DX-D 600

User Manual

Technical Publication
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REVISION HISTORY

REVISION	DATE	REASON FOR CHANGE
A	MAY 20, 2011	First edition
B	AUG 05, 2011	DX-D 600 Semi-automatic & Automatic Systems
C	OCT 27, 2011	DX-D 30C Detector
D	DEC 02, 2013	IEC Standards update Auto-tracking Function update Single Panel Upgrade New Automatic Positioning Control Box Remote Control RAD Table Tabletop Pinch Points upgrade
E	MAR 24, 2015	New Flat Tabletop of the RAD Table Collimator Mechanical Detents New Overhead Patient Holder Lateral DR Detector (35x43) Holder with Trolley Specifications Update
F	DEC 18, 2018	New DX-D 600 System Label IEC Standards update Errors List Upgrade Modification of the name of the Legal Manufacturer Applied Parts Heating Warning 1000 mA Generator (option) General Upgrades

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 does not necessarily relate to possible injury or damage to equipment.

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SECTION 1 INTRODUCTION

1.1 SYSTEM OVERVIEW

This nual contains all the necessary information to understand and operate the ***DX-D 600 X-ray System.*** It provides a general description, safety information, operating instructions and specifications concerning the equipments of the different configuration possibilities: **Semi-automatic** and **Automatic.**

This manual is not intended to teach radiology or to make any type of clinical diagnosis.

This system comprises:

- **Ceiling Suspension** with the Control Console, X-ray Tube and Collimator subassemblies. There are two different models available depending on the system configuration:
  - ***Semi-automatic Ceiling Suspension*** with the Touchscreen Control Console, but it is just motorized the vertical axis to allow the Auto-tracking function. Other axis are not motorized, so it is not possible to complete fully the Auto-position functions.
  - ***Automatic Ceiling Suspension*** with the Touchscreen Control Console, Auto-positioning, Auto-centering and Auto-tracking functions available.
- **RAD Elevating Table,** available in double panel systems
- **RAD Wall Stand DR**
- **X-ray Generator**

There are two different system configurations depending on the number of available DR Detectors (refer to *Illustration 1-1*):

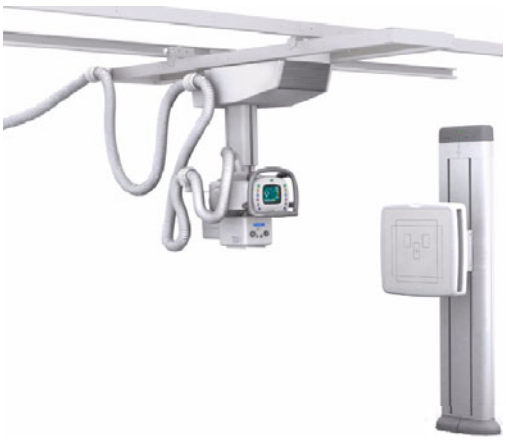
- **Double Panel System** (default configuration). It is provided with horizontal DR Detector or RAD Table and vertical DR Detector or RAD Wall Stand DR.
- **Single Panel System** is provided just with the RAD Wall Stand DR which can operate vertically and horizontally, in that case it is provided always with a spacer to be adapted to work with any kind of stretcher or mobile tables.

1.2 SYSTEM CONFIGURATION

Illustration 1-1
DX-D 600 X-ray Systems

Double Panel

Single Panel



DX-D 600 SYSTEMS		
COMPONENTS	**SEMI-AUTOMATIC**	**AUTOMATIC**
Ceiling Suspension		
Control Console	Touchscreen Control Console	Touchscreen Control Console
Collimator	Ralco R225DHHS Manual Collimator Ralco R225ACS Automatic Collimator	Ralco R225ACS Automatic Collimator
X-Ray Tubes	Canon E7252X Canon E7254FX Canon E7869XX Canon E7884X	Canon E7252X Canon E7254FX Canon E7869XX Canon E7884X
Longitudinal Rails	3.4 / 4.0 / 4.6 / 5.3 / 6 m	3.4 / 4.0 / 4.6 / 5.3 / 6 m
Transverse Rails	2.0 / 2.25 / 2.5 / 2.75 / 3.0 / 3.5 m	2.0 / 2.25 / 2.5 / 2.75 / 3.0 / 3.5 m
Movements policy	Manual movements and motorized movement only in vertical axis	Manual movements and motorized movements in all axes
Automatic Movements	Auto-tracking just along vertical axis of the Ceiling Suspension	Auto-positioning Auto-tracking Auto-centering

DX-D 600 SYSTEMS		
Components	**Semi-automatic**	**Automatic**
RAD Table		
Receptor	Fixed DR Detector & Portable DR Detector	Fixed DR Detector & Portable DR Detector
Sensing Tray	-	-
Grid	132 Lines, 10:1, FFD 1 m	132 Lines, 10:1, FFD 1 m
Ion Chamber (AEC)	Claymount SSMC-617	Claymount SSMC-617
Functionalities	DR Vertical Auto-tracking	DR Vertical Auto-tracking DR Horizontal Auto-tracking DR Auto-positioning
RAD Wall Stand DR		
Model	RAD Wall Stand DR	RAD Wall Stand DR
Receptor	Fixed DR Detector & Portable DR Detector	Fixed DR Detector & Portable DR Detector
Sensing Tray	-	-
Grid	132 Lines, 10:1, FFD 1 m 132 Lines, 10:1, FFD 1.5 m 132 Lines, 10:1, FFD 1.8 m	132 Lines, 10:1, FFD 1 m 132 Lines, 10:1, FFD 1.5 m 132 Lines, 10:1, FFD 1.8 m
Ion Chamber (AEC)	Claymount SSMC-617	Claymount SSMC-617
Functionalities	DR Vertical Auto-tracking	DR Vertical Auto-tracking DR Auto-positioning
X-ray Generator		
Model	50 kW (640 mA) 1T, LS/HS, Power Line 400 / 415 / 440 / 480 V~ 64 kW (640 mA), 1T, HS, Power Line 400 / 415 / 440 / 480 V~ 80 kW (800 mA), 1T, HS, Power Line 400 / 415 / 440 / 480 V~ 80 kW (1000 mA), 1T, HS, Power Line 400 / 415 / 440 / 480 V~ + Auxiliar Boost Transformer to adequate the line voltage to 530 V~	
Fail-safe	Mandatory	

1.3 GENERAL FEATURES

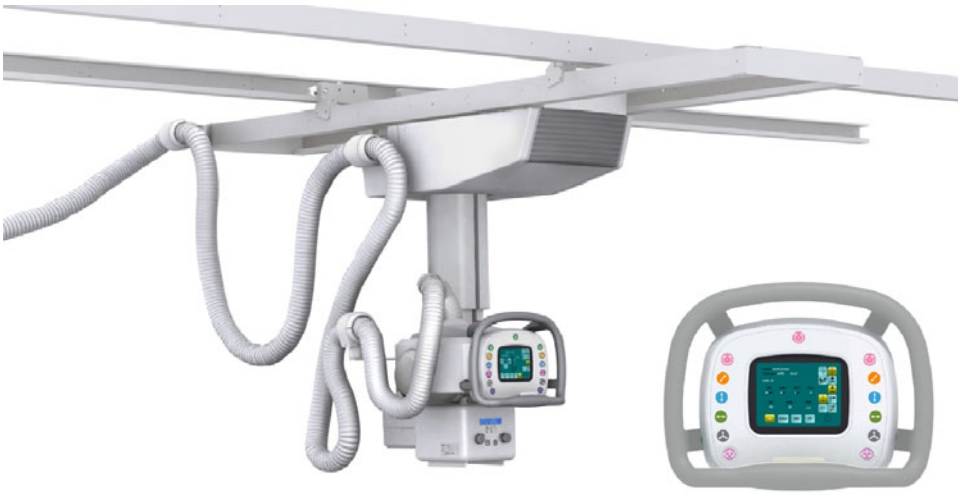
The main features of the X-ray System are:

- 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 CEILING SUSPENSION

- The Control Console of the Ceiling Suspension 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.
- Light weight telescopic column design with four 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.
- Optimal mechanical balancing system for manual movements with almost no efforts.
- X-ray Support with 360^{o} for X-ray Tube rotation and 270^{o} 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.

Illustration 1-2
DX-D 600 Ceiling Suspension



Beside the mentioned features, the differences between both models are:

SEMI-AUTOMATIC CEILING SUSPENSION

- Fully manual positioning in all axis with Vertical Axis motorized for automatic movement.
- Auto-positioning, Auto-tracking and Auto-centering in Vertical Axis.

AUTOMATIC CEILING SUSPENSION

- Motorized positioning in all axis for automatic movement.
- Full servo electronics for balancing and positioning.
- Auto-positioning, Auto-tracking and Auto-centering in all axes.

1.3.2 RAD TABLE

Illustration 1-3
DX-D 600 RAD Table

- Smooth and extra optimized elevating mechanism for outstanding patient comfort with a large vertical travel.
- Foot pedal control for RAD Table movements.
- Four way floating Tabletop.
- Patient safety is guaranteed with the use of electromagnetic brakes in all moving axis. Double click action pedal avoiding any incident while patient is unattended.
- DR Detector (max. 430 x 430 mm).
- Configurable automatic stops at 3 different height levels: maximum, minimum and intermediate.
- Accessories: Handgrips, Compression Band and Lateral Cassette Holder.

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

- Equipped with Emergency OFF Switch to stop the whole System in the event of an emergency,
- In the Automatic System the DR Detector is motorized allowing its Auto-positioning and Horizontal Auto-tracking.

1.3.3 RAD WALL STAND DR

Illustration 1-4
DX-D 600 RAD Wall Stand DR

- Manual and motorized vertical motion balanced with internal counterweights.
- DR Detector (max. 430 x 430 mm).
- Manual Tilting which provides DR Detector angulation from +90º (horizontal position) to -20º.
- DR Detector Rotation of ±90º.
- Optional spacer for Single Panel Systems, it means that there is just one DR Detector, which can operate vertically and horizontally.
- Accessories: Handgrips and Overhead Hands Support.

1.3.4 X-RAY GENERATOR

Illustration 1-5
DX-D 600 X-ray Generator

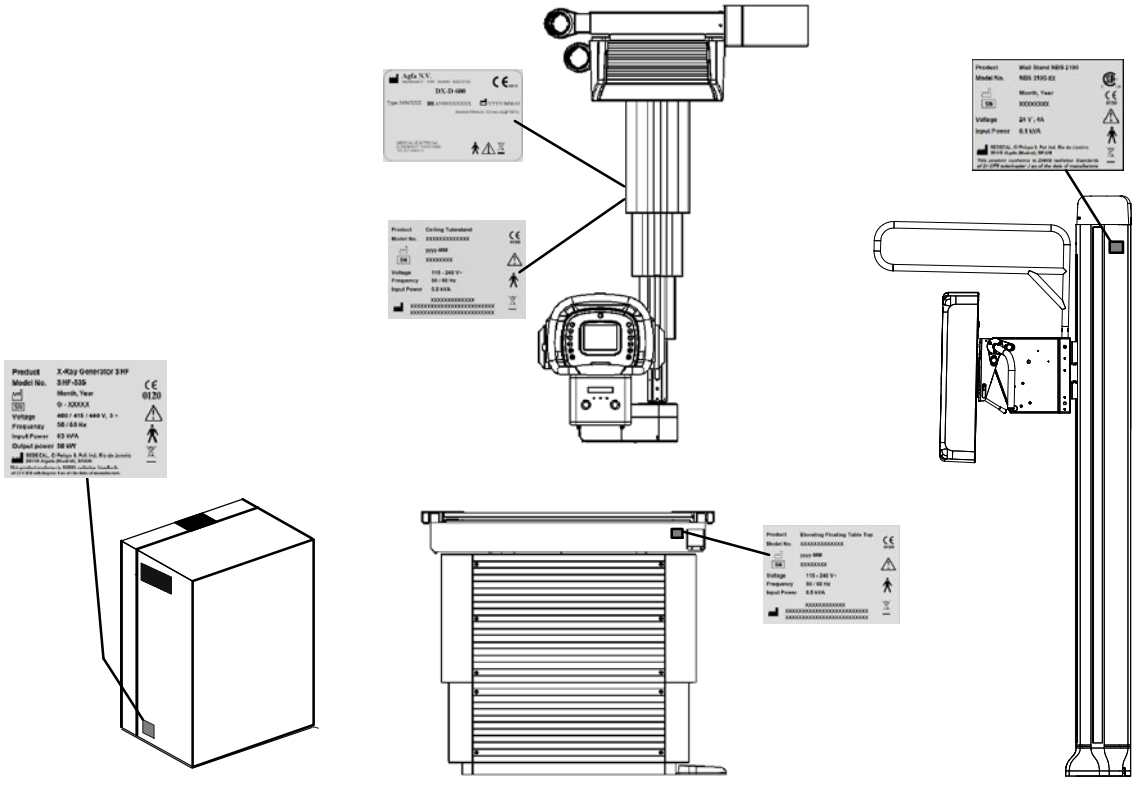
- The Generator Cabinet comprises the Power Module, which contains the power and control components and the High Voltage Transformer.
- The Generator is controlled by multiple microprocessors providing increased exposure consistency, efficient operation and extended X-ray Tube life. A high level of self-diagnosis greatly increases serviceability and reduces down time.
- Constant potential high frequency that provides all the advantages of high frequency wave form Generators including lower patient dose, shorter exposure times and greater accuracy and consistency.
- Three point control by selecting kVp, mA and ms, or two point control by selecting kVp and mAs (no AEC), or one point control by selecting kVp with AEC operations.
- Automatic Exposure Control (AEC).
- Fail-safe function (Receptor detection and exposure rapid termination).
- Two DR Detectors can be directly connected to the Generator.
- 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.

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

This equipment is intended for use by qualified personnel only.

The **X-ray System Units** are equipment included in a Medical Equipment System designed for general radiography in hospitals, clinics and medical practices to provide X-ray radiographic images of the skeleton, skull, chest, abdomen, extremities and other body parts.

Images can be obtained with the patient in the sitting, standing or lying position. Examinations can be performed to any kind of patient group. Patients may be physically abled, disabled, immobilized or in a state of shock.

The **DX-D 600** X-ray System contributes to the metrics of imaging performance ensuring the efficient use of radiation.

The X-ray image receptors used in this system are Digital Detectors.

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 not intended for mammography applications.

This X-ray System is not especifically designed for paediatric purposes; if children are to be examined, they should always be accompanied by an adult.

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)
- Other accessories

RAD WALL STAND DR

- Front panel of the RAD Wall Stand DR
- Hand Grips
- Overhead Hands 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.

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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
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.

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 SAFETY SYMBOLS

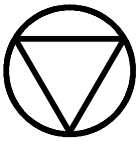
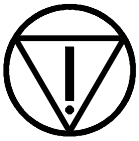
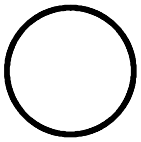
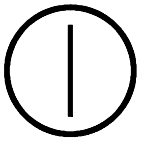
The following safety symbols may appear in the equipment.

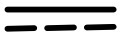
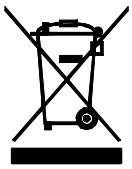
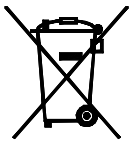
Their meaning are described below.

	**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)*

	**General Mandatory action.**
	**Type B applied part.**
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: Dangerous voltage.**
	**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.**
	**Electrostatic sensitive devices.**
	**No pushing.**
	**No sitting.**
	**No stepping on surface.**

	**Stop (of action).**
	**Emergency stop.**
	“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 ***DX-D 600 Radiographic Room*** 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/EC concerning Medical Devices.

Statement of Compliance with IEC 60601-1-3: ***DX-D 600*** *with radiation protection in accordance with IEC 60601-1-3:1994, IEC 60601-1-3:2008 and IEC 60601-1-3:2008/AMD1:2013.*

Statement of Compliance with IEC 60601-2-7: ***DX-D 600*** *in accordance with IEC 60601-2-7: 1998.*

Statement of Compliance with IEC 60601-2-54: ***DX-D 600*** f*or Radiography and/or Radioscopy in accordance with IEC 60601-2-54: 2009 and IEC 60601-2-54:2009/AMD1:2015.*

Statement of Compliance with 21CFR Subchapter J: ***DX-D 600*** *conforms to DHHS radiation Standards of 21CFR subchapter J as of the date of manufacture.*

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.
- *Continuous operation with intermittent loading,* in accordance with Standard IEC 60601-1:1988.
- *Permanently Installed Equipment.*

2.7.4 PROTECTION AGAINST ELECTRIC SHOCK HAZARDS

Protection against electric shock hazards in accordance with Standards: IEC 60601-1:1988, 2005 and 2012, IEC 60601-2-7:1998, IEC 60601-2-54:2009 and 2015.

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.

ACCORDING TO MDD/93/42/CEE, THIS UNIT IS EQUIPPED WITH EMC FILTERS. THE LACK OF PROPER GROUNDING MAY PRODUCE ELECTRICAL SHOCK TO THE USER.

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 60601-1:1988, 2005 and 2012.

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 60601-1:1988, 2005 and 2012.

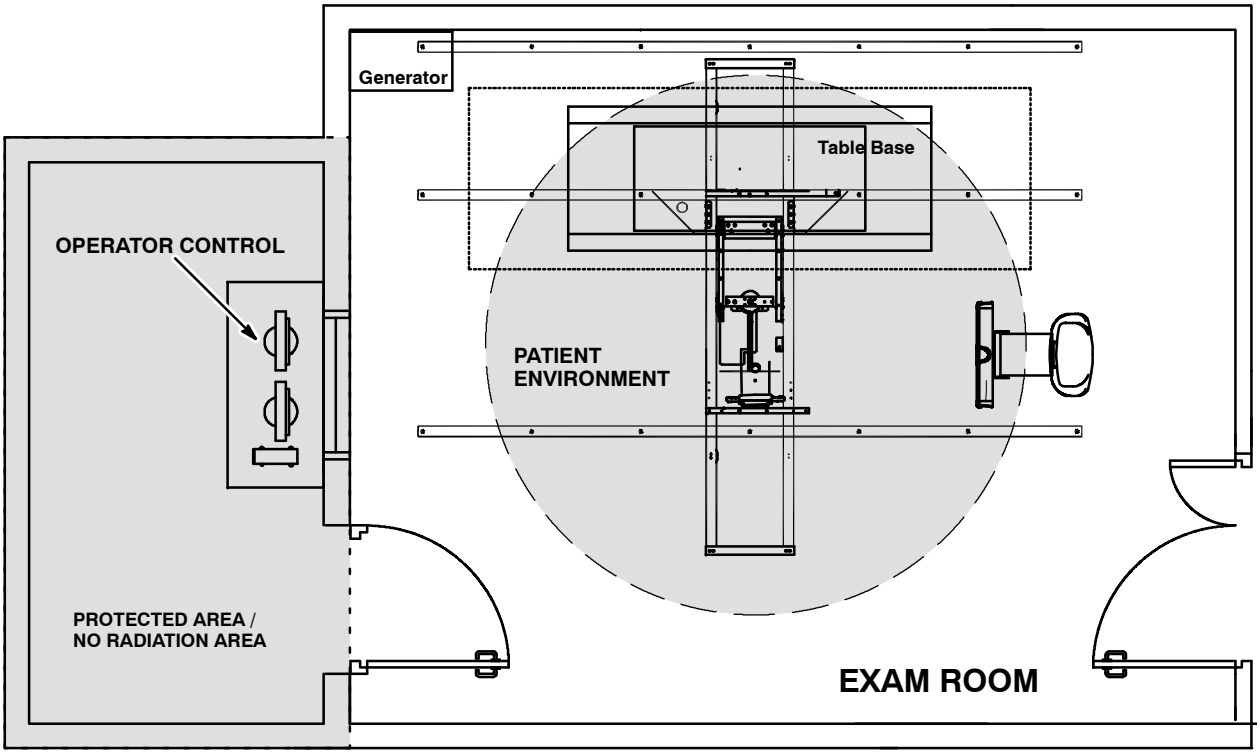
2.7.7 PROTECTION AGAINST HAZARDS FROM UNWANTED OR EXCESSIVE RADIATION

Protection against hazards from unwanted or excessive radiation in accordance with Standard IEC 60601-1:1988, 2005 and 2012, and IEC 60601-1-3:1994, 2008 and 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 DR

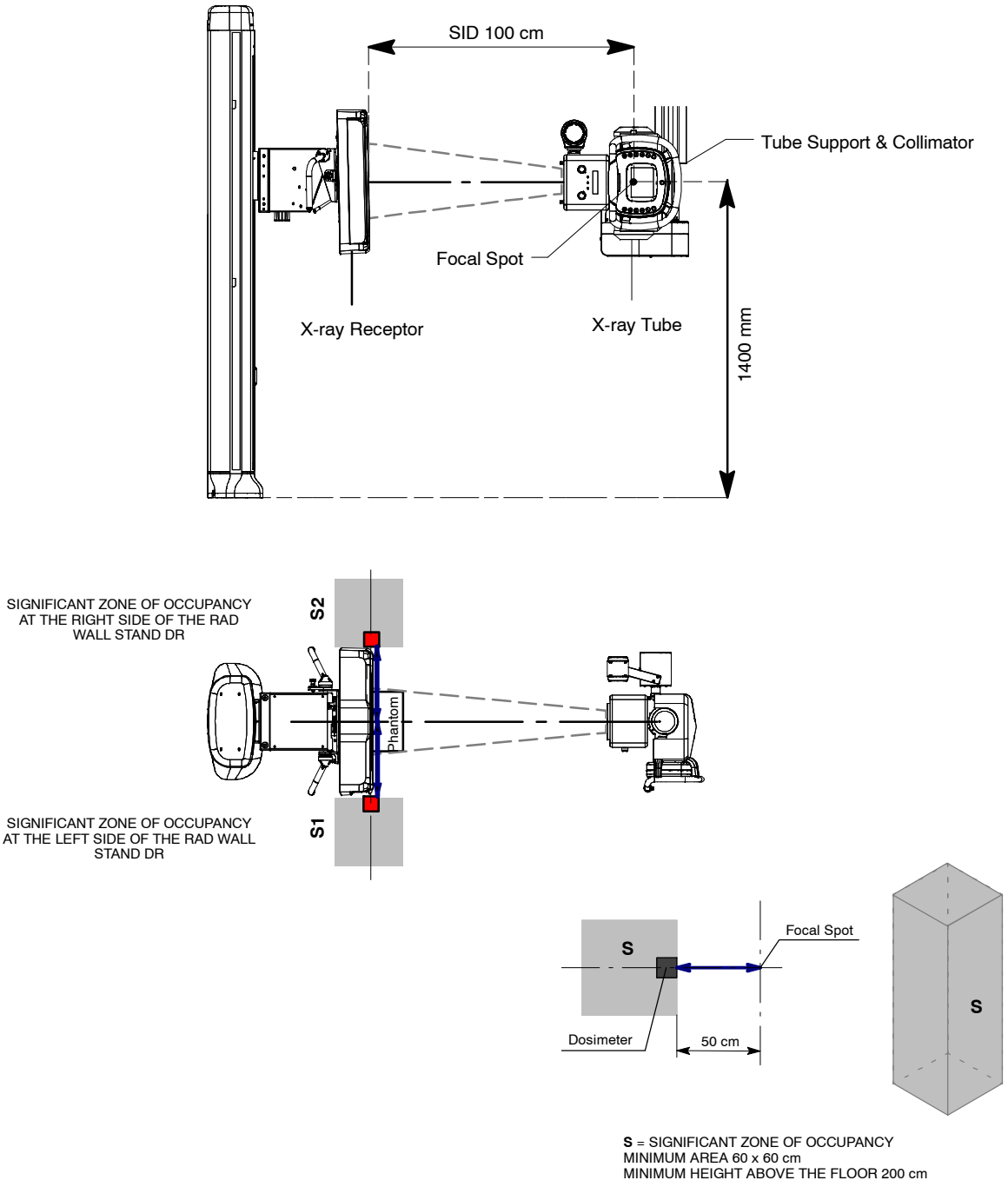
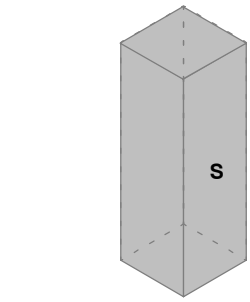
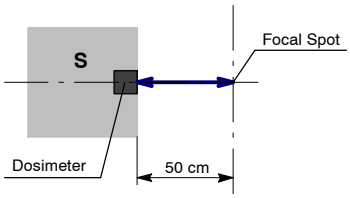
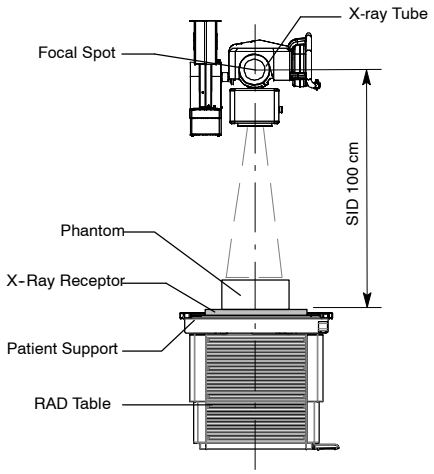


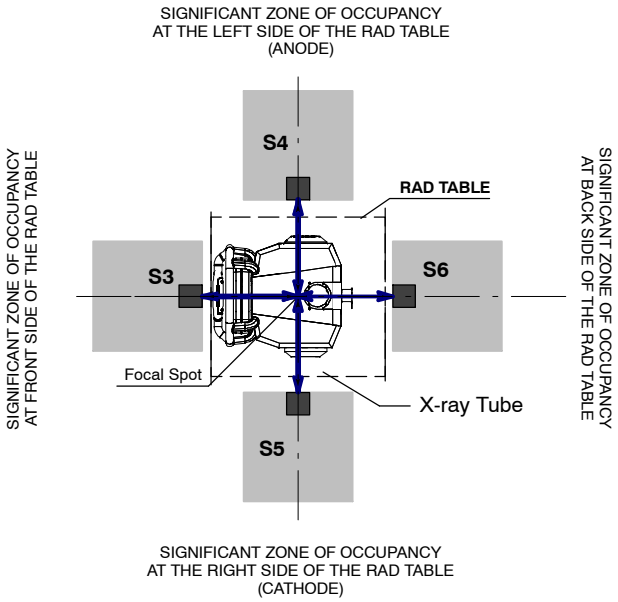
Illustration 2-2
Radiographic Examination on the RAD Table



S = SIGNIFICANT ZONE OF OCCUPANCY
MINIMUM AREA 60 x 60 cm
MINIMUM HEIGHT ABOVE THE FLOOR 200 cm







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 IEC60601-1-3:1994, 2008 and 2013:

- Exposure Parameters RAD mode: 150 kVp, 10 mAs, 50 mA.
- 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.*

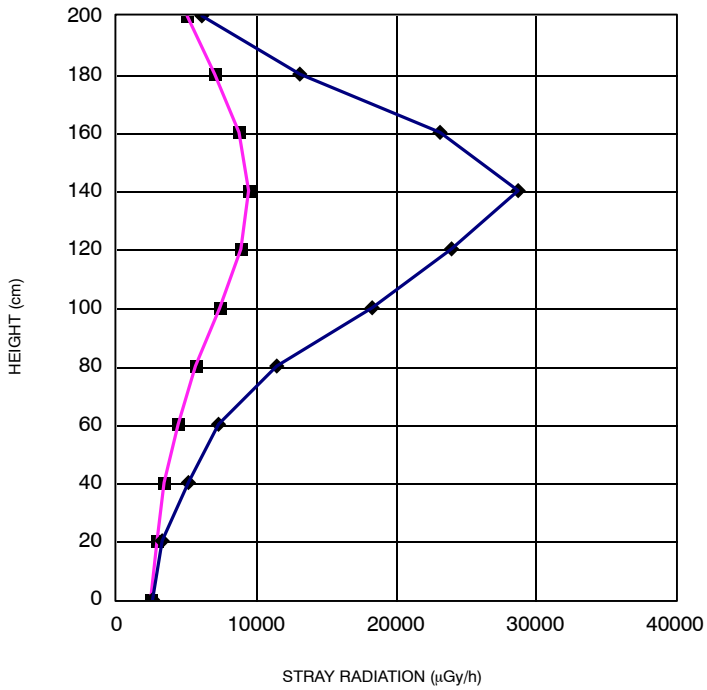
Refer to *Illustration 2-1* for Receptor in Vertical position and refer to *Illustration 2-2* for Receptor in Horizontal position.

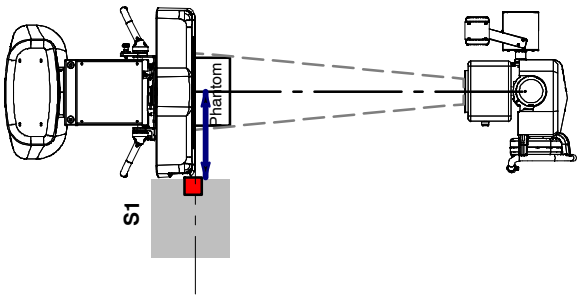
The following illustration shown the Distribution of Stray Radiation in each examination position, where:

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.

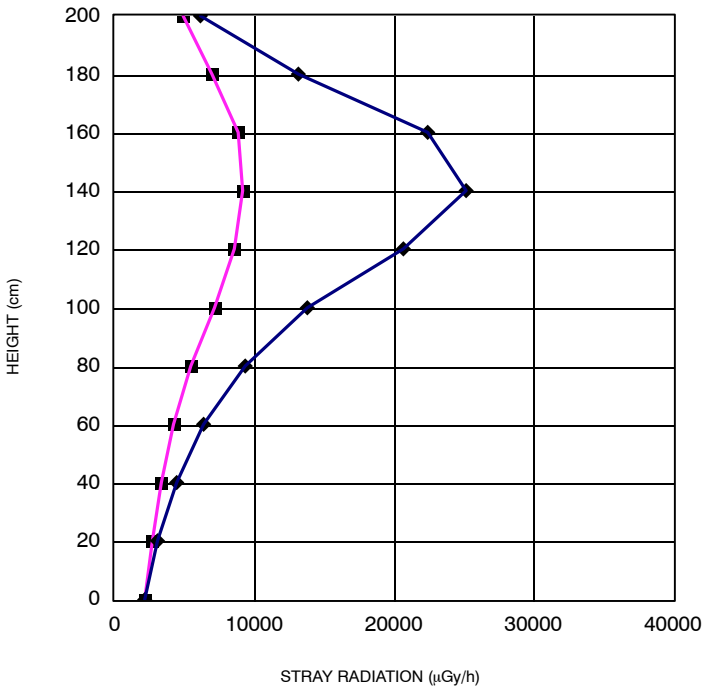
Illustration 2-3
Distribution of Stray Radiation with the Receptor in Vertical Left Position (S1)

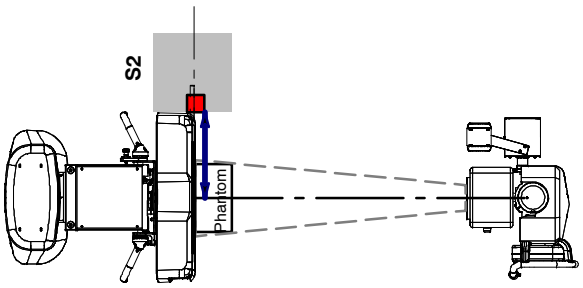




SIGNIFICANT ZONE OF OCCUPANCY
ON THE LEFT SIDE OF THE RAD WALL
STAND DR

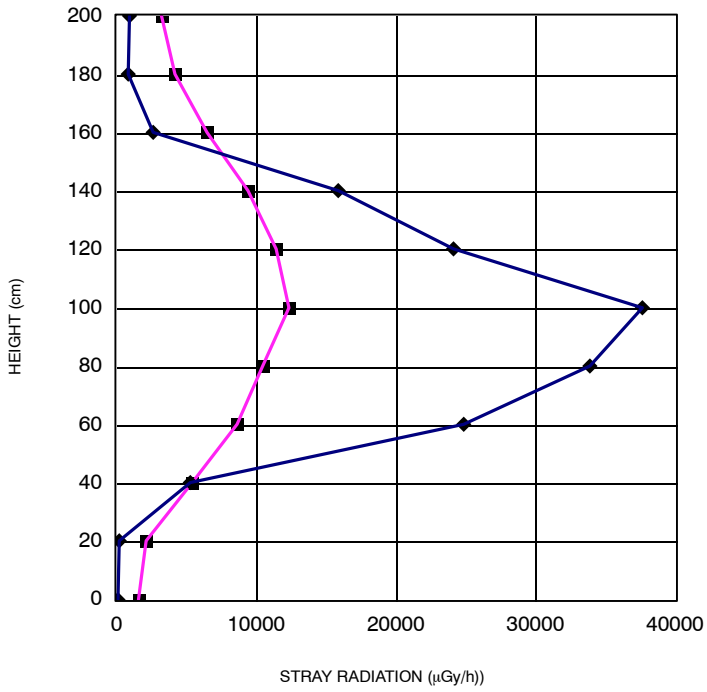
Illustration 2-4
Distribution of Stray Radiation with the Receptor in Vertical Right Position (S2)

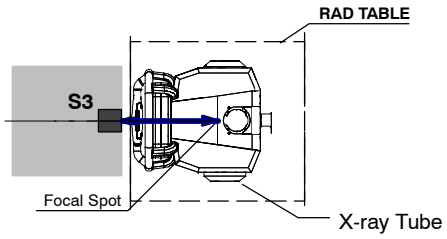




SIGNIFICANT ZONE OF OCCUPANCY
ON THE RIGHT SIDE OF THE RAD
WALL STAND DR

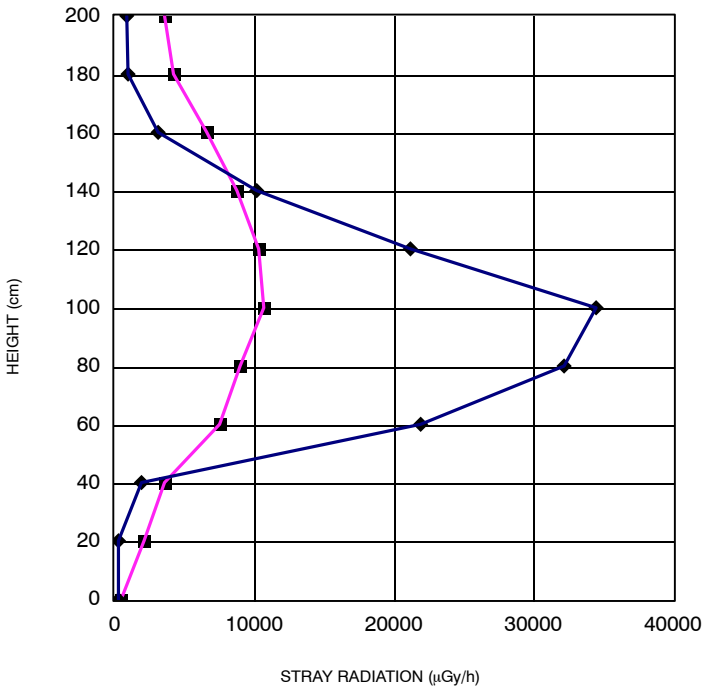
Illustration 2-5
Distribution of Stray Radiation within the Receptor in Horizontal Front Side Position (S3)

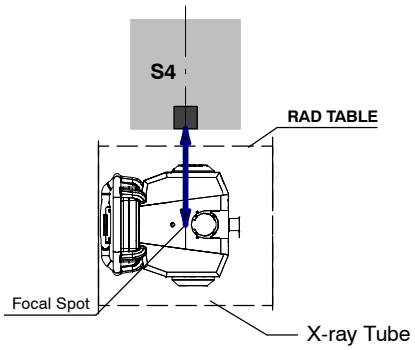




SIGNIFICANT ZONE OF OCCUPANCY
AT THE FRONT OF THE RAD TABLE

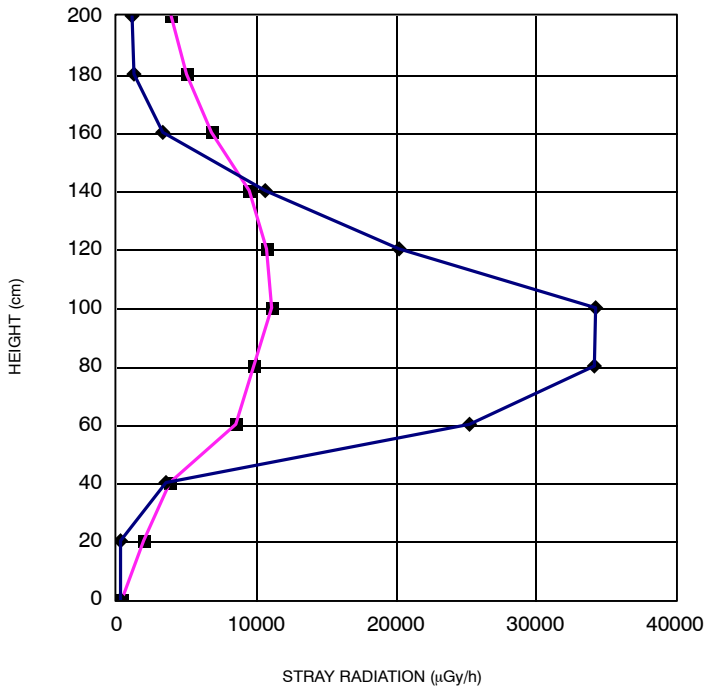
Illustration 2-6
Distribution of Stray Radiation with the Receptor in Horizontal Left Side Position (S4)

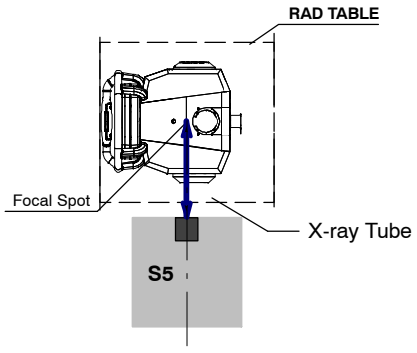




SIGNIFICANT ZONE OF OCCUPANCY
ON THE LEFT OF THE RAD TABLE
(ANODE)

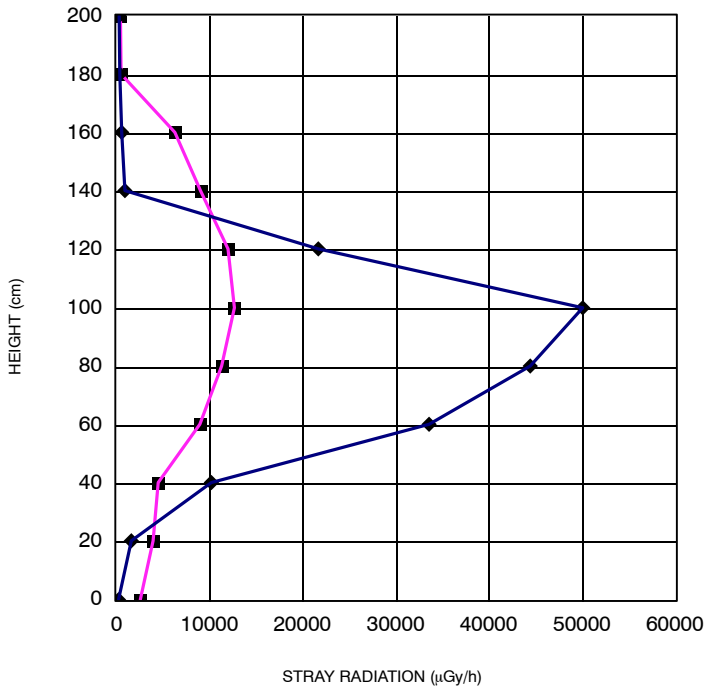
Illustration 2-7
Distribution of Stray Radiation with the Receptor in Horizontal Right Side Position (S5)

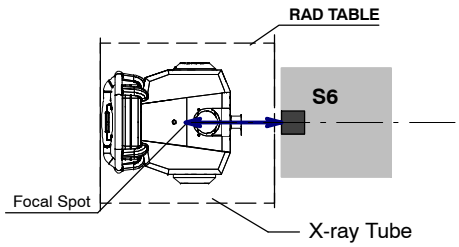




SIGNIFICANT ZONE OF OCCUPANCY
ON THE RIGHT OF THE RAD TABLE
(CATHODE)

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





SIGNIFICANT ZONE OF OCCUPANCY
AT THE BACK 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 Directive as stated in IEC 60601-1-2: 2007 and 2014. 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 Commission 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 60601-1-2:2007 and 2014 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.

GUIDANCE AND MANUFACTURER'S DECLARATION - ELECTROMAGNETIC EMISSIONS (IEC 60601-1-2:2007 AND IEC 60601-1-2:2014)		
The DX-D 600 Radiographic Room is intended for use in the electromagnetic environment specified below. The customer or the user of the DX-D 600 Radiographic Room should assure that it is used in such an environment.		
Emissions test	**Compliance**	**Electromagnetic environment - guidance**
RF emissions CISPR 11	Group 1	The DX-D 600 Radiographic Room use 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	The DX-D 600 Radiographic Room 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 60601-1-2:2007)			
The DX-D 600 Radiographic Room is intended for use in the electromagnetic environment specified below. The customer or Operator of the DX-D 600 Radiographic Room should assure that it is used in such an environment.			
Immunity Test	**IEC 60601-1-2:2007 Test Level**	**Compliance Level**	**Electromagnetic Environment - Guidance**
Electrostatic discharge (ESD) IEC 61000-4-2	± 6 kV contact ± 8 kV air	± 6 kV contact ± 8 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	± 2 kV for power supply lines ± 1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	± 1 kV line(s) to line(s) ± 2 kV line(s) to earth	± 1 kV symmetrical coupling ± 2 kV asymmetrical coupling	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	<5 % UT (>95 % dip in UT) for 0.5 cycles 40 % UT (60 % dip in UT) for 5 cycles 70 % UT (30 % dip in UT) for 25 cycles <5 % UT (>95 % dip in UT) for 5 s	>95 % for 0.5 periods 60 % for 5 periods 30 % for 25 periods >95 % for 250 periods	Mains power quality should be that of a typical commercial or hospital environment. If the user of the DX-D 600 Radiographic Room requires continued operation during power mains interruptions, it is recommended that the DX-D 600 Radiographic Room is powered from an Uninterruptible Power Supply or a battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 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 60601-1-2:2007)

This DX-D 600 Radiographic Room is intended for use in an electromagnetic environment specified below. The customer or Operator of this DX-D 600 Radiographic Room should assure that it is used in such an environment.

Immunity test	IEC 60601-1-2:2007 test level	Compliance level	Electromagnetic environment guidance
Conducted RF IEC 61000-4-6 Radiated RF IEC 61000-4-3	3 Vrms 150 kHz to 80 MHz 3 V/m 80 MHz to 2.5 GHz	3 Vrms 150 kHz to 80 MHz 3 V/m 80 MHz to 2.5 GHz	Portable and mobile RF communications equipment should be used no closer to any part of the DX-D 600 Radiographic Room, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance $d = 1.2\sqrt{P}$ $d = 1.2\sqrt{P}$, 80 MHz to 800 MHz $d = 2.3\sqrt{P}$, 800 MHz to 2.5 GHz where 'P' is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and 'd' is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey[a]), should be less than the compliance level in each frequency range[b]). Interference may occur in the vicinity of equipment marked with the following symbol: 

NOTE 1 - At 80 MHz and 800 MHz, the higher frequency range applies.

NOTE 2 - These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

a) *Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the DX-D 600 Radiographic Room is used exceeds the applicable RF compliance level above, this DX-D 600 Radiographic Room should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating this DX-D 600 Radiographic Room.*

b) *Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.*

RECOMMENDED SEPARATION DISTANCES BETWEEN PORTABLE AND MOBILE RF COMMUNICATIONS EQUIPMENT AND THE X-RAY SYSTEM (IEC 60601-1-2:2007)

This DX-D 600 Radiographic Room is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of this DX-D 600 Radiographic Room can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the DX-D 600 Radiographic Room as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of transmitter **W**	**Separation distance according to frequency of transmitter** **m**		
	150 KHz to 80 MHz $d = 1.2\sqrt{P}$	**80 MHz to 800 MHz** $d = 1.2\sqrt{P}$	**800 MHz to 2.5 GHz** $d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

TYPICAL RF DEVICES (Worst-Case scenario)

Device: Power @ Frequency	**Recommended distance(m)**
GMRS device (Professional Walkie-Talkie): 5 W @ 462-467 MHz	2.7
GSM / UMTS cell phone: 2 W @ 850/1700/1900 MHz	3.3
FRS device (Amateur Walkie-Talkie): 500 mW @ 462-467 MHz	0.9
WiFi / Bluetooth devices: 100 mW @ 2400-2500 MHz	0.8
DECT devices (modern cordless phones): 100mW @ 1880-1900 MHz	0.8
RFID reader (3): 10 mW @ 125-150 KHz / 13.56 MHz	0.12
RFID reader (3): 10 mW @ 902-928 MHz / 2400-2500 MHz	0.23
Station transmitter ATSC TV broadcasting: 100 kW @ 54-800 MHz	380
Station transmitter ATSC TV broadcasting: 100 kW @ 800-890 MHz	730
Station transmitter FM radio broadcasting: 100 kW @ 87.5-108 MHz	380

For transmitters rated at a maximum output power not listed above, the recommended separation distance 'd' in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where 'P' is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE 1 - At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

NOTE 2 - These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

GUIDANCE AND MANUFACTURER'S DECLARATION - ELECTROMAGNETIC IMMUNITY (IEC 60601-1-2:2014)			
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)			
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)			
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 with 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:

- Rad Positioner with Ralco Collimator.

Instrumentation used:

- Dosimeter: Vacudap
- Dosimeter: Unfors
- 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 / 60601-2-54:2009 and IEC 60601-2-54:2009/AMD1:2015).*

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 / 60601-2-54:2009 and IEC 60601-2-54:2009/AMD1:2015).*

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 / 60601-2-54:2009 and IEC 60601-2-54:2009/AMD1:2015).*

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 / 60601-2-54:2009 and IEC 60601-2-54:2009/AMD1:2015).*

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 / 60601-2-54:2009 and IEC 60601-2-54:2009/AMD1:2015).*

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 / 60601-2-54:2009 and IEC 60601-2-54:2009/AMD1:2015).*

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.

2.11 PRODUCT COMPLAINTS

Any health care professional (for example a customer or a user) who has any complaints or has experienced any dissatisfaction with the quality, durability, reliability, safety, effectiveness, or performance of this product must notify Agfa.

If the device malfunctions and may have caused or contributed to a serious injury of a patient, Agfa must be notified immediately by telephone, fax or written correspondence to the following address:

AGFA Service Support - local support addresses and phone numbers are listed on www.agfa.com

AGFA N.V.

Septestraat 27, B-2640 Mortsel, Belgium

Fax +32 3 444 7094

SECTION 3 STARTUP AND SHUTDOWN

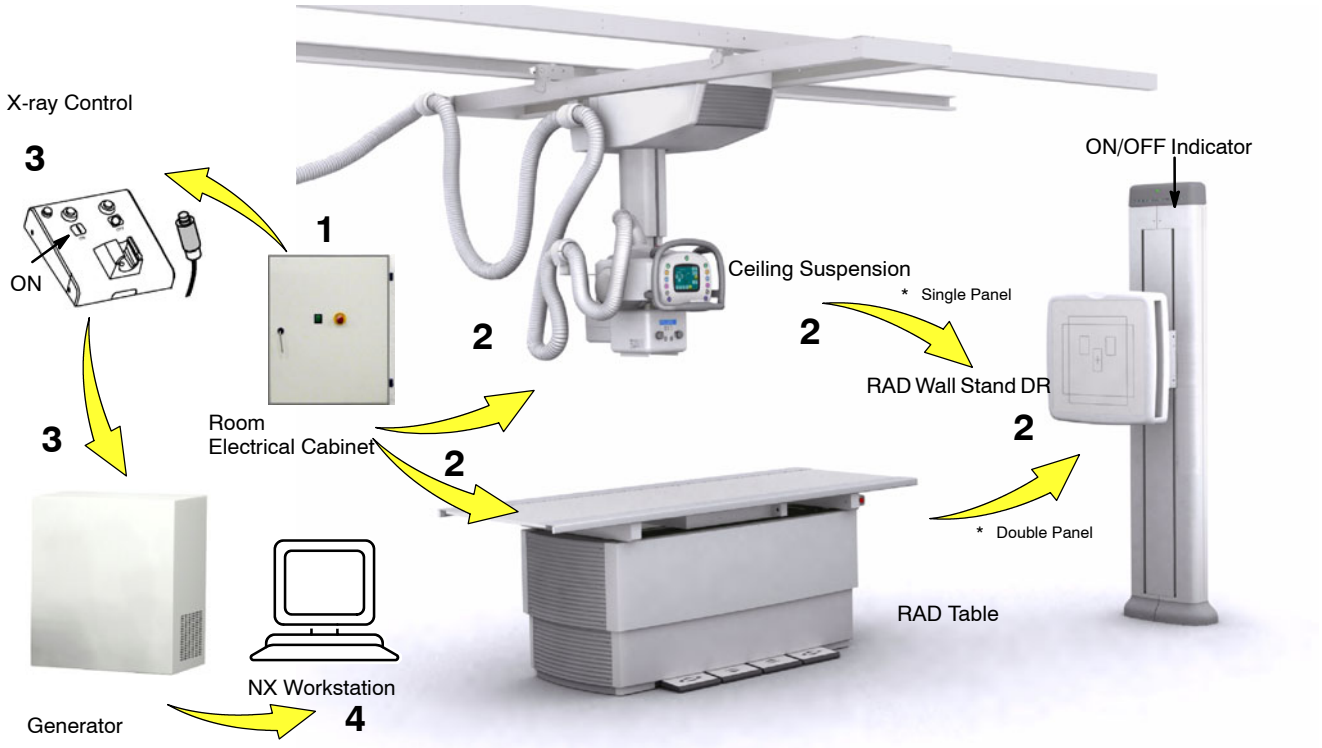
3.1 START UP

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.

TO TURN THE SYSTEM ON

1. Turn ON the Room Electrical Cabinet Switch. **The Emergency OFF Switch must not be activated.**
2. The RAD Table, RAD Wall Stand and Ceiling Suspension turn ON. RAD Wall Stand ON/OFF Indicator turns ON (green lighted).
3. Press the X-ray Generator Control ON button. ON Indicator turns ON (green lighted).
4. Turn ON the NX Workstation.

Illustration 3-1
Start Up sequence



The Ceiling Suspension and the RAD Table are provided also with an Emergency OFF Switch that cuts the power supply to the Unit. Once pressed, wait almost one minute before turning ON the Unit again.

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

TO ISOLATE THE EQUIPMENT FROM MAINS, TURN OFF THE SWITCH LOCATED AT THE ROOM ELECTRICAL CABINET.

3.2 SHUTDOWN ROUTINE

TO TURN THE SYSTEM OFF

1. Turn OFF the NX Workstation.
2. Press the X-ray Generator Control OFF button, the Green lamp turns OFF.
3. Turn OFF the Room Electrical Cabinet Switch. **Do not activate the Emergency OFF Switch.**
4. The RAD Table, RAD Wall Stand and Ceiling Suspension turn OFF. RAD Wall Stand ON/OFF Light turns OFF.

AFTER SHUTDOWN OR WHEN THE POWER IS TURNED OFF, THE BRAKES FOR THE LONGITUDINAL AND TRANSVERSE AXIS OF THE CEILING SUSPENSION AND THE BRAKES FOR LONGITUDINAL AND TRANSVERSE MOVEMENT OF THE TABLETOP ARE RELEASED.

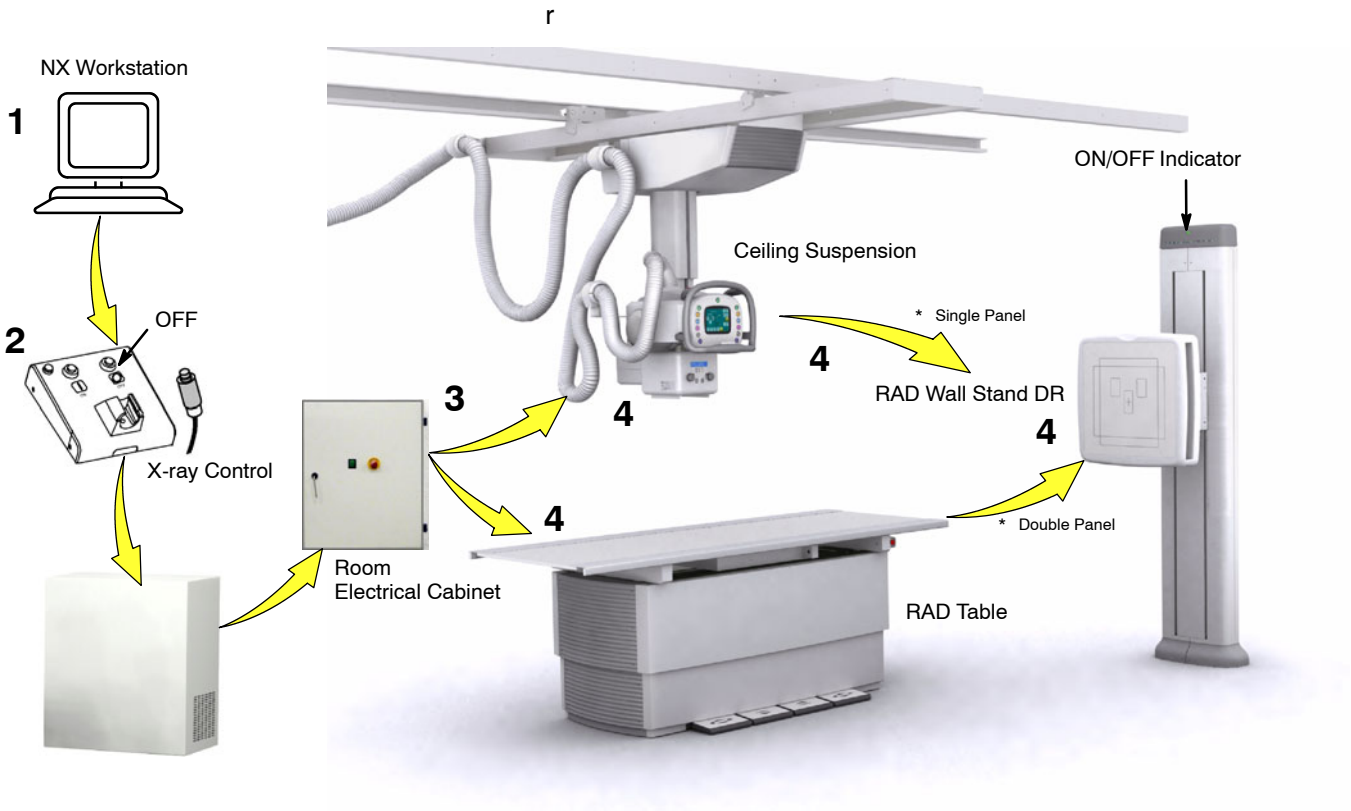
WARNING

THE CEILING SUSPENSION CAN MOVE FREELY ALONG THE LONGITUDINAL AND TRANSVERSE AXIS WHEN MINIMAL FORCE IS APPLIED. THE CEILING SUSPENSION MOVEMENT WILL STABILIZE AT THE CENTER POSITION.

WARNING

THE TABLETOP CAN MOVE FREELY IN LONGITUDINAL AND TRANSVERSE DIRECTION WHEN MINIMAL FORCE IS APPLIED. IF THE PATIENT IS STILL ON THE TABLE, HE MAY NEED HELP TO STEP DOWN FROM THE RAD TABLE.

Illustration 3-2
Shutdown sequence



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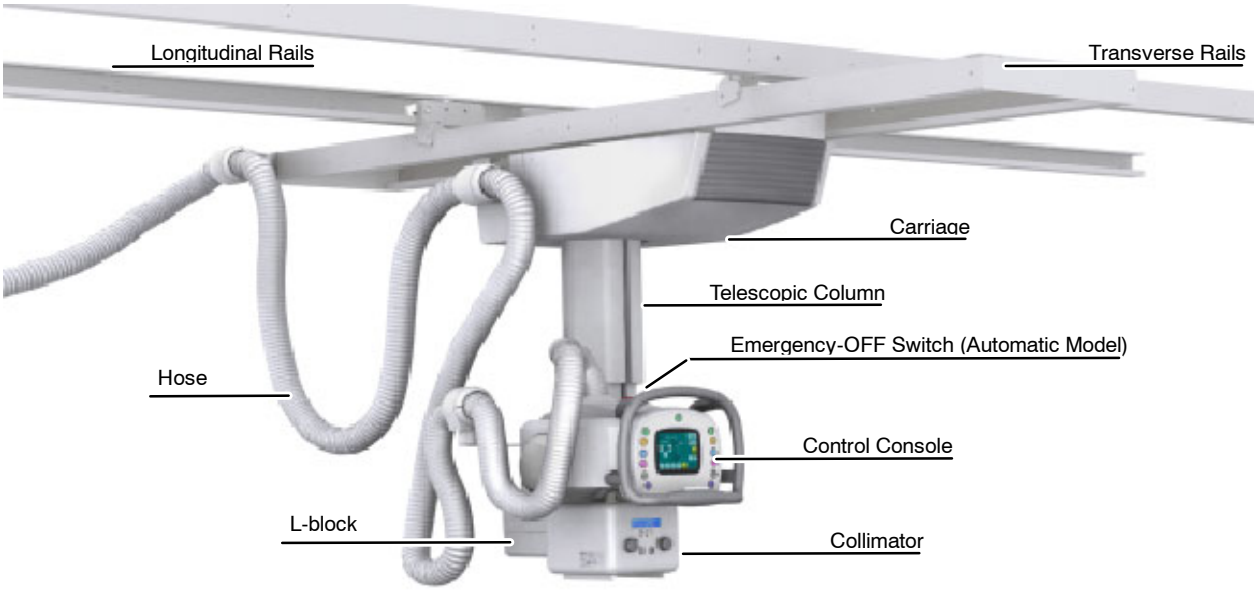
SECTION 4 CEILING SUSPENSION OPERATION

Illustration 4-1
Ceiling Suspension Nomenclature



RAIL SYSTEM

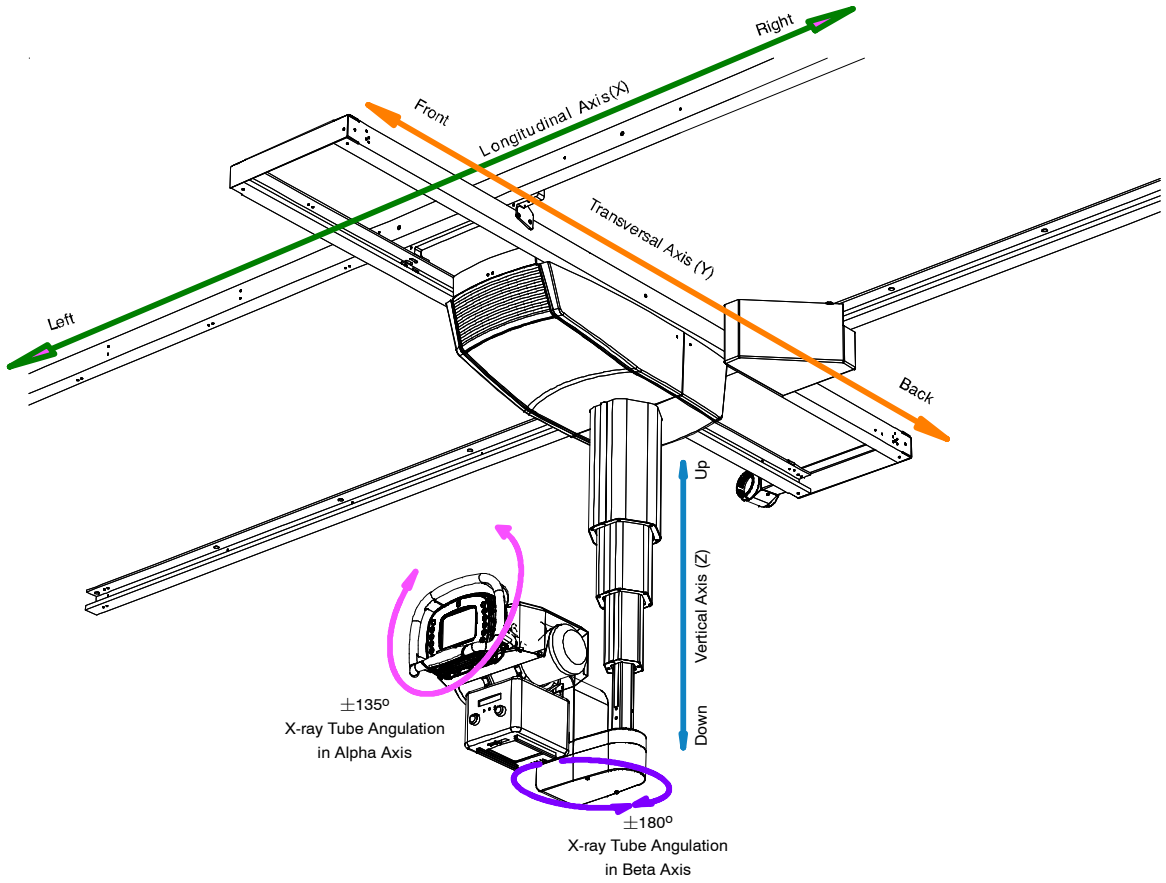
The Rail System is formed by two pairs of rails made of aluminum and available in different lengths (*refer to Section 1.2*). The rails allow the displacement of the Carriage along the Longitudinal and Transverse Axis.

Longitudinal Rails or **Axis (X)**, different lengths extrusion bars which fix the Ceiling Suspension to the ceiling. They are marked with green color strips to match the Brakes 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 orange color strips to match the Brakes Buttons of the Control Console.

The system may be provided with a Cable Support Rail, an unistrut rail with the same length of the Longitudinal Rails, located behind the back Longitudinal Rail.

Illustration 4-2
Ceiling Suspension Axis and Travels



CARRIAGE

The Carriage contains some electronics and mechanics components of the Ceiling Suspension and supports the Telescopic Column, L-Block Assembly, X-ray Tube Support with the Tube, Collimator and Control Console.

TELESCOPIC COLUMN

It is composed of four different sized hexagonal tubes of steel. Fixed to the Carriage, the Telescopic Column allows vertical movement of the X-ray Tube Assembly in the **Vertical Axis (Z)**. This motion is controlled by the Vertical Brake.

The Focal Spot vertical travel is 1570 mm (61.8”). The minimum distance Focus-Ceiling is 737 mm (29”) and the maximum distance is 2307 mm (90.8”).

L-BLOCK ASSEMBLY

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

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) $\pm 135^{o}$ from 0^{o} position (perpendicular to the floor).

COLLIMATOR

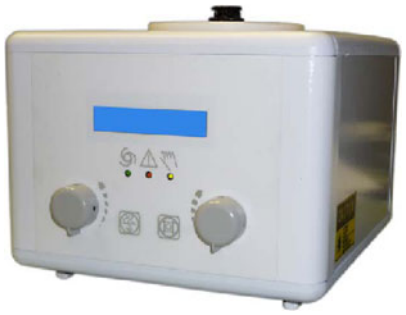
The Suspension can be associated with two Collimation options:

- **Ralco R225/R225 DHHS** Manual Collimator.
- **Ralco R225ACS** Automatic Collimator.

Illustration 4-3
Collimators

Manual Collimator

Automatic Collimator



CONTROL CONSOLE

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

Brakes Buttons are used to control each axis brake/movement. When a button is pressed and held, the brake is released, so the equipment can be moved in the free axis. Once the button is released, the brake is activated and the motion stops.

Note ☞ *If any of the Touchscreen buttons or Control Console brake buttons is pressed during an automatic motion, it will be stopped immediately.*

Illustration 4-4
Control Console and Brakes Buttons

Alpha Axis Brake. Angle of the X-ray Tube.	**Longitudinal Axis Brake.** Right & Left.
Transverse Axis Brake. Back & Front.	**Omni-directional Brake.** Transverse and Longitudinal. Vertical and/or Alpha will be also activated according to the configuration during installation.
Vertical Axis Brake. Up & Down.	**Beta Axis Brake.** Rotation of the X-ray Tube.
Wheel Omni-directional Brake. Transverse and Longitudinal. Other axis could be also activated according to the configuration during installation.	

Use always the Control Console **Wheel** to drive all manual movements of the Ceiling Suspension. Otherwise, operator could get injured due to the potential pinch points areas.

4.1 TOUCHSCREEN CONTROL CONSOLE

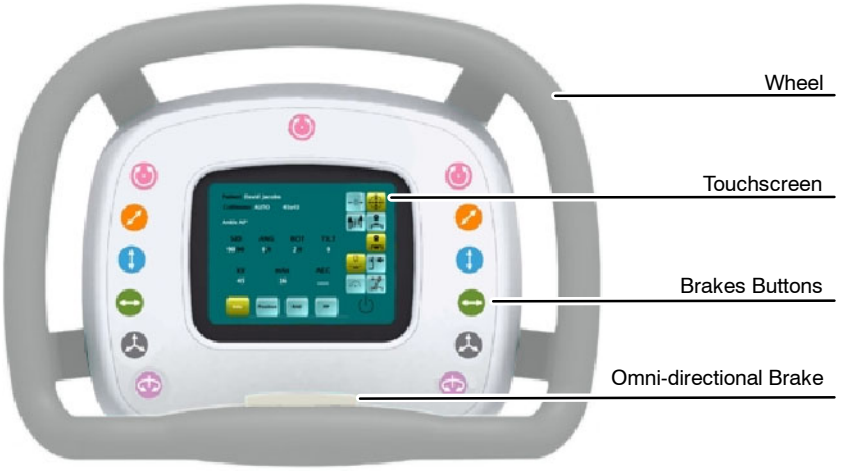
Both Automatic and Semi-automatic Ceiling Suspension models are provided with the Touchscreen Control Console and a Graphical User Interface (GUI) that allow the operator to configure the Exposure Technique, Workstation, X-Ray Tube and DR Detectors position.

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

For both systems the User Interface is almost similar, with same functions, but the movements policy is different:

- **Automatic System.** All 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.
- **Semi-automatic System.** Only Vertical Axis is motorized and it is not possible to move automatically the X-ray Tube in all directions, just in Vertical Axis are Auto-positioning, Auto-centering and Auto-tracking functions available. Move manually the Ceiling Suspension along Transverse, Longitudinal, Alpha and Beta Axes.

Illustration 4-5
Control Console

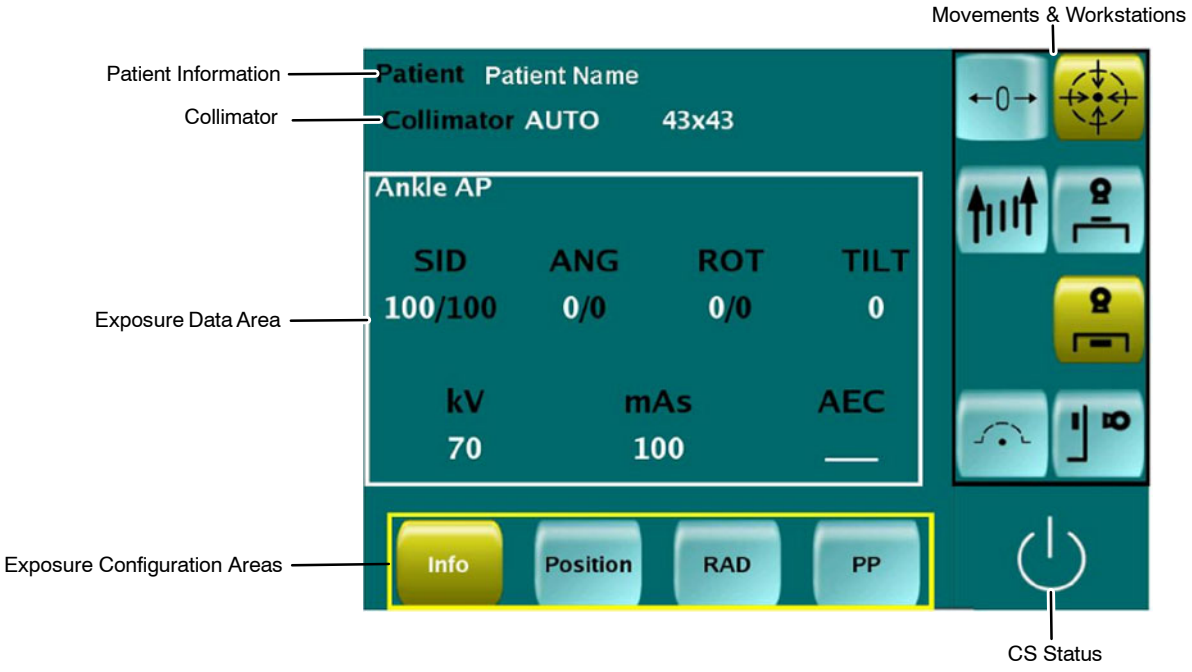


The Touchscreen interface is composed by the next data areas:

- **PATIENT INFORMATION**. Patient Name is displayed.
- **COLLIMATOR**. Mode and configuration of the collimation indicator.
- **MOVEMENTS & WORKSTATIONS**. Select the Workstation and activate/deactivate the automatic movements.
- **CEILING SUSPENSION (CS) STATUS**. Check the Ceiling Suspension status.
- **EXPOSURE CONFIGURATION AREAS**. Press to select the area to be configured.
- **DATA AREA**. Check and modify according to the available Area. Depending on the selected Exposure Configuration Area the displayed parameters change.

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

Illustration 4-6
Touchscreen Initial Display



Press on Configuration Areas buttons to access to them.

- **INFO** check exposition configuration: Patient data, Collimation and APR configuration, X-ray Tube position, Technique and AEC configuration.
- **POSITION** configure the X-ray Tube position.
- **RAD** for Technique configuration and modification.
- **PROGRAMMED POSITION** (**PP**). Configure X-ray Tube position and other radiological parameters automatically.

It is possible to change at any moment the Area.

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

4.1.1 WORKSTATION SELECTION

Workstation Buttons are always available for changing the desired option.

DIRECT WORKSTATION: Press to select Direct exposure when the DR Detector is not required. When selected it is possible to execute an exposure at any moment without DR 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 DR Detector of the RAD Table. When this option is selected the Active Workstation Indicator of the RAD Table (under top Base Cover) gets lighted. In **Single Panel Systems** it can be selected to work with the RAD Wall Stand DR in horizontal position.

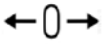
RAD WALL STAND WORKSTATION: Press for an exposure with the DR Detector of the RAD Wall Stand. When this option is selected the Active Workstation Indicator of the RAD Wall Stand (at the Top Cover) gets lighted.

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

4.1.2 MOVEMENTS CONTROLS AND INDICATORS

AUTO-CENTER. Get active the Auto-center function to align the X-ray Tube with the DR Detector. RAD Table or RAD Wall Stand Workstations must be selected. It is not active for Direct Workstation.

AUTO-TRACKING. Get the Auto-tracking motion active. It is possible to activate it just when the X-ray Tube is aligned with DR Detector of the selected Workstation, RAD Table or RAD Wall Stand Workstations. It is not active for Direct Workstation. Auto-tracking function remains active for 5 minutes after Ceiling Suspension becomes inactive.



PARKING POSITION. It indicates when the X-ray Tube has reached to the configured Position or Auto-position. Active for all Workstations.

DETENT SKIPPER. Press to activate the Detent Points Skipper. No Detent Point is activated when active. Active for all Workstations.

4.1.3 CEILING SUSPENSION STATUS INDICATOR

Current status of Ceiling Suspension are indicated at the right bottom corner of the Touchscreen Console. The available status are:

The Ceiling Suspension is ready to make X-ray exposures. It is aligned with the DR Detector. The Ceiling Suspension and the DR Detector are aligned when the central beam of the X-ray Tube hits inside the previously defined image reception area. This area is defined by Service Engineer during configuration and calibration procedure.

The Ceiling Suspension is in motion. Not possible to make X-ray exposures.

The Ceiling Suspension is stopped and not centered with the DR Detector. Not possible to make X-ray exposures.

The Ceiling Suspension is not synchronized with the Generator.

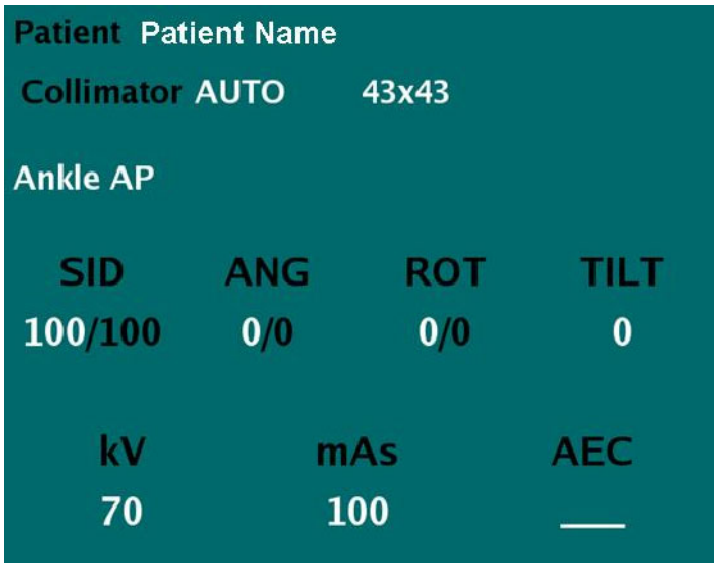
X-ray Interlocks. Unable to make exposures. Press on it to know the reason of the Status *(refer to Section 4.2.3.5 " X-ray Interlock" for further details)*.

4.1.4 INFO AREA

INFO appears just after the Ceiling Suspension has been switched ON. In this display it is possible to check:

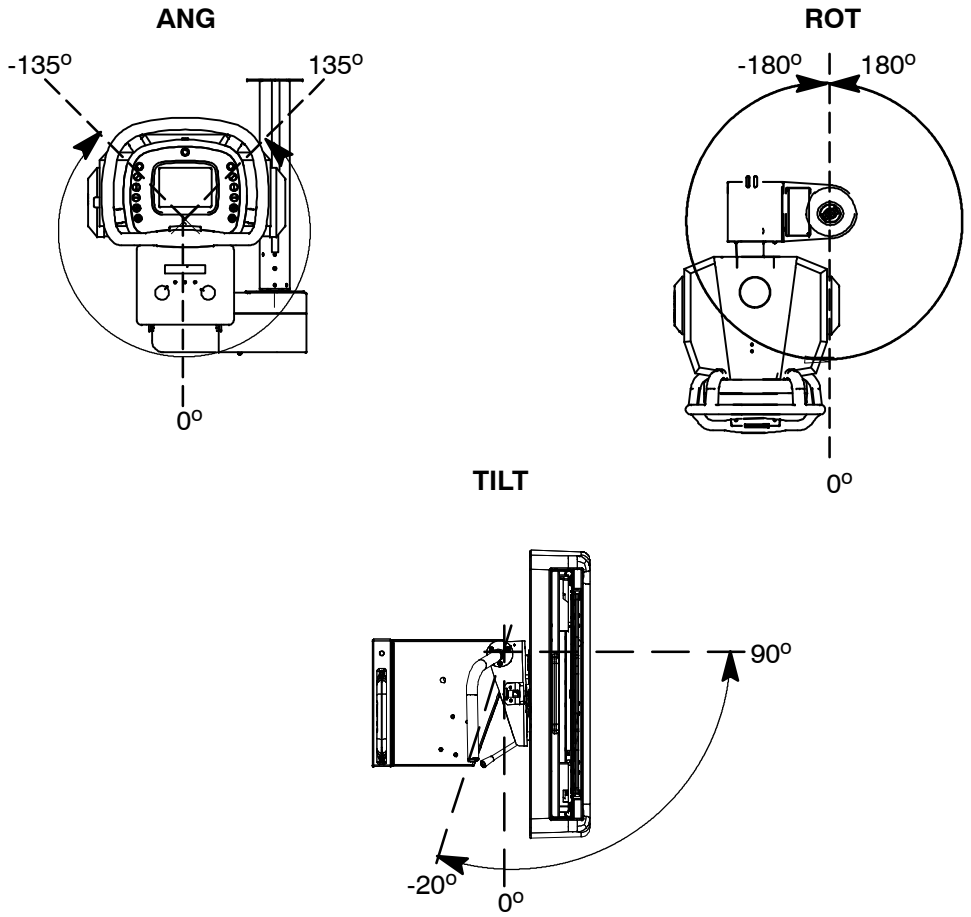
- Configured exposure.
- X-ray Tube Position:
  - **SID**
  - **ANG** or X-ray Tube angle
  - **ROT** or X-ray Tube rotation angle
  - **TILT** or RAD Wall Stand DR Detector tilting angle
- X-ray Tube Position and Technique set up, depending on the technique 2P or 3P parameters are different **(kV-mAs** or **kV-mA-ms).**
- AEC set up.

Illustration 4-7
INFO Display



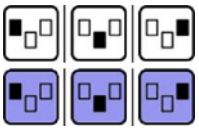
When the position values are in white, they indicate the current ones and in black the previously set by default.

Illustration 4-8
Tube Position Description and Vertical DR Detector Tilting



4.1.5 RAD AREA

Select for Technique configuration:



AEC. It is possible to select any combination of **AEC** area. Selected option is highlighted by the shaded background.

It is possible that the **AEC** were not available by configuration or if the Direct Workstation is selected. It is displayed but it is not possible to set it up.

FOCAL SPOT. Small or Large toggle when the Button is pressed.

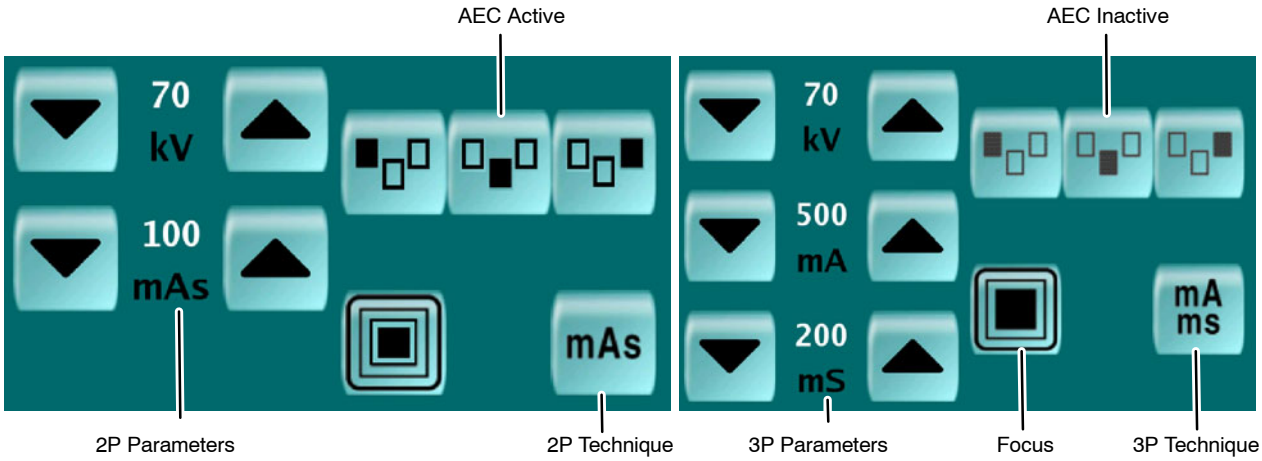
OPERATING MODE. mAs (2P) or mA/ms (3P) toggle when the Button is pressed. Configure the Technique:

- **kV** and **mAs** for the **2P.**
- **kV, mA** and **ms** for the **3P.**

PARAMETERS. Press on the **INCREASE**/**DECREASE** Buttons to set up the desired values.

Note ☞ *All new parameters set up modification is automatically transferred to the X-ray Generator.*

Illustration 4-9
RAD display



4.2 CEILING SUSPENSION 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.

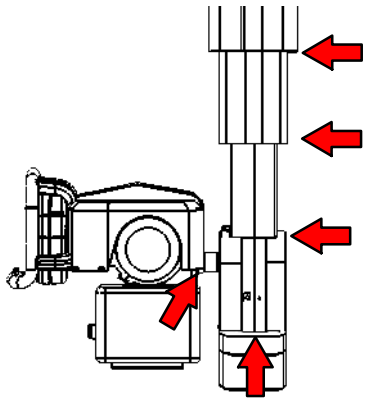
WARNING

USE THE CONTROL CONSOLE WHEEL TO CONTROL AND DRIVE 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 4-10
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 SUSPENSION.

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 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.

THIS EQUIPMENT MUST BE CONTROLLED JUST BY ONE OPERATOR. SIMULTANEITY OF ACTIONS IN MOVEMENT OR RADIATION PUSHBUTTONS MUST BE AVOIDED. ONLY IF AN SPECIAL ACTION IS INDICATED IN THIS MANUAL SIMULTANEITY OF ACTIONS IS ALLOWED.

IN THE EVENT OF AN EMERGENCY, TURN OFF THE CEILING SUSPENSION 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.

4.2.1 CEILING SUSPENSION MANUAL MOTION

To move the equipment in relation with its axes:

1. Press and hold the corresponding button of the axis Brake on the Control Console. The Brake will be released.
2. Drive the Ceiling Suspension to the desired position.
3. Release the button. This will re-energize the brake.

To carry out freely all movements simultaneously on the Vertical, Transverse or Longitudinal Axes, use the Omni-directional Button located on the Wheel of the Ceiling Suspension.

Note ☞ *The equipment stops moving at Detent Points even when the brake has been released. Press and hold the button again to continue with the movement.*

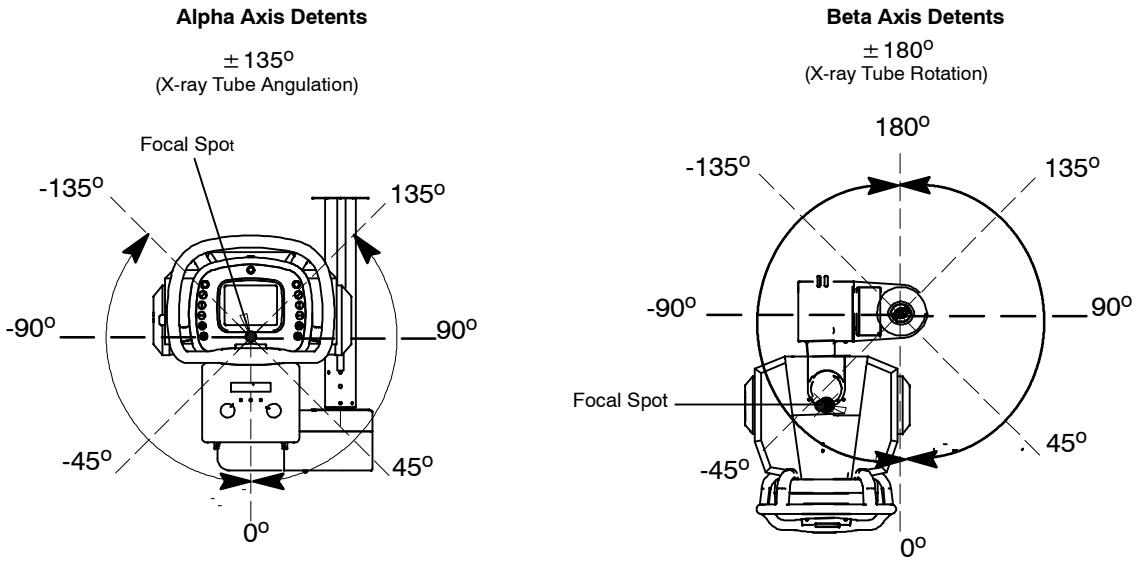
4.2.2 DETENT POINTS

Detent Points are defined work positions where locks are activated once the Ceiling Suspension reaches at one of these positions. When stopped at one of these Detent Points, in order to continue with the movement, just released the brake by pushing its corresponding button and move manually or perform another auto-position.

These Points for the equipment are specified by Service Engineer according to useful positions in normal radiographic studies. So:

- On the Longitudinal and Transverse Axes they are configured for a good alignment with the Receptor according to the direction in which the X-ray Tube is pointing, or at some specific positions defined by the user.
- On the Vertical Axis defined according to the defined SID Distance.
- On the Alpha and Beta Axes factory set at each 45º. But just in the case of the Automatic System, they can be modified by the Service Engineer. In the Semi-automatic System, these Detent Points are fixed at each 45º, they can not be modified.

Illustration 4-11
Alpha and Beta Detent Points



There are different kind of Detents Points:

- **Floating and Electronic Detent Points.** Both systems are provided with floating Detent Points by default. These points are defined by software in every final position of a PP or Auto-position:
  - In case of the Automatic System *refer to Section 4.2.4 - "Position. Automatic System Auto-positioning". and Section 4.2.6 - "Programmed Positions (PP)".*
  - In case of the Semi-automatic System *refer to Section 4.2.5 - "Position. Semi-automatic System Auto-positioning" and Section 4.2.6 - "Programmed Positions (PP)",* electronic detents are optional.
- **Software defined Detent Points during manual motion**. In some cases it is possible to configure up to 4 different detent positions during for each axis and workstation. This option is available **just if configuration is changed by customer technical service.** At these Detent Points, the equipment will activate the brakes, whenever the manual movement is made smoothly, when the movement is faster than configured then Detent Point is skipped.
- **Mechanical Detents for Semi-automatic Ceiling Suspension.** The Mechanical Detents kit are provided for the Longitudinal and Transverse Axes. Install these mechanical detent kit when it is required to improve the Auto-tracking detent points performance. It is not mandatory their installation when the electronic detents are enabled.

There are some audible signals that alert when:

- the equipment enters/exits into the Detent Point influence area.
- the Detent Point is activated.

To avoid that the Ceiling Suspension stops at these Detent Points, just move faster the Ceiling Suspension to avoid the detent points or press on the Detent Skipper Button to deactivate all Detent Points.

By default there is one Detent Point configured in the center of both Receptor (Table and Wall Stand). If the Auto-tracking is activated this Detent is auto-configured in this initial point, if the Receptor is moved to a new position and the Auto-tracking is activated again, the new position will be configured automatically as the new Detent Point.

4.2.3 AUTOMATIC MOVEMENTS

There are three types of motorized/automatic movements: Auto-center, Auto-tracking and Auto-positioning.

Note ☞ *The Automatic Ceiling Suspension has motorized motion in all axes, but the Semi-automatic Ceiling Suspension is motorized only in Vertical Axis. So, all automatic movements are available just in the Vertical Axis.*

Note ☞ *During Automatic movements, pressing any Touchscreen Console button will stop the motion.*

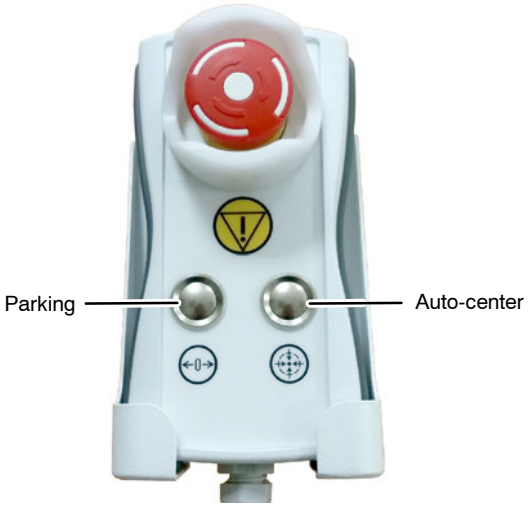
4.2.3.1 AUTOMATIC POSITIONING CONTROL BOX

The Automatic Movements Control Console allows the remote control of the Auto-center and Parking (Auto-positions) movements, instead of using the Ceiling Suspension Console.

Pressing and holding the PARKING, for Auto-positioning movements, and AUTO-CENTER, for Auto-center and Programmed Positions (PP), buttons enables the positioner automatic motion.

- When button is released during the motion, all movement stops.
- When button is reactivated, motion will resume from where it stopped.

Illustration 4-12
Automatic Positioning Control Box



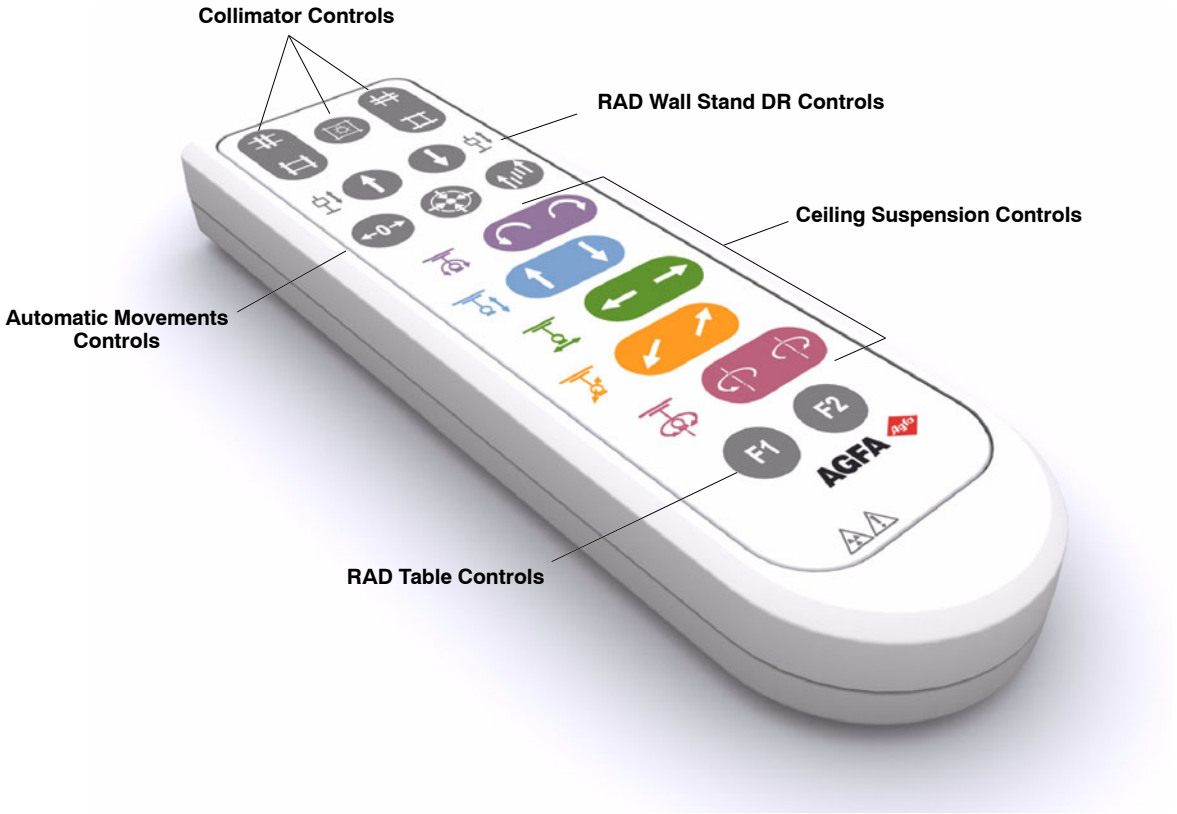
4.2.3.2 REMOTE CONTROL

The Remote Control is an option just for **DX-D 600 Automatic Systems.**

The Remote Control allows:

- to control the Automatic Collimator blades aperture and light,
- to move vertically the DR Detector of the RAD Wall Stand DR,
- to control the automatic movements, auto-center, auto-tracking and auto-positioning,
- to move the Ceiling Suspension in all Axes and
- to move the DR Detector of the RAD Table.

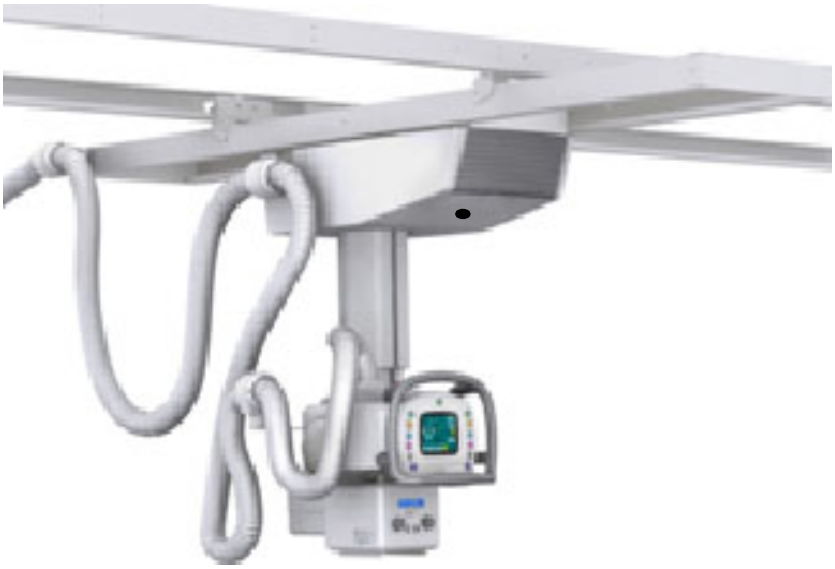
Illustration 4-13
Remote Control



To use the Remote Control:

1. Point the Remote Control to the Ceiling Suspension Carriage, where the IR Detector is located.

Illustration 4-14
Ceiling Suspension IR Detector



2. Hold pressed 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 Remote Control must have a direct line of site to the Ceiling Suspension. Any people or objects between the both will prevent or stop system movement.*

The Remote Control Functions are:

Collimator LONGITUDINAL FIELD SIZE Adjustment:

a. Press the top of the button to close the Collimator
b. Press the bottom to open the Collimator.

Collimator LIGHT SWITCH.

Turn the collimator light ON / OFF.

Collimator TRANSVERSE FIELD SIZE Adjustment:

a. Press the top of the button to close the Collimator
b Press the bottom of the button to open the Collimator.

DR Detector DOWN Movement.

Hold pressed to lower the DR Detector of the RAD Wall Stand DR.

DR Detector UP Movement.

Hold pressed to raise the DR Detector of the RAD Wall Stand DR.

PARKING POSITION.

Hold pressed when executing any Parking Position or Auto-position (*refer to Section 4.2.4*.)

AUTO-CENTER.

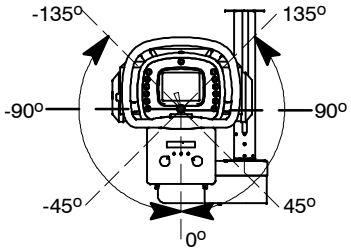
Hold pressed when auto-centering *(refer to Section 4.2.3.6.)*

AUTO-TRACKING

Press to activate/deactivate *(refer to Section 4.2.3.7.)*

X-Ray Tube Angulation

a Hold pressed the left button to move the tube from 0º to -135º
b Hold pressed the right button to move the tube from 0º to 135º



Vertical displacement of the X-ray Tube

a Hold pressed the left button to move upwards
b Hold Pressed the right button to move downwards

Longitudinal displacement of the X-ray Tube

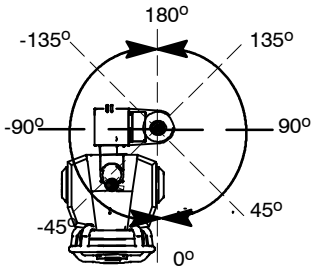
a Hold pressed the left button to move to the left
b Hold pressed the right button to move to the right

Transverse displacement of the X-ray Tube

a Hold pressed the left button to move forwards
b Hold pressed the right button to move backwards

X-Ray Tube Rotation

a. Hold pressed the left button to move the tube from 0º to -180º
b Hold pressed the right button to move the tube from 0º to 180º



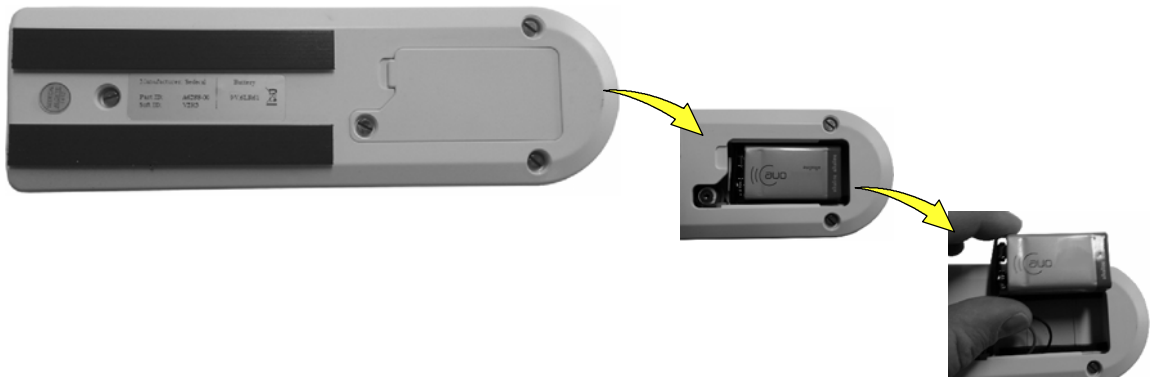
DR Detector Left Movement
Hold pressed to move to the left the DR Detector of the RAD Table.

DR Detector Right Movement
Hold pressed to move to the right the DR Detector of the RAD Table.

The Remote Control Device is powered by an 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 4-15
Remote Control Battery Replacement

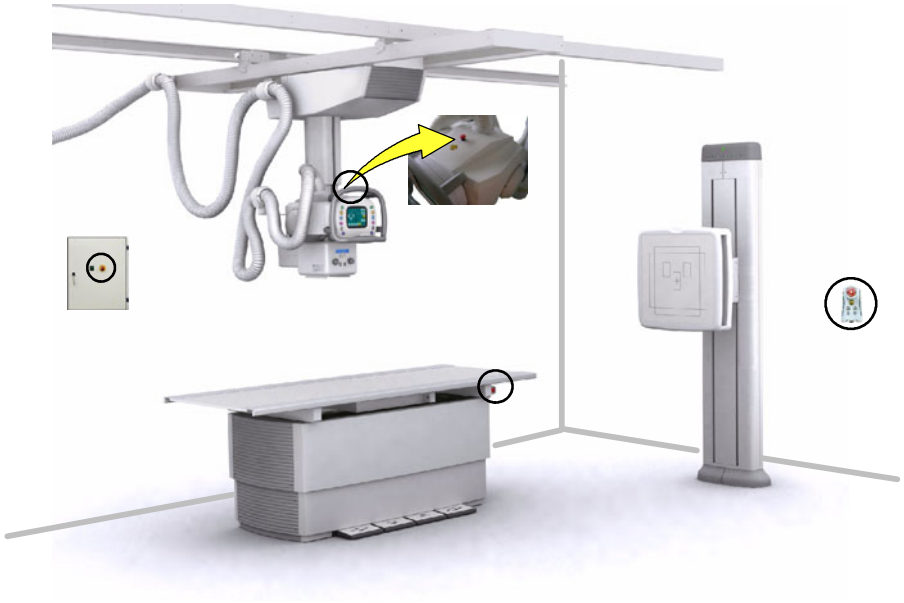


4.2.3.3 EMERGENCY STOP FOR AUTOMATIC MOVEMENTS

The DX-D 600 is equipped with different Emergency OFF Switches placed at top of the X-ray Tube Covers in the Ceiling Suspension (just for Automatic Systems), in the RAD Table, in the Automatic Positioning Control Box and in the Electrical Room Cabinet. The System is OFF when the Emergency-OFF Switch is pressed.

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.

Illustration 4-16
X-ray System Emergency OFF Switches



4.2.3.4 AUTOMATIC MOVEMENTS SAFETY POLICY

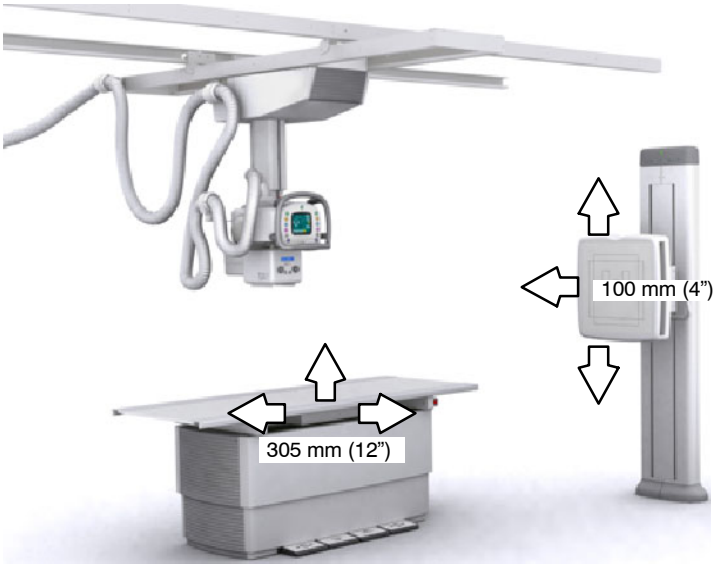
When the operation of the equipment is manually controlled by the Operator, the risk of collision with other equipments, parts of the Room and specially with the other Operators or Patients is very low and totally controllable by the Operator.

But when the System is Semi-Automatic or Automatic, it is provided with several anti-crushing or auto-movement safety rules.

- The speed of automatic movements is optimized for safety and productivity.
- The Operator will be required to press and hold any of the Automatic Positioning Control Box buttons to get all brakes released and start the motion. Once the button is released the equipment stops.

- Volumetric protection areas are activated around both DR Detectors. A virtual safety area has to be configured around a patient lied down on the RAD Table or positioned at the RAD Wall Stand DR.

Illustration 4-17
Patient Virtual Safety Areas



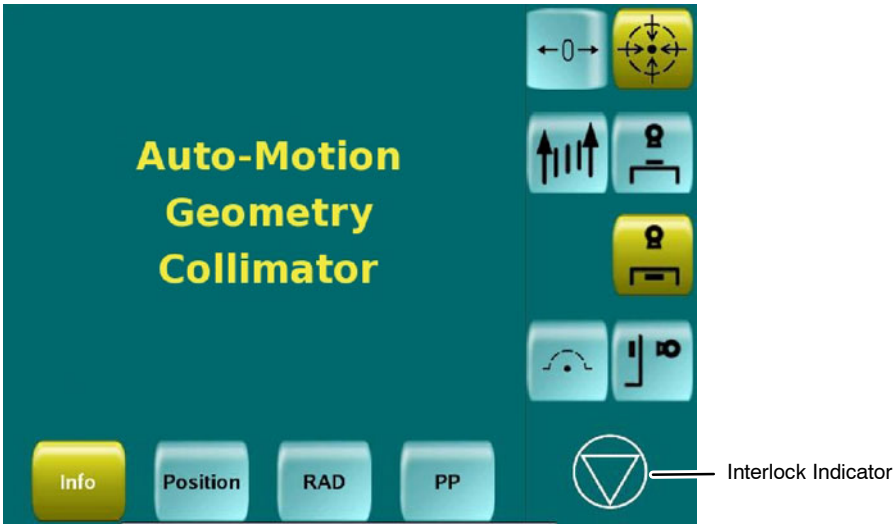
- The equipment speed will be limited to one-half and an audible signal will be activated when the equipment is within 305 mm (12") of the patient Tabletop or within 100 mm (4") of the RAD Table side.
- Manual movements are free inside these protection areas, but automatic movements are forbidden from outside to any place inside this area. **Automatic movement within the virtual safety area is allowed to escape from this area, but at a reduced speed**.
- In these areas, the motion will not continue more than 13 mm (0.5") after the Operator has activated the stop or motion reverse control.
- Minimum SID for automatic movements >950 mm (37.4").
- Maximum SID for automatic movements <4000 mm (137.5"), if Room configuration and rails dimensions allow it.
- In case of collision the pressure is limited to 178.6 kg/m (10 lbs/inch) maximum and 178 Newtons (40 lbs.)
- If the Operator changes the DR Detector position during the Auto-centering movement, the Ceiling Suspension stops this movement and goes back to the initial position.
- It will not be possible to complete any automatic movement when the Input Interlock Signal is active.

4.2.3.5 X-RAY INTERLOCK

The X-ray INTERLOCK Indicator appears at the bottom of the Console on the Ceiling Suspension Status Area. Once the interlock is activated it is not possible to make any exposure, press on the Indicator to get information about the causes of the Interlock.

Causes of the Interlock activation are displayed in the Control Console, or press the Interlock Indicator to get them displayed again.

Illustration 4-18
X-ray Interlock Status



The causes can be different ones at the same time, not just one, get all of them corrected to deactivate the X-ray Interlock:

MESSAGE	DESCRIPTION
MANUAL-MOTION	The Suspension is being moved manually.
AUTO-MOTION	The Suspension is moving automatically (Auto-positioning, Auto-tracking, Auto-centering, etc.).
NO-DETECTOR	The Detector is not inserted.
NO-SID	No SID available. The Suspension is not pointing to the Detector, or too far from it.
GEOMETRY	No SID available. The Suspension is not pointing to the Detector.
COLLIMATOR	Collimator is in BUSY Mode.
GRID-SID	Current SID out of configured range for the Grid.
MODALITY	Selected Study (Stitching, Tomography, etc.) not available.
DETECTOR-MISMATCH	Different Workstations selection on Suspension and Generator
STITCHING	The Suspension is carrying on a Stitching procedure.
NO-TRAY	Tray is out from the DR Detector.

4.2.3.6 AUTO-CENTER

The Ceiling Suspension gets aligned the X-ray Tube with the center of the DR Detectors of the RAD Table or RAD Wall Stand, i**t is not active with the Direct Workstation.**

DUE TO SAFETY REASONS, THE MINIMUM SID FOR AUTO-CENTER FUNCTION IS HELD AT 950 mm (37.4”) FROM THE DR DETECTORS.

Note ☞ *Automatic Collimators should change to Manual mode if the Ceiling Suspension and the DR Detector are not at 2º of the orthogonality.*

Note ☞ *Auto-center movement is initiated by the Automatic Positioning Control Box. For safety reasons, press and hold the Auto-center button to maintain the motion, once it is released the motion stops.*

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

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

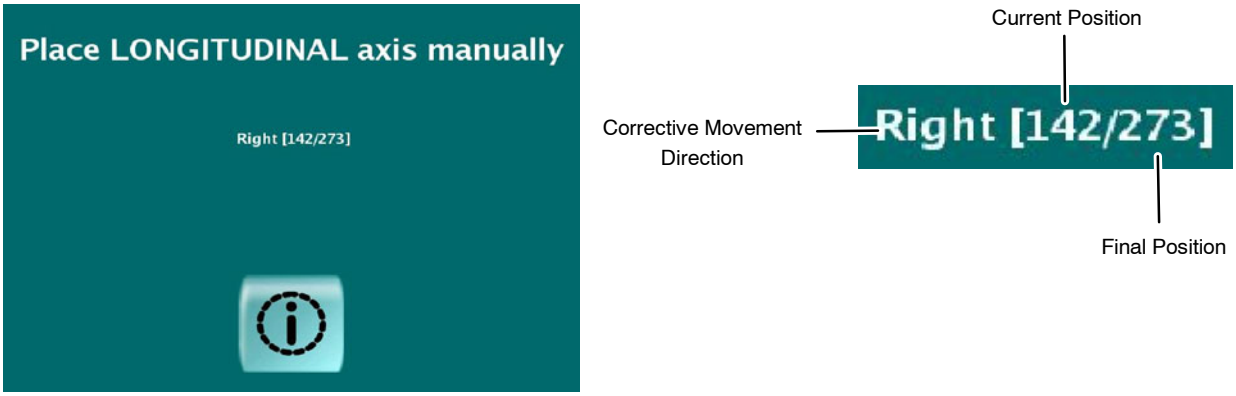
To complete the Auto-center function:

1. Select the Workstation.
2. Configure in POSITION the desired SID. Refer to *Section 4.2.4 for* Automatic System or *Section 4.2.5* for Semi-automatic System.

3. Press on the Touchscreen Console the AUTO-CENTER Control to activate the function.

4. If the Semi-Automatic Ceiling Suspension is not in the correct position in non motorized axes (Longitudinal, Transverse, Alpha or Beta), a message will be displayed explaining the corrective action to be completed. It is indicated first the Current Position and the Final Position too. Place manually the Suspension in the correct position as indicated in the Message.

Illustration 4-19
Position Message for Semi-automatic System

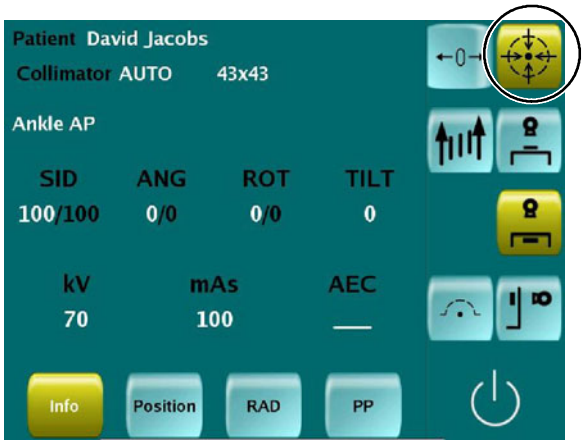


5. Press and hold the Auto-center button of the Automatic Positioning Control Box to complete the movement or, if available, in the Remote Control.

6. The Collimator Lamp gets lighted to indicate the current position of the X-ray tube.

7. Once the X-ray Tube is properly aligned and centered, the Auto-center Control gets lighted.

Illustration 4-20
Ceiling Suspension and Table DR Detector Centered



4.2.3.7 AUTO-TRACKING

This function allows the X-ray Tube to follow the DR Detector 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.

CAUTION

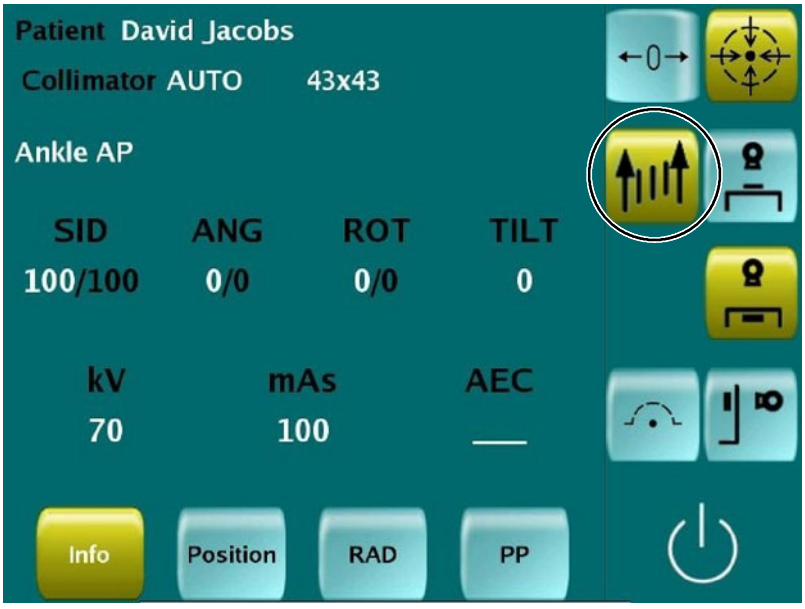
For safety reasons, the displacement speed of the Slave equipment is always slower than the Master's speed.

Auto-tracking function activation**:**

- **Manually**, press the Auto-tracking Control in the Control Console or Remote Control if available. The SID is set at the current distance.
- When the **Programmed Position** (PP) is configured to have the Auto-tracking function activated. It will remain ON automatically after reaching the demanded Programmed Position. Refer to *Section 4.2.6*.

Note ☞ *In case the last PP was configured with the Auto-tracking On, it remains ON until it is deactivated, manually or selecting other PP configured with the Auto-tracking OFF.*

Illustration 4-21
Auto-tracking Function Control



To activate the Auto-tracking function, the SID must be between 950 mm (37.4”) and <4000 mm (137.5”), 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.

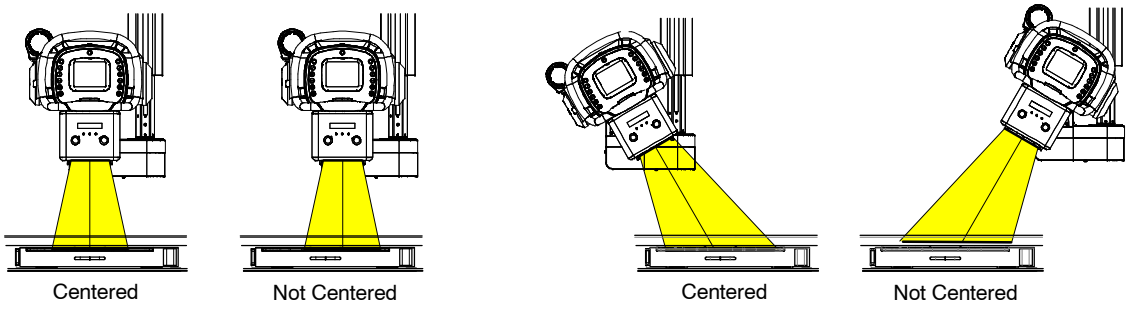
Configure a new SID before activating the Auto-tracking function. Use the Auto-center function to change the SID (refer to *Section 4.2.3.6*) or move manually the X-ray Tube up to the new distance and then, press the AUTO-TRACKING Control.

CAUTION

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

It is not necessary to center the X-ray Tube with the DR Detector, but both pieces of equipment must be aligned; that is, the X-ray tube must be pointing to the DR Detector. The Slave equipment will reach the final position once the X-ray beam is pointing to the same spot of the DR Detector that it was pointing to before starting the displacement.

Illustration 4-22
Ceiling Suspension and DR Detector must be aligned



Note ☞ *There are two different buzzing alarms, one to indicate when the Auto-tracking movement is running and a second one to indicate when it is finished.*

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

AUTOMATIC CEILING SUSPENSION WITH RAD TABLE

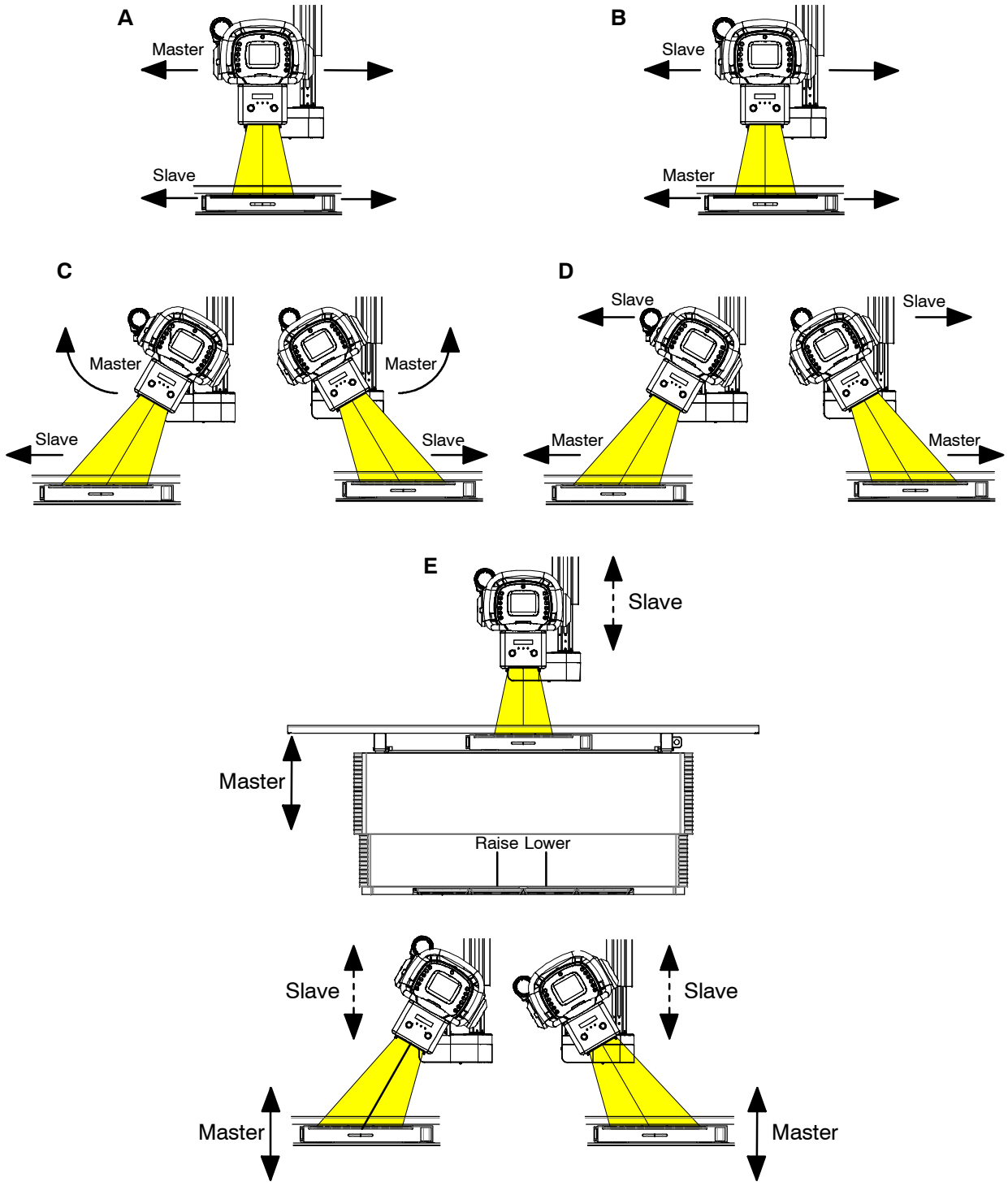
Depending on the Axis:

- **Horizontal Auto-tracking.** Both pieces of equipment can operate as Master or Slave.
- **Vertical Auto-tracking.** The RAD Table is always the Master element and the Ceiling Suspension the Slave.

Proceed as indicated for manually operated Auto-tracking:

1. Press the AUTO-TRACKING control of the Console (or Remote Control if available) to activate the function. The background is in yellow when activated.
2. Move manually the Master equipment (refer to *Illustration 4-23*):
   a. The Ceiling Suspension is the Master and is moved longitudinally. Press and hold the Longitudinal brake Button of the Control Console and move to the right/left. The DR Detector tracks its movement in the same direction. The SID remains constant.
   b. The RAD Table is the Master and the DR Detector is moved longitudinally. Press and hold the DR Detector brake button and move to the right/left. The Ceiling Suspension tracks its movement in the same direction. The SID remains constant.
   c. The Ceiling Suspension is the Master and is moved along its Alpha Axis. Press and hold the Alpha Brake button of the Control Console and angle the X-ray Tube. The DR Detector tracks its movement longitudinally. The SID is modified.
   d. The RAD Table is the Master and is moved longitudinally while the Ceiling Suspension is angled. Press and hold the DR Detector brake button and move to the right/left. The Ceiling Suspension tracks the movement of the DR Detector and moves longitudinally. The SID remains constant.
   e. The RAD Table is the Master and is moved in the Vertical Axis. Step and hold the RAISE or LOWER Control Pedal to move UP/DOWN the DR Detector. The Ceiling Suspension tracks vertically its movement in all cases. The SID remains constant.
3. Press/Step the brake or pedal and hold until the Slave equipment arrives to the final position and is aligned with the Master Equipment.
4. In case the brake button is released before finishing the Auto-tracking movement, it gets aborted. Once the brake button or pedal is pressed again, the Slave equipment gets aligned with the Master equipment at the default SID.

Illustration 4-23
Auto-tracking Movement Policy for Automatic System with RAD Table



AUTOMATIC CEILING SUSPENSION WITH RAD WALL STAND DR

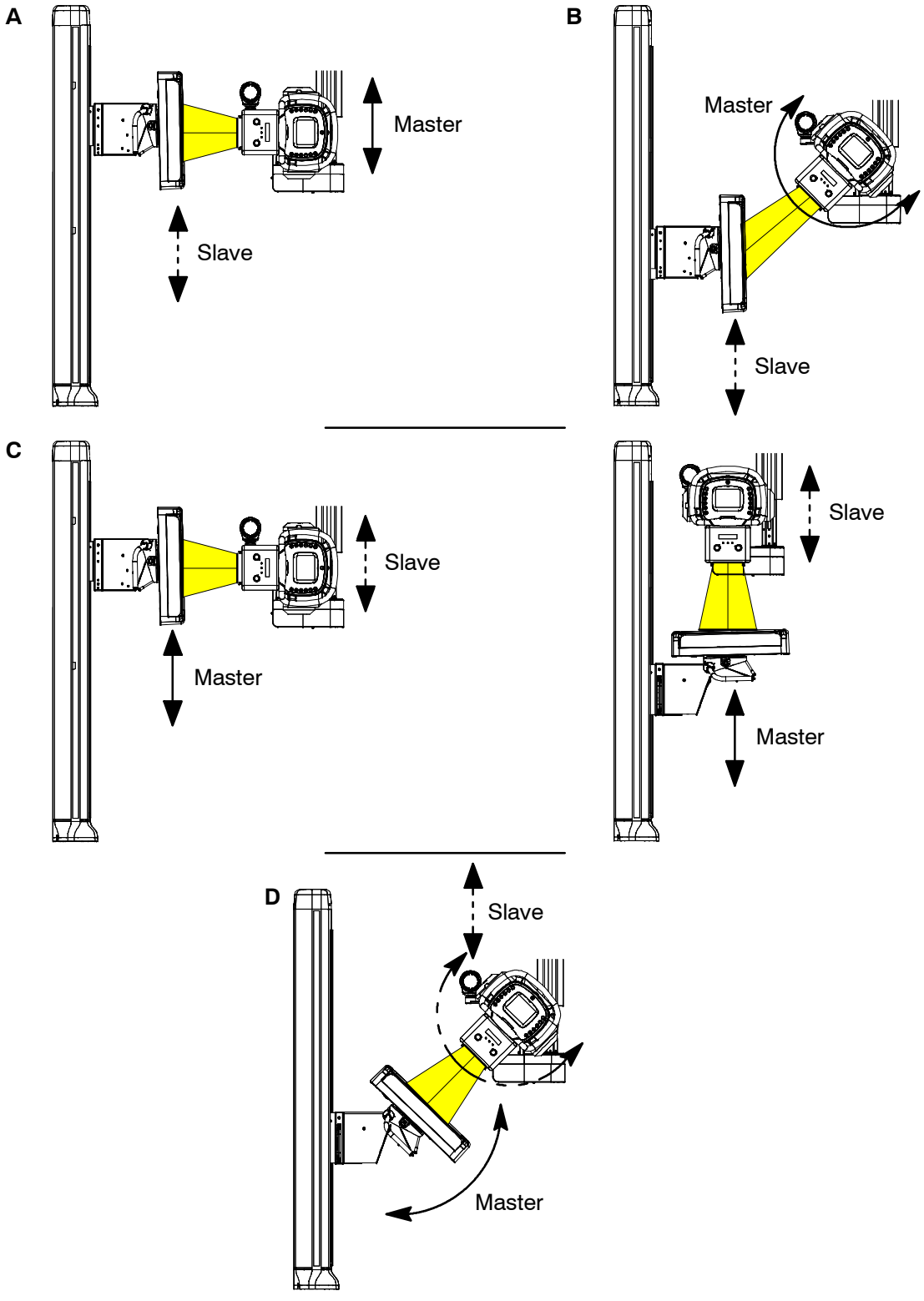
Depending on the DR Detector tilting angle:

- The Receptor can be the Master in all cases, even when it is tilted. The Suspension can move UP/DOWN or in Alpha Axis to get the X-ray tube aligned.
- The Ceiling Suspension is the Master just when the Receptor is at 0º or at 90º. If it is in a different angle, the Ceiling Suspension can be just the Slave. The Wall Stand is the Slave and it can just move UP/DOWN.

Proceed as indicated for manually operated Auto-tracking:

1. Press the AUTO-TRACKING control of the Console (or Remote Control if available) to activate the function. The background is in yellow when activated.
2. Move manually the Master equipment (refer to *Illustration 4-24.*):
   a. The Ceiling Suspension is the Master and is moved vertically. The DR Detector must be at 0º. Press and hold the Vertical Brake button of the Control Console and move UP/DOWN the X-ray Tube. The DR Detector moves in the same direction. The SID remains constant. It is not valid when the Receptor is tilted at 90º.
   b. The Ceiling Suspension is the Master and is moved in the Alpha Axis. Press and hold the Alpha Brake Button and angle the X-ray Tube. The DR Detector tracks its movement vertically, so the SID is modified.
   c. The RAD Wall Stand DR is the Master and is moved vertically. The DR Detector can be tilted at any angle or in vertical position at 0º. Press and hold the Vertical Lock or step on the UP/DOWN Pedal of the Footswitch. The Ceiling Suspension tracks its movement in the same direction in all cases. The SID remains constant.
   d. The RAD Wall Stand DR is the Master and changes its tilting angle. The Ceiling Suspension tracks its movement vertically and changes its angle to get aligned with it, so the SID remains constant.
3. Keep pressing the brake or pedal until the Slave equipment arrives to the final position and is aligned with the Master Equipment.
4. In case the brake button or pedal is released before finishing the Auto-tracking movement, it gets aborted. Once the brake button or pedal is pressed again, the Slave equipment gets aligned with the Master equipment at the default SID.

Illustration 4-24
Auto-tracking Movement Policy for Automatic System with RAD Wall Stand DR



SEMI-AUTOMATIC CEILING SUSPENSION WITH RAD TABLE

In Semi-automatic Systems the Auto-tracking movement is available only in the **Vertical direction**, by default.

Note ☞ *The DR Detector of the Semi-automatic Table is not motorized, so it cannot be controlled and tracked longitudinally by the Ceiling Suspension.*

The RAD Table is always the Master equipment and the Ceiling Suspension is the Slave.

Proceed as indicated for manually operated Auto-tracking:

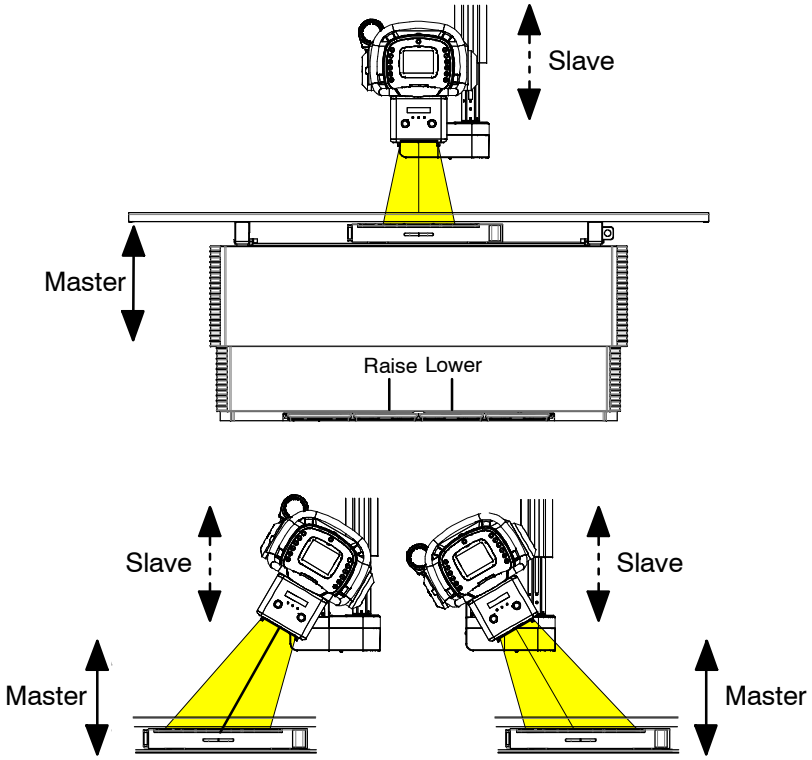
1. Press the AUTO-TRACKING control of the Console (or Remote Control if available) to activate the function, the background is in yellow when activated.

2. Move manually the Table (refer to *Illustration 4-25*). Step and hold the RAISE or LOWER Control Pedal to move UP/DOWN the DR Detector. The Ceiling Suspension tracks vertically its movement in all cases. The SID remains constant in all cases.

3. Step and hold the pedal until the Slave equipment arrives to the final position and is aligned with the Master Equipment.

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

Illustration 4-25
Auto-tracking Movement Policy for Semi-automatic System with RAD Table



SEMI-AUTOMATIC CEILING SUSPENSION WITH RAD WALL STAND DR

Both the DR Detector and the Ceiling Suspension can be Master and Slave, but the Auto-tracking movement is always in vertical direction.

Proceed as indicated for manually operated Auto-tracking:

1. Press the AUTO-TRACKING control of the Console (or Remote Control if available) to activate the function, the background is in yellow when activated.

2. Move manually the Master equipment (refer to *Illustration 4-26):*

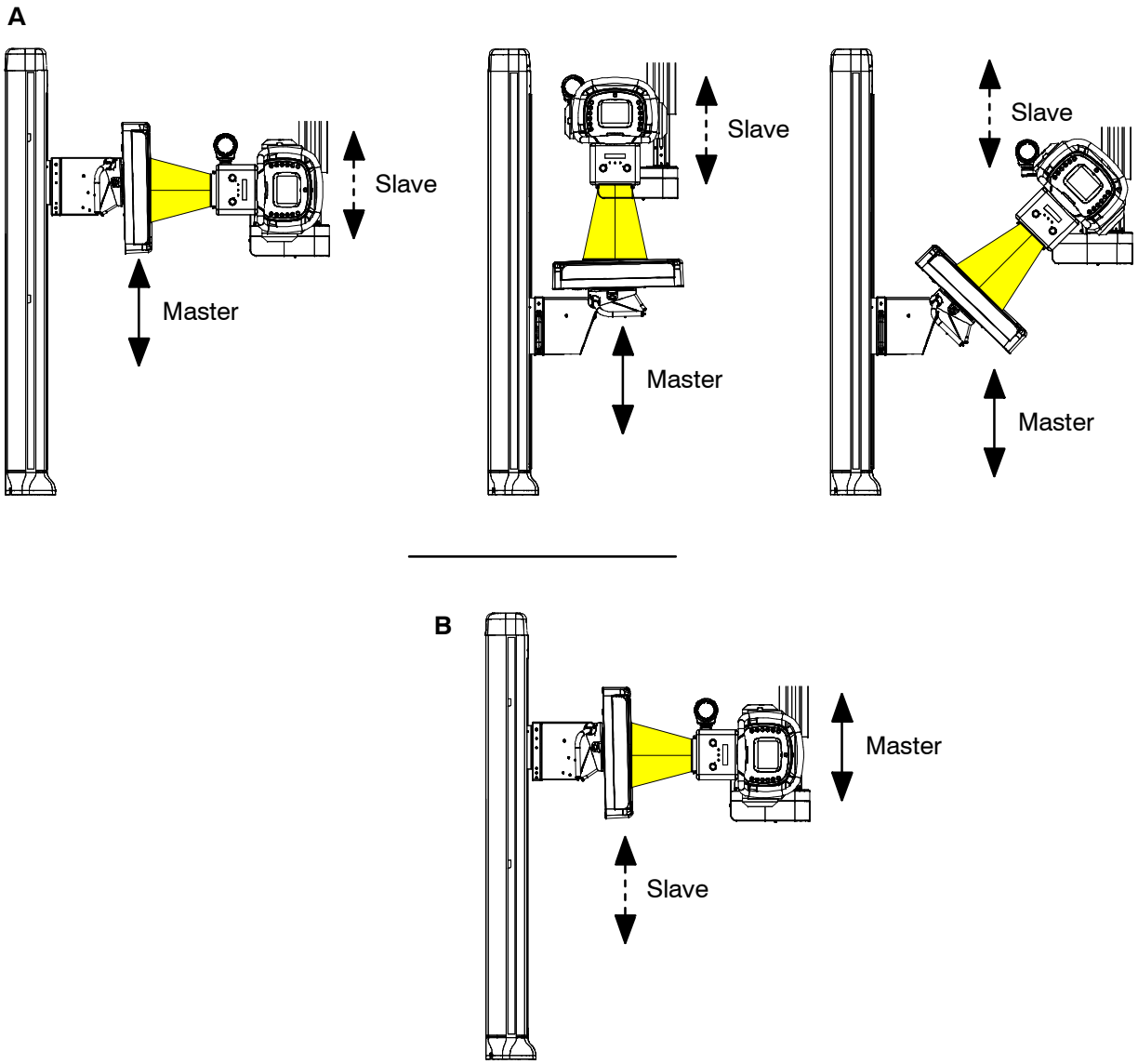
   a. The RAD Wall Stand DR is the Master and is moved vertically. The DR Detector can be tilted at any angle or in vertical position at 0º. Press and hold the Vertical Lock or step on the UP/DOWN Pedal of the Footswitch. The Ceiling Suspension tracks its movement in the same direction in all cases. The SID remains constant.

   b. The Ceiling Suspension is the Master and is moved vertically. The DR Detector must be at 0º. Press and hold the Vertical Brake button of the Control Console and move up/down the X-ray Tube. The DR Detector moves in the same direction. The SID remains constant. It is not valid when the DR Detector is tilted at 90º.

3. Keep pressing the brake or pedal until the Slave equipment arrives to the final position and is aligned with the Master Equipment.

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

Illustration 4-26
Auto-tracking Movement Pollcy for Semi-automatic System with RAD Wall Stand DR



HOW TO DEACTIVATE THE AUTO-TRACKING FUNCTION

- Press the AUTO-TRACKING control of the Console or Remote Control, if available,
- press any brake button of the Control Console,
- press any button that implies misalignment between the DR Detector and the Ceiling Suspension, such as selecting a different Workstation, etc.
- the auto-tracking function remains active just for 5 minutes after the Ceiling Suspension becomes inactive. After this time, activate again the Auto-tracking function.

When working with the Programmed Positions (PP) remember that the Auto-tracking function will be activated or not, depending on the last PP which has been performed. If the Programmed position was set to have the Auto-tracking ON, it remains on once this position is performed. If the position was configured to have the Auto-tracking off, it must be activated on the Console to turn it on.

4.2.3.8 AUTO-POSITIONING

Auto-positioning assists the Operator with the Ceiling Suspension movements, and also with the RAD Table and RAD Wall Stand DR. Then, the operator must adjust the position as needed for the exposure, if required.

The Ceiling Suspension keeps different positions.

- In case of the Automatic Ceiling Suspension refer to *Section 4.2.4 “Position. Automatic System Auto-positioning“* and *Section 4.2.6 - “Programmed Positions (PP)”.*
- In case of the Semi-automatic Ceiling Suspension refer to *Section 4.2.5 “Position. Semi-automatic System Auto-positioning“* and *Section 4.2.6 - “Programmed Positions (PP)”.*

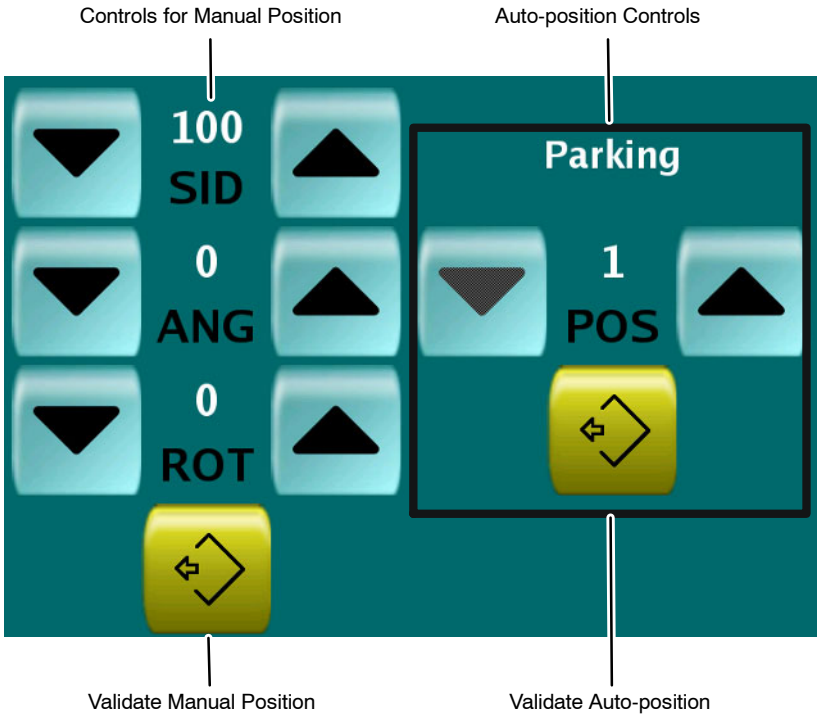
4.2.4 POSITION. AUTOMATIC SYSTEM AUTO-POSITIONING

Configure directly in the Position screen of the Control Console the X-ray Tube position manually or using any Auto-position. Up to 16 Auto-position can be programmed in the field, each one refers to configured parking positions of the X-ray Tube (**SID**, **ANG & ROT**) and of the DR Detectors (RAD Table DR Detector on the longitudinal axis and RAD Wall Stand DR Detector on the vertical axis). With the Auto-position, the Tube position is not referenced to any specific Workstation, so all or just some of the available axes of the X-ray Tube and DR Detectors can be configured on each Auto-position.

Note ☞ *Auto-positions are intended to be used as parking positions or to work with Direct Workstation. For a complete positioning of the Ceiling Suspension, use the Programmed Positions.*

Note ☞ *The Auto-positions are configured by the Service engineer and cannot be modified directly by the user. To modify Auto-positions, contact Service.*

Illustration 4-27
Position Display Option



1. **MANUAL POSITION**

- Select the Workstation.
- Use the **INCREASE**/**DECREASE** Buttons to modify the Position Parameters. Which are:
  - **SID:** Source-Image Distance from **800** to **2000** mm (31.5” to 78.7”).
  - **ANG:** X-ray Tube angle degrees on Alpha Axis from **-90** to **90º**.
  - **ROT:** X-ray Tube rotation degrees on Beta Axis from **-90** to **90º.**
- Press the **VALIDATE MANUAL POSITION** button to activate the position.
- Press and hold the **PARKING** Button on the Automatic Positioning Control Box to execute the movement.

2. **AUTO-POSITIONS**

- Select the Workstation.
- Select the Auto-position with the **INCREASE**/**DECREASE** Buttons.
- Press the **VALIDATE AUTO-POSITION** Button to activate the position.
- Press and hold the **PARKING** Button on the Automatic Positioning Control Box to execute the movement.

Once the new position is reached, the **PARKING POSITION** Indicator lights up.

DUE TO SAFETY REASONS, WHEN A NEW AUTO-POSITION IS SELECTED, IF THE FOCAL SPOT (TUBE) DISPLACEMENT FROM THE ORIGINAL POSITION TO THE FINAL POSITION IS >300 mm (11.8”), THE TELESCOPIC COLUMN WILL BE RETRACTED TO A TRAVEL POSITION TO CARRY ON THE MOVEMENT AND FINALLY ACHIEVE THE REQUIRED POSITION. IF THE DISPLACEMENT DISTANCE IS <300 mm (11.8”) THE CEILING SUSPENSION WILL BE MOVED DIRECTLY.

4.2.5 POSITION. SEMI-AUTOMATIC SYSTEM AUTO-POSITIONING

As the Semi-automatic Ceiling Suspension is **NOT** motorized in all axes, the Auto-positioning function is possible only in the Vertical Axis. Therefore, this feature operation is different to the described for the Automatic Ceiling Suspension.

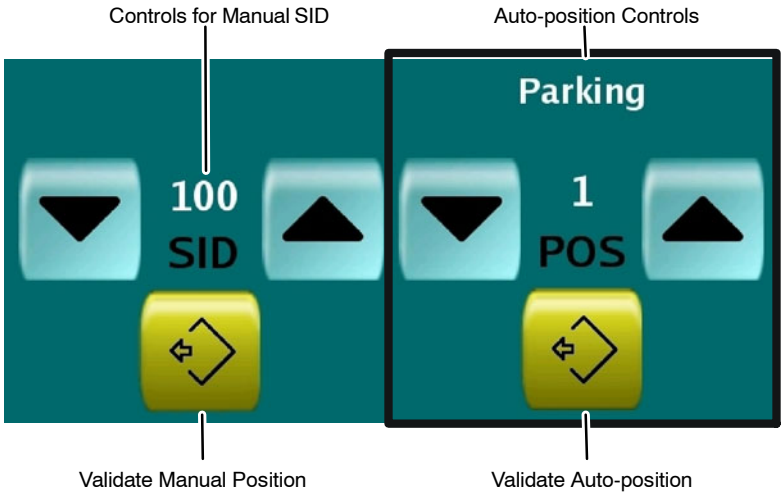
Configure directly in the Position screen of the Control Console the X-ray Tube position manually or using any Auto-position. Up to 16 Auto-positions can be programmed in the field, each one refers to configured parking positions of the X-ray Tube and of the DR Detectors (RAD Table DR Detector and RAD Wall Stand DR Detector). With the Auto-position, the Tube position is not referenced to any specific Workstation, so all or just some of the available axes of the X-ray Tube and DR Detectors can be configured on each Auto-position, taking into account that only the vertical axes of the X-ray Tube and RAD Wall Stand are motorized; so any position configured in any other axis must be completed manually.

Note ☞ *Auto-positions are intended to be used as parking positions or to work with Direct Workstation. For a complete positioning of the Ceiling Suspension, use the Programmed Positions.*

Note ☞ *Remember to get the X-ray Tube at the correct angulation before executing any auto-position that involves the Wall Stand. Alpha Axis is not motorized.*

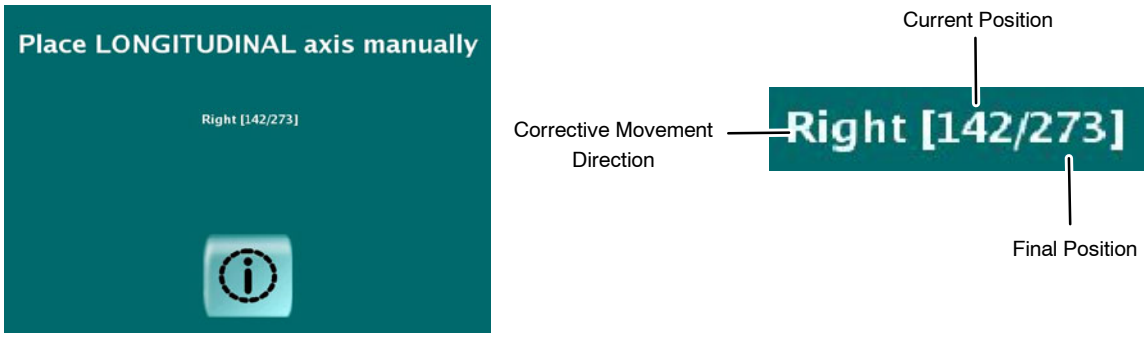
Note ☞ *The Auto-positions are configured by the Service engineer and cannot be modified directly by the user. To modify Auto-positions, contact Service.*

Illustration 4-28
Position Display Options



In case the Auto-position involves any movement in the Longitudinal, Transverse, Alpha and Beta Axes, it must be completed manually before executing the Auto-position. Press the Auto-center Indicator, a message will be displayed in the console explaining the corrective action to be completed. It is also indicated first the Current Position and the Final Position.

Illustration 4-29
Position Message for Semi-automatic System



1. **MANUAL POSITION**

- Select the Workstation.
- Use the **INCREASE**/**DECREASE** Buttons to modify the SID (Source-Image Distance) value, from **800** to **2000** mm (31.5” to 78.7”).
- If necessary, configure manually the new Rotation or Angulation angles when working with the RAD Wall Stand.
- Press the **VALIDATE AUTO-POSITION** Button to activate the position.

- Press and hold the **PARKING** Button on the Automatic Positioning Control Box or Remote Control if available to execute the movement.

2. **AUTO-POSITIONS**

- Select the Workstation.
- Select the Auto-position with the **INCREASE**/**DECREASE** Buttons.
- Press the **VALIDATE AUTO-POSITION** Button to activate the position.

- Press and hold the **PARKING** Button on the Automatic Positioning Control Box or Remote Control if available to execute the movement.

Once the new position is reached, the **PARKING POSITION** Indicator lights up.

4.2.6 PROGRAMMED POSITIONS (PP)

Each PP refers to a position of the X-ray Tube **(SID, ANG & ROT),** but also to the DR Detector of the RAD Table on vertical and longitudinal travels, and to the DR Detector of the RAD Wall Stand on vertical travel and on tilting angle. It can be configured also to have the Auto-tracking movement active.

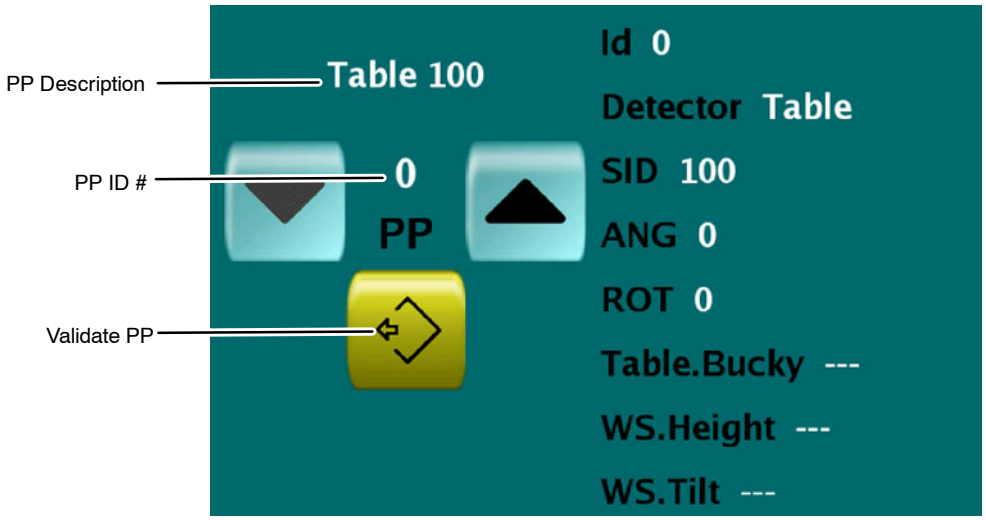
With the Programmed Positions, the Tube position is referenced to a Workstation configured also in the PP.

Note ☞ *In the Semi-automatic System, this function allows to configure automatic movements in the Vertical Axis only. It is important that the RAD Wall Stand and RAD Table were configured correctly before executing the Programmed Position.*

Note ☞ *In case the last PP was configured with the Auto-tracking On, it remains ON until it is deactivated, manually or selecting other PP configured with the Auto-tracking OFF.*

Note ☞ *All PP are previously configured in the field by the Service Engineer, they can not be modified directly by the operator. To modify them, contact Service.*

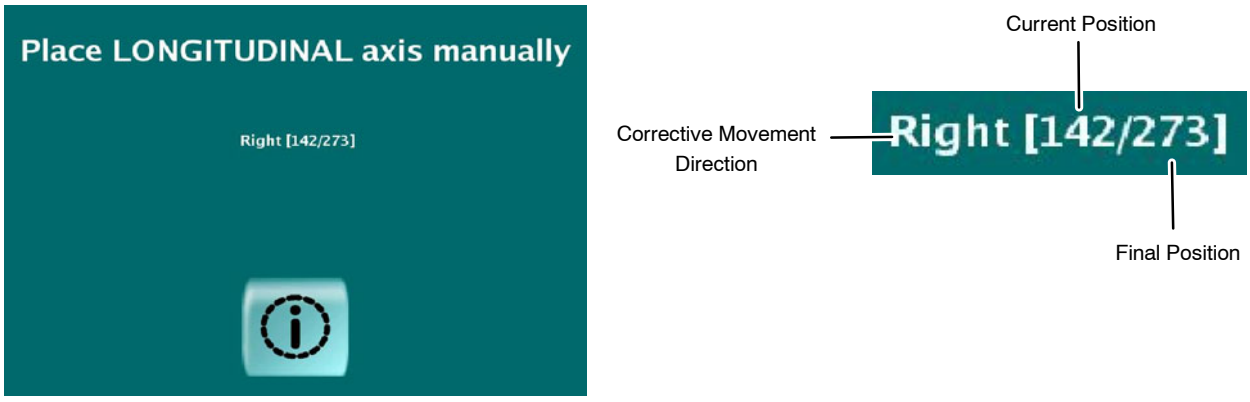
Illustration 4-30
Programmed Positions Area Display



1. Select one of the Programmed Positions (PP), use the **INCREASE**/**DECREASE** Buttons. All parameters values, the Description and ID Number are displayed.

2. In case the Programmed Position (PP) involves any movement in the Longitudinal, Transverse, Alpha and Beta Axes, it must be completed manually before executing the Auto-position. Press the **AUTO-CENTER** Indicator of the Control Console, a message will be displayed in the console explaining the corrective action to be completed. It is also indicated first the Current Position and the Final Position.

Illustration 4-31
Position Message for Semi-automatic System



3. Press the **VALIDATE PP** Button to activate the Programmed Position.

4. Press and hold the **AUTO-CENTER** Button of the Automatic Positioning Control Box or Remote Control, if available, to get the Ceiling Suspension on the configured position.

5. Once the new position is reached the **AUTO-CENTER** Indicator of the Control Console lights up.

4.3 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 4-32*.)
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 assure that the X-Ray beam is correctly positioned.

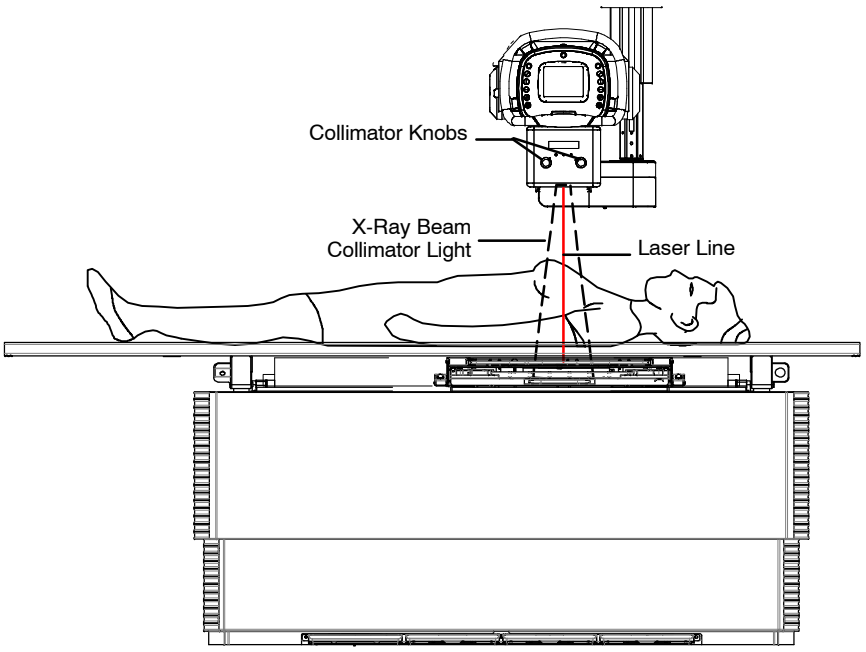
ALWAYS SELECT THE CORRECT FIELD SIZE TO AVOID EXCESSIVE RADIATION.

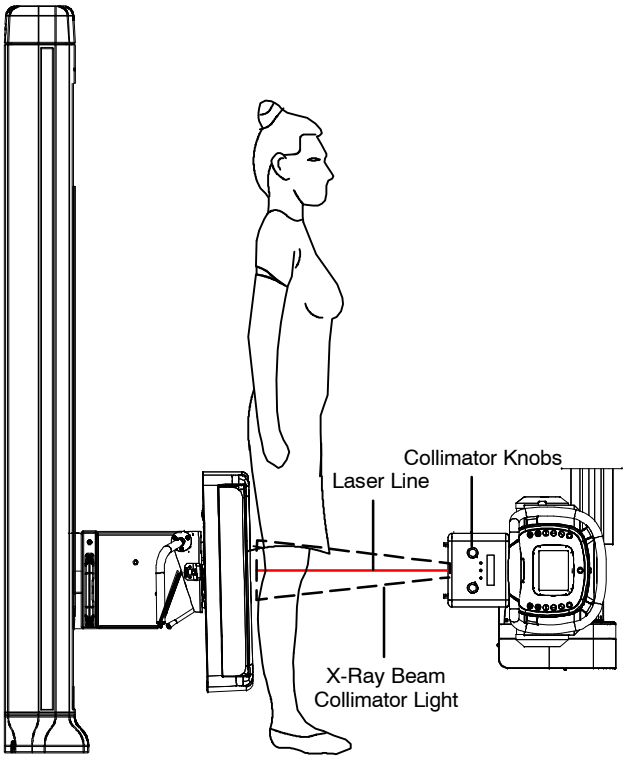
THE X-RAY BEAM AXIS AND THE REFERENCE AXIS OF THE PLANE OF INTEREST COINCIDE AND ARE ORTHOGONAL WITH RESPECT TO THE PLANE OF INTEREST, IN EXAMS PERFORMED WITH THE IMAGE RECEPTOR PERPENDICULARLY POSITIONED WITH RESPECT TO THE TUBE-COLLIMATOR ASSEMBLY.

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 4-32
Patient Positioning In Double Panel Systems





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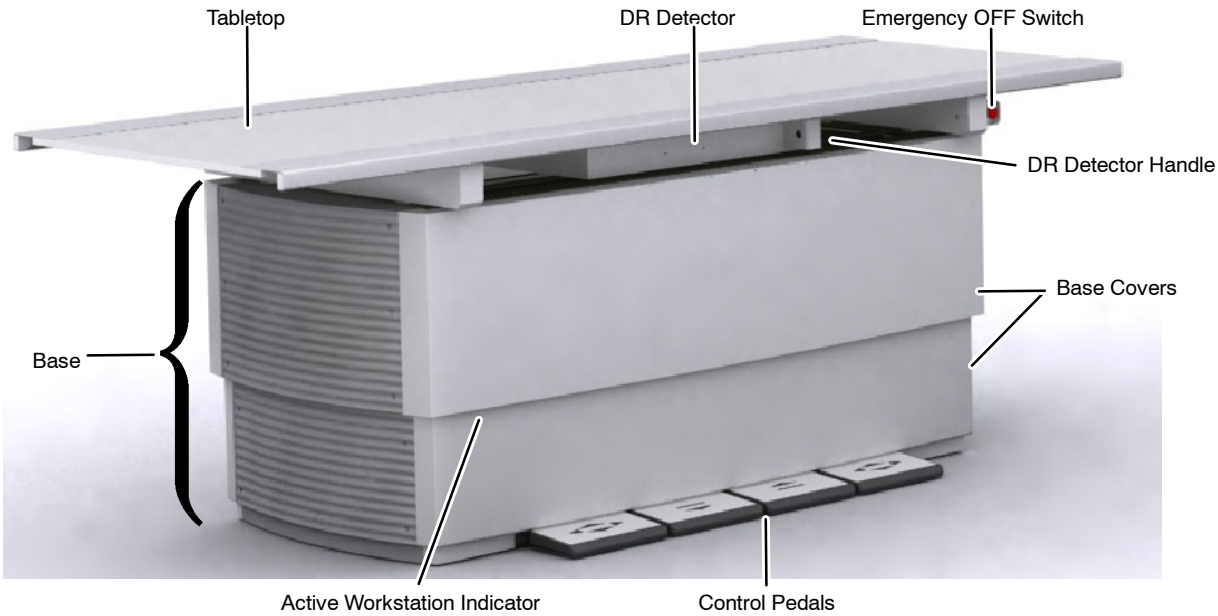
SECTION 5 RAD TABLE OPERATION

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 DR tilting is used when it is required to complete examinations with the DR Detector in horizontal position.*

Illustration 5-1
RAD Table



BASE & COVERS

The RAD Table elevating system mechanism, Power Supply and all electronics are located in the Base. It supports also the Tabletop and the DR Detector Box.

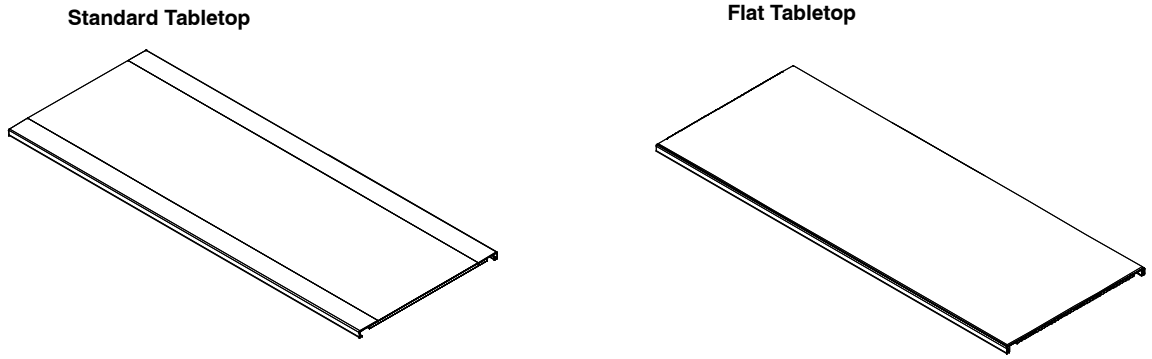
Covers are in charge of protecting the electronics and the mechanics of the Table Base and give the final appearance to the equipment.

TABLETOP

The Patient Support can be longitudinally and transversely moved, allowing an easy patient positioning. It can be also raised up to a maximum height of 920 mm (36.22”) and lowered to a minimum height of 580 mm (22.83”). There are three different tabletop models available:

- Standard Tabletop, which is the default option. It is made of a carbon fibre sheet and two metal frames at the laterals. Its attenuation is <0.65 mm eq. Al at 100 kV.
- Carbon fiber flat Tabletop. It is composed by a sheet of carbon fiber, without metallic frames at the laterals. Its attenuation is <0.6 mm eq. Al at 100kV.
- Laminated flat Tabletop. It is composed by a sheet of laminated melamine. Its attenuation is <1.2 mm eq. Al at 100 kV.

Illustration 5-2
Tabletops



CONTROL PEDALS

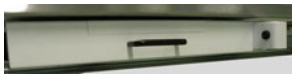
The Control Pedals are used to release the brakes and let the Tabletop free movement for its longitudinal and transverse positioning and vertical motion. There are four different Control Pedals that allow all vertical and horizontal movements and positioning: Tabletop Motions, Raise and Lower.

Depending on the configuration, it may be necessary to step twice or once the Control Pedal to release the brake. It is factory configured to step twice, which is recommendable for safety reasons to avoid occasional brakes release, but configurable in the installation.

DOUBLE CONTROL PEDALS (OPTION)

Optionally, two sets of Control Pedals can be installed, one at the front and one at the back of the RAD Table.

DR DETECTOR ASSEMBLY



It includes the DR Detector, Container Box and Handle Button. The DR Detector can be fixed or portable.

ACTIVE WORKSTATION INDICATOR

When the RAD Table is selected as the current active Workstation on the System, the Active Workstation Indicator gets blue lighted. It is located under the top Cover of the RAD Table.

EMERGENCY OFF SWITCH

The RAD Table is equipped with an Emergency OFF Switch, placed below the front right end of the Tabletop. To release the Emergency OFF Switch, just press and turn it to the same direction indicated with an arrow (Clockwise).

IN THE EVENT OF AN EMERGENCY, TURN OFF THE RAD TABLE PRESSING FORCIBLY THE EMERGENCY OFF SWITCH (RED MUSHROOM-SHAPED SWITCH) ON THE RAD TABLE, CEILING SUSPENSION, AUTOMATIC POSITIONING CONTROL BOX, IF PROVIDED, OR ROOM ELECTRICAL CABINET.

5.1 PATIENT POSITIONING

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 300 kg (661 lbs). The maximum load allowed at the end of the Tabletop in cantilever position is 100 kg (220 lbs).

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.

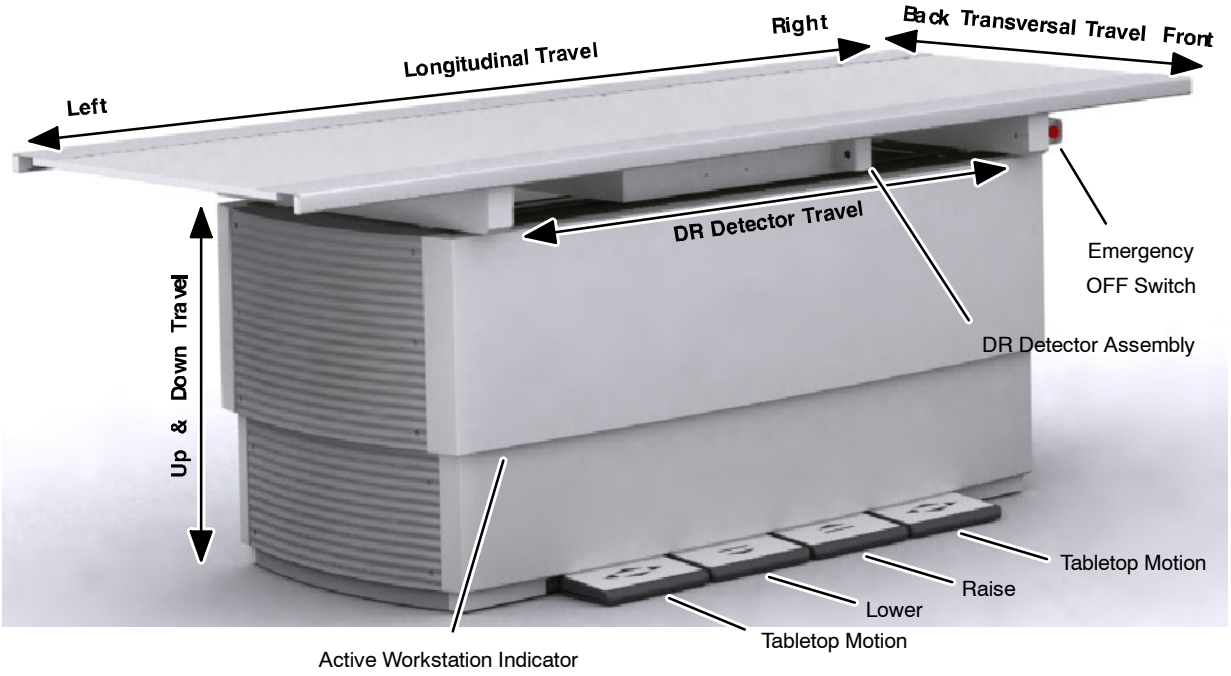
TO EXCEED THESE LIMITS MAY CAUSE DAMAGES TO THE EQUIPMENT AND/OR INJURIES TO THE PATIENT.

- 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 the 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 down, patient must be careful to avoid stepping on the Control Pedals.

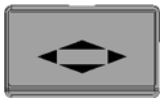
5.2 TABLETOP MOVEMENTS

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

Illustration 5-3
Tabletop travels and Control Pedals



5.2.1 HORIZONTAL MOVEMENTS



For changing the longitudinal or the transverse position of the Tabletop with respect to the DR Detector:

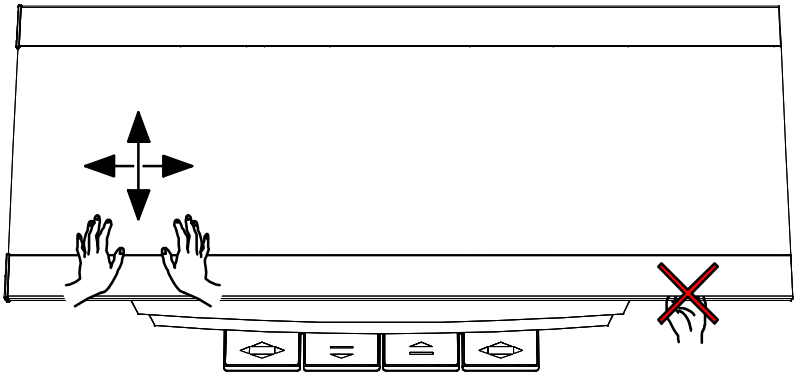
1. Press and hold down one of both **TABLETOP MOTION** Pedals.
2. Move the Tabletop in all directions while the Control Pedal remains held down.
3. Release the Control Pedal when the Tabletop is at the desired position. It will get locked in that position.

The total Transverse travel of the Tabletop is 240 mm (9.4”) and the default total Longitudinal travel is 980 ±20 mm (38.6 ±0.8”). Maximum Longitudinal travel is 1090 ±10 mm (42.9 ±0,4”) when the Table has been modified in field to allow a longer travel to the left (refer to *Illustration 11-1* and *Illustration 11-2*).

WARNING

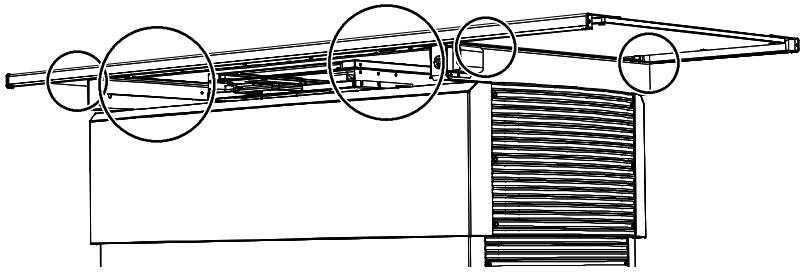
DURING TABLETOP MOVEMENT, BE SURE THAT PATIENT HEAD, HANDS AND FEET ARE COMPLETELY WITHIN THE TABLETOP AREA. IF ANY PART OF THE PATIENT IS OUT OF THE TABLETOP AREA, DAMAGES AND INJURIES CAN BE PROVOKED TO THE PATIENT. WATCH THE TABLETOP MOVEMENTS TO AVOID DAMAGES AND INJURIES.

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.



WHEN THE RAD TABLE IS POWERED OFF, THE BRAKES FOR THE LONGITUDINAL AND TRANSVERSE MOVEMENT OF THE TABLETOP ARE RELEASED AND IT CAN BE MOVED FREELY. WATCH OVER THE MOVEMENT OF THE TABLETOP TO AVOID DAMAGES AND INJURIES.

THE 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 THIS AREA.



THE TABLETOP CAN ALSO MOVE FREELY IN LONGITUDINAL AND TRANSVERSE AXES WHEN MINIMAL FORCE IS APPLIED. IF THE PATIENT IS STILL ON THE TABLE, HE MAY NEED HELP TO STEP DOWN FROM THE RAD TABLE.

DO NOT TRY TO MOVE THE TABLETOP LONGITUDINALLY NOR TRANSVERSELY WITHOUT PRESSING THE CONTROL PEDAL. DAMAGES CAN BE CAUSED TO THE PATIENT, TO THE OPERATOR OR TO THE EQUIPMENT.

5.2.2 VERTICAL MOVEMENTS

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

1. To raise / lower the RAD TABLE, press and hold the **RAISING** / **LOWERING** Control Pedal.
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 to the configured intermediate height. This height is configured in field.
   - It reaches the maximum/minimum height.
   - An obstacle is found during Tabletop movement.

WARNING

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

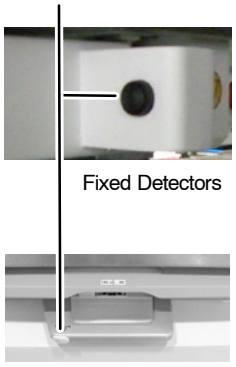
WARNING

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.

5.3 DR DETECTOR HORIZONTAL MOVEMENT



Press on the DR Detector Brake Control to release the brake and move it manually.

With Automatic Ceiling Suspension, the DR Detector can be moved automatically when executing any Auto-position or Programmed Position that has been configured with a DR Detector horizontal displacement.

It is important to have the X-ray Tube exactly centered with the DR Detector. A density drop at the image edges may appear, indicating an inaccurate alignment.

The Longitudinal center of the Grid and the DR Detector matches with the mark of the Grid Handle. The X-ray tube can be aligned with the DR Detector by activating the AUTO-CENTER function on the Ceiling Suspension or moving manually the X-ray Tube until aligning the Collimator light with the mark of the Grid Handle.

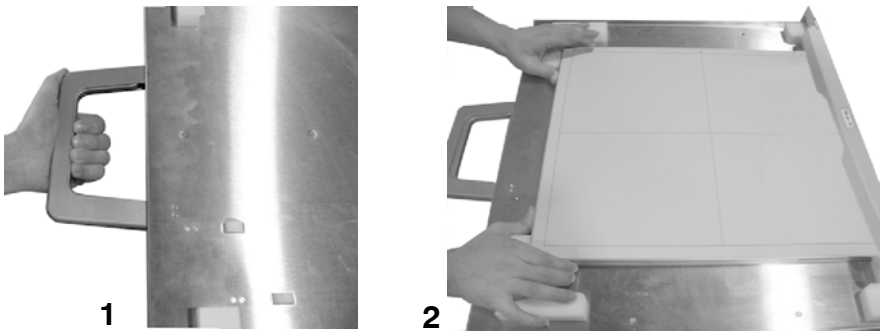
Depending on the position of the Tabletop, the Grid handle may need to be pulled out to allow the collimator light to shine on it.

5.4 PORTABLE DR DETECTOR LOADING

1. Using the DR Detector Handle, pull out the Tray to insert the DR Detector. Press and hold the Handle brake until the Tray is completely pulled out.

2. 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 front end-stops.

Illustration 5-4
DR Detector Loading



3. Push in the tray using the Handle.

Check that the DR Detector is correctly inserted. A click sound means that the Grid is in place.

5.5 GRID LOADING AND REMOVAL

Grids are intended to reduce scattered radiation and significantly enhance image quality.

The RAD Table holds a removable grid focalized and labelled 100 cm (40”). The Grid is provided with a label indicating its features.

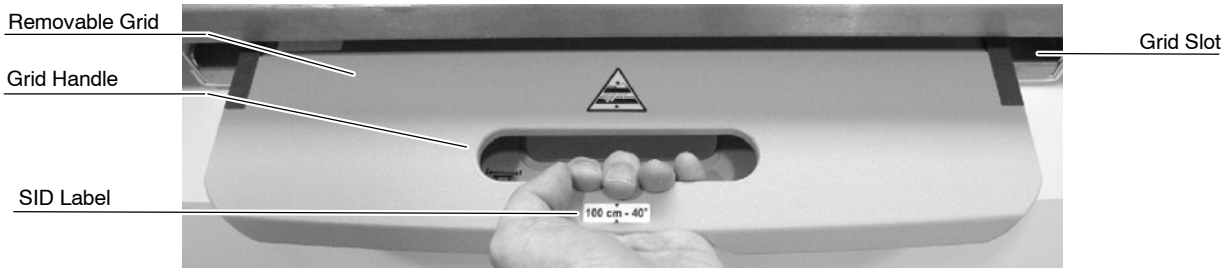
Follow the procedure below for Grid loading. For Grid removal, follow the procedure below in reverse order.

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

1. Pull out the Grid Tray.
2. Install the Grid with the tube side label facing up.
3. Push in the Grid Tray.

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

Illustration 5-5
RAD Table Grid



5.6 ACCESSORIES

5.6.1 HAND GRIPS

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

For safety reasons, Hand grips must be used in all radiological examinations. They can be installed along the Tabletop rails, fit them to the rails and locked at any position with the thumbscrews.

USE ALWAYS THE HAND GRIPS TO AVOID INJURIES IN PATIENT HANDS OR FINGERS WHEN THE TABLETOP IS IN MOVEMENT. PATIENT'S HANDS MUST BE KEPT FAR AWAY FROM THE TABLETOP EDGES IN EVERY MOMENT.

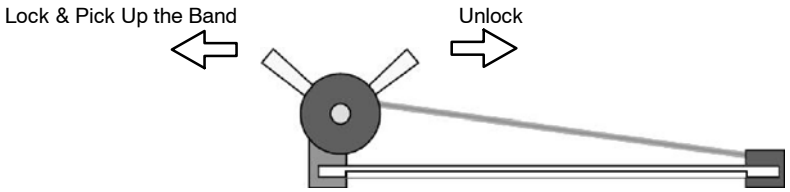
Note ☞ *The Hand grips must not be positioned in the trajectory of the X-ray beam.*

5.6.2 COMPRESSION BAND

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

It is mounted on the Tabletop rails. Fit totally both brackets of the Compression Band to the rails and use the lever lock or unlock the Compression Band to get the required extension of the Band.

Illustration 5-6
Compression Band Operation



5.6.3 LATERAL CASSETTE HOLDER

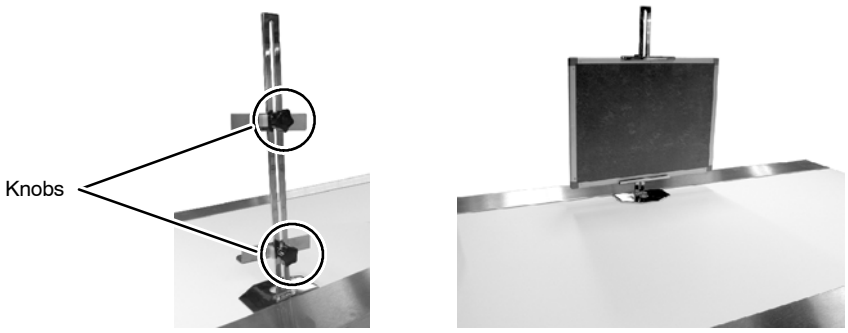
The Lateral Cassette Holder is used for Table lateral work, including knee, shoulder, skull, etc.

This Lateral Cassette Holder is placed directly on the Tabletop. It can be adjusted to hold all standard Cassette sizes and to perform X-ray exams at different heights.

Its adjustable rails are used to easily insert or remove the Cassette and, at the same time, to hold it tight while the X-ray examination is taking place.

Adjust the height using the knobs to raise or lower the rails and tighten the knobs to secure the Cassette. Position the patient and place the Lateral Cassette Holder on the Tabletop behind the patient, in the desired position, to perform the radiographic exam.

Illustration 5-7
Lateral Cassette Holder placement



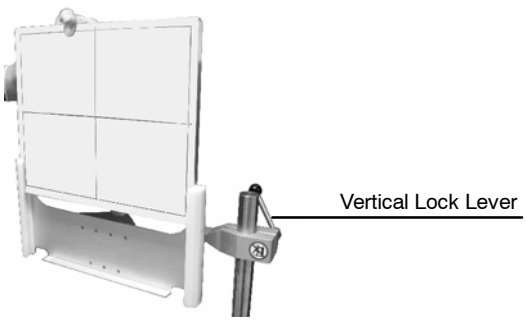
5.6.4 LATERAL DR DETECTOR (35X43) HOLDER WITH TROLLEY

This mobile DR detector holder is designed to acommodate portable DR detectors of 35x43 cm (14”x17”).

Illustration 5-8
Mobile Detector Holder

Insert the portable DR Detector in the Support. It must be always in landscape orientation.

Illustration 5-9
Detector Installation

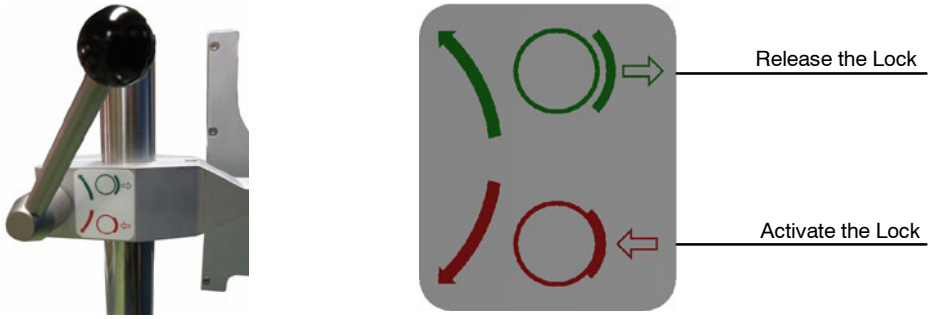


Note ☞ *Make sure that the Vertical Lock is locked when mounting the DR Detector to keep it from falling down unexpectedly, which could cause damages to the DR Detector and Support.*

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

1. Loosen CCW the Vertical Lock Lever to free the DR Detector Support. Hold the Support during this procedure to avoid unexpected falls.

Illustration 5-10
Vertical Lock Lever

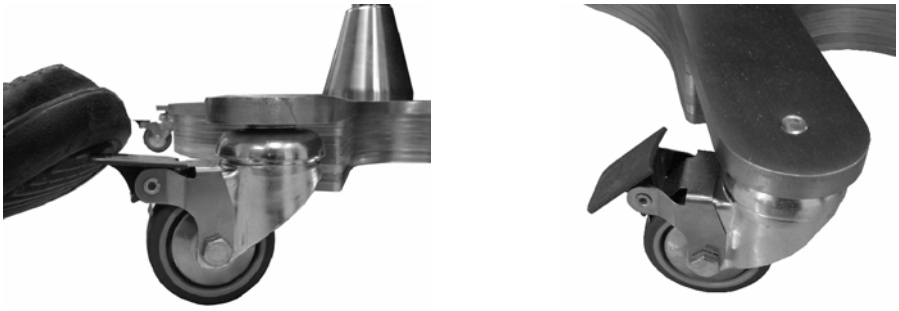


2. Place the Support at the desired height.

3. Tighten CW the Lever to fix again the Support at its new position.

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

Illustration 5-11
Wheel Brake Pedal



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

1. Unlock all wheels.

2. Drive the Holder holding the vertical bar and carry it where corresponds.

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

DRIVE THE UNIT 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 UNIT, AND BY USING IT UNDER THESE CONDITIONS COULD EVENTUALLY REPRESENT A DANGER FOR THE USER.
HOLD ALLWAYS SECURELY THE VERTICAL BAR TO DRIVE CORRECTLY THIS HOLDER.

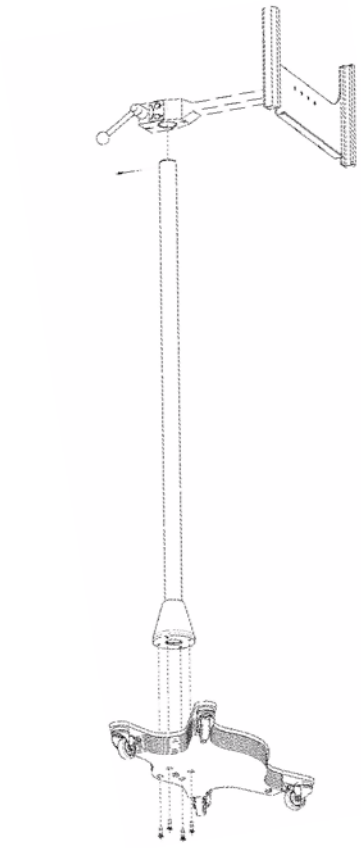
Try not to step over any possible obstacle when moving the holder, the unit could fall over.

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 DR Detector Support and lock it with the Vertical Lock Lever.

Illustration 5-12
DR Detector Holder Assembly Procedure



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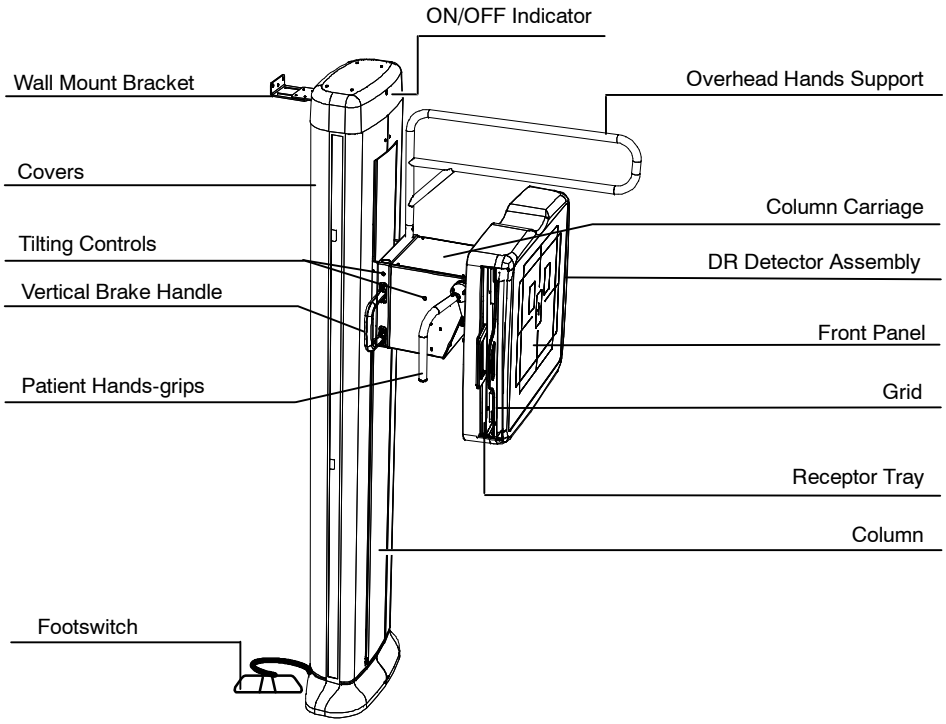
SECTION 6 RAD WALL STAND DR OPERATION

Illustration 6-1
RAD Wall Stand DR Components



COLUMN

The Column Assembly is formed by the following elements:

- **DR Detector Support Assembly**: This assembly comprises the Vertical Carriage that moves along the Column guides, the Vertical Lock Handle with the DR Detector Brake Control and the Tilting and Rotation Controls.
- **Vertical Lock Handle:** It enables the DR Detector Support movement along the Column stand. It can be left or right field configurable.

CAUTION

Do not use the Vertical Lock Handle for any other purpose than to move the DR Detector Support Assembly.

- **Covers:** They protect the electronics and the mechanics of the Column and give the final appearance to the equipment.

Be careful with covers handling to avoid scratches.

- **Counterweights:** They allow the counterbalance of the DR Detector Support Assembly to enable a soft vertical movement.

- **Column Stand:** It is fixed to the floor and holds all the elements of the RAD Wall Stand.

DR DETECTOR ASSEMBLY

It includes the DR Detector, the Detector Container Box and the Front Panel. The Front panel Attenuation <0.70 mm eq. Al at 60 kV. The DR Detector can be Fixed or Portable.

ACTIVE WORKSTATION INDICATOR

When the RAD Wall Stand is selected as the current active Workstation on the system the Active Workstation Indicator gets lighted. It is located in the Top Cover of the Column.

PATIENT HAND-GRIPS

The RAD Wall Stand is optionally provided with suitable Hand-grips. Their use is highly recommended for increasing the patient feeling of security and for the correct positioning of the patient. The patient can hold on to them to separate the arms from the chest.

6.1 RAD WALL STAND DR MOVEMENTS

The RAD Wall Stand DR enables radiographic operations at different positions within the range of the Vertical Carriage travel, adjustable tilting angles as well as rotation of the DR Detector.

WARNING

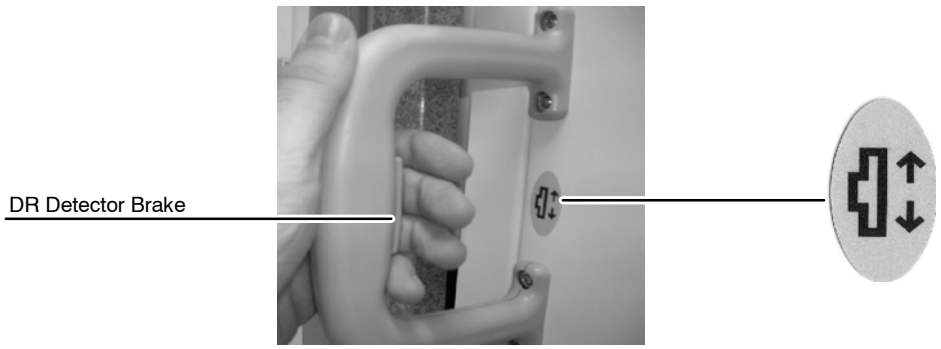
MONITOR WITH SPECIAL CARE THE PATIENT POSITION, HANDS, FEET, FINGERS, ETC.) AND USE THE PATIENT HAND-GRIPS TO AVOID INJURY TO PATIENT CAUSED BY UNIT MOVEMENTS. PATIENT HANDS MUST BE KEPT AWAY FROM MOBILE COMPONENTS OF THE UNIT.

6.1.1 VERTICAL MOVEMENT

The DR Detector assembly can be moved manually by pressing the Brake Control on the Vertical Handle. The DR Detector assembly can be moved automatically when executing any Auto-position or Programmed Position that has been configured with a DR Detector vertical displacement.

1. Press the Brake Control on the Vertical Lock Handle, it is indicated by a label near the handle.

Illustration 6-2
Press Vertical Lock Handle to release the DR Detector Brake



2. Check that the brakes are released and the DR Detector can be moved smoothly up and down.

3. Set the DR Detector assembly at the desired height, depending on the study to be performed.

4. Release the Brake Control on the Vertical Lock Handle, the Brake is activated and the DR Detector is locked.

Note ☞ *The Vertical Lock Handle is factory located at the left side, behind the DR Detector. If needed, it can be field configured at the right side by the Service Enginner.*

6.1.2 AUTOMATIC VERTICAL MOVEMENTS

This automatic movements are available in automatic RAD Wall Stands DR, provided with motorized vertical motion (refer to *Section 1.2 "System Configuration").*

6.1.2.1 DR VERTICAL AUTO-POSITIONING

This function is just available in Automatic Ceiling Suspensions, where several Auto-positions and Programmed Positions are configured, so the Receptor movement may be entailed. The movement is controlled by the Ceiling Suspension, the DR Detector moves up/down depending on the DR Detector height which has been configured in POSITION or PP (Refer to *Sections 4.2.4 "Position. Automatic System Auto-positioning"*, *4.2.5 "Position. Semi-automatic System Auto-positionin*g" and *4.2.6 "Programmed Positions (PP*)").

6.1.2.2 DR VERTICAL AUTO-TRACKING

This functionality allows the X-ray Tube or the DR Detector to be tracked by the other one when one of them initiates the vertical movement, whenever they are previously aligned. The relative distance and the SID are always kept constant (Refer to *Section 4.2.3.7 "Auto-tracking"* for further details about this function).

6.2 FOOTSWITCH OPERATION

The Footswitch controls the vertical movement of the DR Detector. Step on the RAISE or LOWER pedals to raise or lower the receptor. While stepping on the pedal the movement goes on, but once the foot is raised off the pedal, the movement stops.

Illustration 6-3
Footswitch

6.3 TILTING

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

Illustration 6-4
Potential Pinch Points

The DR Detector position is locked using:

- The **Tilting Brakes**. There are two Tilting Brake Control buttons, one at each lateral DR Detector Support. Press and hold any of them to release the Tilting Brake. The DR Detector is locked at any angle between -20º and 90º.
- The **0º/90º Detents**, located on the DR Detector Support left side. These mechanical detents lock the DR Detector at 0º (vertical position) or 90º (horizontal position).

The DR Detector allows a tilting range from -20º to 90º. The movement is manually controlled.

Illustration 6-5
DR Detector Tilting Assembly

1. Unlock the 0°/90° Detent.
2. Press and hold one of the Tilting Brake pushbuttons located on the DR Detector Support.
3. Tilt manually the DR Detector up to the desired position.
4. The angle is indicated on the Tilting Goniometer on the right lateral.
5. Release the pushbutton, to get the DR Detector position locked.
6. If final position is 0° or 90° insert the Lock Detent.

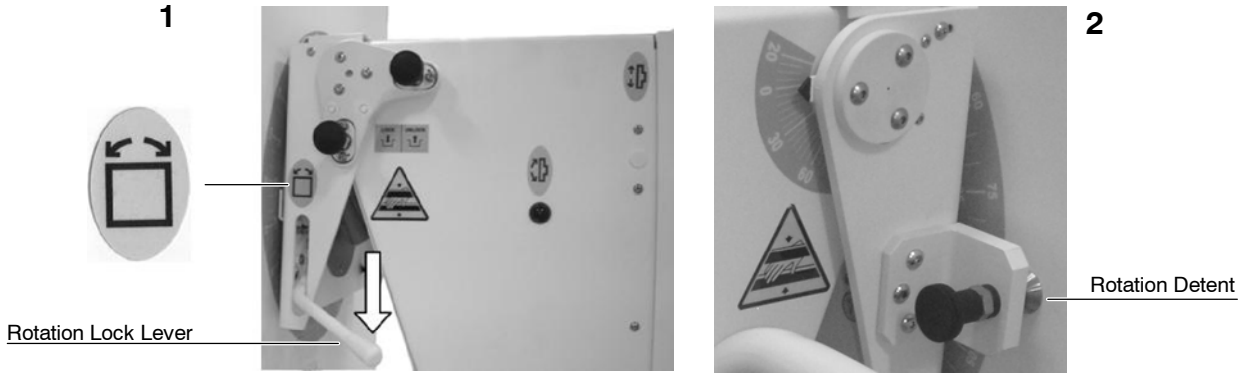
6.4 DR DETECTOR ROTATION

This function allows to rotate the DR Detector around the center of the image, the movement is manually controlled. It is possible to have the DR Detector rotated up to 90º.

Note ☞ *To avoid degradation of image quality and loss of DR Detector functionality, it is recommended to perform exposures with the DR Detector exactly at 0º or 90º positions, even though exposures can be performed in another range position.*

1. Release the Rotation Lock lever. Lower it to release the Rotation Lock.
2. Unlock the Rotation Detent, located at the right of the DR Detector Support. It reinforces the DR Detector Rotation Lock performance and locks the DR Detector at 0º position.

Illustration 6-6
DR Detector Rotation Lock Lever and Rotation Detent



3. Rotate DR Detector to the desired position. The Rotation angle is indicated by the goniometer at the back of the DR Detector.

Illustration 6-7
Goniometer for DR Detector Rotation

4. Lift the Rotation Lock lever to lock the DR Detector Position.

Rotation direction changes depending on the Systems Configuration:

- For Double Panel Systems or default configuration, rotate always the DR Detector before tilting it. The rotation will be upwards, clockwise for the left load configuration of the DR Detector, or counter-clockwise for the right load.

Illustration 6-8
Right load configuration of the Wall Stand for Double Panel System

1 **2** **3**

- For Single Panel Systems, Tilt always the DR Detector before rotating it. The rotation will be downwards counter-clockwise for the left load configuration of the DR Detector, or clockwise for the right load.

Illustration 6-9
Left load configuration of the Wall Stand for Single Panel System

1 **2** **3**

6.5 ALIGNMENT

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

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

To assure that the DR Detector is aligned with the X-ray beam, move the DR Detector or the X-ray Tube, in order that the collimator light is aligned with this center mark of the Front Panel.

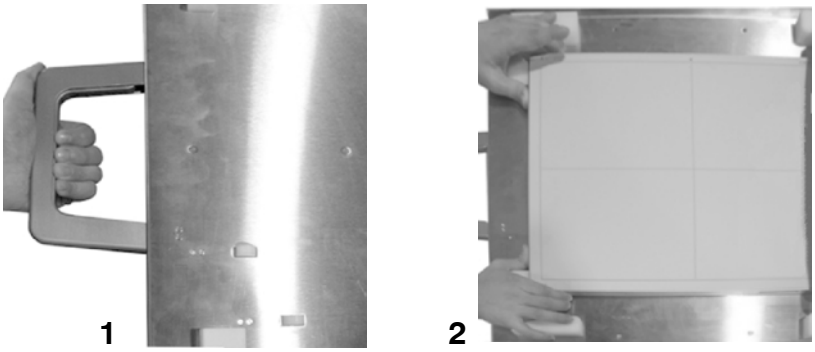
Illustration 6-10
DR Detector Center Mark

6.6 PORTABLE DR DETECTOR LOADING

1. Using the DR Detector handle pull out the tray to insert the DR Detector. Press and hold the handle brake until the tray is completely pulled out.

2. Insert the DR Detector to the back of the tray. Push slightly the back end-stops with the DR Detector for the correct fixation.

Illustration 6-11
DR Detector Loading



3. Lower the DR Detector and fit it with the front End-stops.

4. Push in the tray using the handle.

6.7 USING AND MAINTAINING THE DR DETECTOR

Check the equipment daily and confirm that it works properly before use.

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 (2.4 GHz 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.*

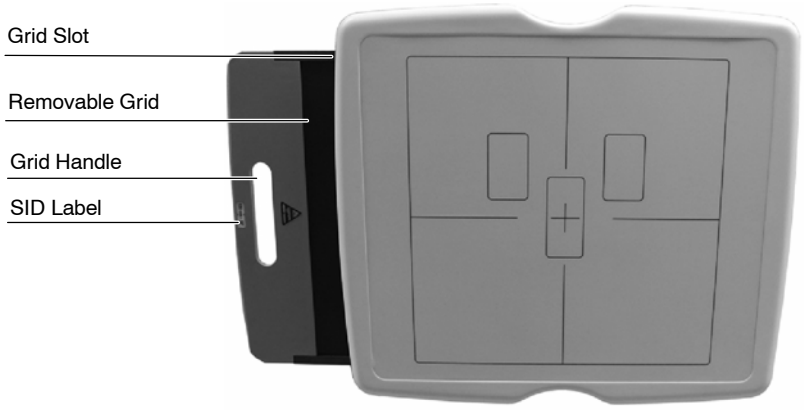
6.8 GRID LOADING AND REMOVAL

Grids are intended to reduce scattered radiation and significantly enhance image quality.

The RAD Wall Stand DR holds a removable grid. When inserting the grid in the RAD Wall Stand DR grid slot, pay special attention to the type of focalization distance of each grid.

The standard removable grids are labelled 100 cm (40”), 150 cm (70”) or 180cm (90”). Use the corresponding grid according to the SID (Source-Image Distance). The Grid is provided with a label indicating its features.

Illustration 6-12
RAD Wall Stand DR Grid



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

CAUTION

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.

1. Pull out the Grid Tray.
2. Install the Grid with the Tube side label facing up.
3. Push In the Grid Tray.

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

6.9 ACCESSORIES

The RAD Wall Stand DR is provided with two different models of overhead patient support, both are used for a correct positioning of patients. The patient can hold on to it to separate the arms from the chest, so it is highly recommended for thorax.

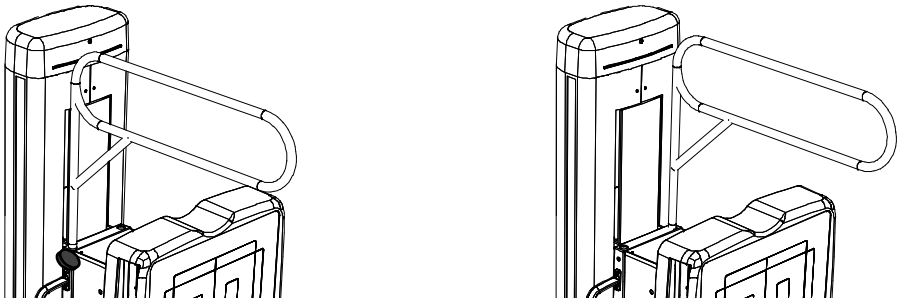
6.9.1 OVERHEAD HANDS SUPPORT

This accessory is provided with two locking knobs that must be placed at each lateral of the DR Detector Support. It can support a maximum load of 15 kg.

It can be installed at both sides of the DR Detector. To install it:

1. Loosen the locking knob.
2. Install the Overhead Arm Support in the holder.
3. Fix it with the locking knob.

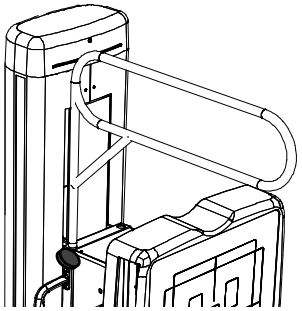
Illustration 6-13
Overhead Hands Support



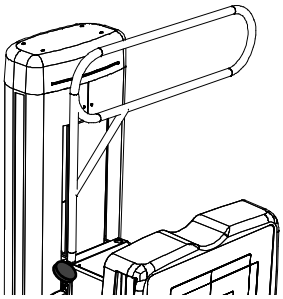
The Support can be used in two different positions: Working position, at 0º, and Parking, at +90º or -90º. When parked it must be always rotated to the opposite of the DR Detector loading configuration.

Illustration 6-14
Working and Parking Position

Working Position



Parking Position

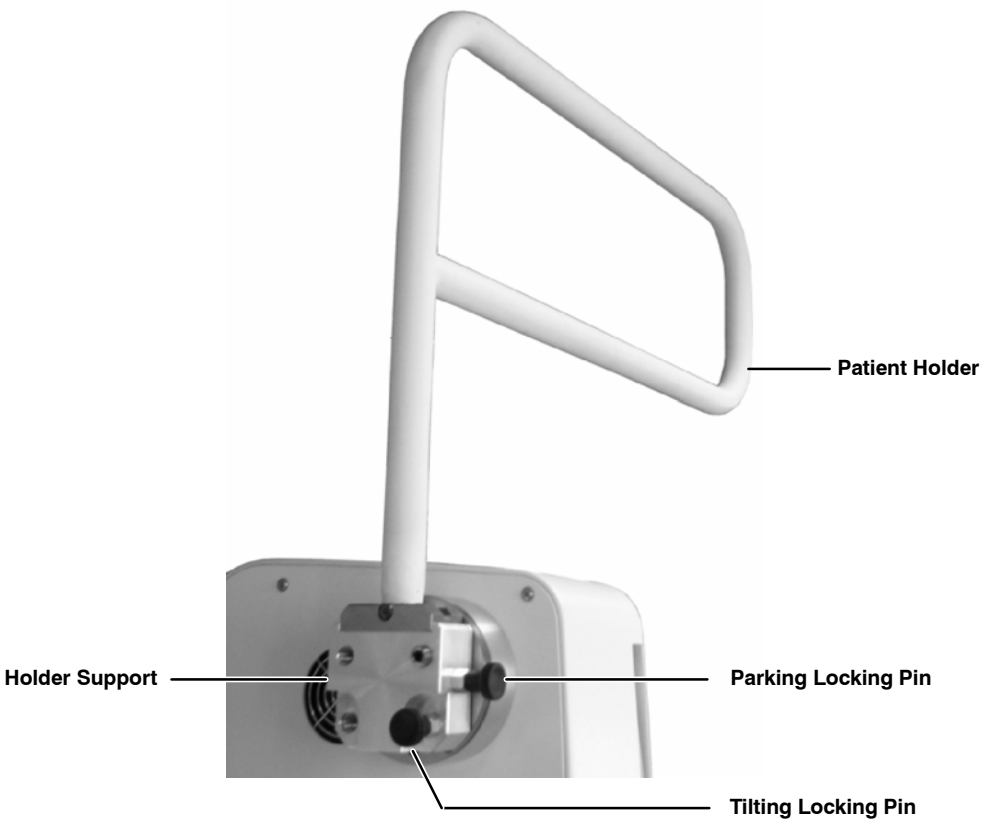


6.9.2 MOBILE OVERHEAD PATIENT SUPPORT

This optional patient support can tilt down to allow a more ergonomic position of the patient. It is provided with one support (optionally two) installed at the back of the DR Detector, provided with two Locking Pins for its use. It can support a maximum load of 15 kg.

The Support is already factory installed when required by the customer and can be installed at both sides of the DR Detector.

Illustration 6-15
Mobile Overhead Patient Support

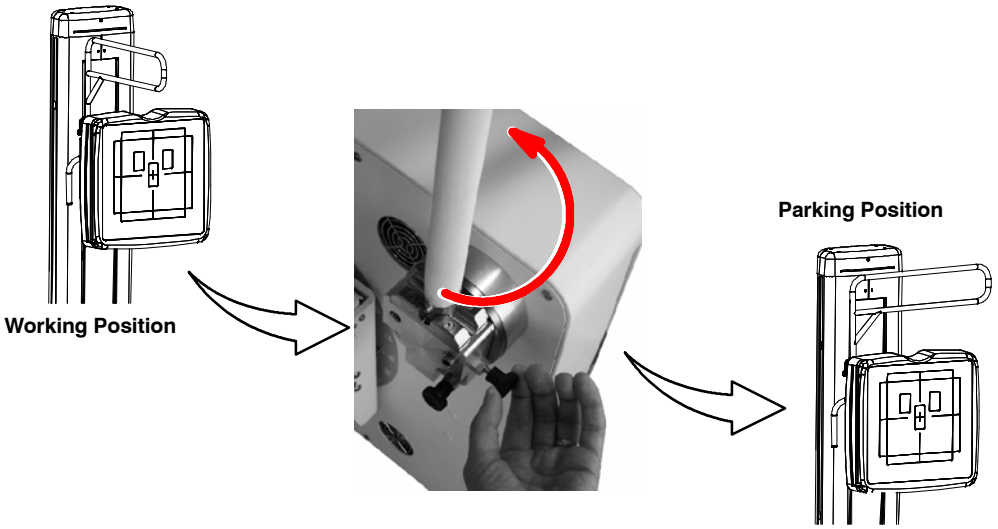


To install it:

1. Pull out the Parking Locking Pin at the center of the Support.
2. Install the Support in the working position.
3. Place the Pin in the locking position.

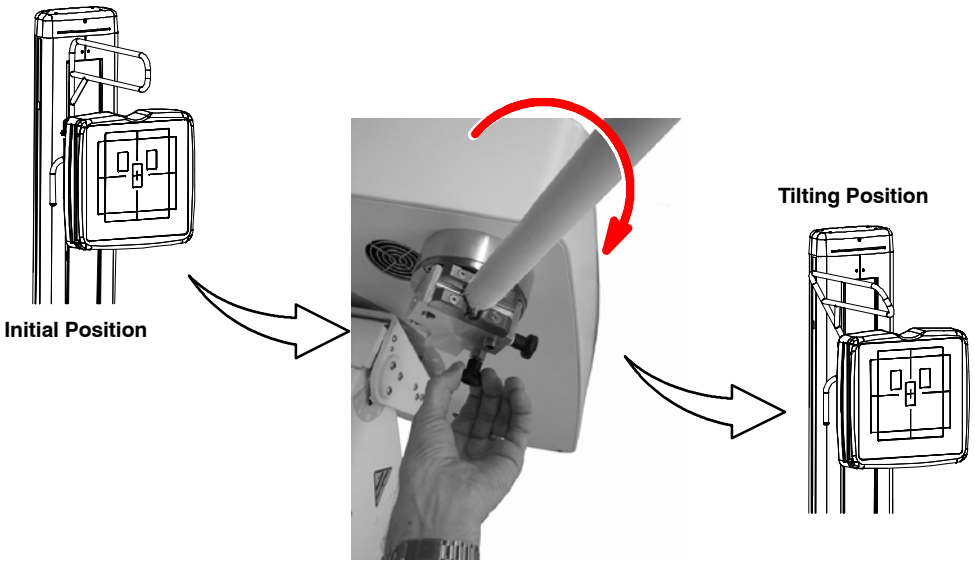
The Patient Support can be used in two different positions: Working position, at 0º, and Parking, at +90º or -90º. Pull out the Parking Locking Pin and turn the Support to the opposite of the DR Detector loading configuration.

Illustration 6-16
Overhead Hands Support Working and Parking Position



To tilt down the Patient Support, pull out the Tilting Locking Pin and then rotate the Holder Support. Use the Locking Pin to fix it. There are two different tilting positions available, at 30º and 50º when the Holder is at the left and at –30º and –50º when the Holder is at the right.

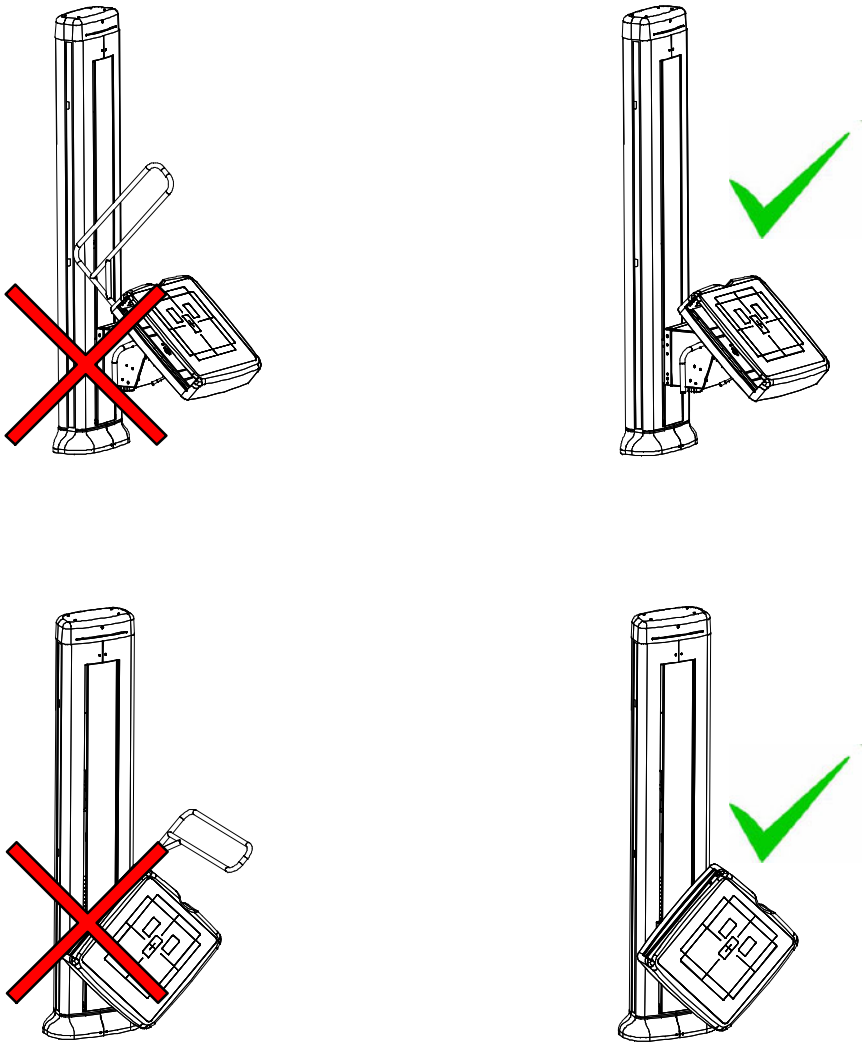
Illustration 6-17
Overhead Hands Support Tilting Procedure



Remember that the Patient Support is installed at the back of the cabinet of the DR Detector, so it is not possible to tilt the DR Detector with it installed. It is necessary to remove it from the Cabinet and then tilt.

It is also recommendable in all cases to rotate the DR Detector with the Patient Support removed and never tilted, as the Support can crash with the carriage.

Illustration 6-18
Correct Tilting and Rotation Procedures



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SECTION 7 COLLIMATION

7.1 RALCO R225 AUTOMATIC COLLIMATOR

Note ☞

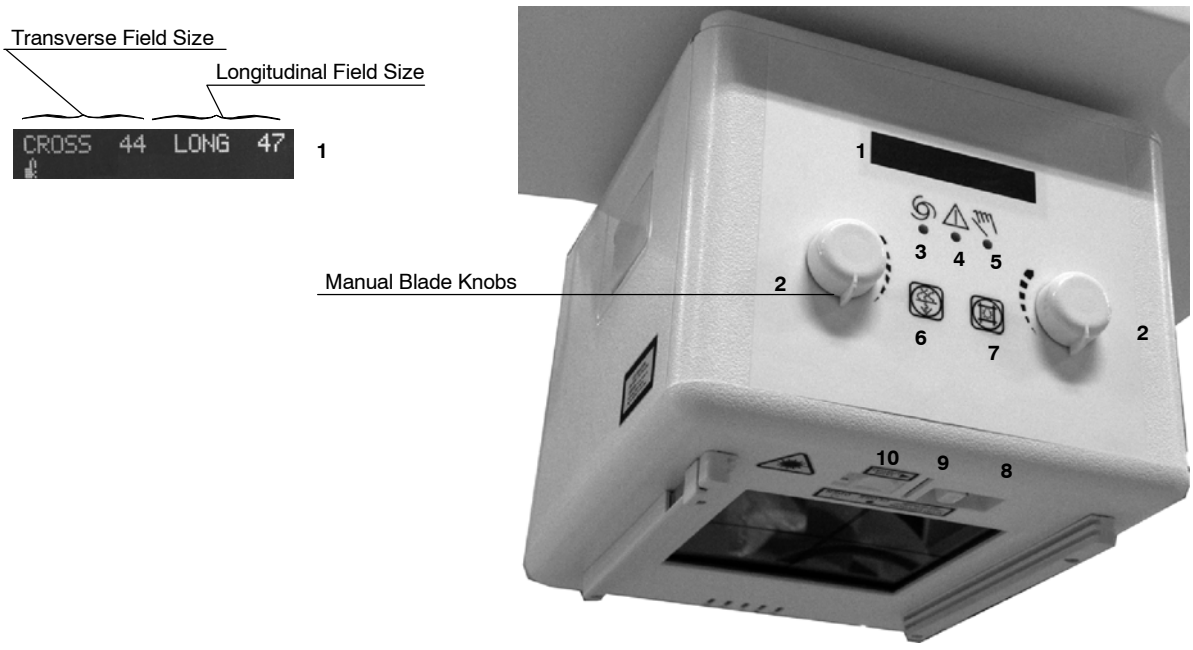
Ralco R225 Collimator operation is CanBus controlled by the Ceiling Suspension. The Collimator operation with the Ceiling Suspension is described on this Section.

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 7-1
Ralco R225 Automatic Collimator



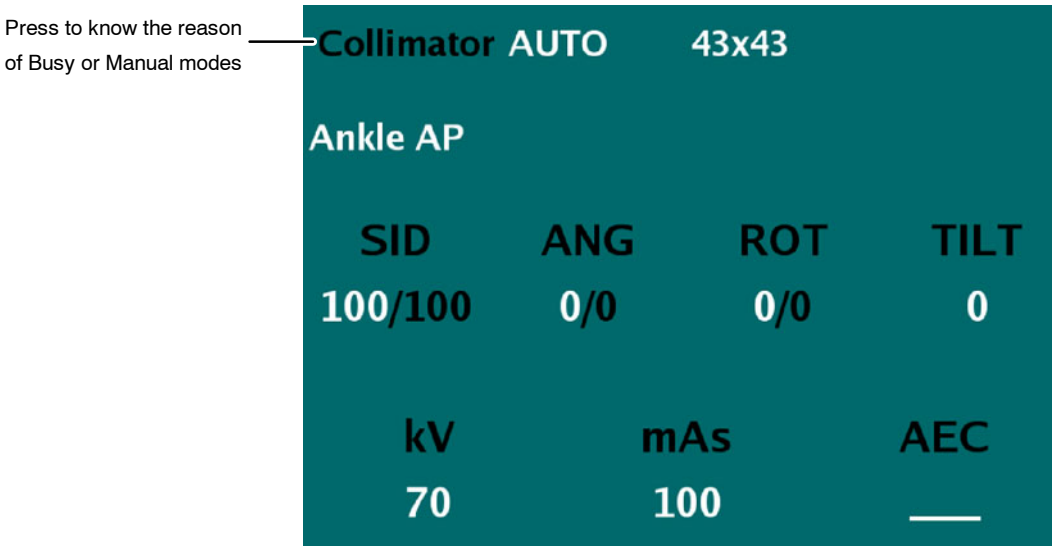
After pressing the Collimator Lamp control, the Lamp remains ON for several seconds to allow for patient/grid alignment before turning OFF automatically. An optional Laser positioner may be included with the Collimator Light in order to facilitate patient positioning.

Exposure field on the DR Detector is adjusted automatically to the size of the DR Detector. 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 the DR Detector Size.

Collimator mode is indicated in the Touchscreen Console, under the Patient Information. The modes are:

- AUTOMATIC
- MANUAL
- BUSY

Illustration 7-2
Press on Collimator Status Data to display the status reason



When the Mode is Manual or Busy, press on the Collimator Status Data on the Touchscreen Console to know the reason why the Automatic mode is not present. After pressing on the Collimator Status Data, an indication appears on the screen *(refer to Busy and Manual Mode paragraphs in this section for further details about each indication).*

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.

7.1.1 AUTOMATIC MODE

The Automatic mode is always activated whenever 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 correspond to 0^{o} of rotation of the X-ray Tube.
- The X-ray Tube and DR Detector must not be rotated, at 0^{o}.
- The Ceiling Suspension must be in PREP 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.*

7.1.2 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. The reasons of the Busy Mode:

MESSAGE	DESCRIPTION
FOV	The blades aperture is being 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.

7.1.3 MANUAL MODE

To be in manual mode, the reasons are:

MESSAGE	DESCRIPTION
DETECTOR	The selected Workstation (DIRECT) does not allow the automatic mode.
KEY	The Collimator back key is turned.
SID	The SID is out of the configured range for the automatic collimation.
STATUS	The Ceiling Suspension 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.

7.1.4 COLLIMATION LIGHT CONTROL

Collimator Light activates in two different modes.

- MANUALLY. Press on the MANUAL CONTROL Button.
- AUTOMATICALLY. The collimator is controlled by the Ceiling Suspension. The light will switch on when:
  - Collimator Blades change their configuration.
  - Collimator is rotated.
  - DIRECT Workstation is selected and any brake of the Ceiling Suspension is released, or any of the Console Controls are pressed.
  - RAD TABLE Workstation is selected and any of the RAD Table or DR Detector brakes are released.
  - RAD WALL STAND DR Workstation is selected and the vertical or tilting brakes are released.
  - The Ceiling Suspension is moving in manual mode and is in the SID area.
  - Just after finishing the Auto-Center and Auto-tracking movements.

7.2 RALCO MANUAL COLLIMATOR R225/R225 DHHS

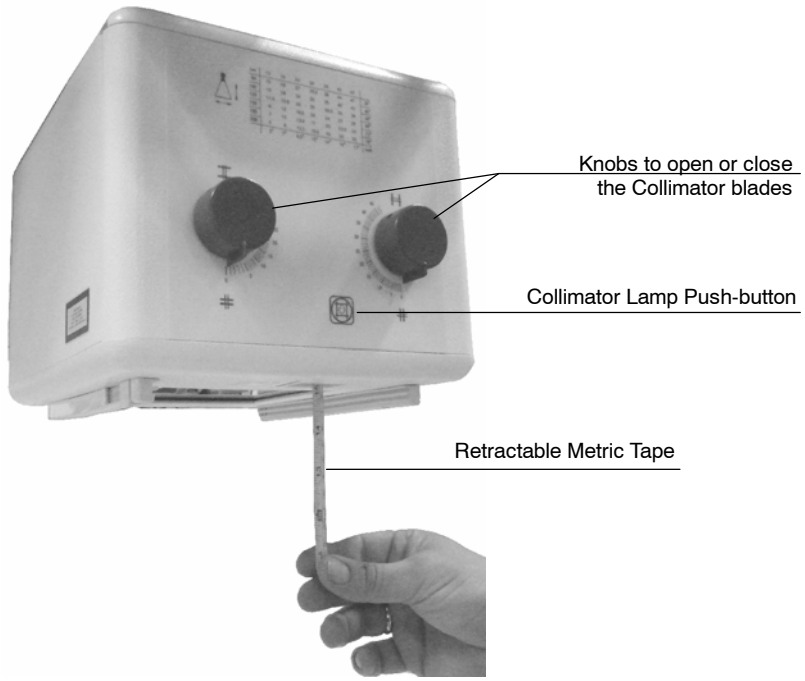
Collimator controls consist of a button to switch on the Collimator lamp and two knobs to open or close the internal blades of the Collimator.

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 SID measure.

Illustration 7-3
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.

7.3 DOSIMETER DEVICE (OPTIONAL)

The optional Dosimeter device is related to the Collimator installed in the equipment. The usual compatible Dosimeter devices are:

- Vacudap 2000 / 2004 Series with Manual Collimator
- Iba Kermax Plus with Automatic Collimator

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 8 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.

8.1 RAD WALL STAND DR

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.
DR DETECTOR VERTICAL MOVEMENT IS NOT POSSIBLE	There is any obstacle on the vertical travel.	Remove anything that may obstruct the vertical movement of the column stand.
	It is locked.	Press and hold the Vertical Lock Handle.
		In case that Vertical lock is broken, contact Service.
THE DR DETECTOR DOES NOT TILT	Power supply is OFF.	Switch on the System.
AUTO-TRACKING FUNCTIONALITY DOES NOT WORK	Check the Ceiling Suspension Control Console Error Message.	Complete the recommended Action by the Ceiling Suspension Control Console.

8.2 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.	Check conditions 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.

8.3 CEILING SUSPENSION

PROBLEM	CHECK IF	ACTION
CEILING SUSPENSION 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 Ceiling Suspension from the Room Electrical Cabinet. If it is correct but it can not be turned ON, contact Service.
CEILING SUSPENSION ON, CONTROL CONSOLE OFF	Check Control Console Cables connections.	Contact Service.
WRONG DISPLAY MEASURES	Wrong calibration.	Contact Service.

8.4 SOFTWARE ERROR MESSAGES

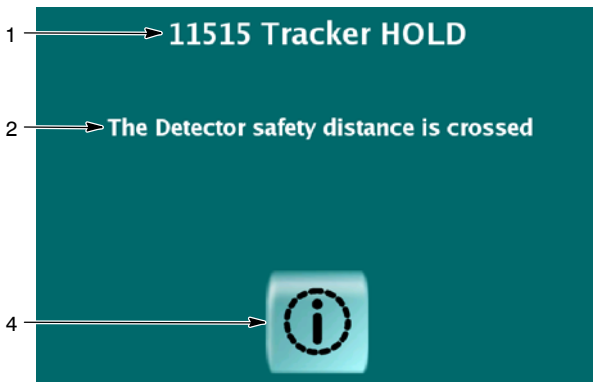
8.4.1 ERROR DISPLAY

The ERROR MESSAGE is displayed in the Control Console.

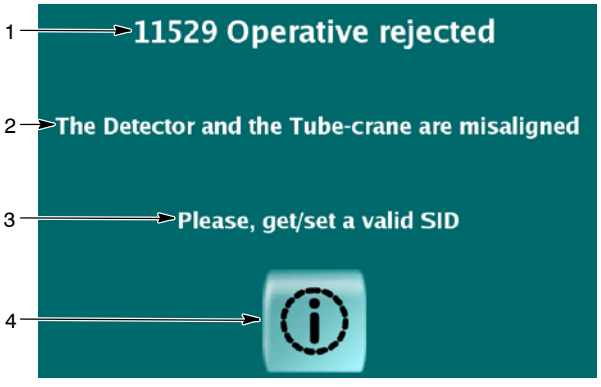
1. Error Message.
2. Cause of the Error.
3. Action to be completed to avoid the Error. This last Level is not displayed with all errors.
4. Press the Error Button to close the Error Message Display.

There are two different display configurations.

Illustration 8-1
Error Display



First configuration



Second configuration

8.4.2 ERROR LIST

Following tables list all defined error codes:

- **Error Code.**
- **User Error Message.** Displayed error message.
- **Error Description:** Explains the error and reasons.
- **Action:** Suggests the action to be completed in order to correct the error.

These errors are divided into nine different categories:

1	**System/Miscellaneous**	0 to 11099
2	**Ceiling Suspension Motor Controller Boards**	11100 to 11199
3	**RAD Wall Stand Motor Controller Boards**	11200 to 11299
4	**RAD Table Motor Controller Boards**	11300 to 11399
5	**Positioning**	11500 to 11599
6	**Safety Messages and Tomography**	11600 to 11699
7	**Auto-position ing**	11700 to 11799
8	**Auto-centering**	11800 to 11899
9	**Auto-tracking**	11900 to 11999

Table 8-1
System/Miscellaneous

CODE	USER ERROR MESSAGE	ERROR DESCRIPTION	ACTION
9	Collimator cause		Click on Collimator Information to know the reason
10	Interlock cause		Check if Interlock is activated. Click on Interlock icon to know the reason
11	Collimator Mode		Click on Collimator Information to know the reason
12	Collimator Error		Check SID/aperture relation
13	Stitching Cause		Try again
15	Dosimeter not communicating	DAP NOT communicating: Test	Contact Service
16	Dosimeter not communicating	DAP NOT communicating: Initialization	Contact Service
17	Dosimeter not communicating	DAP NOT communicating: Heartbeat	Contact Service
18	Dosimeter not communicating	DAP NOT communicating: Measure	Contact Service
19	Collimator not communicating	Collimator NOT communicating	Contact Service

Table 8-1 (Cont.)
System/Miscellaneous

CODE	USER ERROR MESSAGE	ERROR DESCRIPTION	ACTION
20	Initial position unreachable	Sequence Initial position unreachable	Correct and try again
21	Invalid parameter range: Unreachable positions	Sequence Invalid parameter range: Unreachable positions	Correct and try again
22	FLFS Sequence Aborted	Stitching Error	Try again
23	FLFS Sequence Completed	Stitching Error	Try again
24	FLFS: Collimator Key in Manual Mode	Stitching error	Correct and try again
25	FLFS: Detector NOT in Portrait Mode	Stitching Error	Try again
26	FLFS: Incorrect Parameters: Check Grid, Top and Bottom	Stitching Error	Check Grid, Top and Bottom
27	FLFS: Calculating Geometry	Stitching Error	Try again
28	Stitching: Calculating Geometry	Stitching Error	Try again
29	Stitching: Detector NOT in Portrait Mode	Stitching Error	Correct and try again
11001	Read Error in Calibration File	File not present or opened by other application	Try again
11002	Write Error in Calibration File	File not present or locked	Try again
11003	Position Demand Error	Not possible to reach to the configured position	Modify position configuration
11004	Workstation not available	Invalid Workstation	Configure correct Workstation
11005	Tomography: Parameters not Configured	Tomography not configured yet	Configure Tomography parameters
11006	Emergency OFF Switch pressed: Synchronizing Positioner software resources: Please wait	Emergency OFF Switch pressed	Release Emergency OFF Switch after the emergency cause disappears
11007	Safety issue: Keep OUT: Do not operate	Safety Error	Do not operate. Contact Service
11008	CS/Wall Stand: Safety area around the Wall Stand Bucky/Detector crossed		For automatic movements, move out of the safety area manually
11009	CS/Table: Safety area around the Table Bucky/Detector is crossed		For automatic movements, move out of the safety area manually
11010	Operative Rejected: The Auto-movement interlock is activated: Please, release signal state to proceed		Try again

Table 8-2
Ceiling Suspension Motor Controller Boards

CODE	USER ERROR MESSAGE	ERROR DESCRIPTION	ACTION
11100	Control Board Error: CS-Longitudinal	Motor Controller Board not connected or I2C communication problems	Check the Motor Controller I/F Connection
11101	Control Board Error: CS-Transversal	Motor Controller Board not connected or I2C communication problems	Check the Motor Controller I/F Connection
11102	Control Board Error: CS-Vertical	Motor Controller Board not connected or I2C communication problems	Check the Motor Controller I/F Connection
11103	Control Board Error: CS-Angular	Motor Controller Board not connected or I2C communication problems	Check the Motor Controller I/F Connection
11104	Control Board Error: CS-Rotational	Motor Controller Board not connected or I2C communication problems	Check the Motor Controller I/F Connection
11105	Invalid Calibration Data: CS-Longitudinal	Axis not calibrated, calibration file corrupted	Calibrate once again If message persists change SBC/CF
11106	Invalid Calibration Data: CS-Transversal	Axis not calibrated, calibration file corrupted	Calibrate once again If message persists change SBC/CF
11107	Invalid Calibration Data: CS-Vertical	Axis not calibrated, calibration file corrupted	Calibrate once again If message persists change SBC/CF
11108	Invalid Calibration Data: CS-Angular	Axis not calibrated, calibration file corrupted	Calibrate once again. If message persists change SBC/CF
11109	Invalid Calibration Data: CS-Rotational	Axis not calibrated, calibration file corrupted	Calibrate once again If message persists change SBC/CF
11110	Operative rejected: CS-Longitudinal position out of calibrated range: Right there, only MANUAL movement allowed	Axis moved out of defined range manually. Axis not calibrated. Potentiometer misaligned. Potentiometer or Potentiometer Circuitry defective. A/D converter problem	Check position feedback Contact Service
11111	Board failure: CS-Longitudinal	No motor power or motor/driver defective. Potentiometer/Tachometer or circuitry defective. Coupling did not engage	Change board
11112	End-switch limit: CS-Longitudinal	Axis moved out of defined range manually. Axis not calibrated. Potentiometer misaligned. Potentiometer or Potentiometer Circuitry defective. A/D converter problem	Check End Switch Limit position, activation, operation. Check End Switch Limit range

Table 8-2 (Cont.)
Ceiling Suspension Motor Controller Boards

CODE	USER ERROR MESSAGE	ERROR DESCRIPTION	ACTION
11113	Operative rejected: CS-Transversal position out of calibrated range: Right there, only MANUAL movement allowed	Axis moved out of defined range manually. Axis not calibrated. Potentiometer misaligned. Potentiometer or Potentiometer Circuitry defective. A/D converter problem	Check position feedback Contact Service
11114	Board failure: CS-Transversal	No motor power or motor/driver defective. Potentiometer/Tachometer or circuitry defective. Coupling did not engage	Change board
11116	End-Switch Limit: CS-Transversal	Axis moved out of defined range manually. Axis not calibrated. Potentiometer misaligned. Potentiometer or Potentiometer Circuitry defective. A/D converter problem	Check End Switch Limit position, activation, operation. Check End Switch Limit range
11117	Operative rejected: CS-Vertical position out of calibrated range: Right there, only MANUAL movement allowed	Axis moved out of defined range manually. Axis not calibrated. Potentiometer misaligned. Potentiometer or Potentiometer Circuitry defective. A/D converter problem	Check position feedback. Contact Service
11118	Board Failure: CS-Vertical	No motor power or motor/driver defective. Potentiometer/Tachometer or circuitry defective. Coupling did not engage	Change board
11119	End-Switch Limit: CS-Vertical	Axis moved out of defined range manually. Axis not calibrated. Potentiometer misaligned. Potentiometer or Potentiometer Circuitry defective. A/D converter problem	Check End Switch Limit position, activation, operation. Check End Switch Limit range
11120	Operative rejected: CS-Angular position out of calibrated range: Right there, only MANUAL movement allowed	Axis moved out of defined range manually. Axis not calibrated. Potentiometer misaligned. Potentiometer or Potentiometer Circuitry defective. A/D converter problem	Check position feedback Contact Service

Table 8-2 (Cont.)
Ceiling Suspension Motor Controller Boards

CODE	USER ERROR MESSAGE	ERROR DESCRIPTION	ACTION
11121	Board Failure: CS-Angular	No motor power or motor/driver defective. Potentiometer/Tachometer or circuitry defective. Coupling did not engage	Change board
11122	End-Switch Limit: CS-Angular	Axis moved out of defined range manually. Axis not calibrated. Potentiometer misaligned. Potentiometer or Potentiometer Circuitry defective. A/D converter problem	Check End Switch Limit position, activation, operation. Check End Switch Limit range.
11123	Operative rejected: CS-Rotational position out of calibrated range: Right there, only MANUAL movement allowed	Axis moved out of defined range manually. Axis not calibrated. Potentiometer misaligned. Potentiometer or Potentiometer Circuitry defective. A/D converter problem	Check position feedback. Contact Service
11124	Board Failure: CS-Rotational	No motor power or motor/driver defective. Potentiometer/Tachometer or circuitry defective. Coupling did not engage	Change board
11125	End-Switch Limit: CS-Rotational	Axis moved out of defined range manually. Axis not calibrated. Potentiometer misaligned. Potentiometer or Potentiometer Circuitry defective. A/D converter problem	Check End Switch Limit position, activation, operation Check End Switch Limit range
11126	Control Board Error: CS-Interface		Change board

Table 8-3
Wall Stand Motor Controller Boards

CODE	USER ERROR MESSAGE	ERROR DESCRIPTION	ACTION
11201	Control Board Error: Wall Stand-Vertical	No motor power or motor/driver defective. Potentiometer/Tachometer or circuitry defective. Coupling did not engage	Replace the Control Driver Board
11202	Control Board Error: Wall Stand-Tilting	No motor power or motor/driver defective. Potentiometer/Tachometer or circuitry defective. Coupling did not engage	Replace the Control Driver Board
11204	Invalid calibration data: Wall Stand-Vertical		Check Vertical Axis calibration
11205	Invalid calibration data: Wall Stand-Tilting		Check Calibration
11210	Position out of range: Wall Stand-Vertical	Axis moved out of defined range manually. Axis not calibrated. Potentiometer misaligned. Potentiometer or Potentiometer Circuitry defective. A/D converter problem	Check Vertical Axis calibration
11211	Control Board Error: Wall Stand-Vertical	No motor power or motor/driver defective. Potentiometer/Tachometer or circuitry defective. Coupling did not engage	Replace the Control Driver Board

Table 8-3 (Cont.)
Wall Stand Motor Controller Boards

CODE	USER ERROR MESSAGE	ERROR DESCRIPTION	ACTION
11212	End-switch limit: Wall Stand-Vertical	Axis moved out of defined range manually. Axis not calibrated. Potentiometer misaligned. Potentiometer or Potentiometer Circuitry defective. A/D converter problem	Check End Switch Limit position, activation, operation. Check End Switch Limit range.
11213	Position out of range: Wall Stand-Tilting	Axis moved out of defined range manually. Axis not calibrated. Potentiometer misaligned. Potentiometer or Potentiometer Circuitry defective. A/D converter problem	Check Axis calibration
11214	Control Board Error: Wall Stand-Tilting	No motor power or motor/driver defective. Potentiometer/Tachometer or circuitry defective. Coupling did not engage	Replace Control Driver Board
11215	End-switch limit: Wall Stand-Tilting	Axis moved out of defined range manually. Axis not calibrated. Potentiometer misaligned. Potentiometer or Potentiometer Circuitry defective. A/D converter problem	Check End Switch Limit position, activation, operation. Check End Switch Limit range

Table 8-4
Table Motor Controller Boards

CODE	USER ERROR MESSAGE	ERROR DESCRIPTION	ACTION
11300	Control Board Error: Table		Replace Control Board
11301	Invalid Calibration Data: Table-Longitudinal		Check Longitudinal Axis calibration
11302	Invalid Calibration Data: Table-Vertical		Check the Table's Vertical Axis calibration
11310	Operative rejected: Table-Longitudinal position out of calibrated range: Right there, only MANUAL movement allowed	Axis moved out of defined range manually. Axis not calibrated. Potentiometer misaligned. Potentiometer or Potentiometer Circuitry defective. A/D converter problem	Check Longitudinal Axis calibration
11311	Control Board Error: Table-Longitudinal	No motor power or motor/driver defective. Potentiometer/Tachometer or circuitry defective. Coupling did not engage	Replace the Control Driver Board
11312	End-Switch Limit: Table-Longitudinal	Axis moved out of defined range manually. Axis not calibrated. Potentiometer misaligned. Potentiometer or Potentiometer Circuitry defective. A/D converter problem	Check End Switch Limit position, activation, operation. Check End Switch Limit range
11313	Position Out of Range: Table-Vertical	Axis moved out of defined range manually. Axis not calibrated. Potentiometer misaligned. Potentiometer or Potentiometer Circuitry defective. A/D converter problem	Check Axis calibration
11314	Control Board Error: Table-Vertical	Axis moved out of defined range manually. Axis not calibrated. Potentiometer misaligned. Potentiometer or Potentiometer Circuitry defective. A/D converter problem	Replace the Control Driver Board

Table 8-5
Positioning

CODE	USER ERROR MESSAGE	ERROR DESCRIPTION	ACTION
11501	Auto-center forbidden		Try again
11502	Auto-tracking forbidden		Try again
11503	Parking forbidden		Try again
11504	Demand mismatch		Try again
11505	Operative rejected: SID is out of limits 80 cm, 400 cm / 31.5”, 157.5”: Please, check POSITION parameters	SID is out of limits 80 cm, 400 cm / 31.5”, 157.5”	Check SID parameters in POSITION
11506	Operative rejected: Invalid ANG demand: Please, check POSITION parameters	Invalid Tube angulation (ANG) demand	Check ANG parameters in POSITION
11507	Operative rejected: Invalid ROT demand: Please, check POSITION parameters	Invalid Tube rotation (ROT) demand	Check ROT parameters in POSITION
11508	Operative rejected: Invalid Positioner: Please, check Configuration data and POSITION parameters	Invalid Auto-position/position configuration	Check POSITION parameters
11509	Operative rejected: Invalid Receptor: Please, check Configuration data and POSITION parameters	Invalid Receptor configuration	Check Bucky/Detector Demand
11510	Operative rejected: Please, fix the Wall Stand-Tilting geometry state to proceed	Invalid Wall Stand tilting geometry	Get aligned the Bucky/Detector
11511	Detector GRID Rotation: Please, get the Detector aligned	Bucky/Detector and Tube not aligned	Get aligned the Bucky/Detector
11512	Operative rejected: Please, fix the Table-height geometry state	Invalid Table height configuration	Get the Table at the correct height
11513	Operative rejected: Table Safety distance is crossed: Auto-movement Safety Policy activated	The Table Safety distance is crossed: Auto-movement Safety Policy activated	Check SID parameters in POSITION
11514	Operative rejected: Wall Stand Safety distance is crossed: Auto-movement Safety Policy activated	The Wall Stand Safety distance is crossed: Auto-movement Safety Policy activated	Check SID parameters in POSITION
11515	Tracker HOLD: Detector safety distance is crossed	Bucky/Detector safety distance is crossed. Auto-movement Safety Policy activated	Check SID parameters in POSITION
11518	Invalid APR demand	Invalid APR configuration	Check APR configuration
11519	Operative rejected: SID is out of limits 80 cm, 400 cm / 31.5”, 157.5”: Please, check POSITION parameters	SID is out of limits 80 cm, 400 cm / 31.5”, 157.5”	Check SID parameters in POSITION
11520	Operative rejected: Auto-center not allowed for DIRECT workstation: Please, check WORKSTATION selection	Auto-center function is not available when DIRECT Workstation is configured	Change WORKSTATION

Table 8-5 (Cont.)
Positioning

CODE	USER ERROR MESSAGE	ERROR DESCRIPTION	ACTION
11521	Operative rejected: System synchronizing, please wait and try again	System synchronizing	Wait until synchronizing procedure finishes
11522	Operative rejected: System synchronizing, please wait and try again	System synchronizing	Wait for system stop
11523	Operative rejected: Please, release the MANUAL activators to proceed	All brakes activated	Press any Control Console brake button
11524	Auto-center SKIPPED: Positioner is already centered	Positioner is already centered	Try again
11525	Operative rejected: Tracker not allowed for DIRECT workstation: Please, check WORKSTATION selection	Auto-tracking function is not available when DIRECT Workstation is configured	Change WORKSTATION
11526	Auto-tracking forbidden: System synchronizing, please wait and try again	System synchronizing	Wait until synchronizing procedure finishes
11527	Auto-tracking forbidden: System in motion, please wait and try again	System in motion	Wait for system stop
11528	Operative rejected: Please, release the MANUAL activators to proceed	All brakes activated	Press any Control Console brake button
11529	Operative rejected: The Detector and the Tube-crane are misaligned: Please, get/set a valid SID	The Bucky/Detector and the Tube are misaligned	Align X-ray Tube and Bucky/Detector
11530	Auto-tracking skipped: Function already activated	Auto-tracking function already activated	Try again
11531	Operative rejected: System synchronizing, please wait and try again	System synchronizing	Wait until synchronizing procedure finishes
11532	Operative rejected: System synchronizing, please wait and try again	System synchronizing	Wait for system stop
11533	Operative rejected: Please, release the MANUAL activators to proceed	All brakes activated	Press any Control Console brake button
11534	Stitching PileUp: Positioner synchronizing, please wait and try again		Try again
11535	Auto-movement Failure: Positioner out of the auto-centering zone: Please, try the operative again		Try again
11539	Auto-movement aborted: Timeout to position the Detector: Please Try again		Try again
11540	Operative rejected: The auto-movement interlock is activated: Please, check over-speed cause		Check the over-speed cause

Table 8-6
Safety Messages & Tomography

CODE	USER ERROR MESSAGE	ERROR DESCRIPTION	ACTION
11601	Tomography: Auto-positioning movement timeout: Please, check positioning parameters	Auto-positioning movement timeout.	Please, check positioning parameters
11602	Tomography aborted: The Positioner is out of the allowed tolerance: Please, try again	The Positioner is out of the allowed tolerance	Calibrate Table Receptor movement
11603	Tomography: Illegal rotation axis	Rotation angle not allowed	Correct Rotation value and try again
11604	Tomography: The Generator interface board is not synchronizing: Please, check the equipment state	The Generator interface board is not synchronizing	Check configuration
11605	Tomography: The Table is too high to get the SID: Please, lower the equipment to for CS Auto-positioning	The Table is too high to get the SID	Place the table height for enable Tomo SID
11606	Tomography: Action has been aborted by user: Please, try again	Action has been aborted by user	Try again
11607	Tomography: The cut plane must be refreshed	The cut plane must be refreshed	Change cut plane
11608	Tomography: The CS-Longitudinal (pre-tomo) target out of specifications: Please, adjust site parameters	The CS-Longitudinal (pre-tomo) target out of specifications	Please, adjust site parameters
11610	Safety Issue: Abnormal Velocity detected on CS-Longitudinal	Velocity upper-limit detected on Suspension Longitudinal Axis	In Manual motion, move smoothly. In automatic motion calibrate the speed
11611	Safety Issue: Abnormal Velocity detected on CS-Transversal	Velocity upper-limit detected on Suspension Transversal Axis	In Manual motion, move smoothly. In automatic motion calibrate the speed
11612	Safety Issue: Abnormal Velocity detected on CS-Vertical	Velocity upper-limit detected on Suspension Vertical Axis	In Manual motion, move smoothly. In automatic motion calibrate the speed
11613	Safety Issue: Abnormal Velocity detected on CS-Angular	Velocity upper-limit detected on Suspension Angular Axis	In Manual motion, move smoothly. In automatic motion calibrate the speed
11614	Safety Issue: Abnormal Velocity detected on CS-Rotation	Velocity upper-limit detected on Suspension Rotation Axis	In Manual motion, move smoothly. In automatic motion calibrate the speed
11615	Safety Issue: Abnormal Velocity detected on Table-Longitudinal	Velocity upper-limit detected on Table Longitudinal Axis	In Manual motion, move smoothly. In automatic motion calibrate the speed
11616	Safety Issue: Abnormal Velocity detected on Wall Stand-Vertical	Velocity upper-limit detected on Wall Stand Vertical Axis	In Manual motion, move smoothly. In automatic motion calibrate the speed

Table 8-7
Auto-positioning

CODE	USER ERROR MESSAGE	ERROR DESCRIPTION	ACTION
11713	Manual mode aborted: Wall Stand-Vertical timeout: Please, try again	Auto-position not completed, movement on Wall Stand Vertical Axis timed out	Try again
11720	Parking not configured	Parking not present in Configuration File	Configure POSITION
11721	Parking rejected: CS-Longitudinal target out of specifications: Please, check POSITION parameters	Can occur when axis location calibration is re-run after Parking was originally defined	Configure POSITION
11722	Auto-movement aborted: CS-Longitudinal target	Can occur when axis Location calibration is run again after Parking was defined	Configure POSITION
11723	Manual mode aborted: CS-Longitudinal timeout: Please, try again	Auto-position not completed, movement on Ceiling Suspension Longitudinal Axis timed out	Try again
11731	Parking rejected: CS-Transversal target out of specifications: Please, check POSITION parameters		Configure POSITION
11732	Auto-movement aborted: CS-Transversal target		Configure POSITION
11733	Manual mode aborted: CS-Transversal timeout: Please, try again	Auto-position not completed, movement on Ceiling Suspension Transversal Axis timed out	Try again
11741	Parking rejected: CS-Vertical target out of specifications: Please, check POSITION parameters		Configure POSITION
11742	Auto-movement aborted: CS-Vertical target		Configure POSITION
11743	Manual mode aborted: CS-Vertical timeout: Please, try again	Auto-position not completed, movement on Ceiling Suspension Vertical Axis timed out	Try again
11751	Parking rejected: CS-Angular target out of specifications: Please, check POSITION parameters		Configure POSITION
11752	Auto-movement aborted: CS-Angular target		Configure POSITION
11753	Manual mode aborted: CS-Angular timeout: Please, try again	Auto-position not completed, movement on Ceiling Suspension Alpha Axis timed out	Try again
11761	Parking rejected: CS-Rotational target out of specifications: Please, check POSITION parameters		Configure POSITION

Table 8-7 (Cont.)
Auto-positioning

CODE	USER ERROR MESSAGE	ERROR DESCRIPTION	ACTION
11762	Auto-movement aborted: CS-Rotation target		Configure POSITION
11763	Manual mode aborted: CS-Rotational timeout: Please, try again	Auto-position not completed, movement on Ceiling Suspension Beta Axis timed out	Try again
11771	Parking rejected: Wall Stand-Vertical target out of specifications: Please, check POSITION parameters		Configure POSITION
11781	Parking rejected: Wall Stand Rail target out of specifications: Please, check POSITION parameters		Configure POSITION
11791	Parking rejected: Table-Longitudinal target out of specifications: Please, check POSITION parameters		Configure POSITION
11792	Auto-movement aborted: Table-Longitudinal target		Configure POSITION
11793	Manual movement aborted: Table-Longitudinal timeout: Please, try again	Auto-position not completed, movement on Table Longitudinal Axis timed out	Try again

Table 8-8
Auto-centering

CODE	USER ERROR MESSAGE	ERROR DESCRIPTION	ACTION
11801	Auto-movement aborted: CS moved	Auto-centering is cancelled because Ceiling Suspension was moved	Try again
11802	Auto-movement aborted: Wall Stand moved	Auto-centering is cancelled because Wall Stand was moved	Try again
11803	Auto-movement aborted: Table moved	Auto-centering is cancelled because Table was moved	Try again
11804	Auto-movement aborted: Detector changed	Auto-centering is cancelled because current Bucky/Detector was changed	Try again
11815	Auto-movement aborted: No Detector selected	Auto-centering does not start because NO Bucky/Detector is selected	Select Bucky/Detector and try again
11821	Operative rejected: CS-Longitudinal Target is out of calibrated range: Please, check POSITION parameters	Auto-centering does not start because final position for the Ceiling Suspension (slave) is out of range on Longitudinal Axis	Move Bucky/Detector and try again
11822	Auto-movement aborted: The CS-Longitudinal Axis is blocked: Please, try again	Auto-centering does not start because final position for the Ceiling Suspension (slave) Longitudinal Axis timed out	Try again
11831	Operative rejected: CS-Transversal Target is out of calibrated range: Please, check POSITION parameters	Auto-centering does not start because final position for the Ceiling Suspension (slave) is out of range on Transversal Axis	Move Bucky/Detector and try again
11832	Auto-movement aborted: The CS-Transversal Axis is blocked: Please, try again	Auto-centering does not start because final position for the Ceiling Suspension (slave) Transversal Axis timed out	Try again
11841	Operative rejected: CS-Vertical Target is out of calibrated range: Please, check POSITION parameters	Auto-centering does not start because final position for the Ceiling Suspension (slave) is out of range on Vertical Axis	Move Bucky/Detector and try again
11842	Auto-movement aborted: The CS-Vertical Axis is blocked: Please, try again	Auto-centering does not start because final position for the Ceiling Suspension (slave) Vertical Axis timed out	Try again

Table 8-8 (Cont.)
Auto-centering

CODE	USER ERROR MESSAGE	ERROR DESCRIPTION	ACTION
11851	Operative rejected: CS-Angular Target greater than 46º limit: Please, check POSITION parameters	Auto-centering does not start because final position for the Ceiling Suspension is out of range on Alpha Axis, greater than 46º	Move Bucky/Detector and try again
11852	Auto-movement aborted: The CS-Angular Axis is blocked: Please, try again	Auto-centering does not start because final position for the Ceiling Suspension Alpha Axis timed out	Try again
11861	Operative rejected: CS-Rotation Target greater than 30º limit: Please, check POSITION parameters	Auto-centering does not start because final position for the Ceiling Suspension is out of range on Beta Axis, greater than 30º	Move Bucky/Detector and try again
11862	Auto-movement aborted: The CS-Rotation axis is blocked: Please, try again	Auto-centering does not start because final position for the Ceiling Suspension (slave) Beta Axis timed out.	Try again
11871	Operative rejected: Wall Stand-Vertical Target out of calibrated range: Please, check POSITION parameters	Wall Stand-Vertical Target out of calibrated range	Move Bucky/Detector and try again
11881	Operative rejected: Wall Stand-Tilting Target out of calibrated range: Please, check POSITION parameters	Auto-centering does not start because initial position for Wall Stand Tilting is out of specifications. Applied to single panel usage, where tilt must be at 90º	Move Bucky/Detector and try again
11891	Operative rejected: Table-Longitudinal Target out of calibrated range: Please, check POSITION parameters	Auto-centering does not start because final position for the Table (slave) is out of range on Longitudinal Axis	Move Bucky/Detector and try again
11892	Auto-movement aborted: The Table-Longitudinal Axis is blocked: Please, try again	The Table-Longitudinal Axis is blocked	Try again
11893	Auto-movement aborted: The Wall Stand-Vertical Axis is blocked: Please, try again	The Wall Stand-Vertical Axis is blocked	Try again

Table 8-9
Auto-tracking

CODE	USER ERROR MESSAGE	ERROR DESCRIPTION	ACTION
11903	Tracking aborted: No Detector selected	No Bucky/Detector selected	Select Bucky/Detector and try again
11906	Operative rejected: Detector and Tube-crane are misaligned: Please, get a valid SID	Bucky/Detector and X-ray Tube are misaligned	Please get the X-ray Tube aligned
11907	System geometry: Positioner out of limits	Positioner out of limits	Please Place SID: between 80 and 300 cm
11913	Auto-tracking aborted: Detector changed	Target Bucky/Detector changed position	Try again
11914	Auto-tracking aborted: CS moved	Ceiling Suspension moved manually and misaligned	Activate Tracking function
11915	Auto-tracking aborted: Wall Stand moved	Wall Stand moved manually and misaligned	Activate Tracking function
11916	Auto-tracking aborted: Table moved	Table moved manually and misaligned	Activate Tracking function
11921	Auto-tracking aborted: CS-Longitudinal limit	Target position out of calibrated limits on Longitudinal Axis of the Ceiling Suspension	Calibrate the Ceiling Suspension longitudinal Axis
11922	Auto-tracking paused: CS-Longitudinal limit	Target position out of limits on Longitudinal Axis of the Ceiling Suspension	Do not exceed the longitudinal limit
11931	Auto-tracking aborted: CS-Transversal limit	Target position out of calibrated limits on Transversal Axis of the Ceiling Suspension	Calibrate the Ceiling Suspension transversal Axis
11932	Auto-tracking paused: CS-Transversal limit	Target position out of limits on Transversal Axis of the Ceiling suspension	Do not exceed the transversal limit
11941	Auto-tracking aborted: CS-Vertical limit	Target position out of calibrated limits on Vertical Axis of the Ceiling Suspension	Calibrate the Ceiling Suspension vertical Axis
11942	Auto-tracking paused: CS-Vertical limit	Target position out of limits on Vertical Axis of the Ceiling suspension	Do not exceed the vertical limit
11981	Auto-tracking aborted: Wall Stand-Vertical limit	Target position out of limits on Vertical Axis of the Wall Stand	Calibrate the Ceiling Suspension vertical Axis
11991	Auto-tracking aborted: Table-Longitudinal limit	Target position out of calibrated limits on Longitudinal Axis of the Table	Calibrate the Table
11992	Auto-tracking paused: Table-Longitudinal limit	Target position out of limits on Longitudinal Axis of the Table	Do not exceed the Table limits

SECTION 9 OPERATING SEQUENCES

9.1 START-UP ROUTINE

Start-up the System as described in *Section 3*.

9.2 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.

9.3 RADIOGRAPHIC OPERATION

RAD operation can be performed in the following modes:

- Three point control by selecting kVp, mA and Exposure Time independently.
- Two point control by selecting kVp and mAs independently. mAs selection sets the maximum mA available for the selected Focal Spot and the respective Exposure Time. In this control mode, when kVp value is increased, the Generator will automatically look for the adequate combination of mA and Exposure Time factors to avoid the "*Tube Overload*" warning, keeping constant mAs.
- One point control by selecting kVp with AEC operations.
- Anatomical Programs (APR).

A typical RAD examination sequence is as indicated below:

1. Make sure that the X-ray Tube to be used is properly warmed-up.
2. Position the equipment in the initial position of the examination.

THIS EQUIPMENT CAN BE MOVED IN DIFFERENT AXES. PLEASE TAKE CARE THAT NEITHER THE PATIENT NOR THE OPERATOR/STAFF ARE IN THE MOVEMENT AREA OF THE EQUIPMENT. ALWAYS WATCH WHERE YOU STAND. 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. Position the patient for the examination.
4. Select the "*workstation*" and technique parameters using the RAD controls on the NX Station or on the Ceiling Suspension Control Console.
5. Instruct the 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.
6. Instruct the patient to remain still and to hold 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.

7. When the exposure is finished, release the handswitch button.

8. Repeat the procedure if additional exposures are desired.

9.4 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 NX Station 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 NX Station.

5. Select the technique parameters (back-up time / mAs) using the RAD controls on the NX Station or on the Ceiling Suspension Control Console.

6. Continue with the radiographic operation. *(Refer to Section 9.3 - step 4.)*

9.4.1 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 the 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 Table-Top 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 ±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 10 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's manufacturing date.

NEVER ATTEMPT TO PERFORM MAINTENANCE TASKS WHILE THE EQUIPMENT IS IN USE WITH A PATIENT.

10.1 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.

10.2 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 11 TECHNICAL SPECIFICATIONS

11.1 ENVIRONMENTAL REQUIREMENTS

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)	35 ^{O}C (95 ^{O}F)
TRANSPORT & STORAGE					
500 hPa	1060 hPa	10%	90%	-20 ^{O}C (-4 ^{O}F)	70 ^{O}C (158 ^{O}F)

11.2 X-RAY SYSTEM POSITIONERS

11.2.1 POWER LINE REQUIREMENTS

EQUIPMENT	FREQUENCY	VOLTAGE	MAX. PERMANENT CURRENT
CEILING SUSPENSION	50/60 Hz	115 - 240 VAC	**3.5 - 1.6 A**
RAD TABLE	50/60 Hz	115 - 240 VAC	**4 - 2 A**
RAD WALL STAND DR*	50/60 Hz	24 VDC	**4 A**
***** *NOTE: Power Line for the RAD Wall Stand DR is supplied by the RAD Table in Double Panel Systems and by the Ceiling Suspension in Single Panel Systems.*			

11.2.2 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: 160 mm in “X” axis and 240 mm in “Y” axis.
Measured at 125 kVp: 160 mm in “X” axis and 240 mm in “Y” axis.
(Test performed at a distance from the Focal Spot of 1200 mm, in accordance with IEC 60806: 1984)

11.2.3 DIMENSIONS AND PRODUCT WEIGHT

EQUIPMENT	DIMENSIONS			WEIGHT
	DEPTH	WIDTH	HEIGHT	
RAD TABLE	868 mm (34.17”)	2200 mm (86.61”)	580 mm (22.83”) min. 920 mm (36.22”) max.	261 Kg (575.4 lbs)
RAD WALL STAND (w/o DR Detector)	637 mm (25”)	518 mm (20.39”)	2240 mm (88.1”)	193 Kg (425.48 lbs)

CEILING SUSPENSION WEIGHT	Kg.	lbs.
TOTAL WITHOUT CEILING RAILS SYSTEM	207.4	457.23
2 LONGITUDINAL RAILS (6.0 m)	43.2	95.24
BRIDGE OR TRANSVERSE RAILS (3.5 m)	31.7	69.88
CABLE SUPPORT RAIL (6.0 m)	5	11.02
TOTAL WITH CEILING RAILS SYSTEM	287.3	633.39

RAD TABLE

Illustration 11-1
RAD Table Dimensions and Travels with Fixed DR Detector

Note ☞ *Tabletop travel is set by default at 490 ±10 mm (19.2” ±0.4”) on both sides. It is possible to enlarge the Tabletop displacement on the left side to 600 mm (23.6”).*

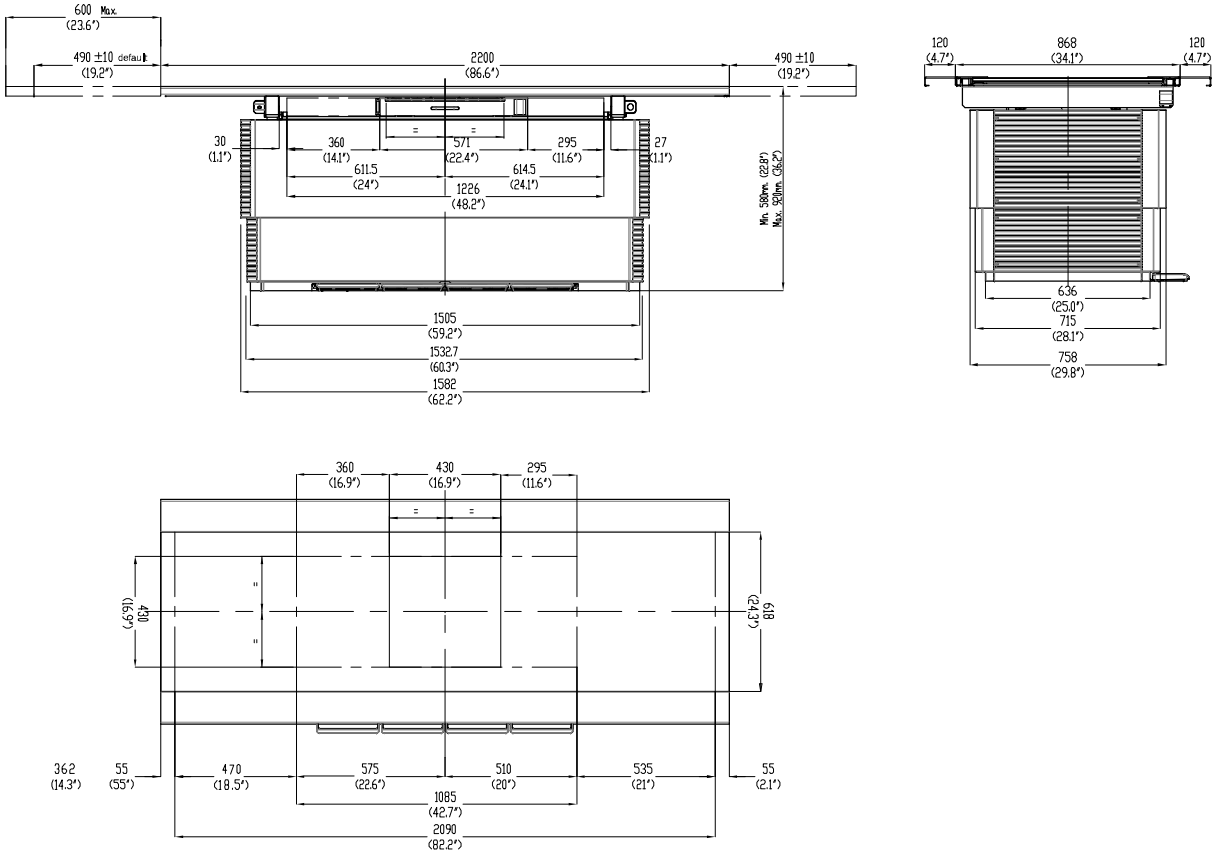
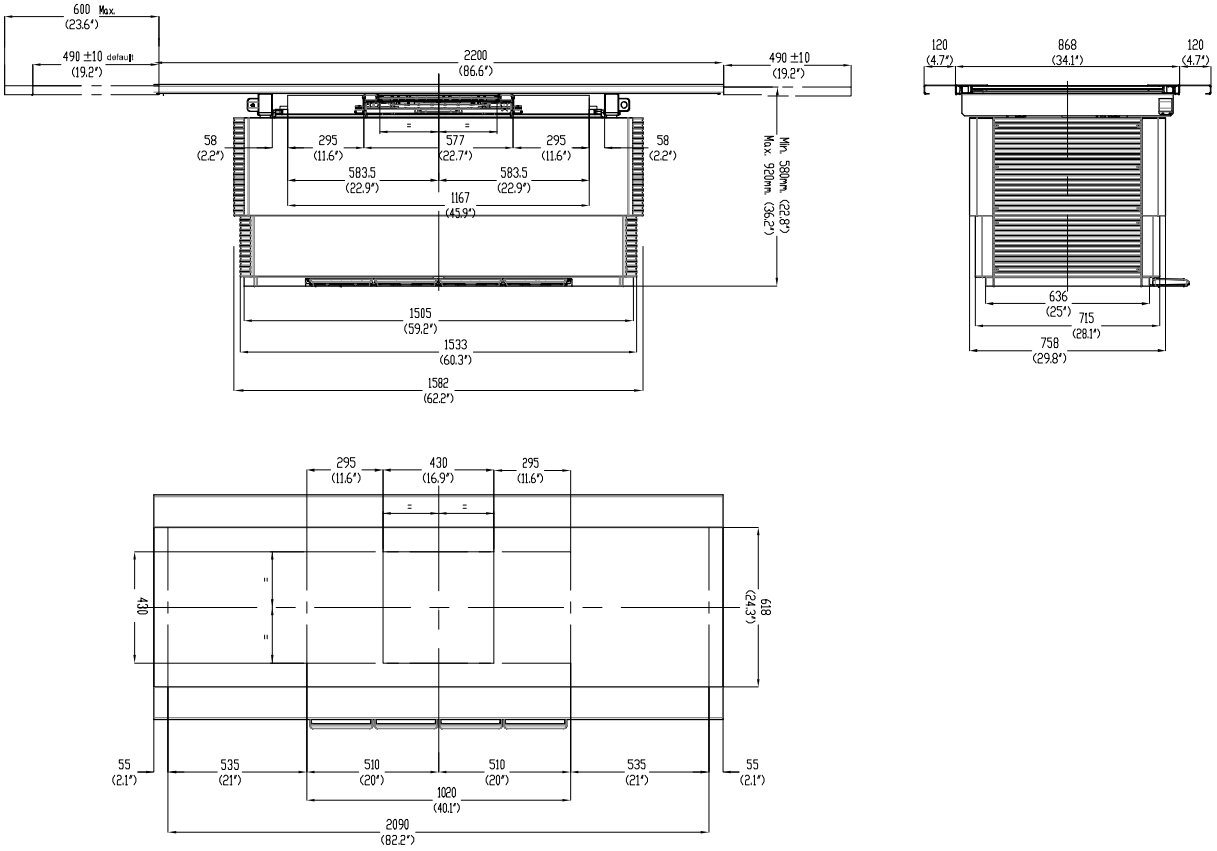


Illustration 11-2
RAD Table Dimensions and Travels with Portable DR Detector

Note ☞ *Tabletop travel is set by default at 490 ±10 mm (19.2” ±0.4”) on both sides. It is possible to enlarge the Tabletop displacement on the left side to 600 mm (23.6”).*



RAD WALL STAND DR

Illustration 11-3
RAD Wall Stand DR Dimensions and Travels (for Double Panel System)

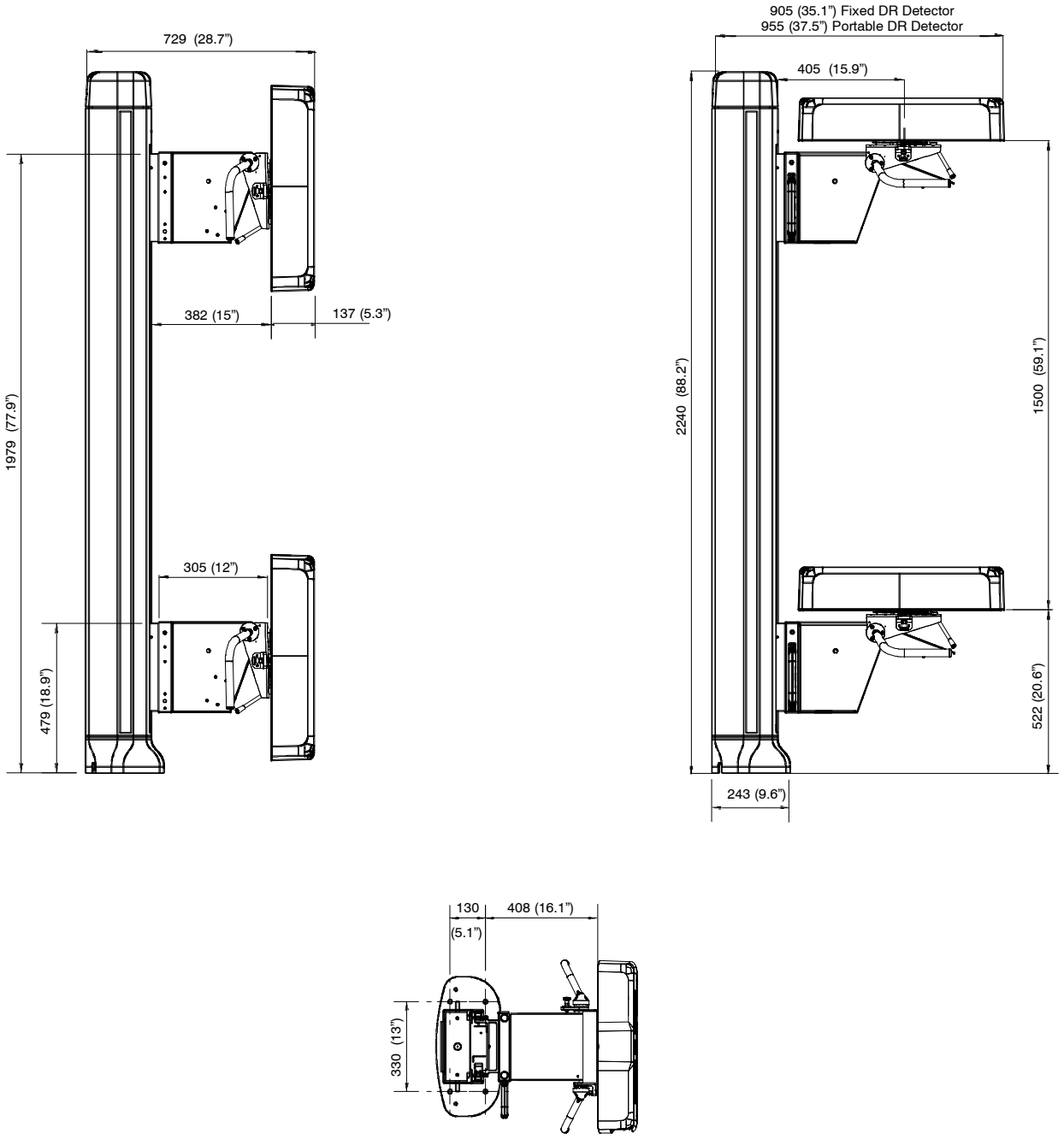


Illustration 11-4
RAD Wall Stand DR Dimensions and Travels (for Single Panel Systems)

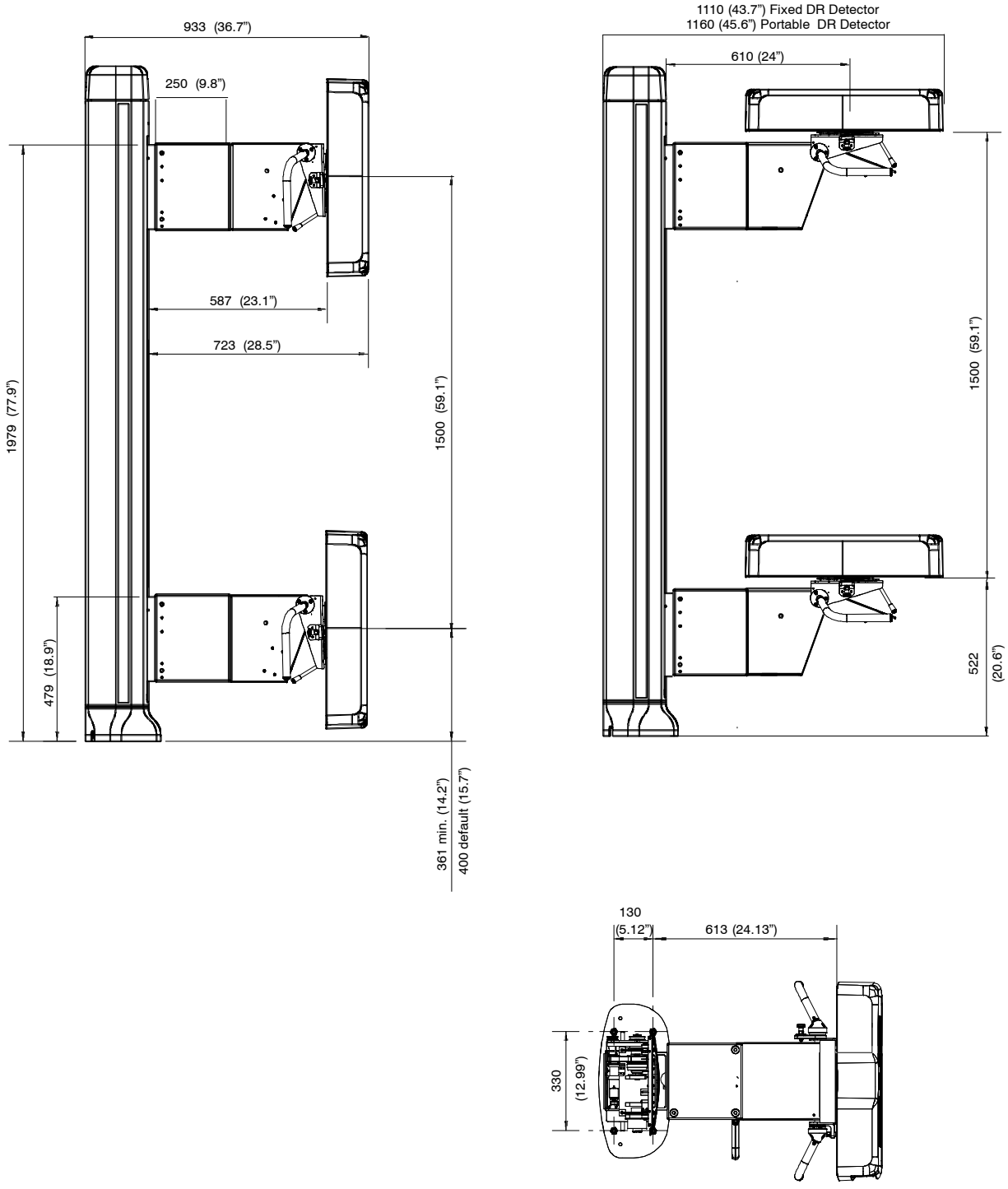


Illustration 11-5
RAD Wall Stand DR Rotation and Tilting Specifications

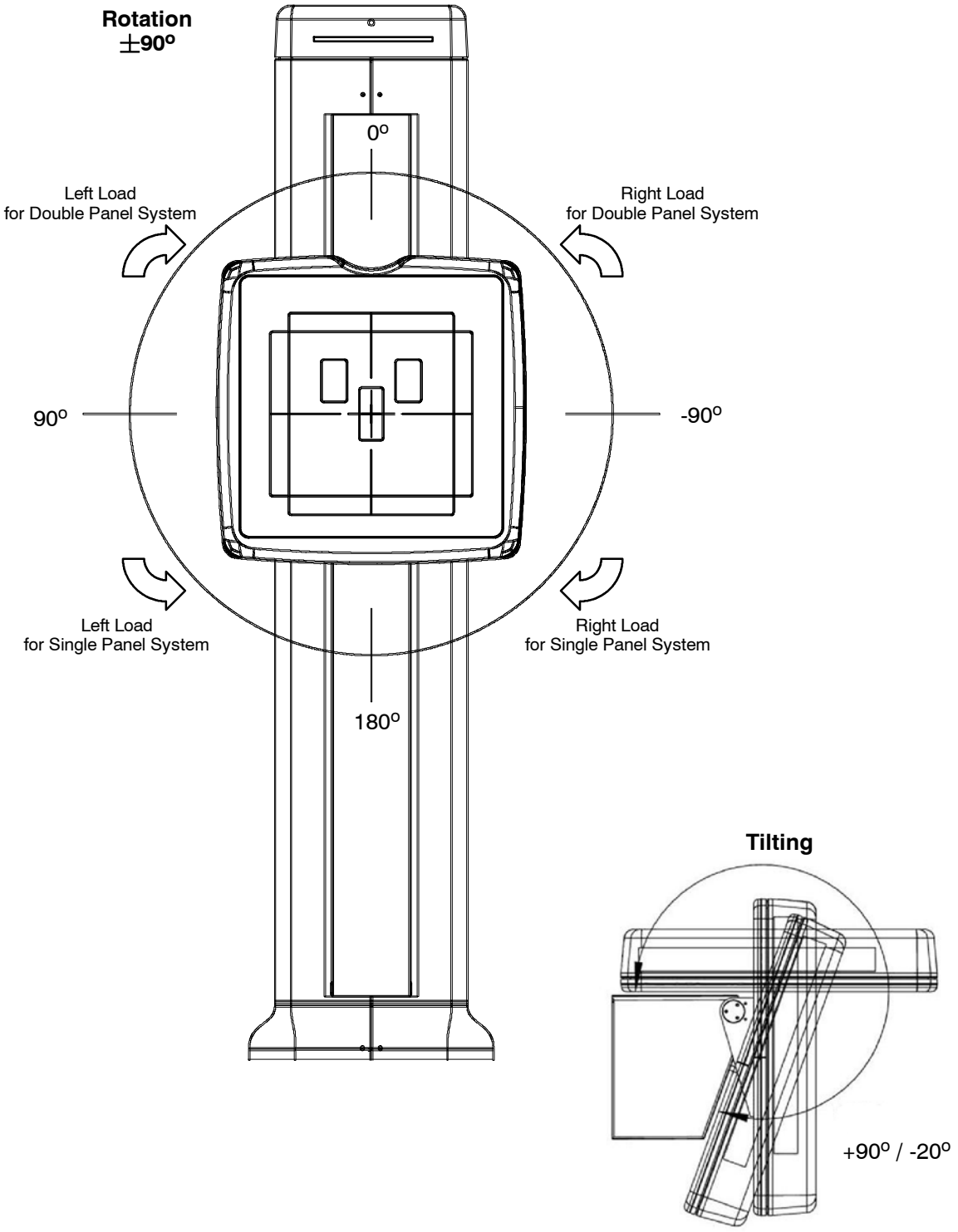
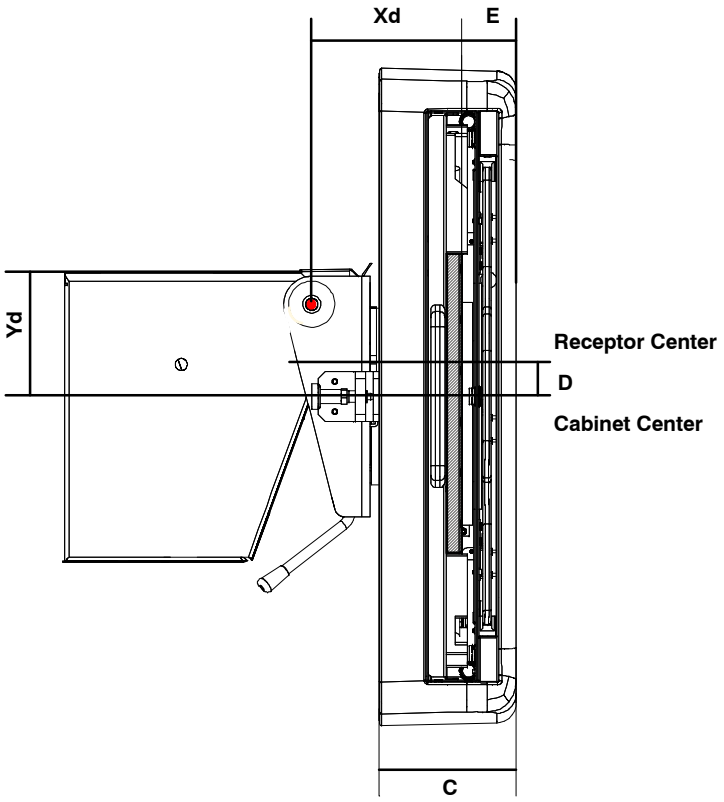
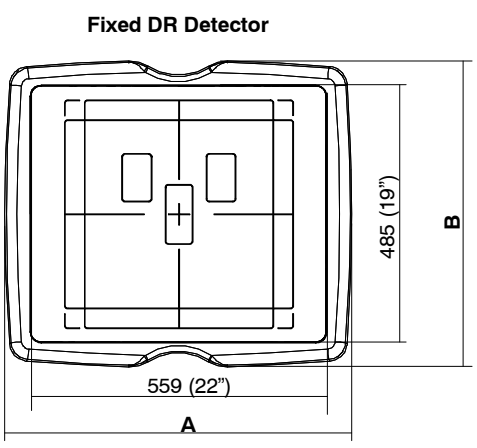


Illustration 11-6
DR Detector Distances related to the RAD Wall Stand DR

DR Detector	EXTERNAL DIMENSIONS			WS GEOMETRY			
	A	B	C	D	E	Xd	Yd
FIXED	657 mm (25.87”)	579 mm (22.80”)	137 mm (5.39”)	0.0 mm (0.0”)	**45.1 mm (1.78”)**	185.1 mm (7.29”)	190 mm (7.48”)
PORTABLE		655 mm (25.79”)	136 mm (5.35”)		**54 mm (2.13”)**	176.2 mm (6.94”)	
					51.2 mm (2.02”)	179 mm (7.05”)	





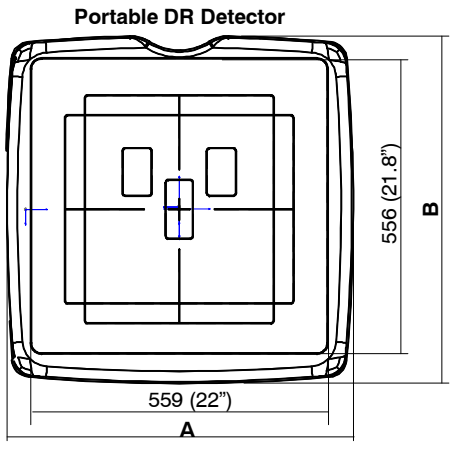
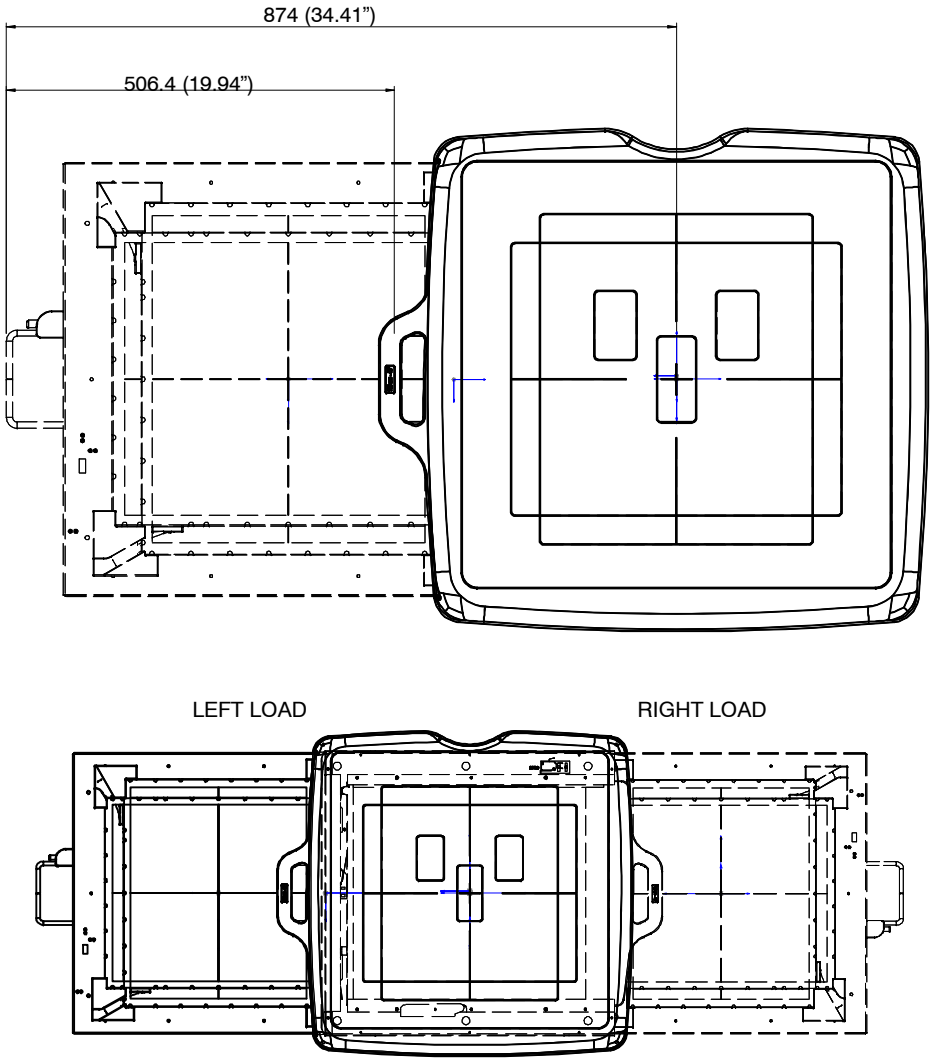


Illustration 11-7
DR Detector Travels in the RAD Wall Stand DR



Note ☞ *Same travel specification for both load configurations (right or left).*

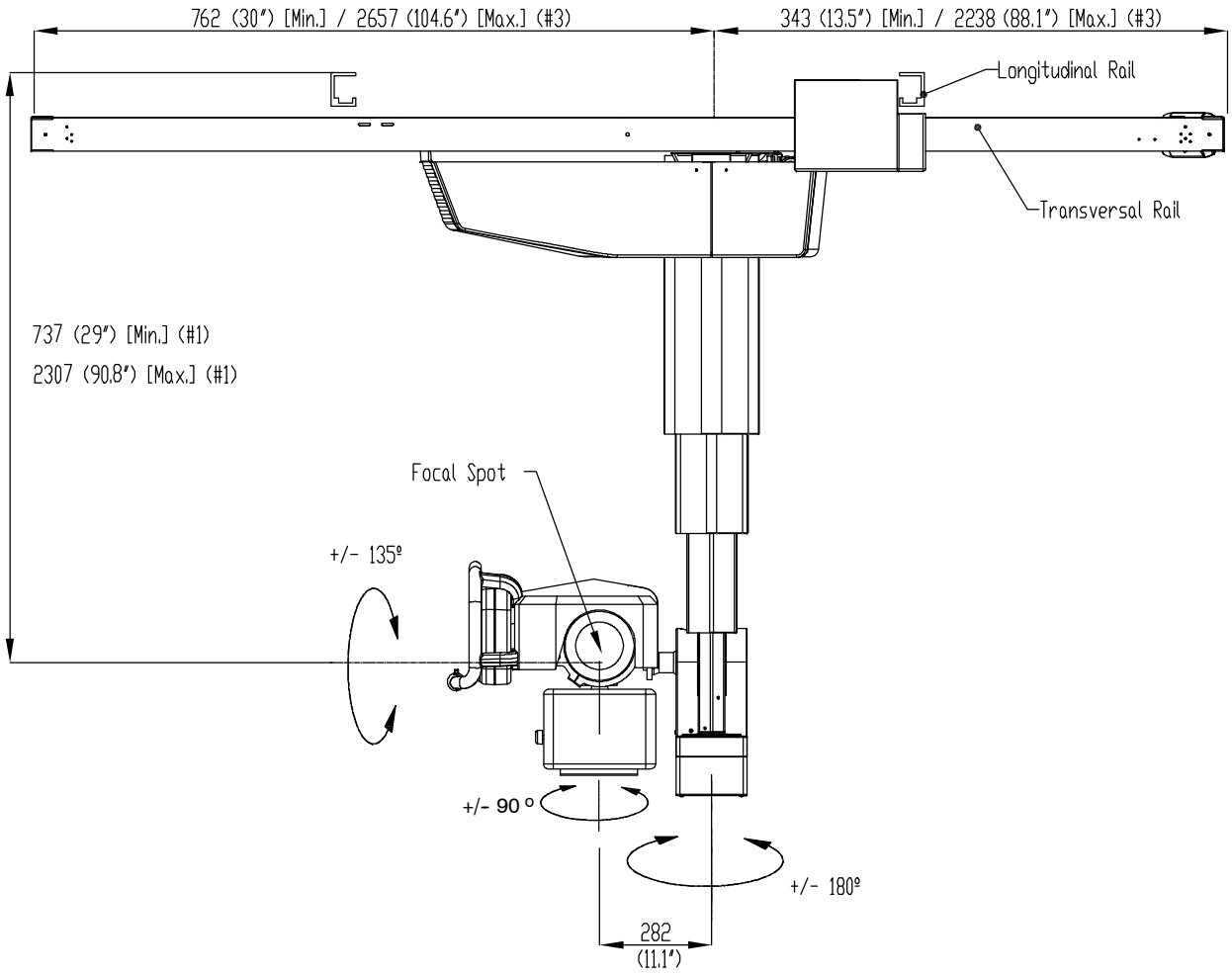
GRIDS

RAD Table . . . . . 1 m – 132 lines/inch – 10:1 (Carbon Fibre)

RAD Wall Stand DR . . . 1 m – 132 lines/inch – 10:1 (Carbon Fibre)
1.5 m – 132 lines/inch – 10:1 (Carbon Fibre)
1.8 m – 132 lines/inch – 10:1 (Carbon Fibre)

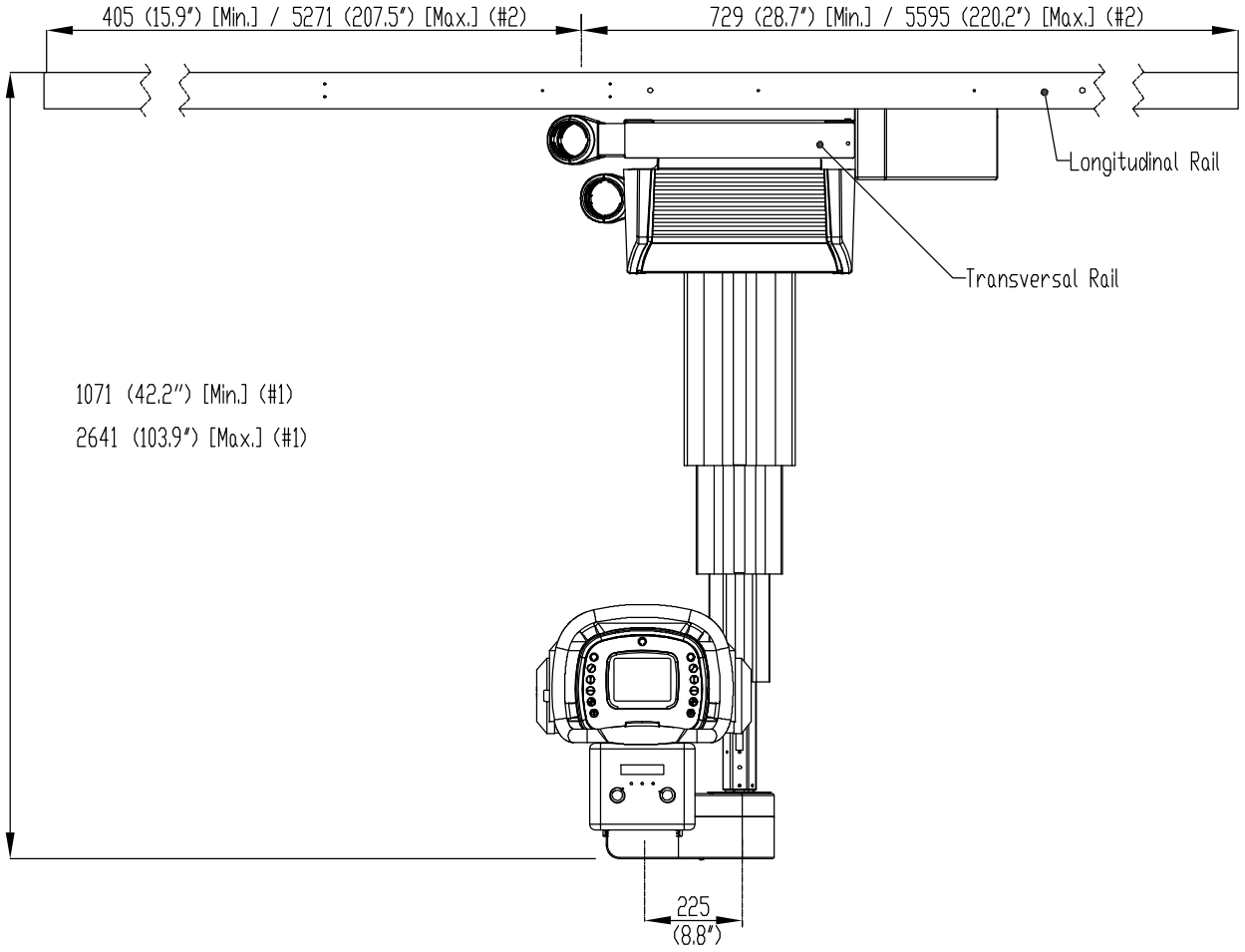
CEILING SUSPENSION

Illustration 11-8
Ceiling Suspension Specifications (Lateral View)



Vertical Travel	1570 mm (61.8")
Longitudinal Travel (for Longitudinal Rails of 6000 mm / 236.2" maximum)	4866 ±10 mm (191.5" ±0.39") max. for Automatic and Semi-automatic Suspension with default End Stops Configuration. 5166 ±10 mm (203.38" ±0.39") max. for Semi-automatic Suspension with modified End Stops Configuration.
Transverse Travel (for Transverse Rails of 3000 mm / 118.1" maximum)	1895 ±10 mm (74.6" ±0.39") maximum

Illustration 11-9
Ceiling Suspension Specifications (Front View)



11.3 X-RAY GENERATOR

11.3.1 FACTORS

GENERATOR MODEL	SHF-535-1T-LS RAPIDT	SHF-535-1T-HS RAPIDT	SHF-635-1T-HS RAPIDT	SHF-835-1T-HS RAPIDT	
Maximum Power (kW)	50 kW		64 kW	80 kW	
Maximum mA	640 mA		640 mA	800 mA	1000 mA (optional)
Maximum kVp	150 kVp		150 kVp	150 kVp	
Power Line	C / D		C / D	C / D	E
Power Output (@ 0.1 s)	640 mA @ 78 kVp 500 mA @ 100 kVp 400 mA @ 125 kVp 320 mA @ 150 kVp		640 mA @ 100 kVp 500 mA @ 128 kVp 400 mA @ 150 kVp	800 mA @ 100 kVp 640 mA @ 128 kVp 500 mA @ 150 kVp	1000 mA @ 80 kVp 800 mA @ 100 kVp 640 mA @ 128 kVp 500 mA @ 150 kVp

POWER LINE		
C	**D**	**E**
400 / 415 / 440 V~ Three-Phase, 50 / 60 Hz	480 V~ Three-Phase, 50 / 60 Hz	530 V~ Three-Phase, 50 / 60 Hz
Line voltage automatic compensation: ±10%		
Maximum line regulation for maximum kVA demand: 5%		
NOTE: For 1000 mA Generators operating with lines at 400 / 415 / 440 / 480 V~ an auxiliary boost transformer is required to adequate the line voltage to 530 V~.		

11.3.2 RANGE OF RADIOGRAPHIC PARAMETERS

PARAMETER	RANGE
kVp	From 40 kVp to 150 kVp in 1 kV steps
mA	From 10 mA to 1000 mA through the following mA stations: 10, 12.5, 16, 20, 25, 32, 40, 50, 64, 80, 100, 125, 160, 200, 250, 320, 400, 500, 640, 800, 1000 *(Depending on the Generator model)*
mAs	Product of mA x Time values from 0.1 mAs to 500 mAs (640 mAs under request)
Exposure Time	From 1 to 10000 milliseconds through the following Time stations: 1, 2, 3, 4, 5, 6, 8, 10, 12, 16, 20, 25, 32, 40, 50, 64, 80, 100, 125, 160, 200, 250, 320, 400, 500, 640, 800, 1000, 1250, 1600, 2000, 2500, 3200, 4000, 5000. 6400, 8000 and 10000
AEC	mAs: 0.1 mAs to 500 mAs
	Exposure Time: Nominal shortest irradiation Time = 8.8 ms

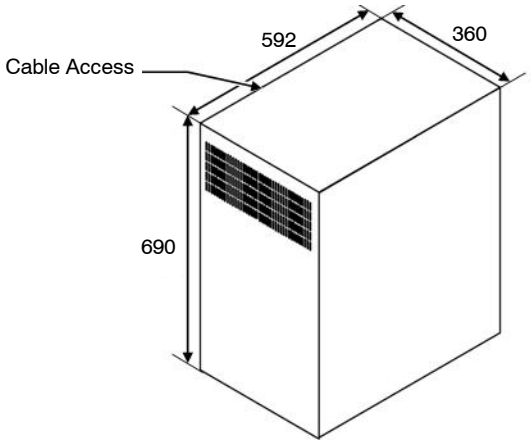
11.3.3 DUTY CYCLE

The Generator Duty Cycle is continuous, but limits should be set during installation depending on the capacity of the X-ray Tube.

11.3.4 PHYSICAL CHARACTERISTICS

COMPONENT	DIMENSIONS			WEIGHT
	LENGTH	WIDTH	HEIGHT	
X-ray Generator	592 mm (23.3”)	360 mm (14.2”)	690 mm (27.2”)	95 Kg (209 lb)

Illustration 11-10
Generator Dimensions



11.4 X-RAY TUBES

CANON E7884X	Low Speed – Rotating Anode, Focal Spots: 0.6 mm / 1.2 mm Anode kHU / kVp: 300 kHU / 150 kVp, Target Angle: 12° Maximum Specified Energy Input in 1 hour: 150 kVp @ 3408 mAs Inherent Filtration of X-ray Source (Tube + Collimator): refer to Identification Label
CANON E7252X	High Speed – Rotating Anode, Focal Spots: 0.6 mm / 1.2 mm Anode kHU / kVp: 300 kHU / 150 kVp, Target Angle: 12° Maximum Specified Energy Input in 1 hour: 150 kVp @ 5760 mAs Inherent Filtration of X-ray Source (Tube + Collimator): refer to Identification Label
CANON E7254FX	High Speed – Rotating Anode, Focal Spots: 0.6 mm / 1.2 mm Anode kHU / kVp: 400 kHU / 150 kVp, Target Angle: 12° Maximum Specified Energy Input in 1 hour: 150 kVp @ 4800 mAs Inherent Filtration of X-ray Source (Tube + Collimator): refer to Identification Label
CANON E7869XX	High Speed – Rotating Anode, Focal Spots: 0.6 mm / 1.2 mm Anode kHU / kVp: 600 kHU / 150 kVp, Target Angle: 12° Maximum Specified Energy Input in 1 hour: 150 kVp @ 5189 mAs Inherent Filtration of X-ray Source (Tube + Collimator): refer to Identification Label

11.5 COLLIMATORS

Model		**R225 / R225 DHHS MANUAL**	**R225 ACS AUTOMATIC**
Field	**Shape**	Rectangular	Rectangular
	Maximum field	430 x 430 mm SID 110 cm (±1% SID)	430 x 430 mm SID 90 cm (±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 dimension (W x D x H)		244 x 282 x 216	244 x 282 x 216

APPENDIX A GUIDELINES FOR PEDIATRIC APPLICATIONS

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 requires 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 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.

Manufacturer: AGFA NV
Septestraat 27, B-2640 Mortsel - Belgium

CE
0413

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/EC dated September 5, 2007.

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