

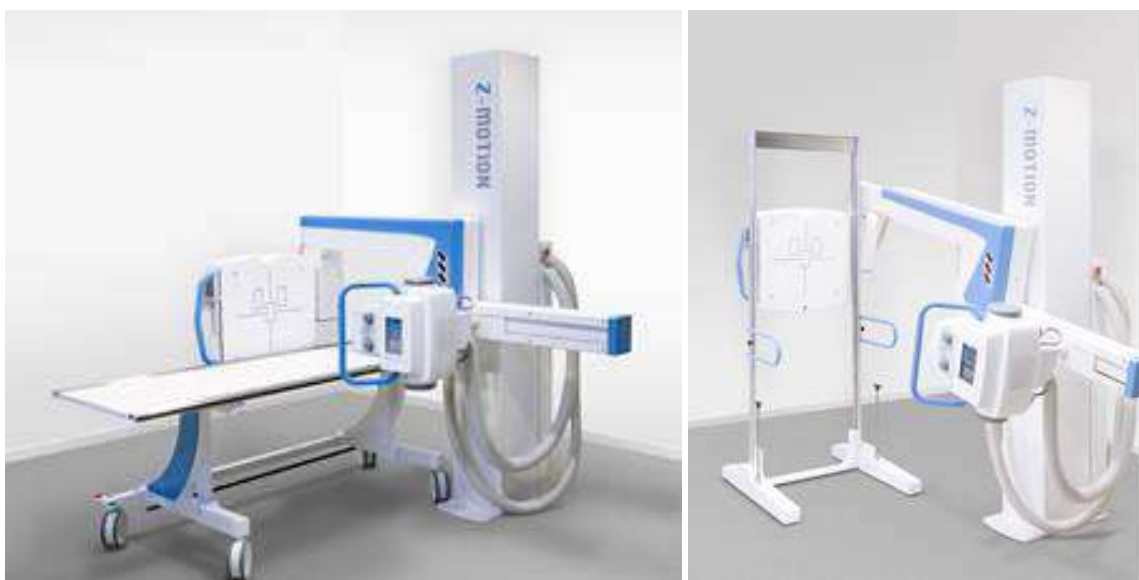


Z-Motion

Universal Digital Radiographic Stand

User Manual

CE
1011



Manufacturer:
Control-X Medical Zrt.
Öv u. 29.
Budapest H-1141, Hungary
www.cxmed.com

86 pages
Document 1165/62
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PLEASE READ THIS PAGE CAREFULLY

- This equipment must be installed, operated and maintained with the understanding that potential hazards exist for all who work with it unless necessary precautions are taken against injury and/or property damage from high voltage and/or X-ray radiation.
- The responsibility of the manufacturer is limited to providing adequate installation, operating and service instructions and information about possible hazards. The manufacturer shall not be liable for injury, loss of any kind, or non-compliance with the specifications, if it was a result of improper handling, installation, operating, servicing, repair or maintenance or unauthorized alteration of this equipment.
- Only properly trained and qualified service personnel should perform installation, maintenance or repair. Failure to follow established safety procedures and practices could result in serious bodily injury or death and/or property damage. This equipment employs lethal voltages that may be present even if power is disconnected. Always make sure that the power is turned off and the energy storage capacitors are discharged before attempting any repair or other work on any circuits in this equipment.
- When this equipment is operated in conjunction with X-ray tubes and energized, X-rays will be produced. All persons working with X-rays must take necessary precautions to protect themselves against the effects of X-ray radiation. This equipment is designed to operate as a part of an X-ray system. To ensure safe-operating conditions only trained and qualified personnel shall operate the equipment, and only with all required beam-limiting devices and protective barriers in place.
- It is the user's responsibility to ensure that the government regulations are observed in the installation and operation of the unit.
- To ensure that this equipment performs according to the specifications it must be installed, operated and serviced according to the information provided in this document.
- To ensure the safe and efficient operation of the equipment, a periodic service inspection shall be performed annually, as it is recommended in the maintenance section of this manual.
- Additional application and safety information can be obtained from the manufacturer upon request.

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1 IMPORTANT SAFETY INFORMATION



CAUTION!

The equipment can be utilized to its full extent only if the user is familiar with its operation and understands how to perform maintenance work on the system. Therefore, the user manual shall be carefully studied before operation.

ELECTRICAL SAFETY

Only trained service personnel are permitted to remove covers and panels from the equipment. The provisions of the local standards and electrical codes shall be conformed to.

To minimize risk of fire, replace fuses only with identical rating and type.

WARNING: To avoid the risk of electric shock, the Z-Motion stand must only be connected to a supply mains with protective earth.

MECHANICAL SAFETY

It is the operator's responsibility to ensure patient safety, during positioning and using the device.

X-RAY PROTECTION

- Devices connected to this equipment may have controls (exposure pushbuttons), which can trigger radiation. Exposure can be initiated only from a radiation-protected area, from the generator control console. Any person present in the room during radiographic examinations shall comply with the local or national radiation protection regulations. To protect the patient and the operator against unnecessary radiation exposure, additional radiation safety devices shall be installed.
- When the equipment is operated in conjunction with X-ray tubes and energized, X-rays will be produced. All persons working with X-rays must take necessary precautions to protect themselves against the effects of X-ray radiation.
- Set safe exposure factors, limit radiation field, keep safe distance and provide radiation protection for the patient.

PROTECTION AGAINST EXPLOSION AND FIRE

- Do not use the equipment in the presence of flammable anesthetics or agents, explosion may occur.
- Before cleaning or disinfecting the unit, the power shall be turned off and kept off until the cleaning or disinfecting material has evaporated.

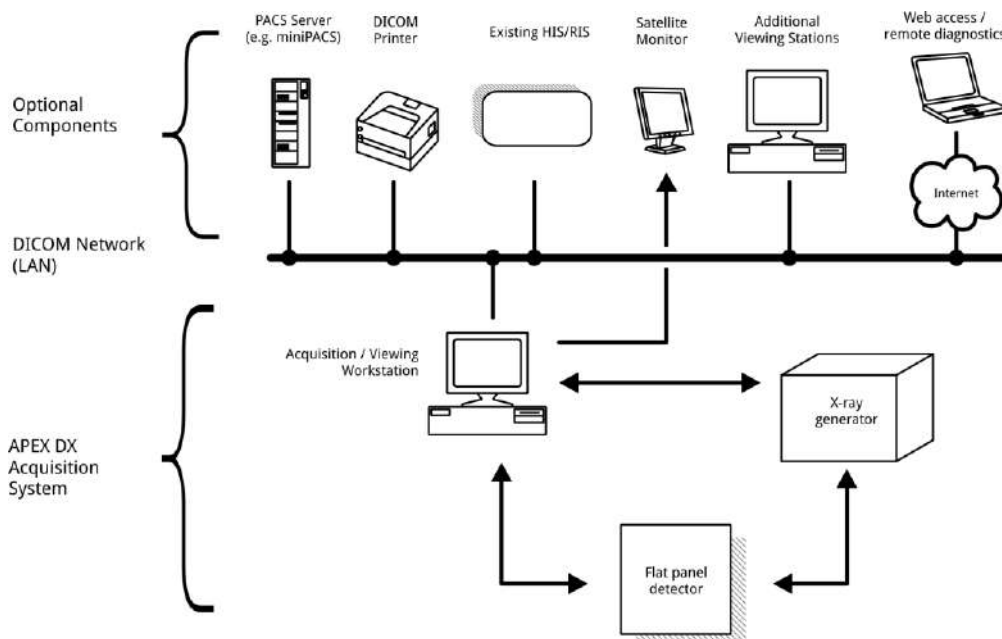
2 GENERAL INFORMATION

2.1 DESCRIPTION

The Z-Motion Universal Digital Radiography Stand is part of a complete digital radiography system. The complete system typically contains the following components:

Type	Description / Features
Z-Motion	Floor mounted universal stand with Z-arm.
Prognost XP, Z-Table or similar	Portable floating-top radiographic table
Milestone HF (LC), Milestone HF 200 or Apex series	High frequency radiographic x-ray generator (different power ratings and options)
APEX	Digital Acquisition Workstation with integrated generator control
CFP-SX1717, FDX4343R/B, PS4343R or similar	Digital flat panel detector
R-108 or similar	Manual multi-leaf beam limiting device (different models)
(X-ray tube, multiple types)	Rotating anode, dual-focus x-ray tube with HV and rotor cables, see manual supplied by manufacturer

The following is a block diagram of the Z-Motion system. The Stand and the table are omitted for clarity (the flat panel detector is built into the Z-Motion stand).



2.2 INTENDED USE

The equipment is intended for holding and positioning the x-ray tube and the x-ray imager.

Its applications include (but are not limited to):

- Chest and chiropractic radiography
 - General gastrointestinal radiograms
 - Extremities work
 - Lateral exposures with the patient standing
 - Emergency radiography when equipped with gurney / trolley table
- a) The stand cannot be used for fluoroscopy / fluorography procedures.
- b) There are no special or additional restrictions on the patients and target population. The equipment can be used for regular radiography procedures on all age groups and patients. General restrictions adopted in X-ray radiography apply, e.g. when working with (possibly) pregnant women.



WARNING!

The stand is **not intended to support the patient** or persons in any way.



WARNING!

Do not use a defibrillator while operating the Z-Motion radiographic system. Electric discharge may cause harm to patient, operator or the equipment.

- Pregnant patients or patients where pregnancy cannot be ruled out must be informed of the potential adverse effects of the ionizing radiation
- The system can be used for infants and children utilizing proper exposure parameters (but is not specifically designed for pediatric applications)



ATTENTION!

The Z-Motion system may contain a **sensitive flat panel detector** (indirect radiography). To avoid property damage and maintain image quality / performance, observe the handling and maintenance instructions set forth in the flat panel detector's user manual at all times.



ATTENTION!

International standards require the use of an operational **AEC system in indirect radiography systems**. Make sure the generator's acceptance test related to AEC is completed before working with the Z-motion system.



ATTENTION!

If the Perform-X system is used for **pediatric diagnostic procedures**, at least 0.1 mm Cu or 3.5 mm Al **additional filter** is mandatory.

2.3 LABELING

 CONTROL-X MEDICAL ZRT. Ov u. 29. H-1141 Budapest, Hungary Made in Hungary		 control-x MEDICAL
SYSTEM: Z-MOTION RADIOGRAPHIC SYSTEM		
PRODUCT: Z-MOTION UNIVERSAL STAND		
REF: 8611		
SN: A4-001/23  2023.01.18 PO: VR-20231234		MD:  1011
INPUT: 1 x 110-240V AC 50/60 Hz / 320 VA		
		

Z-Motion Stand Label
(for labels of other individual components, see the component manuals)

The product label is located on the side of the column near the column base:



 CONTROL-X MEDICAL ZRT. Ov u. 29. H-1141 Budapest, Hungary Made in Hungary		 control-x MEDICAL
SYSTEM: Z-MOTION RADIOGRAPHIC SYSTEM		
PRODUCT: Z-MOTION UNIVERSAL STAND		
REF8611		
SN A4-001/23  2023.01.18 PO: VR-20231234	MD  1011	
INPUT: 1 x 110-240V AC 50/60 Hz / 320 VA		
		

2.4 SYMBOLS AND MARKINGS

The following is a list of symbols used in the manual(s) and on the product labels (additional symbols may be found in the individual component manuals) and elsewhere on the equipment as indicated:

	Date of manufacture, located on the product label.
	Name and address of manufacturer, located on the product label.
	Serial Number of product - located on the product label.
	Single-phase AC main supply - located on the product label.
	WARNING! Refer to manual for additional safety information - located on the product label.
	Type B equipment - located on the product label.
	The User Manual must be consulted before using the equipment.
	Protective earth ground – located inside the equipment at the main grounding terminal.
	The emergency stop label is located on the side of the E-Box below the emergency stop and next to the corrugated tube entry.
	Risk of finger trapping – on the side of the T carriage. Do not insert fingers in the path of the arm from behind.
	WARNING! Do not remove Cover (of the E-box) except for inspection. Located on the cover of the E-box.
	This symbol marks the unreleased level of the counterbalance spring and is located on the side of the column (visible only with the side cover removed).

 Lift here with M12 eye-bolt! D-15d	Lift here with M12 eye-bolt! Located by the M12 threaded bores for lifting the arm and the column. Not visible once the arm covers are in place.
 Use the 19 wrench to hold the spring when tensing! D-15e	Use a 19 wrench the hold the spring when tensing! Located on the side of the column at the base of the spring.
 Do not remove these screws before the arm is not fixed in horizontal position! D-15f	Do not remove these screws before arm is not fixed in horizontal position! Located on the telescopic arm. Refer to Section 4.5.6.

2.5 ENVIRONMENT, FREQUENCY OF USE AND MOBILITY

The Z-Motion stand is designed and manufactured to be used as a fixed equipment permanently installed in a professional hospital or clinical environment.

2.6 INTENDED READERSHIP

2.6.1 TECHNICAL SECTIONS

The *User Manual's* technical sections are intended for trained technical and service personnel to help perform the installation, maintenance and service of the Z-Motion Universal Digital Radiography Stand. The document assumes that the reader has a clear understanding of the general radiography procedures, the effects and properties of x-ray / electromagnetic radiation and basic mechanical / electrical installation and service procedures.

For information on other system components, please refer to the respective technical manuals.

It is strongly recommended to study the *Operating Instructions* section to get familiar with the intended use, capabilities and operation of the system.

2.6.2 OPERATING INSTRUCTIONS SECTION

The *User Manual's* operating instructions section is intended for trained operators and trained / authorized service personnel as well. See the next section for explanation of operators.

2.7 OPERATORS

The Z-Motion stand is to be operated only by qualified radiology personnel authorized to use radiographic diagnostic equipment by local authorities.

Operators must have clear understanding of the hazard associated with taking X-rays and working with patient positioning medical devices.

For operator's training, please contact your local authorized distributor of the manufacturer.

3 SPECIFICATIONS

3.1 MECHANICAL DATA

Minimum ceiling-height:	2350 mm	92.5"
Focus-floor distance:	410 to 1660 mm (400-1660 mm optional)	16.15" to 64.8"
Approximate total assembled weight ⁽¹⁾ :	380 kg	840 lbs

3.2 MOVEMENTS

Vertical movement:	1250 mm	49.2"
SID adjustment:	1000 to 2000 mm	39.4" to 78.75"
Imager rotation:	-45° to +45°	
Z-arm rotation:	-45° to +135°	
Tube rotation:	-90° to +90°	

3.3 POWER REQUIREMENTS

Voltage:	120 – 240 V~ 50/60 Hz (Z-Motion Stand)
Current input:	2 – 1.1 A (Z-Motion Stand)
Supply mains internal impedance	<i>Refer to the generator and flat panel display documentation</i>

The Z-Table (or similar) radiographic table is not powered by electricity.

3.4 ENVIRONMENTAL DATA

Storage temperature range:	-20 °C to 60 °C (-4 to 140°F)
Ambient temperature:	0 to +40°C (32 to 104°F)
Relative humidity range (operating):	30% - 80% (non-condensing)
Relative humidity range (storage & transport):	10% - 90% (non-condensing)
Environment protection class:	IP20
Equipment temperature:	ambient temperature (no excessive heating or cooling is present)
Atmospheric pressure:	operating: 70-106 kPa storage and transport: 50-110 kPa

3.5 EQUIPMENT CLASSIFICATION

Equipment type:	Type B
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3.6 CLEANING, STERILIZATION

See section "**Maintenance**".

(1) Without table X-ray tube, collimator, imager and HV cables

3.7 FLAT PANEL DETECTOR

Type:	(Different types)
Weight:	8.5 to 16 kg 18.7 to 35 lbs
Effective area:	(1) Approx. 430x430 mm 17" x 17" (fixed type) (2) Approx 384 x 460 x 16 mm with docking station (standard 14"x17" cassette size)
Substrate material:	Amorphous silicon TFT (A-Si) or Amorphous Selenium (A-Se)
Scintillator:	CsI:TI
kV range:	40 to 150 kVp
Pixel pitch:	Approx. 143 µm
Effective pixel matrix:	3000 x 3000
Power supply:	230V~ or 110V~ (built into Z-Motion stand)
X-ray attenuation of detector holder front cover or tabletop:	< 0.6 mm Al

3.8 COLLIMATOR

Operation:	Manual, multi-layer with six pairs of shutters
Rated kVp:	150 kV
Inherent filtration (Al equivalent) at 75 kV:	Min. Al 2 mm
Limitation of extra focal radiation (100cm SID):	< 150 mm
Square x-ray field (at 100 cm SID +/- 1%):	0 x 0 to 43 x 43 cm 0 x 0 to 17" x 17"
Round x-ray field selection:	N/A
Light field indicator luminosity:	> 160 lux
Light field indicator contrast:	> 4:1
Precision (light field / x-ray field alignment):	< 1% FFD – SID
X-ray field indication precision:	< 2% FFD – SID
Retractable tape precision:	< 2% FFD – SID
Leakage radiation (at 100 cm / 125 kVp):	< 40 mR/h
Power supply (halogen versions):	24V DC/AC – 50/60 Hz – 6.5 A
Power supply (LED versions):	24V DC/AC +/- 10% – 50/60 Hz – 1.5 A
Replacement lamp type (halogen versions):	OSRAM HLX 64638 – 100W 24V
Laser center line (optional):	Class II Laser, < 1 mW, λ = 635 nm
Max static load for accessory rails:	7.1 kg 15.6 lbs
Max dynamic load for accessory rails:	3.06 kg 6.7 lbs
Weight:	5.5 kg 12.1 lbs

For detailed specifications, see the collimator manual.

3.9 X-RAY TUBE

Several types are available. Please refer to supplied x-ray tube's manual.

3.10 ANTI-SCATTER GRIDS

Two removable anti-scatter grids are provided to cover the entire operating SID range:

Exposures for SID < 106 cm:	34-44"
Exposures for SID > 106 cm:	40-72"
Standard detector holder:	Removable, high density stationary grids
Optional Bucky:	Removable, 103 LPI oscillating grids (with 24VDC internal supply)

3.11 USAGE CONDITIONS

Shortest irradiation time (with / without AEC) ⁽²⁾ :	Usually 1ms (depending on generator model)
Longest possible exposure ⁽²⁾ :	Typically 2.5 sec (limited by the flat panel)
Exposure cycle time without positioning ⁽²⁾ :	Typically 10 sec (depends on the flat panel / DR component)
Exposure cycle time including positioning:	Approx. 1 min depending on positions
Useful expected life time:	10 years (with proper maintenance and average case load – 30 positioning cycles per day)

*(2) Without table X-ray tube, collimator, imager and HV cables
Refer to the generator and flat panel user manual for details.*

3.12 ELECTROMAGNETIC COMPATIBILITY (Z-MOTION STAND)

Guidance and manufacturer's declaration – electromagnetic emissions		
The Z-Motion Radiographic Stand is intended for use in the electromagnetic environment specified below. The customer or the user of the Z-Motion Radiographic Stand should assure that it is used in such an environment.		
Emissions test	Compliance	Electromagnetic environment – guidance
RF emissions CISPR 11	Group 1	The Z-Motion Radiographic Stand uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B+25	The Z-Motion Radiographic Stand is suitable for use in all establishments other than domestic, and may be used in domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes, provided the following warning is heeded:
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations / flicker emissions IEC 61000-3-3	Complies	
		Warning: This equipment/system is intended for use by healthcare professionals only. This equipment/ system may cause radio interference or may disrupt the operation of nearby equipment. It may be necessary to take mitigation measures, such as re-orienting or relocating the Z-Motion Radiographic Stand or shielding the location. The Z-Motion Radiographic Stand must be used only in a shielded location with a minimum RF shielding effectiveness and, for each cable that exits the shielded location, a minimum RF filter attenuation of 25dB for radio signals between 30MHz ... 1000MHz.

Guidance and manufacturer's declaration – electromagnetic immunity			
The Z-Motion Radiographic Stand is intended for use in electromagnetic environment specified below. The customer or the user of the Z-Motion Radiographic Stand should assure that it is used in such an environment.			
Immunity test	IEC 60601 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 transients/ bursts 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 differential mode ± 2 kV common mode	± 1 kV differential mode ± 2 kV common mode	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% U_T (>95% dip in U_T) for 0.5 cycle 40% U_T (60% dip in U_T) for 5 cycle 70% U_T (30% dip in U_T) for 25 cycle < 5% U_T (>95% dip in U_T) for 5 sec	< 5% U_T (>95% dip in U_T) for 0.5 cycle 40% U_T (60% dip in U_T) for 5 cycle 70% U_T (30% dip in U_T) for 25 cycle < 5% U_T (>95% dip in U_T) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If the user of the Z-Motion Radiographic Stand requires continued operation during power mains interruptions, it is recommended that the Z-Motion Radiographic Stand be powered from an uninterruptible power supply.
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 characteristics of a typical location in a typical commercial or hospital environment.
Note: U_T is the AC mains voltage prior to application of the test level			

Guidance and manufacturer's declaration – electromagnetic immunity

The Z-Motion Radiographic Stand is intended for use in electromagnetic environment specified below. The customer or the user of The Z-Motion Radiographic Stand should assure that it is used in such an environment.

Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment – guidance
			Portable and mobile RF communications equipment should be used no closer to any part of The Z-Motion Radiographic Stand, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended protective distance:
Conducted RF IEC 61000-4-6	3 V _{RMS} 150 kHz – 80 MHz	3 V	$d = 1.2 \cdot \sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz – 2.5 GHz	3 V/m	$d = 1.2 \cdot \sqrt{P}$ 80 MHz – 800 MHz $d = 2.3 \cdot \sqrt{P}$ 800 MHz – 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, object 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 Z-Motion Radiographic Stand is used exceeds the applicable RF compliance level above, The Z-Motion Radiographic Stand should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating The Z-Motion Radiographic Stand or its operator console.

^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 telecommunication equipment and The Z-Motion Radiographic Stand

The Z-Motion Radiographic Stand is intended for use in electromagnetic environment where electromagnetic disturbances are under control. Customer and user of The Z-Motion Radiographic Stand can help on preventing electromagnetic influence between portable and mobile RF telecommunication equipment (transmitters) and The Z-Motion Radiographic Stand by determining minimum separation distance between The Z-Motion Radiographic Stand and telecommunication equipment that calculated from maximum output power of transmitter, the following way:

Maximum output power of transmitter W	Separation distance as a function of transmitter frequency m		
	150 kHz – 80 MHz $d = \left[\frac{3.5}{3V_{rms}} \right] \cdot \sqrt{P}$	80 MHz – 800 MHz $d = \left[\frac{3.5}{3 \frac{V}{m}} \right] \cdot \sqrt{P}$	800 MHz – 2.5 GHz $d = \left[\frac{3.5}{3 \frac{V}{m}} \right] \cdot \sqrt{P}$
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

If the transmitter power is not in the table, protective distance d in meter (m) can be calculated by formula depending on frequency, where P is maximum transmit power supplied by manufacturer of the transmitter in watts (W).

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, object and people.

3.13 COMPLIANCE INFORMATION

The Z-Motion stand complies with the following standards:

MDD 93/42/EEC Medical Device Directive
2006/42/EC Machinery Directive
IEC 60601-1:2005 (Third Edition) + CORR. 1:2006 + CORR. 2:2007
IEC 60601-1-2:2007
IEC 60601-1-3:2008 + Am1 and clause 203 of IEC/EN 60601-2-254:2009 + Am1
IEC 60601-2-54:2009
EN ISO 13485:2016
EN ISO 14971:2019
EN ISO 15223-1:2016
EN 62304:2006 + A1:2015
EN 62366-1:2015 + A1:2020

4 INSTALLATION

4.1 REQUIRED TOOL AND MATERIALS

The following tools and materials are required to install the stand:

1. Hand tools (straight and Philips screwdrivers, pliers, cutters, metric wrenches, Allen keys, etc.)
2. Level, tape measure
3. Cable ties
4. Drilling machine and bits for the bores in the concrete floor
5. Lifting machinery (optional, but useful when lifting the weight of the column and assembled arm)
6. Voltmeter for checking the incoming voltage
7. 4 x floor anchors for securing the column (supplied, but **may require special bolts to match floor properties**)
8. Cable channels / ducts with hardware (**not supplied**)
9. 3 x 2.5 mm² cable with yellow-green PE wire for the input line connection (**not supplied**)
10. PC keyboard and / or mouse (optional, but makes configuration easier)

4.2 X-RAY ROOM PREPARATION

4.2.1 X-RAY ROOM REQUIREMENTS

The walls, ceiling, floor and doors / windows may require appropriate shielding against X-ray radiation. Also, the control area of the X-ray room must be protected from the path of X-ray radiation by leaded wall and / or lead-glass window.

A safety door switch and an "X-RAY IN PROGRESS" light may also be needed. Consult the X-ray generator manual for particular details on the X-ray control console and exposure switch location.



ATTENTION!

The site must comply with federal / local regulations and local codes, as well as the dimensional and power requirement set here and for other equipment.

4.2.2 MECHANICAL PREPARATION

Z-MOTION STAND

Inspect the room before installation. If the condition of the floor is not suitable for leveling, corrective actions shall be taken.

The Z-Motion stand is a free-standing radiographic equipment. The stand **MUST BE** securely bolted down to the floor through the provided holes (4 pcs.) located on the column base.



ATTENTION! Contact the manufacturer if **additional wall or ceiling support** is necessary in rooms with inadequate floors.

FLOOR SPACE REQUIREMENT AND MINIMUM CEILING HEIGHT

Plan a layout and prepare the x-ray room before starting the installation. For floor space and minimum ceiling height requirement, please refer to drawing D-1688 (Overall Dimensions).

REQUIREMENT	[mm]	[ft / inch]
Min floor space ¹ (W x D) WITHOUT portable table	2650 x 1500 (4 m ²)	8' 8" x 5' (43 ft ²)
Min floor space ¹ (W x D) WITH portable table	2650 x 2650 (7 m ²)	8' 8" x 8' 8" (75 ft ²)
Recommended floor space ² (W x D) WITHOUT portable table	3000 x 2200 (6.6 m ²)	9' 10" x 7' 3" (71 ft ²)
Recommended floor space ² (W x D) WITH portable table	3000 x 4000 (12 m ²)	9' 10" x 13' (130 ft ²)
Minimum ceiling height	2400	7' 11"
Approximate total assembled weight (without X-ray tube, collimator, imager and HV cables)	350 kg	770 lbs
Floor quality	C15/C20 reinforced concrete floor with no cracks and leveled	

(1) Minimum floor space for enabling all equipment functionality.

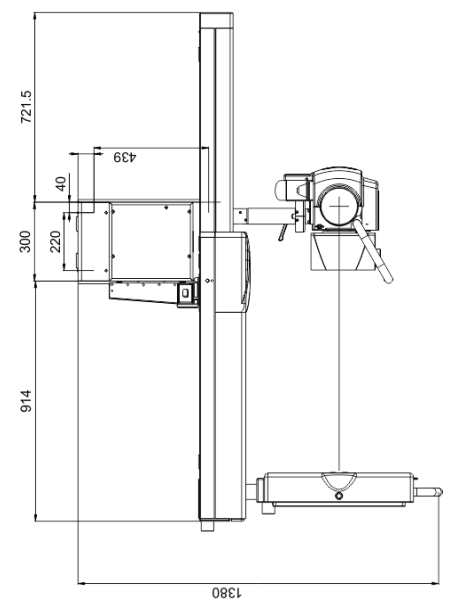
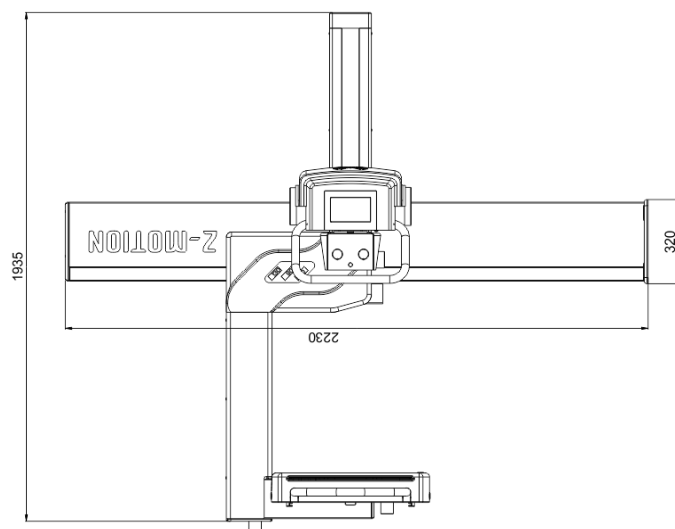
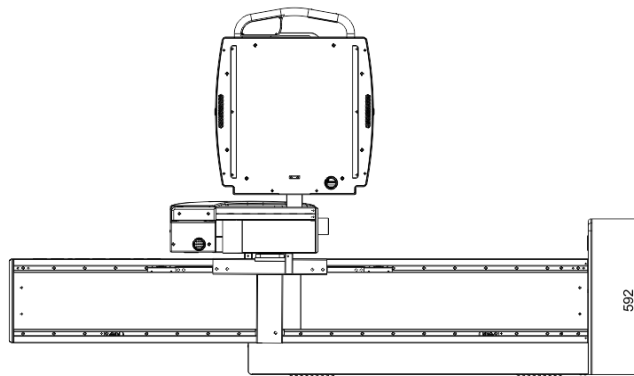
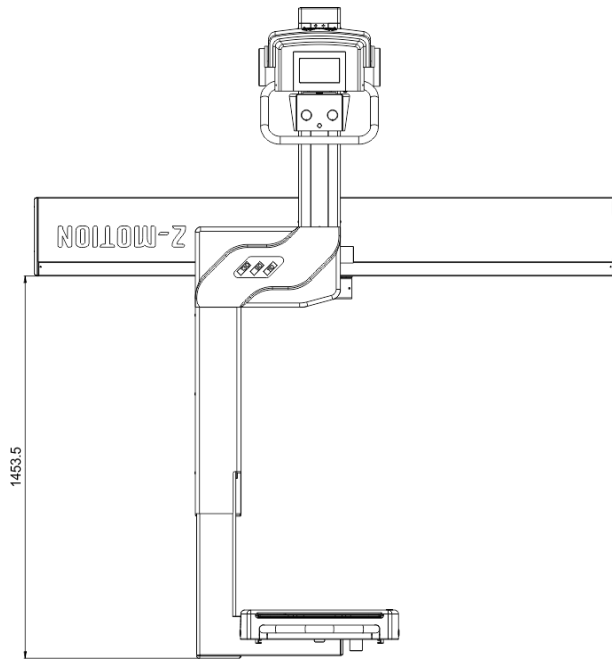
(2) Recommended floor space for convenient workflow.

Please consider the following when preparing for the installation:

- Make sure there is sufficient clearance from the walls to allow for SIDs up to 200 cm (80").

If the equipment is not installed with components that are made by Control-X Medical, please refer to the original manufacturer's specification.

The following are the overall dimensions of the stand with the SID extended:



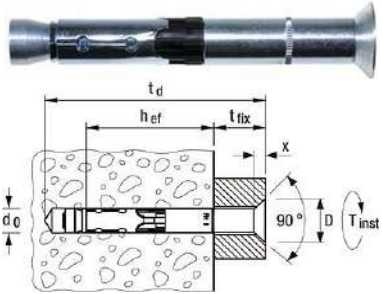
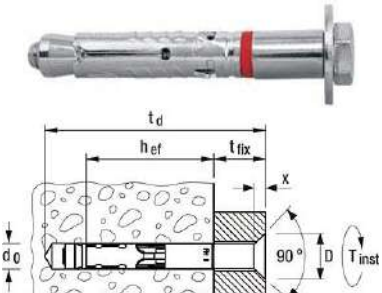
BORES FOR SECURING THE COLUMN

The stand shall be secured to the floor using four M10 bolts. The floor must be of C15/C20 reinforced concrete. Make sure that the floor (1) is level and (2) it is capable of supporting the total weight of the equipment.

1. After marking the position of the stand, drill 4 bores for the stand using the supplied drill template. For room preparation (i.e. the stand has not yet been shipped), refer to the attached column base drawing (D-1689).
2. Install steel anchors for M10 bolts that satisfy local codes and regulations (**anchors are included, but may have to be replaced according to the floor properties**).

ANCHOR REQUIREMENT		
Permissible pull force per anchor	F_{pmin}	> 7 kN
Permissible bending force per anchor	F_{bmin}	> 16 kN
Permissible bending torque per anchor	M_{bmin}	> 30 Nm

The following steel anchors are provided by the manufacturer:

Anchor type	Location	Bore depth (t_d)	Bore diameter
	Fischer FH II 15/15 SK M10 FRONT 2 pieces	Min. 110 mm (4.5")	Ø15 mm (19/32")
	Fischer TA M10T/25 S M10 REAR (under E-box cover) 2 pieces		

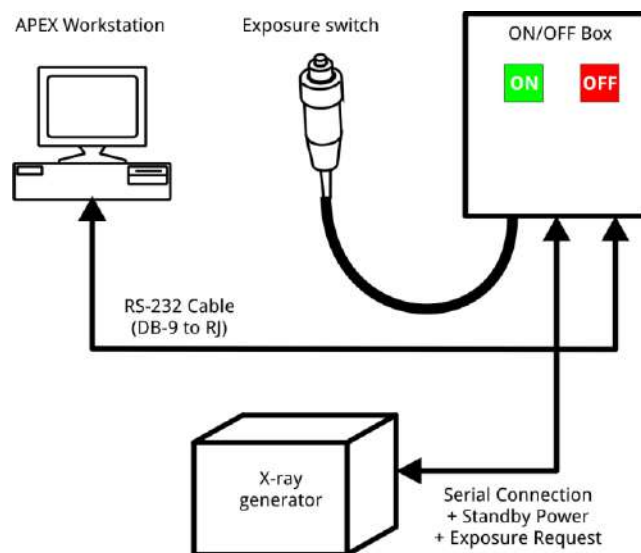
Use the hex head bolts on the rear of the column base (the holes are under the E-box cover). The Allen (hex socket) head countersunk bolts on the front with the large washers. Insert the colored bolt caps on the front of the base after the bolts have been securely fastened.

ON/OFF BOX (OPTIONAL)

The Z-Motion system may include an on/off box for powering the generator on/off manually or automatically by the Apex workstation. The on/off box must be mounted near the Apex workstation, with the following requirements:

1. It must be mounted where the operator initiates exposures (generally behind a lead-glass screen)
2. The supplied serial cable (right side of box) for connection with the Apex workstation must be within reach of the Apex computer (2 .. 3 m / 6 .. 10 feet cable run)
3. The supplied cable for connection with the generator (center cable entry) must be within reach of the generator (15 m / 45 feet cable run)

The following is the connection diagram of the on/off box:



ATTENTION!

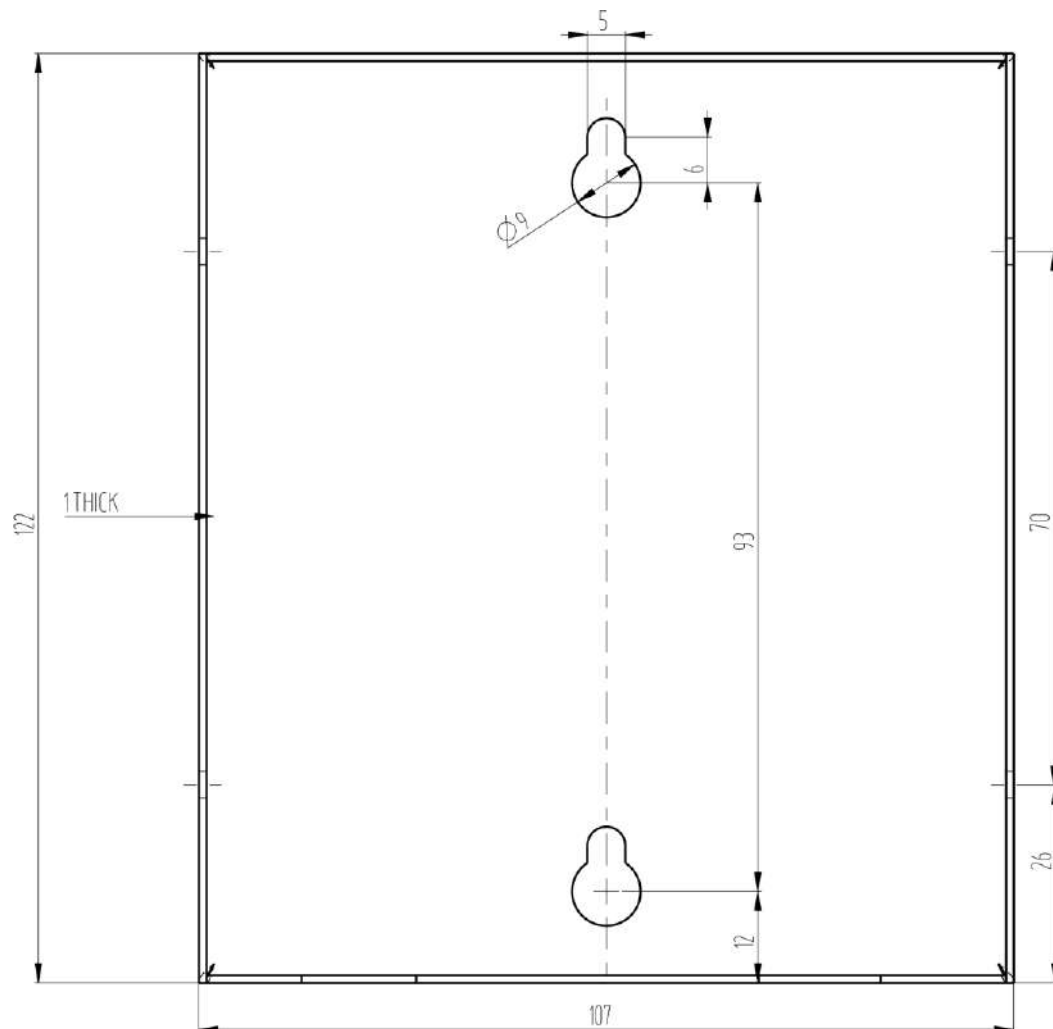
By regulations, exposures can only be taken using the external exposure switch connected to the on/off box. There are no provisions for software initiated exposures.

The box can be mounted on the wall or furniture in a convenient location for the operator. The box can be mounted using the 3 keyholes openings on the back of the box.

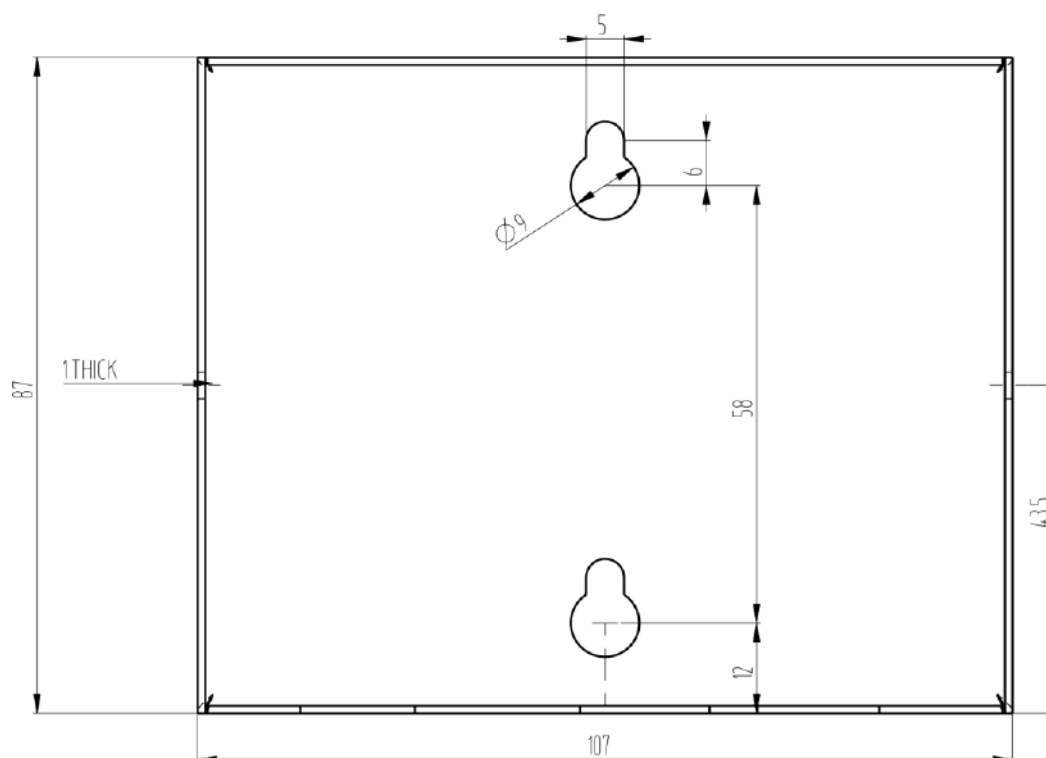
1. Mark and drill the 3 holes for the box using the drill template (see drawing below)
2. Carefully remove the box cover using the 4 screws at the sides. If the center cable is attached to the board inside, leave it connected and make sure it stays intact.
3. To mount the box, use appropriate screws / anchors (not supplied).

4. Mount the back of the box and the PE ground with a quick connect terminal as required.
5. Mount the top of the box with the board using the 4 screws on the side.

Select the appropriate on-off box drill template based on the shipped part:



Milestone HF LC on/off box drill template (copy this page and use for drill marks)



Milestone HF 200 on/off box drill template (copy this page and use for drill marks)

PLACING THE GENERATOR

Place the generator as close to the input power as possible, using short input power cables.

Do not place the generator directly next to a wall. Allow at least 10 cm / 4 inches clearance for air flow.

4.2.3 ELECTRICAL PREPARATION



WARNING!

The following requirements are only for the Z-Motion stand. Please refer to the manuals of the generator and other equipment for overall system power requirement.

The Z-Motion stand is a **permanently installed device**. The input line requirements are as follows:

Z-Motion stand	120–240V~, 50/60Hz, 2–1.1 A
Milestone generator	See generator technical manual
Apex Workstation	120–240V~ (See specifications of workstation) Use of UPS is recommended.



WARNING!

The following requirements are only for the Z-Motion stand. Please refer to the manuals of the generator and other equipment for overall system power requirement.



ATTENTION!

To ensure safe operating conditions, the X-ray room **MUST BE EQUIPPED** with 30 mA (preferably adjustable) RESIDUAL CURRENT DEVICE (RCD).

The stand must be connected to a **wall box with on/off switch** (magnetic contactor) utilizing a **16A C/B circuit breaker**. The contactor must be operated separately from the generator and workstation to allow moving the stand independently from other equipment.

We recommend using a cable run through a cable channel in the floor between the back of the stand, the generator and the workstation. The cables can enter the stand through either the bottom or at the back of the E-Box.

The following cables must into the cable runs / cable channels:

Cable run / channel	Cable
Z-Motion Stand	Input power cable (3 x 2.5 mm ² , 3-conductor cable with yellow-green PE wire)
Generator	Single-phase, 4-conductor or 5-conductor power input cable (according to generator model)
Z-Motion Stand - Generator	2 x HV cable (Ø16 mm flexible HV cable pair)
	Rotor cable (7 x 1.5 mm ²)
	Collimator power cable (3 x 1.5 mm ²)
	Flat panel generator interface cable (optional)

	15 m / 45 ft AEC cable (optional)
	Exposure interlock cable (optional)
Z-Motion Stand - Workstation	FTP (computer network cable, straight) for the flat panel detector (optional)
Generator – Workstation (on/off box)	15 m / 45 ft Generator serial cable

The recommended cable channel (duct) section size is 45 x 30 mm or larger.



WARNING!

Do not use or prepare for the opening at the bottom center of the column base for cable entry!

4.3 UNPACKING

Examine all the crates carefully at the time of the delivery. If damage is apparent have the delivering driver write, "Damaged shipment" on all copies of the freight bill and sign it. After unpacking if you discover obvious damage, immediately notify the freight company and ask for an inspection for the damage. Carriers generally will not accept damage claims if filed after 15 days from the date of receipt of the shipment.

Open the crates carefully and do not discard them until you have located all parts and the equipment is fully assembled.



CAUTION!

The Z-Motion Universal Digital Stand is a heavy object. Lift and move with help.

The Z-Motion stand is shipped in two separate crates:

1. **Column crate**, which includes:

- The column with the E-box and corrugated cable attached
- The cables from the E-box (attached to the E-box cable port)
- Column side cover

2. **Arm and accessories**, which usually includes:

- Arm with the smaller corrugated tube and the vertical carriage attached
- Detector housing and its plastic cover
- Tube holder and LCD controller assembly and its plastic cover
- Accessories (fasteners, bolts, remote controller, etc.)
- Grids (if applicable)
- Optionally the X-ray tube, flat panel and/or collimator (depending on order / type)

When unpacking the equipment, allow at least 30 minutes for the electrical parts to become free of any condensation before turning on.

Unpack the stand in the following sequence:

- Remove the top and the side covers of the crates (or the covering cardboard).
- Remove the braces that secure the different parts of the equipment to the crate as necessary.
- Lift out the stand (column + arm + tube + detector) and move it to the x-ray room
- Place the column horizontally on a soft surface to prevent damage
- Clean any grease or dust from the unit, accumulated during transportation

4.4 CHARGE THE REMOTE CONTROLLER

If your equipment was shipped with a remote controller, connect the remote controller with the supplied USB A-B cable with a computer or a commercially available charger with USB output socket. The batteries should charge up by the end of the mechanical installation.

4.5 MECHANICAL INSTALLATION

4.5.1 PREPARATION

The column, the Z-arm, the detector holder and the tube assembly are separated in the factory for easy installation. During installation, carefully move the parts and use help when moving or lifting them. Prepare the bores for the column as described in section *Room Preparation*.

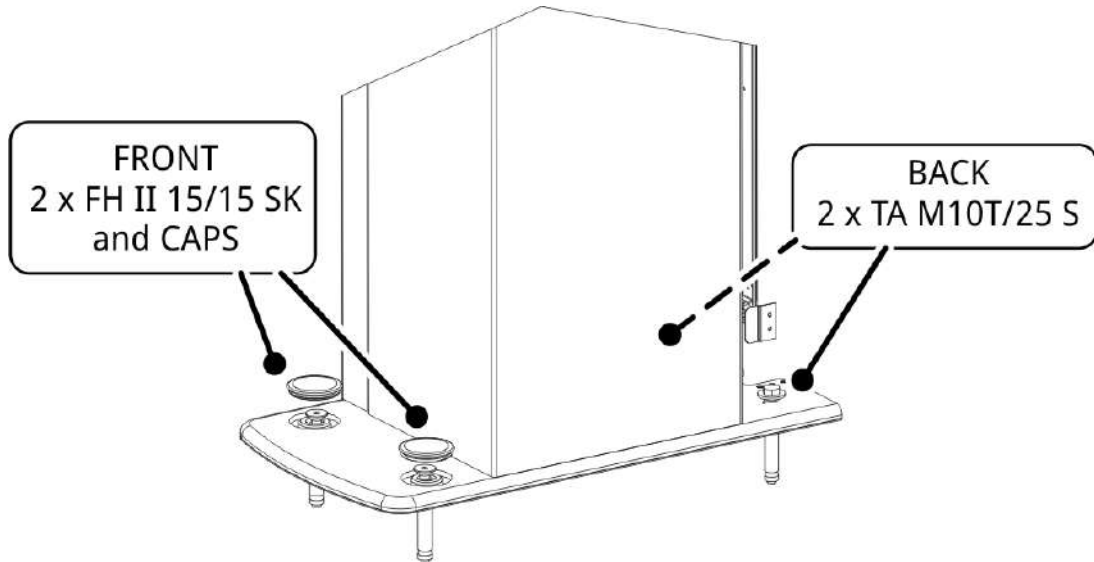
4.5.2 LIFT AND ERECT THE COLUMN

1. Remove the cover of the E-box and set it aside. The cover must stay off the column until the end of the electrical installation.
2. Stand the column over the bores and anchors previously prepared (substitute the supplied anchors as necessary to match the floor quality). For lifting, use help or use a lift truck with the supplied M12 eye bolts in the side of the column.



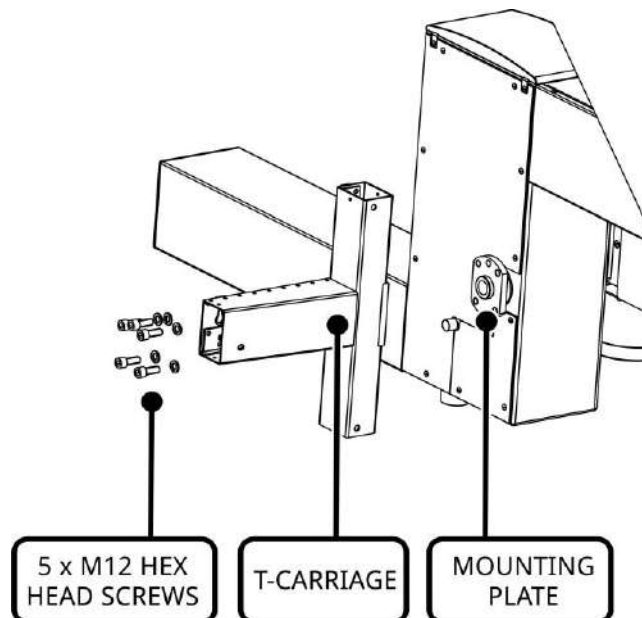
4.5.3 BOLTING DOWN THE COLUMN

Bolt down the column as instructed in section *Room Preparation*.



4.5.4 MOUNTING THE T-CARRIAGE

The T-Carriage is removed from the Z-arm for shipping. Place the arm and secure it on A-frames or folding trestles. Mount the T-Carriage as indicated below using the supplied M12 screws and a long hexagonal key extension.



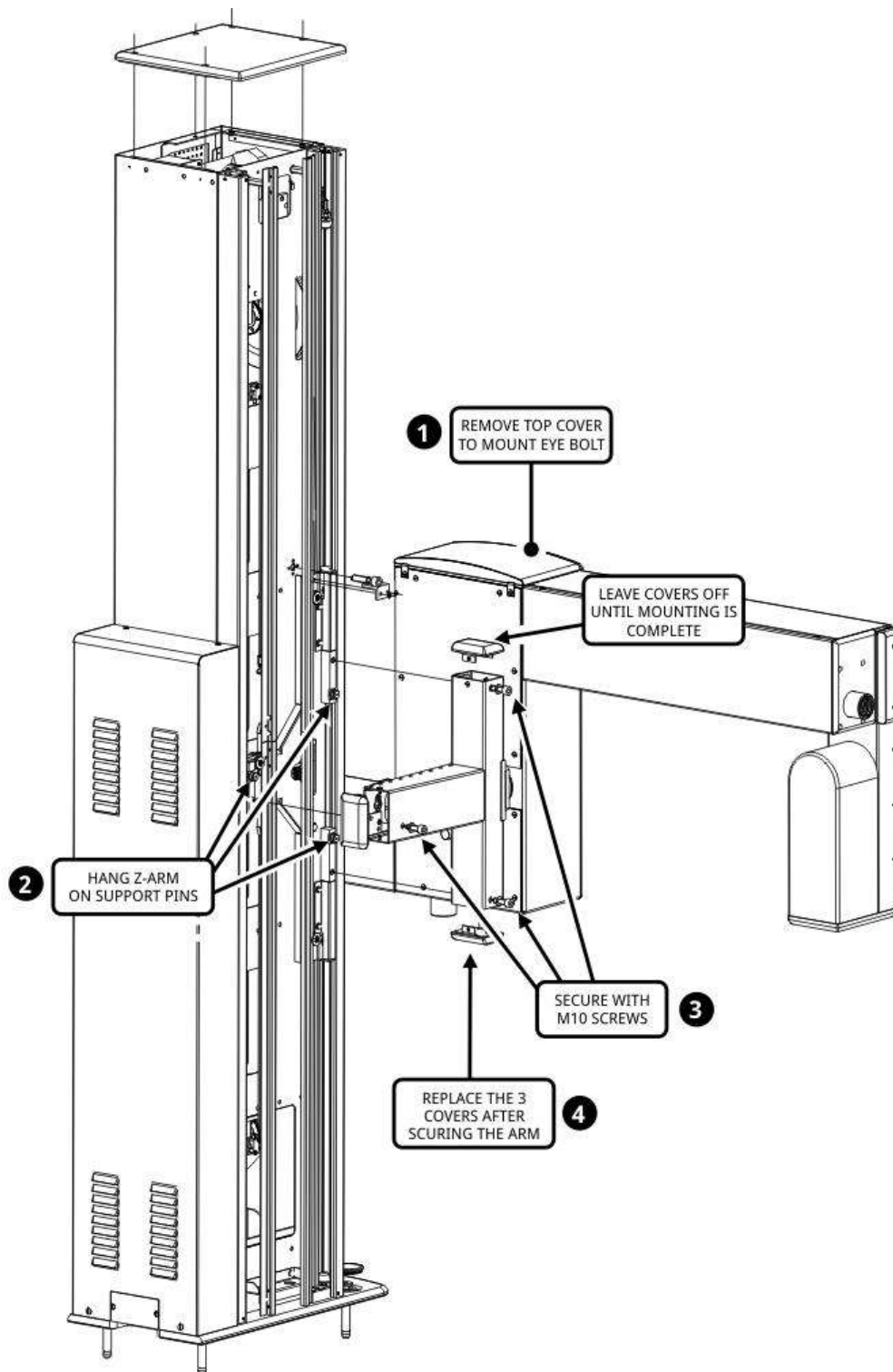
ATTENTION!

MAKE SURE THE SCREWS ARE FASTENED AS TIGHT AS POSSIBLE.

These screws will support the entire weight of the assembled Z-arm, which is more than 100 kg (220 lbs).

4.5.5 MOUNTING THE Z-ARM

With help, carefully mount the Z-arm on the carriage located on the side of the column by hanging the arm on the 3 support pins. For lifting, we recommend using a lift truck and an M12 eye bolt on top of the arm **(1)**.

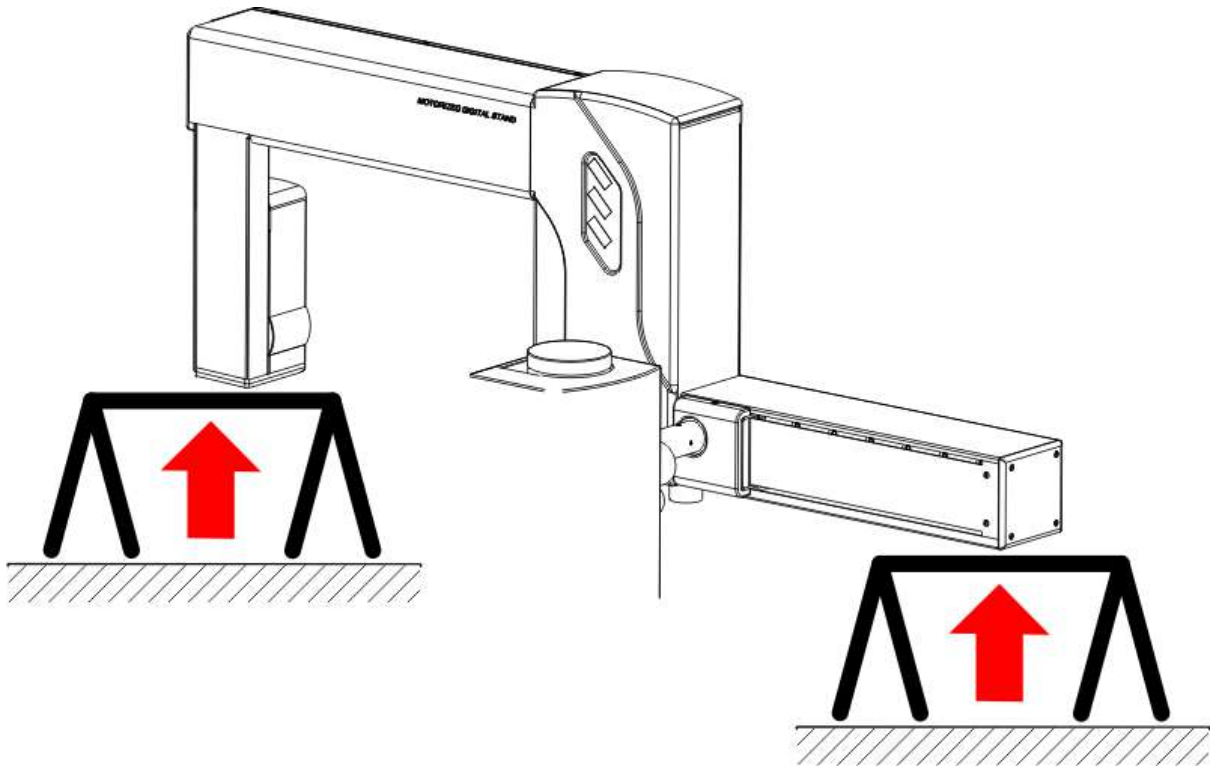


Once the Z-arm is on the support pins **(2)**, secure the arm with the supplied M10 hex socket screws **(3)**. One screw is for each of the three support pins. After securing the arm, mount the three small covers of the vertical carriage **(4)**. Replace the top cover of the Z-arm as well (if

removed for eye bolt).

4.5.6 SUPPORT THE Z-ARM FOR SAFETY

Support the Z-arm at both ends with a folding trestle. The arm in assembling phase is unbalanced!

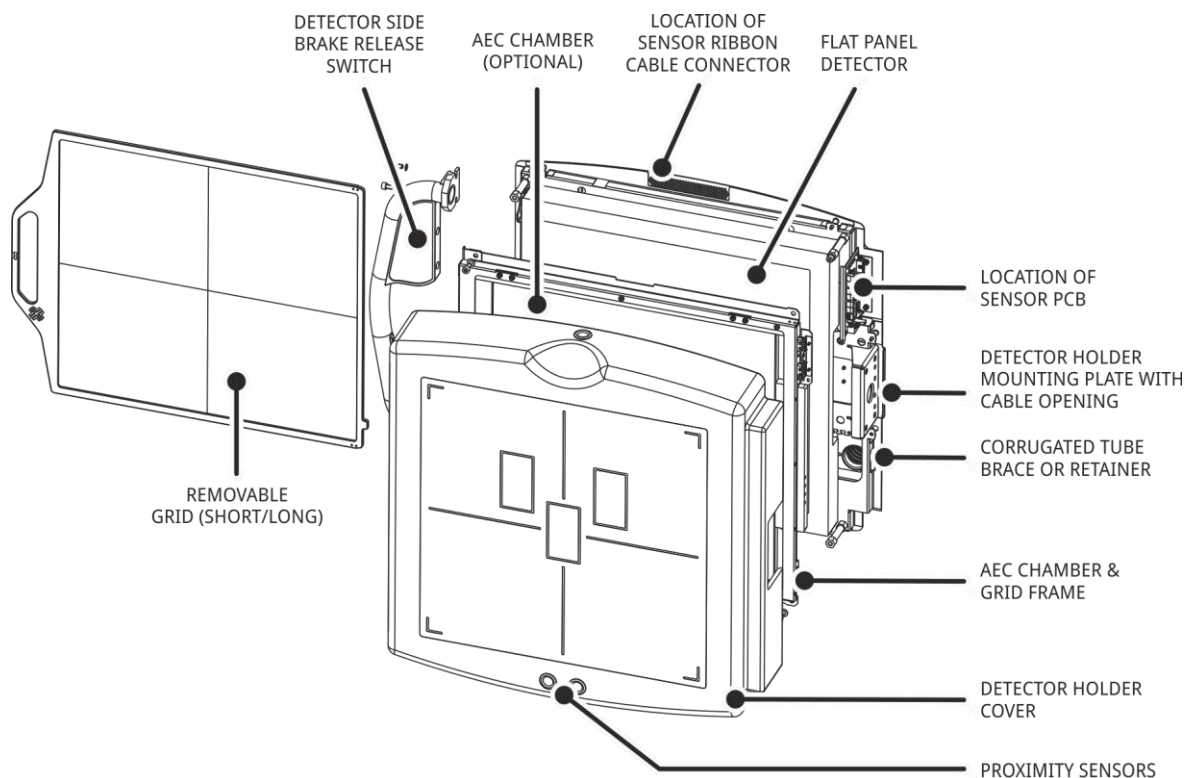


4.5.7 MOUNTING THE STANDARD STATIONARY GRID DETECTOR HOLDER

1. Remove the grid if there's one inserted into the grid frame
2. Unplug the 4-pin Phoenix plug from the sensor PC board. Remove the AEC chamber & grid frame from the detector holder assembly and set it aside.
3. Lead the 24VDC / 5VDC cable and CAT-5 Ethernet cable coming from the detector side of the arm through the opening of the detector holder and mount the detector holder onto the detector arm using four screws.
4. Connect the 24VDC / 5VDC cable and CAT-5 Ethernet cable to the sensor PCB board.
5. Lead the cables from the corrugated tube through the cable opening of the detector holder and secure the corrugated tube with the supplied brace or retaining washer.
6. Mount the flat panel detector into the detector holder. Please note that the detector holder is prepared for several different flat panel models.

If the stand is shipped with a **rotating docking station** for cassette size flat panels, the docking station is already mounted and secured in the detector holder. Remove the securing tapes from the docking mechanism.
7. Connect the cables from the corrugated tube to the flat panel detector. The number and type of cables are different for the various flat panel types. They typically include a power cable, an Ethernet cable and a generator interface cable.

8. Mount the AEC chamber into the AEC & grid frame (if applicable).
9. Mount the AEC & grid frame back onto the detector holder. Reconnect the 4-pin Phoenix plug on the sensor PCB board. If there is an AEC chamber installed, connect the AEC cable (from the corrugated tube) to the chamber preamplifier.



10. Make sure that the cables are arranged so that the grid can be inserted through the grid slot. Use tie wraps and the T cutouts in the inside of the detector holder as necessary. Do not forget to remove the grid after testing the cable arrangement.
11. Mount the plastic cover of the detector holder (with 6 screws).

4.5.8 WORKING WITH THE OSCILLATING GRID BUCKY (OPTIONAL)

MOUNTING THE BUCKY

If your Z-Motion is equipped with a Bucky (oscillating removable grid detector holder):

1. The grid should be packaged separately. The Bucky and the proximity sensors are prewired.
2. Unplug the grid sensor switch cable from the CXZDI3 PC board. Remove the AEC chamber & grid frame from the detector holder assembly and set it aside.
3. Lead the 24VDC / 5VDC cable and CAT-5 Ethernet cable coming from the detector side of the arm through the opening of the detector holder and mount the detector holder onto the detector arm using the provided interface bracket.
4. Connect the 24VDC / 5VDC cable and CAT-5 Ethernet cable to the CXZDI3 board.
5. Lead the cables from the corrugated tube through the cable opening of the detector holder and secure the corrugated tube with the supplied brace or retaining washer.

6. Mount the flat panel detector into the detector holder. Please note that the detector holder is prepared for several different flat panel models.
7. Connect the cables from the corrugated tube to the flat panel detector. The number and type of cables are different for the various flat panel types. They typically include a power cable, an Ethernet cable and a generator interface cable. When using a Bucky, the generator interface cable may be shared with the Bucky interface (e.g. cable #7899, refer to wiring diagram).
8. Mount the AEC chamber into the AEC & grid frame (if applicable).
9. Mount the AEC & grid frame back onto the detector holder. Reconnect the grid sensor cable to the CXZDI3 board. If there is an AEC chamber installed, connect the AEC cable (from the corrugated tube) to the chamber preamplifier.
10. Make sure that the cables are arranged so that the grid can be inserted through the grid slot and the cables will not interfere with grid oscillation.
11. Mount the plastic cover of the detector holder.

INSTALLING GRIDS

1. Make sure that the grid frame is in park position (the eject lever is accessible)
2. To insert a grid, slide the grid into the grid rails until the eject lever latches.
3. To remove the grid, move the eject lever away from the grid and pull the grid out.

GRID SERVICE POSITION

Before removing the plastic cover of the Bucky for maintenance, the grid frame must be put into service position to, otherwise the grid eject lever will prevent moving the cover.

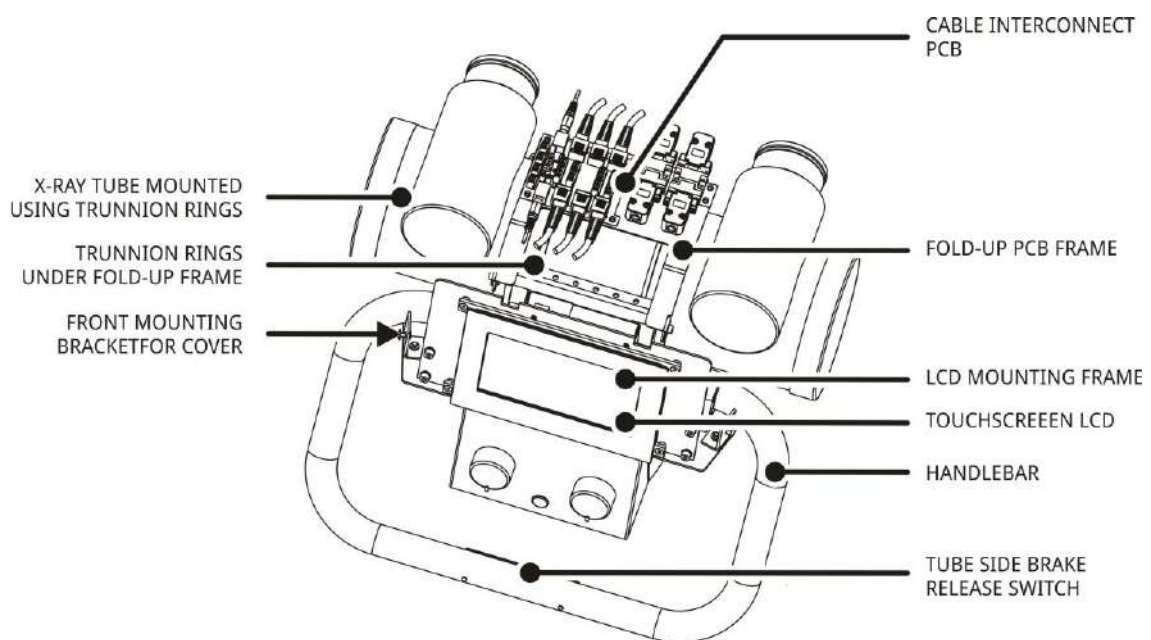
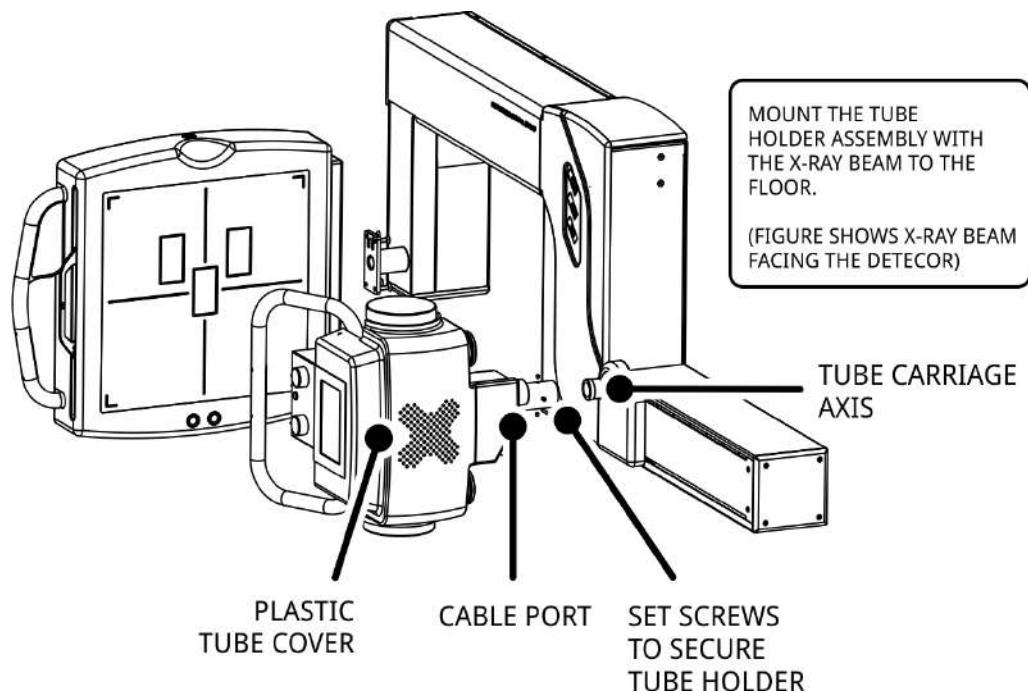


ATTENTION!

The Bucky cover can only be removed and installed when the grid frame is in service position, **even if there is no grid installed in the Bucky**. To move the grid frame in or out service position, the **stand must be powered up**.

1. In order to move the grid frame in or out of park position, the stand must be power up.
2. Make sure the stand is idle (there are no active motorized movements).
3. For grid frame park position, press the red STOP button and hold for 2 seconds on the detector holder keypad. (Pressing and holding the STOP button the second time will move the grid frame out of service position.)
4. Turn the power off.
5. Remove the plastic cover and do necessary maintenance.

4.5.9 MOUNTING AND ASSEMBLING THE TUBE ARM



1. Remove the plastic tube cover (if shipped with the cover on) and set the cover aside.
2. Make sure the colored tube arm cover is installed on the tube carriage. Slide the tube holder assembly onto the axis of the tube carriage. Mount the tube holder with the X-ray beam facing toward the floor for easy tube installation.
3. Secure the tube holder on the axis using the 4 set screws.



You will have to adjust the tube angle later when calibrating the X-ray beam direction. Be prepared to readjust these screws for final beam

ATTENTION! adjustment.

4. Release the screws on the back of the fold-up PCB frame and fold up the frame.
5. Remove the upper halves of the Trunnion rings.
6. Place the X-ray tube on the Trunnion mounts. Secure the X-ray tube with the upper halves of the rings.



ATTENTION!

You will have to adjust the tube angle later when calibrating the X-ray beam direction. Be prepared to readjust the tube in the Trunnions for final at the time of the final adjustment.

7. Mount the collimator using spacers and the collimator mounting ring. Consult the collimator manual for details.



ATTENTION!

When mounting the collimator, be sure to leave enough clearance between the top side of the collimator and the bottom of the tube holder, so that the collimator does not hit the speaker on/off rocker switch.

8. Install the permanent circular Al filters provided with the system as necessary. Consult the X-ray tube and collimator manual for their respective inherent filtration.

TOTAL FILTRATION = X-ray tube + Collimator + Added Al circular filters

TOTAL FILTRATION $\geq$ 2.5 mm Al



ATTENTION!

Use the included circular Al filters (with 0.5 mm and 1 mm thickness) to achieve the required total permanent filtration.

Unless otherwise required by local regulations, a minimum of 2.5 mm Al total filtration must be provided including the X-ray tube

9. Install the two corrugated tubes with the cables to the tube holder cable port. **Make sure that the corrugated tubes are coming from the outside (from the right) of the tube holder axis.**
10. Arrange the cables for connection on the interconnecting PCB. Some cables may have to run under the fold-up frame.
11. Fold the PCB frame back and secure it with the screws on the back.
12. Connect the cables to the respective connectors on the interconnecting PCB as marked. Please note that there may be floating connectors that are not connected to the PCB (e.g. 230VAC supply for certain flat panels).
13. Connect the collimator supply cable leaving enough slack for collimator rotation.
14. To turn the tube into normal operating position, loosen the colored release handle at

the back of the tube holder, rotate the tube facing the detector until the detent and tighten the handle.

4.5.10 CHECKING THE VERTICAL BALANCE

The Z-arm is now almost completely assembled (the tube cover and the grid may be missing). The counter-balancing spring inside the column was adjusted in factory for the nominal weight of the assembled Z-arm.

1. Carefully remove the trestle supports from under the Z-arm. If you notice any sudden drop of the arm, put the supports back and find the source of the problem (e.g. the spring may be released).
2. Remove the safety from the drop brake in the vertical carriage (if applicable).
3. Applying force manually on the center part of the Z-arm, try to move the Z-arm down a few centimeters / inches. The arm should give against the brakes, then it should stay in place when force is removed (i.e. the spring should not pull it back up).
4. If the Z-arm seems approximately balanced, remove the red shipping bolt and brace from the column / vertical carriage.



This concludes the initial mechanical installation procedure. The column side cover, the tube cover and the E-box cover are still removed. You will need to mount these covers and finish the mechanical adjustment after the electrical installation.

4.6 ELECTRICAL INSTALLATION

1. Make sure that the flat panel detector power supply is set to the appropriate input voltage range (110–240V~).
2. Find the dummy cable in the E-box of the stand which shows where to connect the input power.



3. Connect the generator to the power input:
 - Use a 3-conductor 1.5 mm² to 4 mm² power cable conforming to **IEC 60227-1** or **IEC 60254-1** for input power connection
 - The color code of the power cable must be:

Phase	Black or brown	Connect to terminal in E-box
PE ground	Yellow-green	X01.3 – Yellow-green
Neutral	Blue	X01.4 – Blue
Phase	Black or brown	X01.5 – Grey or White

4. Run the cables through the cable channels and connect them as marked to other system components (see also section *Electrical Preparation*).

The following are the usual connections to external devices:

- a) AEC cable (optional)
- b) Generator exposure interlock cable (optional)
- c) High voltage cables
- d) Rotor cable
- e) Flat panel Ethernet cable
- f) Flat panel generator interface cable
- g) Stand input power cable
- h) Collimator power cable

5. If the flat panel power supply is mounted inside the E-box (depending on type of panel), make sure that it is turned on.
6. Turn on the circuit breaker in the E-box.
7. Turn on the wall power to the stand. The red light next to the emergency switch should come on.
8. Make sure that the emergency switch is in the off position (i.e. not pushed in and the stand is powered up). The green light by the emergency switch should light up and the LCD touch screen should boot up.
9. Verify that the controller software start up. If there is no error message on the screen, carefully try to initiate movements from the LCD screen to check operation.
10. If the system includes a remote controller, try some of the movements to check the remote controller connection.
11. Replace the cover of the E-box. Mount the plastic tube cover and install a grid for balancing. **Leave the column side and top covers off.**

The stand is now ready for the final configuration and adjustments.

4.7 BALANCING

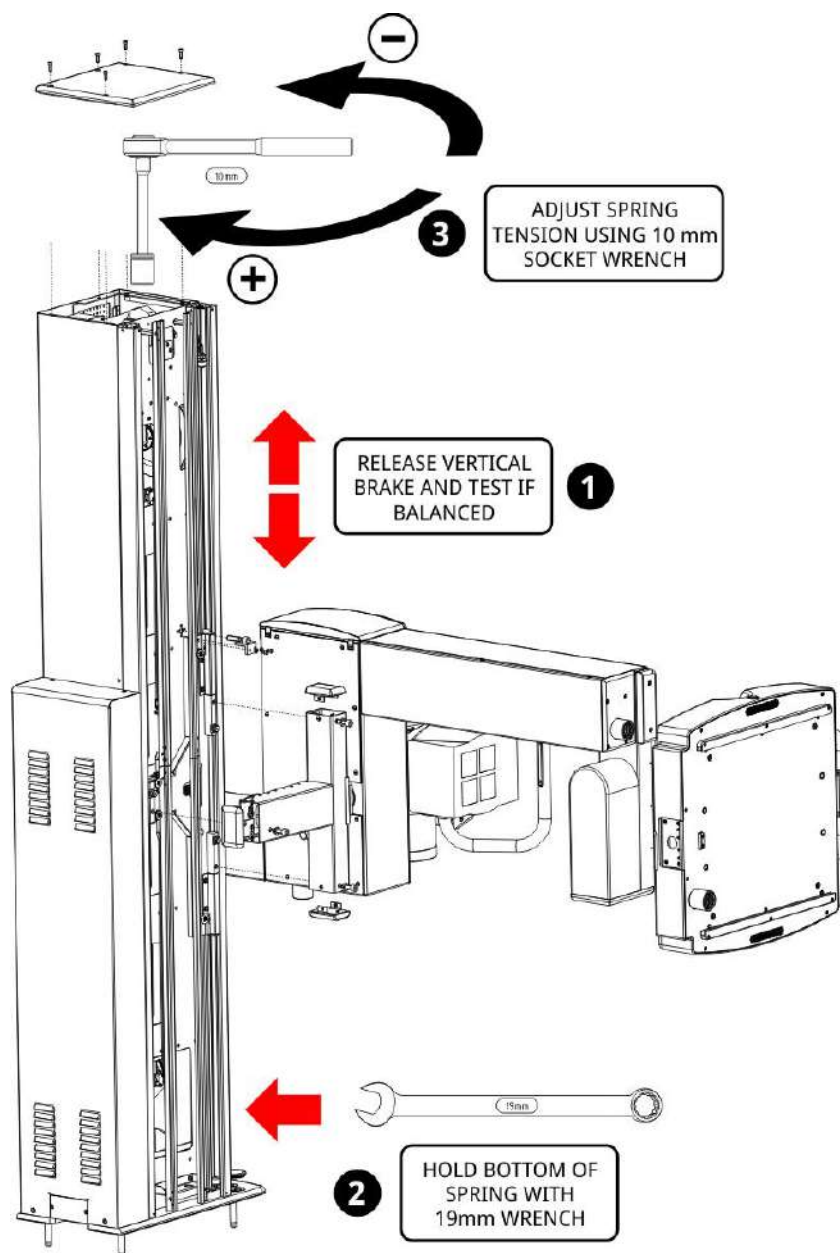
4.7.1 VERTICAL BALANCING

The Z-Motion stand utilizes a spring for balancing the Z-arm vertically.



ATTENTION!

When balanced, the spring pulls the Z-arm slightly towards the center of the vertical motion range (When releasing the brakes for manual movements with no force applied, the Z-arm wants to settle in the center). This is normal and is a feature of the spring mechanism.



1. Release the vertical brake and try to move the Z-arm vertically by hand to check balancing.

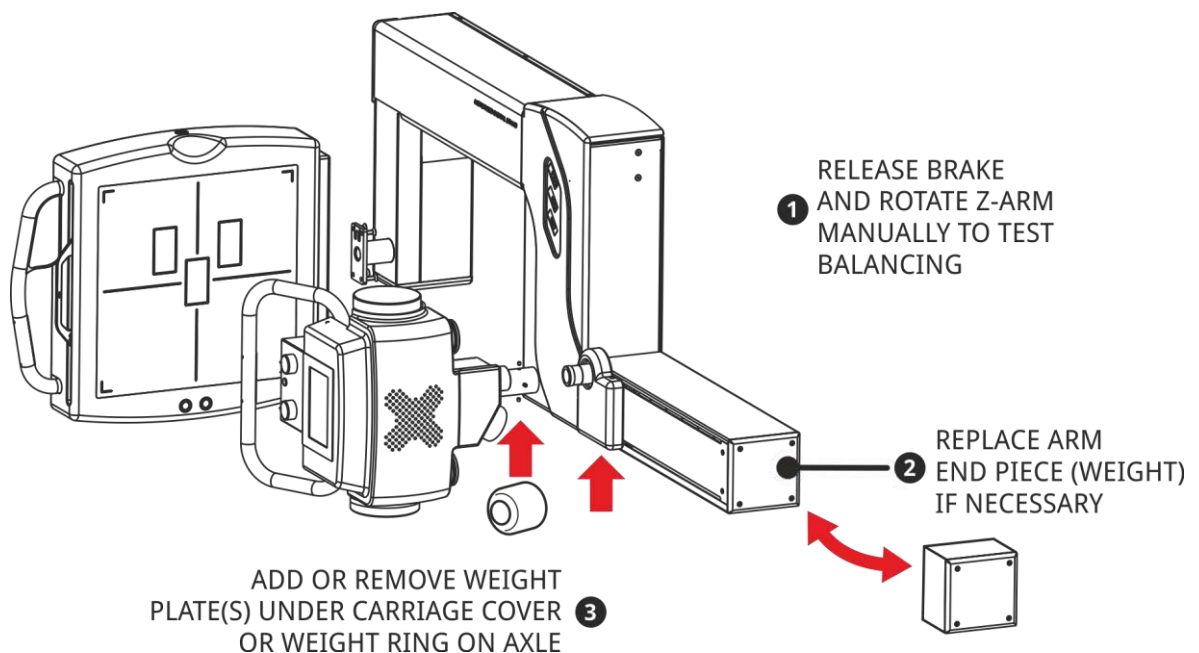
Note: You may have to configure the brake release switch(es) to be able to conveniently initiate vertical manual movement (see section Configuration).

If the Z-arm is pulled up from the center, the spring tension is too much and you'll need to release it. If the Z-arm starts going down with no force applied, the spring tension is too low and you will have to tense it.

2. Using a **19 mm wrench**, secure the bottom of the spring assembly.
The opening is at the bottom of the column side. Make sure not to damage the vertical potentiometer ribbed belt. Use a cloth or soft material to protect the sides of the opening if necessary.
3. Remove the top cover of the column. Using a 10 mm socket wrench with extension, increase or decrease the tension of the spring as necessary as shown on the drawing above. After a few turns, stop and check the balancing of the Z-arm again.
4. After completing the balancing, mount the side and top covers of the column. The side cover can be separated in two halves for easier installation in low-ceiling rooms. Make sure that the side cover runs between the plastic guide rollers of the carriage.

4.7.2 BALANCING THE Z-ARM ROTATION

In some cases, balancing the Z-arm rotation may be necessary if the detector side is heavier than the default (factory configuration (note that the arm is balanced in factory if all the components are supplied by the manufacturer)).



1. Release the vertical brake and try to move the Z-arm vertically by hand to check balancing.

Note: You may have to configure the brake release switch(es) to be able to conveniently initiate vertical manual movement (see section Configuration).

2. Replace the colored arm end piece with the desired size / weight (fixed weight to balance the Z-arm). Note that there are 2 additional weight blocks available to balance heavier detector assemblies.

- 3.If necessary, remove or add weight plates at the tube carriage (under the colored carriage cover) or install the grey weight ring on the tube axle.
- 4.Replace the covers after completing the balancing procedure (the covers should be considered for their weight when balancing the arm).

Note: The weights at the tube carriage / axle move together with the tube when changing the SID. Changing these will have the same effect in the entire SID range. The weight discs in the tube arm are in fixed position regardless of the SID and will have a larger effect at shorter SIDs.

Adjust the beam direction (detector and tube leaning) using the three adjustments in

- Upright position
- Table position

Verify and adjust that the X-ray beam is parallel with the SID movement at

- Short SID and
- Long SID.

4.8 Z-MOTION STAND CONFIGURATION AND CALIBRATION

The Z-Motion system comes preconfigured and calibrated. Additional calibration may be necessary according to room properties (obstacles) or input power properties.

For further instructions, please refer to document *D-2708 Z-Motion Configuration and Calibration Instructions*.

4.8.1 CALIBRATING THE TOUCH SCREEN

The tube-side controller is equipped with the resistive touch screen. The touch screen is factory calibrated. In case it needs recalibration, follow these steps:

- 1.Enter setup mode and close the application to return to the operating system (see document D-2708)
- 2.Connect a USB keyboard to the **USB-A** port on the right side of the tube mount to access the Windows Start menu
- 3.Press the Windows key on the keyboard and select **Settings -> Control Panel**. Alternatively, go to **My Device -> Control Panel**.
- 4.Start **Stylus** and follow the instructions to calibrate the screen.
- 5.When finished, simply do a **power cycle** to return to normal operation.

4.9 CHECKING THE OPERATION OF THE STAND AND THE IMAGE ACQUISITION SYSTEM

Since the following steps require taking X-rays, verify that the imaging system (X-ray generator, flat panel, acquisition SW, AEC etc.), the motor drives and the safety features of the stand operate. For details on taking exposures, refer to the manuals of the image acquisition system.

Correct the problems if there any before continuing the installation.

4.10 CENTERING

4.10.1 CENTERING AND ADJUSTING THE LIGHT FIELD AND THE X-RAY FIELD

To protect the patient from unwanted radiation and to make sure that image will cover the required area, it is necessary to set the light field to the actual X-ray beam area.

Please refer to the collimator technical manual for detailed instructions.

You have to make sure that (1) the X-ray field are is NOT LARGER than the light field and (2) the light field area is within the tolerance of the applicable standards.

4.10.2 CENTERING THE Y-RAY BEAM AND THE IMAGER

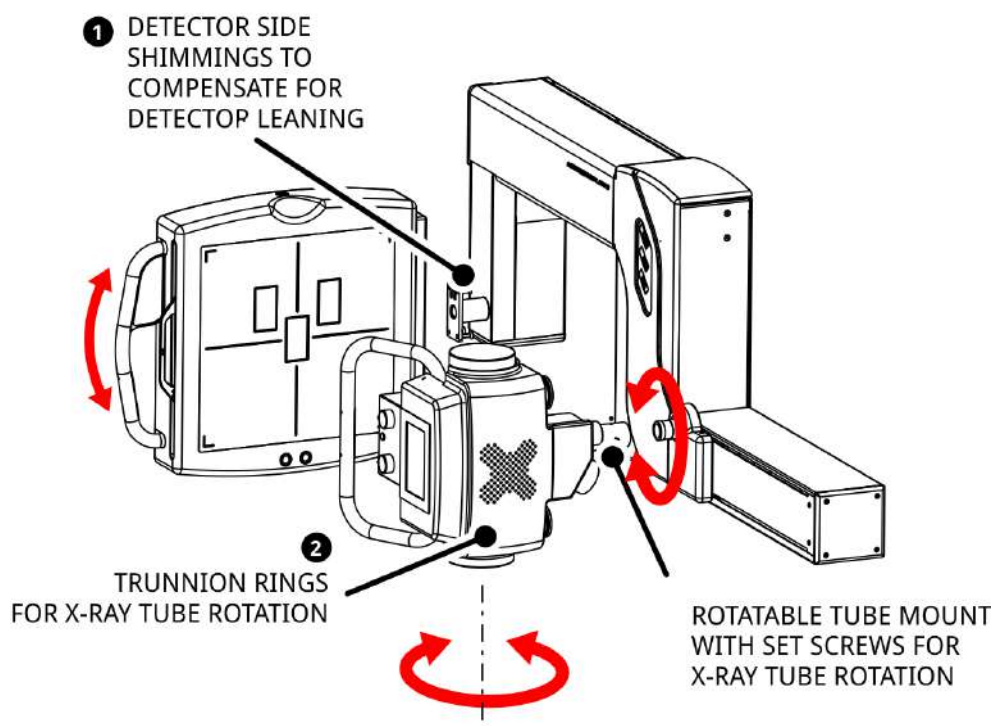
For optimal image quality, it is necessary to center the X-ray beam and the flat panel detector.



ATTENTION!

The Z-Motion stand is a **high degree-of-freedom mechanical system**. The centering procedure must be performed in **several different conflicting positions** resulting in an acceptable overall beam accuracy.

There are three options for adjusting beam and imager positions:



1. Shimming at the detector holder mounting plate to compensate for detector leaning in upright positions.
2. Trunnion mount () to:
 - a. Compensate for the X-ray tube leaning in table position
 - b. Adjust the X-ray beam parallel with the SID motion
3. Rotatable tube mount axis with set screws to:
 - a. Compensate for tube mount leaning in upright position
 - b. Adjust the X-ray beam parallel with the SID motion

5 OPERATING INSTRUCTIONS

5.1 GETTING STARTED

5.1.1 POWERING ON AND OFF

The Z-Motion Stand can be powered on using the wall disconnect switch (not supplied by Control-X, please contact your service provider for details). The green indicator on the side of the column should be ON. To turn the stand OFF, turn the wall disconnect switch to OFF position. The green light should go OFF.

The Z-Motion is functional immediately after power up: the brake release and motion control can be initiated from the detector side keypad and the brake release switches. The following functions require 15-30 seconds from power up:

- Bluetooth remote controller (optional): needs to establish connection with the stand. See section Remote Controller
- The LCD display requires several seconds to boot up. The Preset positions are available only on the LCD.

5.1.2 EMERGENCY STOP



The emergency stop button will disconnect the stand from the mains when pressed. Push this button when there is danger of injury or damage to the equipment while operating the stand.

To turn the stand back on, pull the knob out.

Please note that the brakes remain engaged even with the mains disconnected.

Once the stand is powered up, it can be immediately operated by the Bluetooth remote controller and the brake release switches. The LCD screen is available after a few seconds of boot process.

5.1.3 SAFETY FEATURES

EMERGENCY STOP



The emergency stop button will disconnect the stand from the mains when pressed. Push this button when there is danger of injury or damage to the equipment while operating the stand.

To turn the stand back on, pull the knob out.

Please note that the brakes remain engaged even with the mains disconnected.

CLUTCHES

The built-in electric motors are equipped with electromagnetic clutches that will stop the motion in case of a collision to prevent injury or damage.

FLOOR, CEILING AND WALL CLEARANCE



The vertical motion, SID movement and arm rotation will stop the detector **above the floor**, at the **left wall** and **below the set ceiling height** at a safe distance to prevent foot injuries and / or damage to the equipment.

LATERAL VIEW PATIENT SENSOR



The stand is equipped with an optical gate for preventing injury when using lateral table projections. The sensor disables downward movement when there is obstruction inside the Z arm (detector side).

PROXIMITY SENSORS ON THE DETECTOR SIDE

Four optical proximity sensors are provided for detecting and preventing possible collision with objects (e.g. the table / gurney) or persons.



CRASH DETECTION

The stand will detect and stop motion if the moving parts crash (no movement while driving the motors).



EMERGENCY VERTICAL BRAKE

Should the chain holding the vertical carriage break, an emergency vertical brake is activated.

5.2 OPERATOR CONTROLS

The stand can be controlled from three different locations (in the order of precedence):

1. Detector side keypad
2. Bluetooth remote controller (optional)
3. LCD touch screen

These controls share most of the features for easy and flexible operation.

5.2.1 SIGNIFICANT ZONES OF OCCUPANCY

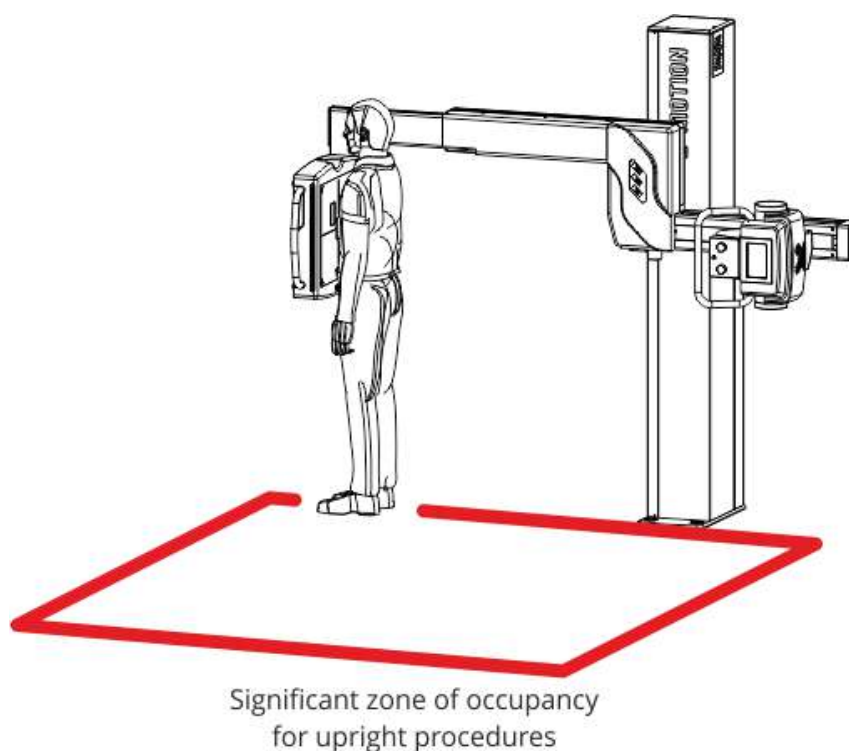


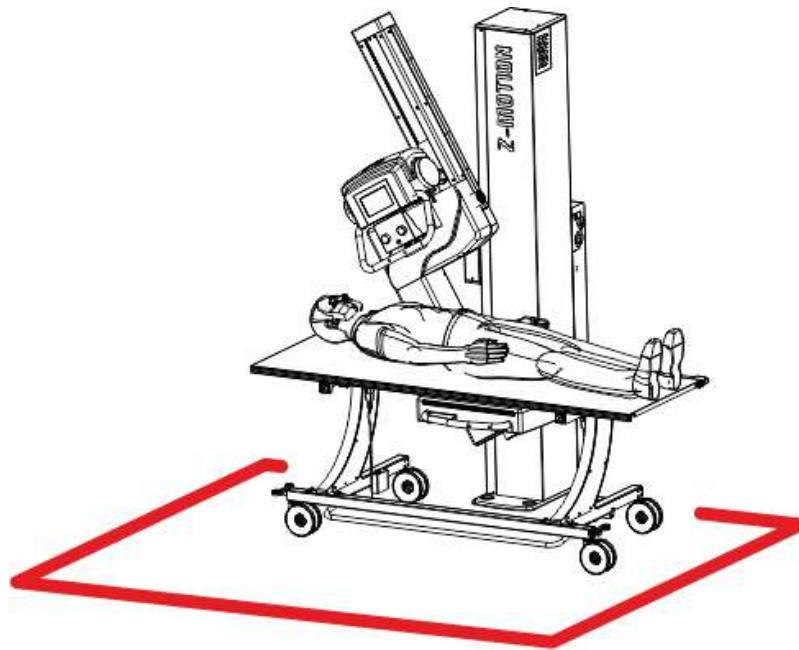
After prolonged operation, the X-ray tube may be hot to the touch and in some extreme cases can cause minor burns.

WARNING!

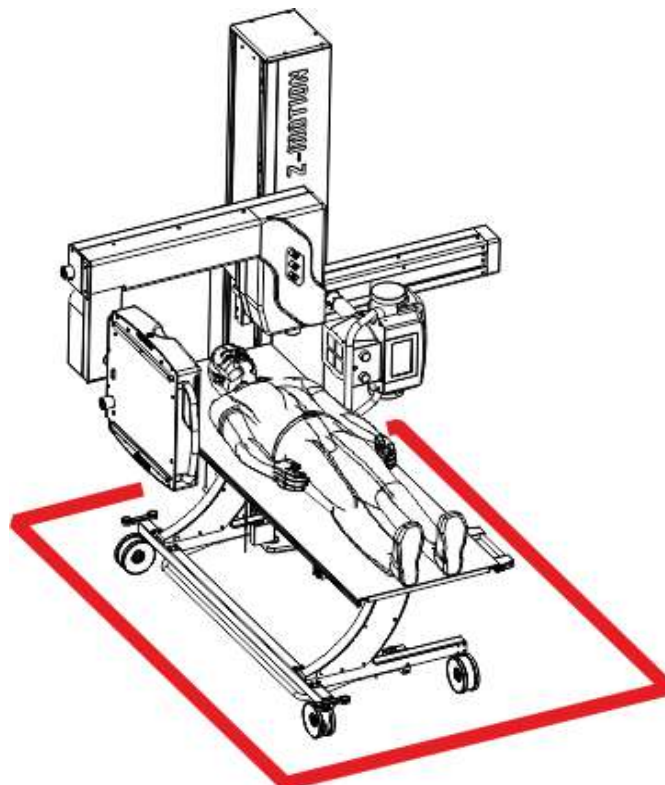
Do not reach behind the tube head assembly.

When operating the Z-Motion stand and associated table, the following are the significant zones of occupancy while positioning the patient and operating the equipment (except for taking exposures):





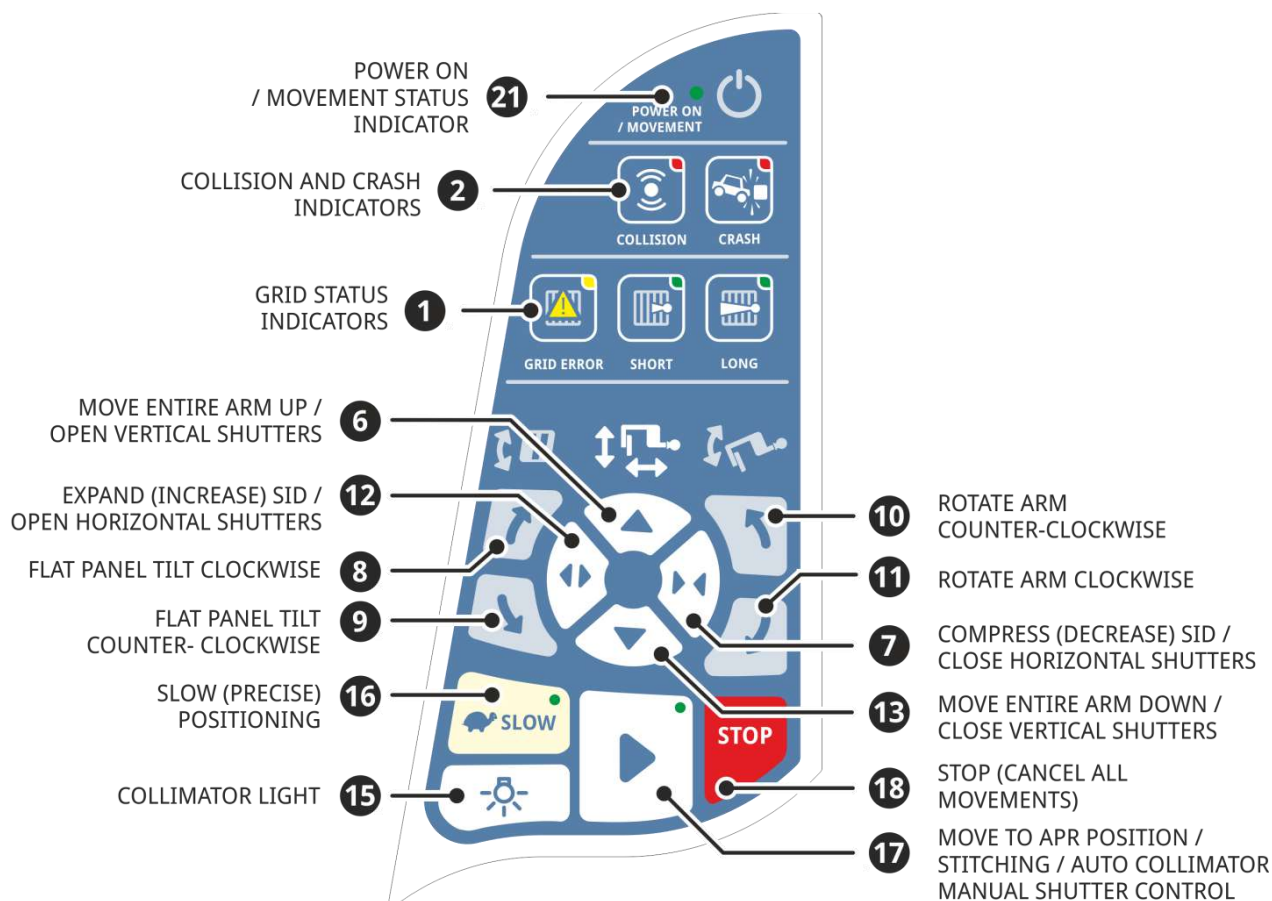
Significant zone of occupancy
for table procedures



Significant zone of occupancy
for lateral table work

5.2.2 DETECTOR SIDE KEYPAD

The detector side keypad provides for convenient positioning close to the patient (e.g. adjusting the detector height for chest exposures). It also provides grid status feedback near the grid slot.



5.2.3 REMOTE CONTROLLER (OPTIONAL)

The stand can be conveniently operated by the rechargeable Bluetooth remote controller.



REMOTE CONTROLLER POWER-SAVE FEATURES

To conserve battery charge, the remote controller goes to power save (sleep) mode if the remote has not been used for approximately 1 hour or if the battery becomes depleted.

When using the remote the first time after power save mode, it may take up to 5 seconds for the remote connection to be reestablished.

WAKING UP THE REMOTE CONTROLLER

To wake up the remote controller from the power save mode, follow these steps:

1. Press the **(17) APR button**. The red LED (22) should light up briefly and the remote controller starts the boot process.



ATTENTION!

If the red LED (22) does not light up at all, the battery may be completely depleted. Charge the remote controller for at least 30 minutes and try again.

2. Press any of the **movement buttons** (6-13) and keep it depressed until the blue

connection LED (23) lights up and starts blinking.

3. After the blue connection LED (23) stops blinking, start using the remote controller. If it does not respond, start over the connection procedure (#1 through #3).

RECHARGING THE BATTERIES

The remote controller operates with a 3.7V rechargeable Li-Ion batteries. Recharge the batteries when the red battery low indicator on the remote appears or when the remote controller cannot operate the stand.

To charge the batteries, connect the remote controller with the supplied USB A-B cable with a computer or a commercially available charger with USB output socket.

The charge LEDs on the remote controller displays the charge status:

1. **Steady yellow light:** batteries are charged
2. **Blinking yellow light:** batteries are being charged
3. **Red light when pressing a key:** the batteries are low.

If the remote controller is not used for a long period of time, allow the remote controller to fully recharge before using it.



WARNING!

- The remote controller was designed to work with the included rechargeable Li-Ion batteries. They are NOT user replaceable. Do not use any other battery.
- To replace worn batteries, contact you service provider.



Batteries may contain materials harmful to environment and health. Used rechargeable batteries must be properly disposed of according to local regulations.

NOTES ON REMOTE CONTROLLER USAGE

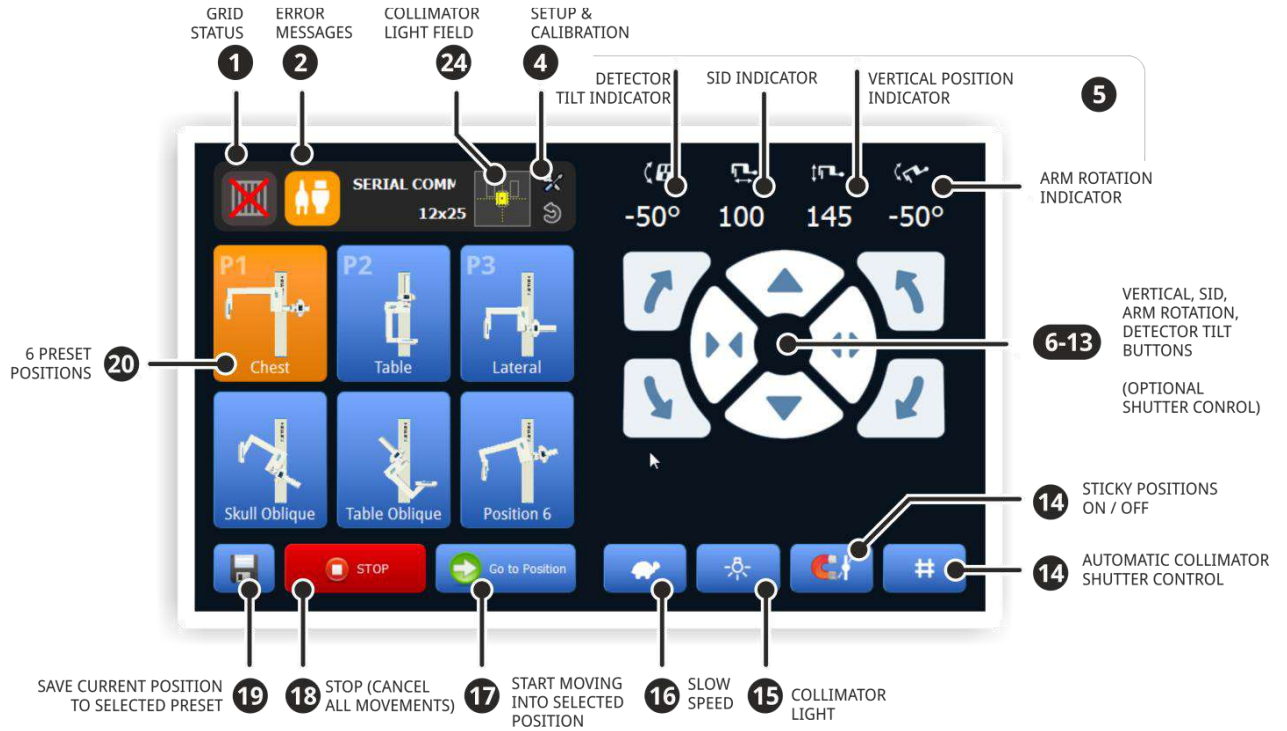
1. The Bluetooth remote controller is designed to work **only** with the Z-Motion stand. The stand cannot be operated with any other Bluetooth device e.g. mobile phones or computers or remote controllers of another stand. If the remote controller needs replacements, please contact service.
2. The remote controllers are paired with their stands, they do not interfere when more than one stands operate in the same building.
3. The range of the remote controller is probably larger than the X-room. **Do not operate the remote controller outside the room as the stand may move and cause injury or damage.**

Fully charging the batteries takes approximately 3 hours (depending on usage conditions and the condition of the battery).

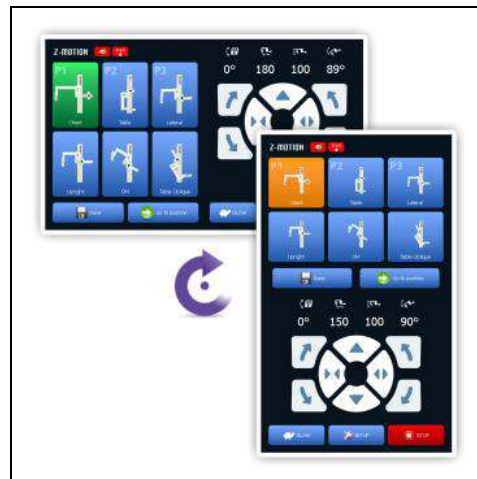
LCD Touch Screen

The Z-Motion stand comes with an easy-to-use 7" LCD touch screen.

The screen displays the following information:



The screen automatically rotates according to the position of the arm for readability.



5.2.4 OPERATOR CONTROL FUNCTIONS

The following is a list of the function of the three different user controls on the stand. The numbers correspond to the figures above.

1. Grid Status

Displays the current status of the replaceable grids (see section 'Working with Grids' for details).

2. Error /Crash / Collision Messages

On the LCD monitor, the error message field displays an icon and a textual error message in case of collision, a problem with the motor drives or the internal communication of the stand.

The detector side keypad indicates the collision (proximity) and the crash conditions with flashing red lights.

4. Setup and Calibration

The Setup button enters the setup / calibration mode. These password protected operating modes are intended to be accessed by service personnel only. Refer to the *Installation Manual* for details.

5. Numerical Position Indicators

These numeric fields display the current position of the stand. The numbers may appear with different colors:

- White color indicates that the motor drive is healthy and the motor is not running.
- Yellow color means that the motor is running or the brake is manually released.
- When the stand is in an end position, the respective number will be red.

6. / 13. Move Entire Arm Up or Down

These buttons move the arm detector and tube vertically.

- On detector side keypad and LCD touch screen: when in collimator shutter mode, these keys open and close the vertical beam limiting shutters (only available with automatic motorized collimator option).

7. / 12. Compress or Expand (Decrease or Increase) SID

Adjust the SID for the desired film-focus distance. The value is displayed on the red LED display of the arm and on the LCD display.

- On detector side keypad and LCD touch screen: when in collimator shutter mode, these keys open and close the horizontal beam limiting shutters (only available with automatic motorized collimator option).

8. / 9. Flat Panel Detector Tilt

Adjust the detector tilt for oblique exposures.

10. / 11. Rotate Arm

Rotate the arm e.g. between upright and table positions.

14. Sticky Positions ON / OFF (optional)

The sticky position mode offers automatic and accurate positioning around the 0 / 90 degree angles when enabled (the button is green).

15. Collimator Light (Requires Compatible Beam Limiting Device)

These buttons activate the light field of the beam limiting device. It's useful when checking the light field at the patient or when the collimator pushbutton is not easy to access.

16. Slow (Precise) Positioning

For precise positioning and small movements, press the SLOW button **on the remote** while

pressing one of the 8 movement buttons (vertical, SID, arm rotation and detector tilt). This button can also be used to slow down the movement at the end of the positioning.

On the touch screen and the keypad (unlike on the remote controller), this button toggles its state when pressed. Green button color indicates slow speed. Slow speed remains selected as long as the button background is green.



WARNING!

During the precise positioning (when holding down the **SLOW** button), the **proximity sensors are intentionally disabled**. This makes it possible to get very close (closer than the clearance range) to the table/patient etc.

17. Move to APR Position

Depending on configuration, this button may have one of the following functions:

- Pressing this button will initiate the automatic positioning for the selected preset position or the APR position received from a compatible digital acquisition workstation. To stop (cancel) the positioning, press the STOP button, or press one of the remote / keypad / LCD movement buttons.
- On the detector side keypad, this button also enters collimator shutter adjustment mode.

Detector side keypad function	LED indication	Vertical movement keys	Horizontal movement keys
Normal operation	LED off	Move arm	Change SID
Manual shutter override	LED flashing	Vertical shutter adjustment	Horizontal shutter adjustment

18. STOP (Cancel All Movements) / Bucky Grid Frame Service Position

The STOP button immediately stops a previously initiated positioning in case of potential danger or obstacle.

In addition, if the Z-Motion stand is equipped with the Bucky (oscillating grid) option, pressing and holding the STOP button on the detector holder keypad for 2 seconds moves the grid frame in and out of service position (for maintenance purposes only – refer to *Z-Motion Technical Manual*).

19. Save Current Position to Selected Preset

The SAVE button can be used to memorize a different position for the selected (highlighted) preset. If an automatic collimator is installed, the shutter positions are also saved.

20. Preset Positions

There are a total of 6 preset positions for accessing the most frequently used projections. The first three (marked P1-3) correspond to the P1/P2/P3 buttons on the remote controller.

21. Power On / Movement Indicator

The steady green light on the keypad indicates the stand is powered up. The green light is

flashing, when the stand is moving in any direction.

22. Battery Low / Charging Indicator Light (Remote Controller)

A red light when pressing the remote keys indicates that the batteries are depleted or charge is getting low. **Recharge the batteries as soon as possible.**

The yellow light informs about the charging process:

- Solid yellow light indicates that the batteries are charged and the remote controller is ready for use.
- Blinking yellow light means that the charging is in progress.

23. Connection Status Light (Remote Controller)

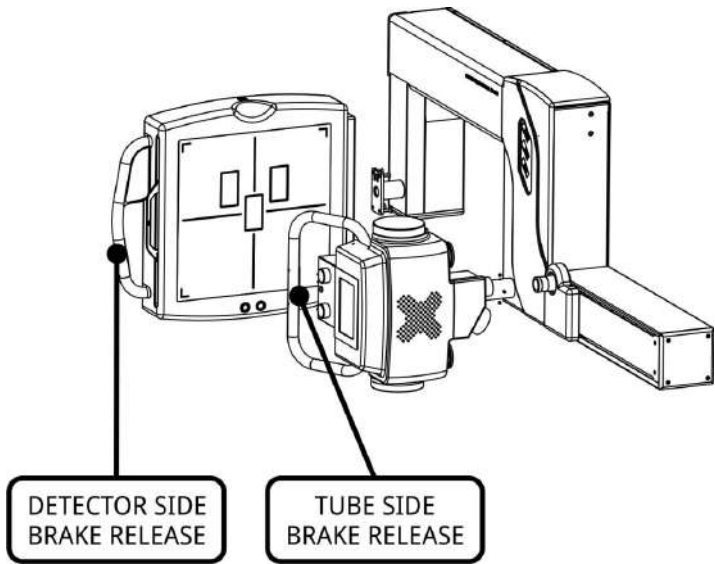
When the blue light is on for a few seconds, a connection is being established with the stand. Rapid blinking blue light while depressing one of the buttons indicates communications between the remote and the stand.

24. Collimator Light Field Indicator (Automatic Collimator Option Only)

When equipped with automatic motorized collimator, a rectangular area indicates the current light field size (the yellow area corresponds to the approximate light / x-ray field). A numeric (cm) indication is also provided (e.g. 18x24).

5.2.5 MANUAL BRAKE RELEASE

The arm is counterbalanced in all operating positions. This makes it possible by quickly adjusting the detector and tube positions manually (without the motors) by using one or both of the brake release switches. The switches are located in the blue handles on the detector housing and the tube mount:



The release of each brake release can be assigned to either:

- only the detector side brake release is pressed,
- only the tube side brake release is pressed,
- both brake release switches are pressed.

The default configuration:	SID brake	Arm rotation brake	Vertical brake
Tube side switch pressed	RELEASED		RELEASED
Detector side switch pressed		RELEASED	
Both switches pressed simultaneously	RELEASED	RELEASED	RELEASED

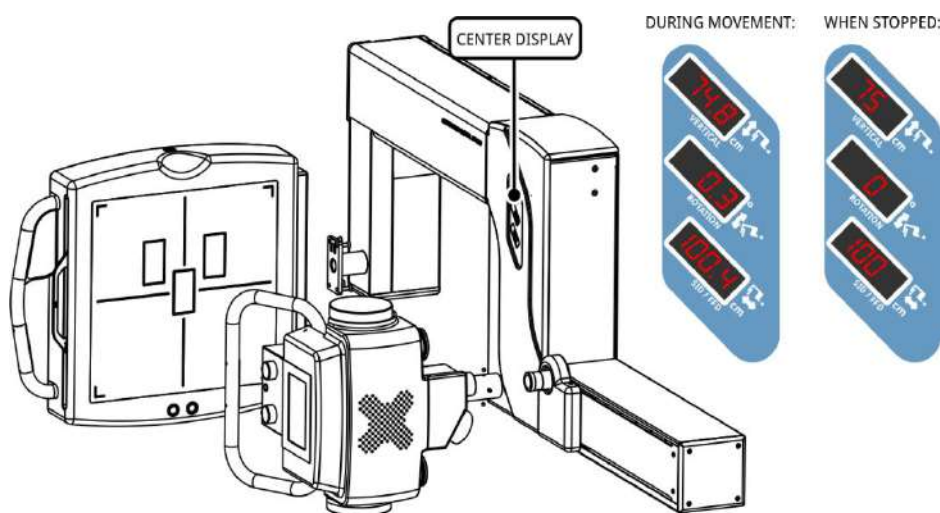
To change the default configuration to suit your application (e.g. primarily chest procedures), please consult the Technical Manual or call your service provider.

5.2.6 CENTER DISPLAY

The center part arm is equipped with a digital display that displays the following parameters at all times:

- vertical position (cm or inches),
- arm rotation (degrees),
- SID (film-focus distance, cm or inches).

The display is mounted in 45 degrees to allow readability in all positions.



The display shows round cm / inch and degree values when the motors are stopped. During positioning, the values are displayed with 1 decimal point accuracy to allow precise adjustment.

The unit of linear distances can be set to **imperial or metric** (cm or inch) in setup mode (refer to *Technical Manual*). The same units will be used on the center display as well as the LCD touch screen.

5.2.7 BUZZER / AUDIBLE SIGNALS

The stand includes a buzzer in the detector holder to provide:

- general error signals
- collision / crash error signals
- grid type mismatch warning

5.3 POSITIONING

5.3.1 PRECAUTIONS

Although the stand is designed to prevent collisions in most cases and to be as safe as possible should a collision happen, **the following must be observed when using the equipment:**



WARNING!

Before and during adjustment of the moving parts, **make sure there is no obstruction** in the way (e.g. wheelchair, table, floor, etc.) and patients and operators are in a safe distance of the movement range.



WARNING!

Please note that when adjusting the SID (FFD), **both the detector and the X-ray tube will move** due to the double telescope arm mechanism.



WARNING!

When a collision happens, use the **STOP** button on the remote controller or on the touch screen to stop movement. You can also press the **brake release** switch(es) and manually move the stand away from the person or obstacle.



WARNING!

If necessary, an **audible warning** sound may be emitted. This feature can be set during installation. Please consult the Technical Manual or call service.



WARNING!

During the precise positioning (when holding down the **SLOW** button), the **proximity sensors are intentionally disabled**. This makes it possible to get very close (closer than the clearance range) to the table/patient etc.



WARNING!

The detector holder of the Z-Motion may contain cooling fans when used with certain flat panel detectors (e.g. Varian PaxScan 4343R). Make sure the air intake openings at the back of the detector holder are never covered.

Hot air may escape at the back of the detector holder – make patient aware if necessary.



WARNING!

When initiating **manual movement**, grab the handles firmly and **be prepared to immediately release the brake release switch** if the equipment feels unbalanced.

The Z-Motion stand should be balanced in all positions. Call for service if in doubt.



WARNING!

Make sure that the **brake of the portable table (Z-Table) is activated** when loading the patient on the table (red end of treadle is down).

The center display and the LCD screen show the numerical values of the current position. To stop the motion at any time, press the STOP button on the remote controller or on the touch screen.

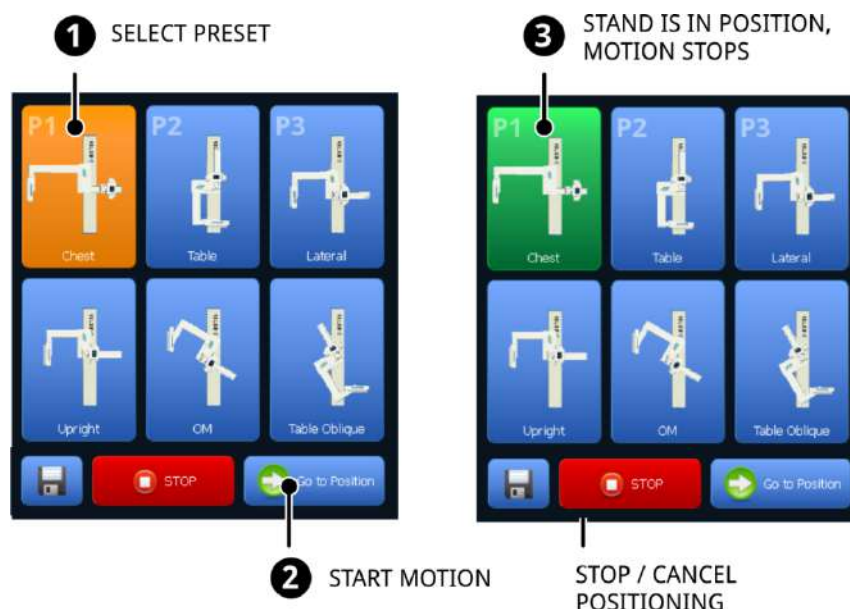
5.3.2 USING THE PRESET POSITIONS

The easiest way to use the Z-Motion stand is through the preset positions. On the LCD touch screen, 6 different positions can be saved and selected. However, on the remote controller, only three positions can be accessed. The first 3 presets (upper row) on the LCD display correspond to the three presets on the remote.

SELECTING A PRESET POSITION FROM THE LCD TOUCH SCREEN

From the LCD touch screen, it is possible to select any of the 6 presets.

1. Press the button with the desired position. The button will be displayed with orange background (except when the current position is the same as that of the button).
2. To start positioning, press the **"Go to position"** button.
3. When the stand is in position, movement stops and the color of the button will change to green.



If the stand is moved out of a previously set position, the color of the button will change to orange. Similarly, if the stand is moved manually to the selected preset position, the button color will change back to green.

SELECTING A PRESET POSITION FROM THE REMOTE CONTROLLER

To select a preset position from the remote, press the desired preset button (P1, P2 or P3) **momentarily**. The stand starts the positioning movement. If the remote is in power save mode, the button may have to be pressed again after the Bluetooth connection has established.

The color of the selected preset position on the screen will be green when the position is reached and orange while moving or when moved out of position.

Note: It is recommended to save the 3 most frequently used positions to programs 1 through 3 so that they would be available on both the remote controller and the touch screen.

HOW TO STOP THE POSITIONING MOVEMENT

To cancel the movement at any time during positioning, press **STOP** (or one of the remote controller buttons, whichever is quicker or safer).

5.3.3 MOTORIZED POSITIONING TO ANY POSITION

For motorized fine adjustments of the preset positions (e.g. setting the height for chest exposures) or to set a position not covered by the presets, use the arrow buttons on the remote control or the touch screen.

1. Press and hold the button that corresponds to the desired direction. On the remote, more than one direction can be pressed simultaneously for quicker adjustment (except opposite directions).
2. The respective motion stops when the button is released.

Please note that the motion is stopped with a slight delay after the button is released. For precise positioning, use the **SLOW** button at the end of the travel.

5.3.4 MANUAL POSITIONING BY HAND

Occasionally, it may be easier or faster to adjust the position by hand.

1. Press the brake release switch(es) that is/are associated with the desired direction. For example, if both the SID and the arm rotation need to be adjusted, grab both handles and press both brake release switches (depending on configuration).
2. When in position, release the switch(es).

Please note that for safety reasons, the buttons on the remote controller and on the touch screen display have no effect when the brakes are manually released.



CAUTION!

The arm is counterbalanced in the entire range of the motion. However, always use a firm grip when operating the manual brake release and be prepared in the event the arm would start moving unexpectedly.

Usage or absence of the grid may slightly affect the balance of the arm.

5.3.5 STICKY POSITIONS MODE (OPTIONAL)

When rotating the arm by hand or using the motors, in some cases the position (angle) may be difficult to set precisely to 90 or 0 degrees. If enabled on the LCD touch screen, the convenient **Sticky Positions** function will automatically rotate the arm into **0 or 90 degree** position after moving the arm in the approximate angle.



This feature is available for the **-30 / 0 +30 degree detector tilt positions** as well.

5.3.6 EXPOSURE INTERLOCK

The stand provides an optional **exposure interlock signal** which may or may not be connected to the X-ray generator.

When connected, an open relay contact prevents exposures:

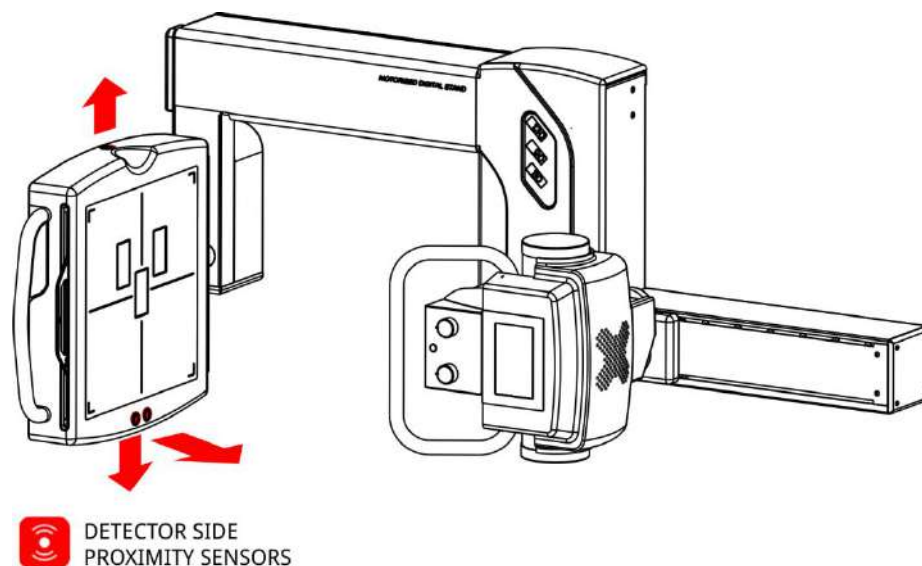
- During any type of movement,
- The wrong type of grid is inserted in the detector cabinet.

5.3.7 COLLISIONS AND CRASHES

SPATIAL AWARENESS

The stand will not let driving the detector or the tube in the floor or the ceiling during motorized movements. The computer inside the stand is continuously monitoring the outermost points of the arm, detector and tube and stops if a collision is imminent. A warning sound indicates the proximity of the floor or ceiling.

PROXIMITY SENSORS

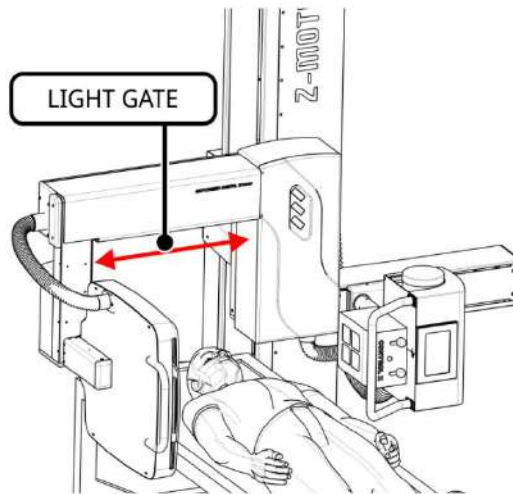


The proximity sensors are disabled during precise positioning (when the SLOW button is held down) to allow positioning to objects / patient as close as possible.

The detector holder includes four optical proximity sensors to help prevent collisions with objects and persons in three directions. When activated, any motion that would cause collision with the obstruction is disabled. A warning sound indicates the proximity of the obstruction.

Note: The sensor operation (sensing distance) may vary depending on the reflecting surface and the relative position of the object or person in front of the sensor.

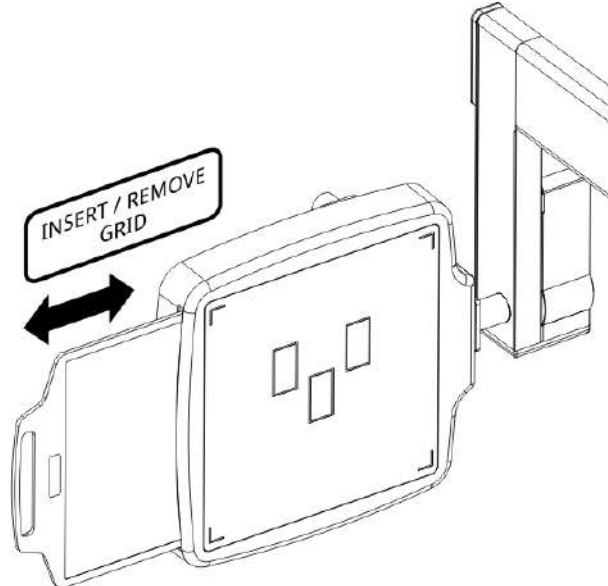
LATERAL VIEW PATIENT SENSOR



5.4 WORKING WITH GRIDS

The stand can be used to perform a wide range of procedures due to its long SID travel of approximately 100 to 200 cm (40" to 72"). Because of the wide SID range, the stand is shipped with to removable / interchangeable focused grids.

Please note that the stand is intended to be used with the grid inside the grid cabinet for optimal mechanical performance and image quality by reducing scattered radiation. When the grid is removed, the arm will become slightly unbalanced.



If your Z-Motion stand features a Bucky (oscillating grid) option, use the lever under the grid slot to eject the grid.

5.4.1 SELECTING THE GRID TYPE

For exposures up to **105 cm** focal distance, use the short grid. For longer focal distance, insert the long grid. The grid frames are marked according to the focal length.

Symbol on LCD touch screen and grid frame	Symbol on keypad	Exposure focal length
		approx. 100 – 105 cm (short grid)
		approx. 105 – 200 cm (long grid)

5.4.2 GRID TYPE SENSING

The grid type is automatically detected by the stand. If the wrong type is inserted, the stand

5.5 PATIENT POSITIONING

The patient positioning is performed depending on the procedure and the available accessories.

In general, try to position the patient (body part) as close to the detector as possible to minimize magnifying and optical distortion on the image.



CAUTION!

Always use patient / operator personal protective accessories as needed to prevent unnecessary irradiation.



CAUTION!

Make sure that patient and operator is out of the way when adjusting the position of the stand. Exercise extreme caution when making fine adjustment with the patient in the exposure position.

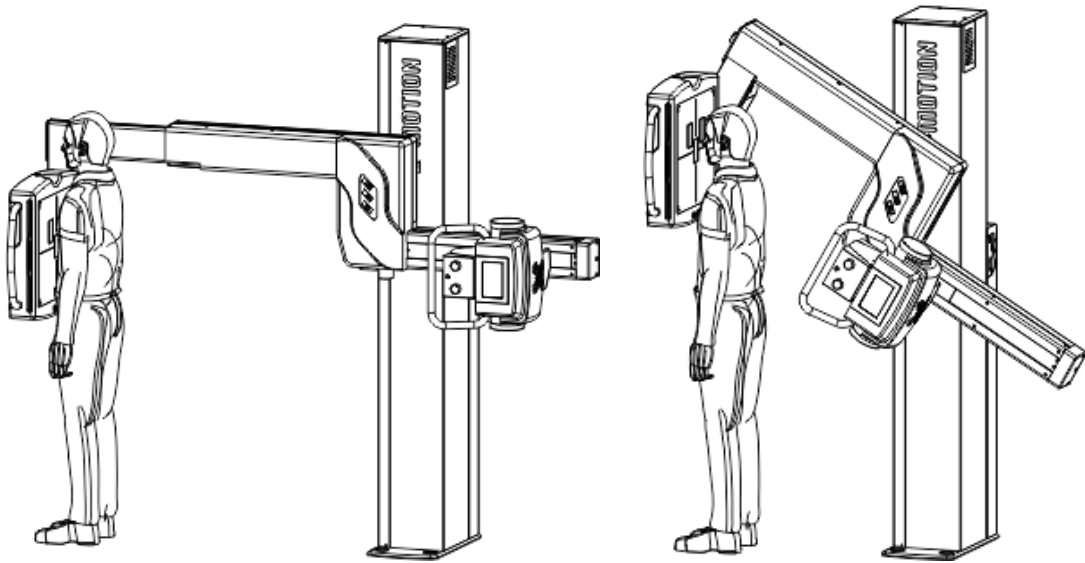
Always inform the patient of the possible movements before operating the stand.



CAUTION!

Be aware that during SID adjustment, both the detector side and the tube side will move.

5.5.1 UPRIGHT EXPOSURES



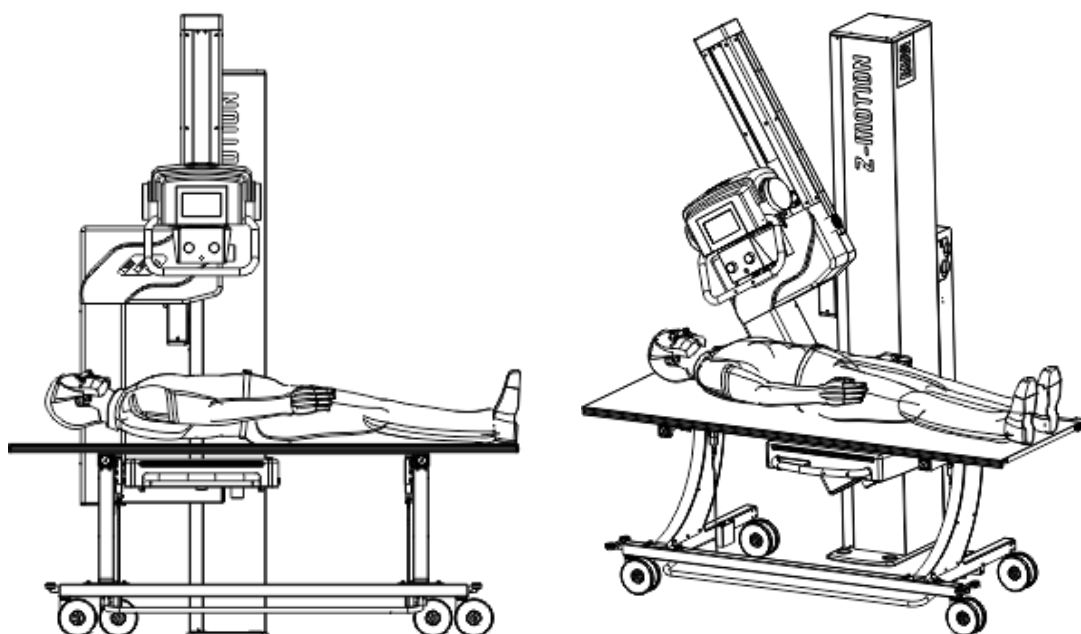
During upright exposures, the patient stands against the grid cabinet, usually facing the detector (AP projection) or standing next to it (lateral views).

For upright procedures, the height of the imager must be adjusted for the patient's height.

5.5.2 TABLE EXPOSURES

When equipped with a portable trolley table or when using the stand with a gurney, position the stand first with the table or gurney and the patient out of the motion range of the stand. These exposures are generally taken at around 100 cm (40") SID.

1. Make sure the right grid is inserted.
2. Move the stand into position and adjust the height of the detector so that the table or gurney will fit above it.
3. Position the patient by rolling the table or gurney above the detector.
4. Adjust the arm height so that the detector is as close to the bottom of the table as possible.
5. Make final adjustments using the collimator light and the table.

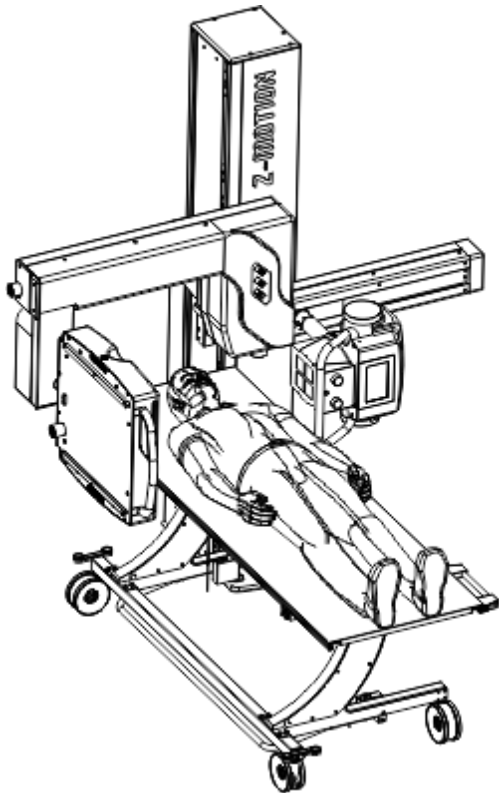


Please note that using a preset position provides for quick and easy table positioning.

5.5.3 LATERAL TABLE EXPOSURES

The short minimum SID of the stand provides for excellent lateral view capabilities. Again, position the stand first with the table or gurney and the patient out of the motion range of the stand. The lateral exposures are generally taken below 110 cm (44") SID.

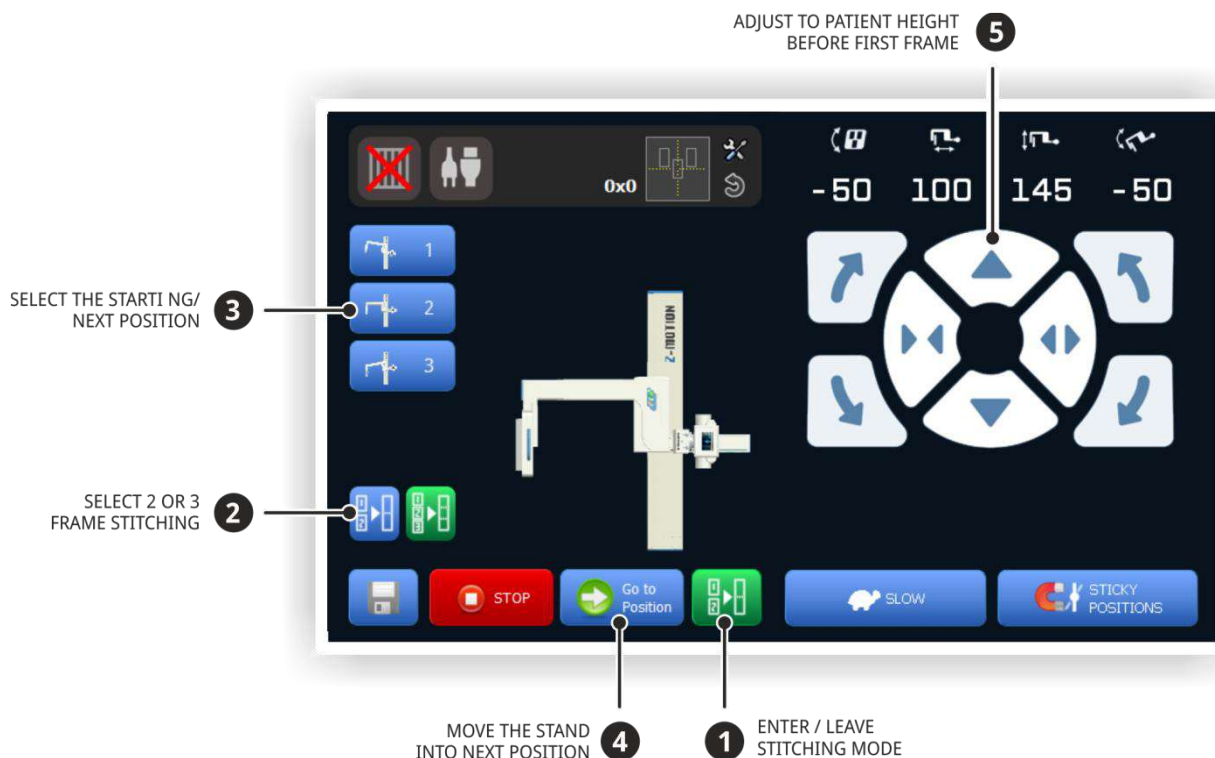
1. Make sure the right grid is inserted.
2. Move the stand into position and adjust the height of the detector so that the table or gurney will safely below the detector and collimator.
3. Position the patient by rolling the table or gurney between the detector and the tube.
4. Adjust the detector height so that the detector is at the desired position for the lateral view.
5. Make final adjustments using the collimator light and the table.



5.5.4 STITCH ASSIST MODE (OPTIONAL)

In upright position, the stand can be used for taking full-spine or other multi-frame procedures, where the individual images will be stitched together during image processing.

The following LCD controls can be used for the stitch assist mode (3-frame stitching mode shown):



1. Enter the stitching mode using the stitching button on the LCD (only available if the stitching mode is enabled).
2. Select 2 or 3 frame operating mode.
3. Select the starting frame (stitching can be performed top-down or bottom-up). The selected position will be highlighted with orange color.
4. Move the stand into the first frame position by pressing the **Go to Position** button. The stand moves into position and the corresponding button will be highlighted with green color when positioning is completed.
5. Adjust stand to patient height using any of the motorized vertical movement controls. **Make sure that the collimator is open enough to cover the image area and the overlap for the stitching.** Note that when using an automatic collimator, the collimator is opened to full frame.
6. Take first exposure.
7. Select the next frame then move the stand into position for the next exposure(s).
8. When all the frames are completed, turn off the stitching function using the stitching button on the LCD to allow for positioning the next patient / procedure.

**WARNING!**

The stitching offset (vertical movement to the next position) is set up automatically to allow the required overlap between the exposures matching the detector size. Make sure that the collimator is adjusted to radiate the overlap area.

**CAUTION!**

To allow precise positioning (closely behind a stitching patient stand), the proximity sensors will be disabled during the stitching procedure.

Please note that you may have to prepare the acquisition software before taking the frames. Also, after taking the images, the manual or automatic stitching is performed by the acquisition software (refer to the corresponding manual for details).

5.5.5 OTHER PROCEDURES

The very low minimum focus-floor distance makes the stand ideal for lower extremity exposures, like ankle and knee procedures.

The flexible positioning options are also useful for working with patients in wheelchairs.

5.6 TAKING EXPOSURES

After positioning and selecting the right exposure parameters and the generator the system is ready to take an exposure. Press the 2-step exposure handswitch. The first step of the switch starts the preparation sequence to preheat the tube filament and rotate the anode. Once the preparation is ready, the READY SYMBOL will activate on the console. Any final positioning (e.g. instructing the patient to hold breath) should be done at this time.

Press the second step of the exposure switch to take an exposure. During the exposure, the yellow exposure symbol will light up on the generator console and an audible signal will also be heard. **Make sure you do not release the exposure switch prematurely!**

After the exposure, the measured feedback values and a termination (or error) message will be displayed on the generator console. The message may remain on display until you press a key on the console or briefly press the preparation switch.

5.7 ADJUSTING BEAM DIRECTION / SIZE AND THE GRID CABINET

5.7.1 EXPOSURES ON THE BUILT-IN DETECTOR / IMAGER

In general, the X-ray beam and the center of the detector are always centered. There may be small differences in the center of the X-ray beam and the detector depending on the arm position. This is normal and does not affect the quality of the image.

The maximum extent of the irradiated area is indicated with marked corners on the detector holder assembly. The AEC detector fields are also marked with corresponding rectangles.



CAUTION!

Never open the collimator to an irradiated area **larger than the maximum extent** marked on the detector holder. The excess radiation will not show on the image and results in **unnecessary patient load**.

1. Before positioning, check the grid inside the grid cabinet slot. After positioning it may be more difficult to access it.
2. To position the tube and the detector, use the **preset positions, motorized positioning** or the **manual positioning** (by hand). Preset or motorized positioning is recommended in most situations. The motors provide smooth, effortless positioning. For small, controlled adjustments use the slow buttons or the manual movements.
3. Before taking an exposure, always check the X-ray beam coverage using the beam limiting device. Since the center of the beam is fixed, make sure that the center of the organ / body part being examined is at the center of the detector.
4. For additional beam limitation, you may want to rotate the beam limiting device around its axis, to better fit the examined area.

5.7.2 COLLIMATOR SHUTTER CONTROL (WITH AUTOMATIC COLLIMATOR OPTION ONLY)

The Z-Motion stand may be optionally equipped with a motorized automatic collimator. The automatic collimator provides the following additional functionality:

- Automatic limitation of the light / x-ray field to the flat panel size (to prevent x-raying tissue outside the imager area)
- Automatic compensation (adjustment) of the light field when changing the SID
- Manual shutter control from the detector side keypad of the LCD touch screen
- Saving the shutter positions for the 6 preset positions
- Light field size indication on the LCD touch screen

SAVING THE LIGHT FIELD SIZE

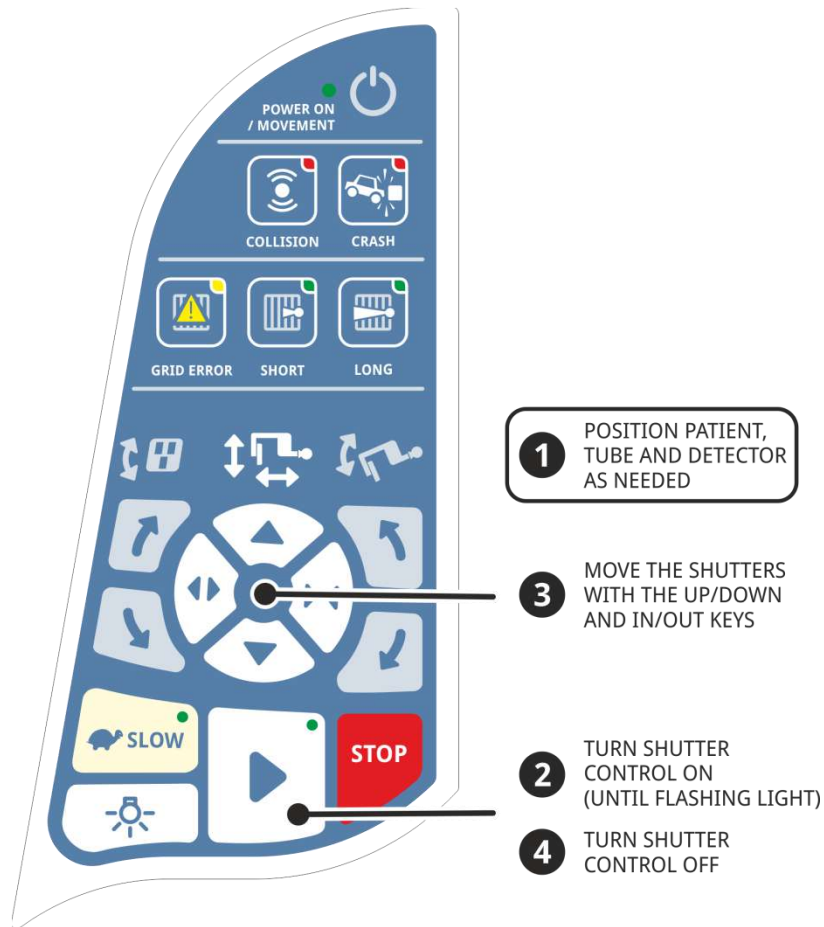
The light field size (shutter positions) is automatically saved whenever a preset position is saved.

Please note that the light field rotation can be operated manually (there is no motorized or automatic function for light field rotation).

ADJUSTING (REDUCING) THE SHUTTERS / LIGHT FIELD

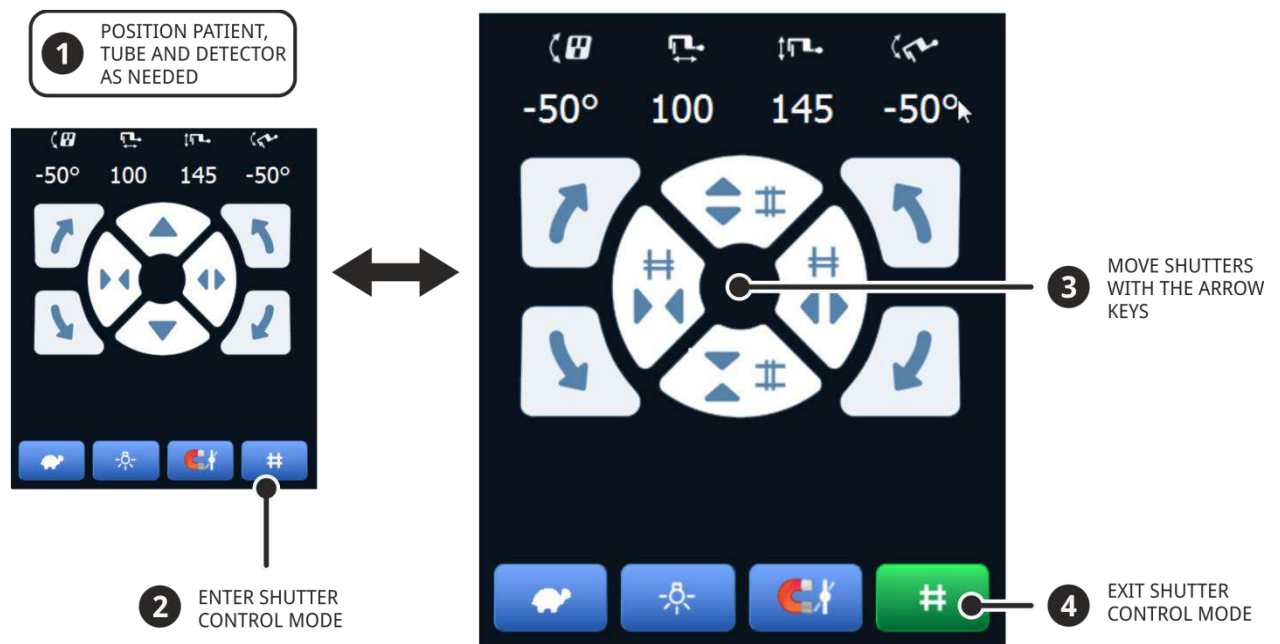
To adjust the light field from the detector side keypad, use the arrow and the motion control keys.

1. Position the stand as necessary using the preset positions or manually. Check (activate) the light field.
2. Press the arrow key until the LED next to the key is flashing.
3. Move the shutters as required using the four arrow keys in the center. Also, adjust light field rotation manually if necessary.
4. When finished, turn off the shutter control mode by pressing the arrow key until the LED next to the key turns off to allow arm / SID motion control.



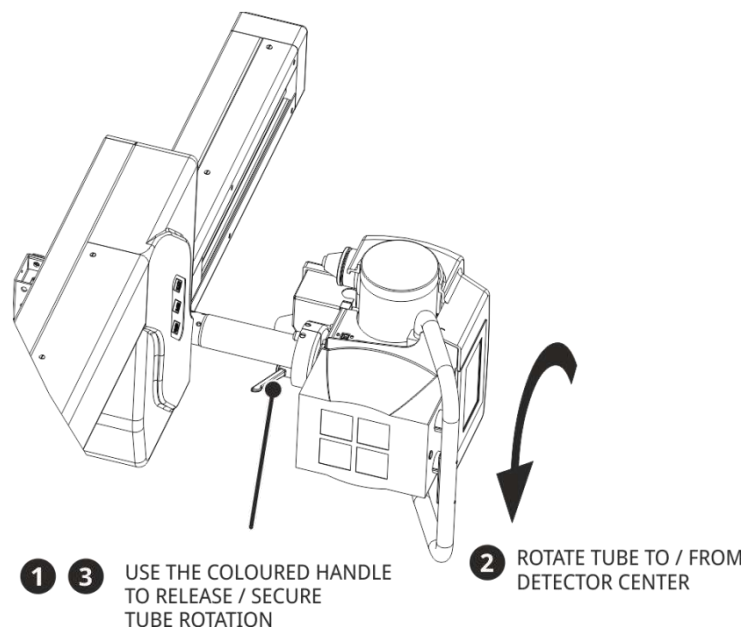
To adjust the light field from the LCD touch screen, use the shutter control key and the motion control keys.

- 1.Position the stand as necessary using the preset positions or manually. Check (activate) the light field.
- 2.Press the shutter control key (#) on the LCD touch screen. The background of the key turns to green and the motion control key icons change to shutter control icons (see image below).
- 3.Move the shutters as required using the four arrow keys in the center. Also, adjust light field rotation manually if necessary.
- 4.When finished, turn off the shutter control mode by pressing the shutter control key (#) on the LCD.

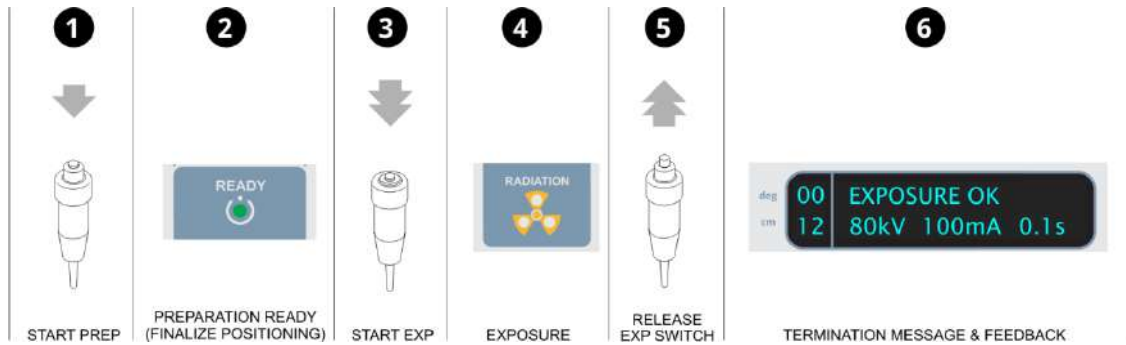


5.7.3 EXPOSURE ON EXTERNAL IMAGERS

The X-ray tube can be manually rotated away from the detector up to 90 degrees for special procedures if additional portable flat panel or CR / film cassettes are also available. **Please note that the LCD screen rotation does not follow the manual tube rotation.**



1. To rotate the tube, **grab and turn the handle** behind the X-ray tube as indicated. It may be necessary to lift the handle and move its position for easier access.
2. **Turn the tube** into the desired position (usually 90 degrees).
3. After the tube is adjusted, **turn the handle in the opposite direction** and make sure that it is securely fastened. There are detents at 0 and 90 degrees to help adjustment.



For faster processing and if there is no need for positioning before the exposure, you may press both steps of the exposure switch immediately.

Note: Please see generator for details and exact messages / procedure. Drawing above is an example only and your generator may appear different.



ATTENTION! The exposure sequence may be interrupted immediately at any time in case of an emergency, patient movement or if other problem occurs by releasing the exposure push-button.

If the system is equipped with a DAP (Dose Area Product) meter, the collimator exit dose is measured and can be recorded in one of two ways:

- automatically if the DAP is compatible with the image acquisition system,
- manually if using a DAP with built-in or remote display.

Refer to the image acquisition user manual for further details.

6 MAINTENANCE

The stand requires regular maintenance to ensure safe operation and increase the operating life of the equipment. The operator shall check the equipment for functional defects or any deviation from the normal operation. In case of a defect or deviation the unit shall be turned off and a professional service company shall be notified. The equipment shall not be used until the defect or deviation is repaired.

6.1 DAILY ROUTINE CHECK

Check the operating elements for proper functioning, including the workstation (including generator control) and the Z-Motion stand.

6.2 WEEKLY CHECK

All bearing tracks of the stand and the table have to be clean for proper and easy operation. Use a lint-free cloth to clean the equipment.

6.3 PERIODIC MAINTENANCE

To ensure safe and trouble free operation, the Z-Motion system shall be checked by a professional service company annually.



ATTENTION!

Any failing component, which effects the safe operation of the equipment, shall be replaced with original spare parts.

Materials resisting to corrosion have been applied. In order to reduce friction and wear they are lubricated by the factory, no re-lubrication is required. In case of renewal only grease with a molybdenum disulfide additive or fluorized graphite can be used.

1. Yearly check of the stand:

- Movements are smooth and there no unusual sound or jams while in motion
- X-ray beam is centered in different positions
- Position display is accurate
- Touch screen operation is accurate
- Safety features are working (sensors, clearances, crash detection)
- Rope is intact and is without any damage
- Perform the Acceptance test (see section 7 of this document)

2. It is recommended to replace the battery of the remote controller when worn out (depending on usage). For replacement, contact your service representative or the manufacturer.

6.4 CALIBRATION

Some of the components require periodic calibration:

- If the annual tests in section PERIODIC MAINTENANCE indicate inaccurate positioning, the Z-motion stand must be calibrated using the service application.
- The X-ray tube must be calibrated every 12 months to compensate for tube aging and ensure accurate operation (refer to the X-ray generator technical manual for calibration instructions)
- If the system is shipped with a DAP (dose area product) meter, the DAP meter is factory calibrated. The calibration certificate is included in the DAP packaging. Recommended frequency of recalibration is 5 years and must be carried out based on the included DAP user manual.

6.5 CLEANING AND DISINFECTING

The Z-Motion system does not require sterilization.

It is recommended to clean exterior surfaces, such as the panel top cover, the brake release handles, the remote controller and the tabletop from time to time. The following section describes the disinfection methods for external surfaces of the Z-Motion stand in hospitals / health care facilities.

	Only the disinfection and cleaning procedures listed in this manual for hospitals and healthcare facilities may be applied for the Z-Motion system. Other cleaning and disinfection procedures not mentioned may potentially affect the performance of the unit. Follow all instructions provided by the disinfection product manufacturer. Failure to follow these instructions or the manufacturer's instructions, or use of cleaning and disinfecting products not listed in this manual, may affect the performance of the product. Only authorized persons should clean exterior surfaces between procedures on patients.
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Follow the steps below to do this:

1. To avoid electric shock, always turn off the power before cleaning the device.
1. Clean the outer surfaces of the device regularly.
2. Use one of the following two products to disinfect all external surfaces of the device.
 - a. DisCide Ultra disinfecting wipes
 - b. Cloth moistened with chlorine bleach (8% sodium hypochlorite) and water (1:10 ratio).
3. Clean corners, crevices and detector holder housings especially thoroughly.
4. Allow the unit and humidifier to air dry completely before reconnecting both to the mains and switching on.

The use of disinfecting spray is not recommended, because it can get inside the equipment.

6.6 ELECTRICAL MAINTENANCE

There are only professionally serviceable components inside the Z-Motion stand.



WARNING!

For continued protection and to minimize risk of fire, replace fuses only with identical rating and type.

The following is a list of replaceable fuses inside the equipment:

CXBPM2 / F2	6.3A @ 250V
CXMCT3 / F1	6.3A @ 250V
CXTSD1 / F1	3.15A @ 250V
CXTSD1 / F3	3.15A @ 250V
CXPWS1 / F1	500mA @ 250V
CXPWS1 / F2	2A @ 250V
CXPWS1 / F3	500mA @ 250V

Recommended type: SIBA No. 179020

Check / visually inspect the connections and the conditions of the interconnecting cables every year and replace the cable if necessary only with the same type / ratings. Contact the manufacturer for custom made Z-Motion cables (refer to wiring diagram D-2145).

7 ACCEPTANCE TEST



WARNING!

The Acceptance Test shall be performed after the installation is completed, before putting the system in service.



WARNING!

For test requiring producing X-rays, also refer to generator's maintenance manual / acceptance test.

7.1 INTRODUCTION

The acceptance test shall be performed on a fully assembled and functional Z-Motion system.

The acceptance testing verifies that the Z-Motion stand / system generator is performing according to requirement that the manufacturer specified and its essential performance requirements are met. It shall be done after the generator is installed and calibrated or when components are replaced which may affect the beam centering / mechanical safety.

These components are:

- X-ray tube (tube assembly)
- Counterbalance spring and associated mechanical components
- Distance / angle measuring potentiometers
- Motor drive circuit boards
- Infrared safety sensors
- Keypads (detector side or remote controller)
- Software



WARNING!

During the following process X-ray may be produced. Take all appropriate safety precautions to protect personnel from irradiation!



WARNING!

Always ensure that the equipment under test and all associated test equipment is properly grounded. Ensure that the high voltage cables are intact / undamaged and properly connected before attempting exposures!

7.2 TESTING THE MANUAL AND MOTORIZED MOTION

- Enter the Setup Menu on the LCD display.
- Select tab 'Calibration' and press the CAL ON button. Perform the following test once the button color changed to green:

Motorized SID movement is possible from the LCD touch screen	☐
Motorized SID movement is possible from the remote controller (if applicable)	☐
Motorized SID movement is possible from the detector side keypad	☐
Manual SID movement is possible using the brake release switch	☐
Motorized arm rotation is possible from the LCD touch screen	☐
Motorized arm rotation is possible from the remote controller (if applicable)	☐
Motorized arm rotation is possible from the detector side keypad	☐
Manual arm rotation is possible using the brake release switch	☐
Motorized vertical arm movement is possible from the LCD touch screen	☐
Motorized vertical arm movement is possible from the remote controller (if applicable)	☐
Motorized vertical arm movement is possible from the detector side keypad	☐
Manual vertical arm movement is possible using the brake release switch	☐
Motorized detector tilt is possible from the LCD touchscreen	☐
Motorized detector tilt is possible from the remote controller (if applicable)	☐
Motorized detector tilt is possible from the detector side keypad	☐

7.3 MOTION RANGE, TESTING THE END POSITIONS

- Move the SID with the motor drive to one of the mechanical end positions, and then move it to the opposite end.
- Repeat this procedure with the **Arm Rotation** / **Vertical Arm Movement** and the **Detector Tilt** movements as well.
- Press the CAL OFF button
- Compress the SID to 100 cm (using a tape measure)
- Set 100 cm as SID/P1 and press button 'SID Calibration P1'
- Expand the SID to 180 cm (or 200 if feasible) using a tape measure
- Set 18/200 cm as SID/P2 and press button 'SID Calibration P2'
- Set the arm rotation to 90 degrees (beam horizontal) using a calibrated level
- Set 90 degrees cm as ROT/P1 and press button 'ROT Calibration P1'
- Set the arm rotation to 0 degrees (beam vertical) using a calibrated level
- Set 0 degrees cm as ROT/P2 and press button 'ROT Calibration P2'
- Move the arm back to horizontal position

- Move the arm vertically until the center of the T-Carriage is 173 cm from the floor
- Set 173 cm as Vertical/P2 and press button 'Vertical Calibration P2'
- Move the arm down until the center of the T-Carriage is 50 cm from the floor
- Set 50 cm as Vertical/P1 and press button 'Vertical Calibration P1'
- Move the detector TILT into 0 degree (detector is vertical)
- Set 0 degrees as TILT/P1 and press button 'Tilt Calibration P1'
- Move the Z-Arm into 30 degree position
- Set the detector into vertical position
- Set 30 degrees as TILT/P2 and press button 'Tilt Calibration P2'
- Perform the following tests:

SID display is accurate at the end of travel and in the center on both the center display and on the LCD touch screen	☐
Arm rotation display is accurate at the end of travel and in the center on both the center display and on the LCD touch screen	☐
Vertical arm movement display is accurate at the end of travel and in the center on both the center display and on the LCD touch screen	☐
Detector tilt display is accurate at the end of travel and in the center on the LCD touch screen	☐
SID travel minimum position ≤ 100 cm	☐
SID travel minimum position ≥ 180 cm	☐
SID movement stops at both ends of travel	☐
Arm rotation travel minimum position ≤ -30 degrees	☐
Arm rotation minimum position ≥ 120 degrees	☐
Arm rotation movement stops at both ends of travel	☐
Vertical travel minimum position ≤ 45 cm	☐
Vertical travel minimum position ≥ 155 cm	☐
Vertical movement stops at both ends of travel	☐
Detector tilt travel minimum position ≤ -30 degrees	☐
Detector tilt minimum position ≥ 30 degrees	☐
Detector tilt movement stops at both ends of travel	☐

7.4 TESTING THE PRESET (APR) POSITION MOVEMENTS

- Exit Setup Mode using button Close Setup
- Move into the following position:
 - SID = 150 cm
 - ROT = 90 degrees
 - Vertical = 120 cm

- Tilt = -30 degrees
- Select preset position P1 and save the position using button 'Save'
- Move into the following position:
 - SID = 100 cm
 - ROT = 0 degrees
 - Vertical = 100 cm
 - Tilt = 0 degrees
- Select preset position P2 and save the position using button 'Save'
- Select preset position P1 and press 'Go to Position'

The stand moves into the expected position	☐
The position button (P1) changes to green	☐

- Select preset position P2 and press 'Go to Position'

The stand moves into the expected position	☐
The position button (P2) changes to green	☐

7.5 SAFETY FEATURES AND ERROR MESSAGES

- Enter Setup Mode and turn 'Sensors Enable' ON
- Exit Setup Mode
- Move into the following position:
 - SID = 150 cm
 - ROT = 90 degrees
 - Vertical = 120 cm
 - Tilt = -30 degrees

The infrared sensor in the top edge of the detector holder prevents motorized movement towards the floor when holding your palm above it < 5 cm	☐
The infrared sensor in the bottom edge of the detector holder prevents motorized movement towards the floor when holding your palm above it < 5cm	☐
The infrared sensors in the front of the detector holder slows down the motorized SID compression when holding your palm in front of it < 10 cm	☐
The infrared sensors in the front of the detector holder STOPS the motorized SID compression when holding your palm in front of it < 5 cm	☐
Place an obstruction between the light gate / reflector in the inside of the Z-Arm and verify that the motorized vertical movement in down direction is disabled.	☐
Place an obstruction between the light gate / reflector in the inside of the Z-Arm and verify that the motorized arm rotation in counter-clockwise direction is	☐

disabled.	
Set the Z-arm into horizontal beam position (90 degrees). Hold the bottom of the detector holder (but do not cover IR sensor) and start CCW arm rotation. Verify that the motion stops and the message 'CRASH' appears on the LCD display and a warning sound is audible.	□

- Move into the following position:
 - SID = 150 cm
 - ROT = 90 degrees (horizontal)
 - Vertical = 90 cm
 - Tilt = 0 degrees

Start CCW arm rotation and verify that the motion stops before the detector holder hits the floor and the message 'COLLISION' appears on the LCD display along with an audible warning sound.	□
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7.6 GRID DETECTION

- Remove the grid (if there any) from the detector holder.

The NO GRID symbol is displayed on the LCD screen and the detector holder keypad	□
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- Move into the following position:
 - SID = 100 cm
 - ROT = 90 degrees (horizontal)
 - Vertical = 120 cm
 - Tilt = -30 degrees
- Insert the short (34"-44") grid into the grid slot.

The SHORT GRID symbol is displayed on the LCD screen and the detector holder keypad with no error message.	□
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- Change the SID to > 120 cm.

The SHORT GRID symbol is displayed on the LCD screen and the detector holder keypad with the message INSERT LONG GRID along with an audible warning sound	□
---	---

- Insert the long (40"-72") grid into the grid slot.

The LONG GRID symbol is displayed on the LCD screen and the detector holder keypad with no error message.	□
---	---

- Change the SID to 100 cm.

The LONG GRID symbol is displayed on the LCD screen and the detector holder keypad with the message INSERT SHORT GRID along with an audible warning sound	□
---	---

7.7 EXPOSURE INTERLOCK

- Disconnect the exposure interlock cable from the generator and measure in using an Ohm-meter
– OR –
- If the generator can display interrupt status, leave the exposure interrupt cable connected.
- Move into the following position:
 - SID = 100 cm
 - ROT = 90 degrees (horizontal)
 - Vertical = 120 cm
 - Tilt = 0 degrees

With all motions stopped, verify that the exposure interlock output is satisfied (short circuit)	□
Start expanding the SID and verify that the exposure interlock output is active (open circuit)	□

8 ERROR MESSAGES AND TROUBLESHOOTING

8.1 ERROR MESSAGES

The error conditions are displayed on the LCD touch screen with descriptive error messages and symbols. Some error conditions are indicated by audible warning signals (if enabled) to help draw attention to the error condition while positioning the patient.

Symbol	Error Message	Audio signal	Description
	SERIAL COMM ERROR	Medium frequency	Communication broken between the LCD controller and the CAN bridge board inside the stand. Check the serial cables and power supplies.
	VERT MOTOR DRIVE ERROR (e.g.)	Medium frequency	One or more of the motor drive boards are faulty. Might be caused by broken communications or power cable inside the stand or PCB failure.
	*** CRASH ***	Yes, strong, rapid beeps	(1) One of the motions is blocked by an obstruction. (2) The motor drive cannot move because of improper balancing or other internal mechanical problem. The motor stops. Remove the obstruction and check for any damage or injury.
	COLLISION	High pitched beeps	The proximity sensors or the light gate inside the arm detected an obstruction. Motor drive stops. Remove the obstruction. If the problem persists, check the sensor cables (ribbon cables inside detector holder, light gate cable) and the sensor controller board inside the detector holder.
	INSERT LONG GRID	Soft beeps every 3-4 seconds	Short SID grid is detected, but long grid expected based on the SID. Insert the long grid to clear the error.
	INSERT SHORT GRID	Soft beeps every 3-4 seconds	Long SID grid is detected, but short grid expected based on the SID. Insert the short grid to clear the error.
	(N/A)	None	No grid detected or the grid may be inserted reversed.

8.2 STATUS INDICATORS ON THE DETECTOR SIDE KEYPAD

Some of the error conditions and operating modes are indicated on the detector side keypad:

- Grid error (if wrong type of grid inserted)
- Grid status (short or long grid inserted)
- Movement in progress
- Collision / obstruction
- Crash condition

8.3 ERROR CONDITIONS

LCD Off

LCD blank, no reaction to touches

Possible causes:

- Breaker in E-box is off
- Emergency switch on side of the column is off
- 5VDC supply is off
- Broken internal DC power cable
- LCD or controller failure

Remote Controller has no Effect

Nothing happens when remote is operated

Possible causes:

- Stand is not power up
- Remote controller battery is depleted (check for activity of power LED on remote)
- Remote controller is not paired with stand

Cannot Move in a particular Direction

Cannot move the stand in one or more particular directions.

Possible causes:

- Proximity sensors detect an object in the way
- Ceiling or floor clearance has been reached
- Unbalanced stand
- Hardware failure (motor drive, sensors, mechanical jamming etc.)

Cannot Take Exposures

Cannot take X-ray exposures (interlock active).

Possible causes:

- Stand is moving while trying to take an exposure

- There is an error condition
- Wrong grid is inserted

Brakes are Permanently Released

Brakes are released and motorized motion is not possible.

Possible causes:

- Brake release switch is stuck.

No Audio

No warning or touch screen tap sounds.

Possible causes:

- Volume on/off switch has been accidentally pushed while rotating the collimator.

Cannot move to exact position

The rotational movements always moves the arm / detector into 0/90 degrees

Possible causes:

- The Sticky Positions feature is enabled.

Center display goes blank (or only a few digits are displayed)

The position values are visible only on the LCD display.

Possible causes:

- High energy power surge on the power input line.

Motorized and manual movements are still possible and the blank display does not result in any danger to the patient or the equipment.

To display the values again, turn the stand off then back on again.

9 APPENDIX

9.1 ACCESSORIES AND SPARE PARTS

9.1.1 ACCESSORIES SHIPPED WITH THE Z-MOTION STAND

Item	Part No.	Qty	Notes
Drill template	URS/SB	1	
Tube assembly with LCD controller (without X-ray tube and collimator)		1	
Detector holder assembly	URS/400	1	
Detector holder shims		2	
Spare fasteners for covers, etc.		10	
M12 hex socket screws and washers for vertical carriage		3	
Vertical carriage covers	URS/200/4/10;11	3	
Column side cover	URS/100/4	1	
Eye bolts for lifting the column & Z-arm		2	
Floor anchors with M10 bolts (front)	FH II 15/15 SK	2	
Floor anchors with M10 bolts (rear)	TA M10T/25 S	2	
Base plate sunken washers		2	
Base plate bolt covers	URS/100-51	2	
Tube carriage weight plate or axle ring		1	
Spare tube arm weight end piece		1	Optional
Grid with frame for short SID		2	
Grid with frame for long SID		2	
Extra weight blocks for tube arm		2	
Bluetooth remote controller	BR-109	1	Optional
USB A-B cable	(commercially available)	1	Optional
Declaration of Conformity statement		1	
User Manual	D-1165	1	

Notes:

- Depending on system configuration, other system components (X-ray tube, collimator, flat panel detector, etc.) may also be shipped with the stand.

2. Most of the fasteners are preinstalled for worry-free installation.

9.2 Z-MOTION DRAWINGS

Mechanical Drawings	Document
Z-Motion Stand Overall Dimensions	D-1688 (Z-Motion Overall Dimensions)
Z-Motion Stand Column Base (for room preparation)	D-1689 (Z-Motion Column Base)
Electrical Drawings	See separate document

REVISION HISTORY

Revision	Date	Description of Changes	Modified Page(s)
1	July 2010	Original release	Whole document
2	Nov 2010	Updates	Whole document
3	Jan 2011	Detector side controls, remote controller, T carriage mounting, etc.	Entire document
D/R2	May 2011	Stitching function	33
1165/4	Dec 2011	Automatic collimator functions, corrections, drawing and screenshot updates	Several pages
1165/6	Feb 2012	Regulatory updates for version M2	Several pages
1165/10	Feb 2012	M2, input voltage and photo updates	Several pages
1165/13	Jul 2012	Stitching mode related changes	34
		Specification update (tube rotation)	9
		Weight discs changed to weight blocks	32, 45
1165/14	Jul 2012	Bucky and grid related changes	11, 24-26
1165/19	Jan 2013	Styling (font) changes	Whole document
1165/23	Apr 2013	60601-1:2005 updates	Several pages
1165/33	Apr 2014	60601-2:2007 updates	12, 51
1165/35	Apr 2014	1. Combining with the operators' instructions into a single User Manual 2. Added EMC guidance info 3. Removed BT remote charger info	Several
1165/36	May 2014	Added the emergency label info	9
1165/40	Jun 2014	Changed remote controller info / removed references to configuration / calibration	Several
1165/45	Aug 2014	PE mains warning added, environmental specs updated; product label updated	6, 9, 13
1165/47	Aug 2014	ISO 7000-1641 explanation added	10
1165/50	Sep 2014	Added information on calibration	74
1165/53	Mar 2016	Changes to floor space requirement info	21

Revision	Date	Description of Changes	Modified Page(s)
1165/54	Mar 2016	Mfr address updated (CAPA-3461)	1
1165/55	2017.07.07	Notified body changed	1
1165/56	2017.10.17	Product labels updated	9
1165/57	2020.04.03	Logo updated	1
1165/58	2020.12.21	Clarify Z-Motion name (delete M2 after Z-Motion)	whole document
1165/59	2022.01.24	Updated cleaning and disinfecting information	Section 6.5
1165/60	2022.03.10	CAPA-5183: update references of standards and regulations	
1165/61	2022.07.04	Focus-floor distance parameter changed to 410 to 1660 mm (16.15" to 64.8")	Section 3.1
1165/62	2023.01.19	Business structure and label updates	p1, section 2.3