

# Digital Radiography X-Ray System

## **X Twin with X Mobil**

# 1 General specifications

The system is intended to be installed with floor mounted components only. It enables space-saving installation without the need of any ceiling component. With the use of one embedded full size 17"x17" digital flat panel detector (DR) only, all common projection techniques of a conventional system with bucky table and wall stand are available. The positioning of the tube and the detector should be motorized and have an autotracking control. The (injured) patient can be examined in all (lying) positions without rearrangement on the table. The mobile patient table has to be motorized for height adjustment without disturbing cables on the ground. The floating table-top allows precise patient positioning under the light collimator.

- Multifunctional Digital Radiography System (DR X-ray System) for routine skeletal, body and chest x-ray examinations
- Automated system positioning system (APS) controlled by organ program routines (APR)
- Motorized movement of tube and detector with auto centering function (ACF)
- Vertical and angel dependend autotracking (ATF)
- Color coding for all directions of manual movements
- Single sided mobile patient table with motorized height adjustment and floating table top
- Thermal Safety Switch for tube housing temperature
- Galvanic network separation



## 2 System design

Two column, floor mounted, motorized and software controlled X-ray system with only one embedded fullsize DR detector for general 2D imaging diagnostics in vertical and horizontal projections. A mobile patient table allows different room setups for different examination requirements.

The change between AP and LAT projection on table should be possible without moving the patient. The distance between tube and detector is largely enough to place a normal hospital bed in between the columns.

Patient support with stairs, handles and specialized stands (i.e. for „long leg“ or „full spine“ examination) should be available to complete the system for specific needs.

### 2.1 Dimension

The system should be able to be installed and operate without limitations in rooms from 245 cm height. It should be adaptable for left or right operation and has options for a modular setup with different active components (see chapter 3) in order to meet the real customer requirements.

The static load on the ground has to be less than 5500 N/m<sup>2</sup>.

### 2.2 Design

The system has options to customize it with lining, light color and custom logos for an individual look to meet the customer CI. A LCD touch display on the tube side and a remote control on the detector side allows to move to standard positions and adjust height, distance and angel of tube or detector.



## 3 System setup

The system should be available in different configurations to meet the customer requirements concerning the foreseen applications.

### 3.1 Generator

The system can operate with at least two different generator manufacturer models with different specifications and power from 50 kW, 65kW up to 80 kW if needed. The software of the modality workstation (MWS) is able to control the generator with a bidirectional interface to send parameters (kV, AEC chamber, operation mode, ...) and receive messages (ready state, error messages, DAP measurements, grid control, ...). A full featured generator membran console is available as an option.

### 3.2 Tube

The system can operate with at least two different tube manufacturer models with different specifications. All of them support high speed options, dual focus and thermal control.

### 3.3 Collimator

The system can operate with at least two different collimator manufacturer models with manual or motorized operation. Options for LED light and cross laser should be available. The required filtration for pediatric imaging should be controlled and adjusted by MWS software via patient age in automatic mode. Pre shutter adjustments should be available for automatic modes.

### 3.4 Detector

A solid detector carrier with easily removable grids for different focus distances comes with two parking positions near the detector housing. Grid position should be controlled by MWS software and affect the generator release state. The used technology should use a CsI-scintillator for low dose imaging with max. 143  $\mu\text{m}$  pixel spacing.

### 3.5 Modality workstation

The system comes with a state of the art workstation hardware for medical applications. The operation system should be at least Windows™ 7 professional or higher with 64 bit support. The LCD display should offer at least a 24" IPS panel with full HD support, contrast up to 1000:1, brightness of 300 cd/m<sup>2</sup>, 170° angle of vision and DICOM presets.

#### 3.5.1 MWS software

The MWS software should be able to:

- control generator settings via APR tables with organ related setups
- adjust a given generator setting regarding age and weight of a patient
- control AEC setup in generator
- control detector settings for manual or automatic modes, states and error messages
- control automatic collimator (if available) regarding shutter and additional filtration
- navigate system positioning (distance, height, angel)
- get feedback of system position, grid usage, DAP measurement, relative exposure

The MWS software takes care of the anatomically pre- and postprocessing of images. It allows user to acces RAW images for not disturbing quality control referring to:

- crop images
- adjust window / level
- rotate and flip
- reprocessing with different organ filtration

The WMS software supports at least the following DICOM classes:

- Basic modality worklist (SCU), to get patient data from HIS/RIS server
- Image store (SCU), to export and save images in PACS
- Print (SCU), for hardcopies on laser imager

The MWS software has options for automatic workflows like:

- long leg exposure (auto-) stitching
- full spine exposure (auto-) stitching

### 3.6 Patient table

The patient table should be mobile to allow the user space saving operations for standing and sitting patients.

For easy positioning over the detector, the table top should be suspended on one side only and provide a X-ray transparent area for all beam directions of at least 170 cm length and 65 cm width. A table support for a maximum patient weight up to 250 kg is required. For an easy patient positioning under the collimator the table top should be able to float over an area of min. 12 x 56 cm<sup>2</sup>.

An electrical cable free height adjustment of the table top over min. 40 cm should be available as an option.



## 4 Parameters

X-ray System	Unit	Value
Minimum source-image distance [SID]	cm	$\leq 100$
Maximum source-image distance [SID]	cm	$\geq 200$
Highest central beam position	cm	$\geq 190$
Lowest central beam position	cm	$\leq 35$
Maximum detector rotation	°	$\pm 100$
Maximum tube rotation	°	$\pm 100$
Possible decentering of X-ray beam	cm	$\pm 12$
All movements should be motorized		yes
Vertical and angel dependend autotracking (ATF)	-	yes
Automated system positioning system (APS) by APR table	-	yes
Touch screen to control the X-ray system positions	-	yes
Remote control to control the X-ray system positions	-	yes
Ceiling support costruction needed?	-	no
Static load on the ground	N/m <sup>2</sup>	$\leq 5500$
Minimum room height	cm	$\geq 245$
Minimum room width	cm	$\geq 395$
Minimum room depth	cm	$\geq 395$
Setup time for all mechanical components	h	$\leq 8$
Complete system up and running	d	$\leq 3$
Hospital bed entrance width on the bottom	cm	$\leq 85$
Made from sustainable, recyclable materials (metal)?	-	yes

Generator	Unit	Value
Different manufacturer available?	N°	$\geq 2$
Microprocessor-controlled HF generator	-	yes
Complete bidirectional control by the MWS software	-	yes
Power range	kW	(50)-65-80
High voltage maximum	kV	150

Tube current range	mA	10-800
Maximum exposure time	s	5
Minimum exposure time	s	0,001
Interface for AEC support	-	yes
Interface for DAP support	-	yes
Program automatic	-	yes
Different exposure techniques	-	yes
3 phase 400 V connection available	-	yes
High speed starter available?	-	yes
Generator operating control console option	-	yes
Weight	kg	≤ 75
Dimensions (H x W x D)	cm³	≤ 55x42x67

Tube	Unit	Value
Large focus	mm	1,2
Small focus	mm	0,6
Heat capacity of anode	kHU	≥ 300
Rotation	min <sup>-1</sup>	≥ 9700
Anode angle	°	12
Anode diameter	mm	74
Permanent filtration	Al / 75 kV	0,9

Collimator	Unit	Value
Automatic motorized shutter	-	yes
Automatic motorized filtration	-	yes
Cross laser sighting	-	yes
LED light	-	yes
Manual mode	-	yes
DAP integration	-	yes
DAP for pediatric imaging available	-	yes

Detector	Unit	Value
Scintillator type	-	CsI / aSi-TFT
Pixel matrix	pixel <sup>2</sup>	4318 x 4320
Active area	mm <sup>2</sup>	432 x 432
Pixel pitch	µm	100
AD converter	bit	16
Size	cm <sup>2</sup>	43 x 43
Weight	kg	4,1
Wired data IF	-	1000BaseT
X-ray IF (trigger)	-	AED
DQE (0 LP/mm)	%	75
MTF (1 LP/mm)	%	70
Limiting resolution	LP/mm	5
Energy range	kV	20-150

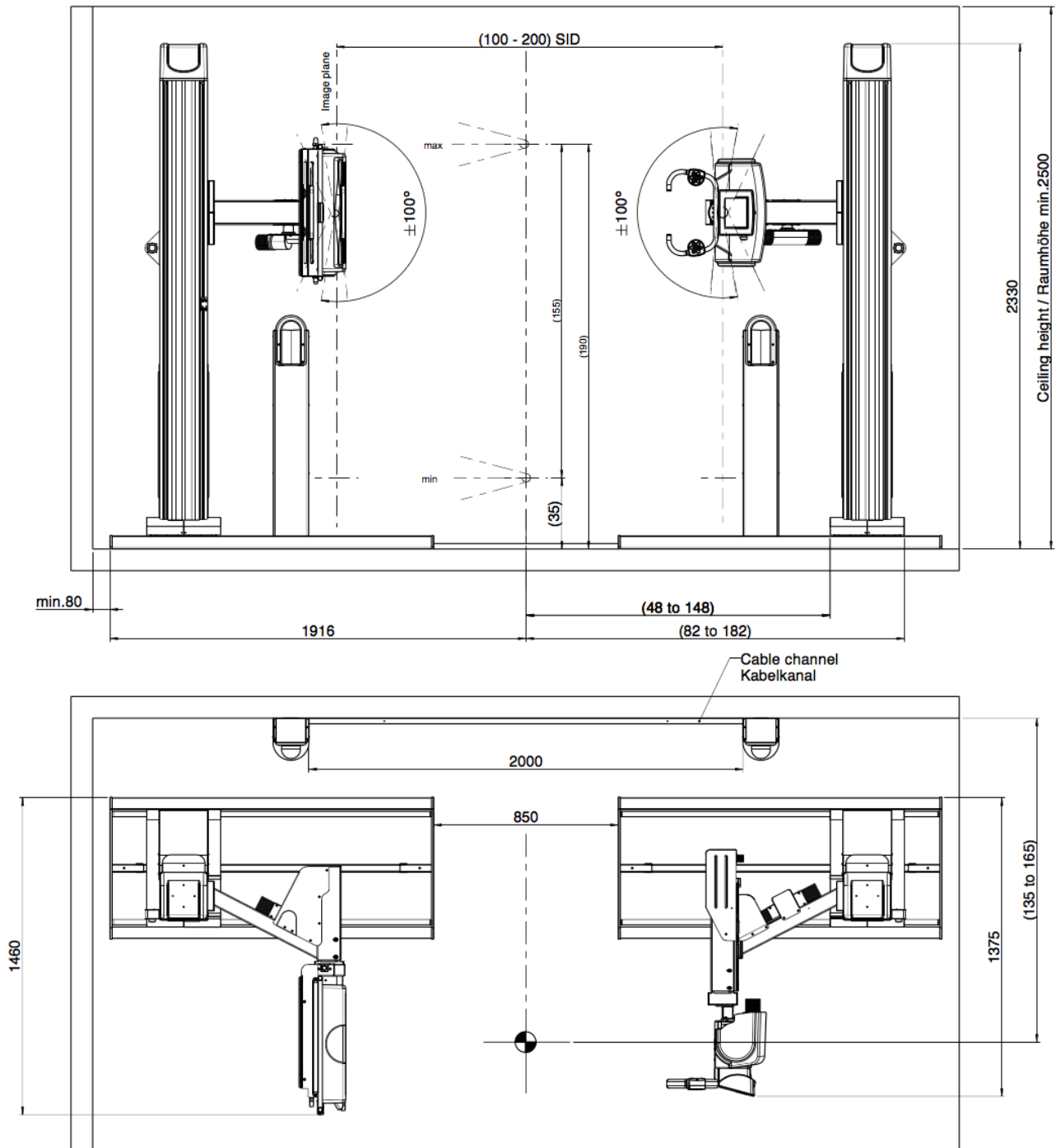
MWS software	Unit	Value
Operating system	-	≥ WIN7pro
Certified according MDD	-	yes
Image processing with RAW data	-	yes
Reprocessing with RAW data available	-	yes
Position control of the X-ray system with APR table	-	yes
Control of generator settings with APR table	-	yes
Bidirectional communication for error messages and DAP values	-	yes
Control of collimator shutter and filtration	-	yes
Control of grid type and position	-	yes
DICOM MWL SCU	-	yes
DICOM store SCU (also for different destinations)	-	yes
DICOM print SCU	-	yes
English GUI setting	-	yes
Local GUI settings on request	-	yes
Dongle protection	-	yes



Patient table	Unit	Value
Mobile patient table	-	yes
Manual brakes	-	yes
Floating table top	-	yes
Floating area	cm <sup>2</sup>	12 x 56
Table construction material	-	carbon fiber
Motorized height adjustment	cm	40
Minimum height	cm	61
Maximum height	cm	101
Battery powered	-	yes
Cable free	-	yes
Maximum patient weight	kg	250
Single sided suspension	-	yes
X-ray translucent area	cm <sup>2</sup>	170 x 65
X-ray translucent for all projection angles	-	yes
Accessories available	-	yes

## 5 Drawings

### 5.1 X Twin



## 5.2 X Mobil

