panoramic™
4321 Goshen Road , Fort Wayne, Indiana 46818
(800) 654-2027 | www.pancorp.com

encompass

TECHNICAL MANUAL:
INSTALLATION, CALIBRATION & SERVICING
Model: HF100 - EAGLE

Version 1.4
Approved

CONFIDENTIAL

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1 GENERAL INFORMATION

1.1 DISCLAIMER

The configuration and calibration of the ENCOMPASS Pan Ceph panoramic machine should be done by technicians authorized by Panoramic Corporation, otherwise, warranty will be voided.

During the process of calibration x-ray generation is required in some parts of the procedure. Please notice local regulation. The responsibility of exposure protection is entitled to the installation personnel.

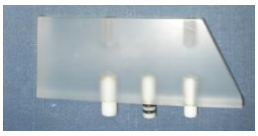
The information available in this material is only for reference. Discretion must be used in the application of the calibration techniques.

For Help, contact Panoramic Corporation Service Department at 1 (800) 654-2027.

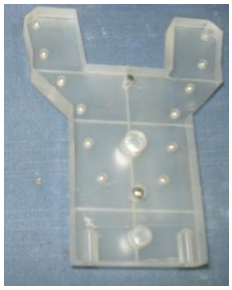
1.2 REQUIRED TOOLS

The following special tools are required during the calibration of the machine:

Figure 1. Equipment used to calibrate the machine.

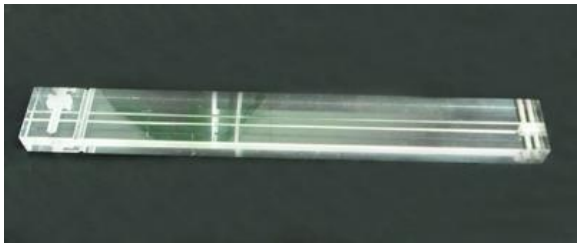


1 2

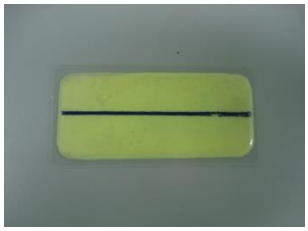


3

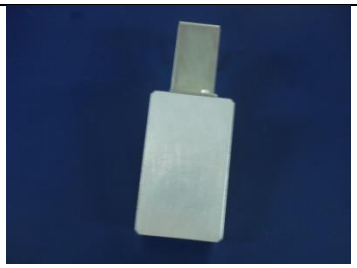
(a) Image Layer Phantom: Support (1), Vertical Positioner (2) and Phantom (3)
P/N 41990-246/3



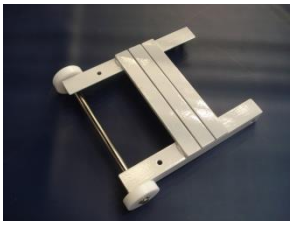
(b) Ruler
P/N 20990-323/4



(c) Fluorescent Tool
P/N 26990-393/6



(d) Aluminum Block
P/N 41990-243/1

 (e) Transportation Tool P/N 41990-243/1	 (f) Ceph calibration Tool P/N 41990-241/7

The following hand tools are required during the calibration of the machine:

Allen wrench 5/16”
Allen wrench 5/32”
Allen wrench 1/4”
Slotted Screwdriver 3/16”x5”
Phillips Screwdriver 3/16”x5”
Double open-end wrench/spanner 1/2 ”
Double open-end wrench/spanner 1 ”
Pistol-grip Drill
Tubehead Communication Verification Tool

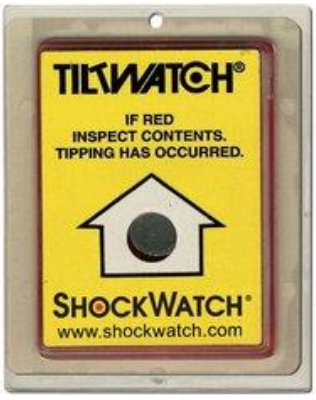
2 MECHANICALLY INSTALLATION

2.1 CHECKING THE SHIPMENT

Before unpacking verify the condition of the transport packages.

Outside the boxes there are two labels that provide evidence of any mishandling. The picture below shows the two labels.

Figure 2 - Monitor labels



"Tiltwatch" label

Shockwatch label

The "Shockwatch" monitor activation indicates an impact beyond the predetermined level. The "Tiltwatch" monitor activation indicates an unacceptable tilting. Both of them are used to monitor cargo in transit. Ensuring your product arrives in its original condition, and at the correct destination.

Before unpacking verify the activation of the monitor labels and if they were activated follow the procedure below for receiving.

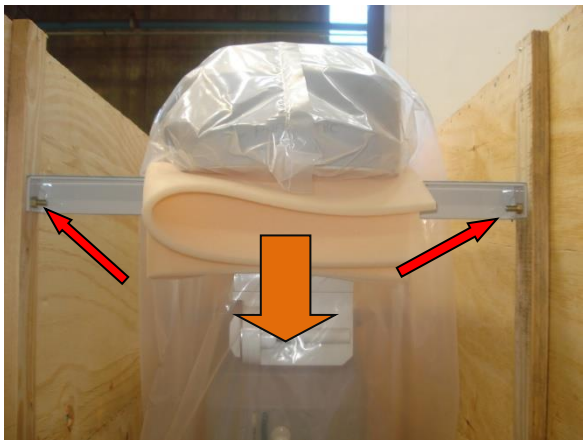
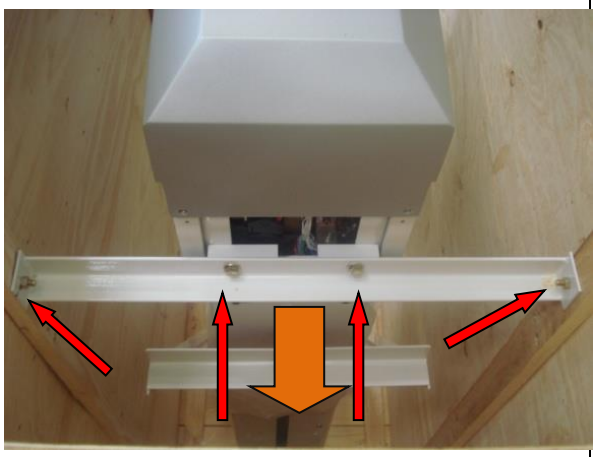
- Please do not refuse to accept shipment.
- An activated (RED) indicator on the label does not mean that damage has occurred. It only indicates that the carton received an impact or was handled above a normally anticipated level. Only an inspection can determine if any damage has occurred.
- If the indicator on the label is RED, please make a notation to that effect on the bill of lading or delivery receipt or document.
- Examine contents immediately for possible damage.
- If damage is discovered, inform carrier immediately and follow normal procedure for a carrier inspection and filing of a concealed damage claim

2.2 UNPACKING

2.2.1 PANORAMIC UNIT

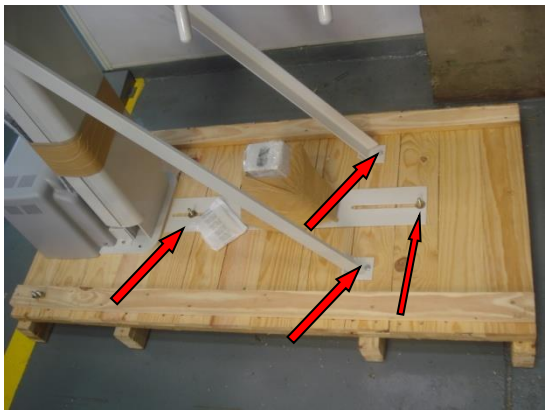
Remove the wood covers as described on the picture below following the sequence.

Figure 3. Unpacking the panoramic unit.

<table>
<tr>
<td> 
Remove Top Panel
(a)</td>
<td> 
Remove Frontal and Back Panel
(b)</td>
</tr>
<tr>
<td> 
Remove Lateral Screws and the front metallic support
(c)</td>
<td> 
Remove Lateral Screws and the back metallic support by removing two screws in the column
(d)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</table>

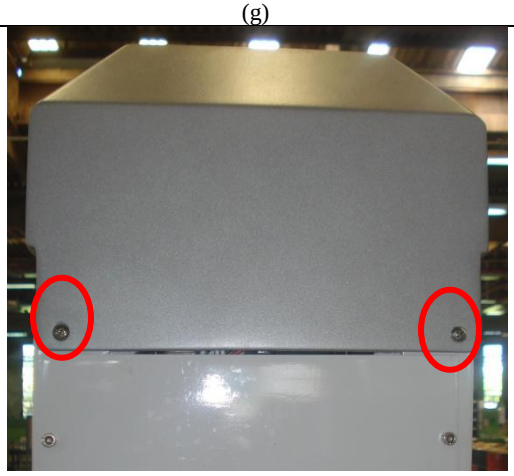
Remove Side Panels
(e)

Remove the plastic protection and the rotation arm´s plastic cover
(f)

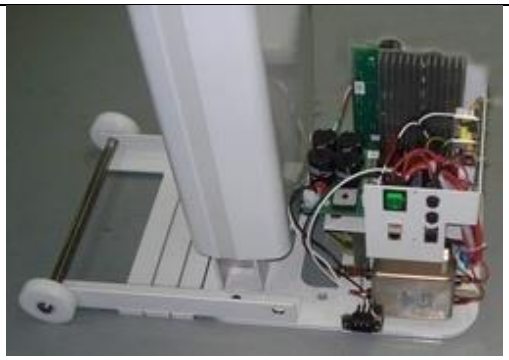


Remove the wall mount and the metallic support screws
(g)

Remove the metallic support by removing the nut in the back of the equipament
(h)



Remove the top plastic cover by removing two screws in the back of the equipment
(i)



Remove the electronic supply's plastic cover in the back and attaching Transportation Tool
(j)

ATTENTION	**Before unlocking the unit from the pallet be sure there is enough space to move the machine, the floor is in the horizontal plane and be aware of the physical effort needed to move the machine and bend it.**

After attaching transportation tool hold the unit tightly and remove the three screws that fix the equipment in the pallet. Move carefully the unit out of the pallet until it is safety in floor level.

2.2.2 OPTIONAL DIGITAL CEPH

Remove the wood covers as described on the picture below following the sequence.

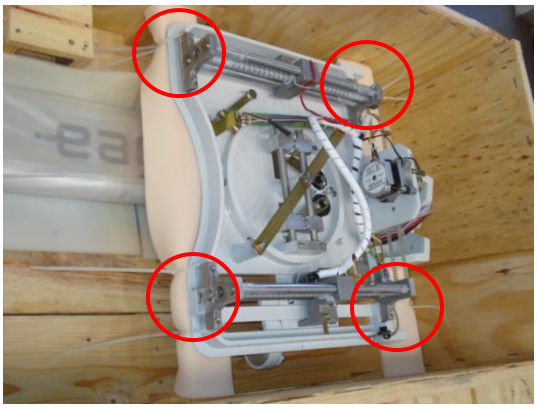
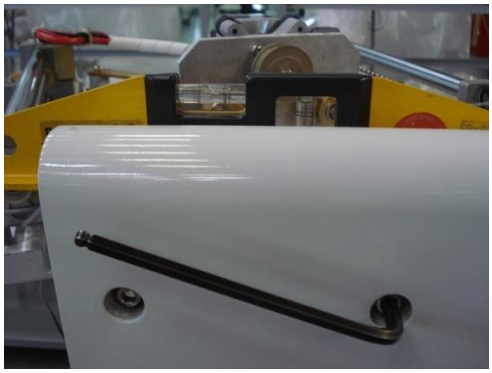
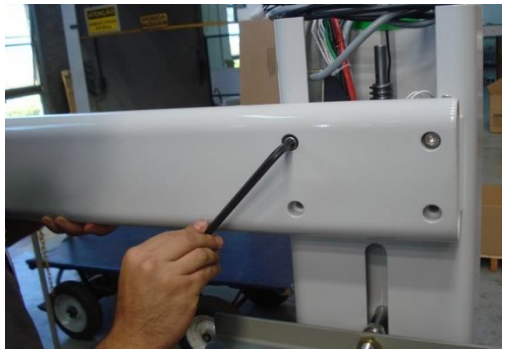
Figure 4 - Unpacking the optional digital ceph

Remove Top Panel
(a)

There are some wood pieces that lock the parts. Unscrew the lateral screws in both sides to remove them
(b)

There is a cardboard box inside the create. This box contains all screws and parts for the ceph. Open it and take all parts.
(c)

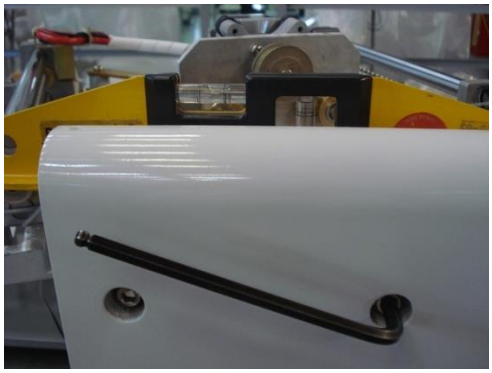
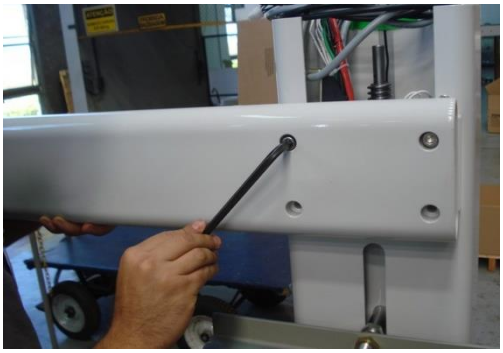
Remove the wood locks
(d)

 Remove the plastic cover (e)	 Remove the cable ties that hold the ceph head. (f)
 The ceph arm is fixed for two bolts. Remove the nuts and bolts. (g)	The cables are already passed, so lift the ceph arm and ceph head together. Put some protection on the floor and lean the head of the ceph against it (h)
 Fix the ceph arm in the ceph head with two screws (i)	 With both systems mount together, fix the ceph system in the panoramic equipment. (j)

2.2.3 OPTIONAL ANALOGIC CEPH

Remove the wood covers as described on the picture below following the sequence.

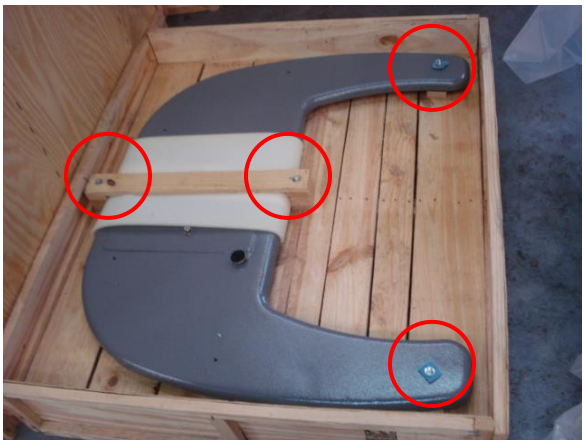
Figure 5 - Unpacking the optional analogic ceph

 Fix the ceph arm in the ceph head with two screws (i)	 With both systems mount together, fix the ceph system in the panoramic equipment. (j)

2.2.4 OPTIONAL FREESTANDING BASE

Remove the wood covers as described on the picture below following the sequence.

Figure 6 - Unpacking the optional freestanding base

 Remove Top Panel (a)	 There are some wood pieces and screws that lock the base. Unscrew all and remove them (b)

 Unscrew the leg levers in the top of the base to place in the correct position. (c)	 Insert the leg levers at the bottom of the base, the place where the screws were (d)

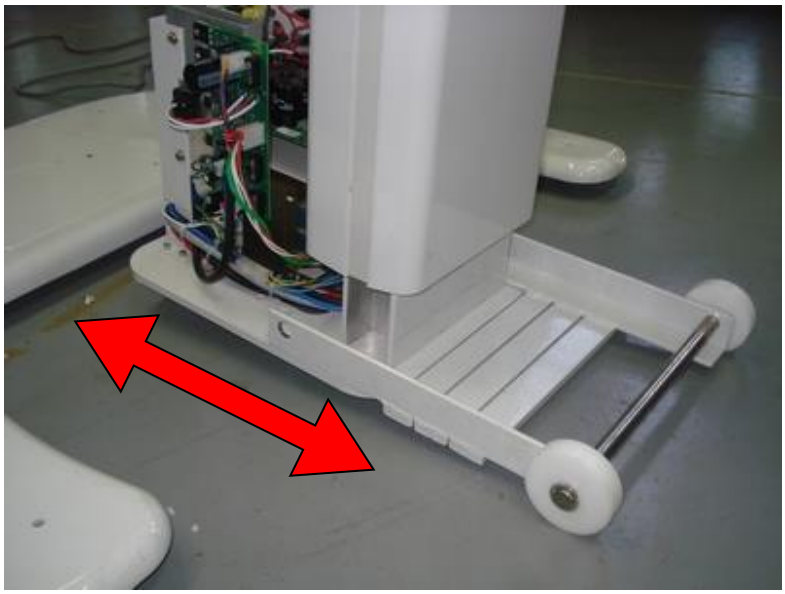
2.3 TRANSPORTING THE UNIT TO THE INSTALLATION ROOM

ATTENTION	**The unit has been designed to be handled easily by one person and to be moved easily inside the installation building considering that there are no large steps and the sizes of the rooms and entry ways are standard. If necessary handle the equipment with more than one person. The responsibility of being able to move the equipment adequately is entirely up to the authorized technician. The manufacturer should not be liable due to any accidents in transportation. The information presented here is for guidance only.**

2.3.1 MOVING THE UNIT ON THE HORIZONTAL PLANE

To move the unit on the horizontal plane hold as described below and lean the unit a few degrees towards you until you feel the unit is stable, i.e. the center of gravity of the unit is above the transportation tool wheels. Move the unit pushing it around as shown below.

Figure 7 - Moving the unit around on the horizontal plane.



The arrow shows the correct direction to movement

2.3.2 MOVING UP ONE STEP

Move the unit forward until you reach the step. Bend the unit towards you until you reach the step height. Push the unit until the front wheel is over the step. Bend up the unit and move it until both wheels are over the step.

2.3.3 MOVING DOWN ONE STEP

Move the unit backwards until you reach the step. Bend the unit far from you until you reach the step height. Pull the unit until the back wheel is over the step. Bend up the unit and move it until both wheels are over the step.

2.3.4 MOVING UP RAMPS

Push the unit to move up ramps. The maximum inclination recommended is 7 (seven) degrees.

2.3.5 MOVING DOWN RAMPS

Push the unit carefully to move down ramps. The maximum inclination recommended is 7 degrees.

2.4 LOCKING THE UNIT WITHOUT FREESTANDING BASE

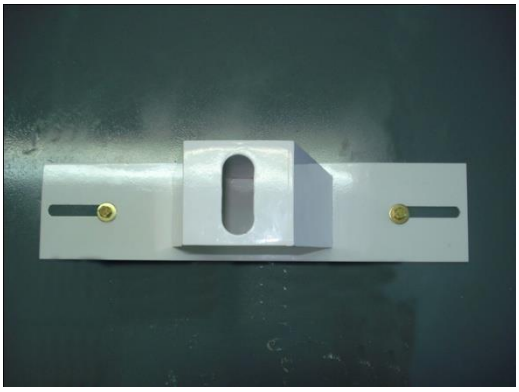
2.4.1 INSTALLING WALL SECURING MOUNT

Put the wall securing mount in position and tighten both screws as shown on the picture.

Figure 8 - Installing the wall fixing part.

Wall Mount

Tools needed



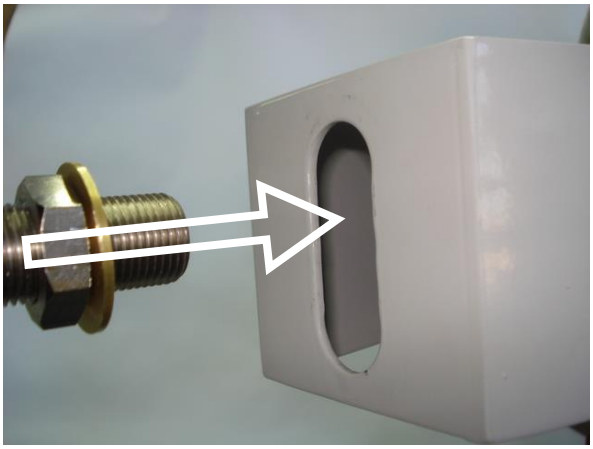
Setting the mount on the wall

2.4.2 LOCKING THE UNIT

Move the unit close to the wall securing mount and attach them together as shown below.

Figure 9 - Attaching unit to the wall fixing part.

The unit must be like this

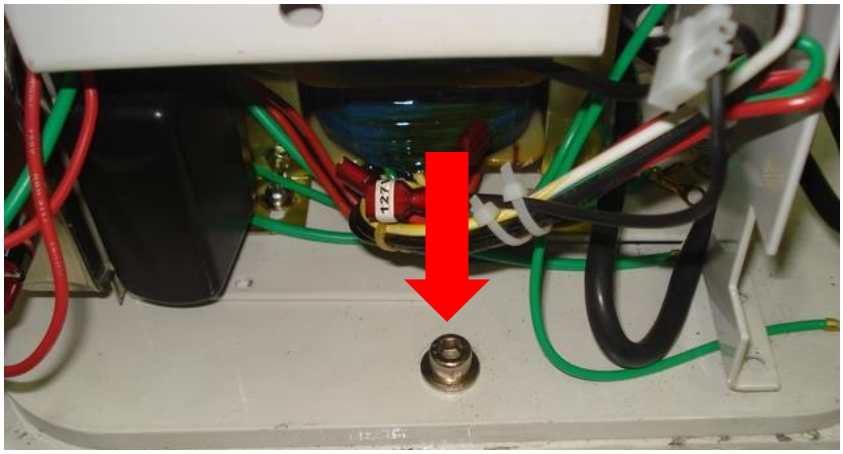


move the unit to attach as shown

Attach the unit with the mount using the screw

Attach the unit to the floor tightening back screw as shown below.

Figure 10 - Tightening the back screw.



Remove the transportation tool and tighten the two other locking screws.

Figure 11 - Tightening the two front screws.

2.4.3 LEVELING THE UNIT

After attach the unit with wall fixing part, move the equipment to the vertical position by tightening the screw as shown below.

Figure 12 - Levels adjustment process

Verify that the column is vertically level

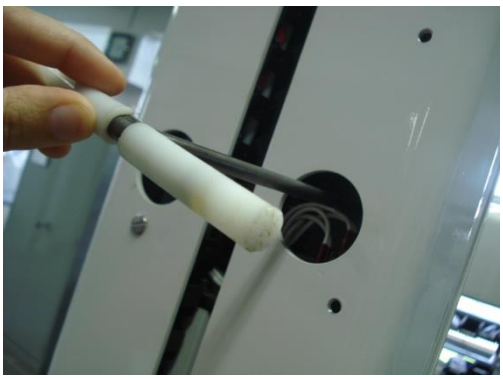
Adjust the level by tightening the screw

Then, verify the inclination of the chin rest with a level. If level adjustments are needed, release the upper screws nuts, adjust the level and tight the screws nuts. Follow the process below.

Figure 13 – Chin rest inclination adjustment process

Verify the level of the chin rest with a level

Move column up until the screw be accessible



Use an allen tool to hold the screw

Release the upper screw and adjust the level

Verify the level of the chin rest as shown below.

Figure 14 - Chin rest level adjustment process

Verify the level of the chin rest with a level

Adjust the level by tightening the screw

If level adjustments are needed, adjust the level by tightening the lower screw.

2.5 LOCKING THE UNIT WITH FREESTANDING BASE

2.5.1 MOVING THE UNIT OVER THE FREESTANDING BASE

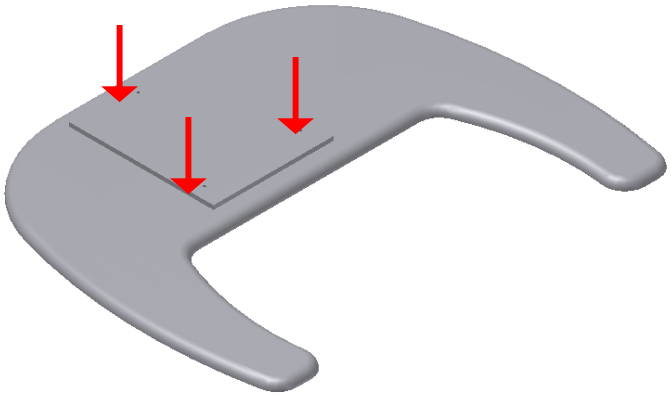
Move the unit over the freestanding base as described on section 2.3.4. Make sure to pre-lock the unit on the back of the base as shown in detail below:

Figure 15 – Pre-locking the unit to the base.

2.5.2 LOCKING THE UNIT

Locate the column mounting holes in the rear center and positioned the unit aligning with the holes. Tighten the three locking screws attaching the unit and the base tightly.

Figure 16 - Mounting holes



ATTENTION	**It is highly recommended to install the Freestanding base before securing the machine to the wall.**

2.5.3 LEVELING THE FREESTANDING BASE

The freestanding base can be leveled by turning the leveling screws on leg levelers as shown in the picture below. Use an allen key for tightening leveling screws. When leveled, adjust all remaining leg levelers against the floor to reach maximum stability.

Figure 17 - Leveling base process

Leg levelers

Adjustment of the leveling screws

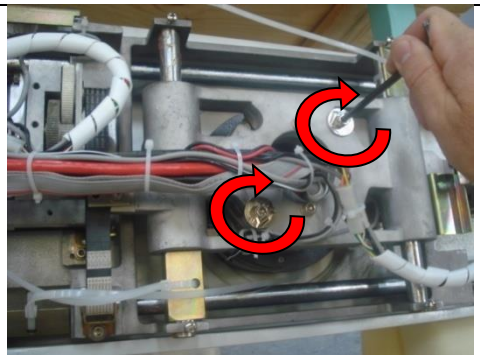
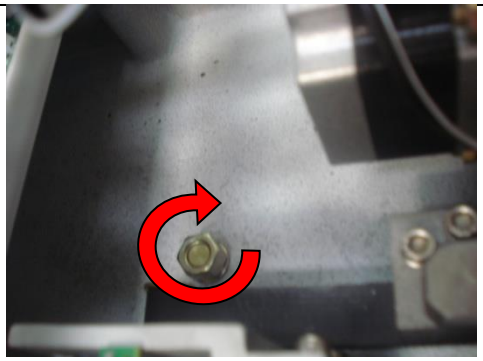
2.6 CONNECTING THE UNIT TO THE WALL OUTLET

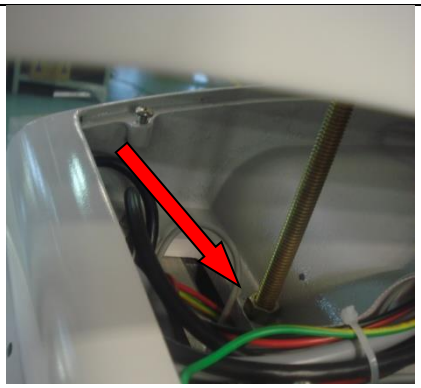
ATTENTION	**The voltage selection of the machine has two steps. Be absolutely sure that you check both before connecting the unit to the wall outlet.** **Before turning on the unit check with a multimeter the mains supply.** **For 220V or 240V:** **- Check that the 127V "switch connector" is NOT connected on the distributor board** **- Check that that transformer input wires connected to the distributor board are correct.** **For 110V or 127V:** **- Check that the 127V "switch connector" is connected on the distributor board** **- Check that that transformer input wires connected to the distributor board are correct.**

2.7 REMOVING TRANSPORTATION´S LOCKS

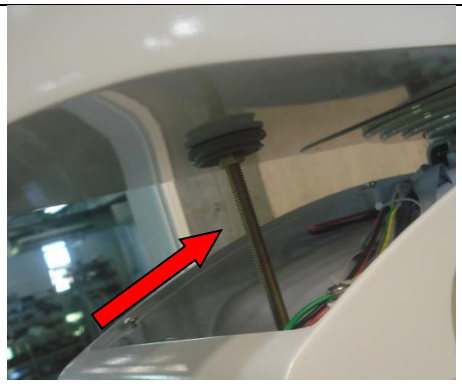
After install and securing the machine, remove all transportation´s lock as show below.

Figure 18 - Transportation´s lock remove procedure

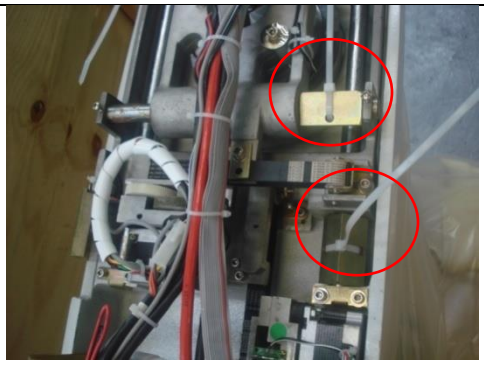
 Remove rotation lock screws (a)	 Remove nut that fix the threaded rod. This nut is located inside the equipment near to the main board (b)



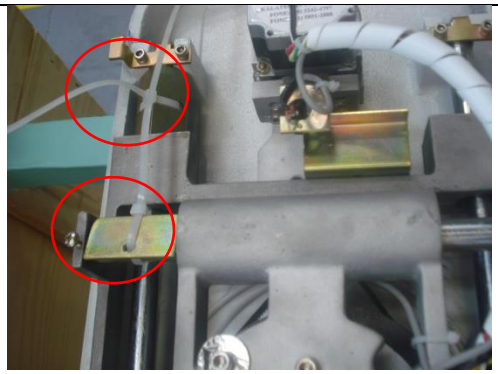
Remove nut in the rotation arm
(c)



Remove nut and the threaded rod
(d)



Cut the clamps and remove the locks
(e)



Cut the clamps and remove the locks
(f)

ATTENTION	**Don´t turn on the equipment until all locks are removed. That could damage you equipment.**

2.8 OPTIONAL DIGITAL CEPH INSTALLATION

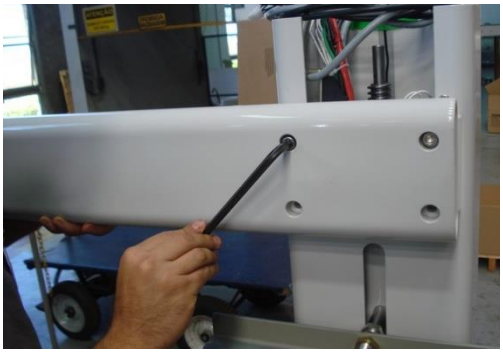
2.8.1 ATTACHING THE CEPH ARM

Position the ceph arm as shown below to screw the first screw on the arm locking on the equipment column.

Figure 19 - Positioning the ceph arm.

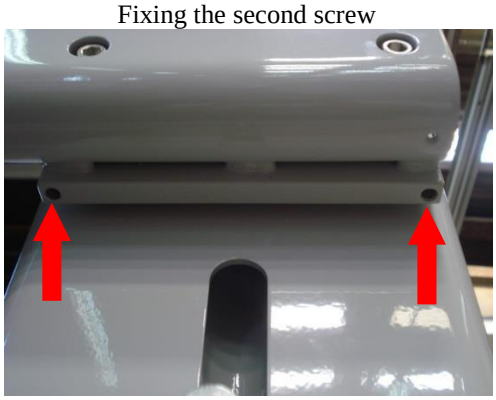
Tools

Fixing the first screw

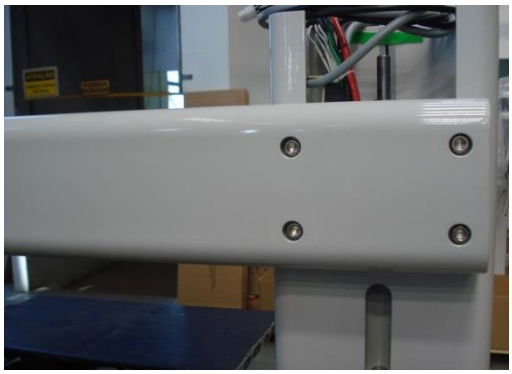


Fixing the second screw

Align verification



Final adjustment



Attaching done

Move the arm to the horizontal position and attach the second screw tightening it making it possible to adjust the level of the arm. Do the same for the other screws.

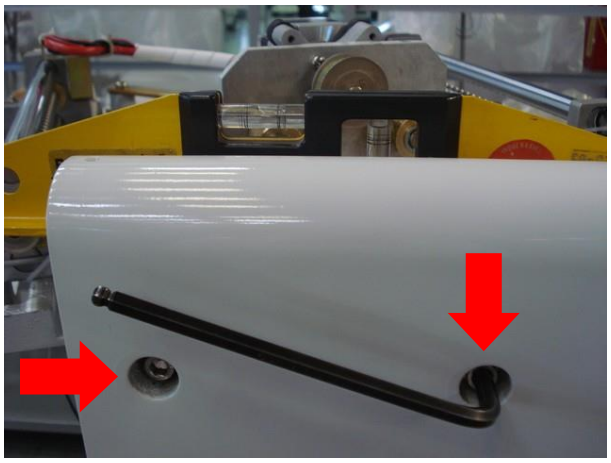
2.8.2 ATTACHING THE DIGITAL CEPH BASE

Remove the digital ceph cover to handle it easily. Put it in position and attach both screws.

2.8.3 LEVELING THE CEPH ARM

Use a level to put the arm in position and adjust the arm level using the following screw. Once in position tighten the four locking screws.

Figure 20 - Arm leveling screw



3 SOFTWARE INSTALLATION

3.1 COMPUTER SYSTEM REQUIREMENTS

The computer running Dental Imaging Software must fulfill the following requirements.

Table 1 - Hardware Prerequisites

Item	Requirement
CPU	Intel I5 3.0 Ghz or higher
Memory	4 GB DDR2 SDRAM
Hard Drive	500 GB or higher
Operating System	Windows 7 professional – 64 bit
PCI	Gigabit Ethernet dedicated

3.2 HARDWARE INSTALLATION

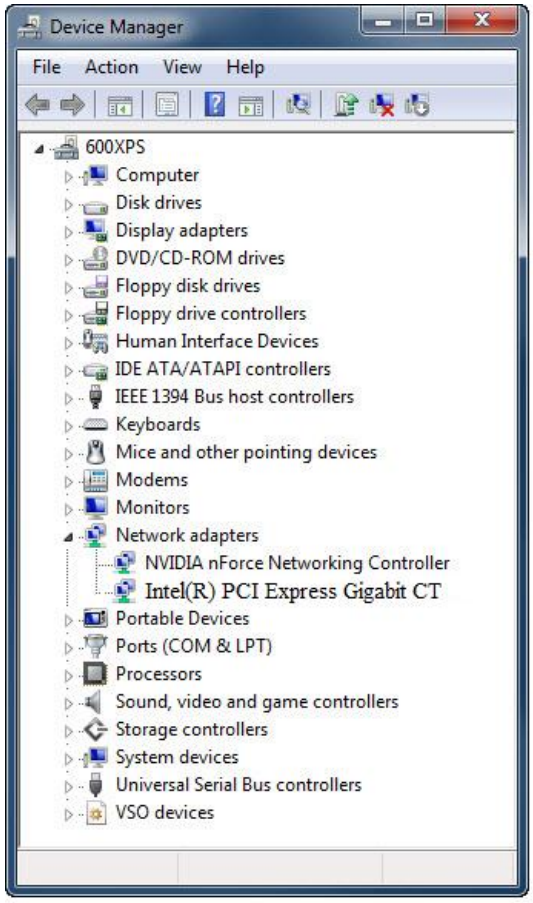
 **ATTENTION**	**The network adapter is sent along with the equipment. Contact a certified service technician of your computer to perform the installation of the network adapter. Damage due to servicing that is not authorized could not be covered under your warranty.**

a) Install the drivers from the Intel website.

NOTE: THE AUTOMATICALLY INSTALLED DRIVERS FROM MICROSOFT WILL NOT WORK

a) Verify if the network adapter was correct installed by access

Control Panel → All Control Panel Items → System → Device Manager → Network adapters



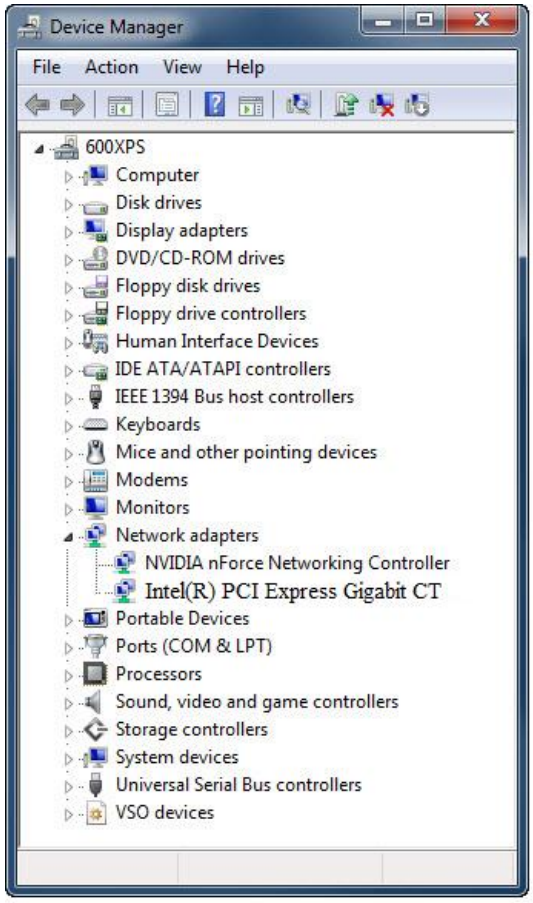
c) After the installation of the drive, restart the computer.

3.3 NETWORK ADAPTER CONFIGURATION

To verify installation of the network card, follow the procedure:

1 – Verify the Windows system automatically installed the driver for the capture card.

Control Panel → All items → Control Panel → System → Device Manager → Network Adapters



2 - Make sure the network adapter is installed. If not, install the network card drive using the CD shipped with the equipment.

3 - After installation restart the computer.

To configure the network card, follow the procedure:

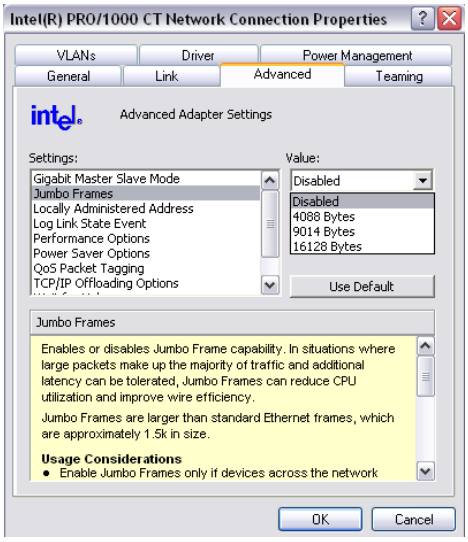
1 - Go to Control Panel → Network → Internet and Network Connections

2 - Click the right mouse button on the connection DESKTOP Intel Gigabit CT, and visit the properties.

3 - Go to Settings → Advanced tab and search for item "Receive Buffer"
4 - Initially, this setting is disabled. Change the value to 2048 and then click OK.

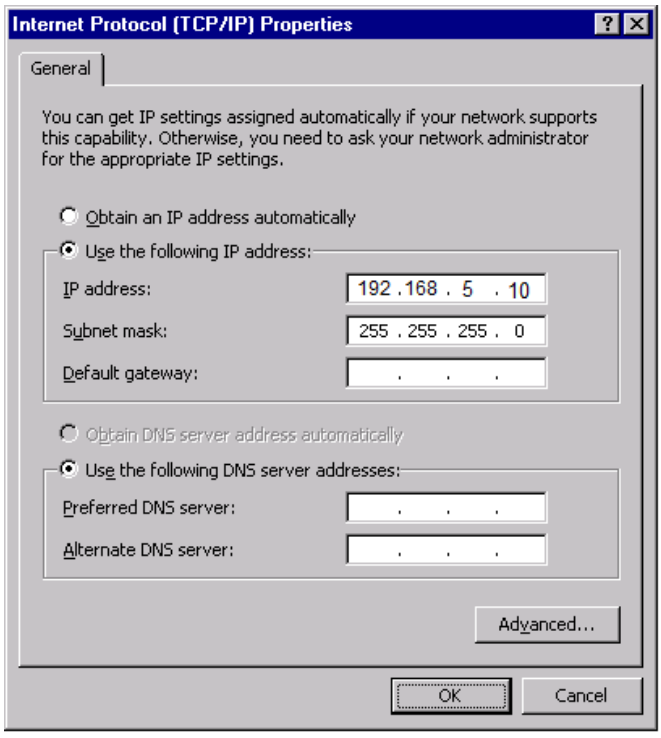
5 - Go to Settings → Advanced tab and search for item "Transmit Buffer"
6 - Initially, this setting is disabled. Change the value to 2048 and then click OK.

7 - Go to Settings → Advanced tab and search for item "Jumbo Frames"
8 - Initially, this setting is disabled. Change the value to 9014 bytes and then click OK.



9 - Go to Settings → Power Management tab and uncheck all items.

10 – Select Internet Protocol TCP/IP Version → Proprieties
11 – Define the IP address **192.168.5.10** and Subnet Mask **255.255.255.0**



ATENTION	**VERIFY IF THE IP ADDRESS IS UNIQUE, OTHERWISE DEFINY A DIFFERENT IP ADDRESS.**

3.4 REMOVE/DISABLE CONFLICTING SOFTWARE

Before software installation Will be necessary remove or/and disable conflicting software.

a) Disable the following software

Windows Firewall
Microsoft Security Essentials
User Account Control (UAC)

b) Remove the following software

Antivirus
Software which includes database engines
Software which allows access from other network resources

3.5 SOFTWARE INSTALLATION PROCEDURE

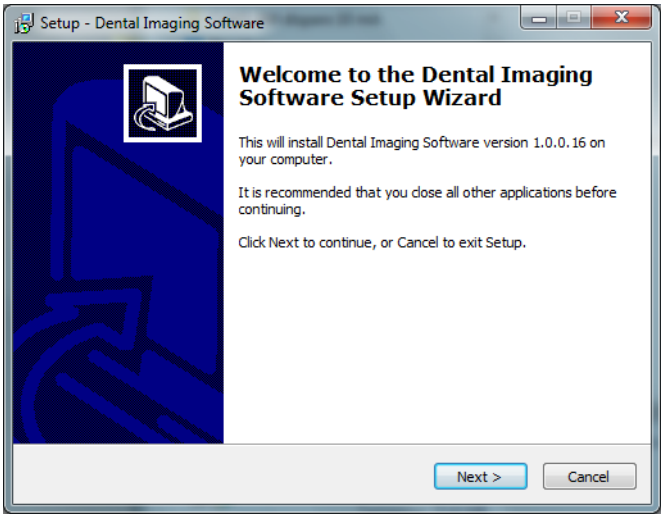
3.5.1 PC CONFIGURATION

a) Verify that the PC's specification is in compliance with the recommended specs. i.e. memory, OS, processor
b) Disable power management, standby and hibernation features.
c) Verify that PC is not being used as a "server"

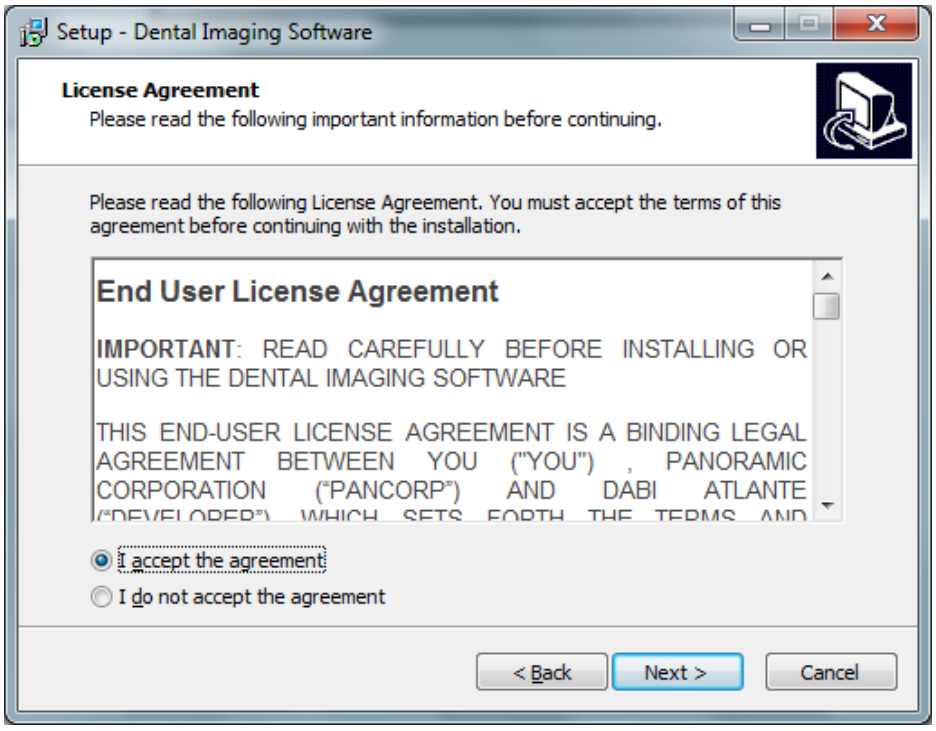
3.5.2 INSTALL DENTAL IMAGING SOFTWARE

Insert the accompanying CD into the CD-ROM drive of the personal computer. The following screen should be displayed. If Microsoft Windows Auto-Run functionality is disabled, open Windows Explorer and start the installation manually by opening the executable file on the root of the provided CD.

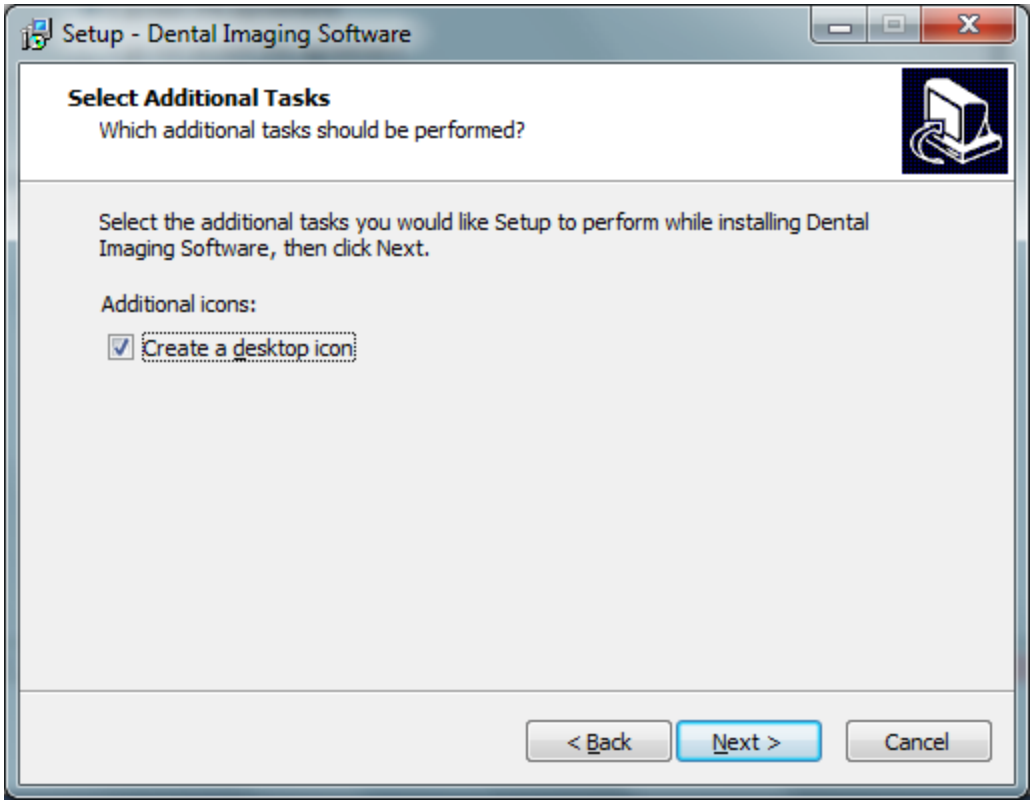
1 - Press NEXT:



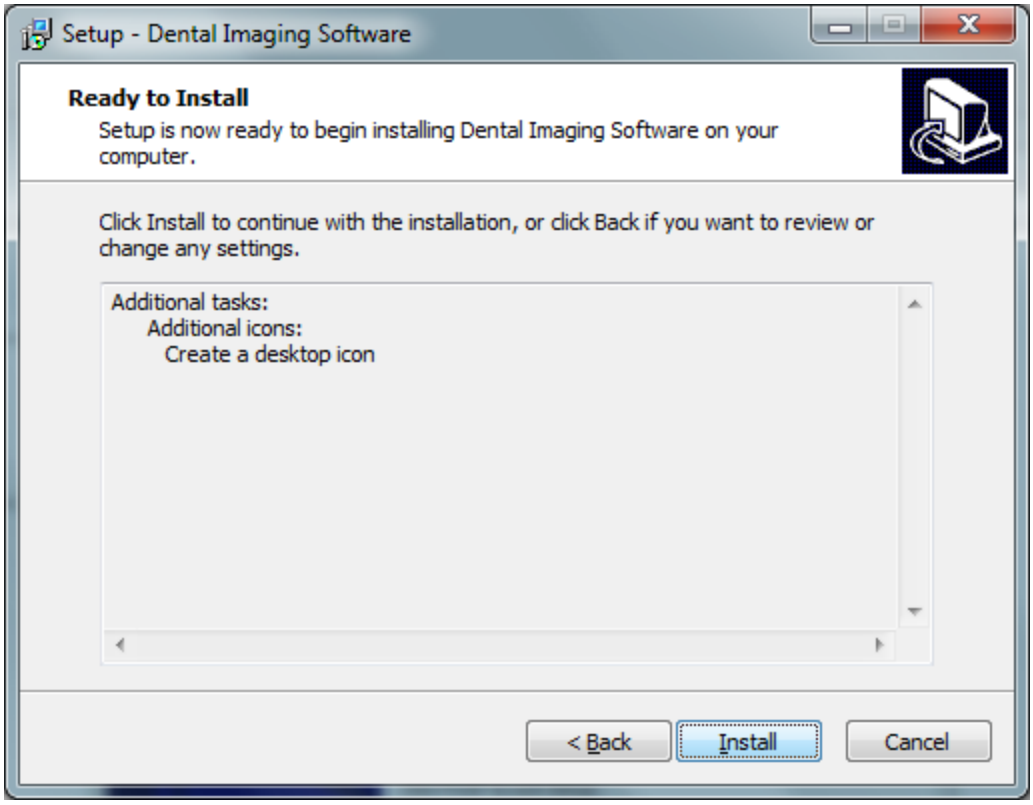
2 –You must accept the EULA to proceed. Press NEXT:



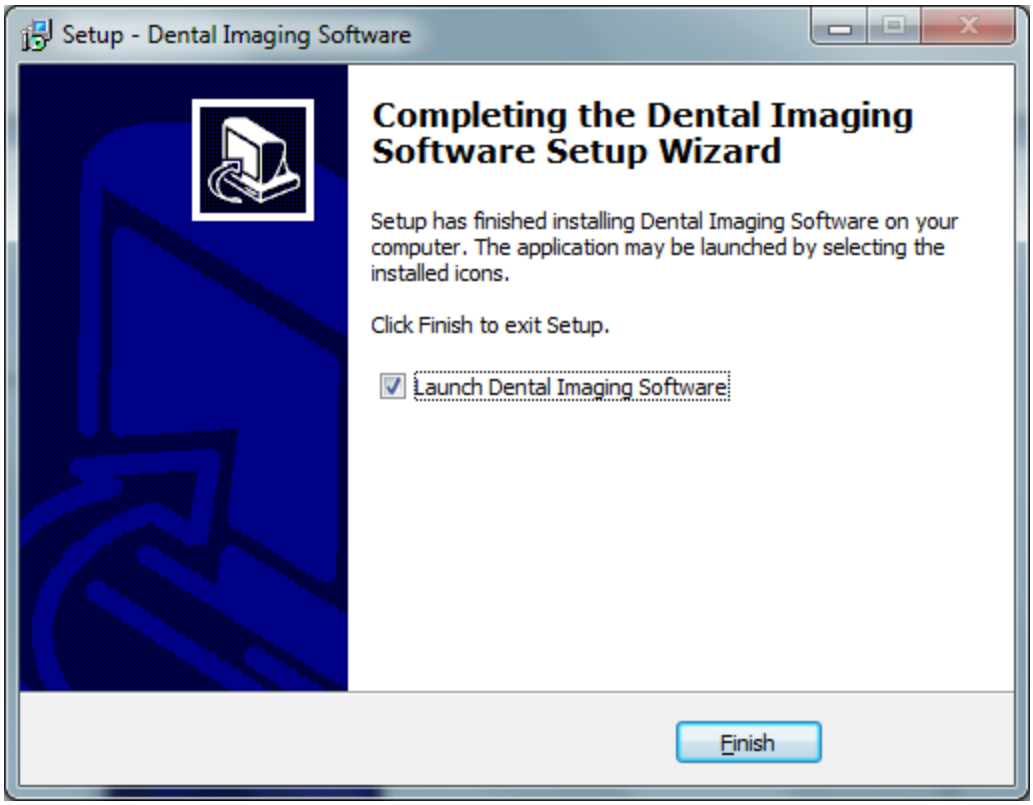
3- Select if you want create a desktop icon



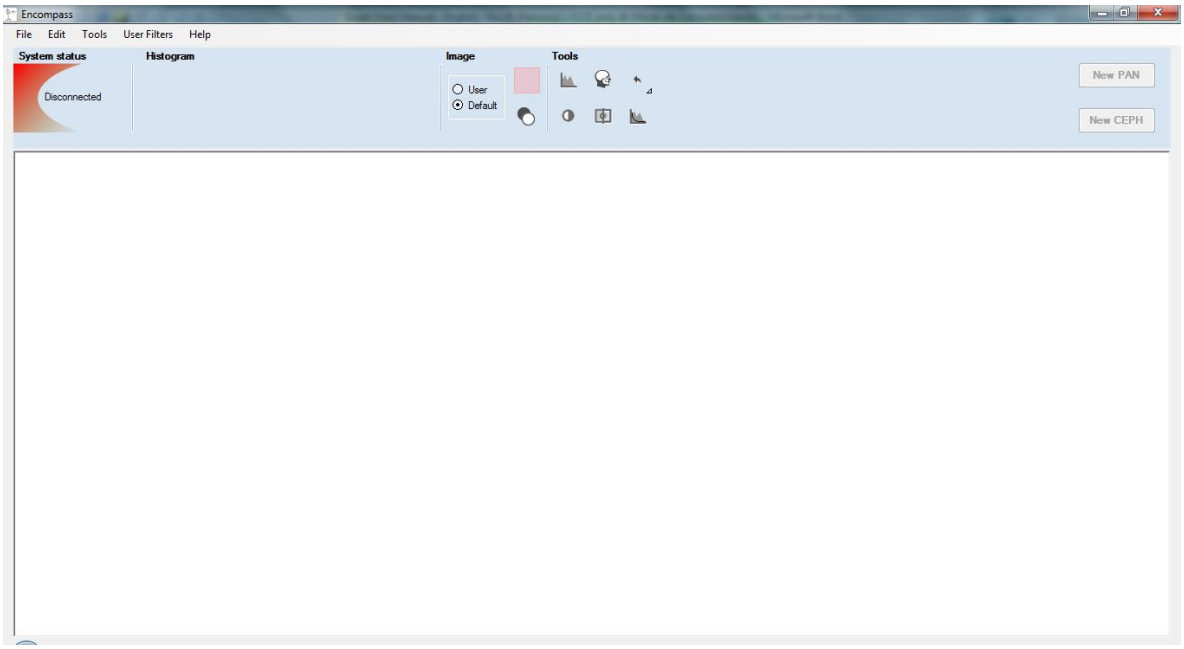
3 – Press Install to start the installation



4- Press FINISH to conclude the installation:



7 - After install the computer click on Windows Start Menu / All Programs / Dental Imaging Software / Dental Imaging Software. The main software window should display as follows:



 **ATENTION**	**A DIGITAL VERSION OF THE SOFTWARE USER MANUAL WILL BE AVAILABLE WITH TECHNICAL CHARACTERISTICS AND GUIDELINES ON THE SOFTWARE OPERATION.**

3.6 SOFTWARE CONFIGURATION

After the installation, start the software. Configure the equipment by following the instruction below.

a) Set the language of the equipment

Tools →Language →[Desired language]

b) Set the panoramic unit model
Access Expert Menu by double click on Histogram label.

Tools → Expert → Set Company → [Desired model]

 **INFO**	**THE STANDARD CONFIGURATION WILL BE SET AS PANORAMIC**

c) Set the license
Access Expert Menu by double click on Histogram label.

Tools → Expert → License → [Desired model]

 **INFO**	**THE STANDARD CONFIGURATION WILL BE SET AS BASIC**

 **ATENTION**	**FOR ADVANCED MODE YOU MUST USE THE USB KEY INCLUDED**

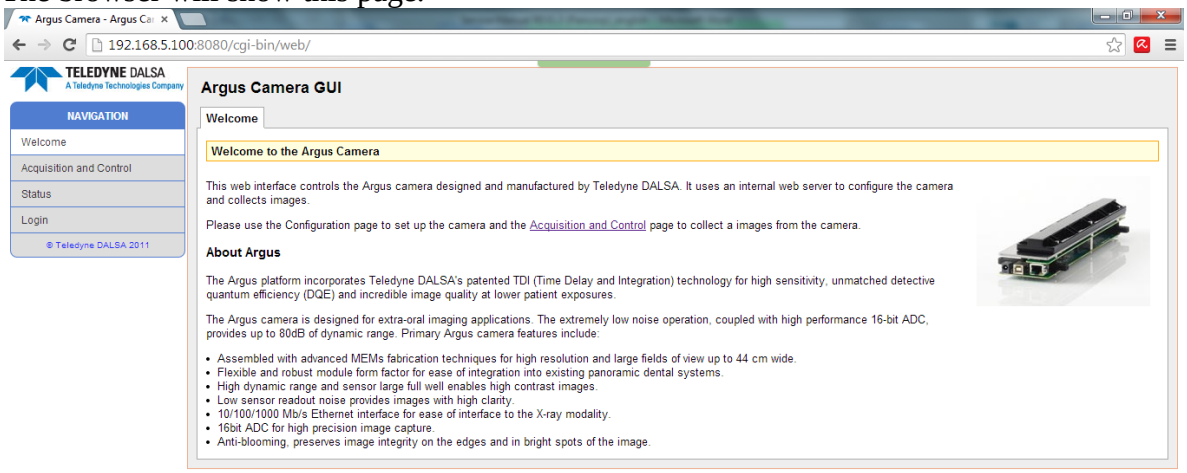
3.7 ENTERING THE SERVICE CONFIGURATION

ATENTION	**IN CASE A CONFLICT IP ADDRESS, DISABLE OTHERS NETWORKS TO ACCESS THE SERVICE CONFIGURATION AND CHANGE THE IP ADDRESS.**

To access the sensor service configuration the network configuration must be finished and the equipment must be connected with the computer.

Open an internet browser and type the follow IP address **192.168.5.100:8080**

The browser will show this page.



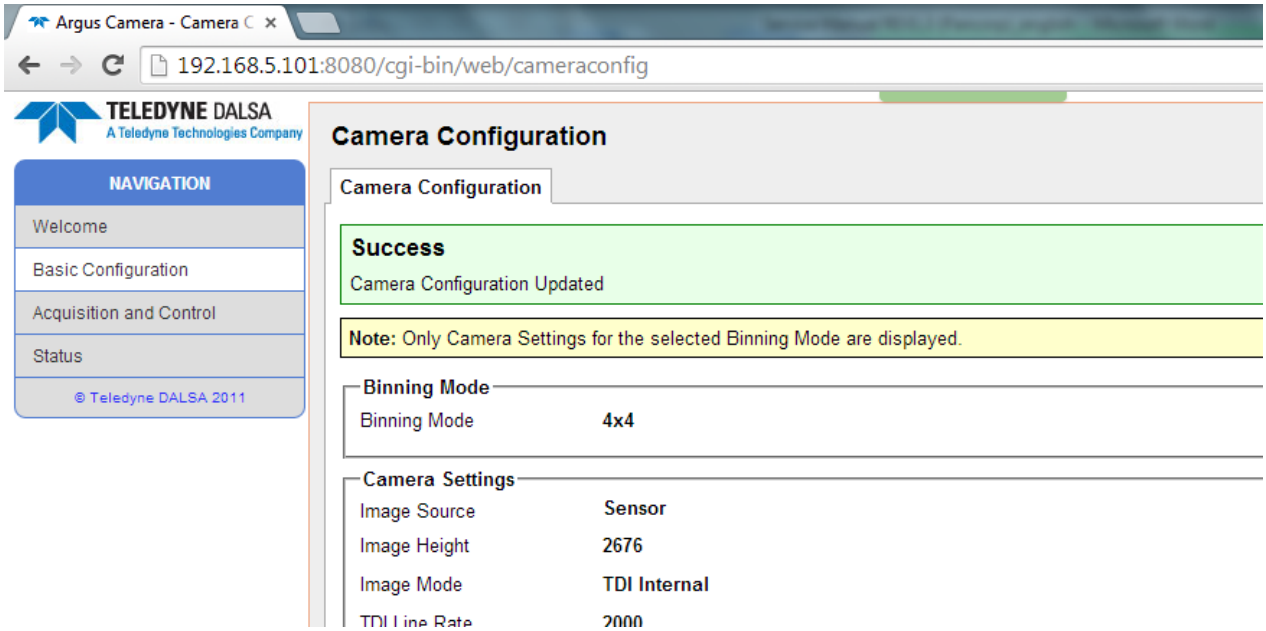
Access the Login tab, enter the username and password and press Login.

Username: technician
Password: technician

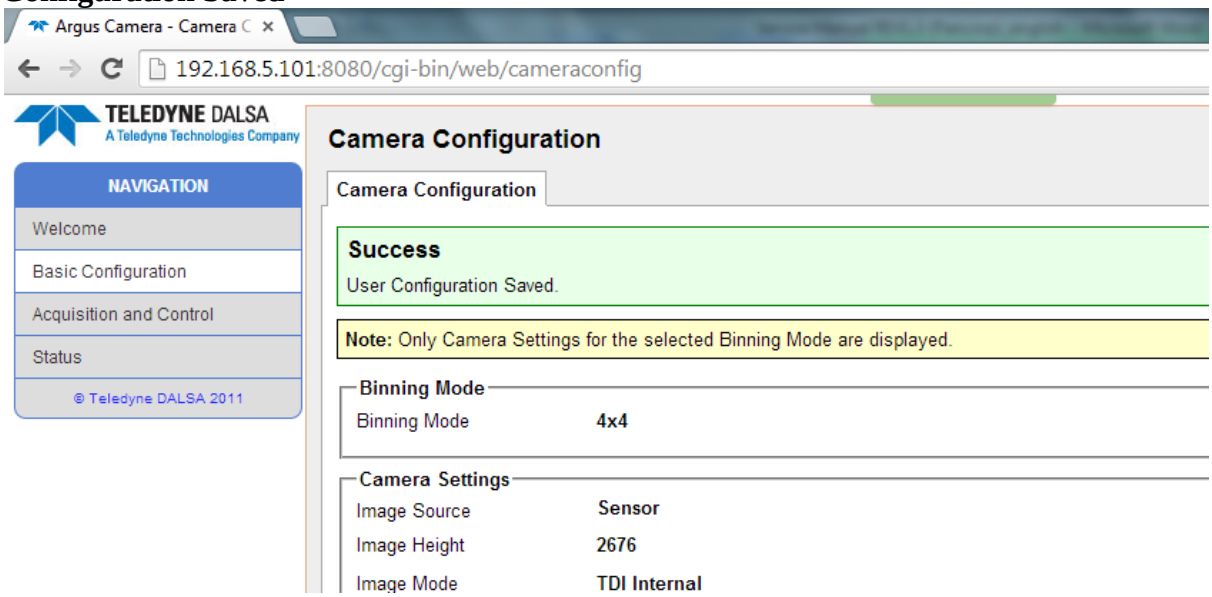
3.8 CHANGING SENSOR IP ADDRESS

Access Basic Configuration tab, and press edit.

Change the IP address and press Submit. The sensor will show the message **“Camera Configuration Updated”**



After that press Save User Setting. The sensor will show the message **"User Configuration Saved"**



The standard IP address for each sensor type was defined bellow

Sensor Type	Sensor Part Numbert	IP Address
Only Pan	DM 20-05K-10-00-R	192.168.5.100
Pan and Ceph	DM 20-08K-10-00-R	192.168.5.101

4 SETTING THE MACHINE CONFIGURATION

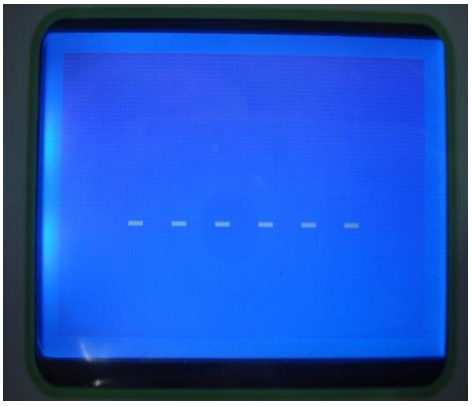
4.1 ENTERING THE SERVICE CONFIGURATION MENU

To set the equipment language it is necessary first to enter the user menu. To do so press select while turning on the main ON/OFF switch. The following screen will be displayed.

Figure 21 - User Menu.

Turn On

Press select



Enter the correct password

4.2 SETTING THE LANGUAGE

After installing the unit mechanically the first step is to set the machine language.

To alter the language, enter in the language configuration menu by pressing SELECT. The following screen will display:

Figure 22 - Language Menu.

Select language

Select the chosen option

Select the appropriate language with PLUS / MINUS and press select to confirm.

4.3 SETTING THE MACHINE TYPE

4.3.1 CONFIGURATION IN THE EQUIPMENT

To set the machine configuration, enter the service configuration menu as described in Section 4.1. To alter the machine configuration, enter in the machine type menu by select ConfigMachine in the main menu. The following screen will display:

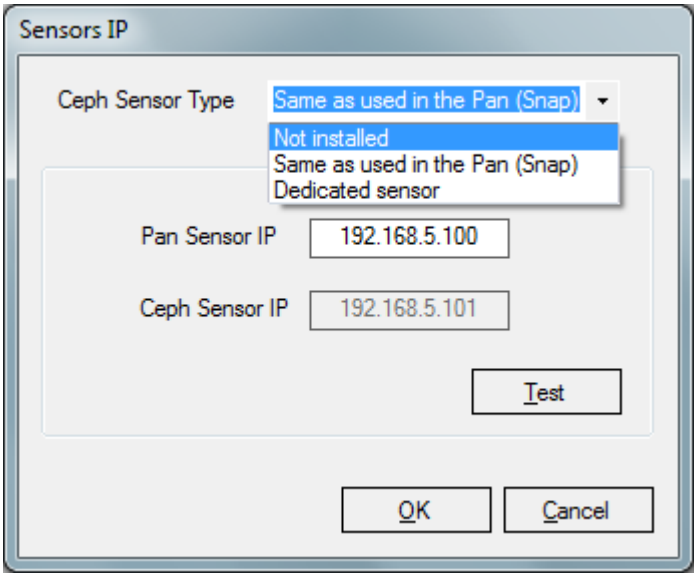
Figure 23 - Machine type menu

Select machine type

Select the correct configuration of your equipment.

4.3.2 CONFIGURATION IN THE SOFTWARE

To set the machine configuration access export menu by click on the Histogram label. Change the configuration under menu Tools → Expert → Sensor IP Configuration. The following screen will display:



Configure following the table below

Machine Type	Ceph Sensor Type
Only Pan	Not Installed
Pan and Ceph Snap	Same as used in Pan (Snap)
Pan and Ceph Fixed	Dedicated Sensor

After configure, press Test bottom to verify the IP address of the sensors.

 **ATENTION**	**THE IP ADDRESS MUST BE UNIQUE, OTHERWISE DEFINY A DIFFERENT ONE.**

PART B - CALLIBRATION

5 PANORAMIC POSITION CALIBRATION

 ATTENTION	**Before you start the calibration procedure, verify the panoramic position calibration by follow the procedure describe in Section 5.5.2 and** Error! Reference source not found. **of this manual. If calibration is needed, follow the complete procedure of this section, otherwise step over it.**

 ATTENTION	**During this procedure there will be exposure of X-RAYS. Take necessary measures to comply to local safety regulation.**

5.1 PREPARATION FOR CALIBRATION

To calibrate the panoramic position, enter the service configuration menu as described in Section 4.1.

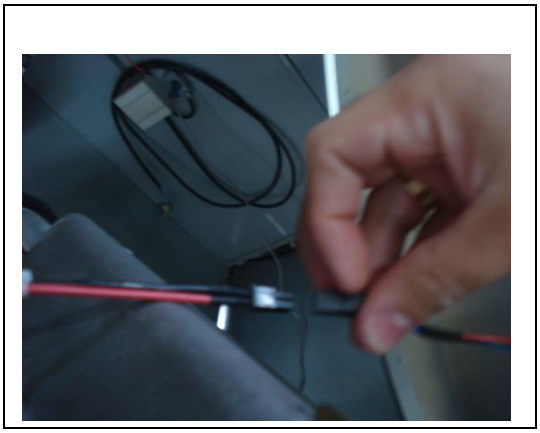
5.1.1 REMOVE TUBEHEAD COVERS

Remove the back tubehead cover by removing the screws shown on the following picture:

Figure 24 - Removing Back Tubehead Cover.

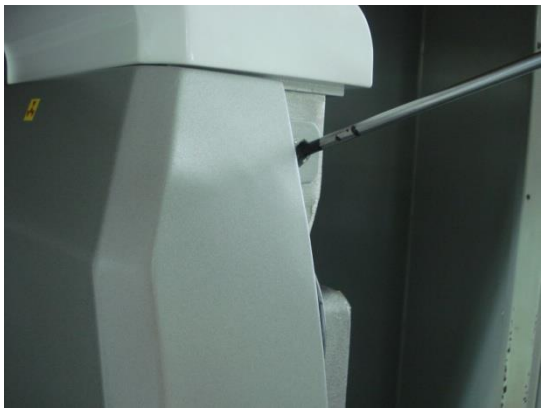
Before completely remove the back tubehead cover, disconnect the cooler as show below

Figure 25 - Disconnect the cooler in back tubehead cover



Remove the front tubehead cover by removing the screws shown on the following picture:

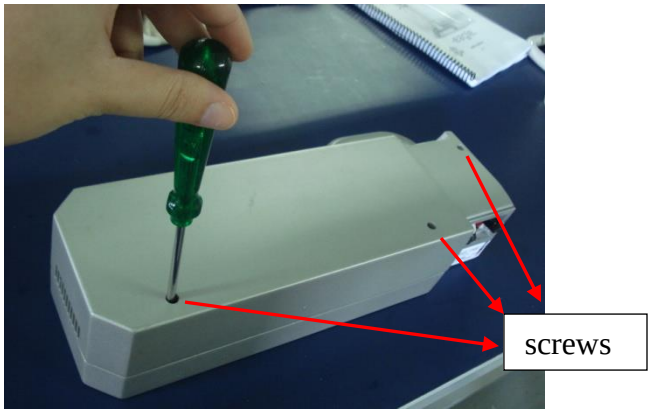
Figure 26 - Removing Front Tubehead Cover.



5.1.2 REMOVE SENSOR COVERS

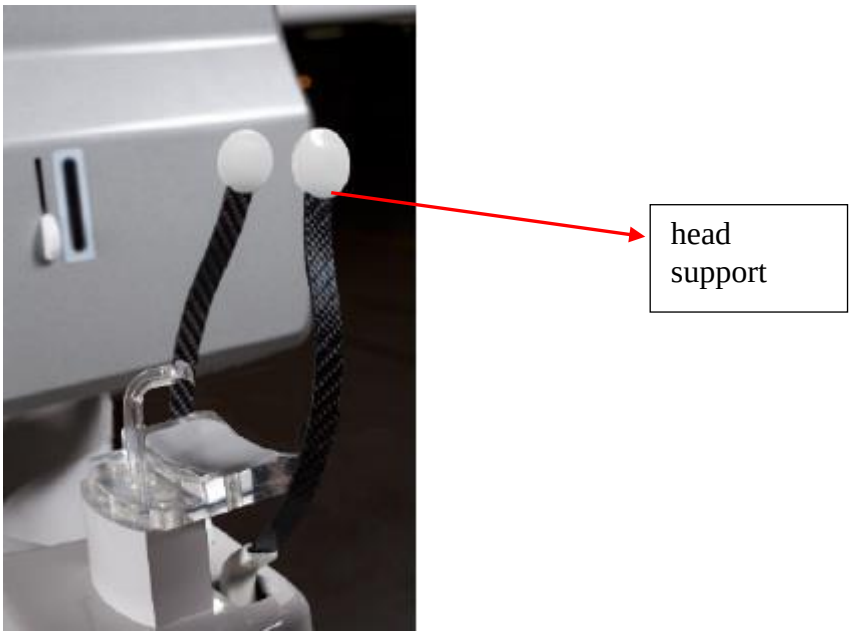
For digital system, remove the sensor from the machine in order to remove its covers. Remove the front cover – the one that receives x-rays – by removing the screws shown on the following picture:

Figure 27 - Removing Front Sensor Cover.



5.1.3 REMOVE HEAD SUPPORT

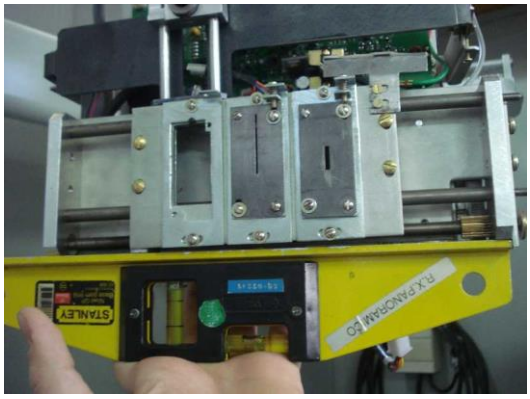
For digital system, remove the head support from the machine in order to calibrate the snesor. Remove it by removing the screws in the patient support:



5.2 CALIBRATING THE BEAM – DIGITAL SYSTEM

Using a level adjust the collimator level with use of level tool as shown below.

Figure 28 - Adjusting collimator level

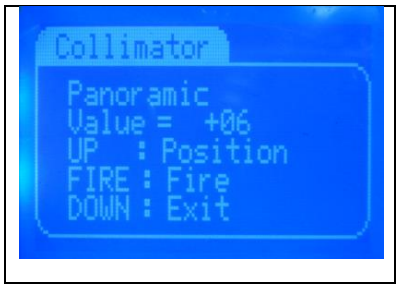


Position the fluorescent tool on the sensor surface as shown on the picture below:

Figure 29 - Positioning Fluorescent Tool.

Enter the Pan Calibration option on the service menu. The first screen of this calibration procedure will display:

Figure 30. Calibrating Beam Service Menu Screen.



5.2.1 PRE-CALIBRATION

In this option the exposure button is active. Protect yourself and others from radiation and take one exposition in order to illuminate the beam. If the beam illuminates the calibration tool to the right press the PLUS KEY on the keypad and press UP KEY to

go the new position. If the beam is to the left press MINUS KEY on the keypad and press UP KEY to go to the new position. Repeat the process until the beam is centered.

5.2.2 FINE-CALIBRATION

To proceed with the fine-calibration remove the Fluorescent Calibration Tool used on the previous section and make an exposure.

Open Dental Imaging software and access expert tool by click on Histogram Label.

Open the beam calibration tool under menu Tools → Expert → Collimator Calibration → Pan.

The software will start a 9-second countdown. During the countdown make an exposure.

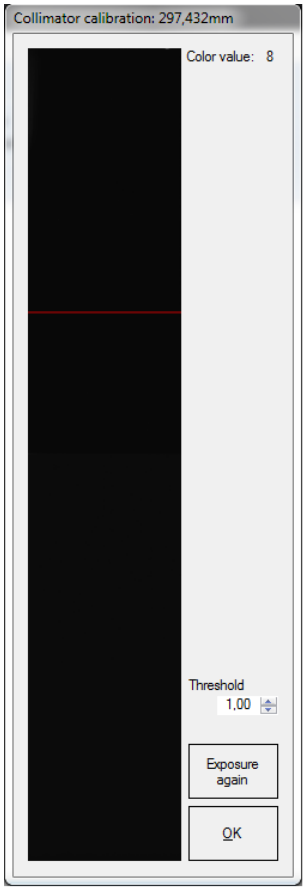


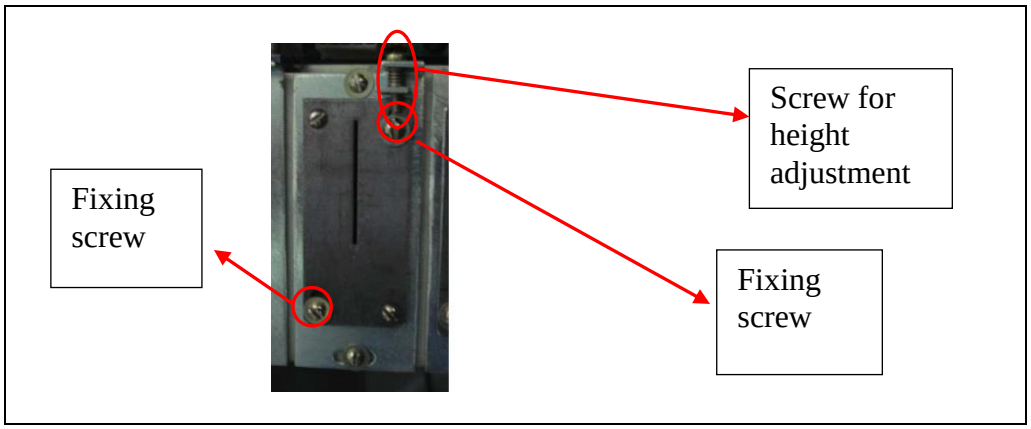
Figure 31 - Mechanical Alignment Tool

To fine calibrate adjust the collimator in the following order: height, tilt and horizontal deviation of the X-Ray Beam in according with the orientations below

HEIGHT

Adjust the height of the beam by mechanical adjustment of the screw as shown on the picture below

Figure 32 - Adjustment of the beam height

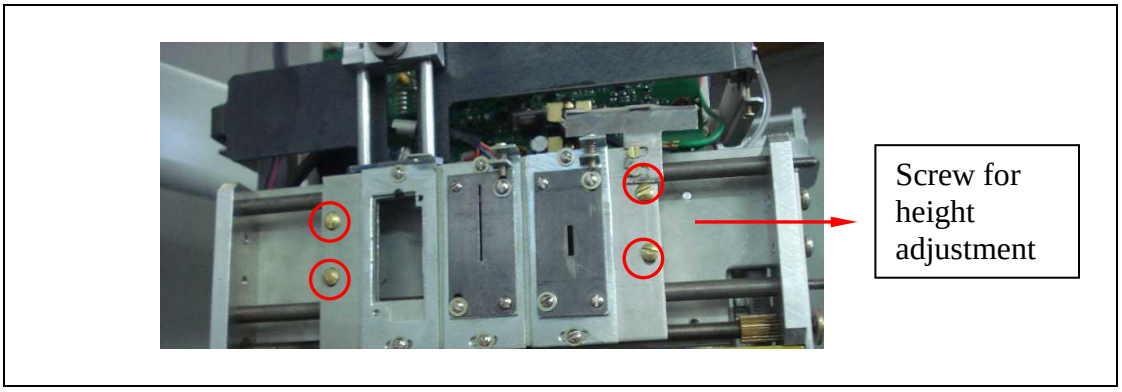


To proceed with fine-calibration of the beam height, loosen slightly the two fixing screws indicated in the picture and use the adjustment screw.

The acceptance standard is that the beam stay between 0 to 5 mm of the bottom edge.

If the adjustment of the height is not enough lose the screws of the holder of the collimator to adjust the height as show below.

Figure 33 - Adjustment of the collimator height



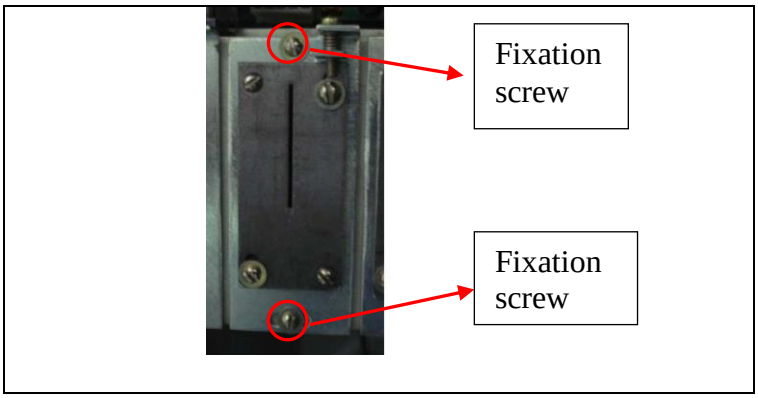
Loosen slightly the four fixing screws indicated in the picture and adjust the collimator height.

ATTENTION	During the adjustment it's necessary to check the height of the Zero Sensor of the collimator.

ANGLE

Adjust the angle of the beam by mechanical adjustment of the screw as shown on the picture below

Figure 34 - Adjustment of the beam height



Loosen slightly the two fixing screws indicated in the picture and adjust the inclination of the collimator slightly.

HORIZONTAL ADJUSTMENT

Use the mechanical alignment tool of the Dental Imaging Software and the equipment software to adjust the beam.

PLUS key: moves the beam to the right in the screen (left on the equipment);
MINUS key: moves the beam to the left in the screen (right of the equipment)
Note: The beam moved approximately 0,1mm for each point adjusted.

Make sure that the beam is centralized.

BEAM REPEATABILITY

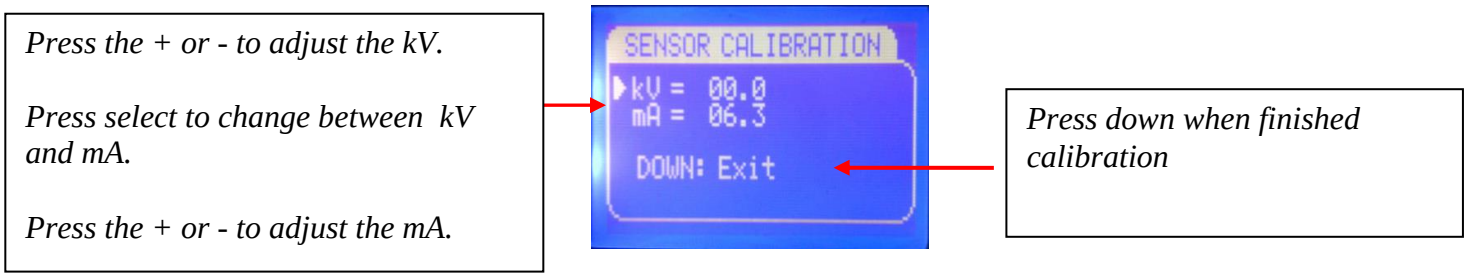
Once calibrated the beam, make 5 shots to check the change in the position of the beam by pressing UP on the interval between each exposure, thus making it go to 0 and back to the pan position.

Press the down key to go to the next calibration screen.

5.3 PANORAMIC SENSOR CALIBRATION

The next calibration screen is for the sensor calibration.

Figure 35 – Pan Sensor calibration screen

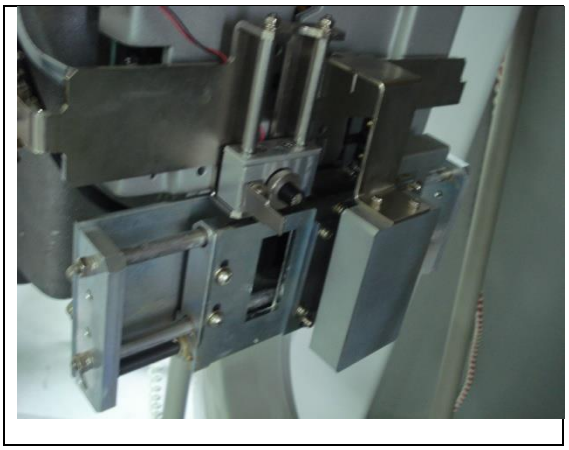


To do the calibration open the calibration tool on the software under Tools → Expert → Sensor Calibration → Pan.

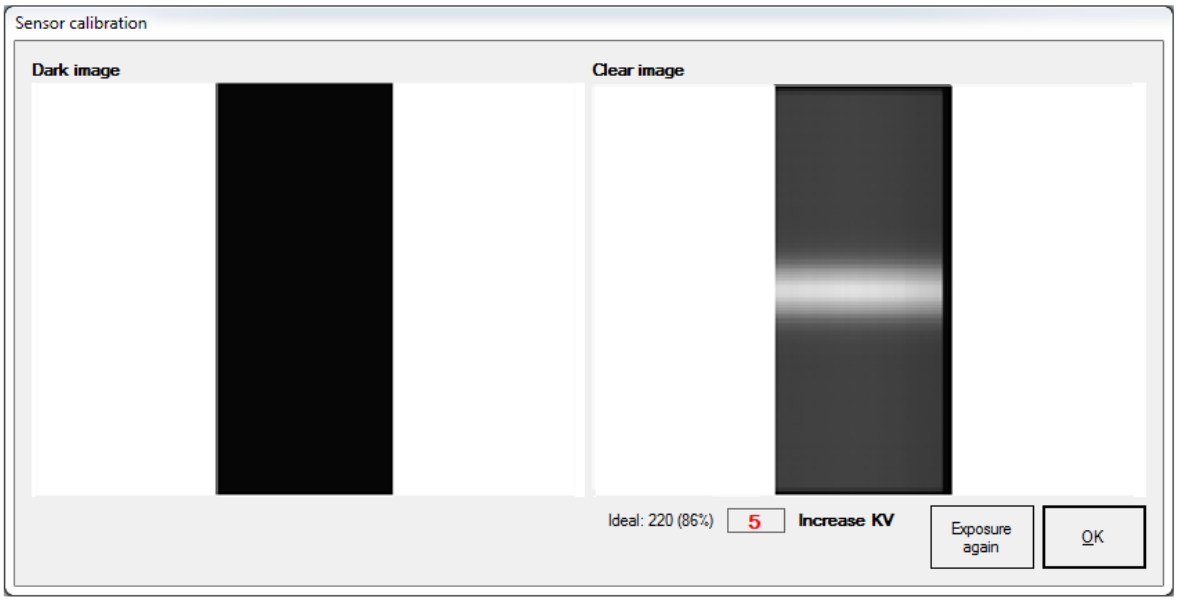
The software will start a 120-second countdown. During the countdown make a demonstration exposure without Kv.

After that press OK. The software will start a 120-second countdown. During the countdown make an exposure with a 20mm aluminum , 80kV and 10mA.

Figure 36 - Aluminum Filter Positioned.



The follow screen will display:



The pixel value should me around **220**. The software will indicate if the calibration was successful. If the value is higher or lower, decrease or increase kVp value following the software instruction and repeat the procedure until the sensor is calibrated. You can also adjust the mA value. After finish restart the software to apply the calibration.

Press the DOWN key when calibration is finished and go to the next step.

5.4 ADJUSTMENT OF THE CHIN SUPPORT HEIGHT

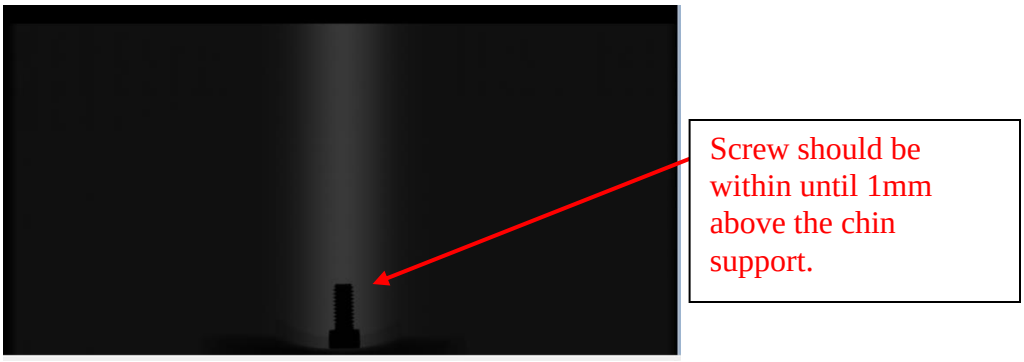
Place a Screw or other metallic above the chin support to verify its height adjustment.

Figure 37 - Screw above the chin support

Take an exposure using Dental Imaging Software. Access expert menu by double click on the Histogram label. To do the calibration, open the calibration tool on the software under Tools → Expert → Sensor Image Calibration → Pan

Press OK before start the exposure. The software will start a 120-second countdown. During the countdown make an exposure.

Figure 38 - Exposure of the Screw in the chin support



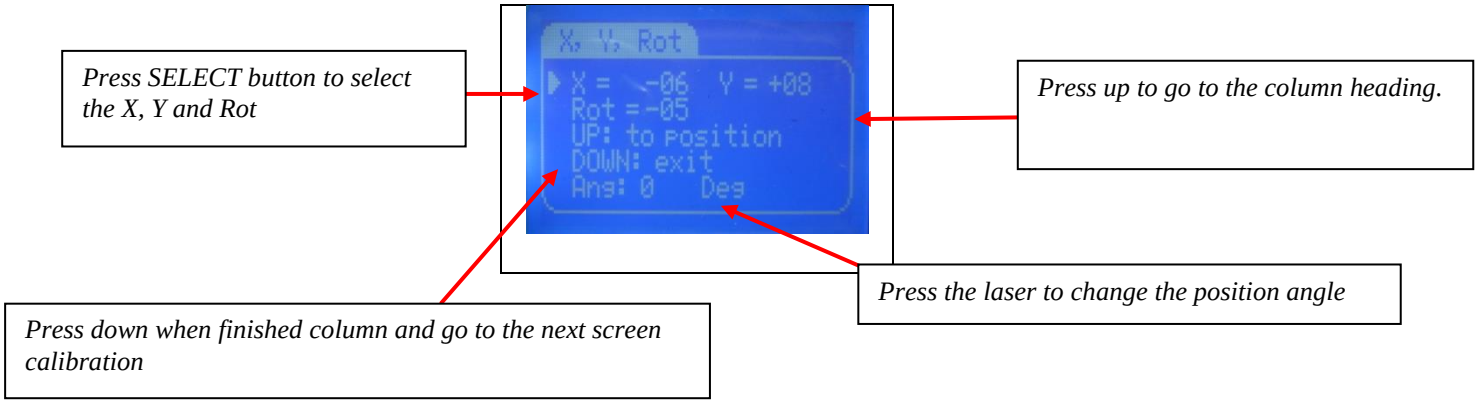
The screw should be within until 1mm above of the chin support.

If necessary adjust the height of the chin support using the screws that fix the chin support to the equipment column showed in Section 2.4.3. Repeat the procedure of Section 2.4.3 and this procedure until screw is 1mm above the chin support.

5.5 X, Y, ROTATION CALIBRATION

After successfully completing the last step you should calibrate the x,y, rotation of the unit. On the equipment the following screen should display:

Figure 39. X, Y, ROTATION Screen Menu.



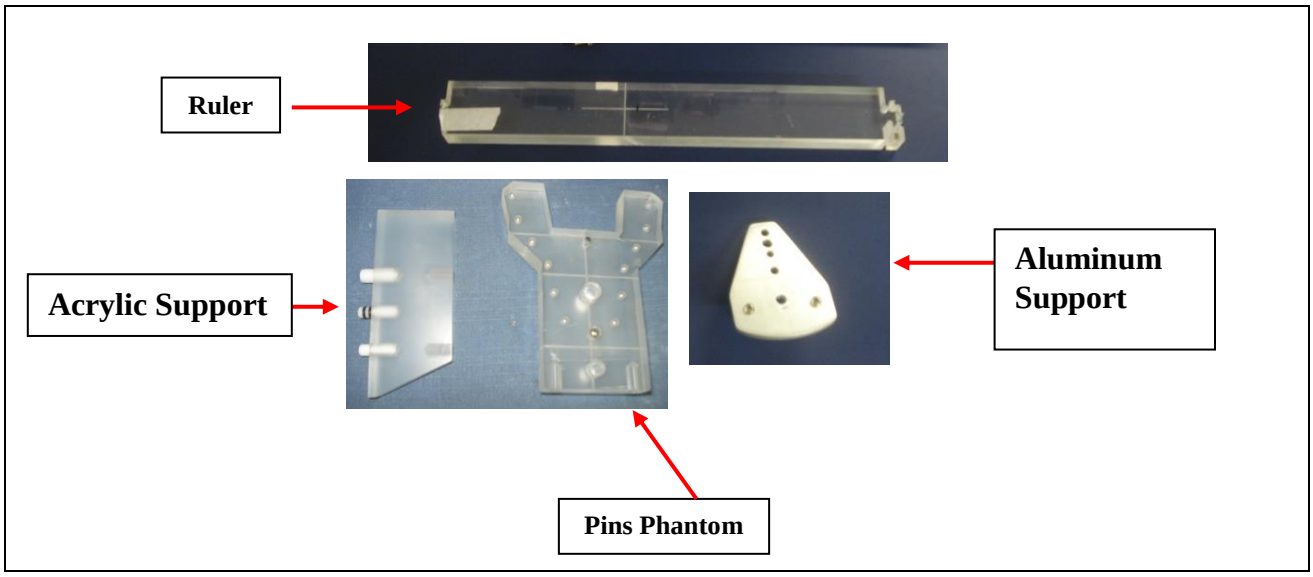
On this screen follow the procedure below to adjust the parameters.

- Change between X, Y and Rotation by pressing the SELECT key on the equipment.
- Adjust the value of X, Y and Rotation by pressing PLUS and MINUS key.

- Change the position angle of the equipment arm by pressing the LASER key.
- Press the UP key to go to adjust position.

This screen has multiple purposes. Follow the instructions without changing the screen by using the DOWN key. The following calibration device should be used in this step.

Figure 40 - Panoramic Calibration devices



5.5.1 THREE-POINT ADJUSTMENT

Y AND ROT ADJUSTMENT

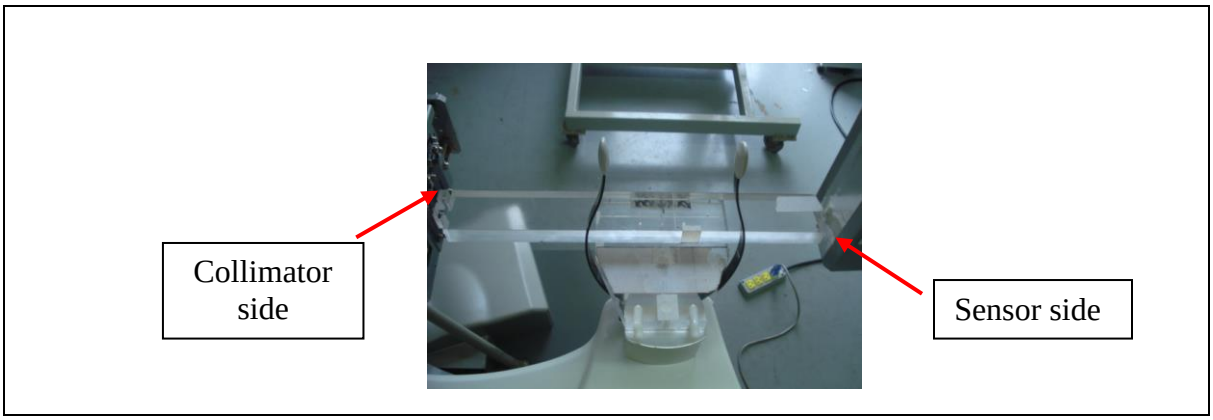
Assemble the Aluminum Support and the Pins Phantom in the Chin Support as shown below.

Figure 41 - Pins Phantom above the chin support

Place the ruler above the Pins Phantom and align the center of the ruler with the center of the sensor and the center of the collimator.

Verify if the line in the center of ruler is aligning with the line in the pins phantom.

Figure 42 - Placing the acrylic ruler



If the lines are not aligning, remove the ruler and adjust the value of Y axis and rotation at 0 (zero) degree on the equipment and restart the position. Follow the procedure below.

- Press SELECT key to alternate between the axis options;
- Press PLUS key to increase the axis parameter;
- Press MINUS key to decrease the axis parameter;
- Press UP key after each configuration to restart the equipment position;

Adjust the Y and Rotation axis until the ruler marker is completely covering the phantom marker

ATTENTION	Remove the ruler before reset the equipment position to avoid damages in the collimator.

The table below shows the directions of movement of the axis:

Table 2 - Directions of movement of the axis

Y+	Direction of the Y axis from the operator	
Y-	Direction of the Y axis from the operator	
Rot -	Rotating Arm Turns clockwise from the top view of the equipment	
Rot+	Rotating Arm Turns counter-clockwise from the top view of the equipment	

Y MECHANICAL ADJUSTMENT

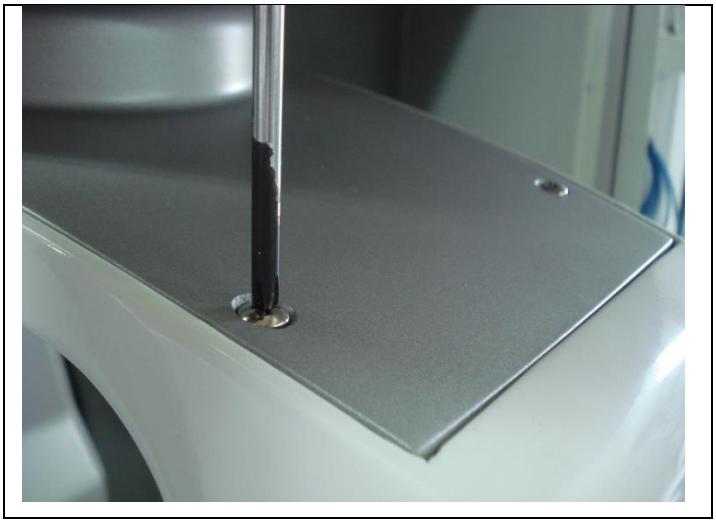
After the previous adjustment you should adjust the centralization of the rotating arm.

First press the LASER key twice to change to 180 degrees position. Press UP key to go to position.

Repeat the procedure of alignment. Verify the distance between the line of the ruler and the line phantom.

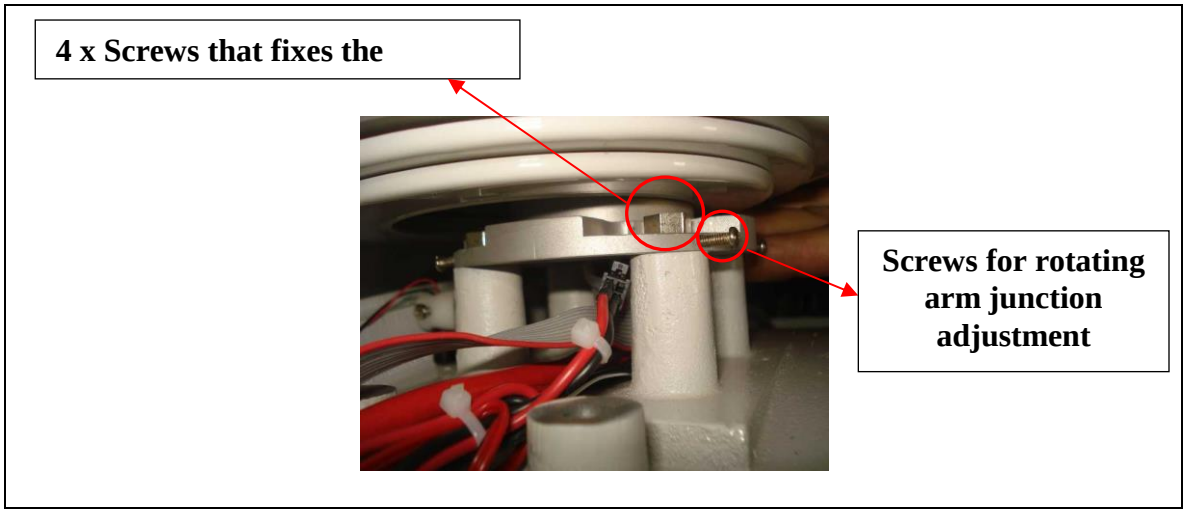
Remove the rotating arm cover by removing the screws as show on the picture below.

Figure 43 - Removing Rotating Arm Cover



Release the adjustment screw without remove them and release slightly the four screws that fixes the rotating arm as show below.

Figure 44 - Mechanical adjustment screws - rotating arm



Move half of the error at the rotating arm junction, each screw turn moves the rotating arm 0.6 mm.

Remove the ruler and press the UP key so the equipment moves to the restart position.

Repeat this procedure, from the beginning until the error in 180 degrees is less than 1mm. When finished tighten all the screws that fix the rotating arm, then tighten the screws of the rotating arm junction adjustment.

Y AT ZERO DEGREE ADJUSTMENT

Return the equipment to the 0° degrees position by pressing the LASER key to select the degree and UP to go to the position. With the ruler check the distance between the line of the ruler and the line of the Pins Phantom. If necessary adjust the Y parameter on the equipment screen to match the lines.

SETTING X AND ROT AT 90 DEGREES

Press the LASER key to select 90 degrees position, press UP to go to the position.
Adjust the X axis position as the instructions of the previous for the Y-Axis.
The reference table for the X-Axis are the following:

Table 3 - Reference table for the X-Axis movement

Action		
X-	Moves the arm to the left of the operator	←
X+	Moves the arm to the right of the operator	→

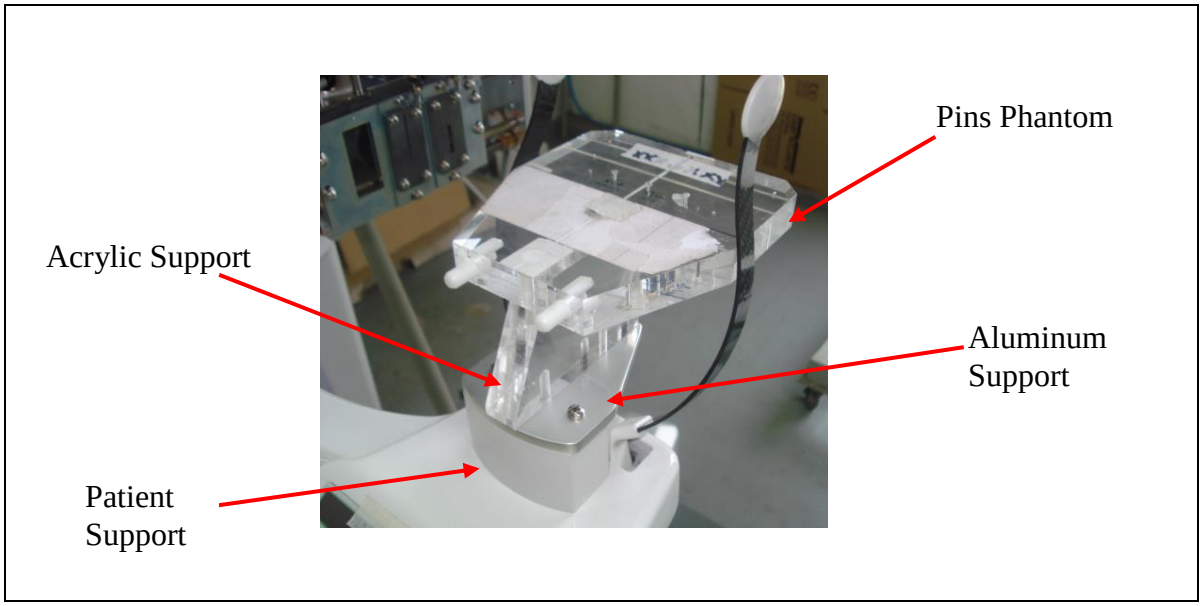
5.5.2 IMAGE FINE ADJUSTMENT

With a good pre-positioning of the X, Y and Rotational axis this fine calibration step is simple and fast.

Keep the equipment in the same calibration screen.

Assembly the complete pins phantom in the patient support (Pins Phantom, Acrylic Support and Aluminum Support). See the picture below for reference.

Figure 45. Phantom Tool Positioned.



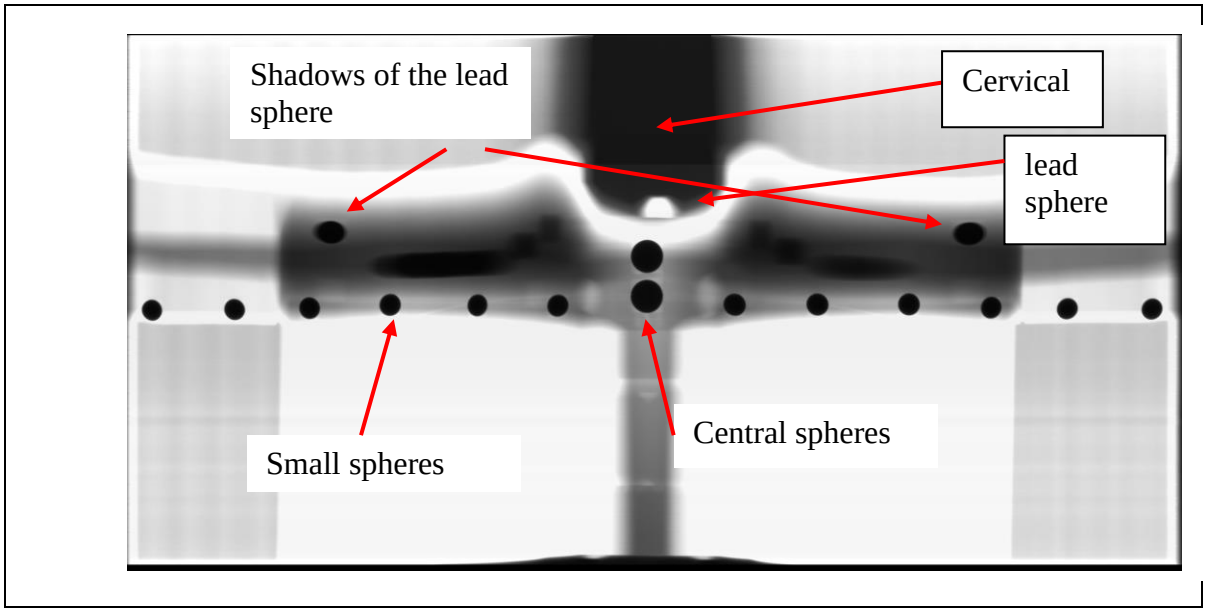
Take an exposure using Dental Imaging Software. Access expert menu by double click on the Histogram label. To do the calibration open the calibration tool on the software under Tools → Expert → Sensor Image Calibration → Pan

Press OK before start the exposure. The software will start a 120-second countdown. During the countdown make an exposure.

Protect yourself and others from radiation and take an exposure by pressing the exposure button. The equipment will perform a standard panoramic. At the end of the profile execution, the software will show a panoramic radiography of the pins phantom.

The image will be composed as the picture below.

Figure 46. X-Ray Test Pattern.



The relevant measurements on the image are the following:

- Width of center sphere
- Height of center sphere
- Distance from center sphere to left smaller spheres
- Distance from center sphere to right smaller spheres
- Distance from lead sphere to edges

The radiography of the phantom should be analyzed as follow:

- Sphere size:

If the height is different of the width the Y parameter should be changed.

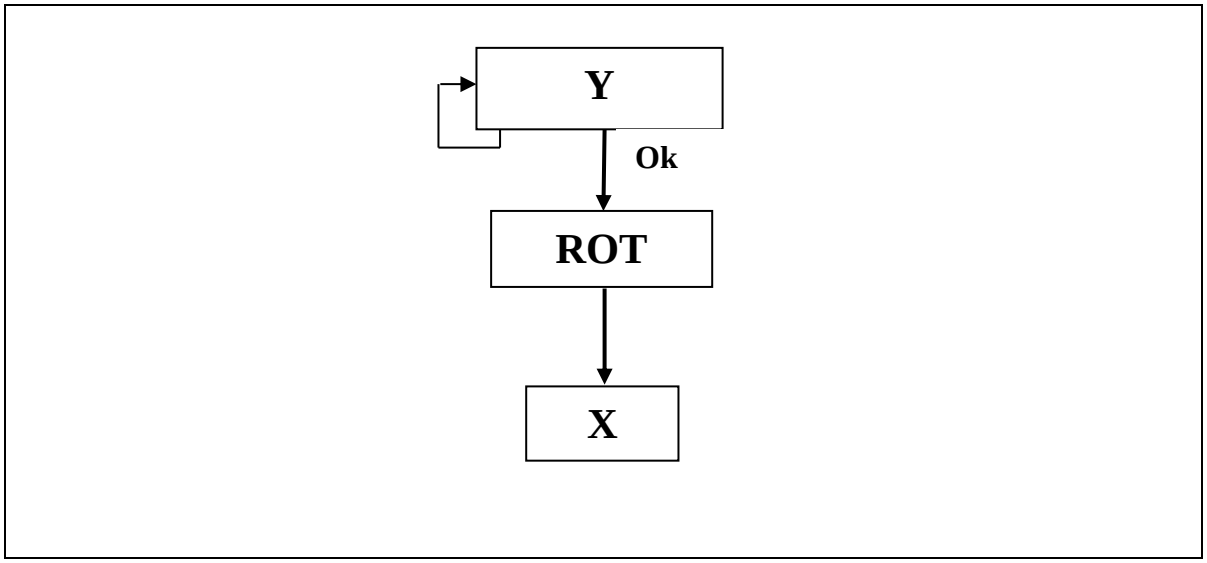
- Distance of the left spheres and right spheres to the central sphere:

If the distances are different the X parameter should be changed.

- Distance of Lead sphere and central sphere:

If the distance between the lead sphere and the central sphere is more to right or left the ROT parameter should be changed.

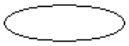
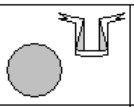
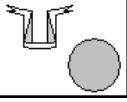
Figure 47 – Adjustment Flowchart



5.5.3 MANUAL CALIBRATION

For a manual adjust use the table below as a reference for change the parameter:

Table 4 - Image Layer Position Calibration Chart

Sphere	Y	Pins	X	Cervical	X	Shadow	Rot
	+		-		-		-
	-		+		+		+

Proceed with the changes in parameter settings and press the UP key for the equipment restart the position. Take another X-Ray exposure and verify the image layer after any adjustments.

The Width and Height of the center sphere must be lower than **1.5%**.

The difference between the distance of the lead sphere and the central sphere must be lower than **15 pixels**.

After that see all distances between center spheres and others spheres on the left and right and write down everything. The percentages must be greater than **2%** for the first four spheres and less than **4%** to sphere 5 and 6.

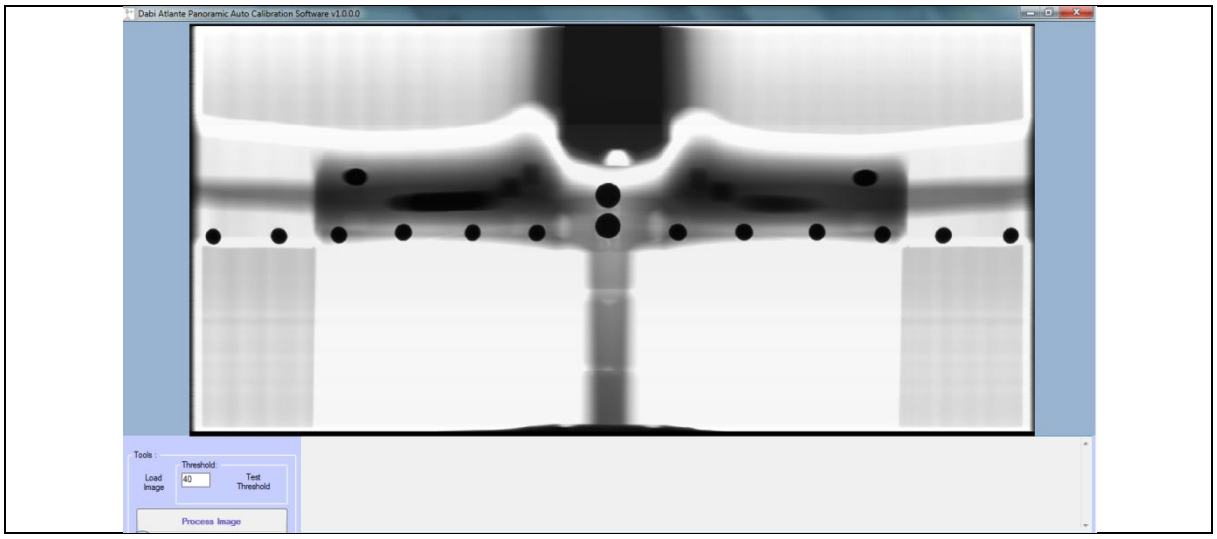
Re-adjust if necessary until the calibration error is lower than tolerance.

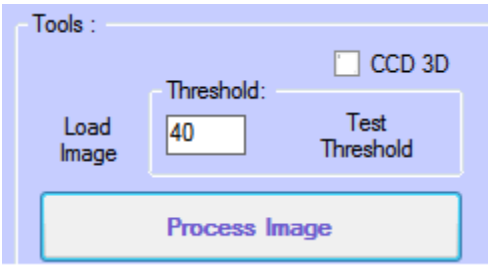
5.5.4 AUTO PAN CALIBRATION

Open the sensor auto calibration tool at software Dental Imaging.

Tools → Expert → Sensor Image Calibration → Auto Pan Calibration

Figure 48 - Auto Pan Calibration

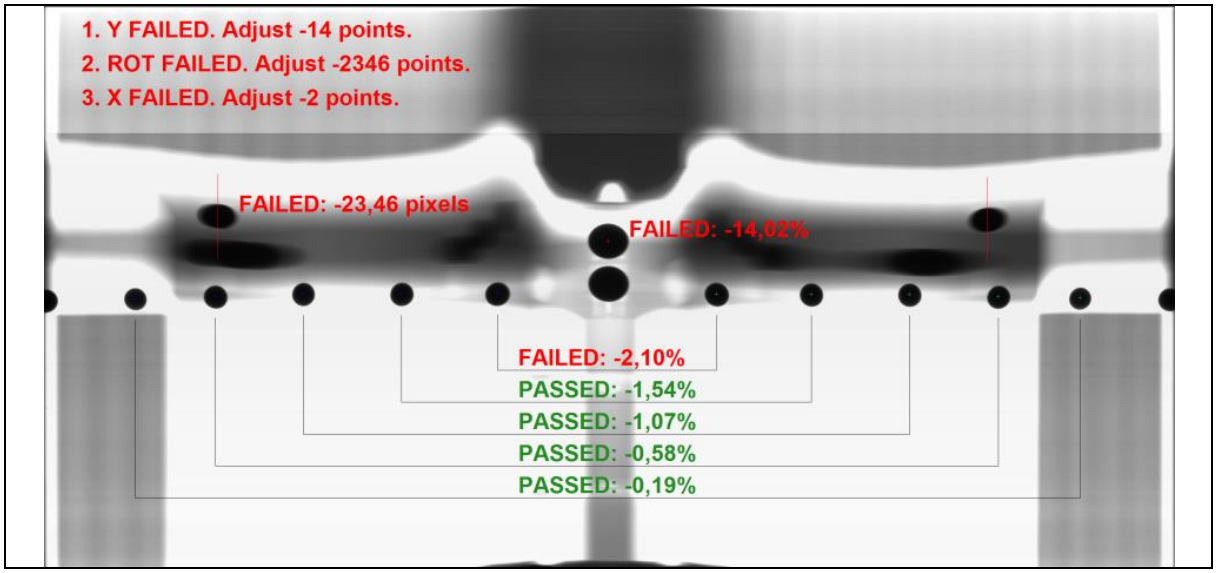




ATENTION	**MAKE SURE THAT THE CCD 3D CHECKBOX IS UNCHECKED.**

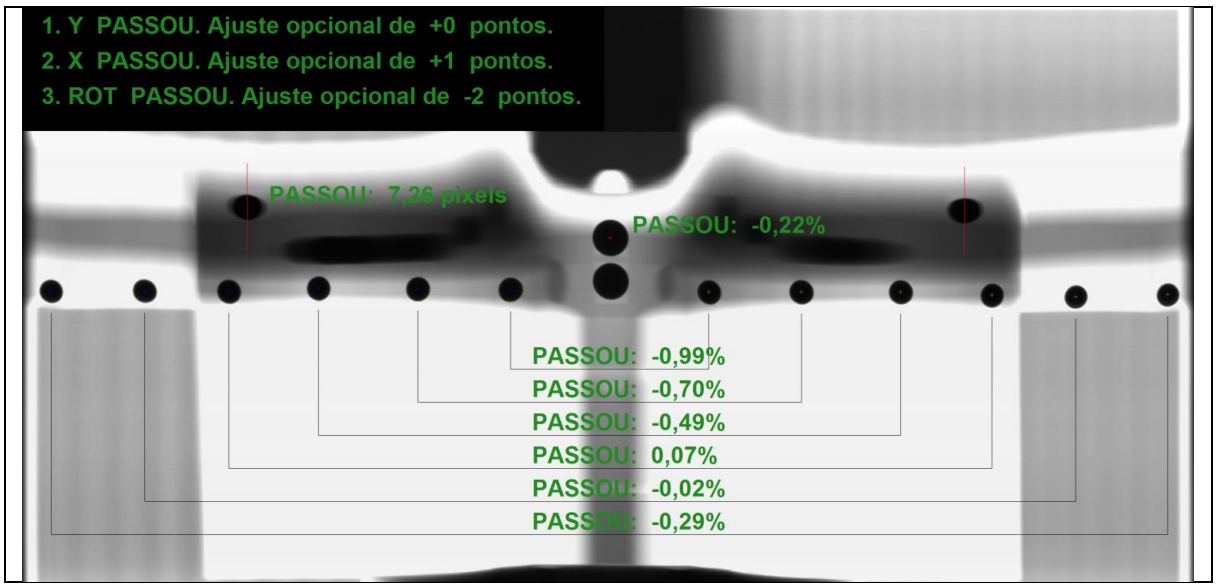
Press process image. The software will measure the dimensions and distances of the spheres and give you the value to adjust X, Y and ROT

Figure 49 - Auto Pan Calibration adjustments



Adjust until all indications be green.

Figure 50 - Calibration finished

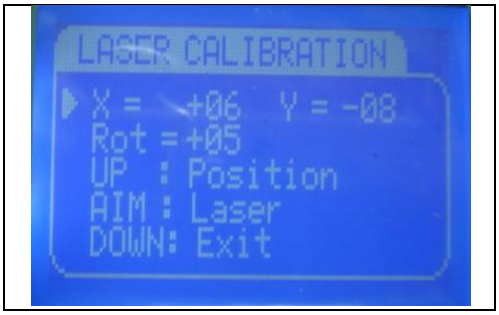


5.6 CALIBRATING THE POSITIONING LIGHTS

5.6.1 CALIBRATING THE FRANKFURT PLANE/CANINE

After successfully completing the last step you should calibrate the x,y, rotation of the unit. On the equipment the following screen should display:

Figure 51 - Laser Calibration Screen Menu.

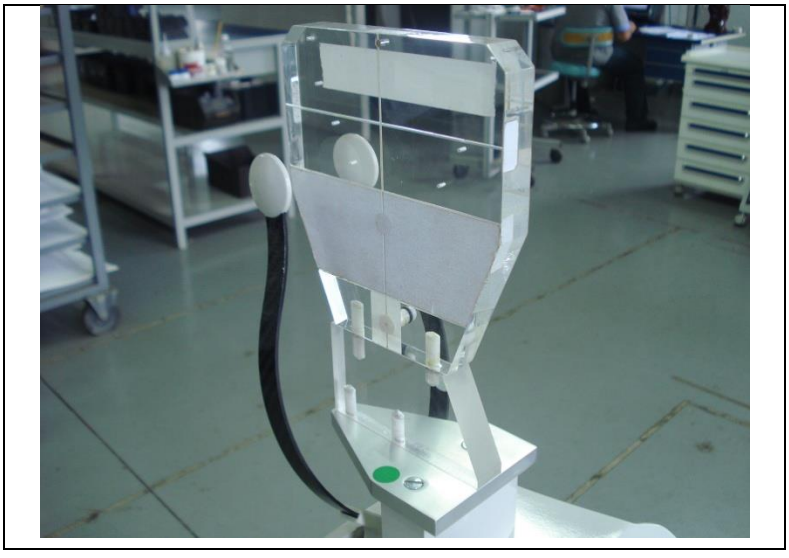


On this screen follow the procedure below to adjust the parameters.

- Change between X, Y and Rotation by pressing the SELECT key on the equipment.
- Adjust the value of X, Y and Rotation by pressing PLUS and MINUS key.
- Activate the Laser by pressing the LASER key.
- Press the UP key to go the position.

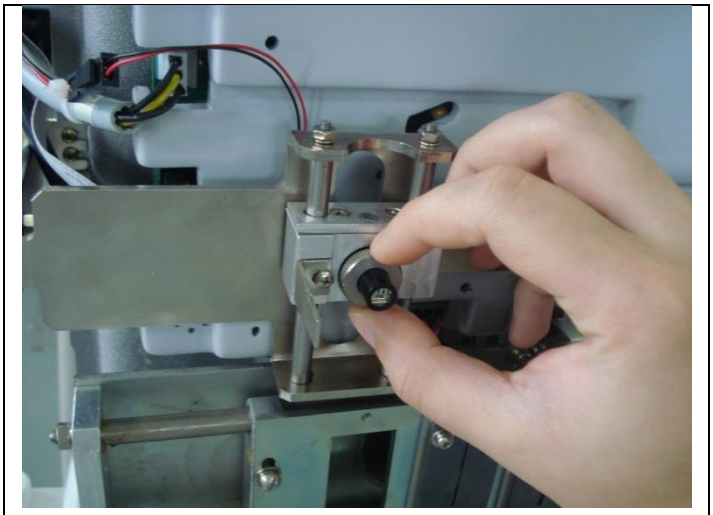
Position the Position the Laser Calibrating Tool over the Phantom Calibrating Tool shown on the following picture.

Figure 52 - Phantom in Position for rotation adjustment of laser beam Frankfurt/Canine.



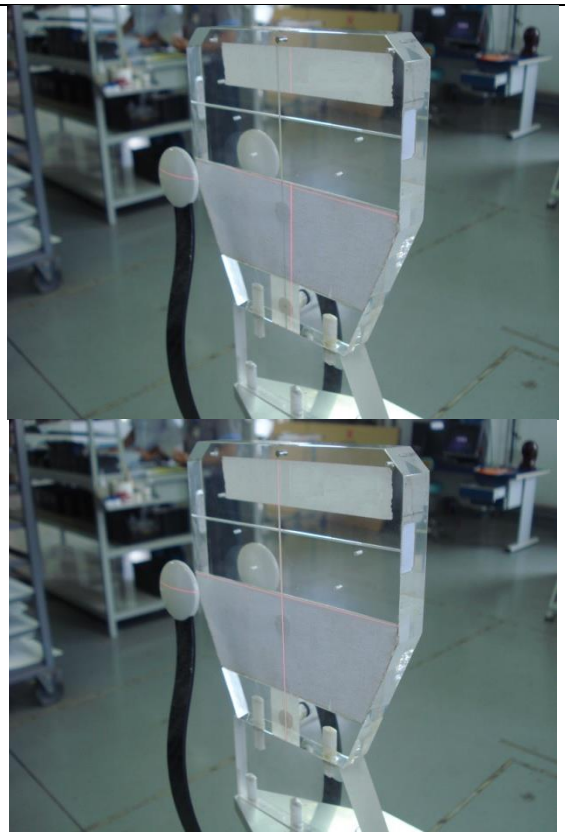
Adjust the rotation of the Laser such as the lines are in the vertical (center line) and in the horizontal. See the picture below:

Figure 53 - Adjusting laser rotation



If the laser beam is more right or left that center, the Y parameter should be changed. Restart the position by pressing the UP key.

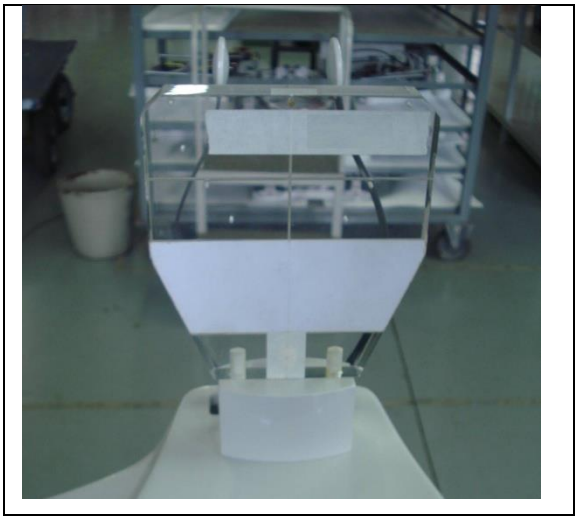
Figure 54 – Rotation adjustment of laser beam



Move the laser up and down looking at the laser crossing point, case the crossing point is not in the center line of the device use the lateral screws to align the guides ensuring that the crossing point is always in the centerline.

Place the device vertically, but now by front, place the horizontal beam on the center line and check the parallelism. The beam must illuminate the device in the same direction on both sides, see the picture below:

Figure 55 - Phantom in Position for parallelism adjustment of laser beam Frankfurt/Canine.



Adjust the screw shown on Figure 56 so that the laser is illuminating the Frankfurt plane / canine line as shown on **Error! Reference source not found.**.

Figure 56. Frankfurt/Canine Laser Beam Adjustment Screws

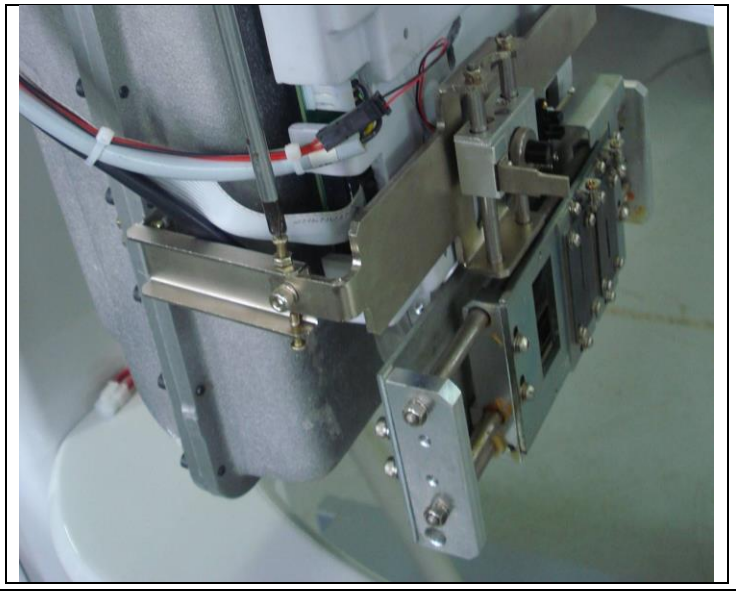
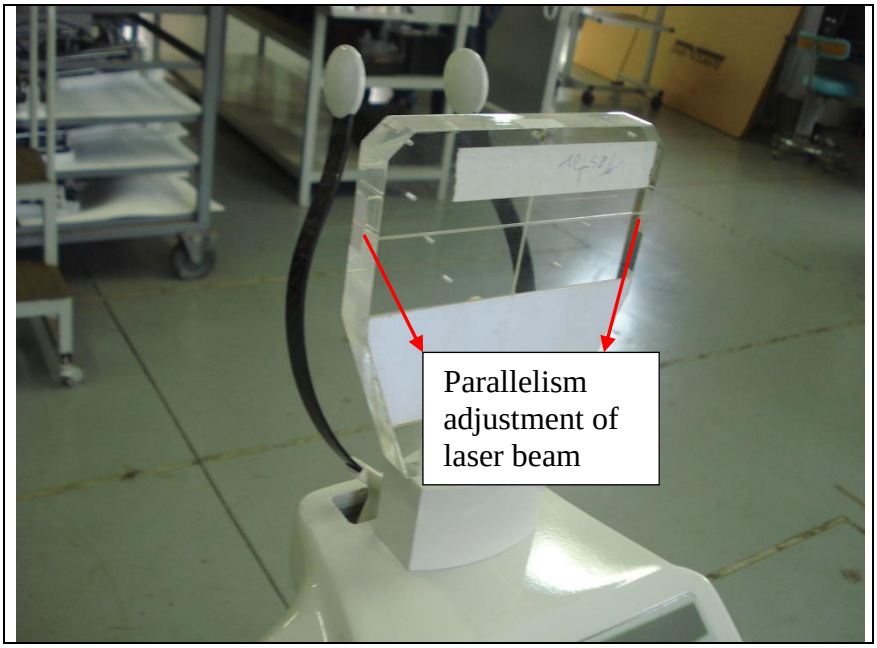


Figure 57 - Parallelism adjustment of laser beam



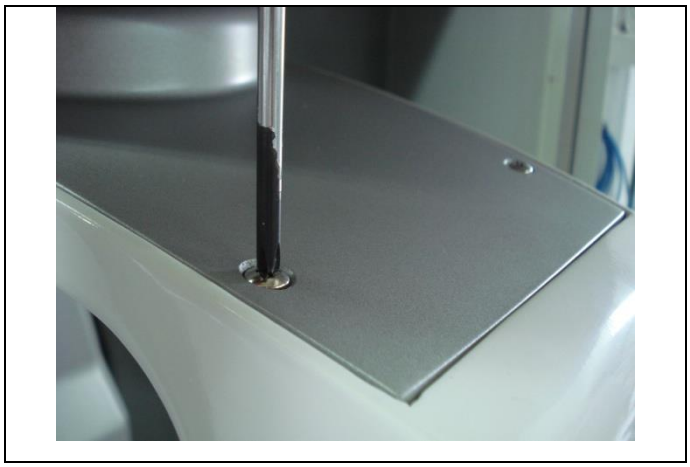
5.6.2 CALIBRATING MID-SAGITTAL PLANE

With the Pins Phantom placed in the vertical position, proceed with the mechanical adjustment of the laser light verifying that the beam passes to the center of the device. See the picture below for reference

Figure 58 - Laser Calibrating Tool in Position for Mid-Sagittal.

Remove the rotating arm cover by unscrewing the screws in the following picture

Figure 59 - Removing Rotating Arm Cover.



Adjust the screw shown in Figure 60 so that the laser is illuminating the mid-sagittal line as shown in Figure 61.

Figure 60. Mid-Sagittal Laser Beam Adjustment Screw.

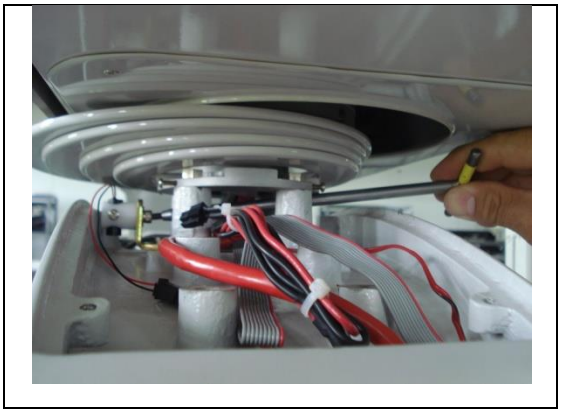
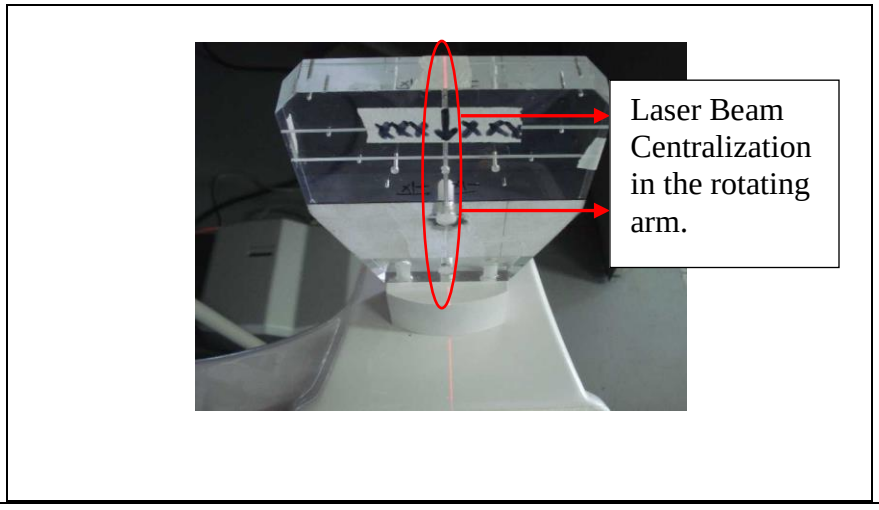


Figure 61. Adequate Mid-Sagittal Laser Position.



If rotation adjustments are needed, the ROT parameter should be changed. Restart the position by pressing the UP key.

If the laser beam is more right or left that center, the X parameter should be changed. Restart the position by pressing the UP key.

Press the DOWN key to finish the panoramic calibration and return to the Service Main Menu.

6 SNAP-ON CEPHALOMETRIC ARM CALIBRATION

ATTENTION	**Before calibrating the Snap-On Cephalometric Arm it is imperative that the Panoramic calibration is fully completed.**

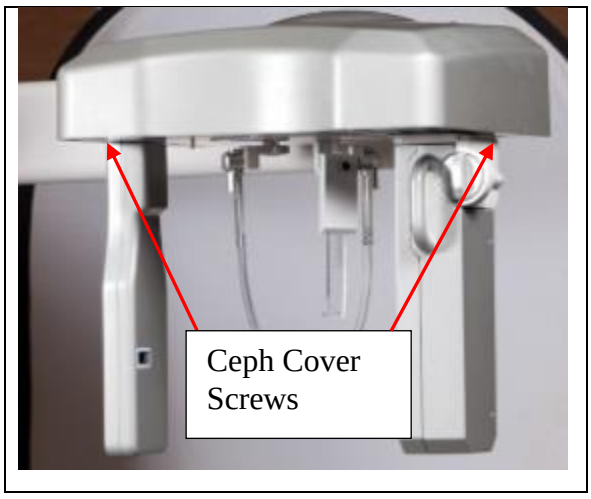
ATTENTION	**During this procedure there will be exposure of X-RAYS. Take necessary measures to comply to local safety regulation.**

6.1 PREPARATION FOR CALIBRATION

To start the calibration of the Snap-On Ceph it is necessary to remove the ceph cover, collimator covers, frontal sensor cover and secondary collimator.

To remove the cover, unscrew the screws shown in the following picture.

Figure 62. Ceph Cover Screws

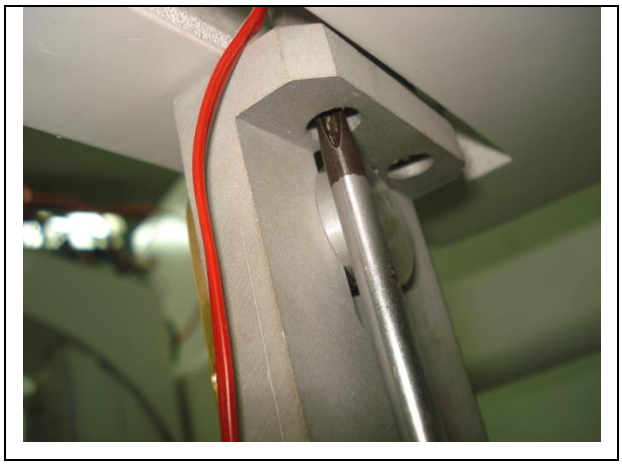


To remove the secondary collimator cover, unscrew the screws shown in the following picture.

Figure 63. Secondary Collimator Cover Screws

To remove the secondary collimator, unscrew the screws shown in the following picture.

Figure 64 - Secondary Collimator Screws



Remove everything between the tubehead and the sensor, include chin rest, open and lock the head support.

Figure 65 - Opening and locking the head support

6.2 CALIBRATING C-ARM SENSOR POSITION

Enter the Service Configuration Menu. Open Snap-On Ceph option

Calibrate the Snap Sensor support position leaving it at the center of the ceph axis. Measure the distance of the sensor support of the right and the left sides. The distances should be equal on both sides.

Using the calibration menu, to make the adjustment of the distance of the c-arm sensor.

Follow the procedure to adjust the distance.

Figure 66 – Sensor position calibration procedure

Distance calibration screen

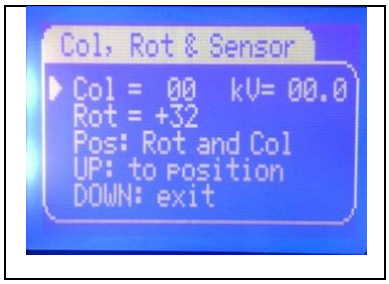
The right and left distance should be equal.

Calibration should be done by pressing PLUS or MINUS key on the equipment.
Press the UP key after software adjustment to check the Snap Sensor position.
Press the DOWN key when finish the calibration and go to the next step.

6.3 CALIBRATING C-ARM ROTATION

When you go to the next step, the following screen should display

Figure 67 - C-ARM Rotation Calibration Screen.



First proceed with an adjustment with a fluorescent tool, after that proceeds with a fine adjustment using the software.

Position the fluorescent tool in front of the sensor as shown below:

Figure 68. Fluorescent tool in Snap-On Ceph Position.

Press laser key to select the function. Select the mode **ROT and COL**

Set the kV value at **60kV**, press and hold the exposure button. Using the fluorescent calibration tool, adjust the COL parameters and make the beam avoid the sensor´s covers in panoramic position and adjust ROT parameters to align the beam and the sensor in ceph position.

After adjusting the calibration value, move the equipment to the new calibration position by pressing UP key.

Repeat the exposure and check visually until the beam is centralized

To proceed with the fine-calibration, remove the Fluorescent Calibration Tool used on the previous procedure.

Open Dental Imaging software and access expert tool by click on Histogram Label.

Open the beam calibration tool under menu Tools → Expert → Collimator Calibration → Ceph.

The software will start a 9-second countdown. During the countdown make an exposure.

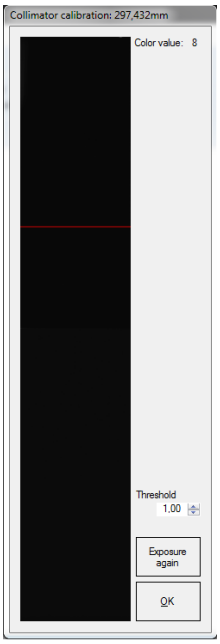


Figure 72 - Mechanical Alignment Tool

If necessary, adjust the threshold value.

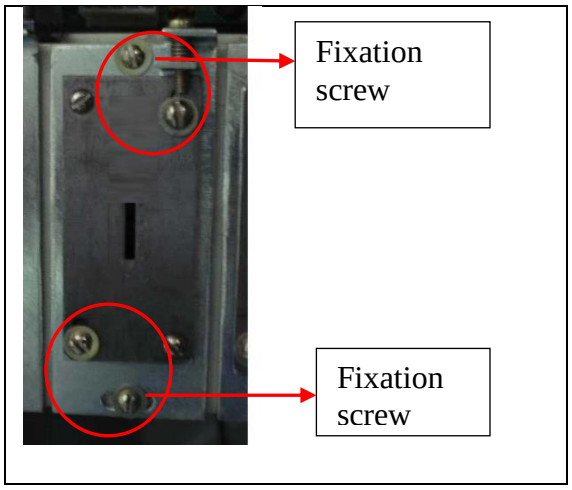
Verify and adjust the alignment of the beam until the beam is centered.

6.4 CALIBRATING PRIMARY CEPH COLLIMATOR

Make the calibration of the primary ceph collimator position by software, height and angle mechanically.

Calibrate the primary ceph collimator, adjusting the height and the inclination mechanically and finally horizontally by software.

Figure 69 – Mechanical adjustment of primary ceph collimator



Open the beam calibration tool under menu Tools → Expert → Collimator Calibration → Ceph.

The software will start a 9-second countdown. During the countdown make an exposure.

Verify and adjust the alignment of the beam until the beam is calibrated.

After adjusting the calibration value, move the equipment to the new calibration position by pressing UP key.

6.5 CALIBRATING CEPH SECONDARY COLLIMATOR

Assembly the secondary collimator

Insert the ceph calibration tool inside the gap of the secondary collimator

Figure 70 – Ceph calibration tool position in secondary collimator.

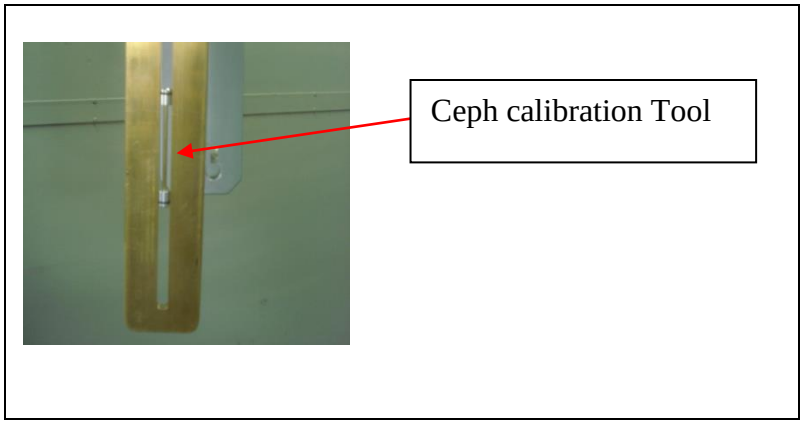


Figure 71 - Horizontal adjustment

Use laser key to change the modes

Only Center: Press Up key to restart only the collimator support position/ Collimator position will be in the center.

Full Center: Press Up key to a full restart position/ Collimator position will be in the center.

Only Right: Press Up key to restart only the collimator support position/ Collimator position will be in the right.

Full Right: Press Up key to a full restart position/ Collimator position will be in the right.

Only Left: Press Up key to restart only the collimator support position/ Collimator position will be in the left

Full Left: Press Up key to a full restart position/ Collimator position will be in the left

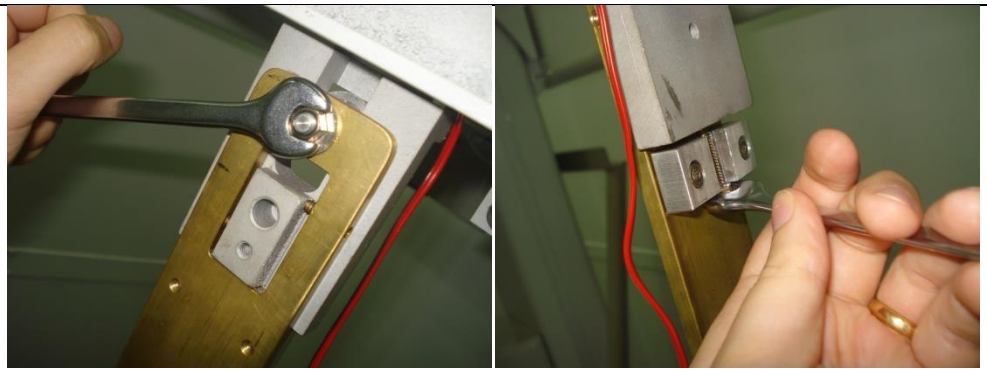
Using Dental Imaging software check the centralization of the beam. Adjust the horizontal position, angle and height mechanically.

 QUICK TIP	A good order to align the collimator is: 1st: Vertical only in central position 2nd: Angle only in central position 3rd: Horizontal in central, left and right position

6.5.1 VERTICAL ADJUSTMENT

This adjustment is mechanical. The following picture shows the mechanical adjustment procedure:

Figure 72. Mechanical Vertical Adjustment of Secondary Collimator.

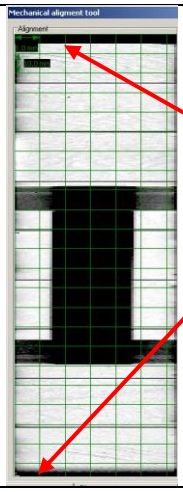


Release the screw that locks the collimator

Adjust the height by tightening or release the screw

Take an exposure with the fluorescent tool in position. The beam should be within vertical limits as shown in the following picture:

Figure 73. Beam Vertical Limits.



If the beam is off limits follow the procedure above and take another exposure. Repeat the process until the vertical calibration is calibrated and the beam is divided equally on the vertical position.

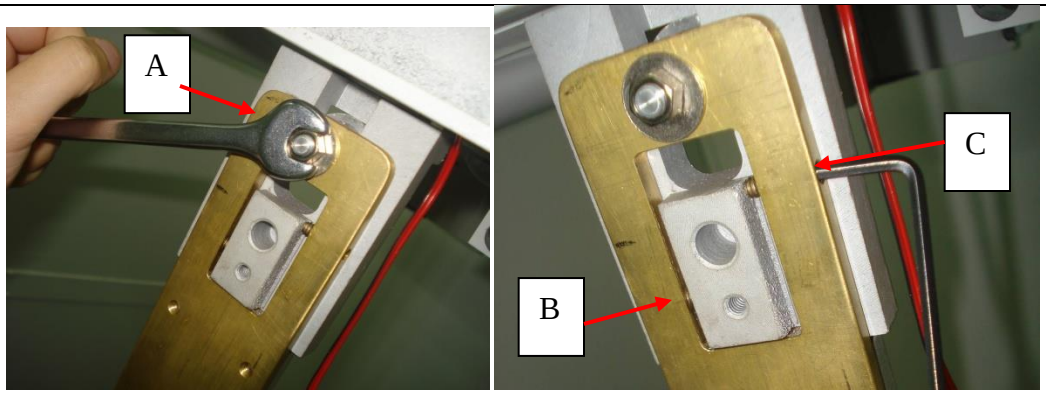
6.5.2 ANGLE ADJUSTMENT

This calibration is mechanical.

 QUICK TIP	A good way of identifying if the angle is correct before exposing x-rays it is to look though the secondary collimator in the sensor direction. The internal hole of the collimator should be aligned with the sensor vertical lines.

The Screw A is used to lock the system and screws A and B are used to adjust the angle of the collimator. The following picture shows the mechanical adjustment procedure.

Figure 74 - Mechanical Angle Adjustment of Secondary Collimator.



Release the screw that locks the collimator

Adjust the angle by tightening and release the screws

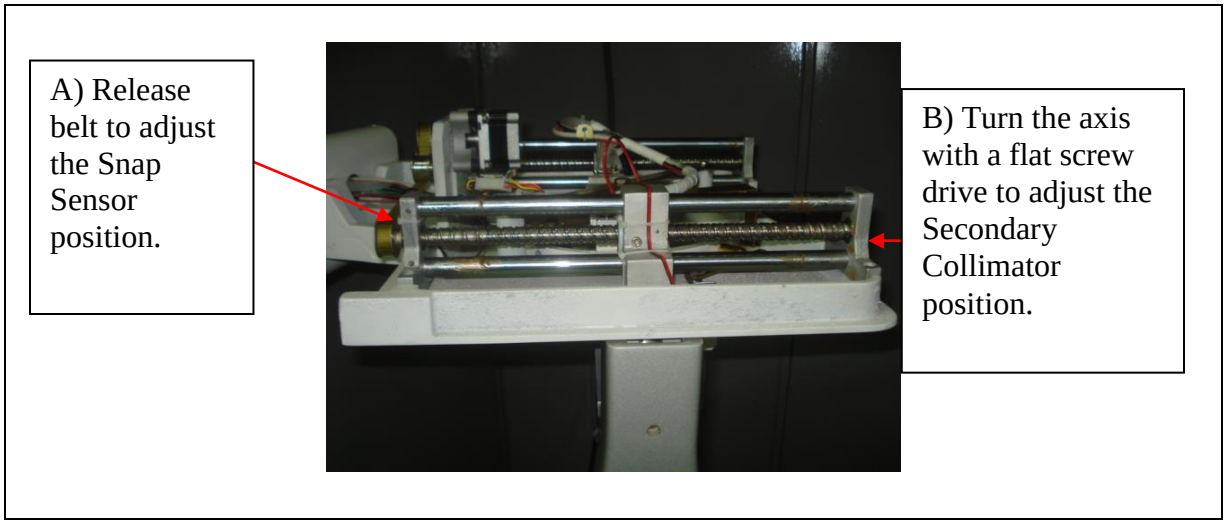
After adjusting the angle of the collimator take an exposure and check vertical alignment. After a successful calibration tighten screws.

6.5.3 HORIZONTAL ADJUSTMENT

This calibration is mechanical. Start this calibration in center position. The following mechanical assembly is used to calibrate horizontally the unit.

Adjust horizontally the secondary collimator, releasing the belt as show in the section 6.3 than move the secondary collimator, with a flat screw driver turn the axis to position the X-Ray beam in the Center of the collimator. If necessary, use the fluorescent tool.

Figure 75 - Secondary collimator calibration procedure



The screw A is used to mechanically release the belt. The slot B is used to finally tune the horizontal position. To move the system to the right or to the left use a slotted screwdriver in slot B and rotate the shaft in order to make screw A visible. Loosen screw A and rotate the shaft using the screwdriver. One rotation on the shaft is equivalent to a 10mm shift of the secondary collimator. After adjusting tighten screw A.

In each adjustment of the collimator positioning press the UP key in the "Only" mode to the collimator go to the new position. If all the ceph reposition was necessary, change to the mode Full Center by pressing the Laser key and press UP key for the repositioning.

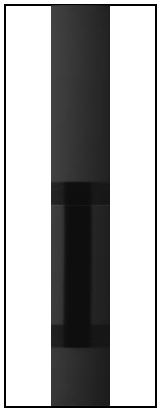
6.5.4 FINE CALIBRATION

Open the mechanical alignment on Dental Imaging software adjustment.

Tools → Expert → Collimator Calibration → Ceph

The software will start a 9-second countdown. During the countdown make an exposure. The beam should be centralized in the sensor area. Adjust by the way that beam is distributed equally by the ends of the sensor

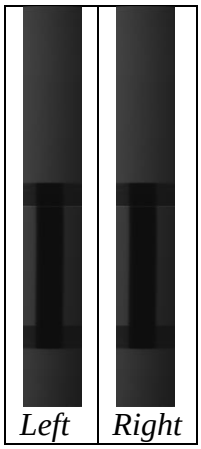
Figure 76 - Beam centralized at the center position



ATTENTION	**After adjusting the secondary collimator position it is imperative to move the system to its calibrating position again. Move the system by pressing the UP KEY.**

After the beam adjustment in the Center, check the beam in right and left position

Figure 77 - Beam centralized at the left and right position



If the beam present a deviation too large in one of the sides repeat the procedure of this section.

Remove the ceph calibration tool of the secondary collimator

6.6 CEPH SENSOR CALIBRATION

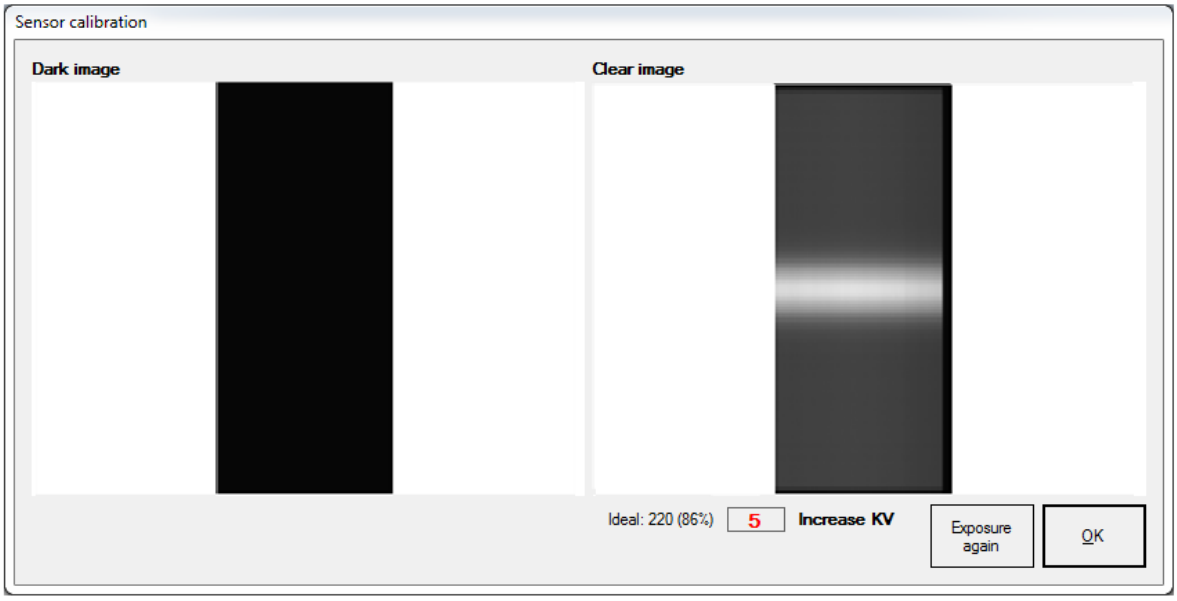
Press laser key to select the function. Select the mode **SENSOR.**

To do the calibration open the calibration tool on the software under Tools → Expert → Sensor Calibration → Ceph.

The software will start a 120-second countdown. During the countdown make a demonstration exposure without Kv.

After that press OK. The software will start a 120-second countdown. During the countdown make an exposure **without** a 20mm aluminum and 85kV.

The follow screen will display:



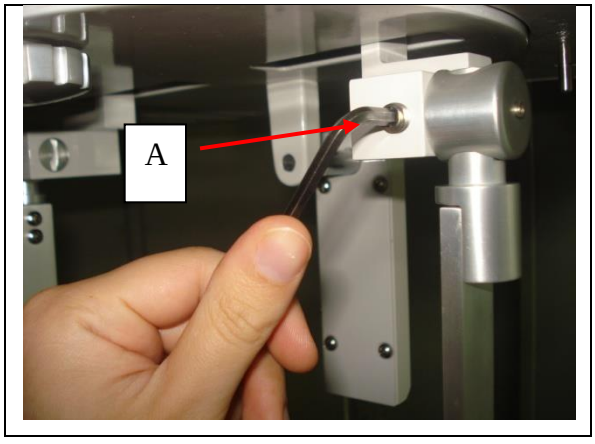
The pixel value should me around **220**. The software will indicate if the calibration was successful. If the value is higher or lower, decrease or increase kVp value following the software instruction and repeat the procedure until the sensor is calibrated. After finish restart the software to apply the calibration.

Press the DOWN key when calibration is finished and go to the next step.

6.7 EAR HOLDER CALIBRATION

This calibration is mechanical. First, fix the ear rods as show below.

Figure 78 - Fixing ear rods



The screw A is used to fix the ears rod.

QUICK TIP	A good way to start this calibration is putting the ceph in the center position and look through the hole of the secondary collimator. Both ear holders should be at center position vertically.

After that, it is necessary adjust the ear rods' height. The ear rods' height should be equal the focal point´s height. Adjust both of them as show below.

Figure 79 - Height alignment procedure

Measure at the center of the ear rods

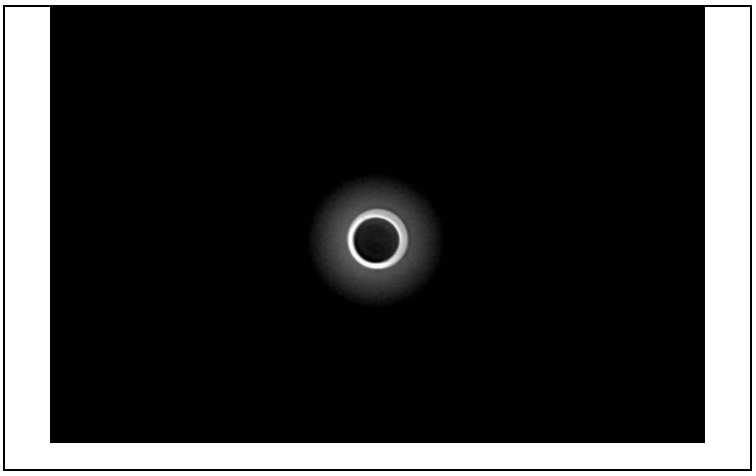
Measure at the base of the cylinder in back side of tubehead

A fine-adjustment will be needed. The calibration is checked by inspection of generated x-ray ceph image. To do the calibration, open the calibration tool on the software under Tools → Expert → Sensor Image Calibration → Ceph

Press OK before start the exposure. The software will start a 120-second countdown. During the countdown make an exposure.

Both ear holders have mechanical discs that appear in a clear way on the x-ray. The calibration consists in putting one circle inside the other as shown in the following picture:

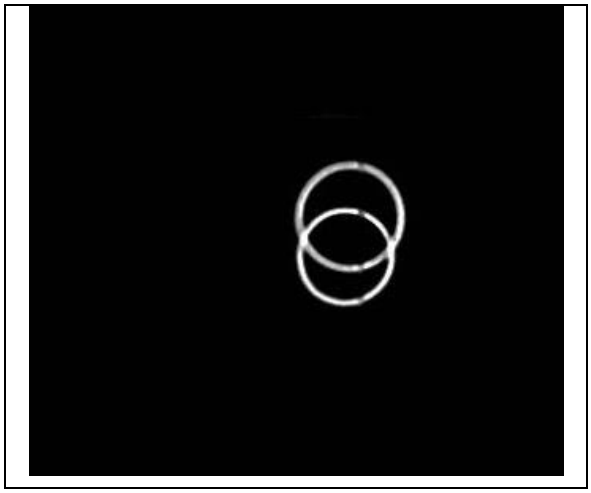
Figure 80. Ear Holder Circles.



HEIGHT ADJUSTMENT

To proceed with a height adjustment takes an exposure. The image below should appear.

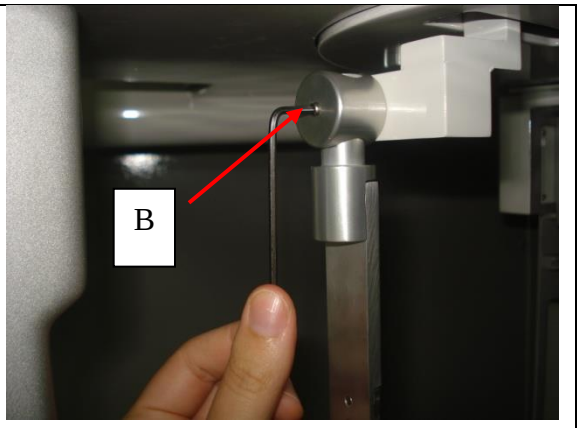
Figure 81 - Ear rods´ height misalignment



Measure the distance between the ears rod. For each 20 pixels misalign for any direction you should adjust 1mm.

If adjustments of height are need, lose the screw B as show below and adjust until both of them are at same height.

Figure 82 - Height adjustment

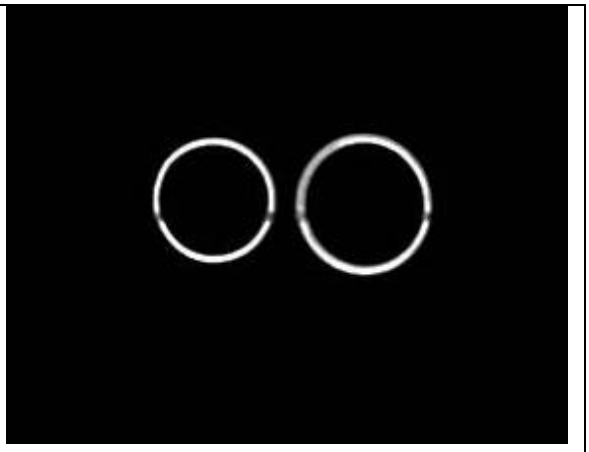


 QUICK TIP	The bigger disc is the nearest ears rod to tubehead.

HORIZONTAL ADJUSTMENT

Once the height adjustment is finished, initiate a horizontal adjustment by taking another exposure. The image below should appear.

Figure 83 - Ear rods´ horizontal misalignment



For adjust the rotation of ear rods´ support, release the screw of ear rod´s support lock, adjust the rotation and tight again as show below

Figure 84 – Rotation adjustment of the ear rods´ support

Follow the procedure below until both of them are align.

- Measure the distance between the ears rod. For each 20 pixels misalign you should adjust 1mm.
- If the biggest ear rod is on RIGHT side, rotate the ear rods´ support in CLOCKWATCH DIRECTION
- If the biggest ear rod is on LEFT side, rotate the ear rods´ support in COUNTER-CLOCKWATCH DIRECTION

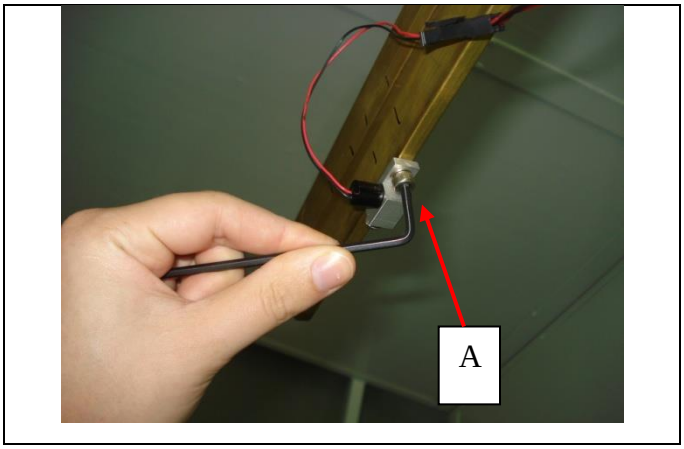
Take another exposure with the ear rod complete closed than repeat the procedure but with the ear rods complete opened. The circles must be inside at any position.

Repeat the procedures until the ear rod are calibrated.

6.8 CALIBRATING THE FRANKFURT POSITIONING LASER

This calibration is mechanical. The following mechanical assembly is used for calibration:

Figure 85. Ceph Laser Calibration Assembly.



Adjust the laser loosening and tightening screw A in order to pass the beam trough both ear holders.

 QUICK TIP	*The height of the ears rods with the bottom edge should be equal or bigger than 900 pixels*

7 FINISHING THE DELIVERY

The form on ANNEX A should be completed and approved before releasing the equipment to the responsible party.

PART C – SERVICING THE EQUIPMENT

8 SERVICE MENU

The service menu has tools to evaluate the equipment and help to find error.

8.1 CHK: HMI/DC MOTOR

Select in the service menu CHK: HMI/DC MOTOR

The equipment will start a test to verify the communication between the HMI (Human-Machine Interface) and main board. After the test is finish, the display will show the number of the lost packet in 1000 communication.

Figure 86- HMI communication test

If the number of the lost packets is superior of 50, check the communication cable. After the finish of the test press SELECT to continue.

The next part of this check will be the DC motor. The equipment will go up and down several times to verify the communication between the motor and the main board. At the end of the test, the screen should display the number of error during this movement.

Figure 87 - DC motor communication test

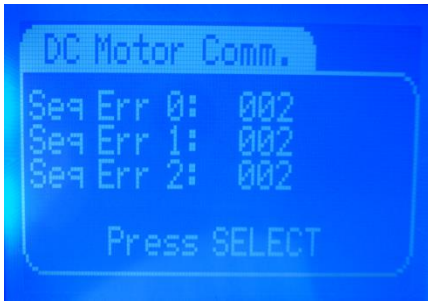


Table 5 - Sequence Error

Error Sequence	Description
Seq Err 0	Worst case
Seq Err 1	2nd Worst case
Seq Err 2	3rd Worst case

If the number of the errors is superior of 50, check the cables. After the finish of the test press SELECT to continue.

This menu shows also a value proportional to the motor current during the movement.

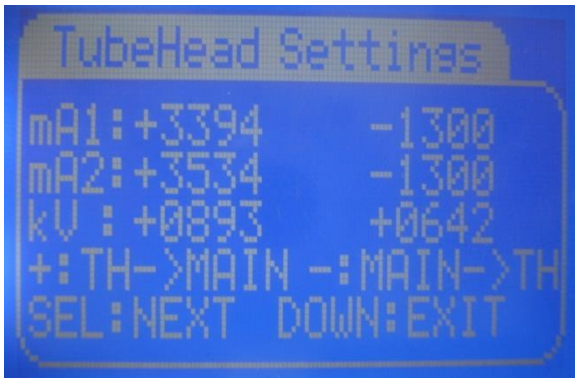
Figure 88 - DC motor values

8.2 CHK: TUBE COMM

Select in the service menu CHK: TUBE COMM

The first screen will display the values of tubehead calibration.

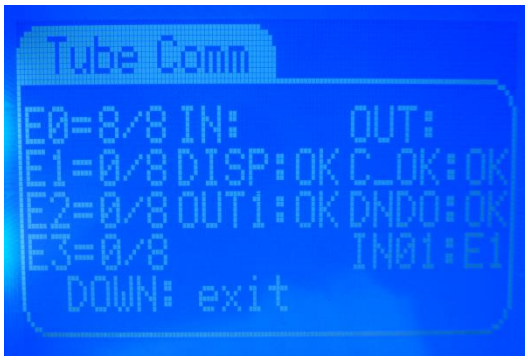
Figure 89 - Tubehead calibration values



You can backup the tubehead calibration parameters to main board memory by pressing PLUS Key. If you need to restore tubehead calibration parameters, from Mainboard backup location, press MINUS key.

The equipment will start a test to verify the communication between the Tube Head and main board. After the test is finish, the following screen should display.

Figure 90 - Tubehead communication test



The table below shows the error code for tubehead communication test:

Table 6 - Tubehead Error Code

Tubehead Error Code	**Description**
E3	Number of error with normal communication speed
E2	Number of error with 2x communication speed
E1	Number of error with 4x communication speed
E0	Number of error with 8x communication speed
DISP	Trigger signal to tubehead
C_OK	Tubehead OK
DNDO	Trigger signal to mainboard
OUT1	Not used
IN01	Not used

The E3 and E2 **MUST BE** zero.

You can also verify an error directly using tubehead Led

Table 7 - Tubehead LED Error Code

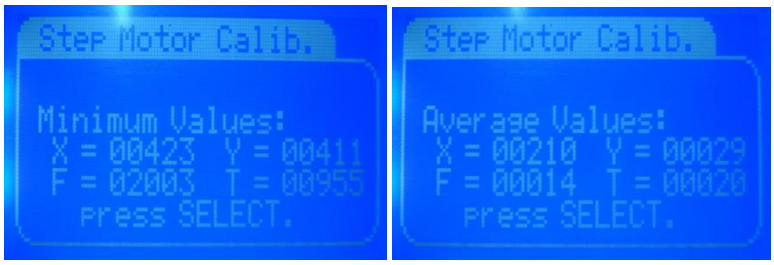
Nº	**Led Code**					**Error Name**	**Description**	**Limit**
	1	2	4	8	*			
	0	1	2	3	4			
1	*					ERR_LO_KV	High Voltage too low	30kV
2		*				ERR_HI_KV	High Voltage too high	106kV
3	*	*				ERR_LO_MA	Anodic current too low	3mA
4			*			ERR_HI_MA	Anodic current too high	10mA
5	*		*			ERR_LO_VFIL	Filament voltage too low	40mV
6		*	*			ERR_HI_VFIL	Filament voltage too higt	8,0V
7	*	*	*			ERR_LO_VLINE	Tubehead Power supply voltage too low (NOT USED)	-
8				*		ERR_HI_VLINE	Tubehead Power supply voltage too high (NOT USED)	-
9	*			*		ERR_LO_VBUCK	Buck voltage too low (NOT USED)	-

10		*		*		ERR_HI_VBUCK	Buck voltage too high (NOT USED)	-
11	*	*		*		ERR_LO_IRES	Resonant current too low (NOT USED)	-
12			*	*		ERR_HI_IRES	Resonant current too high (NOT USED)	-
13	*		*	*		ERR_INCORRECT_ PARAMETER	Parameters received from the main board, for exposure, incorrect	Aceitos: kV até 100; mA até 8; tempo até 20s; vFil até 6V
14		*	*	*		ERR_INVALID_ DUTY_CYCLE	Duty cycle of kV or mA invalid (too high)	-
15	*	*	*	*		ERR_HW_KV_ MA_OVER	Hardware error (red LED) indicate kV and/or mA too high	125kV e/ou 12,5 mA
16					*	ERR_LOOP_TIME	Loop time error	-
17	*				*	ERR_INVALID_ SM_STATE	Equipment state invalid	-
18		*			*	ERR_INVALID_ KV_SET_POINT	kV Setpoint incorrect.	-
19	*	*			*	ERR_EXITED_ MAIN_LOOP	Left software main loop	-
20			*		*	ERR_HI_MA_ RELAXED	During the transition period between the control loop filament voltage control loop for the anodic current, there is a loosening of the maximum mA to accommodate the transition. This error is generated if this transition, yet the accommodation was not enough and mA above threshold.	11,2mA
21	*		*		*	ERR_RES_60	Error reserved for future use	-
22 until 31	Other combinations					Errors do not exist		

8.3 CHK: STEPPER MOTORS

The stepper motor check menu will be show a proportional to current of the motor.
Select in the service menu CHK: STEPPER M.
The following screen should display.

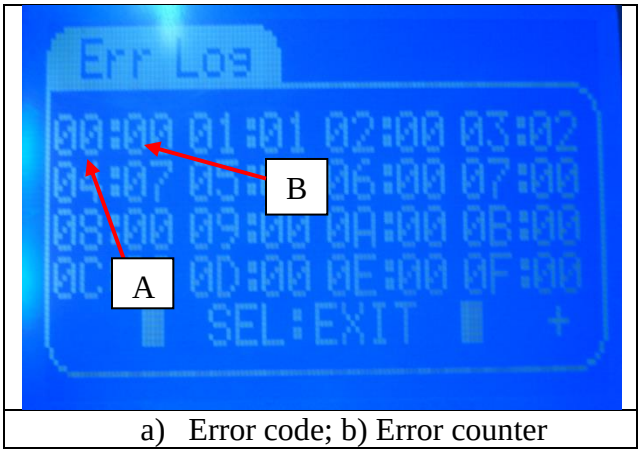
Figure 91 - Stepper motor values



8.4 CHK: ERROR LOG

The error log register is a counter of the error that happens with the equipment.
Select in the service menu CHK: ERROR LOG
The following screen should display.

Figure 92 - Error log display



a) Error code; b) Error counter

The first number represents the error code and the second number represents the counter (the number of times that this error happens). The table below shows the error code:

Table 8 – Error Code Table

Error Code (Hexadecimal)	Description
00	Fatal error while reading EEPROM memory
01	Fatal error while writing EEPROM memory
02	Error during patient exit position movement after exposure
03	General error from the stepper motor
04	Stepper motor X error during movement
05	Stepper motor Y error during movement
06	Stepper motor Rotational error during movement

07	Stepper motor Collimator error during movement
08	Stepper motor Ceph error during movement
09	Stepper motor Film error during movement
0A	Communication Error from FPGA
0B	Communication Error from Display
0C	Timeout error from Stepper motor X during movement
0D	Timeout error from Stepper motor Y during movement
0E	Timeout error from Stepper motor Rotational during movement
0F	Timeout error from Stepper motor Collimator during movement
10	Timeout error from Stepper motor Ceph during movement
11	Timeout error from Stepper motor Film during movement
12	Timeout error from Stepper motor Film during movement
13	Timeout error from Column motor Film during movement
14	Flash consist error from mainboard
15	Flash consist error from Display
16	Flash consist error from FPGA
17	Flash consist error from Tubehead
18	X-ray Exposure too long
19	Early X-ray exposure
1A	No X-ray exposure on expected time
1B	Tubehead communication error
1C	Tubehead Null error when it is asked about what error occurred
1D	Tubehead CABOK signal error
1E	Tubehead timeout error
1F	Emergency button pressed
20	Tubehead error while writing configuration
21	Reserved space
22	Reserved space
23	Reserved space
24	Reserved space
25	Reserved space
26	Reserved space
27	Reserved space
28	Low kV error
29	High kV error
2A	Low mA error
2B	High mA error
2C	Low VFil error
2D	High VFil error
2E	Low VLine error
2F	High VLine error
30	Low VBuck error
31	High VBuck error
32	Low IRes error
33	High IRes error
34	Exposure parameter sent to tubehead incorrect

35	Invalid Duty Cycle error
36	kV or mA hardware error
37	Loop time error from mainboard
38	Invalid exposure state machine on mainboard
39	Invalid kV set point configured
3A	Exited main loop from tubehead
3B	High mA relaxed
3C	Reserved space

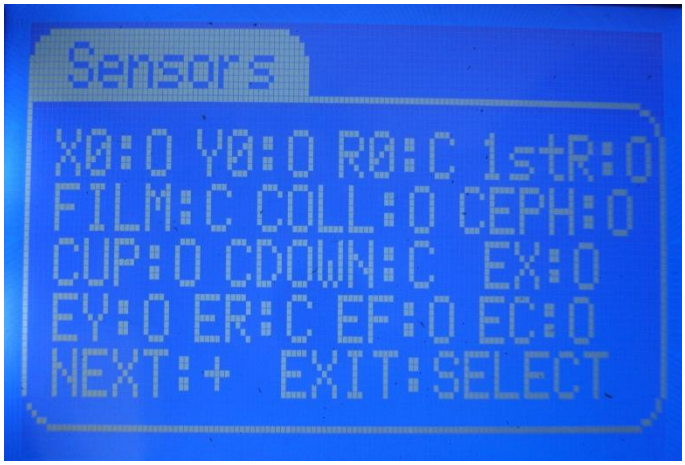
8.5 CHK: SENSORS

In this menu, you will be able to see the state of the sensors in the equipment.

Select in the service menu CHK: SENSORS

The firsts characters represent the code of the sensor and the second represent the state(“O” to open and “C” to close).

Figure 93 – Sensors Check



The table below shows the sensor code:

Table 9 - Sensors code

Character	Description
X0	Zero X
Y0	Zero Y
R0	Zero rotation
1stR	First rotation
FILM	Zero film
COLL	Zero collimator
CEPH	Zero ceph
CUP	End-of-course column up
CDOWN	End-of-course column down

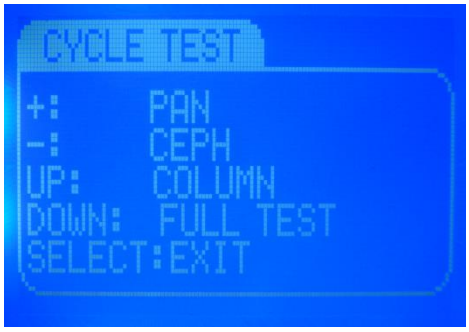
EX	Encoder X
EY	Encoder Y
ER	Encoder rotation
EF	Encoder film
EC	Encoder ceph
LPAN	Lock pan
LCEPH	Lock ceph
L3D	Lock 3D
HPAN	Has sensor pan
HCEPH	Has sensor ceph
CEPH TYPE	Ceph type (analogic only)
CDOWN (second screen)	Button column up
CUP (second screen)	Button column down
RES3	Not used
RES4	Not used

8.6 CHK: CYCLE TEST

This tool allows that you a complete profile movement without x-ray emission.

Select in the service menu CHK: CYCLE TEST and the following screen should display.

Figure 94 - Cycle test display



PLUS key: only panoramic movement during the cycle test
MINUS key: only ceph movement during the cycle test
UP key: only column movement during the cycle test
DOWN key: all movement during the cycle test

8.7 CHK: SW VERSION

Select in the service menu CHK: SW VESION

Figure 95 - Software version

All software versions (Main, FPGA, Tubehead and Keyboard) **MUST BE** equal higher than 1.000 and with last digit being an even number (0, 2, 4, 6 or 8).

8.8 CHK: PROFILE VERSION

Select in the service menu CHK: PROF. VERS.

Figure 96- Profile version

All profile versions **MUST BE** equal higher than 1.000 and with last digit being an even number (0, 2, 4, 6 or 8).

8.9 CHK: CONFIG VIEW

The config view is a tool gives some information of the main board. It´s only for internal test.

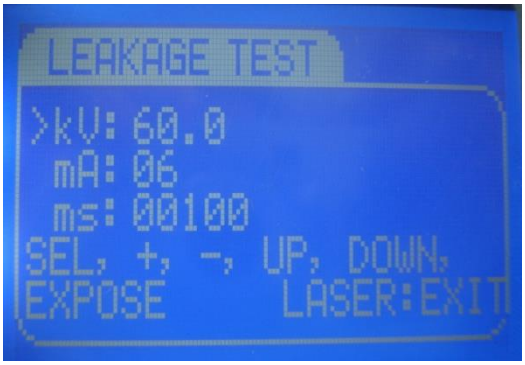
Figure 97 - Config view

8.10 CHK: LEAKGE TEST

Select in the service menu CHK: LEAKAGE TST

This tool is using to make the leakge test. In this menu you are able to select the kVp (adjustable from 60 to 85 kVp, 2.5 steps), mA (6 or 8 mA) and the time of the exposure (100ms to 14s).

Figure 98 - Leakage test menu



Use the SELECT key to navigate through to the menu. Adjust the value using the PLUS, MINUS,UP or DOWN keys.

ATTENTION	**IF THE EXPOSURE BUTTON IS PUSHED, THERE WILL BE EMISSION OF X-RAYS. TAKE NECESSARY MEASURES TO COMPLY TO LOCAL SAFETY REGULATION.**

8.11 RESET CONFIGURATION

The reset configuration tool is responsible to reset some parameter of the equipment to factory values.

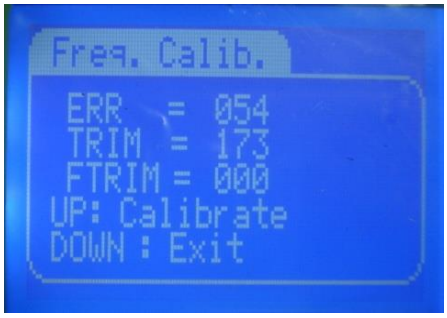
Select in the service menu RESET CONFIG and start the reset configuration procedure. The following screen should display.

Figure 99 - Clear EEPROM

Press the PLUS key to select the YES option. Press the SELECT key to confirm the cleaning of the EEPROM.

After this, the frequency calibration procedure will start. The following screen should display.

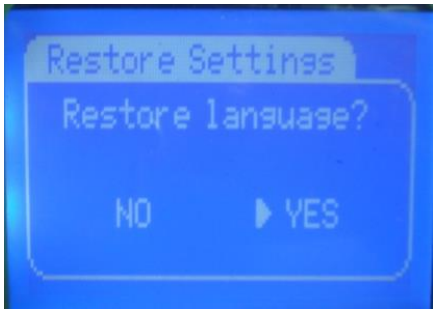
Figure 100 - Frequency calibration



Press the UP key to calibrate the equipment timer. Wait for the timer calibration. After it the Frequency Calibration main menu press the DOWN key to go to the next step.

After this procedure, you will be able to restore the standard language of the equipment.

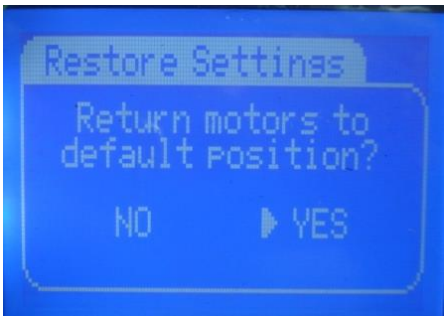
Figure 101 - Restore language



Select the YES option by pressing the PLUS key, confirm by pressing the SELECT key. The system will return to the default language (English).

On the next screen, you will be able to restore the default position of the motors.

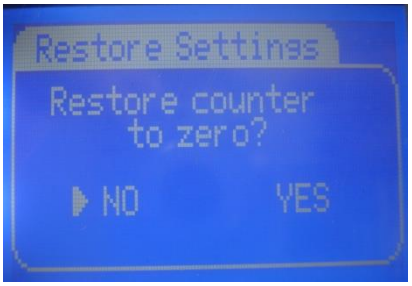
Figure 102 - Motor default position



Select the YES option by pressing the PLUS key, confirm by pressing the SELECT key. The motors configuration will be restored.

The next screen will have the option of clear the radiographies counter.

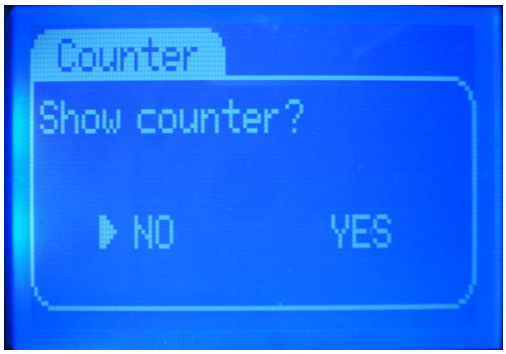
Figure 103 - Clear radiographies counter



Select the NO option, confirm by pressing the SELECT key. The radiography counter should be restored only at the factory.

The next screen will have the option of show or hide the radiographies counter.

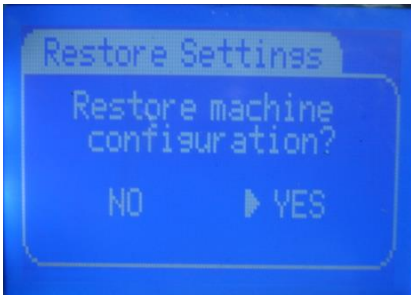
Figure 104 - Show radiographies counter



If you select the NO option and confirm by pressing the SELECT key, the radiography counter will be hidden. If you choose YES option, it will be shown after each exposure.

The last screen will have the option to restore the machine configuration.

Figure 105 - Restore machine configuration



Select the YES option by pressing the PLUS key, confirm by pressing the SELECT key. The machine configuration will be restored.

9 TROUBLESHOOTING GUIDE

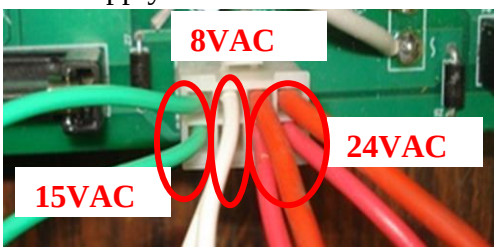
ATTENTION	**SOME SERVICING PROCEDURES REQUIRE ANALYZING LIVE PARTS AND/OR HIGH VOLTAGE PARTS. THE SERVICING TECHNICIAN MUST BE VERSED ON THIS PRACTICE AND USE ADEQUATE SAFETY PROCEDURES.**

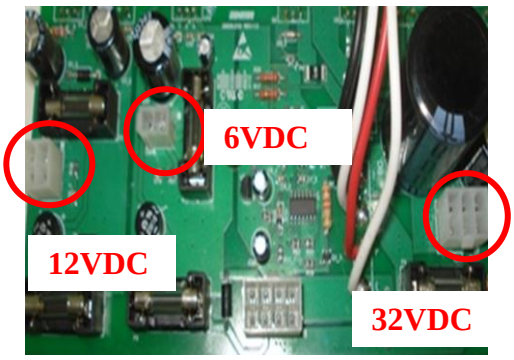
ATTENTION	**DURING THE MAINTENANCE PROCEDURE THE EXPOSURE OF X-RAYS MIGHT BE NECESSARY. TAKE NECESSARY MEASURES TO COMPLY TO LOCAL SAFETY REGULATION.**

This section is intended to be a reference to different symptoms. After finding the symptom please read each possible cause in its order. Notice that the order is important and the last option should be the last one to be executed.

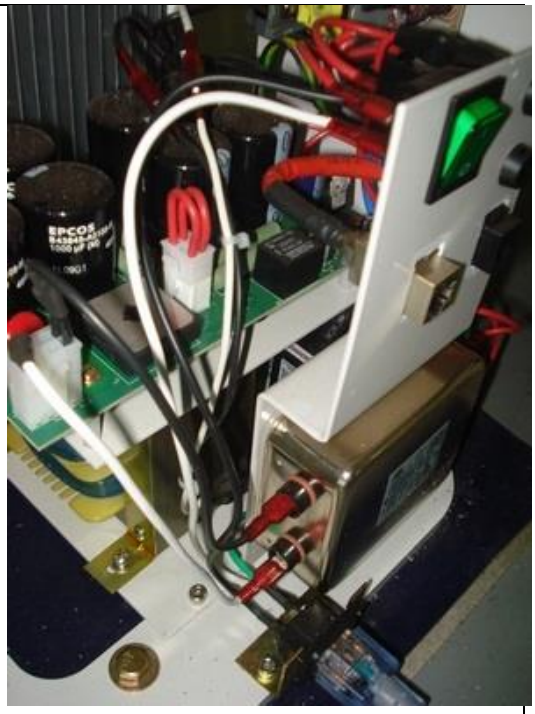
Please use the following servicing guide along with Equipment Wiring on ANNEX B.

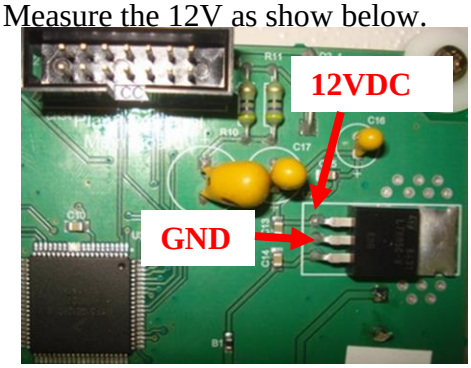
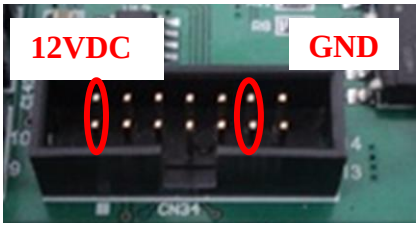
9.1 MAIN BOARD POWER SUPPLY

Symptom	Possible Causes	Identification
The equipment does not respond at all when turned on, including main switch lamp does not turn on.	Mains supply not ok	Measure mains voltage with a multimeter and check if the value is as specified for the equipment. If not ok check Circuit Breaker. Energy available in the moment. Proceed if this step is ok only.
	Incorrect internal wiring	Check if the input wiring of the equipment is correct according to ANNEX B. Check cable 55 connections.
	Defective main switch.	With the equipment turned off disconnect output from main switch (cable 54) and check voltage on input of main switch (cable 55) and output. If input voltage is ok and output is not ok while the main switch is turned on, turn off the equipment and replace the main switch. If the problem persists proceed to the following section.
Main Switch with light turned on when the equipment is turned on but the equipment is not responding.	Blown input fuses.	Turn off the equipment and check both input fuses (201) with a multimeter measuring continuity between their poles. If not ok replace blown fuses.
	Blown Power Supply Board fuses.	Turn off the equipment and check power supply fuses (215 up to 219) with a multimeter measuring continuity between their poles. If not ok replace blown fuses.
	Defective power supply board	With the equipment turned off disconnect power supply output cable, cable 61. Turn on the equipment and measure AC voltage values on the power supply as indicated below:  Measure DC output voltages as indicated below:

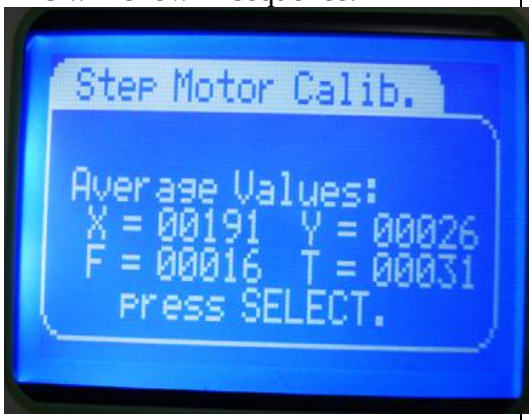
		 If fuses are correct and values measured not ok, replace power supply board.
	Incorrect wiring	Check if the input wiring of the equipment is correct according to ANNEX B. Check cables 54, 56, 79, 59, 61. Input transformer connection to distributor board and supply board.
	Defective Main Switch	Turn off the equipment and disconnect cable 54 from main switch. Turn on the equipment and check voltage on the input (line) and output (place to put cable 54) of the main switch. If input is ok and output not ok turn off the equipment and replace main switch.
	Defective Fuse Cable (54)	Turn off the equipment and disconnect cable 54 from filter (204). Turn on the equipment and check voltage on the input and output of the fuse cable. If input is ok and output not ok turn off the equipment and replace fuse cable.
	Defective Input Filter	Turn off the equipment and disconnect output wires from input filter (cable 56). Turn on the equipment and check voltage on the input and output of the input filter. If input is ok and output not ok turn off the equipment and replace input filter.
	Defective input cable to distributor board (cable 56)	Turn off the equipment and disconnect cable 56 from CN1 on distributor board. Turn on the equipment and check voltage on cable 56. If not ok replace cable 56.
	Distributor board defective to supply power to transformer	With the equipment turned off disconnect transformer from distributor board. Check voltage to connector on distributor board. If not ok replace distributor board.

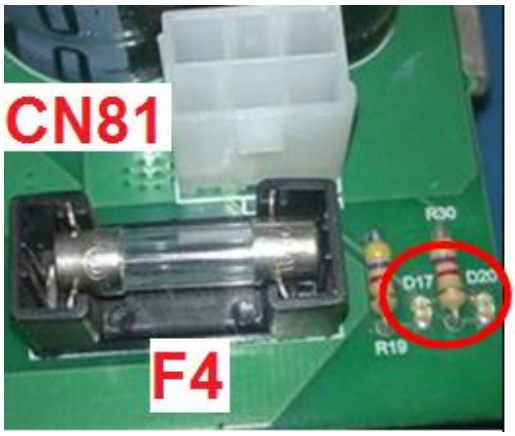
	Defective transformer	With the equipment turned off disconnect transformer outputs to supply board, to cable 59 and the three wire connection to distributor board maintaining the input of transformer connected to the distributor board. Turn on the equipment and check voltage on transformer output:  Measuring: 1 & 2: 18VAC; 3 & 2: 18VAC; 1 & 3: 36VAC; 4 & 5: 8VAC; 6 & 8: 18VAC; 7 & 8: 18VAC; 6 & 7: 36VAC. If not ok, replace transformer.
	Defective main board supply cable	Replace supply cable
Main Switch does not light when the equipment is turned on but the equipment is functioning normally	Main switch light broken	Replace Main Switch
Main switch light turned on even with equipment turned off	Connection of input cable (55) and fuse cables (54) in the wrong order	Connect as shown below:

		 
9.2 EMERGENCY STOP		
The equipment shows a screen indicating that the Emergency stop button has been pressed	Emergency connection failure	Check CN78 on main board and verify if there is a jumper or a normally closed emergency button attached
9.3 EEPROM MEMORY ERROR		
The system shows an error concerning the EEPROM memory.	Failure in EEPROM on main board.	Access reset config. menu and clear the EEPROM memory. Access this option and enter the password, when

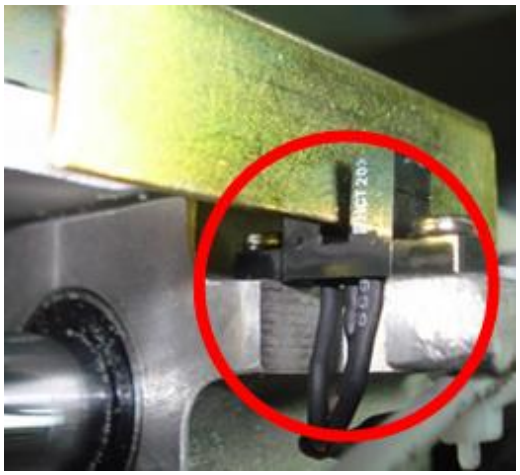
		requested. The memory will be erased. The system should be re-calibrated after this step!
9.4 USER INTERFACE		
Interface board does not respond at all. The backlight if off.	Communication cable not connected (cable 34)	Check cable 34 connection
	Communication cable failure (cable 34)	Make a visually inspection in the cable 34 and measuring continuity with a multimeter. If you find any problem replace cable 34.
	Board without input power supply	Measure the 12V as show below.  If the voltage is ok replace board. If not ok check output voltage on main board as show below:  If ok replace cable 34. If not ok and tests in section MAIN BOARD POWER SUPPLY are ok, replace main board.
Difficult to read display	Contrast need to be adjusted	Adjust contrast using trimmer TP1 in order to improve the display contrast.
	Backlight defective	If the luminosity of the LCD is not adequate, you are having difficult to read the display and the 12V input voltage has been checked as before, replace display board.
Messy screen on display	Defective display board	If the screen is messy with invalid characters replace the display board.

No response when pressing a key.	System not waiting for that key at that moment.	Make sure that the operation of the machine allows that a specific key can be pressed at the moment of the test.
No keys at all are functioning	Communication cable failure (cable 34)	Make a visually inspection in the cable 34 and verify the continuity with a multimeter. If you find any problem replace cable 34.
Some or no keys at all are functioning	Membrane failure	Replace membrane and check if the problem is solved. If it is not, remove the new membrane and keep the older one.
	Display board failure	Replace the interface board and check if the problem is solved. If it is not, remove the new board and keep the older one continuing the following steps
9.5 X, Y, ROTATION MOVEMENT		
The equipment halts in the screen "moving equipment to standard position"	Stepper motor cable not connected	Check if all stepper motor cables and cable to cable connections are ok.
	32V power supply not present	Make sure if the connection between the power supply to main board is ok as described in section MAIN BOARD POWER SUPPLY.
	Problem with an stepper motor driver.	Turn off the machine. Disconnect all stepper motors from the machine. Enter the service menu option Stepper Motors Check. With a spare stepper motor proceed as described on the screen to identify a stepper motor failure. If the screen indicates that a driver should be moving and no motor is moving replace the main board.
While going to a standard position the equipment moves to its end of limit and hits the mechanical limit	Problem with zero position sensor	Enter the switch sensor verification screen on service menu. Verify all motors sensors. In case of problem replace sensor cable. If not solved replace main board.
	Problem with stepper motor mux on main board (not applicable for X and Y motors)	Check MAIN BOARD POWER SUPPLY to evaluate if 12V supply is OK for main board. If yes, turn off the machine. Disconnect all stepper motors from the machine. Enter the service menu option Stepper Motors Check. With a spare stepper motor proceed as described on the screen to identify a

		stepper motor failure. If the screen indicates that a driver should be moving and other motor is moving replace main board.
The motor halts during profile execution or during going to standard position.	Defective stepper motor	Replace the stepper motor you suspect with a spare one and do the stepper motor current check. Check the hold current as below: Enter the menu:  You will see this screen:  This will show in sequence:  The minimum values must be within the limits: X or Y: 330-480;

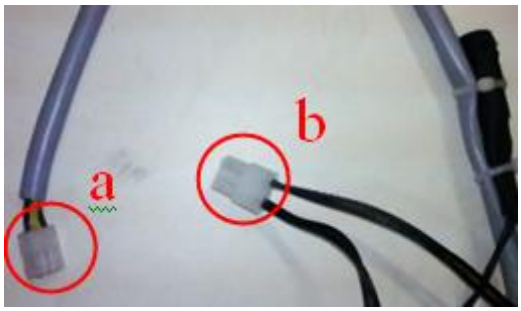
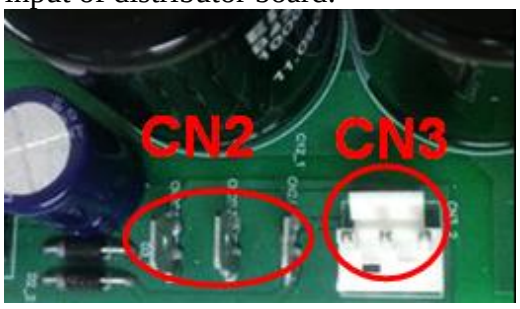
		F or T: 720-880.
	Mechanical loading beyond normal	Check manually mechanical system.
	Pulley failure	Loosen or tighten the pulley.
	Reduction gear box failure	Loosen the belt on the output of the gear box and rotate manually the gear closer to the stepper motor. The gear must rotate without extra effort. In case the system is hard enough replace the gear box.
	Defective 32V power supply over current protection.	During a fault condition monitor the 32V power supply output and evaluate if the power supply shuts down. This can be done by looking at the led below:  If the led turns off unplug the connector CN81 and check the LED again. If the LED turn on verify the main board If the LED turn off check the fuse F4. If the fuse ok replace the board.
Movement stops with the message of motor feedback failure	Encoder not connected	Verify cables 5, 19, 24 and 43. If it not ok, upgrade FPGA software. The version 1.004 was implemented a new security system (time out during the return to zero position), so, the encoders won't be used any more (upgrade others software (MAIN, HMI and TUBEHEAD according compatibility software table).
	Defective encoder	Enter the service menu and enter the sensor check menu. Move all stepper

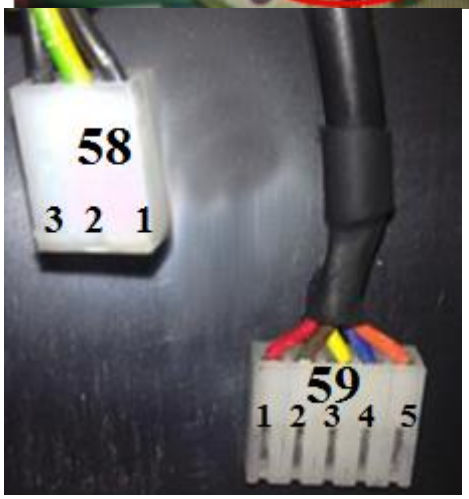
		motors gears and check if the encoder of each one change its value. If it not ok, upgrade FPGA software. The version 1.004 was implemented a new security system (time out during the return to zero position), so, the encoders won't be used any more (upgrade others software (MAIN, HMI and TUBEHEAD according compatibility software table).
	Defective main board	Access the check sensor menu in the service mode. Remove the main board cable and make a jumper between the pins 1 and 2 in this connector. If it not ok, upgrade FPGA software. The version 1.004 was implemented a new security system (time out during the return to zero position), so, the encoders won't be used any more (upgrade others software (MAIN, HMI and TUBEHEAD according compatibility software table).
Noise during motors movement	Screws loose generating vibration system	Tight the screws that are loose
	Damage gears	Replace damage gears
	Damage motors	Replace damage motors
	Finishing Covers of center of C-arm too pressed	Remove the complement of C-arm cover to reduce the press on system
Error Driver motor X, Y or ROT	Reed switch Broken	Upgrade FPGA software. The version 1.004 was implemented a new security system (time out during the return to zero position), so, the encoders won't be used any more (upgrade others software (MAIN, HMI and TUBEHEAD according compatibility software table).
	Reed Switch untidy with magnet	
	Magnet released of gears	
9.6 COLUMN MOVEMENT		
The motor does not move at	Up or Down key	If the screen does not change after

all	not working	pressing the keys to move up or down the keys are not being sensed. Please refer to Interface Board section.
	Limiting software switches not connected.	Check connectors CN32 and CN33 on main board. These switches are normally closed so they need to be connected in order for normal functioning.
	Defective limiting switches.	Enter the sensor check screen on the service menu and verify if the sensor state changes by actuating the sensor as indicated below: For Example, the X switch: If it´s like this:  The screen must be like this:  Else, if it´s like this:

		 The screen must be like this:  When the sensor is not actuated the state must be 0 and when the sensor is actuated the state must be C.
	Defective safety nut switch	With the equipment turned off check continuity between the poles of the safety nut switch.
	Incorrect power wiring cables.	Check wiring of cables 31, 32 and 33.
	Defective power cables.	Check continuity of cables 31, 32 and 33. Please notice presence of diodes and measure accordingly.
	Defective 24V or 12V power supply	Please refer to MAIN BOARD POWER SUPPLY.
	Defective DC motor.	Uncouple mechanically the dc motor from the system by loosening the Allen screw located on the output shaft of the motor. Execute the service menu DC Motor check. The current must be

		within 140 and 175.
	Defective main board.	If none of above solved the problem replace main board.
The motor halts during moving up or moving down during movement execution without the user releasing the up or down key and not at the limiting switches.	Lubrication problem	Enter the DC Motor service menu and start the test. Check if the current is within limits and compare the value with the last measurement. If not adequate check mechanical system lubrication.
	Defective 32V power supply over current protection.	Check the homonymous section under the X, Y, ROTATION MOVEMENT section.
	Motor failure	Uncouple mechanically the dc motor from the system by loosening the Allen screw located on the output shaft of the motor. Execute the service menu DC Motor check. The current must be within 140 and 175.
	Safety nut failure	Check with the tip of your finger if the safety nut moves freely within limits as indicated below. If necessary apply lubrication.
The power supply fuse blows when movement is executed	Wrong type of fuse	Check if fuse is as specified for current and speed of acting.
	Main board failure	Check if the problem persists with the DC motor disconnected from the main board. If so, replace main board.
	Motor short circuit	Measure resistance between input poles of the motor. The value should be between 1OHM and 5OHM. If not correct replace DC Motor.
	Lubrication Problem	Check the lubrication of the whole column system
9.7 TUBEHEAD		
Image generated with geometric abnormality such as half height exposition, clear exposition in one side and dark on another, etc.	Collimator covering x-rays during exposition	Verify the generation of x-rays as described in Section 4.2.
	Calibration Problem	Make sure the calibration is within parameters as described in PART B of this technical manual.
Equipment showing the error message of higher or lower input voltage than limit	Mains voltage over limit	Check wall outlet to see if the value is within specified parameters as described on the user manual.
	Equipment configured to a	Check the following: For 110V or 127V the jumper in

	different voltage level.	distributor board is placed correctly. For 220V or 240V the jumper is not placed correctly.
	High voltage cable disconnected (applicable for low voltage error)	Check wiring of cable 58 – High DC voltage side.
	High voltage cable problem (applicable for low voltage error)	Turn off the unit. Disconnect cable 58 from the tubehead and distributor board. Check continuity on the multimeter to see if cable is ok.
	Live parts logic supply disconnected	Check cable 58 – 18/0/18Volts ac side.
	Live parts logic power supply defective	Turn off the unit. Disconnect cable 58 from the tubehead. Measure the values as indicated below:  The values should be within limits: Measuring connector a: Between the yellow and black: 18VAC. Measuring connector b: Between the wires: 350VDC. If not ok check if same values of voltage are present at the output and input of distributor board:  If not ok at the output but ok at the input replace the distributor board.

		If not ok at the input replace the transformer.
	Distributor board problem.	Measure the high DC voltage (CN7 from distributor board) using a multimeter during an exposure. If the value is more than 10% lower than the initial values replace distributor board. Follow the security procedure necessary for you on safety.
	Tubehead board problem	Replace the tubehead.
Equipment showing the error message of error communicating to the tubehead	Communication cable disconnected.	Check cable 42.
	Tubehead power supply disconnected.	Check cable 59.
	Defective tubehead power supply.	Turn off the unit. Disconnect cable 58 from the distributor board. Disconnect cable 59 from the tubehead. Turn on the unit. Measure the values of voltage as show below:  

		The values should be within limits: KK 3ways of the cable 58 - 1&2 = 18VAC - 2&3 = 18VAC - 1&3 = 36VAC KK 5 ways of the cable 59 - 1&2 = 8VAC - 2&3 = 18VAC - 1&3 = 36VAC - 4&5 = 18VAC If not ok turn off the unit and disconnect cable 59 from the input transformer. The values should be as show below: 1&2 = 18VAC 2&3 = 18VAC 4&5 = 8VAC If not ok verity section MAIN BOARD POWER SUPPLY.
	Communication cable problem.	Turn off the unit. Check continuity on cable 42.
	Tubehead communication problem	Turn off the unit. Remove cables 59, 58 and 42 from the tubehead and attach cables 59 and 42 to the Tubehead Communication Verification Tool. Turn on the unit. Enter the service menu and enter the Tubehead Comm option. Run the test. If successful replace the tubehead. If not successful replace the main board.
Equipment showing an error of tubehead high or low: kV, mA, Vfil, Ires or VBuck	Distributor board problem	See above.
	Tubehead logic supply not ok	Check cable 58 – 18/0/18 – as above.
	Tubehead DC supply not ok	Check cable 58 – high voltage – as above.
	Filament fuse blown	Check if fuse on cable 77 is ok.
	DC voltage fuse blown	Check if fuse on cable 58 is ok.
	Punctual problem (due to mains fluctuation for	Repeat the exposure to see if the problem is still present. Evaluate the stability of the mains supply voltage

	instance)	during the exposure
	Poor quality grounding / ground not present / tubehead not grounded	Evaluate the quality of the grounding of the system. Make sure the installation is ok and the tubehead is grounded.
	Failure in communicating to the tubehead	Check cable 42 as above.
	Tubehead board problem	Replace the tubehead.
9.8 SNAP-ON MECHANISM (FOR PAN AND CEPH)		
Sensor not recognized by the machine	Cables on snap-on support are disconnected	Open the support by removing the board and connect the cables
	Electronic contacts should be dirt	Turn off the equipment and clear the electronic contacts by rubbing them or by using *isopropyl alcohol* and a cotton swab. If the problem persist contact Panoramic Corporation Service Department
Sensor not recognized by the computer	Software problem/sensor problem	Restart the software. If the problem persist contact Panoramic Corporation Service Department
	Configuration of the NIC are incorrect	Configure the NIC for use jumbo frames.
	Ethernet cable are disconnected	Verify the connection of the Ethernet cable between the computer and the machine
	Connection problem with the switch	Verify the cables connected on switch near to the main board. If all connections are OK, restart the switch by turning off and turning on. If the problem persist contact Panoramic Corporation Service Department
Machine asks the user to lock the sensor	Reed switch sensor should be broke	Remove the bottom of the snap-on support e verify the condition of the reed switch. If necessary replace the malfunction sensor
Machine informs that multiple sensors have been inserted	Reed switch sensor should be broke	Remove the bottom of the other snap-on support (if the sensor is placed on panoramic support verify the ceph support and vice-versa) e verify the condition of the reed switch. If necessary replace the malfunction

		sensor
SNAP ON Sensor, turn on and turn off frequently without be removed of machine	Snap on Sensor locked, turn on and turn off frequently during exposure without being disconnected	Make the communication test with the C-ARM in several different positions to evaluate if the flat cable is working, if not ok in all positions tested, the flat cable must be replaced. Make the same test to ceph, positioning the ceph in several positions to evaluate if the flat cable ceph is working, if not ok in all positions tested, the flat cable must be replaced. Check if the sensor's pins is not bent, if the pins is bent, the snap on sensor must be replaced Check if all pins of snap on sensor is connected with equipment connector, if any pins are unconnected, the equipment connector must be shimmed to reduce the distance and improve the connection Check if the flat cable is not interrupted in any point, if is interrupted the flat cable must be replaced.
	Snap on sensor is connected but lost data pack	
	Sensor is not recognized	
9.9 SNAP-ON SENSOR		
Sensor is not working	Sensor was dropped	Remove the covers as show in the section 4.1.2. Check if the shockwatch label is RED as show below  Contact Panoramic Corporation Service Department
	Cables on snap-on support are disconnected	Open the support by removing the board and connect the cables
	Connector are broke	Verify the connector on snap-on sensor. If the pins are broke contact Panoramic Corporation Service Department

9.10 LASER POSITIONING SYSTEM		
Laser not turning on	Faulty main board supply to the laser	Remove all the laser modules from main board (CN45, CN46 and CN47). Check voltage from CN45 pin 1 to GND; CN46 pin 1 to GND; and CN47 pin 1 to GND on main board The value should be 5V+/-1V. If incorrect check troubleshooting on main board supply. If still incorrect replace main board. Turn on the laser and Check voltage from CN45 pin 1 to pin 1; CN46 pin 1 to pin 2; and CN47 pin 1 to pin 2 on main board. Note: as the laser is not functioning turn on and off the laser to do the testing. Watch out that the laser has a time-out shutdown mechanism on the software. The value should be 5V+/-1V. If incorrect check troubleshooting on main board supply. If still incorrect replace main board.
	Faulty cabling	Check in detail for cable problems on the overall cable. If does not solve check for faulty laser module.
	Faulty laser module	While turned on check that there is 5V on the laser supply and the laser is off. If so, replace laser module.
Laser continuously on	Faulty main board	Verify that the lasers are connected to the right connectors on main board: CN45, CN46 and CN47. Inspect visually the main board for problems, shorts. If does not solve, replace main board.
9.11 COLLIMATOR		
Stepper motor position go to an end limit and keeps halted	Optical sensor are not working	Verify the optical sensor. if necessary replace it

The beam is not always fixed in one position at the target. The beam is unstable.	Fixing screw are loose	Recalibrate the machine and tight the screw
Noisy/unusual movement	Collimator are touch the cover	Verify the covers´ fixing
	Collimator´s gears are not very well engaged	Re-engaging the gears and recalibrate the machine
Incorrect illumination area	Calibration Error	Check calibration procedures for the x-ray imaging type of the error (pan, ceph, analog, digital) on PART B of this service manual.
9.12 PANORAMIC (DIGITAL OR ANALOG)		
No image at all	Tubehead failure	Check troubleshooting on tubehead
	Collimator calibration error	Check calibration procedures for the x-ray imaging type of the error (pan, ceph, analog, digital) on PART B of this service manual.
Stepper motor not moving	An object are block the movement	When the machine is packing, a metal corner is fixed to protect the equipment during transportation. Verify if this metal corner are removed.
	Belts are loose	Verify the belts. Recalibrate the machine
	Reed switch are break	Verify the reed switch in reducer unit. If necessary replaced it
Stepper motor moving beyond zero sensor limit	Optical sensor with problem	Verify the optical sensor. If necessary replaced it
Exposition happens without selecting any parameter	Stuck exposure switch	Verify the exposure switch. If necessary replaced it.
Distortion, Extension or overwrite of Image	Patient is moving during exposure	Request to patient don't move during exposure
	Bad positioning, of patient	Improve the positioning of patient
	Lasers out of calibration	Execute laser calibration procedure
Vertical white lines on image	Lost data pack during data transmission.	Do the communication test with the C-ARM in several different positions to evaluate if the flat cable is working, if not ok in all positions tested, the flat cable must be replaced
	Problem With	Install the last upgrade of gigabit net

	driver of gigabit net board	board driver.
	Problem with image software	Install the last upgrade of Dental Imaging Software
Horizontal white lines on image	Collimator untidy with sensor	Execute the collimator calibration procedure
	Vibration of system during exposure	Verify if all screws of the systems are tighten
9.13 ANALOG CEPH		
No image at all	Tubehead failure	Check troubleshooting on tubehead
	Collimator calibration error	Check calibration procedures for the x-ray imaging type of the error (pan, ceph, analog, digital) on PART B of this service manual.
9.14 DIGITAL CEPH		
No image at all	Tubehead failure	Check troubleshooting on tubehead
	Collimator calibration error	Check calibration procedures for the x-ray imaging type of the error (pan, ceph, analog, digital) on PART B of this service manual.
	Sensor failure	Check troubleshooting on the snap on sensor
Ear guides not aligned on the image	Ear guides not aligned correctly	Check ear guide alignment on PART B of this technical manual.
Image quality	Calibration problem	Check calibration on PART B of this technical manual
	Loosen holding screws	Check for loosen screws on the arm to the column and ceph base. Check for loosen screws on the parts that hold the shafts. If necessary, recalibrate.
	Digital sensor not calibrated	Check snap-on sensor calibration on PART B of this technical manual
	Digital ceph calibration problem	Check digital ceph calibration on PART B of this technical manual.
	Faulty image sensor	Check troubleshooting guide on Snap On Sensor
	Faulty communication between main board and image	Check troubleshooting guide on Snap On Sensor

	sensor	
Ceph axis not moving	Fixing screw of the pulleys are loose	Tight the screw and recalibrate the ceph.
Noisy/Unusual ceph movement	Fixing screw of the pulleys are loosing	Tight the screw
Ceph axis moving beyond zero sensor limit	Optical sensor with problem	Verify the sensor. If necessary replaced it.
Ceph axis moving very slow opposite to the initial position	Optical sensor are disconnected or with problem	Verify the connection of the sensor in the main board. If necessary replace the sensor.
Vertical white lines on image	Lost data pack during data transmission.	Do the communication test in ceph mode, positioning the ceph in several positions to evaluate if the flat cable ceph is working, if not ok in all positions tested, the flat cable must be replaced.
	Problem With driver of gigabit net board	Install the last upgrade of gigabit net board driver.
	Problem with image software	Install the last upgrade of Dental Imaging Software
Horizontal white lines on image	Collimator untidy with sensor	Execute the collimator calibration procedure
	Vibration of system during exposure	Verify if all screws of the systems are tighten

ANNEX A – ELECTRICAL SCHEMATIC