STEPHANIX
MEDICAL IMAGING SOLUTIONS

Technical Publication
OM-0542R3_EN_STX

Operation

XTREME PREMIUM
X-ray System

CE
1639

This product bears a CE marking in accordance with the provisions of the 93/42/EEC MDD dated June 14, 1993, as amended by 2007/47/EEC dated September 5, 2007.

Este producto ostenta una marca CE de acuerdo con las disposiciones de la Directiva 93/42/CEE del 14 de junio de 1993 sobre Productos Sanitarios, modificada por la directiva 2007/47/CEE del 5 de septiembre de 2007.

Ce produit porte la marque CE de conformité aux réglements de la Directive 93/42/CEE du 14 juin 1993 relative aux Dispositifs Médicaux, modifiée par la directive 2007/47/CEE du 5 septembre 2007.

Questo prodotto presenta un marchio CE in ottemperanza a quanto disposto nel 93/42/EEC MDD del 14 giugno 1993, rettificato da 2007/47/CEE il 5 settembre 2007.

This manual covers the following equipments / Este manual cubre los siguientes equipos

Ce manuel couvre les équipements suivants / Il presente manuale descrive i seguenti dispositivi

X-ray System XTREME PREMIUM:
XTREME PREMIUM AP Radiographic System, composed of:
Ceiling Suspension CHALLENGE X: SP4S Premium
Elevating Table NET500: TPF5S Premium
Wall Stand CHALLENGEX: PMB4S Premium

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REVISION HISTORY

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1	OCT 21, 2020	Electrical Requirements updated for Generators connected at 208 V~. Image Preview section added. Miscellaneous corrections.
2	JUL 09, 2021	Lateral Detector Holder with Trolley section added. System Messages updated. RAD Table Drawings updated. Cabinet types and specifications updated. Miscellaneous corrections.
3	JUN 02, 2023	Regulatory Information updated. Indications for Use updated. Dosimeter and Collimator updated. Screen Cleaning Mode option added. Stitching procedure updated. Tomography section added. Camera Area added in CXDI NE Software. Miscellaneous corrections.

This Document is the English original version, edited and supplied by the manufacturer.

The Revision state of this Document is indicated in the code number shown at the bottom of this page.

ADVISORY SYMBOLS

The following advisory symbols will be used throughout this manual. Their application and meaning are described below.

DANGERS ADVISE OF CONDITIONS OR SITUATIONS THAT IF NOT HEEDED OR AVOIDED WILL CAUSE SERIOUS PERSONAL INJURY OR DEATH.

ADVISE OF CONDITIONS OR SITUATIONS THAT IF NOT HEEDED OR AVOIDED COULD CAUSE SERIOUS PERSONAL INJURY, OR CATASTROPHIC DAMAGE OF EQUIPMENT OR DATA.

Advise of conditions or situations that if not heeded or avoided could cause personal injury or damage to equipment or data.

Note ☞

Alert readers to pertinent facts and conditions. Notes represent information that is important to know but which do not necessarily relate to possible injury or damage to equipment.

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SECTION 1 INTRODUCTION

1.1 SYSTEM OVERVIEW

This manual contains all the necessary information to understand and operate this ***X-ray System***. It provides a general description, safety information, operating instructions and specifications concerning the equipments of the **Automatic Configuration.** This manual is not intended to teach radiology or to make any type of clinical diagnosis.

This system comprises:

- **Overhead Tube Crane (OTC)** with the Control Console, X-ray Tube and Collimator subassemblies. Auto-positioning, Auto-centering and Auto-tracking functions are available.
- **RAD Table** is automatic with Auto-positioning, Auto-centering and Auto-tracking functions available. It can reach a minimum height of 500 mm (19.68”).
- **RAD Wall Stand** is automatic with Auto-positioning, Auto-centering and Auto-tracking functions available. It has different configurations depending on the installed options (Rotation and/or Tilting).
- **High Frequency X-ray Generator.** It is designed for general radiography. It provides all the advantages of high frequency waveform Generators including lower patient dose, shorter exposure times and greater accuracy and consistency.

  The Generator is controlled by multiple microprocessors providing increased exposure consistency, efficient operation and extended Tube life. A high level of self-diagnosis greatly increases serviceability and reduces down time.

  All functions, displays and controls are logically arranged, easily accessible and identified to prevent confusion. Technique factors and functions are selected by touch sensitive push-buttons and displayed on the Control Console.
- **RCC Console**, with the Generator power ON/OFF controls and the exposure Hand-switch.

The X-ray Generator consists of the following essential parts:

- **Power Cabinet**, that comprises:
  - Power Module, which contains the power and control components.
  - High Voltage Transformer.

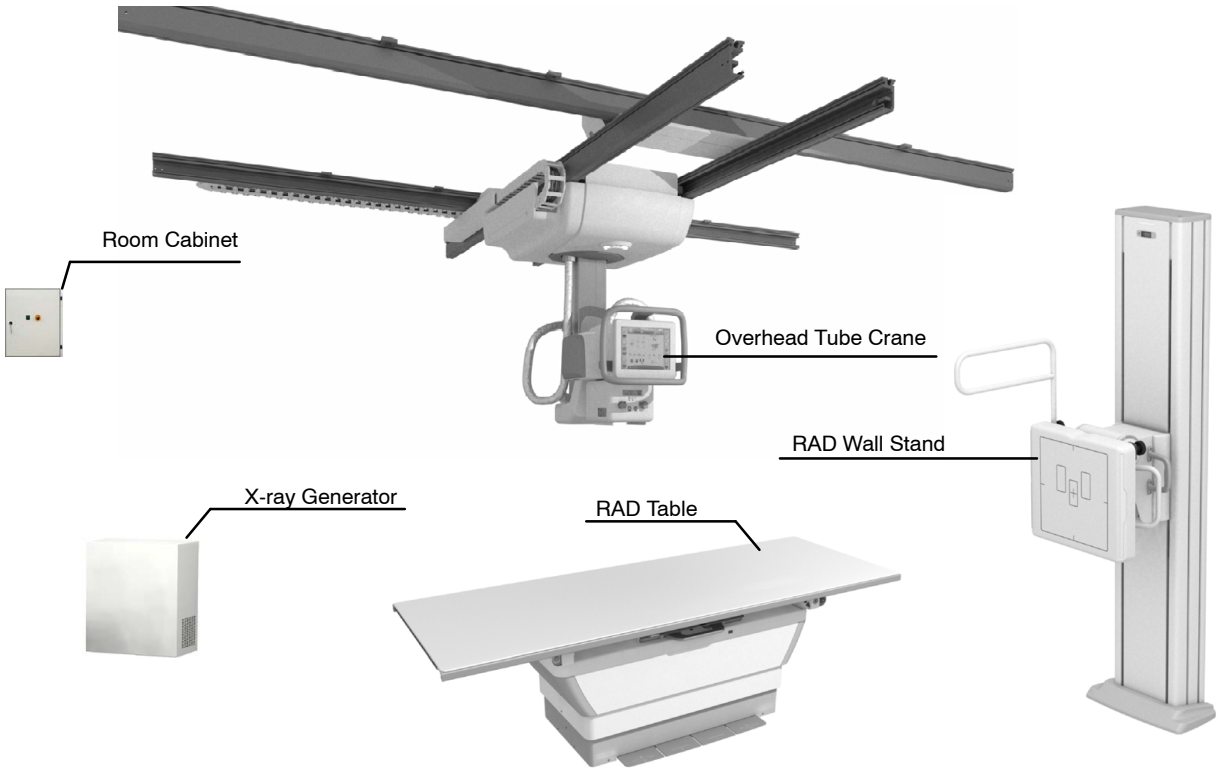
1.2 SYSTEM CONFIGURATION

The components of the X-ray System can be divided into the Examination Room components and the Control Room components in accordance with their installation locations.

EXAMINATION ROOM CONFIGURATION

The Examination room is configured as shown in the illustration below.

Illustration 1-1
Examination Room Components



Note ☞ *When a wireless detector is included, Battery Charger, Interface Unit and Generator Interface Unit may be added to the components of the Examination Room.*

Note ☞ *The components of the Examination Room can be used only in an enclosed environment.*

X-RAY SYSTEM					
Type of Components	**Components**				
X-ray Generator					
Maximum Power kW	32 kW	40 kW	50 kW	65 kW	80 kW
Input Line Operation	Single-Phase Generator of 32 kW: 208/230 V~ - 50 / 60 Hz. Single-Phase Generator from 40 to 50 kW: 208*/230 V~ - 50/60 Hz. Three-Phase Generator from 32 to 50 kW: 208/230/400/415/440/480 V~ - 50 / 60 Hz. Three-Phase Generator from 65 to 80 kW: 400/415/440/480 V~ - 50/60 Hz. Line voltage automatic compensation ±10% V~. Maximum line regulation for maximum kVA demand: 6%.				
	* *(NOTE: For Single-Phase Generators from 40 to 50 kW operating with lines at 208 V~ or below, an auxiliary boost transformer is required to adequate the line voltage to 230 V~.*				
Console	RCC Console (DIG-CON-CHX)				
AEC	SHFRAEC				
HV Cables	HV Cables 22 m HV Cables 30 m				
Overhead Tube Crane					
Control Console	Touchscreen Control Console 1.1.27				
X-Ray Tubes	E7239X / E7240X / E7242X / E7252X / E7254FX / E7865X / E7869XX / E7886X / XRR-3331X				
Collimator	Ralco R225 DHHS Manual Collimator Ralco R225 ACS DHHS Automatic Collimator				
Longitudinal Rails	3.9 / 4.6 / 5.1 / 6.1 m				
Transversal Rails	2.5 / 3.0 / 3.5 m				
Movements policy	Manual movements and motorized movements in all axis 1.1.22				
Automatic Movements	Auto-centering Auto-positioning Auto-tracking				
Options	Stitching 1.1.28 Anti-Collision Sensors Focal Skin Distance Sensor DAP Device 1.1.52				

X-RAY SYSTEM	
TYPE OF COMPONENTS	**COMPONENTS**
RAD Table	
Tabletop	NET5FCFT (Flat Carbon Fiber Tabletop) NET5FLT (Flat Laminated Tabletop)
Receptor	CXDI-401 / CXDI-401 Compact / CXDI-402 / CXDI-410 CXDI-701 / CXDI-702 / CXDI-710 / CXDI-801 / CXDI-810
Grid	FFD 1 m, 10:1, 40Lp/cm
Ion Chamber (AEC)	Claymount SSMC
Functionalities	DR Vertical Auto-tracking DR Horizontal Auto-tracking DR Auto-positioning
Options	Compression Band Hand Grips 1.1.41 Lateral Detector Holder Head Support Double Pedal Tabletop Handle Console
RAD Wall Stand	
Receptor	CXDI-401 / CXDI-401 Compact / CXDI-402 / CXDI-410 CXDI-701 / CXDI-702 / CXDI-710 / CXDI-801 / CXDI-810
Grid	FFD 1 m, 10:1, 40Lp/cm FFD 1.5 m, 10:1, 40Lp/cm FFD 1.8 m, 12:1, 40Lp/cm
Ion Chamber (AEC)	Claymount SSMC
Functionalities	DR Vertical Auto-tracking DR Auto-positioning Patient Hands Supports Automatic Movements Control Box Vertical Movement Footswitch
Options	Double Movement Handle Motorized Rotation Motorized Tilting 1.1.49 Patient Holder

X-RAY SYSTEM	
TYPE OF COMPONENTS	**COMPONENTS**
System Options	
IR Remote Control	IRCCHAP
Image Preview	IDTS
Accessory Equipment	IP Barrier X-ray Footswitch

1.3 GENERAL FEATURES

The main features of the X-ray System are:

- Ergonomic, robust and light weight design, to withstand intensive hospital use.
- Easy operation, security and precision of all positioning movements with respect to patient.
- Controls for lock release of each equipment of the X-ray System.

1.3.1 OVERHEAD TUBE CRANE

Illustration 1-2
Overhead Tube Crane

The main features of the **Overhead Tube Crane** are:

- The OTC Control Console is ergonomically built, equipped with controls logically arranged and easily accessible in every angle and position of the X-ray Tube and Collimator assembly.
- Provided with Touchscreen Control Console. The operator controls and displays for radiographic operations and X-ray Tube positioning are shown on the Touchscreen Control Console.
- The Control Console is provided with a capacitive steering wheel, which allows an easy and effortless drive of the Overhead Tube Crane in Longitudinal, Transversal and Vertical Axes.
- Optimal mechanical balancing system for manual movements with almost no efforts.
- Light weight telescopic column design with five independent parts guided by a high precision alignment mechanism for a smooth and quiet operation. This rigid and durable design reduces instability and vibration to the minimum, to facilitate precision in positioning.
- X-ray Support with 360º for X-ray Tube rotation and 270º for X-ray Tube angulation.
- Safety devices including negative locks on horizontal rotation and angulation.
- Complete safety policy during automatic movements to avoid any collision risk with other equipments of the room or patient, or operator crushing risk.
- Equipped with Emergency OFF Switch to stop the whole System in the event of an emergency.
- Compatible with a high range of Detector Trays (max. 430x430 mm).
- Optionally provided with Dosimeter Device.

1.3.2 RAD TABLE

Illustration 1-3
RAD Table

RAD Table can go down to a minimum height of 500 mm (19.6”) and the maximum patient weight allowed is 350 kg (771.6 lb) with the patient lying down, even when raising and lowering the Tabletop.

The main features of the **RAD Table** are:

- Floating Tabletop with longitudinal and transverse motion. There are two different types available:
  - Carbon fiber flat Tabletop.
  - Laminated flat Tabletop.
- Control pedals set to lower and raise the Table and to control the Tabletop movements. Optionally provided with an additional control pedals set.
- Horizontal cabinet compatible with a wide range of DR Detectors, fixed direct or portable. Optionally the Table can be provided with external accessories to hold film and detectors for vertical expositions.
- Receptor tray (max. 430 x 430 mm / 17”x17”).
- Operating functions:
  - Auto-positioning
  - Auto-tracking
  - Stitching (optional)
- Optional Ion Chamber.
- Optional accessories: Hand-grips, Compression Band, Lateral Detector Holder, Head Support. Double Pedal and Tabletop Handle Console.

1.3.3 RAD WALL STAND

There are two different configurations of the **RAD Wall Stand** depending on whether they are provided with the tilting feature or not.

Illustration 1-4
RAD Wall Stand Configurations

WALL STAND WITH TILTING (Optional Rotation Function)

WALL STAND WITHOUT TILTING

- **RAD Wall Stand with Tilting**. The tilting feature allows the Receptor Assembly to be tilted at any angle between +90º (horizontal) and –20º. This configuration can be equipped with the Receptor rotation function.

1.1.50

- **RAD Wall Stand without Tilting**. The size of the Column Carriage is considerably reduced, allowing to minimize the distance between the Receptor Assembly and the Column.

The main features of the **RAD Wall Stand** are:

- Ergonomic and robust design, to withstand intensive hospital use.
- Intuitive and easy release buttons.
- Effortless motions, all of them counterbalanced.

- Auto-positioning and auto-tracking functions available in all axes for automatic systems.
- Universal, right or left use. Adjustable in the field.
- To facilitate the room layout is floor mounted without extra hardware.
- Receptor tray (max. 430 x 430 mm / 17”x17”).
- Lateral Hands Support to provide patient support during exposures.
- Automatic Movements Control Box provided with an Emergency Off Switch.
- Operating functions:
  - Auto-positioning
  - Auto-tracking
  - Stitching (optional)
- Optional functions:
  - Rotation of 180º (only available for Wall Stand with Tilting). This option involves an Automatic Movements Control Box with additional buttons.
- Optional accessories:
  - Overhead Arm Support. It is installed on the upper side of the Receptor to provide the patient with a secure support to adopt the correct positioning for certain examinations.
  - Double Movement Handle. The Wall Stand can be provided with two Movement Handles on each sides of the Carriage for more accessible vertical control.

1.3.4 X-RAY GENERATOR

Illustration 1-5
X-ray Generator

The main features of this Generator are:

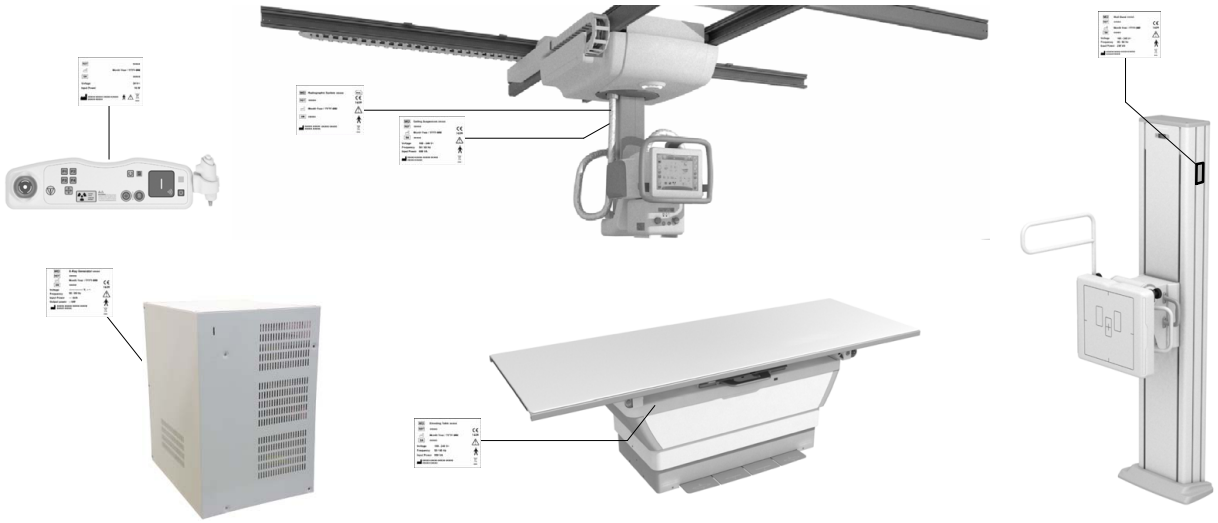
- Constant potential high frequency.
- Three point control by selecting kVp, mA and Exposure Time, or two point control by selecting kVp and mAs, or one point control by selecting kVp with AEC operations, or zero point control by auto-tracking of the RAD kVp during Fluoro with AEC operations (optional).
- Anatomical Programmer (APR) for four patient sizes (Baby, small, medium and large), with pre-programmed anatomical views for automatic selection. The operator may manually modify all the original APR techniques and store them for later use.
- Two Receptors can be directly connected to the Generator (standard).
- Self-diagnosis indicators identify malfunctions in the system.
- Tube protection circuitry prolongs Tube life and increases system performance.
- Equipped with closed loop control of X-ray Tube current, kVp and filaments, which minimizes potential errors and the need for readjustments.
- Automatic line compensation due to closed loop operation of X-ray Tube current and kVp.
- Heat Unit storage for the X-ray Tube, even after turning ON / OFF the equipment.
- Independent memory for storing Radiographic or Fluoroscopic operating parameters. This permits rapid switching from one technique to another.

1.4 PRODUCT IDENTIFICATION

The major items in the equipment have some identification labels attached to them which provide the following manufacturer and product information.

- Product
- Model
- Volts (V), Line Phases, Frequency (Hz), and Power (kVA, kW)
- Date of manufacture
- Serial number
- Reference
- Manufacturer
- Place of manufacture
- Certification

Illustration 1-6
X-ray System Labeling Location



1.5 INDICATIONS FOR USE

1.5.1 INTENDED USE

Intended for use by qualified personnel only, as radiology technicians and doctors who have licenses in the radiology field, on both adult and pediatric subjects for taking diagnostic radiographic exposures of the skull, spinal column, chest, abdomen, extremities, and other body parts. Neither for mammography nor for chest survey.

Note ☞ *If children are to be examined, they should always be accompanied by an adult.*

This **X-ray System** is designed for general radiography in hospitals, clinics, radiology imaging centers and medical practices.

Applications can be performed with the patient sitting, standing, or lying in the prone or supine position. Patients may be physically able, disabled, immobilized or in a state of shock.

This **X-ray System** contributes to the metrics of imaging performance ensuring the efficient use of radiation. It is designed for multiple uses/cases per day.

As example of X-ray image receptors types that can be used in this System there are: Cassette with Film, CR (Computed Radiography) or Digital Detector.

1.5.2 NORMAL USE

The Normal Use of this X-ray System is defined as the Intended Use plus the Maintenance and Service tasks.

1.5.3 CONTRAINDICATIONS

Do not use this X-ray System for any purposes other than those for which it is intended. Operation of the equipment for unintended purposes could lead to fatal or other serious injury.

This X-ray System is neither intended for mammography applications nor for chest surveys.

1.6 APPLIED PARTS

Applied Parts refer to parts of the medical equipments that in Normal Use necessarily comes into physical contact with the patient for the medical equipment to perform its function. These equipments include the following Applied Parts:

RAD TABLE

- Tabletop of the RAD Table
- Hand Grips (optional)
- Compression Band (optional)
- Lateral Holder for Portable Detectors (optional)
- Portable DR Detector (optional)
- Head Support (optional)
- Other accessories

RAD WALL STAND

- Front panel of the RAD Wall Stand
- Hand Supports
- Overhead Arm Support (optional)
- Other accessories

BEAR IN MIND THAT SOME APPLIED PARTS MAY HEAT UP TO 48 ºC (118.4 ºF) WHEN THE AMBIENT TEMPERATURE FOR OPERATION IS ON THE LIMIT. THIS IS COMPLETELY NORMAL AND DOES NOT MEAN A MALFUNCTION OF THE EQUIPMENT.

SECTION 2 SAFETY AND REGULATORY INFORMATION

This section describes the safety considerations, general precautions for patient, operator and equipment in order to perform a safe operation and service tasks.

Regulatory information and symbols used in the equipment are detailed in this section to operate it safely.

2.1 GENERAL

FOR CONTINUE SAFE USE OF THIS EQUIPMENT FOLLOW THE INSTRUCTIONS IN THIS OPERATING MANUAL. BOTH OPERATOR AND SERVICE PERSONNEL HAVE TO STUDY THIS MANUAL CAREFULLY, INSTRUCTIONS HEREIN SHOULD BE THOROUGHLY READ AND UNDERSTOOD BEFORE ATTEMPTING TO PLACE THE EQUIPMENT IN OPERATION, ESPECIALLY THE INSTRUCTIONS CONCERNING SAFETY, REGULATIONS, DOSAGE AND RADIATION PROTECTION. KEEP THIS OPERATING MANUAL WITH THE EQUIPMENT AT ALL TIMES AND PERIODICALLY REVIEW THE OPERATING AND SAFETY INSTRUCTIONS.

TECHNICAL INSTRUCTIONS FOR SERVICE PERSONNEL SUCH AS PRE-INSTALLATION REQUIREMENTS, INSTALLATION, CALIBRATION OR MAINTENANCE ARE DESCRIBED IN THE RESPECTIVE CHAPTERS OF THE PRE-INSTALLATION AND SERVICE MANUALS PROVIDED WITH THIS EQUIPMENT.

PLEASE STUDY THIS MANUAL AND THE MANUALS FOR EACH SYSTEM COMPONENT TO BE FULLY AWARE OF ALL THE SAFETY AND OPERATIONAL REQUIREMENTS.

OPERATOR AND SERVICE PERSONNEL AUTHORIZED TO USE, INSTALL, CALIBRATE AND MAINTAIN THIS EQUIPMENT MUST BE AWARE OF THE DANGER OF EXCESSIVE EXPOSURE TO X-RAY RADIATION. IT IS VITALLY IMPORTANT THAT EVERYONE WORKING WITH X-RAY RADIATION IS PROPERLY TRAINED, INFORMED ON THE HAZARDS OF RADIATION AND TAKE ADEQUATE STEPS TO ENSURE PROTECTION AGAINST INJURY.

OPERATOR MUST HAVE SUFFICIENT KNOWLEDGE TO COMPETENTLY PERFORM THE DIFFERENT DIAGNOSTIC IMAGING PROCEDURES WITH X-RAY DEVICES. THIS KNOWLEDGE IS ACQUIRED THROUGH A VARIETY OF EDUCATIONAL METHODS INCLUDING CLINICAL WORKING EXPERIENCE, AND AS PART OF MANY COLLEGE AND UNIVERSITY RADIOLOGIC TECHNOLOGY PROGRAMS IN ACCORDANCE WITH LOCAL LAWS OR REGULATIONS.

SERVICE PERSONNEL MUST HAVE SUFFICIENT KNOWLEDGE TO COMPETENTLY PERFORM THE SERVICE TASKS RELATED TO X-RAY DEVICES AND PARTICULARLY TO THE EQUIPMENT DESCRIBED IN THIS MANUAL. THIS KNOWLEDGE IS ACQUIRED THROUGH A VARIETY OF EDUCATIONAL METHODS FOR TECHNICIANS IN ACCORDANCE WITH LOCAL LAWS OR REGULATIONS, INCLUDING SPECIFIC TRAINING ON THIS EQUIPMENT.

X-RAY EQUIPMENT IS DANGEROUS TO BOTH PATIENT AND OPERATOR UNLESS PROTECTION MEASURES ARE STRICTLY OBSERVED. IF THE EQUIPMENT IS NOT ACCURATELY USED, IT MAY CAUSE INJURY.

ALTHOUGH X-RADIATION CAN BE HAZARDOUS, X-RAY EQUIPMENT DOES NOT POSE ANY DANGER WHEN IT IS PROPERLY USED.

WARNING

SPECIAL ATTENTION MUST BE GIVEN TO DIAGNOSTIC X-RAY EQUIPMENT SPECIFIED TO BE USED IN COMBINATION WITH ACCESSORIES OR OTHER ITEMS. BE AWARE OF POSSIBLE ADVERSE EFFECT ARISING FROM THESE MATERIALS LOCATED IN THE X-RAY BEAM. (SEE THE TABLE BELOW FOR THE MAXIMUM EQUIVALENT ATTENUATION OF MATERIALS POSSIBLY LOCATED IN THE X-RAY BEAM).

ITEM	MAXIMUM ATTENUATION EQUIVALENT mm AL	
	21 CFR	IEC 60601-2-54:2009 AND IEC 60601-2-54:2009+ AMD1:2015+AMD2:2018
Total of all layers composing the front panel of cassette holder	1.2	1.2
Total of all layers composing the front panel of FILM CHANGER	1.2	1.2
Total of all layers, excluding detector itself, composing the front panel of DIGITAL X-RAY IMAGING DEVICE	1.2	1.2
Cradle	2.3	2.3
PATIENT SUPPORT, stationary, without articulated joints	1.2	1.2
PATIENT SUPPORT, movable, without articulated joints (including stationary layers)	1.7	1.7
PATIENT SUPPORT, with radiolucent panel having one articulated joint	1.7	1.7
PATIENT SUPPORT, with radiolucent panel having two or more articulated joints	2.3	2.3
PATIENT SUPPORT, cantilevered	2.3	2.3

Note 1.- Devices such as RADIATION DETECTORS are not included in the item listed in this table.

Note 2.- Requirements concerning the ATTENUATION properties of RADIOGRAPHIC CASSETTES and of INTENSIFYING SCREENS are given in ISO 4090 [3], for ANTI-SCATTER GRIDS in IEC 60627[1].

Note 3.- ATTENUATION caused by table mattresses and similar accessories is not included in the maximum ATTENUATION EQUIVALENT for PATIENT SUPPORT.

Note 4.- Maximum ATTENUATION EQUIVALENT mm Al is only applied to the corresponding item. If several items given in this table are located in the path of the X-RAY BEAM between the PATIENT and the X-RAY IMAGE RECEPTOR, each corresponding maximum ATTENUATION EQUIVALENT mm Al is separately applied to each item.

2.2 RESPONSIBILITIES

THIS X-RAY UNIT MAY BE DANGEROUS TO PATIENT AND OPERATOR UNLESS SAFE EXPOSURE FACTORS, OPERATING INSTRUCTIONS AND MAINTENANCE SCHEDULES ARE OBSERVED.

THE EQUIPMENT HEREIN DESCRIBED IS SOLD WITH THE UNDERSTANDING THAT THE MANUFACTURER, ITS AGENTS, AND REPRESENTATIVES ARE NOT LIABLE FOR INJURY OR DAMAGE WHICH MAY RESULT FROM OVEREXPOSURE OF PATIENTS OR PERSONNEL TO X-RAY RADIATION.

THE MANUFACTURER DOES NOT ACCEPT ANY RESPONSIBILITY FOR OVEREXPOSURE OF PATIENTS OR PERSONNEL TO X-RAY RADIATION GENERATED BY THIS EQUIPMENT WHICH IS A RESULT OF POOR OPERATING TECHNIQUES OR PROCEDURES.

NO RESPONSIBILITY WILL BE ASSUMED FOR ANY EQUIPMENT THAT HAS NOT BEEN SERVICED AND MAINTAINED IN ACCORDANCE WITH THE MANUFACTURER INSTRUCTIONS, OR WHICH HAS BEEN MODIFIED OR TAMPERED WITH IN ANY WAY.

IT IS THE RESPONSIBILITY OF THE OPERATOR TO ENSURE THE SAFETY OF THE PATIENT WHILE THE X-RAY EQUIPMENT IS IN OPERATION BY VISUAL OBSERVATION, PROPER PATIENT POSITIONING, AND USE OF THE DEVICES THAT ARE INTENDED TO PREVENT PATIENT INJURY.

ALWAYS WATCH ALL PARTS OF THE SYSTEM TO VERIFY THAT THERE IS NEITHER INTERFERENCE NOR POSSIBILITY OF COLLISION WITH THE PATIENT OR WITH OTHER EQUIPMENTS.

IT IS THE RESPONSIBILITY OF THE PURCHASER / CUSTOMER TO PROVIDE THE MEANS FOR AUDIO AND VISUAL COMMUNICATION BETWEEN THE OPERATOR AND THE PATIENT.

IT IS THE RESPONSIBILITY OF THE OPERATOR TO ENSURE THAT ALL THE EXPOSURE PARAMETERS ARE CORRECT BEFORE PERFORMING AN EXAM TO THE PATIENT, BY VERIFYING THAT THE PARAMETER SELECTION HAS NOT BEEN MODIFIED UNINTENTIONALLY OR BY THE CONTACT OF EXTERNAL ELEMENTS ON THE CONTROL CONSOLE, IN ORDER TO AVOID THE OVEREXPOSURE OR THE NEED OF PERFORMING A NEW EXAM TO THE PATIENT.

MAKE SURE THAT THE X-RAY TUBE IS SET IN WORKING POSITION WITH THE REFERENCE AXIS (X-RAY BEAM) POINTING TO THE RECEPTION AREA.

IF ANY SERIOUS INCIDENT INVOLVING THE EQUIPMENT OCCURS, IT MUST BE REPORTED TO THE MANUFACTURER, AS WELL AS TO THE COMPETENT AUTHORITY OF THE COUNTRY/REGION IN WHICH THE USER AND/OR PATIENT IS ESTABLISHED.

2.3 MAXIMUM PERMISSIBLE DOSE (MPD)

Before operation, people qualified and authorized to operate this equipment should be familiar with the Recommendations of the International Commission on Radiological Protection, contained in Annals Number 60 of the ICRP, with applicable National Standards; and should have been trained in use of the equipment.

THE OPERATOR SHALL USE THE LARGEST POSSIBLE DISTANCE FROM THE FOCAL SPOT TO SKIN IN ORDER TO KEEP THE ABSORBED DOSE AS LOW AS REASONABLY ACHIEVABLE.

2.4 RADIATION PROTECTION

Although this equipment is built to the highest safety standards and incorporates a high degree of protection against X-radiation other than the useful beam, no practical design of equipment can provide complete protection, nor can any practical design compel the operator to take adequate precautions to prevent the possibility of any persons carelessly, unwisely, or unknowingly exposing themselves or others to X-radiation.

IT IS THE RESPONSIBILITY OF THE OPERATOR TO RESTRICT ACCESS TO THE EQUIPMENT IN ACCORDANCE WITH LOCAL REGULATIONS FOR RADIATION PROTECTION.

Because exposure to X-ray radiation can be damaging to the health, use great care to ensure protection against exposure to the primary beam. Some of the effects of X-ray radiation are cumulative and may extend over a period of months or years. The best safety rule for an X-ray operator is *"Avoid exposure to the primary beam at* ***all times****"*.

Any object in the path of the primary beam produces secondary (scattered) radiation. The intensity of secondary radiation depends on the energy and intensity of the primary beam and the atomic number of the object material struck by the primary beam. Secondary radiation may be of greater intensity than that of the radiation reaching the receptor. Take protective measures to safeguard against it.

An effective protective measure is the use of lead shielding. To minimize dangerous exposure, use such items as lead screens, lead impregnated gloves, aprons, thyroid collars, etc. Lead screens should contain a minimum of 2.0 mm of lead or equivalent and personal protective devices (aprons, gloves, etc.) must contain a minimum of 0.25 mm of lead or equivalent. For confirmation of the local requirements at your site, please refer to your "Local Radiation Protection Rules" as provided by your Radiation Protection Advisor.

Observe the following rules for radiation protection of the personnel in the examination room during X-ray exposures:

- Wear radiation protective clothing.

- Wear a personal dosemeter.

- Use the different recommended protective materials and devices against radiation.

- While operating or servicing X-ray equipment, always keep as large a distance as possible from the Focal Spot and X-ray beam, never shorter than 2 meters, protect body and do not expose hands, wrists, arms or other parts of the body to the primary beam.

- Protect the patient against radiation outside the area of interest by using protection accessories.

- Use the smallest X-ray field collimation. Make sure that the area of interest will be completely exposed and the X-ray field does not exceed the area of interest.

- Select a Focal Spot to patient skin distance (SID) as large as possible to keep the absorbed dose for the patient as low as reasonably possible.

The radiation dose decreases or increases according to the Focal Spot to patient skin distance (SID): the greater the SID distance, the lower the radiation dose. The radiation dose is inversely proportional to the distance squared.

- Select as short an examination time as possible. This will reduce total radiation dose considerably.

- Use Grids and Automatic Exposure Control with Ion Chambers whenever possible.

- Place the region of interest as close as possible to the image receptor. This will reduce exposure to radiation and optimize the exposure.

- Be sure that audible and visual communication between the patient and operator is established throughout the entire examination.

2.5 MONITORING OF PERSONNEL

Monitoring of personnel to determine the amount of radiation to which they have been exposed provides a valuable cross check to determine whether or not safety measures are adequate. It may reveal inadequate or improper radiation protection practices and potentially serious radiation exposure situations.

The most effective method of determining whether or not the existing protective measures are adequate is with the use of instruments to measure exposure to radiation. These measurements should be taken at all locations where the operator, or any portion of the body may be exposed. Exposure must never exceed the accepted tolerable dose.

A frequently used, but less accurate method of determining the amount of exposure is the placement of film at strategic locations. After a specified period of time, develop the film to determine the amount of radiation.

A common method of determining whether personnel have been exposed to excessive radiation is the use of personal radiation dosimeters. These consist of X-ray sensitive film or thermoluminiscent material enclosed within a holder that may be worn on the body. Even though this device only measures the radiation which reaches the area of the body on which they are worn, they do provide a reasonable indication of the amount of radiation received.

2.6 SYMBOLS

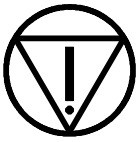
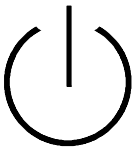
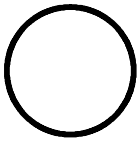
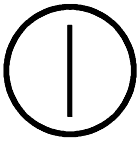
The following symbols may appear in the equipment.

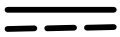
Their meanings are described below.

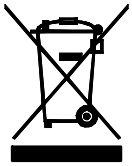
	**Caution. Consult accompanying documents.**
	**Safety Symbol. Follow instructions for use, especially those instructions identified with Advisory Symbols to avoid any risk for the Patient or Operator.** *(Only applies to IEC 60601-1:2005 and IEC 60601-1:2005+AMD1:2012+AMD2:2020)*
	**Manufacturer.**
	**Date of Manufacture.**
	**Medical Device.**
	**Catalogue Number (Model reference).**
	**Serial Number.**
	**Model Configuration.**
	**Unique Device Identifier.**

	**General Mandatory action.**
	**Type B applied part.**
	**Weight of device.**
IPX0	**Protection against harmful ingress of water or particulate matter.** **IP Classification: Ordinary.**
	**Ionizing radiation.**
	**Non-ionizing electromagnetic radiation.**
	**Radiation of Laser apparatus.** Do not stare into beam. *(Only applicable to equipment with Laser Pointer)*
	**Dangerous voltage.**

	**General warning, caution, risk of danger.**
	**Warning: Ionizing radiation.**
	**Warning: Non-ionizing radiation.**
	**Warning: Laser beam.**
	**Warning: Electricity.**
	**Warning: Do not place fingers between mobile and fixed parts of the equipment, it may cause serious injuries to patient or operator. As well, make sure the patient extremities are correctly positioned into limit areas during operation, movement of parts may cause serious damages to patient.**
	**Warning: Do not place foot under mobile parts of the equipment, it may cause serious injuries to patient or operator. As well, make sure the patient extremities are correctly positioned into limit areas during operation, movement of parts may cause serious damages to patient.**
	**Warning: Electrostatic sensitive devices.**

	**No pushing.**
	**No sitting. Surface unsuitable to sit on.**
	**No stepping on surface.**
	**Do not handle.**
	**Emergency stop.**
	**“Stand-by” power.** *(Only applies to IEC 60601-1:2005 and IEC 60601-1:2005+AMD1:2012+AMD2:2020)*
	“ON” power.
	**“OFF” power.**
	**“ON” / “OFF” (push-push).** *Each position, “ON” or “OFF”, is a stable position.*

	**Alternating current.**
	**Three-phase alternating current.**
	**Three-phase alternating current with neutral conductor.**
N	**Connection point for the neutral conductor on Permanently Installed equipment.**
	**Direct current.**
	**Both direct and alternating current.**
	**Protective Earth (Ground).**
	**Earth (Ground).**

	**This symbol according to the European Directive indicates that the Waste of Electrical and Electronic Equipment (WEEE) must not be disposed of as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer or an authorized waste management company for information concerning the decommissioning of your equipment.**
 **Li/Pb/Cd/Hg**	**This separate collection symbol is affixed to a battery or its packing, to advise that the battery must be recycled or disposed of in accordance with local or country laws. The letters below the symbol indicate whether certain elements (Li=Lithium, PB=Lead, CD=Cadmium, Hg=Mercury) are contained in the battery. All batteries removed from the equipment must be properly recycled or disposed. Please contact an authorized representative of the manufacturer or an authorized waste management company for information concerning the decommissioning of your equipment.**
	**Pollution Control.** *(Only applicable to People's Republic of China (PRC)).* **This symbol indicates the product contains hazardous materials in excess of the limits established by the Chinese Standards. It must not be disposed of as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer or an authorized waste management company for information concerning the decommissioning of your equipment.**

2.7 REGULATORY

2.7.1 CERTIFICATIONS

The ***X-ray System*** covered by this Operation Manual is authorized to be marked with **CE MARKING** in accordance with the provisions of the Council Directive 93/42/EEC as amended by 2007/47/EEC concerning Medical Devices.

Statement of Compliance with IEC 60601-1-3: ***X-ray System*** *with radiation protection in accordance with IEC 60601-1-3:2008 and IEC 60601-1-3:2008+AMD1:2013.*

Statement of Compliance with IEC 60601-2-54: ***X-ray System*** f*or Radiography and/or Radioscopy in accordance with IEC 60601-2-54:2009 and IEC 60601-2-54:2009+AMD1:2015+AMD2:2018.*

Note ☞ ***X-ray System*** *or other equipment model references are stated at the back of the cover page of this document.*

2.7.2 ENVIRONMENTAL STATEMENT ON THE LIFE CYCLE OF THE EQUIPMENT OR SYSTEM

This equipment or system contains environmentally dangerous components and materials (such as PCBs, electronic components, used dielectric oil, lead, batteries etc.) which, once the life-cycle of the equipment or system comes to an end, becomes dangerous and need to be considered as harmful waste according to the international, domestic and local regulations.

The manufacturer recommends to contact an authorized representative of the manufacturer or an authorized waste management company once the life-cycle of the equipment or system comes to an end to remove this equipment or system.

2.7.3 MODE OF OPERATION

- *Continuous operation,* in accordance with Standard IEC 60601-1:2005 and IEC 60601-1:2005+AMD1:2012+AMD2:2020.
- *Permanently Installed Equipment.*

2.7.4 PROTECTION AGAINST ELECTRIC SHOCK HAZARDS

Protection against electric shock hazards in accordance with Standards: IEC 60601-1:2005 and IEC 60601-1:2005+AMD1:2012+AMD2:2020, IEC 60601-2-54:2009 and IEC 60601-2-54:2009+AMD1:2015+AMD2:2018.

This equipment has been classified as a *type-B (🚶) device,* in accordance with Standard IEC 60601-1 requirements. *Class I - Type B applied parts.*

TO AVOID THE RISK OF ELECTRIC SHOCK, THIS EQUIPMENT MUST ONLY BE CONNECTED TO A SUPPLY MAINS WITH PROTECTIVE EARTH.

THIS UNIT IS EQUIPPED WITH EMC FILTERS. THE LACK OF PROPER GROUNDING MAY PRODUCE ELECTRICAL SHOCK TO THE USER.

BASED ON THE FINAL SAFETY/INSULATION CONCEPT OF THE END EQUIPMENT/DEVICE/SYSTEM, ONLY IEC 60601-1, IEC 60950 OR IEC 62368-1 CERTIFIED EQUIPMENT SHALL BE CONNECT TO THE PROVIDED SIP/SOP'S.

2.7.5 PROTECTION AGAINST HARMFUL INGRESS OF WATER OR PARTICULAR MATTER

Protection against harmful ingress of water or particulate matter: *Ordinary (IPx0)*, in accordance with Standard IEC 60601-1:2005 and IEC 60601-1:2005+AMD1:2012+AMD2:2020.

2.7.6 PROTECTION AGAINST HAZARDS OF IGNITION OF FLAMMABLE ANAESTHETIC MIXTURES

Degree of Safety in the presence of Flammable Anesthetics Mixture with air or with oxygen or with nitrous oxide: *Not suitable for use in the presence of Flammable Anesthetics Mixture with air or with oxygen or with nitrous oxide*, in accordance with Standard IEC 60601-1:2005 and IEC 60601-1:2005+AMD1:2012+AMD2:2020.

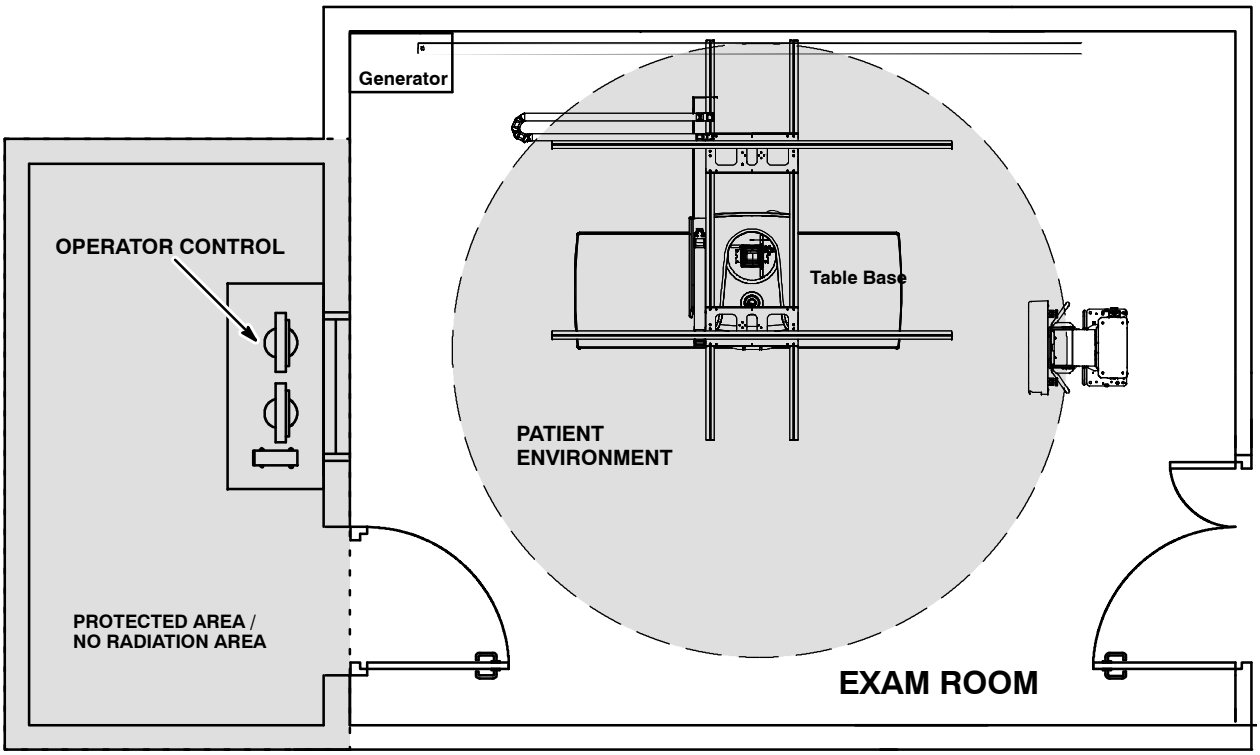
2.7.7 PROTECTION AGAINST HAZARDS FROM UNWANTED OR EXCESSIVE RADIATION

Protection against hazards from unwanted or excessive radiation in accordance with Standard IEC 60601-1:2005 and IEC 60601-1:2005+AMD1:2012+AMD2:2020, and IEC 60601-1-3:2008 and IEC 60601-1-3:2008+AMD1:2013.

2.7.8 DESIGNATED SIGNIFICANT ZONES OF OCCUPANCY

X-ray equipment specified for examination that do not need the operator or staff to be close to the patient during normal use shall be provided with means to allow the following control functions from a "*Protected Area*" (*refer to illustration below*):

- Selection and control of modes of operation.
- Selection of loading factors for the exposure.
- Actuation of the exposure controls.
- Other necessary controls for the operator during exposure.



Note ☞ *Patient environment center position depends on the Tube position in the exam room.*

X-Ray equipment specified for any radiological examination that requires the operator or staff to be close to the patient during normal use (e.g., some pediatric examinations or other types of examination for patients that may require assistance), shall have at least one "*Significant Zone of Occupancy*" for the use of the operator and staff, designated as follows:

Illustration 2-1
Radiographic Examination on the RAD Wall Stand

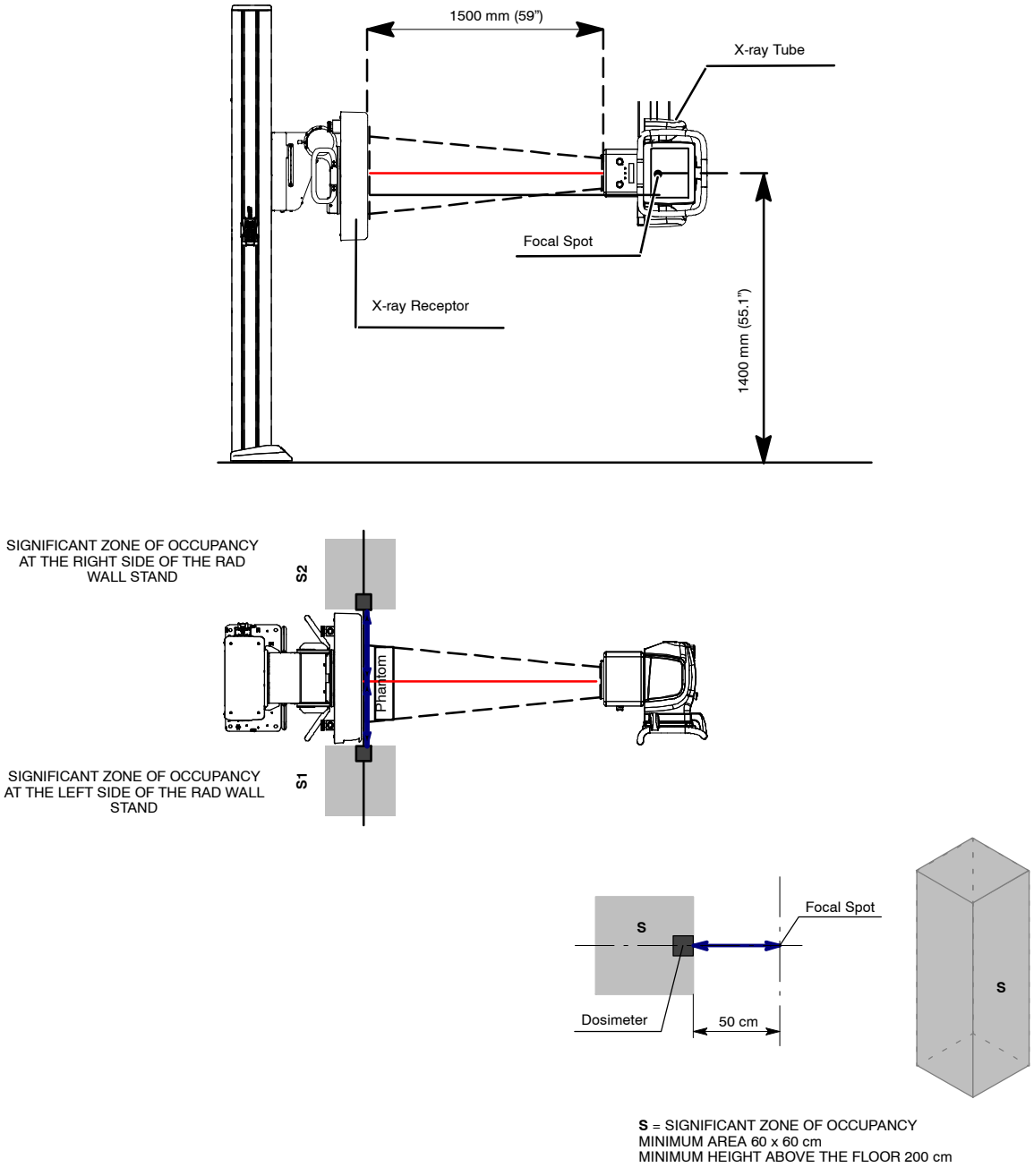
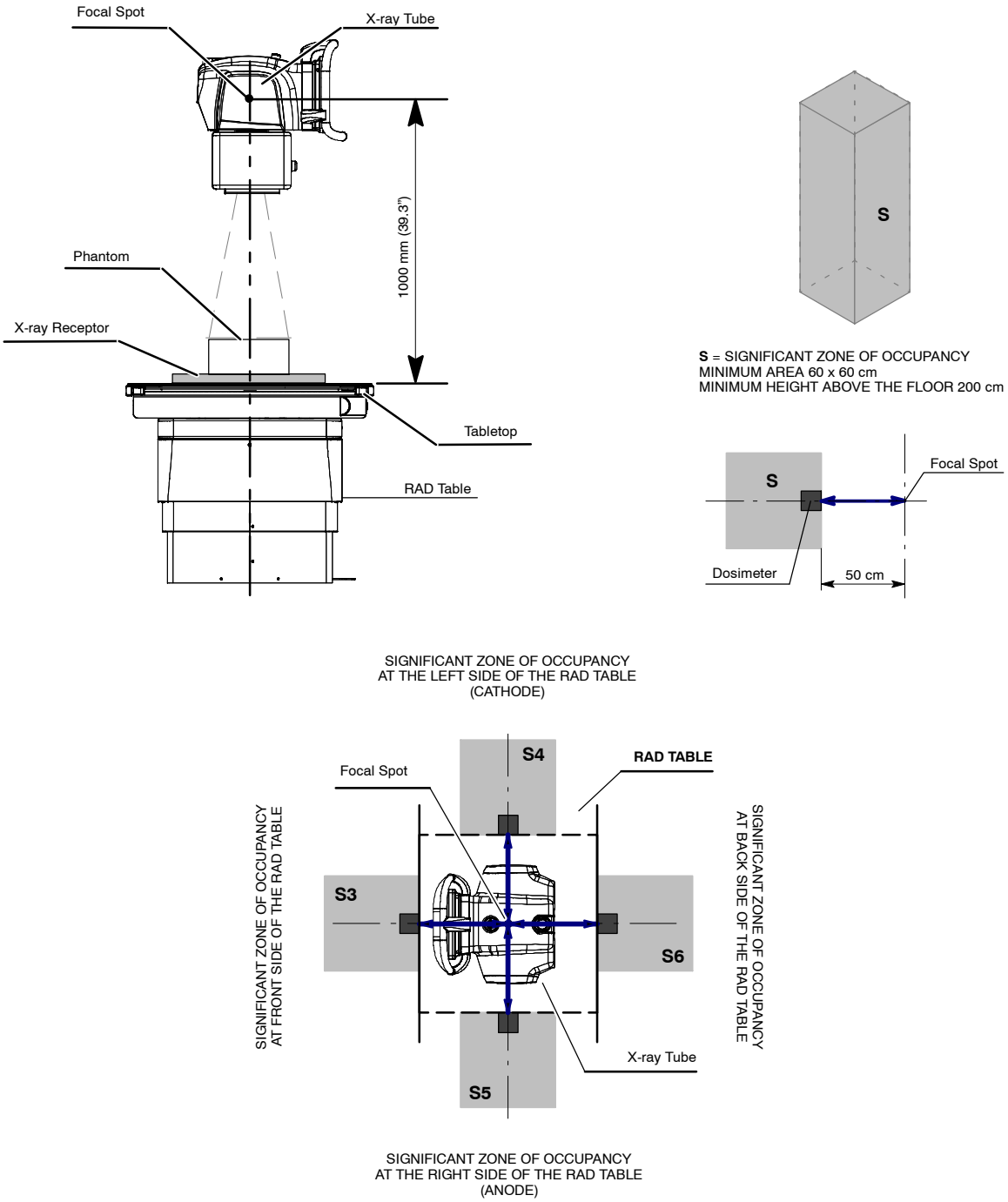


Illustration 2-2
Radiographic Examination on the RAD Table



2.7.9 DISTRIBUTION OF STRAY RADIATION

Measurements conditions to determine the distribution of Stray Radiation in the Significant Zone of Occupancy are in accordance with Standard IEC 60601-1-3:2008 and IEC 60601-1-3:2008+AMD1:2013.

- Exposure Parameters RAD mode: 150 kVp, 20 mAs, 20 mA, 1 s.
- Collimator opening for Field Size 18 x 18 cm, at SID 50 cm and 100 cm.
- Phantom: Rectangular water phantom of 25 x 25 x 15 cm, or a material having a similar X-Ray attenuation coefficient.
- Radiation measuring instrument: Low Radiation Dosimeter.

Note ☞ *The results have been obtained with a configuration that is representative of the worst case within the different configurations of the unit.*

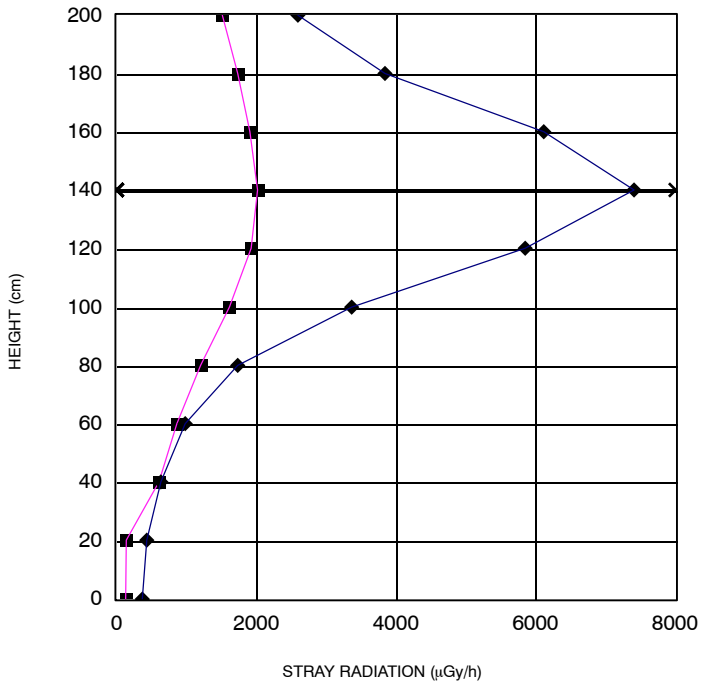
Refer to *Illustration 2-1* for Receptor in Vertical position and refer to *Illustration 2-2* for Receptor in Horizontal position.

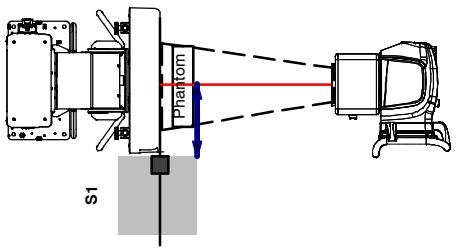
The following illustration shown the Distribution of Stray Radiation in each examination position, where:

DISTANCE TO CENTRAL X-RAY BEAM	
SID	**Line in Chart**
50 cm	
100 cm	

In order to obtain the Distribution of Stray Radiation to distances greater than 1000 mm, the radiation decreases with the square of the distance.

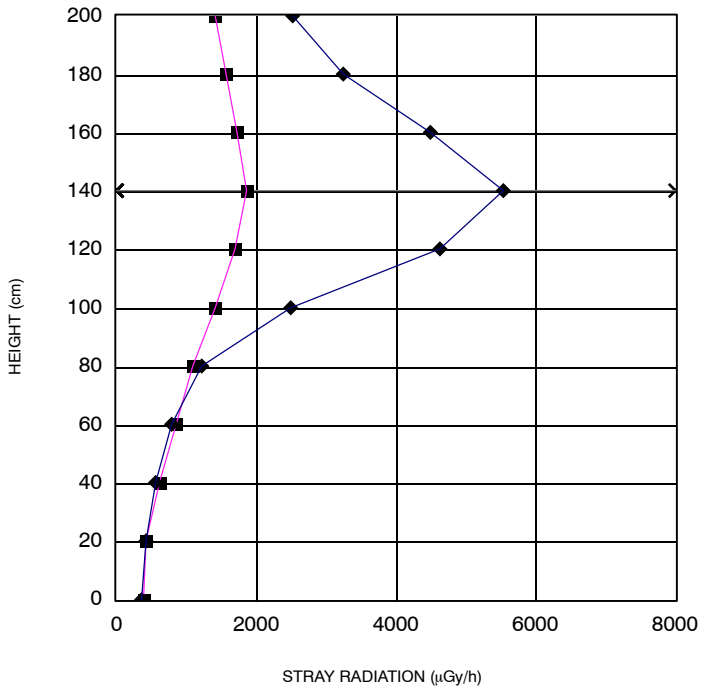
Illustration 2-3
Distribution of Stray Radiation with the Receptor in Vertical Left Position (S1)

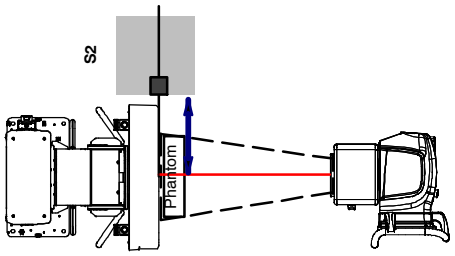




SIGNIFICANT ZONE OF OCCUPANCY
AT THE LEFT SIDE OF THE RAD WALL
STAND

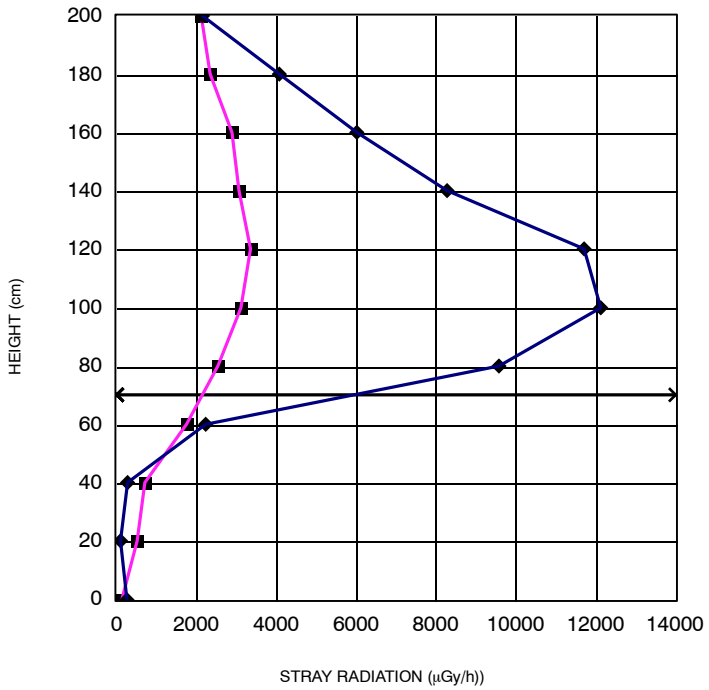
Illustration 2-4
Distribution of Stray Radiation with the Receptor in Vertical Right Position (S2)

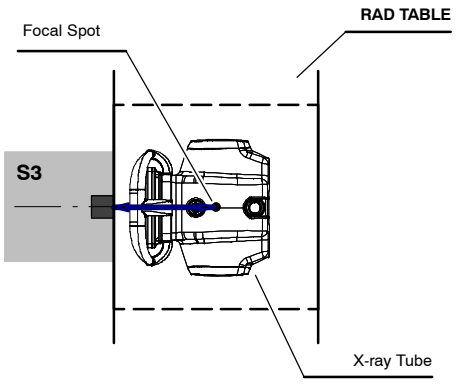




SIGNIFICANT ZONE OF OCCUPANCY
AT THE RIGHT SIDE OF THE RAD
WALL STAND

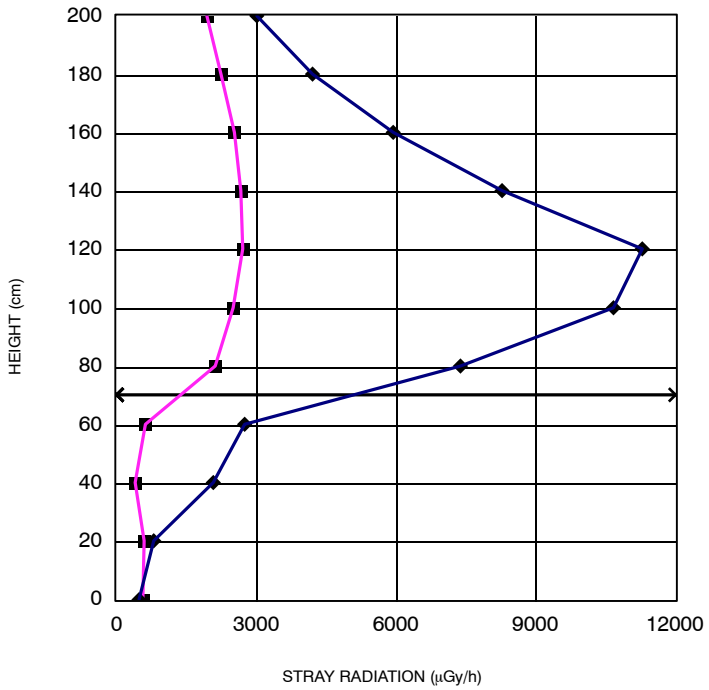
Illustration 2-5
Distribution of Stray Radiation within the Receptor in Horizontal Front Side Position (S3)

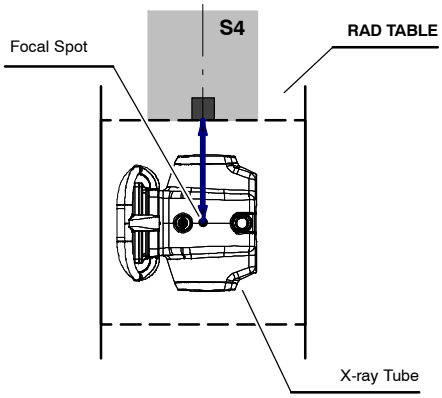




SIGNIFICANT ZONE OF OCCUPANCY
AT FRONT SIDE OF THE RAD TABLE

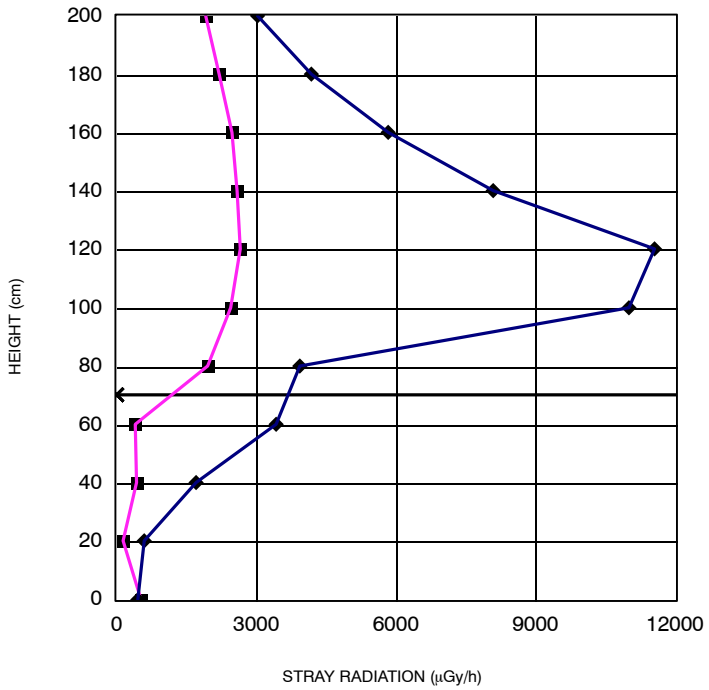
Illustration 2-6
Distribution of Stray Radiation with the Receptor in Horizontal Left Side Position (S4)

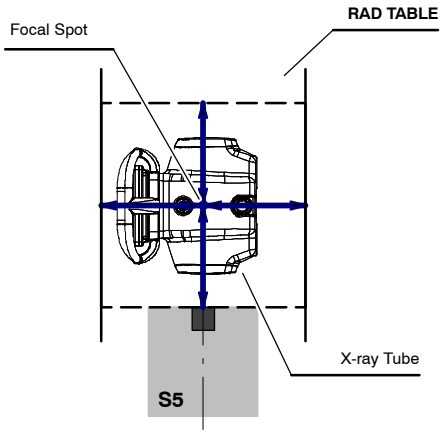




SIGNIFICANT ZONE OF OCCUPANCY
AT THE LEFT SIDE OF THE RAD TABLE
(CATHODE)

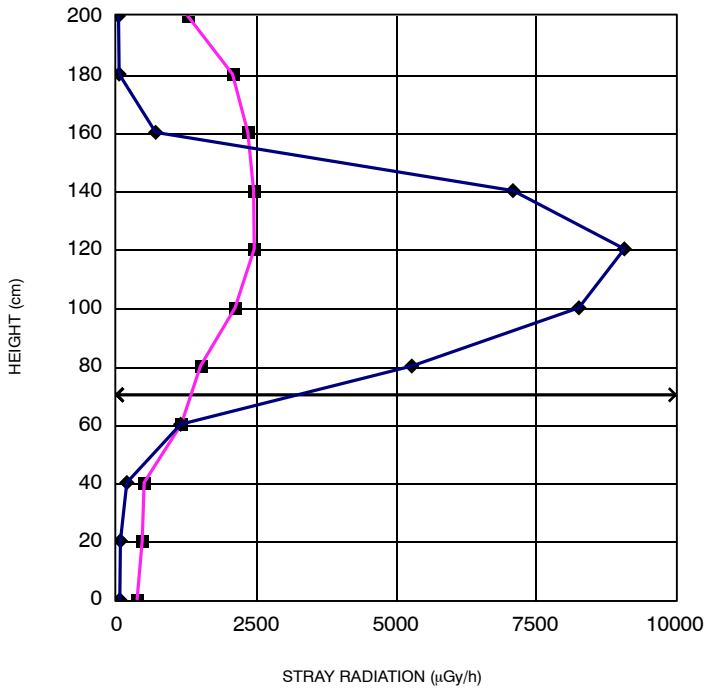
Illustration 2-7
Distribution of Stray Radiation with the Receptor in Horizontal Right Side Position (S5)





SIGNIFICANT ZONE OF OCCUPANCY
AT THE RIGHT SIDE OF THE RAD TABLE
(ANODE)

Illustration 2-8
Distribution of Stray Radiation with the Receptor in Horizontal Back Side Position (S6)



SIGNIFICANT ZONE OF OCCUPANCY
AT BACK SIDE OF THE RAD TABLE

2.8 ELECTROMAGNETIC COMPATIBILITY (EMC)

This equipment generates, uses, and can radiate radio frequency energy.

***The equipment may cause radio frequency interference to other medical or non medical devices and to radio communications*.**

To provide reasonable protection against such interference, this equipment complies with emissions limits for a Group 1 – Class A Medical Devices as stated in IEC 60601-1-2:2014 and IEC 60601-1-2:2014+AMD1:2020. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment is found to cause interference (which may be determined by turning the equipment on and off), the operator (or qualified service personnel) should attempt to correct the problem by one or more of the following measures:

- reorient or relocate the affected device,
- increase the separation between the equipment and the affected device,
- power the equipment from a source different from that of the affected device,
- consult the service engineers for further suggestions.

To comply with the regulations applicable to an electromagnetic interference for a Group 1 – Class A Medical Device, all interconnect cables to peripheral devices must be shielded and properly grounded. Use of cables not properly shielded and grounded may result in the equipment causing radio frequency interference in violation of the European Union Medical Device Directive and of Federal Communications Commissions regulations.

Before using this equipment make sure that all requirements about EMC included in this manual are accomplished.

Should any interference (EMC) be detected with other equipment, please position other equipment away from this one.

It is customer responsibility to assure that this equipment and vicinity equipment complies the value of radio frequency interferences shown in General Regulation for safety according to IEC 60601-1-2:2014 and IEC 60601-1-2:2014+AMD1:2020 Tables as described in this section.

The manufacturer is not responsible for any interference caused by using other than recommended interconnect cables, accessories and transducers or by unauthorized changes or modifications to this equipment.

ESSENTIAL PERFORMANCE

The system (e.g. Generator, Patient Support, Tube, Detector, etc.) is designed to use X-rays for diagnostic purposes according to international standards, to prevent patient, user, and others from electrical and mechanical hazards by using adequate EMC measures like using filters, screened cables or housings.

EMC-COMPLIANCE CRITERIA DUE TO THE ESSENTIAL PERFORMANCE

- No unintended movement
- No unintended X-radiation
- No unintended change of generator parameters (kV, mAs)

GUIDANCE AND MANUFACTURER'S DECLARATION - ELECTROMAGNETIC EMISSIONS (IEC 60601-1-2:2014+AMD1:2020)		
This X-ray System is intended for use in the electromagnetic environment specified below. The customer or the user of this X-ray System Radiographic Room should assure that it is used in such an environment.		
Emissions test	**Compliance**	**Electromagnetic environment - guidance**
RF emissions CISPR 11	Group 1	This X-ray System uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class A	This X-ray System is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/flicker emissions IEC 61000-3-3	Complies	
NOTE - In accordance with Standard IEC 60601-1-2:2014, the emissions characteristics of this equipment make it suitable for use in industrial areas and hospitals (CISPR 11 Class A. If it is used in a residential environment (for which CISPR 11 Class B is normally required) this equipment might not offer adequate protection to radio-frequency communication services. The user might need to take mitigation measures, such as relocating or re-orientating the equipment.		

GUIDANCE AND MANUFACTURER'S DECLARATION - ELECTROMAGNETIC IMMUNITY (IEC 60601-1-2:2014+AMD1:2020)			
This X-ray System is intended for use in the electromagnetic environment specified below. The customer or Operator of this X-ray System should assure that it is used in such an environment.			
Immunity Test	**IEC 60601-1-2:2014 Test Level**	**Compliance Level**	**Electromagnetic environment - guidance**
Electrostatic discharge (ESD) IEC 61000-4-2	± 8 kV contact ± 2 kV, ± 4 kV, ± 8 kV, ± 15 kV air	± 8 kV contact ± 2 kV, ± 4 kV, ± 8 kV, ± 15 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %.
Electrical fast transient/burst IEC 61000-4-4	± 2 kV for power supply lines ± 1 kV for input/output lines (100 kHz repetition frequency)	± 2 kV for power supply lines ± 1 kV for input/output lines (100 kHz repetition frequency)	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	± 0.5 kV, ± 1 kV line(s) to line(s) ± 0.5 kV, ± 1 kV, ± 2 kV line(s) to earth	± 0.5 kV, ± 1 kV line(s) to line(s) ± 0.5 kV, ± 1 kV, ± 2 kV line(s) to earth	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines. IEC 61000-4-11	0% U_T for 0.5 cycle at 0º, 45º, 90º,135º, 180º, 225º, 270º and 315º 0 % U_T for 1 cycle at 0º 70 % U_T for 25/30 cycles at 0º 0% U_T 250/300 cycles	0% U_T for 0.5 cycle at 0º, 45º, 90º,135º, 180º, 225º, 270º and 315º 0 % U_T for 1 cycle at 0º 70 % U_T for 25/30 cycles at 0º 0% U_T 250/300 cycles	Mains power quality should be that of a typical commercial or hospital environment. If the user of the This X-ray System requires continued operation during power mains interruptions, it is recommended that this X-ray System is powered from an Uninterruptible Power Supply or a battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	30 A/m	30 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE - U_T is the a.c. mains voltage prior to application of the test level.			

GUIDANCE AND MANUFACTURER'S DECLARATION - ELECTROMAGNETIC IMMUNITY (IEC 60601-1-2:2014+AMD1:2020)			
This X-ray System is intended for use in an electromagnetic environment specified below. The customer or Operator of this X-ray System should assure that it is used in such an environment.			
Immunity Test	**IEC 60601-1-2:2014 Test Level**	**Compliance Level**	**Electromagnetic environment - guidance**
Radiated RF EM fields IEC 61000-4-3	3 Vrms from 80 MHz to 2.7 GHz (80% AM at 1 kHz)	3 Vrms from 80 MHz to 2.7 GHz (80% AM at 1 kHz)	
Proximity fields from RF wireless Communications equipment IEC 61000-4-3	Refer to next table "IMMUNITY REQUIREMENTS FOR RF WIRELESS COMMUNICATIONS EQUIPMENT"	Refer to next table "IMMUNITY REQUIREMENTS FOR RF WIRELESS COMMUNICATIONS EQUIPMENT"	Portable RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30 cm to any part of the equipment, including cables specified by manufacturer. Otherwise, degradation of the performance of this equipment could result.
Conducted disturbances induced by RF fields IEC 61000-4-6	3 Vrms from 150 kHz to 80 Mhz 6 Vrms in ISM bands from 150 kHz to 80 MHz (80% AM at 1 kHz)	3 Vrms from 150 kHz to 80 Mhz 6 Vrms in ISM bands from 150 kHz to 80 MHz (80% AM at 1 kHz)	
NOTE - The ISM (industrial, scientific and medical) bands between 0.15 MHz and 80 MHz are 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 MHz to 40.70 MHz. *The amateur radio bands between 0.15 MHz and 80 MHz are 1.8 MHz to 2.0 MHz; 3.5 MHz to 4.0 MHz; 5.3 MHz to 5.4 MHz; 7 MHz to 7.3 MHz; 10.1 MHz to 10.15 MHz; 14 MHz to 14.2 MHz; 18.07 MHz to 18.17 MHz; 21.0 MHz to 21.4 MHz; 24.89 MHz to 24.99 MHz; 28.0 MHz to 29.7 MHz; and 50.0 MHz to 54.0 MHz.*			

IMMUNITY REQUIREMENTS TO RF WIRELESS COMMUNICATIONS EQUIPMENT (IEC 60601-1-2:2014+AMD1:2020)			
This X-ray System is intended for use in an electromagnetic environment specified below. The customer or Operator of this X-ray System should assure that it is used in such an environment.			
Band [a] **(MHz)**	**Modulation** [b]	**Distance (m)**	**Immunity Test Level (V/m)**
380 – 390	Pulse modulation [b] 18 Hz	0.3	27
430 – 470	FM [c] ±5 kHz deviation 1 kHz sine		28
704 – 787	Pulse modulation [b] 217Hz		9
800 – 960	Pulse modulation [b] 18Hz		28
1700 – 1990	Pulse modulation [b] 217Hz		28
2400 – 2570	Pulse modulation [b] 217Hz		28
5100 – 5800	Pulse modulation [b] 217Hz		9

[a] *For some services, only the uplink frequencies are included.*

[b] *The carrier shall be modulated using a 50 % duty cycle square wave signal.*

[c] *As an alternative to FM modulation, 50 % pulse modulation at 18 Hz may be used because while it does not represent actual modulation, it would be worst case.*

2.9 QUANTITATIVE INFORMATION

Note ☞ *The following tables show the Quantitative Information associated to this X-ray System according to the Standard IEC 60601-1-3:2008 and IEC 60601-1-3:2008+AMD1:2013. These tables illustrate loading factors for image performance and supply Dose indication examples. Therefore, they are an example of the adjustment of Loading Factors, Focal Spot Selection, SID and Collimator opening, which affect to the radiation quality or to the radiation dose rate applied in normal use.*

2.9.1 FUNCTIONAL TESTS PERFORMED TO OBTAIN THE QUANTITATIVE INFORMATION

Equipment:

1.1.85 • Rad Positioner with Ralco Collimator.

Instrumentation used:

1.1.85 • Dosimeter: Vacudap 1.1.52

• Dosimeter: Unfors

1.1.85 • Rectangular Phantom made of Polymethyl-methacrylate (PMMA) layers: 25 cm x 25 cm x 20 cm.

Test Details:

- Minimum SID distance from Table: 100 cm.
- Maximum SID distance from Wall Stand: 180 cm.
- Open Collimator size: 13 cm x 13 cm (min.), 43 cm x 43 cm (max.)
- The measurements were made with the exposure parameters shown on the results table:
  KVp Range: 40 KVp, 60 KVp, 80 KVp, 100 KVp, 125 KVp
  mAs Range: 1 mAs, 2 mAs, 10 mAs, 50 mAs, 100 mAs
- Performed measurements of Air Kerma or Air Kerma Rate at the following designated positions:
  - Distance SID doses
  - Patient (Phantom) Entrance doses and Entrance doses Rate
  - Patient (Phantom) Output doses and Output doses Rate
  - Collimator Output doses

Quantitative Information													
Loading Factors				Parameter Selection			Filtrat.	Measured Doses					
KVp	mA	Time (s)	mAs	Focal Spot Selection	SID Source-Image Distance (cm)	Collimator blades opening (cm)	HVL (min. value allowed) (mmAl)	Collimator Output Dose (µGy*m2)	SID Dose (mGy)	Phantom Input Dose (mGy)	Phantom Input Dose Rate (Gy/h)	Phantom Output Dose Rate (mGy/h)	Phantom Output Dose (µGy)
40	160	0.012	2	Small	100	13x13	1.6	0.2	0.016	0.025	7.479	10.795	0.036
	100	0.1	10	Small				1.1	0.087	0.136	4.906	7.682	0.213
	200	0.5	100	Large				11	0.836	1.307	9.407	14.125	1.962
	400	1	400	Large				40	3.073	4.802	17.286	23.863	6.629
	160	0.012	2	Small		43x43		2.1	0.016	0.025	7.615	18.691	0.062
	100	0.1	10	Small				11.8	0.090	0.140	5.038	13.354	0.371
	200	0.5	100	Large				107.1	0.862	1.347	9.698	23.798	3.305
	400	1	400	Large				391.3	3.166	4.947	17.809	41.228	11.452
	160	0.012	2	Small	180	13x13		0.2	0.005	0.006	1.865	4.273	0.014
	100	0.1	10	Small				1.1	0.027	0.034	1.214	3.453	0.096
	200	0.5	100	Large				11	0.257	0.325	2.343	5.985	0.831
	400	1	400	Large				40	0.940	1.190	4.283	11.723	3.257
	160	0.012	2	Small		43x43		2.1	0.005	0.007	1.962	6.243	0.021
	100	0.1	10	Small				11.8	0.028	0.035	1.269	4.420	0.123
	200	0.5	100	Large				107.1	0.267	0.338	2.432	7.400	1.028
	400	1	400	Large				391.3	0.979	1.239	4.461	12.763	3.545

Note ☞ *Combined standard uncertainty is ±35% (IEC 60580:2000 / IEC 60601-2-54:2009 and IEC 60601-2-54:2009+AMD1:2015 +AMD2:2018).*

Quantitative Information													
Loading Factors				Parameter Selection			Filtrat.	Measured Doses					
KVp	mA	Time (s)	mAs	Focal Spot Selection	SID Source-Image Distance (cm)	Collimator blades opening (cm)	HVL (min. value allowed) (mmAl)	Collimator Output Dose (µGy*m2)	SID Dose (mGy)	Phantom Input Dose (mGy)	Phantom Input Dose Rate (Gy/h)	Phantom Output Dose Rate (mGy/h)	Phantom Output Dose (µGy)
60	160	0.012	2	Small	100	13x13	2.2	0.6	0.046	0.072	21.746	113.713	0.379
	100	0.1	10	Small				3.9	0.252	0.394	14.195	79.388	2.205
	200	0.5	100	Large				39.4	2.587	4.042	29.103	157.649	21.896
	400	1	400	Large				191.4	10.009	15.639	56.299	295.137	81.983
	160	0.012	2	Small		43x43		7.5	0.048	0.074	22.299	233.322	0.778
	100	0.1	10	Small				40.6	0.265	0.414	14.894	161.562	4.488
	200	0.5	100	Large				389.3	2.691	4.205	30.277	320.682	44.539
	400	1	400	Large				1491.3	10.435	16.304	58.696	596.348	165.652
	160	0.012	2	Small	180	13x13		0.6	0.014	0.018	5.345	53.374	0.178
	100	0.1	10	Small				3.9	0.078	0.098	3.538	36.438	1.012
	200	0.5	100	Large				39.4	0.796	1.007	7.251	72.125	10.017
	400	1	400	Large				191.4	3.078	3.896	14.025	145.377	40.383
	160	0.012	2	Small		43x43		7.5	0.015	0.019	5.677	71.217	0.237
	100	0.1	10	Small				40.6	0.082	0.103	3.717	48.584	1.350
	200	0.5	100	Large				389.3	0.832	1.053	7.582	96.355	13.383
	400	1	400	Large				1491.4	3.219	4.074	14.667	179.186	49.774

Note ☞ *Combined standard uncertainty is ±35% (IEC 60580:2000 / IEC 60601-2-54:2009 and IEC 60601-2-54:2009+AMD1:2015 +AMD2:2018).*

Quantitative Information													
Loading Factors				Parameter Selection			Filtrat.	Measured Doses					
KVp	mA	Time (s)	mAs	Focal Spot Selection	SID Source-Image Distance (cm)	Collimator blades opening (cm)	HVL (min. value allowed) (mmAl)	Collimator Output Dose (µGy*m2)	SID Dose (mGy)	Phantom Input Dose (mGy)	Phantom Input Dose Rate (Gy/h)	Phantom Output Dose Rate (mGy/h)	Phantom Output Dose (µGy)
80	160	0.012	2	Small	100	13x13	2.9	1.4	0.087	0.136	40.753	378.000	1.260
	100	0.1	10	Small				7.4	0.461	0.702	25.909	256.070	7.113
	200	0.5	100	Large				74.5	4.674	7.303	52.582	511.763	71.078
	400	1	400	Large				366.7	18.374	28.709	103.353	982.017	272.783
	160	0.012	2	Small		43x43		14.3	0.090	0.141	42.391	829.043	2.763
	100	0.1	10	Small				77	0.483	0.754	27.162	553.148	15.365
	200	0.5	100	Large				735.9	4.884	7.632	54.949	1099.409	152.696
	400	1	400	Large				2856.2	19.209	30.014	108.049	2111.165	586.435
	160	0.012	2	Small	180	13x13		1.4	0.026	0.033	9.931	181.096	0.604
	100	0.1	10	Small				7.2	0.142	0.179	6.462	120.177	3.338
	200	0.5	100	Large				74.5	1.449	1.834	13.201	239.228	33.226
	400	1	400	Large				366.7	5.703	7.218	25.986	480.835	133.565
	160	0.012	2	Small		43x43		14.3	0.027	0.035	10.419	249.574	0.832
	100	0.1	10	Small				77	0.149	0.189	6.799	162.094	4.503
	200	0.5	100	Large				735.9	1.520	1.924	13.851	328.883	45.678
	400	1	400	Large				2856.2	5.988	7.578	27.282	632.661	175.739

Note ☞ *Combined standard uncertainty is ±35% (IEC 60580:2000 / IEC 60601-2-54:2009 and IEC 60601-2-54:2009+AMD1:2015 +AMD2:2018).*

Quantitative Information													
Loading Factors				Parameter Selection			Filtrat.	Measured Doses					
KVp	mA	Time (s)	mAs	Focal Spot Selection	SID Source-Image Distance (cm)	Collimator blades opening (cm)	HVL (min. value allowed) (mmAl)	Collimator Output Dose (µGy*m2)	SID Dose (mGy)	Phantom Input Dose (mGy)	Phantom Input Dose Rate (Gy/h)	Phantom Output Dose Rate (mGy/h)	Phantom Output Dose (µGy)
100	160	0.012	2	Small	100	13x13	3.6	2.1	0.131	0.205	61.550	854.348	2.848
	100	0.1	10	Large				11.2	0.698	1.091	39.282	562.852	15.635
	200	0.5	100	Large				113	7.136	11.149	80.276	1132.591	157.304
	400	1	400	Large				448.9	28.400	44.375	127.800	1784.097	619.478
	160	0.012	2	Small		43x43		21	0.137	0.215	64.362	1829.478	6.098
	100	0.1	10	Large				114.8	0.735	0.140	41.371	1221.809	33.939
	200	0.5	100	Large				1067.6	7.491	1.347	84.277	2346.574	325.913
	400	1	400	Large				4373	29.791	4.947	134.061	3901.774	1354.78
	160	0.012	2	Small	180	13x13		2.1	0.040	0.006	15.334	396.261	1.321
	100	0.1	10	Large				11.2	0.217	0.034	9.877	263.614	7.323
	200	0.5	100	Large				113	2.224	0.325	20.269	536.807	74.557
	400	1	400	Large				448.9	8.878	1.190	32.361	861.997	299.304
	160	0.012	2	Small		43x43		21	0.043	0.007	16.187	555.391	1.851
	100	0.1	10	Large				114.8	0.228	0.035	10.404	363.757	10.104
	200	0.5	100	Large				1067.6	2.334	0.338	21.268	743.791	103.304
	400	1	400	Large				4373	9.313	1.239	33.946	1173.788	407.565

Note ☞ *Combined standard uncertainty is ±35% (IEC 60580:2000 / IEC 60601-2-54:2009 and IEC 60601-2-54:2009+AMD1:2015 +AMD2:2018).*

Quantitative Information													
Loading Factors				Parameter Selection			Filtrat.	Measured Doses					
KVp	mA	Time (s)	mAs	Focal Spot Selection	SID Source-Image Distance (cm)	Collimator blades opening (cm)	HVL (min. value allowed) (mmAl)	Collimator Output Dose (µGy*m2)	SID Dose (mGy)	Phantom Input Dose (mGy)	Phantom Input Dose Rate (Gy/h)	Phantom Output Dose Rate (mGy/h)	Phantom Output Dose (µGy)
125	160	0.012	2	Small	100	13x13	4.5	2.9	0.194	0.303	90.897	1611.652	5.372
	100	0.1	10	Large				19.1	1.037	1.620	58.304	7.682	0.213
	200	0.5	100	Large				164.1	10.722	16.753	120.620	2195.061	304.870
	400	1	400	Large				823.7	43.078	67.310	121.158	2211.652	1228.696
	160	0.012	2	Small		43x43		29.7	0.204	0.319	95.666	3558.261	11.861
	100	0.1	10	Large				163.4	1.090	1.704	61.337	2407.617	66.878
	200	0.5	100	Large				1595.2	11.243	17.568	126.489	4963.617	689.391
	400	1	400	Large				5679.6	45.270	70.734	127.321	4418.609	2454.783
	160	0.012	2	Small	180	13x13		2.9	0.058	0.073	21.923	776.609	2.589
	100	0.1	10	Large				19.1	0.317	0.401	14.449	520.278	14.452
	200	0.5	100	Large				164.1	3.349	4.238	30.515	1068.730	148.435
	400	1	400	Large				823.7	13.470	17.047	30.685	1072.487	595.826
	160	0.012	2	Small		43x43		29.7	0.062	0.078	23.395	1085.478	3.618
	100	0.1	10	Large				163.4	0.338	0.428	15.416	728.765	20.243
	200	0.5	100	Large				1595.2	3.523	4.459	32.108	1509.496	209.652
	400	1	400	Large				5679.6	14.191	17.961	32.330	1515.913	842.174

Note ☞ *Combined standard uncertainty is ±35% (IEC 60580:2000 / IEC 60601-2-54:2009 and IEC 60601-2-54:2009+AMD1:2015 +AMD2:2018).*

Quantitative Information													
Loading Factors				Parameter Selection			Filtrat.	Measured Doses					
KVp	mA	Time (s)	mAs	Focal Spot Selection	SID Source-Image Distance (cm)	Collimator blades opening (cm)	HVL (min. value allowed) (mmAl)	Collimator Output Dose (µGy*m2)	SID Dose (mGy)	Phantom Input Dose (mGy)	Phantom Input Dose Rate (Gy/h)	Phantom Output Dose Rate (mGy/h)	Phantom Output Dose (µGy)
150	160	0.012	2	Small	100	13x13	5.4	3.8	0.253	0.395	118.573	2493.391	8.311
	100	0.1	10	Large				24.4	1.375	2.148	77.331	1679.791	46.661
	200	0.5	100	Large				239.3	14.530	22.704	163.467	3508.591	487.304
	400	1	400	Large				882.9	59.548	93.043	133.983	2882.504	2001.739
	160	0.012	2	Small		43x43		38.5	0.262	0.409	122.731	5744.348	19.148
	100	0.1	10	Large				210.7	1.444	2.257	81.244	3862.957	107.304
	200	0.5	100	Large				2124.2	15.252	23.832	171.587	8057.739	1119.130
	400	1	400	Large				8581.3	62.748	98.043	141.183	6629.009	4603.478
	160	0.012	2	Small	180	13x13		3.8	0.077	0.098	29.337	1208.087	4.027
	100	0.1	10	Large				24.4	0.426	0.539	19.410	819.235	22.757
	200	0.5	100	Large				239.3	4.548	5.756	41.442	1714.226	238.087
	400	1	400	Large				882.9	18.687	23.651	34.057	1409.948	979.130
	160	0.012	2	Small		43x43		38.5	0.080	0.102	30.467	1700.870	5.670
	100	0.1	10	Large				210.7	0.453	0.573	20.646	1152.939	32.026
	200	0.5	100	Large				2124.2	4.803	6.078	43.764	2436.730	338.435
	400	1	400	Large				8581.3	19.748	24.993	35.990	2005.983	1393.043

Note ☞ *Combined standard uncertainty is ±35% (IEC 60580:2000 / IEC 60601-2-54:2009 and IEC 60601-2-54:2009+AMD1:2015 +AMD2:2018).*

2.10 DETERMINISTIC EFFECTS

Deterministic effects may occur when the Radiation dose to a certain organ or tissue exceeds a specific threshold. Particular organs or tissues of such concern in diagnostic Radiology are the skin and the eye lens. The numerical value of the threshold dose is in the range between 1 Gy and 3 Gy.

As shown in the Quantitative Information Tables, the radiation dose effects measured in this equipment are below the threshold in which the severity of certain effects would take place on human skin or eyes lens.

This mentioned threshold was established by the International Commission on Radiological Protection (ICRP Publication No 60).

Quantitative Information tables (*Refer to Section 2.9*) illustrate examples of available loading factors for image performance and supply Dose indication, which affect to the radiation quality or to the radiation dose rate applied in normal use.

As indicated in the Quantitative Information Tables, the number of exposures needed to reach the previously described maximum radiation values will depend on the selected techniques for each radiographic study.

SECTION 3 START-UP AND SHUTDOWN

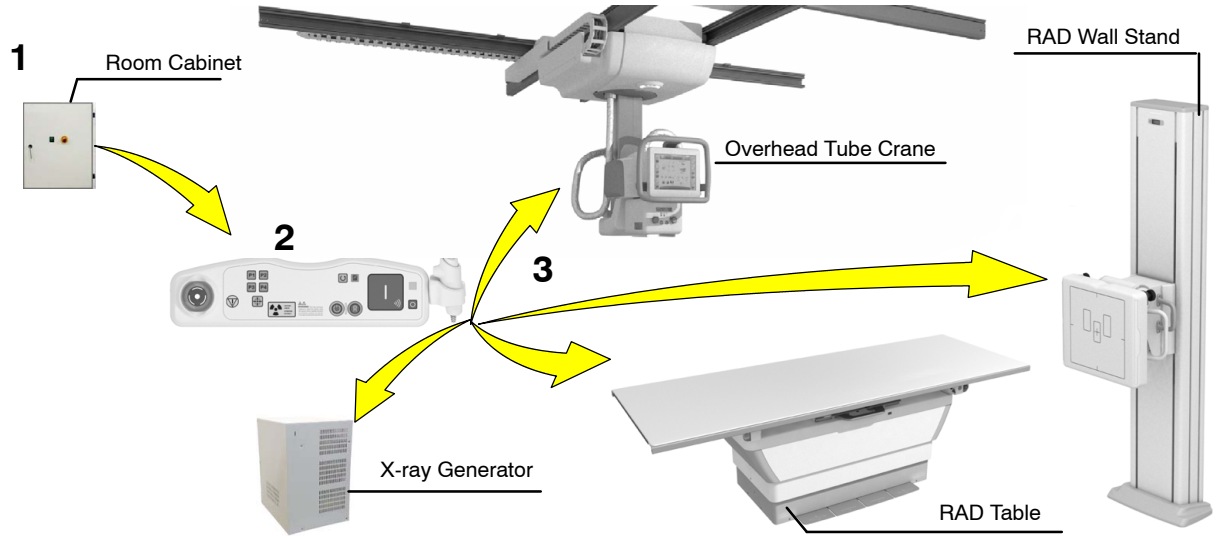
3.1 START-UP

The System should be powered by the same Room Electrical Cabinet where the X-ray Generator is connected, that is, the whole System will be powered from the same Electrical Cabinet. Each equipment is powered independently and provided with its own ON/OFF switch.

TO TURN THE SYSTEM ON

1. Turn ON the Room Electrical Cabinet Switch. **The Emergency OFF Switch must not be activated**.
2. Press the ON Button of the RCC located in the Control Room. The RCC indicator will blink in white for seven seconds in order to validate a correct access card. At this point, swipe the RFID card through the RCC reader.
    a. In case the RFID is accepted, the indicator blinks in blue.
    b. If RFID card is rejected an acoustic signal is emitted. After that, the seven-second time period for inserting a valid card is again enabled.
3. The ON Indicator remains blue while the system is initializing.
4. The Generator, RAD Table, RAD Wall Stand and Overhead Tube Crane turn ON. Then, the ON Indicator will light up according to the corresponding system status.
5. Turn ON the Image Workstation. Check that the software starts normally.
6. The ON indicator of all equipments, Detector and Workstation must be lighted. Check the status of the equipment ON Indicators.

Illustration 3-1
Start-Up sequence



3.2 SHUTDOWN ROUTINE

TO TURN THE SYSTEM OFF

There are two ways to shut down the X-ray System:

- By turning OFF the Acquisition Software from the Image Workstation. This operation automatically triggers the shutdown of all System components.
- Following the routine described below from the RCC Console:

  a. Press the RCC OFF button.

  b. A confirmation message appears in the OTC Control Console. Accept to turn OFF the system. Then, the ON indicator of the RCC will light in steady blue until the system is turned off completely.

  c. Turn OFF the Room Electrical Cabinet Switch. **Do not activate the Emergency OFF Switch**.

  d. The RAD Table, RAD Wall Stand and Overhead Tube Crane turn OFF. ON Indicators of the equipment turn OFF.

3.3 EMERGENCY OFF SWITCHES

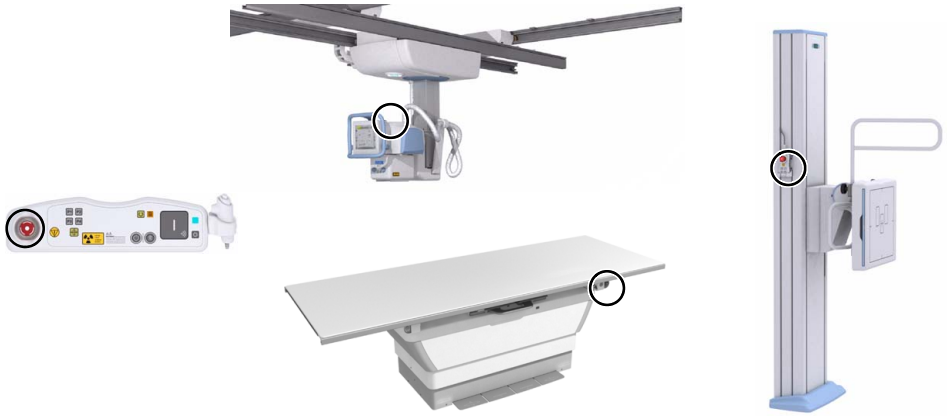
The System is OFF when the Emergency-OFF Switch in the Electrical Room Cabinet is pressed.

Illustration 3-2
System Emergency OFF Switch in the Electrical Room Cabinet

The System is stopped when one of the different equipped Emergency OFF Switches is pressed. The different locations of these switches are:

- At the top of the Tube-Collimator Assembly of the Overhead Tube Crane.
- Under the right side of the Tabletop of the RAD Table.
- In the Control Box of the RAD Wall Stand.
- In the RCC Console.

Illustration 3-3
System Emergency OFF Switches for Movements



To release the Emergency OFF Switch just press and turn clockwise the red mushroom shaped switch, the correct direction is indicated with an arrow on it.

TO ISOLATE THE EQUIPMENT FROM MAINS, TURN OFF THE SWITCH LOCATED AT THE ROOM ELECTRICAL CABINET. ALL OTHER SWITCHES STOP THE MOTION IN ALL EQUIPMENT BUT DO NOT ISOLATE THEM FROM MAINS.

IN THE EVENT OF AN EMERGENCY FORCIBLY DEPRESS THE "EMERGENCY OFF SWITCHES" (USUALLY A RED MUSHROOM-SHAPED SWITCH) AT ROOM ELECTRICAL CABINET, OVERHEAD TUBE CRANE, AUTO-POSITIONING CONTROL BOX OR AT THE RAD TABLE. MORE THAN ONE OF THESE SWITCHES MAY BE PLACED AROUND THE ROOM FOR GREATER ACCESSIBILITY.

3.4 OPERATION MODE INDICATORS, LED CODES AND ACOUSTIC SIGNALS

The System equipments are provided with LED Indicators and acoustic interface to indicate the current Operation Mode or the status of the System, and/or the Equipment. Once the System has been turned ON, the different Indicators turn ON too, operator must be aware about the acoustic notification, the lighted color and whether it is blinking or not.

The Status LED Indicators are located in:

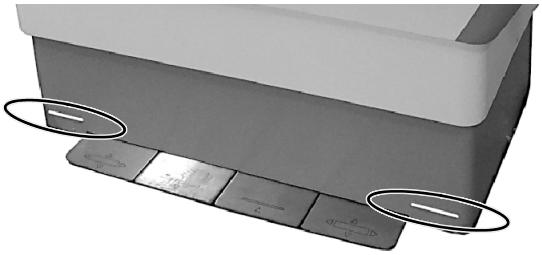
- Overhead Tube Crane Carriage
- RAD Table
- RAD Wall Stand
- RCC Console

Illustration 3-4
System Status LED Indicators

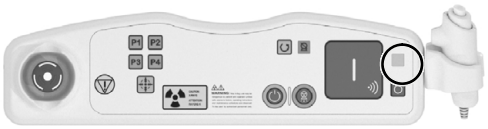
Wall Stand

OTC Carriage

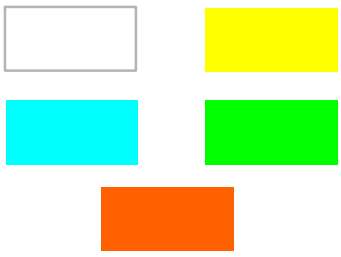
Table



RCC



The Operation modes are:



- **User Mode**:The System is ON and operative. Depending on the action that is taking place the color might change. The colors indicating "*User Mode*" are white, yellow, blue, green and orange.

- **Safety Mode**:It is indicated by the fixed pink Color. System is ON but not available for normal operation. No acoustic signal is active.

- **Emergency Mode**: It is indicated by the blinking pink color, it lights just in the equipment where the Emergency OFF Switch has been pressed. No acoustic signal is active.

- **Install/Service Mode**: It is indicated by the fixed dark blue color. Specific working mode activated by hardware and used during the installation of the system. System is ON but not operative for normal operation. It must be activated by the Field Engineer.

- **Service Mode**: It is indicated by the fixed red color when the Service Mode is activated by software. System is ON but not operative for normal operation. It must be activated by the Field Engineer whenever a maintenance and service task must be completed.

Table 3-1
Visual and Acoustic Indicators

ACTION	LED SIGNAL			ACOUSTIC SIGNAL
	Location	Color	Blinking	Beep
USER MODE				
System Initializing / Shutdown	OTC & RCC	Pink	1x1”	NO
Waiting for User Identification (RFID)	RCC	White	1x1”	NO
User Rejected (RFID)	RCC	NO	NO	2x1”
User Accepted (RFID)	RCC	Blue	NO	1x1”
OTC Standby	OTC & RCC	White	NO	NO
OTC Moving	OTC & RCC	White	1x1”	1x1”
OTC Moving inside Safety Area	OTC & RCC	White	2x1”	2x1”
Table Unselected	NO			
Table Selected	OTC & RCC & TABLE	White	NO	NO
Table Moving	OTC & RCC & TABLE	White	1x1”	1x1”
Table Moving inside Safety Area	OTC & RCC & TABLE	White	2x1”	2x1”
Wall Stand Unselected	NO			
Wall Stand Selected	OTC & RCC & WS	White	NO	NO
Wall Stand Moving	OTC & RCC & WS	White	1x1”	1x1”
Wall Stand Moving inside Safety Area	OTC & RCC & WS	White	2x1”	1x2”
Target reached	NO			2x1”
Eventuality / User intervention required (errors, active interlocks, ...) in System	RCC & OTC	Orange	NO	8x1” (1 each 100 ms)
Eventuality / User intervention required (errors, active interlocks, ...) in Table	RCC & TABLE	Orange	NO	8x1” (1 each 100 ms)

Table 3-1
Visual and Acoustic Indicators (Cont.)

ACTION	LED SIGNAL			ACOUSTIC SIGNAL
	Location	Color	Blinking	Beep
USER MODE				
Eventuality / User intervention required (errors, active interlocks, ...) in Wall Stand	RCC & WS	Orange	NO	8x1" (1 each 100 ms)
OTC Prepared	OTC & RCC	Blue	NO	NO
Table Prepared	TABLE	Blue	NO	NO
Wall Stand Prepared	WS	Blue	NO	NO
System Ready for Exposure	OTC & RCC	Green	NO	NO
Exposure (X-ray On)	OTC & RCC	Yellow	NO	Continuous
EMERGENCY MODE				
OTC Emergency OFF switch activated	OTC	Pink	1 x 1"	NO
Table Emergency OFF switch activated	TABLE	Pink	1 x 1"	NO
WS Emergency OFF switch activated	WS	Pink	1 x 1"	NO
RCC Emergency OFF switch activated	RCC	Pink	1 x 1"	NO
SAFETY MODE				
OTC in Safety Mode	OTC	Pink	NO	NO
Wall Stand in Safety Mode	WS	Pink	NO	NO
Table in Safety Mode	TABLE	Pink	NO	NO
INSTALL / SERVICE MODE				
OTC Install/Service Mode Enabled	OTC	Dark Blue	NO	NO
Table Install/Service Mode Enabled	TABLE	Dark Blue	NO	NO
Wall Stand Install/Service Mode Enabled	WS	Dark Blue	NO	NO
SERVICE MODE (by Software)				
System in Service Mode	OTC & RCC	Red	NO	NO
Table Selected when System in Service mode	TABLE	Red	NO	NO
Wall Stand Selected when System in Service mode	WS	Red	NO	NO

3.5 SYSTEM INTERLOCKS

This system has a series of interlocks that can inhibit exposures when certain conditions exist. More than one interlock may be activated at the same time, correct all of them to allow exposures:

INTERLOCK	DESCRIPTION	ACTION
MANUAL MOTION	The Overhead Tube Crane is moving manually.	Wait until the equipment is stopped and ready to be used.
AUTOMATIC MOTION	The Overhead Tube Crane is moving automatically (Auto-positioning, Auto-tracking, Auto- center, etc.).	Wait until automatic movement stops and the equipment is ready to be used.
NO DETECTOR	Detector not inserted in the selected workstation.	Insert the Detector in the selected Workstation.
NO-SID	No SID available. The Overhead Tube Crane is not pointing to the Receptor, or too far from it.	Place the Tube at the correct position and distance.
I.GEOMETRY	No SID available. The Overhead Tube Crane is not pointing to the Bucky/Detector.	Place the Tube at the correct position and distance.
COLLIMATOR BUSY	Collimator is in BUSY Mode.	Wait until the Collimator is ready to be used.
GRID-SID	Current SID out of configured range for the Grid.	Place the tube inside the correct range.
I.MODALITY	Selected Study (Stitching, Tomography, etc.) not available.	Configure the system to allow the completion of the selected study.
I.DETECTOR MISMATCH	Different Workstations selection on Overhead Tube Crane and Generator	Modify selection to match the configuration of the exposure in both equipment.
I.STITCHING	The Overhead Tube Crane is performing a Stitching procedure.	Wait until the stitching procedure is completed.
I.NO-TRAY	Tray is out from the Receptor	Insert the Tray in the correct position.

The system beeps and the X-ray INTERLOCK Indicator appears in the Acquisition Workstation and in the OTC Control Console. Exposures are inhibited until the lock is resolved.

3.6 X-RAY TUBE WARM-UP PROCEDURE

Before effecting X-ray exposures ensure that the X-ray Tube is properly warmed-up. Make sure that no people will be inadvertently exposed to unnecessary X-rays during this procedure.

Routine exposures should not be effected unless the X-ray Tube is previously warmed-up, this prolongs X-ray Tube life.

It is recommended that the following procedure will be performed for X-ray Tube warm-up, at the start of each day and when the X-ray Tube selected has not been in use for approximately one hour.

This warm-up procedure is used for a typical X-ray Tube. Consult the X-ray Tube manufacturer instructions for the current X-ray Tube in use, comparing its recommendations with this procedure. If there is conflict with this procedure, comply with the X-ray Tube manufacturer's instructions.

Perform X-ray Tube warm-up as follows:

- Close the collimator blades fully.
- Select 70 kVp, 100 mAs, 200 mA and 500 ms exposure.
- Make sure that no one will be exposed.
- Make a total of three exposures, 15 seconds apart.

Excessive filament evaporation shortens X-ray Tube life. Minimize evaporation by keeping Exposure "Preparation" time to an absolute minimum.

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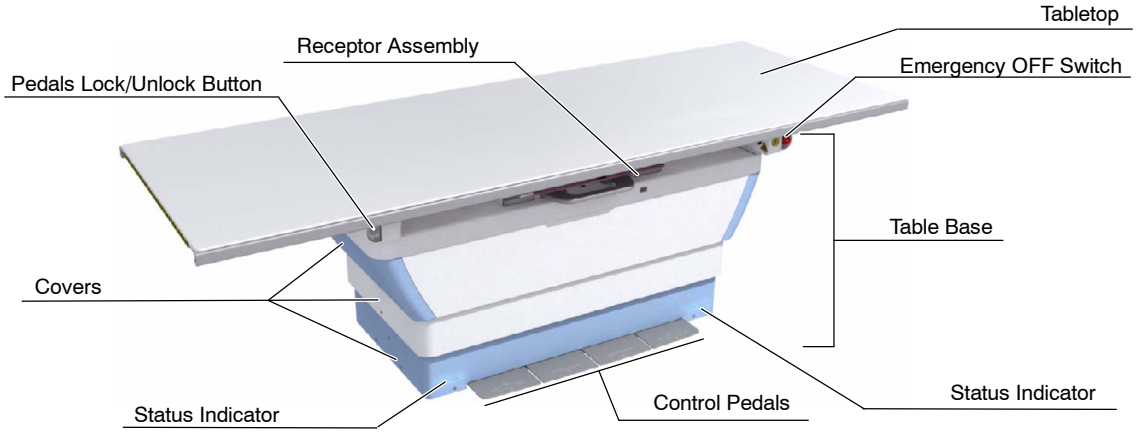
SECTION 4 SYSTEM COMPONENTS OPERATION

4.1 RAD TABLE

4.1.1 RAD TABLE COMPONENTS

Note ☞ *The RAD Table is mandatory for Double Panel System Room Configuration, but it is not present in Single Panel Systems, where the RAD Wall Stand is used when it is required to complete examinations with the Receptor in horizontal position.*

Illustration 4-1
Parts of the RAD Table



BASE & COVERS

The Table elevating system mechanism, Power Supply and all electronics are located in the Base. It supports also the Tabletop and the Receptor Cabinet.

The RAD Table is provided with a set of 6 telescopic metallic covers. These covers protect the electronics and the mechanics of the Table Base and give the final appearance to the equipment.

STATUS WORKSTATION INDICATOR

When the RAD Table is selected as the current active Workstation on the system, the Workstation Indicator gets lighted and visible under the covers (*refer to Illustration 3-4*). The indicator shows the status of the RAD Table (*refer to Section 3.4 for detailed information about system LED Indicators*).

TABLETOP

The Tabletop is a floating patient support which can be longitudinally and transversely moved, allowing an easy patient positioning when capturing the images. There are available two different Tabletop options:

- Carbon fiber Tabletop. It is composed of a sheet of carbon fiber and <0.8 mm eq. Al at 100kV of attenuation.
- Laminated Tabletop. It is composed of a sheet of laminated melamine and <1.2 mm eq. Al at 100kV of attenuation.

The maximum patient weight allowed for *RAD Table* with the patient completely lain down, even when raising and lowering the Tabletop, is 350 kg (771.6 lb).

The Tabletop can be raised up to a maximum height of 900 mm (35.43”) and lowered to a minimum height of 500 mm (19.68”).

THE MAXIMUM PATIENT WEIGHT SUPPORTED WITH THE TABLETOP AT ANY POSITION IS 350 KG (771 LB) EVENLY DISTRIBUTED OVER THE SURFACE OF THE TABLETOP. EXCEEDING THIS LIMIT MAY CAUSE EQUIPMENT DAMAGE OR INJURY TO THE PATIENT.

CONTROL PEDALS

Use the Control Pedals to activate the Vertical Movement of the Table or release the Tabletop brakes for its longitudinal and transverse positioning. There are four different Control Pedals: one to “*Raise*” the Table, one to “*Lower*” it and two for “*Tabletop Horizontal Motion*” located on the left and right of the assembly.

Depending on the configuration, it may be necessary to step twice or once each Control Pedal to adjust the Table height or release the Tabletop brakes.

Note ☞ *By default, the pedals are factory set to be stepped on twice (“double click” function), which is recommendable for safety reasons to avoid occasional brakes release.*

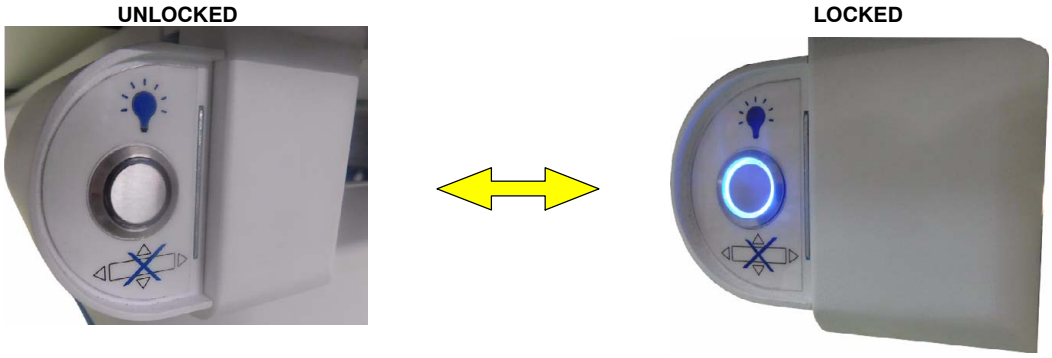
Illustration 4-2
Control Pedals Assembly

Optionally the RAD Table is provided with an additional Control Pedals Set that is mounted in the opposite lateral at the back of the RAD Table.

PEDALS LOCK/UNLOCK CONTROL

Use this button to lock the Tabletop to avoid any unexpected movements. Press once to lock its longitudinal and transverse motion. The button LED lights up in blue, indicating the Tabletop lock.

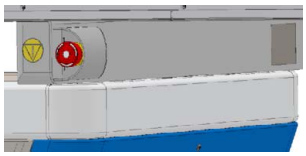
Illustration 4-3
Pedals Lock/Unlock Control



WARNING

USE THIS CONTROL TO LOCK THE LONGITUDINAL AND TRANSVERSE MOVEMENTS OF THE TABLETOP AND AVOID ANY UNEXPECTED ACTION WHICH COULD CAUSE AN UNCONTROLLED MOTION AND BE REASON OF ANY DAMAGE OF THE PATIENT OR OPERATOR.

EMERGENCY OFF SWITCH



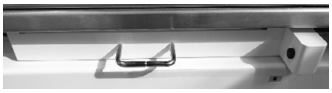
The RAD Table is equipped with an Emergency OFF Switch (Red mushroom shaped switch), placed below the front right end of the Tabletop. To release the Emergency OFF Switch, press and turn it clockwise.

IN THE EVENT OF AN EMERGENCY, TURN THE TABLE OFF BY PRESSING FORCIBLY THE EMERGENCY OFF SWITCH ON THE TABLE OR ANY OTHER EMERGENCY OFF SWITCH AT THE ROOM, AS AT TUBE SUPPORT, ELECTRICAL CABINET, ETC.

4.1.2 RAD TABLE RECEPTOR ASSEMBLY

The Receptor assembly is installed below the Tabletop. It includes a Detector Tray, suitable for all standard DR Detectors and sizes. In the Receptor assembly there are also other optional parts located, such as the Grid and the Ion Chamber, used for AEC exposures.

Note ☞ *RAD Table is compatible with the detectors listed in Section 4.7.*



FIXED DR DETECTOR CABINETS

It includes the Detector Cabinet for 43x43 Detectors (17x17”), portable Grid, Ion Chamber and Brake Button.

PORTABLE DR DETECTOR ASSEMBLY

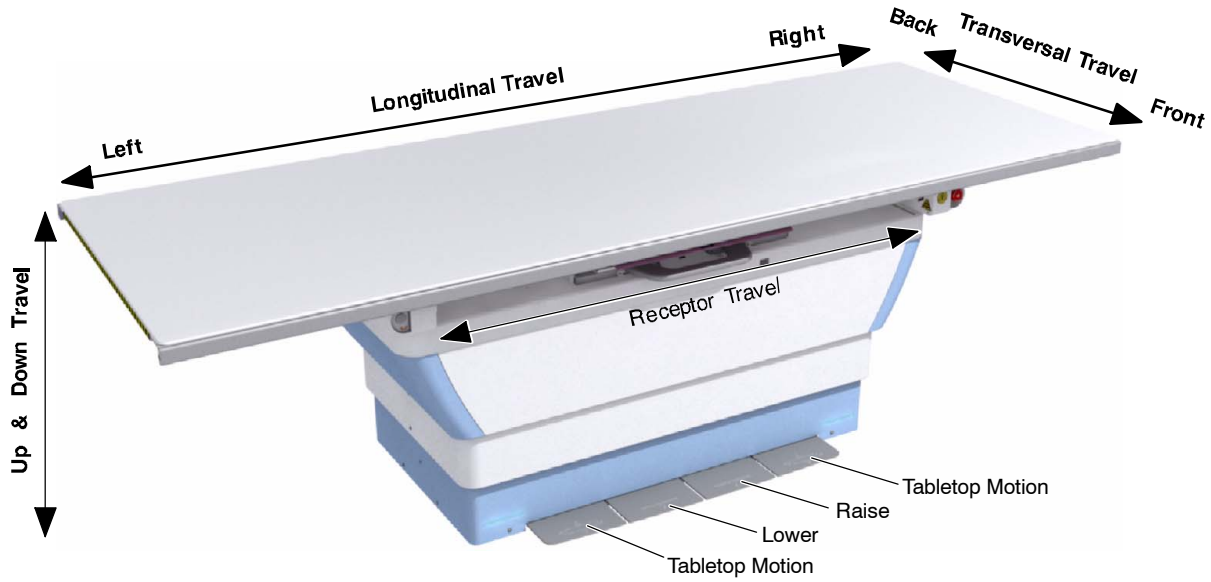
It includes the Detector Tray, which is compatible with all kind and sizes of sensor units of Detectors (factory adapted to hold a specific Detector size), portable Grid, Ion Chamber and Handle with Brake Button and Tray Brake.

4.2 RAD TABLE OPERATION

The Tabletop can be raised, lowered and four way moved by pressing the corresponding Control Pedal.

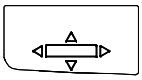
Note ☞ *The default configuration of the Control Pedals requires double tapping to release the movement brakes.*

Illustration 4-4
Tabletop Travels and Control Pedals



4.2.1 HORIZONTAL MOVEMENTS

For changing the longitudinal or the transverse position of the Tabletop in respect of the Receptor:



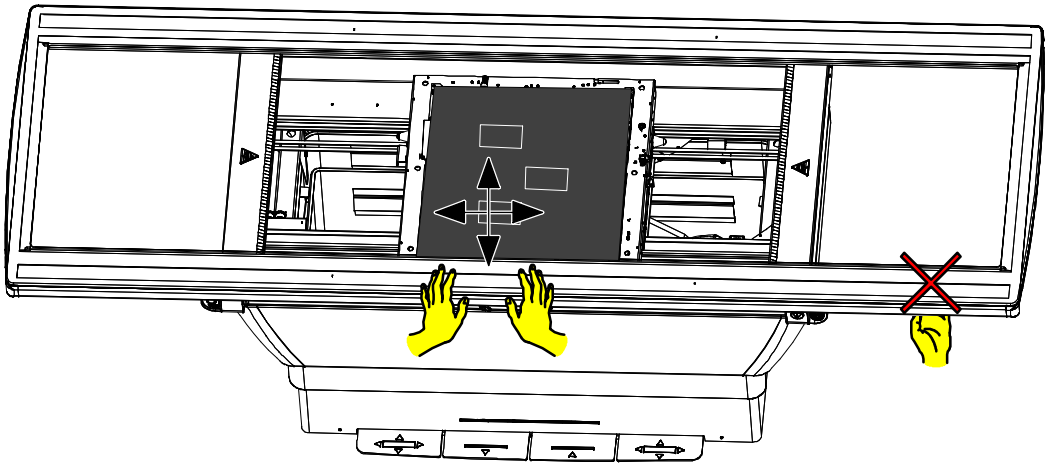
1. Press and hold down one of the **TABLETOP MOTION** Pedals.
2. Manually move the Tabletop in a longitudinal or transverse direction to the desired position.
3. Release the Control Pedal to lock the Tabletop.

The total transverse travel of the Tabletop is 300 mm (11.8”) and the default total Longitudinal travel is 1200 mm (47.2”).

WARNING

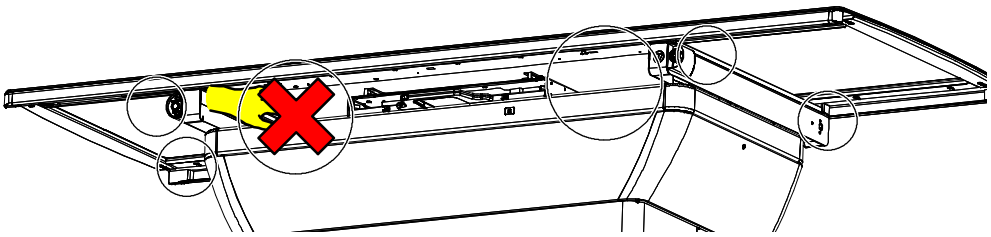
DURING TABLETOP MOVEMENT, BE SURE THAT PATIENT HEAD, HANDS AND FEET ARE COMPLETELY WITHIN THE TABLETOP AREA. IF ANY PART OF THE PATIENT IS OUT OF THE TABLETOP AREA, DAMAGES AND INJURIES CAN BE CAUSED TO THE PATIENT. WATCH THE TABLETOP MOVEMENTS TO AVOID DAMAGES AND INJURIES.

TO AVOID INJURY TO HANDS OF OPERATOR CAUSED BY TABLETOP MOVEMENT, DRIVE THE TABLETOP WITH THE HANDS ON TOP OF THE TABLETOP. HANDS MUST BE KEPT AWAY FROM THE BOTTOM OF THE TABLETOP EDGES AT ALL TIMES.



WARNING

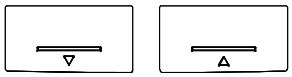
THE FOLLOWING ILLUSTRATION INDICATES DANGEROUS LOCATIONS WHERE PATIENT OR OPERATOR CAN BE INJURED OR PINCHED. PLEASE, TAKE CARE THAT NEITHER THE PATIENT NOR THE OPERATOR GETS PINCHED OR HURT IN THESE AREAS.



WARNING

DO NOT TRY TO MOVE THE TABLETOP LONGITUDINALLY OR TRANSVERSELY WITHOUT PRESSING THE CONTROL PEDAL. DAMAGES CAN BE CAUSED TO THE PATIENT, TO THE OPERATOR OR TO THE EQUIPMENT.

4.2.2 VERTICAL MOVEMENTS

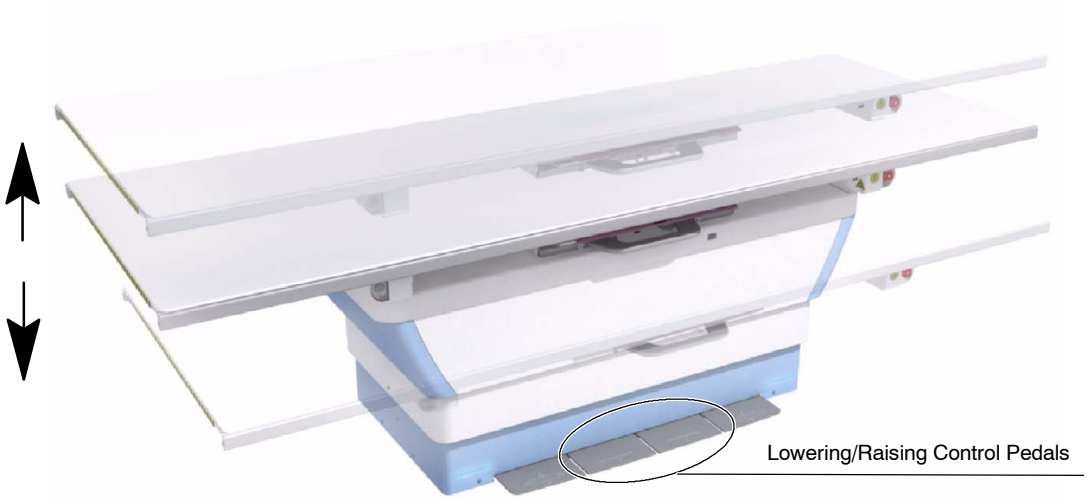


LOWERING **RAISING**

The vertical movements (raise and lower) of the Tabletop can be performed by both central Control Pedals, **LOWERING** and **RAISING**.

1. To raise/lower the RAD Table, press and hold the **RAISING**/**LOWERING** Control Pedal.

Illustration 4-5
RAD Table Vertical Movement



2. Raise/lower the Tabletop up to the desired position. If the maximum/minimum heights have not been reached, continue pressing it.
3. Release the Control Pedal, the Tabletop will get locked automatically.
4. The Tabletop automatically stops when:
   - The Control Pedal is released.
   - It reaches the configured intermediate height. This height is configured in field.
   - It reaches the maximum/minimum height.
   - An obstacle is found during Tabletop movement.

THE TABLETOP MUST BE PREVIOUSLY CENTERED AND WITH THE PATIENT COMPULSORY LIED DOWN FOR A SAFE VERTICAL MOVEMENT.

WARNING

THE RAD TABLE PROVIDES A SAFETY SYSTEM WHICH STOPS THE VERTICAL MOVEMENT WHEN THE TABLETOP TRAVEL FINDS AN OBSTACLE.

CAUTION

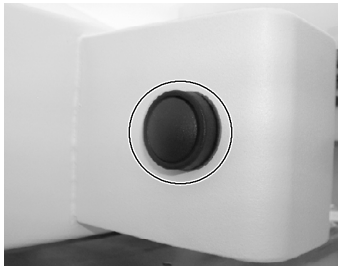
Before raising or lowering the Tabletop, make sure that no obstacles are above or below it.

4.2.3 HORIZONTAL MOVEMENT OF THE RECEPTOR

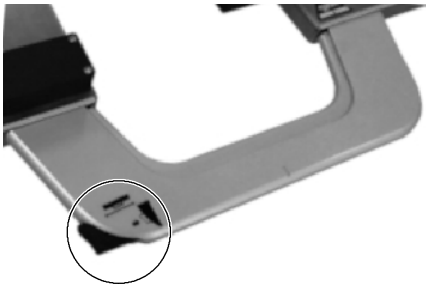
As long as the Tray is fully inserted, the Receptor can be moved beneath the Tabletop up to the desired position. Hold and press the brake button to get the Receptor unlocked and move it manually.

Illustration 4-6
Receptor Brake Buttons

Fixed Detectors



Portable Detectors



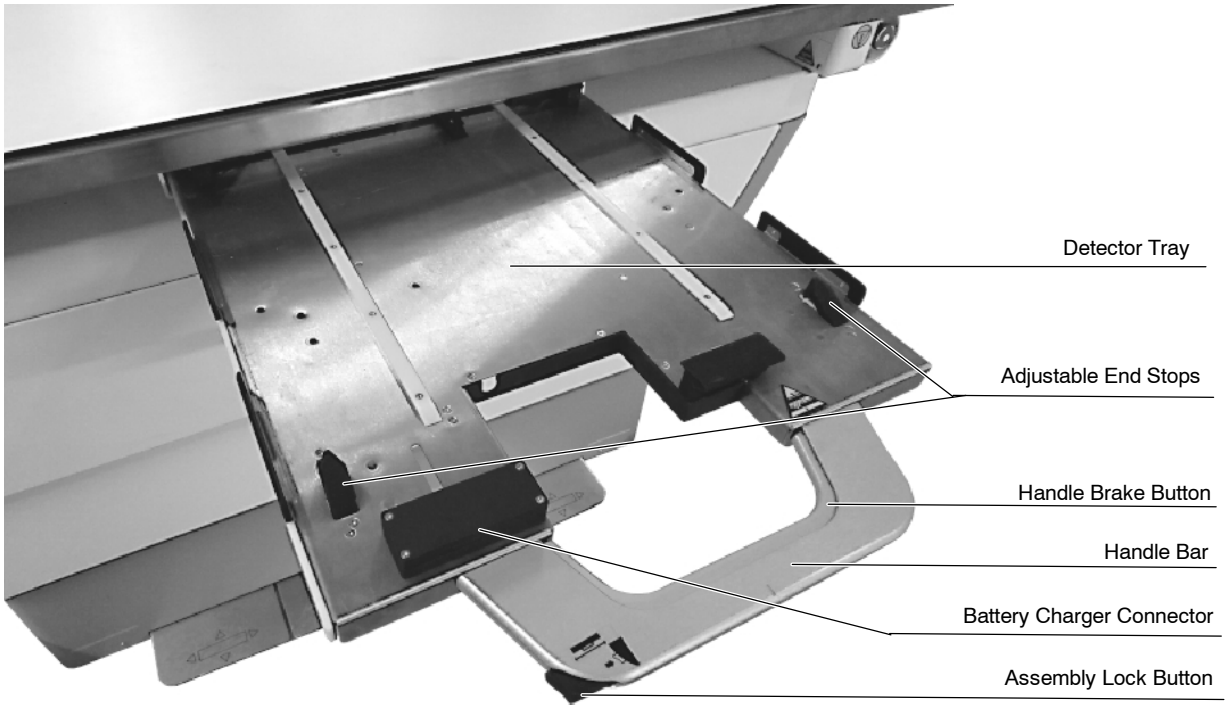
The Receptor is motorized so it can be moved automatically when executing any Auto-position or Programmed Position that has been configured with a Receptor horizontal displacement.

4.2.4 RAD TABLE PORTABLE DETECTORS

The Portable Detector Assemblies have been designed to conveniently house a Receptor (DR Detector), an Ion Chamber and a Grid. It can also provide the system with information about the position and status of the Grid and Detector.

The Handle of the Assembly includes a push button for extracting the Tray. The Brake Button also allows the horizontal movement of the Detector Assembly.

Illustration 4-7
Portable Detector Assembly in the RAD Table



Note ☞ *Check the charging port of the portable detector is oriented to the tray battery connector during the detector loading.*

4.2.4.1 PORTABLE DETECTOR INSTALLATION

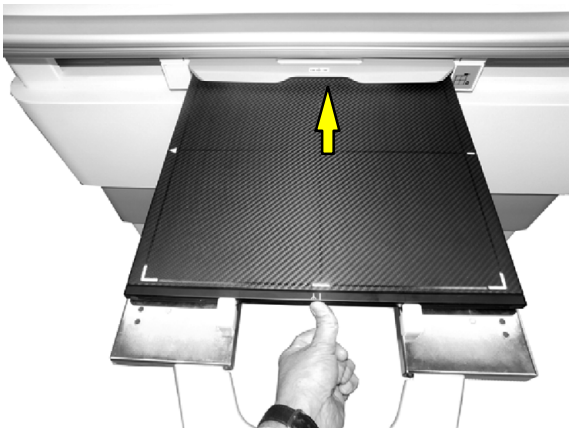
The Cabinet allows the installation of a 4343 Detector and the installation of a 3543 Detector both in portrait and landscape position, with a simple adjustment.

4343 DETECTOR LOADING

1. Pull the Handle while pressing the Handle Brake Button until the Tray is completely out of the Cabinet.

2. Then place the Detector centered in the Tray and insert it until its edge slightly presses the inner flexible end-stop and it can be fitted with the front stop of the tray.

Illustration 4-8
4343 Detector Loading



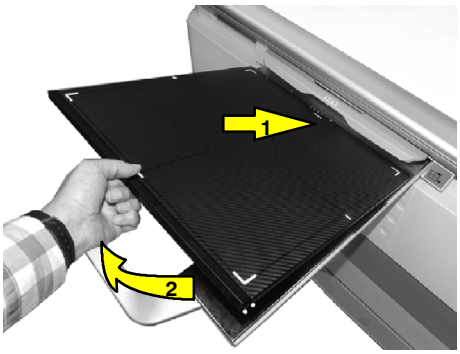
3. Finally grab the Handle while pressing the Handle Brake Button and reinsert the Tray into the Cabinet.

4343 DETECTOR REMOVAL

1. To unload the Detector, grab the Handle and pull the Tray until it is completely out.

2. Push the Detector inwards until there is enough space to release it from the front stop, lift it slightly and carefully remove it.

Illustration 4-9
4343 Detector Removal



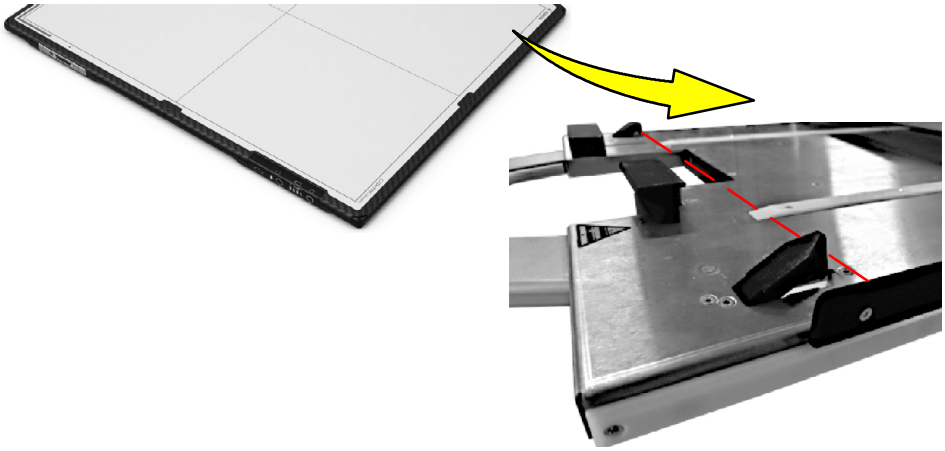
3. Finally grab the Handle while pressing the Handle Brake Button and reinsert the Tray into the Cabinet.

3543 DETECTOR LOADING IN LANDSCAPE POSITION

1. Pull the Handle while pressing the Handle Brake Button until the Tray is completely out of the Cabinet.

2. Then place the 3543 Detector in Landscape position in the Tray and push slightly the end-stop with the Detector end until it is fitted in the two adjustable end stops of the tray.

Illustration 4-10
3543 Detector Loading in Landscape Position



3. Finally grab the Handle while pressing the Handle Brake Button and reinsert the Tray into the Cabinet.

3543 DETECTOR LOADING IN PORTRAIT POSITION

1. Pull the Handle while pressing the Handle Brake Button until the Tray is completely out of the Cabinet.

2. Then place the 3543 Detector in Portrait position in the center of the Tray between the two adjustable end tops. Push slightly the inner end-stop with the Detector end until it is fitted in the front stop of the tray.

3. Finally grab the Handle while pressing the Handle Brake Button and reinsert the Tray into the Cabinet.

3543 DETECTOR REMOVAL

1. To unload the Detector, grab the Handle and pull the Tray until it is completely out.

2. Push the Detector inwards until there is enough space to release it from the front stop, lift it slightly and carefully remove it avoiding the adjustable stops.

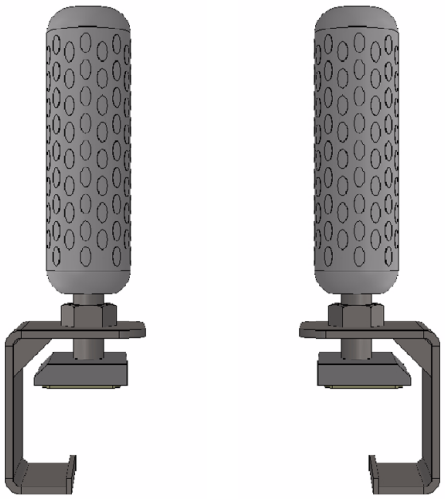
3. Finally grab the Handle while pressing the Handle Brake Button and reinsert the Tray into the Cabinet.

4.3 RAD TABLE OPTIONS

4.3.1 HAND GRIPS

The two Hand Grips are used to get patient hands away from the Tabletop edges and make the patient feel secure when the Table is in motion. They do not support patients weight, but give patients a feeling of security and help to avoid injuries.

Illustration 4-11
Hand Grips



The Hand Grips can be moved along the patient support rails and locked at any position with the thumbscrews.

WARNING

WHEN PROVIDED WITH THE OPTIONAL HAND GRIPS, USE THEM TO HELP THE PATIENT TO POSITION BOTH HANDS OUT FROM TABLETOP EDGES, SO IT IS POSSIBLE TO AVOID INJURIES IN PATIENT HANDS OR FINGERS WHEN THE TABLETOP IS IN MOVEMENT.

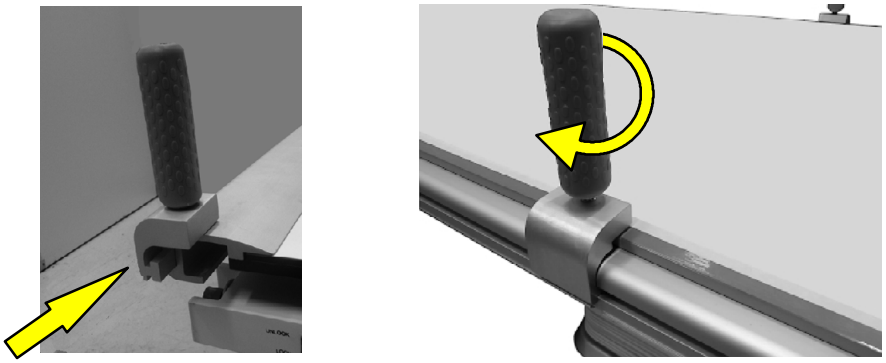
To install the Hand Grips on the Tabletop of the Table:

1. Insert the Hand Grips in the Tabletop rails and couple them in the desired position.

Note ☞ *The Hand Grips must not be positioned in the trajectory of the X-ray beam.*

2. Fix the Hand Grips by tightening clockwise the Grip itself.

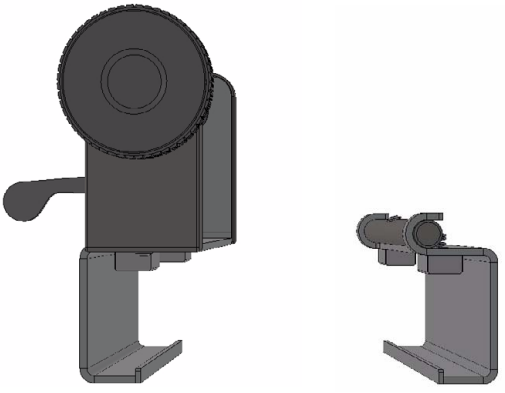
Illustration 4-12
Hand Grips Installation



4.3.2 COMPRESSION BAND

This device supplies compression to the anatomical area of interest in order to avoid unnecessary movements.

Illustration 4-13
Compression Band

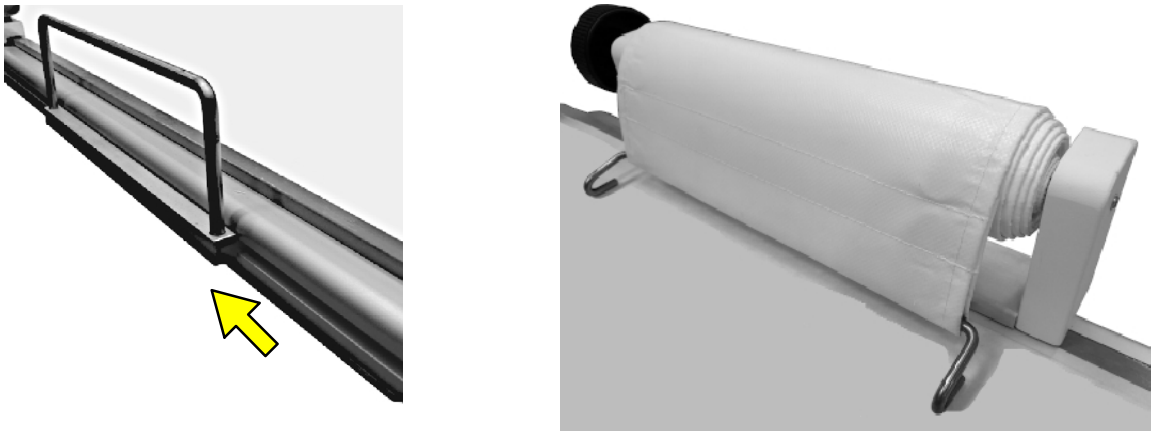


Note ☞ *The Compression Band must not be positioned in the trajectory of the X-ray beam. Therefore, it is recommended to Install the band bracket with the locking lever at the farthest from the X-ray Tube.*

To install the Compression Band on the Tabletop:

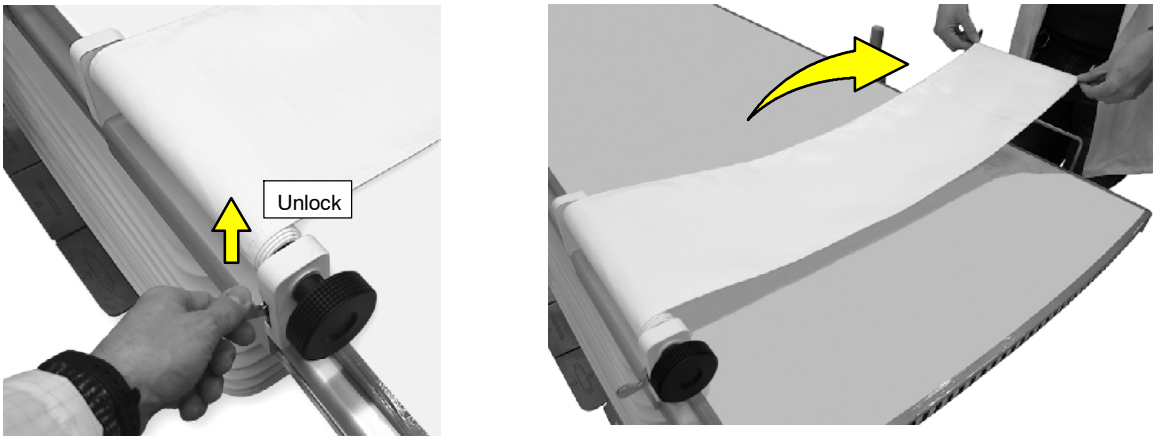
1. Couple both brackets to the Tabletop by sliding it through the Tabletop frame up to the desired position.

Illustration 4-14
Brackets Installation



2. Unlock the Band to get it extended and secure it with the hooks of the opposite bracket.

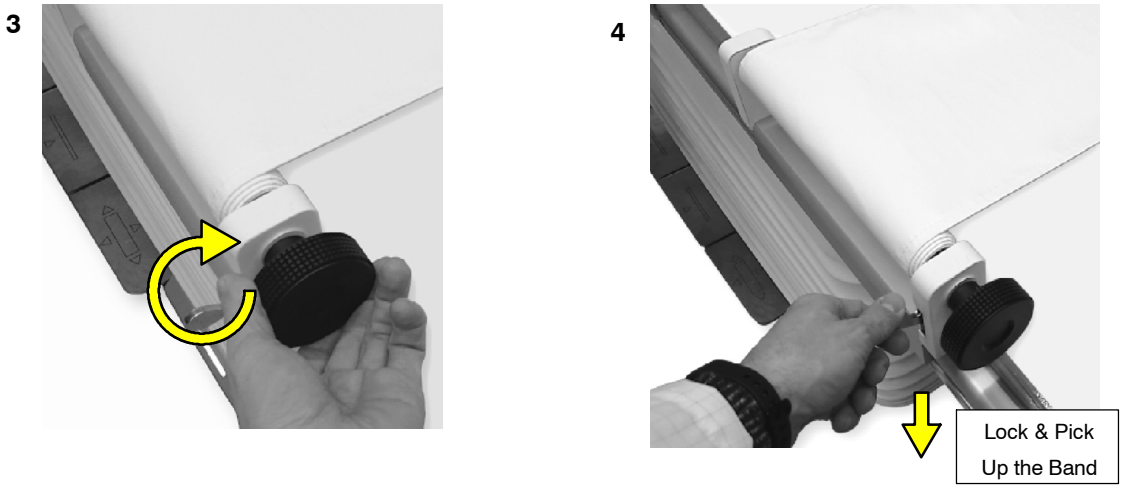
Illustration 4-15
Extending the Band over the Tabletop



3. Adjust the pressure exerted by the Band using the knob. Tighten or loosen the knob to secure the patient.

4. Use the lever to lock the position of the Compression Band.

Illustration 4-16
Snapping the Compression Band in the Tabletop



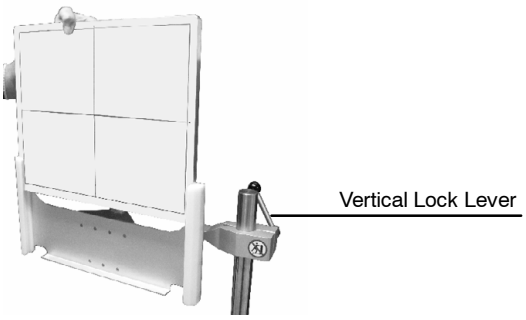
4.3.3 LATERAL DETECTOR HOLDER 35X43 WITH TROLLEY

This mobile detector holder is designed to accommodate portable DR detectors of 35x43 cm (14”x17”) (*refer to the Table 4-1 for detailed list of compatible Detectors*).

Illustration 4-17
Lateral Detector Holder 35x43 with Trolley

Insert the portable DR Detector in the Support, the orientation is always landscape.

Illustration 4-18
Detector Installation

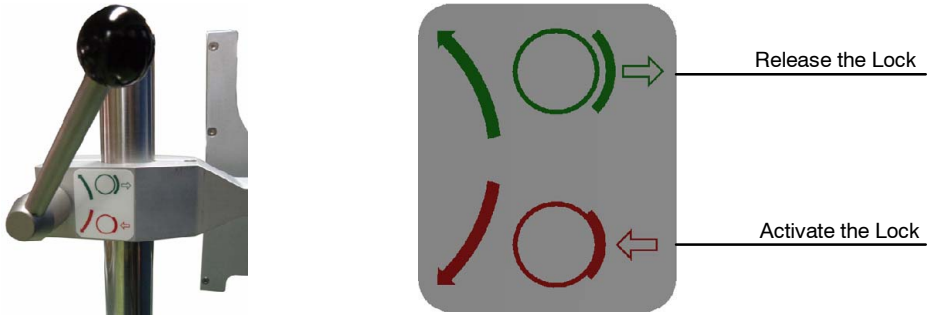


Note ☞ *Make sure that the Vertical Lock is blocked when mounting the Detector to keep it from falling down unexpectedly, which could cause damages to the Detector and Support.*

The Holder is adjustable for height, the vertical travel of the Detector is 750 mm (29.5”). To move up/down the Detector Support:

1. Loosen CCW the Vertical Lock Lever to free the Detector Support. Hold the Detector Support during this procedure to keep it from falling down unexpectedly.

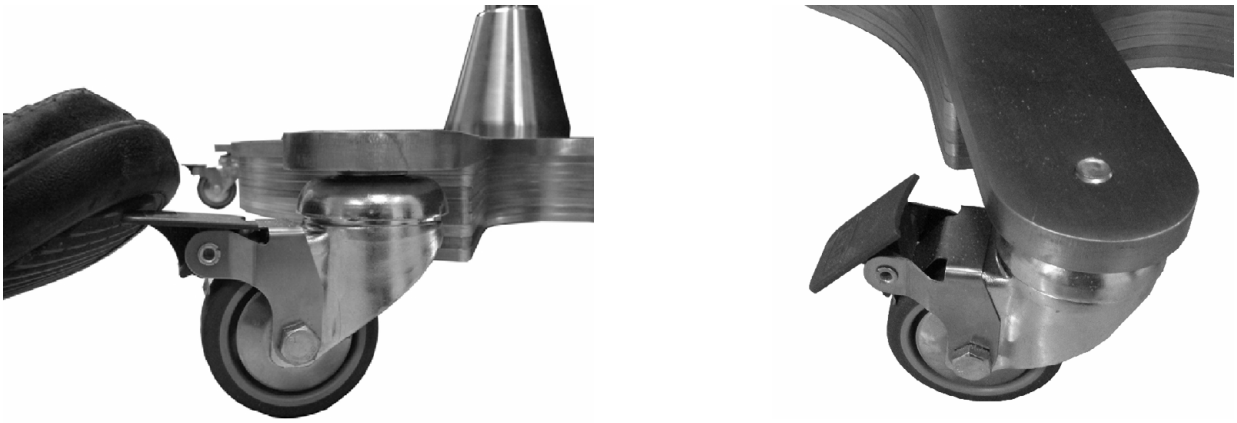
Illustration 4-19
Vertical Lock Lever



2. Move the Detector up to the desired height.
3. Tighten CW the Lever to fix again the Support at its new position.

The Holder is also mobile, it is provided with four wheels and each with its own brake pedal. To lock the wheel step the brake pedal.

Illustration 4-20
Wheel Brake Pedal



To move the Holder in order to place it in its working position or to store it, proceed as indicated below:

1. Unlock all wheels.

2. Push the Holder from its Vertical Bar and carry it where corresponds.

DRIVE THE EQUIPMENT WITH CARE. AVOID ANY IMPACT OF THE UNIT WITH WALLS, FURNITURE OR OTHER ELEMENTS IN THE ROOM THAT MAY CAUSE DAMAGE TO THE EQUIPMENT AND/OR THE OTHER ROOM ELEMENTS.

DRIVE THE EQUIPMENT IN FLAT SURFACES. IF IT IS NOT POSSIBLE, TRAVEL SURFACES SHOULD NOT EXCEED 5º INCLINATION RAMPS, EXCEEDING THIS ANGLE COULD CAUSE SERIOUS DAMAGE TO THE EQUIPMENT, AND BY USING IT UNDER THESE CONDITIONS COULD EVENTUALLY REPRESENT A DANGER FOR THE USER. HOLD ALWAYS THE VERTICAL BAR TO DRIVE CORRECTLY THIS ACCESSORY EQUIPMENT.

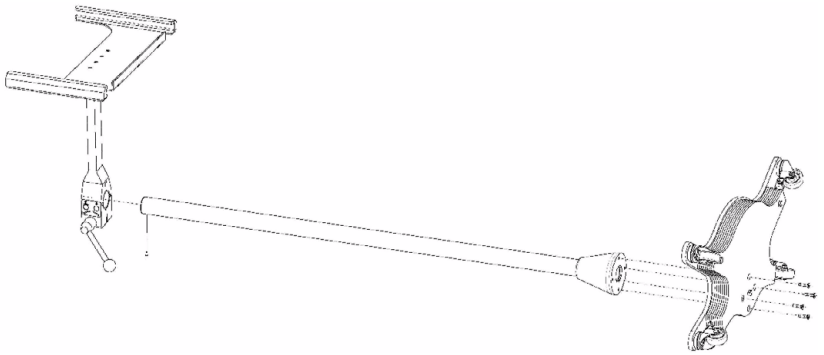
Do not try to step over any possible obstacle when moving the holder, the equipment could fall over.

ASSEMBLY PROCEDURE

Before its first use, the Holder must be mounted in the field as it is shipped splitted. Refer to the image below for graphical information about its assembly procedure.

1. Tighten the Column to the Trolley.
2. Mount the Detector Support and lock it with the Vertical Lock Lever.

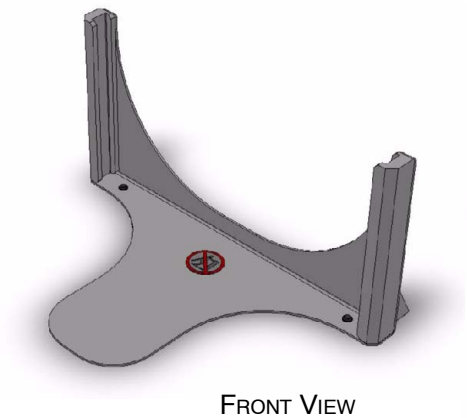
Illustration 4-21
Detector Holder Assembly Procedure



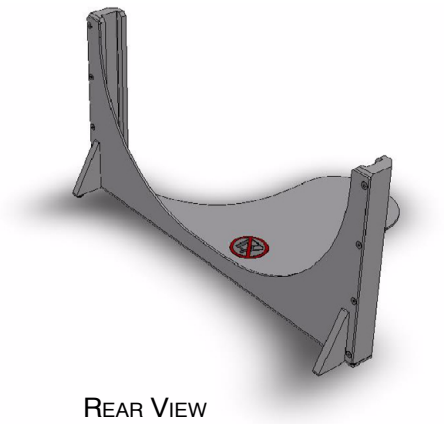
4.3.4 LATERAL HOLDER FOR PORTABLE DETECTORS

The Lateral Holder for Portable Detectors is used for Table lateral work, including knee, shoulder, skull, etc. This Lateral Detector Holder is placed directly on the Tabletop. It can hold a Detector of 35 x 43 cm.

Illustration 4-22
Lateral Holder for Portable Detectors



FRONT VIEW

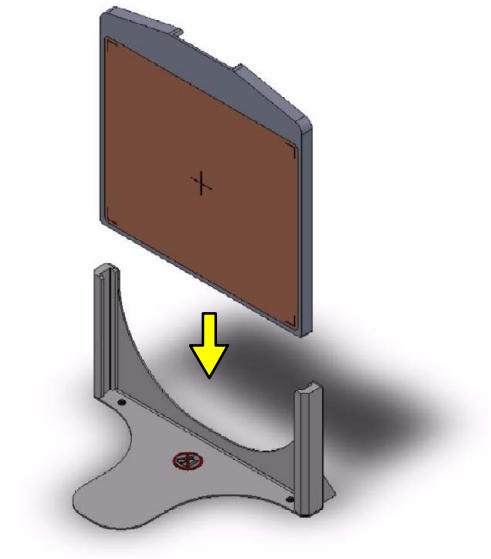


REAR VIEW

LATERAL HOLDER INSTALLATION

1. Place the Detector Holder on one of the side ends of the Tabletop.
2. Position the patient and adjust the location of the holder at the area to be irradiated.
3. Insert the Detector inside the rails of the Detector Holder with the 43 cm (17”) side in the longitudinal axis.

Illustration 4-23
Detector Insertion



4. After the exposure take out the Detector from the Lateral Holder before removing it.

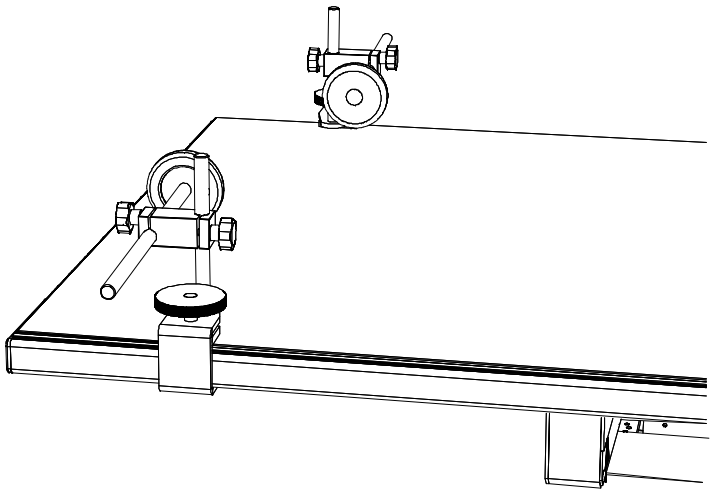
IT IS ABSOLUTELY MANDATORY TO REMOVE THE DETECTOR BEFORE REMOVING THE LATERAL HOLDER FROM THE TABLETOP. NEVER CARRY THE DETECTOR HOLDER WITH THE DETECTOR INSIDE THE RAILS.

4.3.5 HEAD SUPPORT

The Head Support is used to hold the patient head during a Rad examination and avoid moved images.

The Head Support can be installed along the Tabletop rails, fitted to the rails and locked at any position with the thumbscrews.

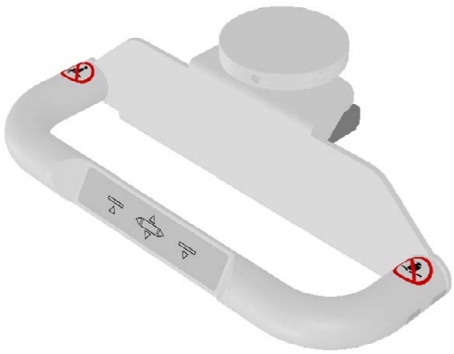
Illustration 4-24
Head Support



4.3.6 HANDLE CONSOLE

The Handle Console for RAD Table is used to move the Tabletop for its longitudinal and transverse positioning, as well as to raise and lower it.

Illustration 4-25
Handle Console



The Handle Console is operated in the same way as the Control Pedals of the RAD Table, with the difference that no double tap is required to initiate movements. The Tabletop can be raised, lowered or moved in four directions just by pressing the corresponding button of the Handle Console.

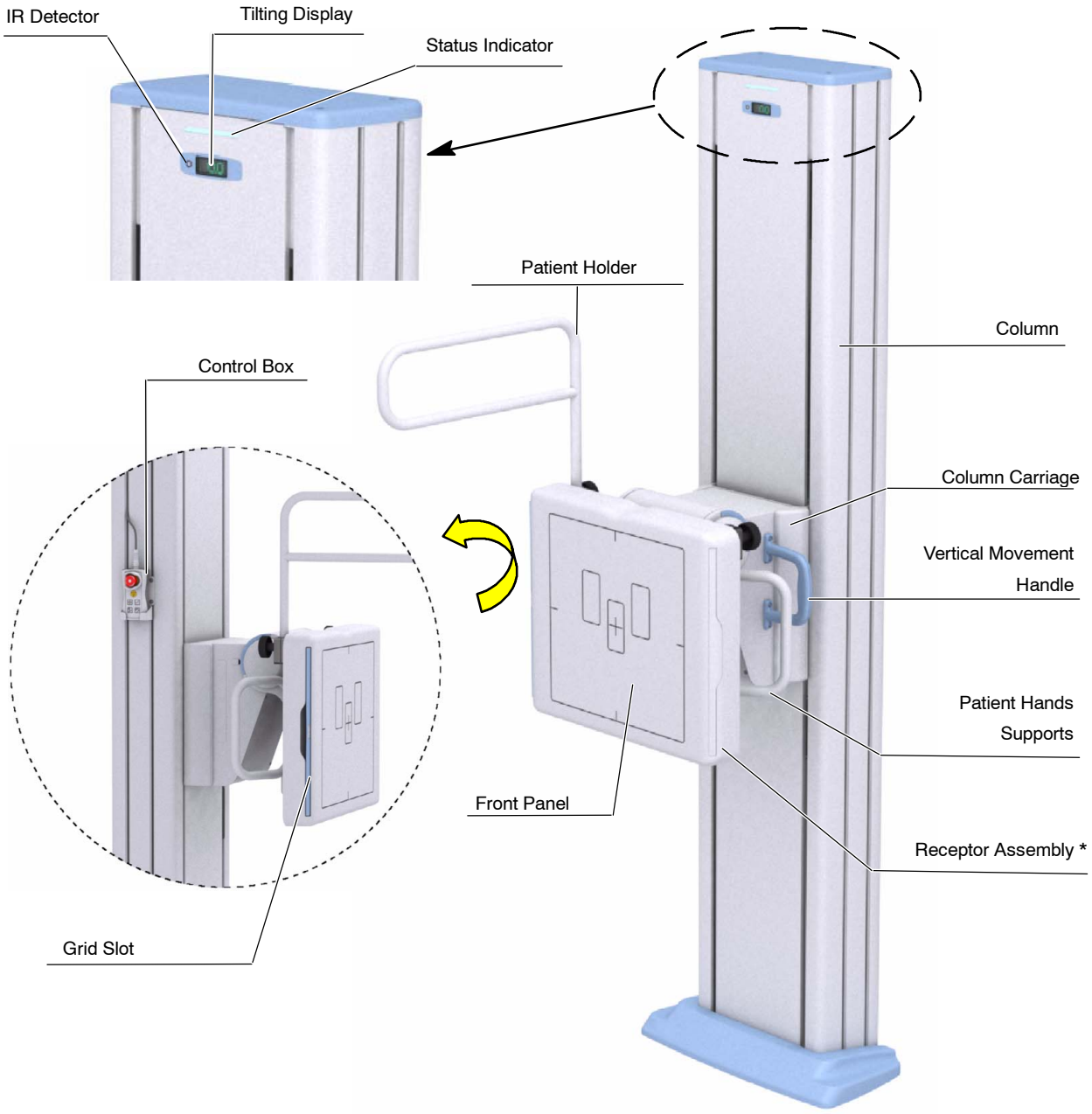
Note ☞ *Refer to Section 4.2 for further information about the Control Pedals operation.*

CAUTION ***Only service personnel may perform the installation of the Handle Console.***

4.4 RAD WALL STAND

4.4.1 RAD WALL STAND COMPONENTS

Illustration 4-26
RAD Wall Stand Components



* There are available different Receptor Assemblies and Column Carriages depending on the Receptor model and optional functions.

COLUMN

The Column Assembly is formed by the following elements:

- **Receptor Support Assembly:** It is made of steel and joins the Column Assembly to the Receptor Assembly by means of the Column Carriage that moves along the guide on the column. Includes the Vertical Movement Handle to control the vertical movement of the Receptor Assembly. 1.1.45
- **Covers:** Give the final appearance to the equipment and cover all the electronics installed in the Column.

Be careful with covers handling to avoid scratches.

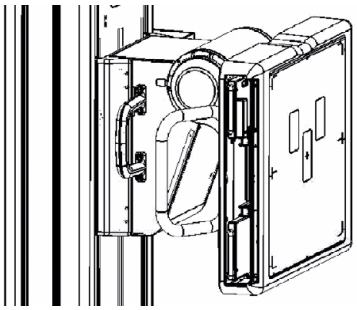
- **Counterweights:** They are manufactured of Carbon Steel and allow to counterbalance the Column Carriage and Receptor Assembly to enable a soft vertical movement.
- **Column Stand:** Manufactured of steel. It is the main part of the Column Assembly, as it is the support for all of them. It is fixed to the floor and is in charge of holding all the elements.
- **Main cabling and electronic devices:** In the Column Assembly, the equipment cables and electronic boards are located.

COLUMN CARRIAGE

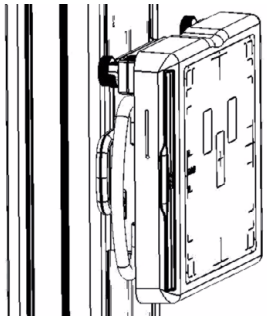
Column Carriage functions are to support the Receptor Assembly and to enable the positioning of the Receptor in the vertical and horizontal Axes and its rotation. It contains mechanical and electronic devices for the Vertical travel and Tilting and Rotation functions (if available).

Illustration 4-27
Column Carriage

WALL STAND WITH TILTING



WALL STAND WITHOUT TILTING



STATUS WORKSTATION INDICATOR

When the RAD Wall Stand is selected as the current active Workstation on the system the Workstation Indicator gets lighted, indicating the Wall Stand status (*refer to Section 3.4 for detailed information about system LED Indicators*). The indicator is located in the Top Cover of the Column.

VERTICAL MOVEMENT HANDLE

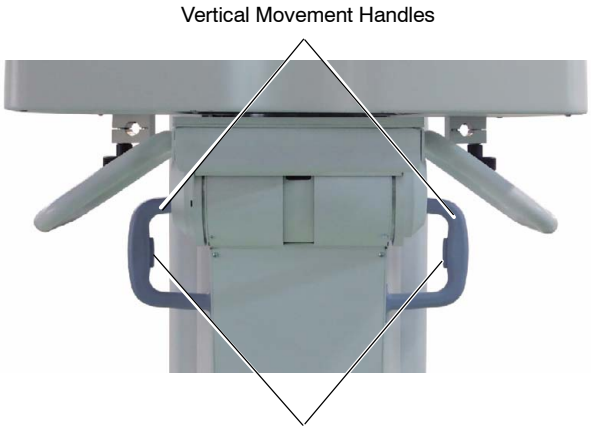
The vertical movement of the RAD Wall Stand is motorized and operator controlled. The Vertical Movement Handle enables the displacement of the Column Carriage holding the Receptor assembly along the column stand.

The Movement Handle is located by default on the left side of the Column Carriage, as well as the Receptor loading, which by default is configured on the left side. However, it is possible to configure the Wall Stand with the Handle on the right or double Handle on both sides of the Carriage.

Illustration 4-28
Movement Handle Configurations

SINGLE HANDLE (Lateral View)

DOUBLE HANDLE (Bottom View)



Use the Movement Handle to move the Receptor in the vertical axis. Press and hold the Handle button to release the brake, the Receptor moves in the selected direction. Once the button is released, the movement stops.

Illustration 4-29
Vertical Movement Handle

Do not use the Vertical Movement Handle with another purpose but to move vertically the Receptor.

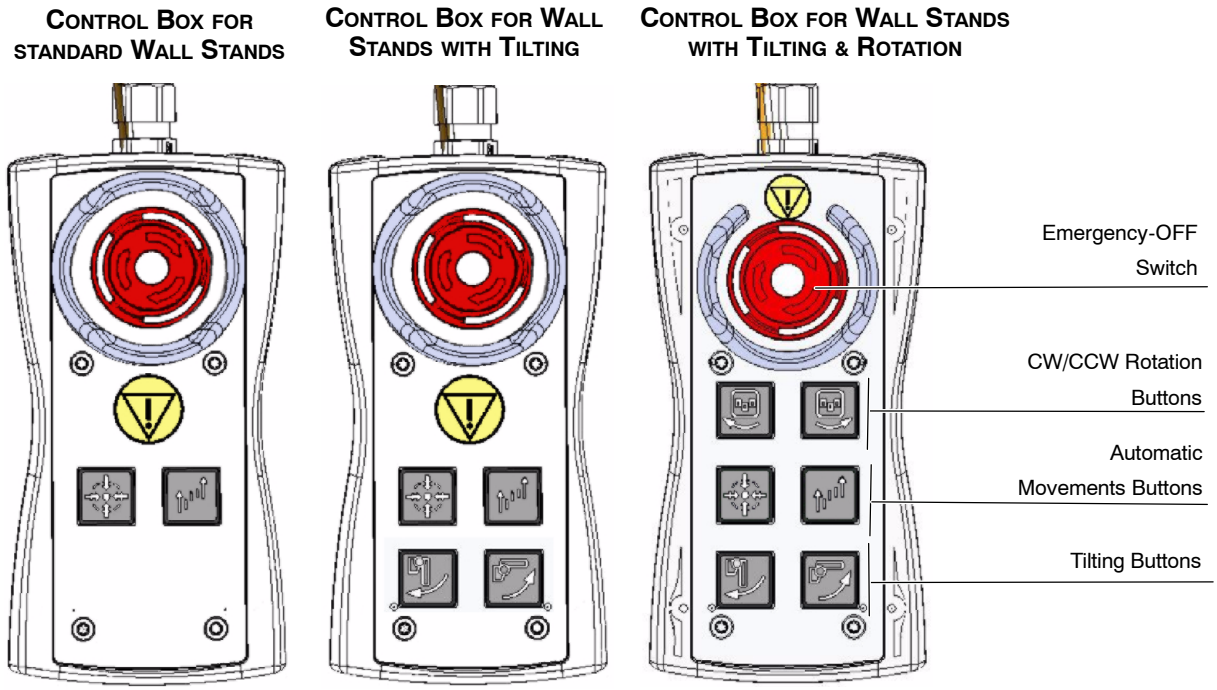
AUTOMATIC MOVEMENTS CONTROL BOX

The Automatic Movements Control Box is located on its own bracket placed on the Column Stand. It can be installed at the left or right depending on the Customer required configuration.

Use the Control Box to tilt or rotate the Receptor or to activate Auto-center and Auto-tracking movements. All movements are motorized and operator controlled. Press and hold the corresponding button to release the brake, the Receptor moves in the selected direction. Once the button is released, the movement stops.

Note ☞ *For RAD Wall Stands without Tilting and Rotation functions, the Control Box only has available the Emergency-OFF Switch and the Auto-center and Auto-tracking buttons.*

Illustration 4-30
Automatic Movements Control Boxes

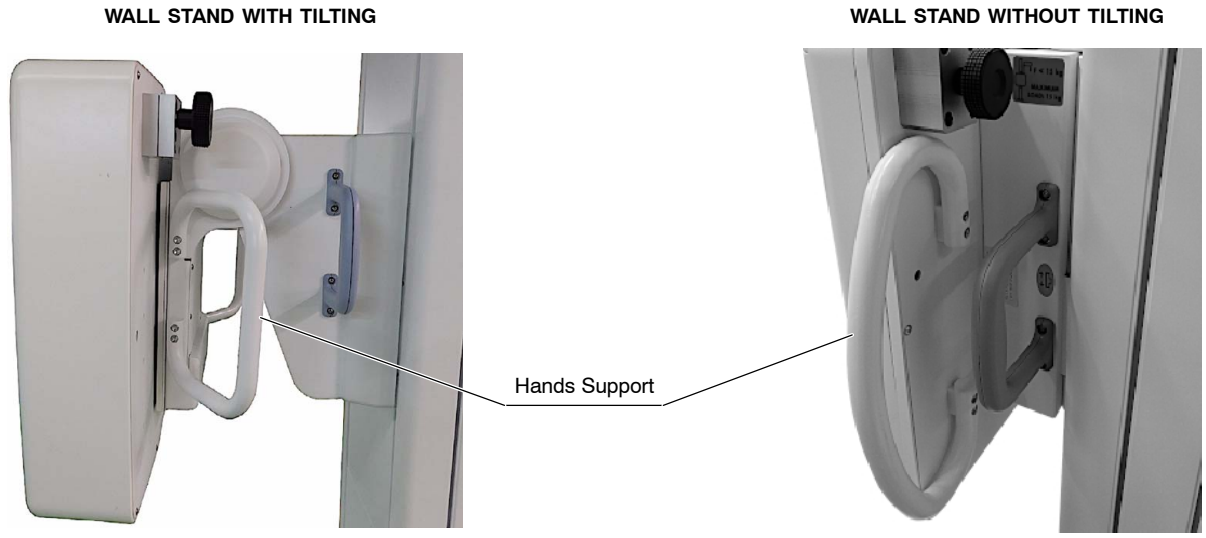


Note ☞ *For further information about the Emergency Off Switch, refer to Section 3.3.*

PATIENT HANDS SUPPORTS

The Patient Hands Supports are useful for better positioning of the Patient during specific examinations. Hands Supports are located at both laterals of the Receptor Support of the RAD Wall Stand, easily accessible to patients.

Illustration 4-31
Patient Hands Supports



CAUTION

Do not use the Patient Hand Supports for any other purpose than positioning the patient. Otherwise, serious damage to the equipment may occur.

VERTICAL MOVEMENT FOOTSWITCH

The Footswitch controls the vertical movement of the Receptor. Step on the UP or DOWN pedals and hold to lift or lower the Receptor. While stepping on the pedal the movement goes on, but once the pedal is kept off the movement stops.

Illustration 4-32
Footswitch

4.4.2 RAD WALL STAND RECEPTOR ASSEMBLY

The Receptor assembly is installed in the support on Column Carriage. It includes a Cassette/Detector Tray, suitable for all standard Cassette and Detector sizes. The main components of the Receptor are:

- Front Panel,
- Receptor Cabinet,
- Receptor and
- Optional accesories, as the Grid and Ion Chamber, used for AEC exposures.

Note ☞ *RAD Wall Stand is compatible with the detectors listed in Section 4.7.*

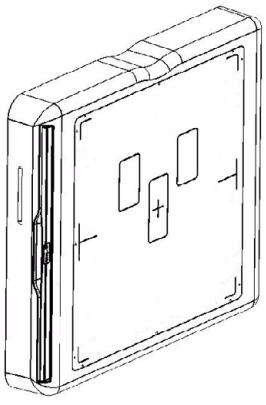
FRONT PANEL

The Receptor Assembly includes the Front Panel made with formica for a low radiation absorption. The Front Panel attenuation is <0.40 mm eq. Al at 100 kV.

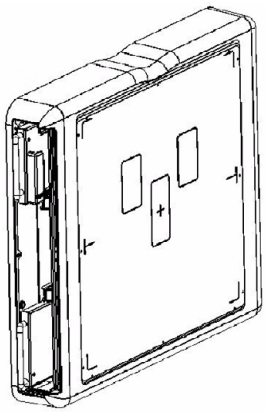
There are three different Front Panel models depending if the Receptor is fixed DR detector or portable DR Detector (*Refer to the illustration below*).

Illustration 4-33
Front Panels

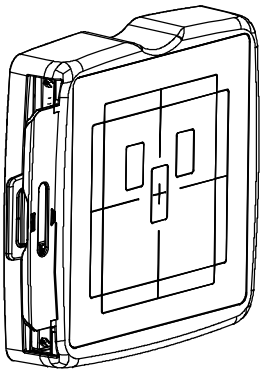
Cabinet for Fixed DR Detectors



Cabinet for Portable DR Detectors



Cabinet for Portable DR Detectors with Rotating Tray



In the Front Panel are indicated:

- the center of the Receptor needed for the correct alignment with the X-ray Tube (*refer to Section 4.15.1)*.
- the AEC Areas (*refer to Section 4.9 AEC Areas*),
- guide lines for FOV indication for Fixed DR Detectors,
- guide lines for Receptor position indication (landscape or portrait) for portable DR Detectors.

4.5 RAD WALL STAND OPERATION

The Receptor placement may be adjusted vertically, tilted or rotated. All axes and movements are motorized, so the position of the Receptor can be controlled automatically in all axes by the Overhead Tube Crane when executing the Auto-tracking, Auto-positioning and Stitching functions. 1.1.28

IT IS THE RESPONSIBILITY OF THE OPERATOR TO ENSURE THE SAFETY OF THE PATIENT WHILE THE X-RAY EQUIPMENT IS IN OPERATION BY VISUAL OBSERVATION, PROPER PATIENT POSITIONING, AND USE OF THE DEVICES THAT ARE INTENDED TO PREVENT PATIENT INJURY.

ALWAYS WATCH ALL PARTS OF THE SYSTEM TO VERIFY THAT THERE IS NEITHER INTERFERENCE NOR POSSIBILITY OF COLLISION WITH THE PATIENT OR WITH OTHER EQUIPMENT.

MONITOR WITH SPECIAL CARE THE PATIENT POSITION (HANDS, FEET, FINGERS, ETC.) TO AVOID INJURY TO PATIENT CAUSED BY UNIT MOVEMENTS.
INTRAVENOUS TUBING, CATHETERS AND OTHER PATIENT CONNECTED LINES SHOULD BE ROUTED AWAY FROM MOVING EQUIPMENT.

WARNING

NEVER PLACE THE PATIENT'S AND/OR OPERATOR'S HANDS OR FINGERS INSIDE THE TILTING ASSEMBLY: IT MAY CAUSE SERIOUS INJURIES TO PATIENT OR OPERATOR. MAKE SURE THAT THE PATIENT EXTREMITIES ARE INSIDE THE ACCESSORIES LIMITS DURING OPERATION: MOVEMENT OF PARTS MAY CAUSE SERIOUS DAMAGES TO PATIENT.

CAUTION

Be careful of the Hand Supports that stick out below the RAD Wall Stand when positioning patients wheelchair or any other equipment under the RAD Wall Stand.

4.5.1 MANUAL VERTICAL MOVEMENT

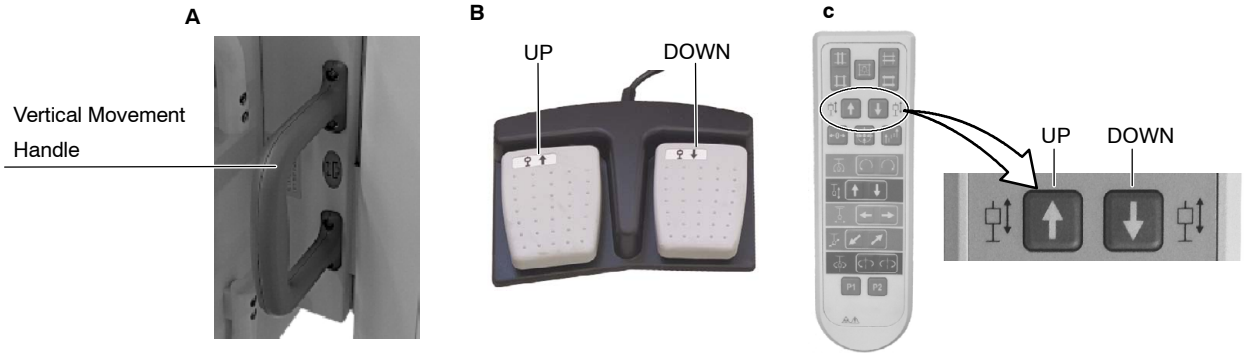
The Receptor remains locked in its vertical position when the equipment is switched ON, thanks to the electromagnetic vertical brakes. In addition, the vertical movement is locked when the equipment is turned OFF.

Note ☞ *Maximum vertical travel is 1560 mm (61.42") with cabinets for portable detectors with rotating tray and 1625 mm (64") with cabinets for fixed detectors & cabinets for portable detectors without rotating tray.*

For vertical displacement proceed as detailed below:

1. Enable the Vertical Movement:
   a. Press and hold the push button on the Vertical Movement Handle,
   b. step and hold any pedal of the Footswitch or
   c. press and hold any of the Vertical Movement buttons of the IR Remote Control Device.

Illustration 4-34
Vertical Movement Activation



2. If using the Vertical Movement Handle, check that the brake is released and the Receptor can be displaced smoothly up and down with the Handle. With the Footswitch and the IR Remote Control, the motion is motorized.

3. Set the Receptor at the desired height, depending on the study to be performed.

4. Release the used button and the Vertical Brake will be activated, so the Receptor stops immediately.

TAKE CARE OF FEET WHEN MOVING DOWN THE RECEPTOR ASSEMBLY TO THE LOWEST POSITION, FEET COULD BE TRAPPED OR DAMAGED. ALWAYS ROTATE AND/OR TILT THE RECEPTOR BEFORE MOVING IT DOWN.

4.5.2 RECEPTOR TILTING MOVEMENT

Note ☞ *Tilting functionality is only available with the corresponding Wall Stand model.*

The Receptor can be tilted automatically in different angles from -20º up to 90º (maximum range), so the Receptor can be placed horizontally and also tilted at any angle between both values.

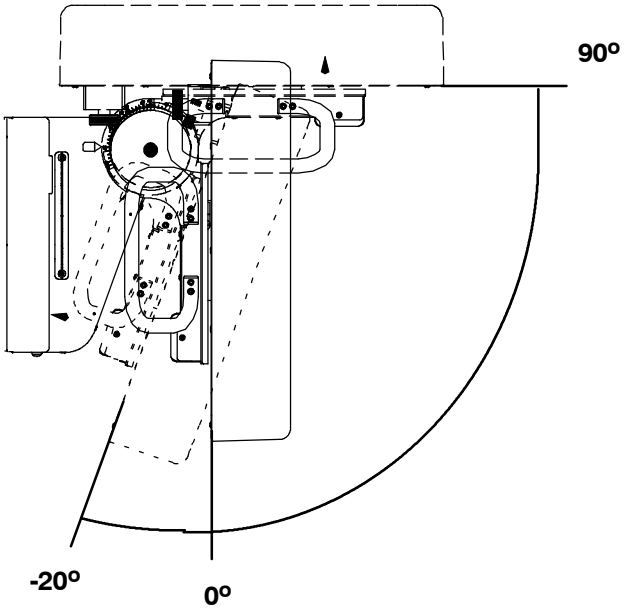
CAUTION

Patients should stay away from the equipment when the Receptor tilting movement is in process.

Note ☞

Depending on the X-ray System configuration, the tilting range can be configured with a smaller range, but always between -20º and 90º values.

Illustration 4-35
Tilting Range



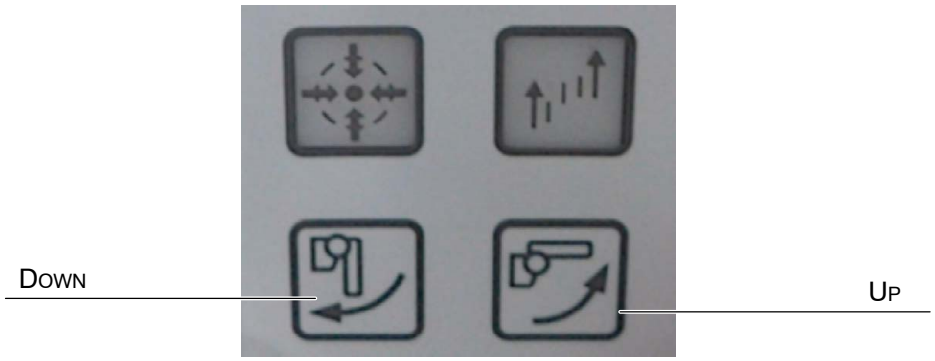
Default operating positions are 0º or 90º. It is possible to perform exposures in any position without degradation of image quality and loss of Receptor functionality.

Tilting movement is automatic and servo-controlled, with negative brake, so it is ON by default even with the equipment switched OFF. Tilting velocity is also automatically controlled and according to the safety standards.

The Receptor can be tilted by:

- Pressing and holding any of the Tilting Brake buttons, UP or DOWN, located at the Automatic Movements Control Box, to initiate the tilting motion. Once the Brake button is released, the Receptor stops automatically at any angle.

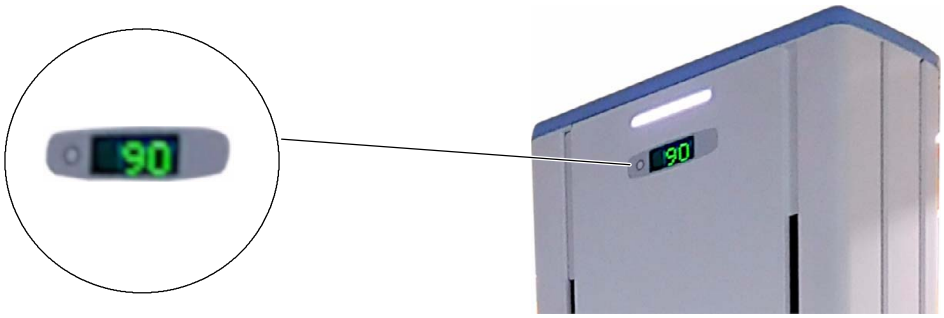
Illustration 4-36
Tilting Brake Buttons



- Selecting any auto-position controlled by the Overhead Tube Crane. Select it at the OTC Control Console and press the Automatic Movements Control Box. The Receptor will perform the tilting movement until achieving the configured angle for the auto-position, ±0.5º. Refer to *Section 4.11.4* for further details about Auto-positioning.

The Tilting angle is indicated in the display located in the top Column Cover.

Illustration 4-37
Tilting Display



4.5.3 RECEPTOR ROTATION

Note ☞ *Rotation functionality is only available with the Tilting Wall Stand model.*

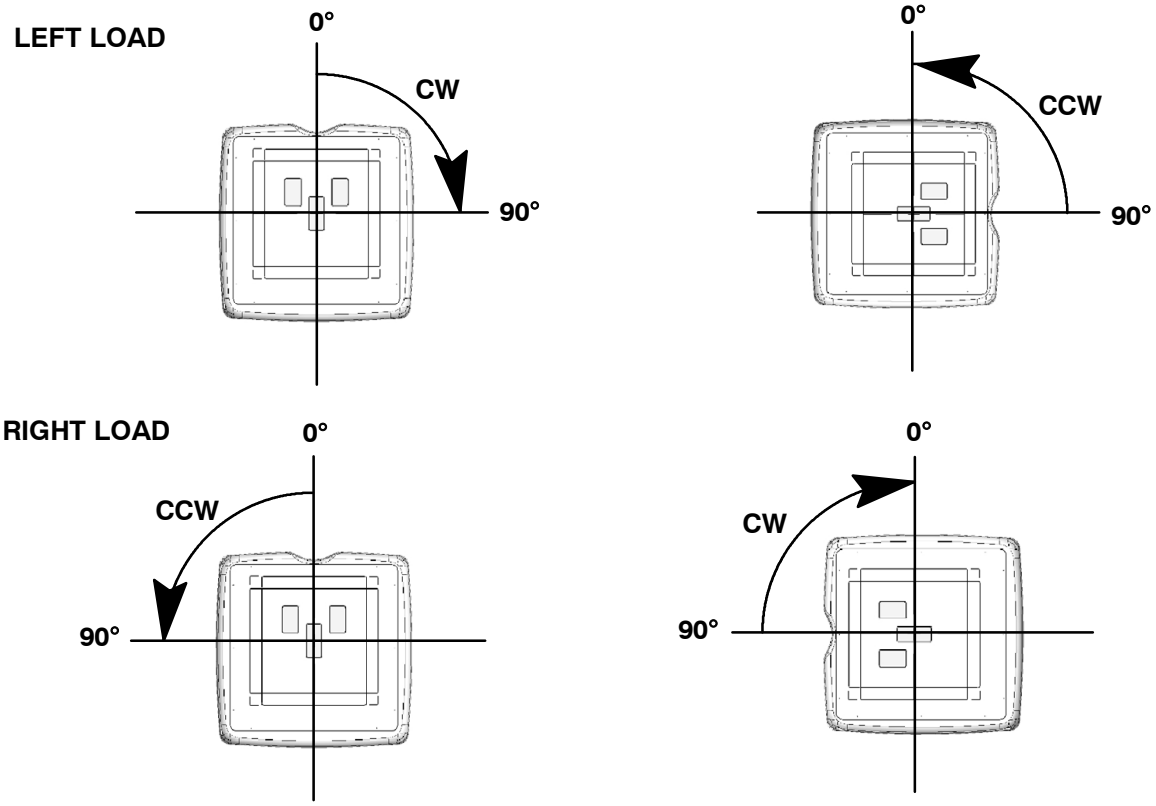
This function allows to rotate the Receptor around the center of the image. The movement is motorized and servo-controlled. Rotation movement is not controlled by the OTC Control Console, so it is not selectable when configuring auto-positions.

It is possible to rotate the Receptor up to 90º for left loading or -90º for right loading.

CAUTION

Patients should stay away from equipment when the Receptor rotation movement is in process.

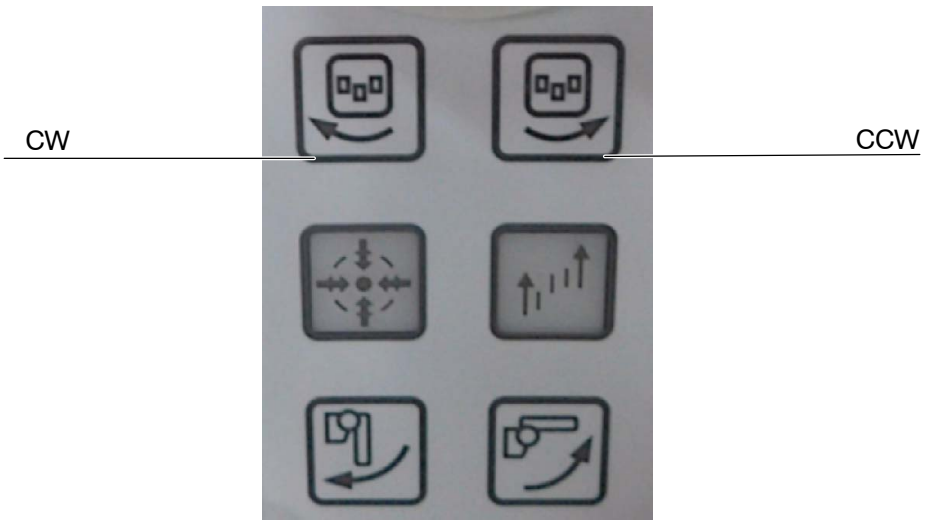
Illustration 4-38
Rotation Ranges



To rotate the Receptor:

- Press and hold any of the Rotation buttons, CW or CCW, located at the Automatic Movements Control Box. Once the button is released, the Receptor stops automatically at the desired angle.

Illustration 4-39
Rotation Buttons



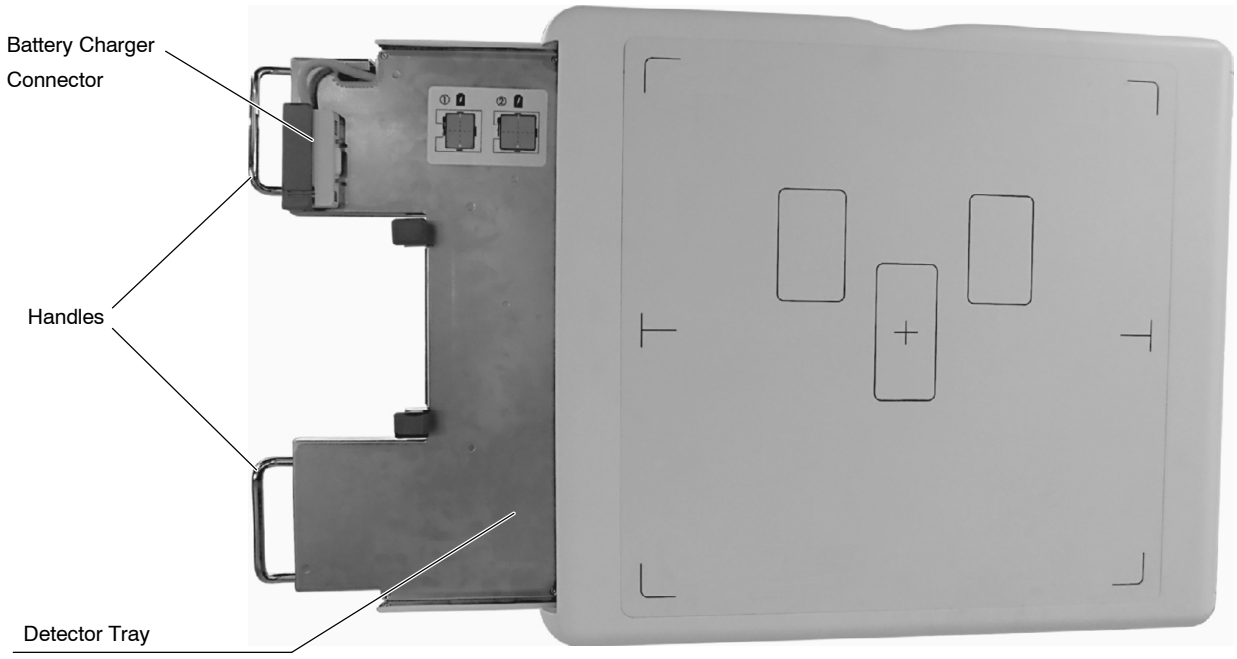
To avoid degradation of image quality and loss of Receptor functionality, it is recommended not to perform exposures with the Receptor in other position than 0^{o} or 90^{o}, as the equipment has been designed to operate mainly at these positions.

4.5.4 RAD WALL STAND PORTABLE DETECTORS

The Portable Receptor Assembly is designed to conveniently house a Portable Detector, an Ion Chamber and a Grid. It can also provide the system information about the position and status of the Grid and Detector.

The Tray has two handles to pull it out to remove/replace the detector or change its orientation. For Wireless Detector, there is a Battery Charger Connector mounted on the upper corner of the Tray.

Illustration 4-40
Portable Detector Assembly



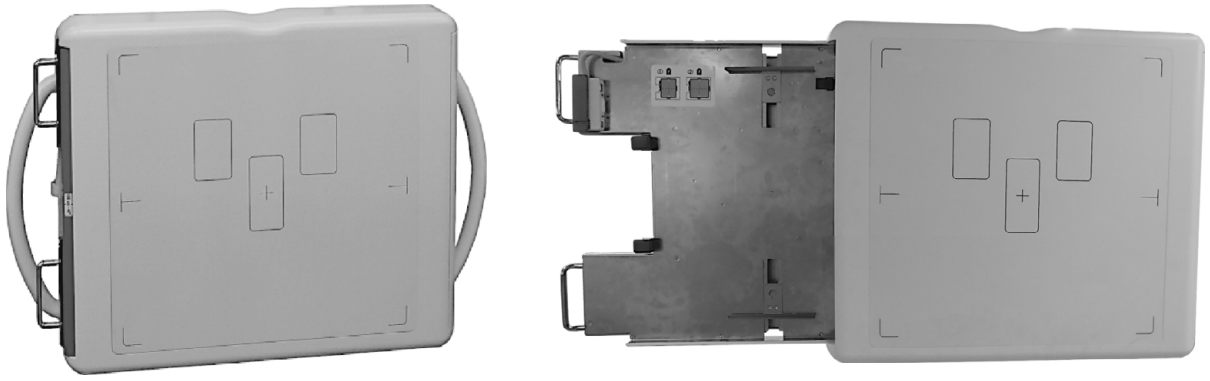
Note ☞ *Check the charging port of the portable detector is facing the tray battery connector during the detector loading (refer to Section 4.5.4.2).*

The Tray has two different operating positions, the travel of the Rotating Tray is provided with two detents in its horizontal motion to position the Detector in both positions:

- Fully Inserted, in Portrait or Landscape position, ready for exposure.
- Fully Extended for Detector loading.

Hold the handle (cabinets for portable detectors with rotating tray) or one of the handles (cabinets for portable detectors without rotating tray) and slide the Tray in or out.

Illustration 4-41
Tray Positions



EXPOSURE POSITION - TRAY FULLY INSERTED

LOADING POSITION - TRAY FULLY EXTENDED

4.5.4.1 PORTABLE DETECTOR LOADING

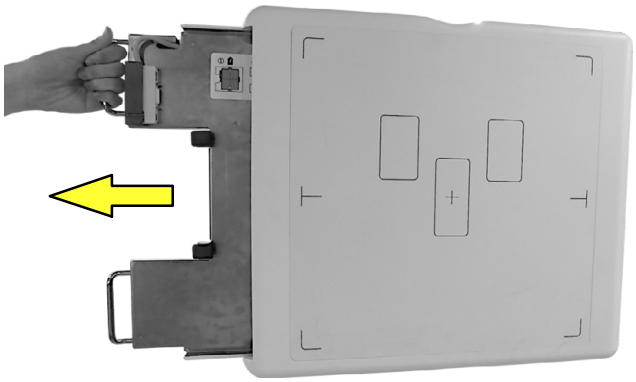
The design of the Tray, equipped with manual end stops and clamps, enables to house DR Detectors in Landscape or Portrait position depending on their dimensions.

4343 DETECTOR INSTALLATION

To insert a DR Detector of 43x43 cm (17”x17”):

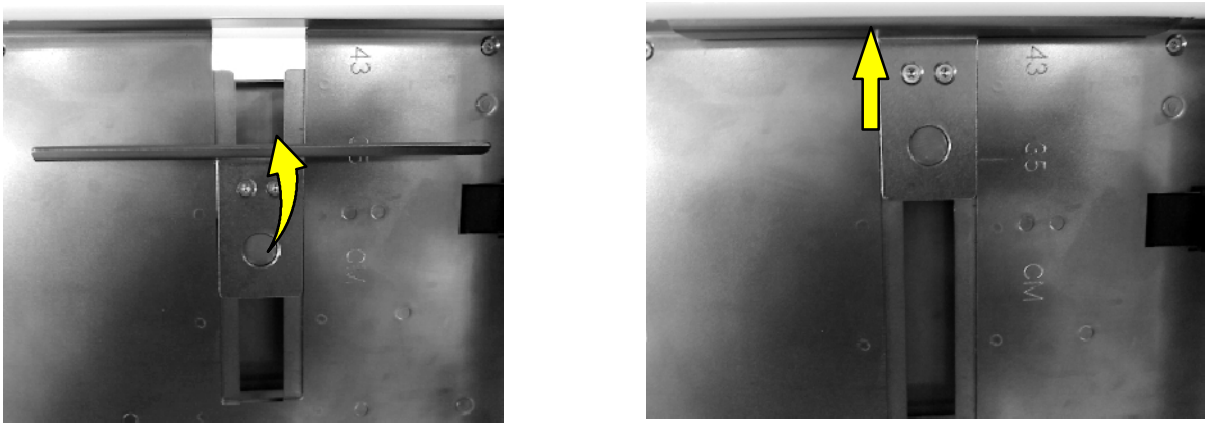
1. Hold one of the handles and extract the Tray to the loading position.

Illustration 4-42
Pulling out the Tray



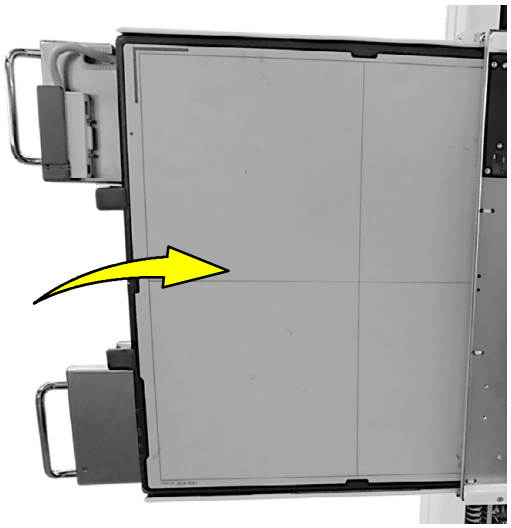
2. Press and hold the release pin of the top clamp and push it up to the 43 cm. (17”) notch (outer position). Repeat the same operation with the bottom clamp.

Illustration 4-43
Preparing the Tray for 4343 Detector



3. Insert the Detector to the back of the Tray. Push slightly the back end stops with the Detector for a correct fixation and fit it with the retractable front end stops.

Illustration 4-44
4343 Detector Installation



WARNING

MAKE SURE THAT THE DETECTOR IS PROPERLY MOUNTED, BEING HOLD WITH BOTH HANDS, AND ONCE IT IS INSTALLED THAT IS TOTALLY SECURED BY THE END STOPS OF THE TRAY.

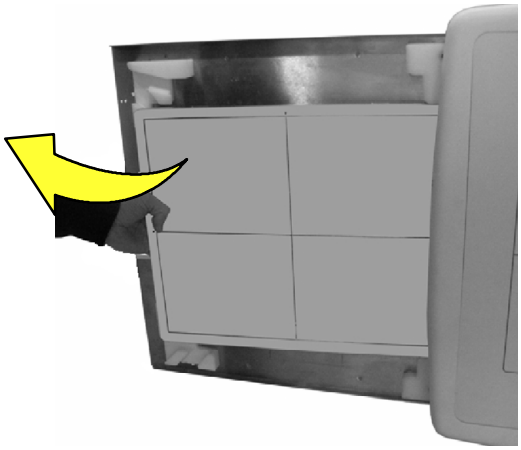
3543 DETECTOR ROTATION

To change the orientation of a 35x43 cm. (14x17”) DR Detector:

1. Hold one of the handles and extract the tray until it is completely extended (*Refer to Illustration 4-42*).

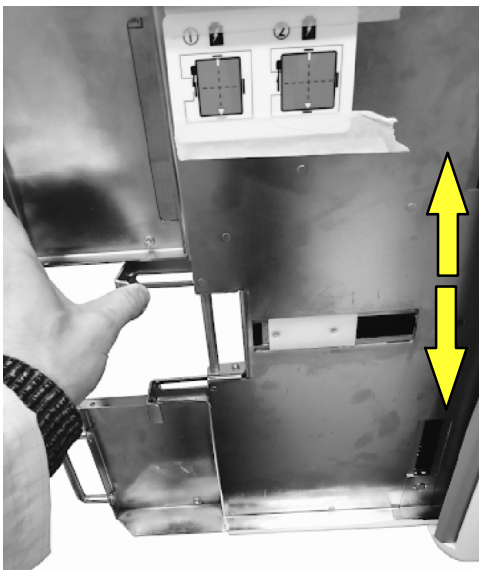
2. Pull the retractable front end stops and raise the DR Detector with both hands. Put the Detector aside.

Illustration 4-45
Remove the DR Detector



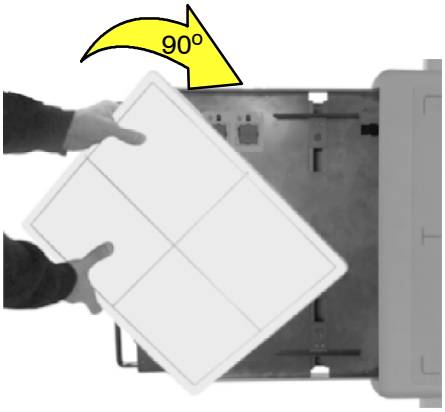
3. Manually set the vertical end stops according to the new Detector position.

Illustration 4-46
Preparing the Tray for Portrait Position



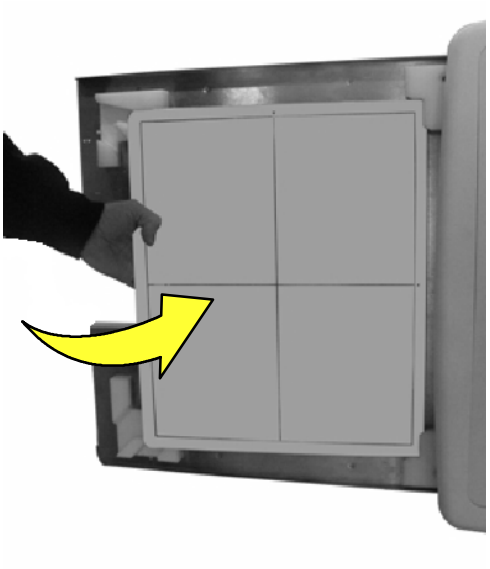
4. Turn the DR Detector 90º clockwise, checking that the charging port is in front of the battery connector on the tray.

Illustration 4-47
Rotating the DR Detector



5. Then place the DR Detector centered in the Tray and push slightly the retractable end stops until it is fitted in the four stops of the tray.

Illustration 4-48
Inserting the DR Detector

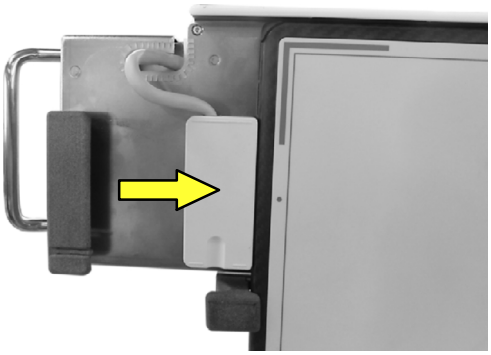


4.5.4.2 RECHARGING THE WIRELESS DETECTOR BATTERY

Load the Detector in the correct position by checking the Charging Port of the portable detector is facing the battery connector installed in the Tray.

Then move the Battery Charger Connector towards the Detector Charging Port to plug it in and start recharging the battery.

Illustration 4-49
Connecting the Charging Connector to the Wireless Detector



Note ☞ *Refer to the corresponding Wireless Detector manuals for detailed information on the specifications of the Detector and its battery.*

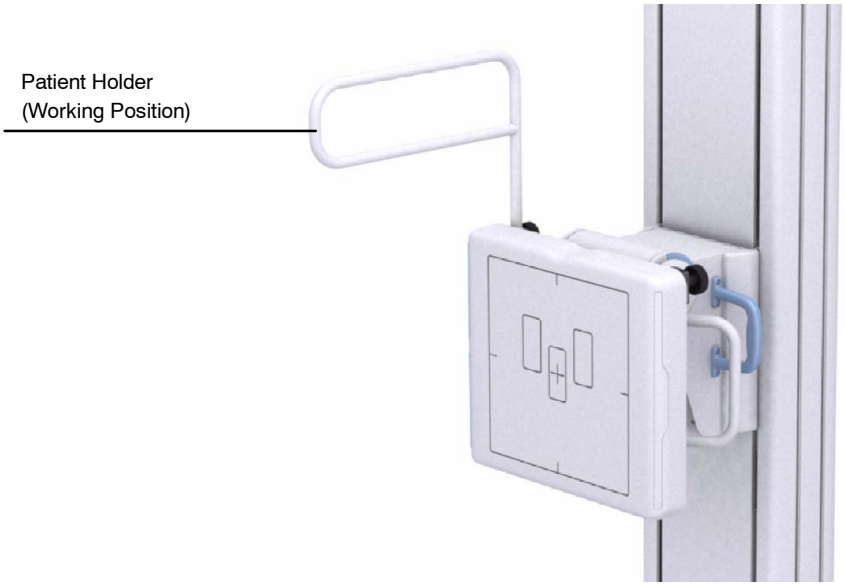
4.6 RAD WALL STAND OPTIONS

4.6.1 PATIENT HOLDER

A Patient Holder can be optionally installed on the equipment. It allows for greater patient stability when performing exams with one or both arms raised.

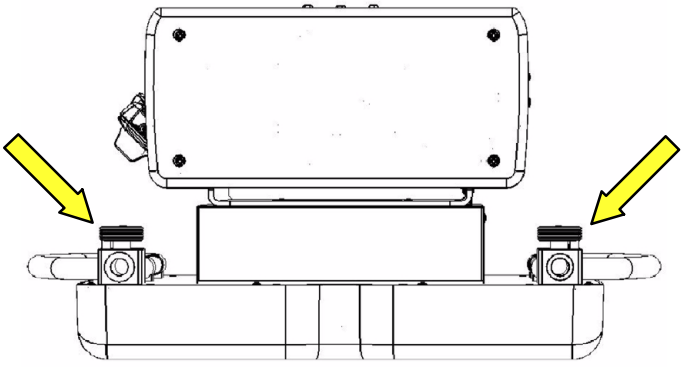
Illustration 4-50
Patient Holder

1.1.48



The Patient Holder is a handle with a bar mounted at the top of the Receptor Assembly which includes two housings for the Support at both sides of the assembly. Use the knobs of these housings to fix the Patient Holder to the desired side (right or left).

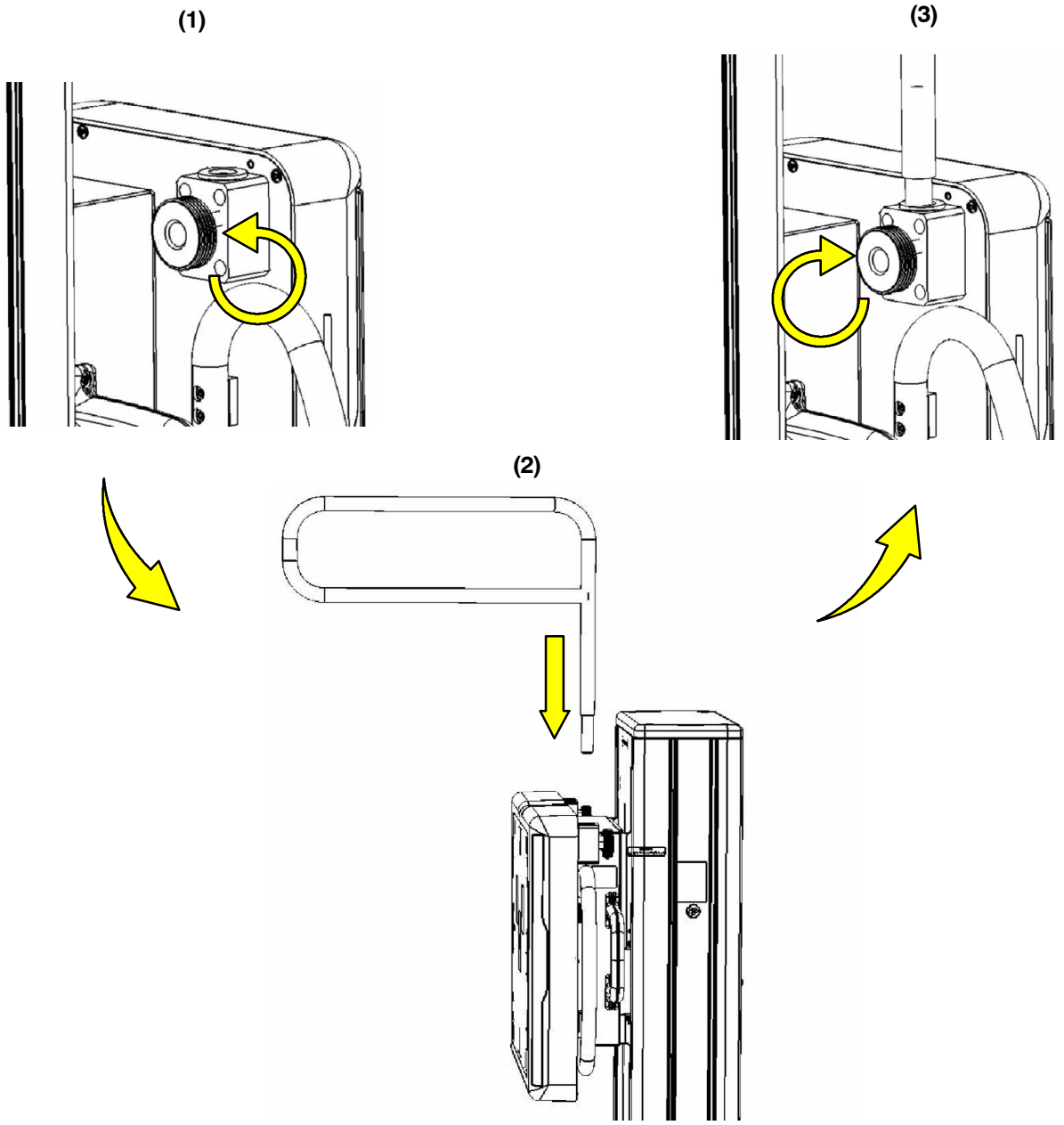
Illustration 4-51
Holder Housings (Top View of the Wall Stand)



To install it:

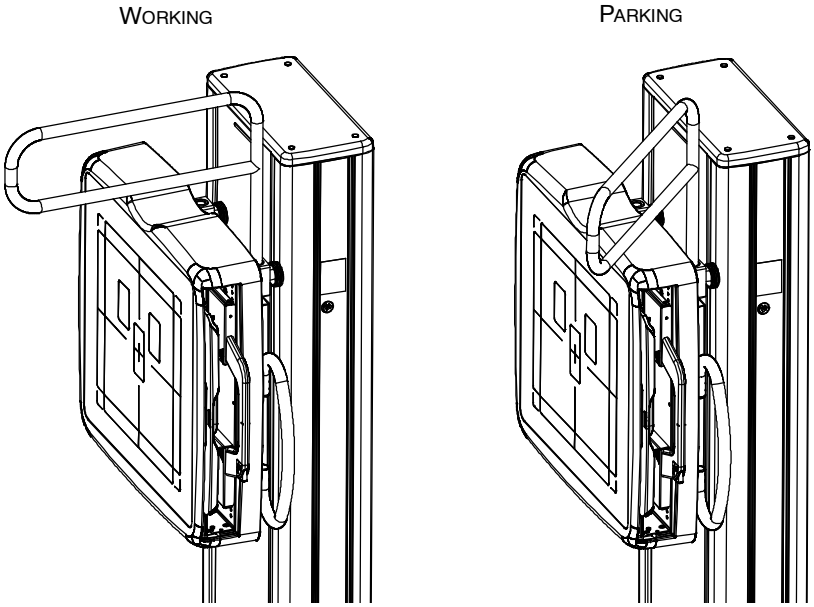
1. Check that the fixing knob is properly loosened.
2. Install the Patient Holder in the desired housing.
3. Fully tighten the fixing knob of the housing.

Illustration 4-52
Patient Holder Installation



The Holder can be used in two different positions: Working position, at 0º, and Parking, at +45º or -45º. When parked it must be always at the opposite of the Receptor loading configuration.

Illustration 4-53
Patient Holder Positions



Once mounted, do not remove from the equipment if it is not absolutely needed. Use the Parking Position to pull aside the Patient Holder during exposures that do not require it or where normal operation may be disturbed.

Note ☞ *The Patient Holder can bear a maximum weight of 15 kg (33 lb).*

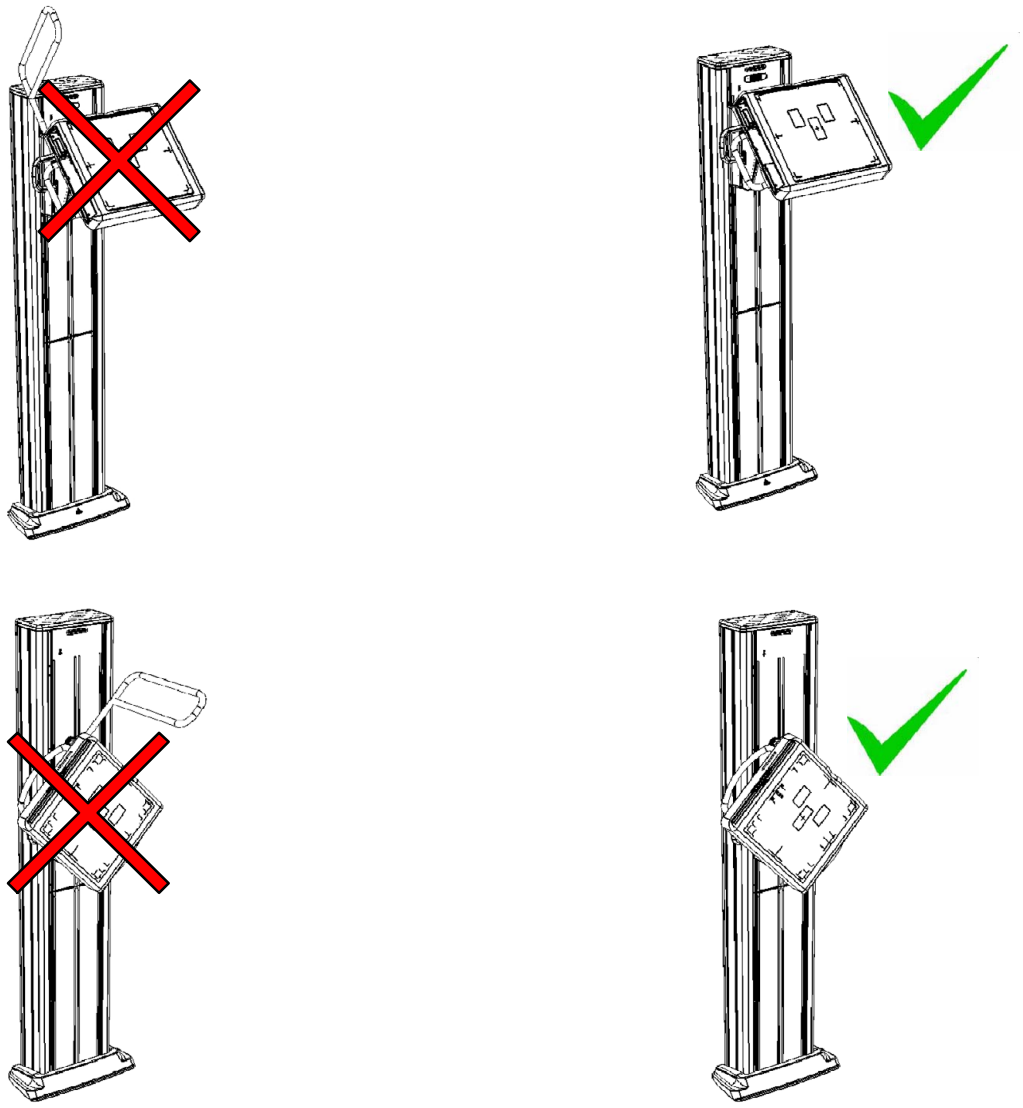
WARNING

REMEMBER THAT WHEN REMOVING OR INSTALLING IT, THE DEFECTIVE COUNTERBALANCE MAY CAUSE UNEXPECTED MOVEMENTS. PROCEED CAREFULLY.

WARNING

REMEMBER THAT THE PATIENT HOLDER IS INSTALLED AT THE BACK OF THE RECEPTOR ASSEMBLY, SO IT IS NOT POSSIBLE TO TILT THE ASSEMBLY WITH IT INSTALLED. IT IS NECESSARY TO REMOVE IT FROM THE ASSEMBLY AND THEN TILT. IT IS ALSO RECOMMENDABLE IN ALL CASES TO ROTATE THE RECEPTOR ASSEMBLY WITH THE PATIENT HOLDER REMOVED AND NEVER TILTED, AS THE HOLDER CAN CRASH WITH THE CARRIAGE.

Illustration 4-54
Correct Tilting and Rotation Positions



4.7 DR DETECTOR

The Receptor Assemblies of the X-ray System are compatible with a wide range of DR Detectors, direct, portable or fixed Detectors and Wi-Fi connected or wired connected ones.

Note ☞ *All Detectors are provided with its own technical documentation. Refer to their operation manual for further details about complete operating instructions.*

Table 4-1
List of the Most Common Compatible Digital Detectors

RECEPTOR	TYPE	MEASURES (WxLxH)	WEIGHT
CXDI-401 COMPACT	Fixed Wired Detector	460 x 460 x 15 mm (18 x 18 x 0.6 in)	7 kg (15.4 lb)
CXDI-401	Portable Wireless Detector	460 x 460 x 15.9 mm (18 x 18 x 0.6 in)	3.8 kg (8.4 lb)
CXDI-402	Portable Wireless Detector	460 x 460 x 15.7 mm (18 x 18 x 0.6 in)	3.7 kg (8.2 lb)
CXDI-410	Portable Wireless Detector	460 x 460 x 15.7 mm (18 x 18 x 0.6 in)	2.8 kg (6.2 lb)
CXDI-701	Portable Wireless Detector	384 x 460 x 15.7 mm (15.1 x 18 x 0.6 in)	3.3 kg (7.3 lb)
CXDI-702	Portable Wireless Detector	384 x 460 x 15.7 mm (15.1 x 18 x 0.6 in)	3.1 kg (6.8 lb)
CXDI-710	Portable Wireless Detector	384 x 460 x 15.7 mm (15.1 x 18 x 0.6 in)	2.3 kg (5.1lb)
CXDI-801	Direct Wireless	384 x 307 x 15.7 mm (15.1 x 12.1 x 0.6 in)	2.3 kg (5.1lb)
CXDI-810	Direct Wireless	384 x 307 x 15.7 mm (15.1 x 12.1 x 0.6 in)	1.8 kg (4 lb)

4.7.1 USING AND MAINTAINING THE DR DETECTOR

Before Exposure, check the equipment daily and confirm that it works properly.

The action of the Air-conditioning or Heating may produce condensation in the equipment, wait until the condensation evaporates before performing an exposure. As a general rule, raise or lower the room temperature gradually to avoid condensation.

During exposure, do not use the DR Detector near devices generating a strong magnetic field.

For Wireless DR Detectors, do not cover the IR Data Port with hands or other parts of the body and do not use the selected frequency channel (2.4GHz band) for other wireless devices.

After every examination, wipe with a cloth slightly damped the patient contact surfaces as well as the handle and Grid with disinfectants such as ethanol. For cleaning, wipe with a cloth damped in neutral detergent.

Note ☞ *For further information on the DR Detector Handling and Maintenance, refer to the DR Detector manuals.*

4.8 GRID

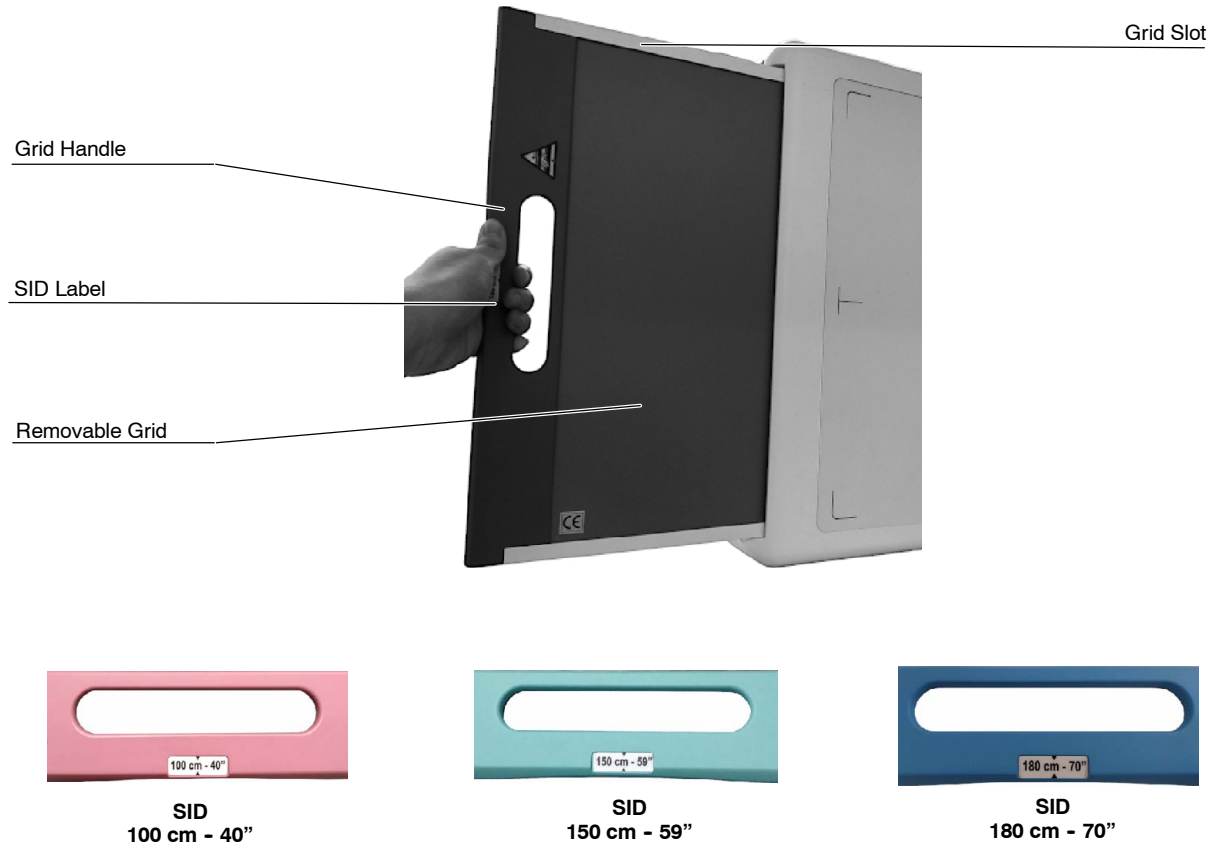
1.1.42 1.1.47 The Grid is intended to reduce scattered radiation and significantly enhance image quality. The RAD Table and RAD Wall Stand may hold a Fixed Grid or a Removable Grid.

The standard Removable Grids are labelled 100 cm (40”), 150 cm (59”) or 180 cm (70”). Use the corresponding Grid according to the SID (Source to Image Distance).

1.1.42 For the RAD Table there is just one option of removable Grid available, it is by default the 100 cm (40”), although for the RAD Wall Stand the three different Grids are available.

In the case of the Removable Grid, when inserting the Grid in the Table Grid Slot, pay special attention to the type of focalization distance of each Grid.

Illustration 4-55
Available Grids



SID
100 cm - 40”

SID
150 cm - 59”

SID
180 cm - 70”

Before using the Grid, clean the front and back side with a dry cloth to remove dust and dirt.

Follow the procedure below for Grid loading. For Grid removal, follow the procedure below in reverse order.

1. Insert the Grid in the slot with the label side facing the tube.

2. Check that the Grid is correctly inserted in the slot. A click sound means that the Grid is in place.

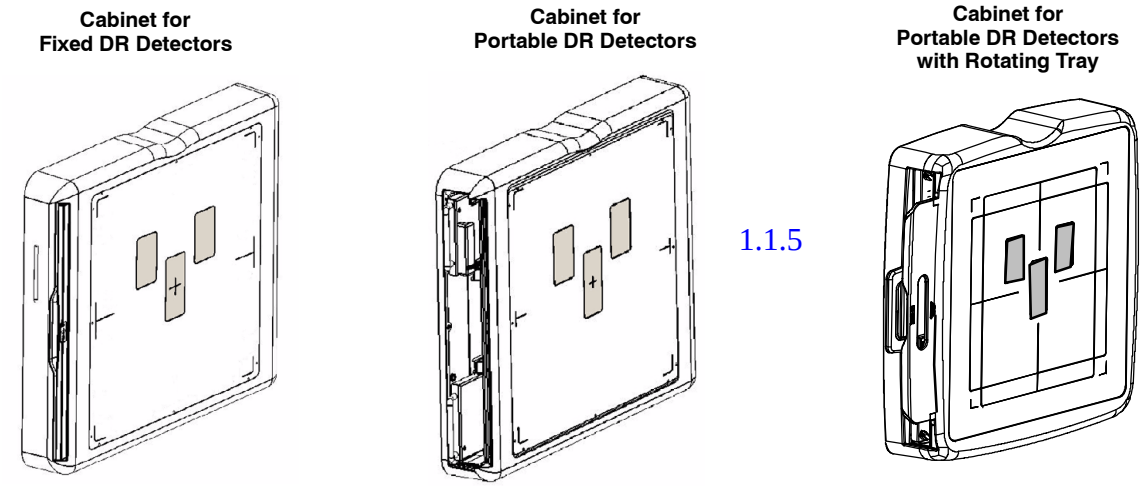
Handle the Grid with care and place it in the accessories holder when not in use. Dropping the Grid could cause damage and reduced image quality.

4.9 ION CHAMBER AND THE AEC

The RAD Wall Stand and Table may operate with an Ion Chamber Detector. For further information about the operation of the Ion Chamber Detector, refer to generator service and operator manuals or Automatic Exposure Control operator manual.

In the case of the RAD Wall Stand, the three field pattern on the Front Panel of the RAD Wall Stand corresponds to the three detection areas for the Ion Chamber Detector.

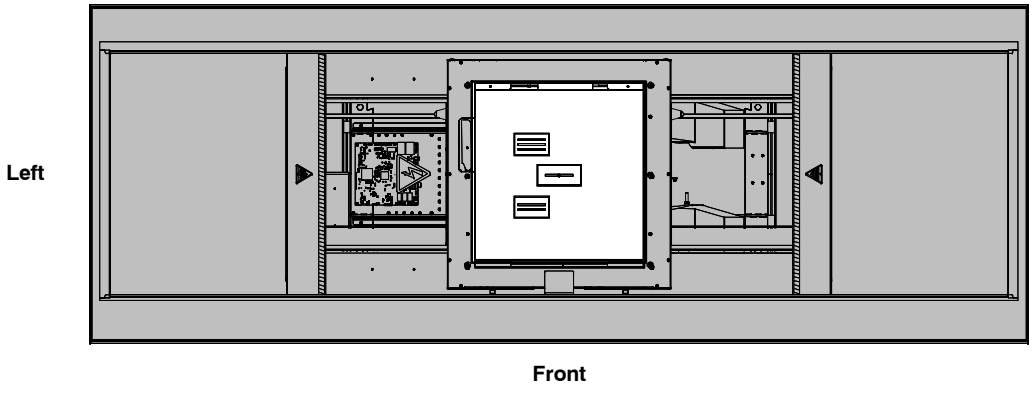
Illustration 4-56
AEC Areas Patterns in the Front Panel of the RAD Wall Stand



1.1.5

In the RAD Table, the Ion Chamber is mounted inside the Receptor Assembly. It is not visible for the operator, but it is mounted by default as shown in the illustration below.

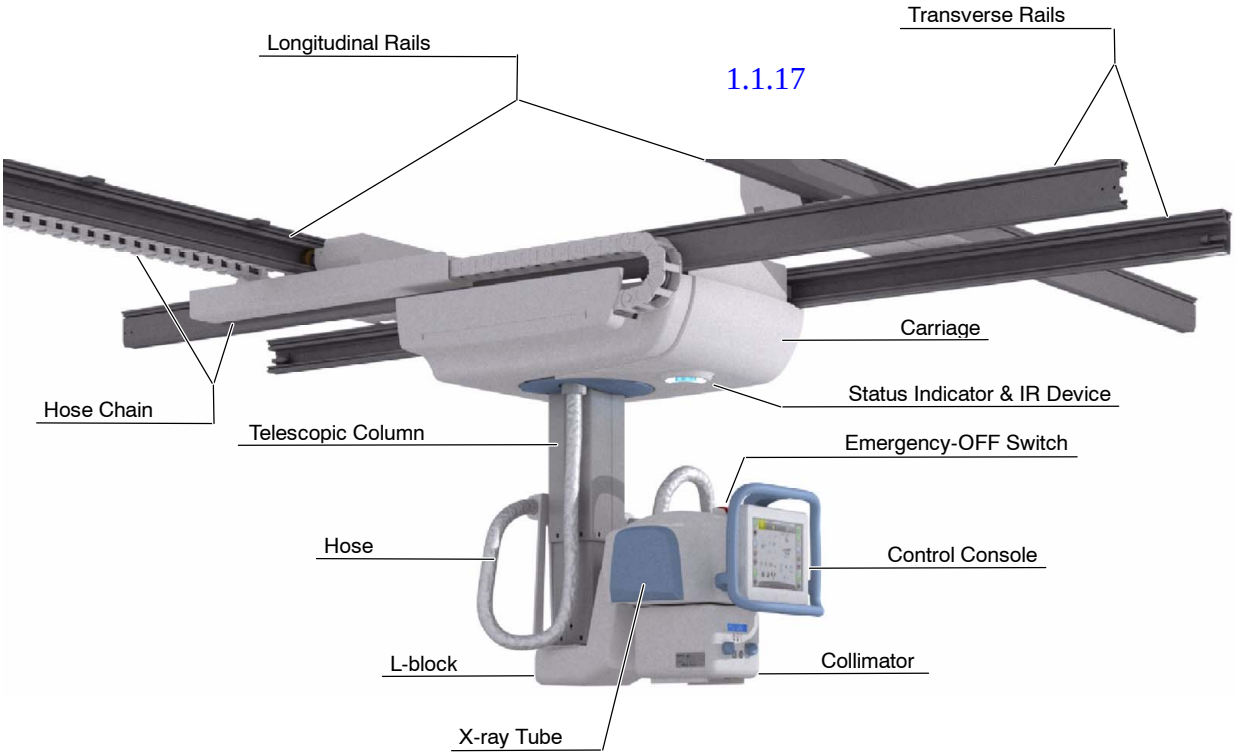
Illustration 4-57
Ion Chamber mounted in the Receptor Assembly 1.1.5

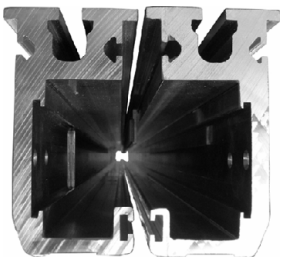


4.10 OVERHEAD TUBE CRANE

4.10.1 OVERHEAD TUBE CRANE COMPONENTS

Illustration 4-58
Overhead Tube Crane Nomenclature





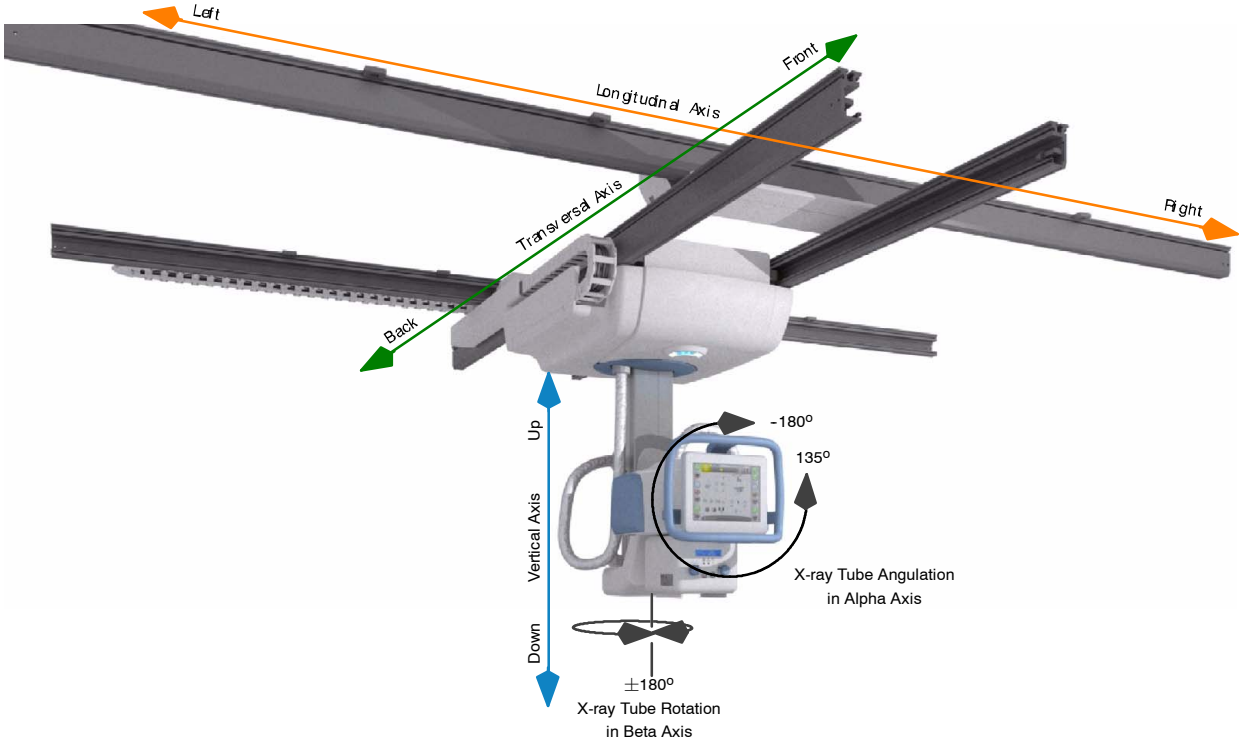
RAIL SYSTEM

The Rail System is formed by two pairs of rails made of aluminum and available in different lengths (*refer to Section 1.2*). The rails allow the displacement of the Carriage along the Longitudinal and Transverse Axes.

1.1.7 **Longitudinal Rails** or **Axis (X)**, different lengths extrusion bars which fix the Overhead Tube Crane to the ceiling. They are marked with orange color strips to match the Movement Buttons of the Control Console.

Transverse Rails or **Axis (Y),** an horizontal structure fixed to the Longitudinal Rails by two bearings assemblies that allow the movement along the Longitudinal Rails. The bearings maintain also the alignment of the Transverse Rails with the RAD Table. They are marked with green color strips to match the Movement Buttons of the Control Console.

Illustration 4-59
Overhead Tube Crane Axis and Travels



CARRIAGE

The Carriage contains some of the electronic and mechanical components of the Overhead Tube Crane and supports the Telescopic Column, L-Block Assembly, X-ray Tube Support with the Tube, Collimator and Control Console.

TELESCOPIC COLUMN

The Telescopic Column is fixed to the Carriage, it allows vertical movement of the X-ray Tube Assembly in the **Vertical Axis (Z)**. This motion is controlled by the Vertical Motor.

The Telescopic Column has a length of 2000 mm (78.7”), composed by five different sized hexagonal steel tubes. The Focal Spot vertical travel is 2000 mm (78.7”), minimum distance Focus-Ceiling is 767 mm (30.2”) and the maximum distance is 2510 mm (98.8”).

L-BLOCK ASSEMBLY

This assembly is the junction between the Telescopic Column and the X-ray Tube and Collimator Assembly. It contains the required electronic and mechanical components to allow the movement of the X-ray Tube in the **Alpha Axis (Angulation)**.

X-RAY TUBE SUPPORT

It is designed to support the X-ray Tube, which can rotate around the vertical axis of the Telescopic Column **(Beta axis**) $\pm 180^{o}$ from the front position (0^{o}), and it can rotate around its transverse axis (**Alpha axis**) from -180^{o} to 135^{o} from 0^{o} position (perpendicular to the floor).

CONTROL CONSOLE

The Control Console enables the operator to control the movements (manual and/or motorized) of the Overhead Tube Crane and also the automatic movements of the System (Auto-tracking, Auto-positioning, Auto-centering).

Movement Buttons are used to activate or deactivate the movements of the OTC in each axis. When a button is pressed and selected, movements on that axis are enabled. Otherwise, the manual movement of the axis will remain deactivated.

Note ☞ *During an automatic motion, pressing any of the Control Console movement buttons will automatically stop it.*

Illustration 4-60
Control Console and Movement Buttons

Alpha Axis Movement. Angle of the X-ray Tube.	**Beta Axis Movement.** Rotation of the X-ray Tube.
Vertical Axis Movement. Up & Down.	**Transverse Axis Movement.** Back & Front.
Longitudinal Axis Movement. Right & Left.	

Use always the Control Console **Wheel** to handle all manual movements of the Overhead Tube Crane. Otherwise, operator could get injured due to the potential pinch points areas.

4.10.2 X-RAY TUBE

The X-ray Tube is supported by the Overhead Tube Crane. It is designed to rotate around the vertical Axis of the Telescopic Column (Beta Axis) $\pm 180^{o}$ from the front position ($0^{o)}$ and, also, around its transverse Axis (Alpha Axis) from -180^{o} to 135^{o} from 0^{o} position (perpendicular to the floor).

The X-ray System can be provided with the following X-ray tubes:

Table 4-2
List of Standard X-ray Tubes

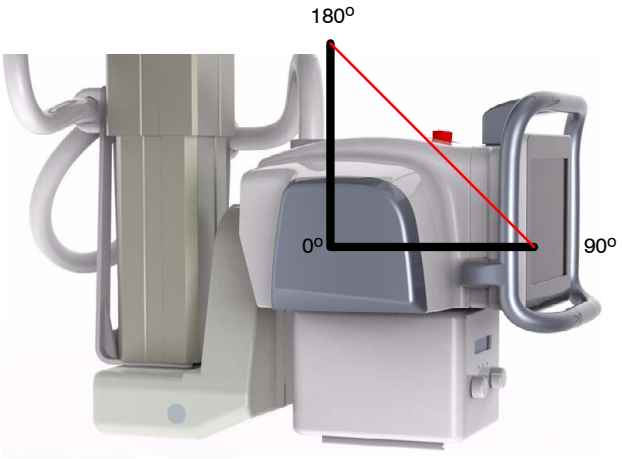
HOUSING	INSERT	FOCAL SPOT *	TARGET ANGLE	ANODE HEAT CAPACITY (KHU)	SPEED
E7239X	N/A	1.0 - 2.0	16^{o}	140	Low
E7240X	N/A	0.6 - 1.2	12^{o}	140	Low
E7242X	N/A	0.6 - 1.5	14^{o}	200	Low
E7252X	N/A	0.6 - 1.2	12^{o}	300	High/Low
E7254FX	N/A	0.6 - 1.2	12^{o}	400	High/Low
E7865X	N/A	0.3 - 1.0	12^{o}	140	Low
E7869XX	N/A	0.6 - 1.2	12^{o}	600	High/Low
E7886X	N/A	0.7 - 1.3	16^{o}	300	Low
XRR-3331X	N/A	0.6 - 1.2	12^{o}	300	High/Low
* NOTE: The focal spots are stated per IEC 60336:1993 or later edition.					

Note ☞ *In case of non Standard X-ray Tubes, contact with Technical Service for detailed information.*

Tube adaptation kits will be supplied to allow the correct assembly and fixation of the X-ray tubes to the Overhead Tube Crane and provide compatibility. Each of these adaptation kits is compound of fixation rings, console fixture and OTC fixture. All components are designed for the specific characteristics of the X-ray tubes (type, dimensions, weight…).

Note ☞ *Only tubes with a horn angle between 90º and 180º can be mounted on the Overhead Tube Crane.*

Illustration 4-61
Allowed Orientations for Tubes



4.10.3 COLLIMATOR

The Overhead Tube Crane can be associated with these Collimation options:

- **Ralco R225 ACS DHHS** Automatic Collimator.
- **Ralco R225 DHHS** Manual Collimator.

Illustration 4-62
Collimators

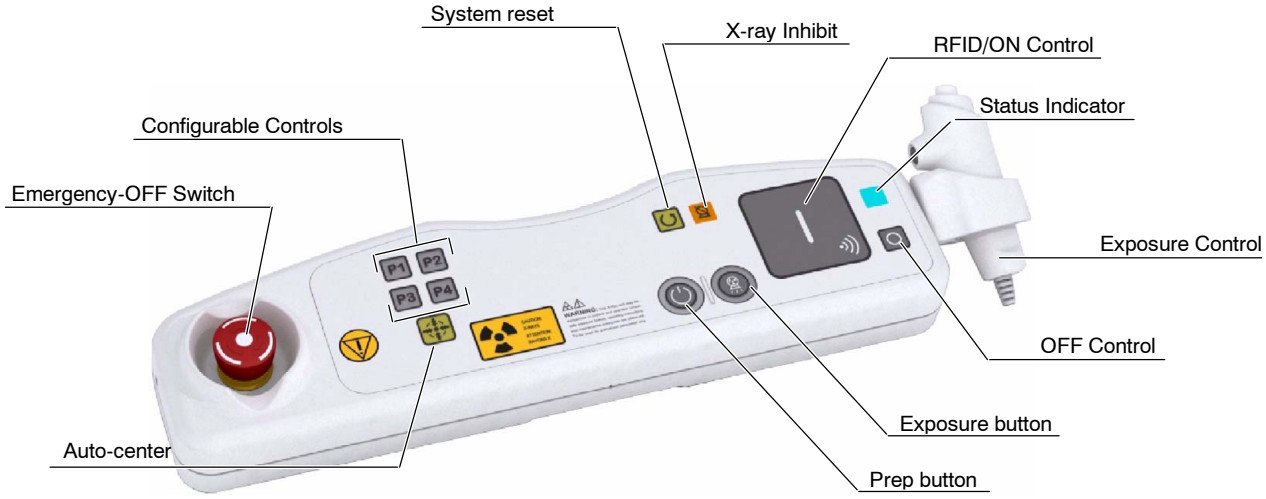
4.10.4 RCC CONSOLE

The RCC controls the System power ON/OFF and is also used to:

- Check the X-ray Exposure Status,
- hold the Exposure Control,
- hold an Emergency OFF Switch,
- control the automatic Movements,
- optionally, RFID authentication for Power ON.

The RCC can also be configured with optional functions depending on the customer requirements.

Illustration 4-63
RCC Console



The RCC Console controls and indicators are:

Emergency OFF Switch. Use this to stop the System in case of emergency. *(Refer to Section 3.3 for further information)*.

Prep button. Press and hold the ”Prep” push-button to prepare the X-ray Tube for exposure *(refer to Section 4.10.5).*

X-ray Exposure button. Press to start an X-ray exposure *(refer to Section 4.10.5)*.

X-ray Inhibit. Lighted in orange to indicate that the X-ray Exposure is inhibited.

RFID Control/System Switch ON. Press and pass the RFID card to switch ON the System.

Status Indicator. Lighted in System status color when the System is switched ON.

- Blinks in white for seven seconds when the System Switch ON button is pressed. The RFID card may be swiped through the RCC reader during those seven seconds. If no activity is registered, the RCC will be turned off.
- If validation is successful, the Indicator will blink once in blue after swiping the RFID card and will remain pink during System initialization. Otherwise, an acoustic signal will be emitted. *(Refer to Section 3.4 for detailed information about LED Indicators).*

System Switch OFF. Press to switch OFF the System.

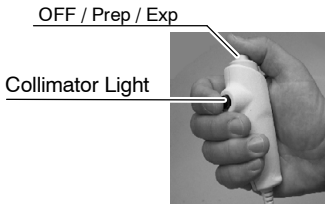
Auto-center. Use this button to automatically move the OTC towards a predefined position. (*Refer to Section 4.13.2.1*).

System reset. Press to reboot the System. This will shutdown and restart all the X-ray Room equipments.

Customizable Controls. They allow to automatically move the OTC towards different Programmed Positions configured in factory on client request or during the installation/configuration of the system. (*Refer to Section 4.11.4*).

4.10.5 EXPOSURE CONTROL AND INDICATORS

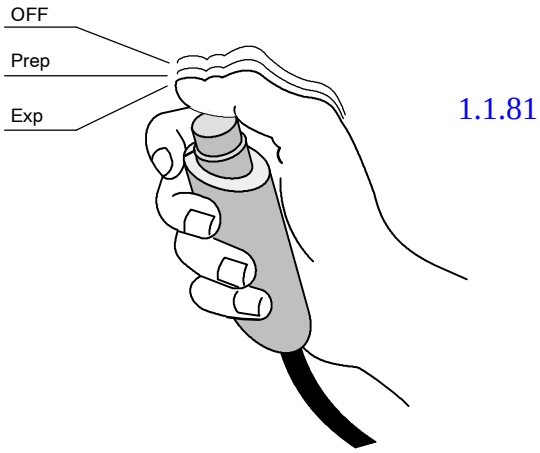
1.1.81



Radiographic exposures are initiated with the Handswitch or with the optional Footswitch (*refer to Section 4.14.2*). The status of the exposure is indicated by the "*Ready*" and "*X-ray On*" indicators for the duration of the exposure.

The X-ray Handswitch as well as the Footswitch have three positions: "*OFF*", "*Preparation*" (halfway) and "*X-ray Exposure*" (fully depressed).

Illustration 4-64
X-ray Handswitch Positions



1.1.81

PREP: Press the Handswitch or Footswitch half-way (*"Prep"* position) to prepare the X-ray Tube for exposure. The *"Ready"* indicator on the Console will light when the X-ray Tube is prepared and there are no interlock failure or system faults.

After pressing it, the following functions are activated:

- anode rotation
- filament current switches from stand-by to the selected mA

Note ☞ *Press "Prep" only when the technique is selected and the Patient is ready for the exposure. The Generator can be configured so that the anode remains running for the time established during installation when "Prep" is pressed a predetermined number of times in less than a minute.*

EXP: After the Status Indicator is illuminated on the RCC Console, fully press the handswitch to start an X-ray exposure. If the button is released before the Generator completes the selected time or the AEC time, the exposure will be prematurely terminated. The Status Indicator of the RCC Console remains illuminated in yellow during the length of exposure.

COLLIMATOR LIGHT: The X-ray Handswitch is equipped with a Collimator Light Button that helps patient positioning. Push this button to turn on the Collimator Light for 30 seconds before it automatically switches off. 1.1.32

Illustration 4-65
Collimator Light Button

Radiographic exposures from the RCC Console can also be made with the “Prep” (preparation) and “Expose” (X-ray exposure) push-buttons. The status of the exposure is indicated by the Status Indicator.

Prep button. Press and hold the ”Prep” push-button to prepare the X-ray Tube for exposure. The RCC Status Indicator will light up in green when the X-ray Tube is prepared and there are no interlock failures or system faults.

X-ray Exposure button. After the RCC Status Indicator is illuminated in green, press this push-button, keeping the “Prep” push-button pressed, to start an X-ray exposure. When it is in progress, the RCC Status Indicator will light up in yellow and an acoustic indication will be emitted.

Status Indicator. Lights in green when the X-ray Tube is prepared and in yellow during the length of exposure. *(Refer to Section 3.4 for detailed information about LED Indicators).*

4.11 OVERHEAD TUBE CRANE CONTROL CONSOLE OPERATION

The Overhead Tube Crane is provided with the Touchscreen Control Console where it is displayed the Graphical User Interface (GUI) that allows the operator to configure the Exposure Technique, Workstation, X-ray Tube and Receptors position; and with a capacitive wheel used to manually handle the movements of the Overhead Tube Crane.

Note ☞ *Changing any parameter on the User Interface or on the Acquisition Workstation will result in a change of both.*

The Capacitive wheel allows that once the wheel is held with the hands, the Tube-Collimator Assembly can be moved with a minimal effort in Longitudinal, Transverse and Vertical axes whenever the axes movements have been enabled on the Control Console. It can be moved just in one axis, in two or in all of them at the same time.

Note ☞ *If the Capacitive wheel bumps into an obstacle or it is hit by the operator, the system stops immediately.*

All OTC axes are motorized and it is possible to move automatically the X-ray Tube in all directions. Auto-positioning, Auto-centering and Auto-tracking functions are available in all axes. 1.1.22

Illustration 4-66
Control Console

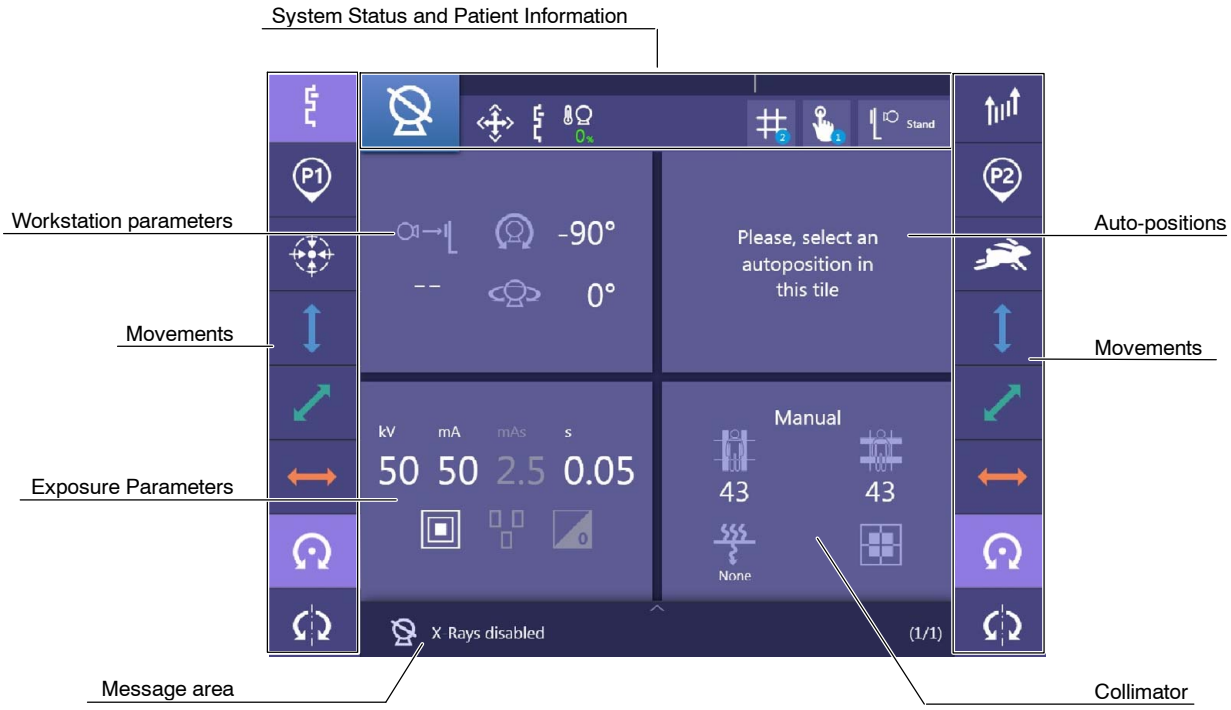
Note ☞ *The Capacitive steering wheel can be operated even with latex gloves.*

The Touchscreen interface consists of the following data areas:

- **SYSTEM STATUS AND PATIENT INFORMATION.** System status icons, patient data and Workstation selection.
- **MOVEMENTS.** Automatic / Manual movements and movement options.
- **WORKSTATION PARAMETERS.** Displays the current parameters of the selected Workstation.
- **AUTO-POSITIONS.** Displays the selected auto-position.
- **EXPOSURE PARAMETERS.** Displays the selected parameters for the X-ray exposure.
- **COLLIMATOR.** Displays the collimator settings.
- **MESSAGE AREA.** Shows inhibit conditions and informative messages.

Note ☞ *Depending on the Workstation selection some of the Configuration Areas might not be displayed on the Touchscreen Console.*

Illustration 4-67
Touchscreen Main Menu



4.11.1 SYSTEM STATUS AND PATIENT INFORMATION

PATIENT INFORMATION

Patient name, ID and the selected technique are shown in the upper bar of the Main menu.

Note ☞ *Tap on this bar to hide the information displayed.*

SYSTEM STATUS

The status of the system is indicated by different icons in the square on the left side of the upper bar. This status can be as follows:

- **Normal Status.** The Detector is ready, the RAD technique is correctly set and there is not Error or Interlock condition in the system.

- **Handswitch Pressed.** The Handswitch or Footswitch half-way has been pressed (*"Prep"* position) to prepare the X-ray Tube for exposure.

- **Ready.** The system is prepared for the exposure.

Note ☞ *Whenever the Free Workstation is selected, Detector and Tube alignment is not required for exposures.*

- **Exposure.** Active during the exposure.

- **Inhibit Conditions.** There are one or more reasons that are causing an inhibition of exposure. Press this icon to display the message list of conditions that inhibit exposures.

  - **Filaments disabled.** If filaments has been disabled (regardless of whether it was via software or hardware), the inhibit status icon changes color.

Note ☞ *Refer to Message Windows Section 4.11.7.1 for further information about Inhibit Conditions messages window.*

MOVEMENT STATUS. This indicator displays different status related to the Overhead Tube Crane movement:

1. **Steady White**: There is no movement in progress and no Auto-position has been reached.

2. **Blinking Blue**: A manual/automatic movement is in progress.

3. **Steady Green**: Auto-position has been reached and the automatic movement has been stopped.

4. **Crossed out indicator**: The movement is inhibited.

DETENT POINTS STATUS. Lights when a detent point is reached. Detent points are software configured and have to be activated using the Detent points icon *(refer to Section 4.11.2).*

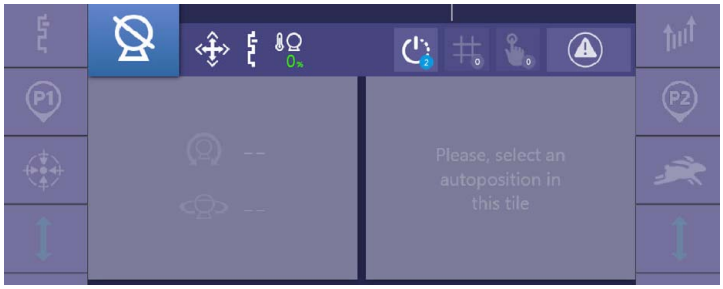
HEAT UNITS. Shows the used Heat Units of the Generator. The Heat Units are calculated and totalled during exposures.

USER ACTION. Active when manual adjustments from the operator are required before making the exposure (e.g. if the Grid is not inserted). If more than one action is required, the number of actions to perform is shown in the icon.

COLLIMATOR INFO. Shows informative messages in a new window with the reasons why the Collimator is not in automatic mode (manual or semi-automatic mode). *(Refer to Section 4.11.7.1).*

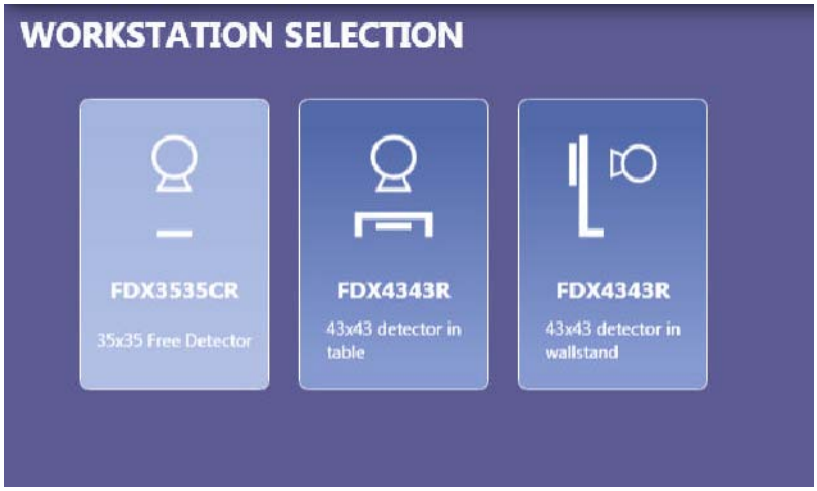
BOOT UP. This button is only available during System booting up. It shows a new window with informative messages regarding the startup of the system components. *(Refer to Section 4.11.7.1).*

Illustration 4-68
System Booting Up



WORKSTATION SELECTION. Shows the selected Workstation (Direct, RAD Table or RAD Wall Stand). Press on it to modify the Workstation selection. A new window will be opened with the available Workstations. Tap on the desired one to select it and return to the main menu by pressing again on this icon or on the "*Home*" icon.

Illustration 4-69
Workstation Selection



Workstation icons are always available for changing the desired option.

- **Free Workstation:** Press to select Direct exposure. When selected, it is possible to execute an exposure at any moment without Detector and X-ray Tube alignment. AEC Controls, Auto-center and Auto-tracking movements are not available in Direct Workstation.

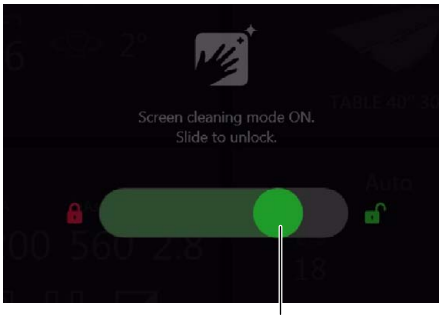
- **RAD Table Workstation:** Press to select exposure with the Detector of the Table. When this option is selected, the Active Workstation Indicator of the Table (above the Control Pedals) gets lighted in white.

- **RAD Wall Stand Workstation:** Press for an exposure with the Detector of the RAD Wall Stand. When this option is selected, the Active Workstation Indicator of the RAD Wall Stand (at the Top Cover) gets lighted in white.

Note ☞ *Once the Workstation is modified or selected, this selection is automatically transferred to the X-ray Generator.*

SCREEN CLEANING MODE (Option). Locks the Touchscreen and the Capacitive Wheel for cleaning purposes. Once finished, drag the slider to unlock.

Illustration 4-70
Screen unlock



4.11.2 MOVEMENTS

The Control Console enables the operator to control the movements of the Overhead Tube Crane and also the automatic movements of the equipment (Auto-tracking, Auto-positioning and Auto-centering).

AUTOMATIC MOVEMENTS

- **Detent Points.** Press to activate the Detent Points. At these Detent Points, the equipment will activate the brakes, whenever the manual movement is made smoothly. When the movement is faster than configured, the Detent Point is skipped.

- **Auto-tracking.** Get the Auto-tracking motion active. It is possible to activate it just when the X-ray Tube is aligned with the Receptor of the selected Workstation, RAD Table or RAD Wall Stand. It is not active for Direct Workstation. Auto-tracking function remains active for 5 minutes after Overhead Tube Crane is inactive. For additional information about the operation with Auto-tracking function refer to *Section 4.13.2.2*.

- **Fast Alignment with the Predefined Position 1.** Press to move the OTC towards a previously assigned position (*P1* Predefined Position, which corresponds to the “P1” customizable control on the RCC Console). When active, hold the wheel and the Overhead Tube Crane will automatically move to the predefined position. This position is displayed in the Auto-position selection and can be modified by the Operator. (*Refer to Section 4.11.4*).

- **Fast Alignment with the Predefined Position 2.** Press to move the OTC towards a previously assigned position (*P2* Programmed Position, which corresponds to the “P2” customizable control on the RCC Console). When active, hold the wheel and the Overhead Tube Crane will automatically move to the predefined position. This position is displayed in the Auto-position selection and can be modified by the Operator. (*Refer to Section 4.11.4*).

- **Auto-center.** Get active the Auto-center function to align the X-ray Tube with the Receptor. Table or Wall Stand Workstations must be selected. This button is not active for Direct Workstation. For additional information about the operation with Auto-center function refer to *Section 4.13.2.1*.

- **Motion Speed.** Press to select the desired motion speed of the Overhead Tube Crane. Available options are slow (“Turtle” icon) and fast (“Rabbit” icon).

MOVEMENT BUTTONS

Movement Buttons are used to control each axis movement. When a button is pressed and selected, movements on that axis are enabled. Otherwise, the manual movement of the axis will remain deactivated.

- **Vertical Axis Movement.** Up & Down.

- **Transverse Axis Movement.** Back & Front.

- **Longitudinal Axis Movement.** Right & Left.

Note ☞

Vertical, Transverse and Longitudinal movements can be performed all together whenever their respective icons are all selected or deselected at the same time. Once touched the Capacitive Wheel, the Tube-Collimator Assembly can be driven without any effort.

- **Alpha Axis Movement.** Angle of the X-ray Tube.

- **Beta Axis Movement.** Rotation of the X-ray Tube.

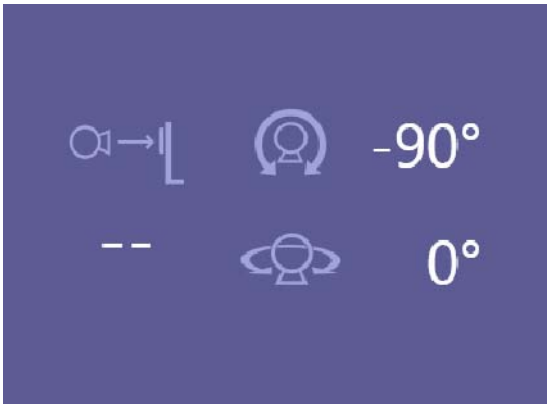
Note ☞ *When one of the Vertical, Transverse or Longitudinal Axes icons is pressed, Alpha and Beta axes icons are automatically deactivated, if any where active. Also, when Alpha or Beta axes icons are pressed, Vertical, Transverse and Longitudinal Axes icons are automatically deactivated, if any where active.*

- **Omnidirectional Movement (Option).** All movement axes are activated, so the Tube-Collimator Assembly can be driven in totally free motion.

Note ☞ *The optional Omnidirectional Movement button can be configured during the installation. By default, all movement axes are activated with this function but it is possible to select only certain axes.*

4.11.3 WORKSTATION PARAMETERS

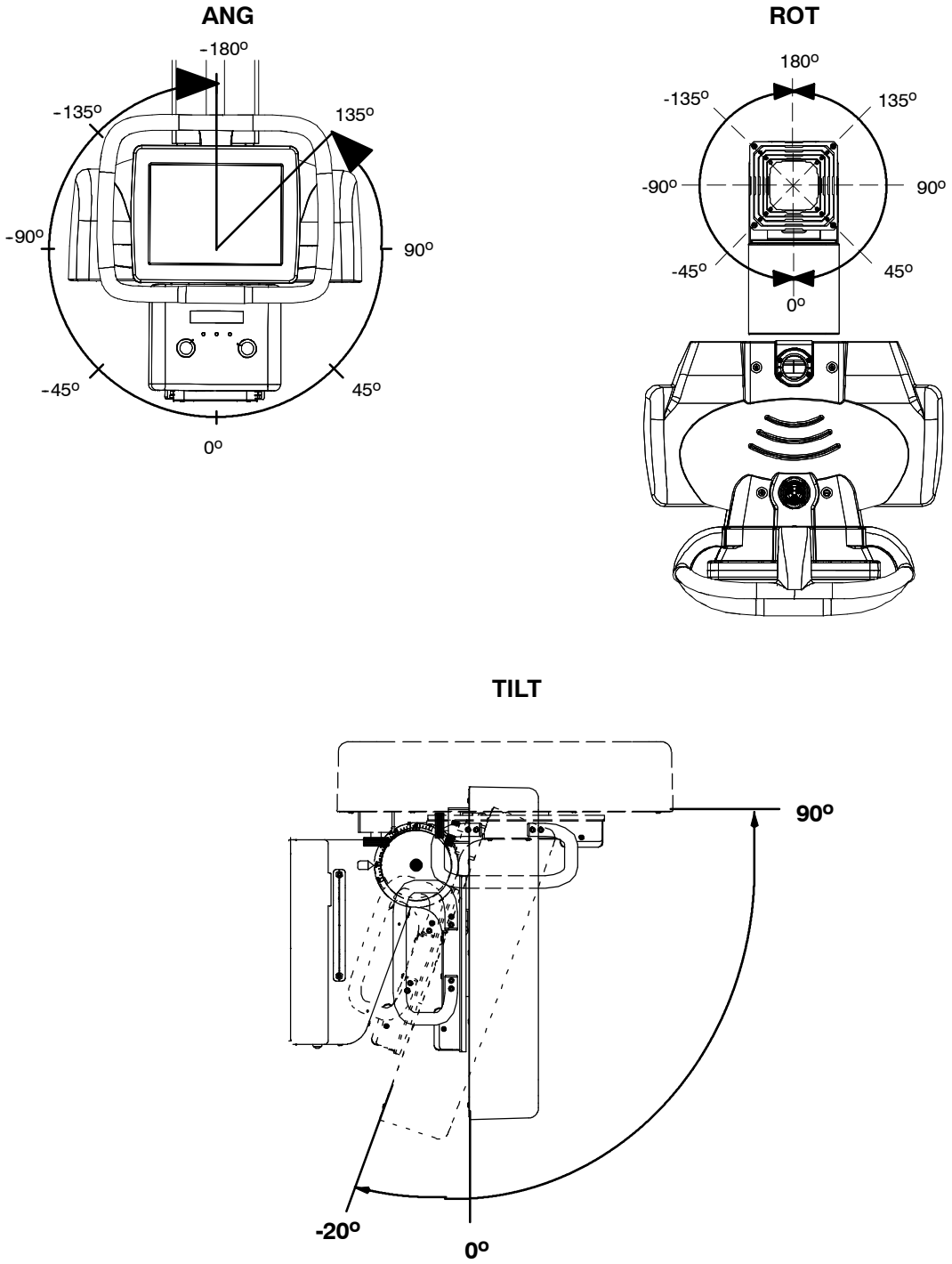
Illustration 4-71
Workstation Parameters in the Main Menu (RAD Wall Stand Workstation)



The Workstation Parameters area of the Main menu shows the information related to the selected workstation (Direct, Table or RAD Wall Stand).

It shows the rotation and angulation angles of the X-ray Tube, the SID (when Table or RAD Wall Stand are selected) and the position and angulation of the Detector (when RAD Wall Stand with Tilting is selected).

Illustration 4-72
Tube Position Description and Vertical Detector Tilting



4.11.4 AUTO-POSITIONS

Each Auto-position refers to a programmed position of the X-ray Tube along any axis of the Overhead Tube Crane (Longitudinal, Transverse, Vertical, Angulation in Alpha Axis & Rotation in Beta Axis). It also refers to the Receptor position of the Table on vertical and longitudinal travels, and to the Receptor of the Wall Stand on vertical travel and on tilting angle.

Note ☞ *Auto-positions can also be configured to have the Auto-tracking movement active.*

The Overhead Tube Crane has different Auto-positions available on the Control Console. Auto-positions are configured in factory on client request or during the installation/configuration of the system.

The Auto-positions area of the Main menu shows the currently selected auto-position. If no Auto-position is selected, the message "*Please, select an auto-position in this tile*" is shown.

Illustration 4-73
Auto-positions Area

In order to select an Auto-position and execute the movement to reach it, follow the steps below:

1. First select a Workstation.

2. Press on the Auto-positions area. All the configured Auto-positions for the selected Workstation will be displayed.

3. Scroll through the list of available Auto-positions and tap once on the desired one to select it.

Illustration 4-74
Auto-positions Selection

4. Press on the Auto-center button to activate the function.

- To complete the movement press and hold Auto-center button on the RCC Console, Wall Stand Control Box or IR Remote Control (if available).

- If Auto-center function is performed from the Control Console, tap on the Auto-center button (the background color becomes lighter when activated) and hold the Wheel to start the automatic movement.

Note ☞ *When the Auto-position is executed with the RCC Console, Wall Stand Control Box or OTC Control Console, it is possible to release the control when the OTC is less than 10 cm. and 20º away from its final destination to let the OTC complete the movement.*

WARNING

IT IS MANDATORY TO REMAIN CLOSE TO AN EMERGENCY OFF SWITCH IN CASE IT IS NEEDED TO STOP THE OTC MOVEMENT WHEN THE CONTROL IS RELEASED AND THE OTC IS COMPLETING THE AUTO-POSITION ON ITS OWN.

To return to the main menu press on the "*Home*" icon.

For further details about automatic movements, e.g. the safety policy, refer to *Section 4.13*.

HOW TO MODIFY THE AUTO-POSITION PARAMETERS

1. Place the Overhead Tube Crane and the Positioner (RAD Wall Stand or Table) in the desired position.

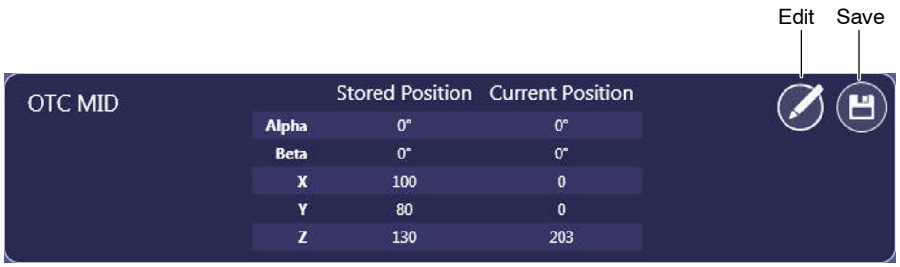
2. Tap on the Auto-positions area of the Main menu.

3. Select the Auto-position to be modified.

4. Check that the "*Current Position*" parameters are the desired ones for the selected Auto-position and press on the "*Save*" icon to modify them.

Note ☞ *In some cases, when a position is manually reached, it may not be automatically selectable. When this occurs, the values are not saved.*

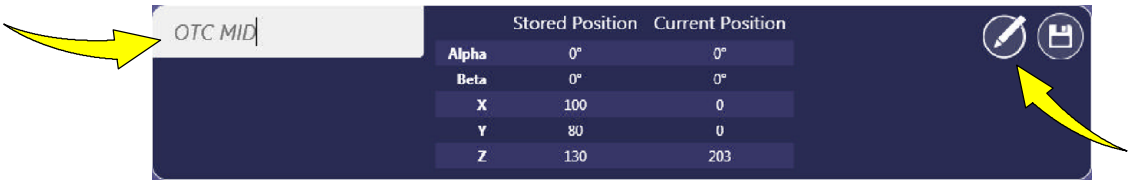
Illustration 4-75
Auto-position Parameters



HOW TO RENAME AN AUTO-POSITION

1. Tap on the Auto-positions area of the Main menu.
2. Select the Auto-position to be modified and press on the "*Edit*" icon.
3. The Auto-position name becomes an editable text box, so that it can be modified.

Illustration 4-76
Auto-position renaming



4. Once the text is modified, press again the "*Edit*" icon to save the new name.

PREDEFINED POSITIONS

A colored icon labels an Auto-position as a Predefined Position. This corresponds to Customizable Control (*P1, P2, P3, P4*) designated on the RCC Console and Fast Alignment buttons (*P1* and *P2*) in the movement buttons bars of the Control Console.

Illustration 4-77
Auto-position set as Predefined Position

In order to select a Predefined Position and execute the movement to reach it, follow the steps below:

1. Select an Auto-position set as Predefined Position in the Auto-positions area of the Control Console (*see Illustration 4-77*).

   Otherwise, press the desired Customizable Control on the RCC Console to select one of the four programmable Auto-positions.

2. To complete the movement press and hold one of the Customizable Controls on the RCC Console or IR Remote Control (if available).

   - The movement can also be executed by pressing and holding the Auto-center button on the RCC Console, Wall Stand Control Box or IR Remote Control (if available).

3. Alternatively, it is possible to select Predefined Positions *P1* or *P2* with the Fast Alignment buttons in the movement buttons bars of the Control Console and hold the Console Wheel to complete the movement.

   - If Auto-center function is performed from the Control Console, tap on the Auto-center button (the background color becomes lighter when activated) and hold the Wheel to start the automatic movement.

Note ☞

When the Auto-position is executed with the RCC Console, Wall Stand Control Box or OTC Control Console, it is possible to release the control when the OTC is less than 10 cm. and 20º away from its final destination to let the OTC complete the movement.

IT IS MANDATORY TO REMAIN CLOSE TO AN EMERGENCY OFF SWITCH IN CASE IT IS NEEDED TO STOP THE OTC MOVEMENT WHEN THE CONTROL IS RELEASED AND THE OTC IS COMPLETING THE AUTO-POSITION ON ITS OWN.

PARKING POSITION

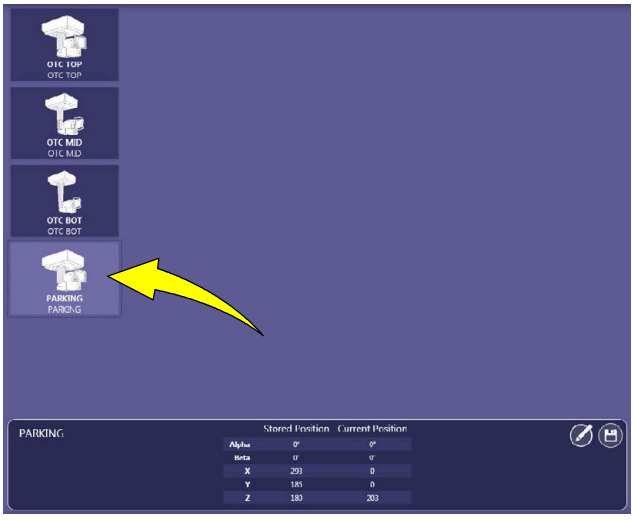
The Parking Position is an Auto-position whose use is intended to place the Overhead Tube Crane with the Telescopic Column retracted during periods of inactivity.

Note ☞ *This position is configured by the Service engineer and cannot be modified directly by the Operator. To modify the Parking Position, contact Service Support.*

To execute the movement to reach the Parking Position, proceed in the same way as a regular Auto-position:

1. Press on the Auto-positions area, where all the configured Auto-positions for Direct Workstation will be displayed.
2. Scroll through the list of available Auto-positions and tap on the “Parking” position.

Illustration 4-78
Parking Position Selection



3. Press on the Auto-center button to activate the movement.

- To complete the movement press and hold Auto-center button on the RCC Console, Wall Stand Control Box or IR Remote Control (if available).

- If Auto-center function is performed from the Control Console, tap on the Auto-center button (the background color becomes lighter when activated) and hold the Wheel to start the automatic movement.

4. Optionally, it is possible to reach the Parking Position by pressing and holding the "*Parking Position*" button of the IR Remote Control (*refer to Section 4.14.1*).

Note ☞

When the Parking position is executed with the RCC Console, Wall Stand Control Box or OTC Control Console, it is possible to release the control when the OTC is less than 10 cm. and 20º away from its final destination to let the OTC complete the movement.

IT IS MANDATORY TO REMAIN CLOSE TO AN EMERGENCY OFF SWITCH IN CASE IT IS NEEDED TO STOP THE OTC MOVEMENT WHEN THE CONTROL IS RELEASED AND THE OTC IS COMPLETING THE AUTO-POSITION ON ITS OWN.

4.11.5 EXPOSURE PARAMETERS 1.1.5

The Exposure Parameters area of the Main menu shows the currently selected kV, mA, mAs and exposure time along with the Focal Spot and AEC selection.

Illustration 4-79
Exposure Parameters in the Main Menu

kVp shows the radiographic kVp value selected for the technique.

mA shows the radiographic mA value selected for the technique.

mAs can show the radiographic mAs value selected for the technique.

Time (s) can show the Time value (in seconds) selected for the radiographic technique.

Focal Spot shows the selected size of the Focal Spot.

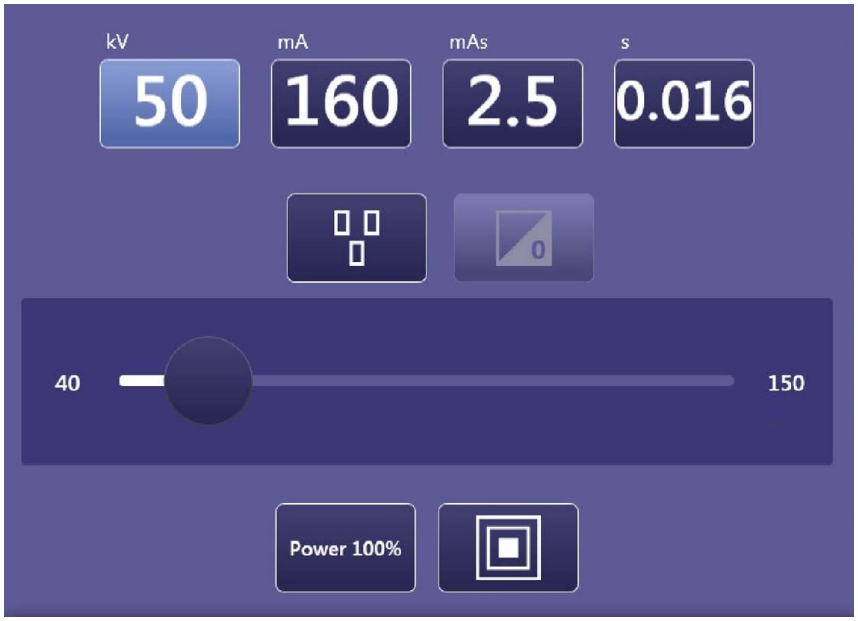
AEC Field shows the selected AEC Field Combination. 1.1.5

AEC Density shows the selected AEC Density value.

RADIOGRAPHIC PARAMETERS

The upper display area of the Exposure Parameters screen shows the kV, mA, mAs and exposure time (s) values (*see Illustration 4-80*). Once selected by tapping on it, the radiographic technique value is increased or decreased by changing the value moving the "*Slider*" position.

Illustration 4-80
Exposure Parameters Configuration



When the "*Slider*" is positioned over a value not allowed, according to the limit of the Tube and the Unit, its pointer comes back to the nearest allowed value.

- **kVp**: Selects the X-ray Tube voltage.
- **mA**: Selects the X-ray Tube current, changing the mAs value and keeping constant the selected Exposure Time, whenever possible.

- **mAs**: Selects the exposure in mAs, setting the maximum mA available for the selected Focal Spot and the respective Exposure Time. If the maximum mA value available coincides with the maximum mA station of the Generator, it sets one mA station below of the maximum mA station of the Generator.
- **s**: Selects the Exposure Time in seconds.

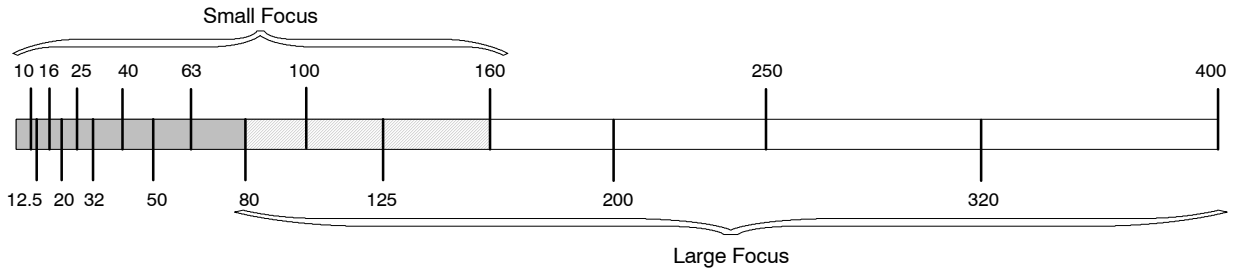
Note ☞ *If after pressing any of these buttons, the technique value is blocked, it could mean that it may have been selected a wrong combination of radiographic parameters that could have caused a warning condition, (refer to Section 6.4 System Messages).*

FOCAL SPOT

This indicator shows the selected Focal Spot of the X-ray Tube: "*Small*" or "*Large*". The Focal Spot is changed by pressing on this indicator or selecting an mA station of the other Focal Spot. It keeps kVp and constant mAs, whenever it is possible.

Small and Large Focal Spots can overlap each other, refer to the graphic below to view an example for the 32 kW Generator.

Illustration 4-81
Small and Large Focus Overlap on a 32 kW Generator



If Small and Large Focal Spots overlap each other, the Focal Spot change must be always performed manually. On the contrary, if they are not overlapped, the Focal Spot change can be made automatically when increasing or decreasing mA.

Note ☞ *The maximum mA station for the Small Focal Spot and the minimum mA station for the Large Focal Spot are configured by the field engineer during the installation.*

In 2P mode, the Focal Spot is changed keeping kVp and mAs constant, whenever possible (maximum mA available and minimum Exposure Time). The mA value available is set according to maximum power, instantaneous power, space charge, etc.

In 3P mode, if the selected mA station is not available for the Focal Spot selection, mA are automatically set to the nearest available station, selecting the respective exposure time in order to keep constant mAs.

Note ☞ *The Focal Spot can be changed whenever the present conditions of the X-ray Tube allow it.*

AUTOMATIC EXPOSURE CONTROL (AEC)

Automatic Exposure Control (AEC) produces consistent density with excellent contrast regardless of the radiographic technique selected. The AEC module comprises the controls for the selection of the Exposure Detector Fields (Ion Chamber) and Density Compensation.

Note ☞ *AEC controls are only enabled when a Workstation with AEC is selected.*

The AEC mode is activated by touching the AEC Field button and selecting one of the combinations with filled fields. The AEC mode is deactivated by selecting the empty combination, the one furthest to the left.

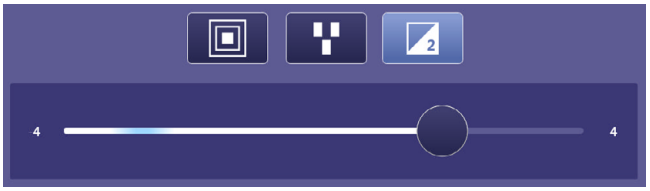
1.1.5

- **Field selection.** Press on the AEC icon to display all the AEC field combinations. Each icon indicates the related physical location of the selected field in the AEC Exposure Detector. Any combination of fields can be selected. The selected icon gets highlighted when active.

- **Density.** To configure the AEC Density, press on its icon and indicate a value from -4 to +4. Density button is only available when an AEC field has been selected.

Illustration 4-82
AEC Selection

1.1.5



POWER REDUCTION

The maximum kW of the Generator is factory set according to the Generator performance. Generator kW can be limited to 80% by pressing on the "*Power Reduction*" icon and selecting the desired power percentage (100% or 80%). If doing so, check that mA and kV selection can be done in accordance to the Power Reduction.

4.11.6 COLLIMATOR PARAMETERS

The Collimator area shows the Collimator aperture and filter selection. Tap on this area to modify the Collimator parameters.

Illustration 4-83
Collimator Area in the Main Menu

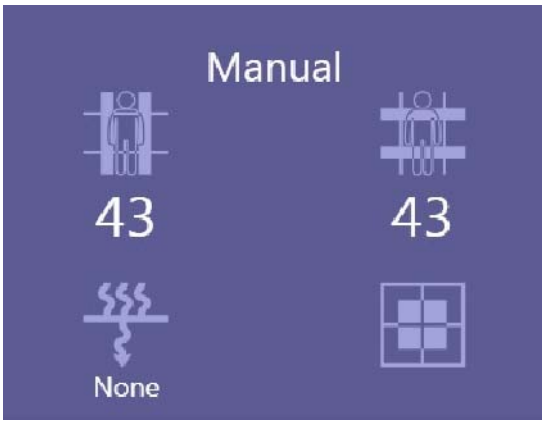
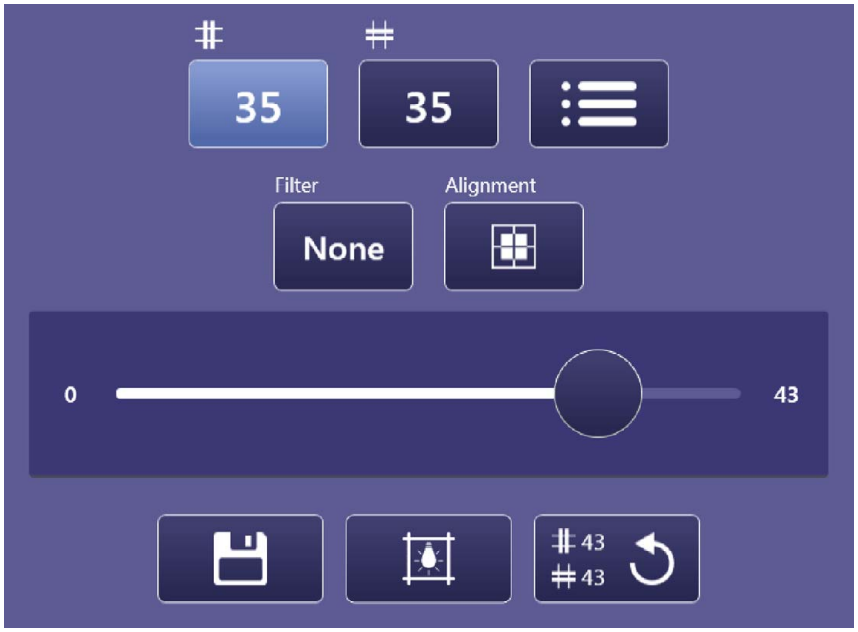


Illustration 4-84
Collimator Parameters



BLADES ADJUSTMENT

Transverse and Longitudinal blades can be adjusted manually, using the slide bar, or automatically, by tapping on the "*List*" icon and selecting one of the preprogrammed Fields of view.

Illustration 4-85
Blades Adjustment Options

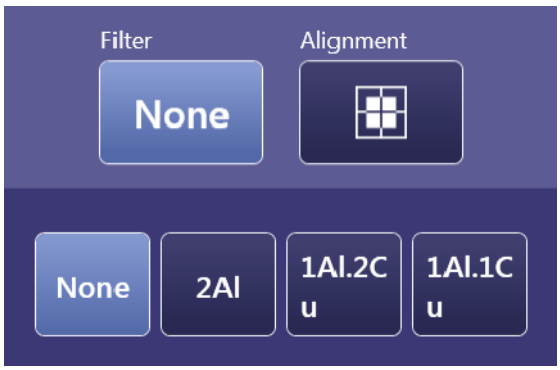
Slide bar for manual adjustment

Preprogrammed fields of view

FILTER SELECTION

To select a Collimator filter, press on the "*Filter*" icon and tap on the option to be selected.

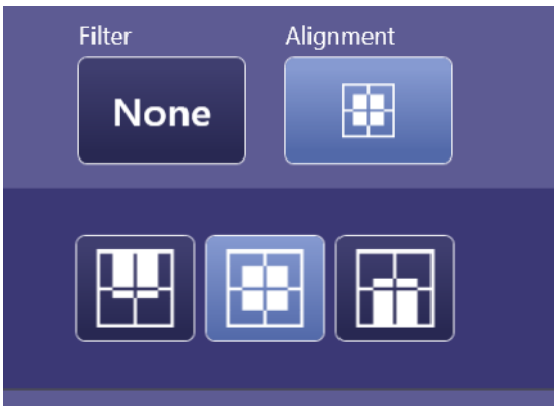
Illustration 4-86
Collimator Filter Options



ALIGNMENT

To select the Tube-Collimator Assembly alignment with the position of a detector of 35x43 cm (14"x17"), press on the "*Alignment*" icon and tap on the option to be selected (*Top / Center / Bottom*).

Illustration 4-87
Alignment Options



Note ☞ *For Top and Bottom configurations the X-ray source assembly would not be aligned with the center marks of the Wall Stand front cover, so the centering lines and AEC indicators will become invalid in theses cases.*

SAVE DATA

Press the “*Save*” icon to save the entered data.

1.1.31 **COLLIMATOR LIGHT**

Press the “*Collimator Light*” icon to turn ON/OFF the Collimator light.

RECOVER

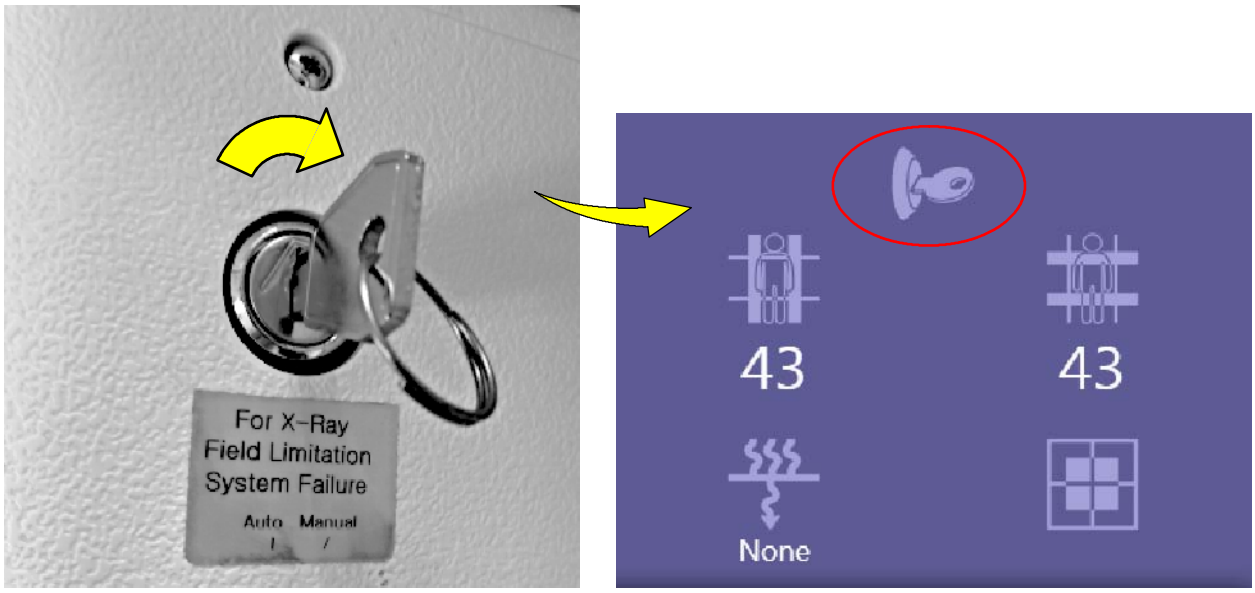
Press the “*Recover*” icon to revert back to the previously saved parameters. It shows the last saved blades aperture sizes.

COLLIMATOR KEY SWITCH

Whenever a problem with the collimation is experienced, a key switch (located at the rear of the Collimator) can be used to force the activation of the Collimator’s manual mode.

In this case, a “*key*” icon is displayed in the Collimator Area.

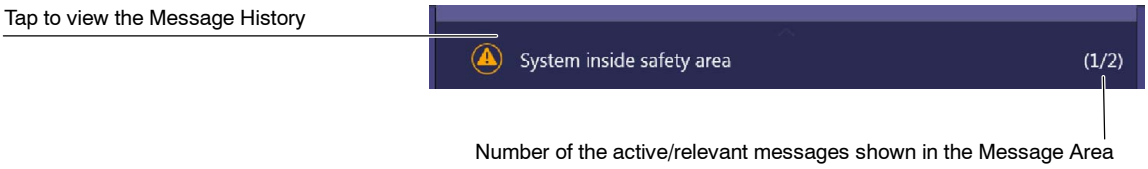
Illustration 4-88
Using the Collimator Key Switch to set the Manual Position



4.11.7 MESSAGE AREA

The Message Area of the Main Menu shows informative messages (warnings, errors, emergency messages, information, inhibit conditions…). Active messages, i.e. those that require action by the operator or report an error or warning, will be displayed consecutively in this area.

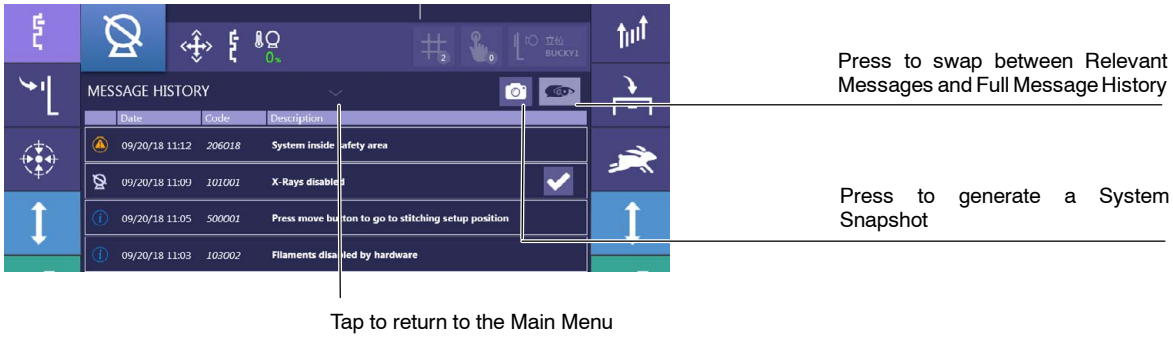
Illustration 4-89
Message Area in the Main Menu



To check the message history, press on the Message area. A pop-up window (titled "***Message History***") will be displayed. To close it, tap on the upper arrow of the Message History window and go back to the previous screen.

It is possible to check just the active messages (those that are relevant to the system) or the complete message history. Use the "*Relevant Messages/Full Message History*" icons to swap between the two options.

Illustration 4-90
Message History



Note ☞ *For information about the different message windows refer to the Section 4.11.7.1.*

Note ☞ *For information about the Types of Messages and Messages List refer to the Section 6 Troubleshooting Guide.*

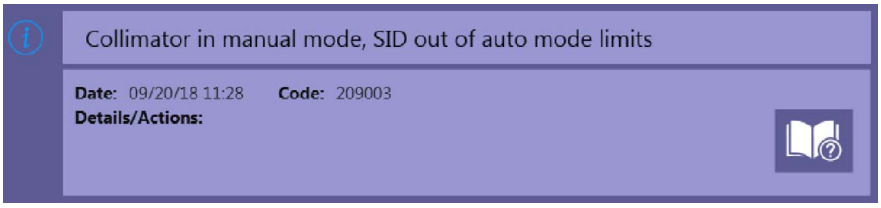
4.11.7.1 MESSAGE WINDOWS

The main message window is the Message History, available from the Message Area of the Main Menu, which contains all system messages.

In addition, there are different pop-up message windows depending on the source of the messages and how to access them. General features of these windows are described in *Message Area Section (4.11.7)*, however some of their particularities are described as follows.

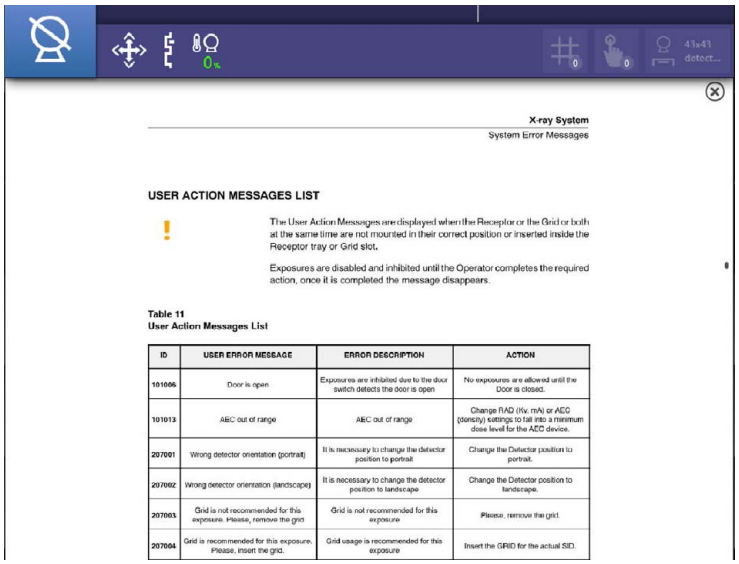
Press on any message to display the date, code and a brief description.

Illustration 4-91
Message Displayed



The "*Consult Manual*" button can be used to access to a digital copy of an extract from the Operator Manual with the list of troubleshooting errors, so that detailed information on the message code can be consulted.

Illustration 4-92
Operator Manual Display



X-ray System
System Error Messages

USER ACTION MESSAGES LIST

The User Action Messages are displayed when the Receptor or the Grid or both at the same time are not mounted in their correct position or inserted inside the Receptor tray or Grid slot.

Exposures are disabled and inhibited until the Operator completes the required action, once it is completed the message disappears.

Table 11
User Action Messages List

ID	USER ERROR MESSAGE	ERROR DESCRIPTION	ACTION
101006	Door is open	Exposures are inhibited due to the door switch detects the door is open	No exposures are allowed until the Door is closed.
101013	AEC out of range	AEC out of range	Change fIAD (kv, mA) or AEC (density) settings to fall into a minimum dose level for the AEC device.
207001	Wrong detector orientation (portrait)	It is necessary to change the detector position to portrait	Change the Detector position to portrait.
207002	Wrong detector orientation (landscape)	It is necessary to change the detector position to landscape	Change the Detector position to landscape.
207003	Grid is not recommended for this exposure. Please, remove the grid	Grid is not recommended for this exposure	Please, remove the grid.
207004	Grid is recommended for this exposure. Please, insert the grid.	Grid usage is recommended for this exposure	Insert the GRID for the actual SID.

Press the "*Home*" icon in any of these windows to return to the Main Menu.

Each of the message windows is detailed below:

NOTIFICATIONS

Notifications of important information to be noticed by the operator can appear during normal operation as pop-up messages in Message Area, allowing to access the Notifications window. Two types of different messages can appear in this pop-up window during normal operation:

- Information messages that do not require confirmation by the user. Automatically cleared by the system after a few seconds.
- Messages that require user confirmation. It is needed to tap on the “Accept” button to continue.

Illustration 4-93
Notifications Pop-up Window

INHIBIT CONDITIONS MESSAGES

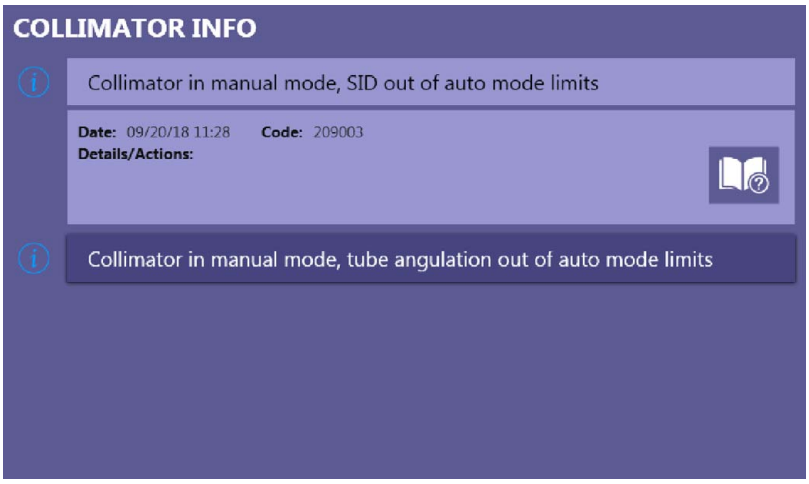
Whenever the System Status is “Inhibit Conditions”, it is possible to press the status icon to display the messages of conditions that inhibit exposures (*refer to Section 4.11.1*).

Illustration 4-94
Inhibit Conditions Messages

COLLIMATOR MESSAGES

The “Collimator Info” window is accessible from the button in the System Status Area of the Main Menu. It shows informative messages with the reasons why the Collimator is operating in Manual or Busy (Semi-automatic) mode.

Illustration 4-95
Collimator Info Window



BOOT UP MESSAGES

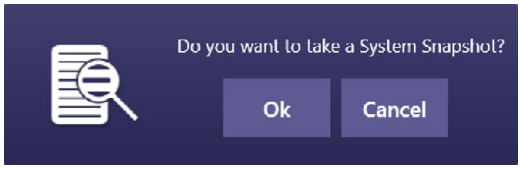
During the booting up of the system, the “Boot Up” button is enabled in the System Status Area. Within that time frame, it is possible to press this button to display the informative messages regarding the startup of the system components.

Illustration 4-96
Boot Up Window

4.11.7.2 SYSTEM SNAPSHOT

Press the “System Snapshot” button, located in the upper side of Message History window, to generate event logs files. Once pressed and after confirmation, a pop-up window displays the result of the log export process for each system component.

Illustration 4-97
System Snapshot Confirmation and Logs Capture Window



The different status of the Log Capture can be:

- Logs export in progress

- Successful logs export

- Failed logs export

Once the logs export is finished, press the “Close” button to go back to the Main Menu.

Note ☞ *The resulting system logs files are generated in folder C:\OEM\Snapshots.*

Note ☞ *During generation of System Snapshot an interlock inhibit the exposures.*

4.12 OVERHEAD TUBE CRANE OPTIONS

4.12.1 STITCHING 1.1.28

The Stitching Sequence function allows to combine multiple radiographic images with overlapping fields of view to produce a panoramic or high-resolution image. This optional function has to be configured previously during the installation and it is initialized through the Acquisition Software in the Image Workstation.

TO ENABLE THE STITCHING OPTION IT IS ABSOLUTELY MANDATORY TO BE PROVIDED WITH A LICENSE.

Once configured, the Stitching is available in the Acquisition Software as an APR technique, distinguishing between Stitching with two, three or four exposures.

Note ☞ *Number of exposures may vary in order to cover the range defined by the Operator.*

Note ☞ *The Stitching Acquisition may be cancelled before starting, if the exposure parameters necessary to perform the technique are not selectable in the Generator.*

Note ☞ *Refer to Section 5.2.5 for further information about collimation during the Stitching Sequence.*

STITCHING PROCEDURE

To perform the Stitching function:

1. Firstly access the Acquisition Software from the Image Workstation.

2. Activate the Stitching function by selecting a Stitching technique (either Table or Wall Stand) from the APR selection. 1.1.28

Note ☞ *The movement buttons on the Control Console remain deactivated during Stitching Sequence. Only the angular movements of the Alpha Axis are allowed.*

3. The Control Console goes into Stitching Mode. A pop-up window will be displayed with instructions and the available configurations.

Illustration 4-98
Stitching Window

4. Hold the Wheel of the Control Console or press the Auto-center button on the RCC Console, the Wall Stand Control Box or the IR Remote Control (if available) to align the X-ray Tube with the bottom of the Detector for the Wall Stand and with the top of the Detector (patient's head) for the Table (Setup Positions). For information about the operation of Auto-center function refer to *Section 4.13.2.1*.

Note ☞ *The automatic movement to reach the Setup Position can also be initiated by pressing the* ***Handswitch****.*

5. Once the Setup Position is reached and alignment is complete, a second window allows to adjust the following parameters:

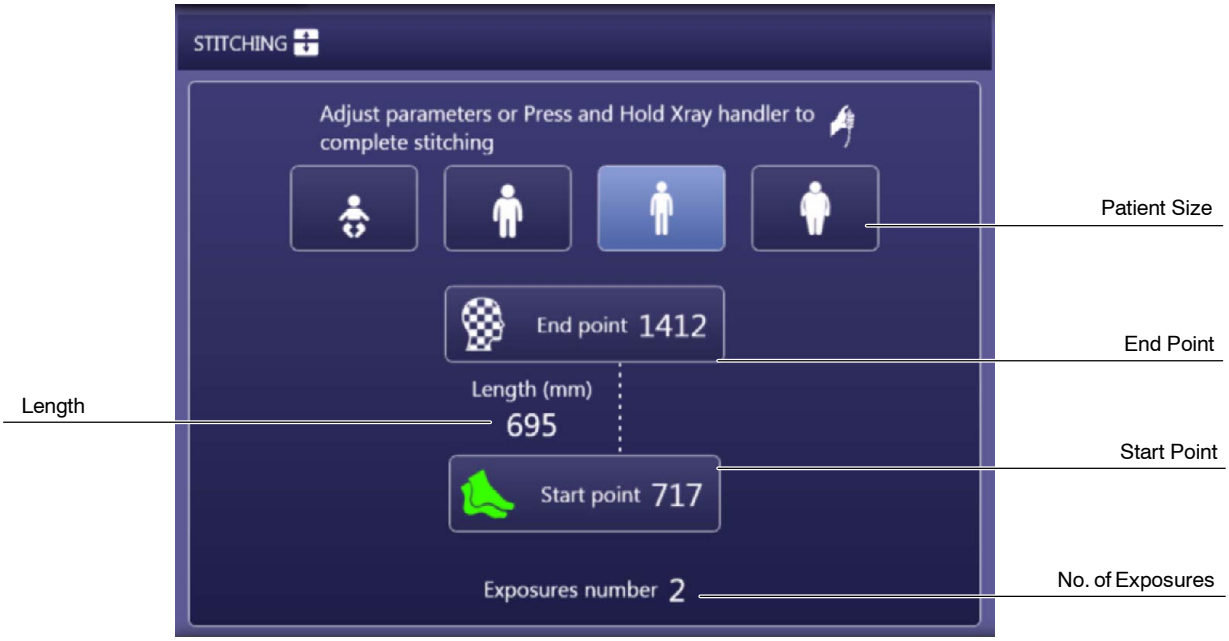
   - **Patient Size**. Four patient sizes are available to adjust Generator parameters: three for Adult and one for Pediatric.

   - **Start Point/End Point**. Used to define the starting and ending points of the Stitching sequence and to indicate the position values of both points in mm.

- **Length**. Means the total length, values are in mm or inches (depending on the selected configuration), of the image to be obtained.

- **Exposures Number**. This indicator shows the number of exposures calculated to perform the Stitching Acquisition, according to the set parameters.

Illustration 4-99
Stitching Parameters in Control Console (Wall Stand Example)



Note ☞ *The Stitching Acquisition of this System is always angular. This means that the Tube performs an angulation movement around the Receptor. Stitching parameters as SID, PID, Overlap, default Length and Direction are defined in the Acquisition Software.*

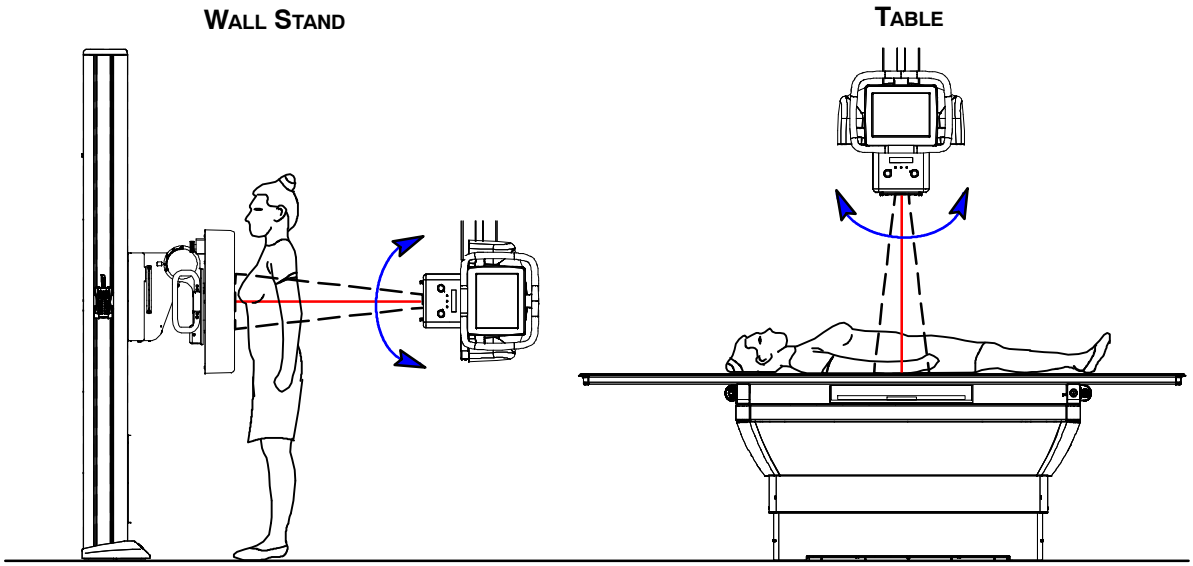
Note ☞ *Depending on whether the Stitching technique is intended for Table or Wall Stand, this window will display the "Start Point" and "End Point" buttons aligned horizontally (Table with Control Console in landscape orientation) or vertically (Wall Stand with Control Console in portrait orientation).*

6. Select the Patient Size.

7. Set the Start and End Points:

   a. To this end, the Alpha Axis is released allowing to change the Tube angulation.

Illustration 4-100
Tube Angulation



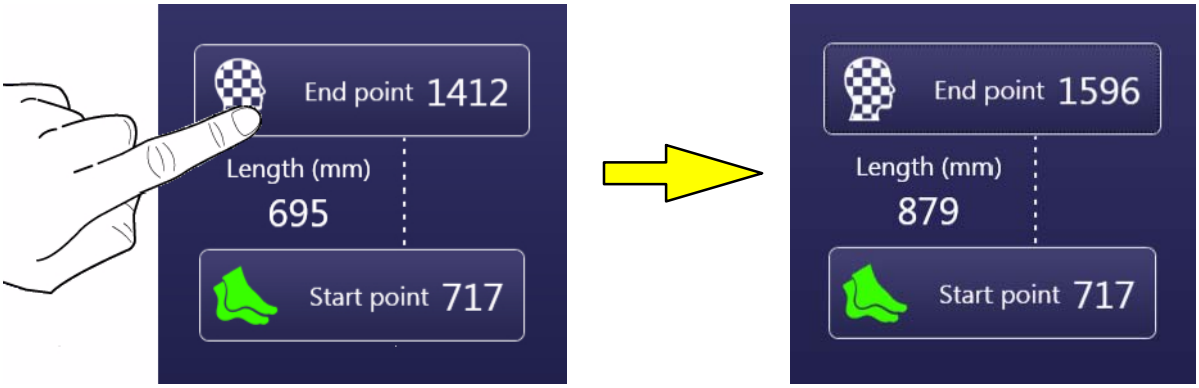
   b. Turn on the collimator lamp and use the projected light field as a reference to set the starting and ending points.
   The upper and lower ends of the light field will be the reference lines for the Start/End points of the Stitching Acquisition (depending on the Direction in which it is taken).

   c. In the case of the Wall Stand, if the Stitching Direction has been configured from *Feet to Head*, the "*0*" value of the Start/End points would correspond to the ground (the lowest point the Receptor can reach in the vertical travel).
   If the Stitching Direction has been configured from *Head to Feet*, the "*0*" value would correspond to the highest point in the vertical travel.

   d. In the case of the Table, the right and left ends of the Receptor longitudinal travel would be the "*0*" value for the *Feet to Head* and *Head to Feet* directions, respectively.

e. When the Tube aims at the desired point, tap on the Start/End point button. The Length value and the Start/End point position value will be recalculated and refreshed in this window.

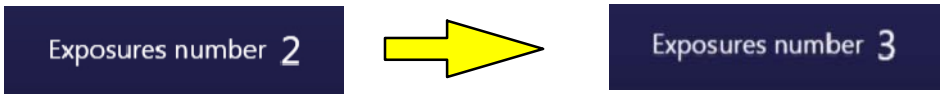
Illustration 4-101
Setting the End Point



Note ☞ *The Acquisition Direction ("Head to Feet" or "Feet to Head") is set in the Acquisition Software technique. Depending on the selected direction, the colors of the icons in the "Start/End Point" buttons will alternate between green color (Start) and checkered flag pattern (End).*

8. If the resulting Stitching Length is necessarily large (or shorter than default set), the final number of exposures may be increased or decreased according to the Acquisition Software calculations.

Illustration 4-102
Exposures Number Indicator



In case the calculated number of exposures was higher than the maximum defined by the technique, the Stitching Acquisition will be inhibited.

9. There may be situations that inhibit the Stitching Acquisition:

   - If the selected start or end point is out of the range configured for Stitching function, a message will be displayed in the Stitching window requesting to select valid parameters.
   - If the selected Length is not compatible with the Stitching technique.

   In both cases an Exposure Inhibition message will be displayed in the Message Area (*Refer to system message 500021 in Section 6.4*).

Illustration 4-103
Stitching Inhibition Notifications

Modify the indicated parameters or select another Stitching technique to continue with the Exposure.

Note ☞ *It is possible to change the orientation of a 3543 Detector during the Stitching sequence. If this is done, all data will be automatically recalculated without the need to restart the Stitching Mode.*

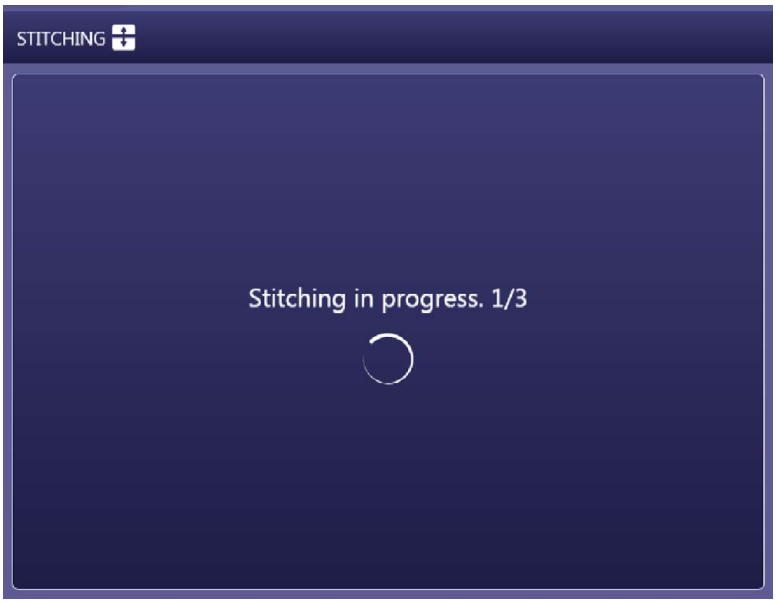
When changing between portrait and landscape orientation (and vice versa), the collimator aperture controls and the exposure area limits are inverted.

Note ☞ *Alignment of a 3543 Detector in the Receptor Tray must always be "Centered" for a Stitching procedure.*

10. Use the Handswitch or RCC Console to perform an X-ray exposure as if it were a normal operation. The Stitching Sequence will start automatically and all exposures will be completed uninterruptedly.

    The Stitching window of the Control Console will show the progress of the acquisition.

Illustration 4-104
Stitching progress



Note ☞ *The Stitching Parameters can be modified before starting with the first exposure, once the procedure has started it is not possible to modify any parameter. It is also necessary to calculate again the new geometry.*

11. Once the Stitching procedure is finished successfully, a confirmation window will be shown. In case of a system error, a message will indicate that the Stitching has failed.

Illustration 4-105
Result of Stitching Sequence

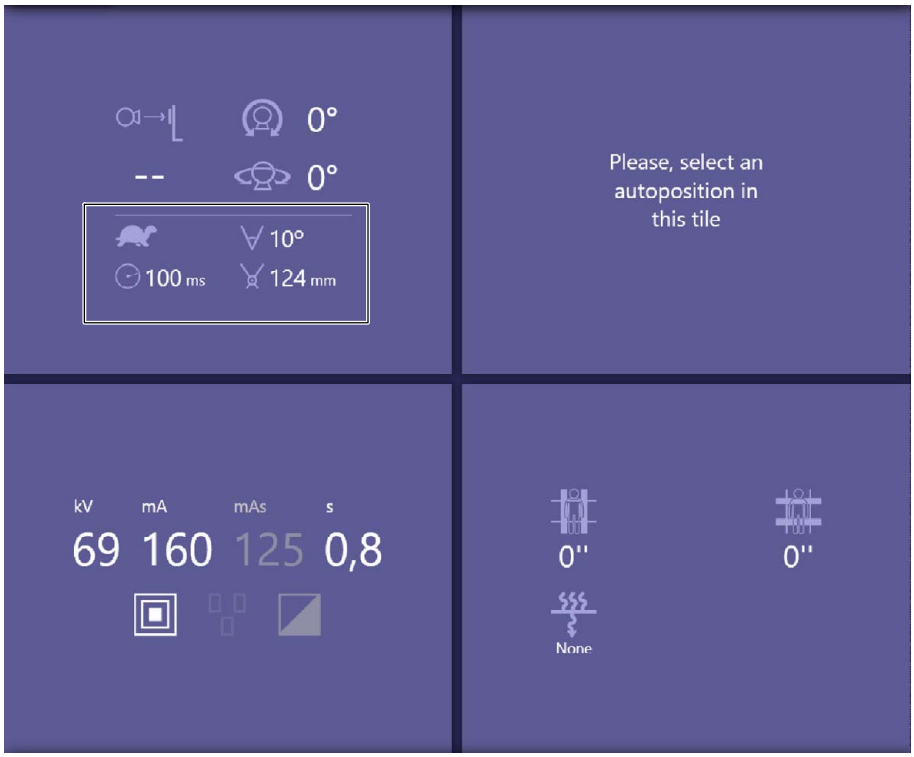
12. Finally, to deactivate the Stitching function, exit the Stitching Mode from the acquisition software in the Image Workstation.

Note ☞ *It must be borne in mind that the Stitching function is also deactivated if you release the Handswitch for more than 3 seconds.*

4.12.2 TOMOGRAPHY

This optional function has to be configured in the Acquisition Software previously during the installation and it is initialized through the Acquisition Software in the Image Workstation. Once configured, the Tomography is available in the Acquisition Software as an APR technique.

The Tomo parameters of the selected technique in the Image Workstation are displayed on the OTC Control Console in the box of the upper left corner.



FULCRUM: Shows the pivot point as measured from the X-ray source. This parameter can be modified in the OTC Control Console.

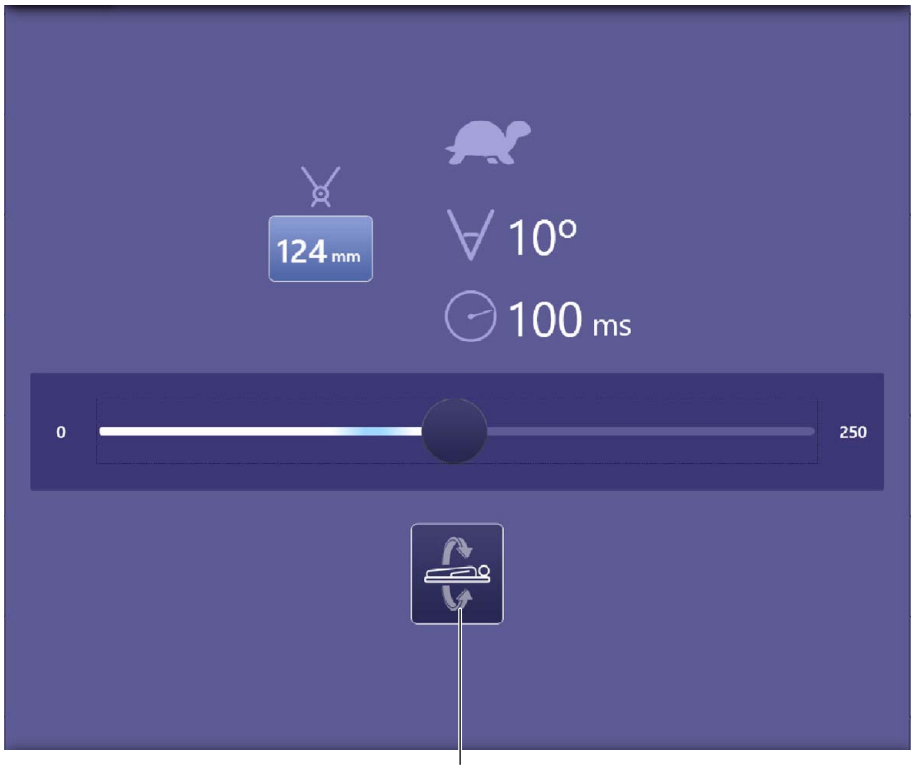
TOMO ANGLE: Shows the angle value for the Tomo process.

SPEED: Shows the tomographic sweep speed: slow or fast.

TOMO TIME: Shows the total time of the Tube displacement.

Note ☞ *Alignment of a 3543 Detector in the Receptor Tray must always be “Centered” for a tomographic procedure.*

TEST TOMO



The Test Tomo button is available in the Tomography area of the Control Console. Tap this button to perform the Tomo sequence without X-rays.

TOMO PROCEDURE

To perform the Tomo function:

1. Firstly, access the Acquisition Software from the Image Workstation.
2. Activate the Tomography function by selecting a Tomo technique from the APR selection.

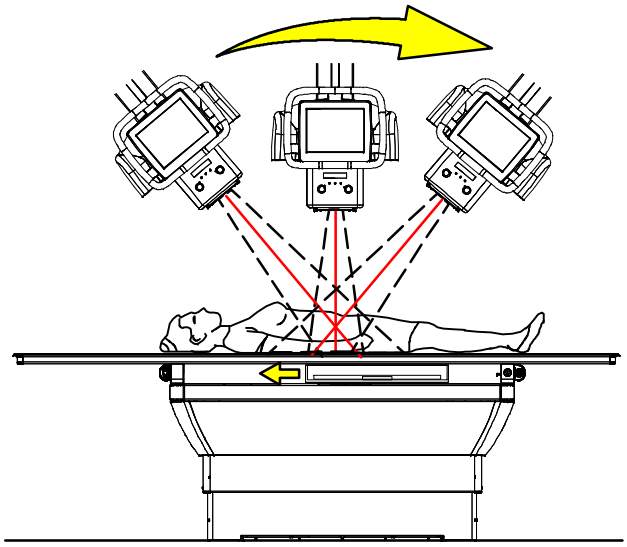
Note ☞ *When Tomography is selected, the AEC field of the Exposure Parameters area of the OTC Control Console is disabled.*

3. Position the equipment at the initial position.

4. Place the patient on the Table.

The Tomo parameters are set by the technique selected in the Acquisition Software and only the Fulcrum can be modified in the Control Console. If any other parameter has to be modified, it is necessary to select a different technique or to edit the selected technique in the APR editor of the Acquisition Software.

Illustration 4-106
Tube and Detector displacement



5. Press and hold Auto-center button on the RCC Console or IR Remote Control (if available) or press the Hand-Switch to PREP position. The Receptor and the Suspension get centered in the central point of the longitudinal travel of the Receptor, it is the exact point where the tomographic exposition will be executed. The Tube stays at a fixed height of 1100 mm (43.31”).

6. Press once the Hand-Switch to get the system in PREP status. The generator gets ready, the Suspension moves to the left of the longitudinal axis and the Receptor moves in the contrary direction, to the right end of its travel.

7. Press the Hand–Switch to initiate the tomographic exposure. Both, Suspension and Receptor, start moving towards the execution point. At the predefined angle and during the specified time, the exposure is executed.

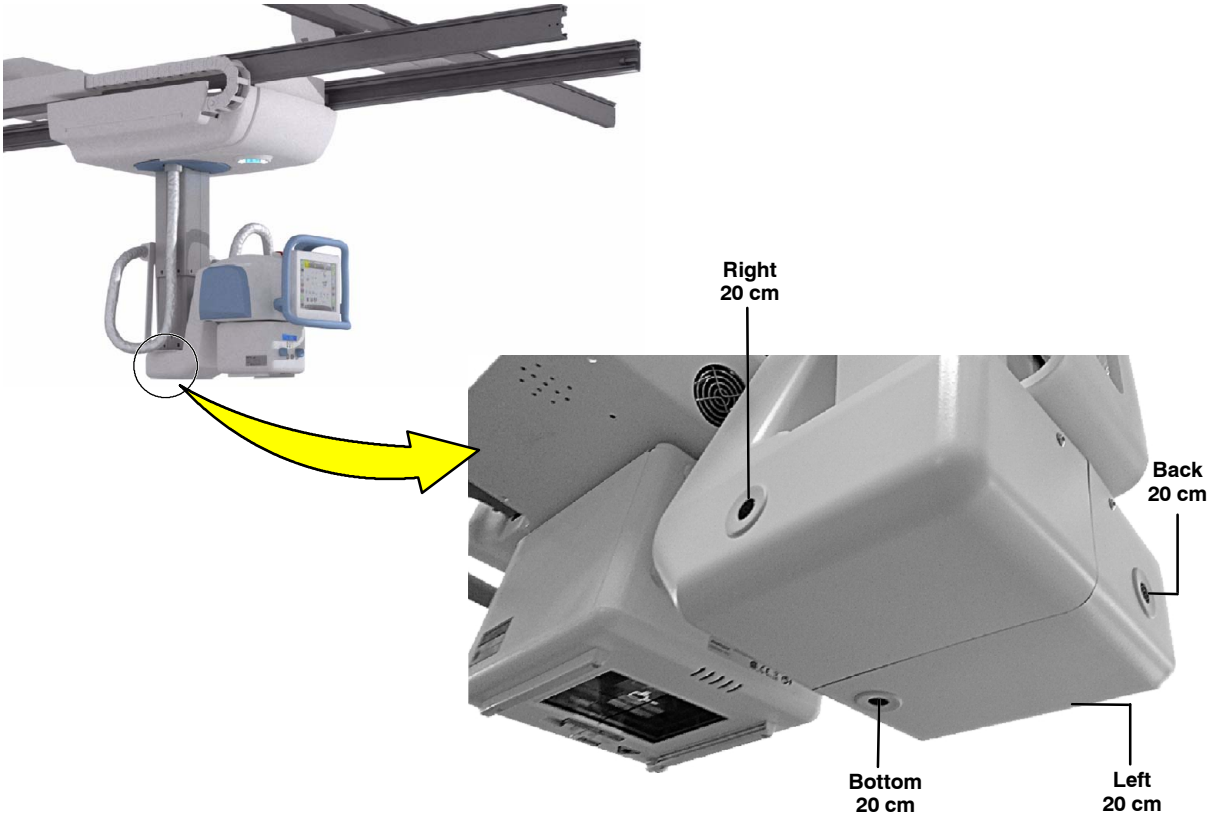
8. Once finished, it is necessary to select a new technique in the APR selection to move the OTC back to the set up position.

4.12.3 PROXIMITY SENSORS

This optional kit is composed by four infrared proximity/anti-collision sensors located in the L-block and an interface board mounted in the upper cover of the the X-ray Tube and Collimator Assembly. Each sensor is orientated to each side of the Beta Axis, at left, right, back and bottom.

This option is a feature complementary to the Automatic Movements Safety Policy. However it is enable with Manual Movements too.

Illustration 4-107
Proximity Sensors Location and Patient Area Limit



Proximity Sensors are enabled with each movement of the Overhead Tube Crane. This includes:

- Manual movements
- Auto-position movements
- Automatic movements performed with IR Remote Control

When the OTC is performing any of this movements, in the case that any sensor detects an element inside the configured security area (The obstacle can be an equipment of the X-ray system or an element of the room as a chair, etc.), an acoustic signal is emitted and a Warning notification is displayed in the Control Console.

Illustration 4-108
Safety Area Warning Notification

Once the patient area is reached, a safety brake limits the speed of movements. If the movement continues until the configured limiting distance of the safety area, an interlock is activated immediately and the movement is stopped, avoiding any risk of crashing with this obstacle.

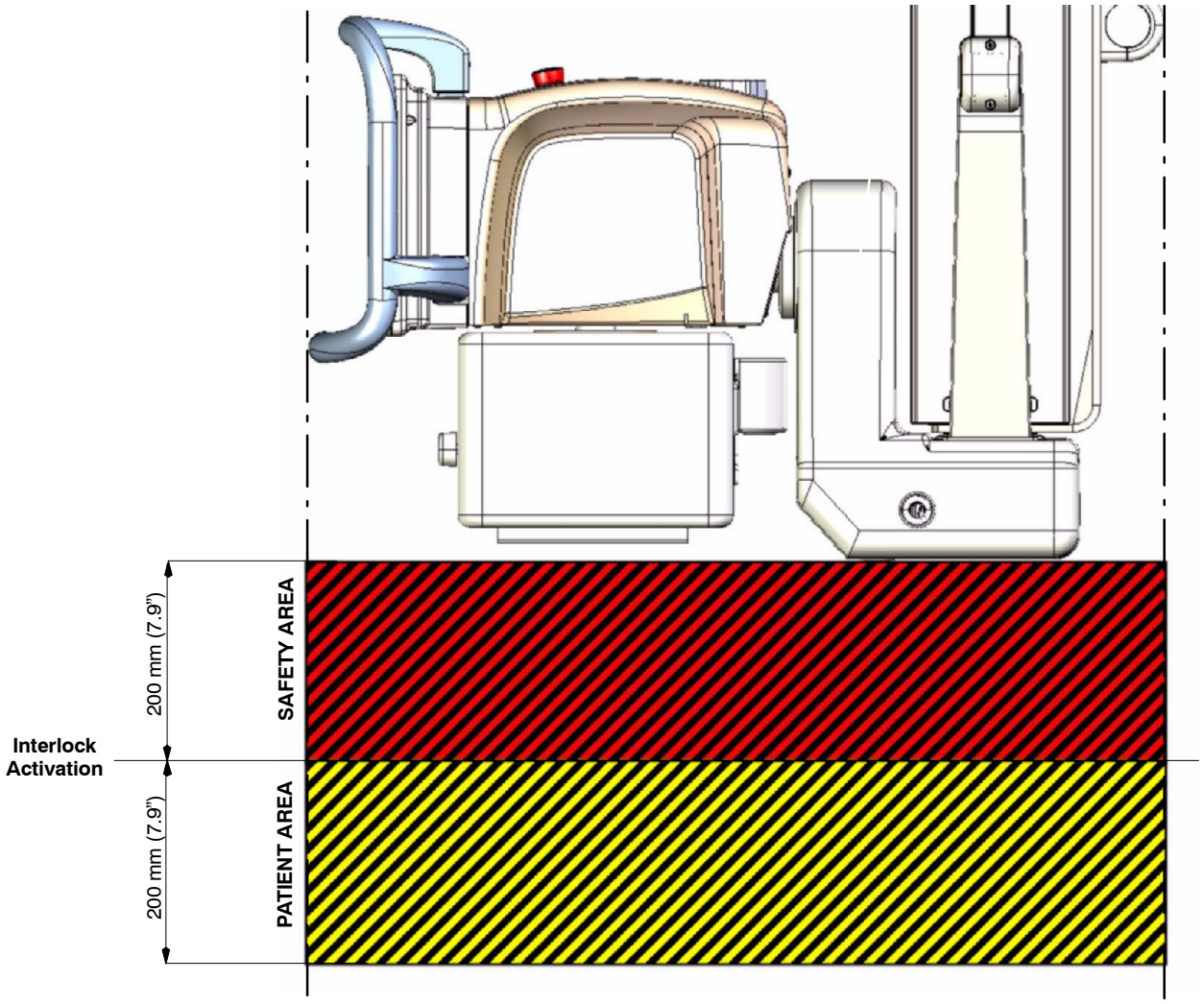
A long acoustic signal is emitted, the LED indicators blink and an Error notification appears in the Control Console.

Illustration 4-109
Patient Area Error Notification

When the Overhead Tube Crane is stopped, the obstacle must be removed before to complete the movement.

If it is not possible to remove the obstacle, in the case of Auto-position movements, move manually the OTC avoiding the obstacle and carry on with the auto-position or directly place the equipment in the target position.

Illustration 4-110
Safety Distances



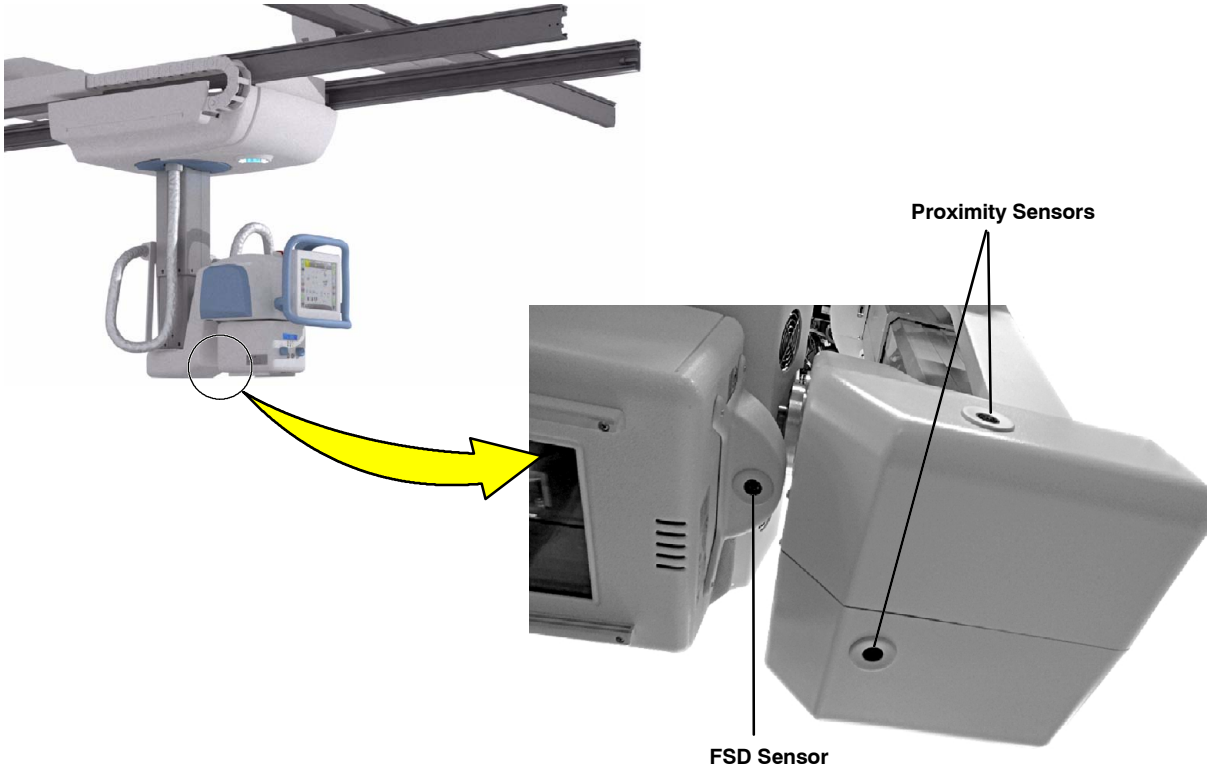
4.12.4 FOCAL-SKIN DISTANCE SENSOR

Note ☞ *Focal-Skin Distance (FSD) is the distance from the focus of the tube to the surface of incidence on a patient, measured along the beam axis.*

This optional kit is composed by one proximity sensor located in the back of the Collimator and an interface board mounted in the upper cover of the X-ray Tube and Collimator Assembly. This sensor is orientated to the bottom side of the Beta Axis.

This option is a feature complementary to the Automatic Movements Safety Policy and allows to measure the actual distance between focus and patient to calculate the estimated radiation Dose/DAP value.

Illustration 4-111
FSD Sensors Location



The behavior of the FSD Sensor is similar to Proximity Sensors. (*For more information, refer to Section 4.12.3*).

4.13 OVERHEAD TUBE CRANE MOVEMENTS

WARNING

MONITOR THE EQUIPMENT MOVEMENTS WITH SPECIAL CARE. AVOID ANY IMPACT OF THE SYSTEM ON FLOOR, WALLS, OR OTHER ELEMENTS IN THE ROOM. IT MAY CAUSE SERIOUS DAMAGE TO THE EQUIPMENT.

WARNING

MONITOR WITH SPECIAL CARE THE PATIENT POSITION (HANDS, FEET, FINGERS, ETC.) TO AVOID INJURY TO PATIENT CAUSED BY UNIT MOVEMENTS. PATIENT HANDS MUST BE KEPT AWAY FROM MOBILE COMPONENTS OF THE UNIT.

INTRAVENOUS TUBING, CATHETERS AND OTHER PATIENT CONNECTED LINES SHOULD BE ROUTED AWAY FROM MOVING EQUIPMENT.

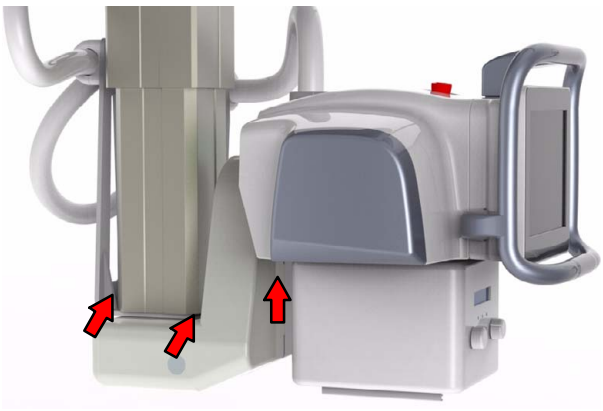
WARNING

USE THE CONTROL CONSOLE WHEEL TO CONTROL AND HANDLE THE UNIT MOVEMENTS, NEVER PUSH DIRECTLY ON THE EQUIPMENT.

WARNING

THE TELESCOPIC COLUMN MOVES UP AND DOWN CREATING PINCH POINT AREAS. FOLLOWING ILLUSTRATION INDICATES DANGEROUS LOCATIONS WHERE PATIENT OR OPERATOR CAN BE INJURED OR PINCHED. PLEASE PAY ATTENTION THAT NEITHER THE PATIENT NOR OPERATOR GET PINCHED OR HURT IN THESE AREAS.

Illustration 4-112
Potential Pinch Points



BEFORE POWERING ON AND MOVE THE UNIT, CHECK THAT THERE IS NO OBJECT OR OBSTACLE ON THE TUBE SUPPORT OR THE L-BLOCK SURFACE FOR THE CORRECT MOTION OF THE OVERHEAD TUBE CRANE.

THIS EQUIPMENT CAN BE MOVED IN DIFFERENT AXES. PLEASE TAKE CARE THAT NEITHER THE PATIENT NOR OPERATOR/STAFF ARE IN THE MOVEMENT AREA OF THE EQUIPMENT. ALWAYS WATCH WHERE YOU ARE STANDING. REMOVE ALL OBJECTS FROM THE COLLISION AREA.

IT IS MANDATORY TO POSITION FIRST THE EQUIPMENT AT THE INITIAL POSITION OF THE RAD EXAMINATION AND THEN WITH THE SYSTEM ALREADY STOPPED, POSITION THE PATIENT.

IN THE EVENT OF AN EMERGENCY, TURN OFF THE OVERHEAD TUBE CRANE PRESSING FORCIBLY THE EMERGENCY OFF SWITCH (RED MUSHROOM SHAPED SWITCH) ON THE X-RAY TUBE SUPPORT, AUTOMATIC POSITIONING CONTROL BOX OR AT THE ROOM ELECTRICAL CABINET.

Note ☞ *If the Capacitive wheel bumps into an obstacle or it is hit by the operator, the system stops immediately.*

4.13.1 OVERHEAD TUBE CRANE MANUAL MOTION

To move the equipment in relation with its axes:

1. Press the corresponding button of the axis movement on the Control Console. The movement will be enabled.
2. Hold the Wheel and drive the Overhead Tube Crane to the desired position.
3. Release the Wheel.
4. Press the activated buttons to deactivate the corresponding axis movement.

To carry out freely all movements simultaneously on the Vertical, Transverse or Longitudinal Axes, press all required movement buttons and hold the capacitive Wheel of the Overhead Tube Crane. The motion can be handled without any effort and softly.

4.13.2 AUTOMATIC MOVEMENTS

4.13.2.1 AUTO-CENTER

This automatic movement consists in the alignment among the OTC and the X-ray Tube with the Detector of the Table or Wall Stand. **This function is not active with the Direct Workstation**.

DUE TO SAFETY REASONS FOR AUTO-CENTER FUNCTION THE MINIMUM SID IS HELD AT 800 mm (31.5”) FROM THE RECEPTOR.

Note ☞ *For safety reasons, when the Auto-center is being performing with the Console Wheel, press the Auto-center button and hold the Wheel to maintain the motion, once it is released the motion stops.*

Note ☞ *Automatic Collimators should change to Manual mode if the Overhead Tube Crane and the Receptor are not at ±3º of the orthogonality.*

Note ☞ *Auto-center **is paused** as soon as the movement control of the selected Receptor is pressed. Once released the Receptor movement button the auto-centering movement continues.*
*Auto-center **is aborted** as soon as the movement control of the non selected Receptor is pressed. In this case it is necessary to restart auto-center.*

Note ☞ *If the selected Receptor position is changed during the auto-center movement, this will be recalculated after Receptor movement control is released and movement is restarted automatically to its new final centering stop.*

To complete the Auto-center function:

1. Select the Workstation in the OTC Control Console.
2. Select an Auto-position in the Control Console . For information about the operation of auto-positioning function refer to *Section 4.11.4*.

3. Press on the AUTO-CENTER button to activate the function.

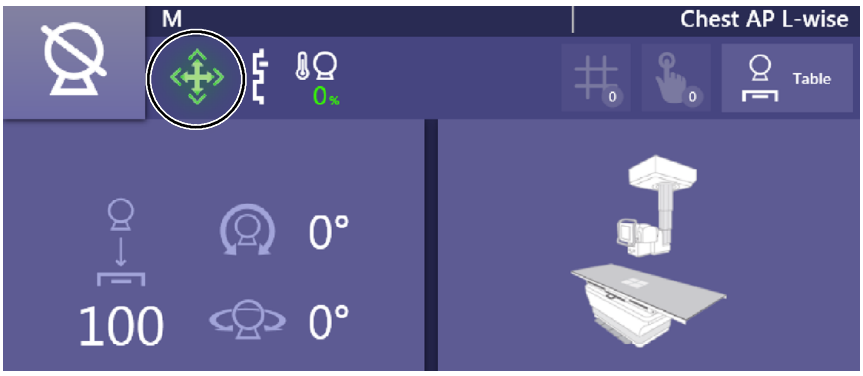
- To complete the movement press and hold Auto-center button on the RCC Console, Wall Stand Control Box or IR Remote Control (if available).

- If Auto-center function is performed from the Control Console, tap on the Auto-center button (the background color becomes lighter when activated) and hold the Wheel to start the automatic movement.

Note ☞ *In the event that the Overhead Tube Crane is not in the correct position in Longitudinal, Transverse, Alpha or Beta Axes, a notification will be displayed in the Message Area. It will be necessary to manually place the OTC in the correct position, within the range.*

4. Once the end position is reached and the X-ray Tube is properly aligned and centered the Movement Status Indicator of the System Status Area turns steady green. (*For further information about Movement Status, refer to Section 4.11.1*).

Illustration 4-113
Movement Status Indicator



Note ☞ *If configured in this way, the Collimator Lamp will light up when the end position is reached.*

HOW TO DEACTIVATE THE AUTO-CENTER FUNCTION

- Press the "*Auto-center*" button of the Control Console, RCC Console, Wall Stand Control Box or IR Remote Control (if available).
- Press any movement button on the Control Console.
- Press any button that implies misalignment between Receptor and the Overhead Tube Crane, such as select a different Workstation, etc.

4.13.2.2 AUTO-TRACKING

1.1.26

This automatic movement allows the X-ray Tube to follow the Receptor when it changes its position or the other way around. By default, in most of the cases the SID is constant.

"***Master***" refers to the equipment which initiates the movement and "***Slave***" to the equipment which tracks the Master movement.

For safety reasons the displacement speed of the Slave equipment is always slower than the Master speed.

Auto-tracking function activation**:**

- Press the Auto-tracking button in the Control Console, Wall Stand Control Box or IR Remote Control (if available) to manually activate the Auto-tracking function. The SID is set at the current distance.

Note ☞ *The background color of the Auto-tracking icon in the Control Console becomes lighter when activated.*

- When the selected Auto-position is configured to have the Auto-tracking function activated. Auto-tracking will remain ON automatically after reaching the demanded Auto-position. Refer to *Section 4.11.4.*

Note ☞ *If the Auto-position was configured with the Auto-tracking ON, it remains ON until it is deactivated, manually or selecting other Auto-position configured with the Auto-tracking OFF.*

To activate the Auto-tracking function the SID must be between 800 mm (31.5”) and <4000 mm (157.5”), if Room configuration and rails dimensions allow it. Once the Auto-tracking function is activated the current SID is the default one during the automatic movement.

CAUTION

Auto-tracking function remains active just for 5 minutes after Overhead Tube Crane becomes inactive. After this time activate again the Auto-tracking function.

It is not necessary to get the X-ray Tube centered with the Receptor, but both equipment must be aligned, that is, the X-ray tube must be pointing to the Receptor. The Slave equipment will reach the final position once the X-ray beam is pointing to the same spot of the Receptor that it was pointing to before starting the displacement. (*Note the alignment selected in the Control Console Collimator Parameters, refer to Section 4.11.6*).

Illustration 4-114
Overhead Tube Crane and Receptor Alignment

There are different Auto-tracking movement policies depending on the the Receptor support, which can be a Table or a Wall Stand.

OVERHEAD TUBE CRANE WITH RAD TABLE

Either the Overhead Tube Crane or the Rad Table can operate as Master or Slave in both Horizontal and Vertical axis.

Proceed as indicated for manually operated Auto-tracking:

1. Activate the "*Auto-tracking*" function as described above.

2. Initiate the Master equipment movement, (refer to *Illustration 4-115*):

1.1.26

a. The OTC is the Master and is moved longitudinally. Press the Longitudinal Axis Movement Button of the Control Console and hold the wheel to handle the OTC to right/left. The Receptor tracks its movement in the same direction. The SID remains constant.

b. The RAD Table is the Master and Receptor is moved longitudinally. Press and hold the Receptor lock button and move to right/left. The OTC tracks its movement in the same direction. The SID remains constant.

c. The OTC is the Master and moved along its Alpha Axis. Press the Alpha Axis Movement Button of the Control Console and hold the wheel to angle the X-ray Tube. The Receptor tracks its movement longitudinally. The SID is modified.

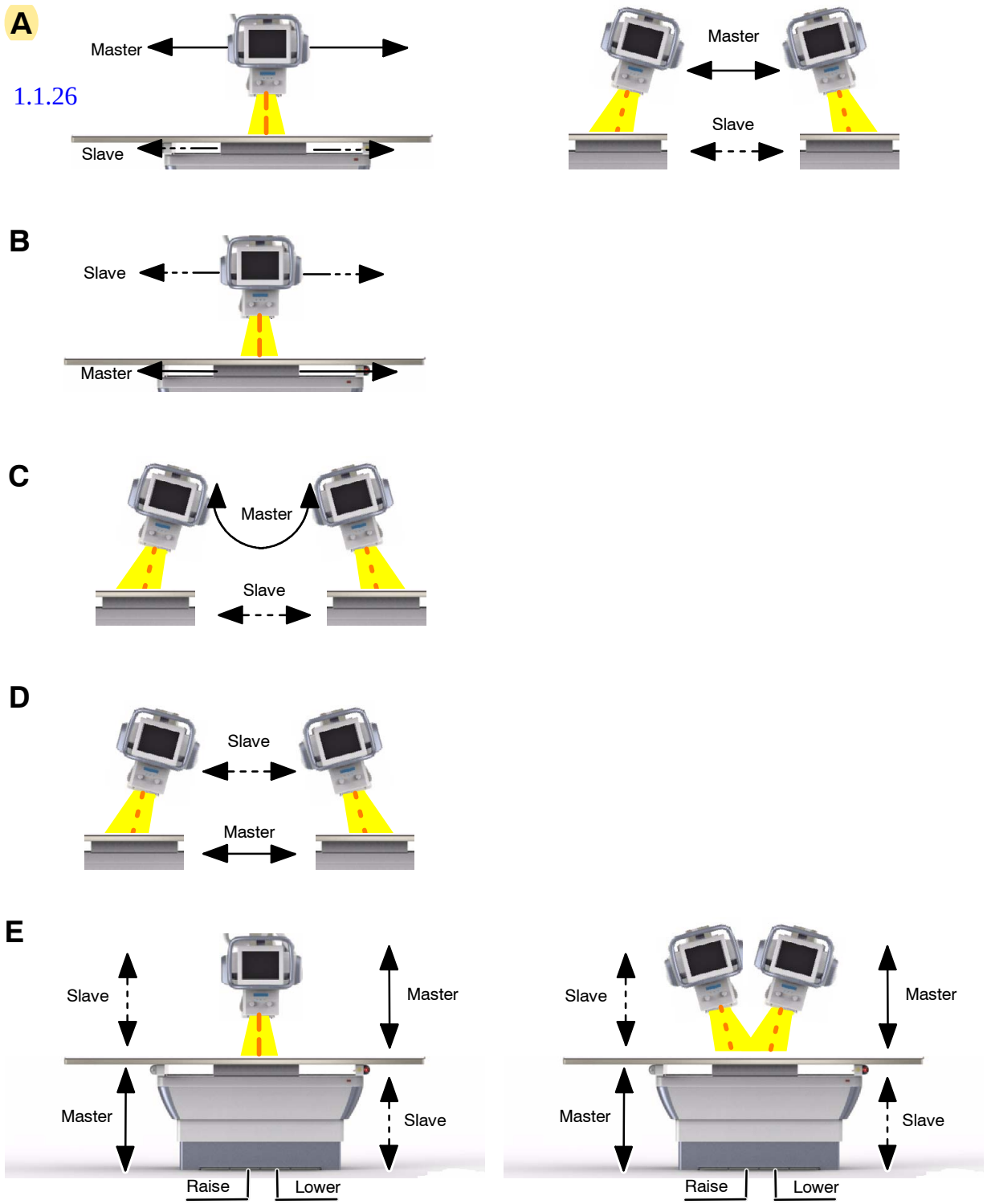
d. The RAD Table is the Master and is moved longitudinally while OTC is angled. Press and hold the Receptor lock button and move to right/left. The OTC tracks the movement of the Receptor and moves longitudinally. The SID remains constant.

e. The RAD Table is the Master and is moved in Vertical Axis. Step and hold the "*Raise*" or "*Lower*" Control Pedal to move *Up / Down* the Receptor until it arrives to the final position. Then, release the Control Pedal. The OTC tracks vertically its movement in all cases. The SID remains constant.

3. Keep handling the OTC or press again the Table pedal (vertical tracking) and hold until the Slave equipment arrives to the final position and is aligned with the Master Equipment.

4. In case the OTC wheel or Table pedal is released before finishing the Auto-tracking movement, it gets aborted. Once the OTC movement is resumed or the Table pedal is pressed again the Slave equipment gets aligned with the Master equipment and at the default SID.

Illustration 4-115
Auto-tracking Movement Policy with RAD Table



OVERHEAD TUBE CRANE WITH RAD WALL STAND

Depending on the Receptor tilting angle (only if the Wall Stand configuration includes the tilting function):

- The Receptor can be the Master in all cases, even when it is tilted. The Overhead Tube Crane can move *Up / Down* or in Alpha Axis to get the X-ray tube aligned.
- The Overhead Tube Crane is the Master just when the Receptor is at 0º or at 90º. If it is in a different angle, the Overhead Tube Crane can be just the Slave. The RAD Wall Stand is the Slave and it can just move *Up / Down*.

Proceed as indicated for manually operated Auto-tracking:

1. Activate the "*Auto-tracking*" function as described above.

2. Move the Master equipment (refer to *Illustration 4-116)*:

1.1.51

a. The OTC is the Master and is moved vertically. The Receptor must be at 0º. Press the Vertical Axis Movement button on the Control Console and hold the wheel to move the OTC up or down. The Receptor moves in the same direction. The SID remains constant. It is not valid when the Receptor is tilted at 90º.

b. The OTC is the Master and is moved in the Alpha Axis. Press the Alpha Axis Movement button and angle the X-ray Tube. The Receptor tracks its movement vertically. The SID is modified.

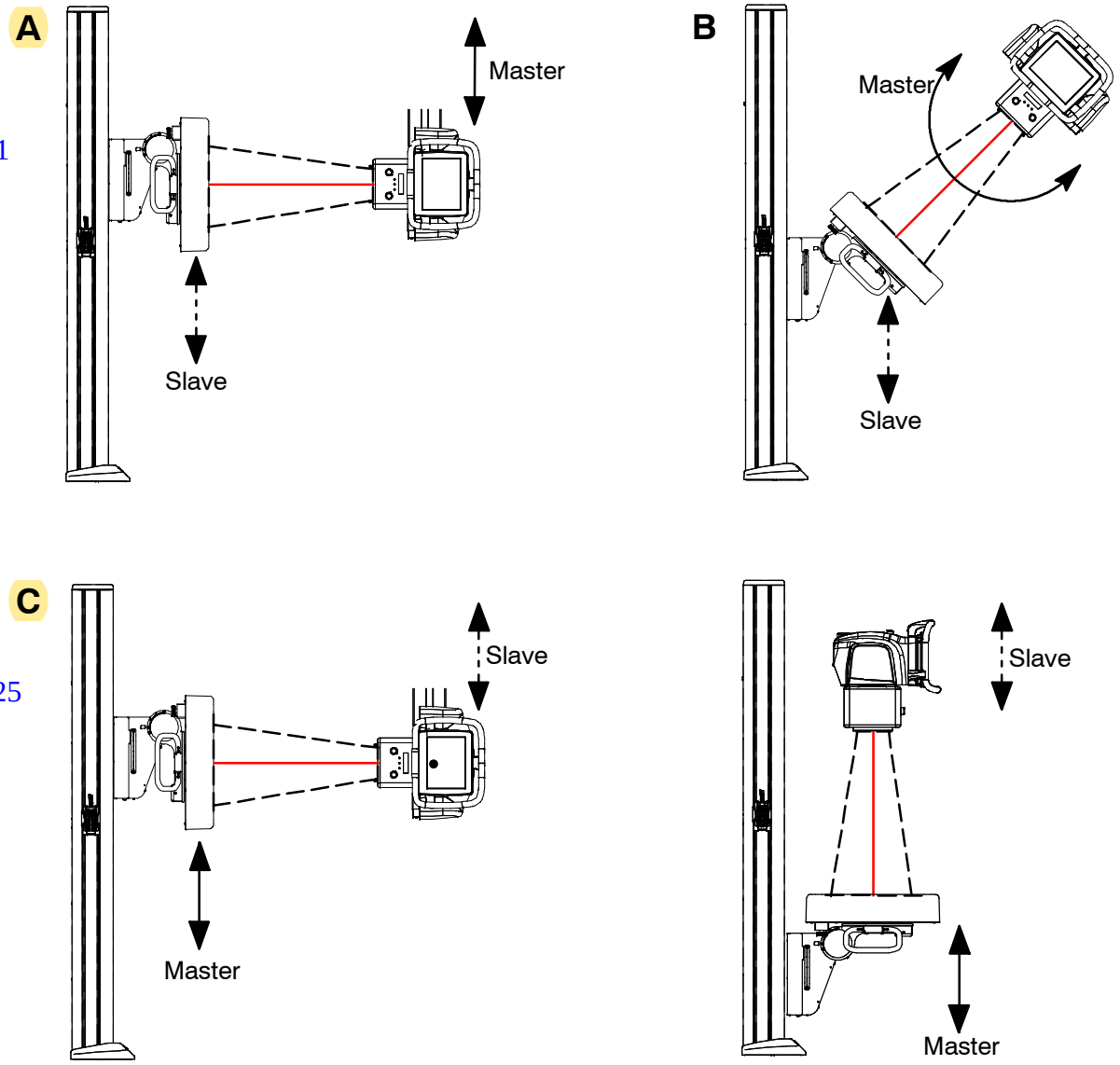
1.1.25

c. The RAD Wall Stand is the Master and is moved vertically. The Receptor can be tilted at any angle or vertical at 0º. Press and hold the Vertical Movement button or "*Raise*"/"*Lower*" Pedal of the Footswitch until the Detector arrives to the final position. Then, release the Control Pedal. The OTC tracks its movement in the same direction in all cases. The SID remains constant.

3. Keep handling the OTC or press again the Vertical Movement button / Footswitch pedal of the Wall Stand (vertical tracking) and hold until the Slave equipment arrives to the final position and is aligned with the Master Equipment.

4. In case the OTC wheel, the Vertical Movement button or Footswitch pedal is released before finishing the Auto-tracking movement, it gets aborted. Once the OTC movement is resumed or the Vertical Movement button / Footswitch pedal is pressed again, the Slave equipment gets aligned with the Master equipment and at the default SID.

Illustration 4-116
Auto-tracking Movement Policy with RAD Wall Stand



1.1.51

1.1.25

Note ☞ *The Auto-tracking button of the RAD Wall Stand is available in the Automatic Movements Control Box (Refer to Section 4.4.1).*

HOW TO DEACTIVATE THE AUTO-TRACKING FUNCTION

- Press the "*Auto-tracking*" control of the Console, Wall Stand Control Box or IR Remote Control if available.
- Press any movement button on the Control Console,
- Press any button that implies misalignment between Receptor and the Overhead Tube Crane as: select a different Workstation, etc.
- Auto-tracking function remains active just for 5 minutes after Overhead Tube Crane is inactive. After this time activate again the Auto-tracking function.

4.13.2.3 AUTO-POSITIONING

For information about the operation of auto-positioning function refer to *Section 4.11.4*.

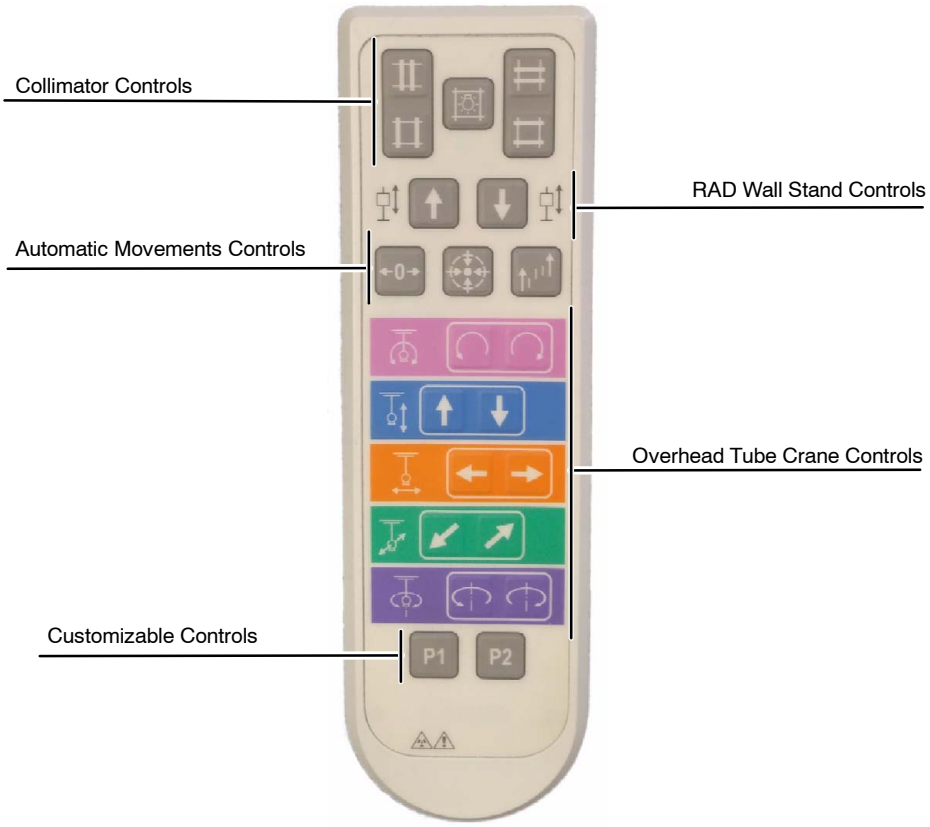
4.14 SYSTEM OPTIONS

4.14.1 IR REMOTE CONTROL

The IR Remote Control is an option just for automatic Overhead Tube Cranes. The IR allows:

- To control the Automatic Collimator blades aperture and light.
- To move vertically the Receptor of the RAD Wall Stand.
- To control the automatic movements, auto-center, auto-tracking and auto-positioning.
- To move the Overhead Tube Crane in all Axes.

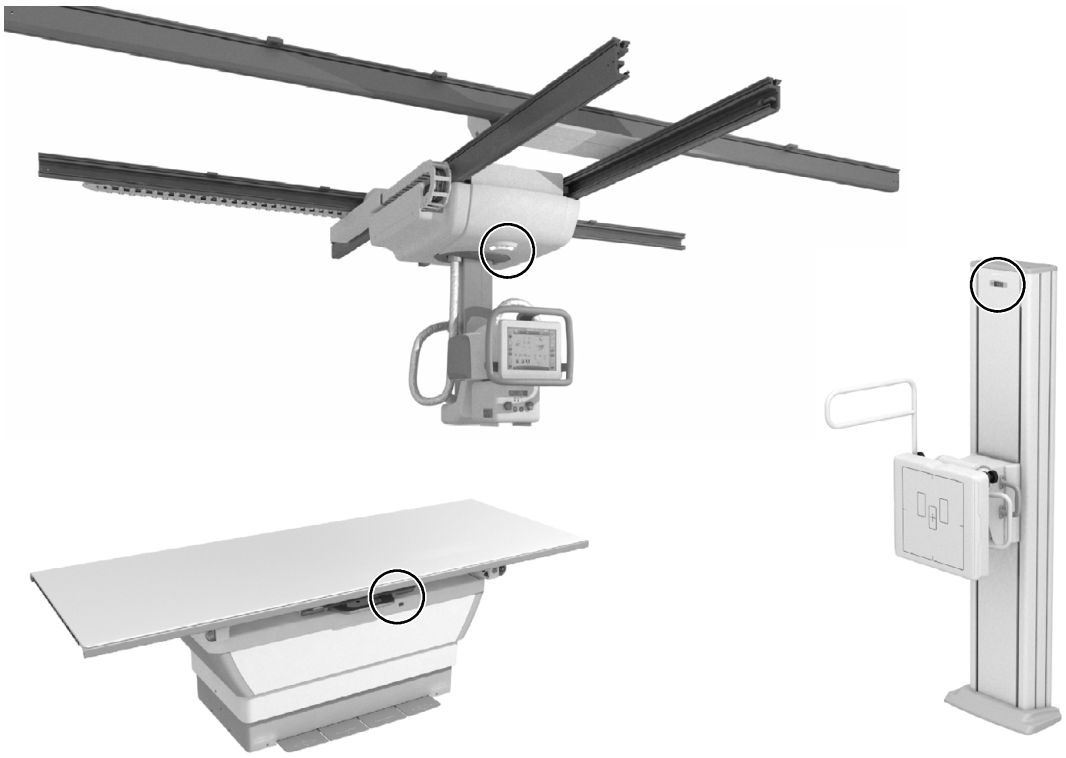
Illustration 4-117
IR Remote Control



To use the IR Remote Control:

1. Point the IR Remote Control to the Overhead Tube Crane Carriage or to the front of the Table, where the IR Detectors are located.

Illustration 4-118
IR Detectors of the X-ray Room

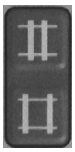


2. Press and hold the desired movement button to move the equipment.
3. Release the button to finish with the equipment movement when reached to the desired position or automatic movement is completed.

Note ☞ *The IR Remote Control must have a direct line of site to the Overhead Tube Crane. Any people or objects between the both will prevent or stop system movement.*

Note ☞ *Overhead Tube Crane movements performed through the IR Remote Control can be blocked in the case that any proximity sensor detects an element inside the configured security area. This function is only available in systems with Anti-Collision Sensors Kit installed in the Overhead Tube Crane.*

The IR Remote Control Functions are:

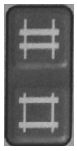


Collimator TRANSVERSE FIELD SIZE Adjustment:

a. Press the upper button to close the Collimator
b. Press the lower button to open the Collimator.

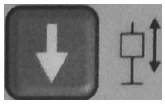
Collimator LIGHT SWITCH.

Turn the collimator light ON/OFF.



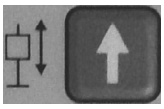
Collimator LONGITUDINAL FIELD SIZE Adjustment:

a. Press the upper button to close the Collimator
b Press the lower button to open the Collimator.



Receptor DOWN Movement.

Press and hold to lower the Receptor of the RAD Wall Stand.



Receptor UP Movement.

Press and hold to raise the Receptor of the RAD Wall Stand.

PARKING POSITION.

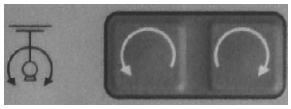
Press and hold when executing the configured Parking Position**.**

AUTO-CENTER.

Press and hold when auto-centering (*refer to Section 4.13.2.1*)**.**

AUTO-TRACKING

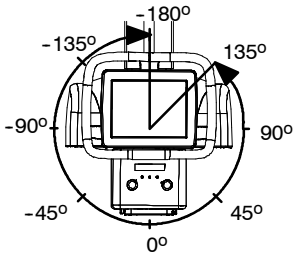
Press to activate/deactivate *(refer to Section 4.13.2.2).*

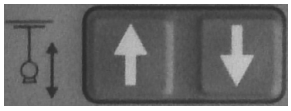


X-Ray Tube Angulation

a Press and hold the left button to move the tube from 0º to 135º

b Press and hold the right button to move the tube from 0º to -180º

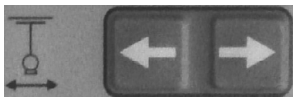




Vertical displacement of the X-ray Tube

a Press and hold the left button to move upwards

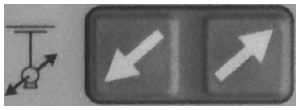
b Press and hold the right button to move downwards



Longitudinal displacement of the X-ray Tube

a Press and hold the left button to move to the left

b Press and hold the right button to move to the right



Transverse displacement of the X-ray Tube

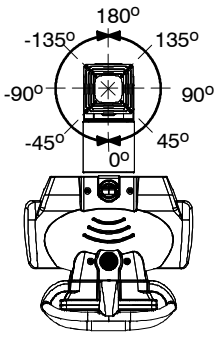
a Press and hold the left button to move forwards

b Press and hold the right button to move backwards

X-Ray Tube Rotation

a. Press and hold the left button to move the tube from 0º to -180º

b Press and hold the right button to move the tube from 0º to 180º



Predefined Position 1

Press and hold to move the OTC towards the Predefined Position 1.

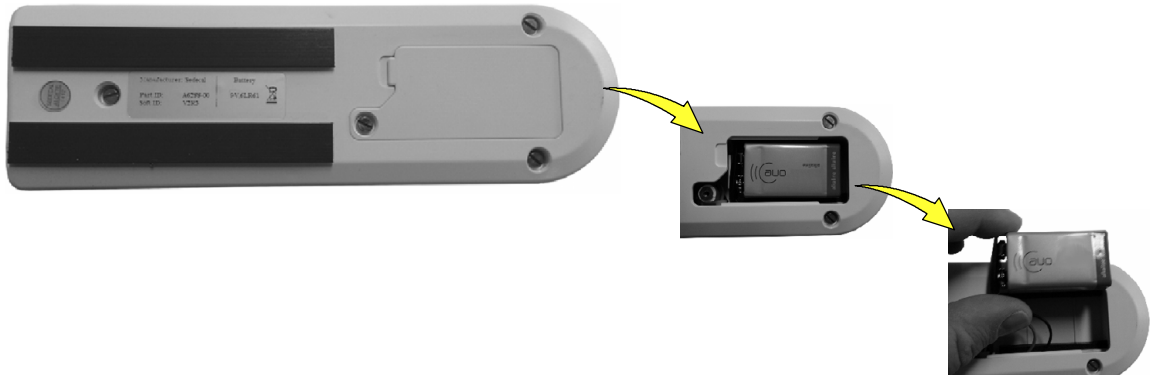
Predefined Position 2

Press and hold to move the OTC towards the Predefined Position 2**.**

The IR Remote Control Device is powered by a alkaline Nine-volt Battery (transistor battery type). For its replacement:

1. Remove the Battery cover.
2. Remove the Battery from the snap connector.
3. Replace old battery with the new one.
4. Insert and fix the cover.

Illustration 4-119
IR Remote Control Battery Replacement



4.14.2 X-RAY FOOTSWITCH

Radiographic exposures can be initiated with the X-ray Footswitch. The status of the exposure is indicated by the "*Ready*" and "*X-ray On*" indicators for the duration of the exposure *(refer to Section 4.10.5. for the Exposure Control operation).*

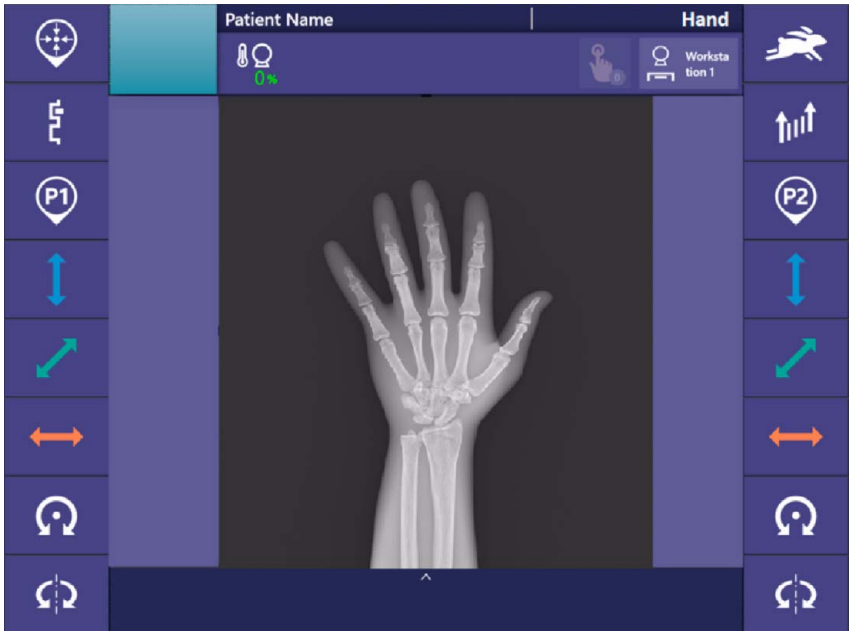
Illustration 4-120
Footswitch

4.14.3 IMAGE PREVIEW

The Image Preview function allows to get a preview of the image at the same time that the Workstation does get it.

Once the exposition is completed, the Image Preview automatically appears on the screen and disappears as soon as the Operator taps the Control Console screen or modifies any parameter.

Illustration 4-121
Image Preview



4.15 PATIENT POSITIONING

4.15.1 X-RAY BEAM ALIGNMENT WITH RESPECT TO PATIENT

After selecting RAD parameters for the technique to be performed:

1. Point the X-ray Tube-Collimator Assembly to the Image Receptor (*refer to Illustration 4-122*).
2. Center the Collimator light, which corresponds to the X-ray beam, with respect to the receptor. For that, use the Collimator Light centering marks and the laser line on the receptor handle if applicable.
3. Position the patient for the examination.
4. Turn ON the Collimator Lamp and adjust the field size with the Collimator controls.
5. Perform any adjustment on the patient position, receptor or tube collimator assembly to ensure that the X-ray beam is correctly positioned.

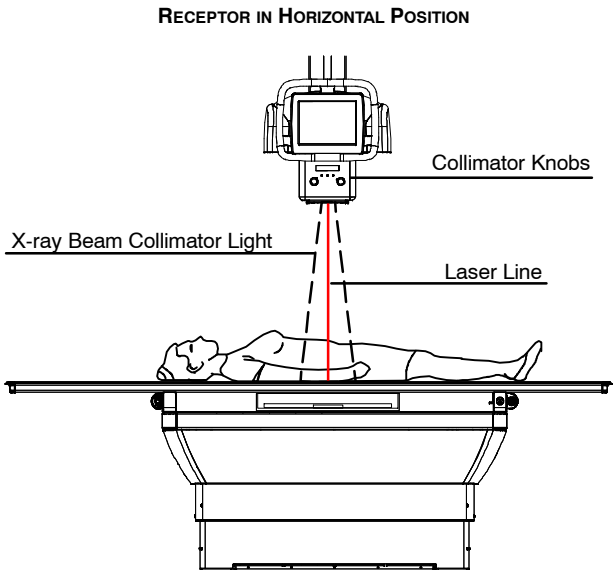
ALWAYS SELECT THE CORRECT FIELD SIZE TO AVOID EXCESSIVE RADIATION.

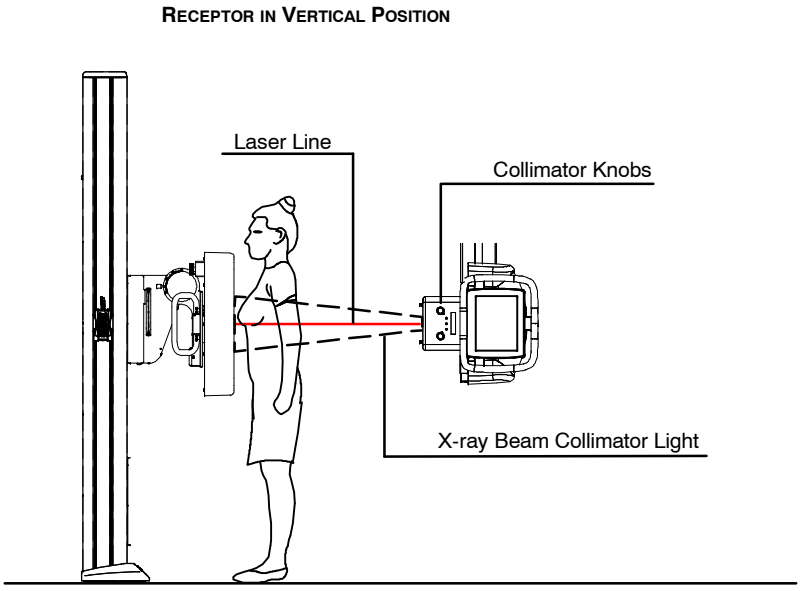
THE X-RAY BEAM AXIS AND THE REFERENCE AXIS OF THE PLANE OF INTEREST COINCIDE AND ARE ORTHOGONAL WITH RESPECT TO THE PLANE OF INTEREST, IN EXAMS PERFORMED WITH THE IMAGE RECEPTOR PERPENDICULARLY POSITIONED WITH RESPECT TO THE TUBE-COLLIMATOR ASSEMBLY.

IN CASE OF EXAMS WHERE THE IMAGE RECEPTOR IS NOT PERPENDICULARLY POSITIONED WITH RESPECT TO THE TUBE-COLLIMATOR ASSEMBLY, THE X-RAY BEAM AXIS DOES NOT COINCIDE WITH THE REFERENCE AXIS OF THE PLANE OF INTEREST AND IT IS NOT ORTHOGONAL WITH RESPECT TO THE PLANE OF INTEREST. THEREFORE, THE RESULTING IMAGE WILL BE DEFORMED.

IT IS THE OPERATOR RESPONSIBILITY THE PROPER POSITIONING OF THE PATIENT AND EQUIPMENT BEFORE PERFORMING AN EXAM.

Illustration 4-122
Patient Positioning In Double Panel Systems





4.15.2 PATIENT POSITIONING ON THE RAD TABLE

WARNING

DURING PATIENT POSITIONING, MAKE SURE THAT PATIENT HEAD, HANDS AND FEET ARE COMPLETELY INSIDE THE TABLETOP AREA. SERIOUS INJURIES OR DAMAGES CAN BE CAUSED IF ANY PART IS OUTSIDE THIS AREA.

Proceed always to position the patient in accordance to the next safety rules:

- The Tabletop supports an evenly distributed maximum load of 350 kg (771.6 lb).

WARNING

GET THE PATIENT ON THE TABLE FROM ITS CENTRAL PART WITH THE TABLETOP CORRECTLY CENTERED. BE CAREFUL THAT NEITHER THE OPERATOR NOR THE PATIENT STEP ON THE CONTROL PEDALS WHILE GETTING ON OR OFF THE TABLE. THIS COULD RESULT IN A RISK OF FALLING OFF.

- When Tabletop horizontal movements reach their maximum limits, the Tabletop and patient are in a cantilever situation. The operator must be careful when manipulating the equipment to avoid getting the patient injured.
- Get the **patient correctly centered on the Tabletop** during examination procedure.
- The patient must lie down or sit on the Tabletop. If the patient stands up or squats on the Tabletop, serious injuries or damages may be incurred by the operator, patient or equipment.
- Do not allow the patient to place his/her fingers outside the area covered by the Tabletop during elevation, slope and displacement movements.
- When getting on the Table or getting down from it, patient must be careful to avoid stepping on the Control Pedals. Lock the Control Pedals *(refer to Illustration 4-3)* to avoid any unexpected movement of the Tabletop in case of stepping on any Control Pedal.

4.15.3 PATIENT POSITIONING ON THE RAD WALL STAND

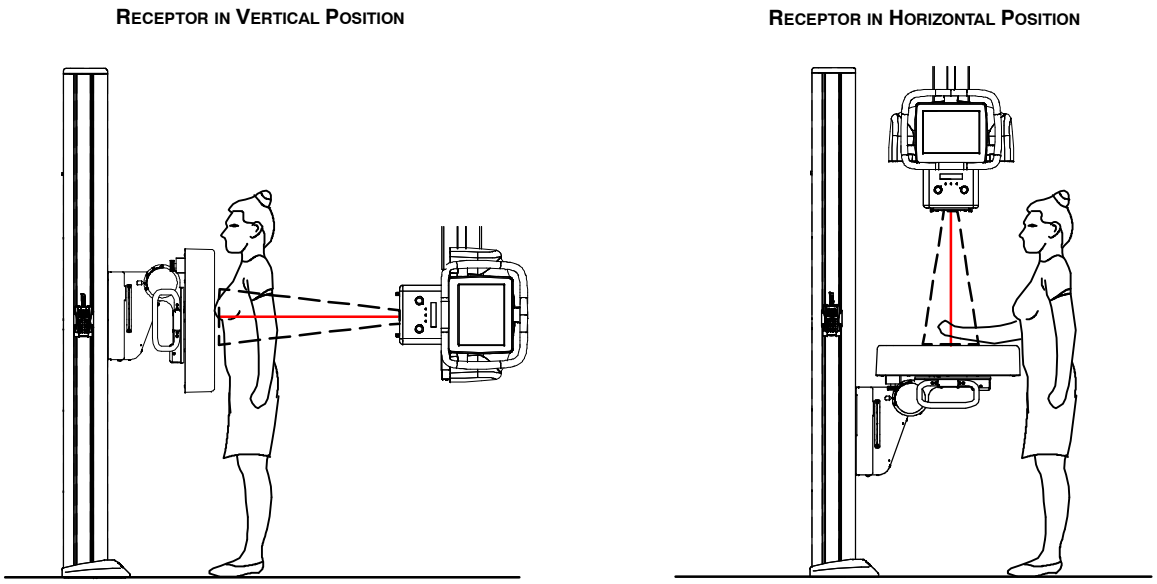
RAD WALL STAND RECEPTOR ALIGNMENT

It is important that the X-ray tube is accurately centered with the Receptor transversely. If the alignment is not accurate, density cut-off at the edges of the film and appearance of grid patterns may be found.

The alignment is not critical when an anti-diffusion grid is used. In this case, tilted tube techniques may be used without undue cut-off.

The Receptor handle is marked to indicate its vertical center. To assure that the Receptor is vertically aligned with the X-ray beam, move the Receptor or the tube in order to align the collimator light with this centre mark. For further information, see also the collimator operator manual.

Illustration 4-123
Correct Alignment of the Tube and Receptor in Vertical and Tilted Positions



Note ☞ *Remember that when removing or adding portable devices as Grid, Patient Holder or Receptor, and depending on the counterweight adjustment, the Column Carriage may move up or down, so the alignment will be lost.*

POSITIONING OF THE RECEPTOR UNDER MOBILE RAD TABLE

The Motorized Tilting RAD Wall Stand is compatible with a wide range of Mobile RAD Tables which can have different height specifications. When working with RAD Tables or with most of the fixed height mobile tables, all the movements required to position the receptor can be driven automatically.

But in those cases that the Table height is too low for an automatic positioning of the Receptor, proceed as indicated:

1. Tilt the Receptor. The mobile table and other elements of the room must be out of the Receptor displacements.
2. Lower the Receptor down to the minimum height. For automatic movements it can be lowered down to 50 mm (1.96”) due to safety reasons.
3. Lower manually the Receptor down to the minimum height.
4. Position the mobile Table in the operation position.
5. Position and align the X-ray Tube.
6. Position the Patient on the Table.

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SECTION 5 COLLIMATION

5.1 RALCO MANUAL COLLIMATOR R225 DHHS

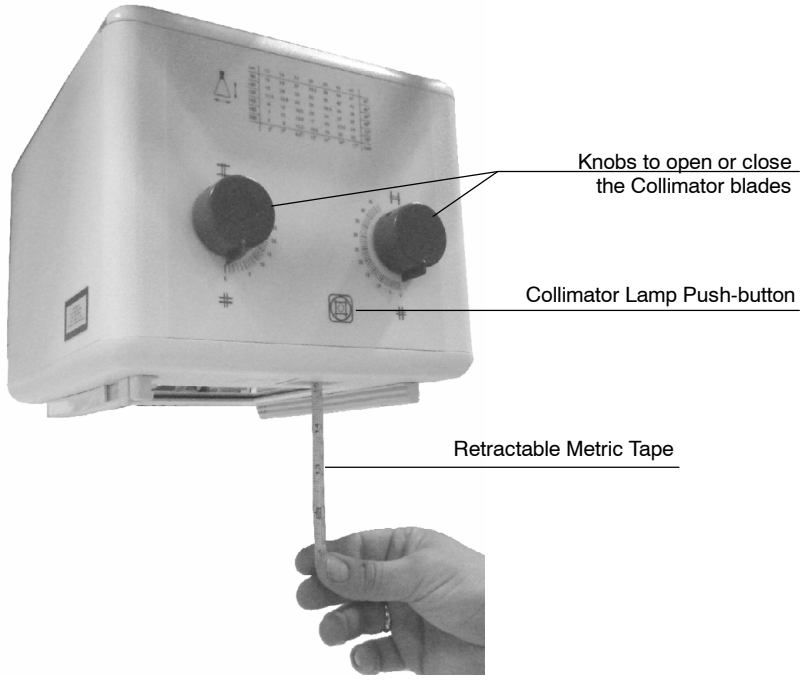
Collimator controls consist of a button to switch on the Collimator lamp and two knobs to open or close the internal blades of the Collimator.

When pressing the Collimator Lamp push-button, the Collimator light and an optional Laser light turn on. They remain lighting for 30 seconds before they switch Off automatically (lighting time can be configured).

Exposure field on the Receptor is adjusted by setting the two knobs. The table on the Front Panel shows the number to set with the knobs to open the blades according to the SID and X-ray field to be used.

Use the retractable Metric Tape to read the distance from the Focal Spot to the Tabletop (RAD Table) or Front Panel (Wall Stand).

Illustration 5-1
Collimator Controls



Note ☞ *Refer to the corresponding Collimator Manual for extended information about operation or technical description needed to maintain compliance with Standard IEC 60601-1-3: 2008.*

The Collimator can rotate ±90º on its vertical axis while the Tube remains in the same position. This movement is performed by manually turning the Collimator and has detents every 90º.

5.2 RALCO R225 ACS DHHS AUTOMATIC COLLIMATOR

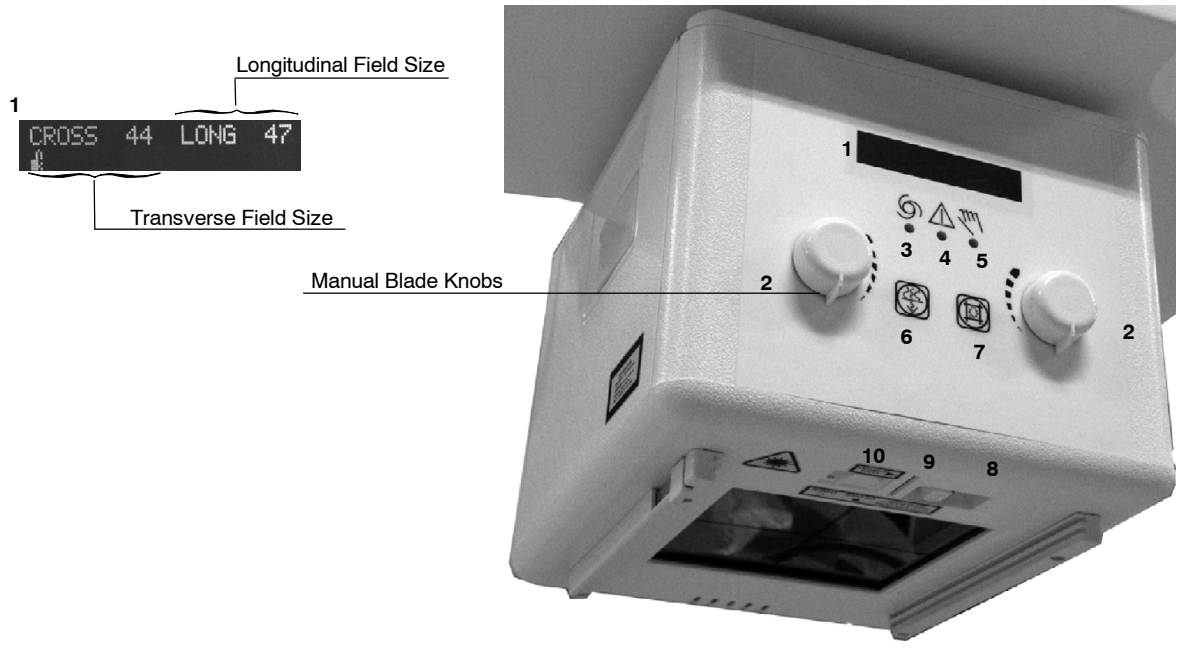
Note ☞ *Ralco R225 ACS DHHS Collimator operation is CanBus controlled by the Overhead Tube Crane. The Collimator operation with the Overhead Tube Crane is described on this Section.*

Refer to the corresponding Collimator Manual for extended information about operation or technical description needed to maintain compliance with Standard IEC 60601-1-3:2008.

Collimator controls consist of the following buttons and knobs:

1	COLLIMATOR DISPLAY	**6**	CHANGE OF FILTER
2	MANUAL BLADE CONTROLS	**7**	COLLIMATOR LAMP CONTROL (LED ON)
3	AUTOMATIC MODE INDICATOR (GREEN)	**8**	RETRACTABLE METRIC TAPE
4	BUSY MODE INDICATOR (RED)	**9**	LASER POINTER WINDOW
5	MANUAL MODE INDICATOR (YELLOW)	**10**	LASER POINTER ON/OFF BUTTON

Illustration 5-2
Ralco R225 ACS DHHS Automatic Collimator



After pressing the Collimator Lamp control, the Lamp remains ON for several seconds to allow for patient/grid alignment before turning OFF automatically. An optional Laser positioner may be included with the Collimator Light in order to facilitate patient positioning.

Exposure field on the DR Detector is adjusted automatically. It can be reduced manually with the two knobs of the Manual Blade Controls. The Exposure field may be resized within the limits of the field-size set automatically, it cannot be larger than DR Detector Size.

The Collimator can rotate $\pm 90^{o}$ on its vertical axis while the Tube remains in the same position. This movement is performed by manually turning the Collimator and has detents every 90^{o}.

Use the retractable Metric Tape to read the distance from the Focal Spot to the Tabletop (RAD Table) or Front Panel (Wall Stand).

5.2.1 AUTOMATIC MODE

The Automatic mode is always activated whenever that all the Positive Beam Limitation (PBL) conditions are complied with:

- The Aperture capacity must be enough to get a Field of View (FOV) according to the std. IEC60601-1-3.
- The Angle of the X-ray Beam must be orthogonal to the DR Detector, the tolerance range is $\pm 3^{o}$.
- Collimator position must be correspondent to the 0^{o} of rotation of the X-ray Tube.
- The X-ray Tube and DR Detector must not be rotated, at 0^{o}.
- The Overhead Tube Crane must be in READY status and pointing to the DR Detector.

If any of this conditions is not complied with, the collimator automatically is in Manual or Busy mode.

Note ☞ *After selecting the Automatic mode from the Manual Mode, check if it is necessary to change the FOV. It already remains as configured for the Manual Mode.*

When the Collimator exits Automatic Mode, the Collimator Status button becomes enabled on the System Status Area of the Touchscreen Console Main Menu. Press this button to access the ”Collimator Info” window, where it is shown informative messages with the reasons why the Collimator is operating in Busy (semi-automatic) or Manual Mode.

Note ☞ *Refer to “Collimator Messages” paragraph in Section 4.11.7.1, Busy Mode Section 5.2.2 and Manual Mode Section 5.2.3 for further details about this situation.*

5.2.2 BUSY MODE

This mode activates the **X-RAY INTERLOCK**, so it is not possible to do any exposure. In Status Area appears the Interlock Icon and the description of the reason of the Interlock is displayed in the Message Area. The reasons why Collimator goes into Busy Mode may be:

KEYWORD	GENERIC MESSAGE
FOV	The blades aperture has been changed automatically.
STS	It refers to the Collimator Busy Mode. When there is a new demand.
USER	The blades aperture is being changed manually, using the manual Blades Controls.

5.2.3 MANUAL MODE

In manual mode, the exposure field is adjusted manually, using the Manual Blade Knobs or from the Blades Adjustment of the Collimator Area on the Control Console.

In order to apply the lowest Dose to patient, it is recommended to use the larger SID that image size allows.

Table 5-1
Image Size according to the SID and Collimator Opening

COLLIMATOR OPENING	SID		
	90 cm (36")	**100 cm (40")**	**180 cm (72")**
13	15 cm (6")	13 cm (5")	7 cm (2.8")
18	20 cm (7.9")	18 cm (7")	10 cm (4")
24	27 cm (10.6")	24 cm (9.4")	13.5 cm (5.3")
30	33.5 cm (13.2")	30 cm (11.8")	15.5 cm (6")
35	39 cm (15.4")	35 cm (13.8")	18 cm (7")
40	44 cm (17.3")	40 cm (15.7")	20 cm (7.9")
43	47 cm (18.5")	43 cm (17")	22 cm (8.7")

Note ☞ *Whenever Free Workstation is selected, note that values displayed on the Control Console are based on the Collimator projection at a distance of 1 m.*

The reasons why Collimator goes into Manual Mode may be:

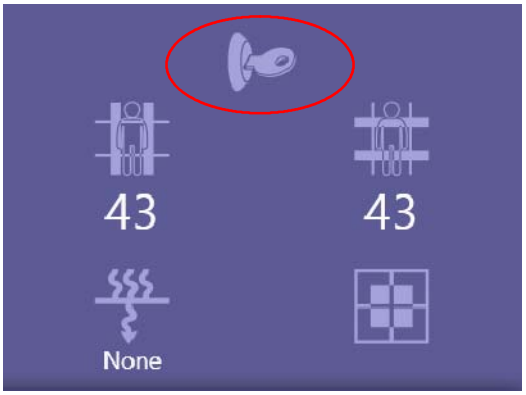
KEYWORD	GENERIC MESSAGE
DETECTOR	The selected Workstation (DIRECT) does not allow the automatic mode.
KEY	The Collimator back key is turn
SID	The SID is out of the configured range for the automatic collimation.
STATUS	The Overhead Tube Crane is not on the DR Detector Area or it is moving.
ANG	The Angulation angle of the Tube is $\geq 3^{o}$
ROT	The Rotation angle of the Tube is $\geq 3^{o}$
COLROT	The Collimator is rotated.
NO-CASSETTE	The Grid is out (Just when the Grid is removable)
BUCKYROT	The RAD Wall Stand Detector is rotated.
CENTER	The X-ray Beam is not centered with the DR Detector center.
MODALITY	The System is currently on STITCHING Mode.

One way to access the Manual Mode is to turn right the key located at the back of the Collimator. This Key Switch is intended to force the activation of the manual mode whenever a problem with the collimation is experienced.

Illustration 5-3
Collimator Back Key

Note ☞ *When the Manual Mode is activated with the Key Switch, a "key" icon is displayed in the Collimator Area of the Control Console.*

Illustration 5-4
Key Icon on the OTC Control Console



5.2.4 COLLIMATION LIGHT CONTROL

Collimator Light activates in two different modes.

- MANUALLY. Press on the MANUAL CONTROL Button.
- AUTOMATICALLY. The collimator is controlled by the Overhead Tube Crane. The light will switch on when:
  - Collimator Blades change their configuration.
  - Collimator is rotated.
  - DIRECT Workstation is selected and any movement of the Overhead Tube Crane is activated.
  - RAD TABLE Workstation is selected and any RAD Table or Tabletop Receptor movement are activated.
  - RAD WALL STAND Workstation is selected and the vertical or tilting movements are activated.
  - Overhead Tube Crane is moving in manual mode and is in the SID area.
  - Just after finishing the Auto-Center and Auto-tracking movements.

5.2.5 COLLIMATION DURING THE STITCHING SEQUENCE

MANUAL MODE

The longitudinal FOV (Field of View) is fixed and not configurable.

It is possible to adjust the direction of the Collimator Blades in perpendicular direction to the STITCHING Sequence and no radiation out of the transversal Field of Acquisition.

The overlapping is also fixed. So the Positioner infers the number of exposures or radiographic imagine to make depending on the Length of the study and communicates it to the Workstation Acquisition Software.

The Acquisition Software adjust its position to the initial one or Position 0. So it is radiate just the area inside the large study.

Note ☞ *It may be possible that the area located at the opposite edge of the last exposure was radiated using this collimation mode.*

Note ☞ *Overlapping is by default fixed. It is configurable to be variable.*

AUTOMATIC MODE

The FOV is calculated depending on the study length and the number of exposures to be obtained in order to get a fixed overlapping. There is no radiation out of the edge of the study in any case.

5.3 DOSIMETER DEVICE (OPTIONAL)

The optional Dosimeter device is related to the Collimator installed in the equipment. The usual compatible Dosimeter devices are:

- Iba Kermax Plus

Note ☞ *Refer to the corresponding Dosimeter Manual for extended information about operation or technical description needed to maintain compliance with Standard IEC 60601-1-3: 2008.*

SECTION 6 TROUBLESHOOTING GUIDE

A guide for a quick solution of main typical problems in the use of this equipment follows. It is recommended to keep this troubleshooting guide with you when operating with the equipment.

6.1 RAD WALL STAND

PROBLEM	CHECK IF	ACTION
RAD WALL STAND CAN NOT BE SWITCHED ON	Emergency Stop Switch is activated.	Deactivate Emergency Stop Switch.
	There is not enough power.	Check that the Line Power is provided to the RAD Wall Stand from the RAD Table and the Room Electrical Cabinet. If it is correct and it can not be turned ON, contact Service Support.
DR DETECTOR VERTICAL MOVEMENT IS NOT POSSIBLE	There is any obstacle on the vertical travel.	Get the column stand free of any element that obstructs the vertical movement .
	It is locked.	Press and hold the Vertical Lock Handle.
		In case that Vertical lock is broken, contact Service Support.
THE DR DETECTOR DOES NOT TILT	Power supply is OFF.	Switch on the System.
AUTO-TRACKING FUNCTIONALITY DOES NOT WORK	Check which Error Message is displayed on the OTC Control Console.	Complete the recommended Action included in the System Message list of this Section.

6.2 RAD TABLE

PROBLEM	CHECK IF	ACTION
RAD TABLE CAN NOT BE SWITCHED ON	Emergency Stop Switch is activated.	Deactivate Emergency Stop Switch.
	There is not enough power.	Check that the Line Power is provided to the RAD Table from the Room Electrical Cabinet. If it is correct and it can not be turned ON, contact Service.
VERTICAL MOVEMENTS ARE BLOCKED	There is not enough power.	Repeat actions for ”RAD Table can not be switched ON” above.
	Control Pedals are not working properly.	Verify that the Control Pedals are not blocked with any obstacle, when the Pedals are pressed. If it is correct, and movement is not possible, contact Service.
	Anti-collision Switches do not work.	Contact Service Support.

6.3 OVERHEAD TUBE CRANE

PROBLEM	CHECK IF	ACTION
OVERHEAD TUBE CRANE CAN NOT BE SWITCHED ON	Emergency Stop Switch is activated.	Deactivate Emergency Stop Switch.
	There is not power enough.	Check that the Line Power is provided to the Overhead Tube Crane from the Room Electrical Cabinet. If it is correct but it can not be turned ON, contact Service Support.
OVERHEAD TUBE CRANE ON, CONTROL CONSOLE OFF	Check Control Console Cables connections.	Contact Service Support.
WRONG DISPLAY MEASURES	Wrong calibration.	Contact Service Support.

6.4 SYSTEM MESSAGES

The System Messages are displayed in the Control Console of the Overhead Tube Crane where it is showed errors, inhibit conditions and informative messages related to the whole operative of the X-ray System, except those messages exclusively related to the Image Acquisition software, which are displayed in the Workstation Console.

Messages types that can be displayed in the Control Console are:

- **Warning.** Alerts user about conditions that do not disable or abort exposures (e.g. maximum kVp value reached while modifying the exposure parameters).

- **Information.** Informative messages that do not require any action by the user. Most are automatically cleared by the system after a few seconds, although some require reading confirmation.

- **Exposure inhibit condition.** Exposures are inhibited. More than one inhibit condition could be active at the same time.

- **Movement inhibit condition.** Movements are inhibited. More than one inhibit condition could be active at the same time.

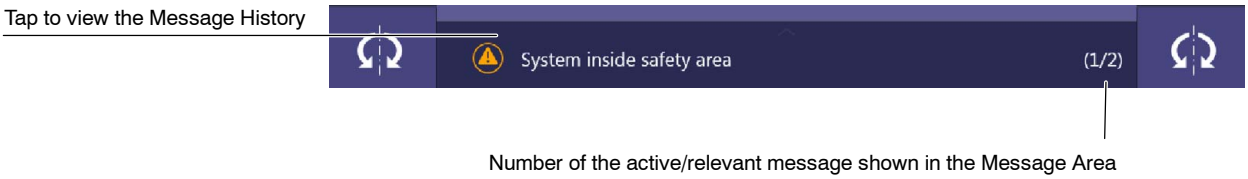
- **Emergency.** The emergency button is pressed. Therefore, movements and exposures are not allowed.

- **User action.** Exposure is inhibited until the required action is performed by the user.

- **Error.** Error Messages indicate the potential cause of a system failure that abort or inhibit the exposure or procedure. User or Service Support must correct the error cause. Until then, the error will remain in the Console and the exposures or movements will keep disabled.

All these System Messages are reported in the Message Area of the Main Menu. Active messages, i.e. those that require action by the operator or report an error or warning, will be displayed consecutively in this area.

Illustration 6-1
Message Area in the Main Menu



Note ☞ *For additional information about the Message Area refer to the Section 4.11.7.*

There are also different Message Windows, which are accessed depending on the source of the messages, in which detailed information about them can be consulted (*refer to Section 4.11.7.1*).

The main message window is the Message History. To enter it, press on the Message area. A pop-up window will be displayed. To close it, tap on the message area again to go back to the previous screen.

Illustration 6-2
Message History

Note ☞ *The following pages show a complete list of System Messages ordered by their Identifier (ID).*

ID	DESCRIPTION	TYPE	USER HELPTEXT
100001	I2C bus error while trying to access the external redundant backup timer.	Error	Turn the Generator OFF, check the proper external cable connections and then turn the Generator ON. If the equipment remains inoperative, turn it OFF and contact service support.
100002	One or more workstations are not properly configured; a default value has been assigned.	Error	Press the "*Accept*" button. If the error code persists, turn the Generator OFF and ON. If the equipment remains inoperative, turn it OFF and contact service support.
100003	All the workstations have no tube configured, there is no workstation available, and a default value has been assigned.	Error	
100004	The Fluoro order input signal is active during the Startup sequence.	Error	Release any external exposure device or buttons. Turn the Generator OFF and ON. If the equipment remains inoperative, turn it OFF and contact service support.
100005	The Exposure order input signal is active during the Startup sequence.	Error	Release any external exposure device or buttons. Generator will reboot after user confirmation. If the equipment remains inoperative, turn it OFF and contact service support.
100006	The Preparation order input signal is active during the Startup sequence.	Error	
100007	The tube index (that points a tube in the tube list) configured for the tube 2 is outside boundaries, a default value has been assigned.	Error	Press the "*Accept*" button. If the error code persists, turn the Generator OFF and ON. If the equipment remains inoperative, turn it OFF and contact service support.
100008	The tube index (that points a tube in the tube list) configured for the tube 1 is outside boundaries, a default value has been assigned.	Error	
100009	The inverter module has been overloaded. There could be an arcing problem in the tube or in the tank, or the inverter is defective.	Error	
100010	Erroneous data stored in the E2PROM.	Error	Turn the Generator OFF and ON. If the equipment remains inoperative, turn it OFF and contact service support.
100011	Error while charging the load capacitors. The DC bus voltage does not reach the right value during Startup.	Error	
100012	Tube current out of range during exposure.	Error	Press the "*Accept*" button. Repeat with same technique values, If the error code persists try with another combinations of kV and mA values.
100013	Anode-Cathode voltage out of range during exposure.	Error	
100014	Anode-Cathode voltage does not reach the final value in the designated rise time.	Error	
100015	Large filament current out of range.	Error	Press the "*Accept*" button. If the error code persists, turn the Generator OFF and ON.
100016	Small filament current out of range.	Error	

ID	DESCRIPTION	TYPE	USER HELPTEXT
100017	DC bus voltage out of range.	Error	Contact service support.
100018	The Anode Rotor Controller (starter) is not sending back the Ready condition within the designated time.	Error	Press the "*Accept*" button. If the error code persists, turn the Generator OFF and ON. If the equipment remains inoperative, turn it OFF and contact service support.
100019	Tube current without exposure order from the microcontroller.	Error	
100020	Anode-Cathode voltage without exposure order from the microcontroller.	Error	
100021	Tube 1 Switch Error	Error	Contact service support.
100022	Tube 2 Switch Error	Error	
100023	Error while writing in the E2PROM.	Error	Turn the Generator OFF and ON. If the equipment remains inoperative, turn it OFF and contact service support.
100024	The timeout for the acknowledge for X-Rays from the Bucky or FPD has been exceeded.	Error	Press the "*Accept*" button. If the error code persists, turn the Generator OFF, check the proper external cable connections and then turn the Generator ON. If the equipment remains inoperative, turn it OFF and contact service support.
100025	Large filament current demand above the limit.	Error	Press the "*Accept*" button. Repeat with same technique values, If the error code persists try with another combination of kV and mA values. If the equipment remains inoperative, turn it OFF and contact service support.
100026	Small filament current demand above the limit.	Error	
100027	I2C bus error while trying to access the digital potentiometer that adjusts the kV oscillator.	Error	Press the "*Accept*" button. If the error code persists, turn the Generator OFF and ON. If the equipment remains inoperative, turn it OFF and contact service support.
100028	I2C bus error while trying to access the digital potentiometers that adjust the ABC window.	Error	
100029	Generator heat capacity exceeded.	Error	Turn the Generator OFF and wait 30 minutes before turning it ON again or decrease the exposure parameters. If the equipment remains inoperative, turn it OFF and contact service support.
100030	Wrong date stored in the Real Time Clock (RTC) and/or the time stamp.	Error	Press the "*Accept*" button. If the error code persists, turn the Generator OFF and ON. If the equipment remains inoperative, turn it OFF and contact service support.
100031	The time stamp checksum is wrong.	Error	
100032	I2C bus error while trying to access the Real Time Clock (RTC).	Error	

ID	DESCRIPTION	TYPE	USER HELPTEXT
100033	The remote console has lost the communications with the generator.	Error	Press the "*Accept*" button. If the error code persists, turn the Generator OFF, check the proper external cable connections and then turn the Generator ON. If the equipment remains inoperative, turn it OFF and contact service support.
100034	Tank presostat opened.	Error	Turn the Generator OFF and wait 30 minutes before turning it ON again. If the equipment remains inoperative, turn it OFF and contact service support.
100035	The acknowledge for X-Rays from the Bucky or FPD has been lost before the end of the exposure.	Error	Press the "*Accept*" button. If the error code persists, turn the Generator OFF, check the proper external cable connections and then turn the Generator ON. If the equipment remains inoperative, turn it OFF and contact service support.
100036	Tube thermostat opened.	Error	Turn the Generator OFF and wait 30 minutes before turning it ON again. If the equipment remains inoperative, turn it OFF and contact service support.
100037	Tube ratings exceeded or not enough Heat Units to perform the selected exposure.	Error	Wait for the Tube to cool down or decrease the exposure parameters. If the equipment remains inoperative, turn it OFF and contact service support.
100038	+5 V power supply failure.	Error	Press the "*Accept*" button. If the error code persists, turn the Generator OFF and ON. If the equipment remains inoperative, turn it OFF and contact service support.
100039	+15V Power Supply Failure	Error	
100040	Imbalanced kVp, there is not the same voltage in Anode and Cathode branches.	Error	
100041	Imbalanced mA, there is not the same current in Anode and Cathode branches.	Error	
100042	The counters checksum is wrong.	Error	
100043	The error log checksum is wrong.	Error	
100044	I2C bus error while trying to access the E2PROM.	Error	
100045	The tube data checksum is wrong.	Error	
100046	I2C bus error, the bus remains always busy.	Error	
100047	I2C bus error while trying to access the Licence.	Error	
100048	The door switch has been opened before the end of the exposure.	Error	

ID	DESCRIPTION	TYPE	USER HELPTEXT
100049	The generator has lost the communications with the remote console.	Error	Press the "*Accept*" button. If the error code persists, check the proper external cable connections and then turn the generator ON. If the equipment remains inoperative, turn it OFF and contact service support.
100050	The user has released the exposure device before the end of the exposure.	Error	Press the "*Accept*" button. If the error code persists, turn the Generator OFF and ON. If the equipment remains inoperative, turn it OFF and contact service support.
100051	The selected exposure time cannot be achieved.	Error	Press the "*Accept*" button. If the error code persists, increase the exposure time. If the equipment remains inoperative, turn it OFF and contact service support.
100052	The timeout for receiving the RAD synchronism pulse has elapsed.	Error	Contact service support.
100053	The timeout for receiving the Fluoro synchronism pulse has elapsed.	Error	Press the "*Accept*" button. If the error code persists, check the proper external cable connections and then turn the generator ON. If the equipment remains inoperative, turn it OFF and contact service support.
100054	The timeout for receiving the Digital/DSI synchronism pulse has elapsed.	Error	
100055	The backup timer has elapsed before the AEC or the System ends the exposure.	Error	
100056	The backup timer has elapsed before the Tomograph ends the exposure.	Error	Press the "*Accept*" button. If the error code persists, check the proper external cable connections and then turn the generator ON. If the equipment remains inoperative, turn it OFF and contact service support.
100057	It is not possible to load next exposure Dual Energy parameters.	Error	Press the "*Accept*" button. Wait for the Tube/Generator to cool down or select a more suitable technique for the current thermal status. If the equipment remains inoperative, turn it OFF and contact service support.
100058	The tube data pointed by the tube 1 index are not defined, a default tube has been selected.	Error	Press the "*Accept*" button. If the error code persists, turn the Generator OFF and ON. If the equipment remains inoperative, turn it OFF and contact service support.
100059	The tube data pointed by the tube 2 index are not defined, a default tube has been selected.	Error	
100060	The number of exposures to autocalibrate a mA station has run out.	Error	
100061	There has been an error while trying to access the Licence data. Default options have been selected.	Information	Press the "*Accept*" button. If the information message persists, turn the Generator OFF and ON. If the equipment remains inoperative, turn it OFF and contact service support.

ID	DESCRIPTION	TYPE	USER HELPTEXT
100062	AEC selection error.	Error	Press the "*Accept*" button. If the error code persists, turn the Generator OFF and ON. If the equipment remains inoperative, turn it OFF and contact service support.
100063	The Ready from the starter has been lost before the end of the exposure.	Error	
100064	The Feedback connector from the tank is not plugged in.	Error	
100065	+24 V Delayed power supply failure.	Error	
100066	+24 V (UNR) power supply failure.	Error	
100067	-15 V power supply failure.	Error	
100068	+3.3 V power supply failure.	Error	
100069	+24 V (UNR) permanent power supply failure.	Error	
100070	AEC Rapid Termination error: Exposure aborted because a lack of radiation received on the AEC.	Error	Press the "*Accept*" button. If the error code persists, turn the Generator OFF, check the proper external cable connections and then turn the Generator ON. If the equipment remains inoperative, turn it OFF and contact service support.
100071	Interlock error: Exposure aborted because an interlock has been deactivated during the exposure.	Error	Press the "Accept" button. If the error code persists, turn the Generator OFF and ON. If the equipment remains inoperative, turn it OFF and contact service support.
100072	Exposure aborted by deactivation of Positioner-OK signal	Error	
100073	XON Feedback Error	Inhibit Exposure	Press the "Accept" button. If the error code persists, turn the Generator OFF and ON. If the equipment remains inoperative, turn it OFF and contact service support.
100074	COP Generator Reset Error	Inhibit Exposure	
100075	CLK Generator Reset Error	Inhibit Exposure	
100076	TRAP Generator Reset Error	Inhibit Exposure	
100077	Software Interrupt Generator Reset Error	Inhibit Exposure	
100078	Memory Interrupt Generator Reset Error	Inhibit Exposure	

ID	DESCRIPTION	TYPE	USER HELPTEXT
100079	Required mA stations calibration error	Inhibit Exposure	At least one required mA station has not been properly calibrated. Contact service support for calibration of mA stations.
100090	R2CP CAN Bus error	Error	Press the "*Accept*" button. If the error code persists, turn the Generator OFF and ON. If the equipment remains inoperative, turn it OFF and contact service support.
100091	R2CP Heartbeat error.	Error	
100099	Incorrect Message	Error	
100100	Starter CAN Bus error	Error	Contact service support.
100101	The starter does not allow starting the tube neither in high speed nor in low one.	Error	Press the "*Accept*" button. If the error code persists, turn the Generator OFF and ON. If the equipment remains inoperative, turn it OFF and contact service support.
100102	The starter does not allow starting the tube in low speed.	Error	
100103	The starter does not allow starting the tube in high speed.	Error	
100104	No answer from Tube 1 Dosimeter.	Error	Press the "*Accept*" button. If the error code persists, turn the Generator OFF, check the proper external cable connections and integrity of the dosimeter and then turn the Generator ON. If the equipment remains inoperative, turn it OFF and contact service support.
100105	Test error from Tube 1 Dosimeter.	Error	
100106	Status error from Tube 1 Dosimeter.	Error	
100107	No answer from Tube 2 Dosimeter.	Error	
100108	Test error from Tube 2 Dosimeter.	Error	
100109	Status error from Tube 2 Dosimeter.	Error	
100125 to 100240	System failure related to Dual Speed Starter	Error	Contact service support.
100801	Procedure finished	Inhibit Exposure	No user action required.
100802	Waiting for detector	Inhibit Exposure	Please, wait for the detector to finish acquisition. If exposures remains inhibited, contact service support.
100803	Activated Procedure is not allowed	Inhibit Exposure	Contact service support.
100901	AEC out of range	Error	Change RAD (Kv, mA) or AEC (density) settings to fall into a minimum dose level for the AEC device.
100902	Detected Radiation too low or AEC Chamber not connected	Error	No dose received on the AEC chamber. Check collimation aperture, patient position, or AEC hardware connection.

ID	DESCRIPTION	TYPE	USER HELPTEXT
100903	AEC rapid termination	Error	Too low dose received on the AEC chamber at the start of this exposure. Check collimation aperture for active AEC chamber or patient position.
100904	Detector acquisition window ended before exposure time selection	Error	Detector finished x-ray acquisition before the generator. Decrease selected exposure time.
100905	Start exposure trigger not received by the generator	Error	Reboot the system and try to repeat the operation. If the message persists, contact service support.
100906	Workstation not defined on this procedure	Error	Reboot the system and try to repeat the operation. If the message persists, contact service support.
100909	Error in *image_receptor.xml* or *workstations.xml* file	Error	
100910	Error in *exposure_switches.xml* file	Error	
100920	*workstations.xml* has not been downloaded	Error	
100921	*image_receptors.xml* has not been downloaded	Error	
100922	*exposure_switches.xml* has not been downloaded	Error	
100923	*generator.xml* has not been downloaded	Error	
100924	*Tube_1.xml* has not been downloaded	Error	
100925	*Tube_2.xml* has not been downloaded	Error	
100926	*uarc_workstations.xml* has not been downloaded	Error	
100927	*ConfigR2CP.xml* has not been downloaded	Error	
100930	Tube file wrong format	Error	
100931	Configuration Process OK	Warning	Generator will reboot after user confirmation.
100932	Configuration Process Error: Tube 1 Setting	Error	Reboot the system and try to repeat the operation. If the message persists, contact service support.
100933	Configuration Process Error: Tube 2 Setting	Error	Reboot the system and try to repeat the operation. If the message persists, contact service support.
100934	Configuration Process Error: Rating Setting	Error	Reboot the system and try to repeat the operation. If the message persists, contact service support.
100935	Configuration Process Error: Behaviour Setting	Error	Reboot the system and try to repeat the operation. If the message persists, contact service support.
100936	Configuration Process Error: Power Control Setting	Error	Reboot the system and try to repeat the operation. If the message persists, contact service support.
100937	Configuration Process Error: Fluoro Setting	Error	Reboot the system and try to repeat the operation. If the message persists, contact service support.

ID	DESCRIPTION	TYPE	USER HELPTEXT
100938	Configuration Process Error: Interlock Setting	Error	Reboot the system and try to repeat the operation. If the message persists, contact service support.
100939	Configuration Process Error: Log Setting	Error	Reboot the system and try to repeat the operation. If the message persists, contact service support.
100940	Configuration Process Error: Dropout Setting	Error	Reboot the system and try to repeat the operation. If the message persists, contact service support.
101001	X-rays disabled	Inhibit Exposure	Tap on the Accept button in the Message History window of the Control Console.
101002	Tube overload	Warning	Change the exposure values or wait for the X-ray Tube to cool.
101003	Tube thermostat	Warning	Wait for the Housing to cool. If the temperature value of the Housing does not decrease, contact service support.
101004	Generator model overload	Warning	Contact service support.
101005	X-ray key not active	Inhibit Exposure	
101006	Door is open	User Action	Close the door. No exposures are allowed while the Door is open.
101011	Grid not detected	Information	Insert a grid if conditions require it.
101012	Positioner does not allow exposures	Inhibit Exposure	Check that the positioner remains completely stationary. If exposures remains inhibited, contact service support.
101013	AEC out of range	User Action	Change RAD (Kv, mA) or AEC (density) settings to fall into a minimum dose level for the AEC device.
101014	Generator In Service Mode	Inhibit Exposure	Contact service support.
101015	Generator has not been calibrated yet	Warning	
101016	mA Station selected has not been calibrated	User Action	Modify RAD (Kv, mA) settings. If error persists, contact service support.
101017	Configurated Tube is different to Calibrated Tube	User Action	Reboot the generator. If the error persists, contact service support.
101018	Exposure does not allowed in this Desktop	Inhibit Exposure	Contact service support.
101019	The system has to be rebooted for being upgraded	Information	No user action required.
101020	Positioner does not allow exposures. Moving. Synchronization signal.	Information	Positioner moving. Please wait...

ID	DESCRIPTION	TYPE	USER HELPTEXT
101023	Upgrade is ongoing, X-ray disabled during this process	Information	No user action required.
102001	Value requested exceeds generator power	Information	No user action required.
102002	Value requested exceeds tube maximum rating	Information	No user action required.
102003	Technique requested not allowed due to tube space charge	Information	No user action required.
102004	kVp requested out of range	Information	No user action required.
102005	mAs requested out of range	Information	No user action required.
102006	mA requested out of range	Information	No user action required.
102007	ms requested out of range	Information	No user action required.
102008	Focal spot change not allowed due to mA-mAs selection	Information	No user action required.
102009	APR warning	Information	No user action required.
102010	Generator thermal limit	Information	No user action required.
102011	Line power limit	Information	No user action required.
102012	Workstation warning	Information	No user action required.
102013	PPs range	Information	No user action required.
102014	AEC Warning	Information	No user action required.
102015	Dual energy warning	Information	No user action required.
102017	AEC disabled. Please, check exposure time	Information	No user action required.
102018	AEC enabled. Please, check exposure time	Information	No user action required.
103001	Filaments disabled by software	Information	No user action required.
103002	Filaments disabled by hardware	Information	No user action required.
103003	Time Stamp has not been updated from SNTP Server	Information	No user action required.
103008	File has not been uploaded. File Manager Service has not found	Information	No user action required.
103009	Demo Mode Enabled	Information	No user action required.

ID	DESCRIPTION	TYPE	USER HELPTEXT
103010	Upgrade only allowed in Service Mode	Information	No user action required.
103011	Demo Mode enabled by Dip Switch	Information	No user action required.
201001	Please wait, positioner is booting up	Inhibit Movement	Wait until positioner is fully booted and keeps operational.
201003	Motion inhibit by service	Inhibit Movement	Contact service support.
201004	Tabletop movement inhibit button active	Inhibit Movement	Release Table movement inhibit button.
201005	Motion inhibit. Ratchet is set	Inhibit Movement	Reboot the system. If movements remains inhibited, contact service support.
201180	Table Bucky by tray out	Inhibit Movement	Make sure the tray has been fully inserted. If movements remains inhibited, contact service support.
201181	Table Bucky by grid out	Inhibit Movement	Make sure the grid has been fully inserted. If movements remains inhibited, contact service support.
201196	Table Vertical by tray out	Inhibit Movement	Make sure the tray has been fully inserted. If movements remains inhibited, contact service support.
201197	Table Vertical by grid out	Inhibit Movement	Make sure the grid has been fully inserted. If movements remains inhibited, contact service support.
201199	Tabletop collision detected	Inhibit Movement	Inspect the room and remove possible obstacles.
201212	Wallstand Vertical by tray out	Inhibit Movement	Make sure the tray has been fully inserted. If movements remains inhibited, contact service support.
201213	Wallstand Vertical by grid out	Inhibit Movement	Make sure the grid has been fully inserted. If movements remains inhibited, contact service support.
201228	Wallstand Tilting by tray out	Inhibit Movement	Make sure the tray has been fully inserted. If movements remains inhibited, contact service support.
201229	Wallstand Tilting by grid out	Inhibit Movement	Make sure the grid has been fully inserted. If movements remains inhibited, contact service support.
201232	Wallstand Tilting by Patient Holder	Inhibit Movement	Remove the Patient Holder. If movements remains inhibited, contact service support.
201233	Wall Stand is too low to tilt. Please move the Wall Stand upwards before tilting	Inhibit Movement	Move the wall stand upwards before tilting.
201292	Tray out	Inhibit Movement	Make sure the tray has been fully inserted.
201293	Grid out	Inhibit Movement	Make sure the grid has been fully inserted.

ID	DESCRIPTION	TYPE	USER HELPTEXT
201296	Wallstand Detector Holder Rotation by Patient Holder	Inhibit Movement	Remove the Patient Holder. If movements remains inhibited, contact service support.
201297	Wallstand is too low to rotate the Detector Holder. Please move the Wall Stand upwards before rotating the docking	Inhibit Movement	Move the Wall Stand upwards before rotating the Detector Holder.
201298	Wallstand Detector Holder Rotation by Tilting position. Please place tilting below 45degrees before rotation	Inhibit Movement	Place tilting below 45° before rotation.
202001	Positioner is booting	Inhibit Exposure	Please wait, positioner is booting up.
202003	X-ray inhibit by service	Inhibit Exposure	Contact service support.
202004	Automatic motion	Inhibit Exposure	Abort the automatic movement or wait for it to complete. If exposures remains inhibited, contact service support.
202005	Detector out	Inhibit Exposure	Make sure the detector has been placed correctly inside the tray.
202006	Tray out	Inhibit Exposure	Make sure the tray has been fully inserted.
202007	Grid partial inserted	Inhibit Exposure	Make sure the grid has been fully inserted.
202008	Tube misaligned	Inhibit Exposure	Check that tube and detector are correctly aligned.
202009	Collimator busy	Inhibit Exposure	Wait until collimation aperture and filters are set.
202010	Grid mismatch	Inhibit Exposure	Make adjustments so that the grid range matches current SID.
202011	Manual motion	Inhibit Exposure	Abort any manual movement and check that system remains completely stationary.
202012	Default procedure	Inhibit Exposure	Set a new system procedure. If exposures remains inhibited, contact service support.
202013	Target not reached in stitching procedure	Inhibit Exposure	Wait until the target is reached.
202014	Safety Mode activated	Inhibit Exposure	Disable Safety Mode to return the system to operating mode.

ID	DESCRIPTION	TYPE	USER HELPTEXT
202015	Service Mode activated	Inhibit Exposure	Exit Service Mode to return the system to operating mode.
202016	Generator Disconnected	Inhibit Exposure	Ensure correct connections of the Generator. If exposures remains inhibited, contact service support.
202017	IS Disconnected	Inhibit Exposure	Wait until IS turns operative. If exposures remains inhibited, contact service support.
202018	Smarthub Disconnected	Inhibit Exposure	Wait until Smarthub turns operative. If exposures remains inhibited, contact service support.
203001	Automatic collimator is not enabled in license	Information	No user action required.
203002	Dosimeter is not enabled in license	Information	
203003	Stitching is not enabled in license	Information	
203004	Tomography is not enabled in license	Information	
203005	Tomosynthesis is not enabled in license	Information	
203006	System will power off: Incorrect system in license	Error	Contact service support.
203007	System will power off: Incorrect startup mode in license	Error	
203008	System will power off: Incorrect system in license	Error	
203009	System will power off after updating license client	Information	Power on the system after shutdown.
203010	Waiting for Generator license	Information	Reboot the Generator. If the message persists, contact service support.
204001	Tube Emergency Stop Switch active	Emergency	Please, release the Tube switch to keep working with the system. For security reasons, no movements or exposures are possible until this button is released.
204002	Table Emergency Stop Switch active	Emergency	Please, release the Table switch to keep working with the system. For security reasons, no movements or exposures are possible until this button is released.
204003	Wall Stand Emergency Stop Switch active	Emergency	Please, release the Wall Stand switch to keep working with the system. For security reasons, no movements or exposures are possible until this button is released.
204005	ASK Emergency Stop Signal active	Emergency	Please, release the ASK switch to keep working with the system. For security reasons, no movements or exposures are possible until this button is released.

ID	DESCRIPTION	TYPE	USER HELPTEXT
204006	RCC Emergency Stop Switch active	Emergency	Please, release the RCC Console switch to keep working with the system. For security reasons, no movements or exposures are possible until this button is released.
205002	Auto-position not configured	Information	No user action required.
205003	System is going to restart	Information	
205004 to 205045	Set of error codes related to configuration files not loaded	Error	Contact service support.
205046	Configuration file not uploaded	Error	
205047	Configuration file not downloaded	Error	
205050	Configuration system failed to initialize	Error	Reboot the system. If the error persists, contact service support.
205051	System not configured	Error	Contact service support.
206015	Unreachable auto-position	Information	No user action required.
206016	Invalid configuration for this auto-position	Warning	Contact service support.
206017	Not possible to find a clear path to specified target	Information	No user action required.
206018	System inside safety area	Information	Perform movements carefully. Avoid approaching the patient area with the tube-collimator assembly.
206019	System inside patient area	Information	No user action required.
206020	The system stopped because is inside patient area	Information	
206021	Target is already reached	Information	
206022	System inside proximity sensor safety area	Information	Perform movements carefully. Avoid approaching the patient area with the tube-collimator assembly.
206023	System inside proximity sensor patient area	Information	No user action required.
206024	OTC can not reach Table position	Information	Place the OTC in front of the Table manually and press the Automatic Movement button again.
206025	OTC can not reach Wall Stand position	Information	Place the OTC in front of the Wall Stand manually and press the Automatic Movement button again.
206050 to 206074	Set of Information Messages: Target axis out of range	Information	No user action required.

ID	DESCRIPTION	TYPE	USER HELPTEXT
207001	Wrong detector orientation (portrait)	User Action	Change the Detector position to portrait.
207002	Wrong detector orientation (landscape)	User Action	Change the Detector position to landscape.
207003	Grid is not recommended for this exposure. Please, remove the grid	User Action	Please, remove the grid.
207004	Grid is recommended for this exposure. Please, insert the grid	User Action	Insert the GRID for the actual SID.
207005	Please, insert a valid detector for ASK1 (Film size)	User Action	Please, insert a valid detector for ASK1 (Film size).
207006	Please, insert a valid detector for ASK2 (Film size)	User Action	Please, insert a valid detector for ASK2 (Film size).
207007	Positioner is not calibrated	User Action	Please, contact service support to request the positioner calibration. If necessary, move the system manually with caution.
207008	OTC in Service mode	User Action	Please, contact service support.
207101 to 207125	System movement axes not calibrated	Warning	Please, contact service support to request a calibration.
208001	Waiting for Autocenter	Information	Reboot the system and try to repeat the operation. If the message persists, contact service support.
208002	Tracking deactivated due to inactivity	Information	No user action required.
208003	Tracking deactivated by Wall Stand tilting	Information	Wall Stand Receptor is out of geometry in the tilting axis. Place the Wall Stand receptor in the original position and try again.
208004	Tracking deactivated by partial inhibit	Information	No user action required.
208005	Tracking deactivated by target unreachable	Information	Try again the tracking procedure to a reachable position.
208006	Tracking cannot be activated. Incorrect workstation	Information	Select another workstation.
208007	Tracking cannot be activated. SID out of range	Information	Place positioners in a SID between 70 and 300 cm. If the message persists, review settings for current request considering room configuration.
208008	Tracking cannot be activated. ANG out of range	Information	Place the X-ray Tube at 0º and try again.
208009	Tracking cannot be activated. ROT out of range	Information	Place the X-ray Tube at 90º and try again.

ID	DESCRIPTION	TYPE	USER HELPTEXT
208010	Tracking cannot be activated. Invalid component movement	Information	Try to perform the tracking again, avoiding any other equipment movement during procedure.
208011	Tracking cannot be activated. Ratchet is set	Information	Contact service support.
208012	Tracking cannot be activated. Positioner in calibration	Information	No user action required.
208013	Tracking cannot be activated. Fast Alignment selected	Information	
209001 to 209011	Set of Information Messages: Collimator working in manual mode	Information	
211001	OTC Iron-Cable loosened	Error	Ask service support to check the Overhead Tube Crane Iron-Cable.
211002	Ratchet is set	Warning	Grab the wheel, the positioner will move upwards automatically to unset the ratchet. If the error persists, contact service support.
211003	Movement is not allowed for security reason	Warning	Contact service support.
211004	Movement is not allowed	Warning	
211011	ASK Module Failure in Device 1 (Wall Stand). Potentiometer Measure Error	Warning	Please, contact service support to request a calibration.
211012	ASK Module Failure in Device 2 (Table). Potentiometer Measure Error	Warning	
212001	Servo Assistance calibration drift error	Warning	
212002	OTC gauges broken	Error	Contact service support.
212003	Servo Assistance DAQ setup error	Warning	Please, contact service support to request a calibration.
212004	Servo Assistance configuration calibration error	Warning	
212005	Offset compensation error for the OTC Longitudinal Axis (X)	Warning	Contact service support.
212006	Offset compensation error for the OTC Transversal Axis (Y)	Warning	Contact service support.
212007	Offset compensation error for the OTC Vertical Axis (Z)	Warning	Contact service support.
213001 to 213031	Set of Errors in OTC Transversal Axis (Y Axis)	Error	Contact service support.

ID	DESCRIPTION	TYPE	USER HELPTEXT
213033 to 213063	Set of Errors in OTC Longitudinal Axis (X Axis)	Error	Contact service support.
213065 to 213069	Set of Errors in OTC Vertical Axis (Z Axis)	Error	Contact service support.
213070	Iron-Cable broken in OTC Vertical Axis	Error	Contact service support.
213071 to 213095	Set of Errors in OTC Vertical Axis (Z Axis)	Error	Contact service support.
213097 to 213127	Set of Errors in OTC Alpha Axis	Error	Contact service support.
213129 to 213159	Set of Errors in OTC Beta Axis	Error	Contact service support.
213161 to 213191	Set of Errors in Table Horizontal Axis	Error	Contact service support.
213193 to 213223	Set of Errors in Table Vertical Axis	Error	Contact service support.
213225 to 213255	Set of Errors in Wall Stand Vertical Axis	Error	Contact service support.
213257 to 213287	Set of Errors in Wall Stand Tilting Axis	Error	Contact service support.
213385 to 213415	Set of Errors in Detector Holder Rotation Axis	Error	Contact service support.
217001 to 217031	Set of Information Messages: System components are booting up	Information	Wait for the system to boot up. (*Refer to "Boot up Messages" in Section 4.11.7.1*)
218001	Tag was qualified successfully	Information	No user action required.
218002	Tag was disqualified successfully	Information	
218003	Valid Tag	Information	
218004	Tag not valid	Information	
218005	There is too many tags present	Information	

ID	DESCRIPTION	TYPE	USER HELPTEXT
218006	There is not a tag present	Information	No user action required.
218007	Error qualifying a tag	Information	
218008	Error disqualifying a tag	Information	
218009	Tag already registered	Information	
218010	Tag can not be qualified	Information	
219113	ASK Module Failure in Table Vertical Axis. Potentiometer Measure Error	Error	Contact service support.
219161	ASK Module Failure in Wallstand Vertical Axis. Potentiometer Measure Error	Error	
220001 to 220024	Set of communication or peripheral access errors related to the OTC	Warning	Reboot the system and try to repeat the operation. If the error persists, contact service support.
220027	Collimator Communication Error	Error	Reboot the system and try to repeat the operation. If the error persists, contact service support.
220028	Collimator Configuration Error	Error	
220029	Collimator Communication Error	Error	
220030	Dosimeter Internal Error	Error	
220031	Dosimeter Configuration Error	Error	
220032 & 220033	Dosimeter Communication Errors	Warning	Reboot the system and try to repeat the operation. If the error persists, contact service support.
220039 to 220053	Set of communication or peripheral access errors related to the OTC	Warning	Reboot the system and try to repeat the operation. If the error persists, contact service support.
220054	Focus Skin Distance Sensor Failure	Error	Reboot the system and try to repeat the operation. If the error persists, contact service support.
220055	OTC Right Proximity Sensor Failure	Error	Reboot the system and try to repeat the operation. If the error persists, contact service support.
220056	OTC Left Proximity Sensor Failure	Error	
220057	OTC Rear Proximity Sensor Failure	Error	
220058	OTC Bottom Proximity Sensor Failure	Error	
220257 to 220308	Set of communication or peripheral access errors related to the RAD Table	Warning	Reboot the system and try to repeat the operation. If the error persists, contact service support.

ID	DESCRIPTION	TYPE	USER HELPTEXT
220513 to 220564	Set of communication or peripheral access errors related to the RAD Wall Stand	Warning	Reboot the system and try to repeat the operation. If the error persists, contact service support.
220769 to 220820	Set of communication or peripheral access errors related to the RCC Console	Warning	Reboot the system and try to repeat the operation. If the error persists, contact service support.
221281 to 221332	Set of communication or peripheral access errors related to AEM	Warning	Reboot the system and try to repeat the operation. If the error persists, contact service support.
221537 to 221588	Set of communication or peripheral access errors related to the RFID device	Warning	Reboot the system and try to repeat the operation. If the error persists, contact service support.
225000	OTC Protocol Function not available	Information	No user action required.
225001	OTC Configuration Error	Error	Reboot the system. If the error persists, contact service support.
225002 to 225007	Set of communication or peripheral access errors related to the OTC	Warning	Reboot the system and try to repeat the operation. If the error persists, contact service support.
225011	Dosimeter Communication Error	Error	Reboot the system. If the error persists, contact service support.
225012	Collimator Offline	Error	
225018	Dosimeter Communication Error	Warning	Reboot the system and try to repeat the operation. If the error persists, contact service support.
225019 to 225024	OTC Servo-assistance Failure	Warning	
225025	Collimator Communication Error	Warning	
225055 & 225060	OTC System Communication Error	Warning	
225256	Table GPIO. Protocol Function not available	Information	No user action required.
225257	Table Configuration Error	Error	Reboot the system and try to repeat the operation. If the error persists, contact service support.
225258 to 225270	Set of communication or peripheral access errors related to the RAD Table	Warning	
225300	Downwards movement inhibit. Check there is not any obstacle under the tabletop	Warning	

ID	DESCRIPTION	TYPE	USER HELPTEXT
225301	Table Downwards Movement disabled	Warning	Reboot the system and try to repeat the operation. If the error persists, contact service support.
225302	Table Upwards Movement disabled	Warning	
225303	Table Elevation Movement out of limits	Warning	
225304	Table reached bottom end switch	Information	No user action required.
225305	Table reached top end switch	Information	
225306	Hardware End of Range out of sync in Table Movements	Information	
225307	Table Elevation Movement Failure	Warning	Reboot the system and try to repeat the operation. If the error persists, contact service support.
225308	Table Elevation Detent: Out of Limits	Warning	
225309	Tabletop Longitudinal Axis is out of limits	Warning	
225310	Tabletop Transversal Axis is out of limits	Warning	
225311 & 225316	Table System Communication Error	Warning	
225317	Table Elevation Out of Limits	Warning	
225512	Wall Stand GPIO. Protocol Function not available	Information	No user action required.
225513	Wall Stand Configuration Error	Error	Reboot the system. If the error persists, contact service support.
225514 to 225527	Set of communication or peripheral access errors related to the RAD Wall Stand	Warning	
225538	Wall Stand Bucky Rotation : Out Of Sync	Warning	
225539	Wall Stand Bucky Rotation : End Of Range	Warning	
225540	Wall Stand Bucky IMMS	Warning	
225567 & 225572	Wall Stand System Communication Error	Warning	
225768	RCC GPIO. Protocol Function not available	Information	No user action required.
225769	RCC Configuration Error	Error	Reboot the system. If the error persists, contact service support.
225770 to 225826	Set of communication or peripheral access errors related to the RCC Console	Warning	Reboot the system and try to repeat the operation. If the error persists, contact service support.

ID	DESCRIPTION	TYPE	USER HELPTEXT
225827	RCC Beep Unknown	Warning	Contact service support.
225828	RCC System Communication Error	Warning	Reboot the system and try to repeat the operation. If the error persists, contact service support.
226280	AEM GPIO. Protocol Function not available	Information	No user action required.
226281	AEM Configuration Error	Error	Reboot the system. If the error persists, contact service support.
226282 to 226340	Set of communication or peripheral access errors related to AEM	Warning	Reboot the system and try to repeat the operation. If the error persists, contact service support.
226536	RFID GPIO. Protocol Function not available	Information	No user action required.
226537	RFID Configuration Error	Error	Reboot the system. If the error persists, contact service support.
226538 to 226596	Set of communication or peripheral access errors related to the RFID device	Warning	Reboot the system and try to repeat the operation. If the error persists, contact service support.
290200	Collision detected	Inhibit Movement	Inspect the equipment and remove possible obstacles.
300001	Programmable Positions configuration could not be loaded	Error	Reboot the system. If error message persists, contact service support.
300002	Positioner configuration could not be loaded	Error	
300003	Switches configuration could not be loaded	Error	
300004	Collimation configuration file not found	Error	
300005	Workstation Selected: {0}	Information	No user action required.
300006	Generator configuration could not be loaded	Error	Reboot the system. If error message persists, contact service support.
300007	Workstations configuration could not be loaded	Error	
300008	Image receptors configuration could not be loaded	Error	
300009	Positioner disconnected	Error	Check the Positioner connections and then reboot the system. If error message persists, contact service support.
300010	Console disconnected	Error	Check the Console connections with the SmartHub. Restart this console, if problem persists, contact service support.
300011	Generator disconnected	Error	Please reboot the generator. If error message persists, contact service support.
300012	Workstation mismatch for Generator and Positioner	Error	Try to select another workstation.

ID	DESCRIPTION	TYPE	USER HELPTEXT
300013	Active Procedure mismatch for Generator and Positioner	Error	Contact service support.
300014	Error reading positioner configuration	Error	Contact service support to check the *positioner_.xml* configuration file. If a problem is detected, it may need to be restored.
300015	Configuration changes could not be saved	Error	Contact service support.
300016	Initializing communications ...	Information	Please, check the network settings if connection time takes too long.
300018	Current collimator aperture has been stored	Information	No user action required.
300019	Generator working in Service operation mode	Warning	
300020	Positioner working in Service operation mode	Warning	
300021	Could not verify Service access	Warning	Contact service support.
300022	License not allow stitching	Warning	
300023	Current position is not valid as auto-position	Warning	Place the OTC to a valid position.
300024	Usability settings configuration could not be loaded	Error	Contact service support.
300025	Layout settings calibration data could not be loaded	Error	
300026	Selecting technique	Inhibit Exposure	Complete the APR technique selection.
300027	Error loading APR Technique	Inhibit Exposure	Check the APR settings for this technique.
300028	AEC Calibration in progress	Inhibit Exposure	No exposures are allowed until the AEC calibration is finished.
300029	Snapshots in progress	Inhibit Exposure	Wait for the System Snapshot files generation to complete.
500001	Press move button to go to stitching setup position	Inhibit Exposure	Press the Auto-center button on the Control Console, RCC Console or IR Remote Control (if available) to align the X-ray Tube with the positioner Detector (Stitching Setup Position).
500002	Stitching in setup mode	Inhibit Exposure	No exposures are allowed until parameters are adjusted.
500003	Keep the handswitch pressed	Information	Keep the handswitch pressed.
500004	Selecting technique	Inhibit Exposure	Complete the technique selection.

ID	DESCRIPTION	TYPE	USER HELPTEXT
500007	Stitching cancelled	Inhibit Movement	Wait until system turns operative and repeat the stitching process. If movements remains inhibited, contact service support.
500008	Generator parameters modified	Information	No user action required.
500009	Cannot open port	Inhibit Exposure	Contact service support.
500010	Communication port with CR system is not open	Inhibit Exposure	
500011	Message queue to CR system WS full	Inhibit Exposure	Contact service support.
500012	There is not workstation configured for this request	Information	Select a workstation.
500013	Gray image. Exposure without radiation	Information	No user action required.
500014	Technique not loaded in generator	Inhibit Exposure	Check the APR settings for this technique.
500015	Detector not ready for exposure	Inhibit Exposure	Check detector connections. If exposures remains inhibited, contact service support.
500016	Error loading APR Technique	Inhibit Exposure	Check the APR settings for this technique.
500017	Image system not available	Information	No user action required.
500018	Power Off not allowed. Please close exam	Inhibit Exposure	Close the current exam and repeat the shutdown operation.
500020	APR settings not defined	Inhibit Exposure	Check the APR settings for this technique.
500021	Stitching parameters not valid	Inhibit Exposure	Check that the entered Stitching parameters are not out of the selectable range of the Generator. In this case, adjust the values.
500022	Console not available	Inhibit Exposure	Check the Console connections.
500023	Loading next stitching exposure	Inhibit Exposure	No user action required.
500024	Please, reselect technique	Inhibit Exposure	Select the technique again.
500025	Please, select a protocol from Image System	Inhibit Exposure	Select a protocol from Image System.

ID	DESCRIPTION	TYPE	USER HELPTEXT
500026	Selected detector not available	Inhibit Exposure	Check detector connections.
500027	Please, close exam	Inhibit Exposure	Close the current exam.
500028	Please, open x-ray acquisition screen	Inhibit Exposure	Open the X-ray acquisition screen.
500029	Changing parameters	Inhibit Exposure	No user action required.
500072	Invalid Exposure Time	Inhibit Exposure	Check Tomography sweep time.

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SECTION 7 OPERATING SEQUENCES

7.1 START-UP ROUTINE

Start-up the System is described in *Section 3*.

7.2 X-RAY TUBE WARM-UP PROCEDURE

X-ray tube warm-up procedure is described in *Section 3*.

7.3 RADIOGRAPHIC OPERATION

A typical RAD examination sequence is as indicated below:

1. Make sure that the X-ray Tube to be used is properly warmed-up (*refer to Section 3.6 X-ray Tube Warm Up*).

2. Position the equipment in the initial position of the examination.

THE OVERHEAD TUBE CRANE CAN BE MOVED IN DIFFERENT AXES. PLEASE TAKE CARE THAT NEITHER THE PATIENT NOR OPERATOR/STAFF ARE IN THE MOVEMENT AREA OF THE EQUIPMENT. ALWAYS WATCH WHERE YOU ARE STANDING. REMOVE ALL OBJECTS FROM THE COLLISION AREA.

IT IS MANDATORY TO POSITION FIRST THE EQUIPMENT AT THE INITIAL POSITION OF THE EXAMINATION AND THEN WITH THE SYSTEM ALREADY STOPPED, POSITION THE PATIENT.

3. Prepare the X-ray exposure:
   - Set the exposure area
   - Select Collimator Filter
   - Select a Grid
   - Set AEC

4. Position the patient for the examination.

5. Select the "*Workstation*" and technique parameters using the RAD controls on the X-ray Generator or on the OTC Control Console.

6. Instruct patient to maintain the required position. Prepare the X-ray Tube by pressing the handswitch button to the "*Prep*" position and maintain it until the "*Ready*" indicator is illuminated.

7. Instruct patient to remain still and to hold their breath as required, then make the X-ray exposure by pressing the handswitch button fully to the "*Exp*" position and maintain it throughout the exposure. The "*X-ray On*" indicator will light and an alarm will sound during the exposure.

8. When the exposure is finished, release the handswitch button.

9. Repeat the procedure if additional exposures are desired.

7.4 AEC OPERATION

The proper use of AEC requires accurate patient positioning. For examination using AEC, the operator will need to select the desired AEC parameters as follows:

1. Make sure that the X-ray Tube to be used is properly warmed-up.

2. Position the patient for the examination.

3. Select the "*Workstation*" and enter in AEC mode by selecting at least one Area Detector "*Field*" on the Image Acquisition Workstation or on the Ceiling Suspension Control Console.

4. If required, choose another "*Film Screen Combination*" and adjust the "*Film Density*" setting ("*0*" is the normal setting) on the Image Acquisition Workstation.

5. Select the technique parameters (back-up time / mAs) using the RAD controls on the Image Acquisition Workstation or on the OTC Control Console.

6. Continue with the radiographic operation *(refer to Section 7.3 - step 4).*

7.4.1 HOW TO VERIFY THE PROPER FUNCTIONING OF THE AEC

Note ☞ *This procedure is not mandatory, it is only a method so that the operator can verify the proper functioning of the Automatic Exposure Control.*

1. Ensure that X-ray Tube has been properly warmed up.

2. Align and center the X-Ray Tube to the image receptor.

3. Set a SID of 1 m (40”).

4. Collimate the X-Ray beam so that it completely covers all three Ion Chambers (Left, Center and Right).

5. Place on the Tabletop and within the X-Ray beam a homogeneous phantom (e.g. a bucket with 10 cm of water) that covers all three Ion Chambers.

6. Set a technique, for example: 70 kVp, 250 mA, 1.0 second back-up time.

7. Select “*Center*” Ion Chamber and Density “*Normal - 0*”.

   Make a RAD exposure and note the exposure mAs and time. For a proper functioning of the AEC, the exposure must not be aborted by the AEC back-up timer.

8. Deselect “*Center*” and select “*Left*” Ion Chamber.

   Make a RAD exposure and note the exposure mAs and time. For a proper functioning of the AEC, the exposure must not be aborted by the AEC back-up timer.

9. Deselect “*Left*” and select “*Right*” Ion Chamber.

   Make a RAD exposure and note the exposure mAs and time. For a proper functioning of the AEC, the exposure must not be aborted by the AEC back-up timer.

10. The noted Exposure mAs and time have to be equal $\pm$10% between all three Ion Chambers. If not, contact Service.

11. Repeat the above steps changing the Density and/or the homogeneous phantom (e.g. a bucket with 5 cm of water). Compare the Exposure mAs and time between each Ion Chamber and between the values noted before (for a lower density or less water, lower mAs and a shorter time; for half of density or half of water, half of mAs / time). If not, contact Service.

12. Finally, check the proper functioning of the AEC back-up timer by making a RAD exposure with the selections indicated in step 6., but with the Collimator blades fully closed. The exposure must be finished by the AEC back-up timer, that is, the exposure length is 1.0 second. If not, contact Service.

SECTION 8 PERIODIC MAINTENANCE

In order to assure a continuous and safe performance of the system, a periodic maintenance program must be established. It is the **owner's responsibility** to supply or arrange for this service.

There are two levels of maintenance, the first consists of tasks which are performed by the user/operator, and the second are those tasks to be performed by qualified X-ray service personnel.

A periodic maintenance service should be performed every six or twelve (6 or 12) months after installation.

The manufacturer undertakes to have available spare parts for this equipment for at least ten (10) years after the unit manufacturing.

NEVER ATTEMPT TO PERFORM MAINTENANCE TASKS WHILE THE ME EQUIPMENT IS IN USE WITH A PATIENT.

8.1 OPERATOR TASKS

The tasks of this periodic maintenance shall include the following items:

DO NOT REMOVE ANY COVER, DISASSEMBLE OR MANIPULATE INTERNAL COMPONENTS OF THE EQUIPMENT. THESE ACTIONS COULD CAUSE SERIOUS PERSONAL INJURIES AND / OR EQUIPMENT DAMAGE.

NEVER ATTEMPT TO CLEAN ANY EQUIPMENT PART WHEN IT IS SWITCHED ON. ALWAYS SWITCH OFF THE SYSTEM BEFORE CLEANING AND ISOLATE THE MAINS ELECTRICAL SUPPLY BEFORE CLEANING.

1. Switch the system OFF.
2. Externally check the proper cable connections between each major component in the X-Ray System.

3. Clean the equipment frequently, particularly if corroding chemicals are present. Clean external covers and surfaces, especially parts in contact with patients, with a cloth moistened in warm water with mild soap. Wipe with a cloth moistened in clean water. Do not use cleaners or solvents of any kind.

8.2 SERVICE TASKS

Only service personnel specifically trained on this medical X-ray equipment should work on service tasks (installation, calibration or maintenance) of the equipment. (*Refer to the respective chapters of the Service Manual provided with this equipment).*

SECTION 9 TECHNICAL SPECIFICATIONS

9.1 X-RAY SYSTEM SPECIFICATIONS

9.1.1 ENVIRONMENTAL REQUIREMENTS

There are no special environmental conditions required for the safe operation of the Overhead Tube Crane. However, it is not designed for the use in the presence of explosive or flammable gases as might be found in operating rooms.

ATMOSPHERIC PRESSURE (hPa)		RELATIVE HUMIDITY (%)		AMBIENT TEMPERATURE	
MIN	**MAX**	**MIN**	**MAX**	**MIN**	**MAX**
WORKING					
700 hPa	1060 hPa	30 %	75 %	10 ^{O}C (50 ^{O}F)	40 ^{O}C (104 ^{O}F)
TRANSPORT & STORAGE					
500 hPa	1060 hPa	10 %	90 %	-10 ^{O}C (14 ^{O}F)	50 ^{O}C (122 ^{O}F)

Note ☞ *STORAGE values only refer to equipment that is still in shipping containers. If the equipment is partially or completely installed, refer to WORKING values.*

Note ☞ *These environmental conditions do not include the Digital Detector. Refer to the Digital Detector Documentation.*

9.1.2 POWER LINE REQUIREMENTS

EQUIPMENT	FREQUENCY	VOLTAGE	MAX. PERMANENT CURRENT
OTC	50/60 Hz	100 - 240 V~	**5.2 - 2.6 A**
RAD TABLE	50/60 Hz	100 - 240 V~	**6 - 2.9 A**
RAD WALL STAND	50/60 Hz	100 - 240 V~	**1.5 - 1 A**
X-RAY GENERATOR	*Refer to Section 9.2.2*		

9.1.3 FUSES

Overhead Tube Crane, RAD Table and RAD Wall Stand are provided in the Input Module with a pair of fuses each, they are identified as F1 & F2. The Fuses have next specifications:

- System set at 100 V~:
  - Input Module Fuses 5A, 250V 3A-SB
  - Breaking Capacity . . . . . 10000 A

- System set at 240 V~:
  - Input Module Fuses 2A, 250V 3A-SB
  - Breaking Capacity . . . . . 100 A

IN CASE OF SINGLE PHASE CHANGE THE F2 FUSE BY THE NEUTRAL CARTRIDGE PROVIDED WITH THE OVERHEAD TUBE CRANE, RAD TABLE AND WALL STAND.

9.1.4 INFORMATION RELATED TO RADIATION

Radiation Output Accuracy: C.V. (Coefficient of Variation) ≤ 0.05
(Reproducibility related to loading factors)

Maximum Symmetrical Radiation Field:

- Measured at 75 kVp: 220 mm (8.6”) in “X” axis and in “Y” axis.
- Measured at 125 kVp: 220 mm (8.6”) in “X” axis and in “Y” axis.

(Test performed at a distance from the Focal Spot of 1200 mm, in accordance with IEC 60806: 1984)

9.2 X-RAY GENERATOR SPECIFICATIONS

9.2.1 RADIOGRAPHIC FACTORS

FACTORS	GENERATOR MODEL *(Refer to the identification Label)* 1.1.2; T1				
Maximum Power kW	32 kW	40 kW	50 kW	65 kW[a]	80 kW
kVp Range	40 to 125 *(40 to 150 optional)* 1.1.3				40 to 150
	From 40 kV to 125 kV or 150 kV in 1 kV steps *(depending on the Generator model)* Accuracy: ± (3% + 1 kVp) 1.1.4				
mAs Range	Product of mA x Time values from 0.1 mAs to 630[b] mAs *(800 or 1000 mAs optional)* Accuracy: ± (10% + 0.2 mAs)				
mA Range	10 to 400[c]	10 to 500[c]	10 to 630[bc]	10 to 630[b]	10 to 800 *(1000 optional)*
	From 10 mA to 400, 500, 630[b], 800 or 1000 mA through the following mA stations: 10, 12.5, 16, 20, 25, 32, 40, 50, 63[b], 80, 100, 125, 160, 200, 250, 320, 400, 500, 630[b], 800, 1000 *(depending on the Generator model)* Accuracy: ± (4% + 1 mA)				
Exposure Time Range	From 1 millisecond to 10 seconds through the following Time stations: Milliseconds:: 1, 2, 3, 4, 5, 6, 8, 10, 12, 16, 20, 25, 32, 40, 50, 63[b], 80, 100, 125, 160, 200, 250, 320, 400, 500, 630[b], 800. Seconds: 1, 1.25, 1.6, 2, 2.5, 3.2, 4, 5, 6.3[b], 8, 10. Accuracy: ± (2% + 0.1 ms)				
AEC	mAs: 0.1 mAs to 500 mAs				
	Exposure Time: Nominal shortest irradiation TIme = 11 ms				
Power Output (@ 0,1s)	400 mA @ 80 kVp 320 mA @ 100 kVp 250mA @ 125 kVp 250 mA @ 128 kVp 200 mA @ 150 kVp	500 mA @ 80 kVp 400 mA @ 100 kVp 320 mA @ 125 kVp 250 mA @ 150 kVp	630 mA @ 79 kVp 500 mA @ 100 kVp 400 mA @ 125 kVp 320 mA @ 150 kVp	630 mA @ 100 kVp 630 mA @ 103 kVp 500 mA @ 125 kVp 500 mA @ 130 kVp 400 mA @ 150 kVp	1000 mA @ 80 kVp 800 mA @ 100 kVp 630 mA @ 127 kVp 500 mA @ 150 kVp
Duty Cycle	1 maximum power exposure at 100 ms, every minute during 8 hours.				
	The Duty Cycle of the Generator is continuous, but limits must be programmed during installation according to the X-ray Tube capacity to be used. Maximum leakage radiation depends on the type of X-ray Tube.				
Radiation Output Accuracy (Reproducibility related to loading factors)	C. V. (Coefficient of Variation) ≤ 0.05				
Maximum heat Output	300 W (1025 BTU/h) (stand-by)				

NOTES: (a) For 65 kW Generator configured with R'10 logarithmic scale, its nominal power (65 kW at 100 kVp) cannot be selected. Using the logarithmic scale with "65 mA, 650 mA and 65 ms, 650 ms, 6.5 s", then it is possible to select its nominal power (650 mA @ 100 kVp)

(b) Under requirement, mA and exposure time stations could be configured to three different logarithmic scales by the Field Service Engineer:
R'10: 63 mA, 630 mA and 63 ms, 630 ms, 6.3 s.
$R'10_{(64)}$: 64 mA, 640 mA and 64 ms, 640 ms, 6.4 s.
$R'10_{(65)}$: 65 mA, 650 mA and 65 ms, 650 ms, 6.5 s.

(c) For Single-Phase Generators of 32 kW at 208 V~, the maximum mA are limited to 160 when the selected kVp are within 126 and 134; to 125 mA when the selected kVp are 135 or 136; and to 100 mA when the selected kVp are higher than 136.
For Three-Phase Generators from 40 to 50 kW at 208 V, the maximum mA are limited to 200 when the selected kVp are 140 or higher.
For Single-Phase Generators of 50 kW at 230 V, the maximum mA are limited to 250 when the selected kVp are 140 or higher.

9.2.2 ELECTRICAL REQUIREMENTS

FACTORS	GENERATOR MODEL *(Refer to the identification Label)*				
	32 kW	**40 kW**	**50 kW**	**65 kW**	**80 kW**
Input Line Operation	Single-Phase and Three-Phase			Three-Phase	
Input Line Operation	Single-Phase Generator of 32 kW: 208/230 V~ - 50/60 Hz. Single-Phase Generator from 40 to 50 kW: 208*/230 V~ - 50/60 Hz. Three-Phase Generator from 32 to 50 kW: 208/230/400/415/440/480 V~ - 50/60 Hz. Three-Phase Generator from 65 to 80 kW: 400/415/440/480 V~ - 50/60 Hz. Line voltage automatic compensation ±10% V~. Maximum line regulation for maximum kVA demand: 6%.				
*NOTE: * For Single-Phase Generators from 40 to 50 kW operating with lines at 208 V~ or below, an auxiliary boost transformer is required to adequate the line voltage to 230 V~.*					

9.2.3 ENVIRONMENTAL REQUIREMENTS

FACTORS	GENERATOR MODEL *(Refer to the identification Label)*
Storage/Transport Environmental Conditions	Temperature range of -10 °C to 70 °C Relative Humidity range of 5% to 95% Atmospheric Pressure range of 500 hPa to 1060 hPa
Operating Environmental Conditions	Temperature range of 10 °C to 40 °C Relative Humidity (no condensing) range of 30% to 75% Atmospheric Pressure range of 700 hPa to 1060 hPa

9.2.4 PHYSICAL CHARACTERISTICS

COMPONENT	DIMENSIONS			WEIGHT
	Length	**Width**	**Height**	
Line Powered Generator with Leveling Legs	445 mm (17.5”)	360 mm (14.2”)	min. 562 mm (22.1”)	65 kg (143 lb)

Note ☞ *Refer to the Pre-Installation Manual provided with the X-ray System for more detailed information.*

9.3 X-RAY TUBES

TUBE	FOCAL SPOTS	ID	STATOR	KHU	KVP	POWER@100MS (KW)			
						SF/LS	LF/LS	SF/HS	LF/HS
E7239X	1.0/2.0	469	Low Speed	140	125	22.5	47.0	--	--
E7240X	0.6/1.2	470	Low Speed	140	150	15.0	30.0	--	--
E7242X	0.6/1.5	471	Low Speed	200	125	18.0	50.0	--	--
E7252X	0.6/1.2	484	XS-AL	300	150	16.0	44.6	27.0	75.0
E7254FX	0.6/1.2	482	XH-157	400	150	23.0	60.0	40.0	102.0
E7865X	0.3/1.0	344	Low Speed	140	150	3.5	40.0	--	--
E7869XX	0.6/1.2	483	High Speed	600	150	23.0	58.0	42.0	100.0
E7886X	0.7/1.3	--	XS-AL	300	150	17.0	40.0	--	--
XRR3331X	0.6/1.2	468	XS-AL	300	150	22.0	54.0	32.0	78.0

1.1.10
1.1.11
1.1.14
1.1.15
1.1.12
1.1.13

9.4 COLLIMATORS

1.1.30

MODEL		R225 DHHS MANUAL	R225 ACS DHHS AUTOMATIC
Field	**Shape**	Rectangular	Rectangular
	Maximum Field	430 x 430 mm (17x17") SID 110 cm (43.3") (±1% SID)	430 x 430 mm (17x17") SID 90 cm (35.5") (±1% SID)
	Minimum Field	00 x 00 mm (±1% SID)	00 x 00 mm (±1% SID)
Light field	**Average Illumination**	> 160 lx	> 160 lx
	Edge Contrast Ratio	> 4:1	> 4:1
	Accuracy	< 2% SID	< 2% SID
	Display of Center	Cross lines	Cross lines
	Inherent Filtration	Min. 2.0 mmAl.	Min. 2.0 mmAl.
	Type of Lamp	White LED	White LED
Drive of Leaves		Manual	Automatic
External Dimensions (W x D x H)		244 x 282 x 216 (96" x 111" x 85")	244 x 282 x 216 (96" x 111" x 85")
Weight		9.8 kg (21.6 lb)	11 kg (24.3 lb)

9.5 OVERHEAD TUBE CRANE SPECIFICATIONS

- Dimensions:
  - Maximum Width . . . . . 3500 mm (137.8”)
  - Maximum Length . . . . . 6100 mm (240.2”)
- Distance between Longitudinal Rails (recommended) . . . . . 1800 mm (70.9”)
- Weights:
  - Main assembly and Control Console 216.3 kg (476.8 lb)
  - Transversal Rails Maximum 3500 (137.8”) 53 kg (116.8 lb)
  - Longitudinal Rails Maximum 6100 (240.2”) 91.3 kg (201.3 lb)
  - Tube . . . . . Depending on the Tube
  - Collimator . . . . . Depending on the Collimator
- X-ray Tube Rotation (Beta Axis) . . . . . ±180° 1.1.21
- X-ray Tube Angulation (Alpha Axis) . . . . . -180° to +135° 1.1.22
- Nominal Speeds in Automatic Movements:
  - Longitudinal Axis . . . . . 180 mm/s
  - Transversal Axis . . . . . 180 mm/s
  - Vertical Axis . . . . . 150 mm/s
- SID Target is within 700 mm (27.5”) and 2000 mm (78.7”). Maximum and Minimum SID from X-ray Tube facing the Table and Wall Stand depends on the Room dimensions and Longitudinal Rails of the System.

Table 9-1
Transversal Rails Length and Transversal & Vertical Travels

TRANSVERSAL RAILS LENGTH	MAXIMUM TRANSVERSAL TRAVEL	MINIMUM DISTANCE FROM COLUMN CENTER TO END OF RAIL	
		To Front	To Back
2500 mm (98.4”)	1595 mm (62.8”)	1.1.19 575 mm (22.6”)	330 mm (13”)
3000 mm (118.1”)	2095 mm (82.5”)		
3500 mm (137.8”)	2595 mm (102.1”)		

Illustration 9-1
Overhead Tube Crane - Lateral View

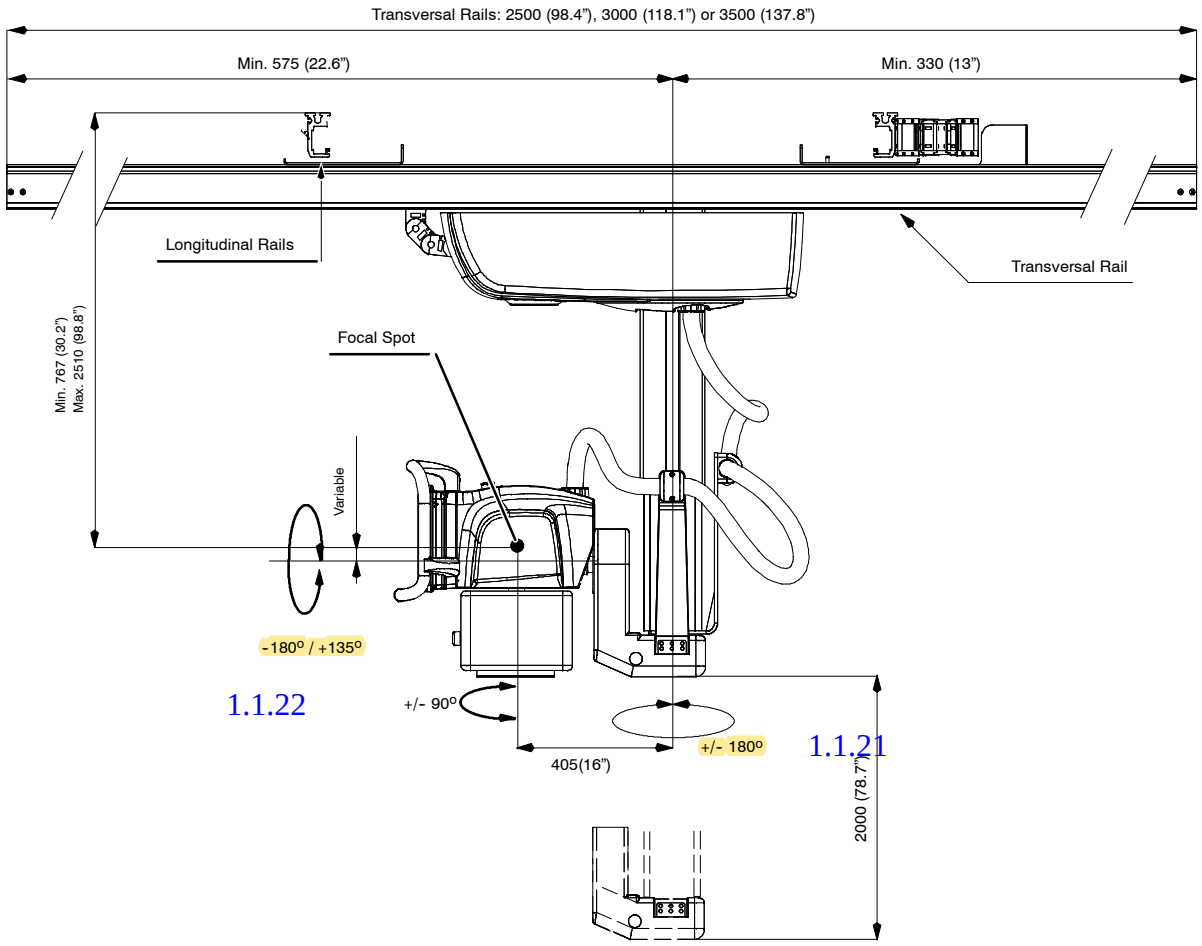


Table 9-2
Rails Dimensions and Carriage Travels

LONGITUDINAL RAILS LENGTH	CARRIAGE MAXIMUM TRAVEL	MINIMUM DISTANCE FROM COLUMN CENTER TO END OF RAIL	
		To Left	To Right
3900 mm (153.5”)	2972 mm (117”)	1.1.18 464mm (18.2”)	464 mm (18.2”)
4600 mm (181.1”)	3672 mm (138”)		
5100 mm (200.8”)	4172 mm (164.3“)		
6100 mm (240.2”)	5172 mm (203.6”)		

Illustration 9-2
Overhead Tube Crane – Front View

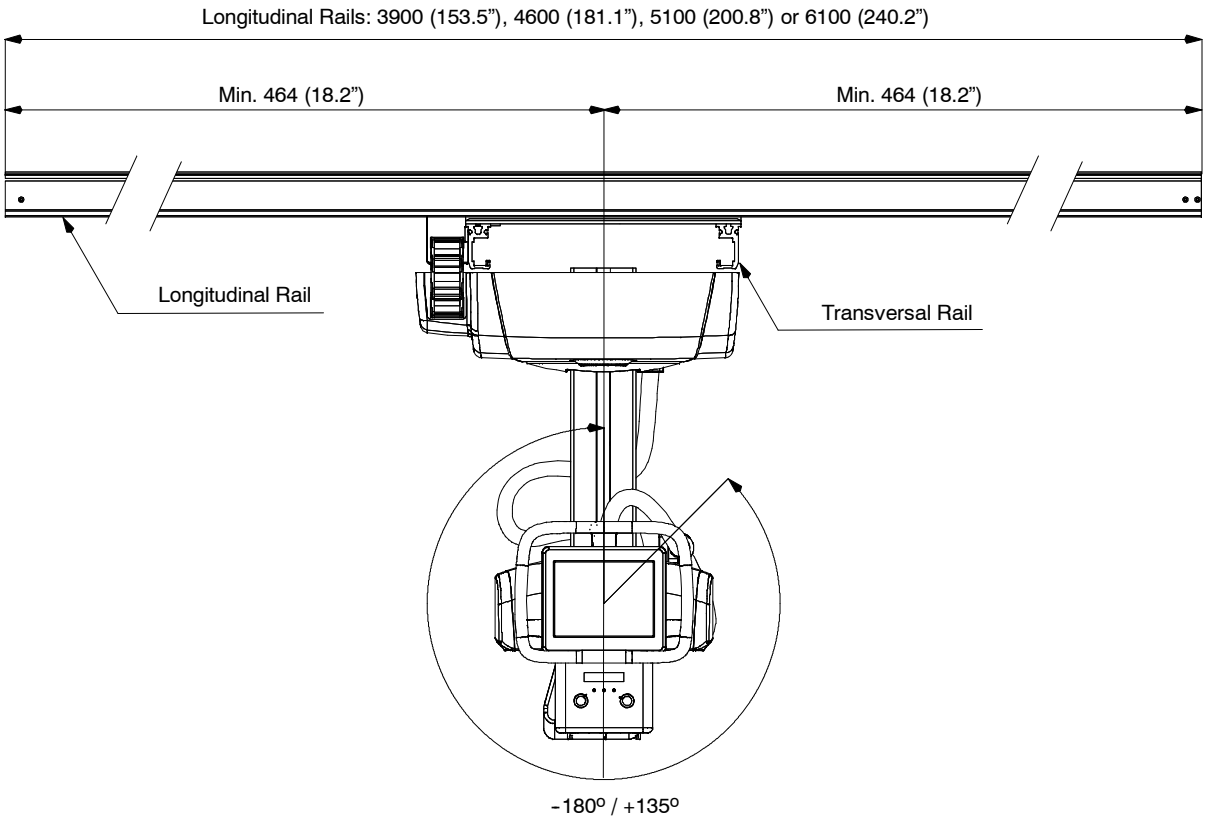


Illustration 9-3
Focal Sport Travel with the Control Console at 0º in Alpha and Beta Axes

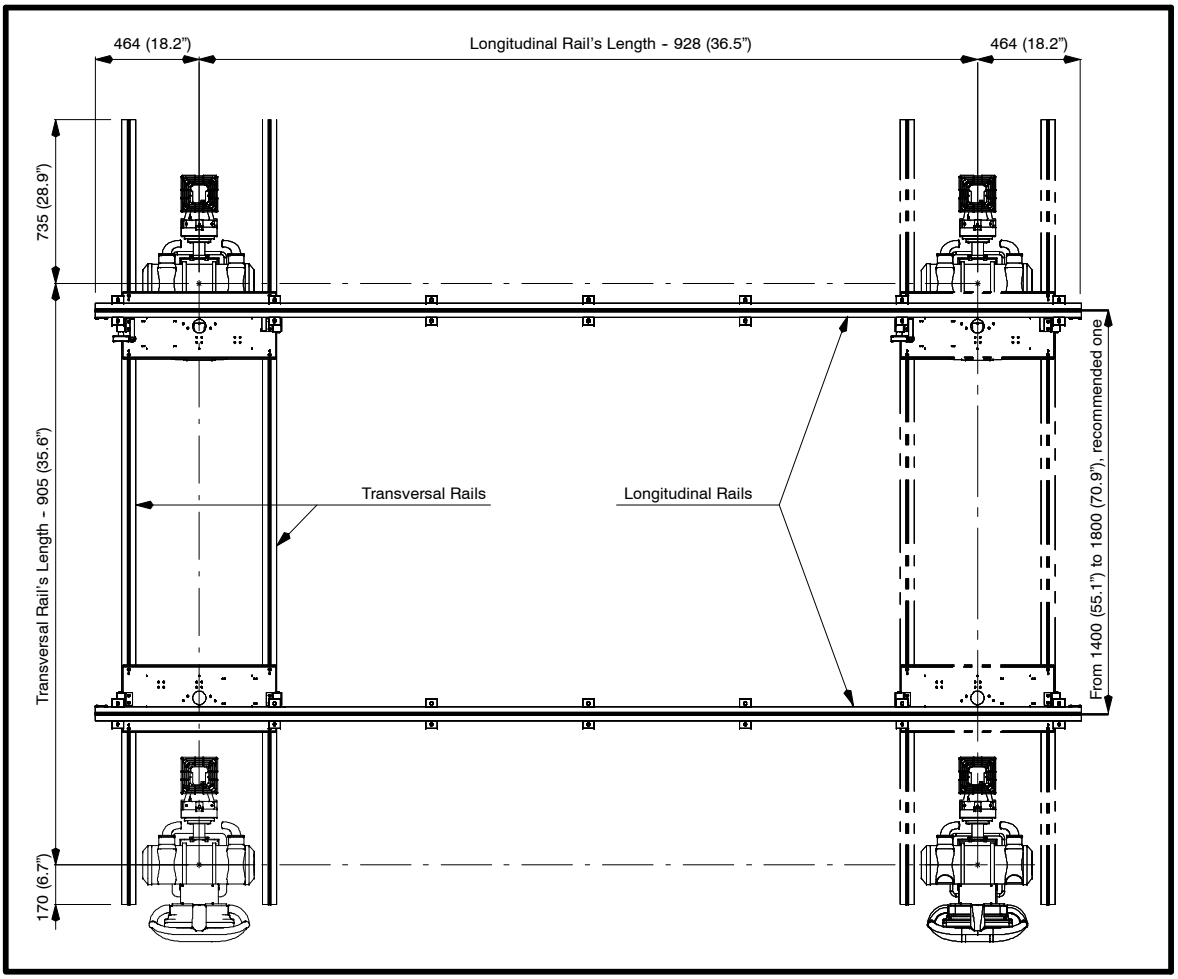


Illustration 9-4
Focal Spot Travel with the Control Console at 90º / -90º in Beta Axis

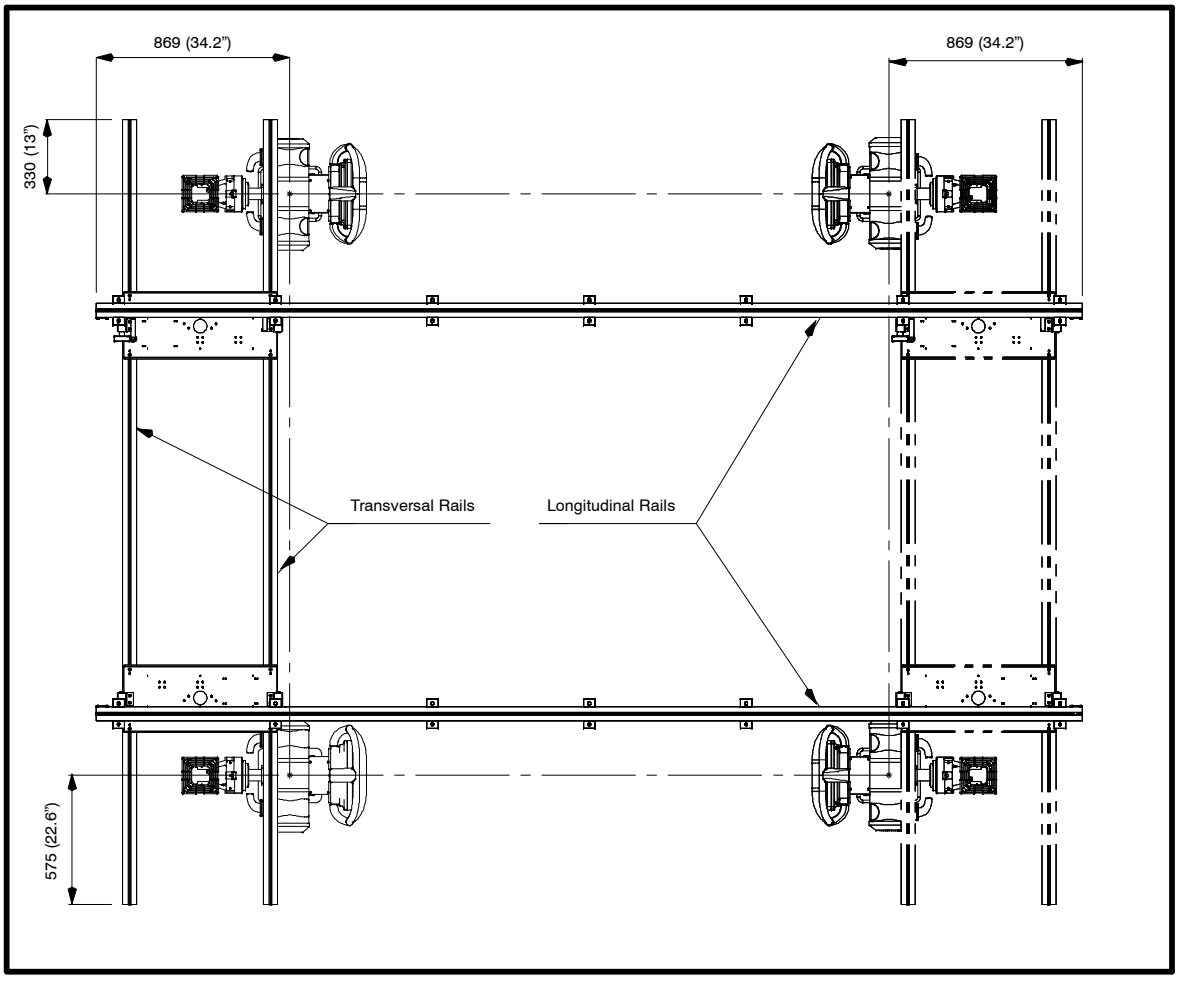
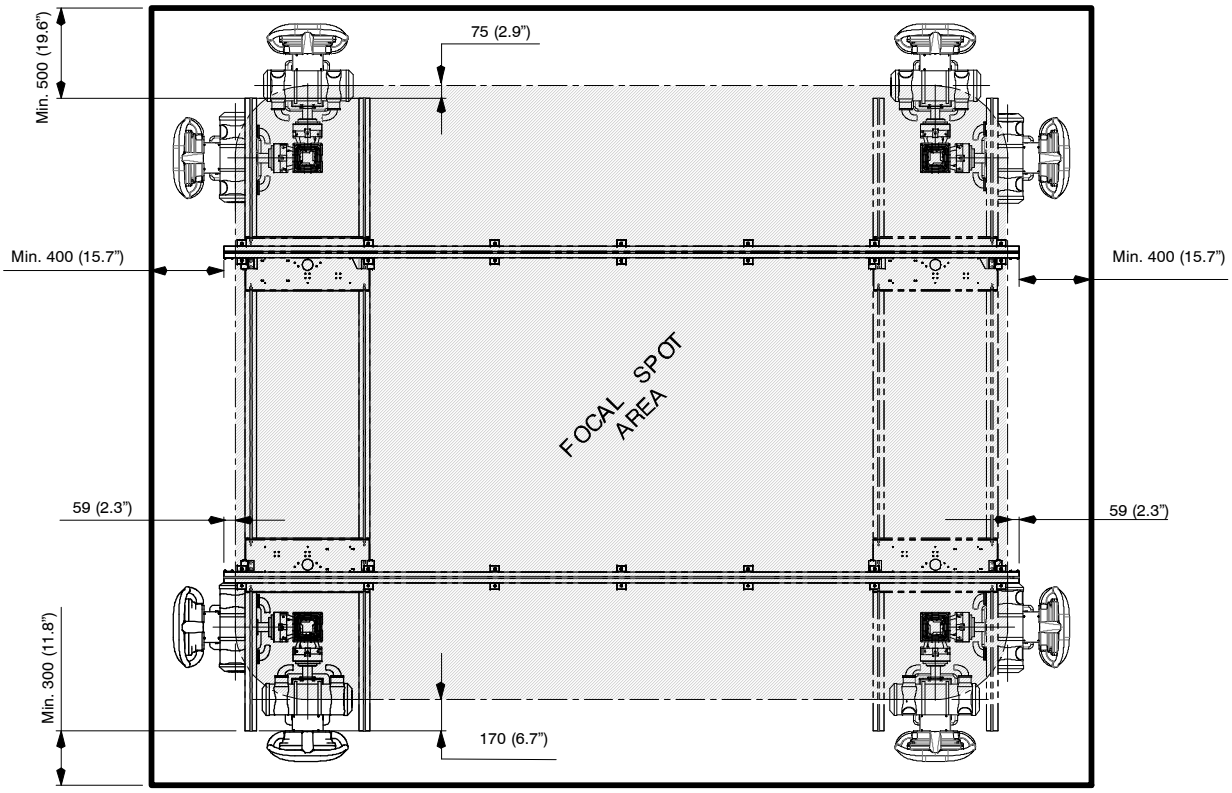


Illustration 9-5
Focal Spot Area



9.6 RAD TABLE SPECIFICATIONS

- Weight: . . . . . 290 Kg (639.3 lb)

Note ☞ *This weight is for a Table with default Digital Detector and standard Tabletop. Depending on the Detector and Receptor, total weight may change.*

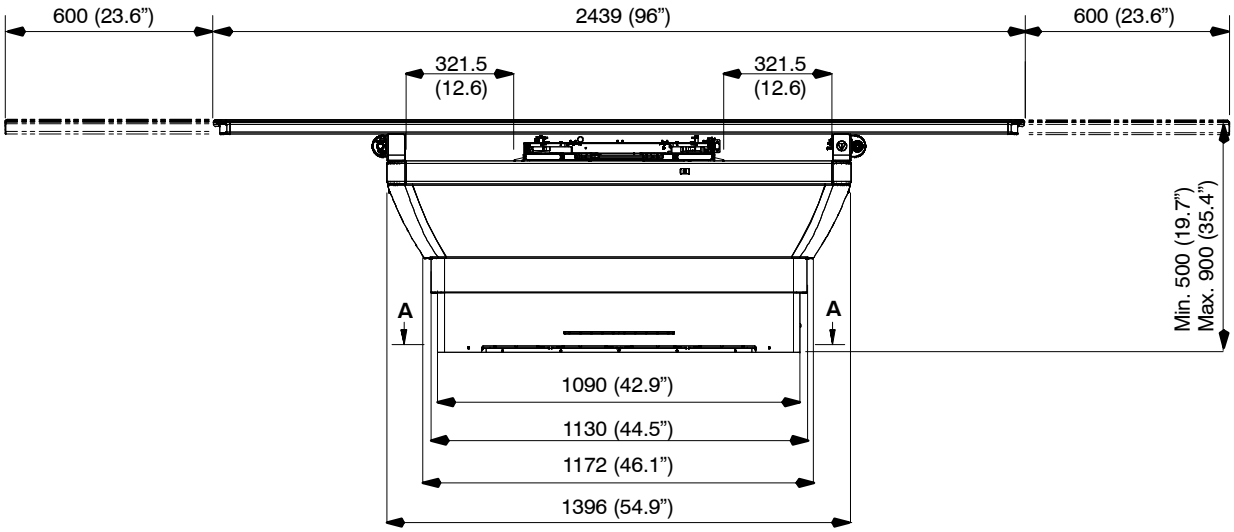
- Dimensions:
  - Length . . . . . 2400 mm (94.5”) 1.1.37
  - Width . . . . . 868 mm (34.2”) 1.1.38
  - Maximum Height . . . . . 900 mm (35.4”)
  - Minimum Height . . . . . 500 mm (19.7”)
- Tabletop maximum Load Allowed . . . . . 350 kg (771.6 lb) 1.1.40
- Extreme duty cycle (maximum load with a 350 kg patient):
  - Entrance and positioning of the patient on the Tabletop: 9 minutes.
  - Elevating movement of the Table: . . . . . 30 seconds.
  - X-ray exam: . . . . . 2 minutes.
  - Lowering movement of the Table: . . . . . 30 seconds.
  - Getting the patient off the Table and exiting the room: 5 minutes.

Note ☞ *The duty cycle with a maximum load of 350 kg on the Tabletop is limited to one radiographic examination every 17 minutes.*

- Tabletop Travels:
  - Longitudinal Travel . . . . . 1200 mm (47.2”)
  - Transversal Travel . . . . . 300 mm (11.8”)
  - Vertical Travel . . . . . 400 mm (15.7”)
- Tabletop Useful Area . . . . . 2299 mm (90.5”) x 618 mm (24.3”)
- Tabletop Attenuation:
  - Carbon Fiber Flat Tabletop . . . . . <0.8 mm eq. Al at 100kV
  - Laminated Flat Tabletop . . . . . <1.2 mm eq. Al at 100 kV

TABLE DRAWINGS

Illustration 9-6
RAD Table Dimensions



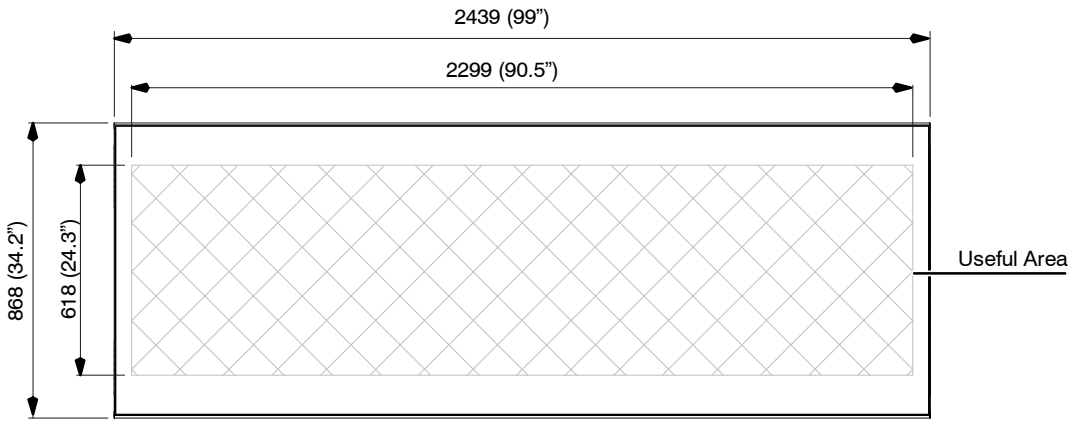


Illustration 9-7
Lateral View of the RAD Table

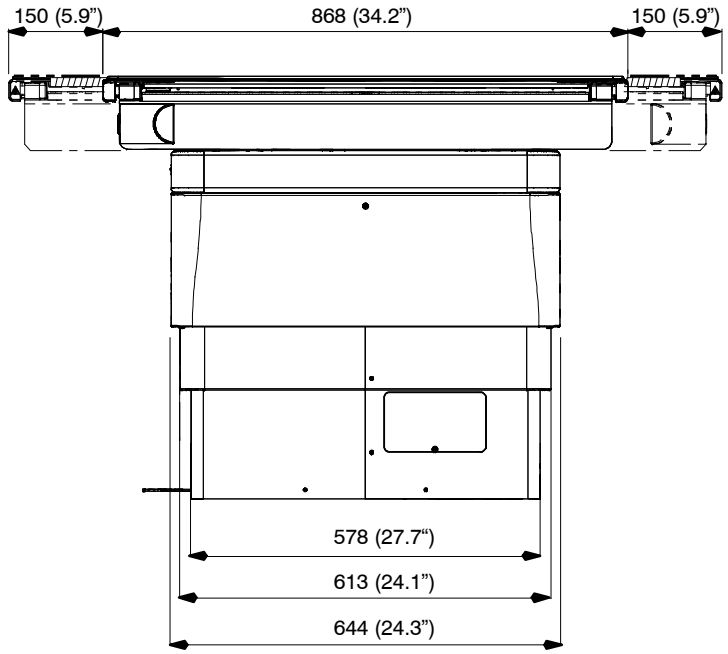


Illustration 9-8
Table Footprint and Anchor Bores Distances of the RAD Table

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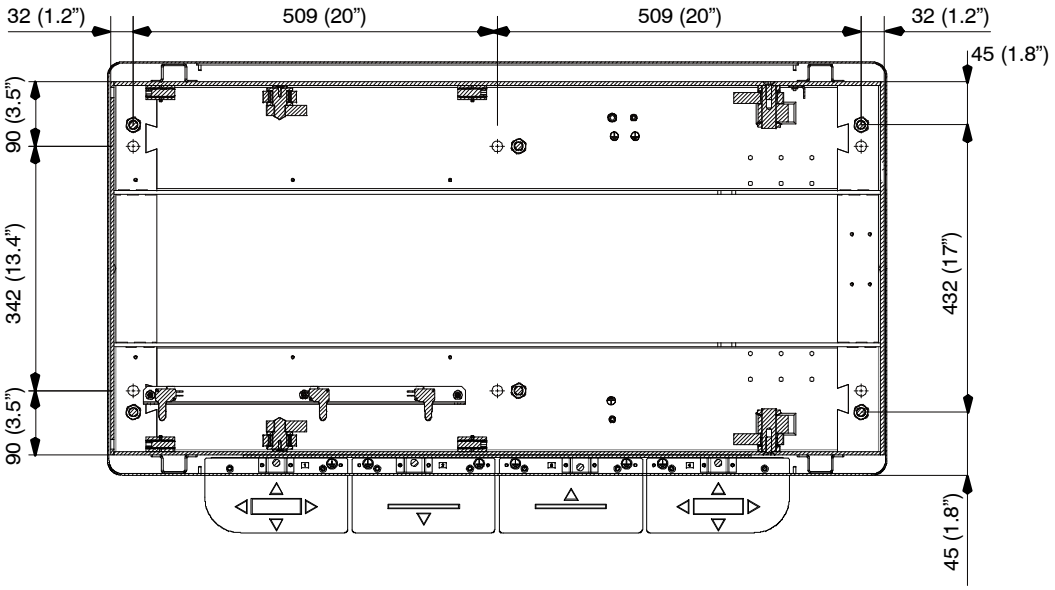


9.7 RAD WALL STAND

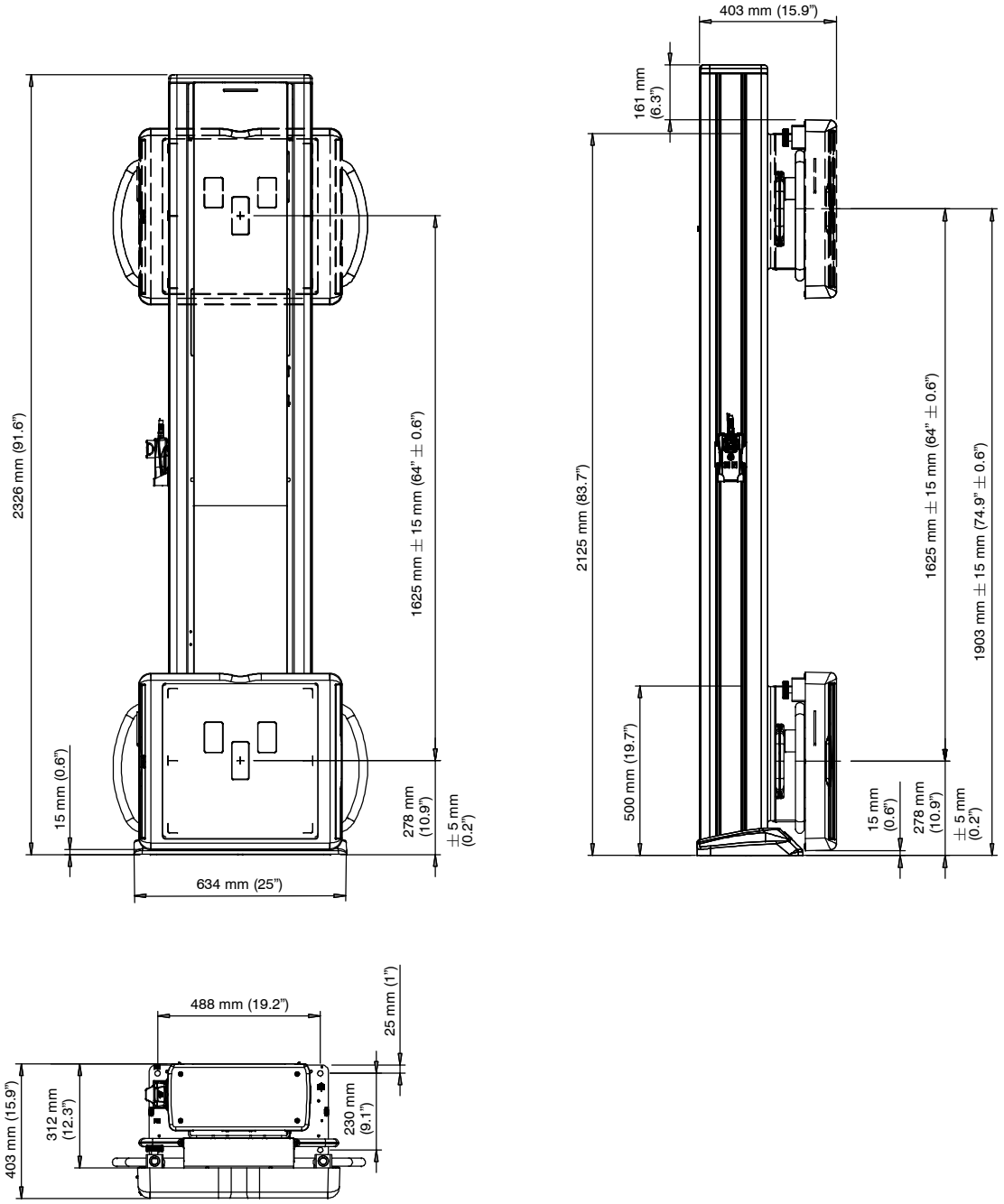
Table 9-3
Weights and Dimensions of the Equipment

CONFIGURATION	WALL STAND WITHOUT TILTING			WALL STAND WITH TILTING			WALL STAND WITH TILTING & ROTATION		
CABINET	Fixed Detectors	Portable Detectors	Portable Detectors with Rotating Tray	Fixed Detectors	Portable Detectors	Portable Detectors with Rotating Tray	Fixed Detectors	Portable Detectors	Portable Detectors with Rotating Tray
WIDTH	606 mm (23.9”)		657 mm (25.9”)	606 mm (23.9”)		657 mm (25.9”)	606 mm (23.9”)		657 mm (25.9”)
DEPTH (Receptor at 0º)	403 mm (15.9”)		449 mm (17.7”)	629 mm (24.8”)		674 mm (26.5”)	645 mm (25.4”)		690 mm (27.2”)
DEPTH (Receptor at 90º)	N/A			885 mm (34.8”)		951 mm (37.4”)	885 mm (34.8”)		951 mm (37.4”)
WEIGHT *	235 kg (518.1 lbs) ± 10 kg (22 lbs)			261 kg (575.4 lbs) ±10 kg (22 lbs)			270 kg (595.3 lbs) ± 10 kg (22 lbs)		
HEIGHT	2326 mm (91.6”)								
FRONT PANEL ATTENUATION	<0.4 mm eq. Al at 100 kV								

*** Note**: These weights do not include any Detector, Grid or the Overhead Arm Support. The margin of tolerance depends on the Cabinet model mounted on the Wall Stand.

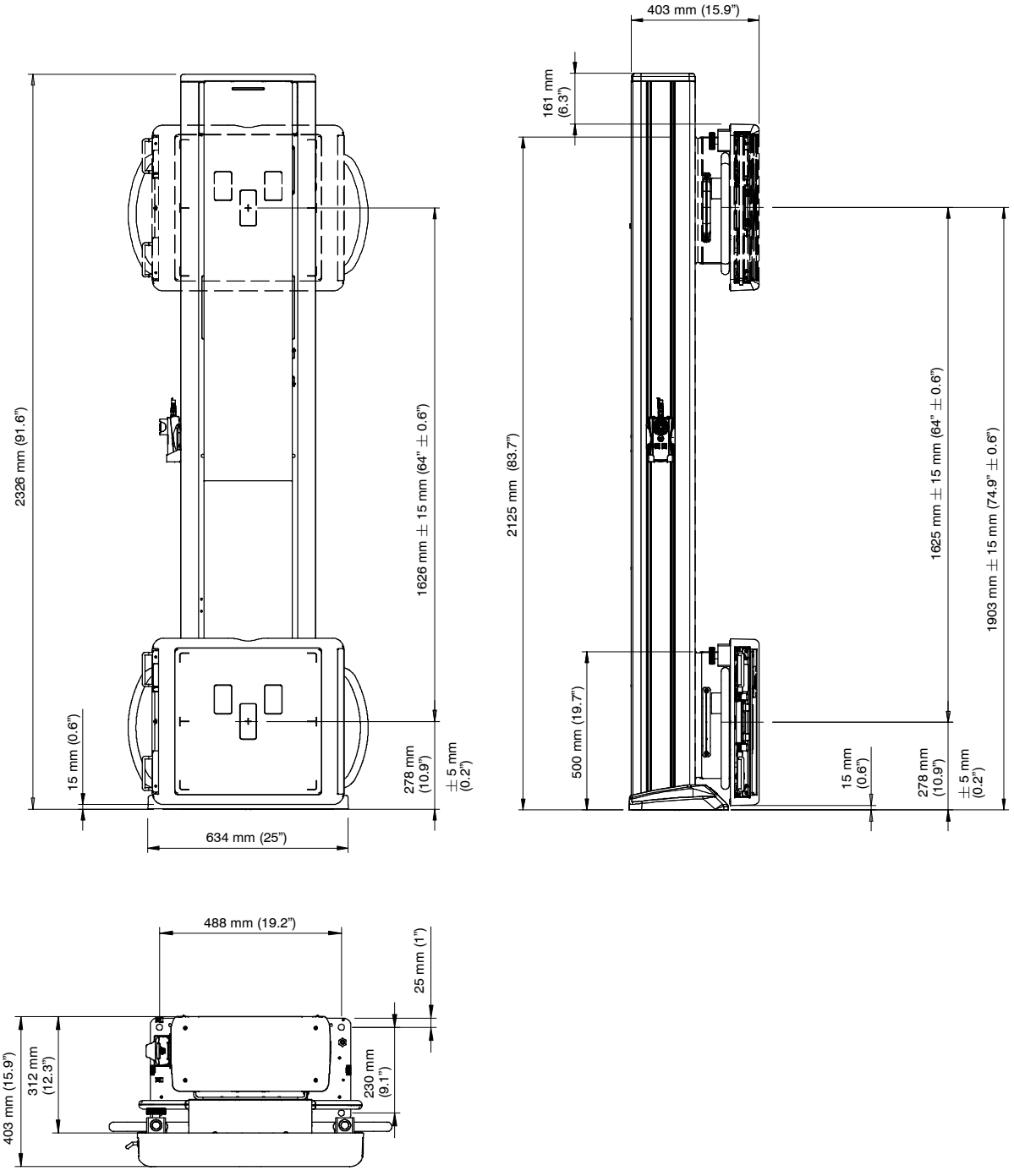
WALL STAND DRAWINGS

Illustration 9-9
Wall Stand Dimensions and Travels of the RAD Wall Stand Without Tilting (Cabinet for Fixed Detectors)



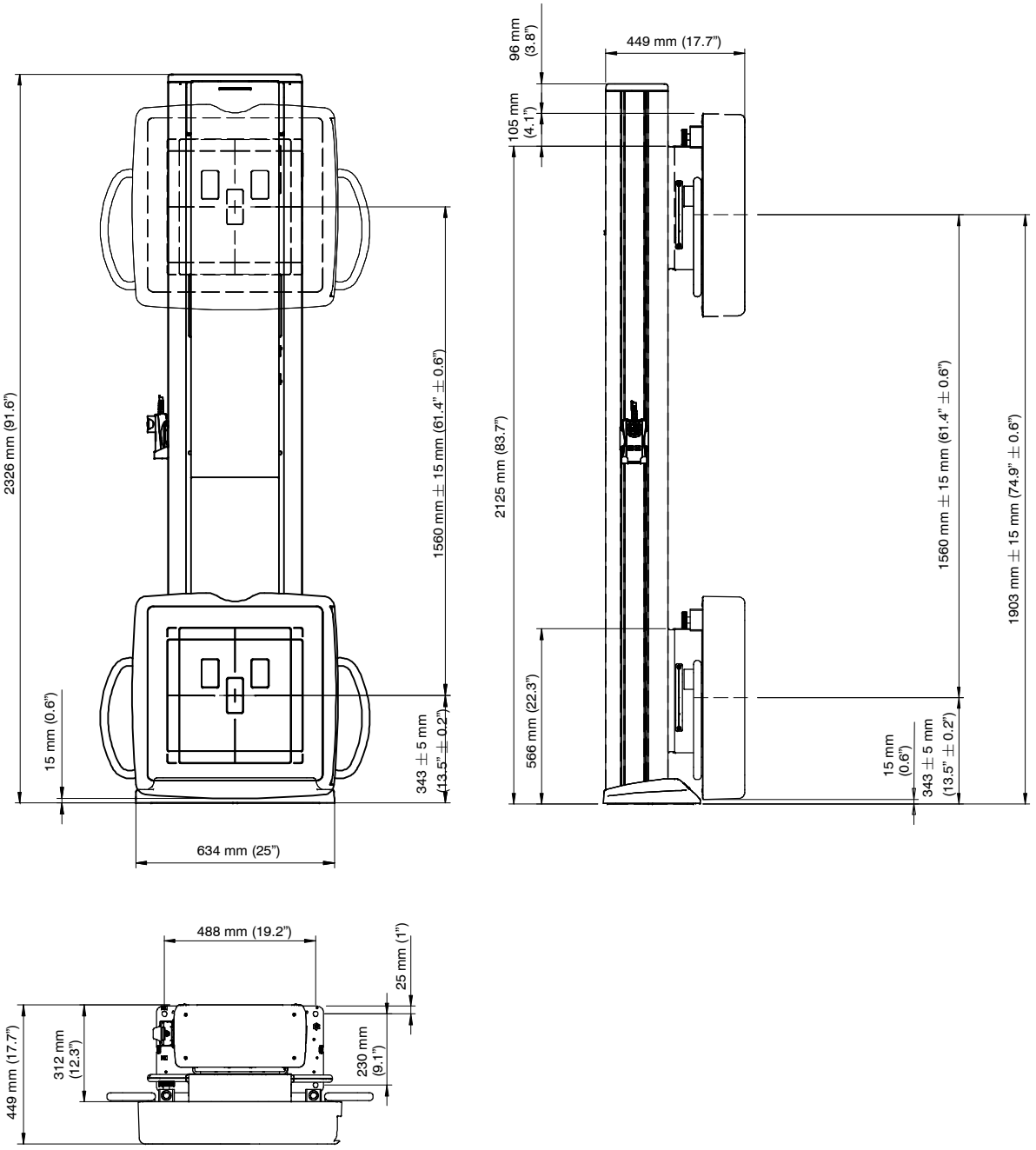
* NOTE *For further details about Cabinet and Detectors refer to Section 9.8 Detectors and Cabinets Specifications.*

Illustration 9-10
Wall Stand Dimensions and Travels of the RAD Wall Stand without Tilting (Cabinet for Portable Detectors)



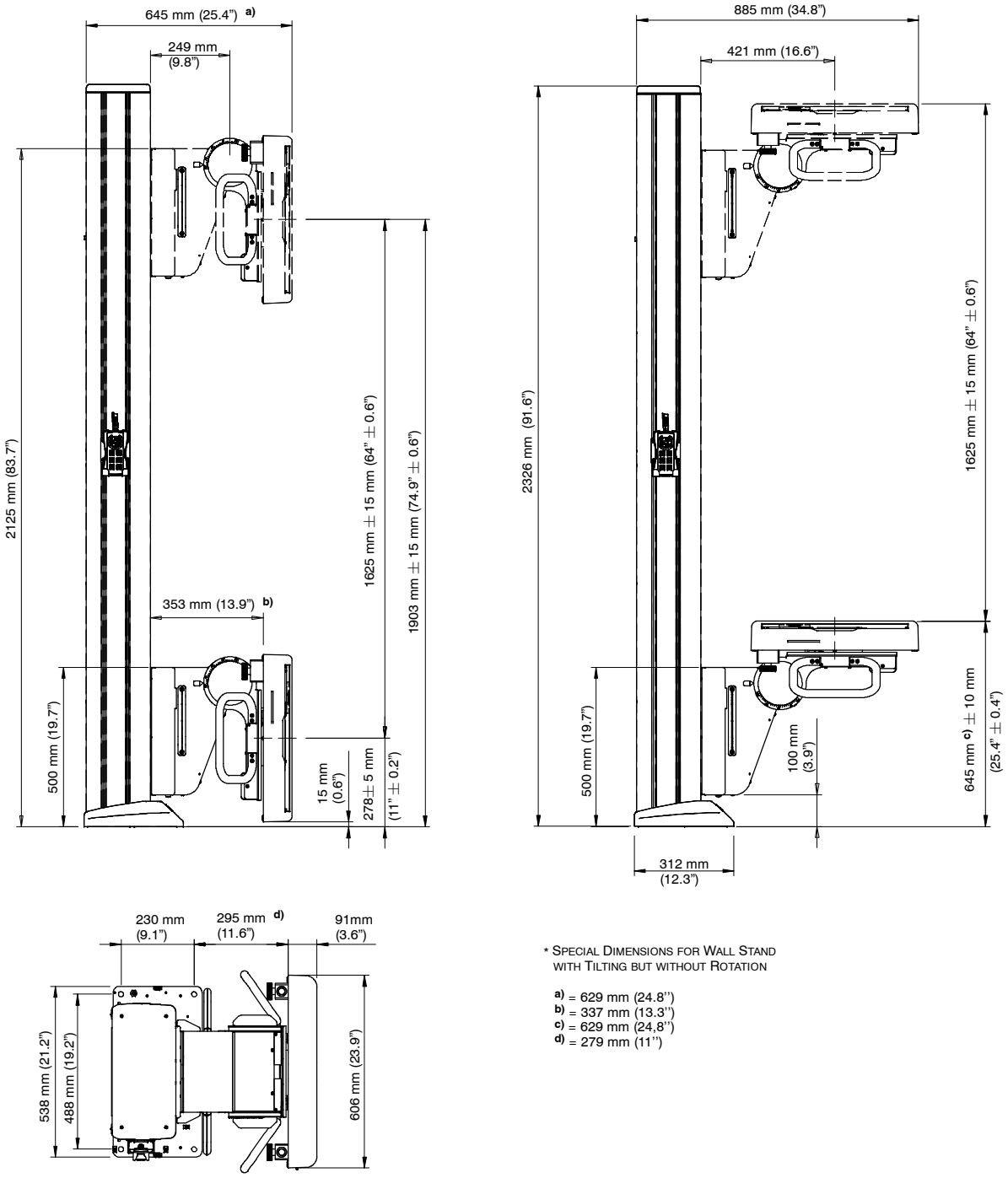
* NOTE *For further details about Cabinet and Detectors refer to Section 9.8 Detectors and Cabinets Specifications.*

Illustration 9-11
Wall Stand Dimensions and Travels of the RAD Wall Stand without Tilting (Cabinet for Portable Detectors with Rotating Tray)



* NOTE *For further details about Cabinet and Detectors refer to Section 9.8 Detectors and Cabinets Specifications.*

Illustration 9-12
Wall Stand Dimensions and Travels of the RAD Wall Stand with Tilting (Cabinet for Fixed Detectors)

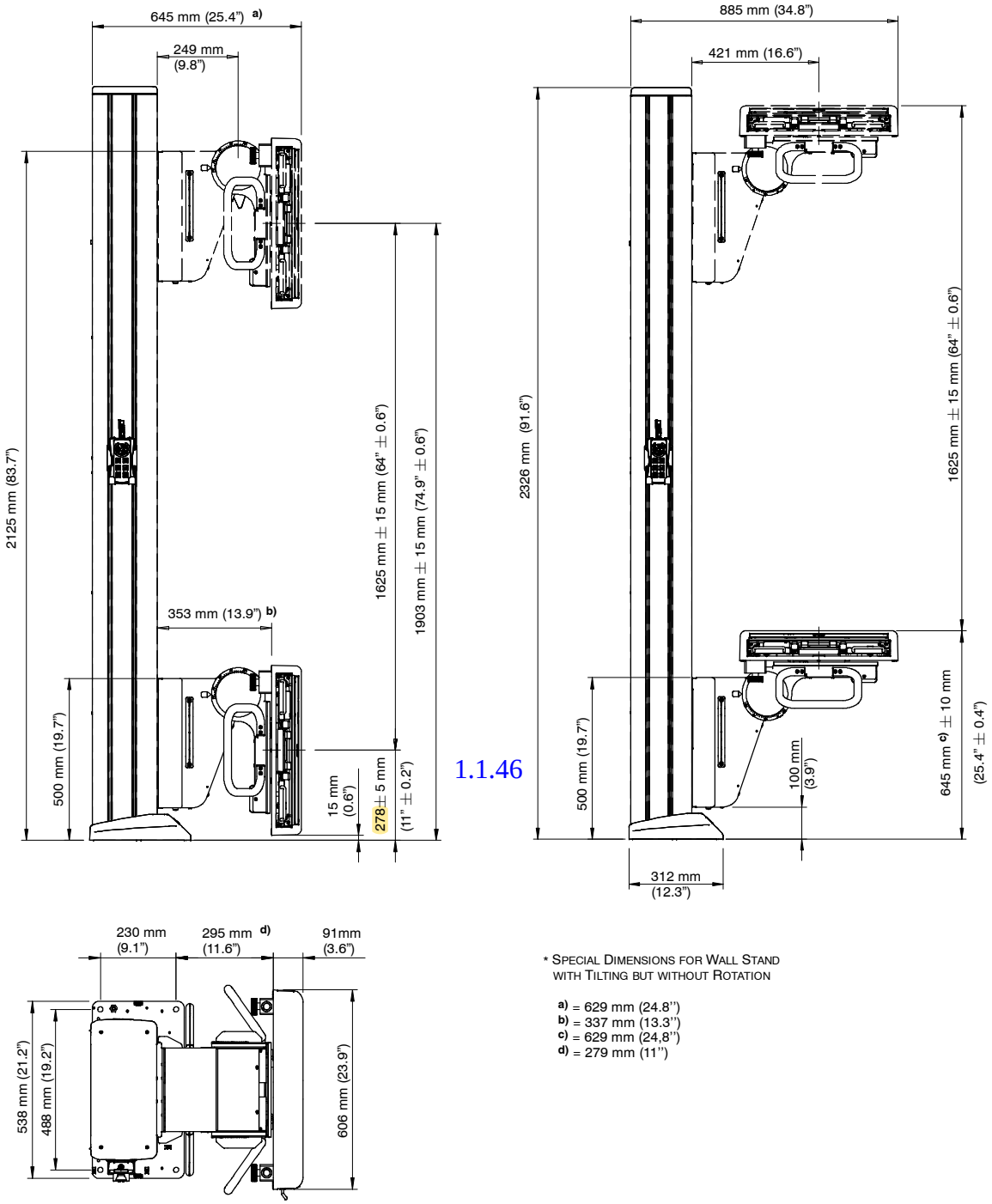


* Special Dimensions for Wall Stand with Tilting but without Rotation

a) = 629 mm (24.8'')
b) = 337 mm (13.3'')
c) = 629 mm (24,8'')
d) = 279 mm (11'')

* NOTE *For further details about Cabinet and Detectors refer to Section 9.8 Detectors and Cabinets Specifications.*

Illustration 9-13
Wall Stand Dimensions and Travels of the RAD Wall Stand with Tilting (Cabinet for Portable Detectors)

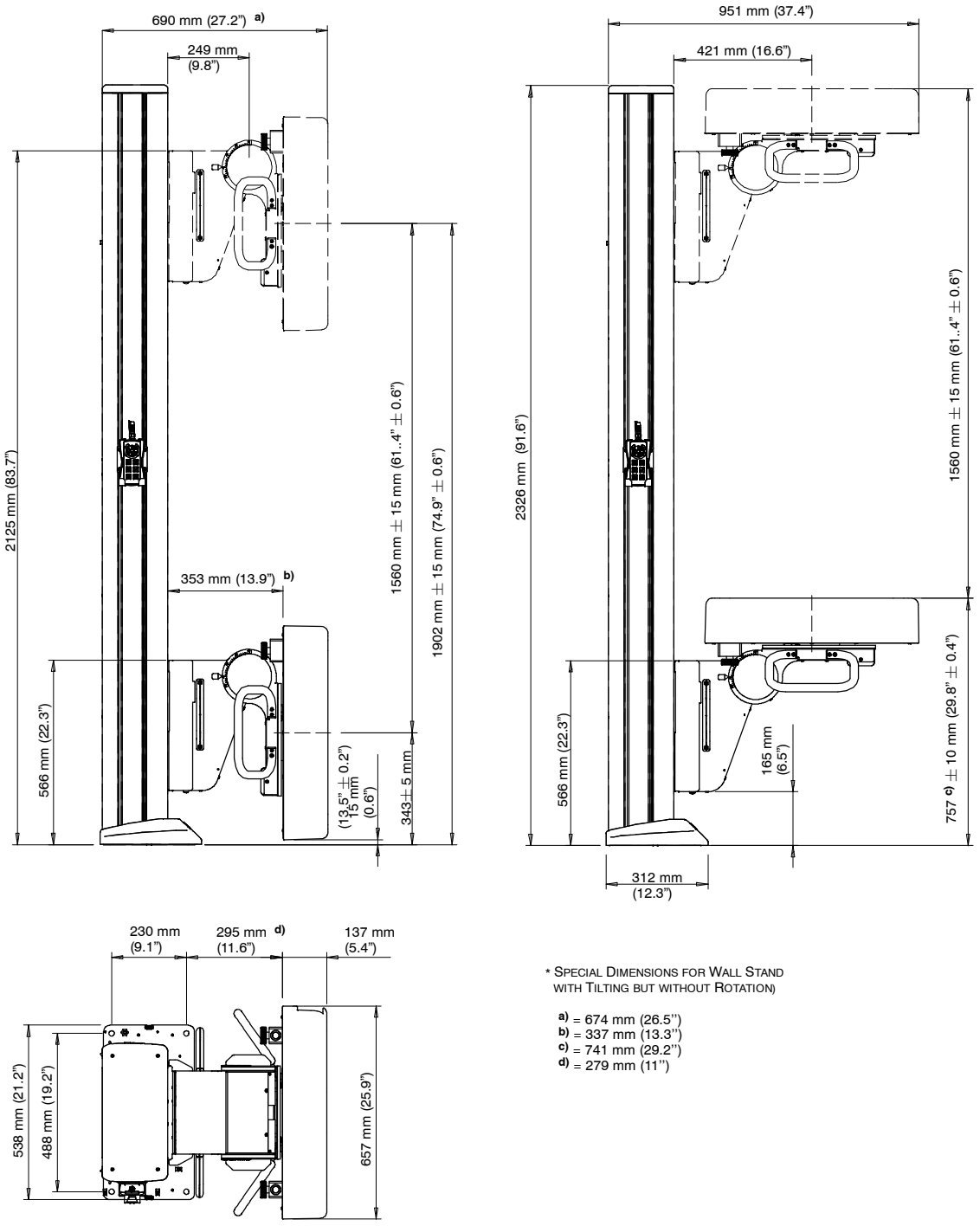


* Special Dimensions for Wall Stand with Tilting but without Rotation

a) = 629 mm (24.8")
b) = 337 mm (13.3")
c) = 629 mm (24,8")
d) = 279 mm (11")

* NOTE *For further details about Cabinet and Detectors refer to Section 9.8 Detectors and Cabinets Specifications.*

Illustration 9-14
Wall Stand Dimensions and Travels of the RAD Wall Stand with Tilting (Cabinet for Portable Detectors with Rotating Tray)



* Special Dimensions for Wall Stand with Tilting but without Rotation)

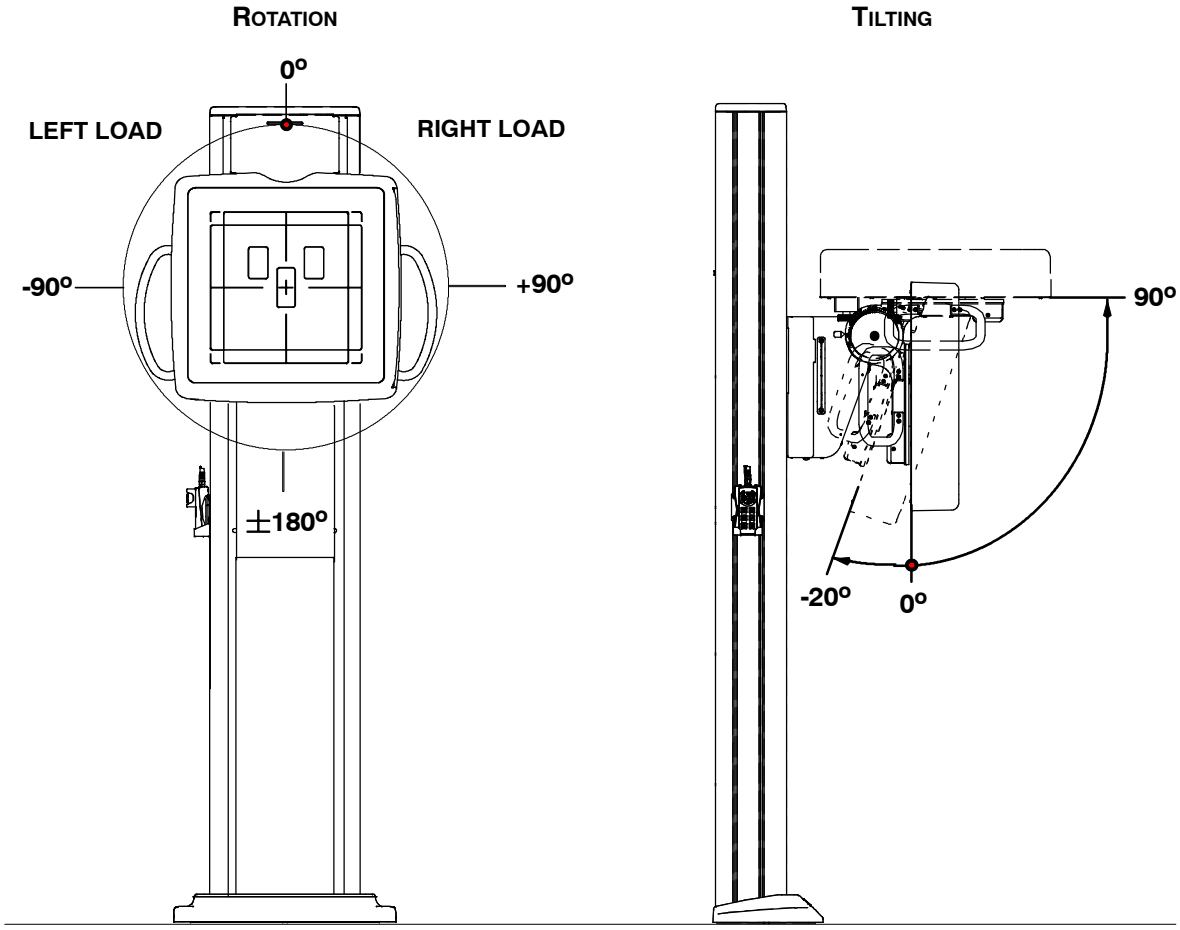
a) = 674 mm (26.5")
b) = 337 mm (13.3")
c) = 741 mm (29.2")
d) = 279 mm (11")

* NOTE *For further details about Cabinet and Detectors refer to Section 9.8 Detectors and Cabinets Specifications.*

Table 9-4
Rotation Configuration

Rotation Configuration		
Receptor	**Left Configuration**	**Right Configuration**
Portable DR Detector	0º — -90º	0º – +90º
Fixed DR Detector	0º — +90º	N/A

Illustration 9-15
Wall Stand Rotation and Tilting specifications (Only for models with these functionalities)



9.8 DETECTORS & CABINETS SPECIFICATIONS

Table 9-5
Digital Detectors List for RAD Table and RAD Wall Stand

RECEPTOR	TYPE	MEASURES (WxLxH)	WEIGHT
CXDI-401 COMPACT	Fixed Wired Detector	460 x 460 x 15 mm (18 x 18 x 0.6 in)	7 kg (15.4 lb)
CXDI-401	Portable Wireless Detector	460 x 460 x 15.9 mm (18 x 18 x 0.6 in)	3.8 kg (8.4 lb)
CXDI-402	Portable Wireless Detector	460 x 460 x 15.7 mm (18 x 18 x 0.6 in)	3.7 kg (8.2 lb)
CXDI-410	Portable Wireless Detector	460 x 460 x 15.7 mm (18 x 18 x 0.6 in)	2.8 kg (6.2 lb)
CXDI-701	Portable Wireless Detector	384 x 460 x 15.7 mm (15.1 x 18 x 0.6 in)	3.3 kg (7.3 lb)
CXDI-702	Portable Wireless Detector	384 x 460 x 15.7 mm (15.1 x 18 x 0.6 in)	3.1 kg (6.8 lb)
CXDI-710	Portable Wireless Detector	384 x 460 x 15.7 mm (15.1 x 18 x 0.6 in)	2.3 kg (5.1lb)
CXDI-801	Direct Wireless	384 x 307 x 15.7 mm (15.1 x 12.1 x 0.6 in)	2.3 kg (5.1lb)
CXDI-810	Direct Wireless	384 x 307 x 15.7 mm (15.1 x 12.1 x 0.6 in)	1.8 kg (4 lb)

Illustration 9-16
Cabinet Specifications in RAD Wall Stands

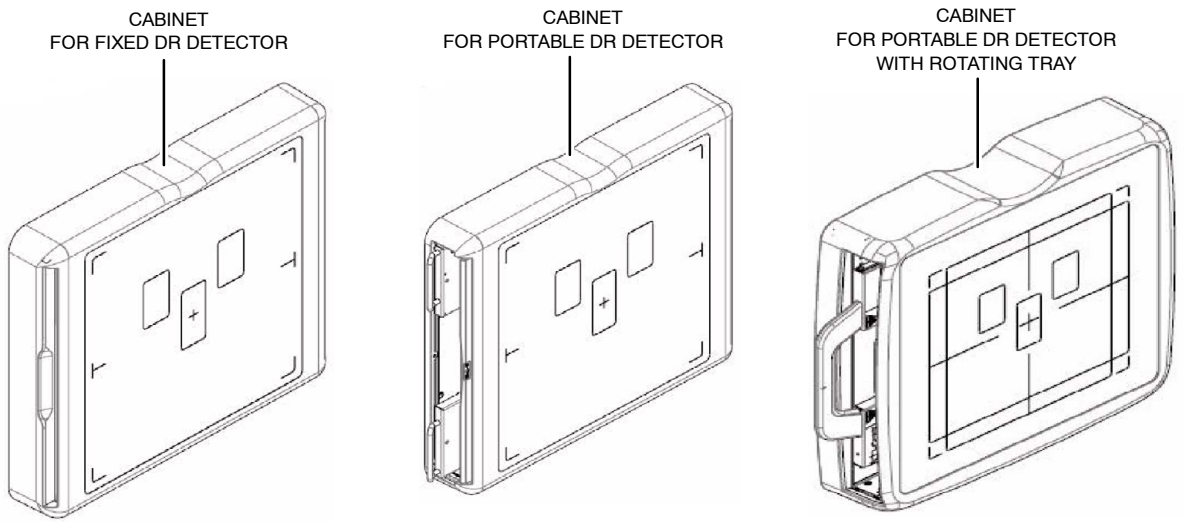


Table 9-6
Cabinet Dimensions and Front Panel to Receptor Distances

CABINET	EXTERNAL DIMENSIONS			WS GEOMETRY			
	A	B	C	D	E	Xd	Yd
For Fixed DR Detectors (*)	607 (23.9”)	526 (20.7”)	91 (3.6”)	0.0	**33 (1.3”)**	146 (5.7”)	255 (10”)
For Portable DR Detectors					**37 (1.5”)**	143 (5.6”)	255 (10”) (**)
For Portable DR Detectors with Rotating Tray	657 (25.9”)	655 (25.8”)	136 (5.3”)		**37 (1.5”)**	186 (7.3”)	178 (7”)

(*) For Canon 401 Compact Detector.
(**) Only for Detectors at its central position.

Illustration 9-17
Cabinet External Dimensions in RAD Wall Stands

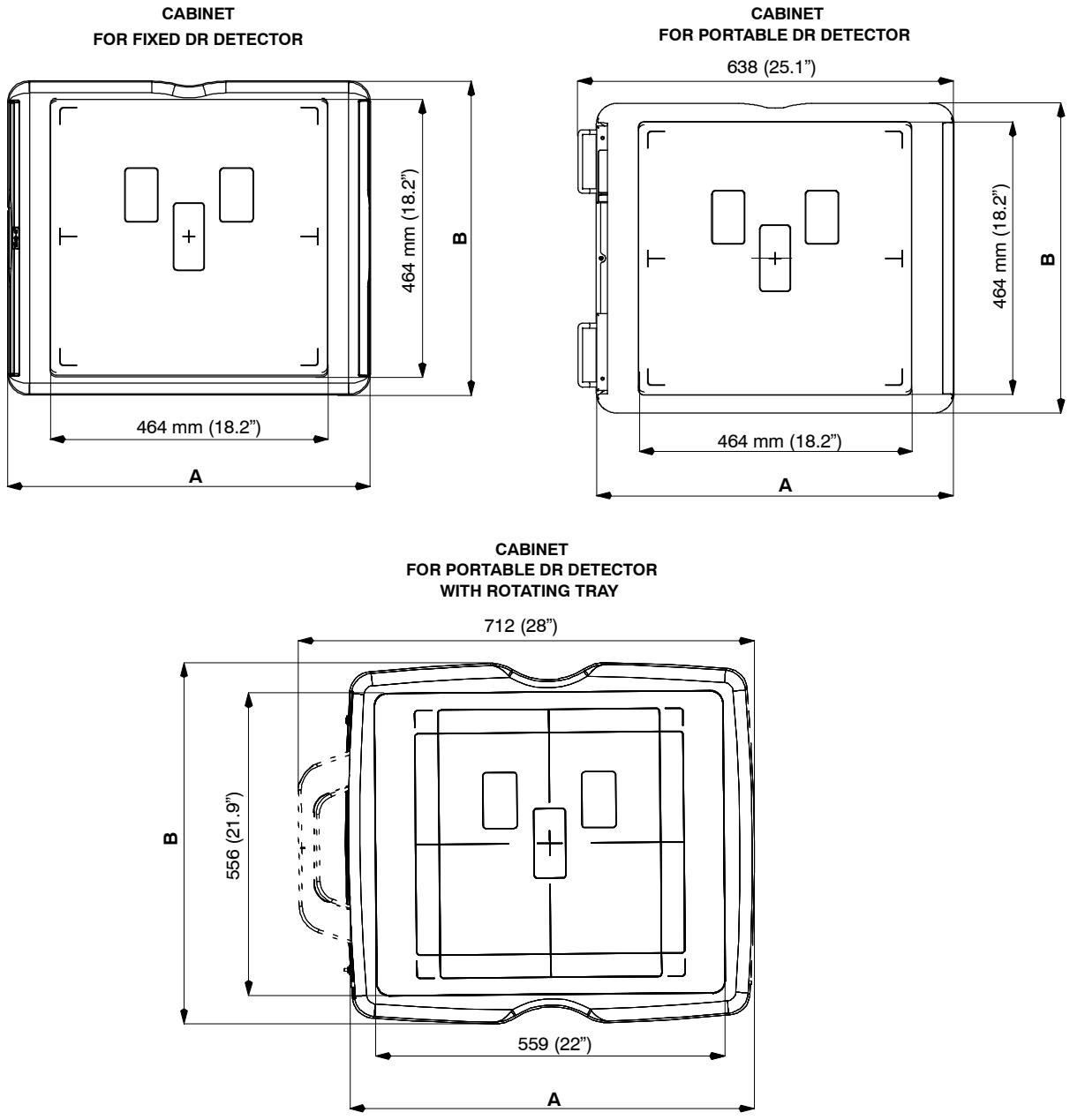


Illustration 9-18
Cabinet Distances and Geometry in RAD Wall Stands with Tilting

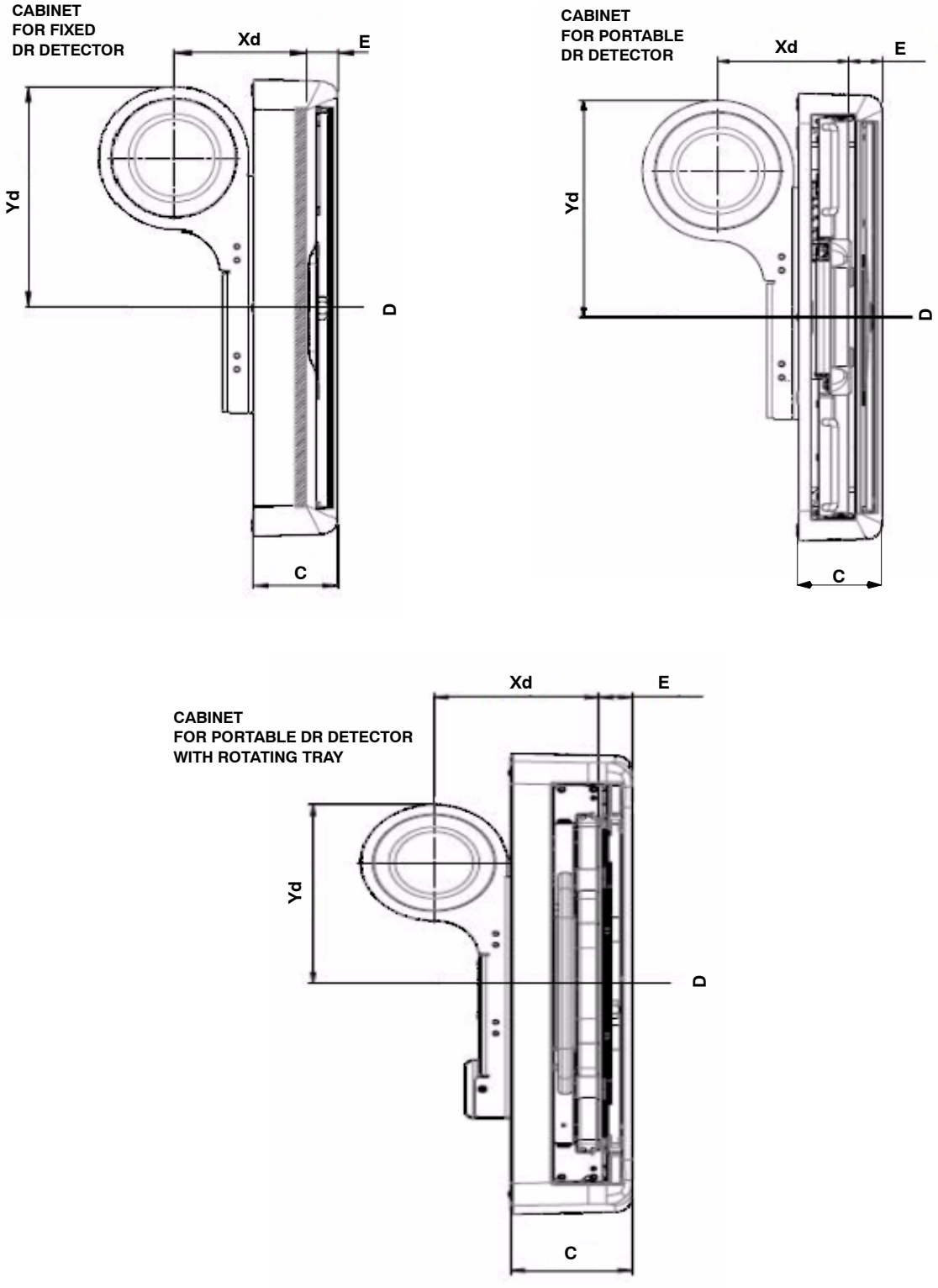
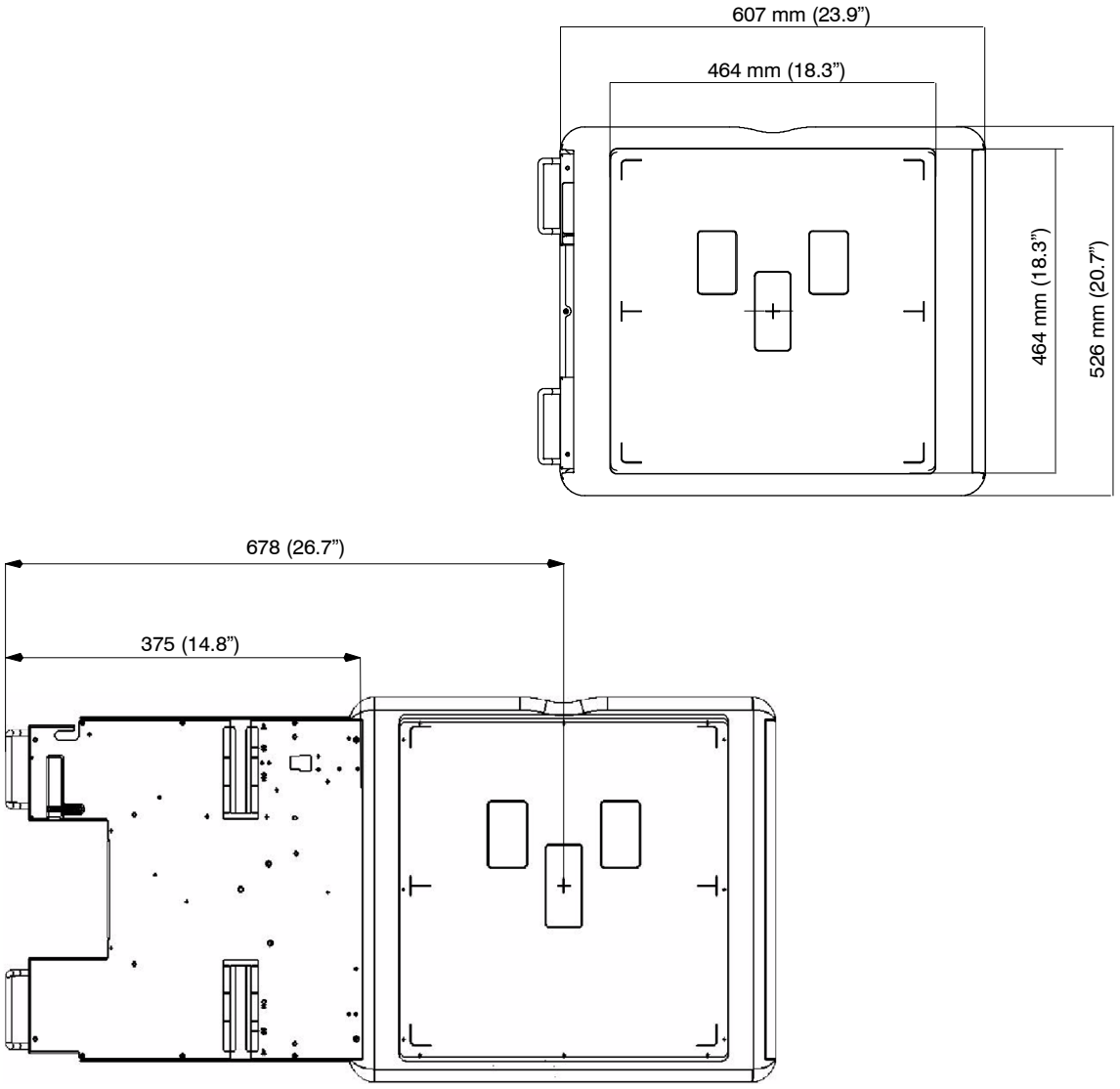
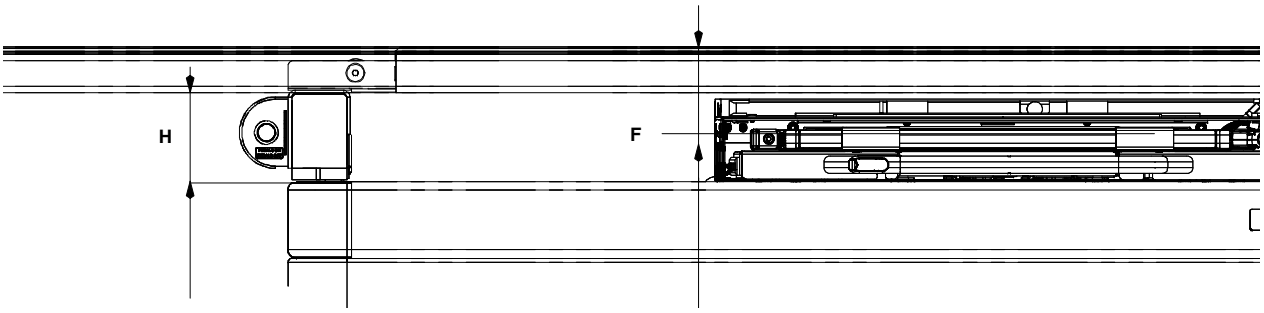


Illustration 9-19
Cabinet for Portable Detectors Dimensions and Tray Travel



Note ☞ *Same travel specification is valid for both load configurations, right or left.*

Illustration 9-20
Cabinets Specifications in RAD Tables



RECEPTOR CABINET	H (Tabletop Support Height)	F (Tabletop-Film Distance)
For Fixed Detectors	73 (2.9")	69 (2.7")
		72 (2.8")
For Portable Detectors	70 (2.8")	78 (3.1")
For Portable Detectors with Rotating Tray		75 (3")

9.8.1 GRIDS

RAD Table . . . . . 100 cm - 10:1 - 40Lp/cm (Carbon Fiber)

RAD Wall Stand . . . . . 100 cm - 10:1 - 40Lp/cm (Carbon Fiber)
150 cm - 10:1 - 40Lp/cm (Carbon Fiber)
180 cm - 12:1 - 40Lp/cm (Carbon Fiber)

APPENDIX A GUIDELINES FOR PEDIATRIC APPLICATIONS

THE PRACTITIONER WILL BE THE ULTIMATE RESPONSIBLE OF APPLYING THE PROPER DOSE TO THE PATIENT FOR RADIOGRAPHIC PROCEDURES. THE PURPOSE OF THESE GUIDELINES IS TO HELP THE PRACTITIONER TO MINIMIZE POTENTIAL RISKS.

Use special care when imaging patients outside the typical adult size range.

Children are more radiosensitive than adults. Adopting the Image Gently campaign guidelines and reducing dose for radiographic procedures while maintaining acceptable clinical image quality will benefit patients.

Please review the following link and reduce pediatric technique factors accordingly: *http://www.pedrad.org/associations/5364/ig/*

As a general rule, next recommendations shall be observed in pediatrics:

- X-Ray Generator must have short exposures times.
- AEC must be used carefully, preferably use manual technique setting, applying lower doses.
- If possible, use high kVp techniques.
- As the use of Grids require higher doses, **never use Grids in pediatric exams**. Remove the Grid from the receptor assembly and select the lower possible doses. If the Grid can not be detached, pediatric exams can not be performed using this device.

Positioning the pediatric patient:

Pediatric patients are not as likely as adults to understand the need to remain still during the procedure. Therefore it makes sense to provide aids to maintaining stable positioning. It is strongly recommended the use **of immobilizing devices** such as bean bags and restraint systems (foam wedges, adhesive tapes, etc.) to avoid the need of repeating exposures due to the movement of the pediatric patients. Whenever possible use techniques based on the lowest exposure times.

Shielding:

We recommend you provide extra **shielding of radiosensitive organs or tissues such as eyes, gonads and thyroid glands.** Applying a correct collimation will help to protect the patient against excessive radiation as well. Please review the following scientific literature regarding pediatric radiosensitivity: *GROSSMAN, Herman. "Radiation Protection in Diagnostic Radiography of Children". Pediatric Radiology, Vol. 51, (No. 1): 141-144, January, 1973: http:///pediatrics.aappublications.org/cgi/reprint/51/1/141*.

Technique factors:

You should take steps to reduce technique factors to the lowest possible levels consistent with good image acquisition.

For example if your adult abdomen settings are: 70-85 kVp, 200-400 mA, 15-80 mAs, consider starting at 65-75 kVp, 100-160 mA, 2.5-10 mAs for a pediatric patient. Whenever possible use high kVp techniques and large SID (Source Image Distance).

Summary:

- Image only when there is a clear medical benefit.
- Image only the indicated area.
- Use the lowest amount of radiation for adequate imaging based on size of the child (reducing tube output - kVp and mAs).
- Try to use always short exposure times, large SID values and immobilizing devices.
- Avoid multiple scans and use alternative diagnostic studies (such as ultrasound or MRI) when possible.

APPENDIX B TECHNIQUE FACTORS GUIDELINES

The effective dose quantifies the radiation risk to a patient undergoing any diagnostic X-ray examination. Benefits of the effective dose include the ease of comparing doses associated with diverse types of radiographic examination, as well as the ability to compare patient doses with natural background and regulatory dose limits.

The following table shows a sample of Technique Chart with effective doses to patients ranging from newborns to adults were determined for representative X-ray examinations of major body regions.

The values indicated in each cell correspond to the radiographic parameters (kVp / mAs), the X-ray beam cross-sectional area and the estimated patient thickness of the body region.

SAMPLE TECHNIQUE CHART

Age	Head	Chest	Abdomen	Extremity (Forearm)
Newborn *(A)*	67 kVp / 2.0 mAs (110 cm^2 / 9.0 cm)	60 kVp / 2.0 mAs (140 cm^2 / 8.0 cm)	66 kVp / 2.0 mAs (200 cm^2 / 10 cm)	N/A
1-year-old *(A)*	72 kVp / 2.0 mAs (160 cm^2 / 12 cm)	66 kVp / 2.0 mAs (250 cm^2 / 9.0 cm)	70 kVp / 4.0 mAs (300 cm^2 / 13 cm)	56 kVp / 5.0 mAs (35 cm^2 / 1.8 cm)
5-year-old *(A)*	75 kVp / 2.0 mAs (210 cm^2 / 14 cm)	70 kVp / 2.0 mAs (430 cm^2 / 10 cm)	72 kVp / 5.0 mAs (540 cm^2 / 15 cm)	60 kVp / 5.0 mAs (84 cm^2 / 3.3 cm)
10-year-old *(A)*	77 kVp / 2.0 mAs (240 cm^2 / 15 cm)	74 kVp / 3.0 mAs (670 cm^2 / 13 cm)	75 kVp / 6.0 mAs (820 cm^2 / 17 cm)	62 kVp / 6.0 mAs (140 cm^2 / 5.0 cm)
15-year-old *(A)*	79 kVp / 2.0 mAs (270 cm^2 / 16 cm)	78 kVp / 4.0 mAs (780 cm^2 / 14 cm)	78 kVp / 7.0 mAs (900 cm^2 / 20 cm)	65 kVp / 6.0 mAs (200 cm^2 / 6.2 cm)
Adult *(B)*	**75 kVp / 15 mAs (320 cm^2 / 20 cm)**	**120 kVp / 2.0 mAs (1300 cm^2 / 15 cm)**	**75 kVp / 15 mAs (1200 cm^2 / 22 cm)**	**65 kVp / 8.0 mAs (200 cm^2 / 7.9 cm)**

(A) Note: No Grid is used in radiographic operations for pediatric procedures.

(B) Note: (Bariatric Patients) Higher radiation doses are needed to X-ray obese patients. Use a Grid and increase the kVp and mAs.

WARNING

TECHNICAL PARAMETERS OF THIS TABLE ARE ONLY INTENDED AS A GUIDELINE. REFER TO THE IMAGE ACQUISITION SOFTWARE MANUALS TO REVIEW THE PREPROGRAMMED TECHNIQUE FACTORS.

WARNING

IT IS OPERATOR'S RESPONSIBILITY TO USE AN APPROPRIATE PREPROGRAMMED TECHNIQUE FACTORS IN ORDER TO AVOID OVEREXPOSURE OF PATIENTS OR PERSONNEL TO X-RAY RADIATION GENERATED BY THIS EQUIPMENT AS A RESULT OF POOR OPERATING TECHNIQUES OR PROCEDURES.

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APPENDIX C PROTECT YOUR IMAGING SYSTEM FROM CYBERSECURITY THREATS

Because Digital Radiography Systems may be connected by Wi-Fi or Ethernet to the Host Computer containing the Software, and the Host Computer may in turn be connected to the hospital information system, and ultimately the Internet, cybersecurity may become an issue for you. Here are some tips to keep your system and your medical images secure.

The medical devices security is a shared responsibility between manufacturer and responsible organization.

Use only materials supplied by Official Support/Technical Service for your Image Management software updates.

REQUIRED STRATEGIES BY THE OWNER / OPERATOR

Antivirus protection:

Use antivirus programs such as:

- Total AV
- ScanGuard Security Suite
- Norton by Symantec
- PC Protect
- Mcafee Antivirus Plus.
- Microsoft Security Essentials.
- Microsoft Windows Defender.

Keep these products up to date.

Limit access to trusted users only:

Limit access to devices through the authentication of users (e.g. user ID and password or smart card).

Ensure trusted content:

Restrict software or firmware updates to authenticated code.

Detect, respond, recover:

- Watch for on-screen warnings of possible virus infections.
- Respond by scanning for and removing possible virus infections.
- Recover from possible virus infections by having up to date backups of your host computer.

REQUIRED STRATEGIES BY THE MEDICAL DEVICE MANUFACTURER / SOFTWARE MANUFACTURER

We affirm our commitment to providing you with validated software updates and patches as needed throughout the life cycle of the medical device to continue to assure its continued safety and effectiveness.

Please promptly apply software updates and patches provided by us and never use image management software supplied by anyone else. Our development process utilizes the CISCO AMP protection. We are constantly scanning our development computers for malware. We hope you are doing the same.

A summary of our integrity controls:

- Our development computers are constantly being scanned for malware, and our supplier for anti-virus software automatically updates the software continuously as new threats are revealed.
- We perform daily backups to our external hard drives. The backups are in other place.
- During software development we disconnect from the Internet to prevent external attacks.
- Our development process utilizes the CISCO AMP protection.
- Copies of software updates we will be sending you are individually scanned for malware.

CONCLUSION

It is our JOINT responsibility to ensure your medical image software and image collection is safe and secure. We must both do our parts.

APPENDIX D RAD SCREEN IN CXDI NE SOFTWARE

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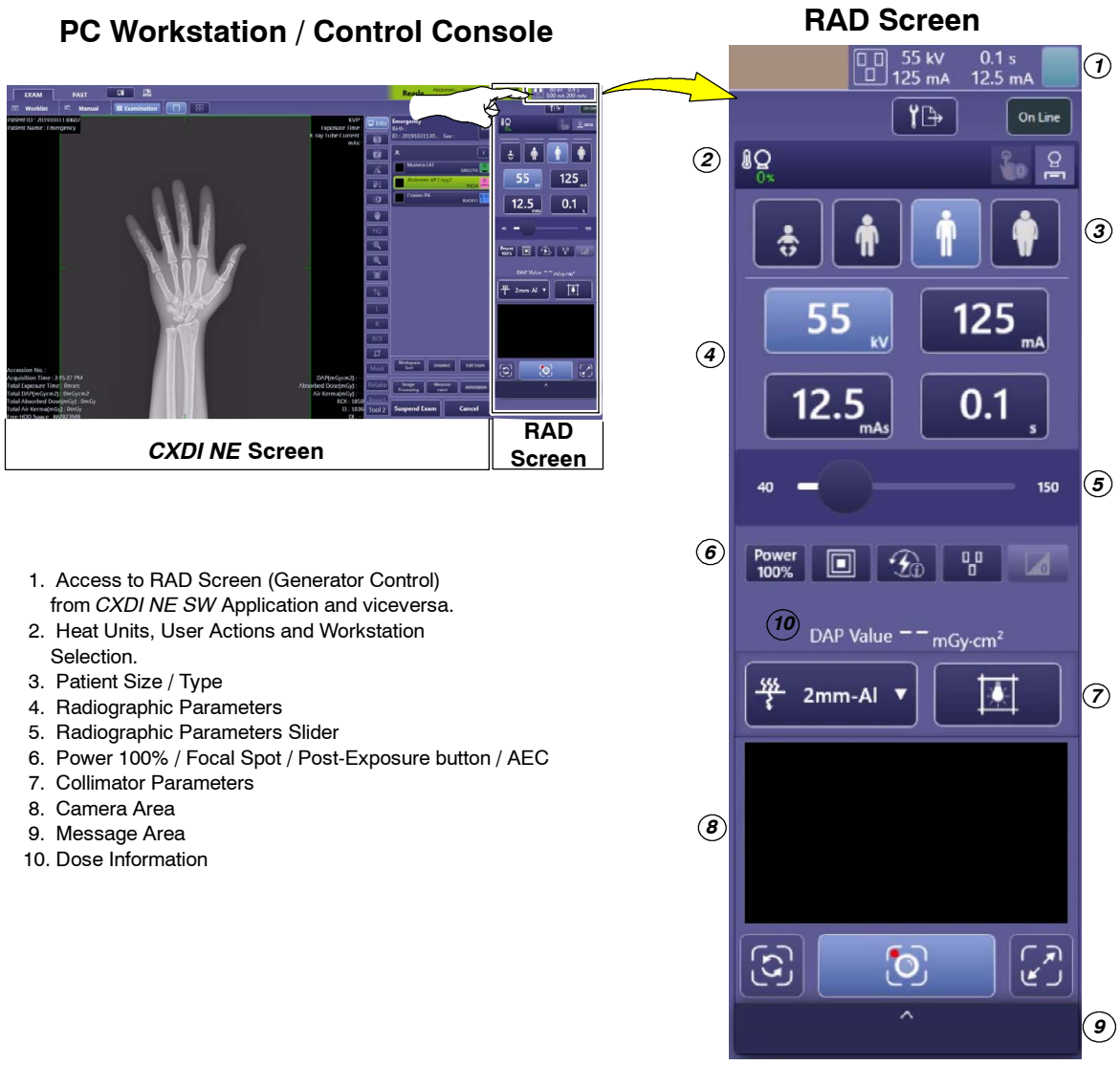
D.1 INTRODUCTION

All controls, indicators and displays located on the Control Console of the Canon CXDI NE application are positioned depending upon their functions.

Note ☞ *Use the operating controls as described in this manual. Any other non-indicated combination may cause an incorrect operation.*

The RAD Screen is enclosed in the *CXDI NE SW* Application. The parameters of the RAD Screen common to those of the Control Console are described in detail in *Section 4* of this operation manual. For operation with controls of *CXDI NE SW* Screen refer to the *CXDI NE SW* Application manuals.

Illustration D-1
CXDI NE Application and RAD Screen



1. Access to RAD Screen (Generator Control) from *CXDI NE SW* Application and viceversa.
2. Heat Units, User Actions and Workstation Selection.
3. Patient Size / Type
4. Radiographic Parameters
5. Radiographic Parameters Slider
6. Power 100% / Focal Spot / Post-Exposure button / AEC
7. Collimator Parameters
8. Camera Area
9. Message Area
10. Dose Information

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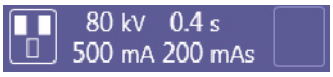
D.2 RAD SCREEN

D.2.1 ENTERING AND EXITING THE RAD SCREEN



Generator Summary Panel

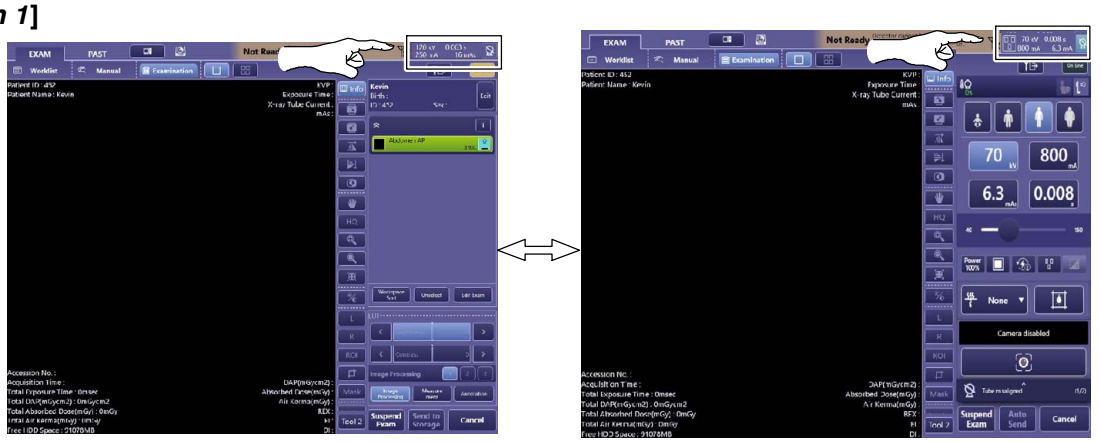
The *"Generator Summary Panel"* appears on the upper right corner of *CXDI NE SW* Application when pressing on "*Start Exam*" button, after selecting the corresponding studies for a patient. It shows the selected exposure parameters, the AEC field selection and a status icon.

Click on the *"Generator Summary Panel"* area to access the RAD Screen. Press on this button again to turn back to the *CXDI NE SW* Screen for operation from this application (except for "*Free Technique*" workstation, *refer to section D.2.5*).

Depending on the size of the monitor used, the RAD Screen may be overlapped over the *CXDI NE* "*Selected Protocols*" module (*Assumption 1*) or be displayed independently on the right side of the screen (*Assumption 2*).

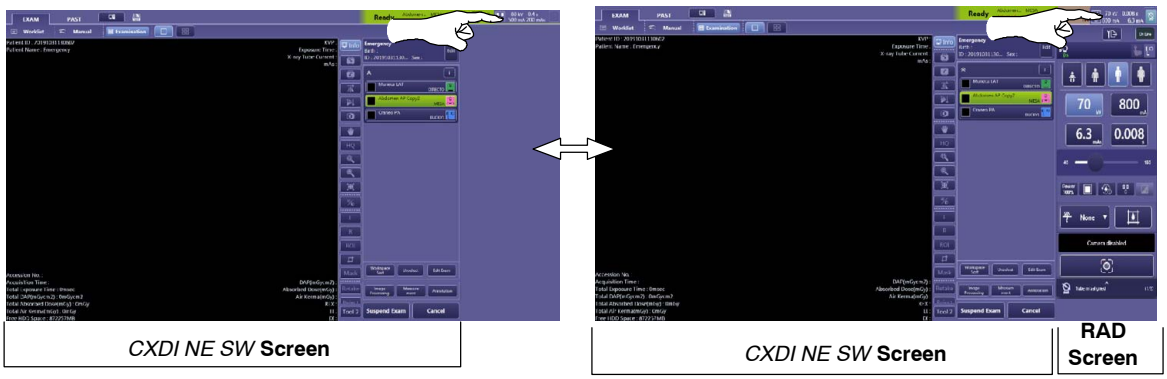
Illustration D-2
RAD Screen Display

[*Assumption 1*]



CXDI NE SW **Screen** | *CXDI NE SW* **Screen** | **RAD Screen**

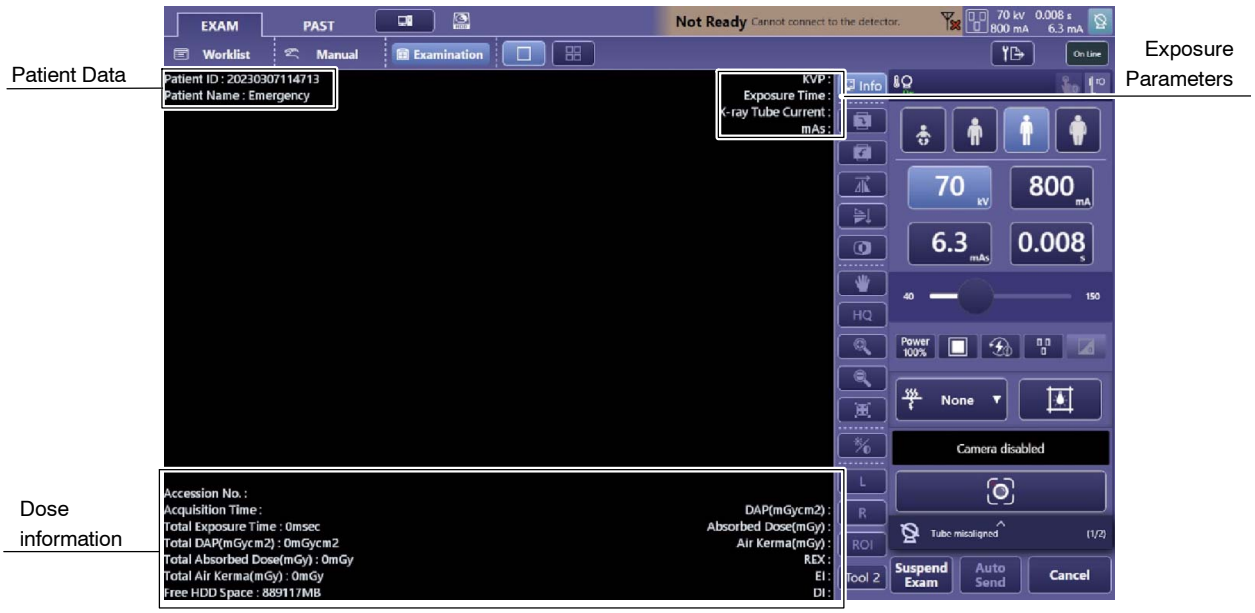
[*Assumption 2*]



CXDI NE SW **Screen** | *CXDI NE SW* **Screen** | **RAD Screen**

After performing an exposure with a Digital Detector, the *CXDI NE* Application receives from the Generator information of the RAD parameters of the exposure as well as Total Exposure Time and Dose received by the patient (if the dosemeter is available in the unit).

Illustration D-3
Exposure Information



D.2.2 EXPOSURE INDICATORS

The "*Status*" icon of the *"Generator Summary Panel"* icon can vary according to the operating status, as described below.

NORMAL STATUS: The detector is ready, the RAD technique is correctly set and there is not Error or Interlock condition in the system.

HANDSWITCH PRESSED: The Handswitch half-way has been pressed ("Prep" position) to prepare the X-ray Tube for exposure.

READY: Indicates that the technique selected is properly set, there are no interlock failures nor system faults, the anode is rotating and the X-ray Tube is ready for exposure.

EXPOSURE: Indicates that the X-ray exposure is in progress. It remains illuminated during the length of exposure. At the same time that radiographic exposure is being made, an audible signal sounds.

INHIBIT CONDITIONS: There are one or more reasons that are causing an inhibition of exposure. Press this icon to display the message list of conditions that inhibit exposures.

- **FILAMENTS DISABLED.** If filaments has been disabled (regardless of whether it was via software or hardware), the inhibit status icon changes color.

D.2.3 HEAT UNITS

This X-ray Generator is equipped with a Heat Unit Calculator. During exposures, the Heat Units are calculated and totalled.

The "*Heat Units*" shows the percentage of utilized thermal capacity of the Tube. For example, "*25*%" would indicate that 25% of Heat Units capacity is used (it can be configured by the service engineer).

D.2.4 USER ACTION

Active when manual adjustments from the operator are required before making the exposure (e.g. if the Grid is not inserted). If more than one action is required, the number of actions to perform is shown in the icon.

D.2.5 WORKSTATION SELECTION

Workstations are automatically selected by the APR configuration. Each icon corresponds to its related workstation and remains highlighted on the RAD Screen when selected.

Although the operator does not need to select any workstation as they are always associated to an APR technique, a specific workstation may be selected if needed (refer to *CXDI NE* SW Application).

Note ☞ *Exposures using the "Free Technique" workstation are not possible from the CXDI NE SW Application.*

To select a different workstation click on the Workstation icon, select the desired one and return to the main menu of the RAD Screen by pressing again on this icon or on the "*Home*" icon.

Illustration D-4
Workstation Selection in RAD Screen

D.2.6 PATIENT SIZE / TYPE

Patient Size is always activated with one of the four available Patient Size (three for Adult and one for Pediatric) icons selected. When an APR technique is chosen in the CXDI application, the medium adult patient size is selected by default.

These controls allow the adjustment of the RAD parameters according to:

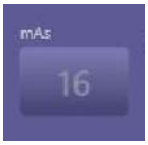
- Patient size: pediatric, small, medium and large. It modifies mAs value.
- Patient type: adult or pediatric. It modifies kVp value.

D.2.7 RADIOGRAPHIC PARAMETERS

Radiographic Parameters are divided into kVp, mAs, mA, and Time (seconds “s”).

kVp shows:

- The radiographic kVp value selected for the technique.



mAs can show:

- The radiographic mAs value selected for the technique.
- If an exposure is aborted by releasing the Handswitch button, the actual mAs value flashes for five seconds, the message “*Aborted Exposure Error*” (100050) appears in the Information Area and an alarm sounds, until the “*Accept*” control is pressed to reset the error condition.

mA shows:

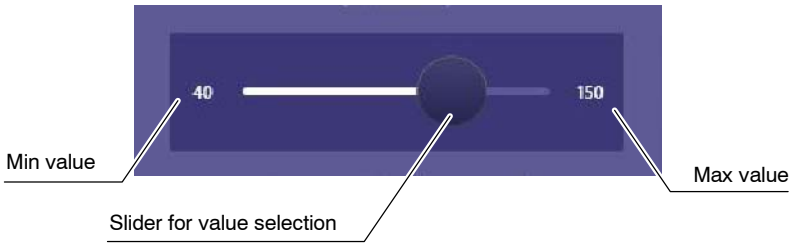
- The radiographic mA value selected for the technique.

Time (s) can show:

- The Time value (in seconds) selected for the radiographic technique.
- If an exposure is aborted by releasing the Handswitch button, the actual Time (s) value flashes for five seconds, the message "*Aborted Exposure Error*" (100050) appears in the Information Area and an alarm sounds, until the "*Accept*" control is pressed to reset the error condition.

INCREASE / **DECREASE**: Radiographic technique values are increased or decreased by changing the value moving the "*Slider*" position.

When the "*Slider*" is positioned over a value not allowed, its pointer comes back to the nearest allowed value, according to the limit of the Tube and the Unit.

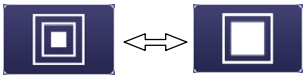


- **kVp**: Selects the X-ray Tube voltage.
- **mA**: Selects the X-ray Tube current, changing the mAs value and keeping constant the select Exposure Time, whenever possible.
- **mAs**: Selects the exposure in mAs, setting the maximum mA available for the selected Focal Spot and the respective Exposure Time. If the maximum mA value available coincides with the maximum mA station of the Generator, it sets one mA station below of the maximum mA station of the Generator.
- **s**: Selects the Exposure Time in seconds.

Note ☞

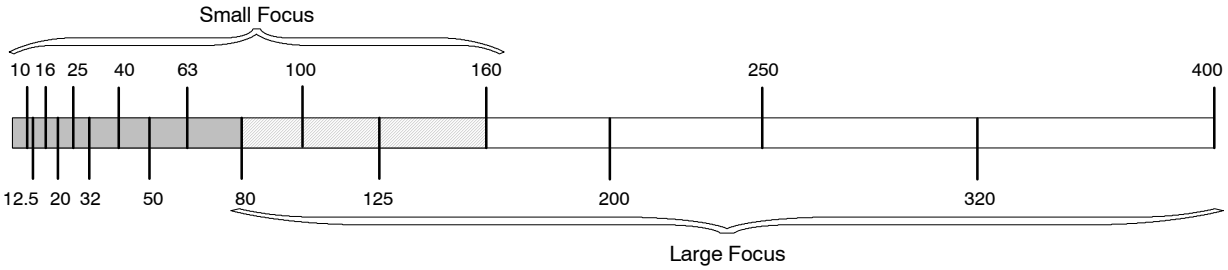
If after pressing any of these buttons, the technique value is blocked, it could mean that it may have been selected a wrong combination of radiographic parameters that could have caused a warning condition, (for further information, refer to Generator and System Messages in the Operation Manual).

D.2.8 FOCAL SPOT



This indicator shows the selected Focal Spot of the X-ray Tube: "*Small*" or "*Large*". The Focal Spot is changed by pressing on this indicator or selecting an mA station of the other Focal Spot. It keeps kVp and constant mAs, whenever it is possible.

Small and Large Focal Spots can overlap each other, refer to the graphic below to view an example for the 32 kW Generator.



If Small and Large Focal Spots overlap each other, the Focal Spot change must be always performed manually. On the contrary, if they are not overlapped, the Focal Spot change can be made automatically when increasing or decreasing mA.

Note ☞ *The maximum mA station for the Small Focal Spot and the minimum mA station for the Large Focal Spot are configured by the field engineer during the installation.*

In 2P mode, the Focal Spot is changed keeping kVp and mAs constant, whenever possible (maximum mA available and minimum Exposure Time). The mA value available is set according to maximum power, instantaneous power, space charge, etc.

In 3P mode, if the selected mA station is not available for the Focal Spot selection, mA are automatically set to the nearest available station, selecting the respective exposure time in order to keep constant mAs.

Note ☞ *The Focal Spot can be changed whenever the present conditions of the X-ray Tube allow it.*

D.2.9 AUTOMATIC EXPOSURE CONTROL (AEC)

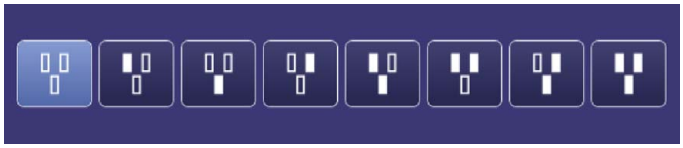
Automatic Exposure Control (AEC) produces consistent density with excellent contrast regardless of the radiographic technique selected. The AEC module comprises the controls for the selection of the Exposure Detector Fields (Ion Chamber) and Density Compensation.

Note ☞ *AEC controls are only enabled when a Workstation with AEC is selected.*

The AEC mode is activated by touching the AEC Field button and selecting one of the combinations with filled fields. The AEC mode is deactivated by selecting the empty combination, the one furthest to the left.

- **FIELD SELECTION.** Press on the AEC Field icon to display all the AEC field combinations. Each icon indicates the related physical location of the selected field in the AEC Exposure Detector. Any combination of fields can be selected. The selected icon gets highlighted when active.

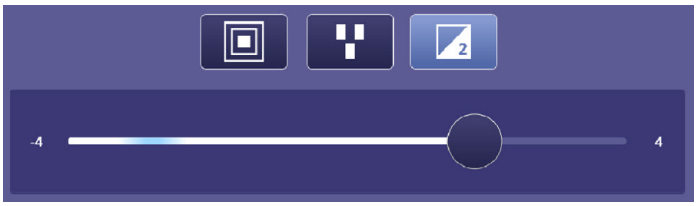
Illustration D-5
AEC Selection



Note ☞ *AEC Field selection is displayed in the Generator Summary Panel.*

- **DENSITY.** To configure the AEC Density, press on its icon and indicate a value from -4 to +4. Density button is only available when an AEC field has been selected and AEC mode is active.

Illustration D-6
Density Compensation Selection



D.2.10 DOSIMETRY

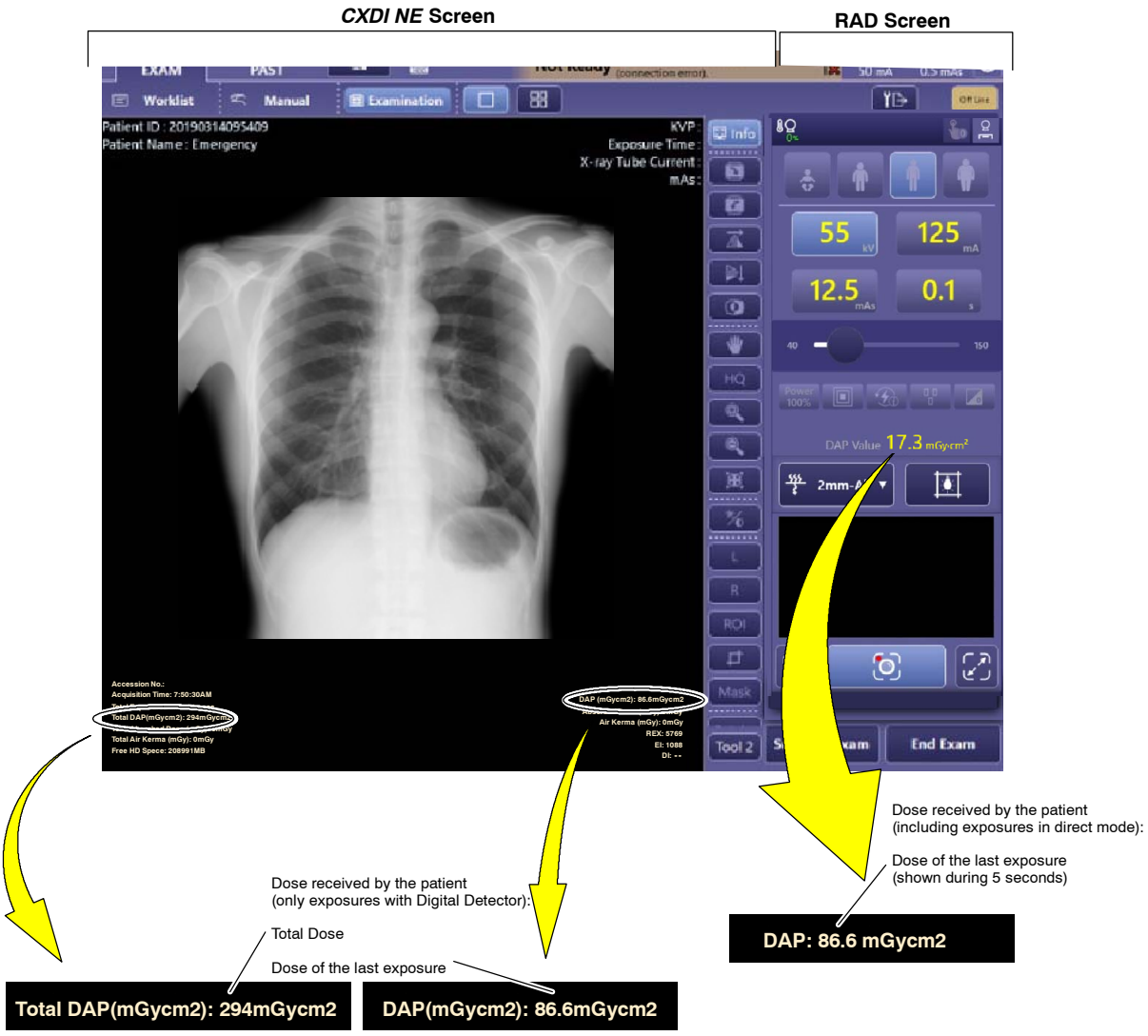
The Dose shows the radiation value received by the patient. Radiation measure is read as DAP value (Dose Area Product) in mGy*cm^2.

The RAD Screen shows for 5 seconds the Dose information of the last exposure in direct mode. All this values are displayed in yellow.

The CXDI NE Screen shows the Dose information of the last exposure and the total dose of the exposures performed with a Digital Detector.

Note ☞ *DAP values on the CXDI NE Screen may differ from those on the RAD Screen after taking an exposure in Direct mode.*

Illustration D-7
Dosimetry in CXDI NE and RAD Screen



Press on the Post-Exposure button to recover the radiation value of the last RAD exposure for other five seconds. During this time, the values of the radiographic parameters of the last exposure are also displayed. All this values are displayed in yellow.

Illustration D-8
Post-Exposure Values

D.2.11 POWER REDUCTION

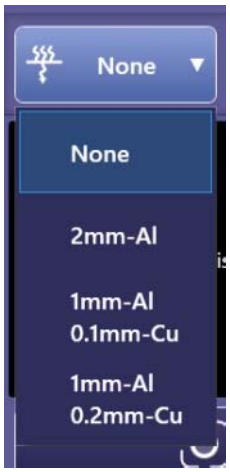
The maximum kW of the Generator is factory set according to the Generator performance. Generator kW can be limited to 80% by pressing on the "*Power Reduction*" icon and selecting the desired power percentage (100% or 80%). If doing so, check that mA and kV selection can be done in accordance to the Power Reduction.

D.2.12 COLLIMATOR PARAMETERS

FILTER SELECTION

To select a Collimator filter, press on the "*Filter*" icon and tap on the option to be selected.

Illustration D-9
Collimator Filter Options



Note ☞ *Filter Selection is only enabled when a Collimator with filters is configured in the system.*

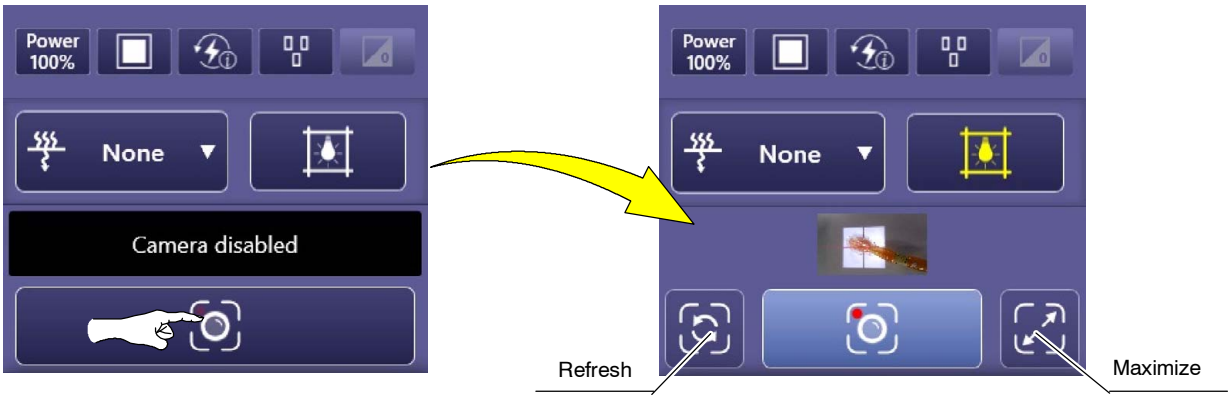
COLLIMATOR LIGHT

Press the "*Collimator Light*" icon to turn ON/OFF the Collimator light.

D.2.13 CAMERA AREA

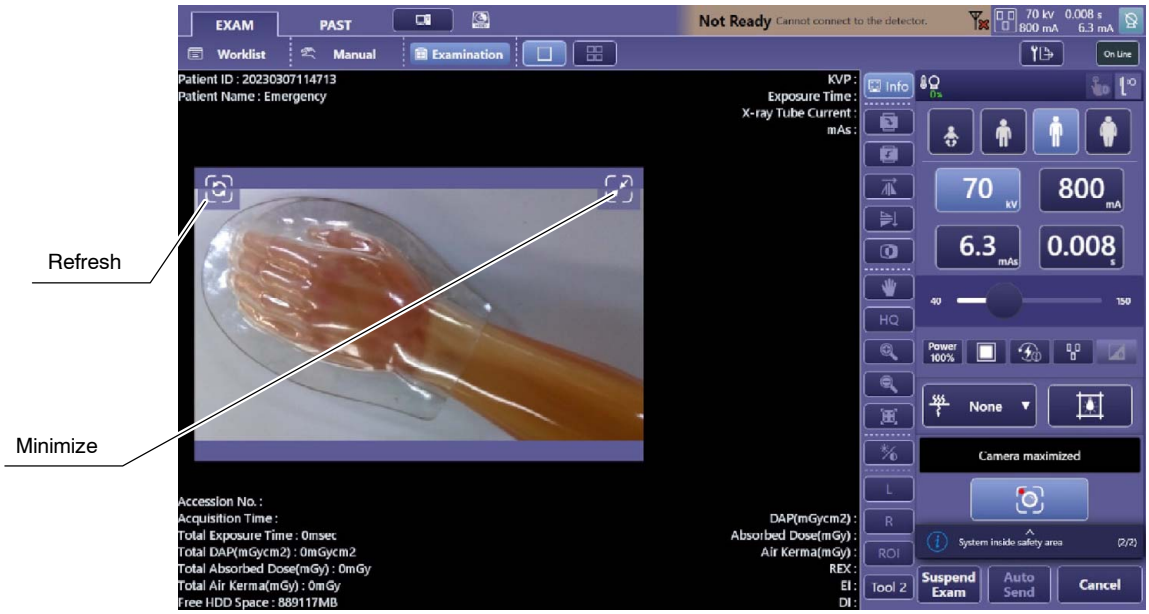
Press the Camera button to enable / disable the image visualization on the RAD Screen.

Illustration D-10
Camera Activation



Press the left button to refresh the image visualization and press the right button to maximize the image visualization on the *CXDI NE SW* Screen.

Illustration D-11
Camera Maximized

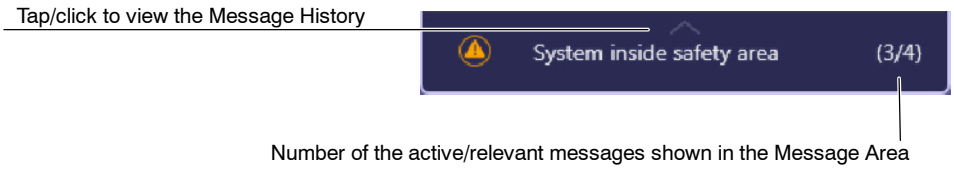


With the Camera maximized on the *CXDI NE SW* Screen, press the left button to refresh the image visualization and press the right button to minimize the image visualization on the RAD Screen.

D.2.14 MESSAGE AREA

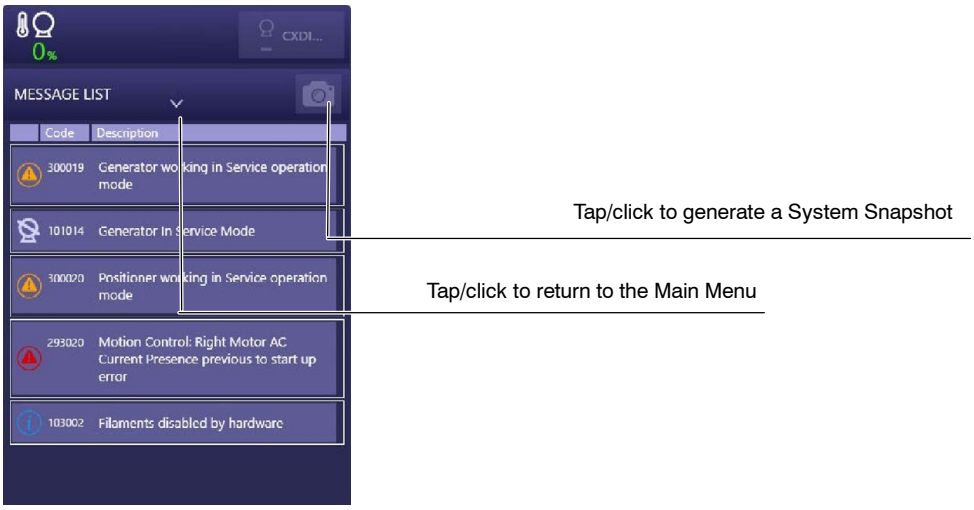
The Message Area in the RAD Screen shows informative messages (warnings, errors, emergency messages, information, inhibit conditions...). Active messages, i.e. those that require action by the operator or report an error or warning, will be displayed consecutively in this area.

Illustration D-12
Message Area in the RAD Screen



To check the message history, press or click on the top of the Message area. A pop-up window (titled *"**Message List**"*) will be displayed. To close it, tap on the upper arrow of the Message History window and go back to the previous screen.

Illustration D-13
Message List



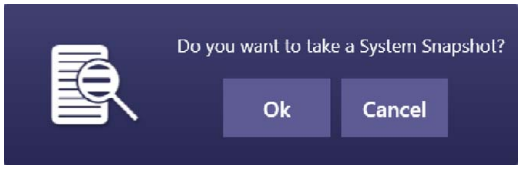
Note ☞ *For information about the Types of Messages and Messages List refer to the Operation Manual.*

Note ☞ *For information about System Snapshot refer to Section D.2.15.*

D.2.15 SYSTEM SNAPSHOT

Press the “System Snapshot” button, located in the upper side of Message List window, to generate event logs files. Once pressed and after confirmation, a pop-up window displays the result of the log export process for each system component.

Illustration D-14
System Snapshot Confirmation and Logs Capture Window



The different status of the Log Capture can be:

- Logs export in progress

- Successful logs export

- Failed logs export

Once the logs export is finished, press the “Close” button to go back to the Main Menu.

Note ☞ *The resulting system logs files are generated in folder C:\OEM\Snapshots.*

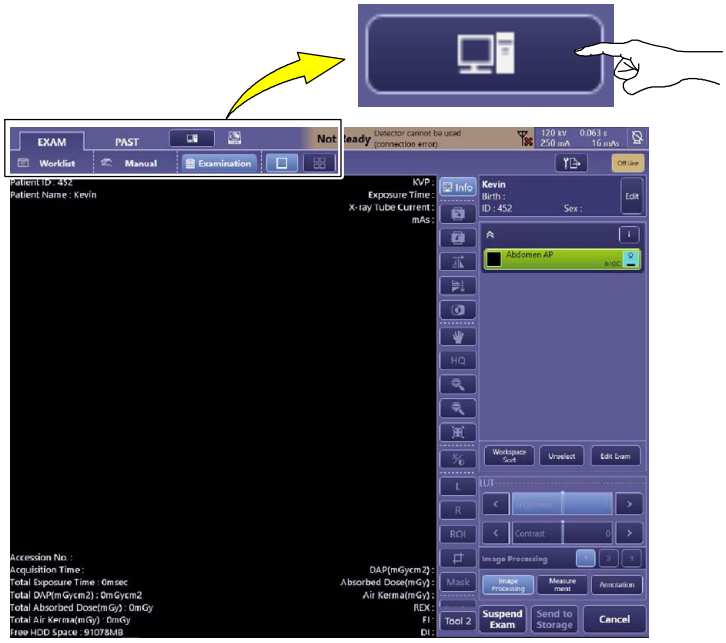
Note ☞ *During generation of System Snapshot an interlock inhibit the exposures.*

D.3 EDITING A PROTOCOL

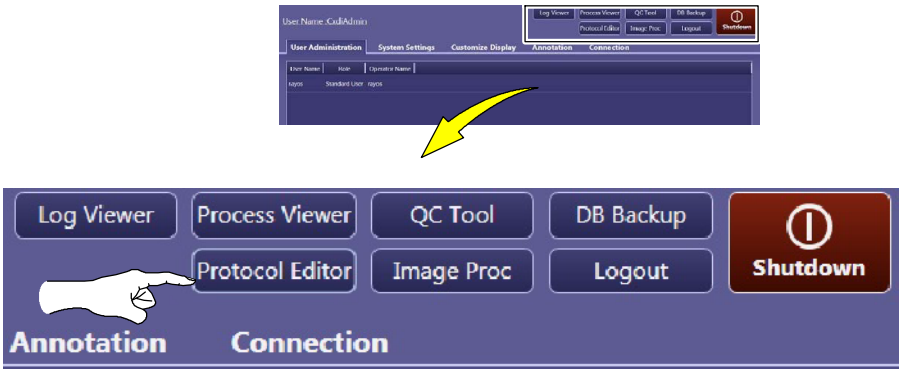
Note ☞ *These Protocols include Radiographic parameters that can be used as a guide, but the final values of each technique must be revised / contrasted / verified and / or modified if necessary, by the operator. For APR further information refer to CXDI NE SW Manuals.*

To edit a Protocol, proceed as described in the following steps.

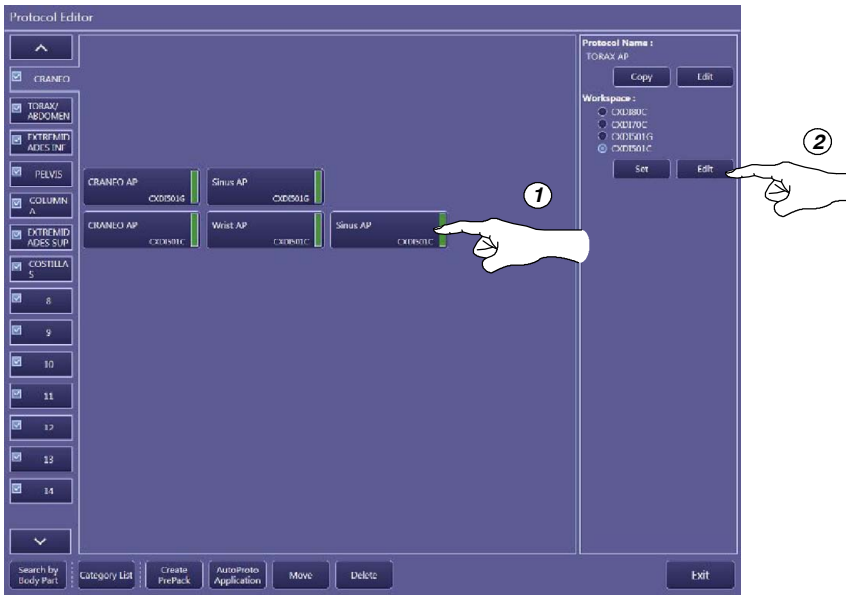
1. Press the *PC icon* located at the top of the screen.



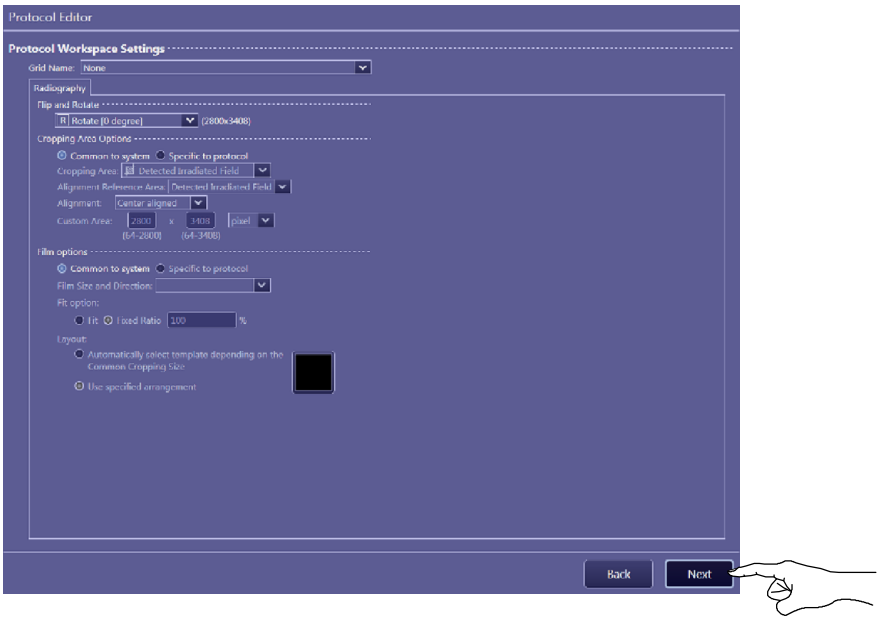
2. Touch the "*Protocol Editor*" button to access the *Protocol Editor menu*.



3. In the *Protocol Editor menu*, touch the button of the technique to be edited, and then, press the *"Edit"* button located on the upper right corner of the screen, as shown in the image below.



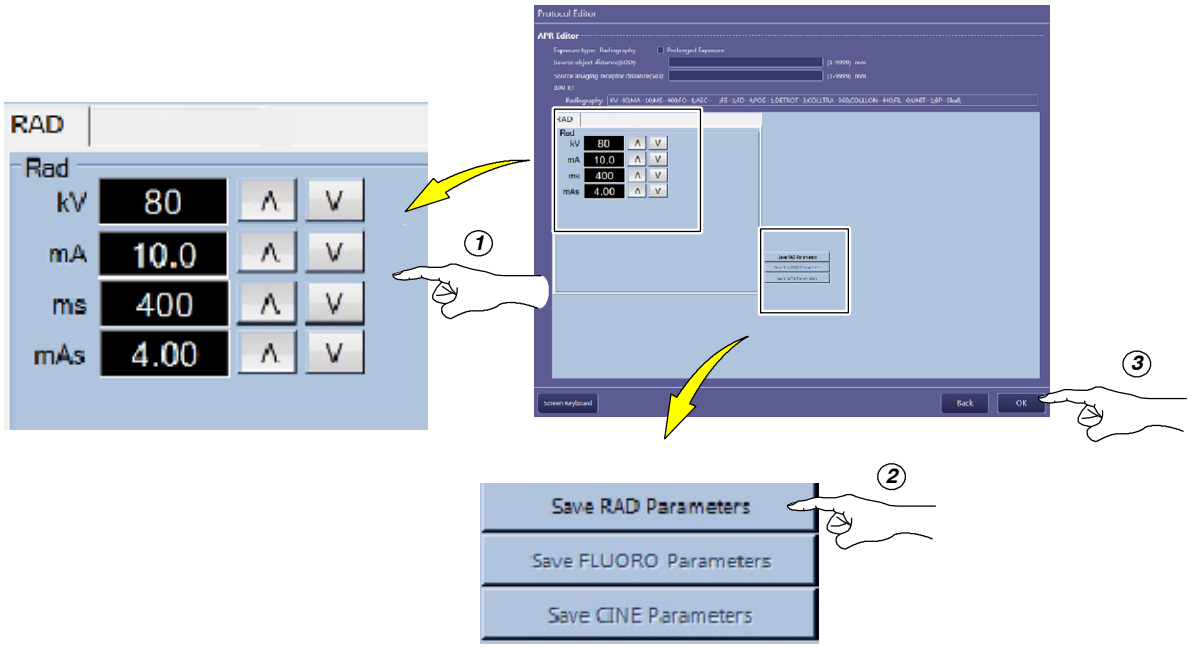
4. In the *Protocol Editor screen*, press the button *"Next"* of the succeeding screens, until reaching the *APR Editor screen*.



5. Once in the *APR Editor screen,* modify the required RAD parameters (kV, mA, ms, mAs) of the technique to be edited.

   Touch on the button *"Save RAD Parameters"* to set the new values in the protocol.

   Then, press *"OK".*



6. In the next *Protocol Editor screen* press *"Exit".*

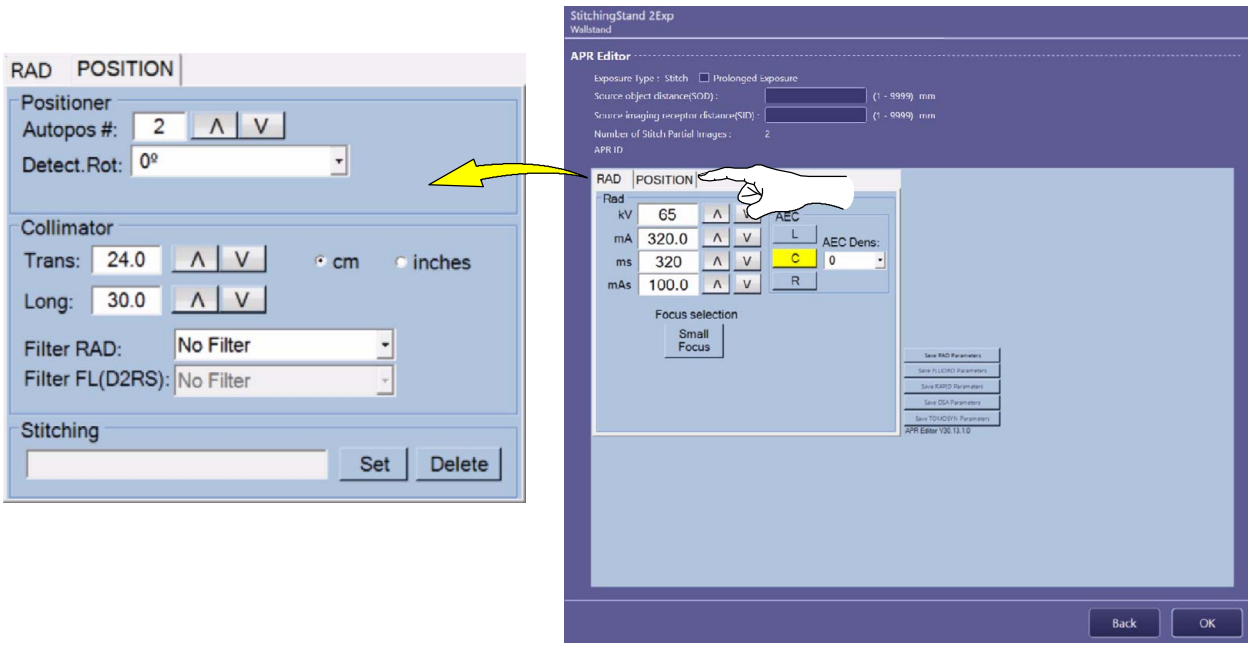
D.3.1 EDITING A STITCHING PROTOCOL

To edit a Protocol, proceed as described in the following steps.

1. Proceed with steps 1. to 5. of *Section D.3*, selecting a Stitching technique.

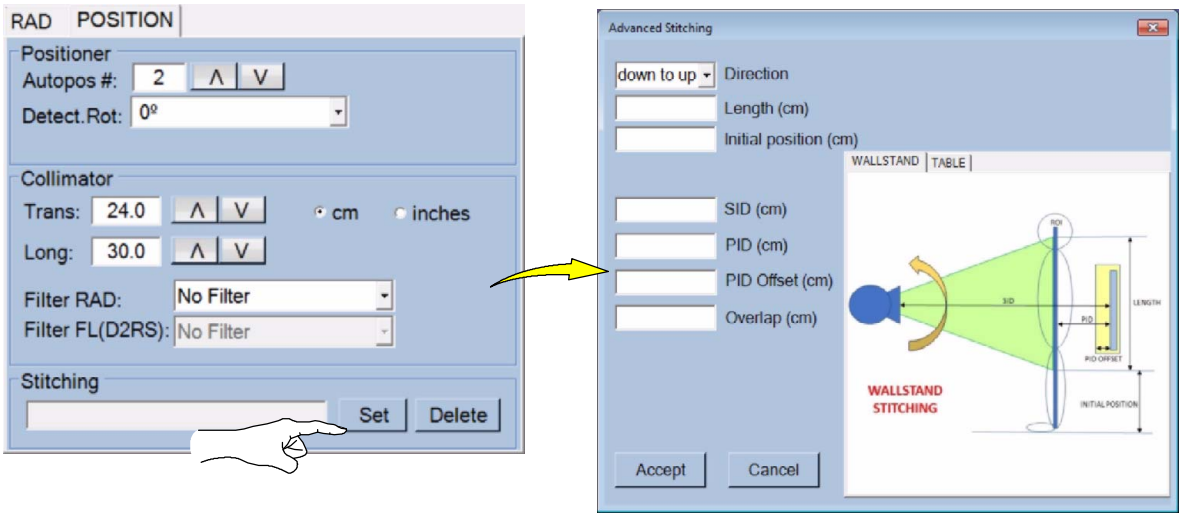
2. Select the *POSITION* tab in the *APR Editor screen,* and set the required Positioner and Collimator parameters.

Illustration D-15
Position Parameters



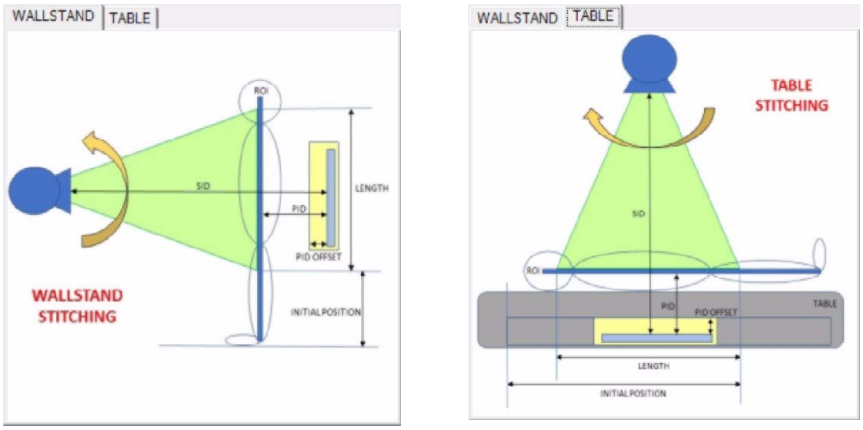
3. Press the “Set” button in the Stitching section and enter/modify the required Advanced Stitching parameters (*Direction*, *Length*, *Initial Position*, *SID*, *PID*, *PID Offset* and *Overlap*).

Illustration D-16
Stitching Parameters



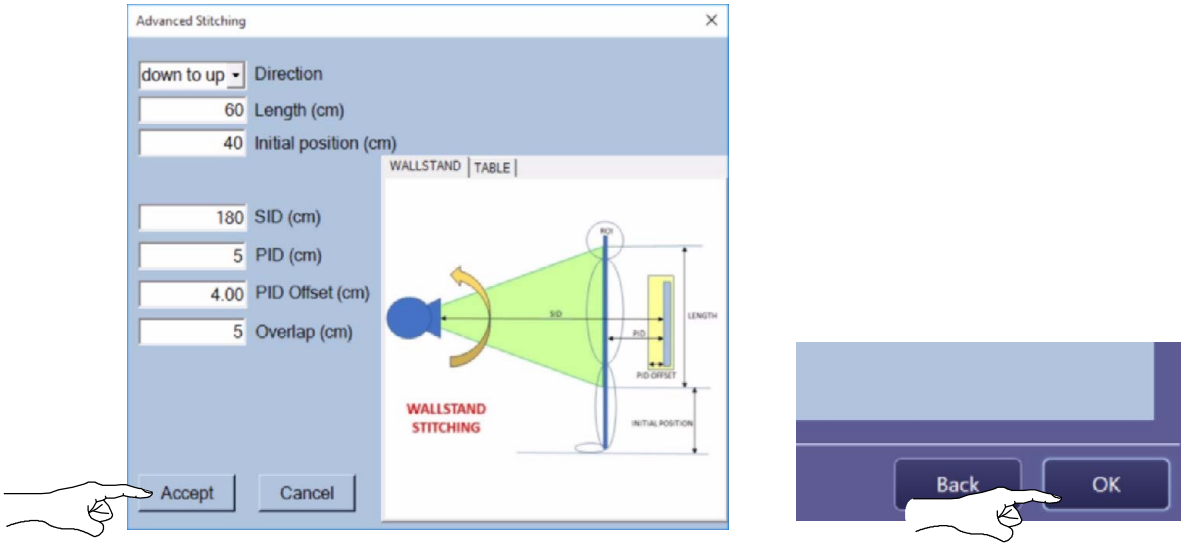
Note ☞ *It is possible to alternate the Stitching illustrations between Table and Wall Stand by selecting the tabs located on the image in the Advanced Stitching window.*

Illustration D-17
Stitching Illustrations



4. Press the *"Accept"* button to set the new Stitching values in the protocol. Then, press *"OK"*.

Illustration D-18
Stitching Parameters



5. In the next *Protocol Editor screen* press *"Exit"*.