 mGy. Medium Full Body AP ± 0.12 mGy. For typical procedures less than 25% (on average) of equivalent conventional dose is needed.
- **Scatter radiation:** Typical scatter dose measured at 1.5 metre from the center of the smart trolley for an averaged sized adult body at maximum workload (8 bodies per hour - 1 x AP Full Body & 1 x Upper Body LAT) is 0.116 mSv per hour.
- **X-ray tube:** 3 500 KHU with rotating anode.
- **X-ray generator:**
  - Peak power: 64 kW
  - Voltage range: 50 - 145 kVp
  - Voltage rise time: 2 mS (10 to 90%)
  - Current range: 32 mA to 400 mA
  - Voltage ripple: 0.5%
  - Exposure time: 0.6 s to 16 s
  - Operating frequency: 40 kHz

**Generator power specifications:**

<table>
<thead>
<tr>
<th>Line Voltage</th>
<th>( I_{\text{max}} ) (( 0.72 \times P )) / VAC</th>
<th>( Z_{\text{L}} \times \Omega )</th>
<th>Circuit Breaker Type*</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 Vac (380 Vac)</td>
<td>115 A</td>
<td>0.138 Ω</td>
<td>B</td>
</tr>
<tr>
<td>415 Vac</td>
<td>111 A</td>
<td>0.148 Ω</td>
<td>50 A</td>
</tr>
<tr>
<td>440 Vac</td>
<td>105 A</td>
<td>0.166 Ω</td>
<td>40 A</td>
</tr>
<tr>
<td>480 Vac</td>
<td>96 A</td>
<td>0.198 Ω</td>
<td>40 A</td>
</tr>
</tbody>
</table>

Differential Sensitivity (Earth Leakage / Ground Fault) 30 mA

Minimum kVA required 80 kVA (Maximum kW x 1.25)

(1) \( I_{\text{max}} \) (\( 0.72 \times P \)) / VAC (\( I_{\text{max}} \) = Maximum instantaneous current based on 100 ms X-ray exposure)

(2) \( Z_{\text{L}} \) = Maximum impedance of the distribution transformer

(3) Circuit Breaker (Differential, Thermomagnetic, Fuses and/or Contactor) Type “B” breaker: \( M = \frac{I_{\text{max}}}{\text{Circuit Breaker Type}} \)

Feeder cable specification available on request.
Loading factors:

<table>
<thead>
<tr>
<th>kV Range</th>
<th>50kV</th>
<th>60kV</th>
<th>70kV</th>
<th>80kV</th>
<th>90kV</th>
<th>100kV</th>
<th>110kV</th>
<th>120kV</th>
<th>130kV</th>
<th>135kV</th>
<th>140kV</th>
<th>145kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>mA Range</td>
<td>32mA</td>
<td>40mA</td>
<td>50mA</td>
<td>64mA</td>
<td>80mA</td>
<td>100mA</td>
<td>125mA</td>
<td>160mA</td>
<td>200mA</td>
<td>250mA</td>
<td>320mA</td>
<td>400mA</td>
</tr>
</tbody>
</table>

The exposure range is from 0.60 to 16.00 seconds (tolerance = 5%).

IMAGE VIEWING - Landscape or Portrait Image Display Capabilities

- Image recall: Images viewed by Previous, Next, Latest, Case number, Referring doctor etc.
- Database: Images in the database belonging to a study or case can be easily retrieved.
- Zoom / Pan / Rotate / Aspect Ratio: Real time “mouse wheel” zoom, pan, rotate, and aspect ratio adjustment all standard.
- Image manipulation / lucid image enhancement: Windowing and levelling of grey scales automatically adjusted for optimal viewing. Initial “best view” with lucid enhanced image processing simultaneously adjusts for soft tissue and bone viewing.
- Anatomical measurement capability: Straight line and angle (eg. Cobb angles) measurements of any body part in any 2D projection.
- Window / Levelling: Allows the user to independently select the range of grey scales to be displayed.
- Invert function: Changes the view from a negative (white bone) to a positive (black bone) image.
- Image size: Variable dependent on exposure area, as well as resolution e.g. Full-body, standard resolution requires approximately 30 MB; largest possible image approximately 188 MB equates to 2 600 images on a 500 GB disk.

POWER REQUIREMENTS

- eXero-dr ASP: Single-phase / N / PE ~ 200 - 240 Vac (25 A) 50/60 Hz
- eXero-dr smart trolley: Single-phase / N / PE ~ 200 - 240 Vac (16A)
- Optional 2 charge point from 110 Vac
- eXero-dr HVG: Option 1 - 400 Vac (380 Vac)
  - Three-phase / PE
  - 400 Vac (380 Vac) 50 Hz ±1 Hz
- Option 2 - 480 Vac
  - Three-phase / PE
  - 480 Vac 60 Hz ±1 Hz
- HVG maximum power: 51 kW
- Minimum kVA required: 76.8 kVA
- RMS line current during exposure: 130 A
- Three phase circuit breaker rating: 60 A
- Single Phase circuit breaker rating: 20 A
- Maximum power line impedance: 0.135 Ω
- HVG standby consumption: 500 W

AMBIENT ENVIRONMENT

- Operating ambient temperature range: +10°C to +25°C
- Relative humidity: 40% - 75%
- Atmospheric pressure: 700 hPa - 1 060 hPa
- Ambient conditions: Dust free, non-corrosive atmosphere
- Estimated heat load: 10 000 Btu / h (2.500 kcal/h)
- Recommend cooling capacity: 20 000 Btu / h (5 000 kcal/h) (dependent on room size)

- The Lodox eXero-dr should ideally be placed in a position where large fluctuations in temperature are avoided (i.e., if possible, not too close to an outside door, open window, etc.)
- The lighting in the Lodox eXero-dr area should be adequate, preferably of the fluorescent type, with no direct light source focused on the smart trolley in position. This will influence the brightness of the beam from the laser localizer.
- It is highly recommended that the DVS area be fitted with dimmable lights to ensure the highest level of image quality when diagnosing from the viewer.
eXero-dr Product Specifications

COMPLIANCE
ISO 13485:2016
MDSAP ISO 13485:2016
US FDA Pre-Market Clearance (510k) No. K013999 Accession #0310920

MEDICAL – FIELD INSTALLED APPLIED ELECTROMAGNETIC RADIATION EQUIPMENT
AS TO ELECTRICAL SHOCK, FIRE AND MECHANICAL HAZARDS ONLY
IN ACCORDANCE WITH


For more information on other accreditations, please visit www.lodox.com

REFERENCES
1. Benjamin Irving, Radiation dose measurement and prediction for linear slit scanning radiography, 2008-07-11
2. A guide to understanding the radiological performance of the Lodox StatscanTM SYSTEM, GD-00-0004 C