EN

Planmeca ProMax

& Planmeca ProMax 3D / 3D s

technical manual

10010812_31

PLANMECA

Chapter A GENERAL & TECHNICAL DATA

Chapter B INFORMATION DISPLAYS

Chapter E C-ARM AND IMAGING ARM

Chapter H CEPHALOSTAT

The manufacturer, assembler, and importer are responsible for the safety, reliability and performance of the X-ray unit only if:

- installation, calibration, modification and repairs are carried out by qualified authorized personnel
- electrical installations are carried out according to the appropriate requirements such as IEC 60364
- equipment is used according to the operating instructions

Planmeca pursues a policy of continual product development. Although every effort is made to produce up-to-date product documentation this publication should not be regarded as an infallible guide to current specifications. We reserve the right to make changes without prior notice.

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Chapter

A

GENERAL & TECHNICAL DATA

1 WARNINGS AND CAUTIONS

WARNING

THE FOLLOWING WARNINGS, CAUTIONS AND NOTES MUST ALWAYS BE CONSIDERED WHILE SERVICING THE UNIT, IN ORDER TO AVOID EITHER PERSONAL INJURY OR DAMAGE TO THE UNIT.

CAUTION ***RADIATION SAFETY RULES***

Some procedures described in this manual produce X-ray radiation. Always follow the rules for radiation protection.

Never attempt to open the TUBE HEAD. It does not contain any serviceable parts, and radiation safety can no longer be guaranteed.

Never make any exposures without the filter or the beam limiting device (collimator) in place. Otherwise the radiation safety cannot be guaranteed.

CAUTION ***ELECTRICAL SAFETY RULES***

The unit contains hazardous voltages. While servicing internal parts, always disconnect the unit from the mains (if possible) by removing the plug from the wall outlet, and wait for 2 minutes before touching any electrical parts.

Always replace the fuses with ones of the same type and rating. Otherwise patient, operator or equipment safety cannot be guaranteed.

The circuit boards can be damaged due to static discharges and requires careful handling.

CAUTION ***GENERAL SAFETY RULES***

The unit must be serviced only by qualified personnel, trained by PLANMECA. Repairs and parts replaced by unqualified personnel carry no warranty.

Periodical maintenance as described in this manual must be performed on a regular basis, to ensure the safety and image quality of the unit.

Some procedures described in the unit could be dangerous, if not followed as stated.

NOTE **The display values shown in this manual are only examples and should not be interpreted as recommended values unless otherwise stated.**

2 MANUAL VERSIONS

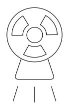
The installed software revision determines the available functions and behaviour of the unit. If the unit is reporting error or help messages not listed in this manual, please refer to a newer revision of the manual.

3 SYMBOLS ON PRODUCT LABELS

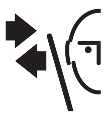
Type B applied part (Standard IEC 60601-1)

Alternating current (Standard IEC 60417)

Attention, consult accompanying documents (Standard IEC 60601-1)

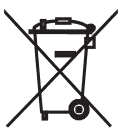


X-ray source assembly: emitting (Standard IEC 60417)



Temple supports

Electrostatic sensitive device (Standard IEC 60417)



Separate collection for electrical and electronic equipment according to Directive 2002/96/EC (WEEE)

4 TECHNICAL SPECIFICATIONS

Generator	Resonant-mode, DSP-controlled, 80...160 kHz complies with the standard IEC 60601-2-7: 1998	
X-ray tube	Toshiba D-054SB-P	
Focal spot size	0.5 x 0.5mm according to IEC 60336	
Total filtration:		
Panoramic	min. 2.5 mm Al	
Cephalometric	min. 2.5 mm Al	
Tomographic	min. 2.5 mm Al	
3D / 3D s	min. 2.5 mm Al + 0.5 Cu	
Anode voltage	Tomo	54 - 84 kV ±5%
	Panoramic	54 - 84 kV ±5%
	Cephalometric	60 - 84 kV ±5%
	3D / 3D s	50 - 90 kV ±5%
Anode current	Tomo	1 - 16 mA ±10%
	Panoramic	1 - 16 mA ±10%
	Cephalometric	1 - 16 mA ±10%
	3D / 3D s	1 - 16 mA ±10%
Linearity of radiation output	< 0.1	
Cooling period	Automatically controlled	
Exposure time	Panoramic	2.5 - 16 s as indicated ±10%
	Tomo	4 - 12 s as indicated ±10%
	Transtomo	24 - 95 s as indicated ±10%
	Ceph / Normal	12 - 18.7 s as indicated ±10%
	Ceph / High speed	6 - 9.3 s as indicated ±10%
	3D / 3D s	Pulsed, effective 2.4 - 12 s
SID	Panoramic and Tomo 500 mm (19.68 in.) Cephalometric 170 cm (66.92 in.) 3D / 3D s 527 mm (20.74 in.)	
Magnification	Panoramic	constant 1.2
	Tomo	constant 1.5
	Cephalometric	constant 1.13
	3D / 3D s	constant 1.57
Pan / ceph image properties:		
CCD pixel size	33 µm	
Image pixel size	99/130 µm	
CCD active surface	Panoramic 9 x 136 mm (0.35 x 5.35 in.) Cephalometric 9 x 270 mm (0.35 x 10.6 in.)	
Image field	Panoramic 14 x 30 cm (5.5 x 12 in.) Cephalometric 27 x 30 cm (11 x 12 in.)	
3D image properties:		
Flat panel pixel size	127 µm	
Flat panel active surface	3D: 13 x 13 cm (5.1 x 5.1 in.) 3D s: 8 x 13 cm (3.2 x 5.1 in.)	

SmartPan image properties:

Flat panel pixel size	127 μm
Flat panel active surface	0.8 x 13 cm (0.31 x 5.1 in.)
Line voltage	100 - 132 V~ / 50- 60 Hz 180 - 240 V~ / 50 Hz
Line current	8 - 15 A
Line harmonics	cos better than 0.9
Max. permissible apparent impedance of supply mains	0.5 Ω (100VAC)
Maximum continuous heat dissipation	< 250W
Electrical classification	Class I, type B
Fuses	

REPLACEABLE FUSES	180-240V~	100-132V~	TYPE
2 pieces (user replaceable)	8A FF	16A FF /500V	195100 ELU

Weight	119 kg (263 lbs) 137 kg (304 lbs) with Cephalostat
Colour	RAL 9016

Environmental requirements

Ambient temperature

Pan / ceph X-ray unit:
Operating +5°C to +40°C
Storage ±0°C to +50°C

3D / 3D s X-ray unit:
Operating +10°C to +30°C
Storage ±0°C to +50°C

Humidity 15% - 85%

Original manufacturer

PLANMECA Oy, Asentajankatu 6, FIN-00880 Helsinki, FINLAND
phone: +358 20 7795 500, fax: +358 20 7795 555, www.planmeca.com

5 USER'S STATEMENT

Radiation leakage technique factors

The maximum rated peak tube potential is **84 kV** and the maximum rated continuous tube current is **3 mA** for the maximum rated peak tube voltage.

Filtration

The Radiation port contains additional filtration of at least **2mm aluminum**.

Total filtration min. **2.5mmAl**.

When the X-ray beam is attenuated with the 3mmAl the resulting dose is **0.5 - 0.6** times the original.

Maximum attenuation equivalent of the front panel of the panoramic sensor head

0.5mmAl

Maximum attenuation equivalent of the front panel of the 3D /3Ds sensor head

1.2mmAl

Rated line voltage

100 - 240 V~ ±10%

Maximum line current

Maximum **15** Amperes at 100 V~, 8A at 230 V~

Technique factors that constitute the maximum line current condition

84 kV / 16 mA

Generator rating and duty cycle

1.5 kW, duty cycle approximately **1:10**. The wait period is calculated using the following formula:

$t_w = f(HS_{MAX} - HS_1) - f(HS_0)$

where HS_{MAX} = maximum tube anode heat storage capacity (28 kJ)
HS_0 = current tube anode heat storage
HS_1 = heat storage caused by next intended exposure (kV x mA x s)
f = tube anode cooling rate as a function of heat storage (given by tube manufacturer)

Maximum deviation of peak tube potential from indicated value

±5%

Maximum deviation of tube current from indicated value

±10%

Maximum deviation of exposure time from indicated value

±10%

DEFINITION OF MEASUREMENT CRITERIA

Exposure time

The beginning and end points of the exposure time are defined at **70%** of the peak radiation waveform measured with a calibrated X-ray monitor.

Peak tube potential

Is defined as the maximum voltage difference over the X-ray tube. It is measured with a calibrated non-invasive kVp meter.

Tube current

Is defined by measuring the voltage difference over mA feedback resistors. The values of mA feedback resistors are known (see section "Preventive maintenance"), so the mA value can be calculated from the feedback voltage.

The nominal X-ray voltage together with the highest X-ray tube current obtainable from the high-voltage generator when operated at its nominal X-ray tube voltage

84 kV 16 mA

The highest X-ray tube current together with the highest X-ray tube voltage obtainable from the high-voltage generator when operated at its highest X-ray tube current

16 mA 84 kV

The X-ray tube voltage and X-ray tube current which result in the highest electric output power

84 kV 16 mA

The nominal electric power for a load time of 0.1s and at the nominal X-ray tube voltage

84 kV 16 mA - 1344 W

The nominal electric power for a load time of 4 s and at the nominal X-ray tube voltage

84 kV 16 mA - 1344 W

The reference current time product

1.2 mAs
Irradiation time 0.2 s, X-ray tube current 6mA, X-ray tube voltage: whole range

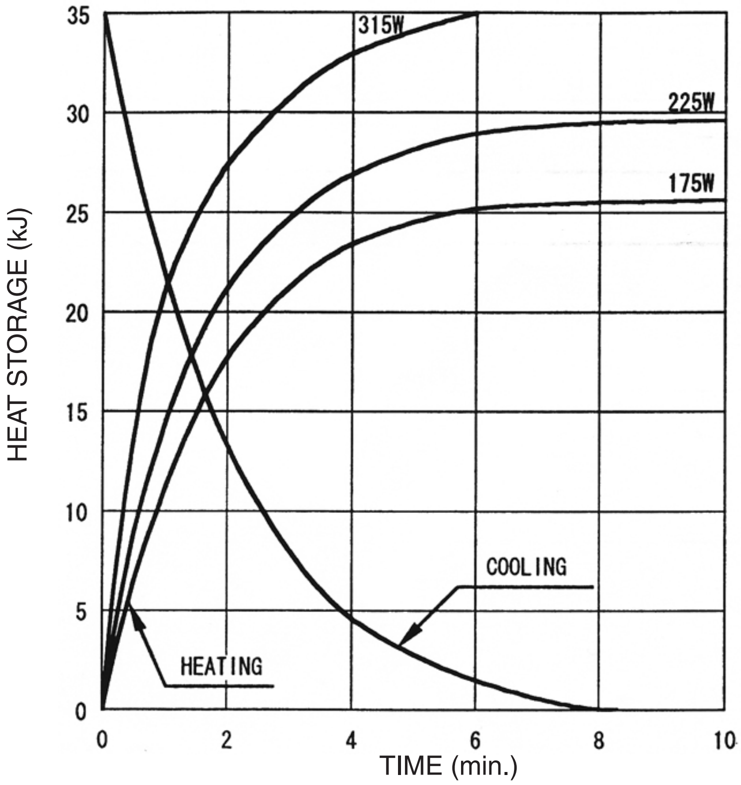
Nominal anode input power of the X-ray tube

1344 W

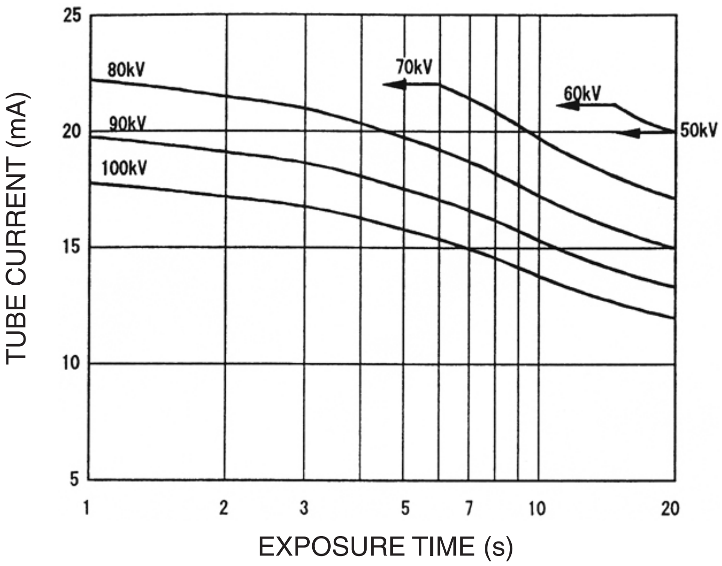
Maximum anode heat content of the X-ray tube

35 kJ

Anode heating/cooling curve of the X-ray tube



Single load rating of X-ray tube



Target material of the X-ray tube

Tungsten anode

Reference axis to which the target angle and the focal spot characteristics of the X-ray tube refer

90° with respect to the anode-cathode axis (pan/ceph)
86.5° with respect to the anode-cathode axis (3D/3D s/pan/ceph)

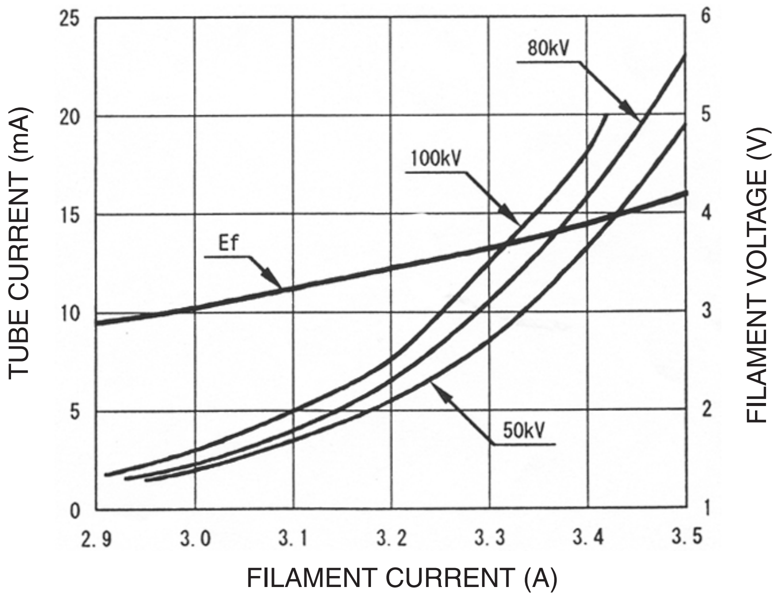
Target angle with respect to the reference axis

5°

Filtration in terms of quality equivalent filtration of the X-ray tube

Inherent filtration at least 0.8 Al/50 kV according to IEC 522/1976

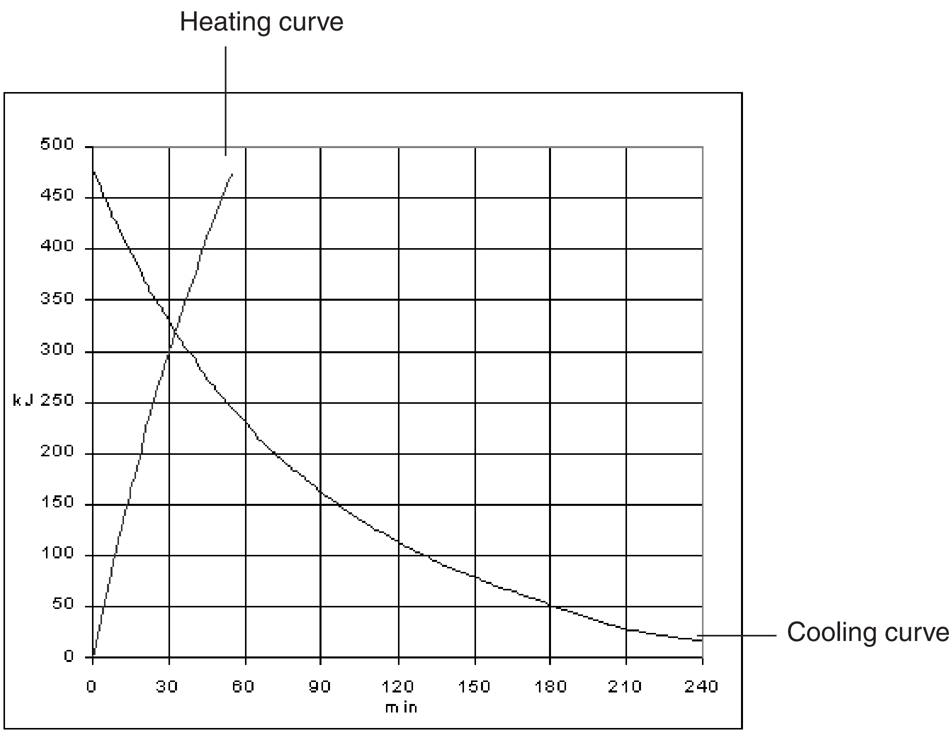
Emission & filament characteristics of the X-ray tube



Maximum X-ray tube assembly heat content

400 kJ

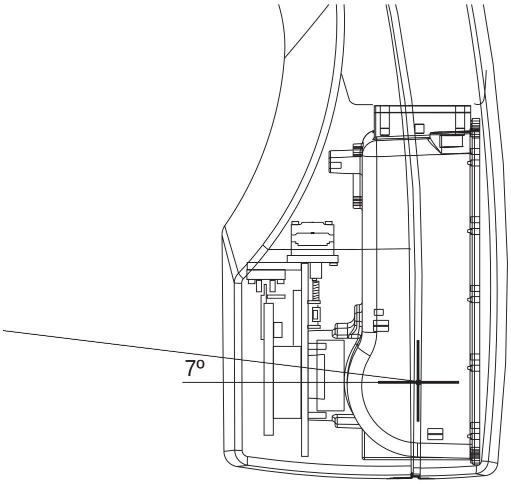
X-ray tube assembly heating/cooling curve



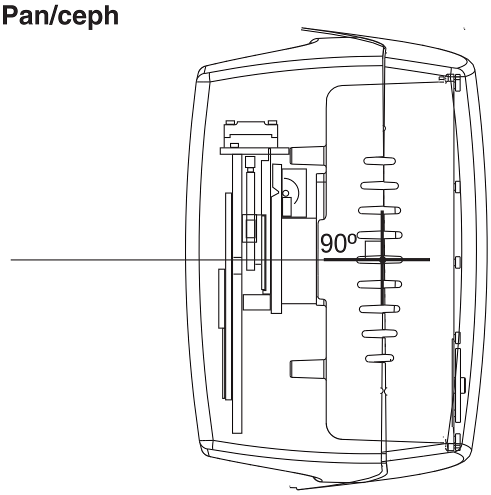
Maximum continuous heat dissipation of the X-ray tube assembly

6 kJ/min.

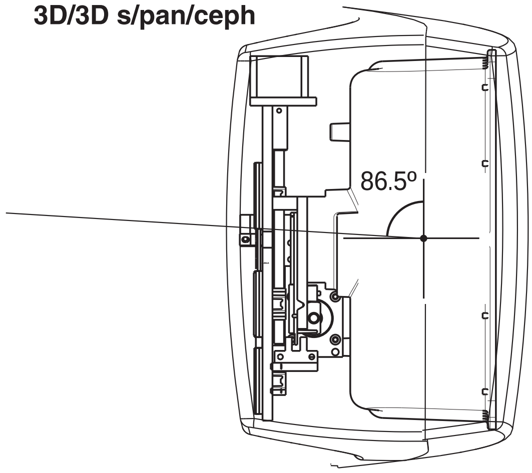
Reference axis to which the target angle and the focal spot characteristics of the tube head assembly refer



Pan/ceph



3D/3D s/pan/ceph



Target angle with respect to the reference axis

5°

Dimensions of the tube head assembly

(WxHxD) 235mm x 340mm x 120mm

Weight of the tube head assembly

10.3 kg without collimator assembly
11.2 kg with collimator assembly

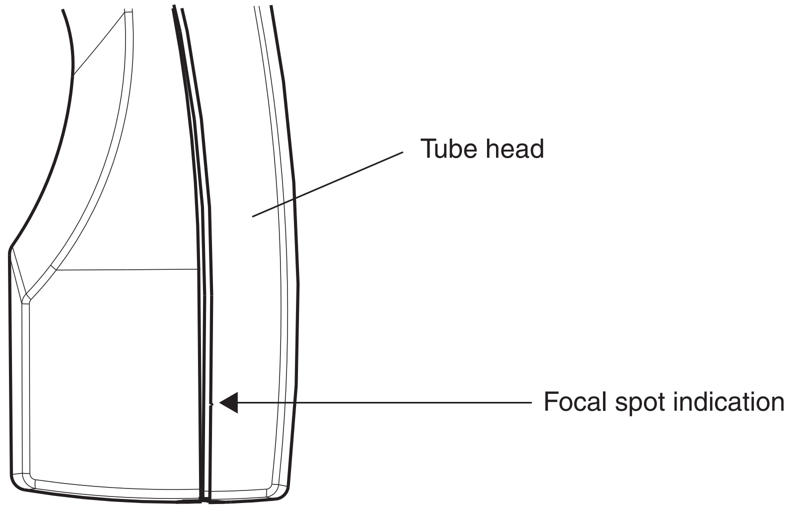
Values of loading factors concerning leakage radiation

84 kV, 16 mA

Tolerances of the focal spot on the reference axis

X= ±0.5mm (sideways)
Y= ±0.5mm (in depth)
Z= ±0.5mm (in height)

Indication of focal spot

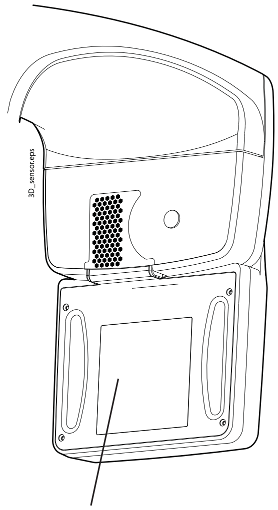


6 PROMAX 3D: CTDI VALUES

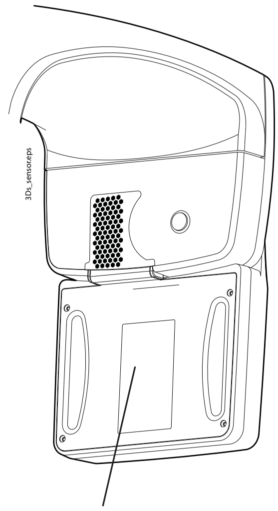
The following dose information was measured using a dosimetry phantom (head phantom) that is compatible with the specification in international standard IEC 60601-2-44.

The dosimetry phantom consists of a PMMA cylinder with a diameter of 160mm. The length of the phantom is 160mm. The phantom is no longer than the sensitive volume of the radiation detector used for the measurements. The phantom contains holes just large enough to accept the radiation detector. The holes are parallel to the axis of symmetry of the phantom and the centres of the holes are located at the centre and 10mm below the surface of the phantom at 90° intervals.

Values were obtained using a dose meter manufactured by Radcal Corporation. Values are presented in milligray (mGy), except in items b) and c) where values are normalized accordingly. Values are shown separately for 3D and 3Ds sensors. **Values for 3Ds sensor are enclosed in brackets**.



3D sensor
(active area 13 x 13 cm)



3D s sensor
(active area 8 x 13 cm)

Values shown
in (brackets)
for 3D s sensor

Dose measurement process is as follows. First the CT conditions of operation are set. These conditions of operation include the parameters given in the following table:

Parameter	Range of possible values
Radiation source tube current (mA)	1...14 (1...14)
Radiation source acceleration voltage (kV)	50...90 (50...90)
X-ray beam collimation	height = lower / upper / full width = half / full (height = lower / upper / full child patient = on / off)
Exposure mode	low dose / normal / high resolution (low dose / normal / high resolution)

After the conditions of operation have been set, the dose meter is placed inside the phantom, the dose meter display is reset and exposure is commenced. Dose meter display is recorded after the exposure.

Dose statements

a)

Default CT scanner conditions of operation in items a) 1- 3 are:

tube voltage: 90 kV (90 kV)

tube current: 10 mA (10 kV)

beam collimation: height = full, width = full (height = full, child patient = off)

exposure mode: normal (normal)

1.

$CTDI_{100\ (centre)}$ = 9.29 (8.27) mGy

2.

The location of the position where the $CTDI_{100}$ at 1 cm interior to the surface of the phantom is maximum as specified in this item is on the midsagittal line of the imaged volume, posterior to the axis of rotation.

$CTDI_{100\ (peripheral,\ max)}$ = 9.14 (6.30)mGy

3.

90°:$CTDI_{100\ (peripheral,\ 90^{\circ})}$ = 6.29 (5.06) mGy

180°:$CTDI_{100\ (peripheral,\ 180^{\circ})}$ = 1.63 (0.94) mGy

270°:$CTDI_{100\ (peripheral,\ 270^{\circ})}$ = 7.26 (5.48) mGy

4.

The average peripheral $CTDI_{100}$ value, $CTDI_{100\ (peripheral)}$ = 6.08 (4.44) mGy

b)

NOTE **Values in this item are normalized to the $CTDI_{100\ (centre)}$ in item a) 1)**

Deviation from the default CT scanner conditions of operation	Relative $CTDI_{100\ (centre)}$
Tube voltage: 50 kV	0.04 (0.02)
Tube voltage: 70 kV	0.33 (0.32)
Tube current: 1 mA	0.09 (0.08)
Tube current: 7 mA	0.71 (0.70)
Tube current: 14 mA	1.39 (1.37)
Beam collimation: height = upper	1.27 (1.25)
Beam collimation: height = lower	1.26 (1.24)
Beam collimation: width = half	0.82
Beam collimation: child patient = on	0.96 (0.94)
Exposure mode: low dose	0.21 (0.38)
Exposure mode: high resolution	1.00 (1.00)

c)

NOTE **Values in this item are normalized to the $CTDI_{100\ (peripheral,\ max)}$ in item a) 2)**

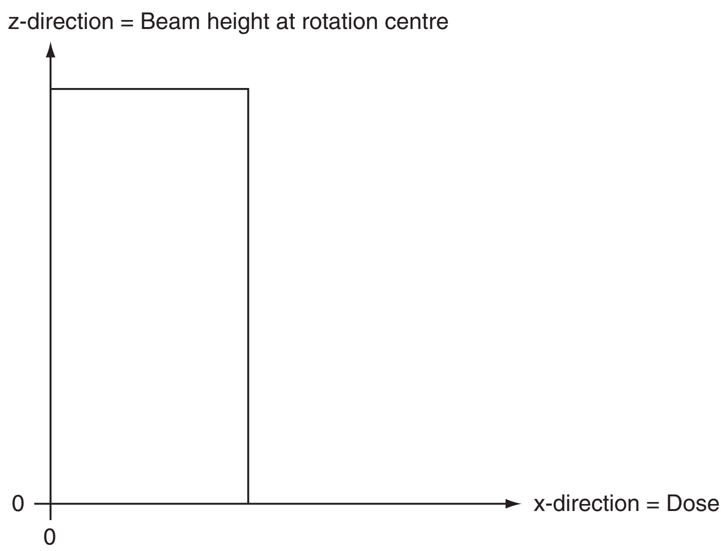
Deviation from the default CT scanner conditions of operation	Relative $CTDI_{100\ (peripheral,\ max)}$
X- ray tube voltage: 70 kV	0.34 (0.34)
X- ray tube voltage: 50 kV	0.05 (0.05)

d)

Maximum deviation from the values given in items a), b) and c) is ±20%.

Dose profile

Graphical presentation of the dose profile along a line z perpendicular to the tomographic plane measured in the centre location of the head-dosimetry phantom:



Sensitivity profile

Sensitivity profile N/A - the resolution is substantially equal in z-direction.

Weighted $CTDI_{100}$

$CTDI_w$ (VolumeComputedTomographyDoseIndex) describes the average dose over the total volume scanned for the selected CT conditions of operation.

$CTDI_W$ = 7.15 (5.72) mGy

Volume $CTDI_w$

$CTDI_{vol} = CTDI_W$ = 7.15 (5.72) mGy

Geometric efficiency in Z-direction

Geometric efficiency in z-direction is 100%.

7 PROMAX 3D: STRAY RADIATION MEASUREMENTS

The measurements are given for loading factors which result in the maximum local dose per current time product. The loading factors include the highest selectable X-ray tube voltage (i.e. 84 kV).

PMMA phantom with a diameter of 160 mm and a length of 160 mm has been used for the measurements. The phantom is compatible with the specification in international standard IEC 60601-2-44. The phantom was positioned in the centre of rotation of the 3D X-ray unit.

The values were measured in the horizontal plane which was at the height of the centre of rotation of the 3D X-ray unit. The unit of measurement was air kerma per mAs applied to the X-ray tube during normal use. Values are presented in nGy/mAs and shown separately for 3D and 3D s sensors.

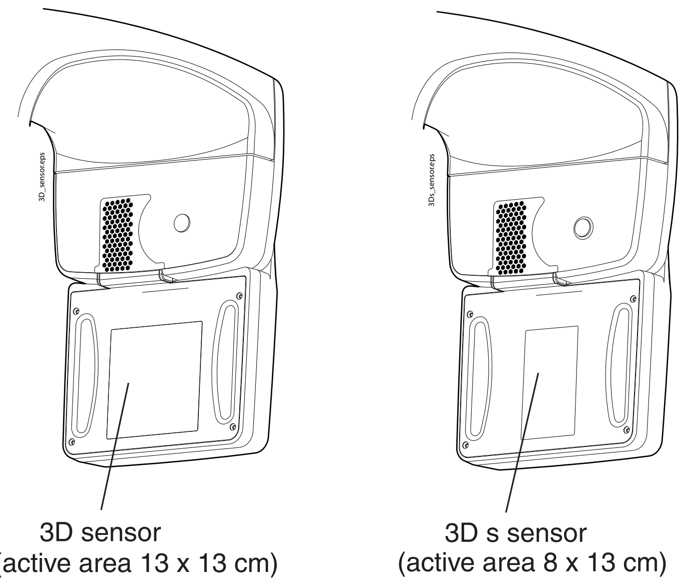


Figure 1 Sensors

7.1 X-ray units with 3D sensor

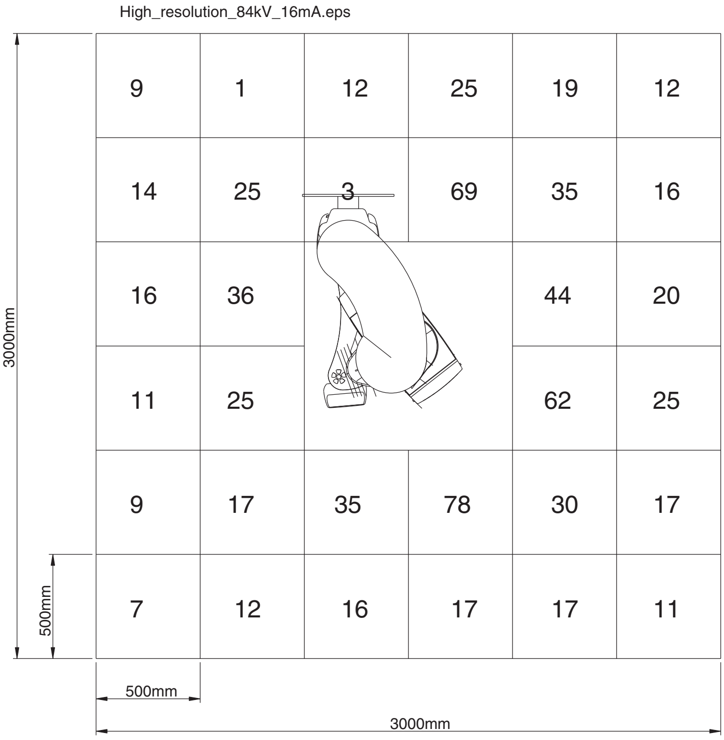


Figure 2 Stray radiation measurements with exposure values 84 kV and 16 mA, high resolution

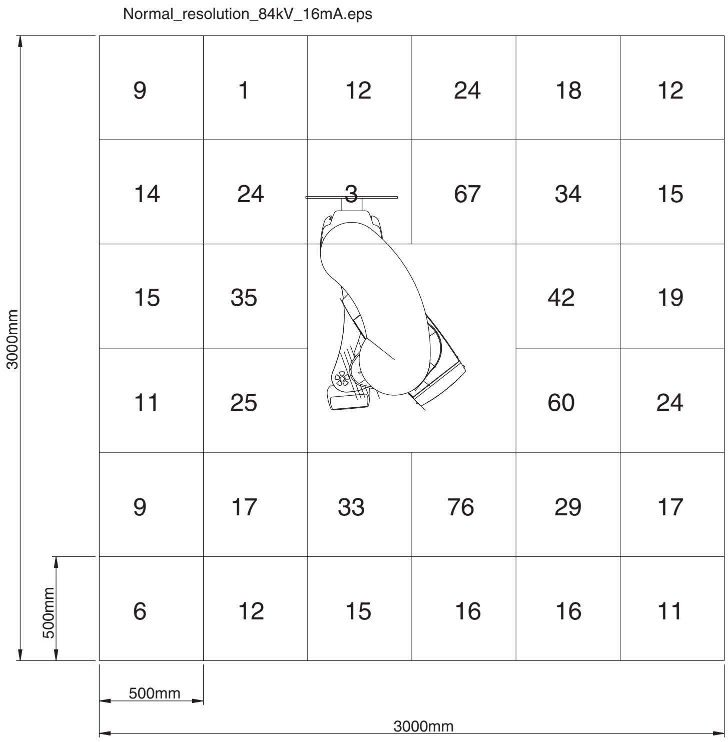


Figure 3 Stray radiation measurements with exposure values 84 kV and 16 mA, normal resolution

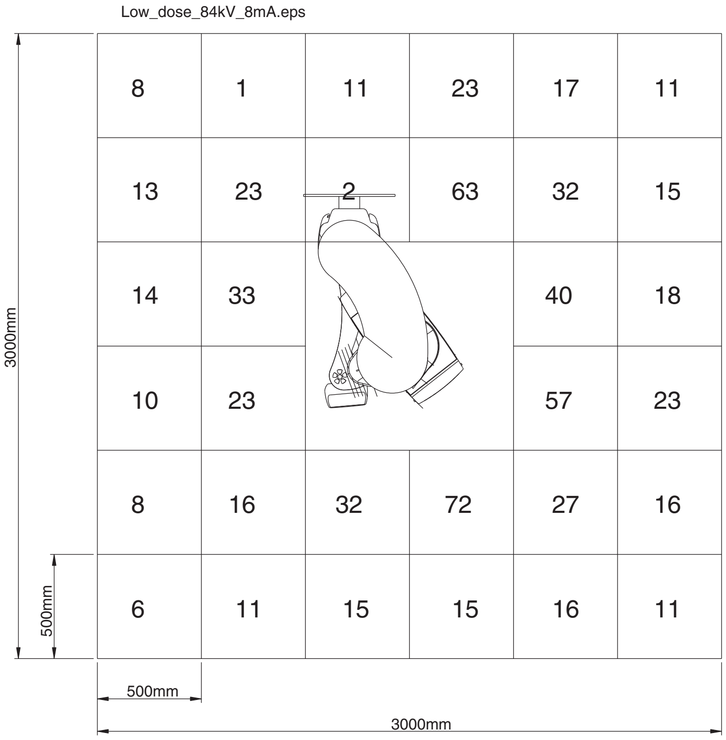


Figure 4 Stray radiation measurements with exposure values 84 kV and 8 mA, low dose

7.2 X-ray units with 3D s sensor

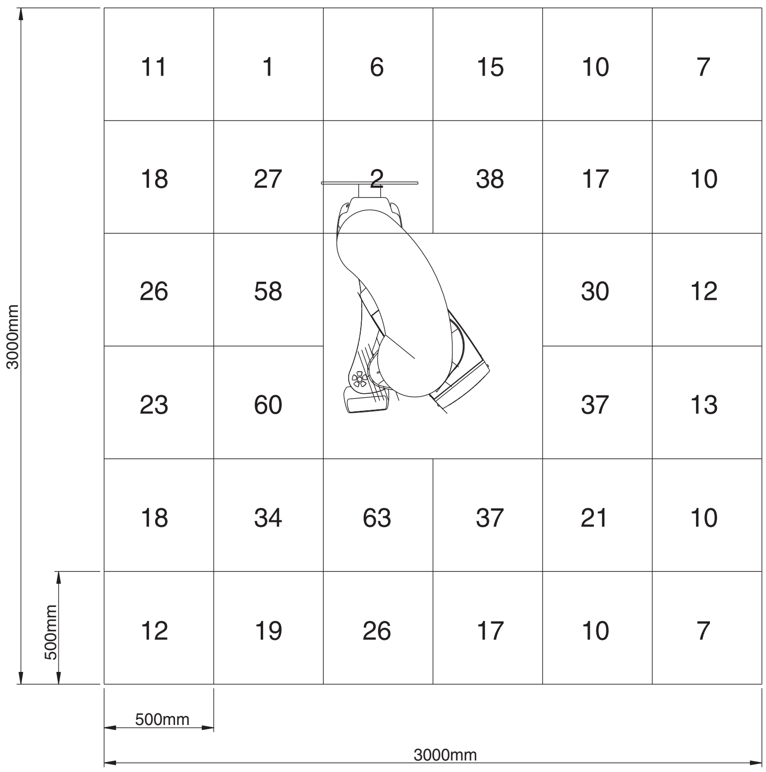


Figure 5 Stray radiation measurements with exposure values 84 kV and 16 mA, high resolution

Figure 6 Stray radiation measurements with exposure values 84 kV and 16 mA, normal resolution

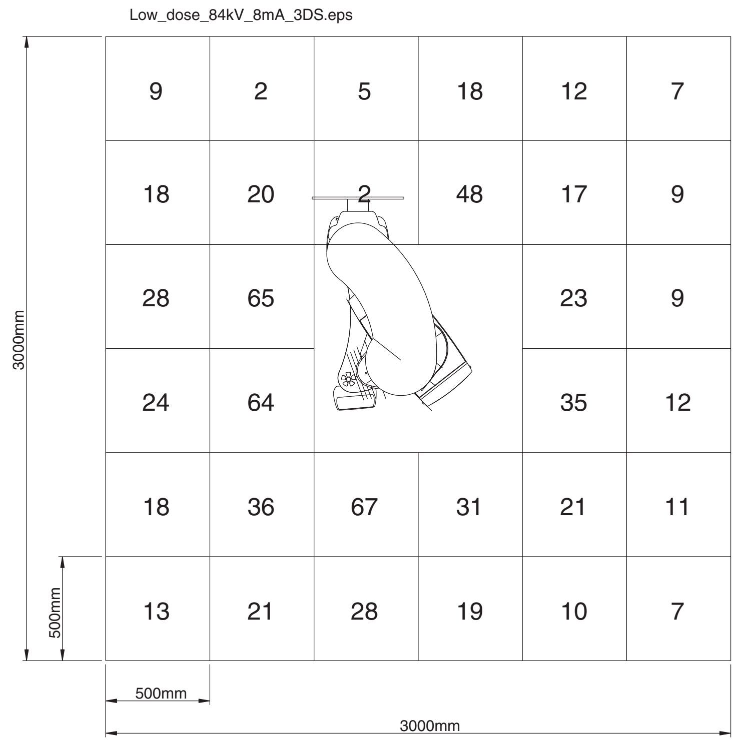


Figure 7 Stray radiation measurements with exposure values 84 kV and 8 mA, low dose

8 HANDLING PRECAUTIONS FOR PCBs AND SOFTWARE CHIPS

8.1 Handling printed circuit boards

The circuit boards are well protected against static discharges when they are in the unit. However, some precautions are necessary when handling the boards since some internal nodes on the PCBs can easily be damaged by static electricity. This is true especially during low humidity conditions when there is a potential risk of static discharges.

WARNING

INPROPER HANDLING MIGHT CAUSE DESTRUCTIVE DAMAGE TO THE CIRCUIT BOARDS. WARRANTY DOES NOT COVER SUCH DAMAGES.

Keep these few simple rules in mind when handling PCBs or software chips:

- Grounding wrist-straps are recommended but not necessarily required when handling the boards as long as you first always touch a grounded exposed metal part in the unit before touching the PCB.
- Place the removed PCB immediately in an antistatic plastic bag without landing it anywhere else in between. PCBs for warranty replacement must be returned to the factory properly packaged in antistatic plastic bags.
- Never place a removed PCB on any surface or hand it to another person without touching the surface or the person first.

8.2 Handling software flash memory chips

It is strongly recommended that the software is always upgraded electronically. If this is done in the old-fashioned way (that is, by replacing the software chips), avoid static discharge problems by following the same rules that apply for PCBs, see above.

Software flash memory chips must always be stored in their specific anti-static plastic tubes that also protect them mechanically. A mechanically damaged chip might also damage the mating socket on the CPU board!

Since the software chips used are of the PLCC type (plastic leadless chip carrier), they must be removed only using a proper extracting tool (see the spare part manual for details). Using any other tool for removal can seriously damage the sockets on the CPU board.

9 EMC INFORMATION

WARNING

Use of any accessories and cables other than those specified in Planmeca ProMax X-ray unit's documentation, with the exception of cables sold by Planmeca as replacement parts for internal components, may result in increased emission or decreased immunity of the X-ray unit.

WARNING

Planmeca ProMax X-ray unit should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, Planmeca ProMax X-ray unit should be observed to verify its normal operation in the configuration in which it is used.

Guidance and manufacturer's declaration - electromagnetic emissions		
Planmeca ProMax X-ray unit is intended for use in the electromagnetic environment specified below. The customer or the user of the Planmeca ProMax X-ray unit should assure that it is used in such an environment.		
Emissions test	**Compliance**	**Electromagnetic environment – guidance**
RF emissions CISPR 11	Group 1	Planmeca ProMax X-ray unit uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B	Planmeca ProMax X-ray unit is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/flicker emissions IEC 61000-3-3	Complies	

Guidance and manufacturer's declaration - electromagnetic immunity			
Planmeca ProMax X-ray unit is intended for use in the electromagnetic environment specified below. The customer or the user of Planmeca ProMax X-ray unit should assure that it is used in such an environment.			
Immunity test	**IEC 60601 test level**	**Compliance level**	**Electromagnetic environment-guidance**
Electrostatic discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	±2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment
Surge IEC 61000-4-5	±1 kV line to line ±2 kV line to earth	±1 kV line to line ±2 kV line to earth	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	<5 % U_T (>95 % dip in U_T) for 0,5 cycle 40 % U_T (60 % dip in U_T) for 5 cycles 70 % U_T (30 % dip in U_T) for 25 cycles <5 % U_T (>95 % dip in U_T) for 5 s	<5 % U_T (>95 % dip in U_T) for 0,5 cycle 40 % U_T (60 % dip in U_T) for 5 cycles 70 % U_T (30 % dip in U_T) for 25 cycles <5 % U_T (>95 % dip in U_T) for 5 s	Mains power quality should be that of a typical commercial or hospital environment. If the user of Planmeca ProMax X-ray unit requires continued operation during power mains interruptions, it is recommended that Planmeca ProMax X-ray unit be powered from an uninterruptible power supply.
Power frequency(50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment. The power frequency magnetic field should be measured in the intended installation location to assure that it is sufficiently low.
NOTE U_T is the a.c. mains voltage prior to application of the test level.			

Guidance and manufacturer's declaration - electromagnetic immunity

Planmeca ProMax X-ray unit is intended for use in the electromagnetic environment specified below. The customer or the user of Planmeca ProMax X-ray unit should assure that it is used in such an environment.

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

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

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

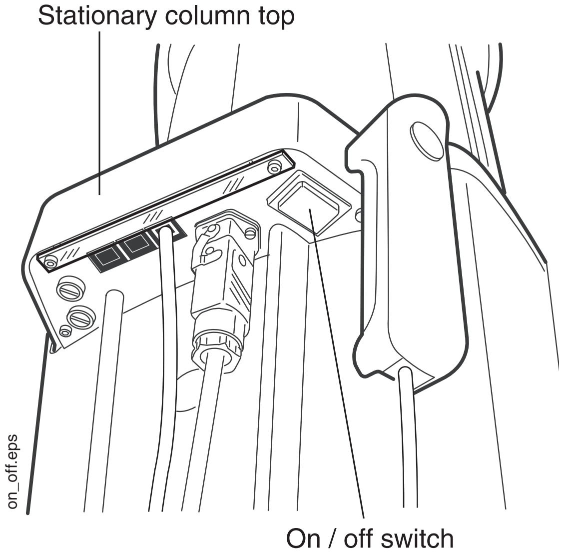
[a] Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters,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

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

<table>
<tr><th colspan="4">Recommended separation distances between
portable and mobile RF communications equipment and Planmeca ProMax X-ray unit</th></tr>
<tr><td colspan="4">Planmeca ProMax X-ray unit is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of Planmeca ProMax X-ray unit can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the Planmeca ProMax X-ray unit as recommended below, according to the maximum output power of the communications equipment.</td></tr>
<tr><th rowspan="2">Rated maximum output power of transmitter

W</th><th colspan="3">Separation distance according to frequency of transmitter
m</th></tr>
<tr><th>150 kHz to 80 MHz
$\mathbf{d} = 1.2\sqrt{P}$</th><th>80 MHz to 800 MHz
$\mathbf{d} = 1.2\sqrt{P}$</th><th>800 MHz to 2.5 GHz
$\mathbf{d} = 2.3\sqrt{P}$</th></tr>
<tr><td>0.01</td><td>0.2</td><td>0.2</td><td>0.3</td></tr>
<tr><td>0.1</td><td>0.4</td><td>0.4</td><td>0.7</td></tr>
<tr><td>1</td><td>1.2</td><td>1.2</td><td>2.4</td></tr>
<tr><td>10</td><td>4.0</td><td>4.0</td><td>8.0</td></tr>
<tr><td>100</td><td>12.0</td><td>12.0</td><td>24.0</td></tr>
</table>

8 SWITCHING X-RAY UNIT ON



The on / off switch is located on the underside of the stationary column top. When you switch the X-ray unit on the main display will be shown on the control panel and the X-ray unit will carry out a self-test which will last a few seconds.

The X-ray unit is then ready for use.

NOTE To prolong the lifetime of the Planmeca ProMax X-ray unit, always switch the X-ray unit off when it is not in active use.

Chapter

B

INFORMATION DISPLAYS

1 GENERAL ABOUT INFORMATION DISPLAYS

CAUTION ***Some of the information displays can be used to alter the operation of the unit. Never use functions that you are not familiar with.***

The unit has a number of additional functions for special requirements. The function modes that can be entered without a password are: User preference settings, Feature program control and Special functions. **Service settings, Technical calibrations and Troubleshooting are for the use of service personnel only and are protected with a password.** The additional functions are entered as follows: Touch the **i** field on the *Main* display. The list of Information displays appears.

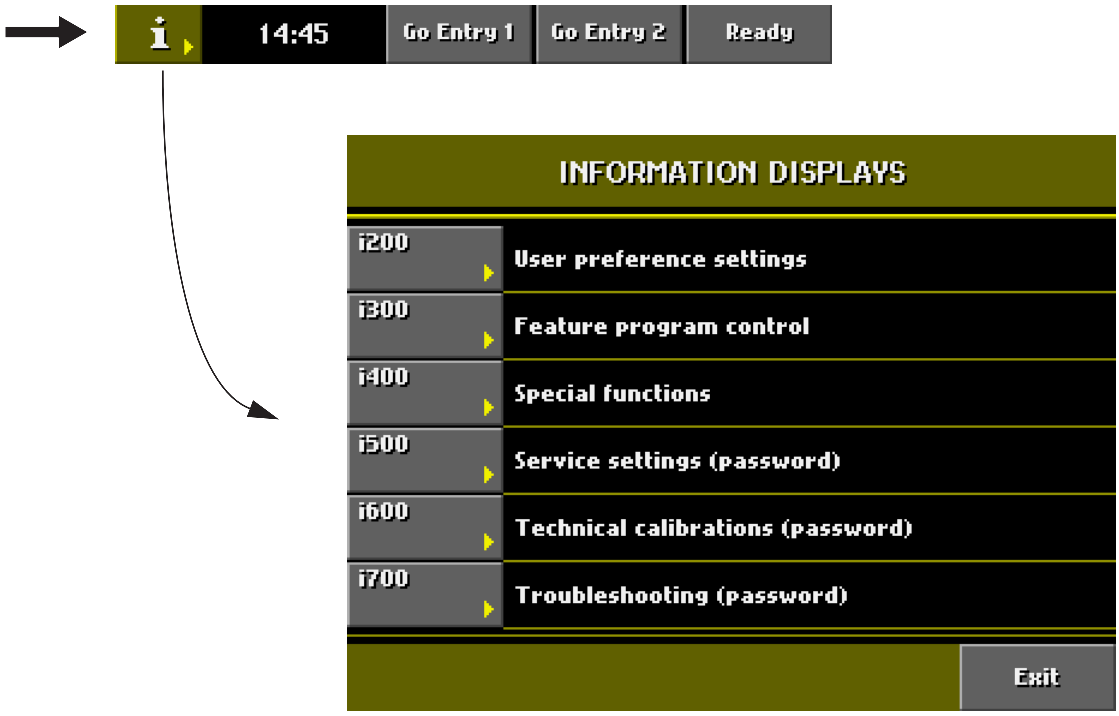


Figure 1

You can return to the *Main* display by touching the **Exit** field. You can return to the previous display by touching the **Back** field in the lower right corner.

1.1 Contents of the Information displays

i200 User preference settings

i210 Date & time
i220 Audio settings
i230 Behavioural preferences
i250 Visual adjustments
i260 Select language
i270 Default program settings

i300 Feature program control

i310 Enable/disable features

i400 Special functions

i410 Special operation mode selection
i420 Error history
i430 Exposure statistics
i460 Test exposure
i470 Beam check
i480 Network settings

i500 Service settings (password)

i510 Special operation mode selection
i520 Preheat calibration
i530 Maximum height
i540 Exposure program tuning
i560 Configuration selftest
i570 Select configuration
i580 Patient support alignment
i590 Software update

i600 Technical calibrations (password)

i610 Primary collimator calibration
i630 DEC calibration
i640 Positioning calibration
i650 Lift motor position sensor calibration
i660 Layer laser calibration
i670 QA Exposure
i680 DAP value adjustments
i999 Demo

i700 Troubleshooting (password)

i760 Communication

2 USER PREFERENCE SETTINGS

From the list of Information displays select **User preference settings (i200).** In this mode you can set the date and time, perform visual adjustments and select the unit's behavioural preferences and language.

Figure 2

2.1 Setting date and time

The clock is set at the factory to local time and it should be set to show the correct time/date before using the unit.

To set time select **Set time** on the *Date & time display (i210)*. If you want to change date, select **Set date.** If you want to change the time and date display format, select **Time & Date display format**.

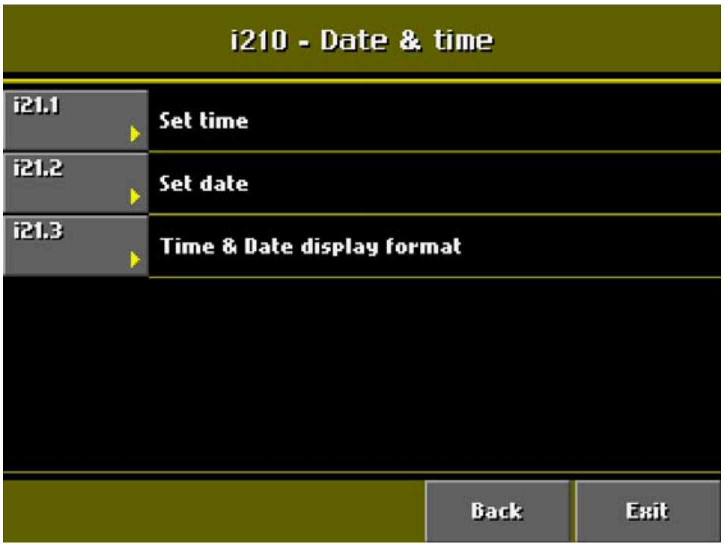


Figure 3

Set the correct time with the **Hour and Minutes** arrow fields. Store the new time by touching the **Done** field, or exit the mode without storing changes by touching the **Cancel** field.

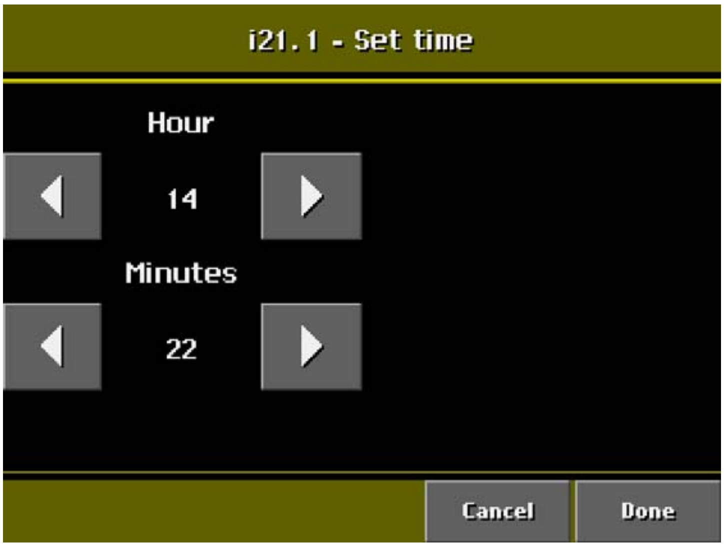


Figure 4

Set the correct date with the **Year, Month and Day** arrow fields. Store the new date by touching the **Done** field, or exit the mode without changes by touching the **Cancel** field.

Figure 5

You can choose either the 12-hour or the 24-hour system. There are three possibilities to choose from for the date display format. Touch the desired formats and confirm your selection by touching **Done**.

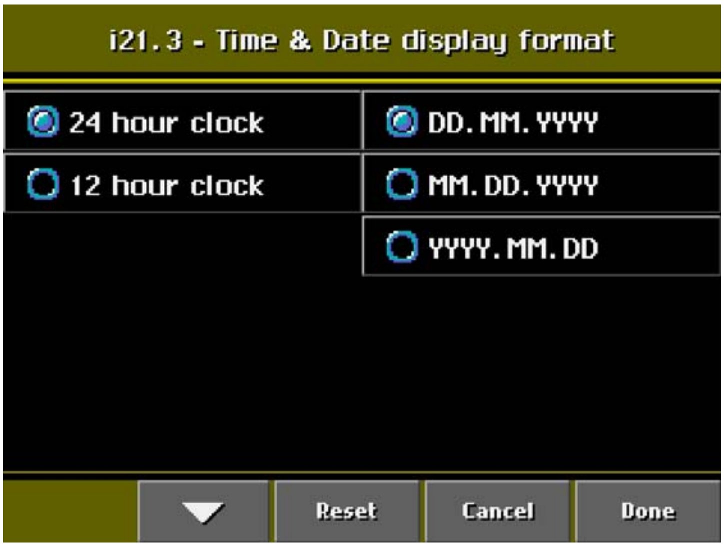


Figure 6

2.2 Audio settings

From the list of User preference settings select **Audio settings (i220).** To adjust sound volumes touch the **Adjust sound volume** field.

The display shown below appears. When an X-ray exposure is taken you will hear a warning tone indicating that radiation is being generated. If the warning sound of the radiation cannot be heard or is considered too loud, it can be adjusted with the arrow fields. The adjustment range is 1-255.

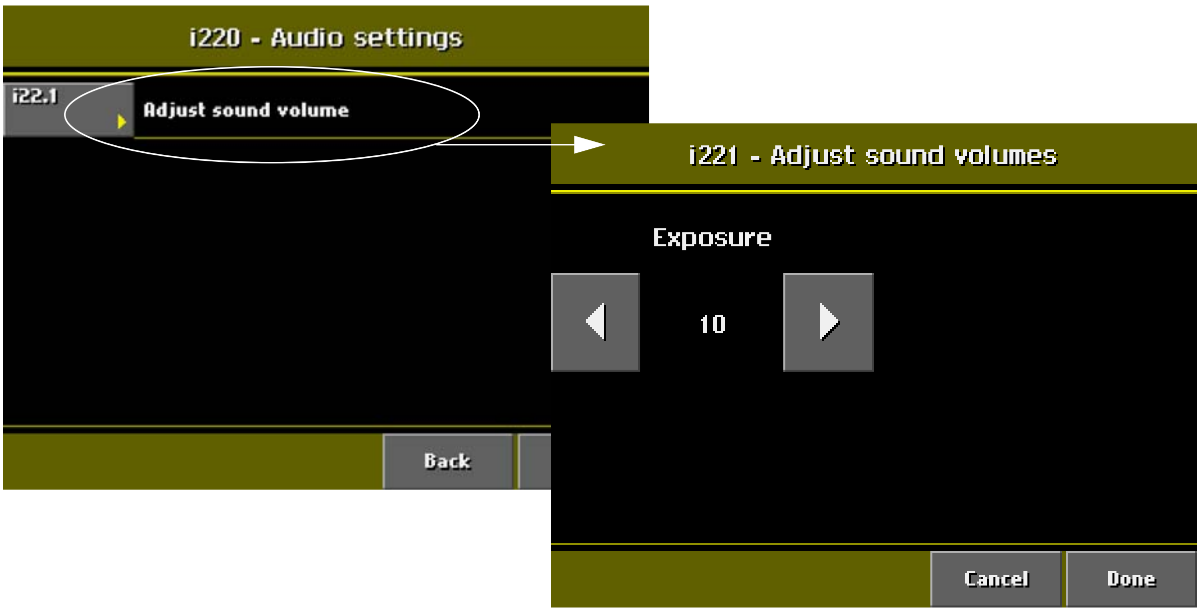


Figure 7

2.3 Behavioural preferences

From the list of User preference settings select **Behavioural preferences (i230)**.

Return C-arm after exposure: The C-arm can be set to automatically return to Entry position after the panoramic exposure. To switch off the automatic return of the C-arm empty the check box.

Disable Entry 1 position: You can disable the C-arm to move to the back from the patient positioning area by selecting **Disable Entry 1** position.

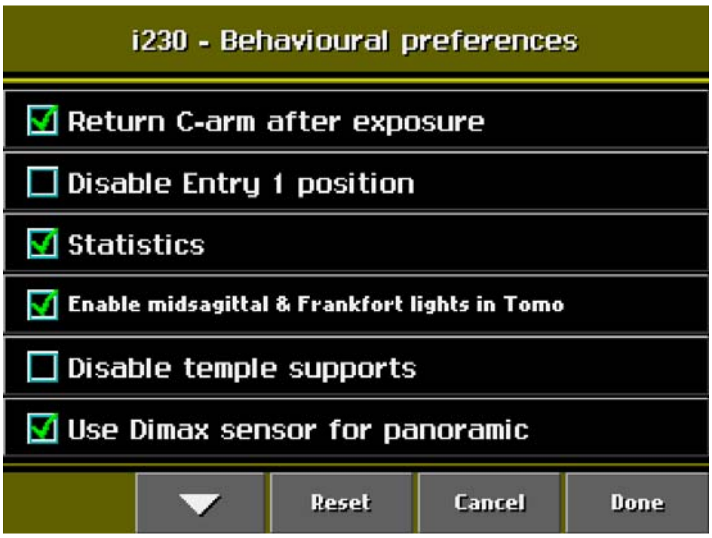
Statistics: The patient's radiation dose will be shown in a pop-up window after each exposure if the *Statistics* option is selected on this display. Radiation dose is indicated in terms of DAP (Dose Area Product) and calculated separately for each exposure. The measurement unit for DAP is milligray per square centimeter *(mGy*cm²).* If needed, DAP values can be calibrated as described in section 6.4 "DAP value adjustments" on page B-38.

Enable midsagittal & Frankfort lights in Tomo: If you wish to use the midsagittal and Frankfort plane lights in Tomo mode, select this option. To enable this feature you need to reboot the unit by switching it off and on again.

Disable temple supports: The X-ray unit can be used without temple supports when the temple support motor is inactivated. Remove the temple supports after selecting the **Disable temple support** function.

Use Dimax sensor for panoramic:
NOTE: This option will be shown only if the X-ray unit has a 3D V2/ 3D s sensor and a SmartPan license.
Select this option if you want to use a 3D V2 / 3D s sensor for taking 3D images and a Dimax sensor for taking panoramic (and tomo / transtomo / cephalometric) images.
When the option is not selected (check box empty) you can take 3D and SmartPan (Smart-Pan, SmartTMJ, SmartSinus) images with the same sensor.

Confirm your selection(s) by touching **Done**. Touching the **Cancel** field will bring you back to the User preference settings display without storing the new settings. Touching the **Reset** field will return the valid values without closing the *Behavioural preferences* display.



X-ray units with 3D V2 / 3D s sensor (with SmartPan license)

Figure 8

2.4 Visual adjustments

From the list of User preference settings (i200) select **Visual adjustments (i250)**.

In this mode you can adjust the Dynamic Exposure Control (DEC) settings *(i25.1)* and Calibrate the Touch panel *(i25.4).*

The image taken can be previewed from the *Preview Settings (i25.5*) **after taking the exposure**.

The 3D settings can be adjusted from the *3D display settings (i25.6).*

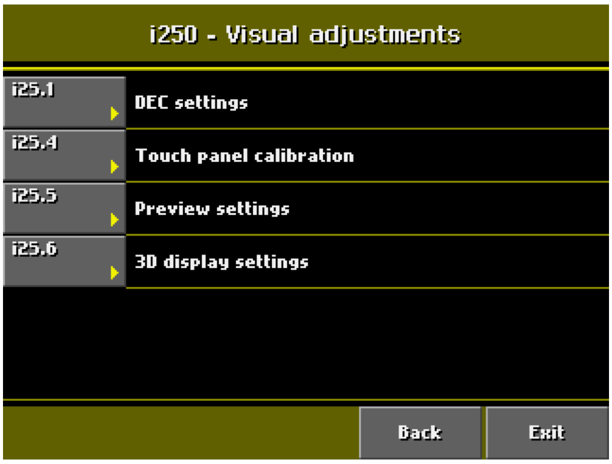


Figure 9

2.4.1 DEC settings

DEC density can be adjusted on the *DEC settings* display (i251).

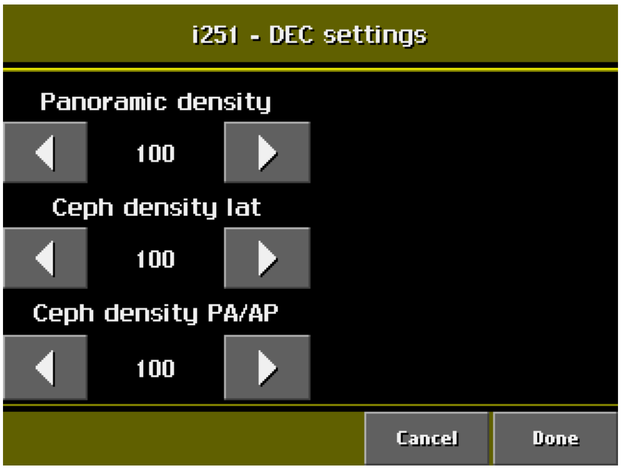


Figure 10

DEC density is expressed in percentage in comparison to DEC calibration value. The setting can be adjusted between 20% (lower exposure values -> brighter image) and 200% (higher exposure values -> darker image). The recommended setting is 100% (default setting)

NOTE **DEC is available for panoramic and cephalometric programs. It is not available for SmartPan programs (3D V2 / 3D s sensor + SmartPan).**

2.4.2 Touch panel calibration

The control touch panel is calibrated when you select the **Touch panel calibration (i254)** on the *Visual adjustments* display (i250). The display shown below will appear.

Figure 11

2.4.3 Preview settings

NOTE **This option is shown on the display only if the X-ray unit has an Ethernet network card.**

The *Show preview after exposure* function allows the user to see a preview of the X-ray image before accepting and storing the image.

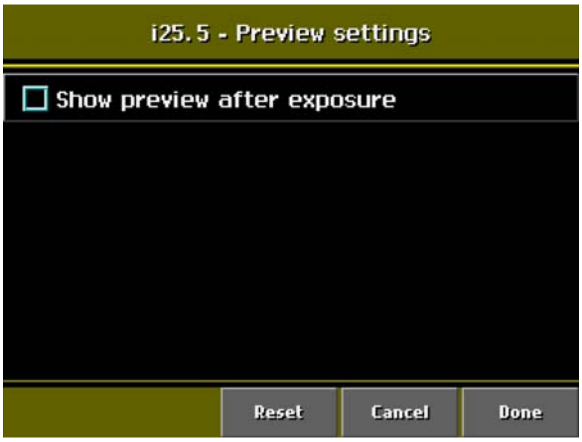


Figure 12

Touching the preview image will zoom the image. Return by touching *Overview.* Accept by touching *OK*.

2.5 Select language

The language of the control panel displays is selected on the *Select language* display.

Select the language you wish to use. The selected language will be marked with a dot. Touch *Done* to confirm the selection.

Figure 13

2.6 Default program settings

On this display you can change default settings for TMJ exposures and specify the tooth identification system used for tomo exposures.

NOTE **The settings can be changed in SCARA3 units only.**

2.6.1 TMJ

Touch the *TMJ* field to change the TMJ default angle. Adjust the angle (lat or PA) with the left and right arrows.

In double TMJ exposures the target position will be automatically moved forwards by 10 mm for the second exposure (open view projection). The setting can be changed by the user. On the *TMJ* display, touch the bottom arrows to select a shorter or longer movement step.

Confirm your selection by touching *Done* and reboot the X-ray unit to save the new default settings for TMJ exposures.

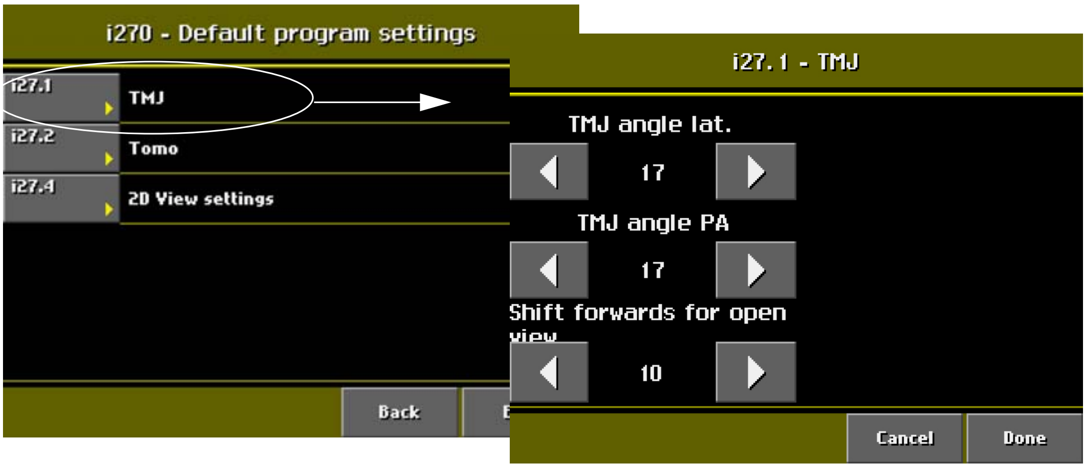


Figure 14

2.6.2 Tomo

On the *Tomo* display, select the tooth identification system you wish to use on the *Tomo/ Select target area* display:

The available options are:
- Planmeca: 0 - 9 (left / right)
- ADA: TMJ-Right, 1 - 8, 32 - 25, 0, 9 - 16, 17 - 24, TMJ-Left
- ISO-FDI: TMJ-Right, 18 - 11, 48 - 41, 0, 21 - 28, 31 - 38, TMJ-Left

The selected option will be marked with a dot. Touch *Done* to confirm your selection.

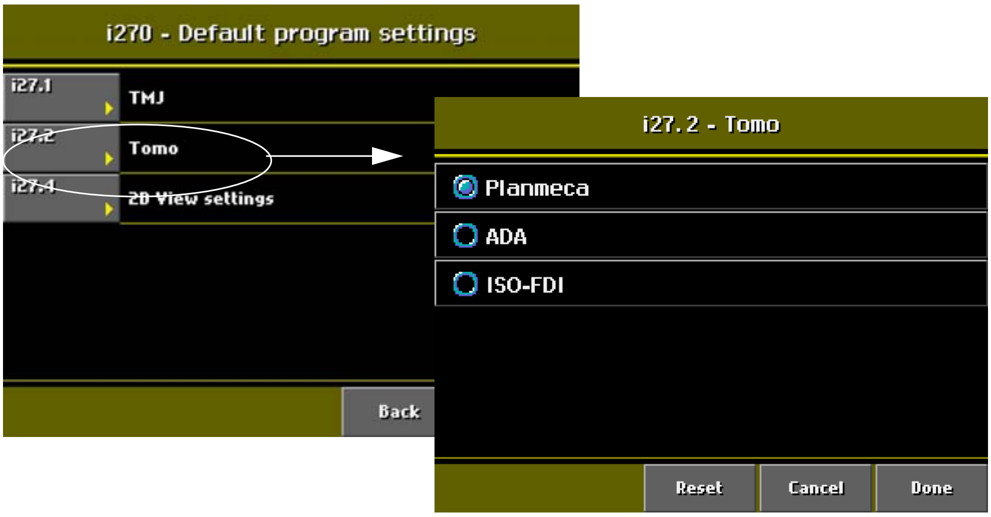


Figure 15

2.6.3 2D View settings

You can set the X-ray unit so that two 2D images (Scout, Lat-PA, Lat or PA) will be shown on the computer screen before you take a 3D image. This will allow you to check the position of the target area or, if necessary, confirm the need for a 3D exposure.

Touch the *2D View settings* field to select the type of 2D views that will be available when taking 3D exposures.

The selected option will be marked with a blue dot. Confirm your selection by touching *Done*.

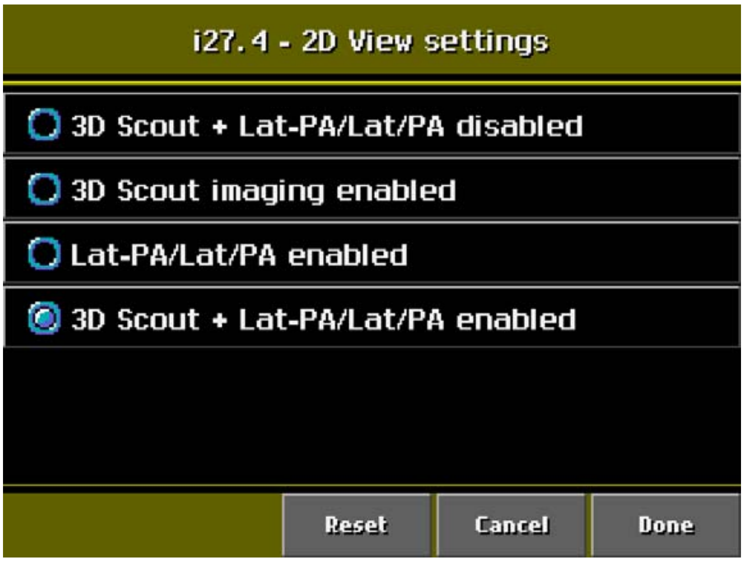


Figure 16

3 FEATURE PROGRAM CONTROL

From the list of information displays select **Feature program control (i300)**. In this mode new features can be added to the X-ray unit.

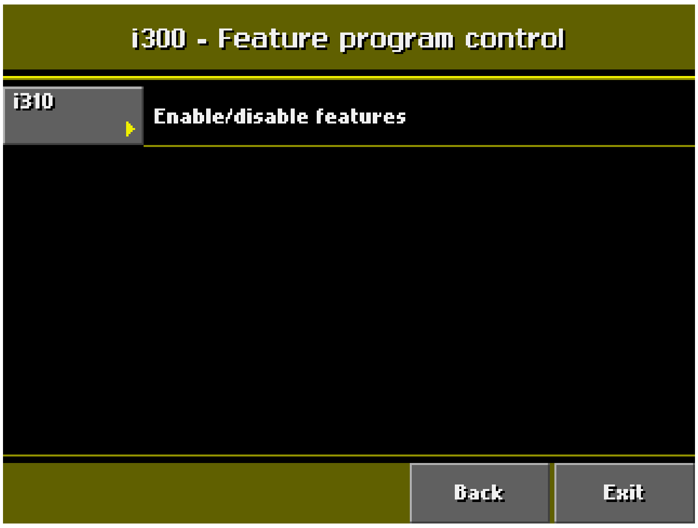


Figure 17

3.1 Enable / disable features

On the *Enable/disable features* (i310) display, touch the feature you wish to activate. Enabled features will be marked with a green check mark. Confirm the selection by touching *Done.*

By touching the down arrow in the lower left corner more features will appear. On the next display, touch the up arrow in the lower left corner to return to the previous display.

NOTE **The option *3D & Panoramic*, *3D & Large Views* or *SmartPan* cannot be selected if the option *3D* is not switched on.**

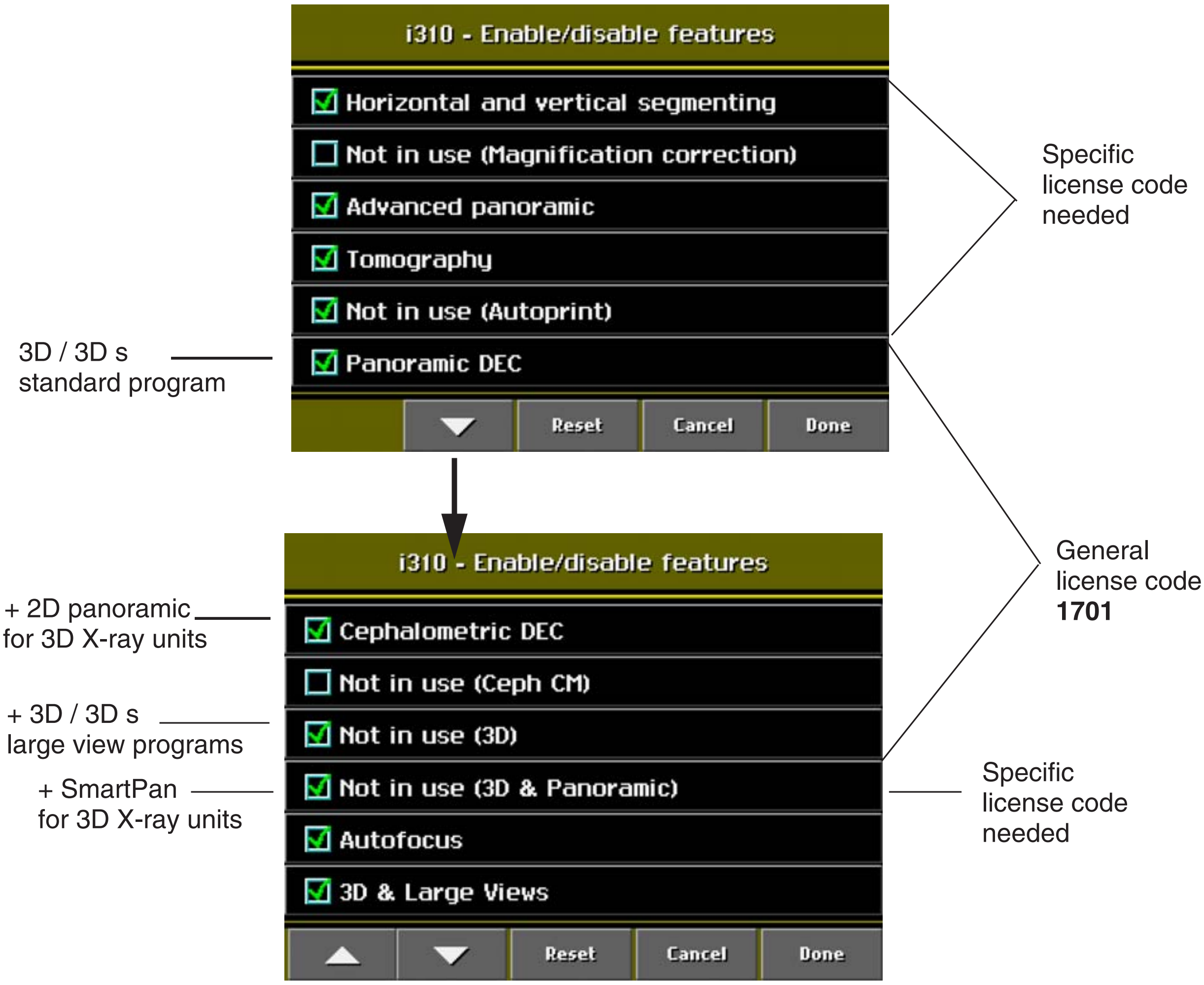


Figure 18

You will need a license code to add a new feature to the X-ray unit. The license code can be a specific code for the selected feature on this X-ray unit or a general code (1701) as shown above.

Touch the feature field (e.g. *Vertical segmenting)* to switch this feature on. A number display will appear. Enter the license code to enable the selected feature.

NOTE **FOR SPECIFIC LICENSE CODES:**
Each license code is unit and module specific, i.e. it can only be used on the specified X-ray unit and for the specified program feature.

NOTE **FOR GENERAL LICENSE CODE:**
The 3D options and Autofocus can be enabled with a general license code (1701).

To disable the selected feature repeat the procedure.

NOTE **After enabling/disabling a new feature the X-ray unit must be switched off and back on again.**

4 SPECIAL FUNCTIONS

From the list of information displays select **Special functions (i400)**. In this mode you can select some special operation modes and take a test exposure.

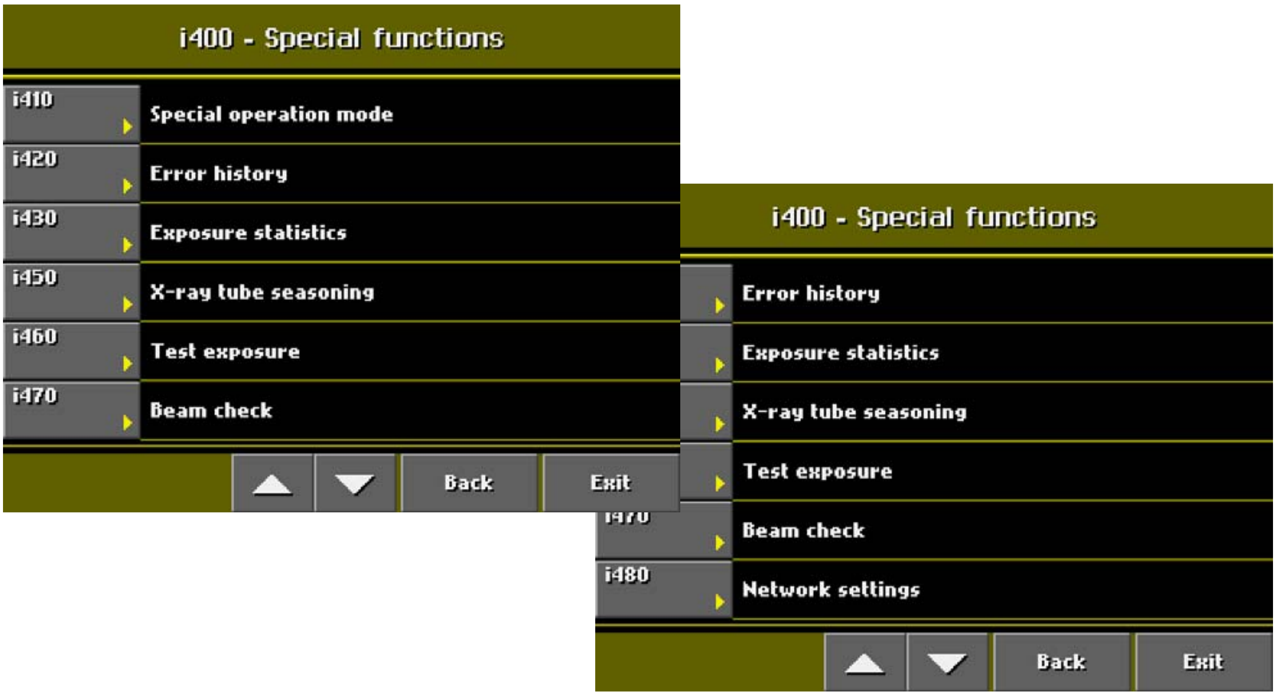


Figure 19

4.1 Special operation mode selection

Select **Special operation mode (i480) selection** on the *Special functions* display. The display shown below appears.

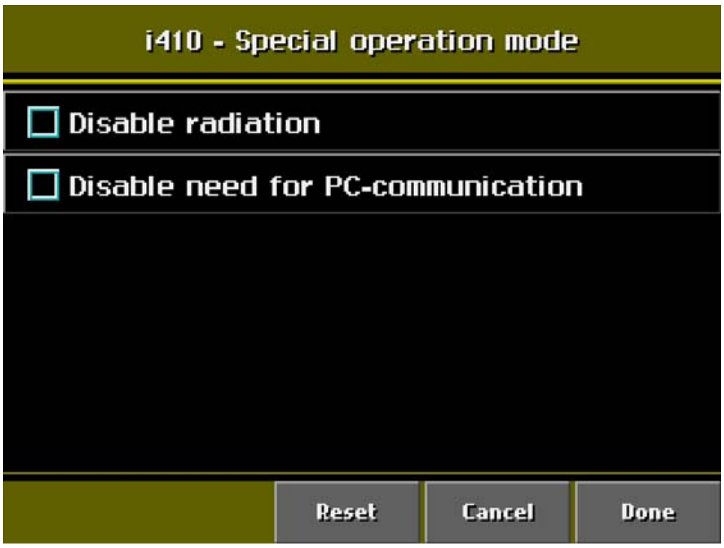


Figure 20

4.1.1 Disable radiation

This option allows you to switch the exposure function **on** or **off**.

When the exposure function is switched off **no** radiation is generated when you press the exposure button. The C-arm will move normally but no radiation will be generated and no radiation warning signals will be given, i.e. this is a “dummy run” function for training and demonstration purposes. For example, you might want to demonstrate the C-arm movements before taking exposures of children or nervous patients.

Touch the **Disable radiation** field to switch the exposure function on (empty the check box). Touch the **Disable radiation** field again to switch the exposure function off.

4.1.2 Disable need for PC communication

This option allows you to demonstrate the ProMax digital X-ray unit without PC connected to the unit.

4.2 Error history

Select **Error history (i420)** on the *Special functions* display. The display shown below appears. In this mode the recent 100 unit and recent 40 tube head error messages are shown. The list is shown in chronological order (by date/time). The oldest error messages are dropped out from the list if the list is full and there are new errors stored.

Figure 21

NOTE **The error history can be cleared on the Configuration selftest (i560) display by touching the Clear exposure history button.**

4.3 Exposure statistics

Select **Exposure statistics (i430)** on the *Special functions* display. The display shown below appears. In this mode it is possible to check the unit tube head’s exposure statistics. The diplays shows the time and the date of the latest exposure, the serial number of the latest unit and the exposure counters of the panoramic, cephalometric, tomographic and 3D exposures. The total amount of mAs, energy and exposure time are also shown.

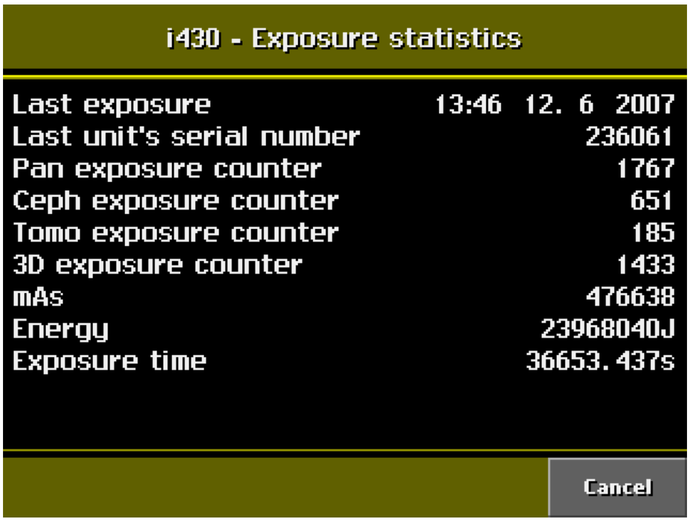


Figure 22

NOTE **The parameters can be cleared on the Configuration selftest (i560) display by touching the Clear exposure history button.**

4.4 X-ray tube head seasoning

Tube head seasoning procedure is recommended if the Planmeca ProMax x-ray unit stands unused for a couple of days or longer.

The x-ray tube head seasoning is done in the **X-ray tube seasoning (i450)** display by pressing the start button.

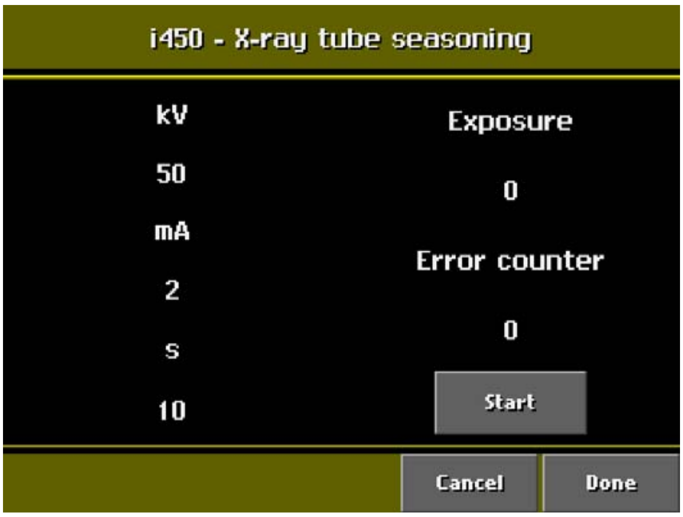


Figure 23

The procedure can be cancelled by pressing Cancel or Done.

The seasoning procedure starts with 50kV, 2mA and makes two 10 second exposures. The kV is then increased by 10kV up to the maximum. Two exposures are done with every kV.

There is a 5 second wait time between every exposure. The maximum kV value depends on the configuration and the maximum kV set.

The exposure values are automatically changed during the procedure. In the GUI you can see kV, mA, time and exposure and error counters. You can also see the status of the procedure, which can be: Ready, Exposure, Wait, Error or OK. If there appears a tube head arching error during the procedure, it returns to the previous used kV. If you get any other error message, the exposure is repeated using the same values.

If you receive 10 errors combined, the procedure is stopped and you get an Error status.

If the procedure is finished successfully, you get Status OK.

A successfully performed seasoning procedure total time takes approximately:

2D: 120s

3D: 150s

The exposure button can be held down during the seasoning procedure or can be released in between the exposures. If you release the exposure switch during an exposure the exposure is repeated without an error.

4.5 Taking a test exposure

Select **Test exposure (i460)** on the *Special functions* display. This option allows you to take a test exposure. The test exposure is taken with the latest used collimation, i.e. the selected program, segmentation and jaw size will affect to the collimation.

Select the desired exposure parameters: kV and mA values and exposure time and touch the **Test** field. The text **Ready** appears to the bottom of the display and the test exposure can be performed.

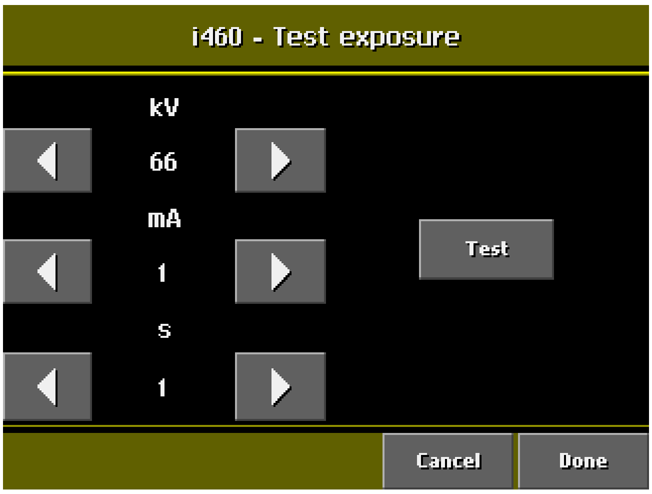


Figure 24

4.6 Beam check

Select **Beam check (i470)** on the *Special functions* display. The display shown below appears. The X-ray beam position on the sensor head can be checked in this mode. The beam check procedures are described in sections 2.8 “Beam check” on page E-38 and 1.14 “Beam check” on page H-37.

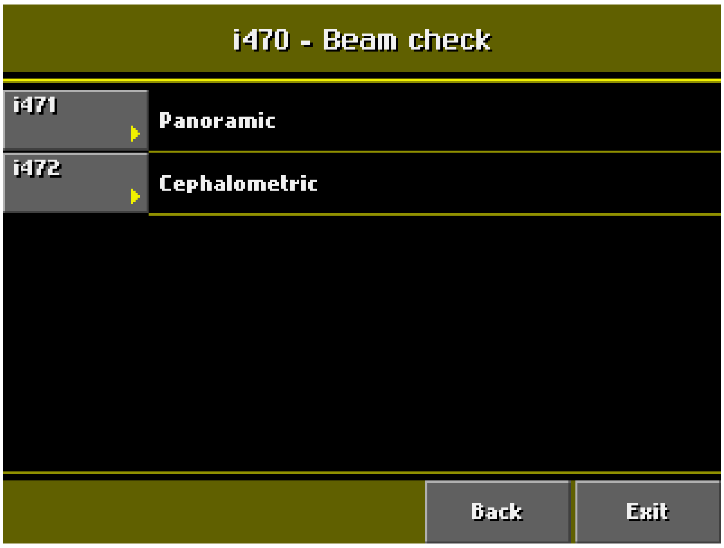


Figure 25

4.7 Network settings

Select **Network Settings (i480)** on the *Special functions* display. The display shown below appears. It is possible to communicate with the **X-ray unit** through a Ethernet link. To enable the communication it is necessary to configure the link settings to the X-ray unit and to the PC which is connected directly or remotely to the unit.

The detailed Ethernet link setup procedure is described in the Installation manual, publication number 688271.

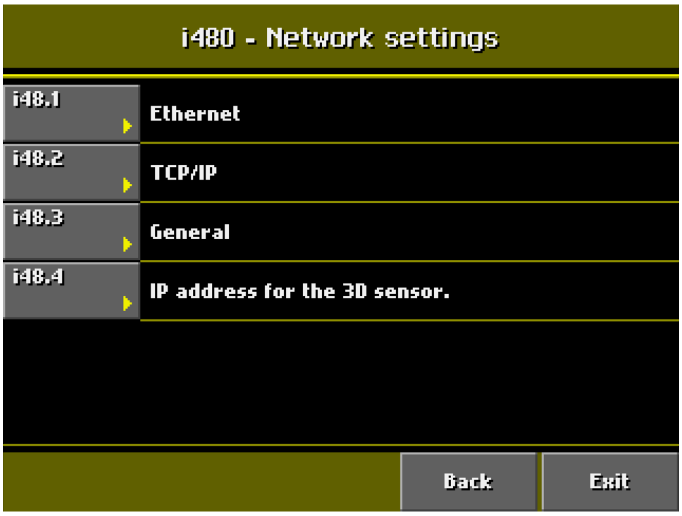


Figure 26

4.7.1 Ethernet

Select **Ethernet mode (i481)** on the *Network Settings* display. The display shown below appears.The **Network Mode** can be chosen as **Auto-negotiation, 10/100 Mb Full-duplex** or **10/100 Mb Half-duplex.** MAC-Address is equipment related and it cannot be changed.

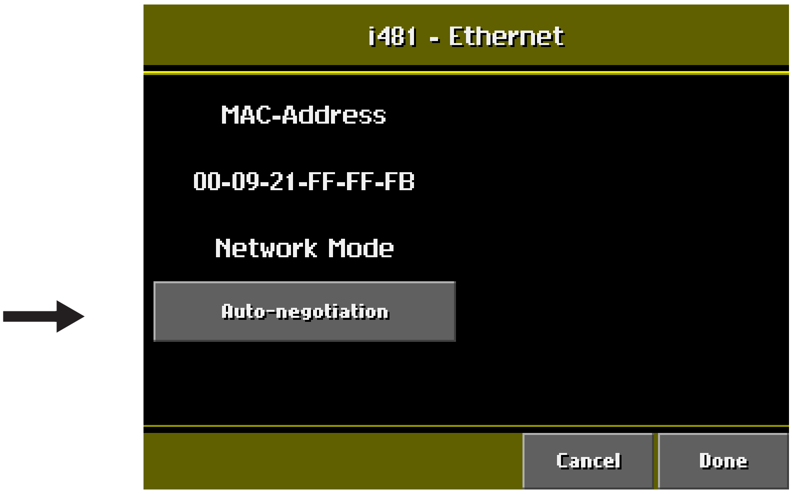


Figure 27

4.7.2 TCP/IP

Select **TCP/IP mode (i482)** on the *Network settings* display. The display shown below appears. All the default settings can be changed by touching the address field.

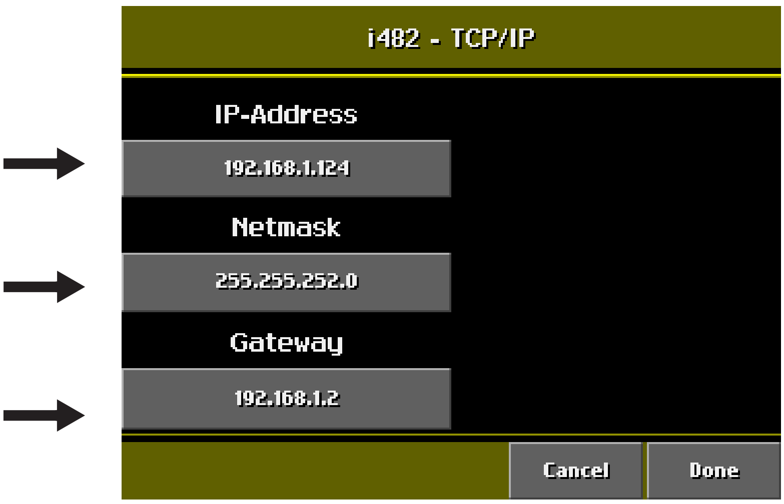


Figure 28

IP Address - The Ethernet interface IP Address (default value is 192.168.0.130)

Netmask - Subnet mask (default value is 255.255.252.0)

Gateway - Gateway address (default value is 192.168.1.2)

NOTE **In case the ProMax is connected to a 10/100 Base Network, the Gateway and the ProMax IP address have to be static and specified by the local administrator to be used only for this configuration.**

When the setting field is touched the following window below will appear. The settings are saved by touching **OK**.

Figure 29

4.7.3 General

Select **General (i483)** on the *Network settings* display. The display shown below appears. In this mode the **Net password** is set for the Ethernet link and also the used **Control port** (default value is 5000). A **Net Password** can be set by the user by touching the **No Password** button.

NOTE **It is recommended to set a Net Password for the Ethernet link, so that it is not possible to enter the Promax unit without authorisation.**

Figure 30

The following window will appear. The Net Password can be from 1 to a maximum of16 characters (no limitation in numbers or letters).

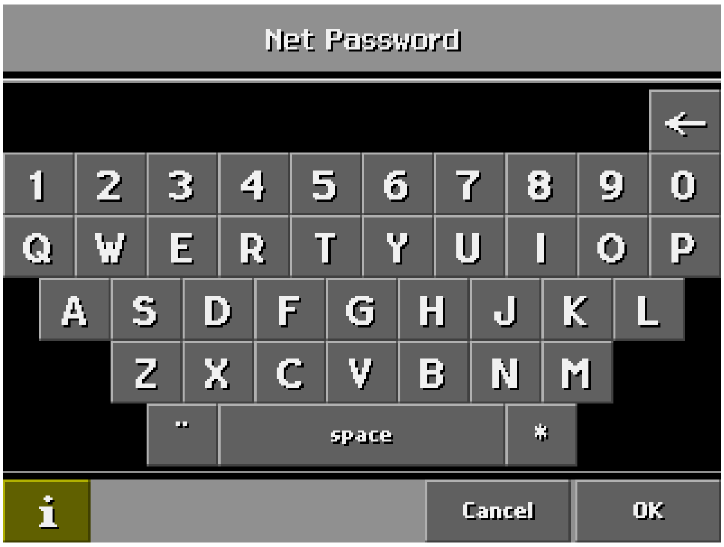


Figure 31

The new Net Password is saved by touching **OK.** Now the Net password button shows the text **Password Set** (= a net password is set). The Net Password **can be removed** by touching the **Password Set** button and when the Net Password keyboard appears by touching **OK**.

4.7.4 IP address for 3D sensor

Select **IP address for 3D sensor (i48.4)** on the *Network settings* display. The display shown below appears. The 3D sensor IP-address default setting can be changed by touching the address field.

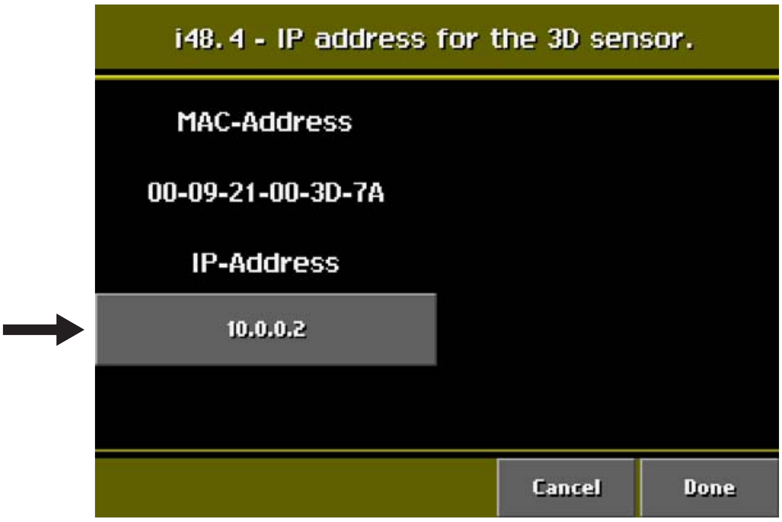


Figure 32

When setting field is touched the following window will appear. The settings are saved by touching **OK**.

Figure 33

5 SERVICE SETTINGS

From the list of information displays select **Service settings (i500).** The service setting mode is password protected and the password is asked when the *Service settings* mode is entered for the first time after switching the unit on. ***The password is 1701.***

Figure 34

In *Service settings* mode the *Special operation* mode selection (i510) and *Exposure program tuning* (i540) can be made, *Preheat calibration (i520)* can be performed and *Maximum height (i530)* of the unit can be set.

The *Factory default settings* (i550) can be recalled and *Configuration selftest (i560)* can be made. The option *Select configuration (i570)* will be shown for 3D units only. *Service settings* mode also allows to perform fine tuning of *Patient support alignment (i580).* GUI software is updated by using the *Software update (i590)* menu.

Figure 35

5.1 Special operation mode selection

From the list of Service settings select **Special operation mode selection (i510).**

Figure 36

5.1.1 Demo licences

The Demo licences option allows you to demonstrate all the ProMax X-ray programs. When this option is selected no radiation is generated when you press the exposure button. The programs can be selected and the C-arm will move normally but no radiation will be generated and no radiation warning signals will be given, i.e. this is a “dummy run” function for training and demonstration purposes.

5.1.2 Enable high speed ceph

This option allows you to enable the high speed ceph function. This feature enables you to take an exposure with a higher sensor speed, i.e. the exposure time is shorter.

5.1.3 Enable Bitewing

This option allows you to enable the Bitewing exposure program. You will need a special licence code for this program. Read detailed instructions given in the user’s manual.

5.2 Preheat calibration

The X-ray tube filament preheat calibration must be performed whenever the tube head and/ or the Power supply PCB is replaced. To perform the X-ray tube filament preheating calibration select **Preheat calibration (i520)** on the *Service settings* display. **Press and hold down the exposure switch until the series of exposures ends.**

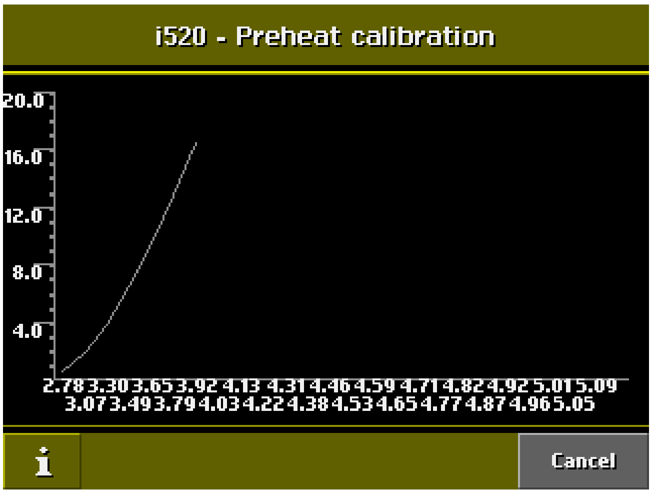


Figure 37

5.3 Maximum height

To set the maximum height of the unit select **Maximum height (i530)** on the *Service settings* display. Drive the unit to the desired maximum height with the height adjusting buttons and touch the **Done** field.

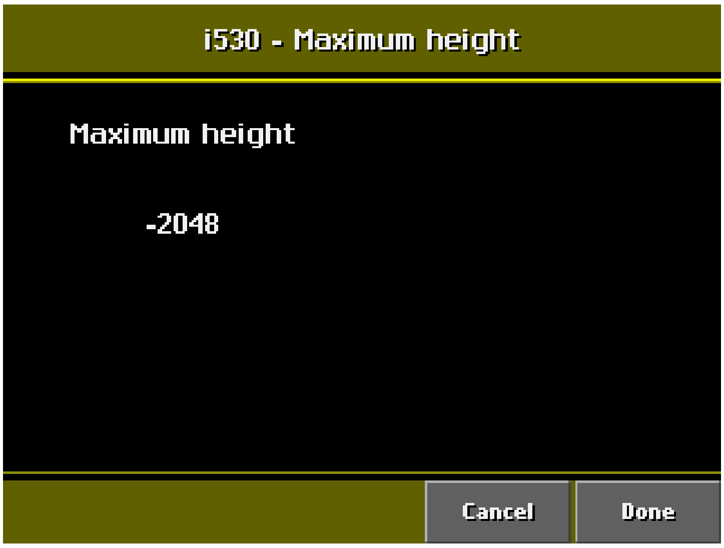


Figure 38

5.4 Exposure program tuning

From the list of Service settings select **Exposure program tuning (i540).** In this mode the maximum and minimum values of the kV and the minimum mA range can be set for panoramic, cephalometric and 3D exposures.

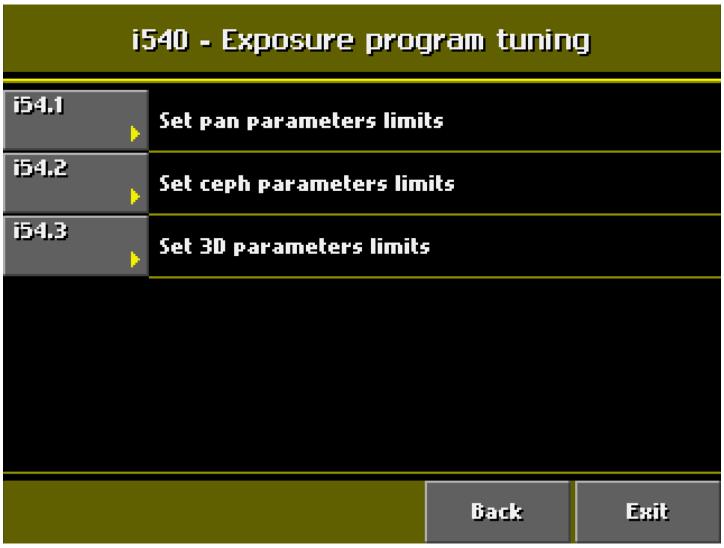


Figure 39

To set the panoramic exposure values select **Set pan parameters (i54.1)** limits. The display shown below appears. Select the **maximum and minimum kilovolt**, and **minimum milliampere** values with the arrow fields and touch the **Done** field.

Figure 40

To set the cephalometric exposure values select **Set ceph parameters limits (i54.2).** The display shown below appears. Select the **maximum and minimum kilovolt,** and **minimum milliampere values** with the arrow fields and touch the **Done** field.

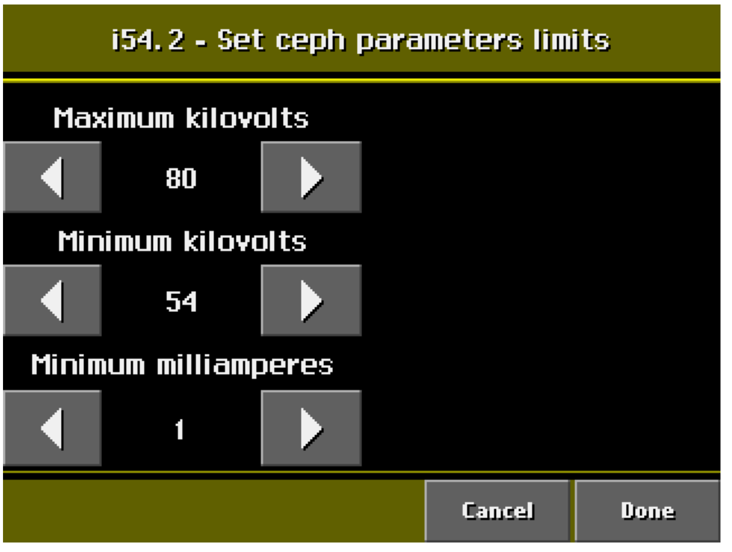


Figure 41

To set the 3D exposure values select **Set 3D parameters limits (i54.3).** The display shown below appears. Select the **maximum and minimum kilovolt,** and **minimum milliampere values** with the arrow fields and touch the **Done** field.

Figure 42

5.5 Factory default settings

The *Factory default settings (i550)* will turn up **only** in case the memory card (RTC) has lost its configuration and user settings or it has been replaced to a new PCB. **In this case the procedure should be done before using the X-ray unit.**

5.6 Configuration selftest

From the list of Service settings select **Configuration selftest (i560)**.

Touch the **Reset system configuration** field if you wish to bring back the default exposure values for the quick buttons that are shown on the *Select kV/mA* display.

The Clear exposure history field clears the Error history (i420) and Exposure statistics (i430) counters.

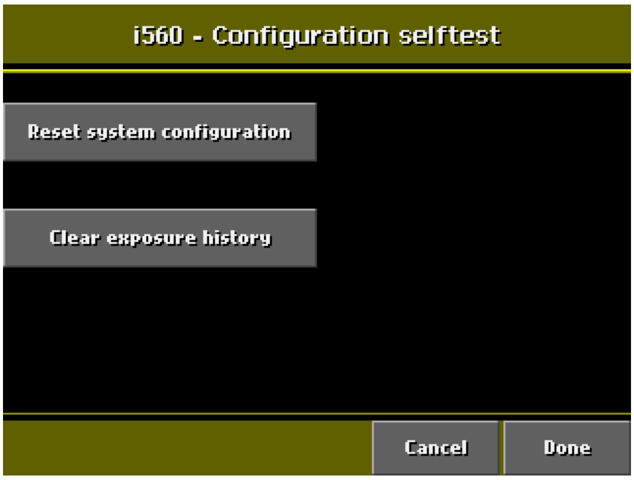


Figure 43

NOTE **It is important to perform the Reset system configuration function in case a device(s) has/have been added or removed from the X-ray unit.**

5.7 Select configuration

NOTE **This option will be shown only if a 3D license has been activated on display i310.**

On the Service settings display, touch **Select configuration (i570).**

A display will appear where you can select the ProMax, collimator and sensor type.

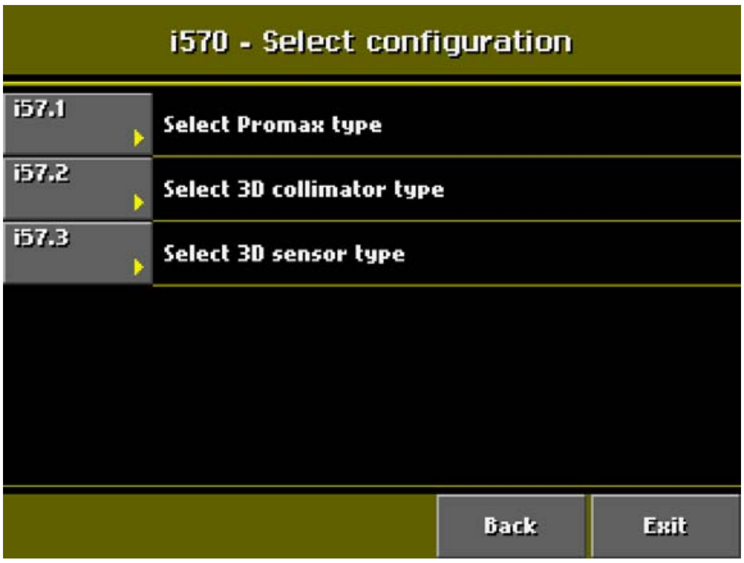


Figure 44

5.7.1 ProMax type

On the *Select ProMax type* display select the configuration of the X-ray unit,

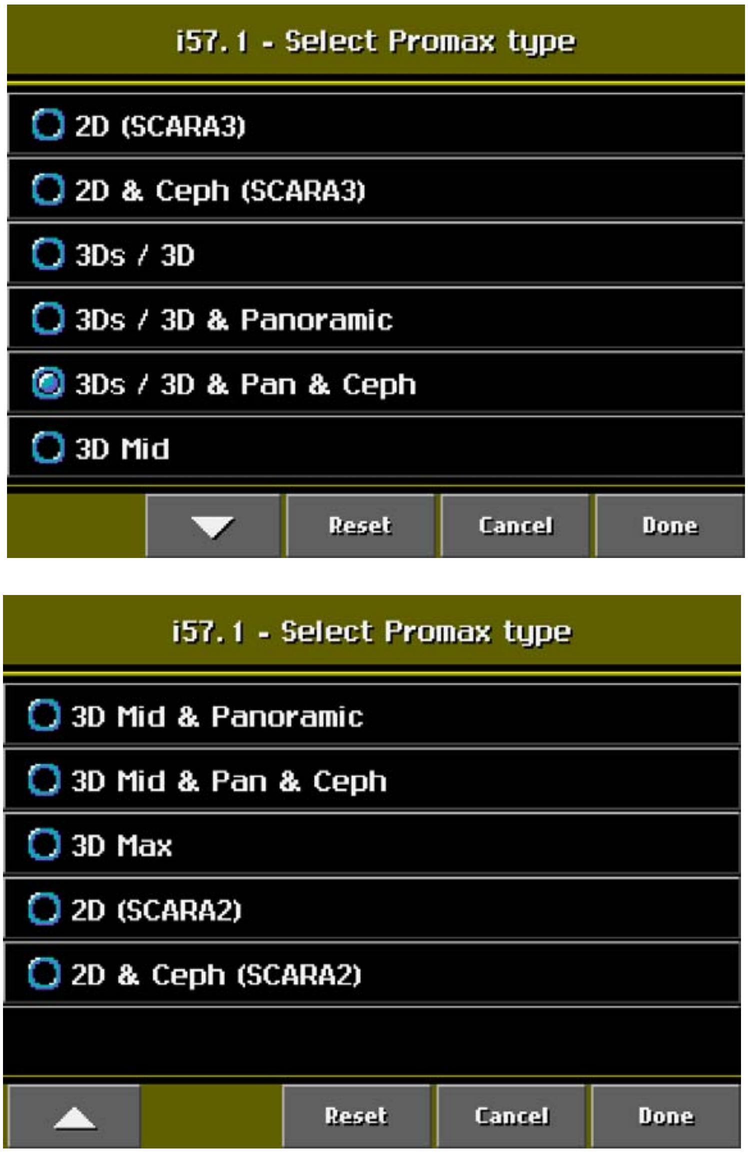


Figure 45

5.7.2 Select 3D collimator type

There are three versions of the collimator: 3D version 0 (V0), 3D version 1 (V1) and 3D version 2 (V2).

Select the 3D collimator that is attached to the X-ray unit. The selected option will be marked with a dot. Touch *Done* to confirm the selection.

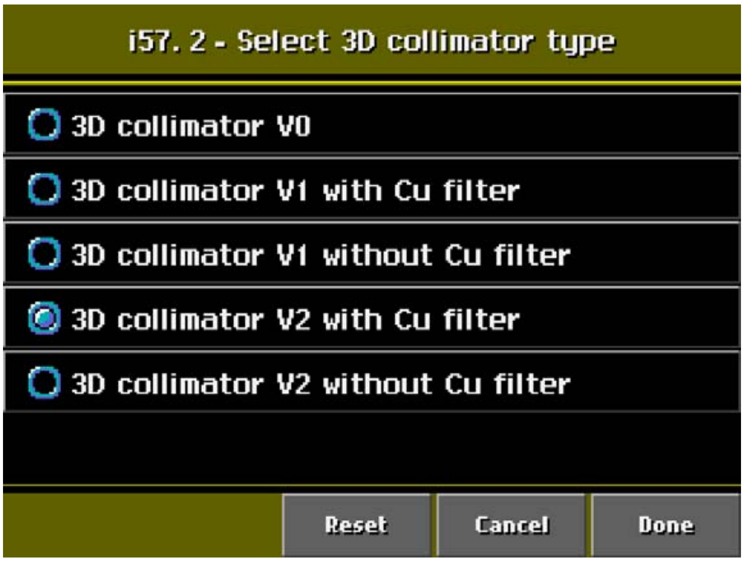


Figure 46

The differences between the collimators are shown below.

3D collimator V0
(part number 10012615)

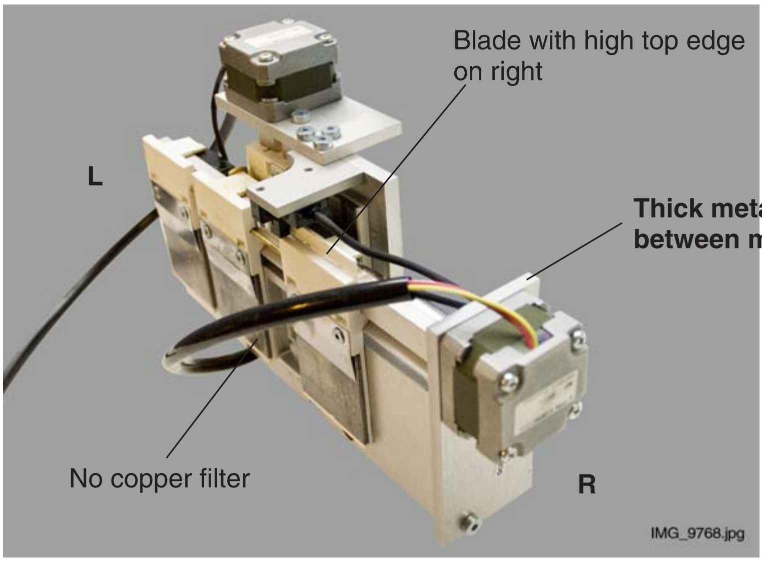
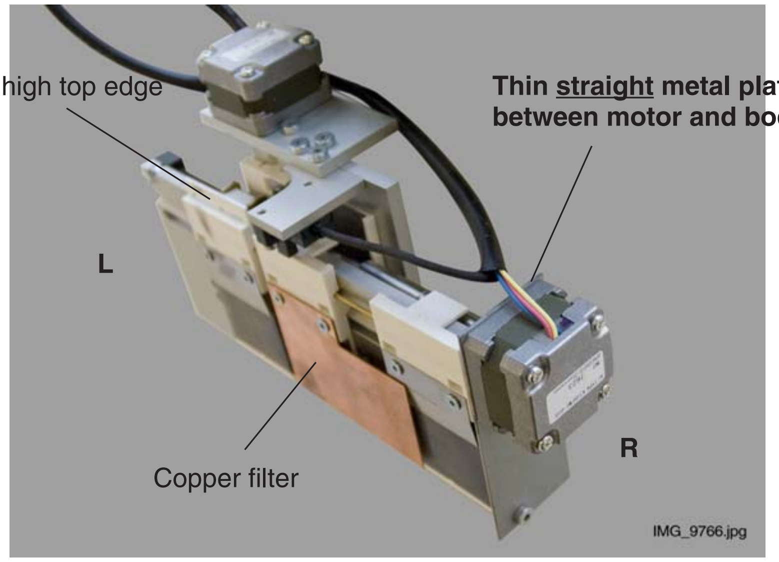


Figure 47

3D collimator V1
(part number 10018019)



3D collimator V2
(part number 10023718)

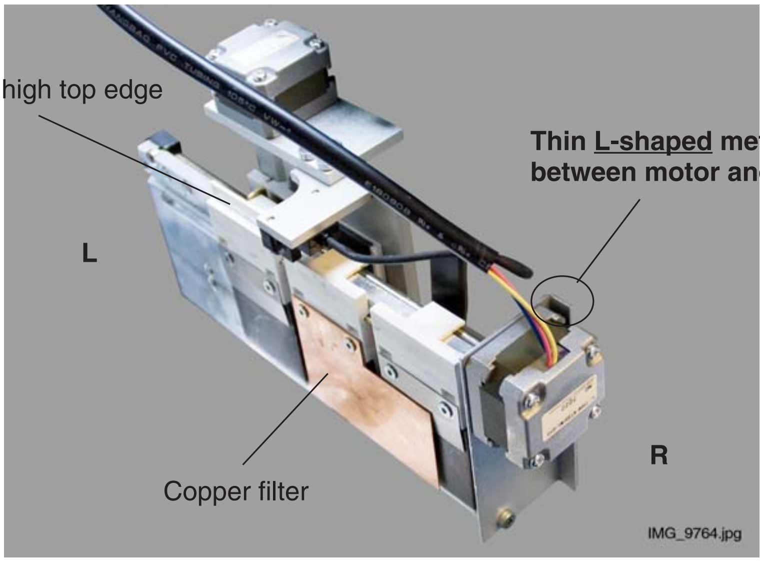


Figure 48

NOTE **We recommend that a copper filter (second or fourth option on display i57.1) is always used. Patient radiation dose will be higher on X-ray units without a copper filter.**

NOTE **For instructions on how to change the collimator, see section 10 “PROMAX 3D: REPLACING COLLIMATOR” on page E-99.**

5.7.3 Select 3D sensor type

There are three versions of the sensor: 3D version 1 (V1), 3D version 2 (V2) and 3D s.

Select the 3D sensor that is attached to the X-ray unit. The selected option will be marked with a dot. Touch *Done* to confirm the selection.

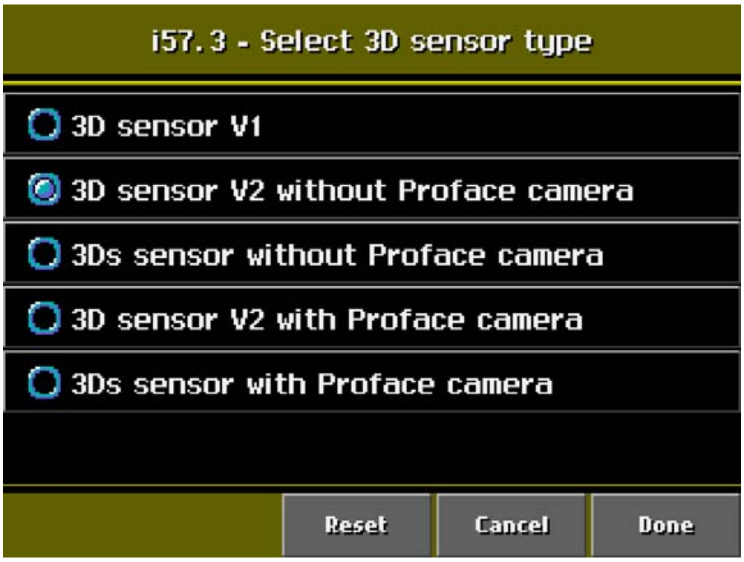


Figure 49

The 3D sensor has a larger active area than the 3D s sensor. The 3D version 1 (V1) sensor has no cooling grille.

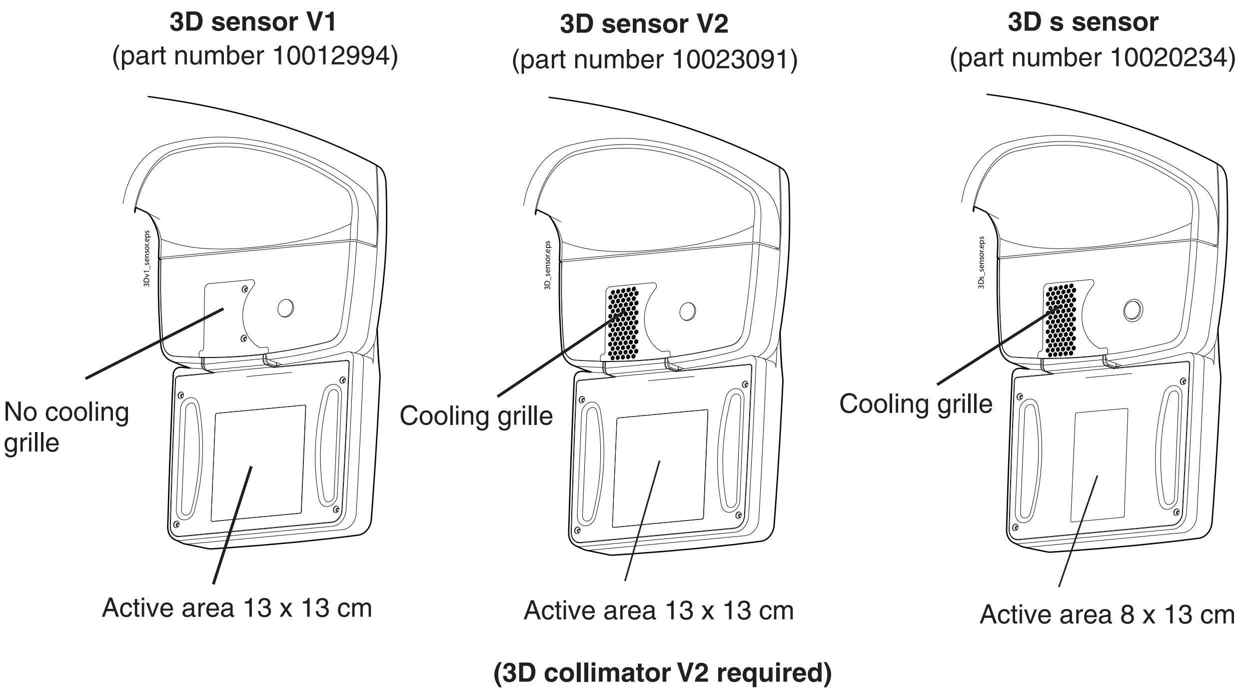


Figure 50

NOTE **A 3D sensor V2 can only be used on X-ray units with 3D collimator V2. If the X-ray unit is fitted with collimator type V0 or V1 (see display i57.1) the collimator has to be changed as described in section 10 "PROMAX 3D: REPLACING COLLIMATOR" on page E-99.**

5.8 Patient support alignment

In the Service settings it is possible to perform a patient support alingment checkup and to do a fine tuning of the patient support by choosing from the Service settings *Patient support alignment (i580).*

NOTE **The fine tuning is done after the mechanical adjustment of the patient support.**

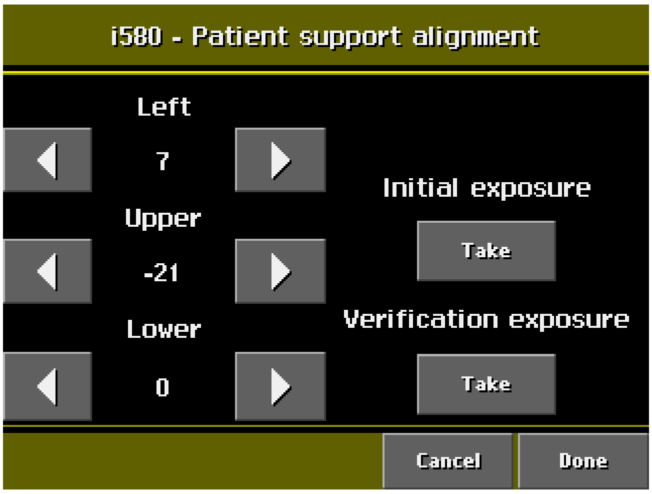


Figure 51

5.9 Software update

From the list of Service settings select **Software Update (i590)**. In this mode the GUI software can be updated.

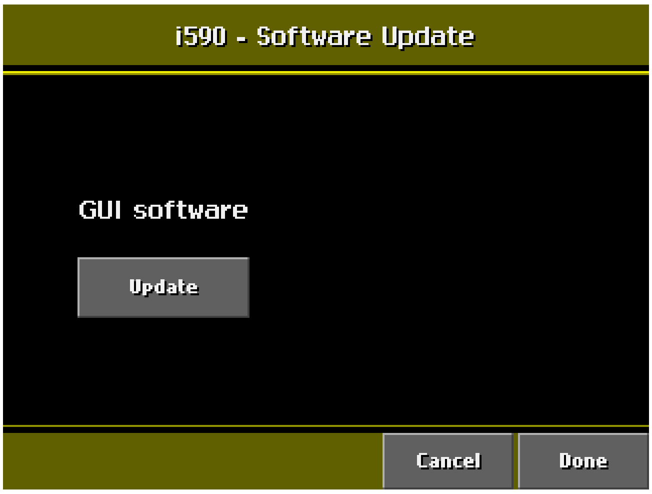


Figure 52

The update procedure is explained in section 3.1 “GUI software update, only for colour GUI” on page F-10.

6 TECHNICAL CALIBRATIONS

From the list of information displays select **Technical calibrations (i600)**.

The technical calibration mode is password protected and the password is asked when the *Technical calibrations* mode is entered for the first time after switching the unit on.

The password is 1701.

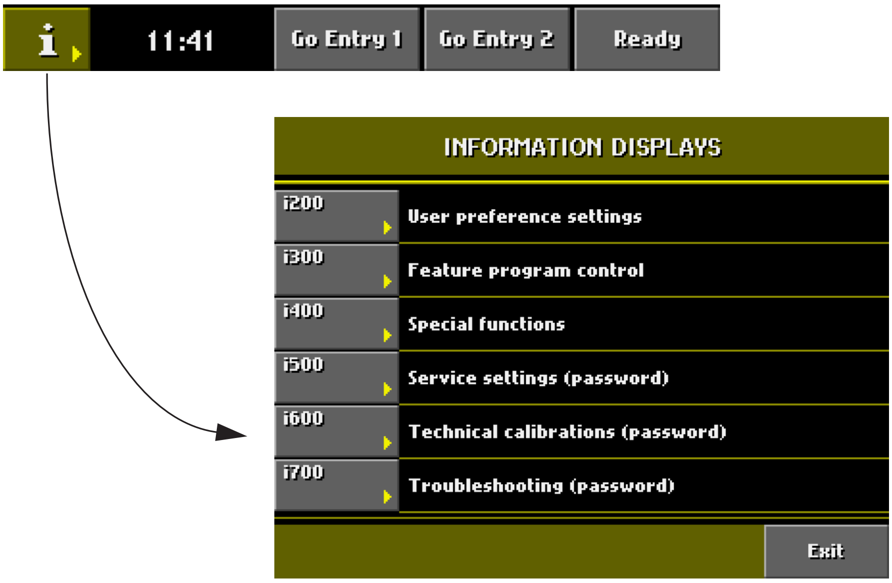


Figure 53

The unit calibrations are performed in this mode. **Detailed descriptions of calibrations are given in respective sections later in this manual.**

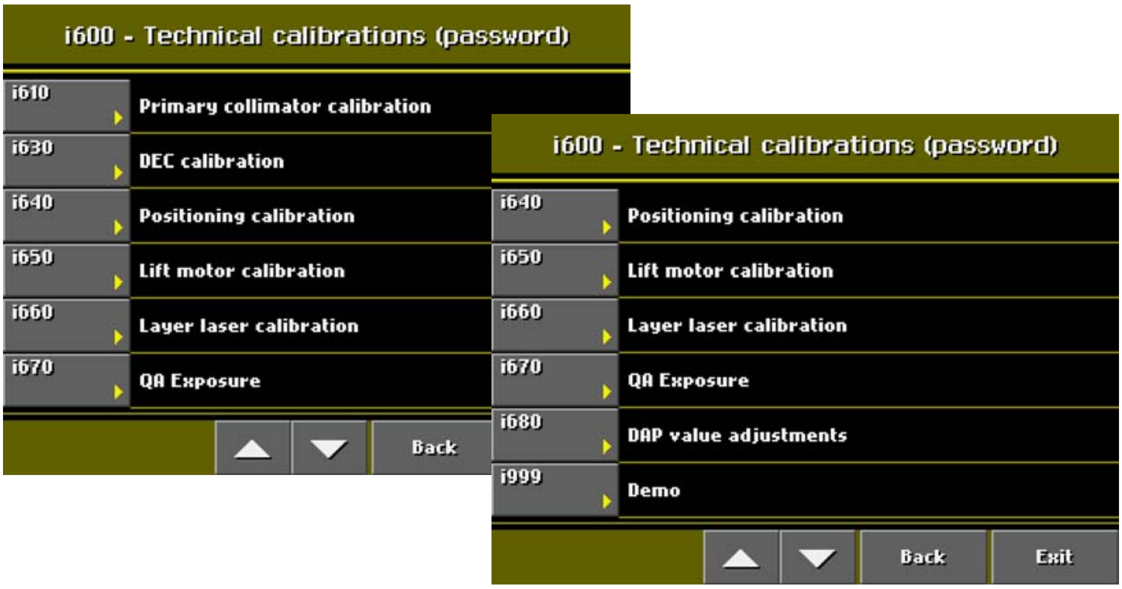


Figure 54

6.1 Collimator speed adjustment

From the list on the *i600* display that appears select **Primary collimator calibration (i610).**

Select **Collimator speed adjustments (i61.16)**

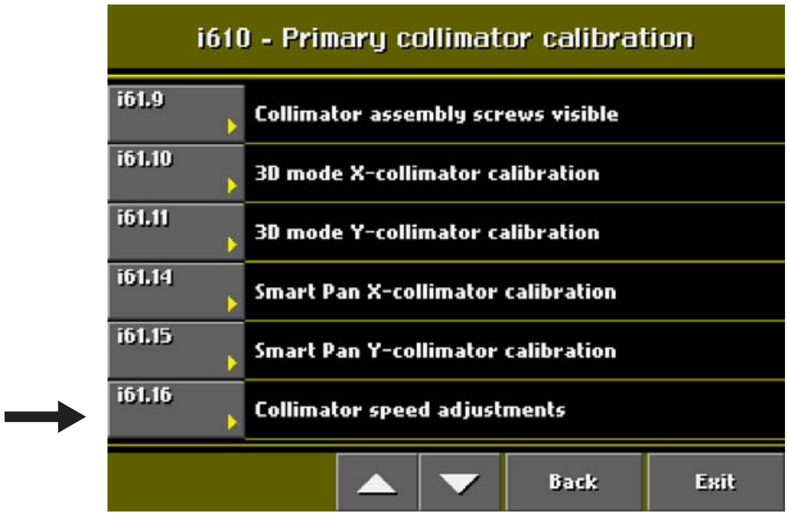


Figure 55

The collimator speed can be adjusted on the this display.

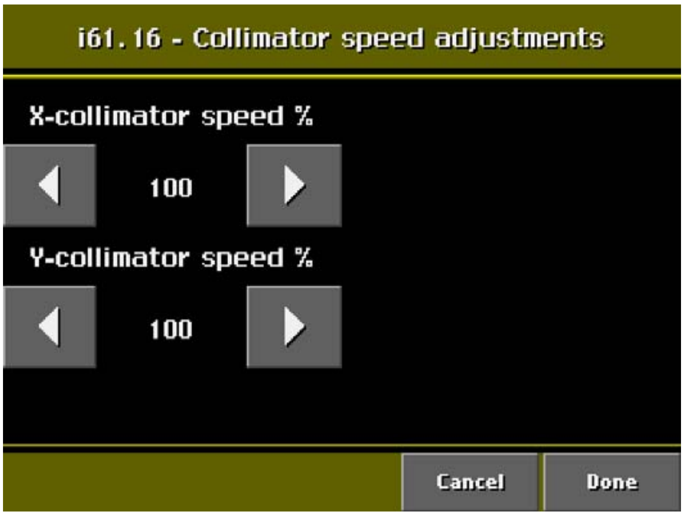


Figure 56

Changing the speed affects to the sound of the collimator movement. You can try to decrease the sound by changing the collimator speed gradually in either direction. The max values x: 105%, y: 115%, equals the same speed as with the previous software version. The factory defaults are 100% with both x and y values.

6.2 Height adjustment maximum speed setting

The telescopic column moves slowly at first and then faster when the up or down button is pressed.

Height adjusting buttons

The maximum speed of the fast movement can be adjusted on the *Height adjustment maximum speed setting (i65.2)* display.

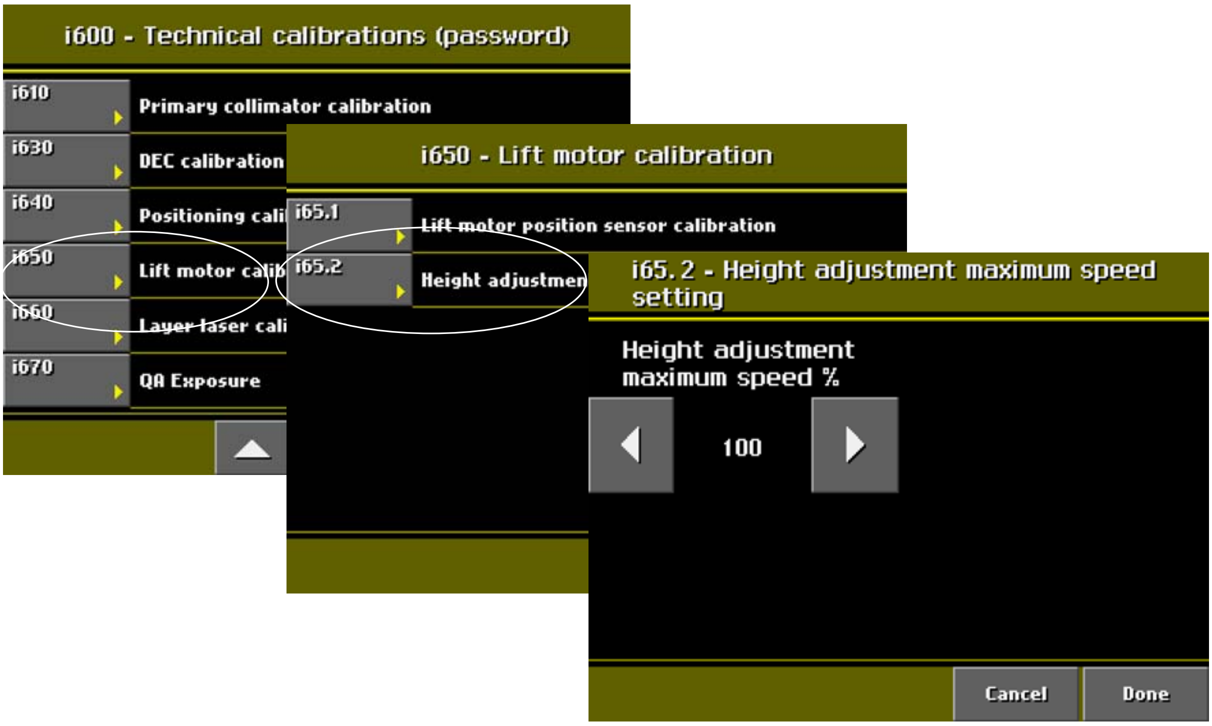


Figure 57

Touch the left arrow to decrease the speed at which the telescopic column moves. Touch the right arrow to increase the speed. The setting can be adjusted between 27% (slowest speed) and 100% (fastest speed). The default setting is 100%.

6.3 QA exposure

Refer to “Image quality monitoring instructions for Planmeca digital X-ray units”, publication number 10016248.

6.4 DAP value adjustments

The patient's radiation dose will be shown in a pop-up window after each exposure if the *Statistics* option is selected on display i230 (*User preference settings (i200) > Behavioural preferences (i230)> Statistics*). Radiation dose is indicated in terms of DAP (Dose Area Product) and calculated separately for each exposure. The measurement unit for DAP is milligray per square centimeter *(mGy*cm²).*

Touch the *DAP value adjustments (i680*) field if you need to calibrate the DAP values which are shown in the pop-up windows. The window shown below appears.

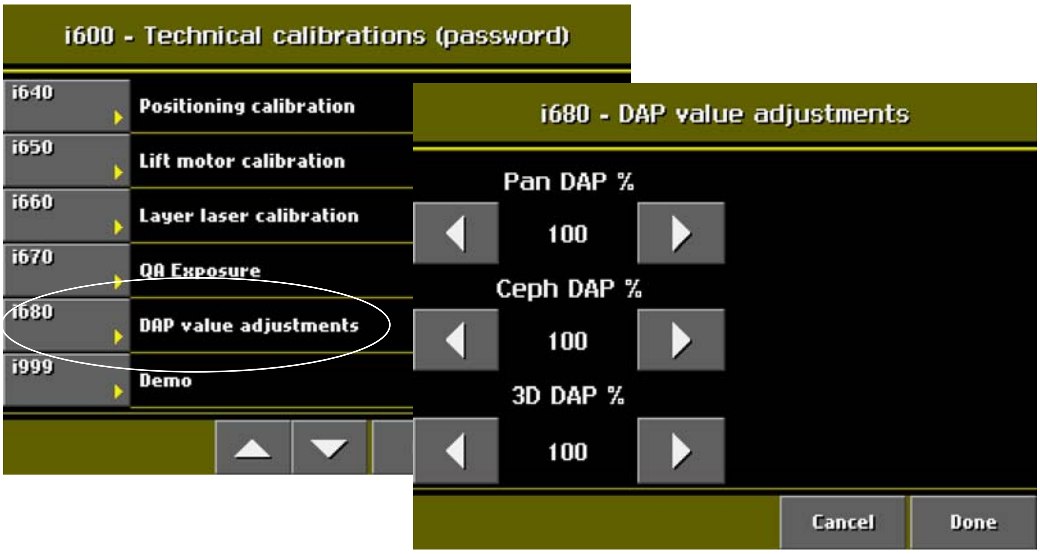


Figure 58

Use a DAP meter to measure the radiation dose and then compare the measured dose (reading on DAP meter) with the calculated dose (value shown in pop-up window). If the measured dose is lower than the calculated dose, touch the left arrow to decrease the percentage value. If the measured dose is higher than the calculated dose, touch the right arrow to increase the percentage value. The setting can be adjusted between 10% and 300%.

Note that you will have to calibrate DAP values separately for panoramic, cephalometric and 3D exposures.

7 TROUBLESHOOTING

From the list of information displays select **Troubleshooting (i570).** The troubleshooting mode is password protected and the password is asked when the mode is entered for the first time after switching the unit on. ***The password is 1701*.**

Figure 59

In this mode the communication between the PC and X-ray unit can be monitored. Select **i760 Communication**.

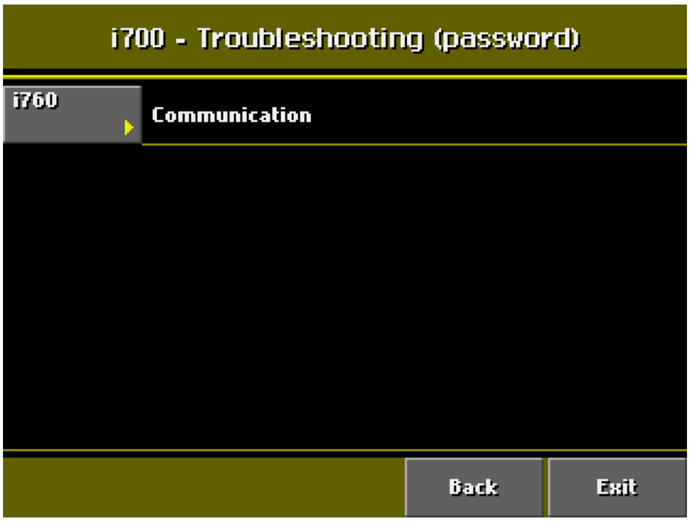


Figure 60

The display shown below appears. **Note that if the X-ray unit is equipped with DIN PCB, only the *i76.1 Dimax* communication is available.**

Figure 61

7.1 Dimax communication

On the *Dimax (i76.1)* display the communication between CPU PCB and panoramic/cephalometric sensor head can be checked. Make sure that the sensor head is attached to the holder before selecting the sensor head (pan or ceph) and that the red light on the sensor head is ON.

The number on the **Count** field should gradually increase after the pan or ceph field is touched. The test can be interrupted by touching the **OFF** field.

If the Error counter number is larger than two, a cable between the sensor head and CPU PCB may be damaged or disconnected.

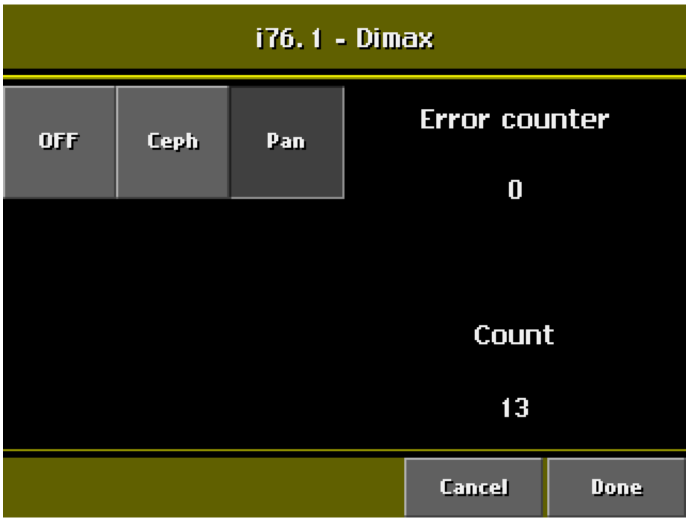


Figure 62

7.2 Network status

On the **Network Mode** field the configuration mode is displayed: 100/10 Mb / Full-duplex or Half-duplex. If the text Disconnected is shown, the problem may be in one of the following: cable between the ProMax X-ray unit and PC / cable or one of connectors is damaged / wrong type cable / Ethernet PCB is defective.

The **Frames Received** field shows the amount of frames received from the Network. If the value increases gradually, the X-ray unit's connection to the Network is operational.

The **Frames Sent** field shows the amount of frames sent by the X-ray unit.

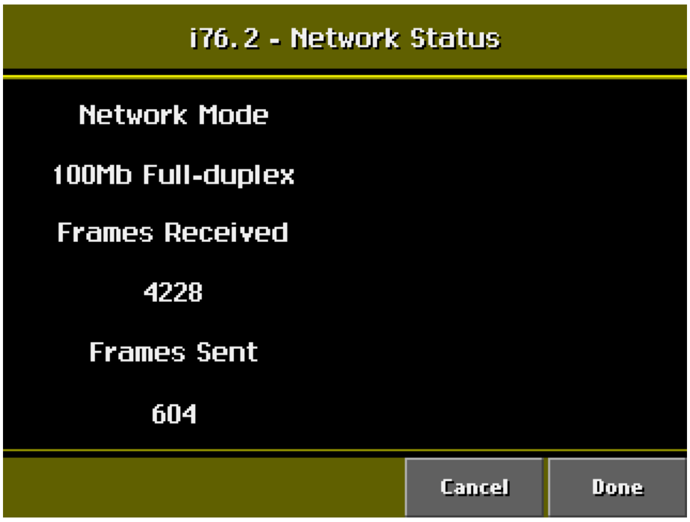


Figure 63

7.3 3D sensor communication

On the *3D sensor (i76.3)* display the communication between CPU PCB and 3D sensor head can be checked. Make sure that the sensor head is attached to the holder.

Start the 3D exposure in Romexis program. Enter the i76.3 display and touch the **Test** field and check that the red light on the sensor head is ON. Check that the values on the **Frames Received** and **Frames sent** fields increase gradually.

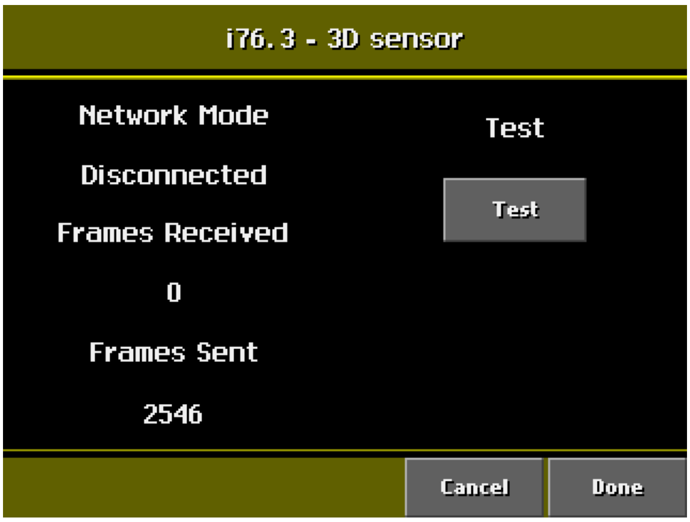


Figure 64

8 ENTERING THE PASSWORD

The *Service settings* and *Technical calibrations* modes are password protected, and the password is entered as follows. Touch the **i** field on the main display.

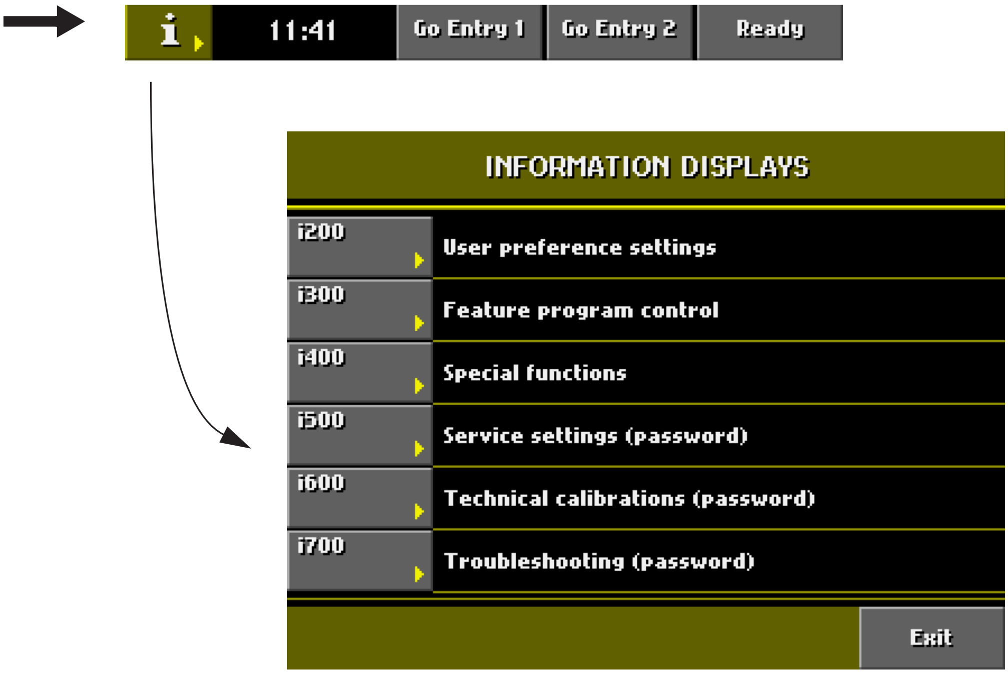


Figure 65

Select **Service settings** or **Technical calibrations** from the list on the display. The password to the selected mode is asked when the mode is entered for the first time after switching the unit on. **The password is 1701.**

Figure 66

Chapter

C

HELP & ERROR MESSAGES

1 MAIN CATEGORIES

Help messages

1xx	Environment related

Error messages

2xx	Motorized motion related
3xx	X-ray generation related
4xx	Feedback errors
5xx	Power supply related
6xx	Communication errors
7xx	Calibration errors
8xx	System conflicts
9xx	Infrastructure errors

2 HELP MESSAGES

Error code	Explanation		Comments
H101	**Exposure switch**	released before end of exposure	Exposure interrupted.
H102		continuously depressed or cable short circuited	Release the exposure button.
H105	**Emergency stop pressed**	Height movement and radiation generation stopped due to the column emergency STOP switch activation	When the STOP switch is released the X-ray unit is ready for use again.
H115	**DEC related**	DEC is receiving too much radiation	Change the exposure values.
H116		DEC is receiving too little radiation	Change the exposure values.
H141	**Height movement**	stopped due to the column emergency STOP switch activation (plate)	When the STOP switch is released the X-ray unit moves again.
H142		stopped due to interference with an external object (former nut switch)	When the STOP switch (plate) is released the X-ray unit moves again.
H144		not possible because one (or more) of the positioning control buttons or the joystick is stuck	Release the button/joystick that is stuck.
H151	**Line voltage**	dropped too low during the exposure	Exposure interrupted.
H152		is too low	Exposure not possible.
H161	**Temperature**	of tube head too high	Exposure not possible before the tube head has been cooled down.
H162		of lift motor too high	Lift motor cannot be run before cooled down.
H163		of the power supply (PSU) heatsink too high	Exposure not possible before cooled down. Check also that the heatsink is attached properly on the PSU.
H164		of tube head too low	Operating temperature too low.
H165		The temperature of the tube head too high for the exposure parameters.	Exposure not possible before the tube head has been cooled down.
H166		Maximum tube head energy exceeded. Lower the exposure parameters.	Lower the exposure parameters.

Error code	Explanation		Comments
H171	**User related messages**	Dimax sensor not attached properly to C-arm	Sensor has not been attached and/or locked in position.
H172		Dimax sensor not attached properly to Cephalostat	Sensor has not been attached and/or locked in position.
H175		PC program selection in conflict with selected ProMax X-ray unit program	Wrong exposure mode has been selected on the PC.
H176		Safety area limit violation.	Change the values for layer thickness, position or angle.
H177		One or more image layers will not be exposed with these settings	Change the exposure settings.
H178		Imaging impossible with selected settings.	Change the exposure settings.
H180		DEC not available	
H181		Exposure interrupted by the workstation	
H182		Timeout in image data transmission	
H183		Attached sensor is not suitable for the selected program.	
H184		Move 3D sensor aside.	
H185		3D sensor not attached properly.	
H186		No IP address defined for 3D sensor.	
H187		Exposure interrupted by reconstruction PC due to data transmission fault.	
H192		It is not possible to enable radiation or PC communication (i410) when demo licenses are switched on (i510).	First switch off demo licenses (i510), then enable radiation or PC communication (i410).

3 ERROR MESSAGES

3.1 Motorized motion related errors (2xx)

Error code	Explanation		Comments
E201	**MCM (motor control module) module overheated**	1 - shoulder motor	Exposure interrupted.
E202		2 - elbow motor	Exposure interrupted.
E203		3 - temple support/Dimax3 CEPH scan	Exposure interrupted.
E204		4 - C-arm rotation motor	Exposure interrupted.
E205		5 - receptor pan / X&Y collimation	Exposure interrupted.
E206		6 - receptor rotation	Exposure interrupted.
E207		7 - for receptor lift (reserved option)/ X&Y collimation	Exposure interrupted.
E208		8 - for tube head lift function (reserved option)	Exposure interrupted.
E210	**Open circuit in**	0 - lift motor	
E211		1 - shoulder motor PCB	Check the motor, interface and cable.
E212		2 - elbow motor	Check the motor, interface and cable.
E213		3 - temple rest motor	Check the motor, interface and cable.
E214		4 - Dimax3 CEPH scan motor (or CEPH marking motor depending on version)	Check the motor, interface and cable.
E215		5 - C-arm rotation motor	Check the motor, interface and cable.
E216		6 - receptor pan motor	Check the motor, interface and cable.
E217		7 - X-collimator motor	Check the motor, interface and cable.
E218		8 - Y-collimator motor	Check the motor, interface and cable.
E219		9 - receptor rotation motor	Check the motor, interface and cable.
E220		10 - receptor lift motor (reserved option)	
E221		11 - tube head lift motor (reserved option)	

Error code	Explanation		Comments
E230	**Overcurrent detected in**	0 - lift motor	Too high current detected in the motor and the movement has been stopped. Check the motor cable. If necessary then replace the PSU PCB.
E231		1 - shoulder motor	Too high current detected in the motor and the movement has been stopped. Check the motor cable.
E232		2 - elbow motor	Too high current detected in the motor and the movement has been stopped. Check the motor cable.
E233		3 - temple rest motor	Too high current detected in the motor and the movement has been stopped. Check the motor cable.
E234		4 - Dimax3 CEPH scan motor (or CEPH marking motor, depending on version)	Too high current detected in the motor and the movement has been stopped. Check the motor cable.
E235		5 - C-arm rotation motor	Too high current detected in the motor and the movement has been stopped. Check the motor cable.
E236		6 - receptor pan motor	Too high current detected in the motor and the movement has been stopped. Check the motor cable.
E237		7 - X-collimator motor	Too high current detected in the motor and the movement has been stopped. Check the motor cable.
E238		8 - Y-collimator motor	Too high current detected in the motor and the movement has been stopped. Check the motor cable.
E239		9 - receptor rotation motor	Too high current detected in the motor and the movement has been stopped. Check the motor cable.
E240		10 - receptor lift motor (reserved option)	
E241		11 - tube head lift motor (reserved option)	

Error code	Explanation		Comments
E250	**Directional error at**	0 - lift motor	The motor drives the mechanism into the wrong position. Check the sensors and the cabling.
E251		1 - shoulder motor	The motor drives the mechanism into the wrong position. Check the sensors and the cabling.
E252		2 - elbow motor	The motor drives the mechanism into the wrong position. Check the sensors and the cabling.
E253		3 - temple rest motor	The motor drives the mechanism into the wrong direction. Check the sensors and the cabling.
E254		4 - Dimax3 CEPH scan motor (or CEPH marking motor, depending on version)	The motor drives the mechanism into the wrong direction. Check the sensors and the cabling.
E255		5 - C-arm rotation motor	The motor drives the mechanism into the wrong direction. Check the sensors and the cabling.
E256		6 - receptor pan motor	The motor drives the mechanism into the wrong direction. Check the sensors and the cabling.
E257		7 - X-collimator motor	The motor drives the mechanism into the wrong direction. Check the sensors and the cabling.
E258		8 - Y-collimator motor	The motor drives the mechanism into the wrong direction. Check the sensors and the cabling.
E259		9 - receptor rotation motor	The motor drives the mechanism into the wrong direction. Check the sensors and the cabling.
E260		10 - receptor lift motor (reserved option)	
E261		11 - tube head lift motor (reserved option)	

Error code	Explanation		Comments
E270	**Timeout in mechanism controlled by**	0 - lift motor	Check the sensor, cable, motor and the PSU PCB.
E271		1 - shoulder motor	Check the sensors, cables and the motor.
E272		2 - elbow motor	Check the sensors, cables and the motor.
E273		3 - temple rest motor	Check the sensors, cables and the motor.
E274		4 - Dimax3 CEPH scan motor (or CEPH marking motor, depending on version)	Check the sensors, cables and the motor.
E275		5 - C-arm rotation motor	Check the sensors, cables and the motor.
E276		6 - receptor pan motor	Check the sensors, cables and the motor.
E277		7 - X-collimator motor	Check the sensors, cables and the motor.
E278		8 - Y-collimator motor	Check the sensors, cables and the motor.
E279		9 - receptor rotation motor	Check the sensors, cables and the motor.
E280		10 - receptor lift motor (reserved option)	
E281		11 - tube head lift motor (reserved option)	
E283		13 - beam limiting device	Check the adjustments and the movement area.

3.2 X-ray generation related errors (3xx)

Error code	Explanation		Comments
E301	**Filament voltage**	missing completely	Exposure not possible. Check the cabling, interfaces and PSU-PCB and tube head.
E302		too low during preheat	Exposure not possible. Check the cabling, interfaces and PSU PCB and tube head.
E303		too high during preheat	Exposure not possible. Check the tube head and the PSU PCB.
E304		dropped suddenly during exposure	Exposure interrupted. Check the tube head and the PSU PCB.
E305		cannot be enabled due to an internal error	Exposure interrupted. Check the tube head and the PSU PCB.

Error code	Explanation		Comments
E311	**Tube voltage**	missing completely	Exposure interrupted.
E312		too low	Exposure not possible. Check the tube head and the PSU PCB.
E313		too high	Exposure not possible. Check the prefilament values are correct or perform the prefilament calibration again.
E314		dropped suddenly without arching (low frequency extreme detected)	Exposure interrupted. Check the functionality of the tube head and the PSU PCB.
E315		dropped suddenly without arching (extreme overcurrent detected)	Exposure interrupted. Check the functionality of the tube head and the PSU PCB.
E316		dropped suddenly without arching (other reason)	Exposure interrupted. Check the functionality of the tube head and the PSU PCB.
E317		overshot suddenly without arching	Exposure interrupted. Check the functionality of the tube head and the PSU PCB.
E318		detected during preheat period (maximum exceeded)	Exposure interrupted. Check the functionality of the tube head and the PSU PCB.
E321	**Tube current**	missing completely	Exposure interrupted. Check the interface, cabling and the PSU PCB.
E322		too low	Exposure interrupted. Check the interface, cabling and the PSU PCB.
E323		too high	Exposure interrupted. Perform the preheat calibration again. Check the interface, cabling and the PSU PCB.
E324		dropped suddenly without arching	Exposure interrupted. Check the interface, cabling and the PSU PCB.
E325		overshot suddenly without arching	Exposure interrupted. Check the interface, cabling and the PSU PCB.

Error code	Explanation		Comments
E331	**Arching**	across X-ray tube, minor	Code not displayed.
E332		across X-ray tube, severe	Exposure interrupted. Check the functionality of the tube head. If the X-ray unit has not been used for a week or more, enter display i460 and take four test exposures with a one-minute interval between exposures. Use the lowest possible kV and mA values and a long exposure time.
E333		at tube head anode end, minor	Code not displayed.
E334		at tube head anode end, severe	Exposure interrupted.
E335		at tube head cathode end, minor	Code not displayed.
E336		at tube head cathode end, severe	Exposure interrupted.
E341	**Monitoring errors**	kV-signal (exposure time) too short/long	

3.3 Feedback errors (4xx)

Error code	Explanation		Comments
E401	**Tube head offsets**	KVPOS failure - shorted	Exposure not possible. Check the cabling between the FBK and the CAM PCB. Check also the functionality of the FBK PCB.
E402		KVPOS failure - out of bounds	Exposure not possible. Check the cabling between the FBK and the CAM PCB. Check also the functionality of the FBK PCB.
E403		KVNEG failure - shorted	Exposure not possible. Check the cabling between the FBK and the CAM PCB. Check also the functionality of the FBK PCB.
E404		KVNEG failure - out of bounds	Exposure not possible. Check the cabling between the FBK and the CAM PCB. Check also the functionality of the FBK PCB.
E405		MAPOS failure - shorted	Exposure not possible. Check the cabling between the FBK and the CAM PCB. Check also the functionality of the FBK PCB.
E406		MAPOS failure - out of bounds	Exposure not possible. Check the cabling between the FBK and the CAM PCB. Check also the functionality of the FBK PCB.
E407		MANEG failure - shorted	Exposure not possible. Check the functionality of the FBK PCB.
E408		MANEG failure - out of bounds	Exposure not possible. Check the functionality of the FBK PCB.
E409		FILAMENT failure - out of bounds	Exposure not possible. Check the functionality of the FBK PCB.
E411	**Tube head signals**	kV-feedback imbalance	Exposure interrupted.
E412		mA-feedback imbalance	Exposure interrupted.
E413		tube head grounding error	Exposure not possible.
E414		temperature measurement error (signal out of bounds)	Exposure not possible. Check the temperature measurement sensor and the FBK PCB.
E415		tube head electronics supply voltage error	Check the FBK PCB and the cabling between the FBK and the CAM PCB.
E416		Tube head not calibrated	Exposure not possible. Perform the preheat calibration again. Check the functionality of the FBK PCB.
E417		Tube head is of non-supported type (reserved)	Exposure not possible.

Error code	Explanation		Comments
E421	**Sensors signal errors (open circuits)**	Lift motor height position	Check the sensors and the cabling.
E422		Shoulder arm angle	Check the sensors and the cabling.
E423		Elbow arm angle	Check the sensors and the cabling.
E424		C-arm rotation angle	Check the sensors and the cabling.
E425		Layer indicator position sensor	Check the sensors and the cabling.
E426		Soft tissue indicator sensor error	Check the sensors and the cabling.
E431	**Sensors signal errors (short circuits)**	Lift motor height position	Check the sensors and the cabling.
E432		Shoulder arm angle	Check the sensors and the cabling.
E433		Elbow arm angle	Check the sensors and the cabling.
E434		C-arm rotation angle	Check the sensors and the cabling.
E435		Layer indicator position sensor	Check the sensors and the cabling.
E436		Soft tissue indicator sensor error	Check the sensors and the cabling.
E441	**Key stuck in Patient position control key pad**	Height adjusting up button	Check the button.
E442		Height adjusting down button	Check the button.
E443		C-arm rotation clockwise button	Check the button.
E444		C-arm rotating counterclockwise button	Check the button.
E445		Joystick not centered	Check the position of the joystick.
E446		Joystick not released	Check the position of the joystick.
E447		Temple rest button	Check the position of the joystick.
E451	**Key stuck elsewhere**	CEPH CA; Height adjusting up button	Check the button.
E452		CEPH CA; Height adjusting down button	Check the button.

3.4 Power supply related errors (5xx)

Error code	Explanation		Comments
E501	**Power supply**	High voltage DC bus voltage too low.	Check the power supply, voltage and the cabling. If needed change the fuse.
E502		26VDC bus voltage too high	Check the voltage.
E503		26VDC bus voltage too low	Check the voltage.
E504		Heatsink temperature sensor failure	Check the sensor.
E505		Power off did not function	Check the power supply.
E506		Power supply overload (short)	Check the power supply.
E507		Mains frequency is out of bounds	Check the mains voltage and the power supply.

3.5 Communication errors (6xx)

Error code	Explanation		Comments
E601	**Internal (CAM)**	Total data communication failure towards CAM	Exposure not possible. Check the cable of the CAM PCB and that it is installed correctly.
E602		Total data communication failure from CAM	Exposure not possible. Check the cable of the CAM PCB and that it is installed correctly.
E603		Data errors received at CAM	Exposure interrupted. Check the cable of the CAM PCB and that it is installed correctly.
E604		Data errors received from CAM	Exposure interrupted. Check the cable of the CAM PCB and that it is installed correctly.
E605		No clock signal received at CAM	Check the cable of the CAM PCB and that it is installed correctly. Check the functionality of the battery and that it is installed correctly.
E606		Data received is wrong polarity at CAM	Check the cable of the CAM PCB and that it is installed correctly.
E607		No clock signal received from CAM	Check the cable of the CAM PCB and that it is installed correctly. Check the functionality of the battery and that it is installed correctly.
E608		Data received is wrong polarity from CAM	Check the cable of the CAM PCB and that it is installed correctly.

Error code	Explanation		Comments
E611	**Internal (other)**	Error in RTC - CPU communication	Check the RTC and the CPU PCB and the cabling.
E612		Error in RTC-FBK communication	Check the cabling between the CAM and FBK PCB. Check the functionality of the FBK PCB.
E613		Error in PAN AEC - CAM communication	Exposure not possible.
E614		Error in CEPH AEC - CPU communication	Exposure not possible.
E615		Error in Dimax - CPU communication	Check the the sensor is correctly installed to the X-ray unit.
E616			Check the the sensor is correctly installed to the X-ray unit.
E617	**External (CAN)**	Error in internal GUI - CPU communication	Check that the software versions of the X-ray unit and the GUI are compatible to each other.
E618		Error in external GUI - CPU communication	Check that the software versions of the X-ray unit and the GUI are compatible to each other.
E619		Received non-implemented CAN message by CPU	
E620	**External (other)**	Errors in PLANET <=> EXT data link	Check the cable and the software version of the Admark. Restart the ProMax X-ray unit after attaching the Admark to it.
E621		Errors in GUI -RS232 link to external keyboard.	Check the cabling and the connectors.
E622		Errors in CPU-RS232 direct COM-port	Check the COM-port.
E623		DIN PCB unable to communicate with the PC	Check the DIN PCB and the cabling.
E624	**Network (ETHERNET)**	Unable to contact server	Check the network connection and the cabling.
E625		No network activity for a prolonged time	Check the network connection and the cabling.
E626		Network disconnected	Check the functionality and installation of the Ethernet PCB. Check also the settings of the network connection and the cabling.
E627		TCP/IP address not set	Check the TCP/IP settings.
E628		Error in communication with 3D sensor.	
E629		Ethernet cable is disconnected or it is broken.	Check the ethernet cable connection and cabling

3.6 Calibration errors (7xx)

Error code	Explanation		Comments
E701	**Missing calibration**	Tube head filament definition not done	Perform the preheat calibration again.
E702		Tube head kV-calibration not done	Perform the preheat calibration again.
E703		Panoramic DEC not calibrated	Calibrate the DEC-PAN.
E704		Cephalometric DEC not calibrated	Calibrate the DEC-CEPH.
E705	**Preheat calibration**	Problem during the preheat calibration.	The current in the tube head is not high enough. Perform the preheat calibration again.
E706		Problem with the preheat calibration.	The current in the tube head is not raising on the voltage area. Perform the preheat calibration again. Check the functionality of the tube head.
E710	**Primary collimator**	Primary y-collimator opening is too big.	Adjust the lower blade upwards or the upper blade downwards.
E711		3D primary x-collimator opening is too wide.	Adjust the left blade to right or the right blade to left.

3.7 System conflicts (8xx)

Error code	Explanation		Comments
E801	**Missing MCM module**	1 - shoulder motor	MCM PCB is broken or badly connected to the PSU PCB. Check also the functionality of the PSU and CPU PCB.
E802		2 - elbow motor	MCM PCB is broken or badly connected to the PSU PCB. Check also the functionality of the PSU and CPU PCB.
E803		3 - temple support/digital CEPH scan	MCM PCB is broken or badly connected to the PSU PCB. Check also the functionality of the PSU and CPU PCB.
E804		4 - C-arm rotation motor	MCM PCB is broken or badly connected to the PSU PCB. Check also the functionality of the PSU and CPU PCB.
E805		5 - receptor pan / X&Y collimation	MCM PCB is broken or badly connected to the PSU PCB. Check also the functionality of the PSU and CPU PCB.
E806		6 - receptor rotation	MCM PCB is broken or badly connected to the PSU PCB. Check also the functionality of the PSU and CPU PCB.
E807		7 - receptor lift / X&Y collimation (reserved option)	MCM PCB is broken or badly connected to the PSU PCB. Check also the functionality of the PSU and CPU PCB.
E808		8 - tube head lift function (reserved option)	

Error code	Explanation		Comments
E811	**Missing internal parts**	PAN-DEC not found	Check the functionality of the PAN-DEC PCB.
E812		CEPH-DEC not found	Check the functionality of the CEPH-DEC PCB.
E813		RTC not found	Check the functionality of the RTC PCB.
E814		CAM not found	Check the functionality of the CAM PCB.
E815		Tube not found	Check the tube head cabling.
E816		Patient position control keypad not found	Check the cabling.
E817		DIN module not found	Check the functionality of the DIN PCB and that it is attached properly.
E818		ETHERNET module not found	Check the functionality of the Ethernet PCB and that it is attached properly on the PSU.
E819		CEPH-CA (CEPH automatic) not found	The X-ray unit has been configured as CEPH-CA. Check the cabling between the CEPH and CPU PCB. Check the functionality of the CPU PCB.
E821	**Software compatibility**	System software must be upgraded (too old with newly installed component)	Check the software requirements of all components.
E822		CAM FPGA version not compatible with main software	Check the software version of the ProMax X-ray unit.
E823		GUI not compatible with newest SW	Check the software version of the the GUI.
E831	**Hardware compatibility**	A Dimax3 found but not a digital machine	Update the GUI software version.
E832		Wrong type of PSU	Change the PSU PCB.
E833		MCM is wrong type (X = MCM-module number; 1-8, 0 & 9 reserved)	Change the MCM PCB.
E834		Dimax3 sensor version is too old	The Dimax sensor version is too old or not compatible with the ProMax X-ray unit software version.

3.8 Infrastructure errors (9xx)

Error code	Explanation		Comments
E901	**Checksum error in**	Main program FLASH, Low Block	Restart the ProMax X-ray unit.
E902		Main program FLASH, High Block	Update the ProMax X-ray unit software version.
E903		Memory Expansion module FLASH	Update the ProMax X-ray unit software version.
E904		RTC PCB memory problem	Check the RTC PCB cabling and the battery.
E905		Tube head FBK PCB memory error	Check the cabling and the functionality of the FBK PCB.
E906		PAN DEC memory problem	Change the cable / PSU PCB.
E907		CEPH DEC memory problem	Change the cable / PSU PCB.
E908		Autofocus module problem (reserved)	
E911	**RAM errors**	DATA RAM BIT ERROR (even bank)	Check the CPU PCB and cabling.
E912		DATA RAM BIT ERROR (odd bank)	Check the CPU PCB and cabling.
E913		FPGA register RAM error	Check the CPU PCB and cabling.
E914		CPU internal RAM error	Check the CPU PCB and cabling.
E915		RTC RAM error (latest settings not stored in memory)	Check the RTC PCB and cabling.
E921	**Program structure errors**	Stack overflow	Restart the ProMax X-ray unit.
E922		Out of RAM	Switch off the X-ray unit and update the ProMax X-ray unit software.
E923		Watchdog reset	Switch off the X-ray unit and update the ProMax X-ray unit software.
E924		Unimplemented opcode trap	Switch off the X-ray unit and update the ProMax X-ray unit software.
E925		Illegal program vector	Switch off the X-ray unit and update the ProMax X-ray unit software.
E926		Unexpected reset	Restart the ProMax X-ray unit.
E927		PathSolver out of memory	Recalibrate the layer light.
E928		PathSolver cannot solve trajectory	Switch off the X-ray unit and move the arms closer to the patient support table.
E929		DSP program error (reserved)	
E931	**Hardware errors**	RTC / CPU clock runs at wrong speed	Check the functionality of the RTC PCB, the cable and the battery.

Chapter D

PREVENTIVE MAINTENANCE

1 SYSTEM MAINTENANCE

1.1 Cleaning

CAUTION ***When disinfecting the unit surfaces, the unit should be turned off. The unit must not be exposed to gaseous disinfectants or explosive anesthetics. Never spill any liquids into the unit. If that happens, make sure that the liquid did not come into contact with any of the internal electronic parts (cables/sensors/PCBs) before turning on the unit.***

The chin support can be cleaned with NON-ALCOHOLIC disinfection solutions.

All the removable patient support parts can be autoclaved up to 135°C or cleaned with alcohol-based solutions.

The patient support handles can be cleaned with alcohol-based solutions.

Other unit surfaces can be cleaned with a soft cloth damped in a mild cleaning solution.

1.2 Operating checks

To guarantee user and patient safety and to ensure consistent image quality, the X-ray unit must be checked and recalibrated by a qualified Planmeca service technician once a year or after every 10 000 exposures if this is sooner.

The following operating checks have to be performed on a regular basis:

Exposure indicators

Confirm that the exposure indicator lights turn on in the control panel (GUI and/or NUI) and in the exposure switch for the length of the exposure. Additionally, check also the (optional) external exposure indicator, if the unit is equipped with such.

Exposure warning signal

Confirm that the units buzzer comes on for the length of the exposure. The exposure switch also contains a buzzer. However, this buzzer can be disabled or enabled (from within the exposure switch assembly) depending on local regulations. Check that this buzzer also comes on for the length of the exposure if it is enabled.

Exposure switch

Confirm that the exposure switch requires continuous activation to maintain the exposure. Releasing the exposure switch during the radiation should stop the exposure and produce an error message. Make a visual check and check for possible wear or damage of the exposure switch spiral. Replace if necessary.

Emergency stop button

Confirm that activating the emergency stop button will stop the X-ray unit operating. Pressing the emergency stop button should block all movements of the X-ray unit, disable radiation and produce a help message.

Labels

Check that no labels are detached or worn and that they are all legible.

2 PREVENTIVE MAINTENANCE CHECKS

2.1 General

Annually, or after every 10 000 exposures (whichever appears first), the electrical exposure parameters of the ProMax X-ray should be checked in order to ensure the initially accurate operation of the equipment, despite of the possible long term component value drifts.

There are no adjustments in the equipment because of its self-calibrating system - therefore no actual parameter trimming of the kV, mA and exposure time can be done. If one of the parameters to be checked is found to be beyond the limit allowed, the corresponding module is to be changed in whole, or a factory- type recalibration should be performed.

2.2 X-ray tube feedback system

The unit performs a complete check on the feedback system before every exposure. Any found errors or deviations are reported as error messages (exposure is prevented). Therefore the actual need for this annual test is dictated by the local authorities and respective regulations. Please be sure to perform all tests required by the authorities.

There are two ways of doing most of the tests, either non-invasively (from the radiation beam) or invasively (from the units feedback signals). Both are presented here. Please note that not all tests can be performed both ways.

CAUTION ***Radiation is emitted during all these tests. Proper protection against unnecessary exposure to radiation must be considered.***

2.2.1 NON-INVASIVE TESTING (directly from the radiation)

A non-invasive method can be used for checking the kVp, radiation quality (half-value layer) and the exposure time. This method is efficient since no covers need to be opened, and it gives a “second” opinion on the measured parameters. However, care must be taken when selecting the appropriate non-invasive X-ray meter; older meters calculate the kVp avg based on the assumption that the kV waveform is AC. The Planmeca ProMax has DC high voltage with very small high frequency ripple, so the accurate measurement of kV waveform can be impossible if, for an example, the meter's sampling frequency isn't high enough. If in any doubt whether or not the meter is suitable for ProMax, please consult the meter manufacturer for additional information. Otherwise, please refer to the radiation meter manufacturers user manual of how to use the meter.

Peak tube potential (kVp) measurement

When a non-invasive meter is used for kVp measurement, following things should be noted:

1) The sensor should be placed exactly in the middle of the X-ray field in both horizontal and vertical directions (very important especially if the measurements are made in the panoramic mode!), use a fluorescent screen to determine the X-ray field area if you are not totally sure about it.

2) The sensor distance from the focal spot should be as short as possible to maximise the signal / noise ratio.

3) The whole sensor area must be within the radiation field.

4) The meter must be properly calibrated and, when necessary, appropriate calibration/correction factors must be used when interpreting the results.

The measured kVp must be within ±5% of the value displayed on the user interface.

Half-value layer measurement

There are different recommended procedures for measuring the HVL. The HVL is defined as the thickness of a specified material (generally expressed inmm Al) which attenuates x-radiation with a particular spectrum to an extent such that the value of air kerma (or exposure or absorbed dose) rate is reduced to one half of the value that is measured without the material. The simplest method to ensure that the unit complies with the requirement (With Promax, the first permissible HVL must be at least 2.5mm Al at 84 kV) is to measure the air kerma rate first without any additional material in the radiation field, then add 2.5mm Al to the radiation field, measure the air kerma rate again and check that the air kerma rate with additional 2.5mm Al is **more** than one half of the one measured without the added material. That is,

(Dose rate with added 2.5mm Al eq filtration) / (Dose rate without added filtration) > 0.5

This is sufficient to ensure that the HVL is at least 2.5mm Al. Depending on the type of the radiation meter used, it is possible that a correction factor needs to be applied to the result measured with added material in the radiation field.

Exposure time measurement

The exposure time is controlled by the microprocessor, so the exposure time accuracy is exactly the same, no matter if the set exposure time is 200 ms (in film-based cephalostatic mode) or 16 s (in panoramic / tomographic mode). The exposure time is defined automatically based on the selected program and is displayed in the upper right corner of the graphical user interface. In panoramic mode, attach the non-invasive sensor to the front panel of the sensor and make sure its whole area is in the radiation field. Select 70 kV / 8mA and press ready. Take an exposure and record the measured exposure time. The measured exposure time must be within ±10% of the exposure time displayed in the user interface.

In film-based cephalostatic mode, the exposure time is selected by the user. Select the shortest possible exposure time, attach the non-invasive sensor to the cephalostatic sensor in the middle of the radiation field, take an exposure and record the measured exposure time.

2.2.2 INVASIVE TESTING (directly from the units own feedback signals)

NOTE The manufacturer does not require the invasive testing. The invasive test must only be performed if the local authorities require it.

An invasive method should be used for checking the tube current (mA), and can be used for checking the kVp and exposure time. This method requires that the covers around the tube head assembly are removed, and a special measurement adapter cable, Planmeca order code 10008320, is connected to the connector J2 in the FBK PCB. The FBK PCB is permanently fastened to the front side of the tube head assembly. The analog feedback voltage signals can be measured with a calibrated multimeter from the adapter cable connectors (labelled kVpos, kVneg, mApos and mAneg). An oscilloscope is required if kV and mA waveforms need to be observed, for an example when determining the exposure time.

NOTE The feedback signals are differential, so measuring only one polarity signal (e.g. kVpos with respect to the X-ray units ground potential) will give false results. The feedback signals must always be measured differentially, kV feedback voltage = (kVpos – kVneg) and mA feedback voltage = (mApos – mAneg).

Peak tube potential (kVp) measurement

Connect the kVpos plug of the Planmeca measurement adapter to the positive terminal of the multimeter and the kVneg plug to the negative (ground) terminal of the multimeter. Select the appropriate DC voltage measurement range for 1 to 5 V signal level. Take an exposure with desired kV setting (selected mA value has no effect, however low mA should be used to minimise the amount of unnecessary radiation) and when the voltage reading has stabilized, record it. The actual tube voltage relates to the measured feedback signal as follows:

Actual tube voltage = 27 000 * measured feedback voltage (in volts)

The resulting tube voltage should be within ±5% of the voltage indicated in the user interface.

Tube current (mA) measurement

Connect the mApos plug of the Planmeca measurement adapter to the positive terminal of the multimeter and the mAneg plug to the negative (ground) terminal of the multimeter. Select the appropriate DC voltage measurement range for 100mV to 5 V signal levels. Take an exposure with desired mA setting (selected kV value has no effect, but lowest possible kV is recommended to minimise the amount of unnecessary radiation) and when the voltage reading has stabilized, record it. The actual tube current relates to the measured feedback signal as follows:

Actual tube current (in mA) = 5.06 * measured feedback voltage (in volts)

The resulting tube current should be within ±10% of the current indicated in the user interface.

Exposure time measurement

A calibrated oscilloscope is needed for invasive exposure time measurement. Connect oscilloscope channel 1 to kVpos, channel 2 to kVneg and oscilloscope ground to the tube head ground. Select differential signal (Ch1 – Ch2) from the oscilloscope math menu and take an exposure with desired values. The exposure time can be defined from the oscilloscope screen as the time interval during which the tube potential exceeds 70% of the peak tube potential. The exposure time must be within ±10% of the value displayed in the user interface.

Feedback signal offset measurement

The feedback signals have a small offset voltage that is used for internal self-testing of the equipment. In some cases, it can be useful to measure these offsets for troubleshooting purposes etc. The offset of all feedback signals (kVpos, kVneg, mApos and mAneg) should be 49 ± 2 mV with respect to the unit ground potential. The offsets should be measured in idle state (before exposure).

3 MECHANICAL CHECKS

3.1 Column motor nut

The column motor is equipped with double motor nut assembly consisting of lower, solid nut (primary), and upper, floating nut (secondary). In case the primary nut fails, the secondary nut becomes active. The visual check of the column motor nut assembly must be performed once a year as follows.

Switch the unit off. Remove the two rear cover plates of the telescopic column as described in section 2.2 “Removing the telescopic column rear cover plates” on page G-10. Switch the unit off.

The column motor nut assembly is attached to the stationary column and can be seen from the opening on the stationary column top. Check, whether the lug of the indicator sheet is bent and the top surface of the secondary motor nut is level with the edge of the column nut frame, or a little higher (see Fig. 1 below).

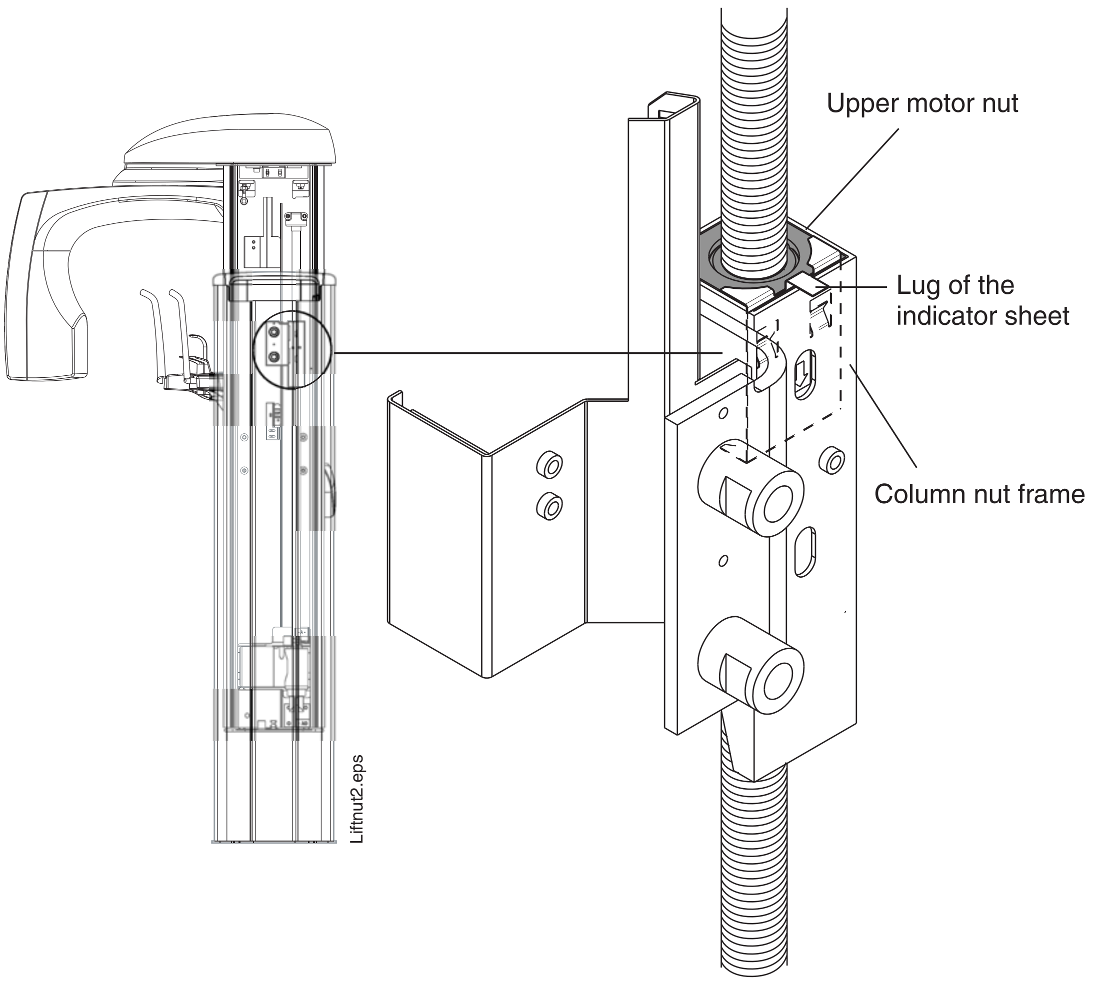


Figure 1

In case the secondary nut is clearly inside the column nut frame and the lug of the indicator sheet is straightened, the column motor nut assembly must be replaced according to the instructions given in section 3.2 “Replacing the lift nut assembly” on page G-18.

Chapter E

C-ARM AND IMAGING ARM

NOTE If you use the *Planmeca Device Tool* software for calibrations, refer to the Planmeca Device Tool manual, publication number 10031558, which should be used in conjunction with this manual. Do not follow the Dimax4Tool instructions given in this chapter.

1 REQUIRED TOOLS

- ProMax alignment tool (part number 10004225). For checking the position of the patient positioning mechanism.

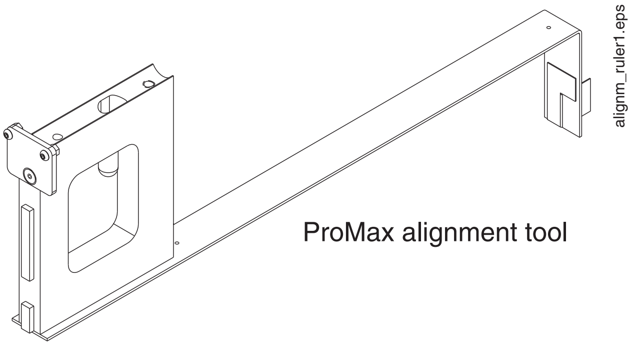


Figure 1

- Sensor head alignment tool (**Dimax4:** part number 10029167, **Dimax2/3:** part number 10002699).For attaching the beam alignment tool.

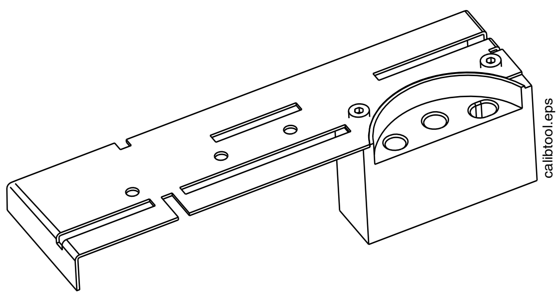


Figure 2

- Ball phantom (part number 10004011). For checking the position of the patient positioning mechanism and the positioning lights.

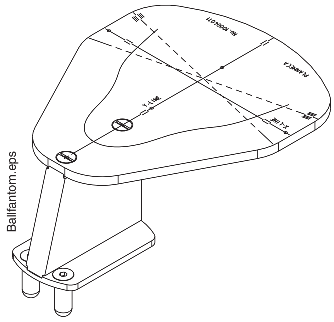


Figure 3

- Frankfort plane alignment tool (part number 50977). Used with the ball phantom for checking the position of the Frankfort plane light.

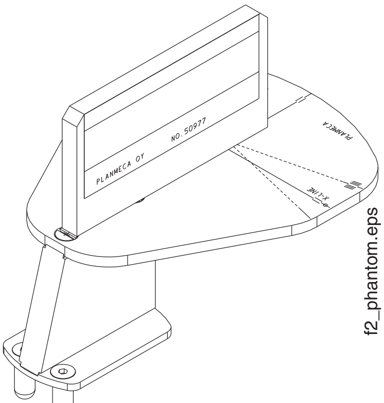


Figure 4

- Beam alignment tool (part number 50972). For checking the position of the panoramic X-ray beam.

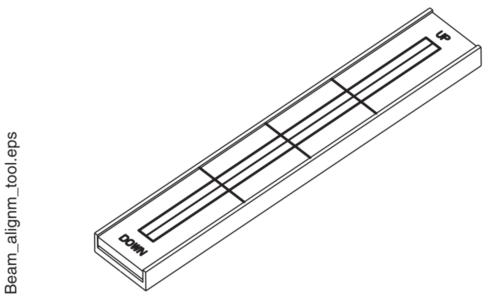


Figure 5

- 3D Flat Field calibration tool (part number 10017348).

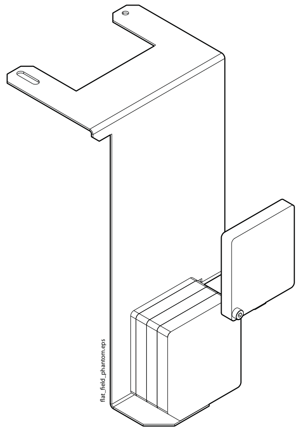


Figure 6

- 3D phantom (part number 10012988). Used in Quality Assurance (Q/A) test.

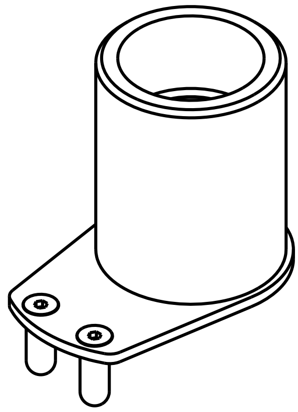


Figure 7

- Geometry calibration platform (part number 10029539). Used in 3D geometry calibration.

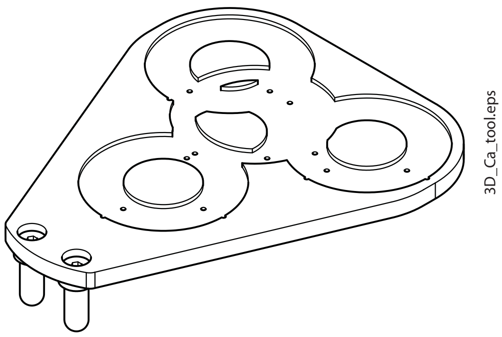


Figure 8

- 3D Max geometry phantom (part number 10021621). Used with geometry calibration platform (part number 10029539) in 3D geometry calibration.

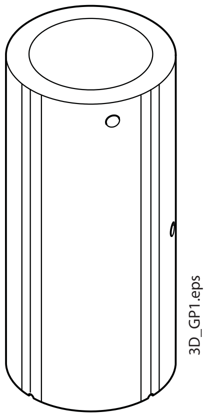


Figure 9

- 3D geometry phantom (part number 10027096). Used with geometry calibration platform (part number 10029539) in 3D geometry calibration.

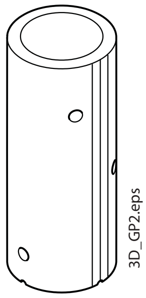


Figure 10

NOTE **Use the blue adapter with the calibration tools, NOT the adjustable adapter.**

2 PANORAMIC BEAM AND PATIENT POSITIONING MECHANISM ADJUSTMENT

Protect yourself from radiation when you are checking the beam alignment.

Perform the adjustments in the order given in this section.

WARNING

It is very important that the room in which the x-ray is installed and the position from which the user operates the equipment are correctly shielded. Since radiation safety requirements vary from country to country and state to state it is the responsibility of the installer to ensure that all local safety regulations are met.

2.1 Adjustment procedure

NOTE Some steps are described in Planmeca Device tool manual, publication number 10031558.

PANORAMIC BEAM AND PATIENT POSITIONING MECHANISM ADJUSTMENT

- Checking the panoramic beam position
- Adjusting the sensor head angle
- Primary collimator angle adjustment
- Panoramic beam adjustment
- Patient positioning mechanism adjustment
- Calibration of angle sensors
- Beam check
- Taking a ball phantom exposure
- Panoramic mode patient positioning lights
- Adjustment of tomo mode patient positioning lights
- Calibrating panoramic sensor head

2.2 Checking the panoramic beam position

Before the X-ray is used the position of the radiation beam must be checked.

Select kilovolt and milliampere values high enough to enable the radiation beam to be seen in the darkened room, e.g. 70 kV and 16 mA. The actual values will depend on how dark the room is.

To be able to check the radiation beam without the rotating unit moving enter the Pan mode X-collimator calibration mode as follows.

To enter the calibration mode first touch the **i** field on the *Main* display.

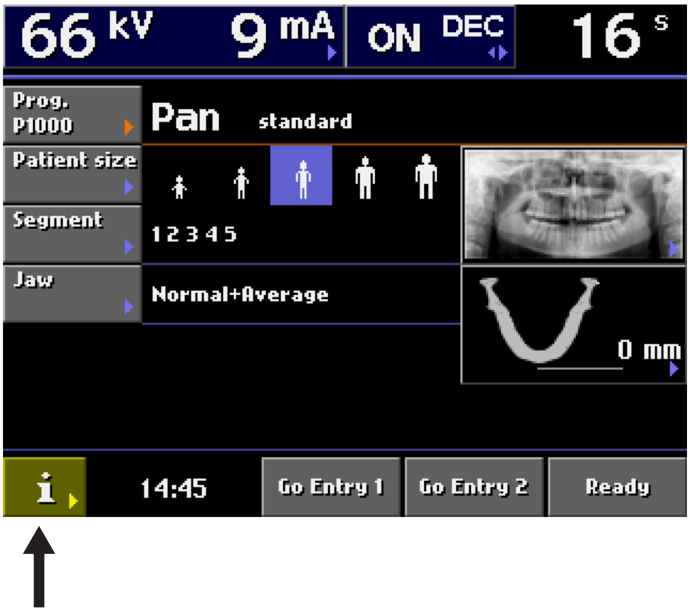


Figure 11

Select **Technical calibrations (i600)** from the list on the display. The password to the Technical calibrations mode is asked when the Technical calibrations mode is entered for the first time after switching the unit on. **The password is 1701.**

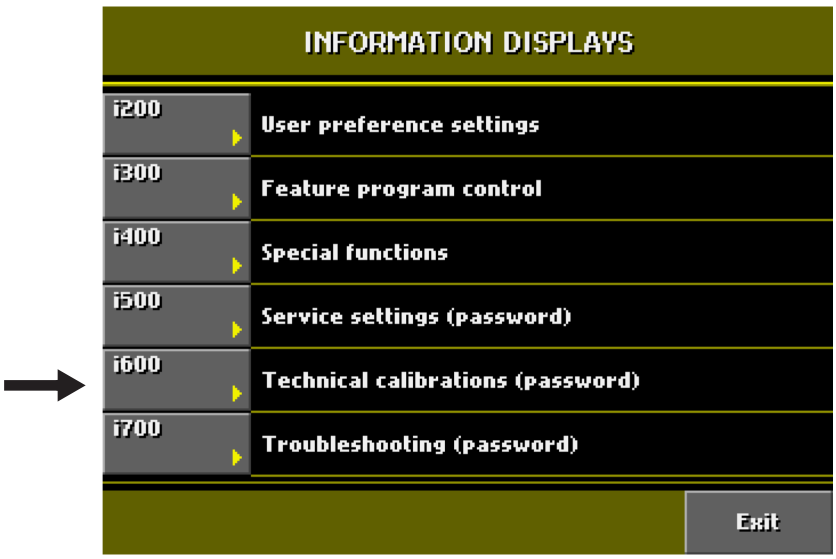


Figure 12

From the list on the *i600* display that appears select **Primary collimator calibration (i610).**

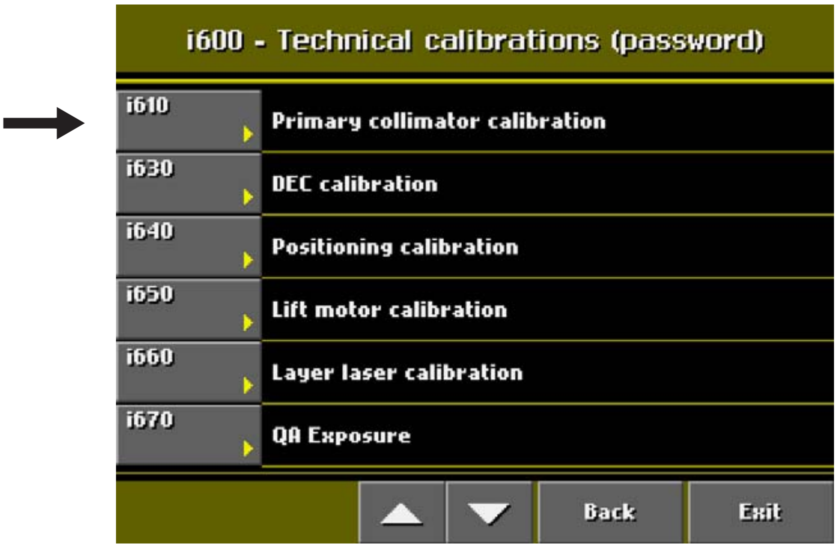


Figure 13

From the list on the *i610* display that appears select **Pan mode X-collimator calibration (i61.1).** The radiation beam from the collimator can now be checked without the rotating unit moving.

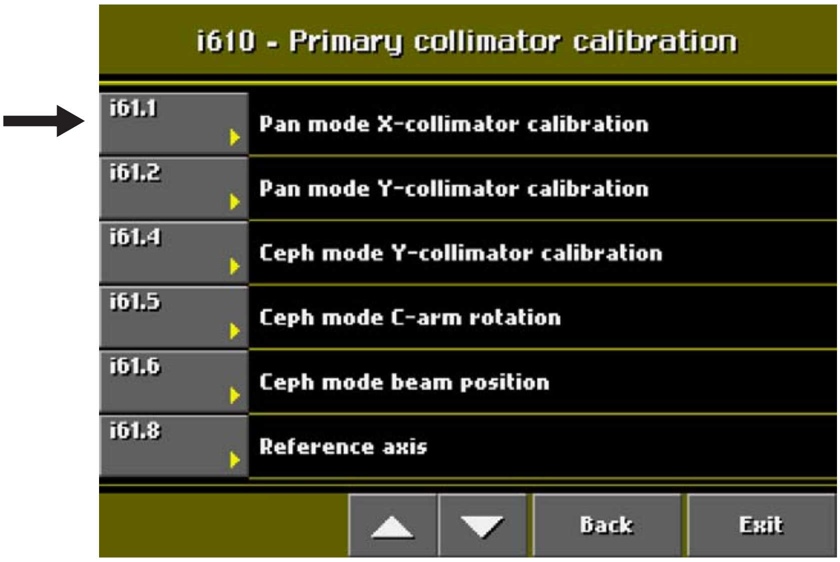


Figure 14

Manually position the C-arm to a convenient position for viewing the sensor head.

Remove the sensor head from the quick connector mechanism, or remove the fixed sensor head from its connector (refer to section 6 “REPLACING THE SENSOR HEAD” on page E-86). Attach the sensor head alignment tool to the connector.

Place the beam alignment tool to the sensor head alignment tool **upside down** as shown in Fig. 15. Slide the beam alignment tool as down as it goes in this sensor head alignment tool position.

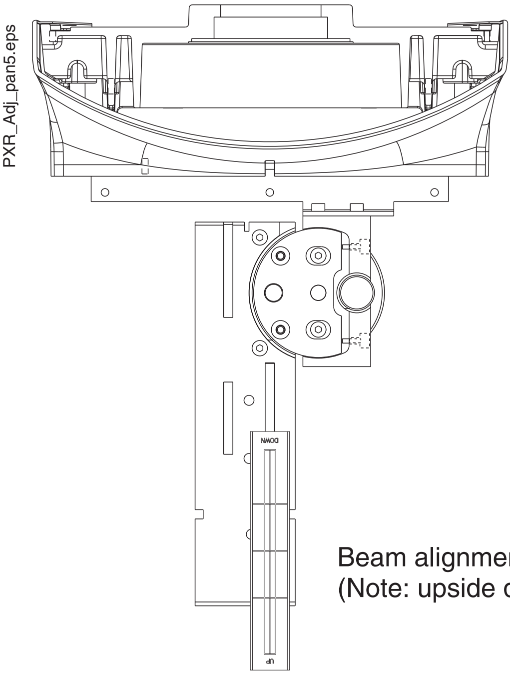


Figure 15

Darken the room sufficiently so that you will be able to see the image of the radiation beam on the alignment tool (it is fluorescent and will glow when the radiation beam strikes it), but not so dark that you cannot see the borders of the alignment rectangle.

Protect yourself from radiation and press the exposure button. The beam image will appear on the alignment tool. Observe the beam from behind the tube head.

CAUTION ***Radiation is generated when the exposure button is pressed. Take adequate protection measures. Keep the exposure time as short as possible.***

The beam image should be 4mm wide and it should appear clearly within the borders of the rectangle marked on the alignment tool.

If the beam is correctly aligned take a ball phantom exposure according to the instructions given in section 2.9 “Taking a ball phantom exposure” on page E-39. Exit the Pan mode X-collimator calibration mode by touching the **Cancel** field.

In case the radiation beam is not correctly aligned, check first the sensor head position by using a spirit level, refer to section 2.3 “Adjusting the sensor head angle” on page E-10. After this the panoramic X-ray beam position must be adjusted as described in sections 2.4 “Primary collimator angle adjustment” on page E-12 and 2.5 “Panoramic beam adjustment” on page E-14.

NOTE **In case the X-ray unit is equipped with a fixed sensor head, adjust the panoramic X-ray beam according to the instructions given in section 2.13 “X-ray unit with fixed primary collimator - primary collimator adjustment” on page E-55.**

2.3 Adjusting the sensor head angle

NOTE **The sensor head (i.e. the sensor head alignment tool) must be perpendicular to the rotating unit, otherwise the angle of the quick connector mechanism must be adjusted.**

Check the position of the sensor head by using the spirit level as shown in Fig. 16 below.

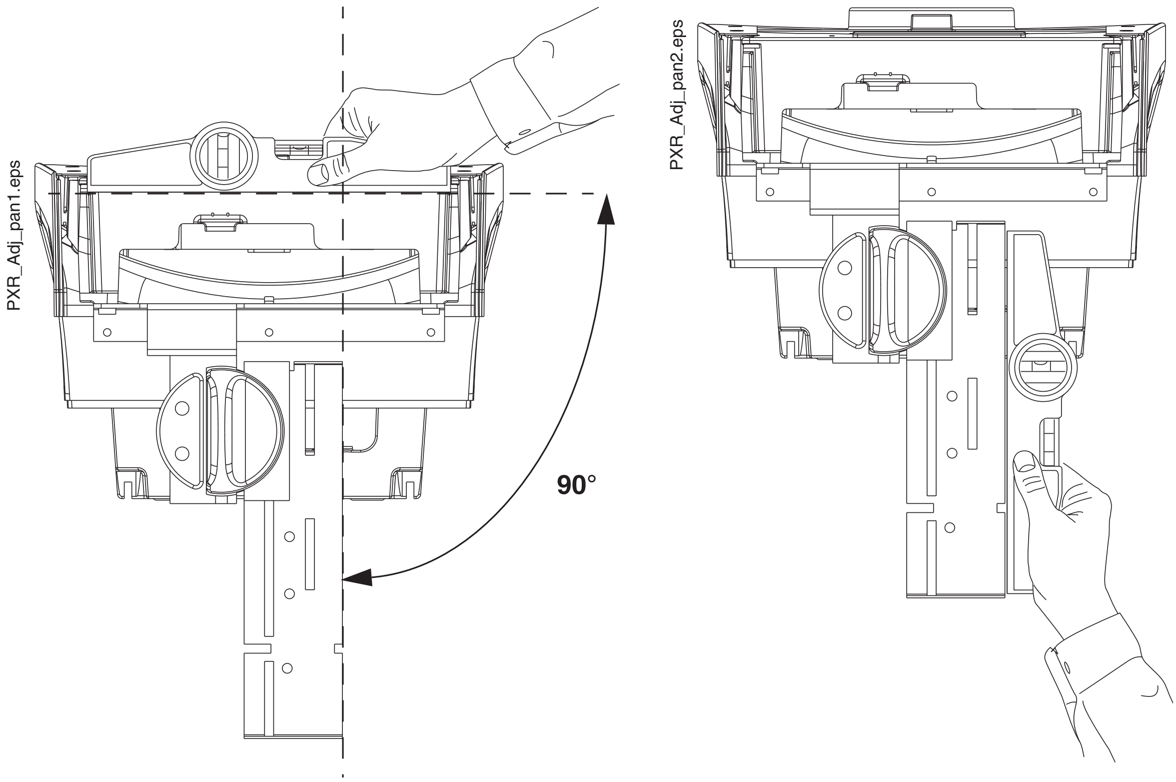


Figure 16

In case the sensor head is attached to the rotating unit, remove the sensor head from the quick connector mechanism (refer to section 6.2 “Sensor head with quick connector mechanism” on page E-90), or remove the fixed sensor head from its connector (refer to section 6.1 “Attaching and removing the fixed sensor head” on page E-86).

Remove the connector covers. Refer to section 6.1 “Attaching and removing the fixed sensor head” on page E-86 or to section 6.2 “Sensor head with quick connector mechanism” on page E-90.

Attach the sensor head alignment tool to the connector.

Loosen the two screws located on the attachment mechanism with the 3mm Allen key. Adjust the head support angle with the two screws (use 3mm Allen key) located on the side of the mechanism. See Fig. 17 below.

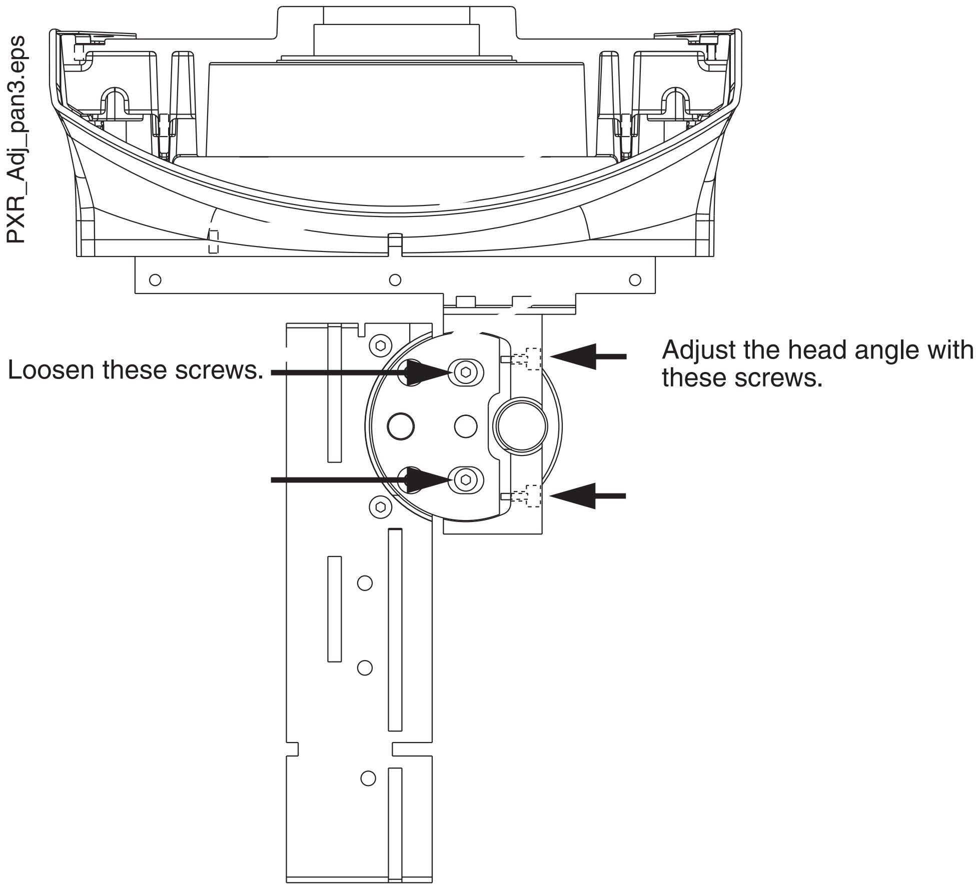


Figure 17

2.4 Primary collimator angle adjustment

NOTE **In case the X-ray unit is equipped with a fixed sensor head, adjust the primary collimator angle according to the instructions given in section 2.13.1 “Fixed primary collimator: Adjusting the primary collimator angle” on page E-57.**

WARNING

Do not adjust the angle of the primary collimator mechanism while X-rays are being generated, i.e. when you press the exposure switch. Check the beam position, adjust the angle, and then recheck the position. If the beam is still misaligned, repeat the procedure.

In case the beam is not vertical, the primary collimator can be rotated. Open the primary collimator mechanism by rotating the primary collimator screws located behind the blades so that you can see the two attachment screws (Fig. 18 and Fig. 19, 1). Loosen the screws and rotate the mechanism (Fig. 18 and Fig. 19, 2) until the beam is correctly positioned. Tighten the screws and check the beam. Repeat the procedure described above until the beam is correctly positioned.

Panoramic primary collimator

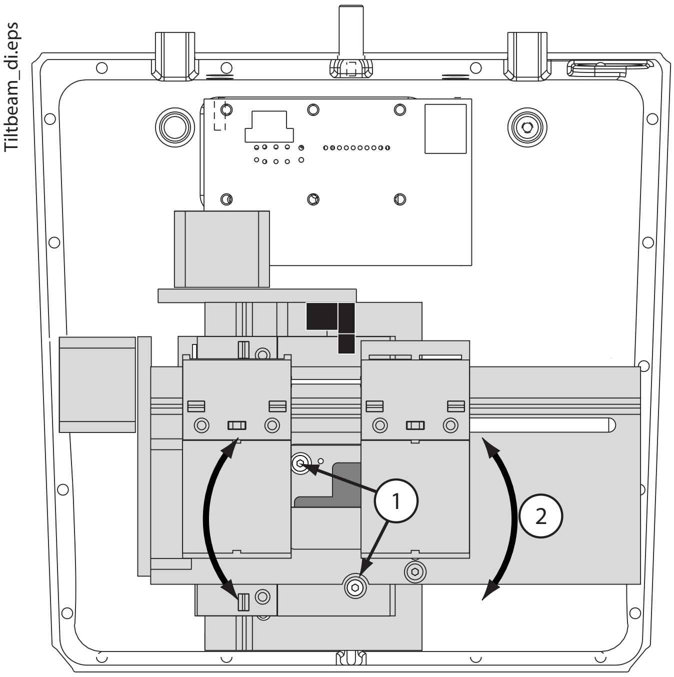


Figure 18

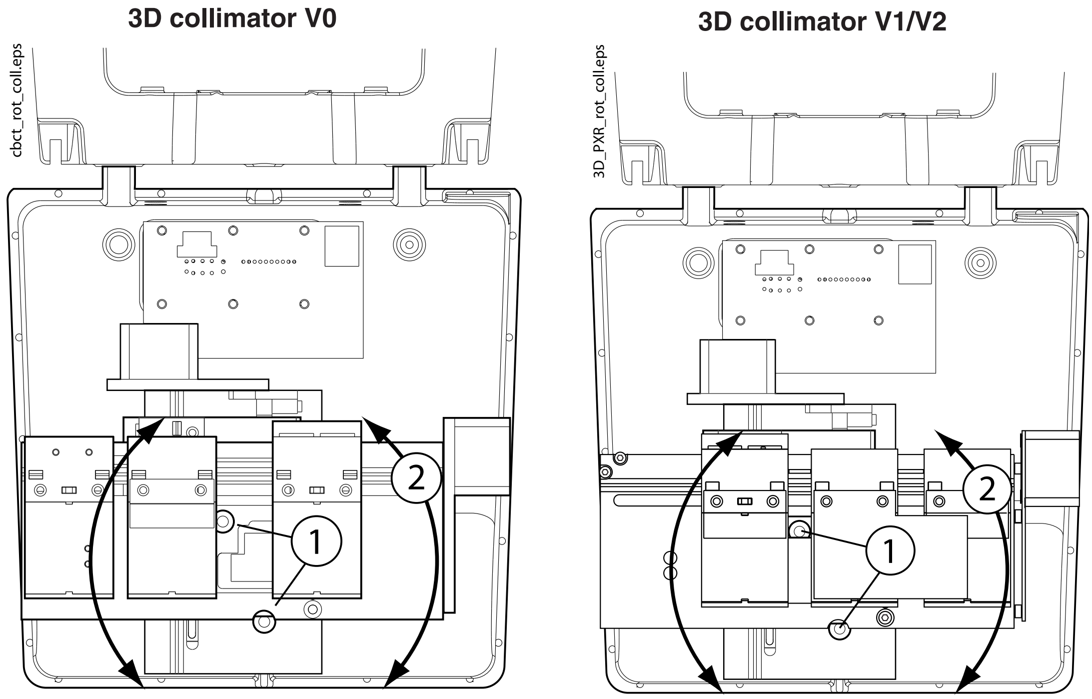


Figure 19

NOTE **The panoramic beam position is checked in the Pan mode X-collimator calibration mode. Do not exit this mode when adjusting the mechanism angle. Drive the horizontal blades to the reference position by touching the Test field on the Pan mode X-collimator calibration display and exit this mode by touching Cancel field. Drive the vertical blades to the reference position in the Pan mode Y-collimator calibration mode by touching the Test field in Pan mode Y-collimator calibration display.**

2.5 Panoramic beam adjustment

NOTE **In case the X-ray unit is equipped with a fixed sensor head, adjust the panoramic X-ray beam according to the instructions given in section 2.13 “X-ray unit with fixed primary collimator - primary collimator adjustment” on page E-55.**

Manually position the C-arm to a convenient position for viewing the sensor head. Place the beam alignment tool to the sensor head alignment tool **upside down**.

Darken the room sufficiently so that you will be able to see the image of the radiation beam on the alignment tool (it is fluorescent and glows when the radiation beam strikes it), but not so dark that you cannot see the borders of the alignment rectangle.

Select kilovolt and milliampere values high enough to be able to see the radiation beam in the darkened room. The actual values depend on how dark the room is.

To enter the calibration mode first touch the **i** field on the *Main* display. Select **Technical calibrations (i600)** from the list on the display. The password to the Technical calibrations mode is asked when the Technical calibrations mode is entered for the first time after switching the unit on. **The password is 1701.**

Panoramic beam horizontal position and panoramic beam width

From the display that appears after selecting Technical calibrations select **Primary collimator calibration (i610)**. From the list on the *i610* display select **Pan mode X-collimator calibration (i61.1).**

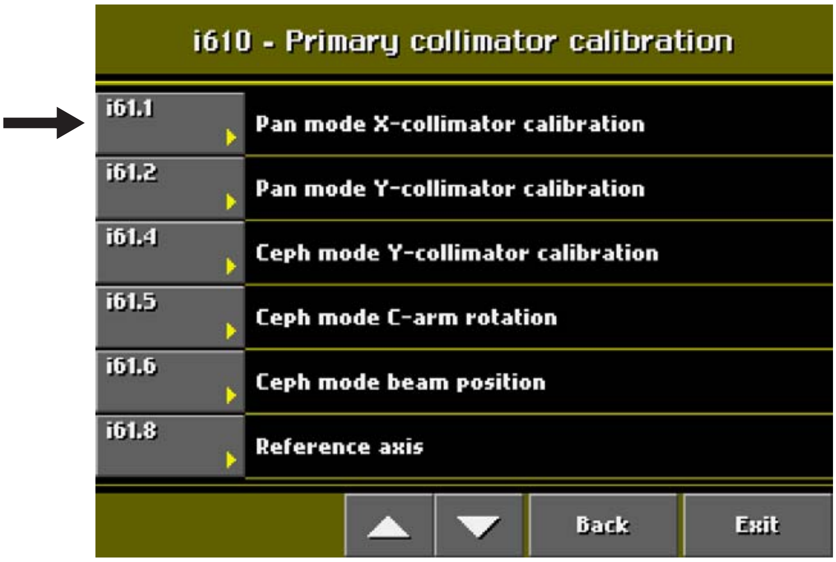


Figure 20

The *Pan mode X-collimator calibration* display appears. In this mode the horizontal position of the X-ray beam and the panoramic beam width are adjusted. To perform beam check touch the *Beam check* button. Performing Beam check requires installation of *beamcheck.exe* file

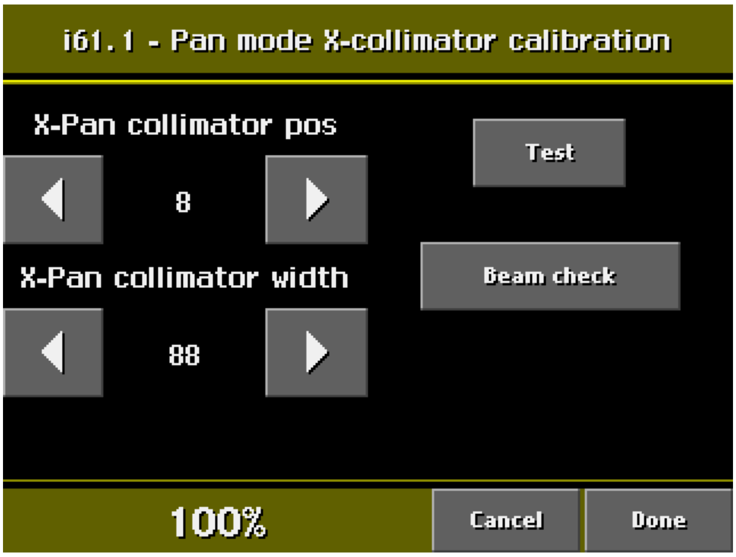


Figure 21

Panoramic beam horizontal position:

If the X-ray beam is too far to the left or right of the alignment rectangle, it must be centered:

Adjust the primary collimator position value with the **X-Pan collimator pos** arrow fields on the display. The left arrow field on the display adjusts the beam to the left, and the right arrow field to the right. Drive the primary collimator to the selected position by touching the **Test** field.

Protect yourself from radiation and press the exposure button to check the position of the beam. If necessary, repeat the procedure.

After the horizontal position of the panoramic beam is correct the beam width must be adjusted.

Panoramic beam width:

If the X-ray beam is **too wide** (it exceeds the borders of the rectangle marked on the alignment tool) or if it is too narrow, the width of the beam must be adjusted. **The beam width on the beam alignment tool should be approx. 4mm (0.16 in.).**

Adjust the **width value of the primary collimator** with the **X-Pan collimator width** arrow fields and drive the primary collimator to the selected width by touching the **Test** field.

Use the 0.6mm feeler to check the width of the opening between the collimator blades as shown in Fig. 22 and Fig. 22 below. The number on the display should be approx. 68 when the opening is 0.6mm.

Panoramic primary collimator

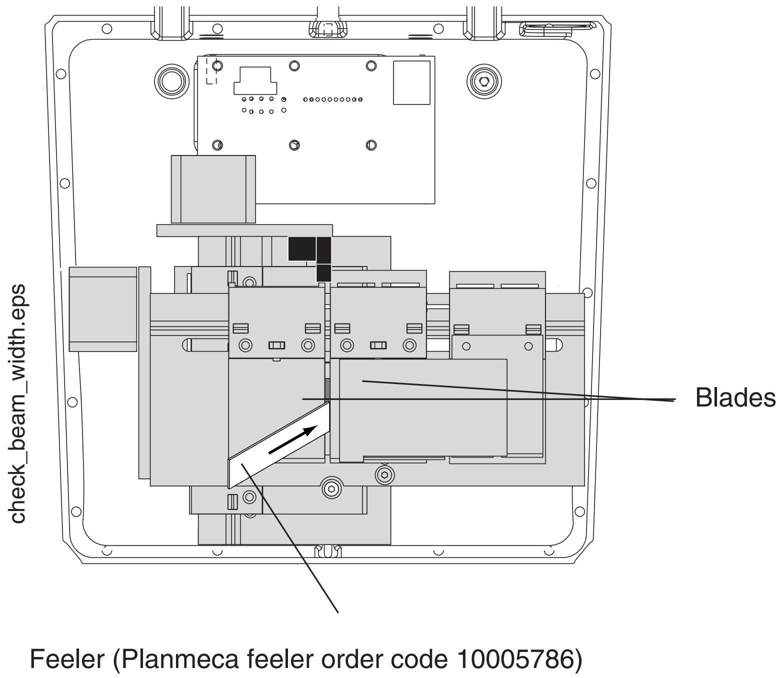


Figure 22

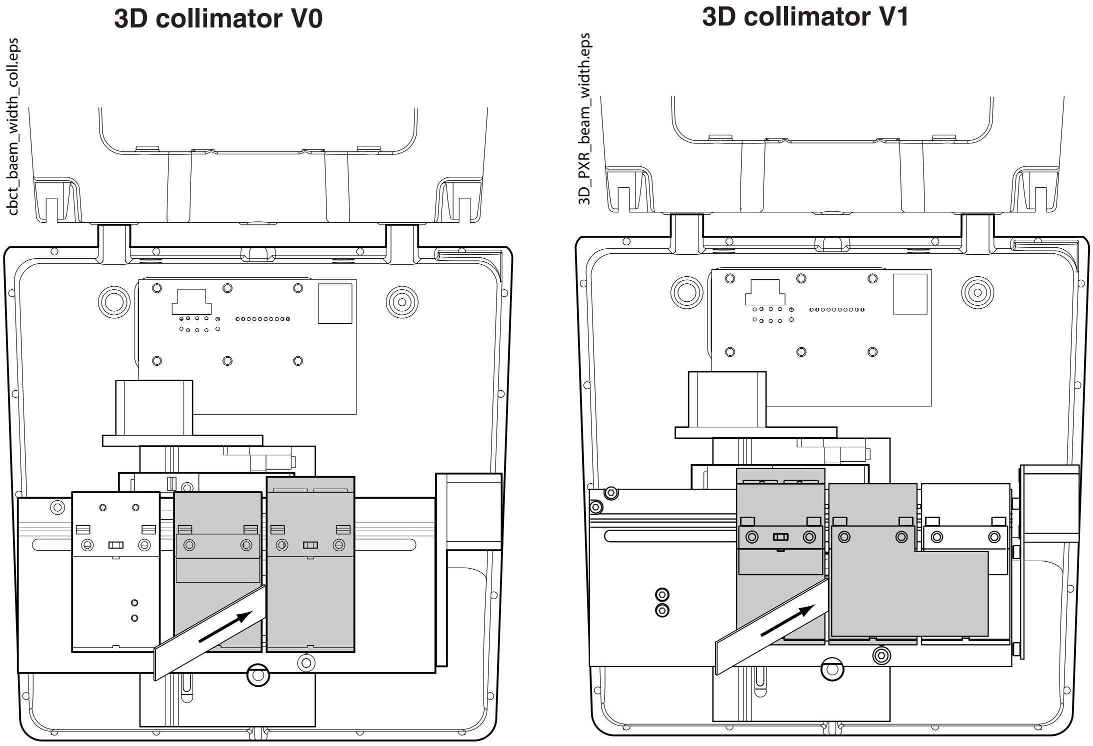


Figure 23

Protect yourself from radiation and press the exposure button to check the width of the beam. Repeat the procedure, if necessary.

Accept the new position and width and exit the Pan X-collimator calibration mode by touching the **Done** field.

Panoramic beam vertical position

NOTE **The lower border limiting plate should not move when the upper limiting plate is moving to its programmed position. Program the upper limit first.**

If the X-ray beam is too low or too high, the **vertical position of the beam must be adjusted**. From the display that appears when you selected Technical calibrations, select **Primary collimator calibration (i610)**. From the *i610* display select **Pan mode Y-collimator calibration (i612)**.

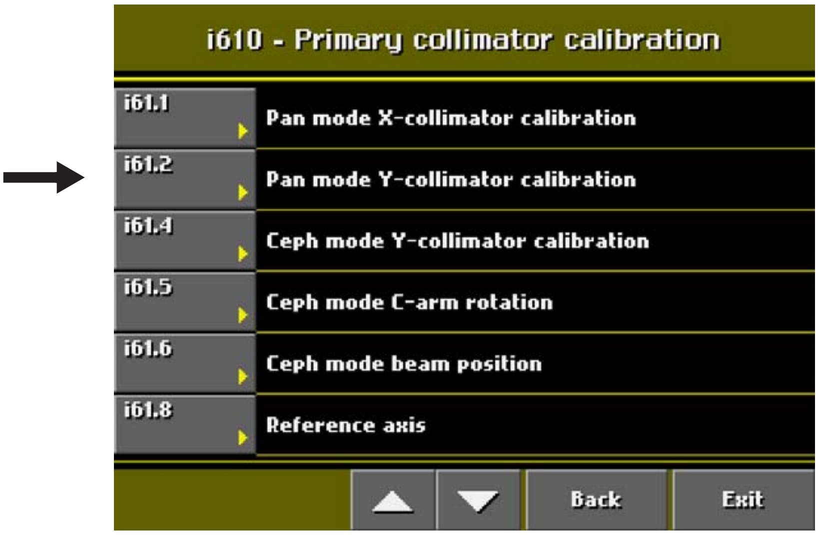


Figure 24

The *Pan mode Y-collimator calibration (i612)* display appears.

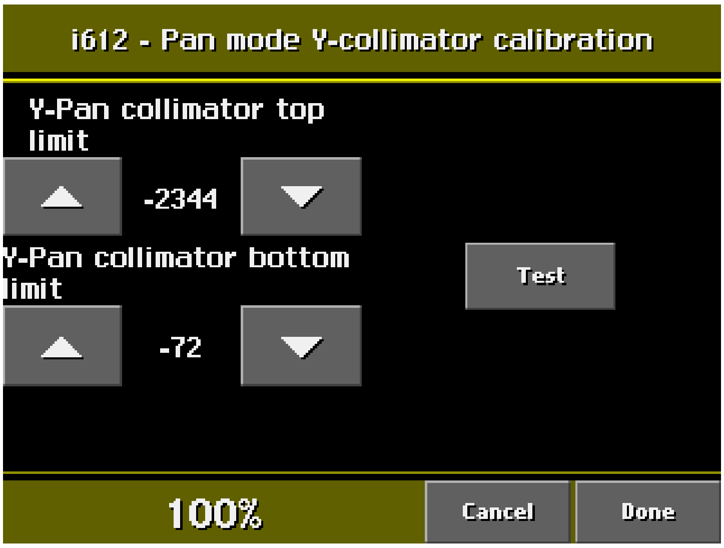


Figure 25

Adjust the **upper limit** value of the X-ray beam with the **Y-Pan collimator top limit** arrow fields. Drive the primary collimator to the selected position by pressing the **Test** field. Protect yourself from radiation and press the exposure button to check the X-ray beam upper edge position. If necessary, repeat the procedure.

Adjust the **lower limit** value of the X-ray beam with the **Y-Pan collimator bottom limit** arrow fields. Drive the primary collimator to the selected position by pressing the **Test** field. Protect yourself from radiation and press the exposure button to check the X-ray beam lower edge position. If necessary, repeat the procedure. Accept the new position and exit the calibration mode by touching the **Done** field.

2.6 Patient positioning mechanism adjustment

Enter the panoramic exposure mode.

Remove the inner cover from tube head assembly, the sensor head covers and the lower cover of the C-arm as well as the shoulder arm cover. Refer to section 5 “REMOVING THE COVERS” on page E-77. Remove the cover of the patient support table, refer to section 2.1 “Patient support table cover” on page F-7.

Attach the ball phantom to the patient positioning mechanism adapter. Attach the sensor head alignment tool to the sensor head connector.

Slide the alignment pin through the hole in the shoulder joint so that it goes into the positioning holes in the shoulder arm and column as shown on the Fig. 26 below.

2.6.1 Adjustment in ball phantom’s x-direction

Manually position the C-arm as shown in Fig. 26 (C-arm perpendicular to the patient support table). Note the position of the tube head and sensor head. Slide the alignment pin through the hole in the elbow joint so that it goes into the positioning hole in the C-arm.

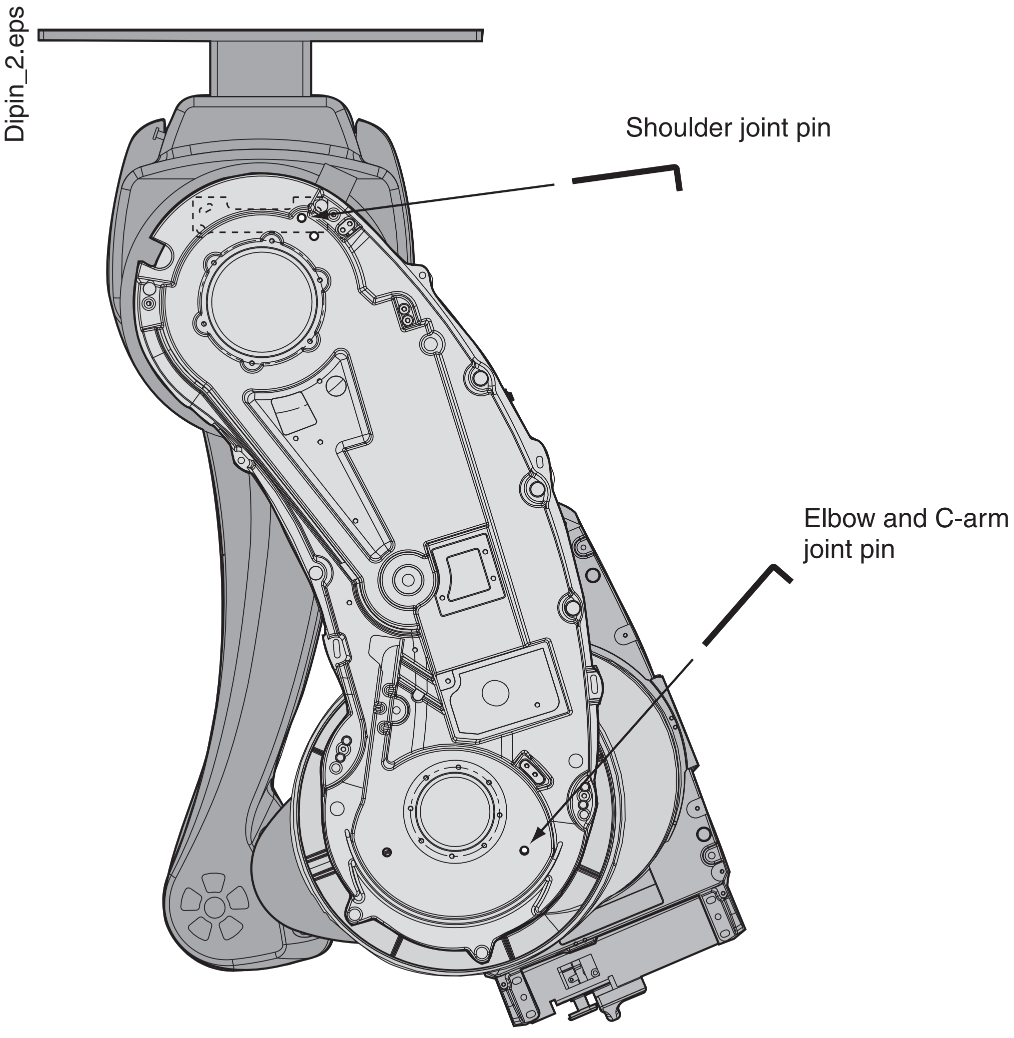


Figure 26

In case there is clearance either in the shoulder joint or in the elbow joint or both (i.e. one or more arms can move even if the pins are in position), the adjustment may be unsuccessful if the following action is not done: Push the arms to the same direction as far as they move. For example: first push the shoulder arm to the right, then the elbow arm and finally the C-arm. **IMPORTANT:** Do not push any of the arms to opposite direction from the others.

Leave the ball phantom tool in position. Place the alignment tool in position between the multi primary collimator and the sensor head alignment tool as described below.

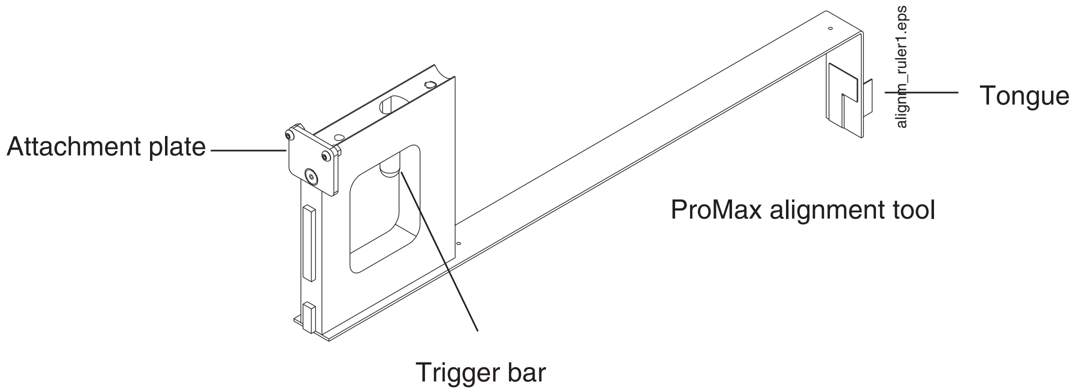


Figure 27

NOTE **Units with fixed primary collimator: Place the alignment tool in position between the tube head and the sensor head alignment tool so that the alignment tool tongue goes into the primary collimator opening.**

Slide the right side blade of the horizontal blade mechanism to the right and position the alignment tool tongue into the opening.

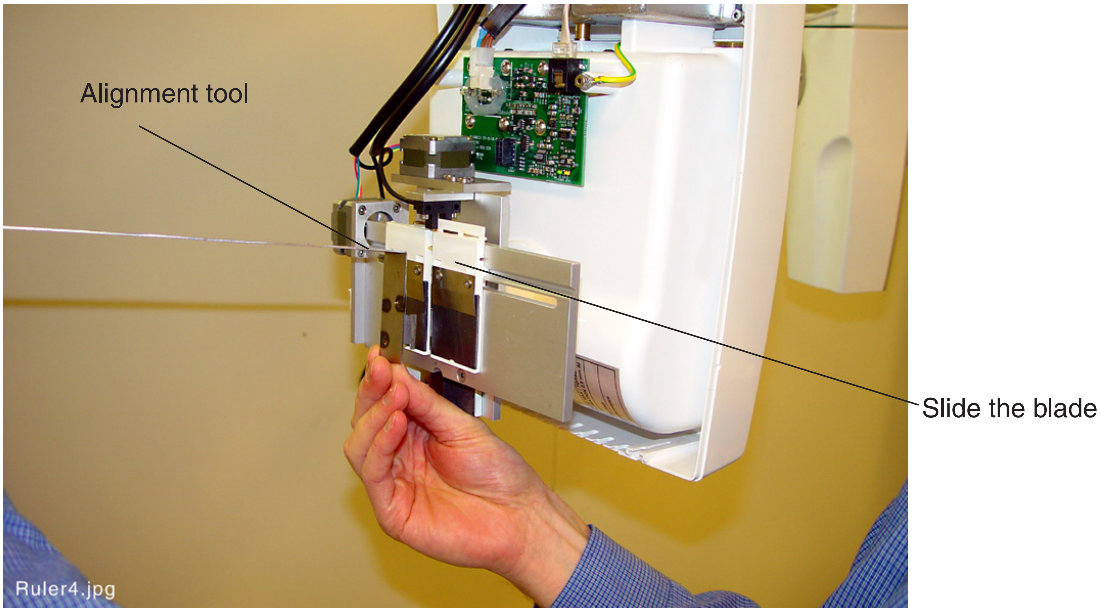


Figure 28

Push the right side blade against the tongue.

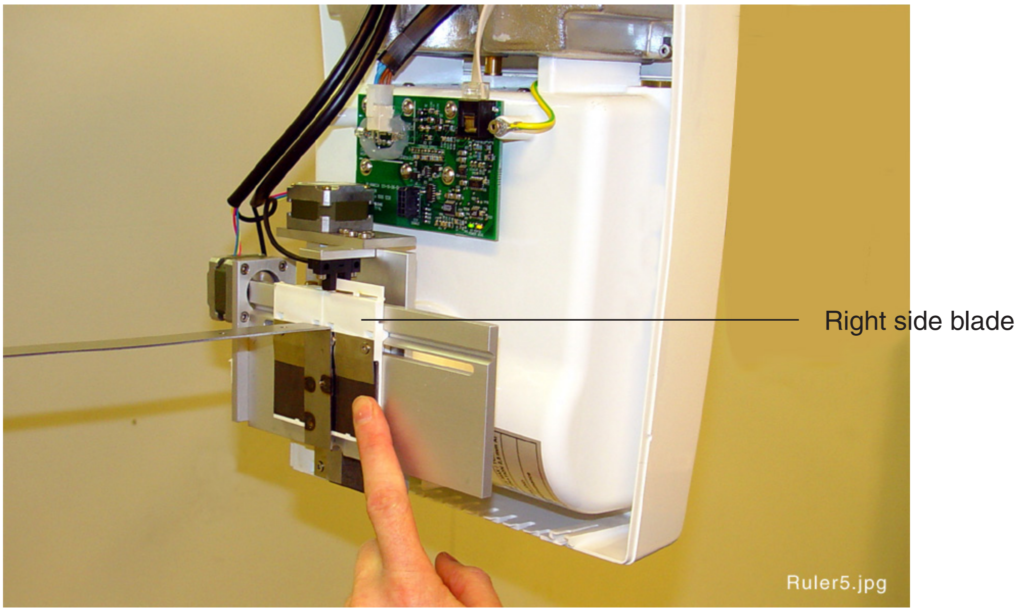


Figure 29

3D collimator V0: Slide the right side blade of the horizontal blade mechanism to the right and position the alignment tool tongue into the opening. Push the right side blade against the tongue (arrows in the figure below).

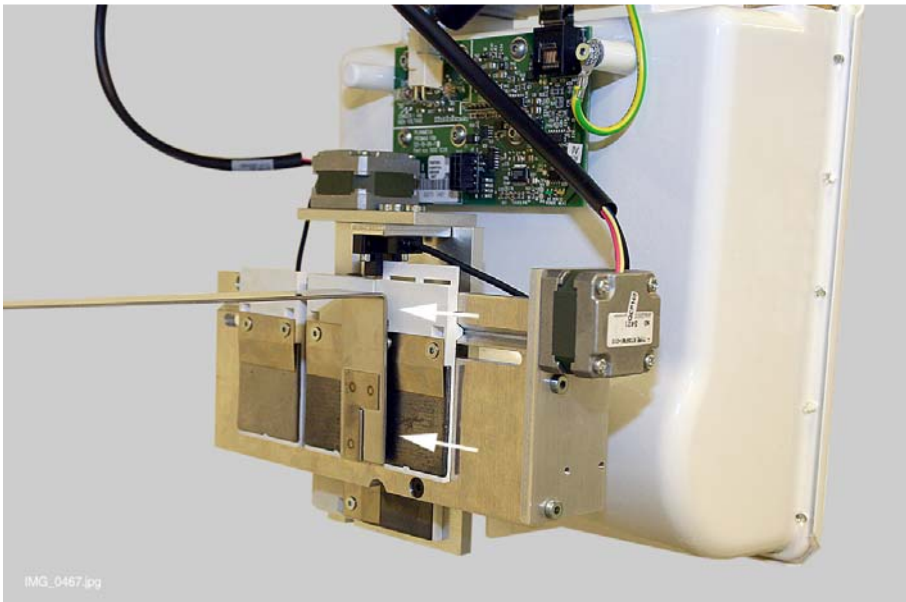


Figure 30

3D collimator V1 / V2 (Cu): Slide the right side blade of the horizontal blade mechanism to the right and position the alignment tool tongue into the opening. Push the right side blade against the tongue.

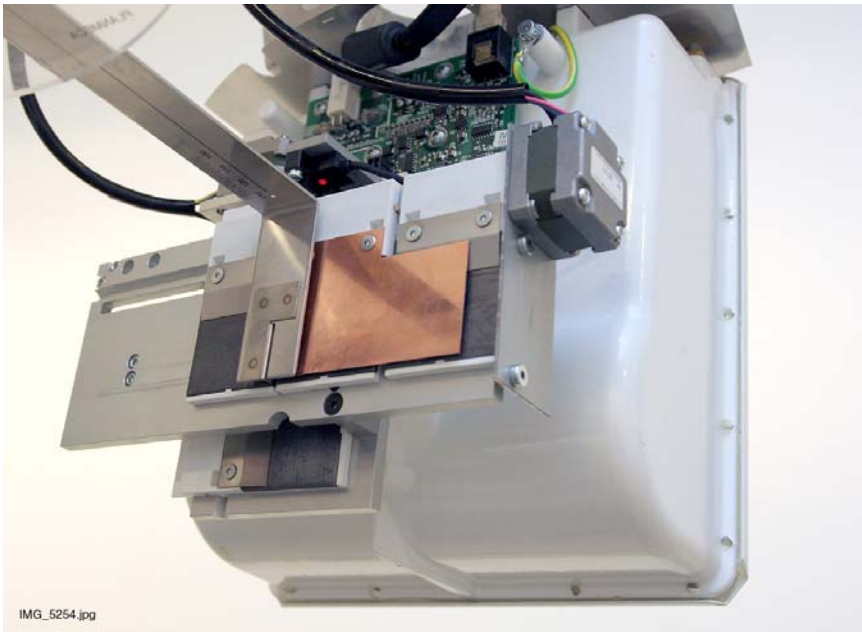


Figure 31

Pull the alignment tool attachment plate inwards by pulling the trigger bar backwards and place the other end of the alignment tool against the sensor head alignment tool.

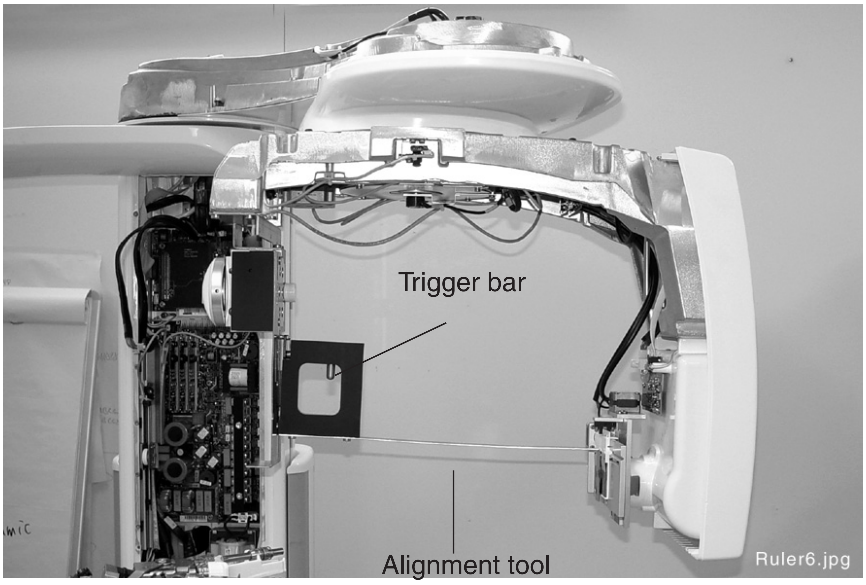


Figure 32

CAUTION ***Never switch the X-ray unit on when the alignment tool is positioned between the tube head and the sensor head alignment tool. To avoid damaging the blades, the unit must be switched on before the alignment tool is positioned.***

CAUTION ***Take care not to make any cuts to the lead (Pb) blades.***

The x-line on the alignment tool plate must be parallel to the x-line on the ball phantom. **Note that the line on the ball phantom and the line on the alignment tool plate do not have to coincide, but they must be parallel, the deviation may be ±1mm.** If not, loosen the patient support table attachment screws with the 3mm Allen key and adjust the table angle and the position backwards or forwards until the line on the ball phantom is in correct position (see arrows on Fig. 33).

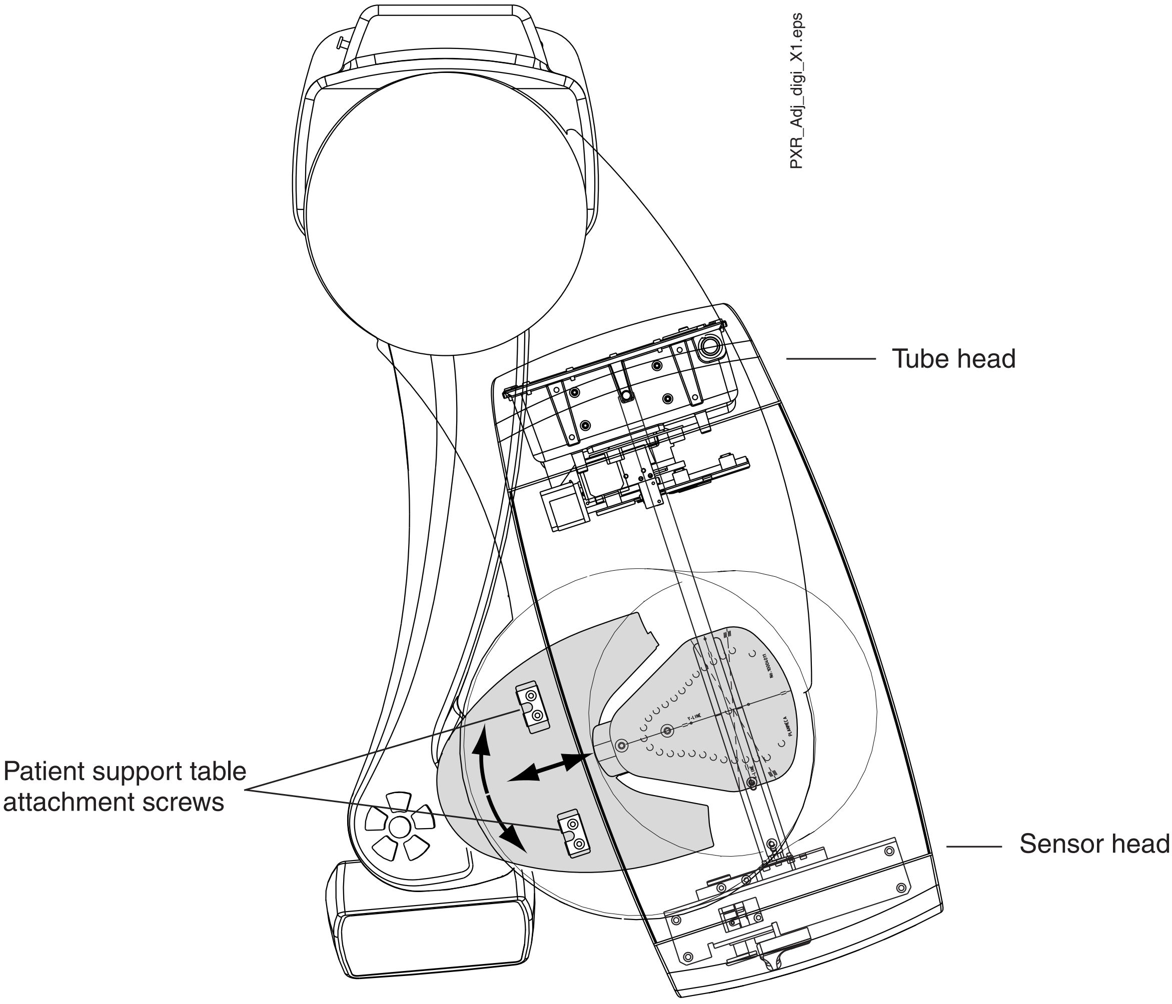


Figure 33 C-arm in x-direction adjustment position (“0° position”)

In case the ±1 deviation cannot be reached by moving the patient support table, the position of the shoulder arm can be adjusted as follows. Make sure that the alignment pin is in the hole in the shoulder joint (Fig. 34, 1). Loosen the screws of the adjustment plate (Fig. 34, 2) and move the shoulder arm (Fig. 34, 3) to required direction by moving the adjustment plate (Fig. 34, 2) until the line on the alignment tool is in correct position.

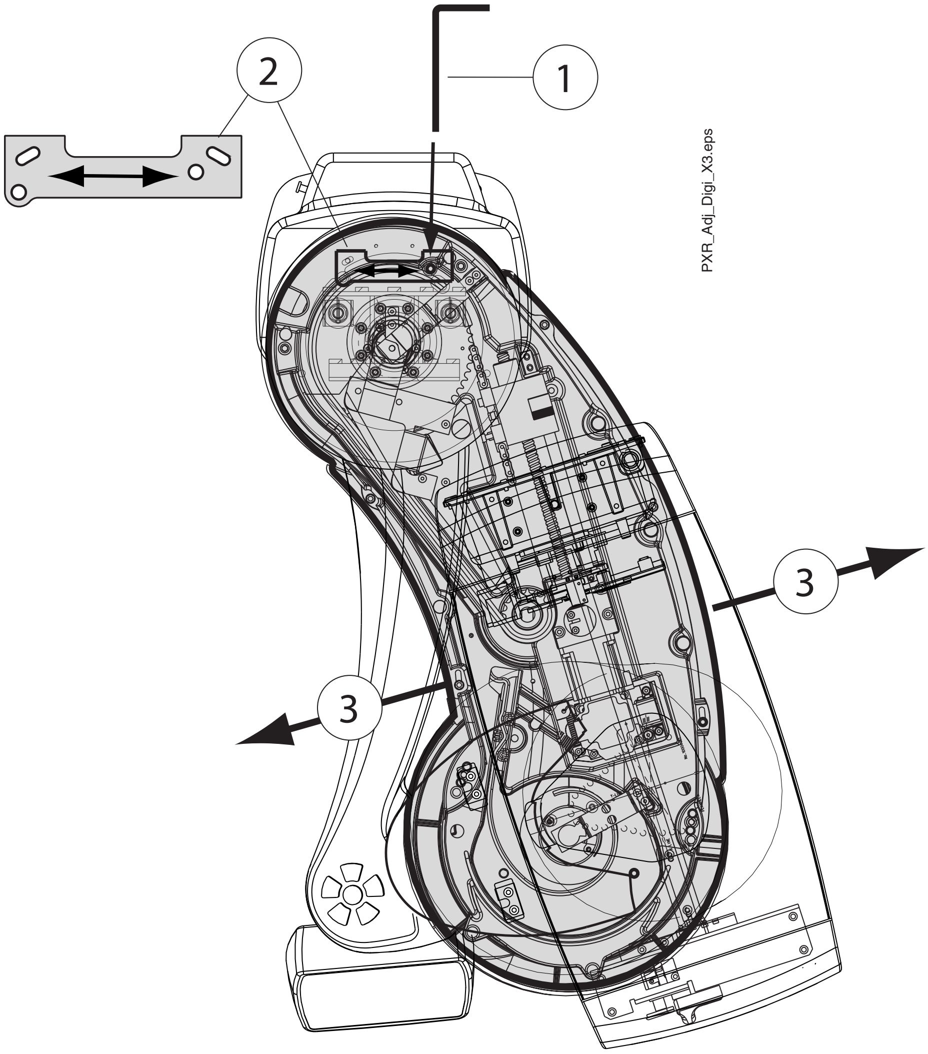


Figure 34

NOTE **The angle sensors must be calibrated after adjusting the shoulder arm position, refer to section 2.7 "Calibration of angle sensors" on page E-31.**

After the x-direction adjustment the adjustment must be performed in y-direction, do not tighten the patient support table attachment screws yet.

2.6.2 Adjustment in ball phantom's y-direction

Remove the alignment pin from the elbow joint and manually position the C-arm as shown in Fig. 35 below (C-arm parallel with the patient support table). Slide the alignment pin through the hole in the elbow joint so that it goes into the positioning hole in the C-arm.

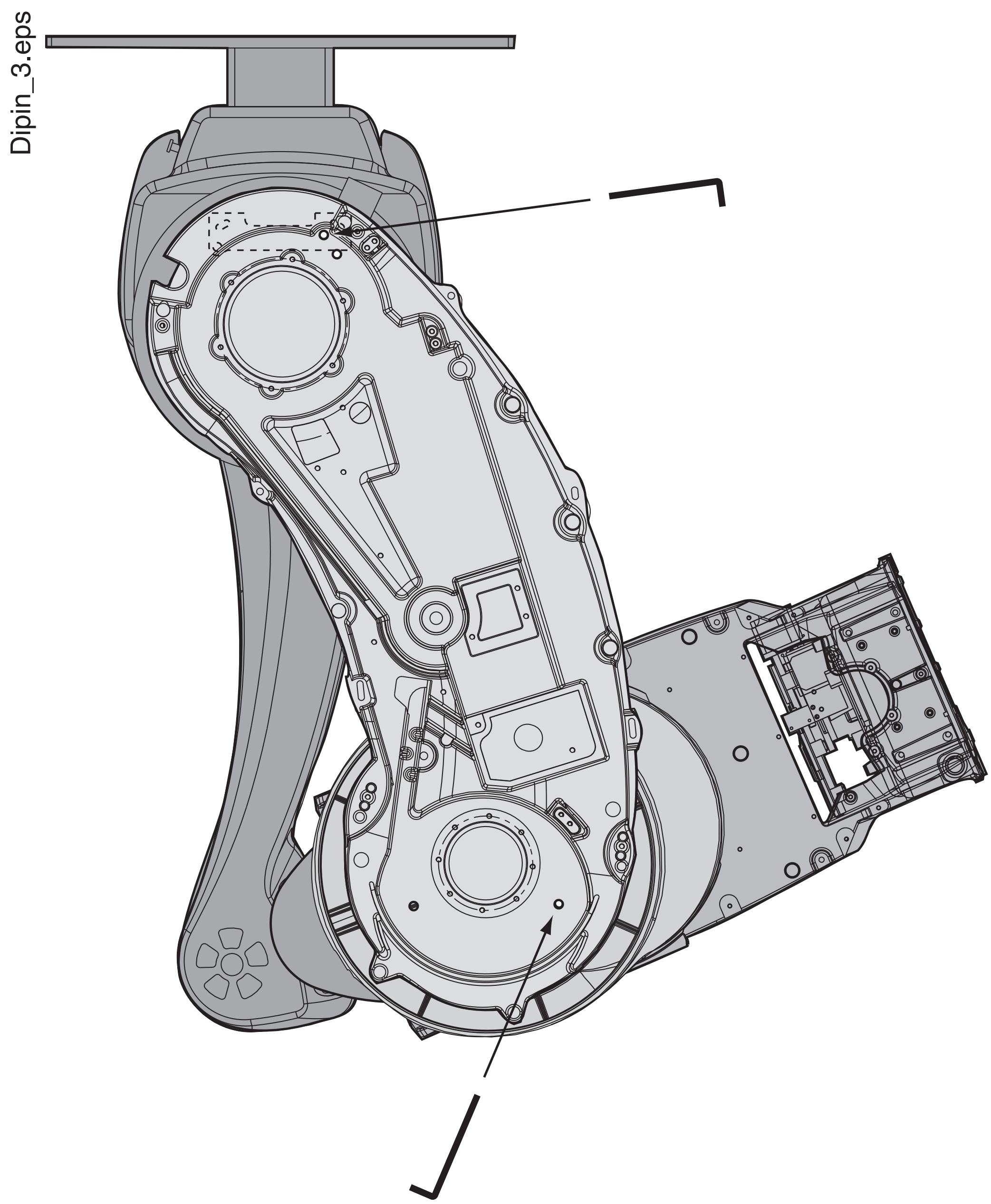


Figure 35

In case there is clearance either in shoulder joint or in elbow joint or both (i.e. one or more arms can move even if the pins are in position), the adjustment may be unsuccessful if you do not push the arms to the same direction as far as they move.

For example: first push the shoulder arm to the right, then the elbow arm and finally the C-arm. **IMPORTANT:** Do not push any of the arms to opposite direction from the others.

The line on the alignment tool plate must be parallel to the y-line on the ball phantom. Note that the line on the ball phantom and the line on the alignment tool plate do not have to coincide, but they must be parallel, the deviation **may be ±1mm**. If not, adjust the table position to the left or right until the line on the ball phantom is in the correct position (see arrows in Fig. 36). Loosen the patient support table attachment screws with the 3mm Allen key, if needed.

After y-direction adjustment the x-direction adjustment must be checked before tightening the patient support table attachment screws.

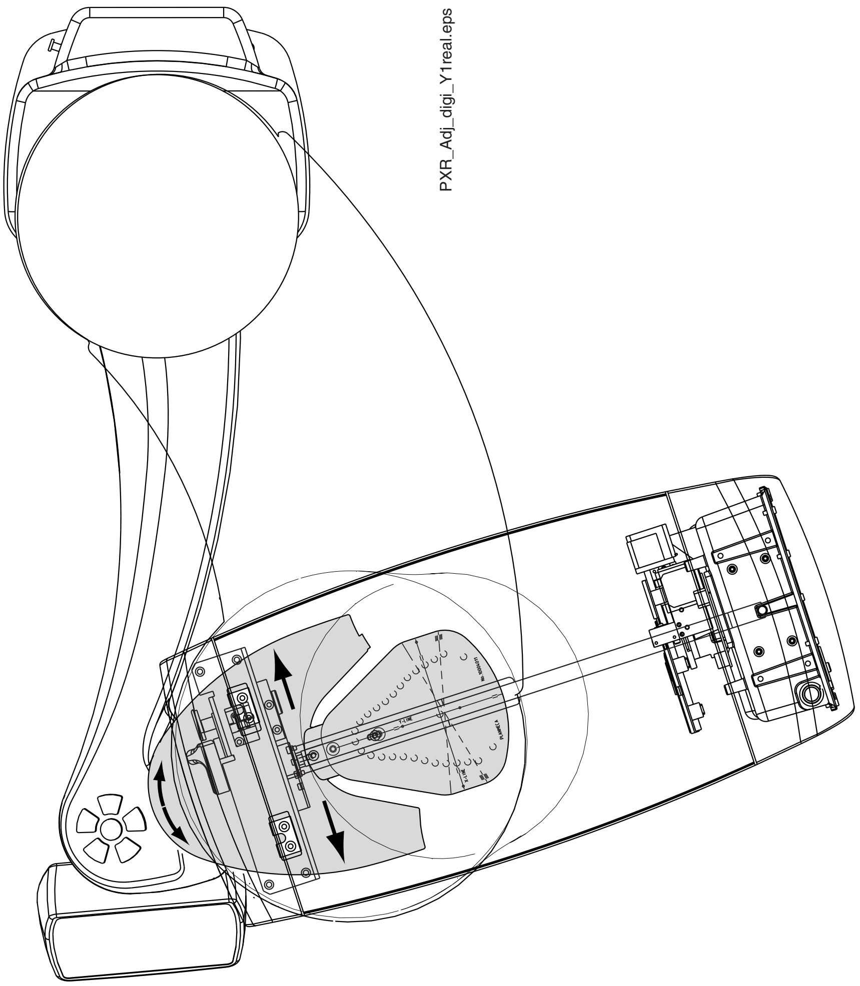


Figure 36 C-arm in y-direction adjustment position

Check both the x-direction and the y-direction adjustment after tightening the attachment screws.

NOTE The calibration of the angle sensors must be checked after checking/adjusting the patient positioning mechanism. Refer to section 2.7 “Calibration of angle sensors” on page E-31.

2.6.3 Checking the eccentricity of the rotation movement

In case the distances on the ball phantom image are not at an acceptable level (see section 2.9 “Taking a ball phantom exposure” on page E-39), the eccentricity of the rotation movement must be checked. This is done by comparing the distances between the line on the alignment tool plate and the x-line on the ball phantom in “0° position” and in “180° position”. If the deviation is more than 1mm, the position of the sensor head must be adjusted.

To check the 0° position manually position the C-arm as shown in Fig. 37 below (C-arm perpendicular to the patient support table). Note the position of the tube head and the sensor head.

Slide the alignment pin through the hole in the shoulder joint so that it goes into the positioning holes in the shoulder arm and column and slide the alignment pin through the hole in the elbow joint so that it goes into the positioning hole in the C-arm.

Dipin_2.eps

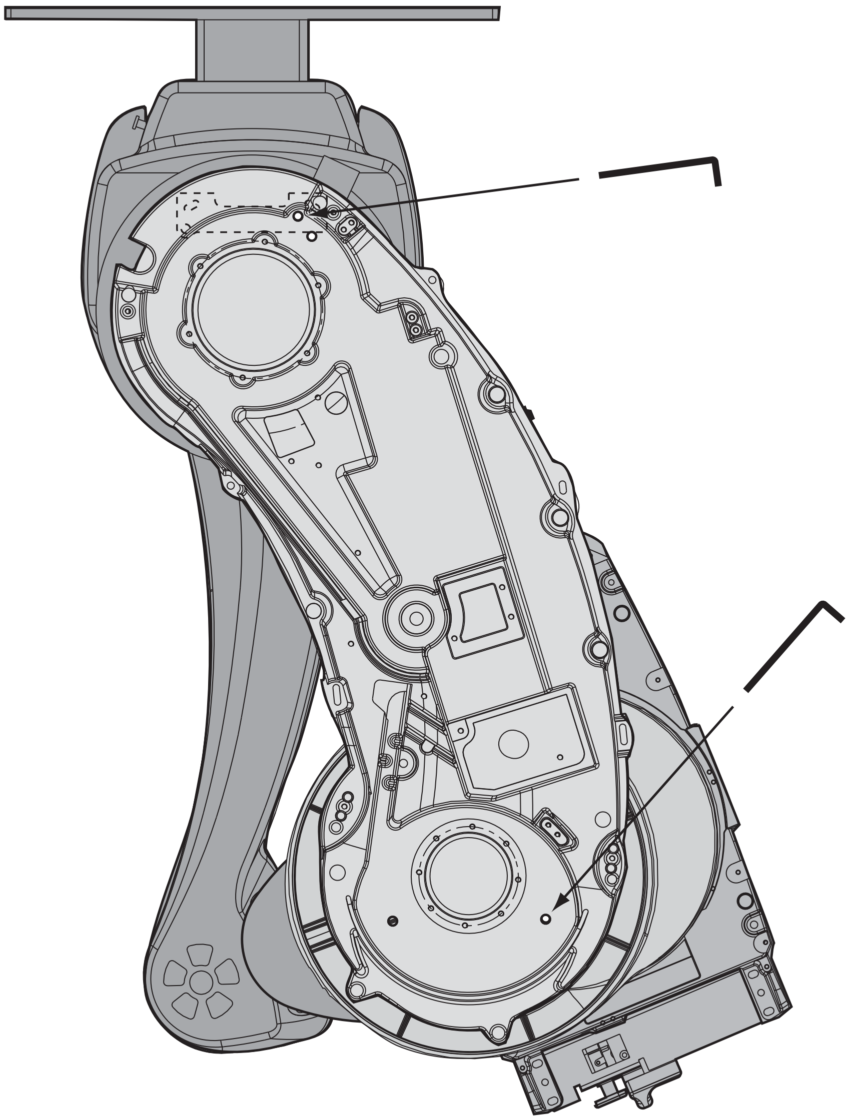


Figure 37

In case there is clearance either in shoulder joint or in elbow joint or both (i.e. one or more arms can move even if the pins are in position), the adjustment may be unsuccessful if you do not push the arms to the same direction as far as they move. For example: first push the shoulder arm to the right, then the elbow arm and finally the C-arm.

IMPORTANT: Do not push any of the arms to opposite direction from the others.

Leave the ball phantom tool in position and place the alignment tool in position between the tube head and the sensor head alignment tool. Measure the distance between the line on the alignment tool plate and the x-line on the ball phantom.

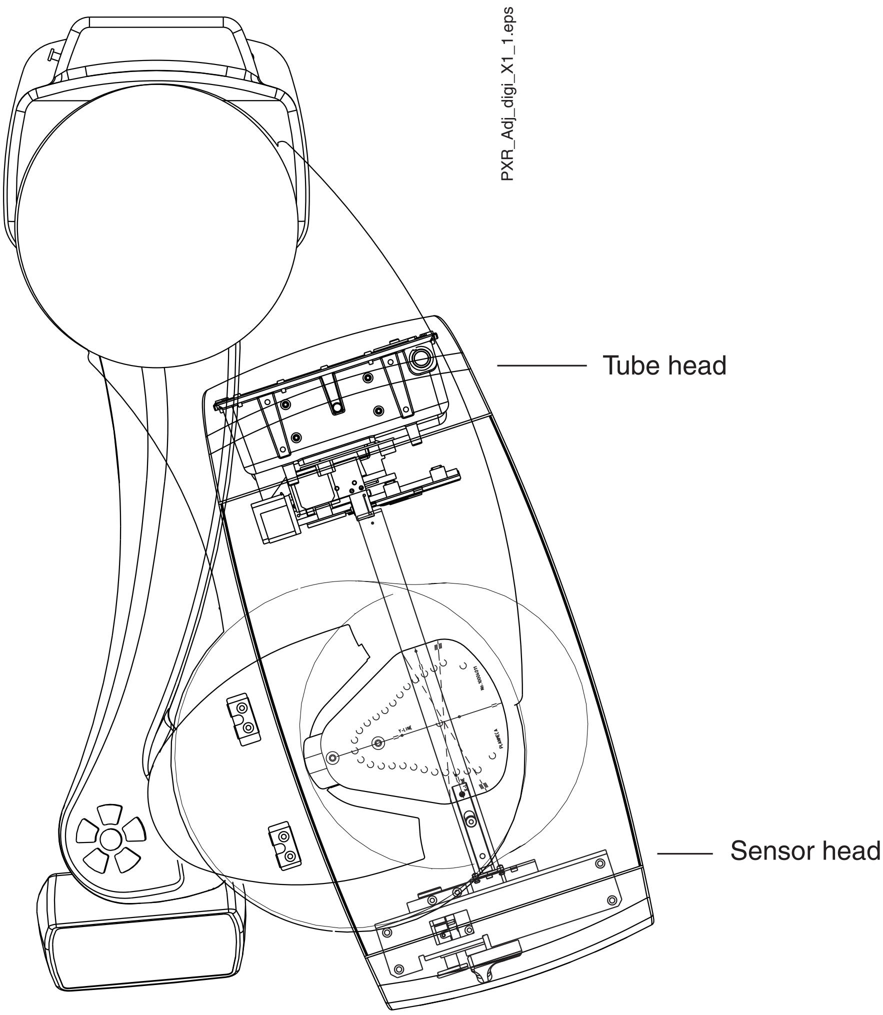


Figure 38 "0° position"

Remove the alignment pin from the elbow joint and manually position the C-arm as shown in the figure below (C-arm parallel with the patient support table).

Note the position of the tube head and sensor head. Slide the alignment pin through the hole in the elbow joint so that it goes into the positioning hole in the C-arm.

Measure the distance between the line on the alignment tool plate and the x-line on the ball phantom.

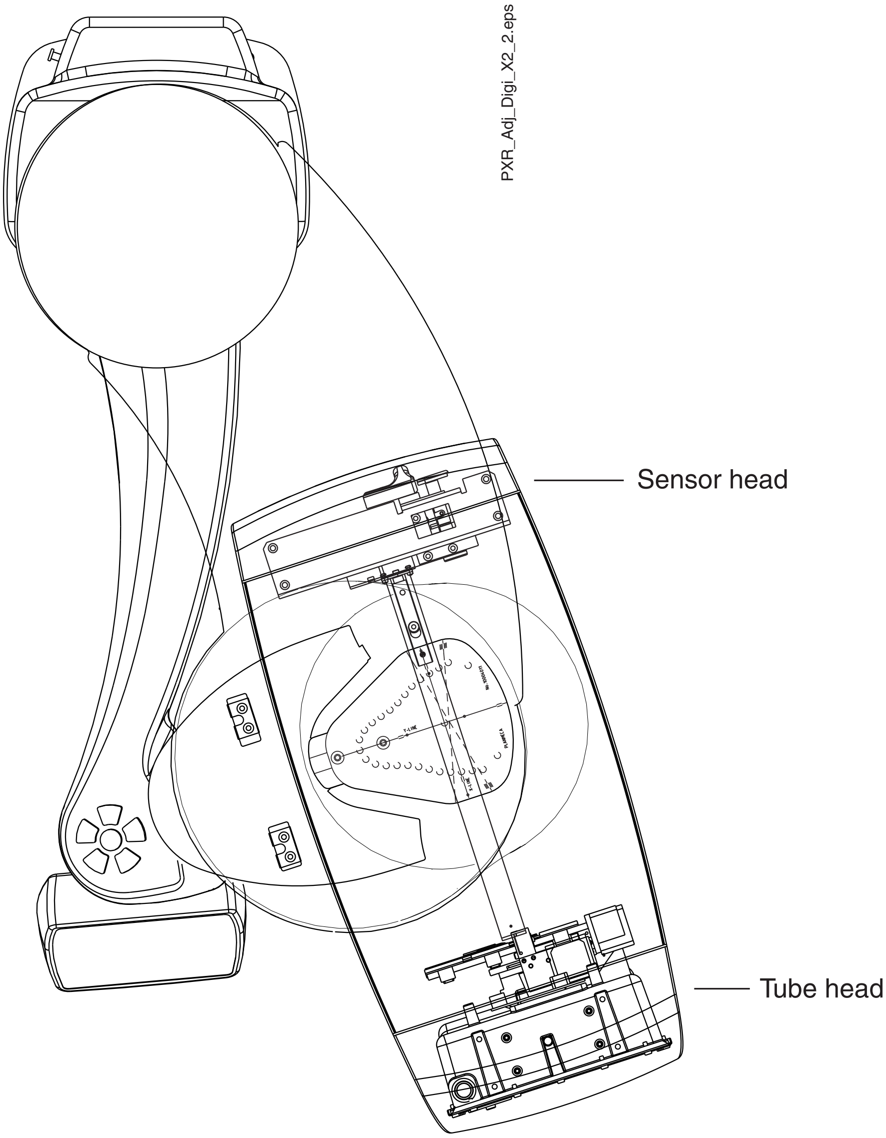


Figure 39 "180° position"

Compare the distances between the line on the alignment tool plate and the x-line on the ball phantom in "0° position" and in "180° position".

If the deviation of the distances is more than 1mm, the position of the sensor head must be adjusted. Adjust the sensor head towards the ball phantom's x-line until the distance is less than 0.5mm according to the instructions given in section "Adjusting the position of the sensor head" on page E-30. Correct only half of the deviation, so that the deviation will be the same in both the 180° and 0° positions.

Adjusting the position of the sensor head

The position of the sensor head can be slightly adjusted. Loosen the four screws that hold the sensor head in rotating unit and move the sensor head to required position.

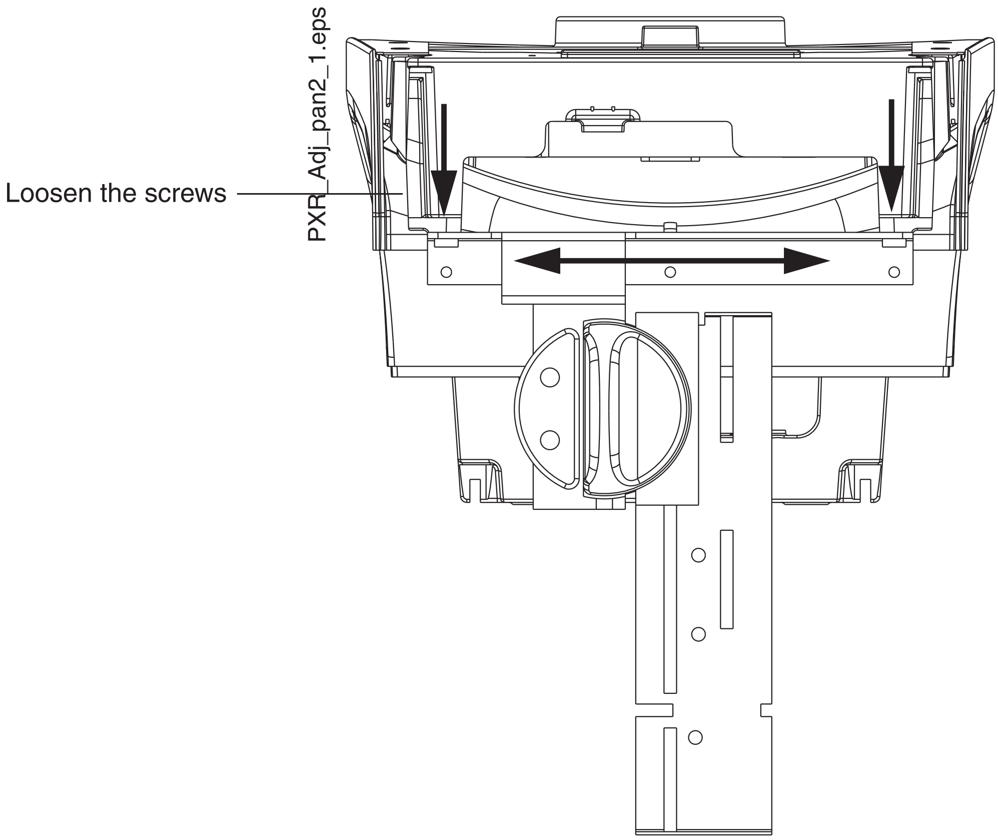


Figure 40

2.7 Calibration of angle sensors

To enter the calibration mode first touch the **i** field on the *Main* display. Select **Technical calibrations** from the list on the display. The password to the Technical calibrations mode is asked when the Technical calibrations mode is entered for the first time after switching the unit on. **The password is 1701.**

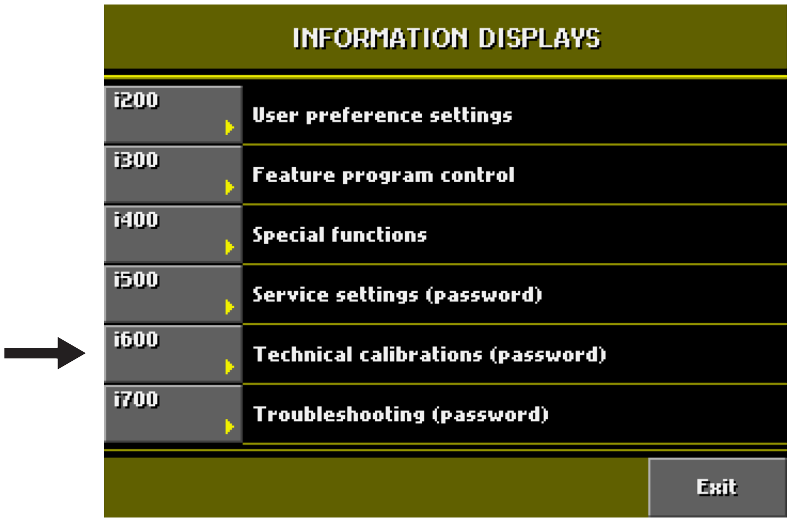


Figure 41

From the list on the *i600* display that appears select **Positioning calibration (i640)**.

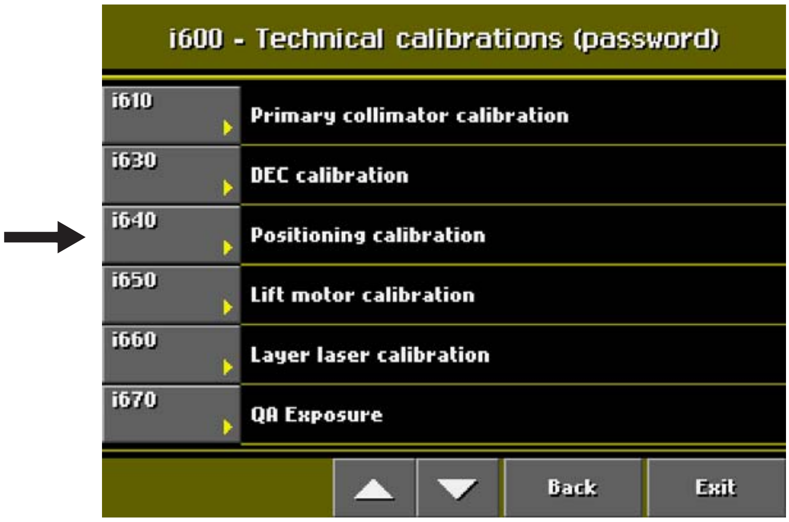


Figure 42

From the list on the *i640* display that appears select **Position sensor calibration (i64.1)**.

The display shown below appears. Drive the C-arm to the calibration position by touching the **Check** field. In case all the three arm angle sensors are correctly calibrated, three green arrows are shown on the display. A red arrow means that this angle sensor is not correctly calibrated.

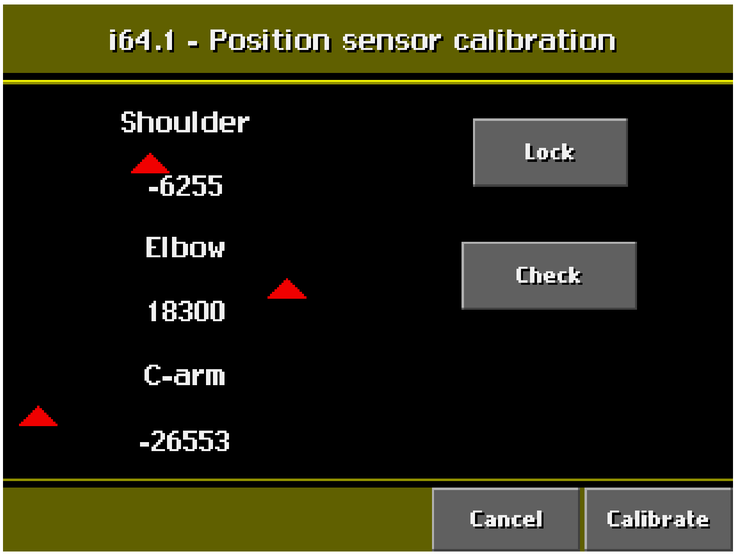


Figure 43

Remove the shoulder arm cover. Slide the alignment pin through the hole in the shoulder joint so that it goes into the positioning holes in the shoulder arm and column. Slide the other alignment pin through the hole in the elbow joint so that it goes into the positioning hole in the C-arm. The positions of the alignment pins are shown in Fig. 44 below.

Pin_3.eps

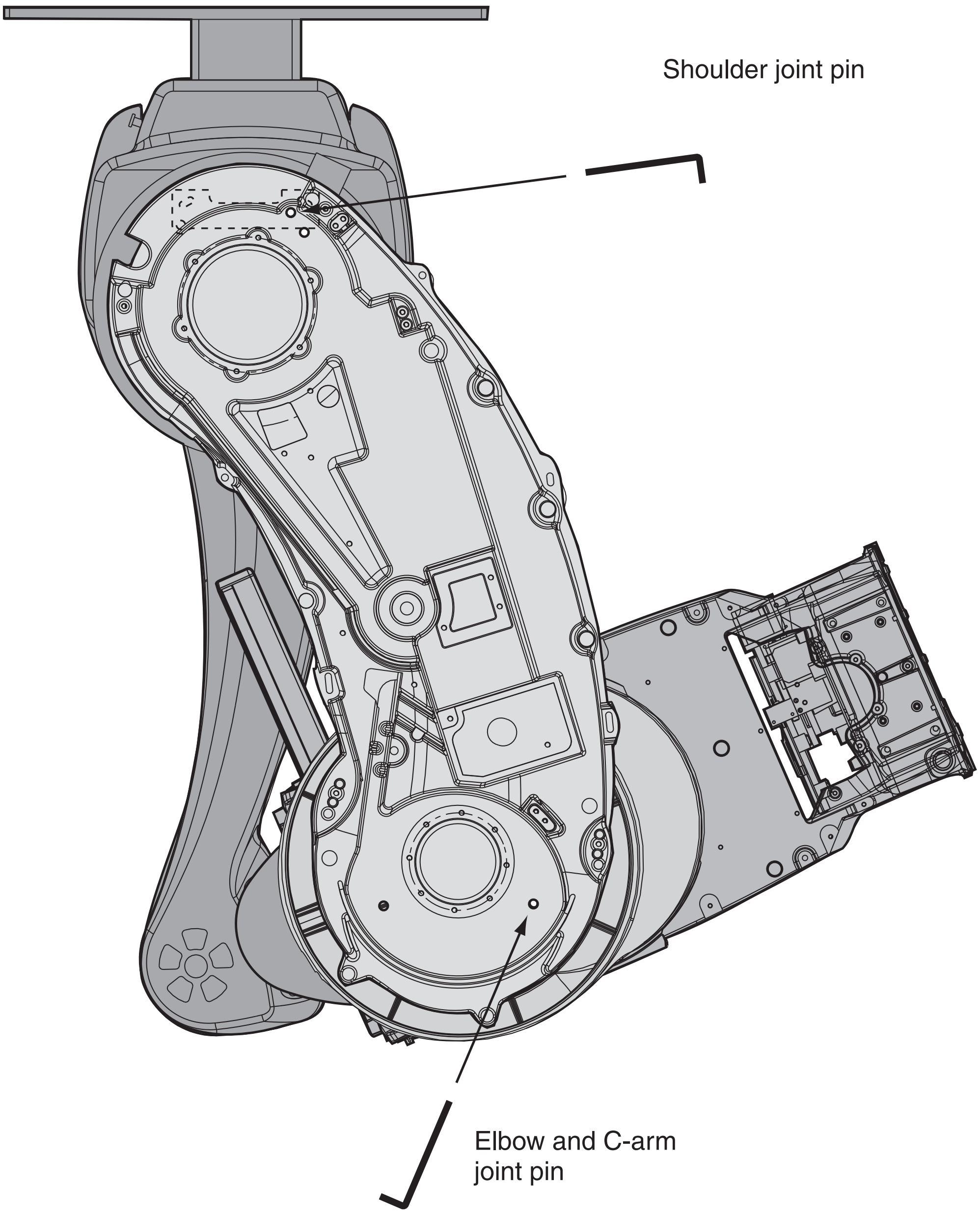
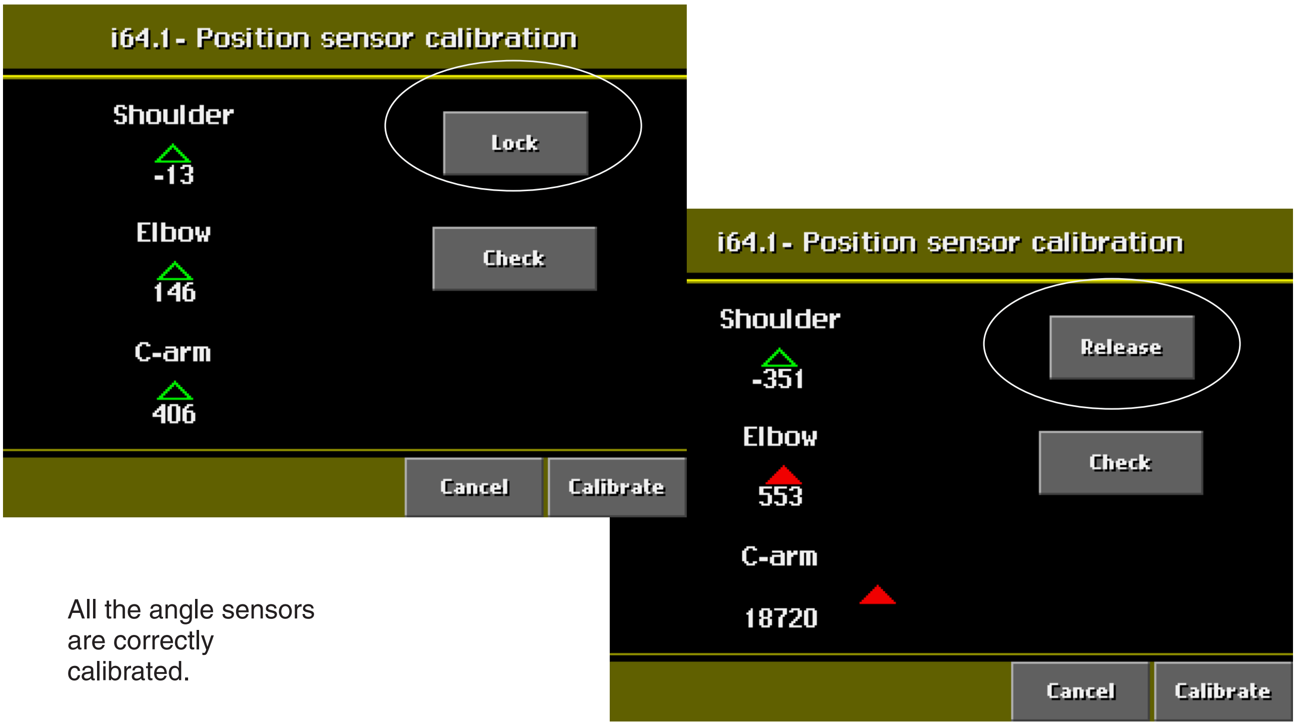


Figure 44 Positions of the alignment pins

In case the angle sensor(s) need to be adjusted, remove the inner cover of the C-arm, refer to section 5.4 “C-arm inner cover” on page E-81.

Adjust the angle sensor axle positions according to the instructions given in sections “Shoulder joint angle sensor” on page E-35, “Elbow joint angle sensor” on page E-36 and “C-arm angle sensor” on page E-37.

When there are three green arrows on the display indicating that all the angle sensors are correctly adjusted, lock the stepper motors by touching the **Lock** field. The text “Release” appears on the field. After locking the motors remove the alignment pins and calibrate the angle sensors by touching the **Calibrate** field.



All the angle sensors are correctly calibrated.

Figure 45

NOTE **If you want to release the motors, touch the Release field.**

Shoulder joint angle sensor

Loosen the attachment screw of shoulder joint angle sensor coupling with a 1.5mm Allen key (Fig. 46, arrow).

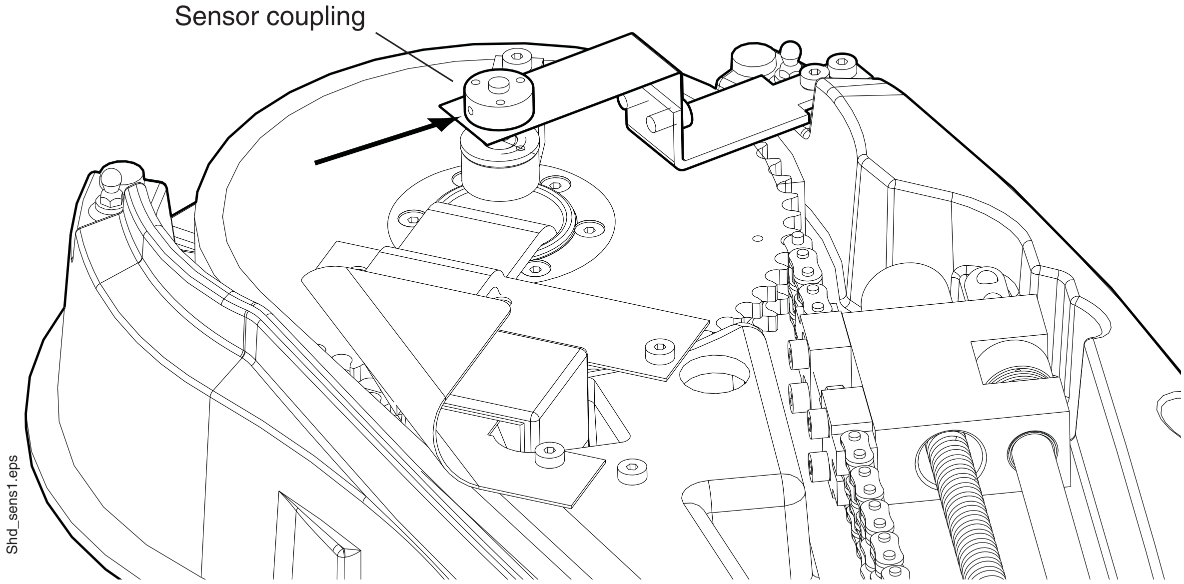


Figure 46

Lift the sensor coupling up and rotate the angle sensor axle until the empty arrow appears on the display.

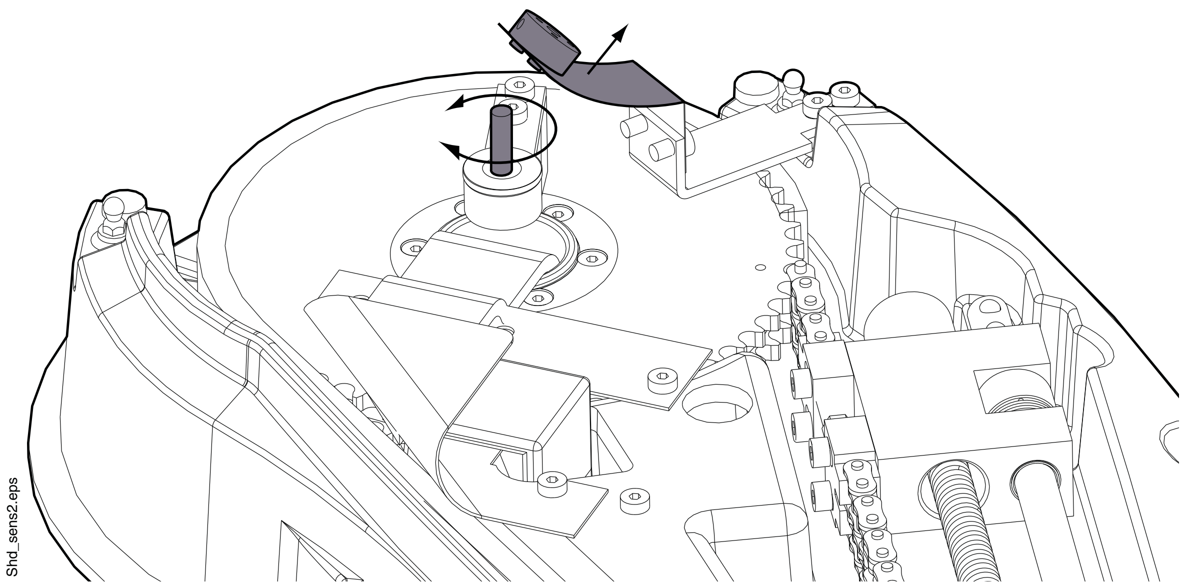


Figure 47

Replace the sensor coupling. **Note that the sensor coupling plate must not hit the sensor body.**

Elbow joint angle sensor

Loosen the attachment screw of the elbow joint angle sensor with a 2mm Allen key.

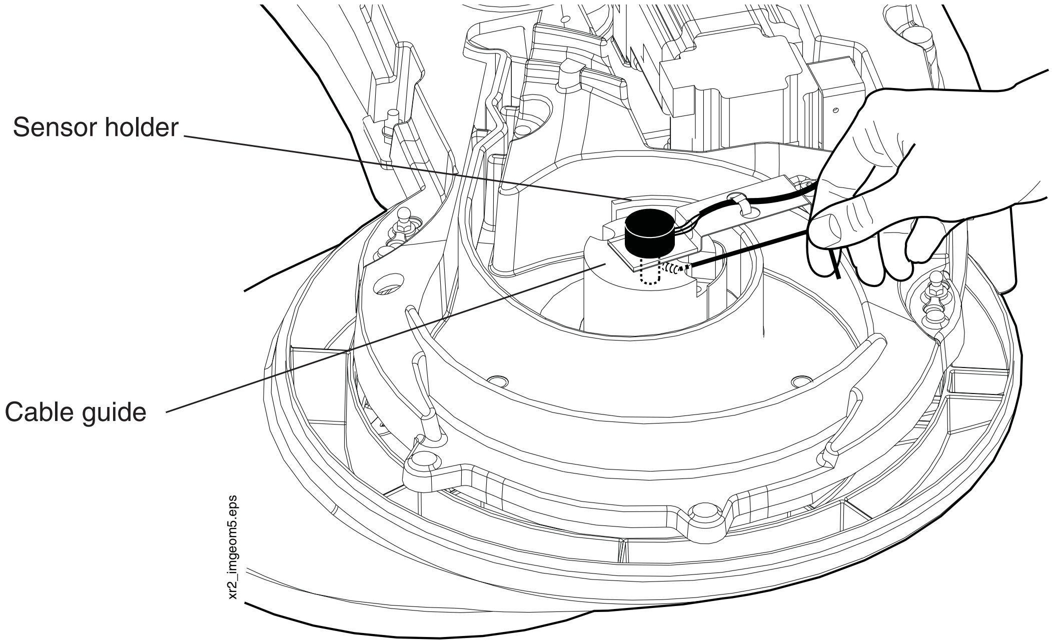


Figure 48

Lift the angle sensor assembly up from its position. Rotate the angle sensor axle until the empty arrow appears on the display. Replace the angle sensor to its position and check that the calibration mark remains on the display.

NOTE The sensor holder must not touch the cable guide.

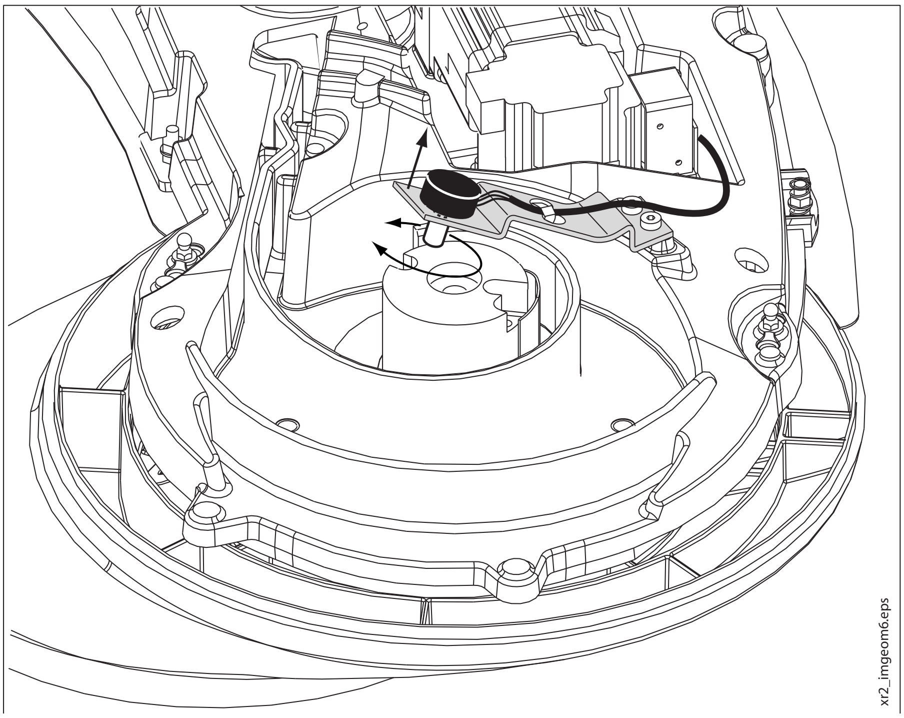


Figure 49

C-arm angle sensor

Loosen the attachment screw of C-arm angle sensor with a 2mm Allen key.

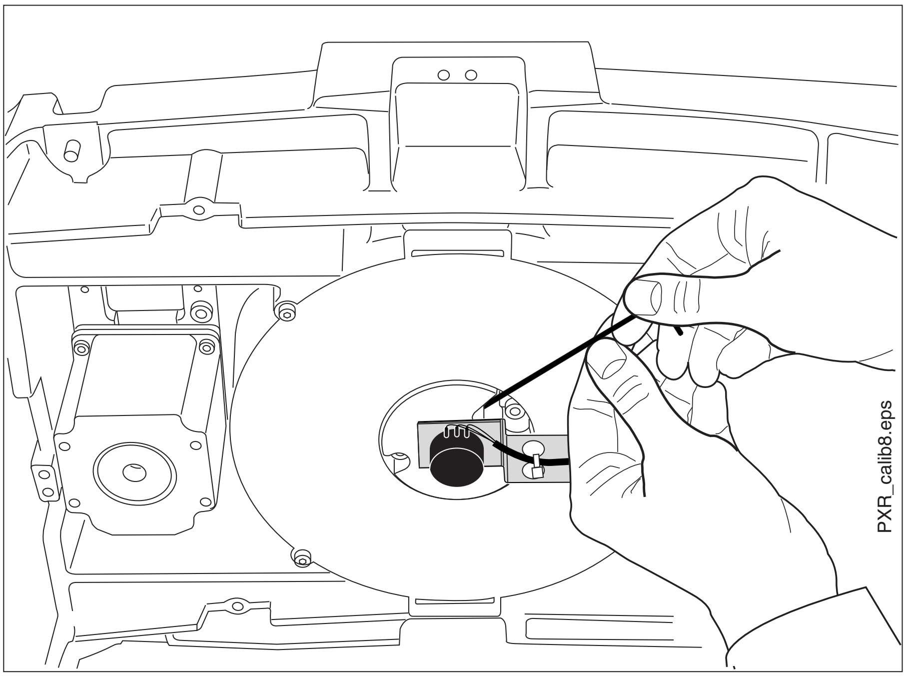


Figure 50

Lift the angle sensor assembly up from its position. Rotate the angle sensor axle until the empty arrow appears on the display. Replace the angle sensor to its position and check that the calibration mark remains on the display.

NOTE **The sensor holder must not touch the cable guide.**

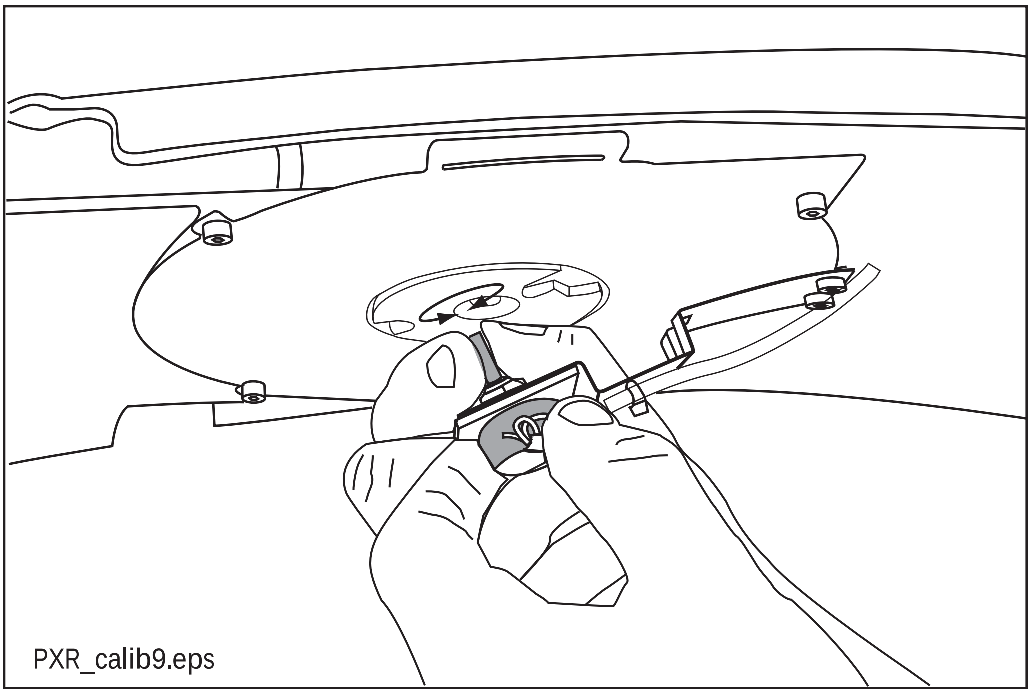


Figure 51

2.8 Beam check

Refer to the Planmeca Device Tool manual, publication number 10031558.

2.9 Taking a ball phantom exposure

NOTE Attach the ball phantom to the adapter on the patient support table.

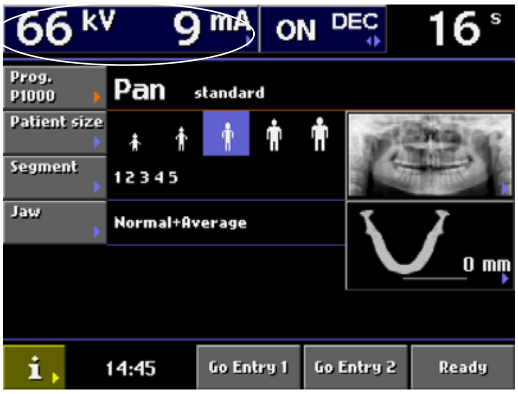
NOTE If the temple supports are in place, remove them before taking a ball phantom exposure.

Take a ball phantom exposure to check that the X-ray beam, the patient support table and the C-arm are correctly adjusted.

On the X-ray unit main display, select following settings:
- standard panoramic program
- full exposure area (no segmentation)
- small adult (third patient size symbol)

Selecting these settings will automatically change the exposure values to 66 kV and 9 mA. Manually set the exposure values to **60 kV** and **2 mA.**

Set exposure values to
60 kV / 2 mA



Layer position value

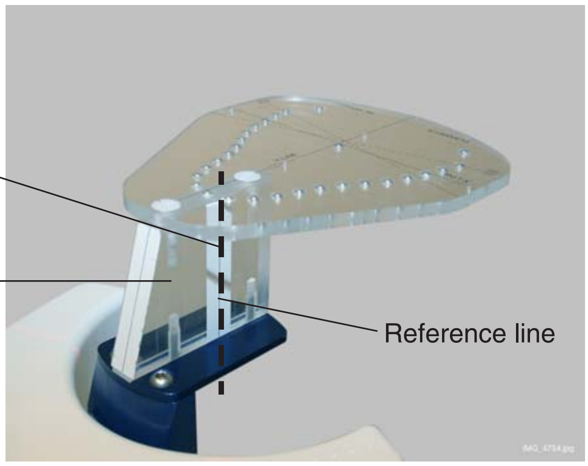
Figure 52

Using the thumb wheel on the underside of the patient support table, position the layer light so that the light beam hits the reference line on the ball phantom support plate. The three patient positioning lights will be automatically switched on.

NOTE The layer position value on the X-ray unit main display must be zero (0) as shown above when the layer light beam is positioned on the reference line. If this is not the case, you will have to calibrate the layer light on display i660. Refer to section 2.10 "Panoramic mode patient positioning lights" on page E-41 for details.

Layer light
beam

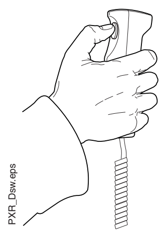
Ball phantom
support plate



Reference line

Figure 53

NOTE **Make sure that you have selected the panoramic exposure mode in the Romexis imaging program before you take a ball phantom exposure. Refer to the Romexis User's Manual.**



Take an exposure. Press and hold down the exposure button for the duration of the exposure.

CAUTION ***Radiation is generated when the exposure button is pressed. Protect yourself from radiation.***

An image showing 23 balls will appear in the Romexis window. **The balls must be round, all the same size and evenly spaced.** The image must be symmetrical (right side = left side). Note that the balls will not necessarily be at the same height.

Use the Romexis measuring tool to measure the distance from the center ball to the tenth ball on both sides. The **difference** between the two measurements **must not be greater than 3.2 mm.**

Additionally, the distance from the center of the front middle ball to the center of the rear middle ball must be **less than 1.6 mm**.

R L

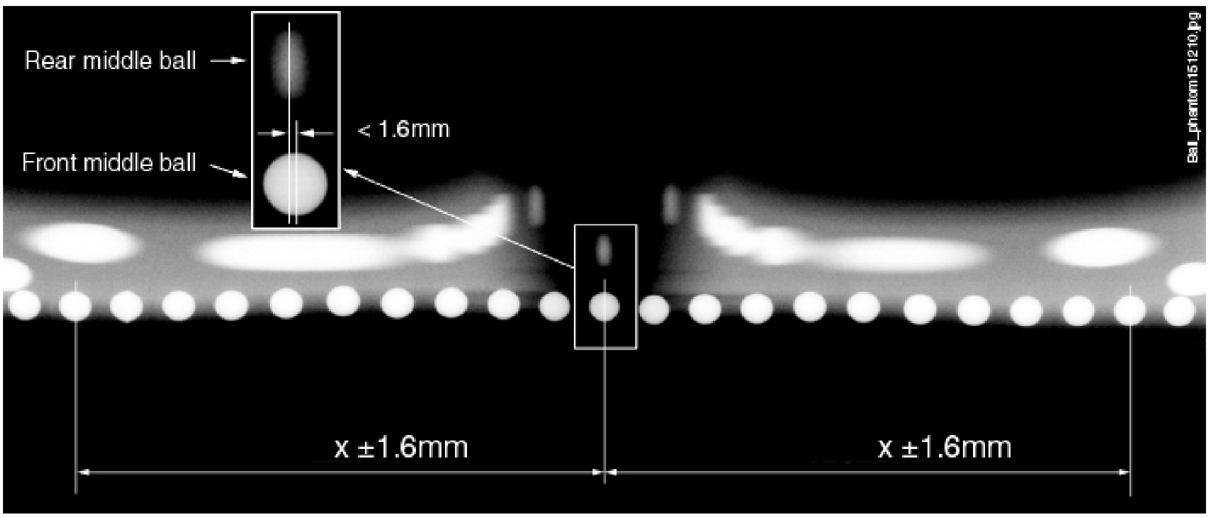


Figure 54

If this is not the case, you will have to check the position of the patient positioning mechanism and calibrate the angle sensors, refer to sections 2.6 “Patient positioning mechanism adjustment” on page E-19 and 2.7 “Calibration of angle sensors” on page E-31.

2.10 Panoramic mode patient positioning lights

Midsagittal plane positioning light

Checking the midsagittal plane positioning light

Attach the ball phantom to the patient positioning mechanism adapter.

Move the thumb wheel of the layer light slightly to switch the three patient positioning lights on. The layer light thumb wheel is located on the underside of the patient support table. The midsagittal light beam should strike the black line on the front of the ball phantom.

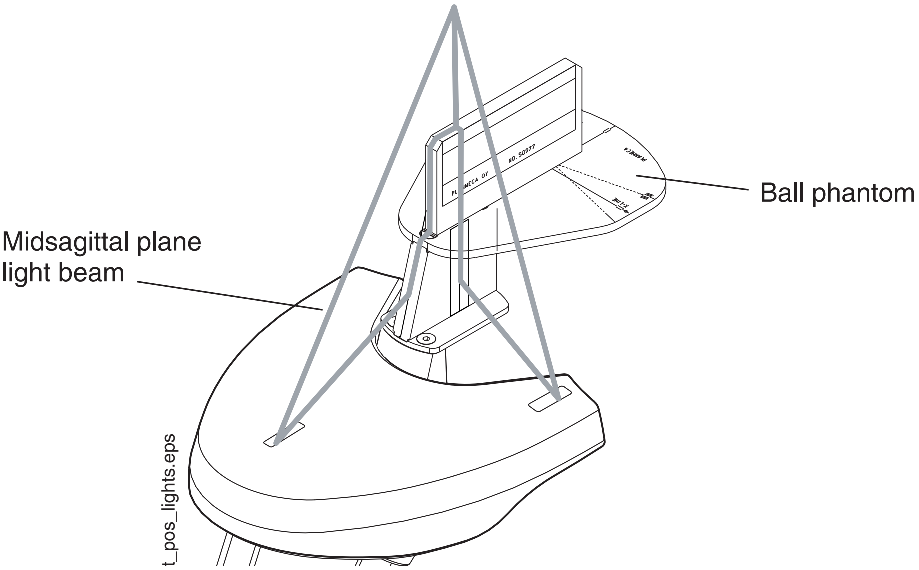


Figure 55

If the light beam does not coincide with the black line or it is not in focus, it must be adjusted according to the instructions below.

Midsagittal plane positioning light adjustment

Remove the patient support table cover according to the instructions given in section 2.1 “Patient support table cover” on page F-7.

Midsagittal plane positioning light

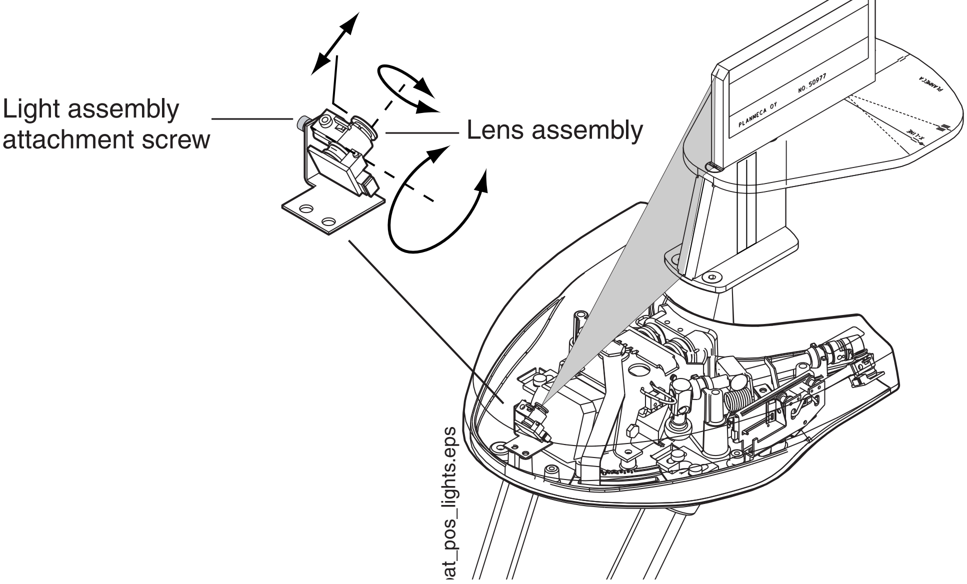


Figure 56

To adjust the light beam angle rotate the lens assembly of the light (Fig. 57, 1).

To adjust the light vertical position loosen the attachment screw of the laser light assembly and rotate the assembly (Fig. 57, 2).

To focus the light beam adjust the depth of the lens assembly (Fig. 57, 3).

To adjust the light beam horizontal position bend the light attachment plate (Fig. 57, 4).

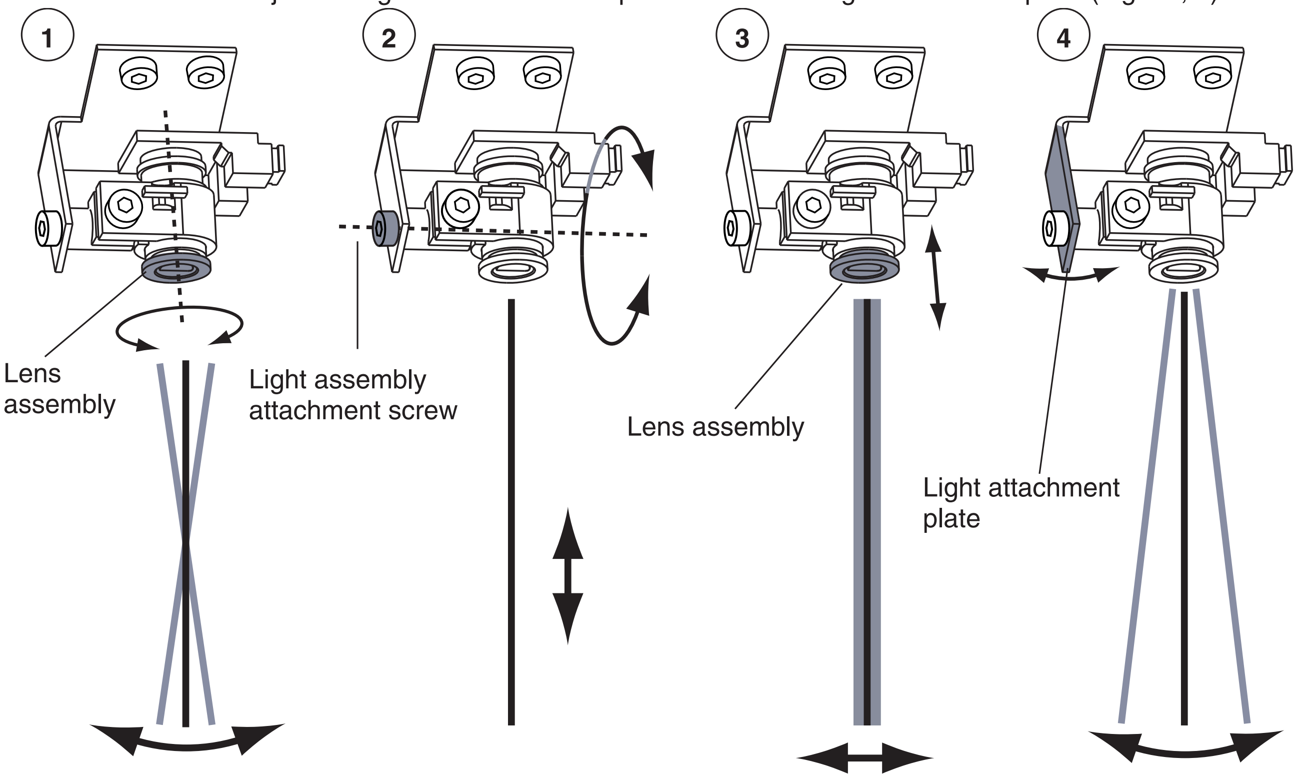


Figure 57

Layer light

Layer light calibration

To enter the calibration mode first touch the **i** field on the *Main* display.

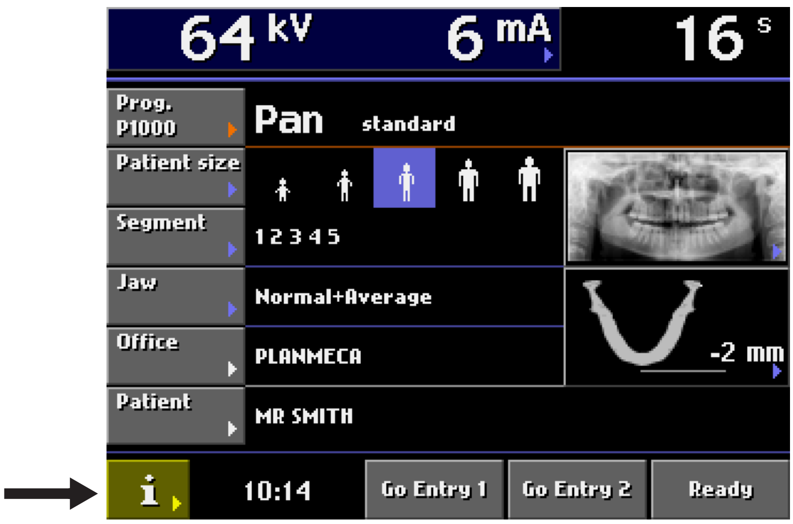


Figure 58

Select *Technical calibrations (i600)* from the list on the display. The password to the Technical calibrations mode is asked when the Technical calibrations mode is entered for the first time after switching the unit on. **The password is 1701.**

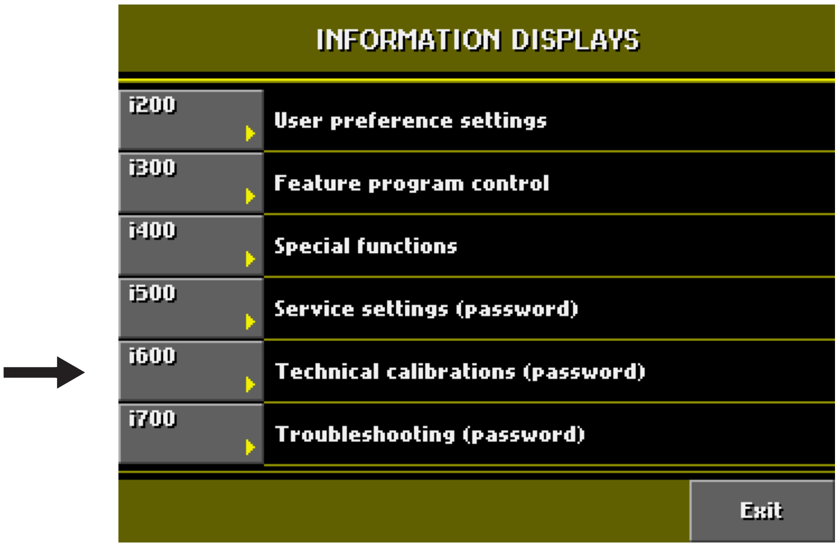


Figure 59

From the list on the *i600* display that appears select *Layer laser calibration (i660).*

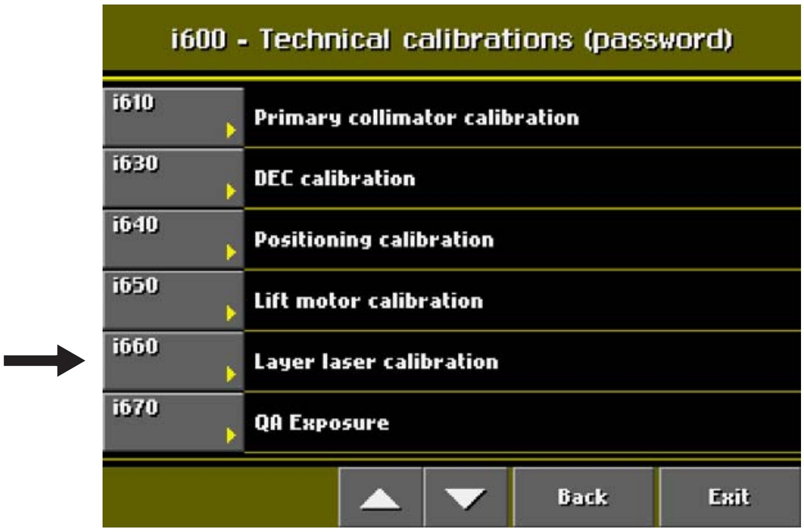


Figure 60

The *Layer laser calibration* display appears.

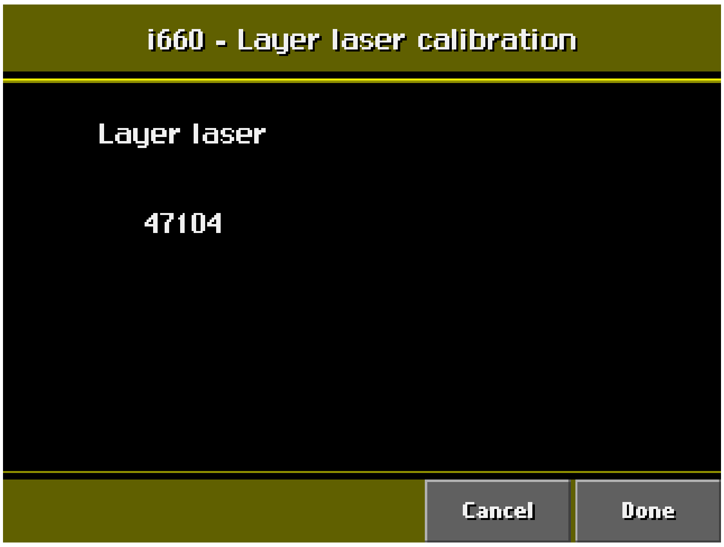


Figure 61

Move the thumb wheel of the layer light slightly to switch the three patient positioning lights on. The layer light thumb wheel is located on the underside of the patient support table. Move the layer light beam so that it is on the black reference line on the side of the ball phantom. Accept the new the layer light zero position and exit the calibration mode by touching the **Done** field.

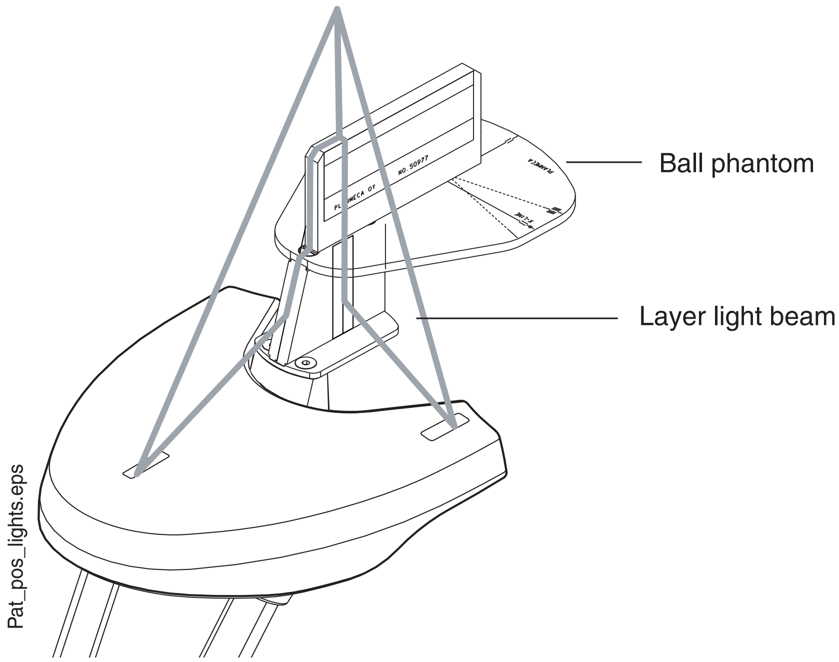


Figure 62

If the light beam is not vertical, or it is in focus, it must be adjusted according to the instructions on next page.

Layer light adjustment

Remove the patient support table cover according to the instructions given in section 2.1 “Patient support table cover” on page F-7.

To adjust the light vertical position loosen the attachment screw of the laser light assembly and rotate the assembly (Fig. 63, 1).

To focus the light beam adjust the depth of the lens assembly (Fig. 63, 2)

To adjust the light beam angle rotate the lens assembly of the light (Fig. 63, 3).

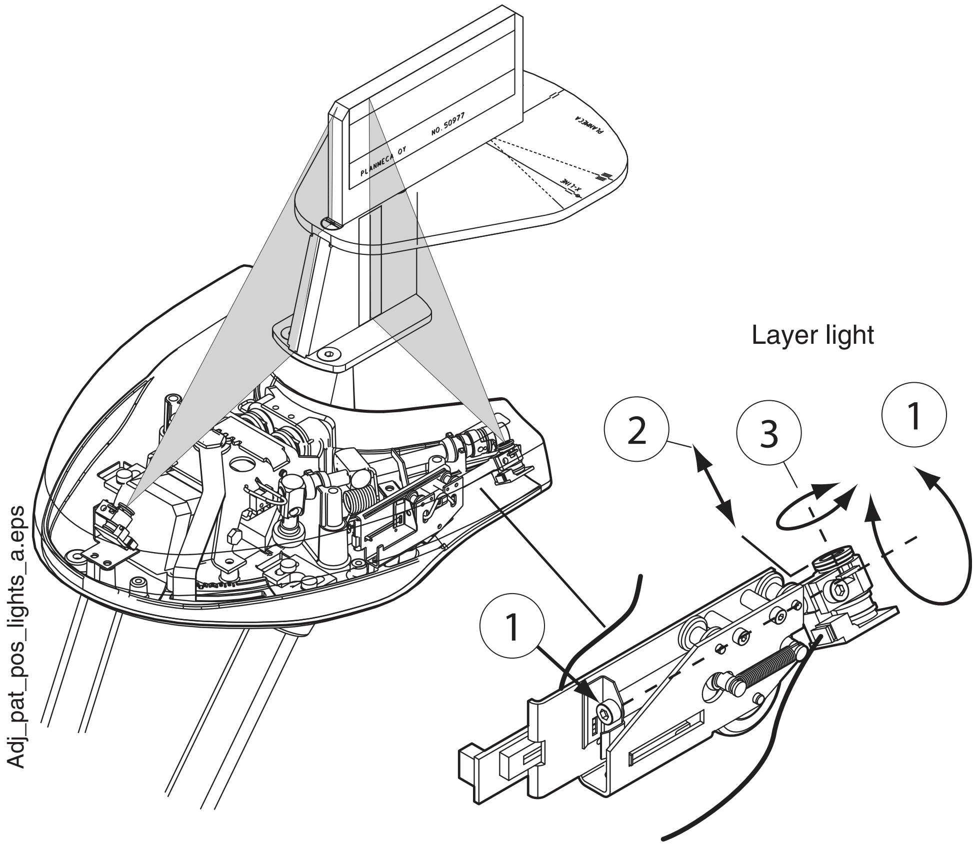


Figure 63

Frankfort plane positioning light

Checking the light

Attach the ball phantom to the patient positioning mechanism adapter and attach the Frankfort plane alignment tool (part number 50977) to the ball phantom.

Move the thumb wheel of the layer light slightly to switch the three patient positioning lights on. The layer light thumb wheel is located on the underside of the patient support table. The Frankfort plane light beam should be horizontal.

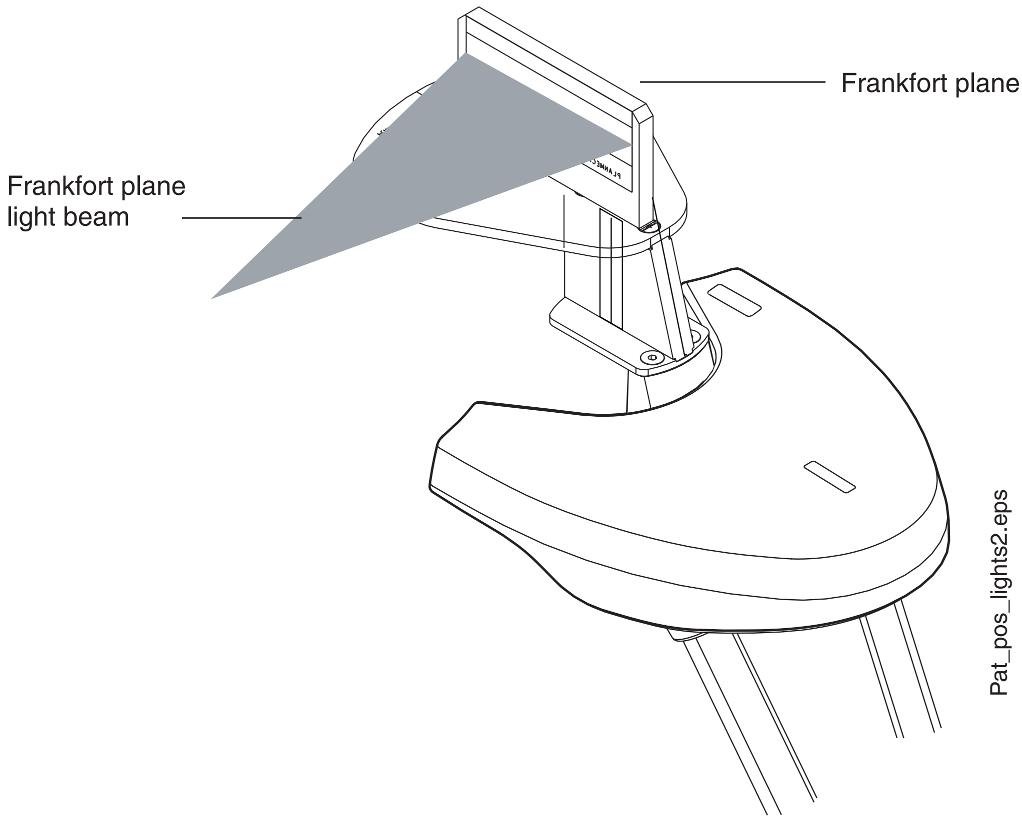


Figure 64

In case the light is not horizontal or not in focus, adjust the light according to the instructions given on next page.

Adjusting the Frankfort plane positioning light

Remove the front cover plate according to the instructions given in section 2.1 “Removing the telescopic column upper front panel” on page G-8.

To adjust the light horizontal position loosen the attachment screw of the laser light roller assembly (Fig. 65, 1). Rotate the assembly so that the light beam will come out from the column front cover opening. The horizontal position of the light can be fine-adjusted by moving the light assembly. Loosen the light assembly attachment screw (Fig. 65, 2) and rotate the assembly.

To adjust the light beam angle rotate the lens assembly of the light (Fig. 65, 3).

To focus the light beam adjust the depth of the lens assembly (Fig. 65, 4)

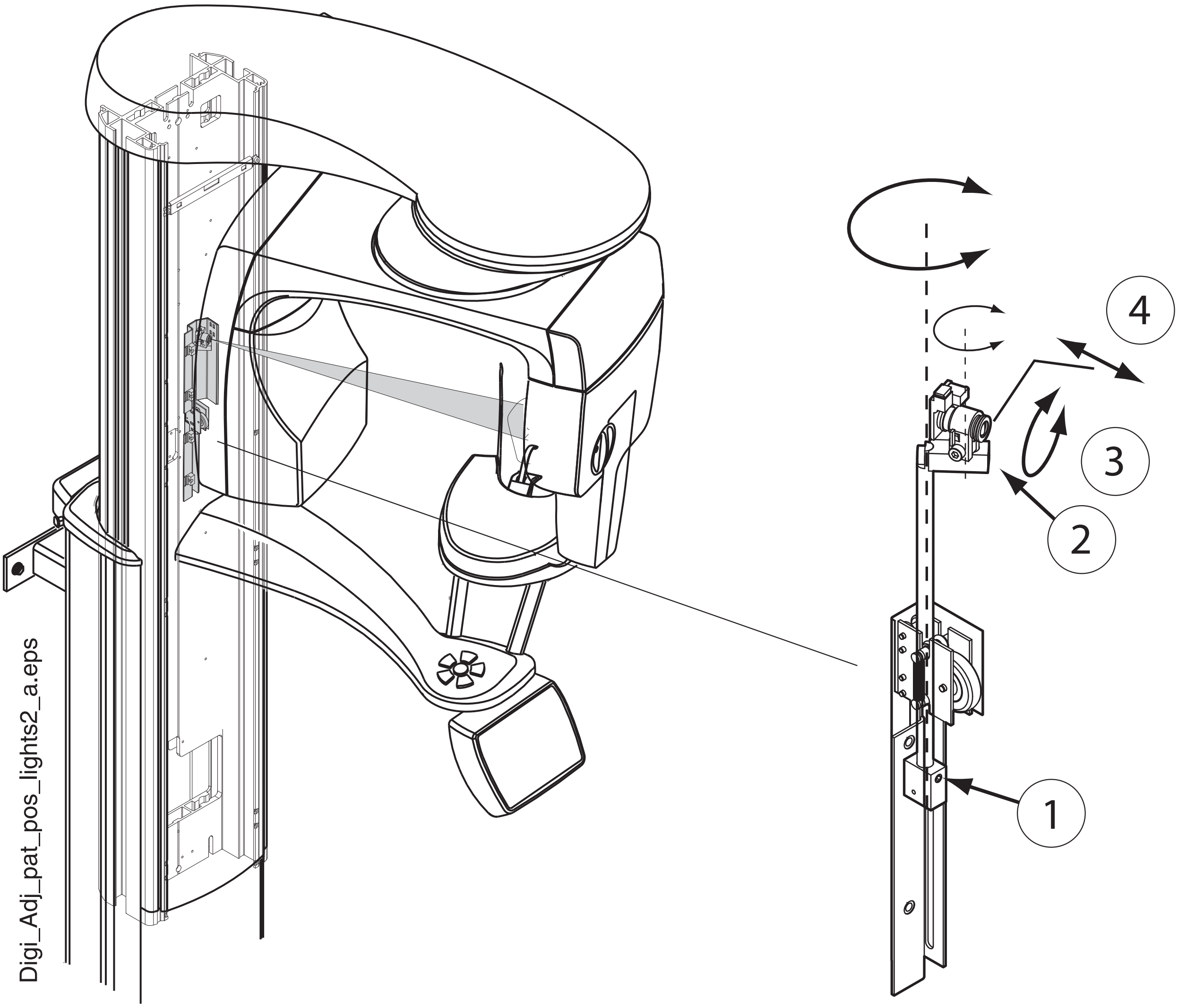


Figure 65

NOTE **The light beam must reach the rear end of the Frankfort plane alignment tool. Make sure that the light beam is not limited by the column front cover.**

2.11 Adjustment of tomo mode patient positioning lights

Select a linear tomography (tomo) exposure and then enter the calibration mode. To enter the calibration mode first touch the **i** field on the *Main* display. Select **Calibration** from the list on the display. The password to the calibration mode is asked when the Calibration mode is entered for the first time after switching the unit on. **The password is 1701.** Enter any of the calibration modes. The tomo mode patient positioning lights are now on and can be adjusted.

Slide the alignment pin through the hole in the shoulder joint so that it goes into the positioning holes in the shoulder arm and column. Slide the alignment pin through the hole in the elbow joint so that it goes into the positioning hole in the C-arm. The positions of the alignment pins are shown on the Fig. 66 below.

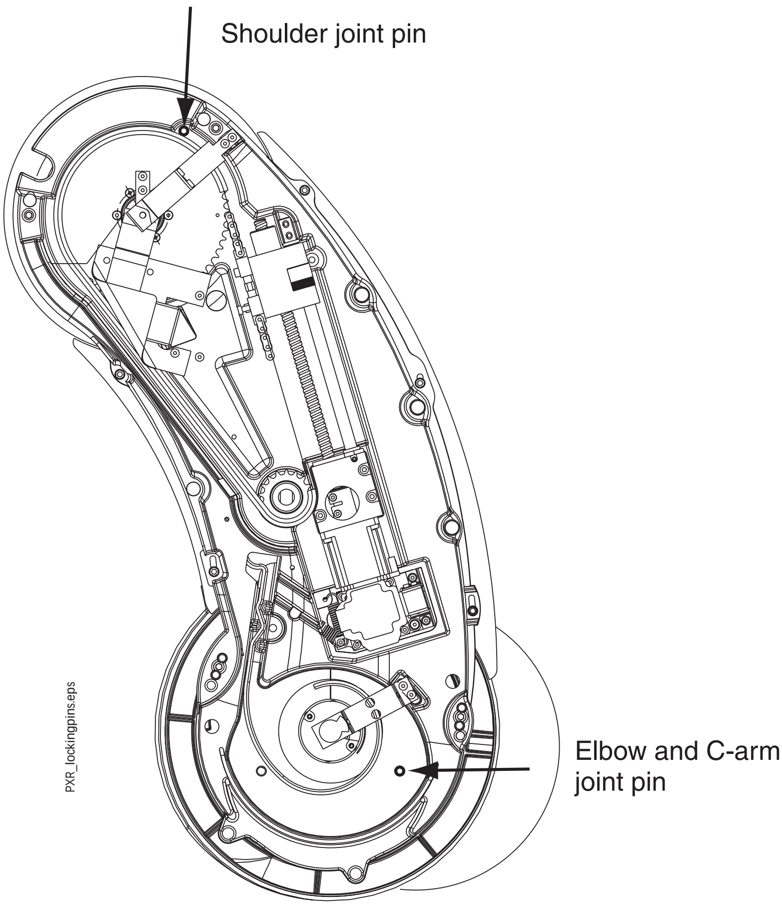


Figure 66

Slide the ball phantom into the patient positioning mechanism. Add masking tape, or respective, on the x- and y-lines of the ball phantom. You can mark the crossing points of the lights to the tape, and the light can be seen more clearly.

The lights 1 and 2 should coincide with the ball phantom x-line, and the light 3 should coincide with the y-line.

NOTE **The lights 1 and 2 must be exactly on the x-line, otherwise they deviate from each other. If you see two parallel lights, the lights must be adjusted, refer to section 2.11.1 “Positioning light adjustment” on page E-53.**

If the light beams do not coincide with the lines or if they are not in focus, they should be adjusted, refer to section 2.11.1 “Positioning light adjustment” on page E-53. When adjusting the lights 1 and 2, it might be useful to cover one light e.g. with tape, when adjusting the other.

Remove the C-arm inner cover according to the instructions given in section 5.4 “C-arm inner cover” on page E-81. Adjust the light.

After adjusting the lights mark the crossing point of the lights (Fig. 67; 1, 2 and 3) to the phantom.

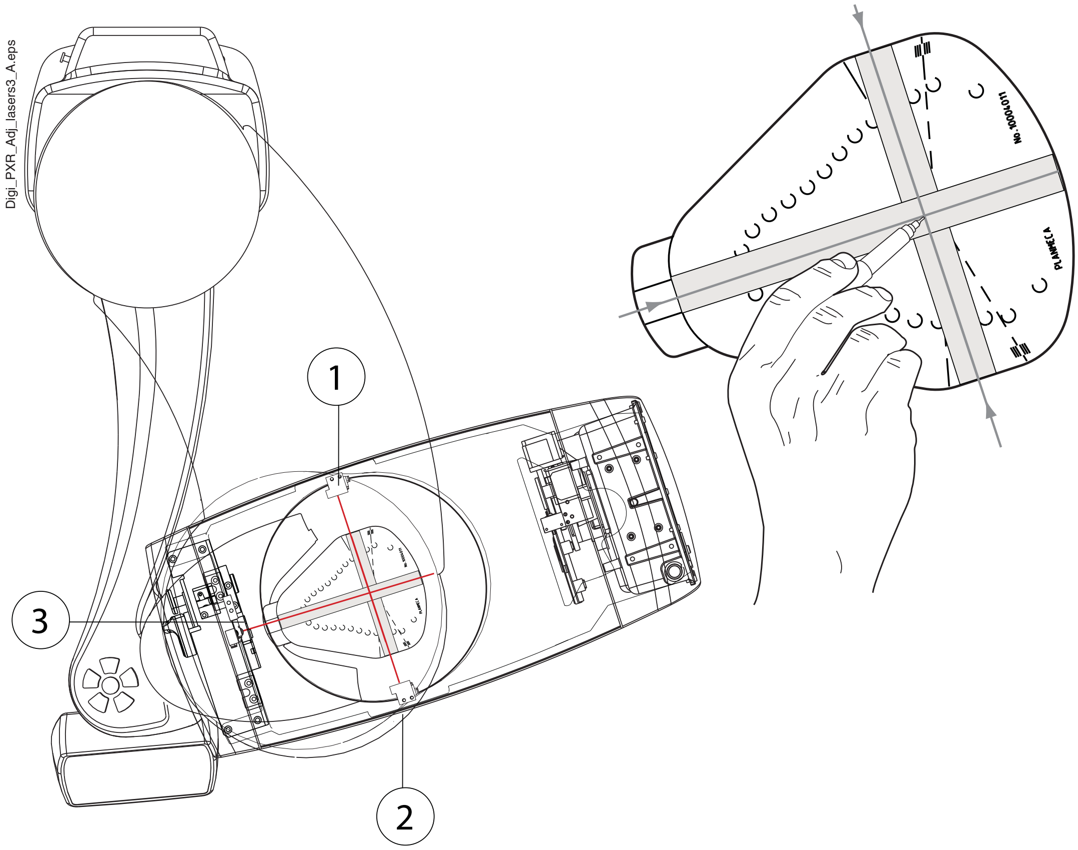


Figure 67

Remove the alignment pin from the elbow joint and rotate the C-arm 90° counterclockwise. Mark the crossing point (point a) of the lights (Fig. 68; 1, 2 and 3) to the phantom.

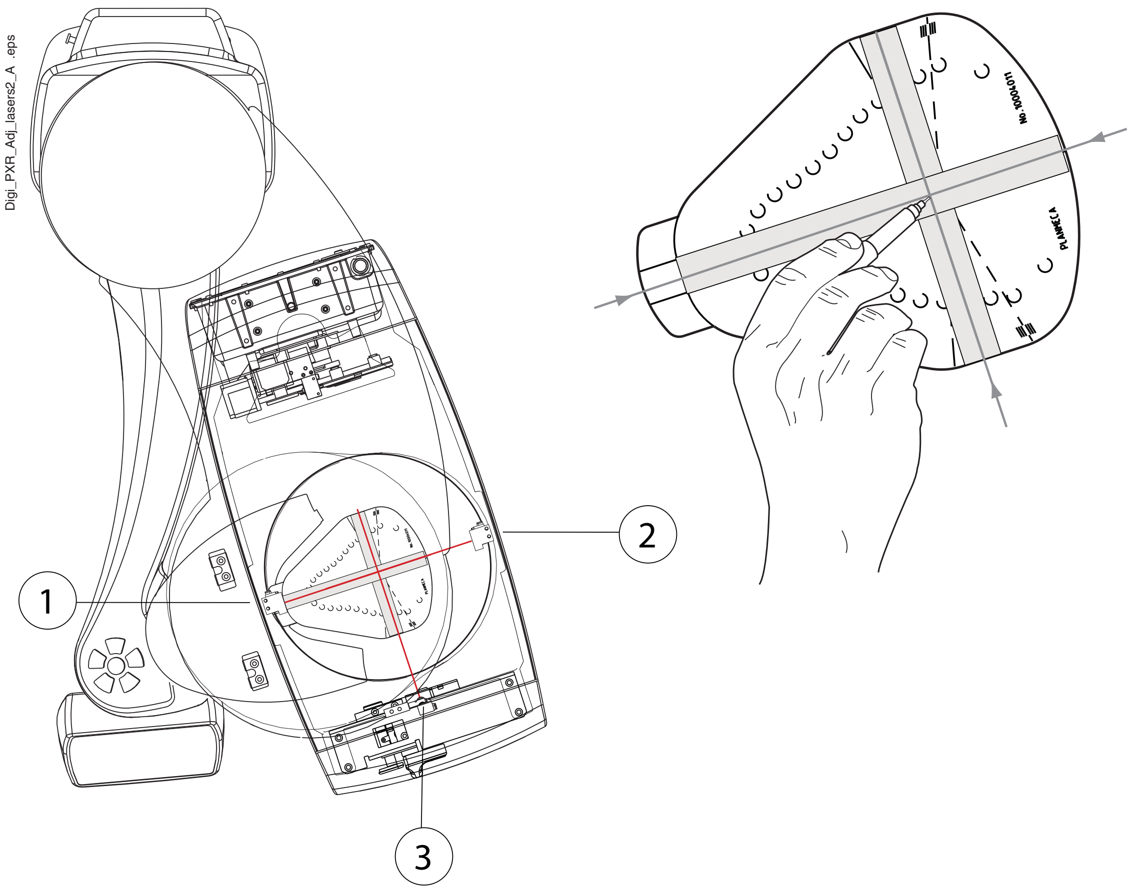


Figure 68

Rotate the C-arm 180° clockwise. Mark the crossing point (point b) of the lights (Fig. 69; 1,2 and 3) to the phantom.

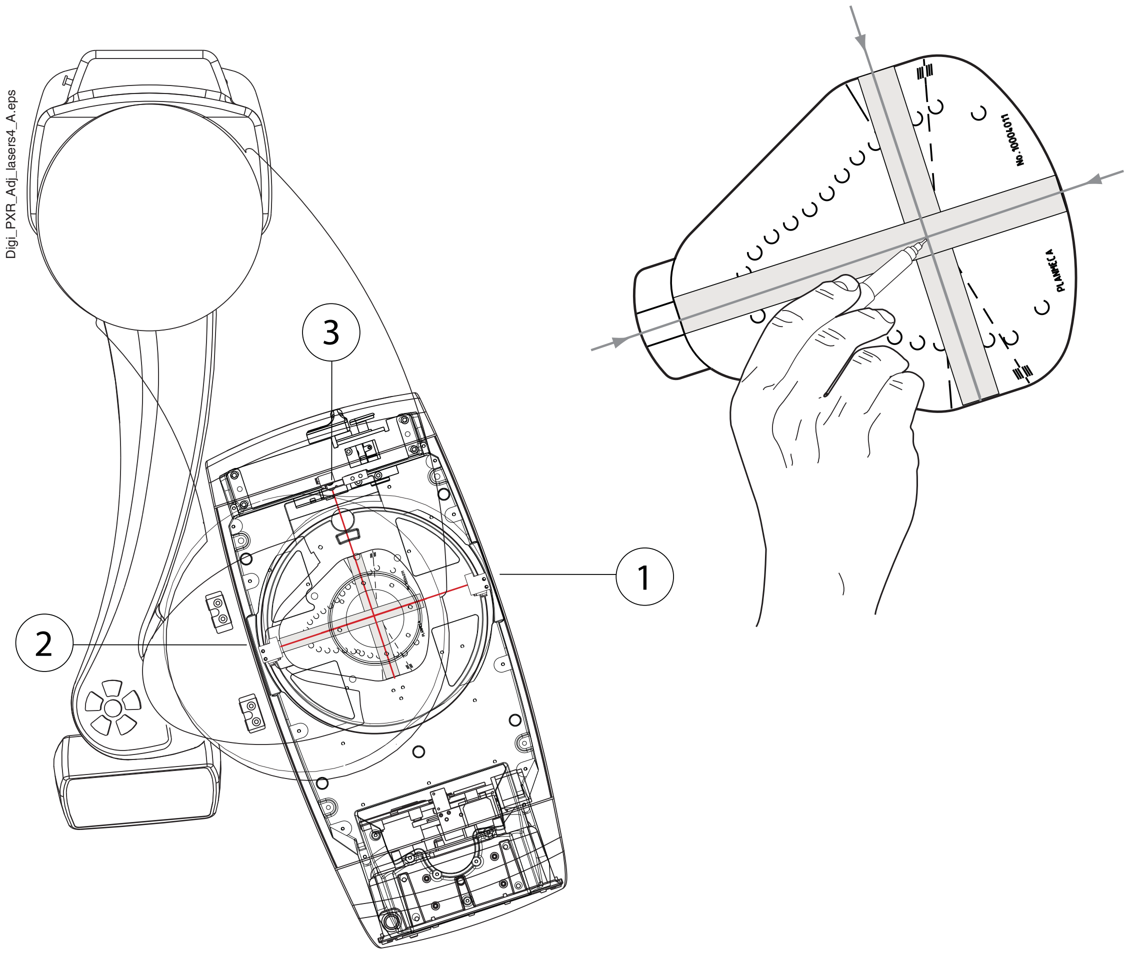


Figure 69

The real rotating centre is in the middle of the line between points a and b. This new crossing point must be inside the **±1mm limits** from the ball phantom x-line and y-line crossing point. If it is, adjust the lights to cross in this point.

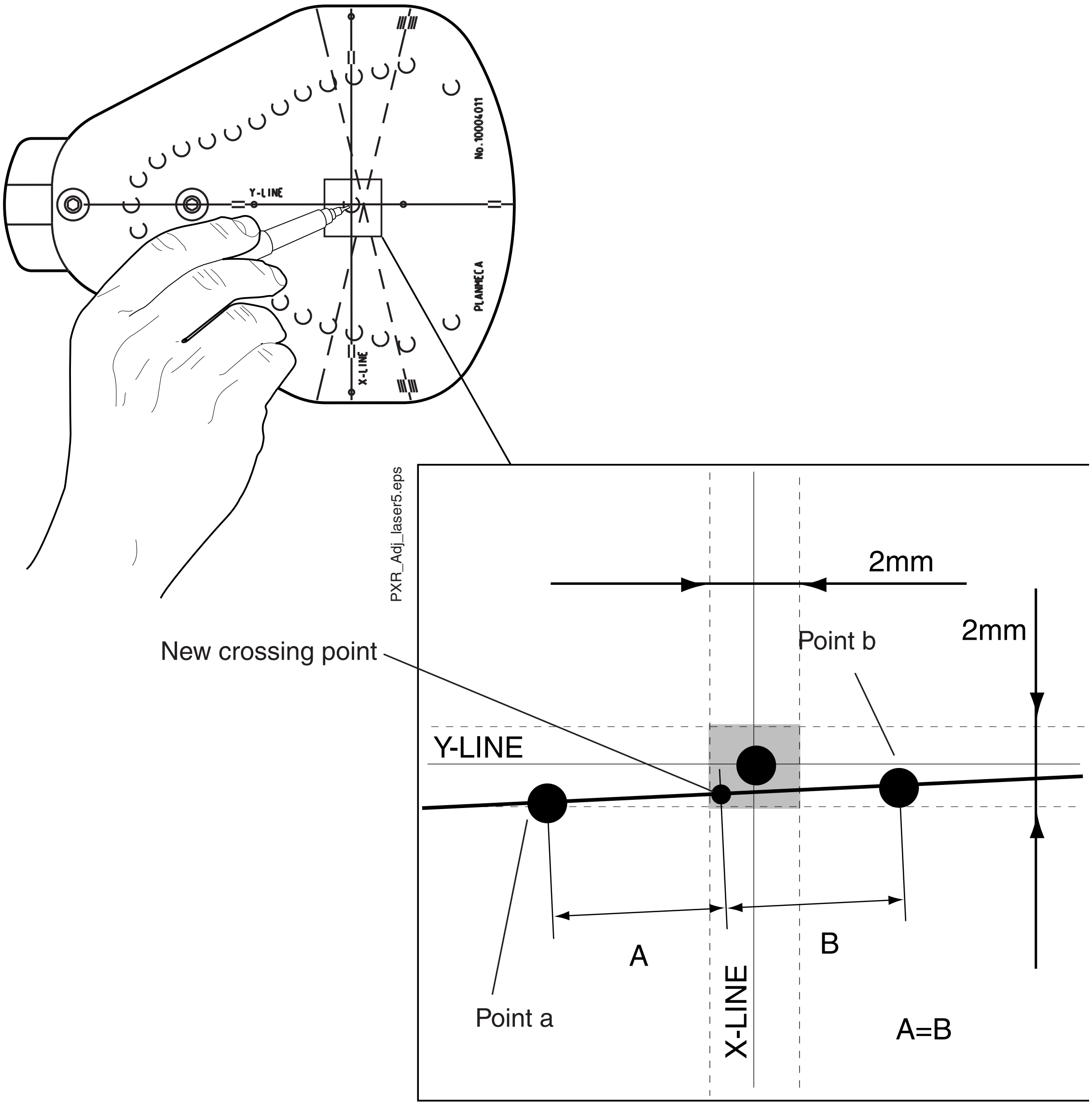


Figure 70

In case the new crossing point is not i**nside the ±1mm** limits from the ball phantom x-line and y-line crossing point, you must readjust the patient positioning mechanism, see section 2.6 “Patient positioning mechanism adjustment” on page E-19.

2.11.1 Positioning light adjustment

To adjust the light beam angle rotate the lens assembly of the light (Fig. 71, 1)

To adjust the light beam vertical position loosen the attachment screw of the laser light assembly and rotate the assembly (Fig. 71, 2).

To focus the light beam adjust the depth of the lens assembly (Fig. 71, 3).

To adjust the light beam horizontal position bend the light attachment plate (Fig. 71, 4).l

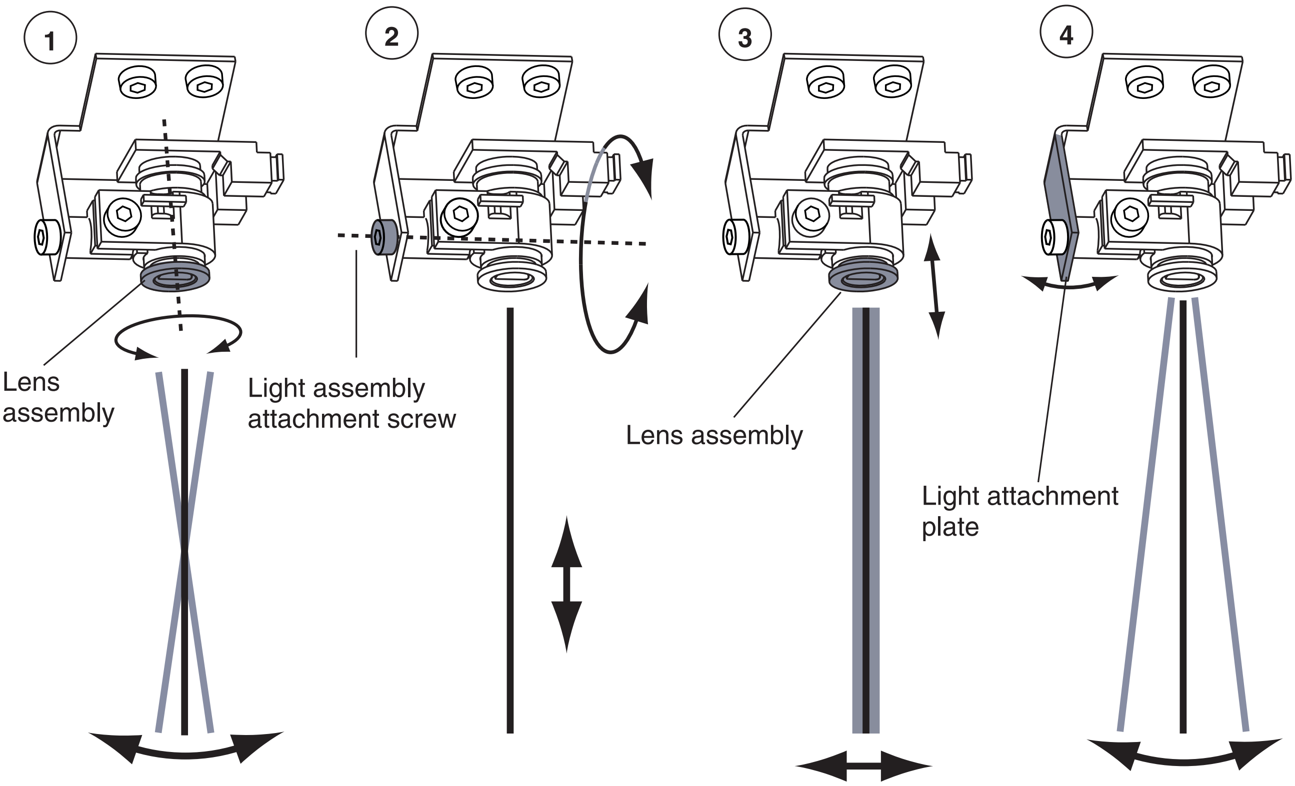


Figure 71

2.12 Calibrating panoramic sensor head

Refer to the Planmeca Device Tool manual, publication number 10031558.

2.13 X-ray unit with fixed primary collimator - primary collimator adjustment

NOTE **In case your X-ray unit is equipped with a multi primary collimator, adjust the primary collimator angle according to the instructions given in section 2.4 “Primary collimator angle adjustment” on page E-12, and adjust the panoramic beam according to the instructions given in section 2.5 “Panoramic beam adjustment” on page E-14.**

WARNING

Do not adjust the position of the primary collimator mechanism while X-rays are being generated. Check the beam position, adjust the position with the X-rays switched off and then recheck the position. If the beam is still misaligned, repeat the procedure.

Select kilovolt and milliampere values high enough to enable the radiation beam to be seen in the darkened room. The actual values depend on how dark the room is.

To enter the calibration mode, first touch the **i** field on the *Main* display. Select **Technical calibrations (i600)** from the list on the display. The password to the Technical calibrations mode is asked when the Technical calibrations mode is entered for the first time after switching the unit on. **The password is 1701.**

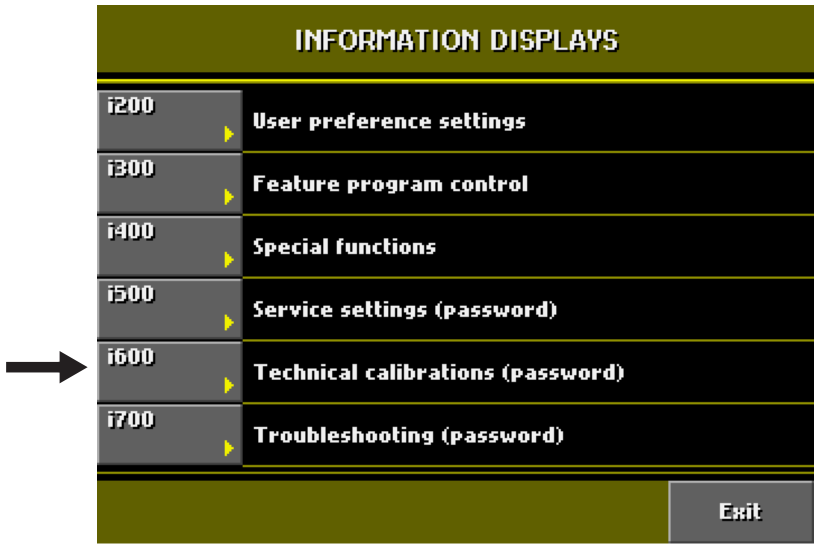


Figure 72

From the list on the *i600* display that appears select **Primary collimator calibration (i610)**.

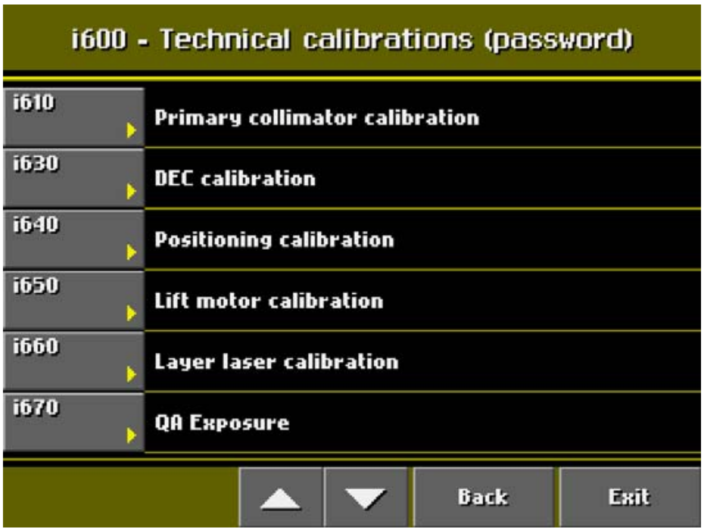


Figure 73

From the list on the *i610* display that appears select **Pan mode X-collimator calibration (i61.1)**. The radiation beam from the collimator can now be checked without the rotating unit moving.

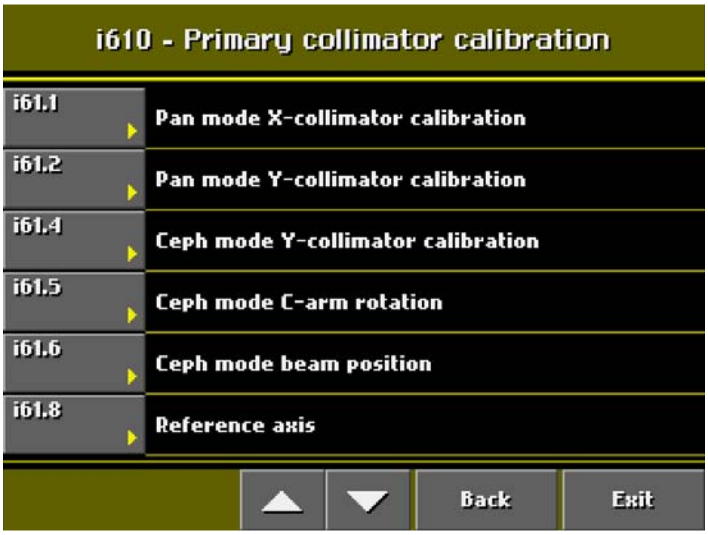


Figure 74

Manually position the C-arm to a convenient position for viewing the sensor head. Place the beam alignment tool to the sensor head alignment tool **upside down**.

Darken the room sufficiently so that you will be able to see the image of the radiation beam on the alignment tool (it is fluorescent and glows when the radiation beam strikes it), but not so dark that you cannot see the borders of the alignment rectangle.

2.13.1 Fixed primary collimator: Adjusting the primary collimator angle

In case the beam is not vertical, the primary collimator can be rotated. Unscrew the three M4x12 DIN 912 screws of the vertical adjustment frame with the 3mm Allen key and remove the frame with the primary collimator plate from its position.

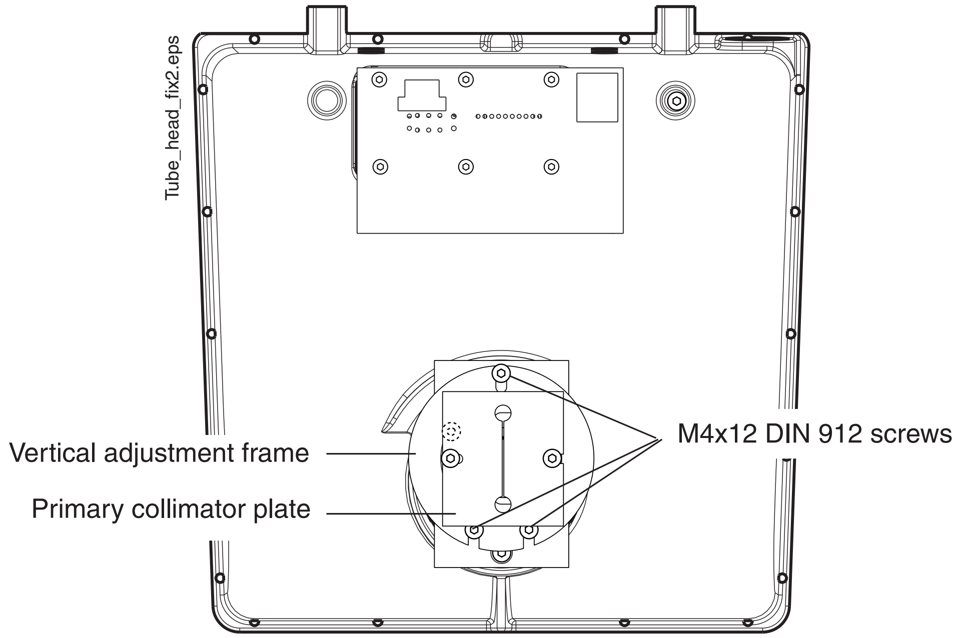


Figure 75

Loosen the two M4x12 DIN 912 screws with the 3mm Allen key and rotate the mechanism until the beam is correctly positioned (Fig. 76, 1). Tighten the screws, attach the vertical adjustment frame with the primary collimator plate to its position and check the beam. Repeat the procedure described above until the beam is correctly positioned.

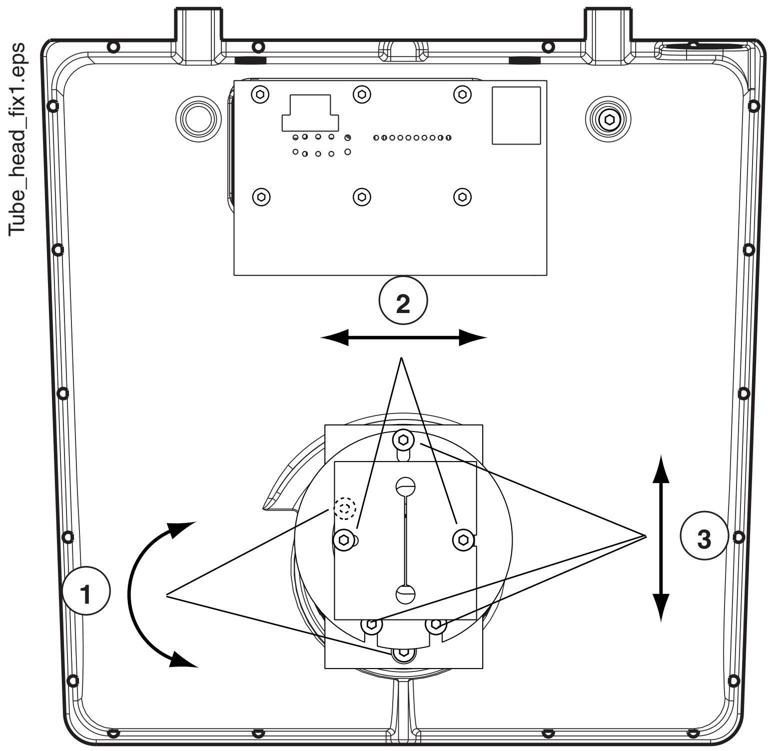


Figure 76

2.13.2 Fixed primary collimator: Panoramic beam horizontal position

If the X-ray beam is too far to the left or right of the alignment rectangle, it must be centered. Loosen the two M3x10 ISO 7380 screws that hold the primary collimator plate in position with the 2mm Allen key and move the plate until the beam is correctly positioned (Fig. 76, 2). Tighten the screws and recheck the beam. Repeat the above procedure until the beam is correctly positioned.

2.13.3 Fixed primary collimator: Panoramic beam vertical position

If the X-ray beam is too low or too high, the vertical position of the beam must be adjusted. Loosen the three M4x12 DIN 912 screws that hold the vertical adjustment frame in position with the 3mm Allen key and move the frame until the beam is correctly positioned (Fig. 76, 3). Tighten the screws and recheck the beam. Repeat the procedure described above until the beam is correctly positioned.

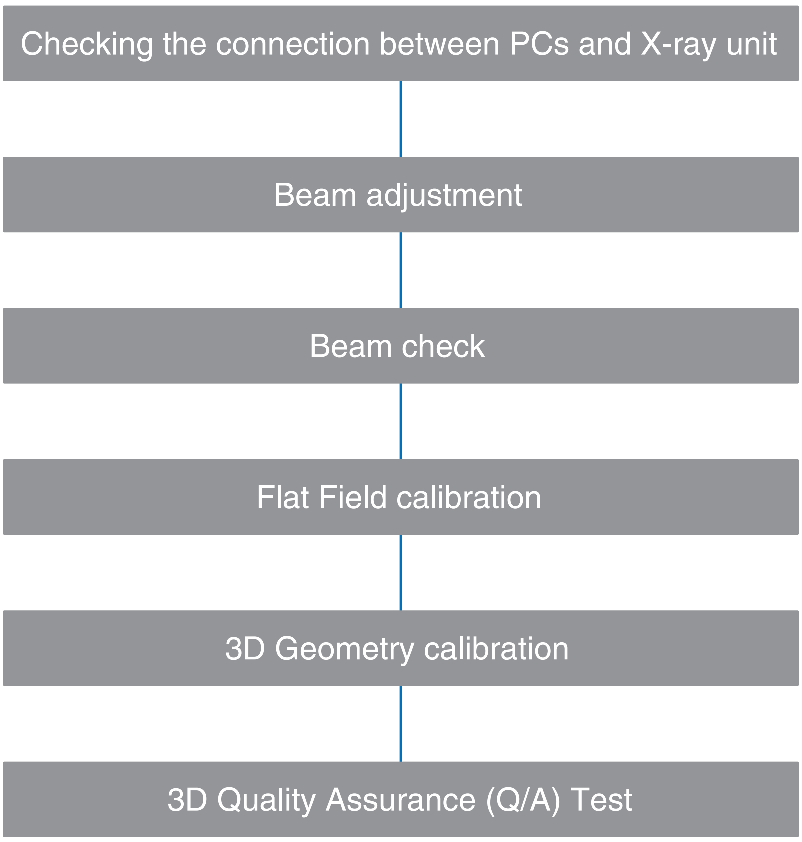
3 PROMAX 3D: ADJUSTMENTS & CALIBRATIONS

3.1 Adjustment procedure

NOTE **The panoramic checks and adjustments must be performed BEFORE 3D adjustments:**

NOTE **Some steps are described in Planmeca Device tool manual, publication number 10031558.**

PROMAX 3D: ADJUSTMENTS & CALIBRATIONS



NOTE **If the X-ray unit is equipped with SmartPan, perform also the SmartPan checks and adjustments: 3.3 “Beam adjustment” on page E-62 (SmartPan mode), 3.4.2 “SmartPan beam check (for 3DV2 / 3D s sensors only)” on page E-80, 3.4.2 “SmartPan beam check (for 3DV2 / 3D s sensors only)” on page E-80, 3.5.2 “SmartPan Flat Field calibration (for 3D V2 / 3D s sensors only)” on page E-88 and 2.9 “Taking a ball phantom exposure” on page E-39.**

NOTE There are three versions of the sensor: 3D version 1 (V1), 3D version 2 (V2) and 3D s. The 3D sensor has a larger active area than the 3D s sensor. The 3D version 1 (V1) sensor has no cooling grille.
Make sure that you have selected the correct 3D sensor on display i57.2, see section 5.7.3 "Select 3D sensor type" on page B-33.

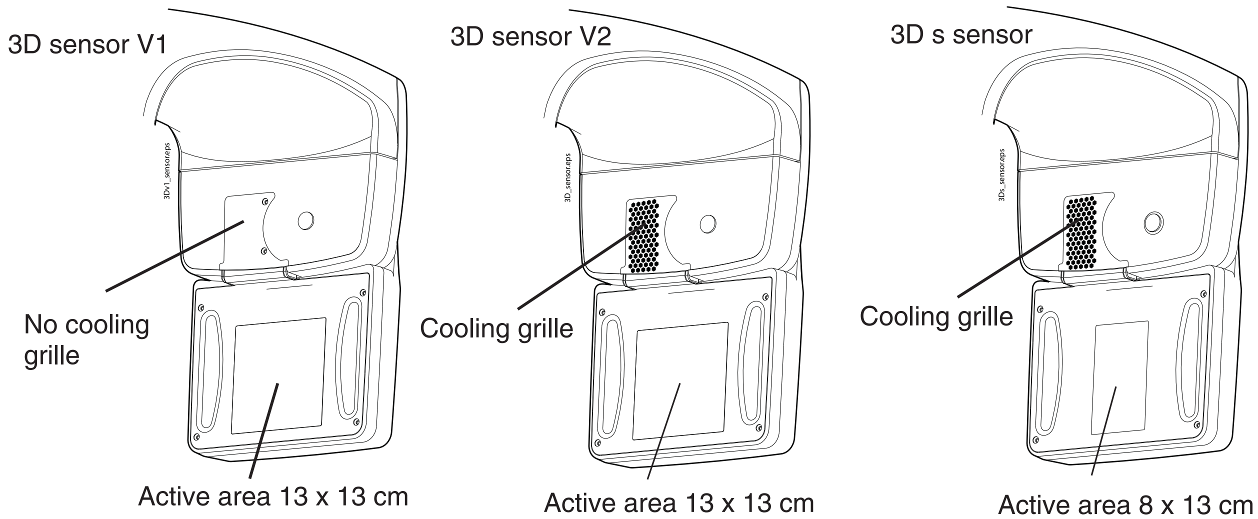


Figure 77

3.2 Checking the connection between PCs and X-ray unit

Switch on the ProMax X-ray unit, Romexis PC and the Reconstruction PC.

ProMax checks

- Check that the Ethernet LINK LED on the Ethernet PCB is on.
- Check that you can ping the ProMax IP address from the Romexis PC to verify that the TCP/IP connection works (executing the command "**ping <ProMax IP address>**", e.g. **ping 192.168.0.130,** see below).

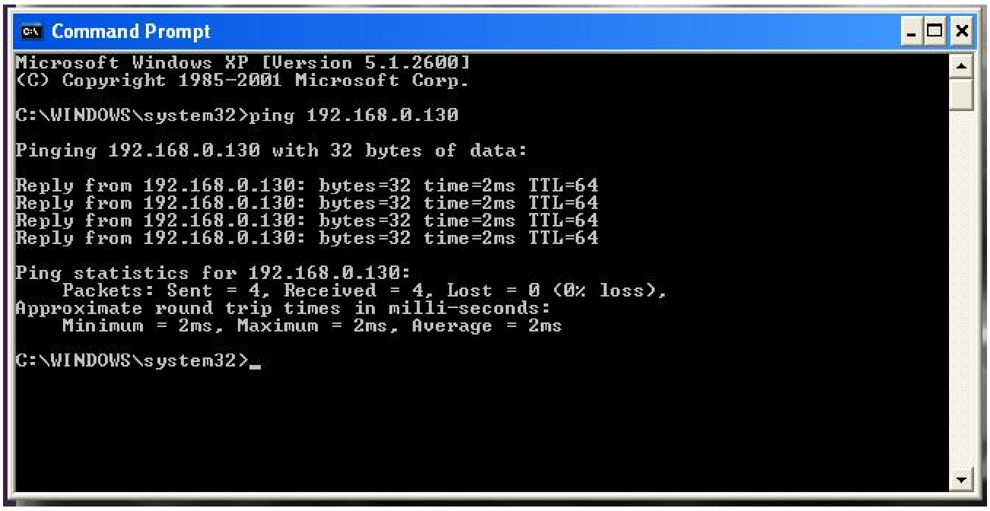


Figure 78

The ProMax sends a **Reply** packet in case the Ethernet link is up and running.

Reconstruction PC checks

- Check that you can ping the Reconstruction PC IP address from the Romexis PC to verify that the TCP/IP connection works.

Connections

- When the Romexis program is ready for the exposure and the ProMax X-ray unit is in Ready state check that:
  - The 3D sensor head indicator light is on.
  - The Ethernet and Sensor ACT LEDs on the Ethernet PCB are blinking.
  - The Sensor LINK LED on the Ethernet PCB is blinking.
- Check that you can ping the ProMax 3D sensor IP address from the Romexis PC when the 3D sensor head indicator light is on.

3.3 Beam adjustment

Select the standard 3D exposure program on the control panel of the X-ray unit.

To be able to check the radiation beam position without the C-arm moving enter the 3D collimator calibration mode as explained below.

Beam vertical position

If the X-ray beam is too low or too high, the vertical position of the beam must be adjusted.

Select **Primary collimator calibration (i610)** from the display that appears when you select **Technical calibrations**.

Depending on the sensor you are using, select **3D or 3D s mode Y-collimator calibration (i61.11 or i61.13)** from the list.

The position of the X-ray beam can now be checked without the C-arm moving.

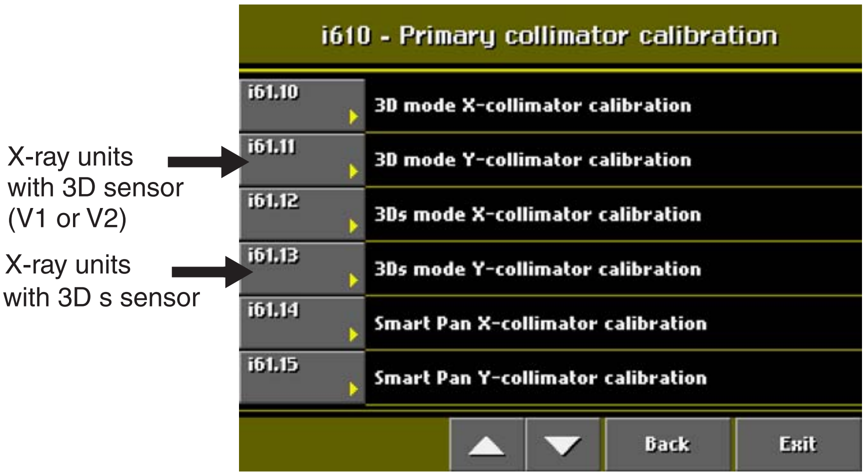


Figure 79

The corresponding Y-collimator calibration (i61.11 or i61.13) display will appear. The vertical position of the X-ray beam is adjusted in this mode.

Remove the sensor head from the quick connector mechanism. Attach the sensor head alignment tool to the connector as shown in Fig. 80.

Manually position the C-arm to a convenient position for viewing the sensor head alignment tool.

Place the beam alignment tool on the sensor head alignment tool **upside down** as shown in Fig. 80. Slide the beam alignment tool as down as it goes.

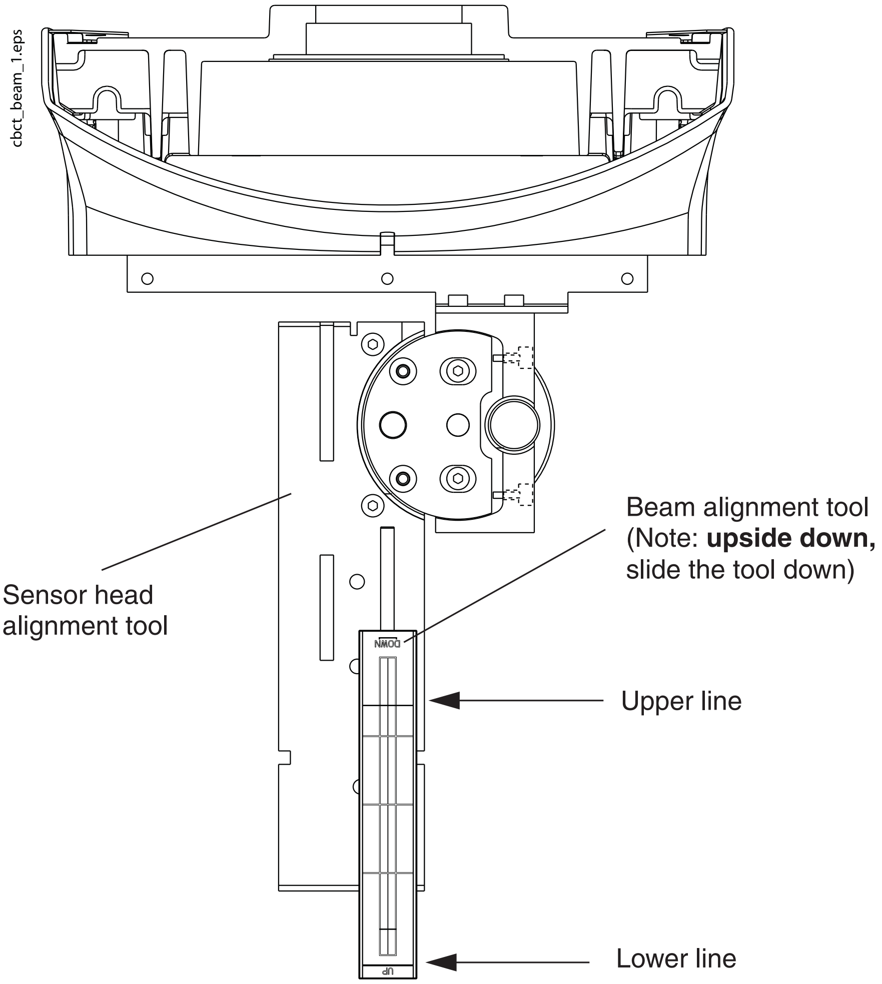


Figure 80

Darken the room sufficiently so that you will be able to see the image of the radiation beam on the beam alignment tool (it is fluorescent and glows when the radiation beam strikes it), but not so dark that you cannot see the lines of the alignment rectangle.

Protect yourself from radiation and press the exposure button. The beam image appears on the alignment tool. Observe the beam from behind the tube head.

CAUTION ***Radiation is generated when the exposure button is pressed. Take adequate protection measures. Keep the exposure time as short as possible.***

<u>X-ray units with 3D sensor V1:</u>

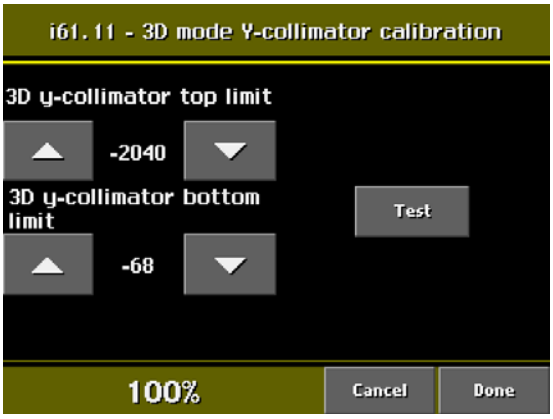
The radiation beam **must reach but not overlap the lines** marked on the beam alignment tool (shown with arrows in the figure above).

<u>X-ray units with 3D sensor V2 / 3D s sensor:</u>

The radiation beam **must overlap the upper line** marked on the beam alignment tool **by 10 mm** and **reach the lower line** marked on the beam alignment tool (both lines shown with arrows in the figure above).

The X-ray beam vertical position is adjusted on the Y-collimator calibration (i61.11 or i61.13) display.

X-ray units with 3D sensor (V1 or V2):



X-ray units with 3D s sensor:

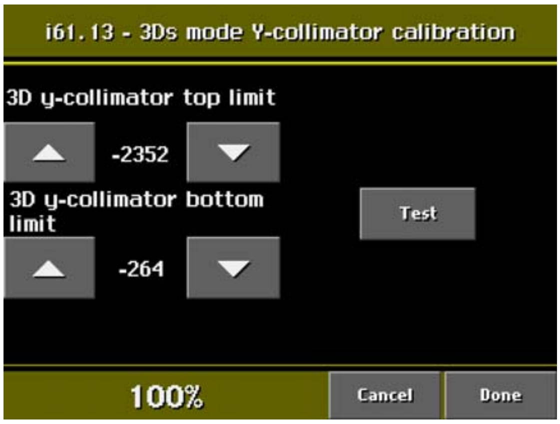


Figure 81

Adjust the **upper limit** value of the X-ray beam with the **y-collimator top limit** arrow fields. Drive the collimator to the selected position by pressing the **Test** field. Protect yourself from radiation and press the exposure button to check the X-ray beam upper edge position. If necessary, repeat the procedure.

Adjust the **lower limit** value of the X-ray beam with the **y-collimator bottom limit** arrow fields. Drive the collimator to the selected position by pressing the **Test** field. Protect yourself from radiation and press the exposure button to check the X-ray beam lower edge position. If necessary, repeat the procedure.

Accept the new position and exit the calibration mode by touching the **Done** field. The values are not stored if you exit the mode with **Cancel** field.

X-ray units with SmartPan license:

If the 3D V2 / 3D s sensor will be used for taking panoramic images (3D + SmartPan, SmartTMJ and SmartSinus) you need to calibrate SmartPan as well.

First select “SmartPan Y-collimator calibration” (i61.15) on the “Primary collimator calibration” (i610) display and proceed as described above for Y-collimator calibration.

SmartPan Y-collimator calibration:

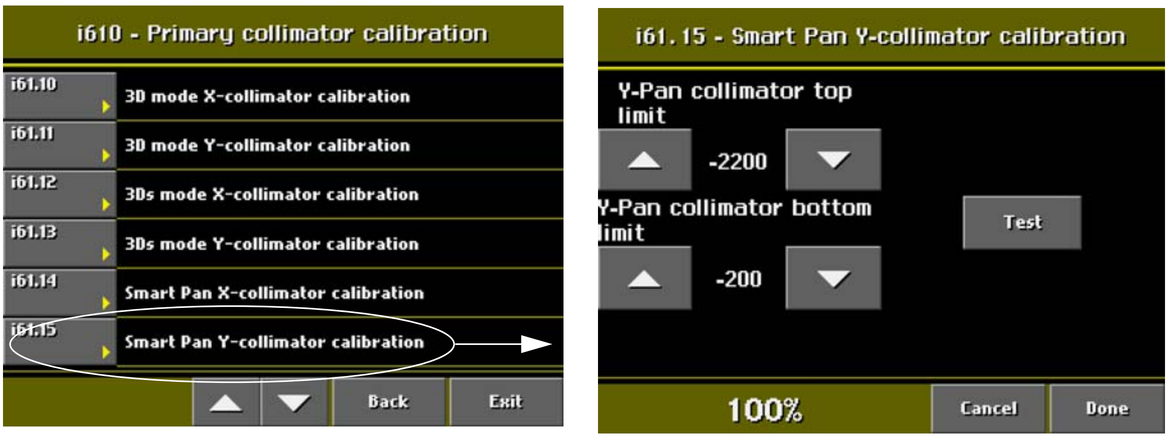


Figure 82

The radiation beam **must overlap the upper line** marked on the beam alignment tool **by 10 mm** and **reach the lower line** marked on the beam alignment tool (both lines shown with arrows in the figure below).

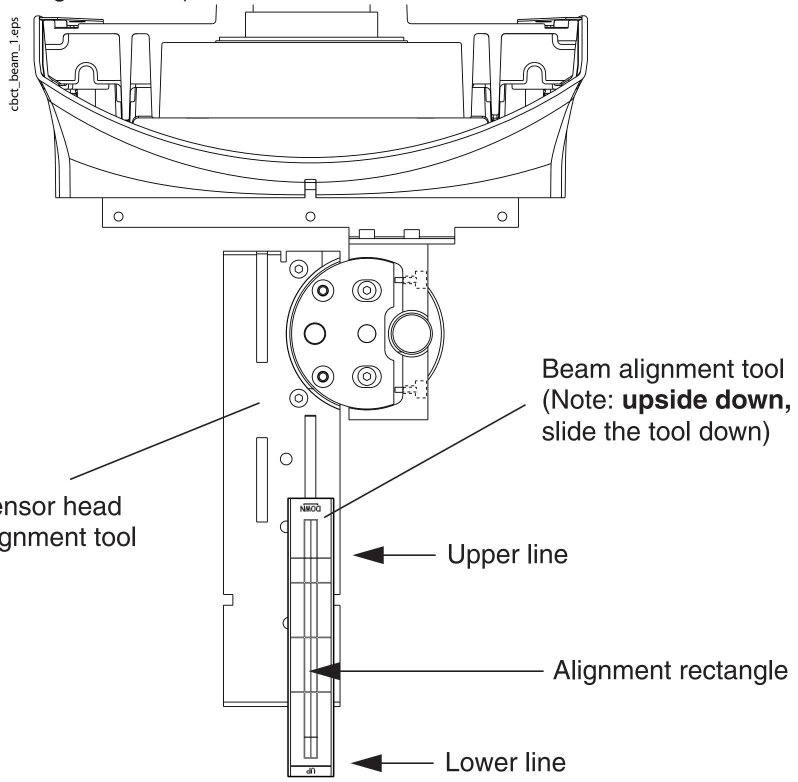


Figure 83

Then select “SmartPan X-collimator calibration” (i61.14) on the “Primary collimator calibration” (i610) display and take another test exposure as described above.

SmartPan X-collimator calibration:

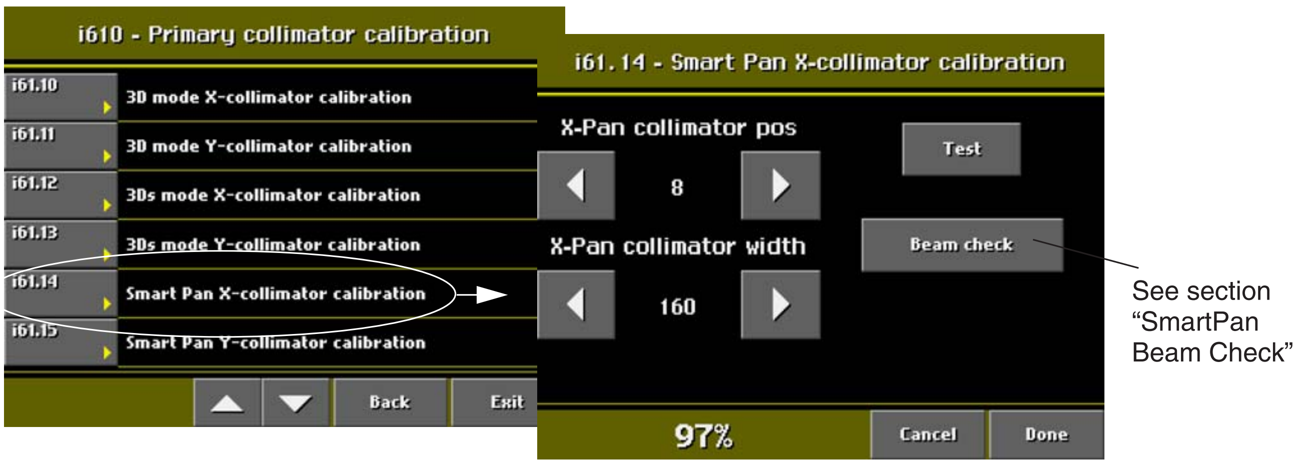


Figure 84

The radiation beam **must be positioned inside the alignment rectangle** marked on the beam alignment tool (shown with arrow in the figure above).

Touch the **Beam Check** field on the “SmartPan X-collimator calibration” display to take a beam check image as described in section 3.4.2 “SmartPan beam check (for 3DV2 / 3D s sensors only)” on page E-80.

Beam horizontal position

Select **Primary collimator calibration (i61.10)** from the display that appears when you select **Technical calibrations**. Depending on the sensor you are using, select **3D or 3D s mode X-collimator calibration (i61.10 or i61.12)** from the list.

The position of the X-ray beam can now be checked without the C-arm moving.

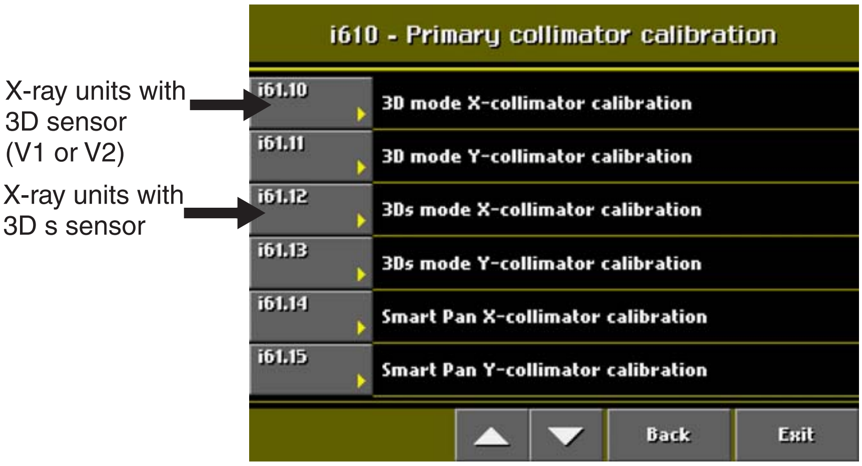


Figure 85

The corresponding X-collimator calibration (i61.10 or i61.12) display will appear. The horizontal position of the X-ray beam is adjusted in this mode.

Place the beam alignment tool on the sensor head alignment tool as shown in Fig. 86.

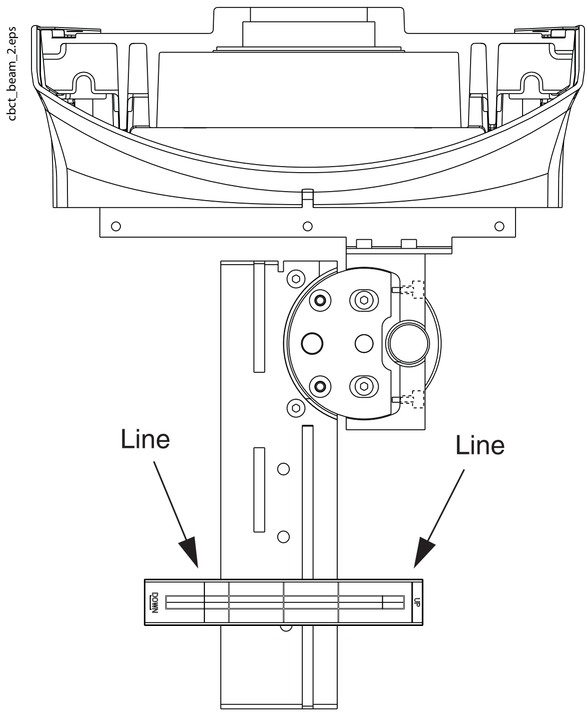


Figure 86

Darken the room sufficiently so that you will be able to see the image of the radiation beam on the alignment tool (it is fluorescent and will glow when the radiation beam strikes it), but not so dark that you cannot see the lines of the alignment rectangle.

Protect yourself from radiation and press the exposure button. The beam image appears on the alignment tool. Observe the beam from behind the tube head.

CAUTION ***Radiation is generated when the exposure button is pressed. Take adequate protection measures. Keep the exposure time as short as possible.***

X-ray units with 3D sensor V1:

The radiation beam **must reach but not overlap the lines marked on the left and right** of the beam alignment tool (shown with arrows in Fig. 86).

X-ray units with 3D sensor V2:

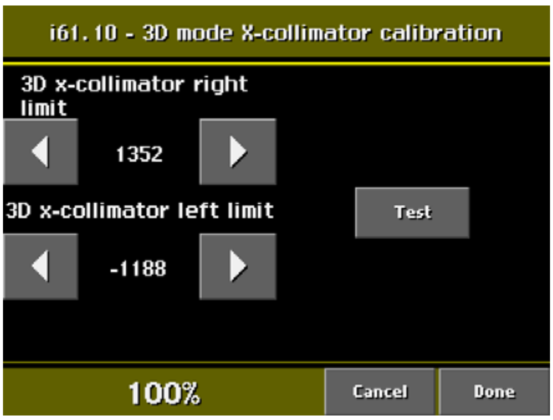
Use the **lines marked on the left and right** of the beam alignment tool as reference lines (shown with arrows in Fig. 86). The radiation beam **must be 4 mm wider on both sides** (total 8 mm wider).

X-ray units with 3D s sensor:

Use the **lines marked on the left and right** of the beam alignment tool as reference lines (shown with arrows in Fig. 86). The radiation beam **must be 20 mm narrower on both sides** (total 40 mm narrower).

The X-ray beam horizontal position is adjusted on the X-collimator calibration (i61.10 or i61.12) display.

X-ray units with 3D sensor (V1 or V2):



X-ray units with 3D s sensor:

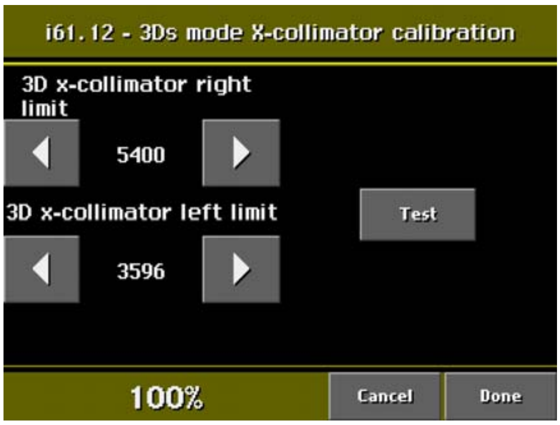


Figure 87

Adjust the collimator position value with the **x-collimator right** and **left limit** arrow fields. The left arrow field on the display adjusts the beam to the left, and the right arrow field to the right. Drive the collimator to the selected position by touching the **Test** field.

Protect yourself from radiation and press the exposure button to check the position of the beam. If necessary, repeat the procedure.

Accept the new position and exit the calibration mode by touching the **Done** field. The values are not stored if you exit the mode with **Cancel** field.

3.4 Beam check

Refer to the Planmeca Device Tool manual, publication number 10031558.

3.5 Flat Field calibration

Refer to the Planmeca Device Tool manual, publication number 10031558.

3.6 3D Geometry calibration

Refer to the Planmeca Device Tool manual, publication number 10031558.

3.7 3D Quality Assurance (Q/A) Test

Refer to the Planmeca Device Tool manual, publication number 10031558.

4 OTHER ADJUSTMENTS AND CALIBRATIONS

4.1 Calibrating the elbow arm and C-arm gear ratios

The tape material of the traction belt located on the elbow arm has been changed. The X-ray units with serial number RPX 235922 or greater, manufactured after March 2006, are equipped with the new traction belts. Because the traction belt with the new tape is slightly thicker than the old one, the correct gear ratio can be selected. The correct ratio has been set at the factory, but it has to be checked and changed if necessary, when replacing the traction belt.

From the list on the *i600* display select **Positioning calibration (i640)**.

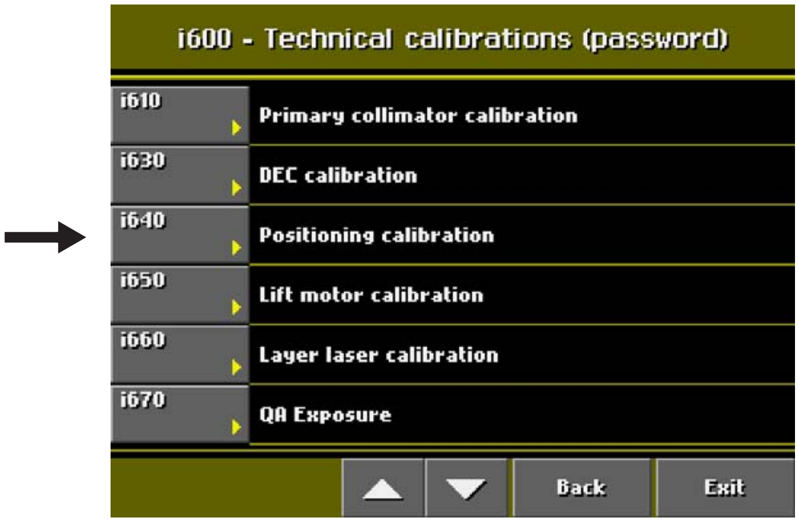


Figure 88

Elbow arm gear ratio

From the list on the *i640* display that appears select **Elbow arm ratio calibration (i64.2)**.

Change the ratio value by touching the **Default** field. The **Default 1** (336.578) is for the **old** traction belt and the **Default 2** (335.646) is for the **new** traction belt.

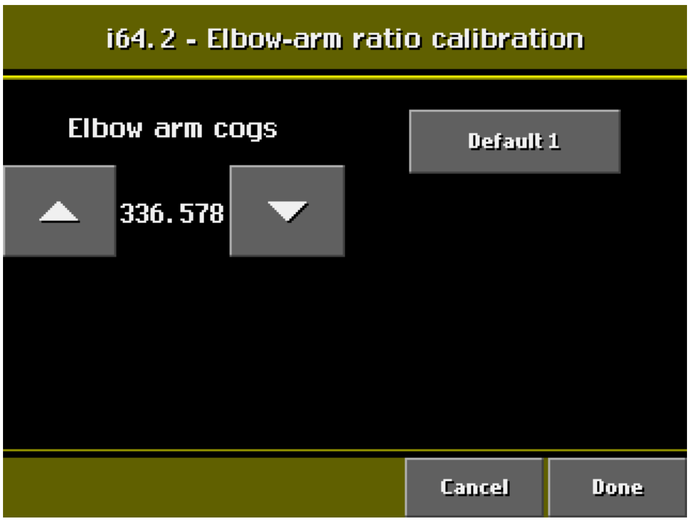


Figure 89

NOTE The X-ray unit must be switched off and on after changing the ratio value. After switching the X-ray unit on again, the angle sensors must be calibrated.

C-arm gear ratio

From the list on the *i640* display that appears select **C-arm ratio calibration (i64.3)**.

Change the ratio value by touching the **Default** field. The **Default 1** (336.578) is for the **old** traction belt and the **Default 2** (335.646) is for the **new** traction belt.

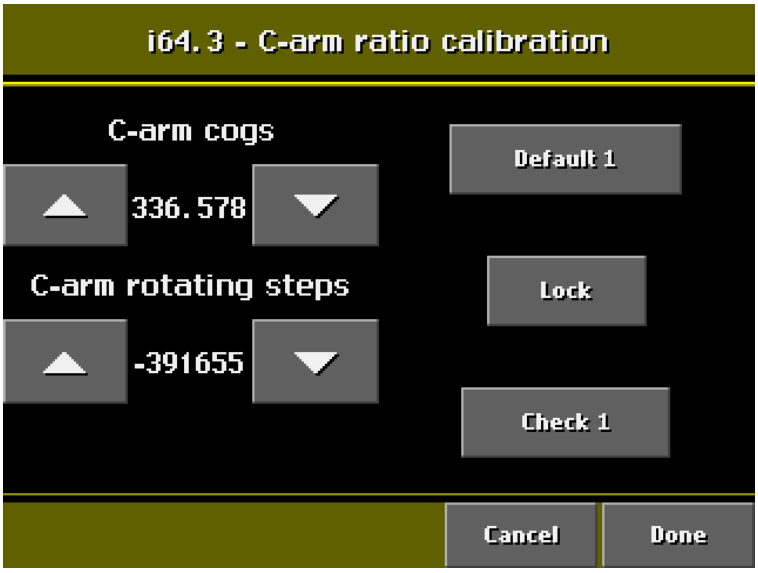


Figure 90

NOTE The X-ray unit must be switched off and on after changing the ratio value. After switching the X-ray unit on again, the angle sensors must be calibrated.

CAUTION The C-arm rotating steps function as well as the respective fields (arrow fields, Lock/release field and Check field) are for factory use only.

4.2 Calibrating the panoramic dynamic exposure control (DEC)

NOTE **The panoramic dynamic exposure control (DEC) function requires software version 1.19.0 or later and a valid DEC licence.**
The use of Flat Field calibration tool requires Reconstruction PC software version 1.6.0.0.r or later.
Note that you can also calibrate DEC with the AEC/DEC calibration tool, part number 10007501.

NOTE **Make sure that the panoramic beam is correctly aligned before calibrating the panoramic DEC. Refer to section 2.2 “Checking the panoramic beam position” on page E-7.**

NOTE **Before starting the DEC calibration the Panoramic DEC feature has to be enabled from the i310 menu. Refer to Chapter B, section 3.1 “Enable / disable features” on page B-13.**

Use the long screws that hold the tube head front cover in position to attach the calibration tool:

Unscrew the long screws and place the Flat Field calibration tool (part number 10017348) in front of the collimator as shown. Position the calibration tool so that the long screw on the left (as seen from the front) touches the outer edge of the oval shaped screw hole as shown. This will ensure that the calibration tool is vertical (not tilted back or forwards). Tighten the long screws firmly to secure the calibration tool in position.

Use the 35mm aluminum filter for the calibration, that is, lift up one of the filters.

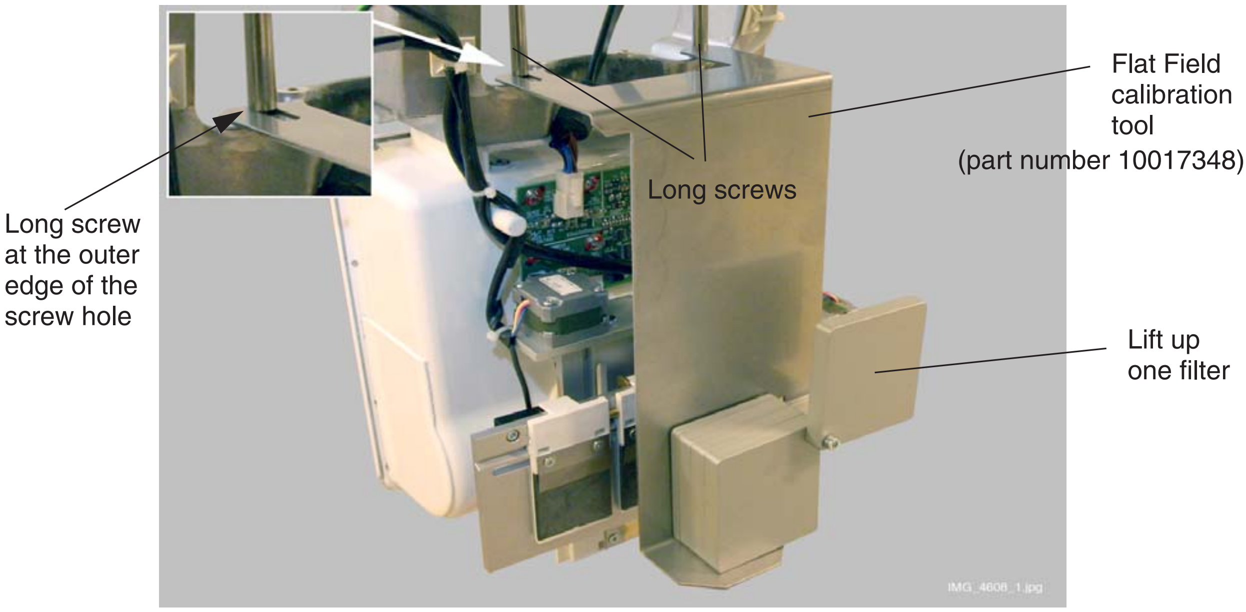


Figure 91

First write down the **current** values of DEC settings (i25.1). You have to restore these values after the DEC calibration. Then set the values to 100 as shown below.

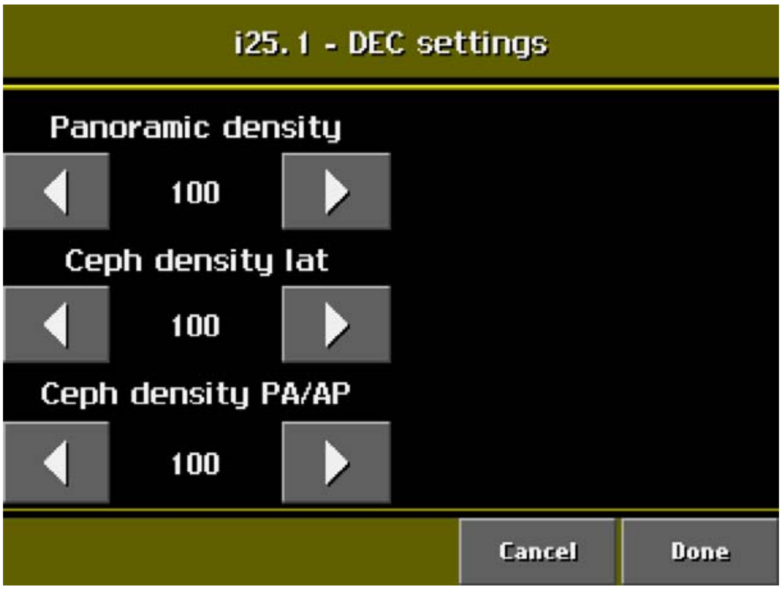


Figure 92

Touch the **i** field on the *Main* display. The list of Information displays appears.

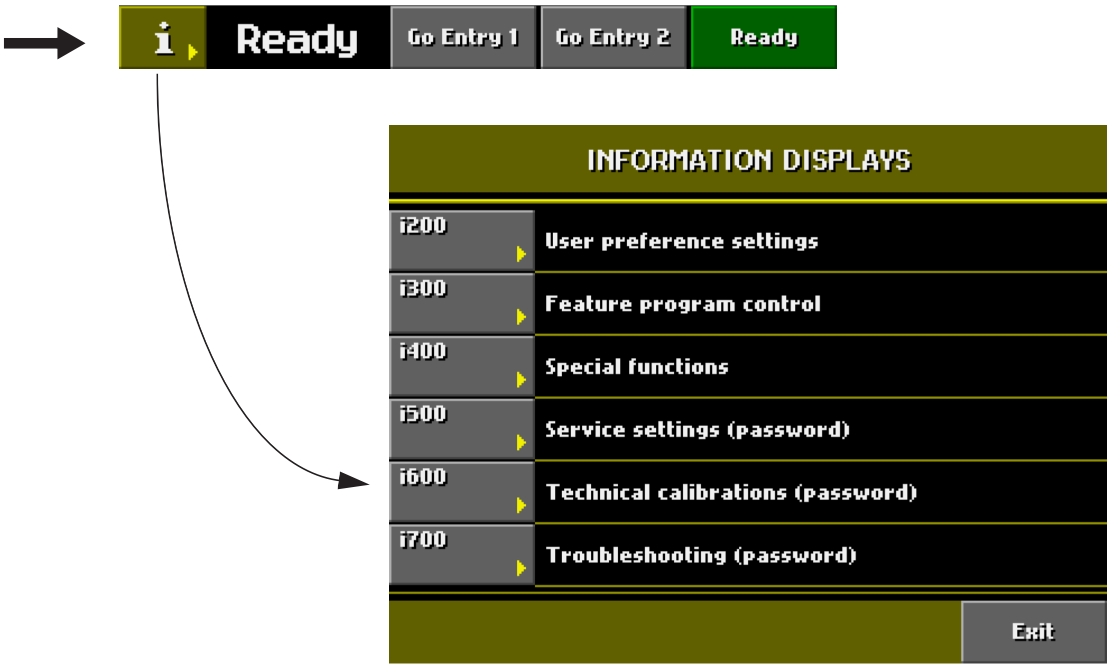


Figure 93

From the list of Information displays select **Technical calibrations (i600)**.

The Technical calibrations mode is password protected and the password is asked when the mode is entered for the first time after switching the unit on. **The password is 1701.**

Figure 94

From the list of Technical calibrations select **DEC calibration (i630)**.

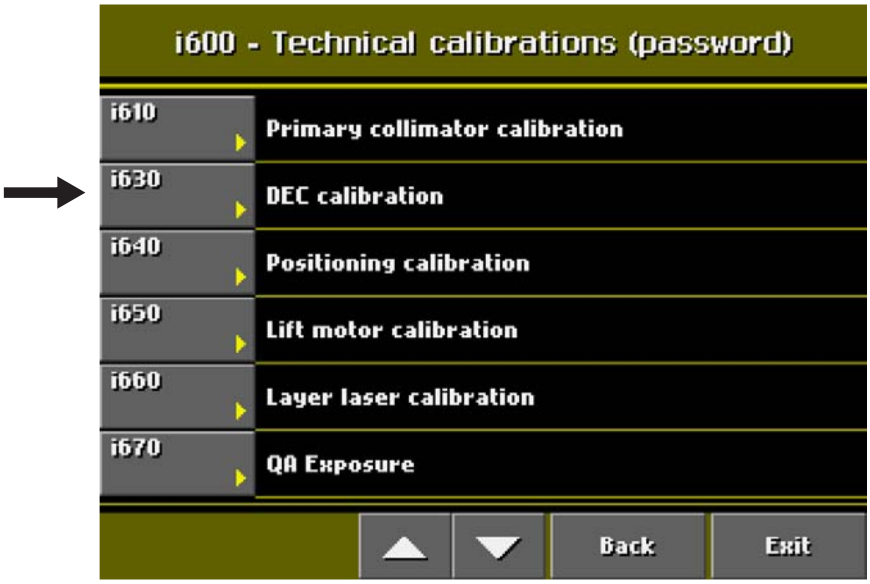


Figure 95

To calibrate the Panoramic dynamic exposure control, select **Panoramic DEC (i631)**.

Figure 96

The *Panoramic DEC* display appears. The exposure values suggested on this display are 66 kV value and 9 mA. **Use these values when taking an OD exposure.** Touch the **OD exposure** field.

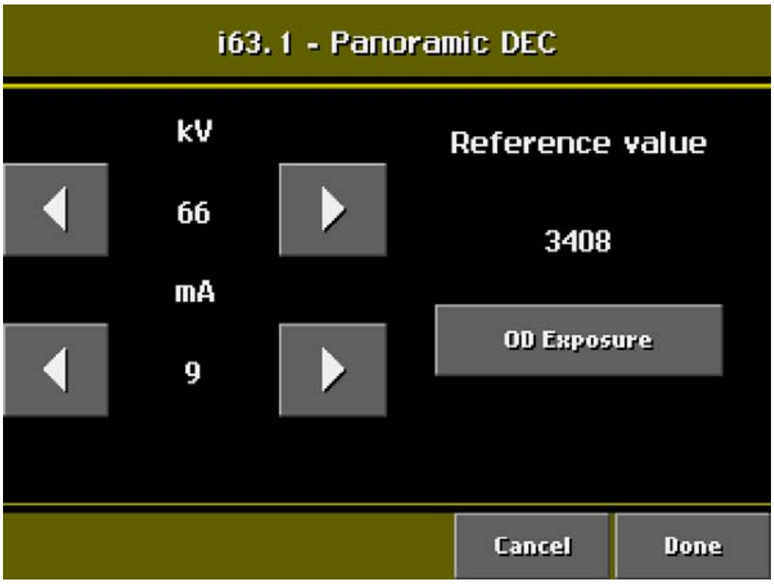


Figure 97

The X-ray unit will move to the ready position and the text *Wait* is shown on the *Panoramic DEC* display. When the unit is ready to start the DEC calibration the text *Ready* is shown on the display.

Figure 98

NOTE **Protect yourself from radiation and take the exposure.**

During the exposure the text *Calibrating* is shown on the *Panoramic DEC* display. **DO NOT RELEASE THE EXPOSURE BUTTON BEFORE THE TEXT COMPLETE IS SHOWN ON THE PANORAMIC DEC DISPLAY.**

Figure 99

When the exposure cycle is completed the text *Complete* is shown on the *Panoramic DEC* display.

Figure 100

NOTE **The recommended reference value is between 2700-4500.**

If the reference value is **greater than 4500, decrease the mA value** and if the reference value is **smaller than 2700, increase the mA value.** Then perform the OD exposure again.

NOTE **The altered exposure value (mA) is not automatically updated to the exposure value setting on the Main menu.**

NOTE **If the value is near zero, the panoramic beam must be re-aligned and if the value is thousands, the AEC/DEC calibration tool does not properly cover the primary collimator opening.**

To accept the DEC parameters touch the **Done** field on the *Panoramic DEC* display and **Exit** field on the *DEC calibration* display.

Take three test exposures from the AEC/DEC calibration tool as follows. Enter the **Main** display. Switch on the **DEC function** and select **normal+average** jaw size.

1) First exposure: Use the OD exposure mA and kV values. Take an exposure. Check in the Main display that the kV and mA values are not changed during the exposure.

2) Second exposure: Increase mA value by 4mA **from the original value**. Take an exposure and after the exposure check in the Main display that the kV and mA values have been decreased.

3) Third exposure: reduce mA value by 4mA **from the original value**. Take an exposure and after the exposure check in the Main display that the kV and mA values have been increased.

If the kV and mA values are not correctly adjusted during the exposure, perform the following checks:

1) Make sure that the DEC function is ON.

2) Check the panoramic beam alignment (position and width) according to the instructions given in section 2.2 “Checking the panoramic beam position” on page E-7.

3) Check that the AEC/DEC calibration tool covers the primary collimator opening.

After the checks perform the DEC calibration again. Remove the AEC/DEC calibration tool and attach the removed covers.

NOTE **All the calibration parameters are stored into the memory making it possible to modify the calibration without a new exposure if the film density is found to be non satisfactory.**

Maximum correction to the set values

The kV and mA values are adjusted during the exposure when the DEC function is on**.**

The scale of the kV value is between 54kV and 84kV and it can be adjusted by + 4kV to - 4kV. Note that if the kV value is e.g. 82kV it can only be increased by 2kV.

The scale of the mA value is between 1mA and 16mA and it can be adjusted by + 4mA to - 3mA. Note that if the mA value is e.g. 15mA it can only be increased by 1mA.

NOTE **The kV and mA values are adjusted to the same direction (increased or decreased). For example: if the measured value is 40% from the reference value, the kV value is increased by 2kV and the mA value is increased by 3mA.**

5 REMOVING THE COVERS

NOTE Switch the unit off before removing the covers.

5.1 C-arm upper covers

Loosen the eight attachment screws with the 2.5mm Allen key (Fig. 101, 1). Do not remove the screws. Slide the tube head cover plate (Fig. 101, 2) and the receptor cover plate (Fig. 101, 3) from their positions as shown below.

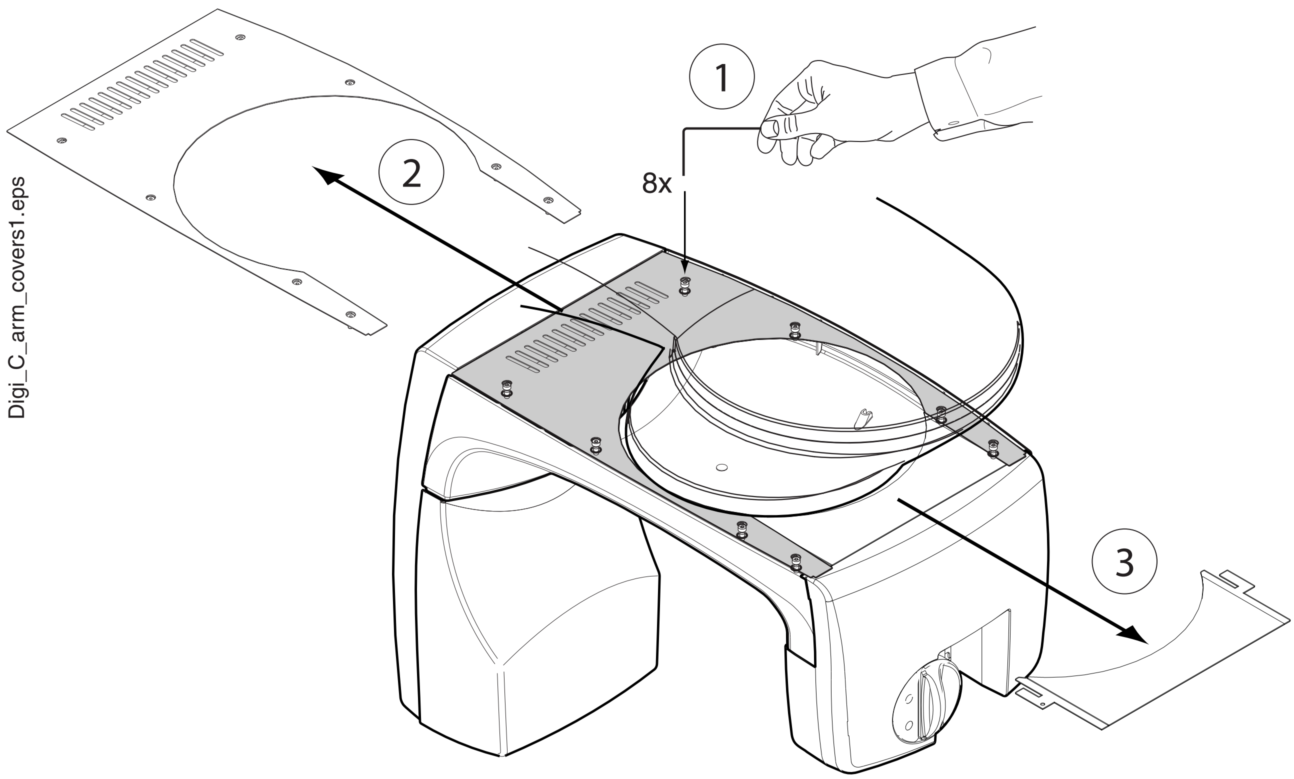


Figure 101

5.2 Removing the fixed sensor head holder covers

Remove the C-arm upper covers as described in section 5.1 “C-arm upper covers” on page E-77.

The sensor head connector front cover is attached to the C-arm with Velcro tapes and can be removed by pulling it from its position.

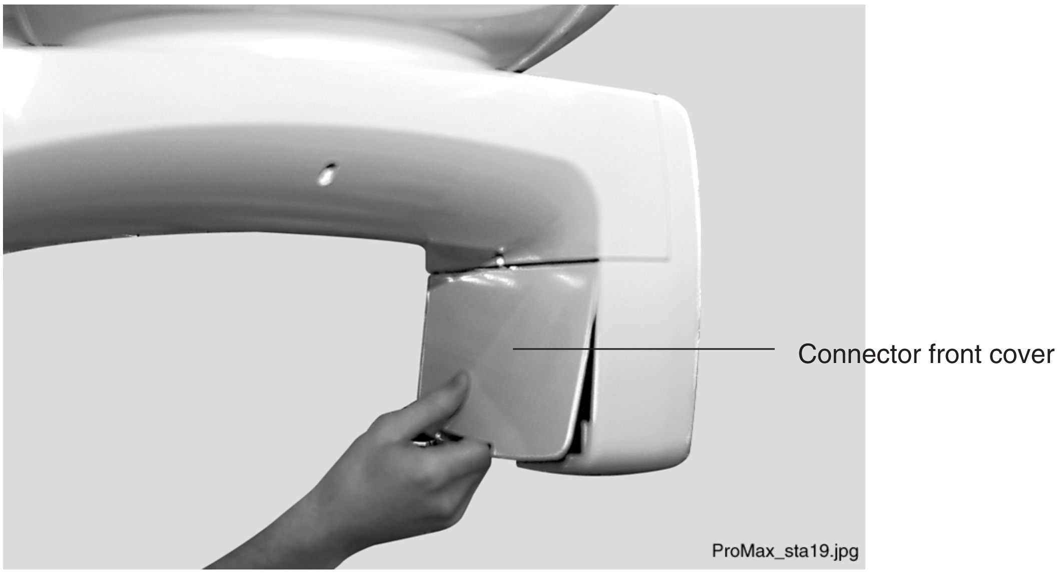


Figure 102

Unscrew the attachment screws of the sensor head connector back cover with the 2.5mm Allen key: two from the inner side and the two from the top of the cover (2).

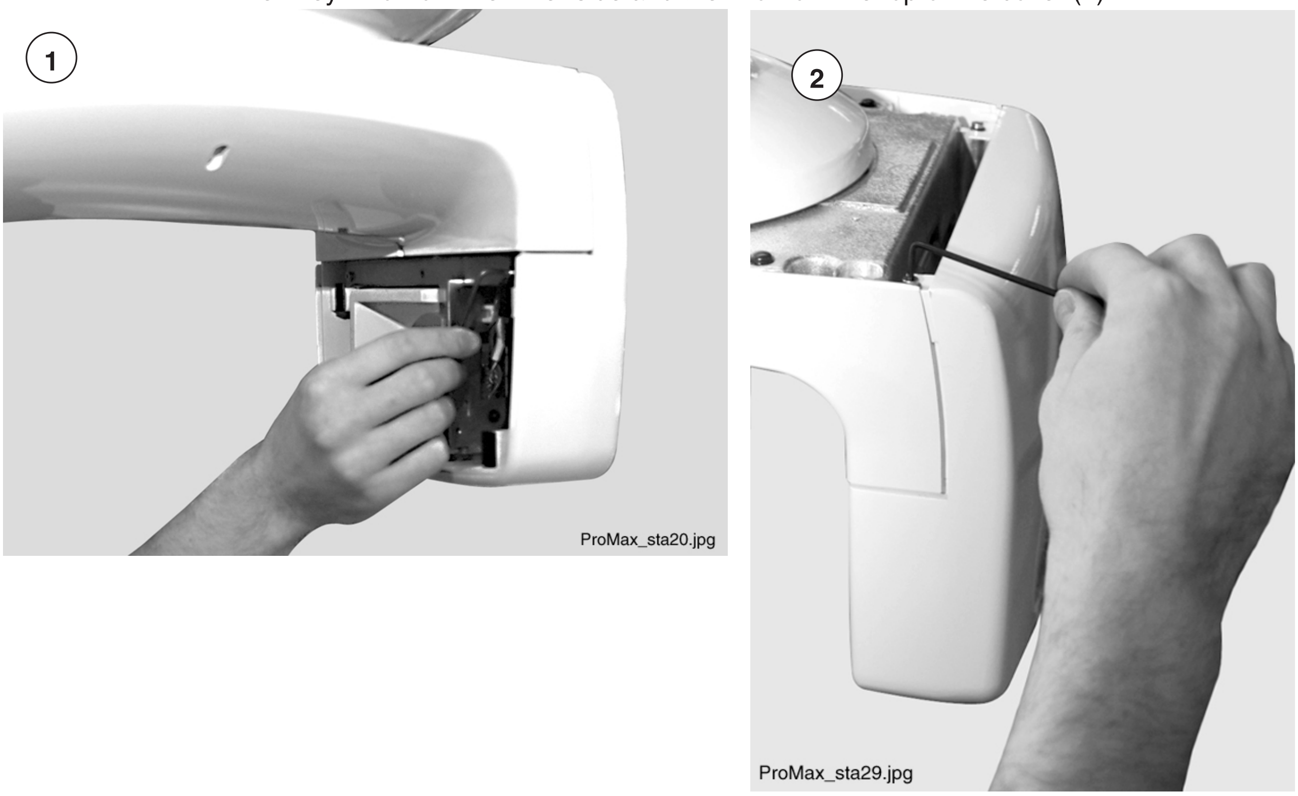


Figure 103

Detach the cover from its position.

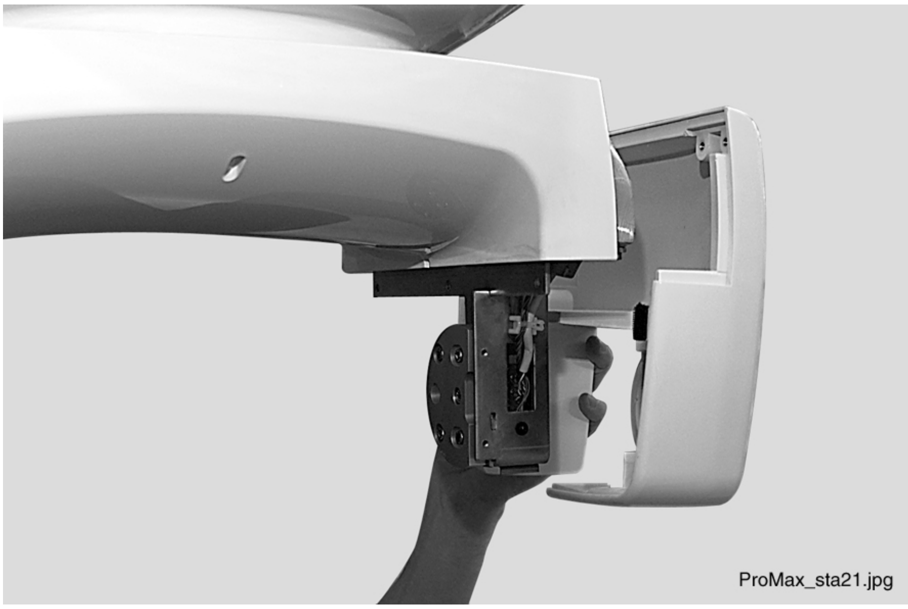


Figure 104

5.3 Removing the movable sensor head holder covers

Remove the C-arm upper covers as described in section 5.1 “C-arm upper covers” on page E-77.

Remove the sensor head from its holder. Push in the button of the C-arm electrical connector. The sensor head connector front cover is attached to the C-arm with Velcro tapes and can be removed by pulling it from its position (Fig. 105, 1).

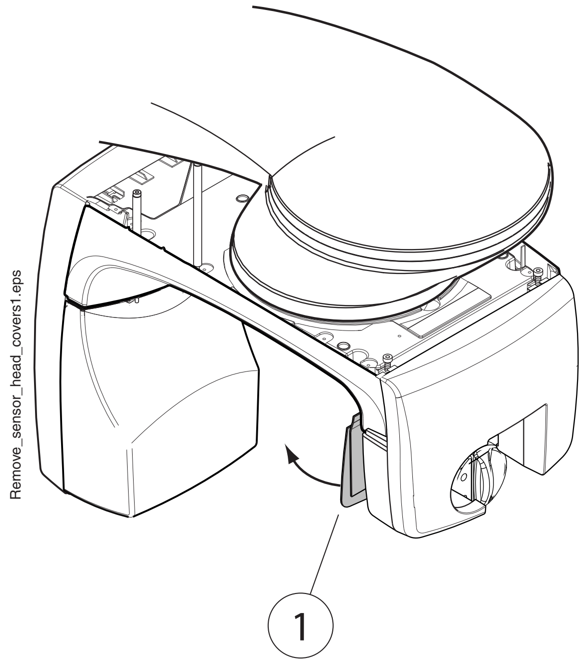


Figure 105

Unscrew the attachment screws of the sensor head connector back cover with the 2.5mm Allen key: two from the top of the cover (Fig. 106, 1) and two from the inner side (Fig. 106, 2). Detach the cover from its position.

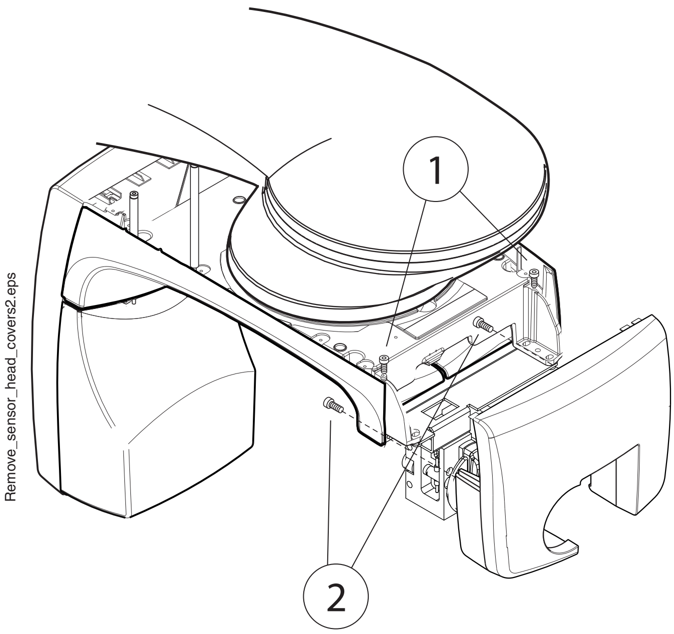


Figure 106

5.4 C-arm inner cover

NOTE You have to remove the C-arm upper covers and sensor head covers before removing the C-arm inner cover.

Unscrew the four screws with the 2.5mm Allen key (Fig. 107, 1) and remove the cover (Fig. 107, 2).

Digi_C_arm_covers4.eps

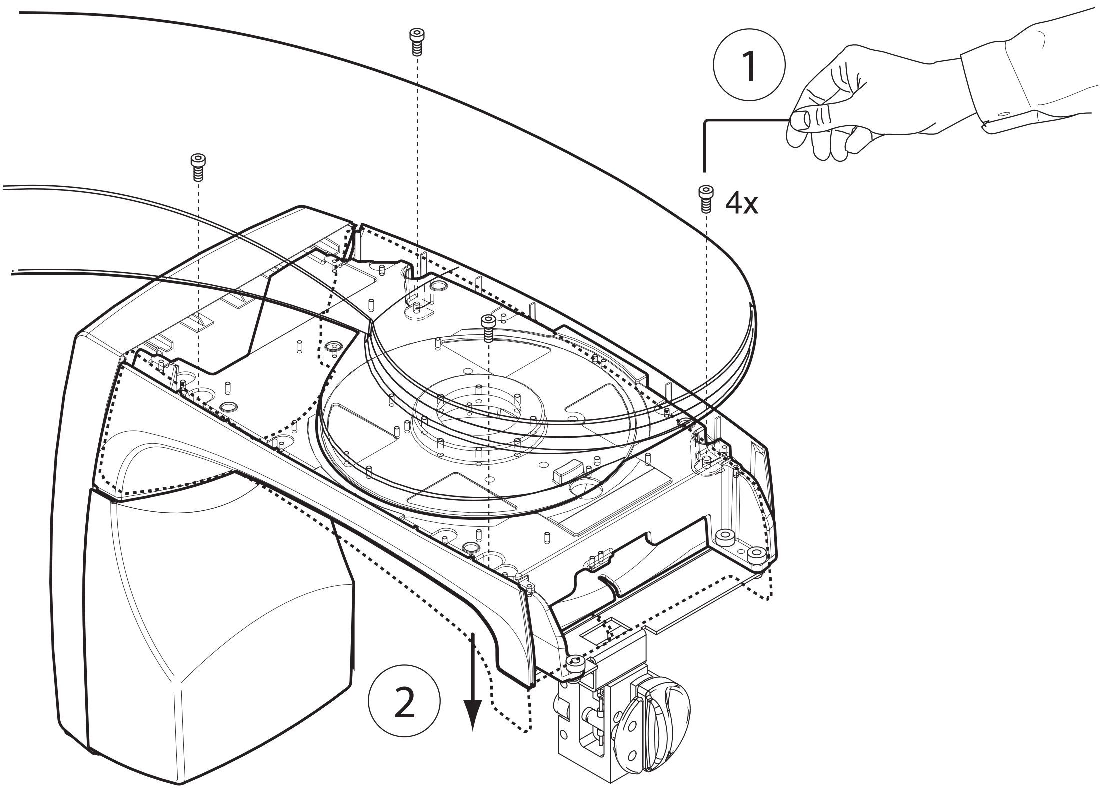


Figure 107

5.5 Tube head covers

NOTE You have to remove the C-arm upper covers before removing the tube head covers.

Tube head front cover

Unscrew the two attachment screws from the top of the front cover (Fig. 108, 1) and the two screws from the bottom of the cover (Fig. 108, 2). The cover can now be removed.

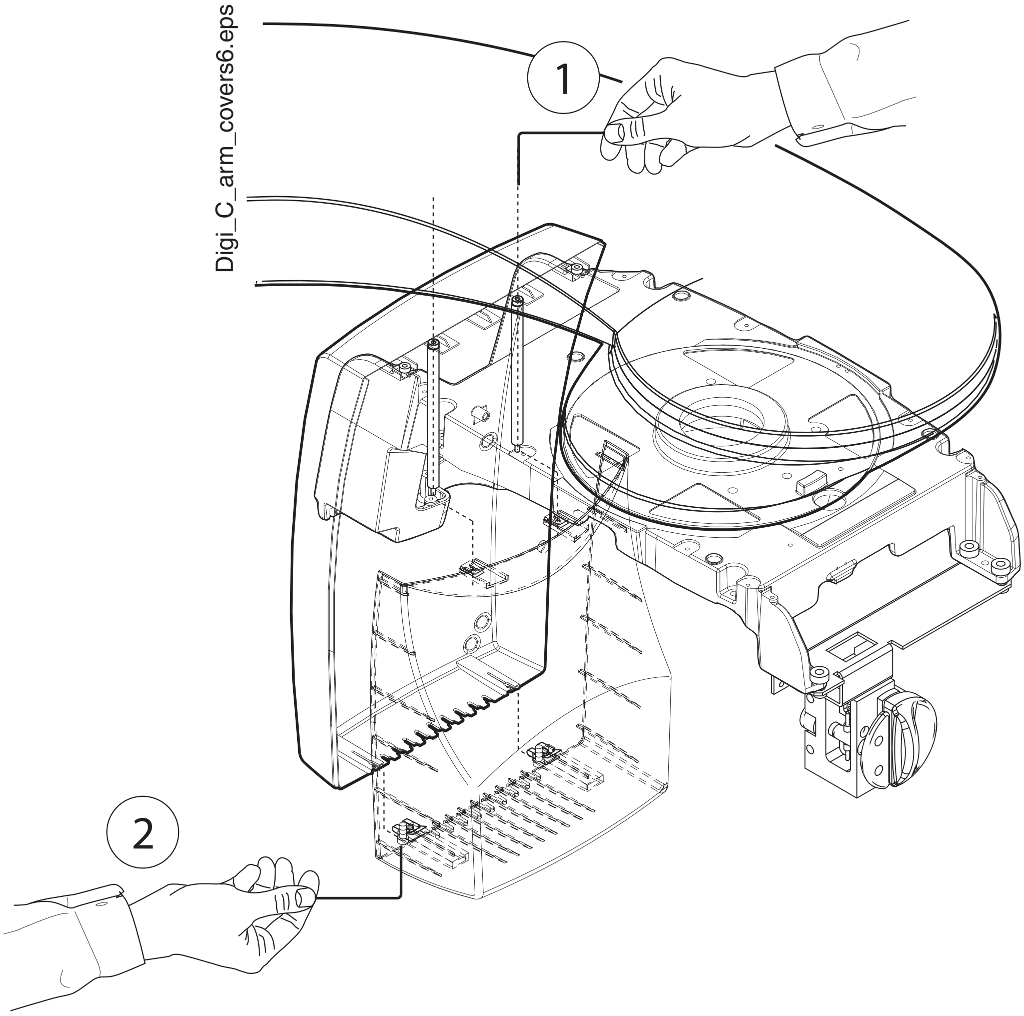


Figure 108

Tube head back cover

Unscrew the two attachment screws from the top of the back cover (Fig. 109, 1) and the two screws from the side of the cover (Fig. 109, 2). The cover can now be removed.

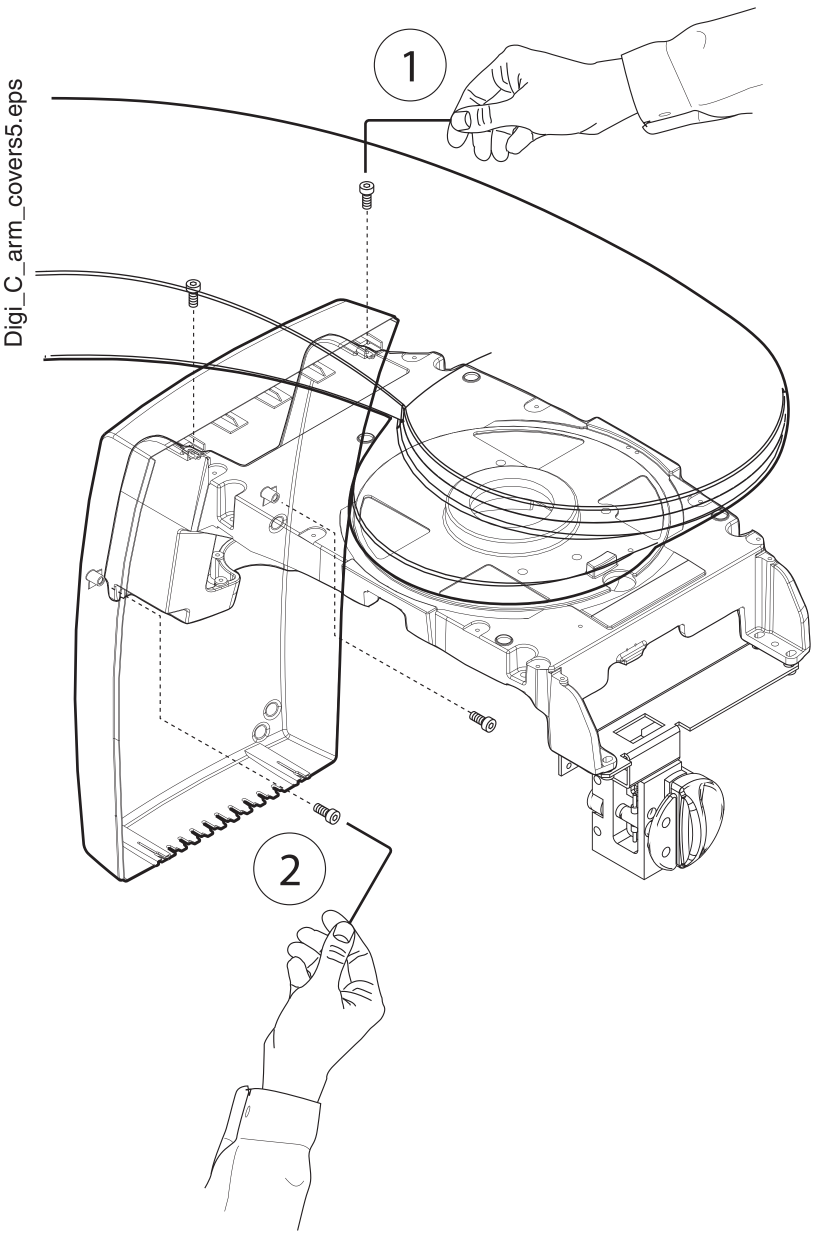


Figure 109

5.6 Shoulder arm covers

Shoulder arm cover

The shoulder arm cover is attached to the shoulder arm with mounting springs. Lift the shoulder arm cover up from its position.

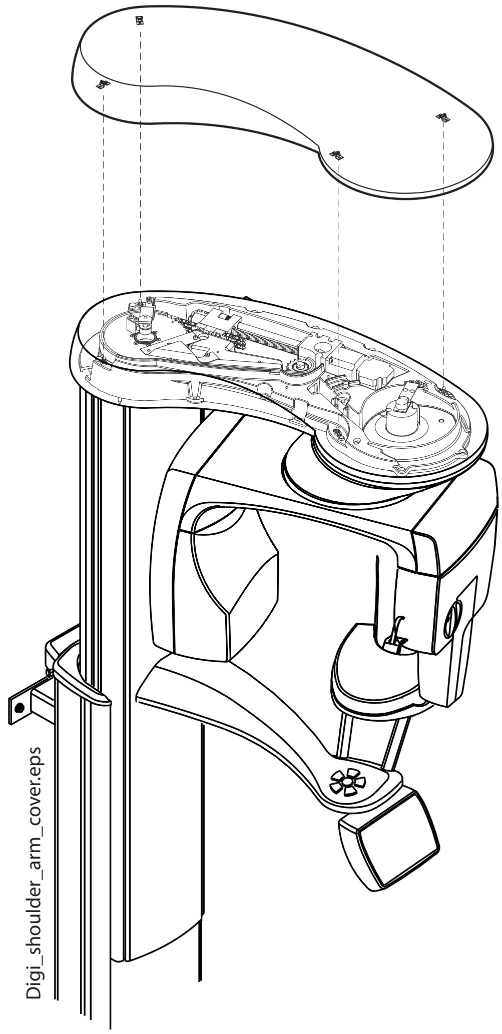


Figure 110

Bottom cover plate

Open the five M5 nuts and remove the nuts, washers and springs. Remove the cover.

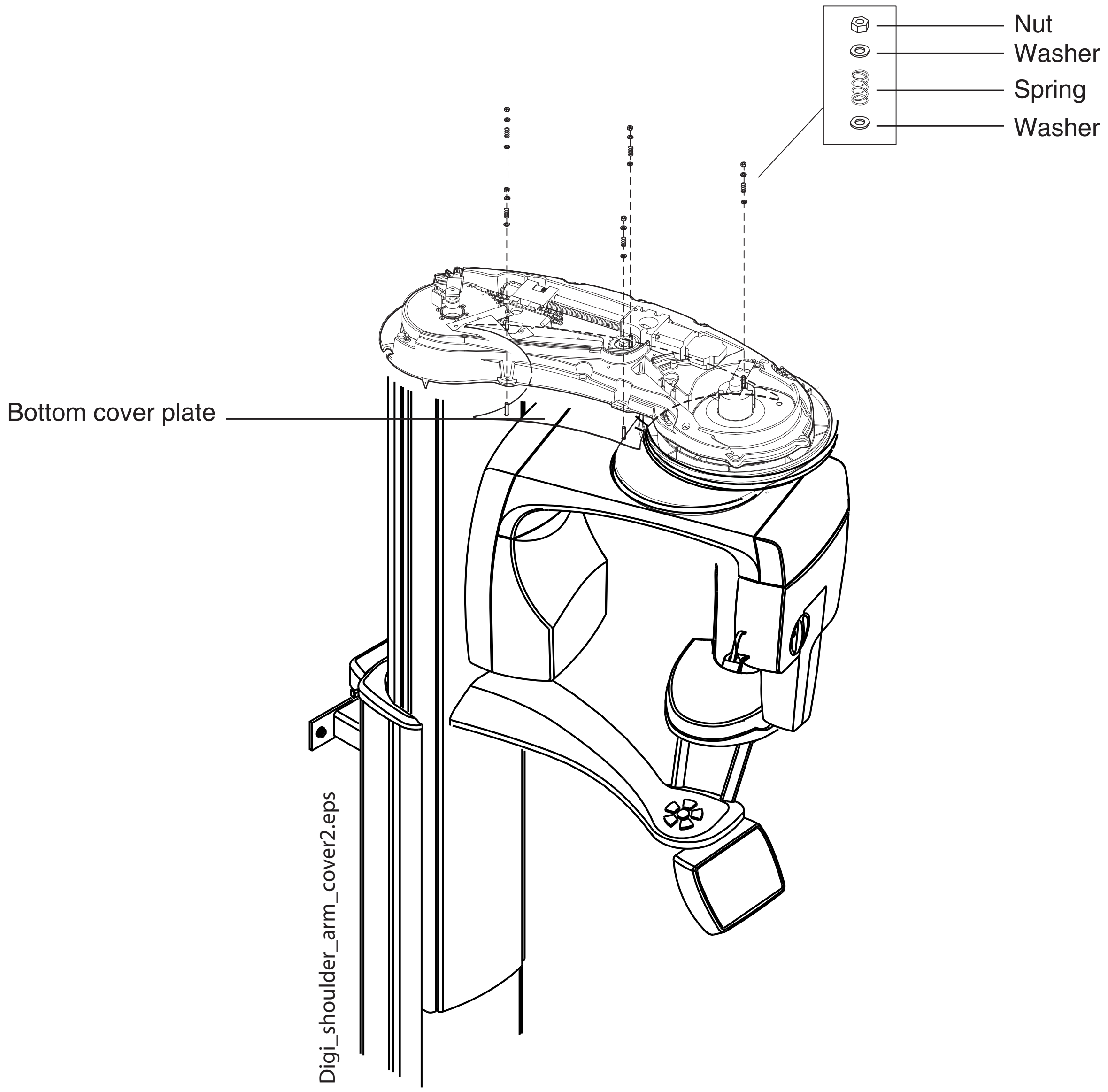


Figure 111

6 REPLACING THE SENSOR HEAD

6.1 Attaching and removing the fixed sensor head

NOTE **If the unit is equipped with movable sensor head, attach and remove the sensor head to the connector according to the instructions given in section 6.2 “Sensor head with quick connector mechanism” on page E-90.**

Remove the sensor head holder covers according to the instructions given in section 5.2 “Removing the fixed sensor head holder covers” on page E-78.

Unscrew the sensor head locking screws from the attachment pins with 3mm Allen key. Remove the screws and washers.

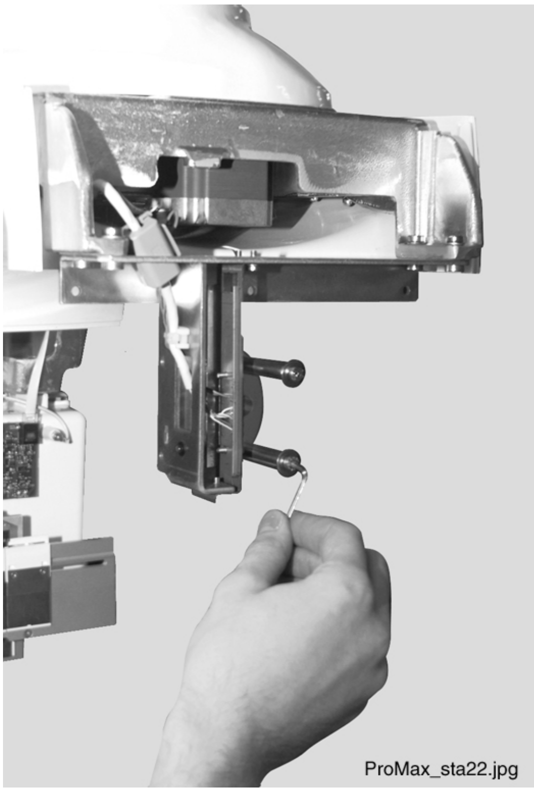


Figure 112

NOTE **When checking the alignment, the sensor alignment tool can now be attached to the connector pins.**

Loosen the electrical connector plate screw with the 2.5mm Allen key.

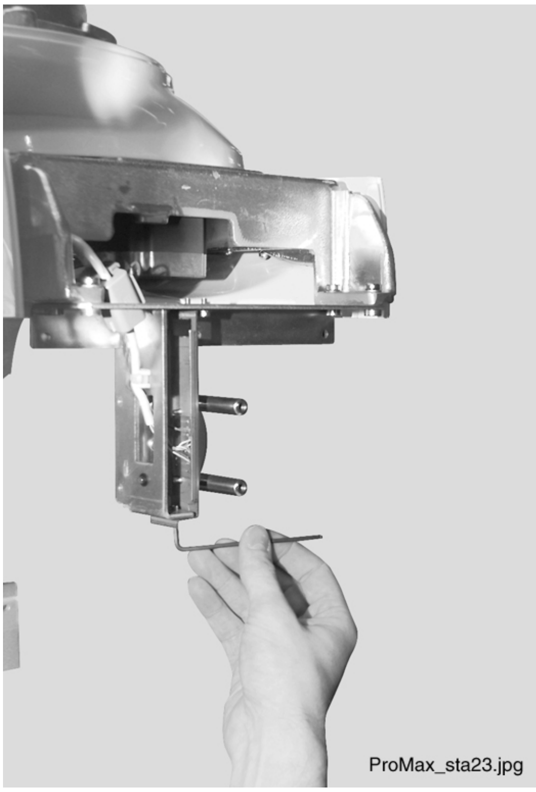


Figure 113

Pull the electrical connector plate towards the connector frame and push the sensor head to its connector.

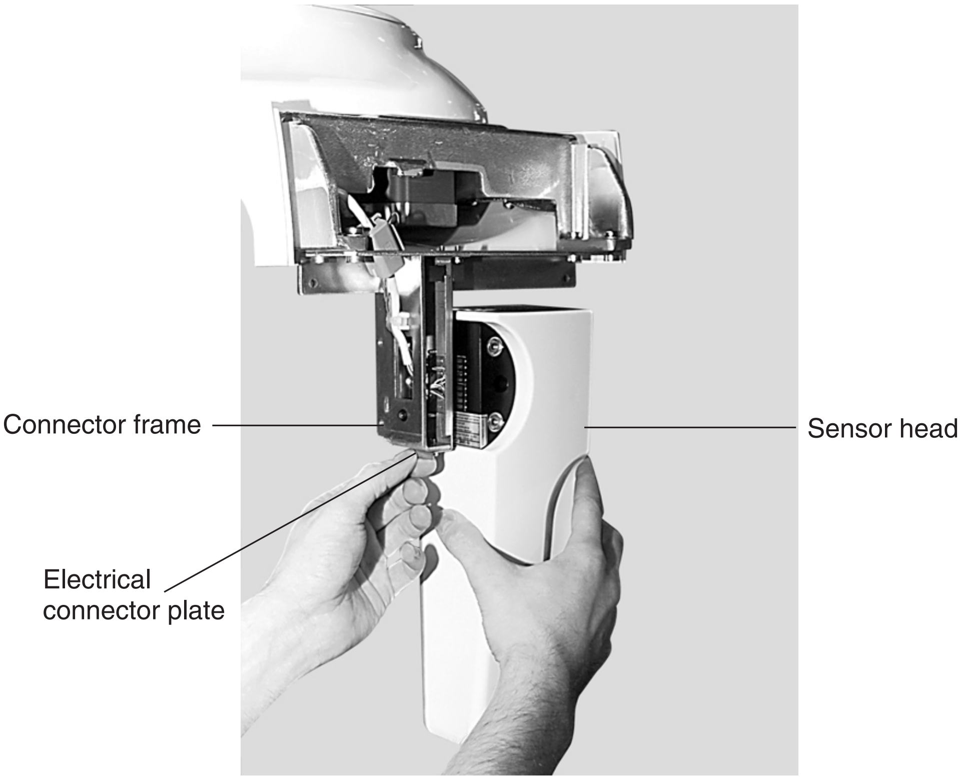


Figure 114

Secure the sensor head with the two washers and attachment screws (use 3mm Allen key).

Figure 115

Push the electrical connector plate towards the sensor head and tighten the plate screw with the 2.5mm Allen key.

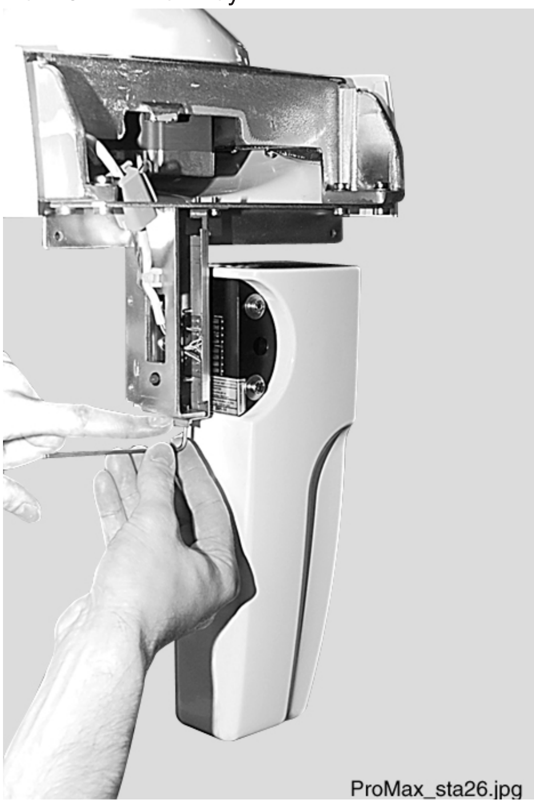


Figure 116

Attach the back cover to its position with the four attachment screws with 2.5mm Allen key.

Figure 117

Press the front cover to its position.

Figure 118

The sensor head is removed in reverse order.

6.2 Sensor head with quick connector mechanism

Detaching the sensor head from the C-arm

NOTE **The indicator light is lit when the Dimax3 sensor is in use. Removing the sensor head when the indicator light is lit might harm the sensor or cause image data loss.**

Push in the C-arm electrical connector located on the sensor head quick connector mechanism. This will disconnect the electrical connection between the sensor head and C-arm.

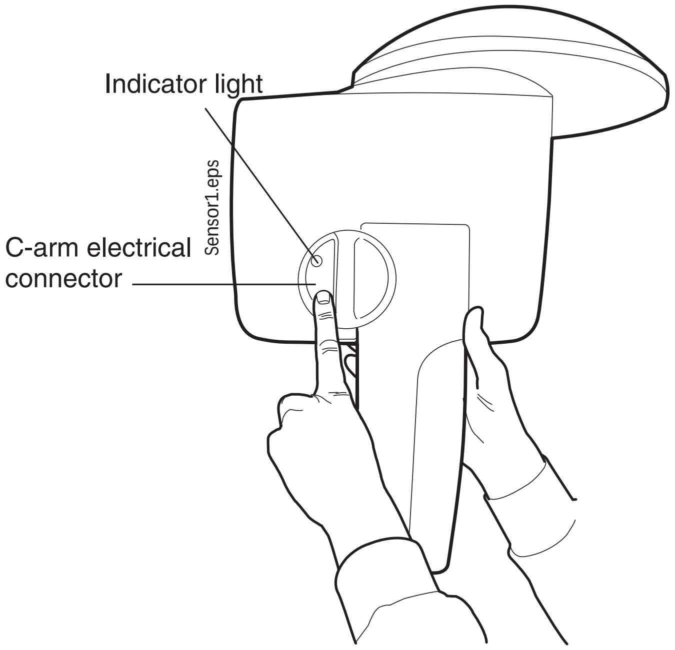


Figure 119

The locking knob can now be turned 180 degrees. This will release the sensor head locking mechanism.

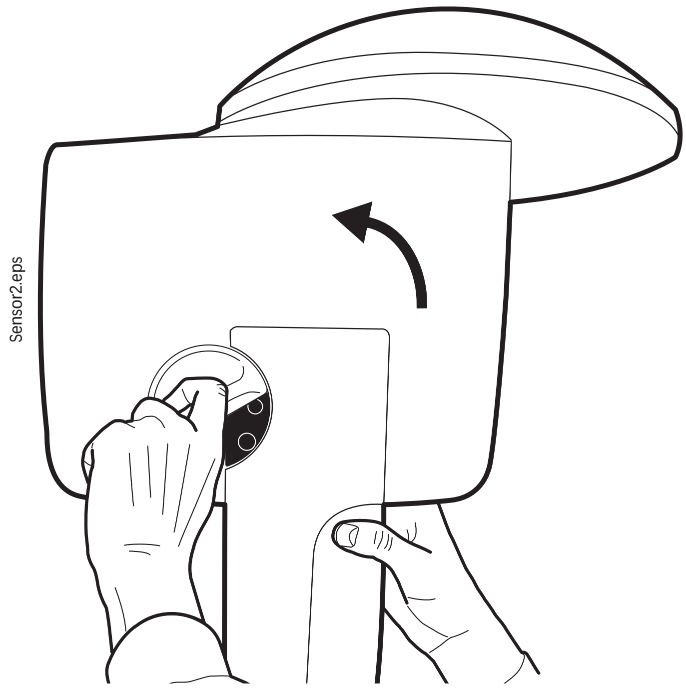


Figure 120

Pull the sensor head carefully out from its position.

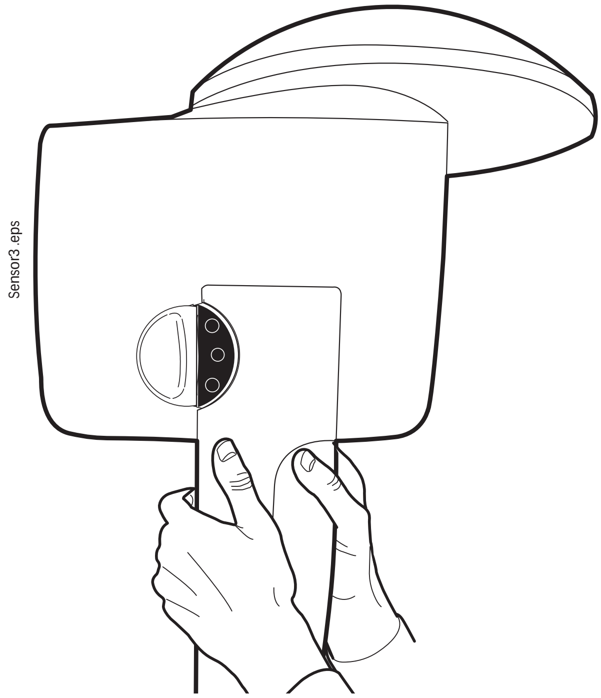


Figure 121

Attaching the sensor head to the C-arm

Push the sensor head onto the connector on the C-arm.

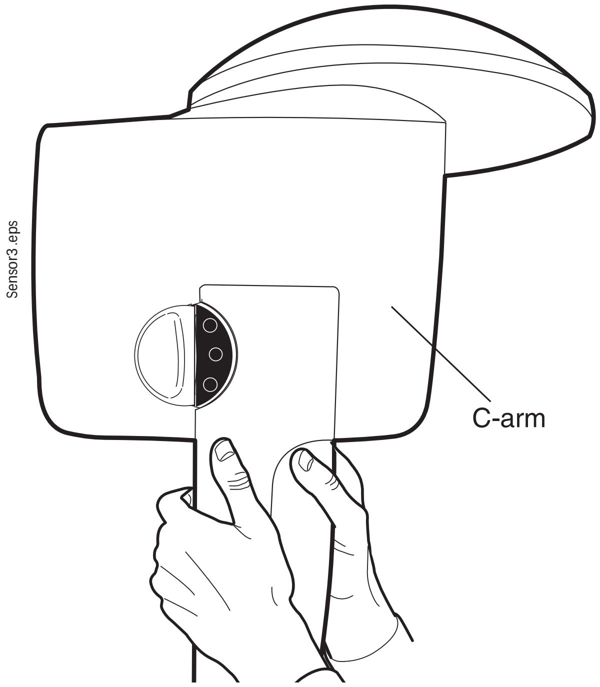


Figure 122

Turn the locking knob over the fastening mechanism. This will secure the sensor head in position.

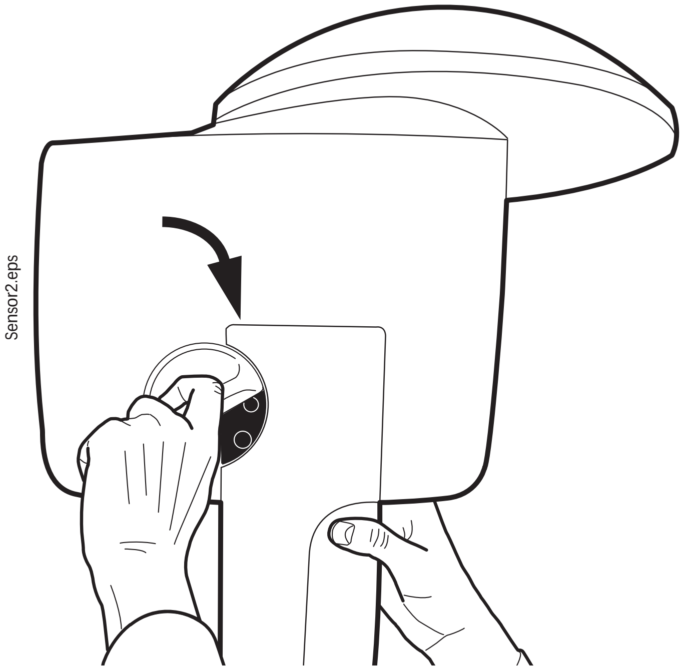


Figure 123

Push in the button of the C-arm electrical connector on the other side to secure the sensor head in position. This will make the electrical connection between the sensor head and C-arm.

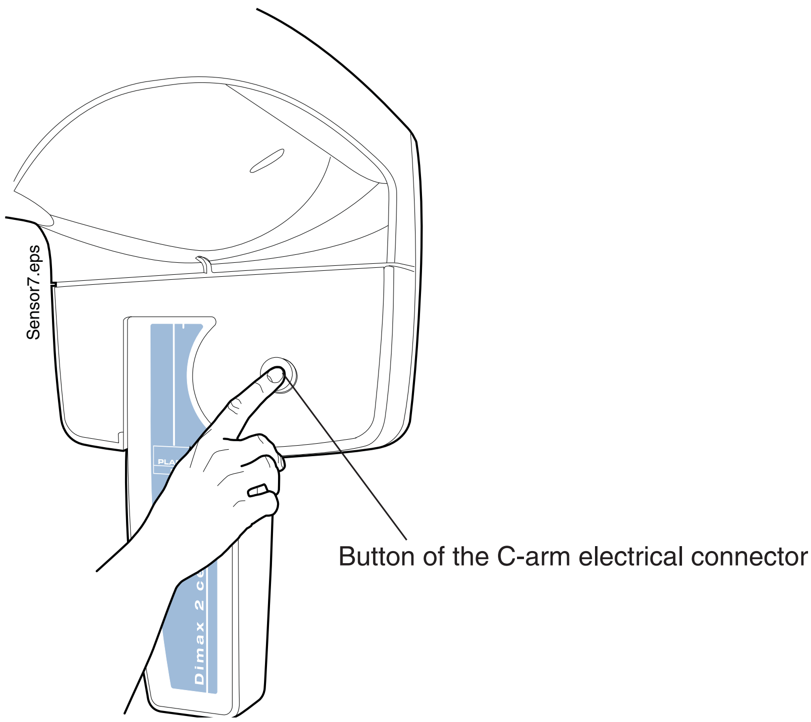


Figure 124

7 PROMAX 3D: REPLACING THE SENSOR HEAD

Detaching the sensor head from the C-arm

NOTE The indicator light is lit when the sensor is in use. Removing the sensor head when the indicator light is lit might harm the sensor or cause image data loss.

Push in the C-arm electrical connector located on the sensor head quick connector mechanism. This will disconnect the electrical connection between the sensor head and C-arm.

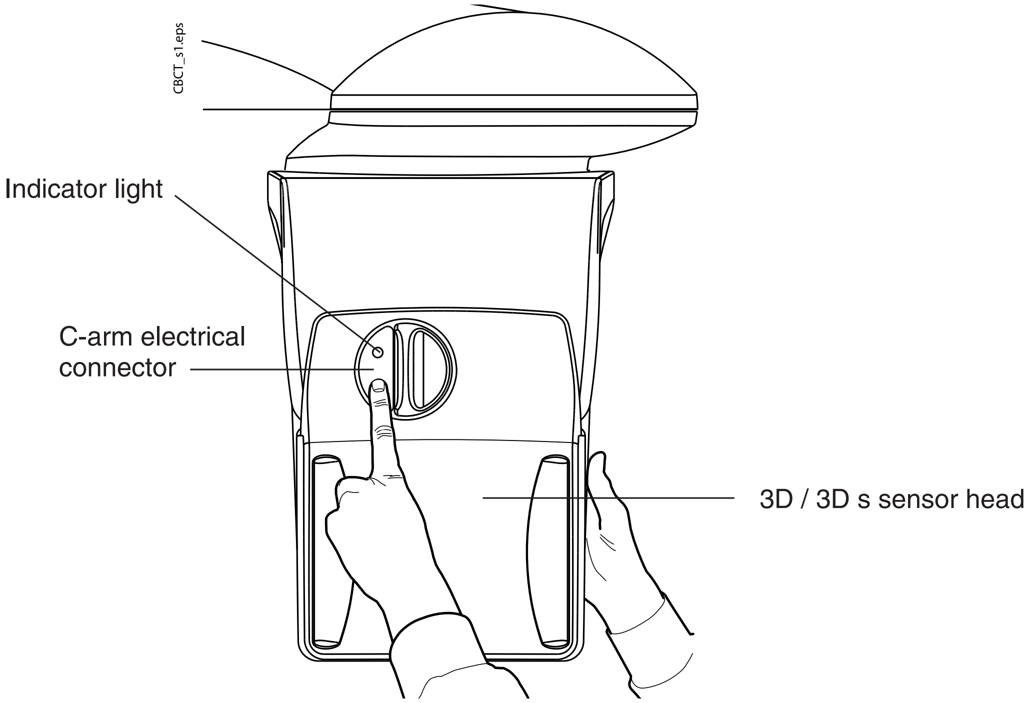


Figure 125

The locking knob can now be turned 180 degrees. This will release the sensor head locking mechanism.

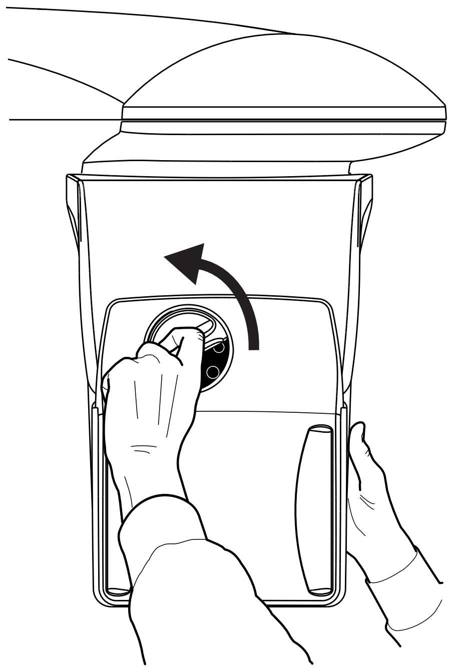


Figure 126

Carefully pull the sensor head out from its position.

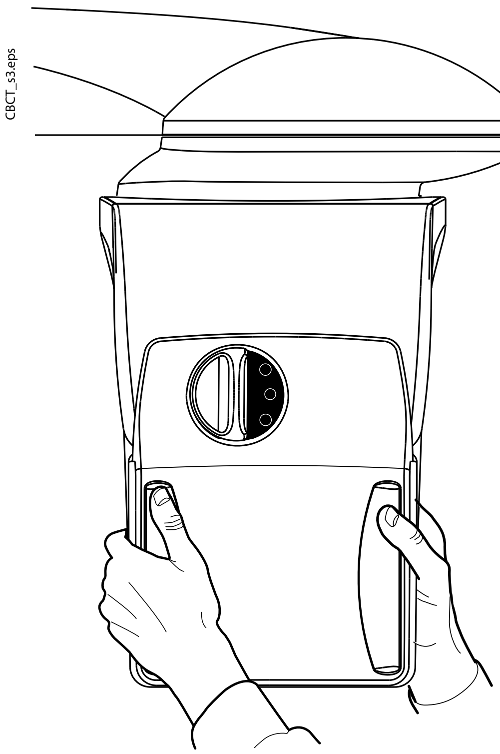


Figure 127

Attaching the sensor head to the C-arm

NOTE Select the sensor you are using on display i57.2 (*Service settings* > *Select configuration* > *Select 3D sensor type*). See section 5.7.3 "Select 3D sensor type" on page B-33 for details.

Push the sensor head onto the connector on the C-arm.

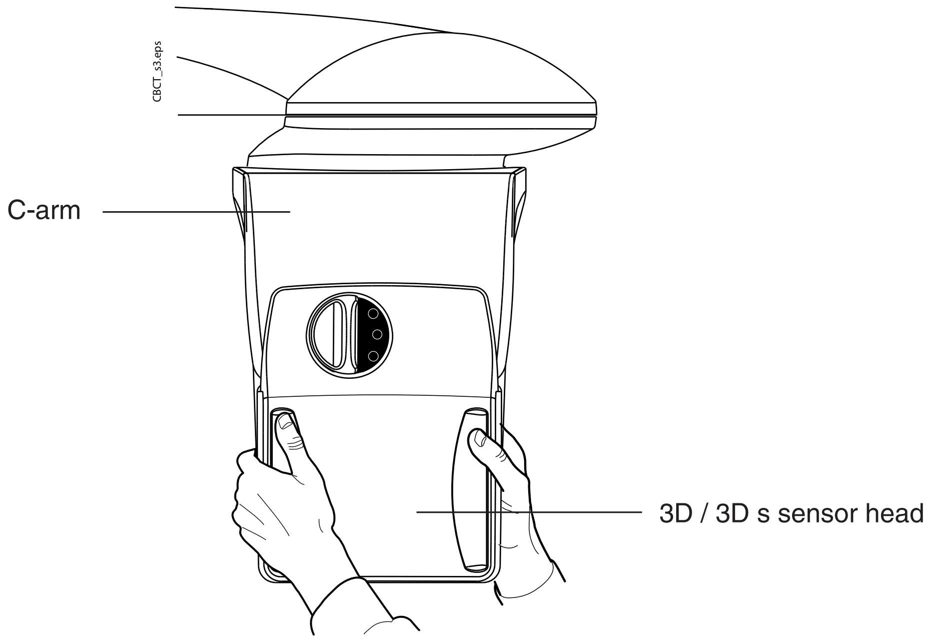


Figure 128

Turn the locking knob over the fastening mechanism. This will secure the sensor head in position.

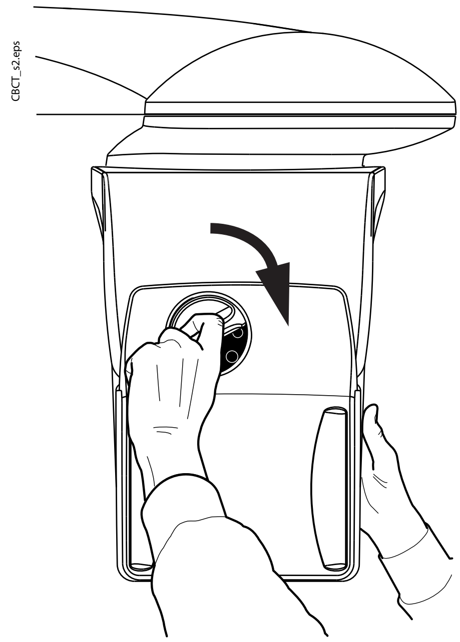


Figure 129

Push in the button of the C-arm electrical connector on the other side to secure the sensor head in position. This will make the electrical connection between the sensor head and the C-arm.

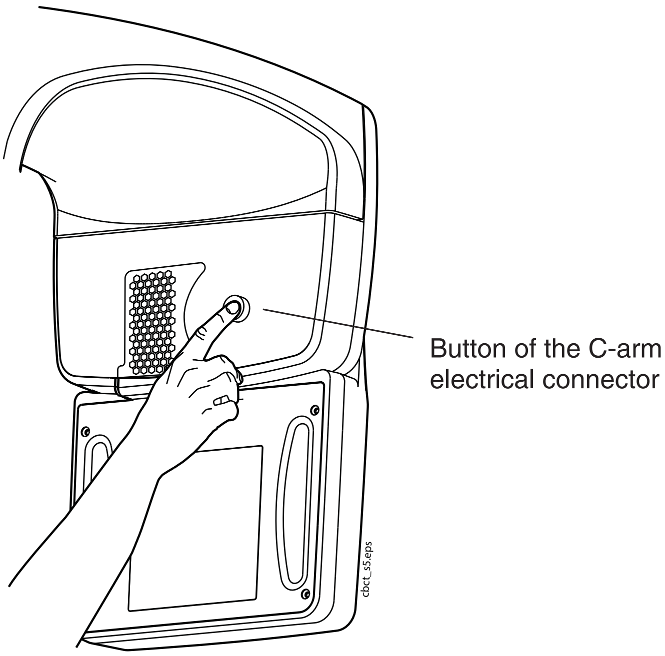


Figure 130

8 REPLACING PCBs

8.1 C-arm PCB

a) Remove the C-arm upper and inner covers, the cassette carriage/sensor head covers and tube head inner cover as described in section 5 “REMOVING THE COVERS” on page E-77.

b) Disconnect all the cables that are connected to the C-arm PCB.

c) Unscrew the C-arm PCB attachment screws with 2.5mm Allen key and remove the PCB (Fig. 131, 1).

d) Install the new C-arm PCB in reverse order. Connect the cables as shown in Fig. 131.

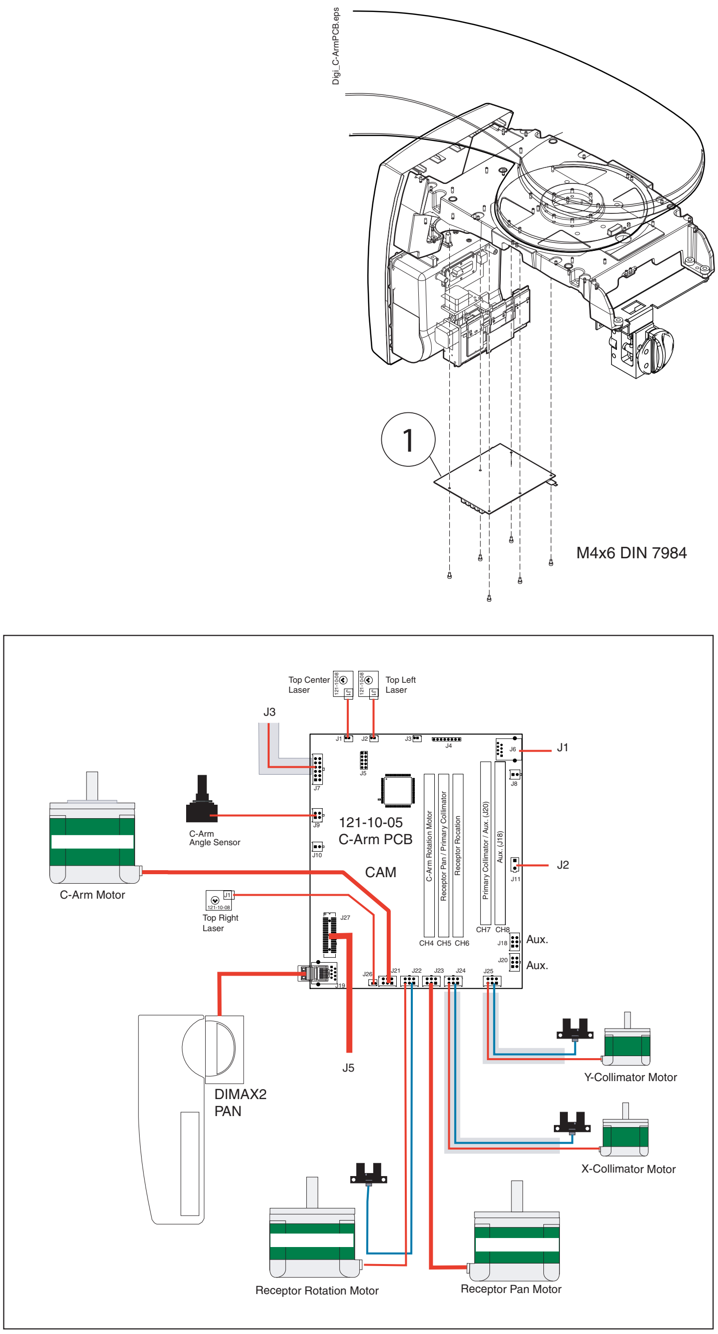


Figure 131

9 REPLACING TUBE HEAD

Remove the C-arm upper and inner covers and the tube head covers as described in section 5 “REMOVING THE COVERS” on page E-77.

Disconnect all the cables coming from the tube head from the C-arm PCB (Fig. 132, 1 - 5).

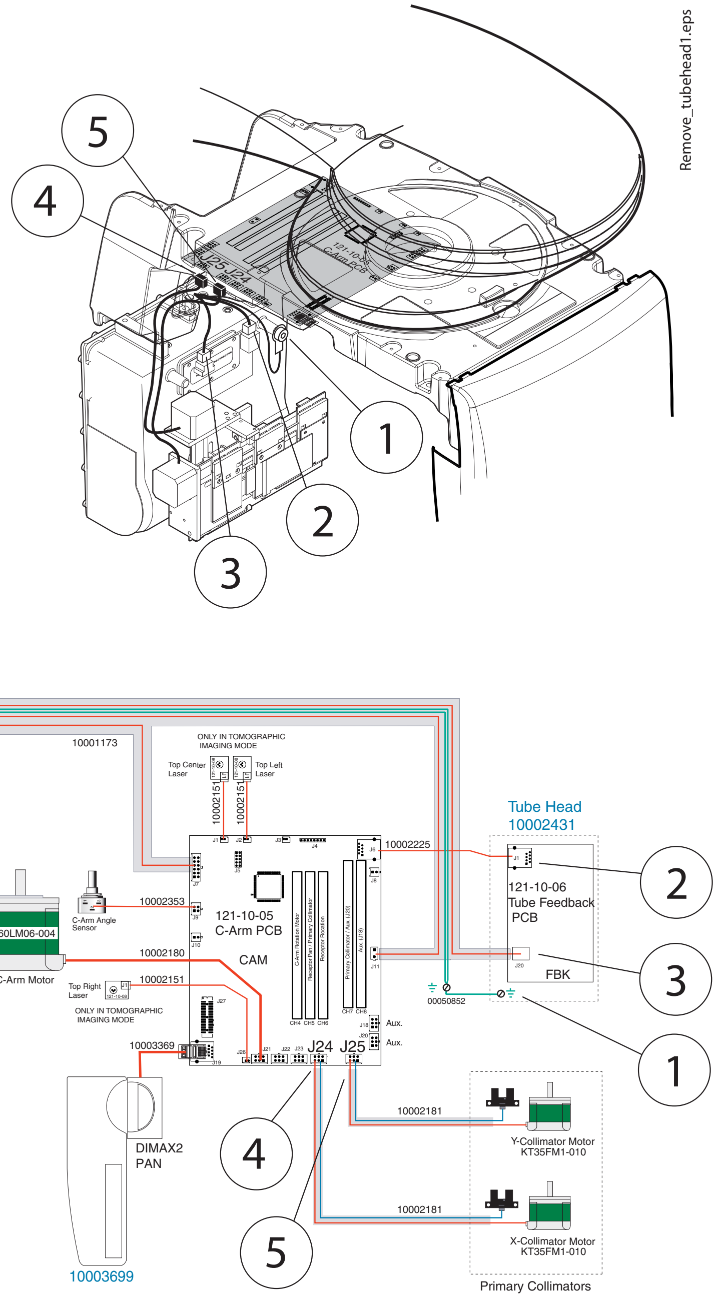


Figure 132

Open the primary collimator mechanism by rotating the primary collimator screws located behind the blades (Fig. 133, 1) so that you can see the two attachment screws (Fig. 133, 2). Unscrew the screws with 2.5mm Allen key and remove the primary collimator (Fig. 133, 3).

Unscrew the four tube head attachment screws with 4mm Allen key and remove the tube head.

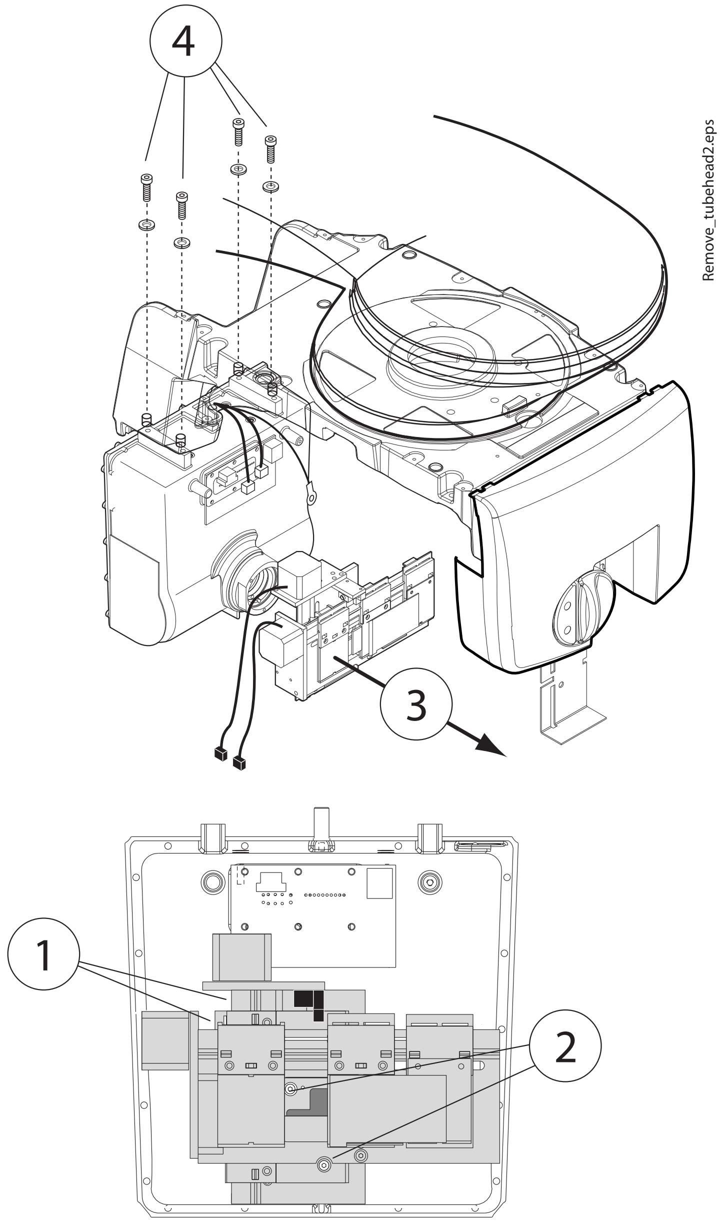


Figure 133

Install the new tube head in reverse order. Make sure that the tube head is parallel with the C-arm casting back edge.

Connect the cables as shown in Fig. 132 on page E-97. Perform the adjustments according to the instructions given in section 2.4 “Primary collimator angle adjustment” on page E-12.

10 PROMAX 3D: REPLACING COLLIMATOR

NOTE Use of 3D collimator V1 requires ProMax software revision 1.21.0.0.r or later. Use of 3D collimator V2 requires ProMax software revision 1.31.0.0.r or later.

NOTE A 3D sensor V2 can only be used on X-ray units with 3D collimator V2. If the X-ray unit is fitted with collimator type V0 or V1 (see display i57.1) the collimator has to be changed.

To remove the collimator that is attached to the X-ray unit, proceed as follows.

Remove the C-arm upper and inner covers and the tube head covers as described in section 5 “REMOVING THE COVERS” on page E-77.

Move the collimator to a position where the collimator screws are visible by selecting *Technical calibrations (i600) > Primary collimator calibration (i610) > Collimator assembly screws visible (i61.9) > Drive*.

NOTE You need a password to gain access to the technical settings. The password needs to be entered each time the X-ray unit is switched on. The password is 1701.

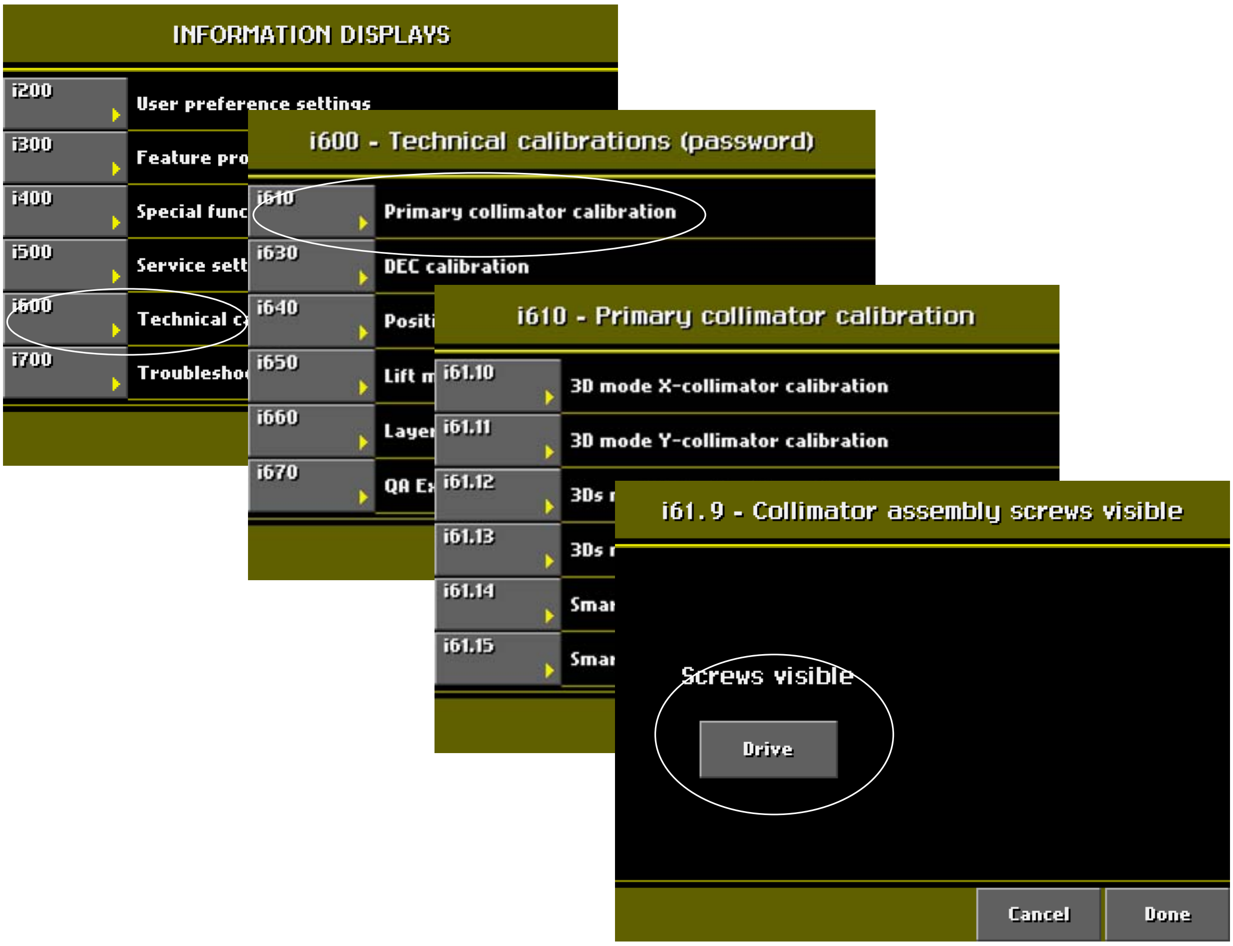


Figure 134

The collimator will now be in a position where the screws that secure the collimator in place are visible as shown below. The collimator blades can now be manually moved.

Then switch the X-ray unit off.

Disconnect both collimator cables (y-collimator motor cable and x-collimator motor cable).

Remove the upper collimator screw.

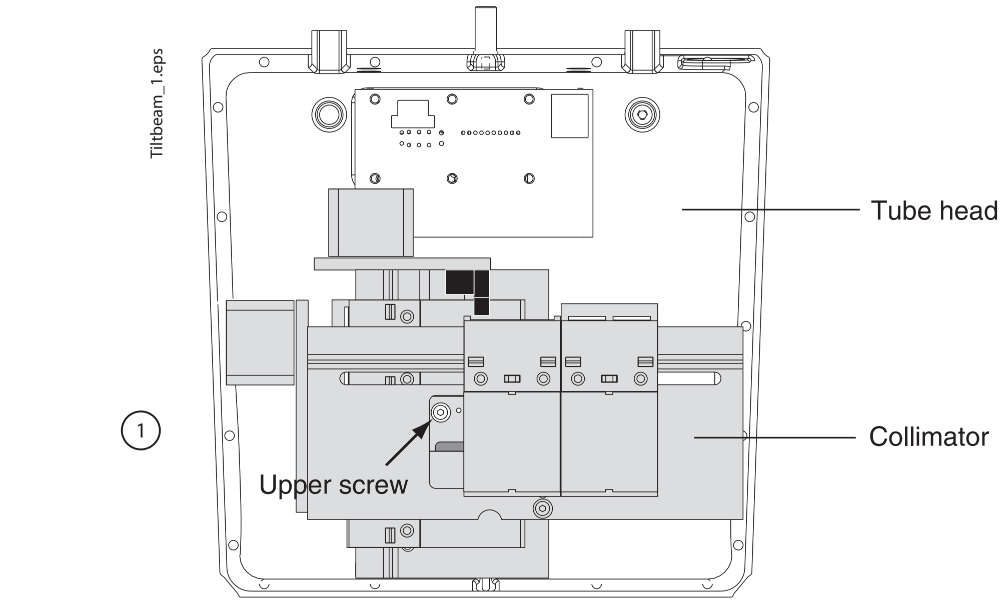


Figure 135

Manually lift up the lower blade so that you can reach the lower screw which is behind it. Remove the lower screw.

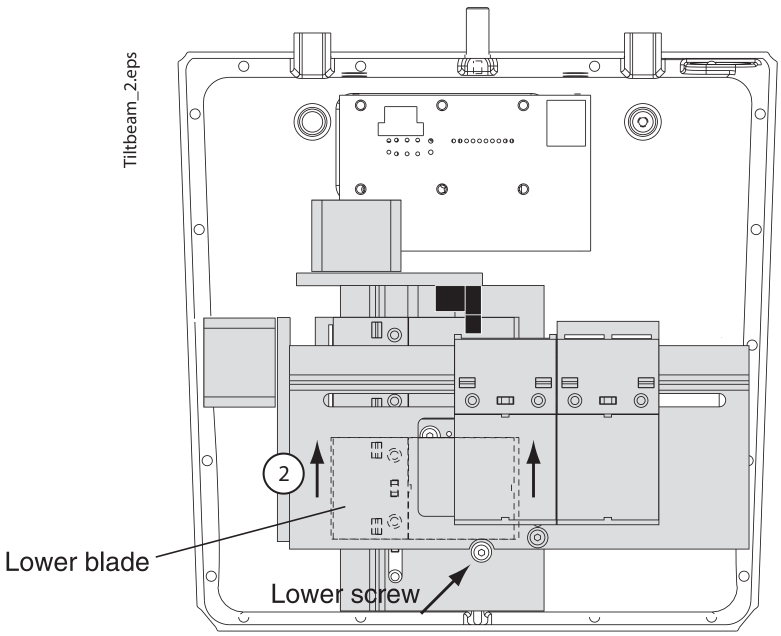


Figure 136

You can now detach the old collimator from the tube head.

To attach a 3D collimator, proceed as follows.

Attach the 3D collimator by tightening the two screws that hold it in position. DO NOT CONNECT THE CABLES YET.

Then switch the X-ray unit on.

On display i57.1, now select the 3D collimator you are using. Refer to section 5.7.2 “Select 3D collimator type” on page B-31 for full details.

NOTE **You need a password to gain access to the technical settings. The password needs to be entered each time the X-ray unit is switched on. The password is 1701.**

NOTE **If the option *Select configuration (i570)* is not shown on the list, you will need to activate the 3D license(s) as described in section 3.1 “Enable / disable features” on page B-13.**

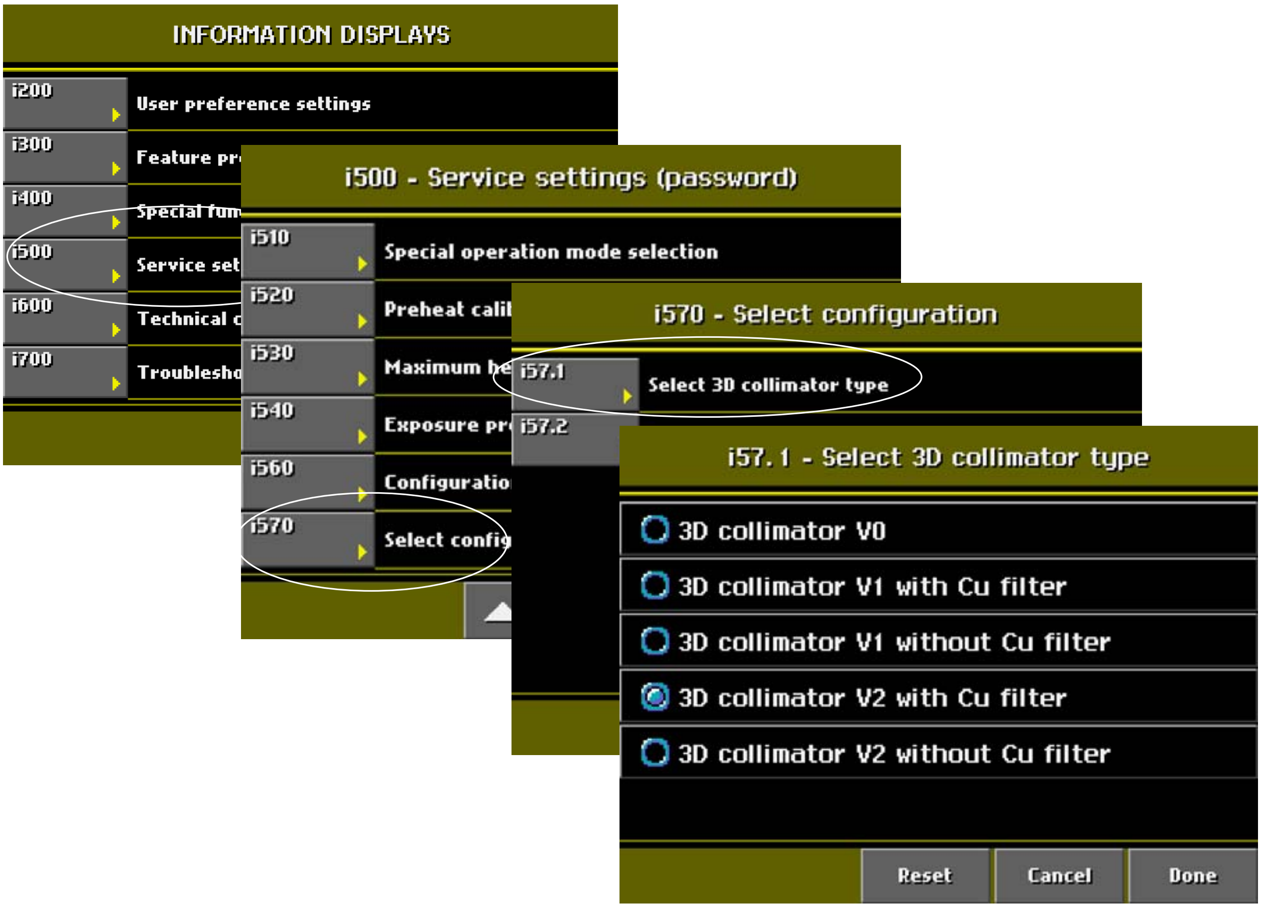


Figure 137

Switch the X-ray unit off. Connect the collimator cables as shown in Fig. 132 on page E-97. Replace any covers you had to remove.

Restart the X-ray unit.

Perform beam check as described in section 3.4 “Beam check” on page E-68. If needed, adjust the collimator angle as described in section 2.4 “Primary collimator angle adjustment” on page E-12.

11 PROMAX 3D: UPDATING RECONSTRUCTION PC SOFTWARE

NOTE **The reconstruction PC software is updated from an external PC.**

a) Start the **ProMax3D Tool** program.

b) Select **Software – Update Reconstruction PC Software**.

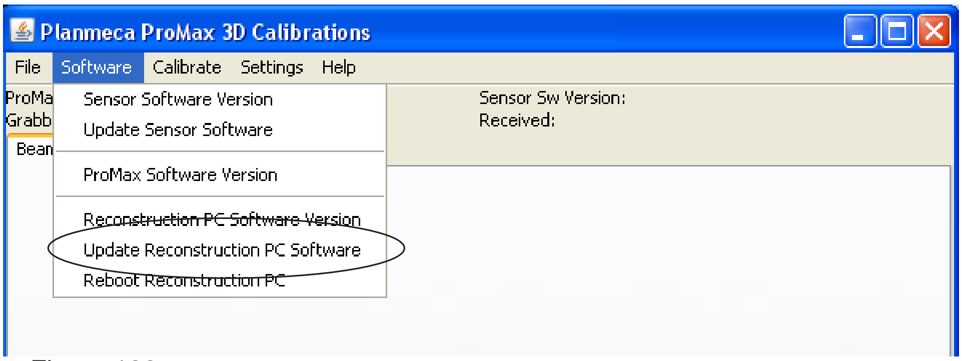


Figure 138

c) Select loaded software from the browser (e.g. recpc_2.2.0.0.R.tar.gz).

d) Wait until the software has been loaded successfully. “Software Updated” message will be displayed.

e) After loading the Reconstruction PC will be <u>automatically</u> rebooted. Wait until rebooting has been performed.

f) Select **Software – Reconstruction PC Software Version** to check that the software was updated.

g) Take a beam check image as described in section 3.4 “Beam check” on page E-68.

h) Calibrate the sensor as described in sections 3.5 “Flat Field calibration” on page E-68 and 3.6 “3D Geometry calibration” on page E-68.

i) Carry out a Q/A test as described in section 3.7 “3D Quality Assurance (Q/A) Test” on page E-68.

12 PROMAX 3D: UPDATING SENSOR SOFTWARE

NOTE **The sensor software is updated from an external PC.**

a) Start the **ProMax3D Tool** program.

b) Select **Software – Update Sensor Software**.

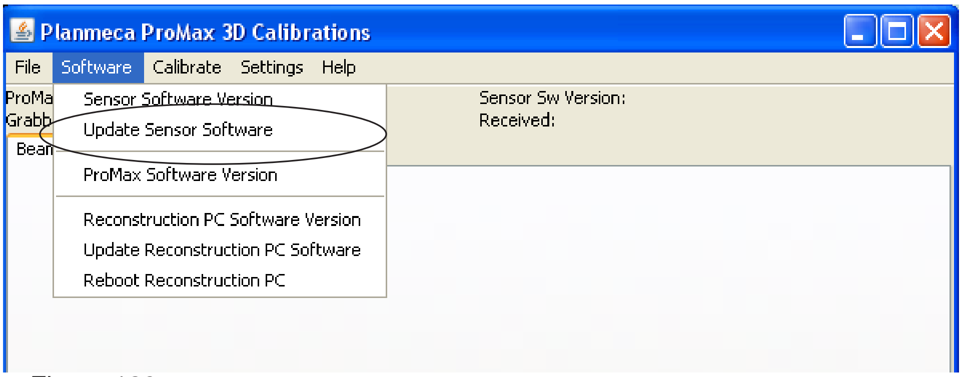


Figure 139

c) Select the software from the browser (e.g. 3D_sensor_2.2.0.0.R.EthUpgrd.ldr).

d) Wait until the software has been loaded successfully, “Sensor Software Updated” message will be displayed.

e) Select **Software – Sensor Software Version** to check that the software was updated.

Chapter

F

PATIENT SUPPORT ARM

1 ADJUSTMENTS

1.1 Patient positioning mechanism adjustment

In case the panoramic X-ray beam is not correctly aligned, the patient positioning mechanism adjustment must be performed before adjusting the panoramic X-ray beam. Because the adjustment of the patient positioning mechanism is a part of the C-arm adjustments, this adjustment is also described in chapter E “C-ARM AND IMAGING ARM”.

1.2 Panoramic mode patient positioning lights

Checking the midsagittal plane positioning light

Attach the ball phantom to the patient positioning mechanism adapter.

Move the thumb wheel of the layer light slightly to switch the three patient positioning lights on. The layer light thumb wheel is located on the underside of the patient support table. The midsagittal light beam should strike the black line on the front of the ball phantom.

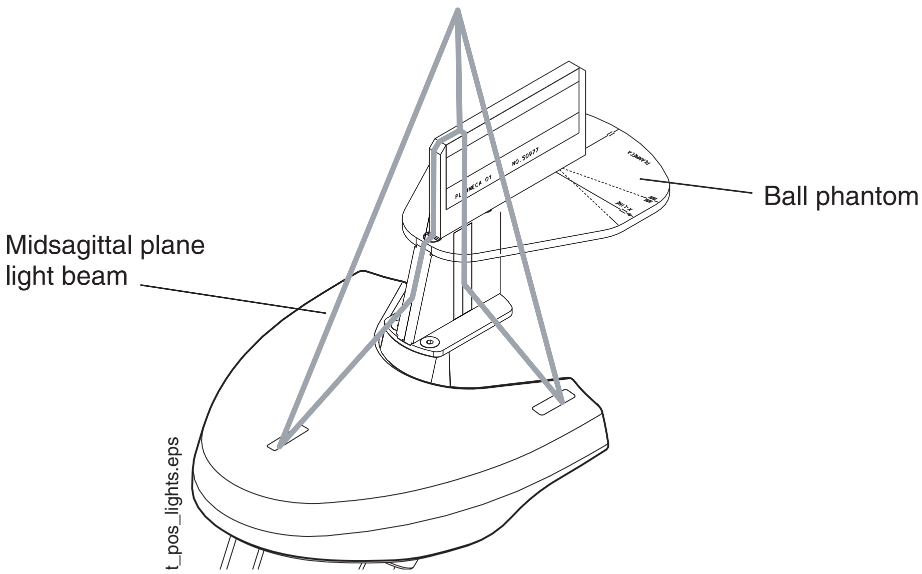


Figure 1

If the light beam does not coincide with the black line or it is not in focus, it must be adjusted according to the instructions in section “Midsagittal plane positioning light adjustment” on page F-2.

Midsagittal plane positioning light adjustment

Remove the patient support table cover according to the instructions given in section 2.1 “Patient support table cover” on page F-7.

Midsagittal plane positioning light

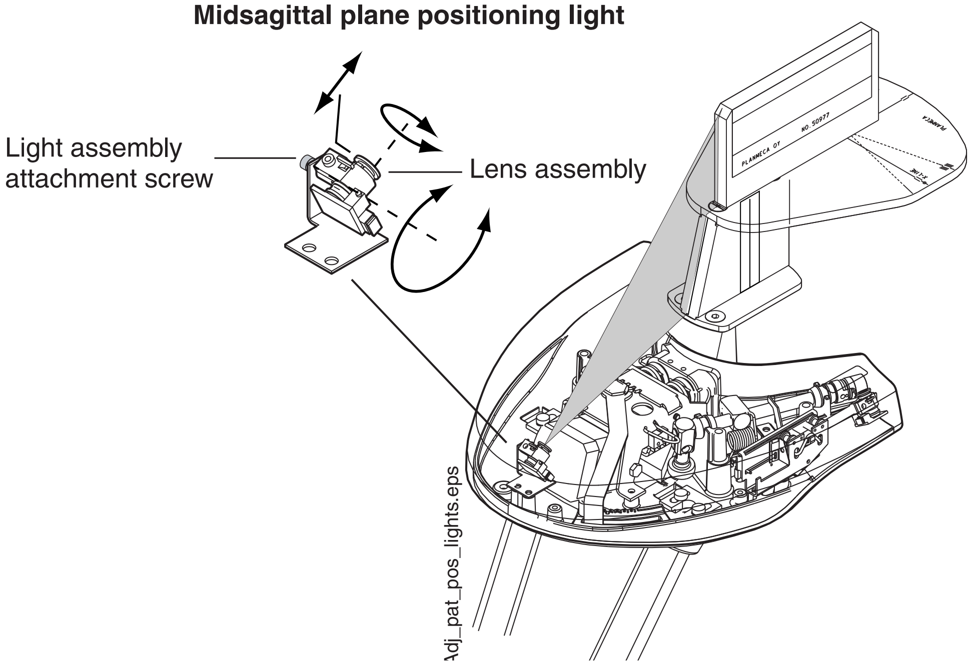


Figure 2

To adjust the light beam angle rotate the lens assembly of the light (Fig. 3, 1).

To adjust the light vertical position loosen the attachment screw of the laser light assembly and rotate the assembly (Fig. 3, 2).

To focus the light beam adjust the depth of the lens assembly (Fig. 3, 3).

To adjust the light beam horizontal position bend the light attachment plate (Fig. 3, 4).

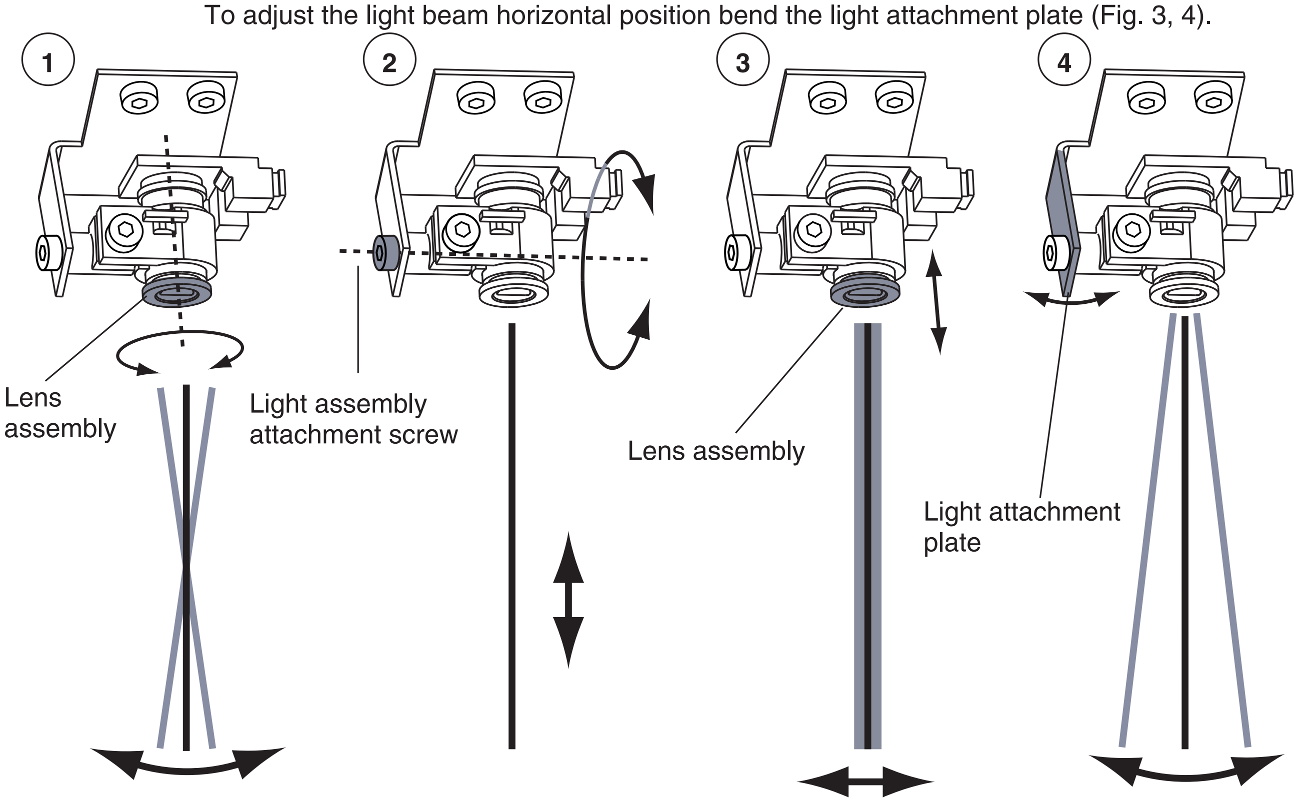


Figure 3

Layer light calibration

Perform the panoramic beam adjustment according to the instructions given in chapter E “C-ARM AND IMAGING ARM”.

To enter the calibration mode first touch the **i** field on the *Main* display.

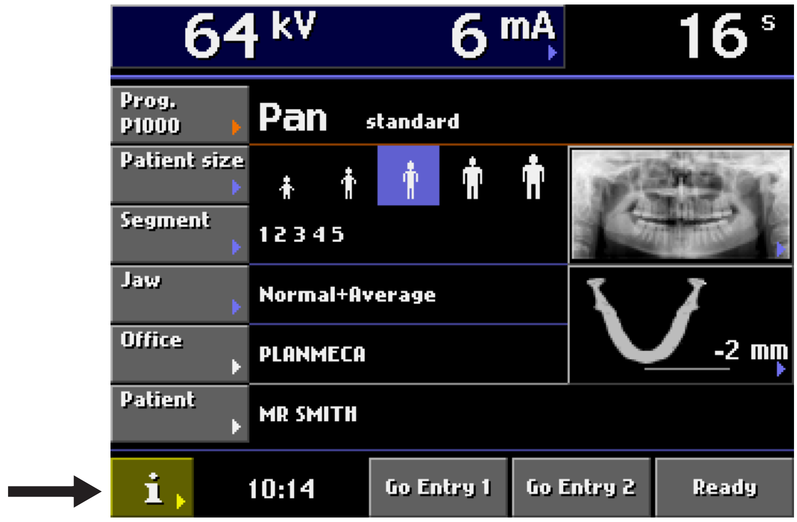


Figure 4

Select *Technical calibrations (i600)* from the list on the display. The password to the Technical calibrations mode is asked when the Technical calibrations mode is entered for the first time after switching the unit on. **The password is 1701.**

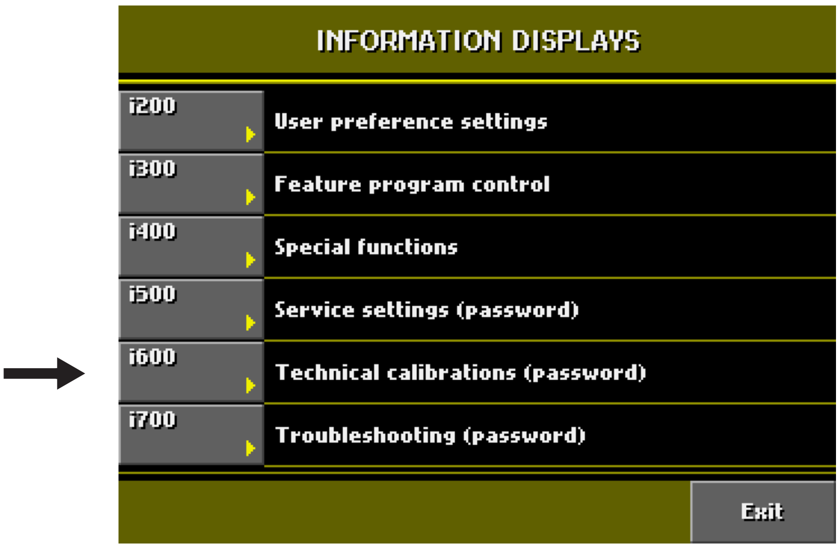


Figure 5

From the list on the *i600* display that appears select *Layer laser calibration (i660).*

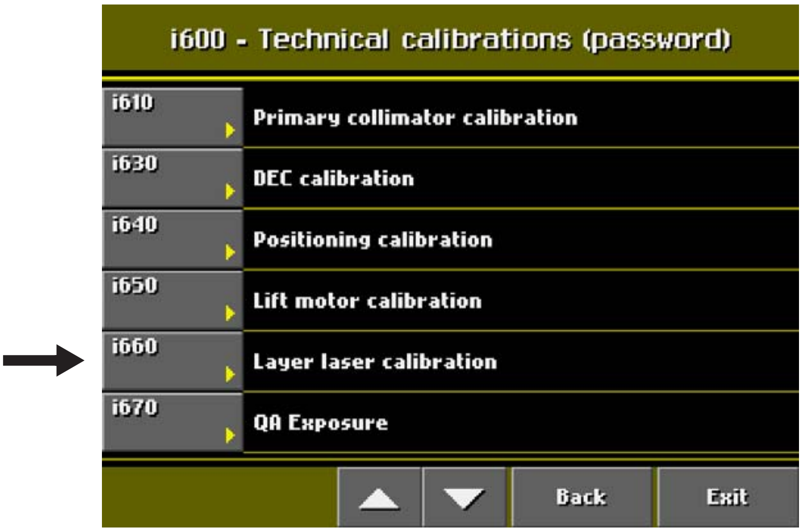


Figure 6

The *Layer laser calibration* display appears.

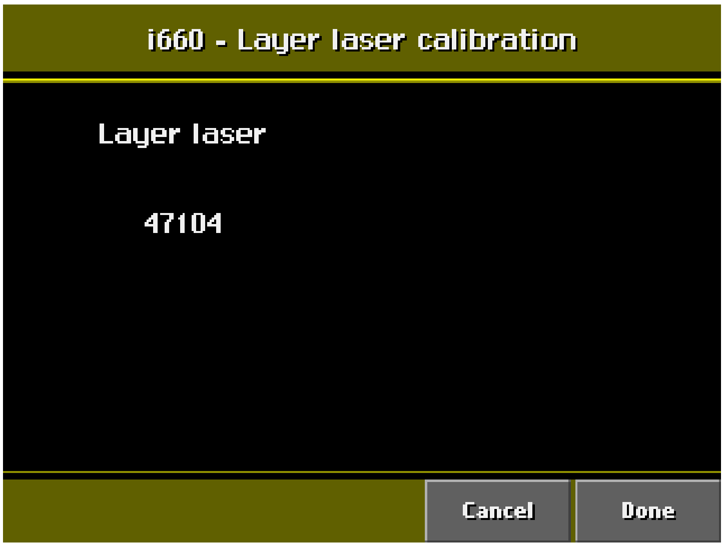


Figure 7

Move the thumb wheel of the layer light slightly to switch the three patient positioning lights on. The layer light thumb wheel is located on the underside of the patient support table. Move the layer light beam so that it is on the black reference line on the side of the ball phantom. Accept the new the layer light zero position and exit the calibration mode by touching the **Done** field.

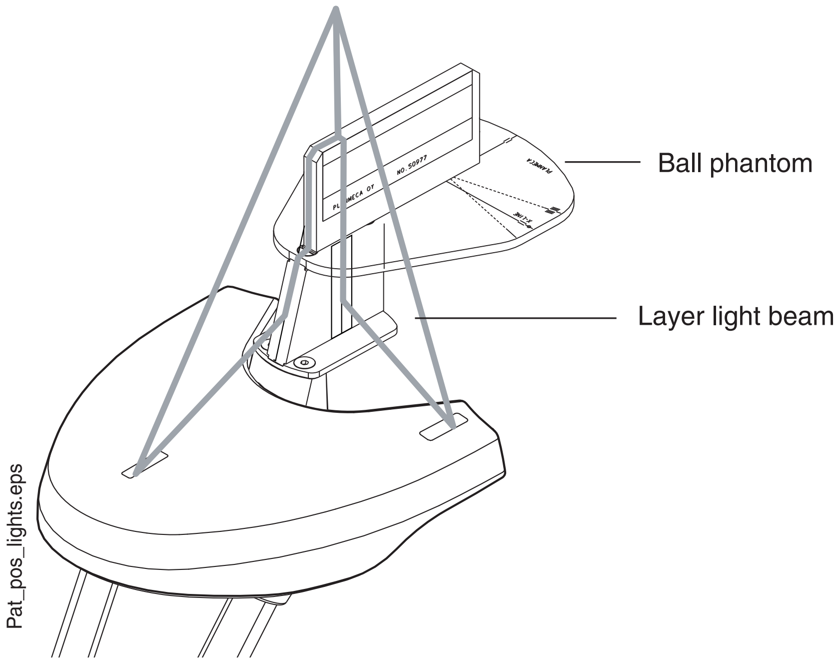


Figure 8

If the light beam is not vertical, or it is in focus, it must be adjusted according to the instructions in section “Layer light adjustment” on page F-6.

Layer light adjustment

Remove the patient support table cover according to the instructions given in section 2.1 “Patient support table cover” on page F-7.

To adjust the light vertical position loosen the attachment screw of the laser light assembly and rotate the assembly (Fig. 9, 1).

To focus the light beam adjust the depth of the lens assembly (Fig. 9, 2)

To adjust the light beam angle rotate the lens assembly of the light (Fig. 9, 3).

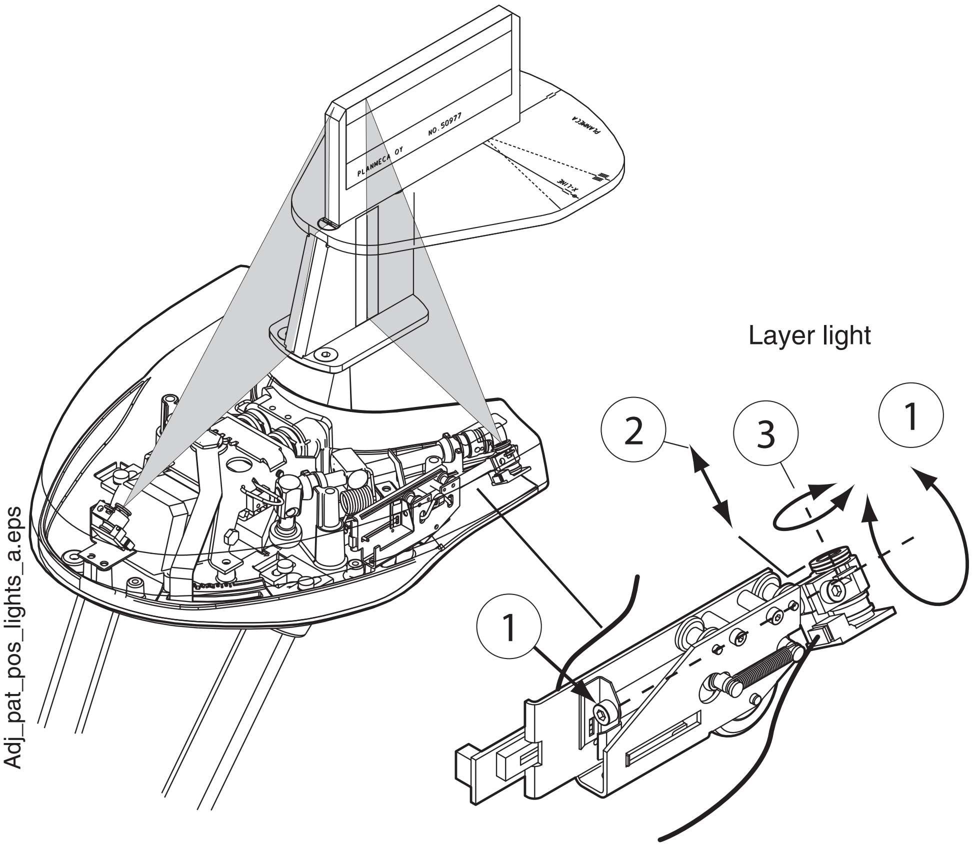


Figure 9

2 REMOVING THE COVERS

2.1 Patient support table cover

Unscrew the five cover attachment screws and remove the cover.

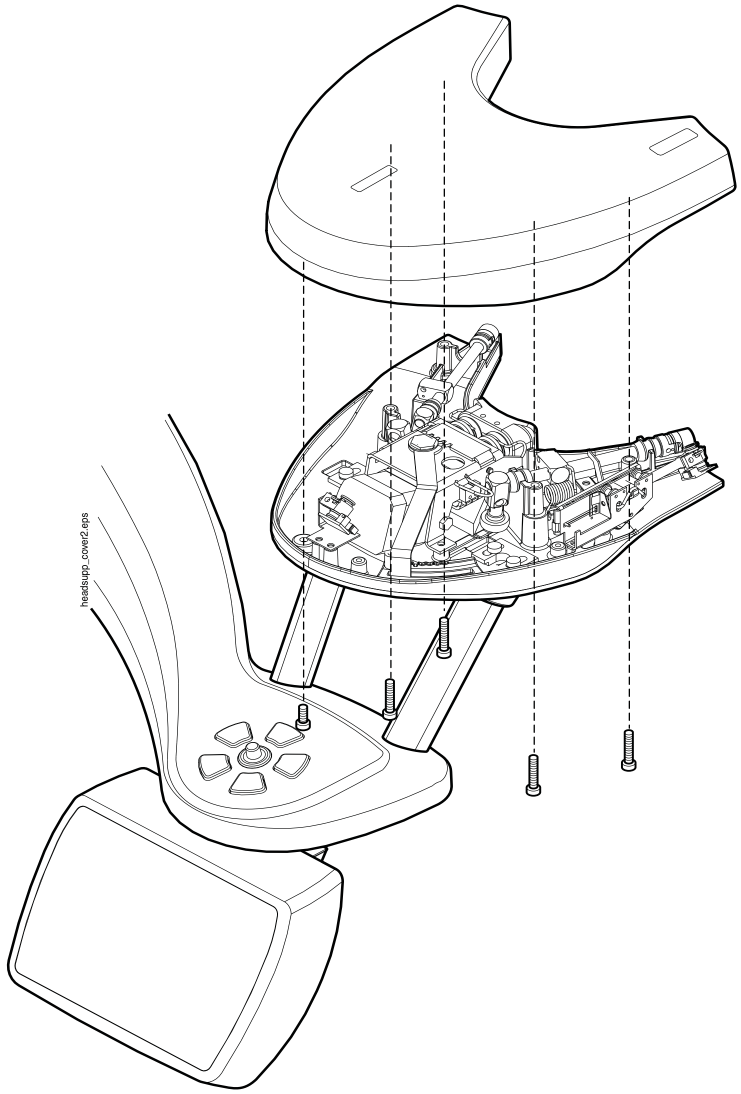


Figure 10

2.2 Support arm lower cover

Detaching the user interface

1) Unscrew the back cover attachment screw (PT 3x12 rst WN 1451 torx) and remove the cover (Fig. 11, 1).
2) Disconnect the graphic interface cable from the connector J3 on the GUI PCB (Fig. 11, 2).
3) Unscrew the four attachment screws of the user interface box (PT 3x12 rst WN 1451 torx) and remove the box (Fig. 11, 3).

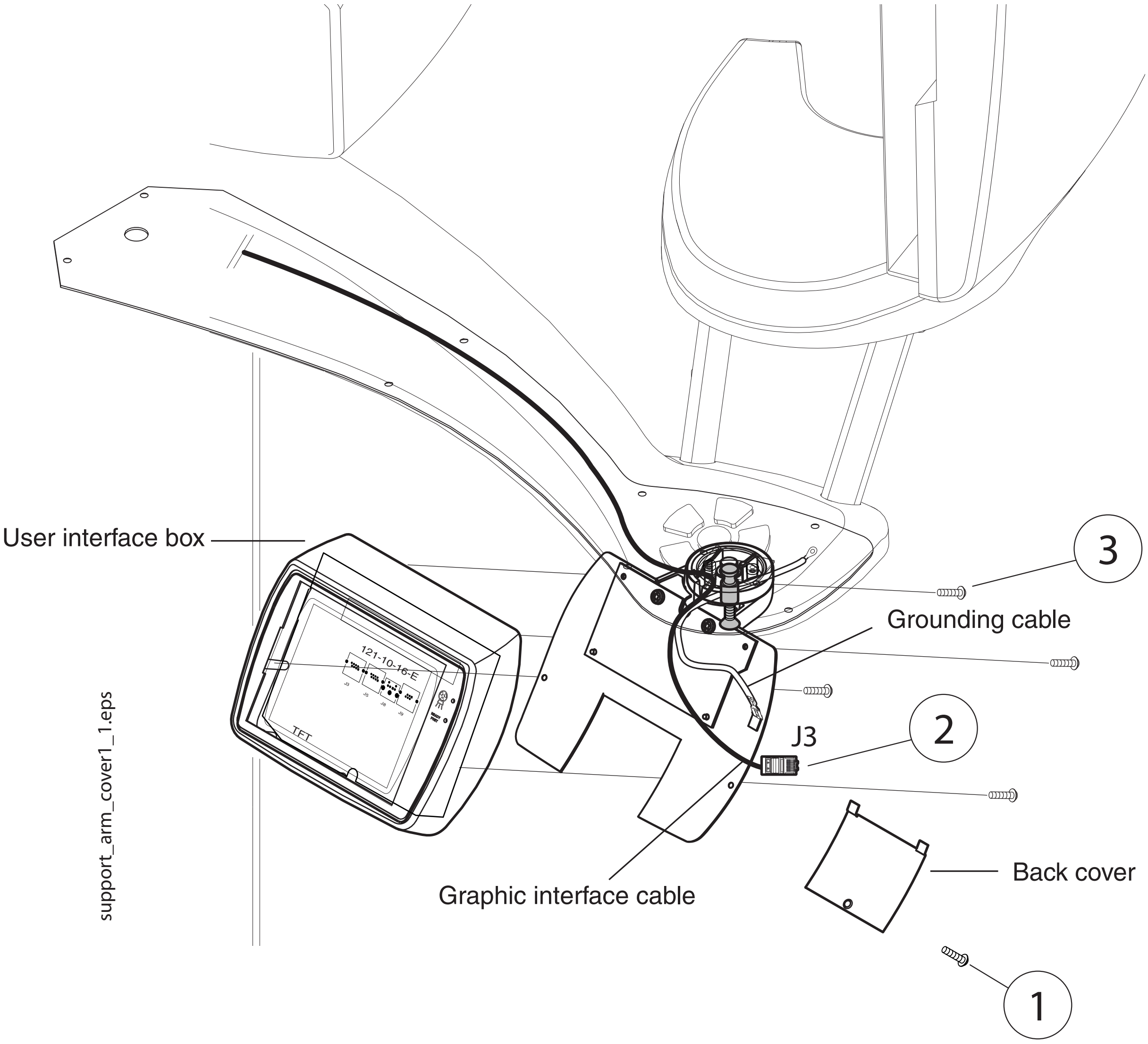


Figure 11

Detaching the user interface support and support arm lower cover

4) Unscrew the attachment screw of the user interface joint with the 4mm Allen key (Fig. 12, 4).
5) Press the joint with an Allen key upwards to release it from the locking plate opening (Fig. 12, 5.1-5.3).
6) Detach the grounding cable from the support plate.
7) Pull the user interface support from the arm lower cover (Fig. 12, 6).
8) Unscrew the attachment screws of the support arm lower cover with the 2.5mm Allen key and remove the cover (Fig. 12, 7).

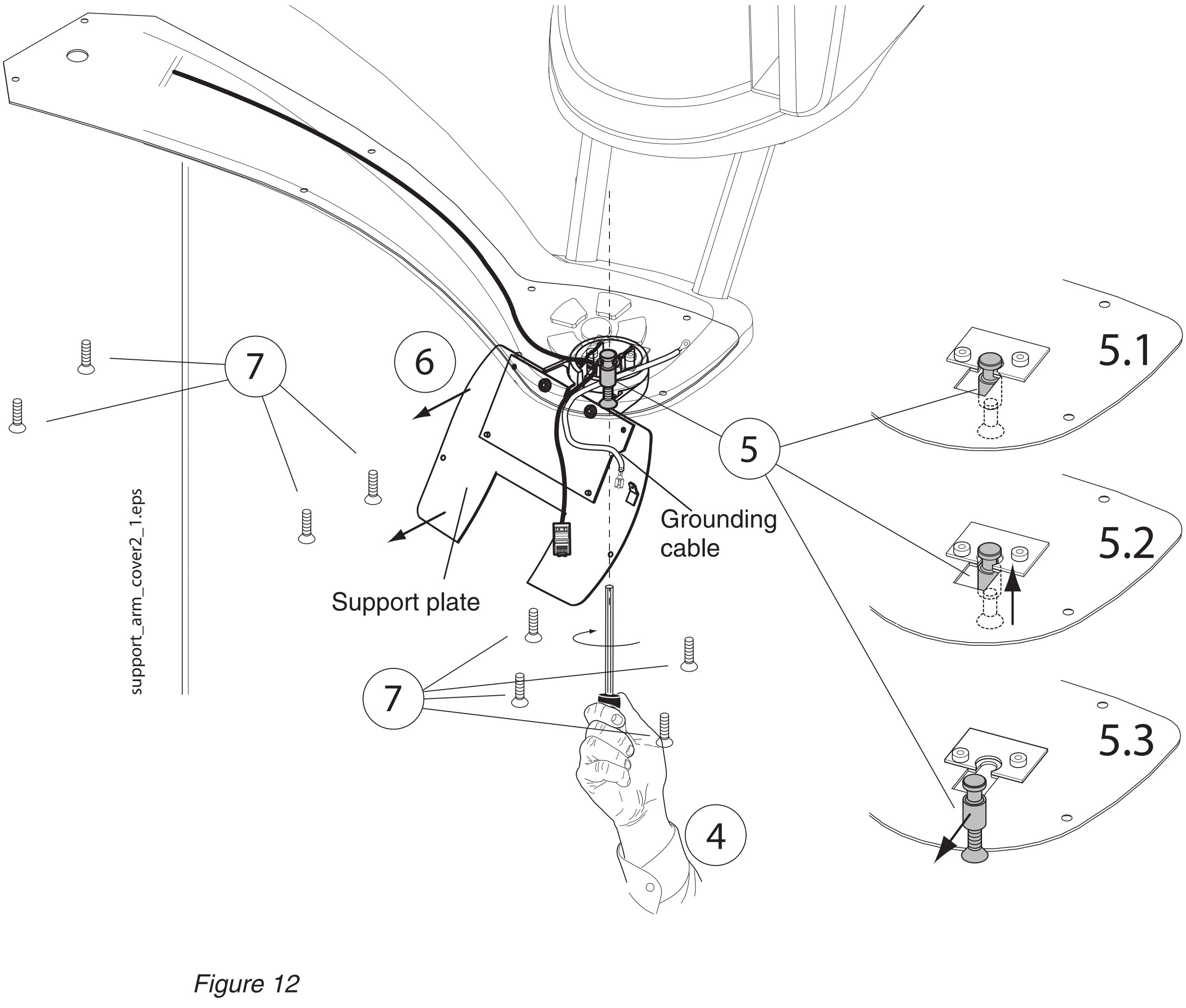


Figure 12

3 REPLACING THE GUI SOFTWARE

The software update for a colour GUI is explained in section 3.1 “GUI software update, only for colour GUI” on page F-10 and the software update for black/white GUI is explained in section 3.2 “Replacing GUI software chip, only for black/white GUI” on page F-11.

3.1 GUI software update, only for colour GUI

NOTE **The colour GUI software has to be updated every time when the X-ray unit software is updated.**

The GUI software can be updated by choosing *Software update (i590)* from the Service Settings (i500) menu.

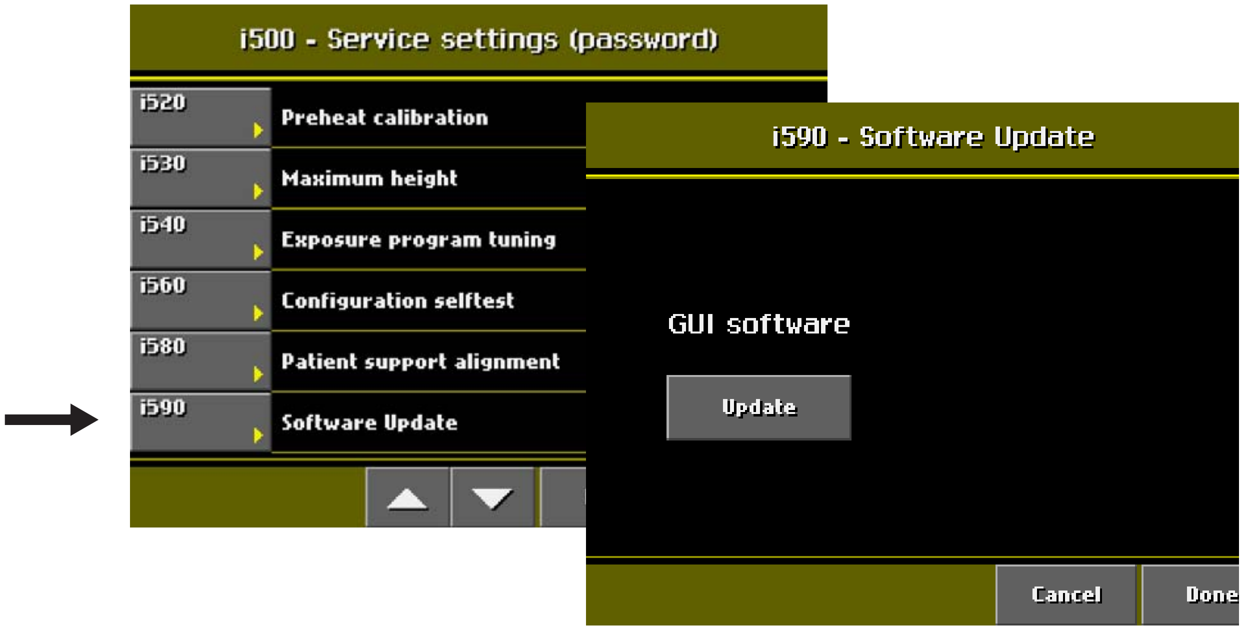


Figure 13

When touching the **Update** button the GUI software update procedure starts and a text “Updating GUI software” occurs on the screen. When the procedure is completed the GUI restarts and returns automatically to Software Update (i590) menu. The exit of the mode is by touching the **Done** field.

NOTE **If there are several GUIs connected to the ProMax X-ray unit then the software update has to be done for every GUI separately. Detach other GUIs while updating the software to one of them.**

3.2 Replacing GUI software chip, only for black/white GUI

WARNING

Always turn the X-ray unit off before removing the software chip from its socket.
Never turn the unit on, if the software chips are not in their sockets.

NOTE **Antistatic precautions must be performed when handling the software chip. Touch any grounded metal part of the unit before touching the software chip.**

NOTE **The GUI software update by changing the software chip can be ONLY done for a black/white GUI.**

Detach the user interface according to the instructions given in section 2.2 “Support arm lower cover” on page F-8.

Remove the software chip from its socket marked IC16 with the special tool.

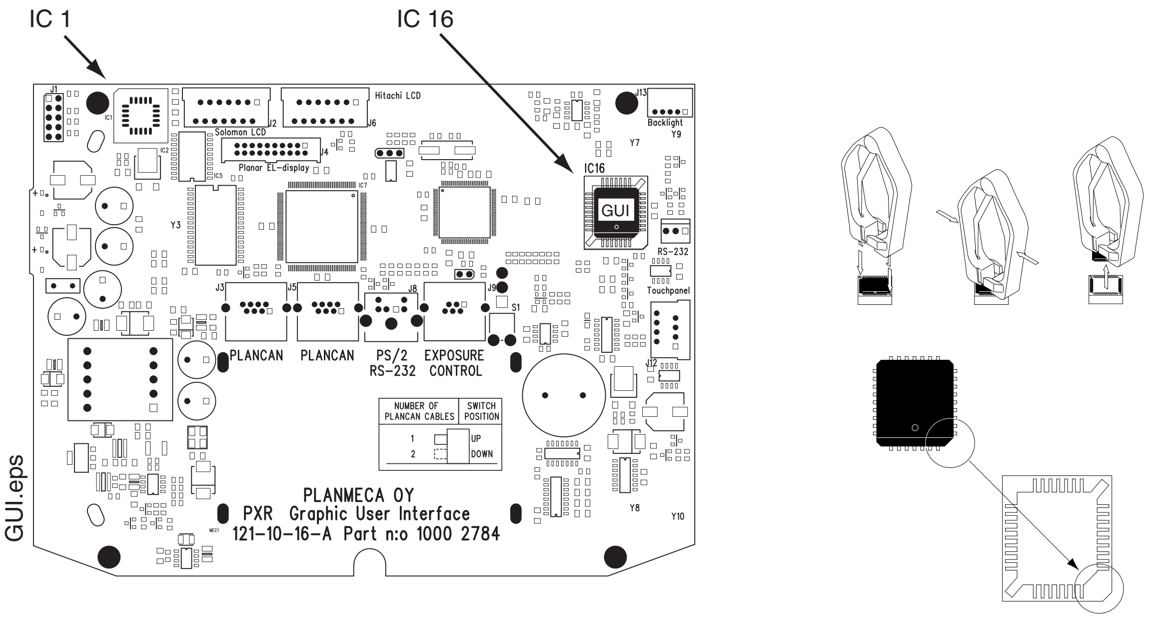


Figure 14

NOTE **If an IC1 chip is present, remove it too.**

Carefully place the new software chip into the socket.

Attach the user interface to the patient support arm.

4 REPLACING PCBS

4.1 Patient position control PCB

Detach the user interface and the user interface support according to the instructions given in section 2.2 “Support arm lower cover” on page F-8.

Unscrew the attachment screws of the support arm lower cover with the 2.5mm Allen key and remove the cover.

Detach the grounding cable from the patient support arm.

Unscrew the two M4x6 DIN 7984 screws of the PPC bridges with 2.5mm Allen key and remove the bridges.

Disconnect all the cables that are connected to the Patient position control PCB.

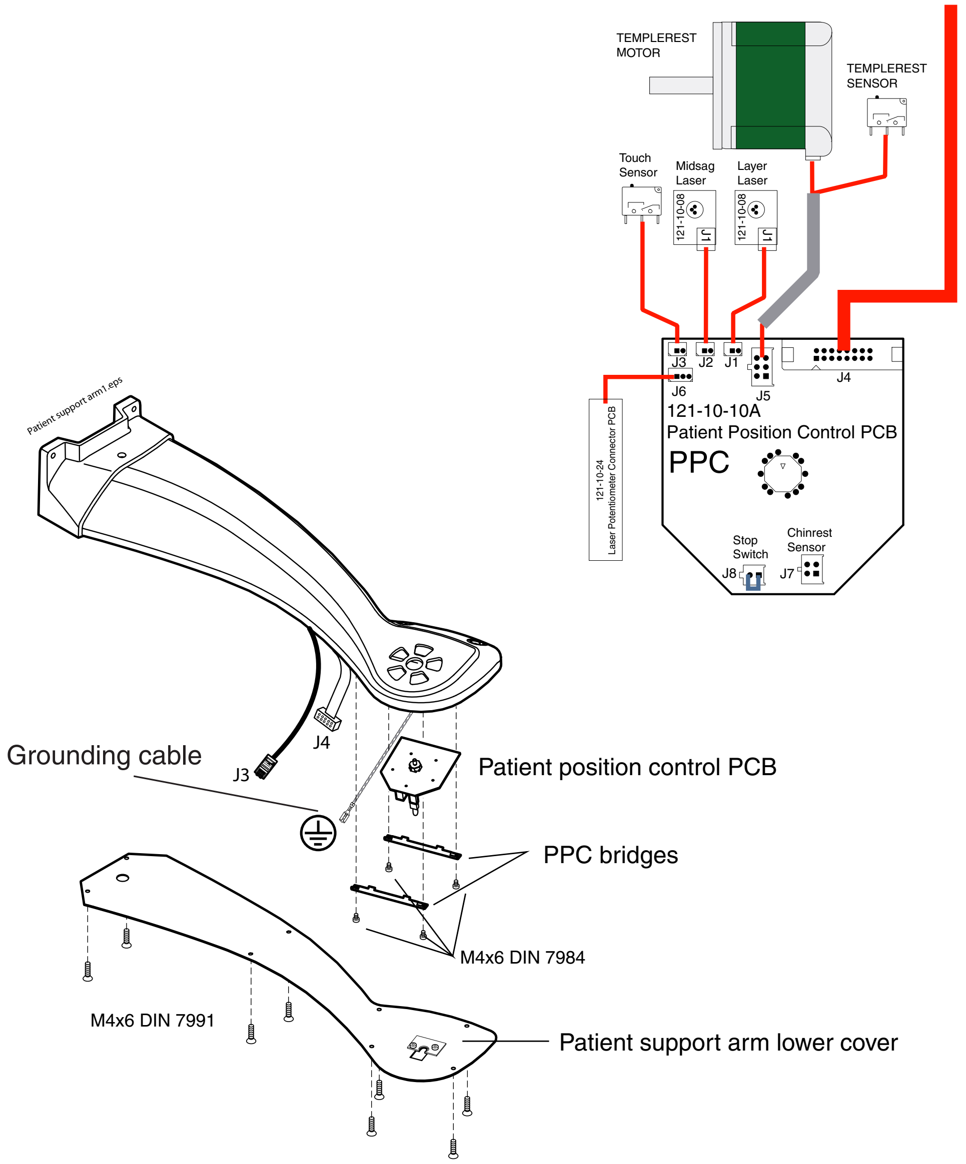


Figure 15

Install the new PCB in the reverse order

4.2 Graphic user interface (GUI) PCB

Detach the user interface according to the instructions given in section “Detaching the user interface” on page F-8.

Detach the grounding cable from the support plate.

Detach the user interface assembly from the interface box by unscrewing the four PT 3x12 rst WN1451 Torx screws.

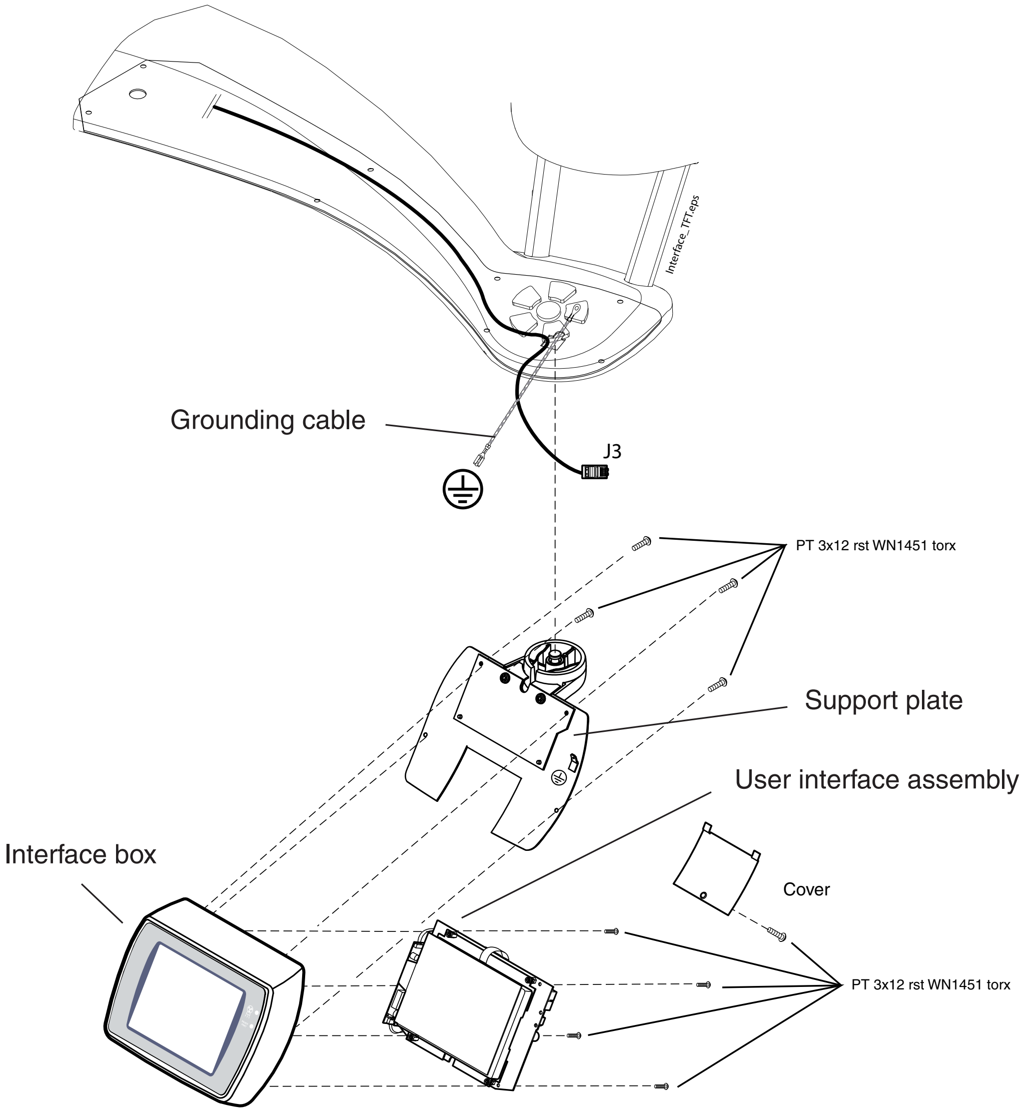


Figure 16

Colour GUI

The GUI PCB is attached to the user interface with the four M3x6 ISO 7380 screws that are located behind the PCB. Unscrew these screws and detach the PCB from the interface. Disconnect the flat cable from the connector J2, J12 and J16 on the GUI PCB.

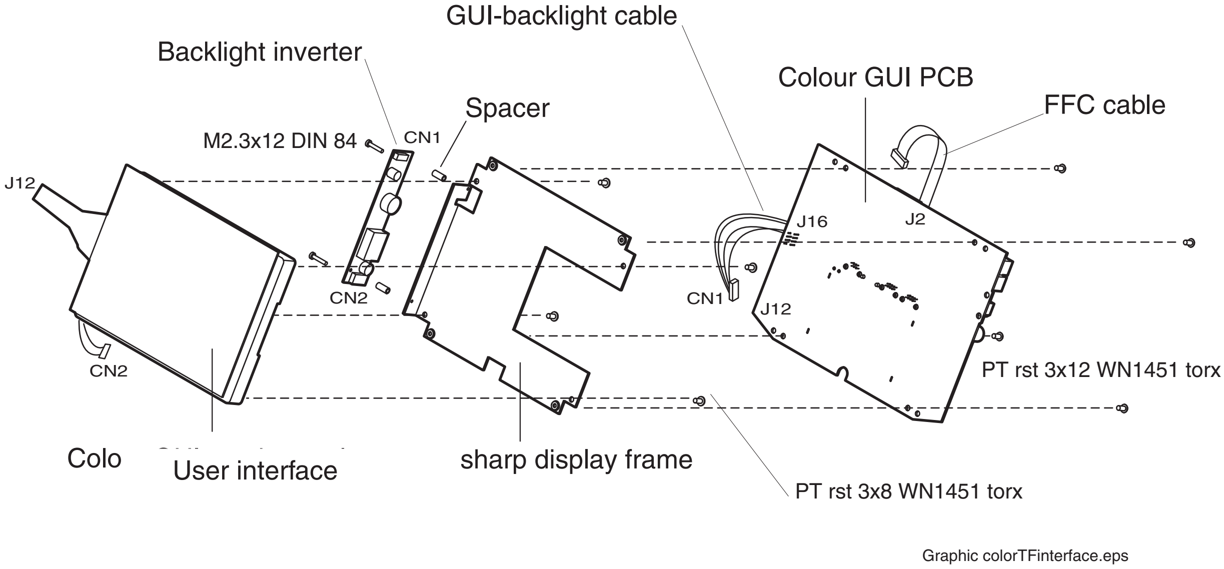


Figure 17

Install the new GUI PCB in reverse order.

Black/white GUI

The GUI PCB is attached to the user interface with the four M3x6 ISO 7380 screws that are located behind the PCB. Unscrew these screws and detach the PCB from the interface. Disconnect the flat cable from the connector J4 on the GUI PCB.

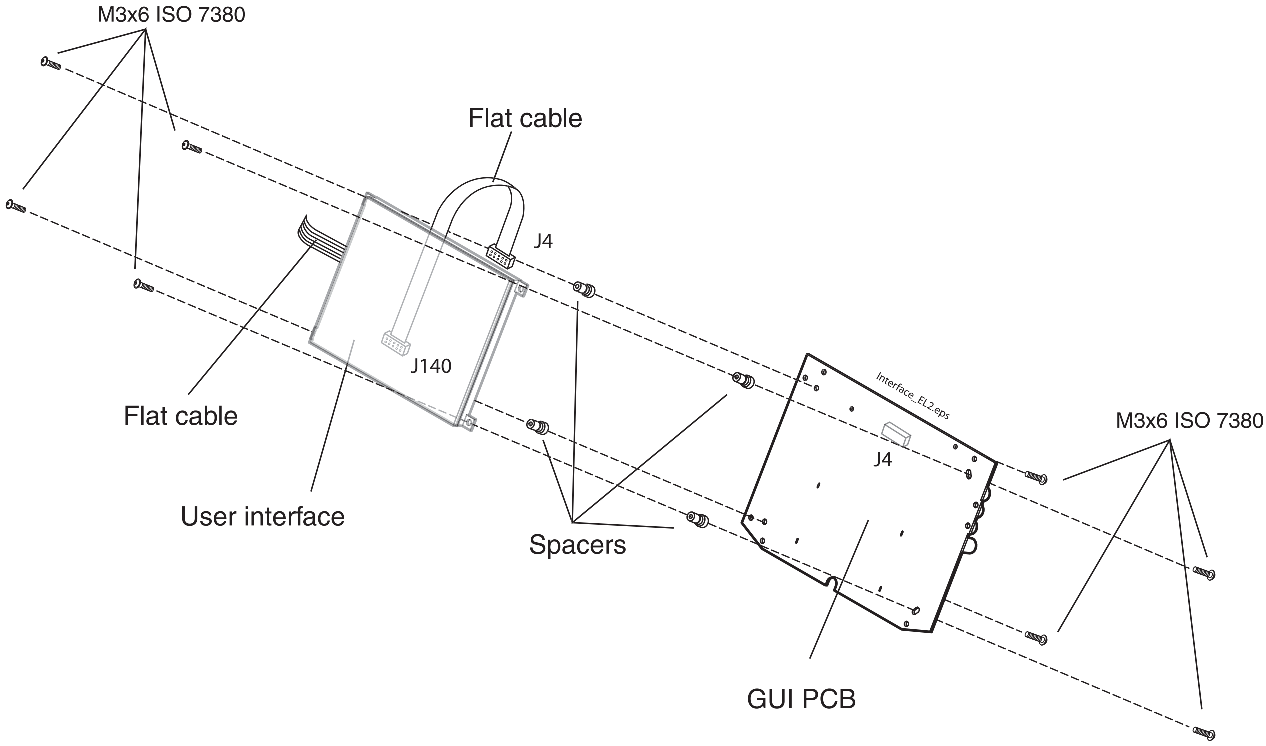


Figure 18

Install the new GUI PCB in reverse order.

Chapter

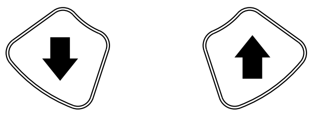
G

COLUMN

1 ADJUSTMENTS

1.1 Adjusting the telescopic column position

With the height adjusting buttons drive the unit to the position shown in Fig. 19 below.



With a spirit level make sure that the telescopic column is parallel with the stationary column both in depth and sideways. To adjust the sideways position loosen the two attachment screws on the left side of the column. Rotate the nuts located between the columns so that the space between the columns on the left side is equal to the space on the right side, and the telescopic column is parallel with the stationary column. Tighten the upper attachment screw.

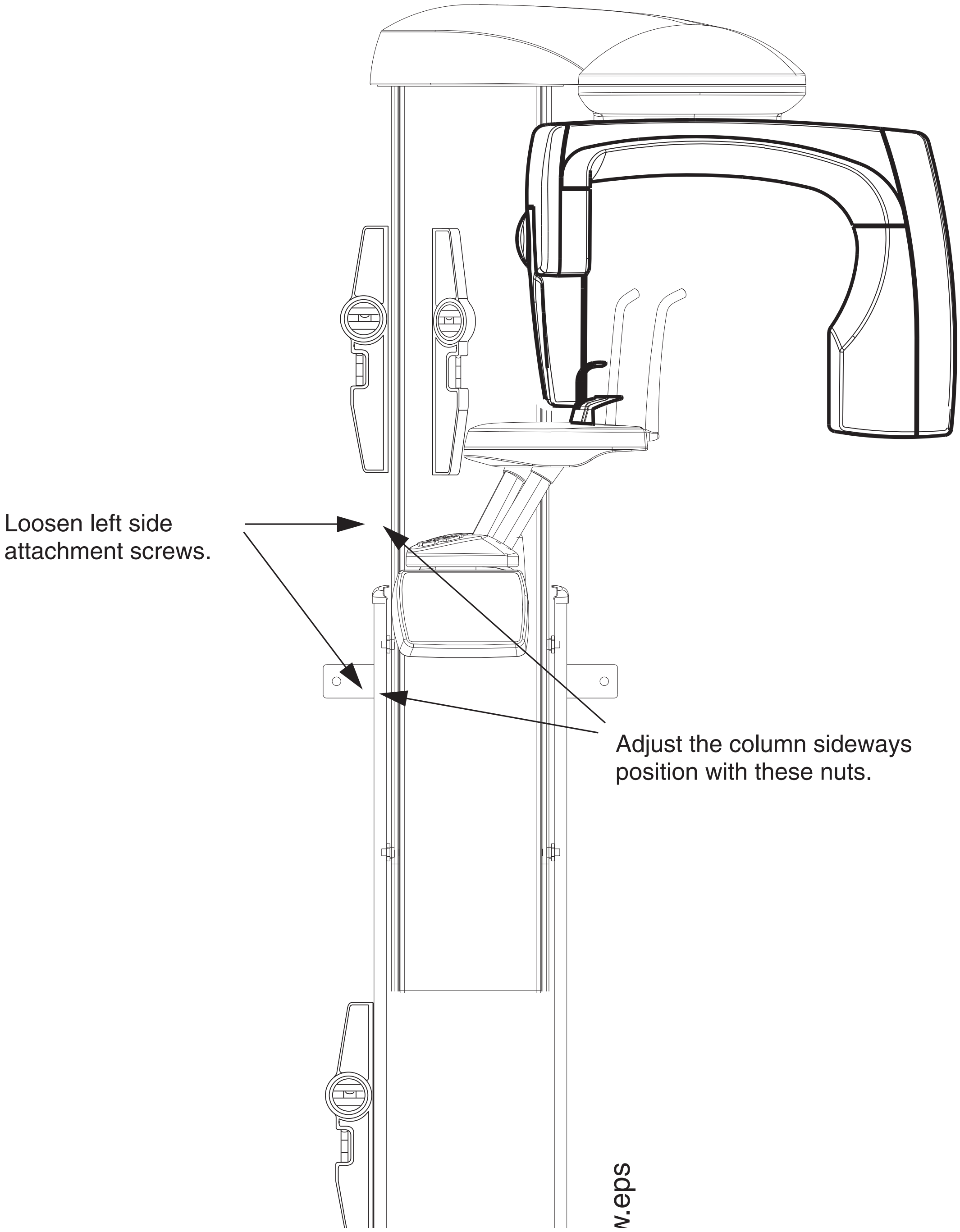


Figure 19

To adjust the column position in depth loosen the lower attachment screws located on the left and right sides of the column. Use a spirit level to check the column position and manually move the telescopic column so that it is parallel with the stationary column.

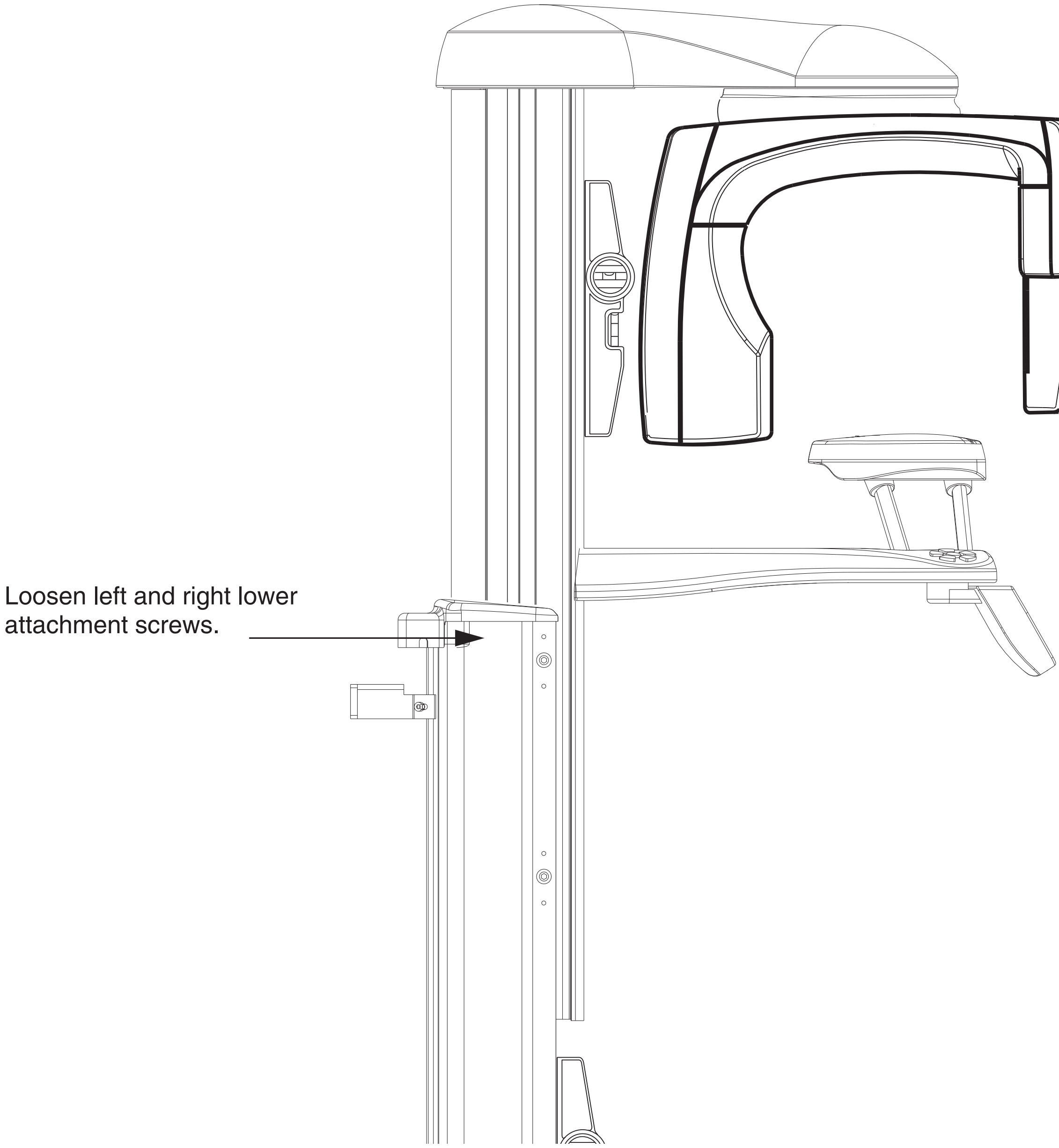


Figure 20

Tighten the attachment screws.

1.2 Calibrating the column motor position sensor

CAUTION Protect yourself against electrical shock. The unit contains live parts on some PCBs and connectors.

Unscrew the four attachment screws of the stationary column top cover with the 3mm Allen key and remove the cover (Fig. 21, 1).

Using the height adjusting buttons, drive the telescopic column into position (Fig. 21, 2) where the reference mark on the telescopic column and the upper edge of the stationary column are aligned (Fig. 21, 3).

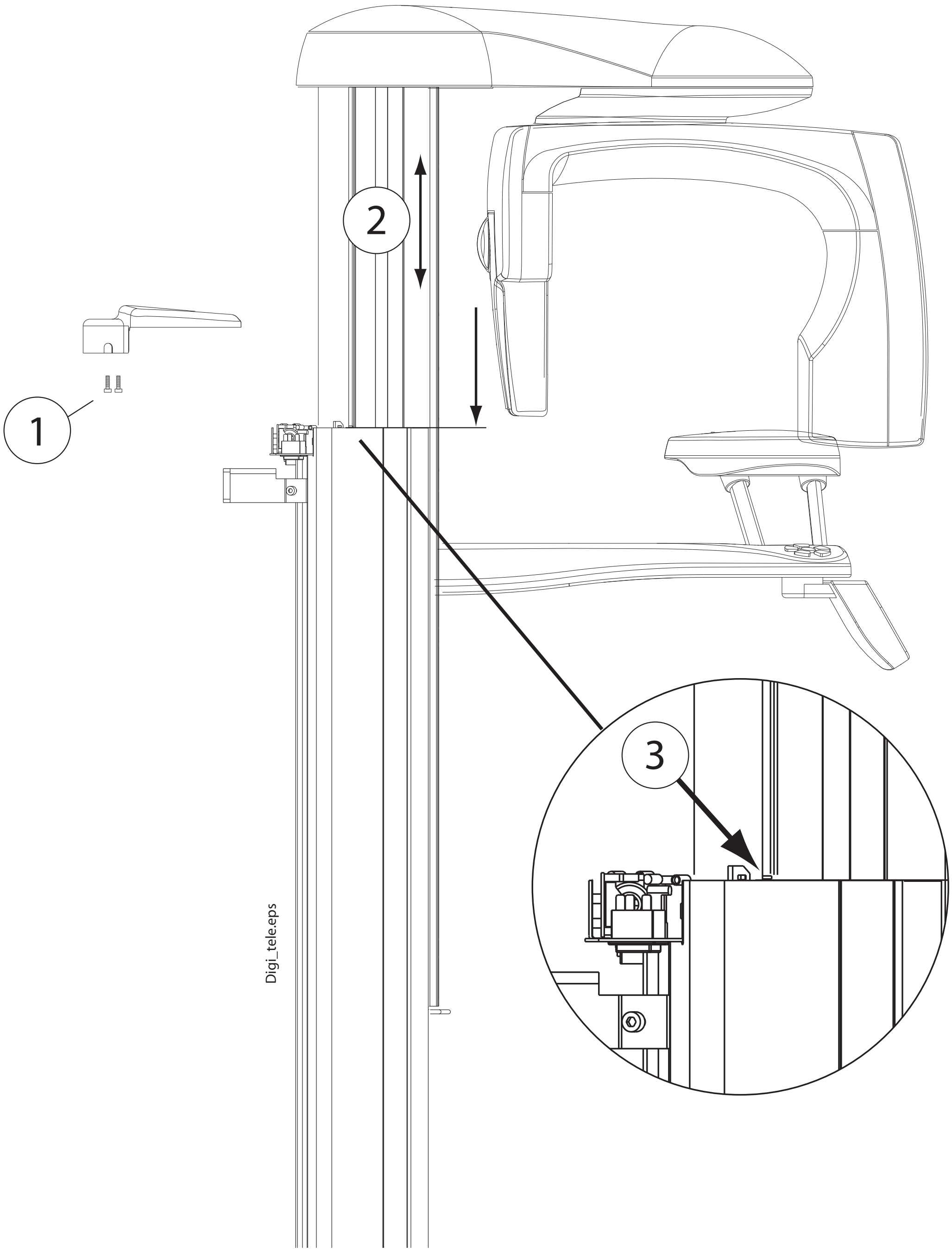


Figure 21

To enter the calibration mode first touch the **i** field on the *Main* display.

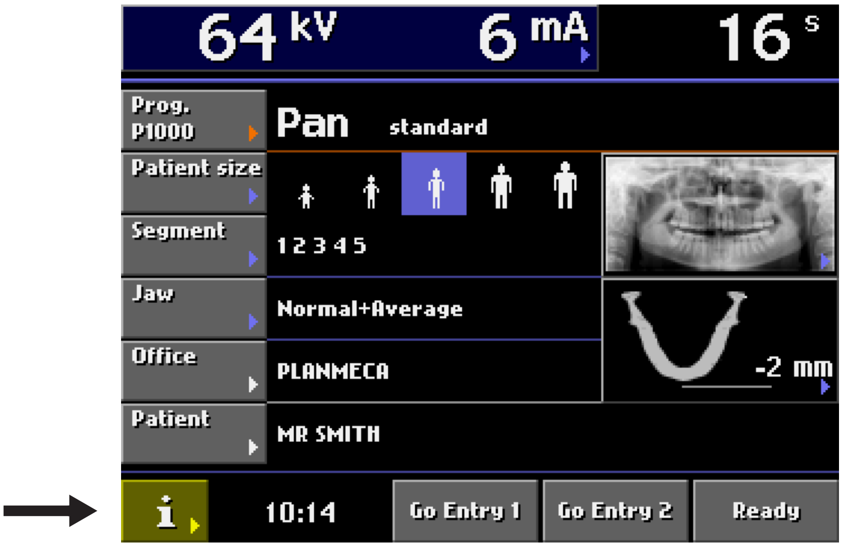


Figure 22

Select Technical calibrations (i600) from the list on the display. The password to the Technical calibrations mode is asked when the Technical calibrations mode is entered for the first time after switching the unit on. **The password is 1701.**

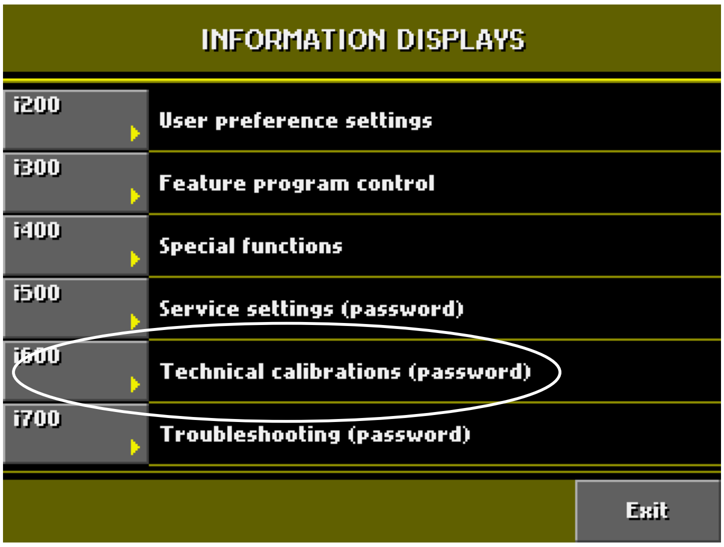


Figure 23

Now select *Lift motor calibration (i650)* and then *Lift motor position sensor calibration (i65.1)*.

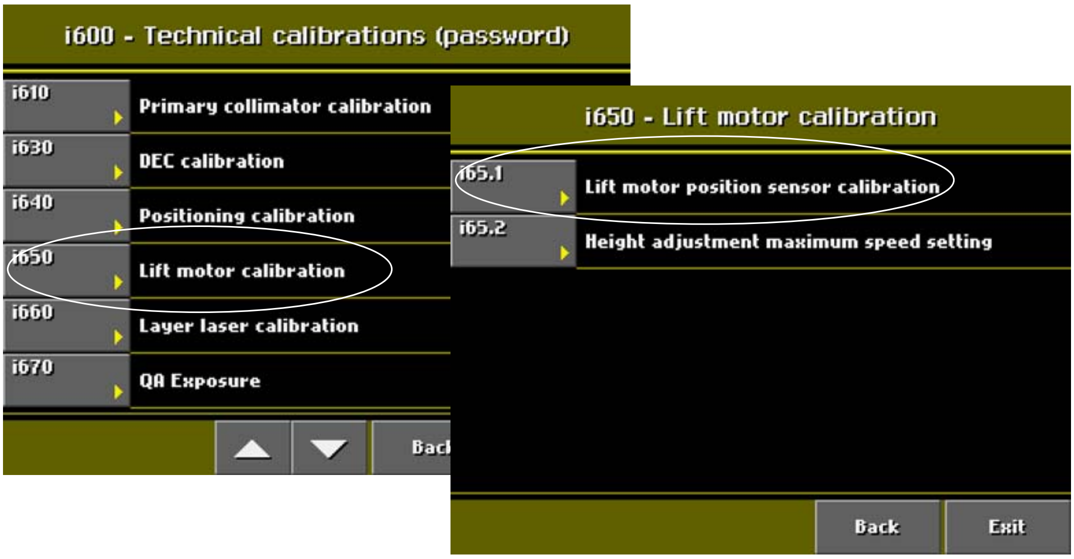


Figure 24

The *Lift motor position sensor calibration* display appears. If the sensor is correctly calibrated, a green arrow is shown on the display. If the sensor is not correctly calibrated, a red arrow is shown on the display.

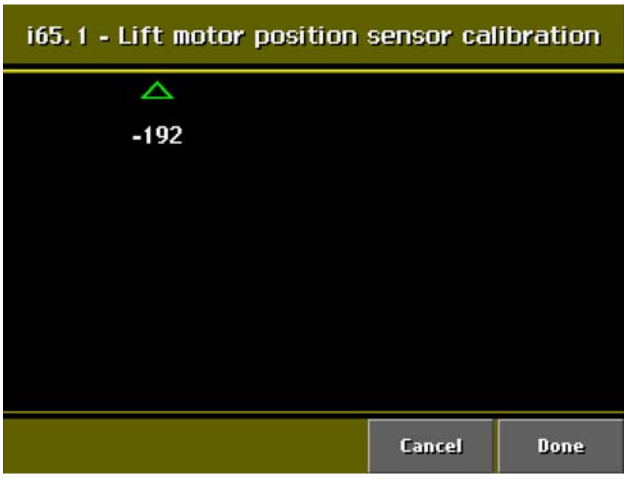


Figure 25

Loosen the two screws at the side of the cog wheel of the sensor (Fig. 26, 1). Note that you have to drive the telescopic column to be able to loosen both the attachment screws. Detach the cog wheel (Fig. 26, 2).

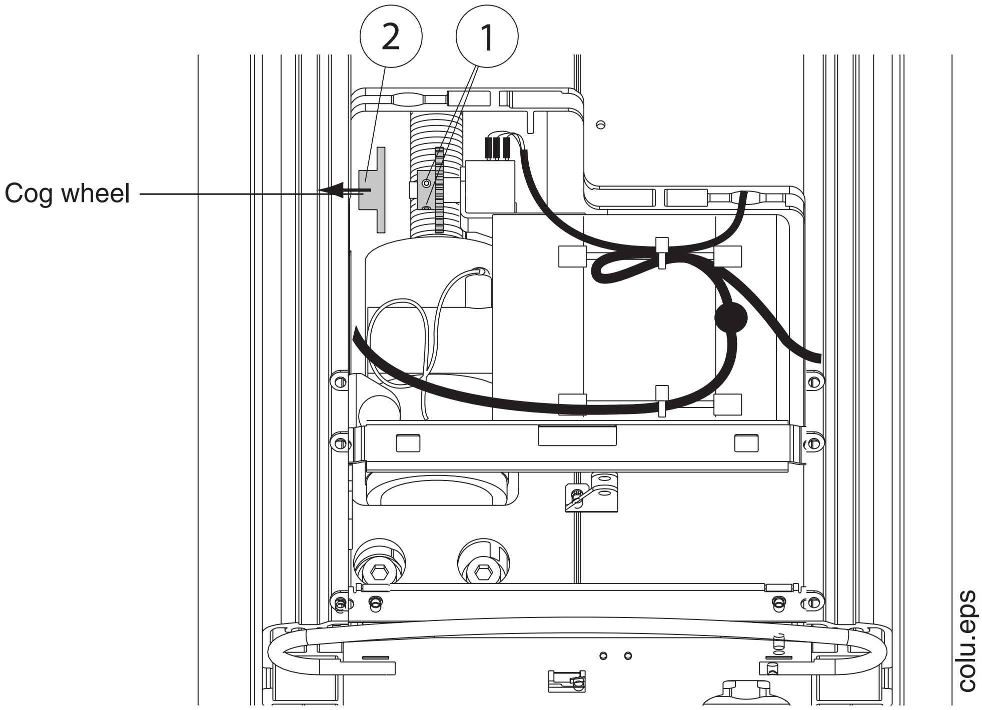


Figure 26

Rotate the axle of the sensor (Fig. 27, 3) until an empty arrow is shown on the calibration display (Fig. 25).

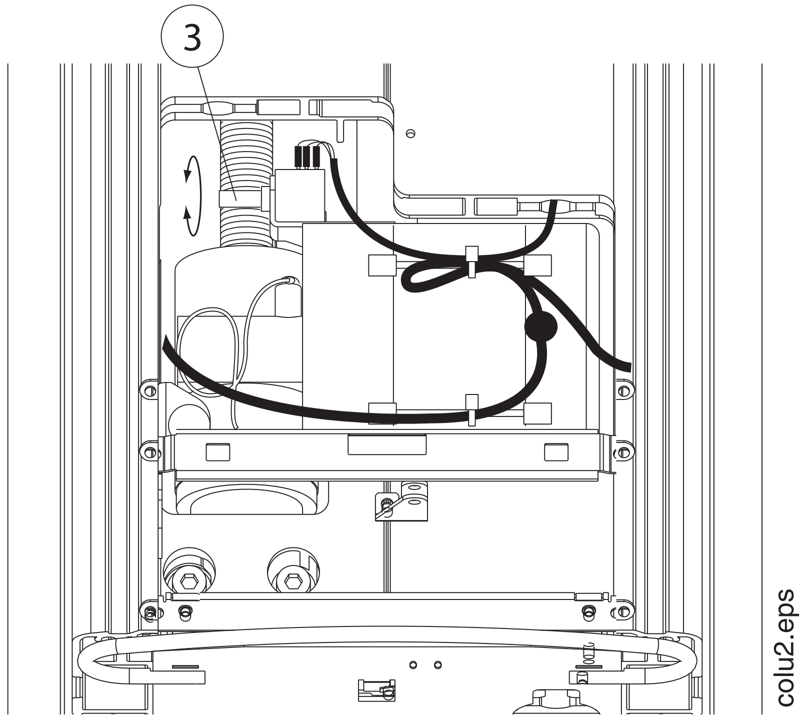


Figure 27

Replace the cog wheel to the sensor axle and tighten the attachment screws. Note, that you have to drive the telescopic column to be able to tighten both the attachment screws. Touch the **Done** field on the *Lift motor position sensor calibration* display.

2 REMOVING THE COVERS

2.1 Removing the telescopic column upper front panel

Drive the column to the convenient height and switch the unit off.

X-ray units without accessories cabinet: Remove the telescopic column lower front panel (1). Detach the panel mounting frame (2).

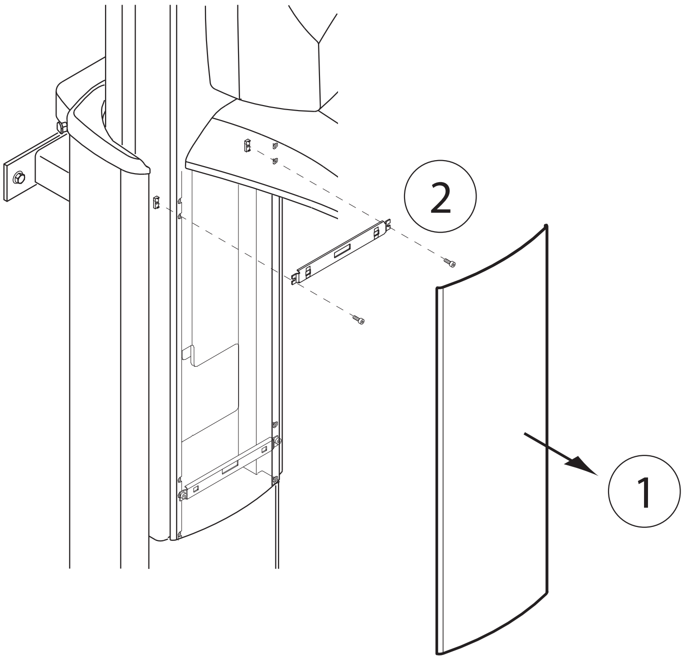


Figure 28

Units with accessories cabinet: Open the cabinet door and remove the accessory boxes.

Press the locking bolt located behind the front panel (Fig. 29, 1) and turn the bolt 90° counter-clockwise (Fig. 29, 2). Detach first the lower part of the panel from the column and then pull the panel out from its position (Fig. 29, 3).

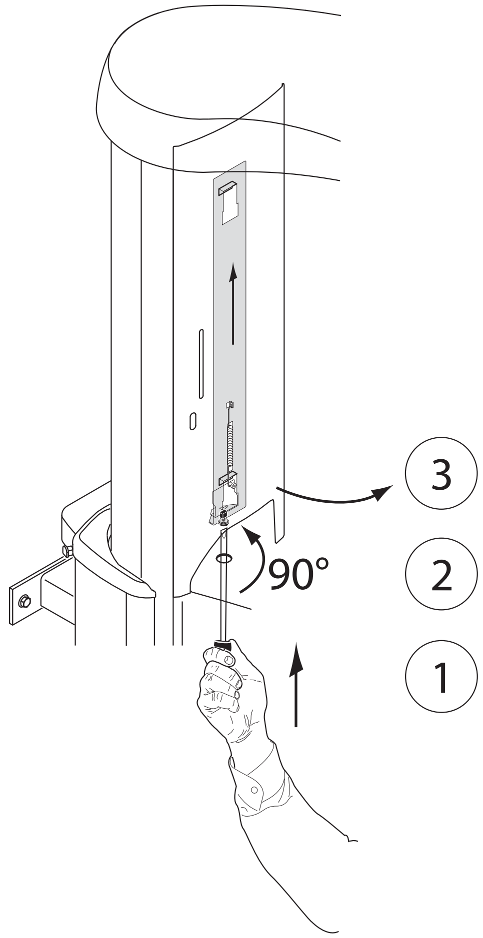


Figure 29

2.2 Removing the telescopic column rear cover plates

Remove the two rear cover plates of the telescopic column as follows. Switch the unit on and drive the telescopic column to the uppermost position (Fig. 30, 1). Switch the unit off. Detach the upper inner corner of the cover plate by carefully pulling it outwards (Fig. 30, 2). Detach the cover plate by pushing the cover plate inwards (see small arrows in the figure below) (Fig. 30, 3).

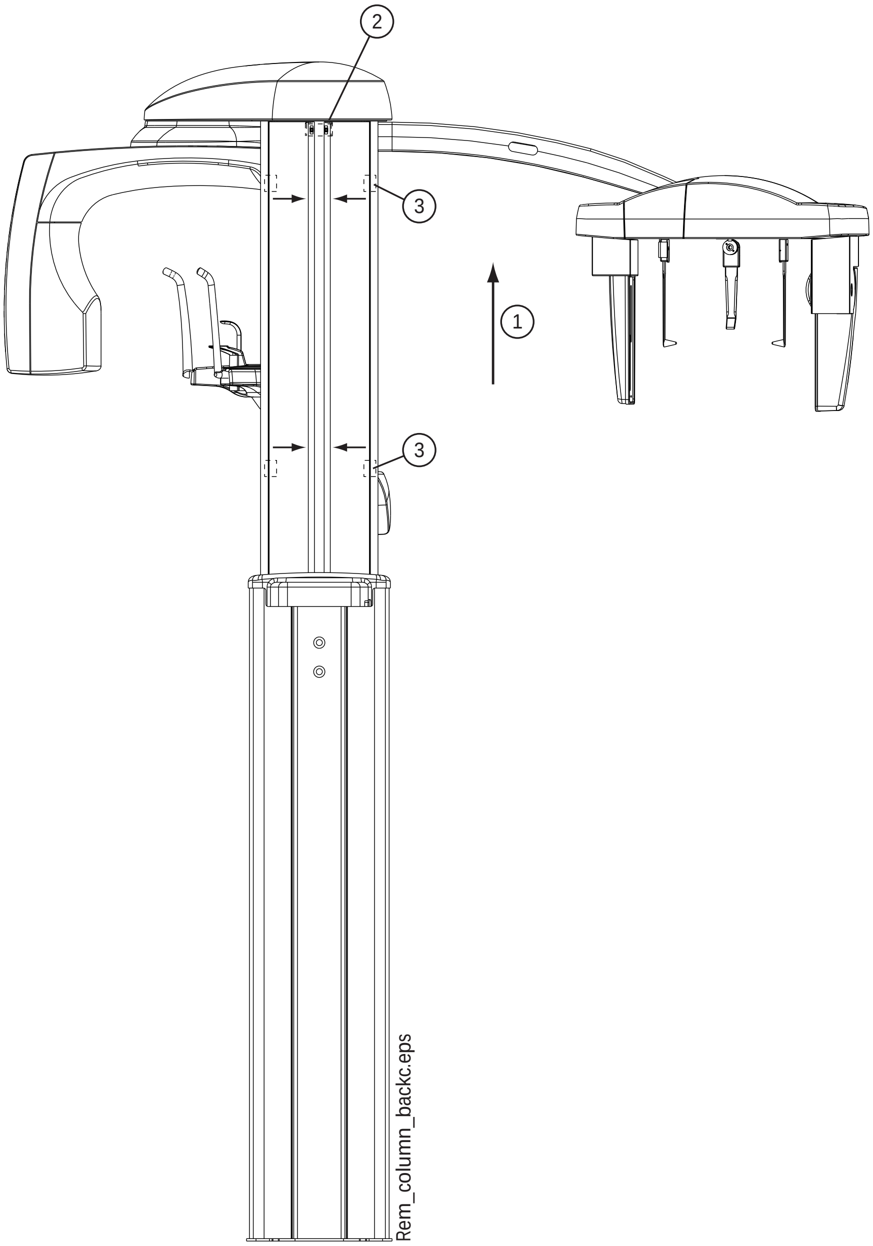


Figure 30

3 REPLACING THE COLUMN MOTOR

3.1 Replacing the motor

WARNING

Care must be taken when replacing the column motor. Removing parts of the lifting assembly may enable the column to fall causing a dangerous situation and/or damage to the equipment. The downward movement of the telescopic column must be eliminated before detaching the parts.

WARNING

The X-ray unit contains live mains voltage parts. Always unplug the unit from mains outlet before attempting to service the Input module.

CAUTION ***At least two persons are needed when replacing the column motor. Never try to replace the motor on your own.***

1) Remove the temple supports and chin support from the patient support table.
2) Remove the shoulder arm cover (Fig. 31, 1) (see section 5.6 “Shoulder arm covers” on page E-84). Remove the telescopic column rear cover plates (Fig. 31, 2) according to the instructions given in section 2.2 “Removing the telescopic column rear cover plates” on page G-10.
3) Unscrew the four M4x16 DIN 912 attachment screws of the column top cover with the 3mm Allen key and remove the cover (Fig. 31, 3).
4) Detach the stationary column side covers (Fig. 31, 4).
5) Remove the telescopic column upper front panel (Fig. 31, 5) according to the instructions given in section 2.1 “Removing the telescopic column upper front panel” on page G-8.
6) Remove the telescopic column lower front panel by pulling it outwards (Fig. 31, 6). Unscrew the M4x8 DIN 7984 screws with the 2.5mm allen key and remove the panel mounting frames.
   OR
   Remove the accessory cabinet as follows. Remove the accessory boxes. Detach the cabinet door from the its hinges. Unscrew the four attachment screws of the accessory cabinet base and remove the base (Fig. 31, 7). Unscrew the two M4x6 DIN 7984 attachment screws of the motor cover and remove the cover (Fig. 31, 8).
7) If the column motor is functional, drive the telescopic column to the lowest possible position.
8) Switch off the unit and unplug the unit from mains outlet.
9) Detach the Input module from the telescopic column (Fig. 31, 9) according to the instruction given in section 6.3 “Input PCB” on page G-36. Disconnect the connectors from the Input PCB.
10) If the column motor is not functional, move the telescopic column to the lowest position either by rotating the motor screw with an Allen key and a ratchet spanner.
    The telescopic column can also be moved downwards by detaching the lift nut assembly from the stationary column. In this case properly support the telescopic column when detaching the nut. Detaching the nut may enable the column to fall causing a dangerous situation and/or damage to the equipment.
11) Lock the shoulder arm and the C-arm to the transportation position with the alignment pins as shown on the Fig. 31, 10.
12) Detach the hinges and the three mounting blocks from the column (Fig. 31, 11).
13) If the unit is equipped with a cephalostat, disconnect all the cephalostat cables from the CPU PCB and detach the cephalostat.

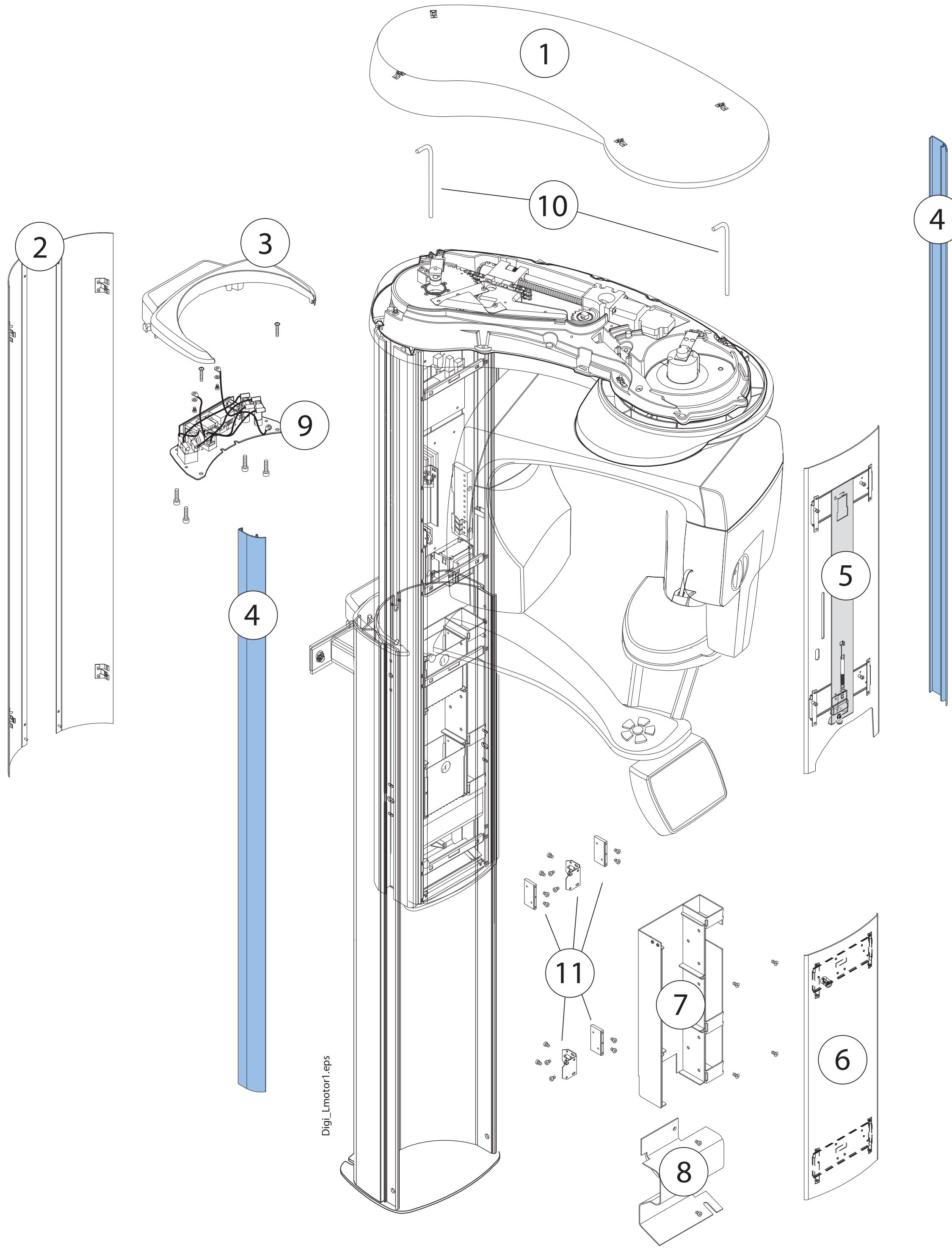


Figure 31

14) Disconnect the motor cables from the Power PCB, connectors J3 and J10.
15) Unscrew the two M4x6 DIN 7984 attachment screws of the emergency stop microswitch and detach the microswitch (Fig. 32, 1). Detach the column motor earthing cable (Fig. 32, 2).

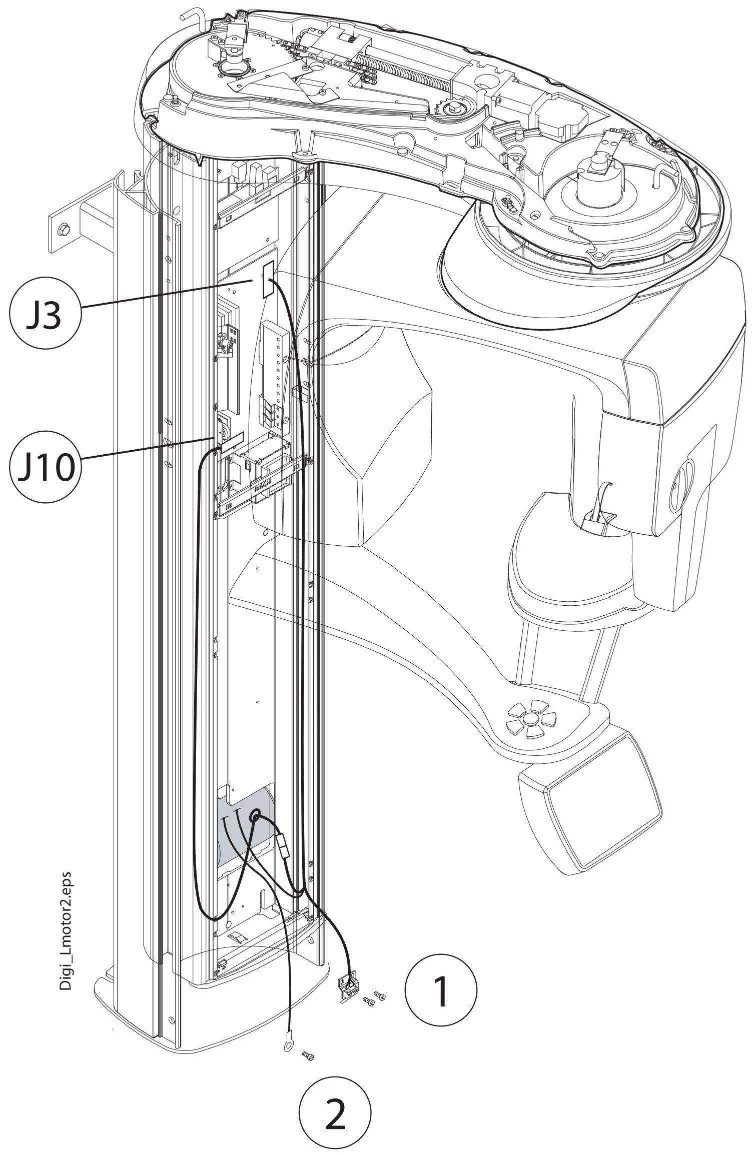


Figure 32

16) The X-ray unit must be detached from the wall and placed to the floor. It is recommended to use the ProMax package support frame and the styrofoam pieces. If you overturn the unit without using the ProMax package, you may damage the unit. If you are not using the package, remove the C-arm covers and use e.g. styrofoam pieces under the unit.
17) First attach the transportation support bar attachment pin to the telescopic column (Fig. 33, 1).
18) Attach the styrofoam pieces to the unit (Fig. 33, 2). Push the support frame over the styrofoam pieces (Fig. 33, 3). Attach the transportation pin to the support frame with the two M8x30 DIN 7984 screws (Fig. 33, 4). To be able to reach the guide assemblies, cut openings to the styrofoam pieces as shown on the Fig. 33 below (5).
19) Detach the wall bracket(s) from the wall and detach the unit from the floor (Fig. 33, 6).

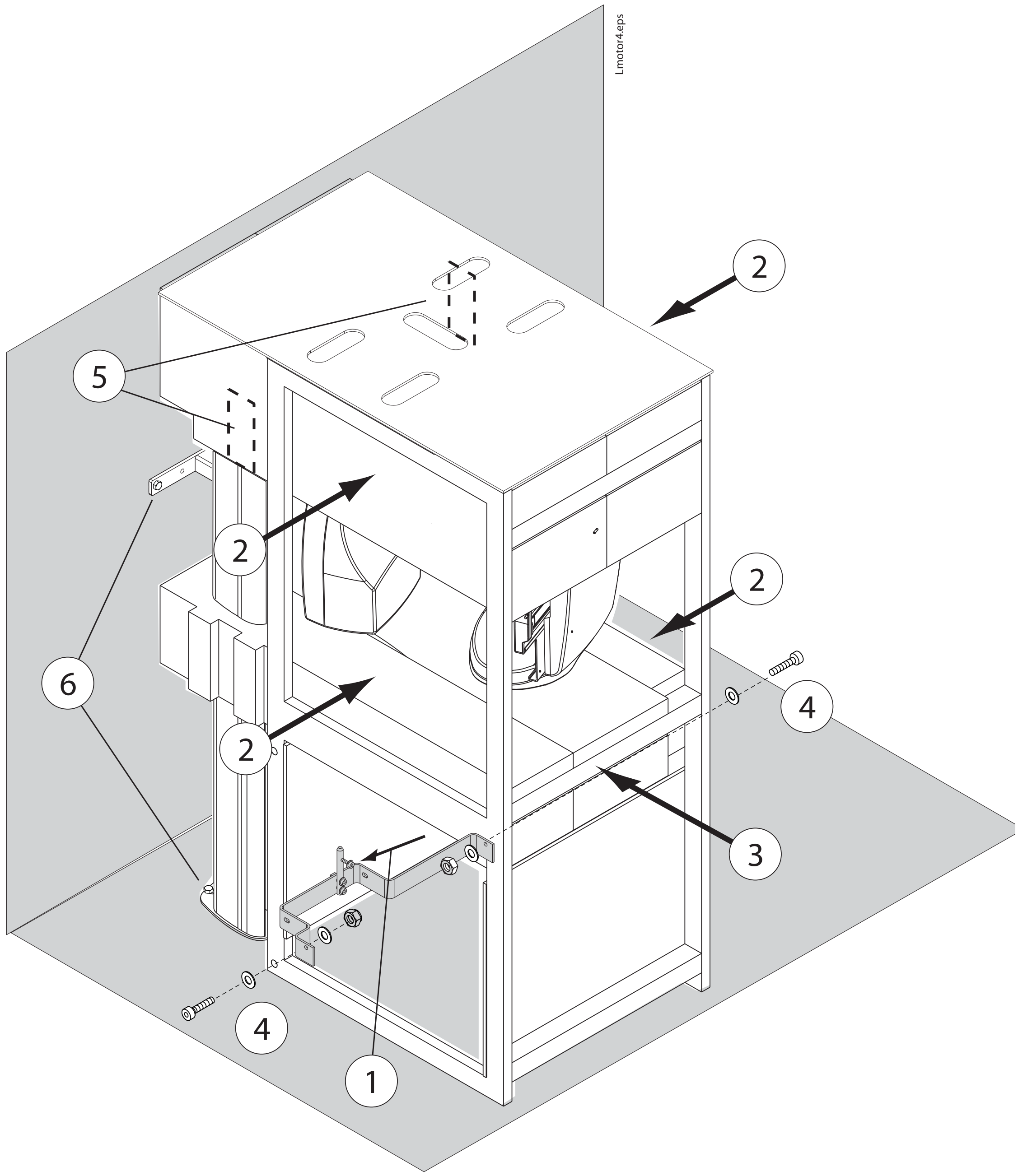


Figure 33

20) Carefully overturn the unit to the floor to the units right side.

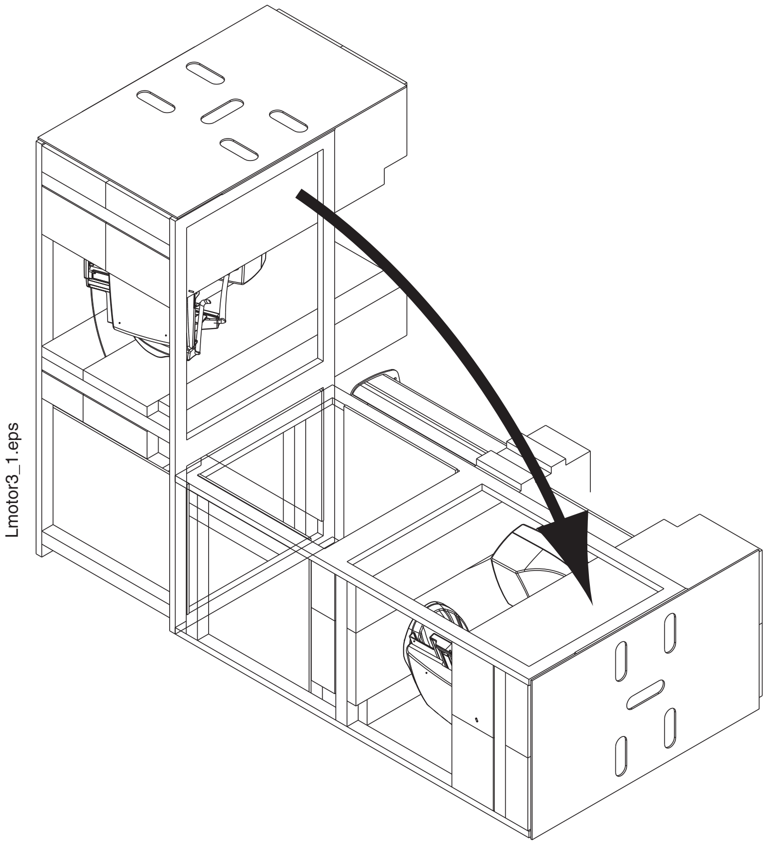


Figure 34

21) To be able to remove the stationary column from inside the package, cut the bottom of the styrofoam pieces slightly. Unscrew the attachment screws of the lift nut (Fig. 35, 1).

22) Unscrew the attachment screws of the guide assemblies (Fig. 35, 2). Note that it is easier to assemble the unit if the guide assemblies are in the same position as they were. Pull the stationary column away from the telescopic unit (Fig. 35, 3).

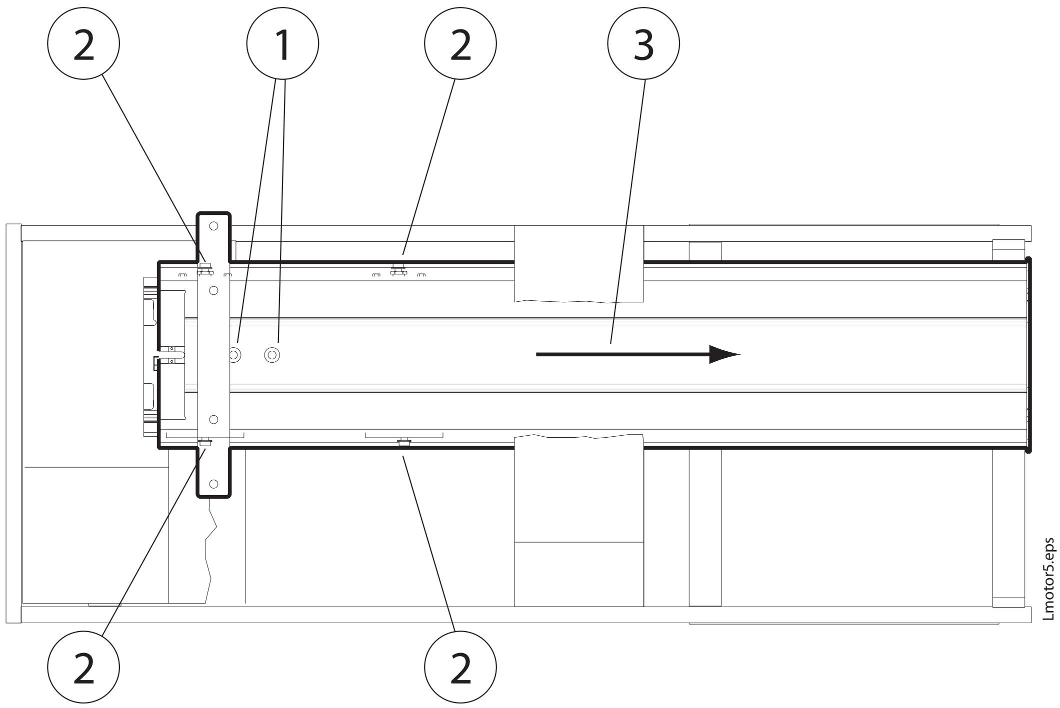


Figure 35

23) Measure the position of the lift nut. Rotate the new motor's lift nut to the same height with the old motor's lift nut. Unscrew the four M8x16 DIN 912 screws of the column motor mounting lug (Fig. 36, 1). Unscrew the two M6x35 DIN 912 screws of the motor absorber support (Fig. 36, 2). Remove the column motor from the telescopic column.

24) Detach the column cable guide from the lift nut by unscrewing the two M4x6 DIN 7984 screws (Fig. 36, 3).

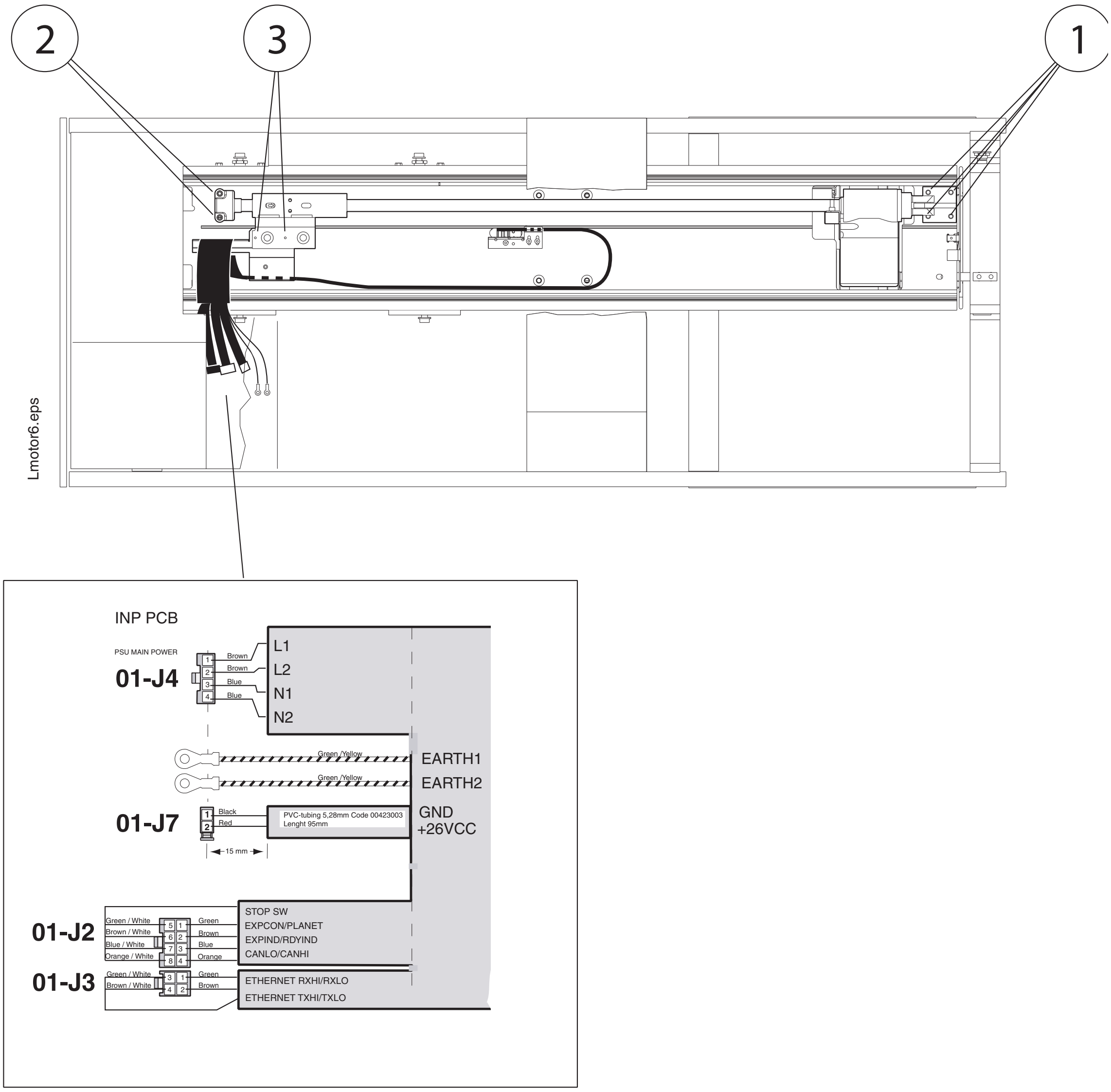


Figure 36

25) Prepare the new motor as follows.
- Lubricate the motor threaded axle.
- Remove the potentiometer cog wheel from the old motor and attach it to the new one.
- Detach the column cable assembly from the new motor's lift nut and attach the column cable assembly from the old motor to the new motor's lift nut.

26) Assemble the new motor in reverse order.

27) After assembling the motor check and adjust the telescopic column position as described in section 1.1 "Adjusting the telescopic column position" on page G-1. Calibrate the column motor position sensor as described in section 1.2 "Calibrating the column motor position sensor" on page G-4.

3.2 Replacing the lift nut assembly

WARNING

Care must be taken when replacing the lift nut assembly. Removing parts of the lifting assembly may enable the column to fall causing a dangerous situation and/or damage to the equipment. The downward movement of the telescopic column must be eliminated before detaching the parts.

Drive the telescopic column approx. 65-70mm up from the column base plate and switch off the unit. Make sure that you have a suitable support for the telescopic column, see Fig. 42 on page G-21.

Remove the telescopic column rear cover plates according to the instructions given in section 2.2 “Removing the telescopic column rear cover plates” on page G-10. Remove the stationary column top cover.

Figure 37

Open the accessory cabinet door or remove the lower front panel. Unscrew the two M4x6 DIN 7984 screws of the motor cover and remove the cover.

Figure 38

Detach the emergency stop switch by unscrewing the two M4x6 DIN 7984 attachment screws.

Figure 39

Detach the input module from the stationary column top by unscrewing the four M4.8x19 torx 7981 screws so that you can reach the attachment screws of the lift nut assembly.

Figure 40

Detach the earthing cables.

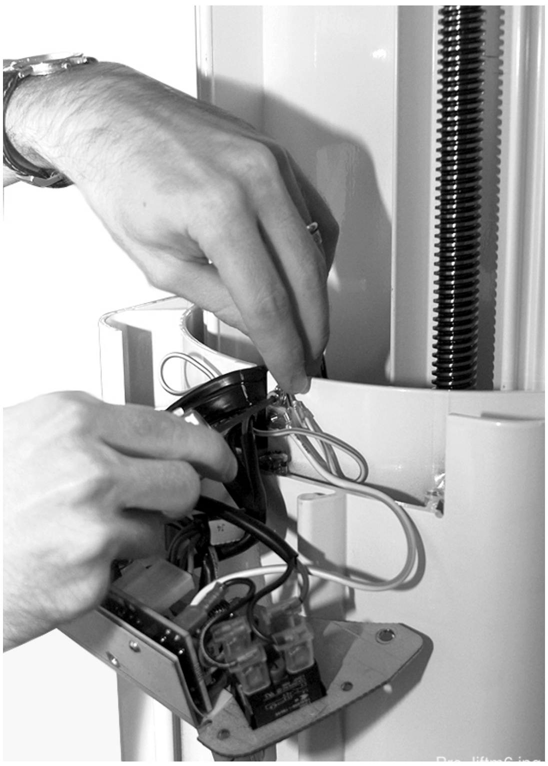


Figure 41

Support the telescopic column properly to eliminate the downward movement of the column. Position the support so that it leans against the column profile.

NOTE!
The support must lean against column profile.

Figure 42

Unscrew the lift nut assembly attachment screws.

Figure 43

Switch on the unit and drive the telescopic column **slowly** downwards. The lift nut moves upwards. When the lift nut has reached its uppermost position mark the position of the nut frame upper edge to the column with a marker pen or tape.

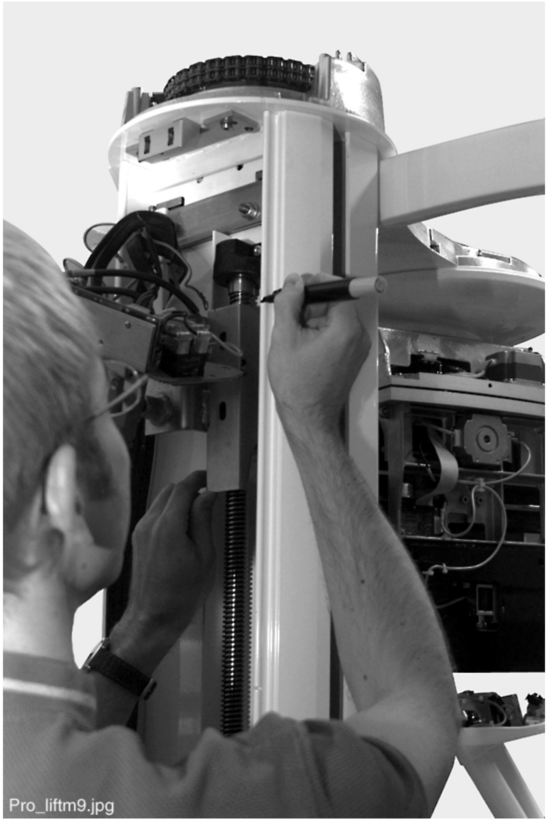


Figure 44

Switch off the unit.

Detach the motor absorber support. Note that you have to prevent the motor from falling down when the support is detached.

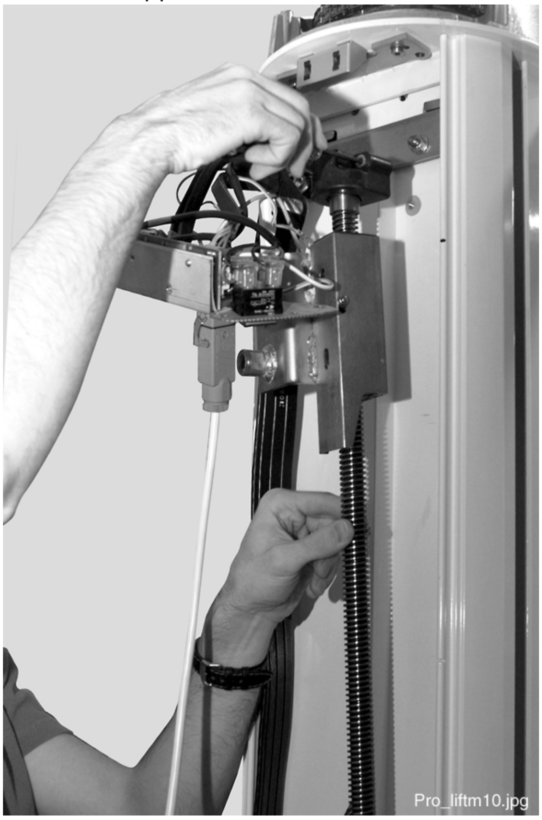


Figure 45

Remove the column cable guide plate from the lift nut.

Figure 46

Remove the absorber support from the motor screw and rotate the lift nut out from the motor screw.

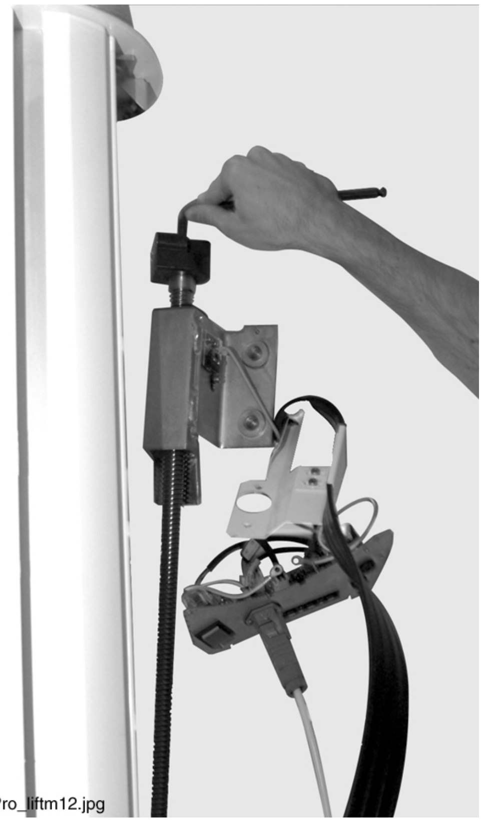

Pro_liftm12.jpg

Figure 47

Install the new lift nut assembly in reverse order.

Make sure that you have connected the emergency stop switch before attaching the motor cover to its position.

4 REPLACING/UPGRADING SOFTWARE

NOTE **You can upgrade the software either by replacing the software chips (see section 4.1 "Replacing the CPU PCB software chips (alternative 1)" on page G-25) or by loading the software from a computer (see section 4.2 "Loading the software from a computer (alternative 2)" on page G-27).**

4.1 Replacing the CPU PCB software chips (alternative 1)

WARNING

Always turn the X-ray unit off before removing the software chip from its socket.
Never turn the unit on if the software chips are not in their sockets.

NOTE **Take care of antistatic precautions when handling the software chip. Touch any grounded metal part of the unit before touching the software chip.**

NOTE **The X-ray unit contains four software chips located in the CPU PCB, marked with FLASH1, FLASH2, FLASH3 and FLASH4. The software versions used must be compatible. Incompatible software versions should never be used together, the X-ray unit would either be totally non-functional, produce continuous error messages, or some important features or functions could be missing. However, no damage or safety hazard would result if two non-compatible software chips are accidentally used together.**
Check the markings above the sockets, never put the chip intended for one socket to another socket.

NOTE **The CPU PCB version B contains four software chips. Put the FLASH1 chip to the socket marked FLASH 1, the FLASH2 chip to the socket FLASH 2, the FLASH3 chip to the socket FLASH 3 and the FLASH4 chip to the socket FLASH 4.**

Turn off the unit from the mains switch. Remove the column front cover as described in section 2 "REMOVING THE COVERS" on page G-8.

Detach the Ethernet PCB from the CPU PCB as described in section 6.2 "ETHERNET PCB and CPU PCB" on page G-35.

Remove the software chip from its socket with the special tool as illustrated in Fig. 48.

NOTE **The orientation of the software chip is critical. Never try to force the chip into the socket.**

Carefully place the new software chips into the sockets.

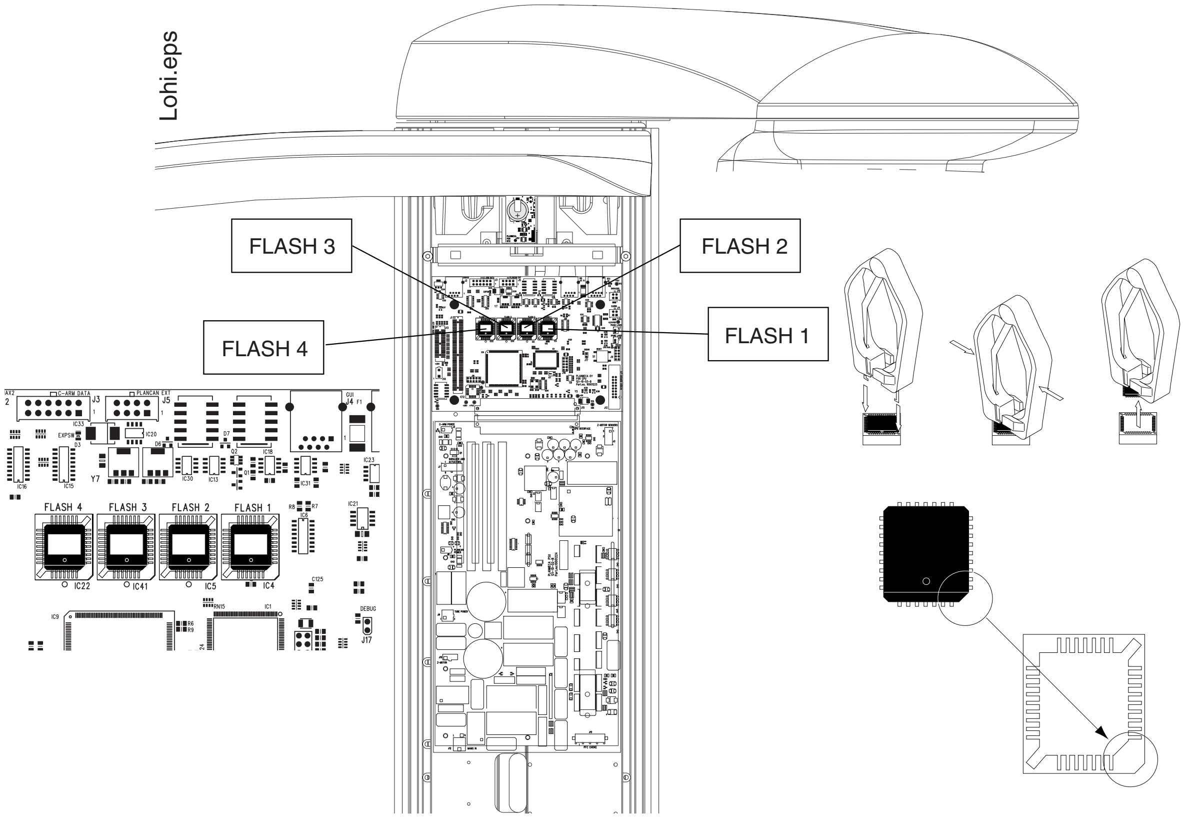


Figure 48

Assemble the Ethernet PCB and column covers to their positions.

4.2 Loading the software from a computer (alternative 2)

NOTE **Keep always the software chips as spare-part in case the loading of the software from a computer is not successful.**

Unscrew the back cover attachment screw (PT 3x12 rst WN 1451 torx) and remove the cover. Connect the Software loading cable (Planmeca part number 10003926) to the PS/2 connector at the underside of the user interface.

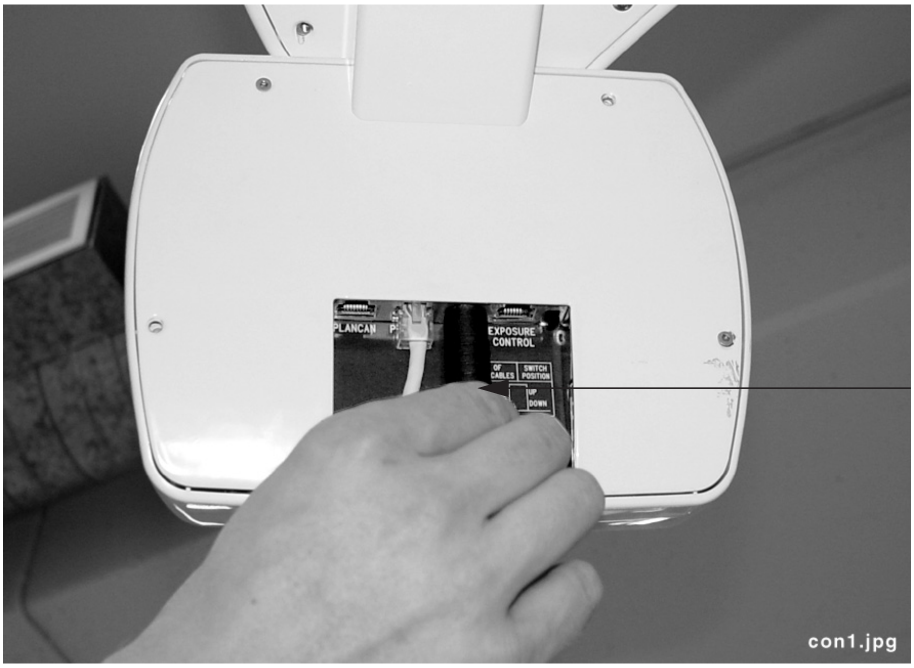


Figure 49

Connect the other end of the Software loading cable to the computer serial port COM1 or COM2.

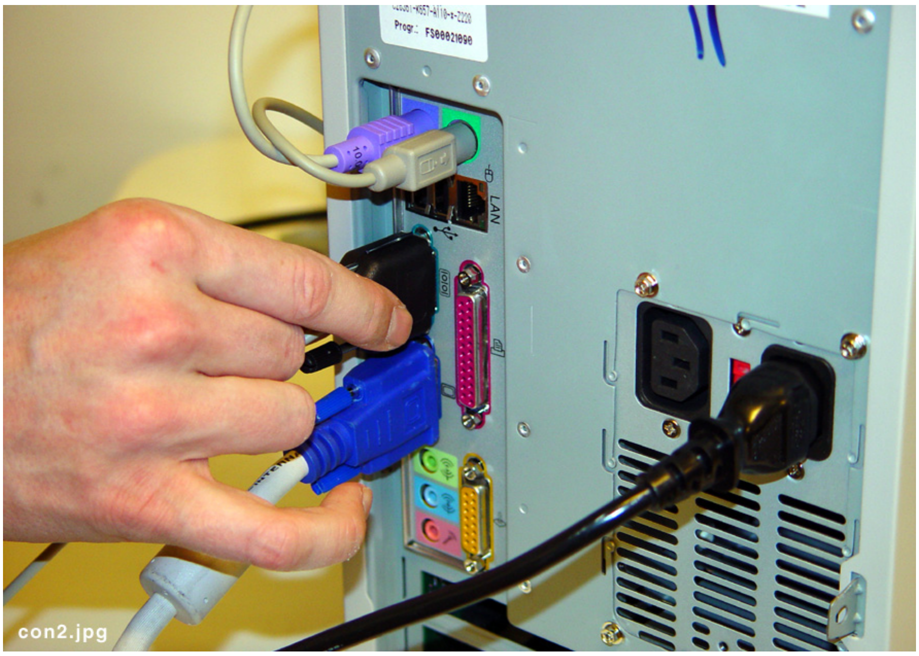


Figure 50

To start the software loading double-click the ProMax software loading program icon:

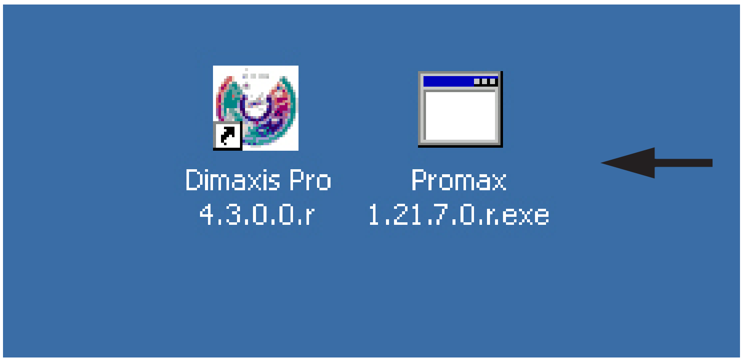


Figure 51

The serial port number is asked first. Type the port number and press the **Enter** key. The software loading starts.

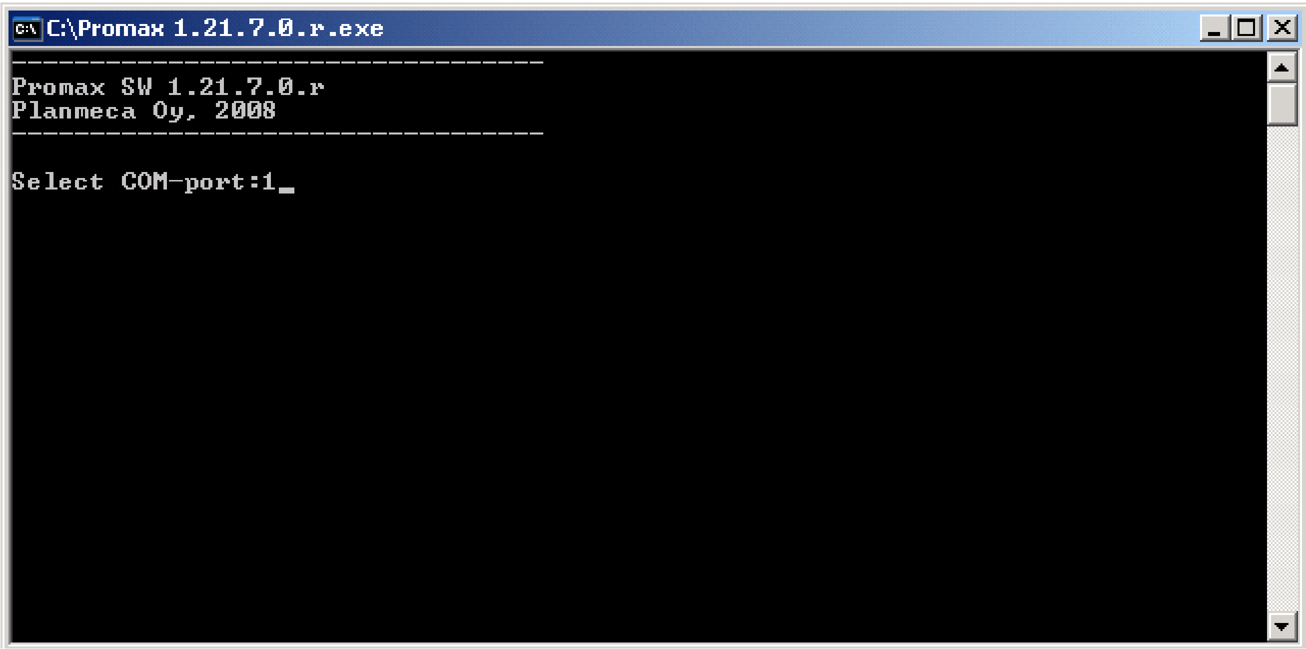


Figure 52

The loading software will automatically close after the loading is completed.

5 REPLACING THE BATTERY ON THE RTC PCB

WARNING

Always turn the X-ray unit off before replacing the battery.

Turn off the unit from the mains switch. Remove the column front cover as described in section 2 “REMOVING THE COVERS” on page G-8. Unscrew the two M4x6 Din 7984 screws with a 2.5mm Allen key from the RTC PCB cover and remove the cover.

Remove the old battery from its socket on the RTC PCB and place a new *20mm Lithium Coin Cell Battery 3V* (type CR2032) to the battery socket.

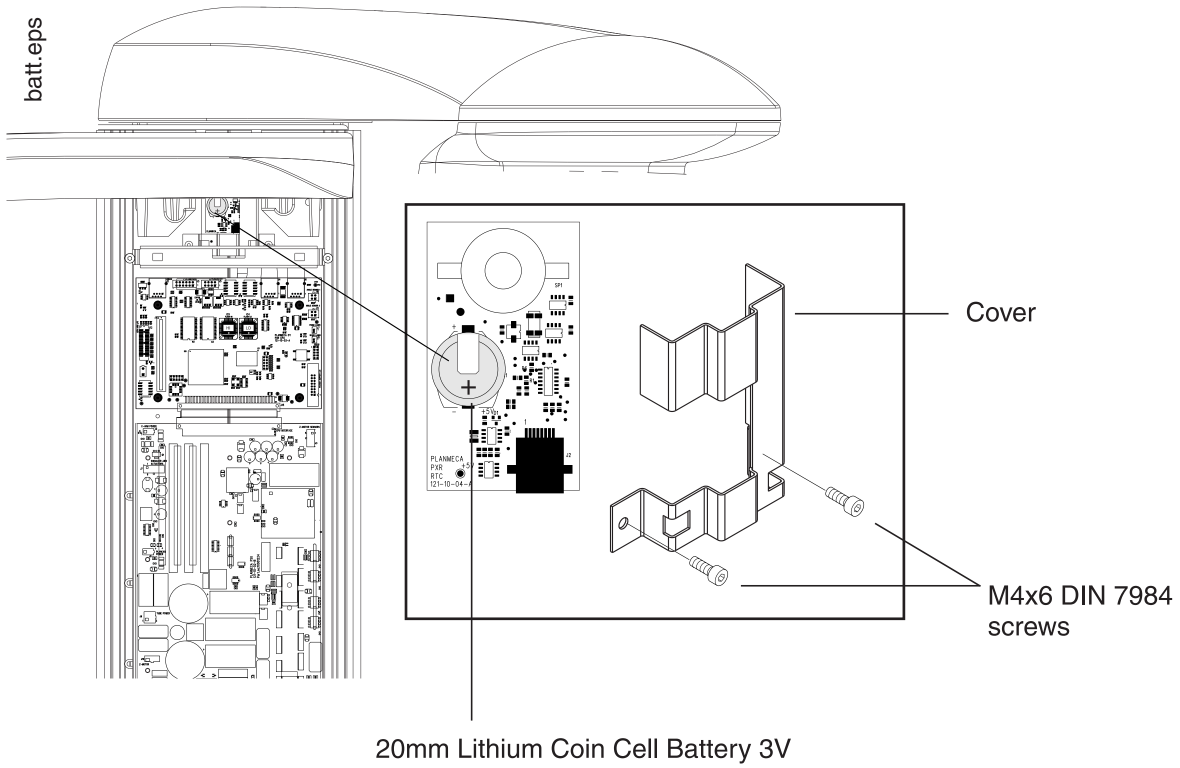


Figure 53

6 REPLACING PCBS

6.1 Power PCB

Removing the Power PCB

WARNING

The X-ray unit contains live mains voltage parts. Unplug the unit from mains outlet before replacing the Power supply PCB.

Drive the column to a convenient height and switch off the X-ray unit.

Unplug the unit from mains outlet. Press the locking bolt located behind the front panel (1) and turn the bolt 90° counter clockwise (2).

Detach first the lower part of the panel from the column and then pull the panel out from its position (3). Wait until all the leds are gone out.

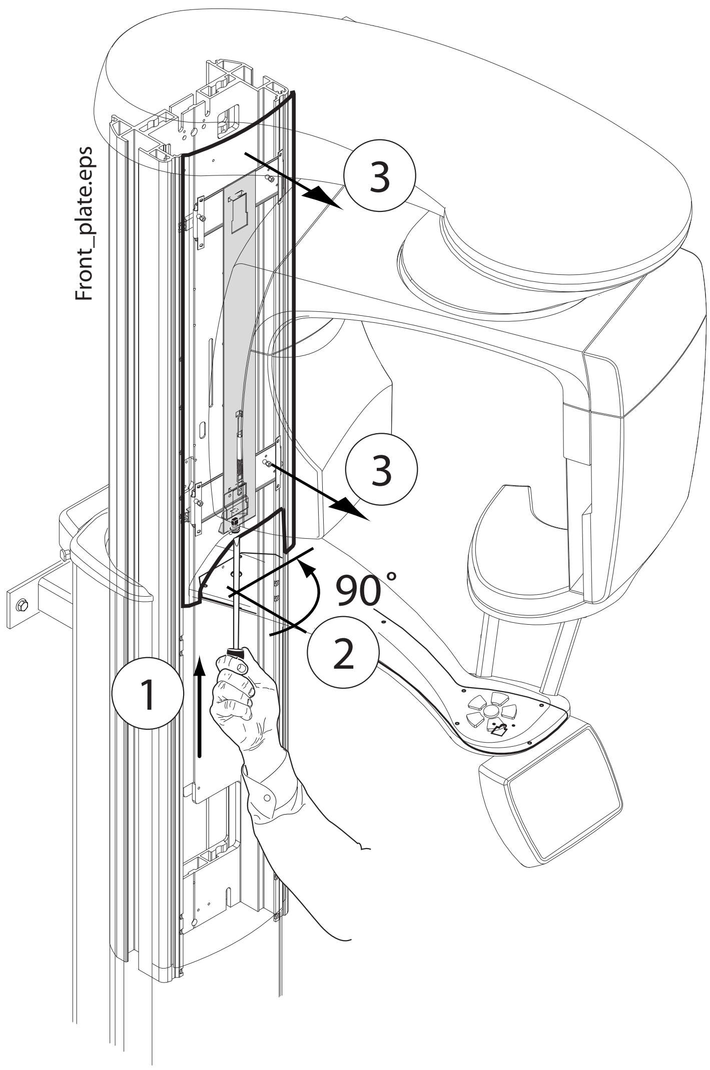


Figure 54

The Frankfort plane positioning light assembly **must be removed before** the Power supply PCB can be removed.

Unscrew the two attachment screws of the panel mounting frame (1).

Unscrew the four attachment screws of Frankfort plane positioning light assembly (2).

Disconnect the light cable from the CPU PCB terminal J7 (3) and lift the assembly from its position.

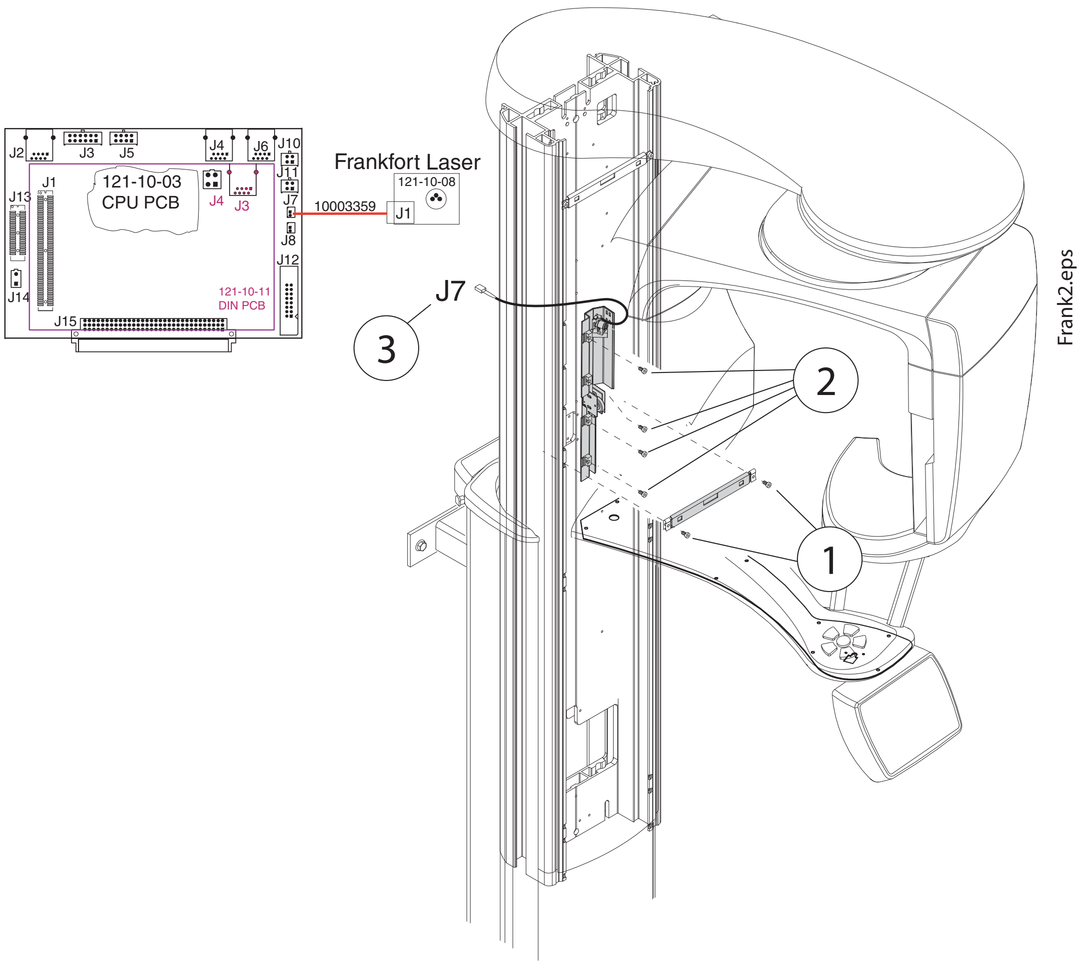


Figure 55

Disconnect all the cables that are connected to the Power supply PCB.

NOTE **All the cable connectors are labelled.**

Unscrew the Power PCB attachment screws with the 2.5mm Allen key and detach the Power supply PCB from the CPU PCB.

Remove the Power supply PCB.

Loosen the CPU PCB attachment screws.

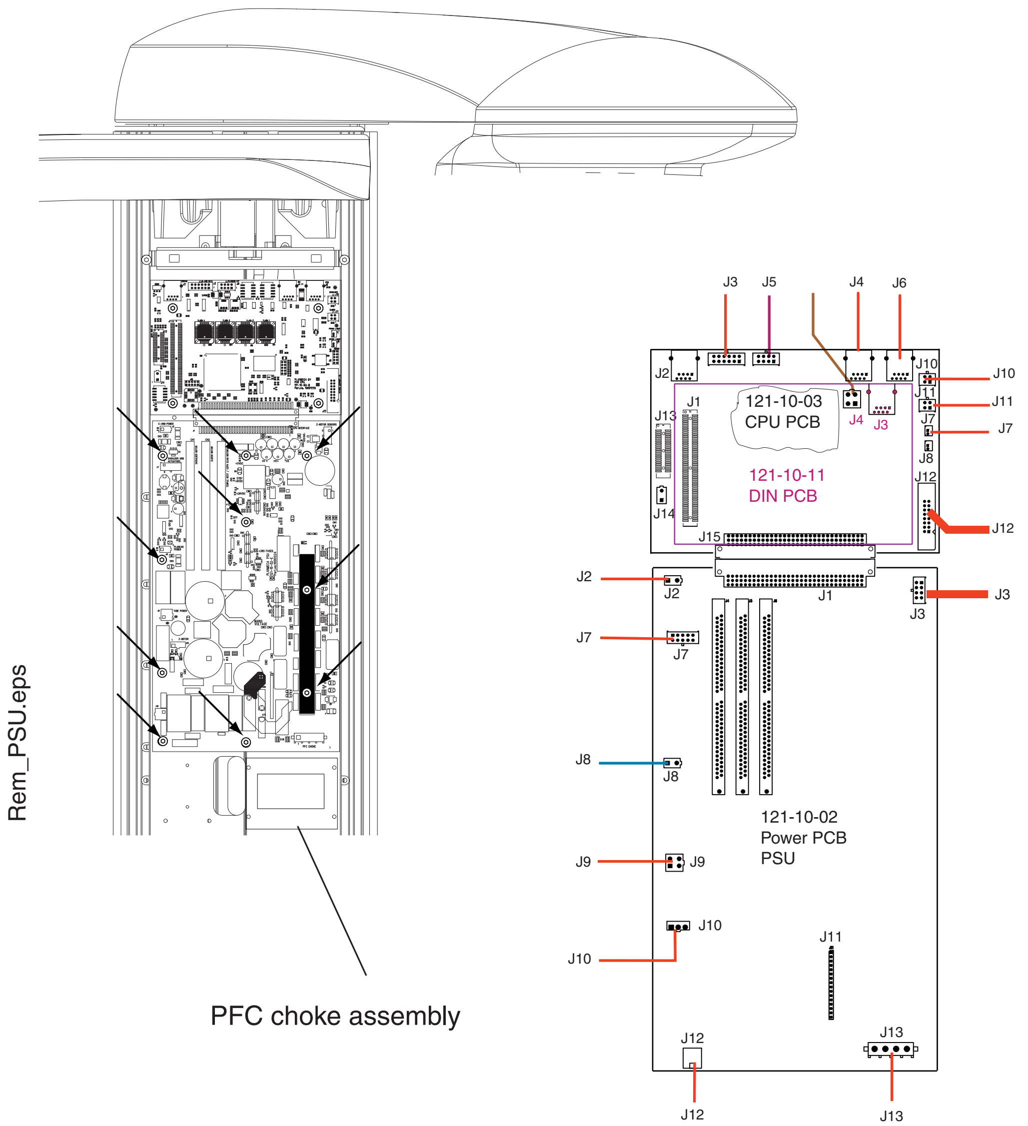


Figure 56

Power PCB version F or older

NOTE **You have to remove the PFC-Choke assembly before installing the new Power PCB version G or later.**

Unscrew the four PFC-Choke assembly attachment screws using the 2.5mm Allen key and remove the PFC-Choke assembly.

Detach the lowest right PCB holder bush and attach it to the upper left attachment hole of the removed PFC-Choke assembly (see figure below).

Attach the PCB holder bush supplied with the Power supply PCB to the upper right attachment hole of the removed PFC-Choke assembly

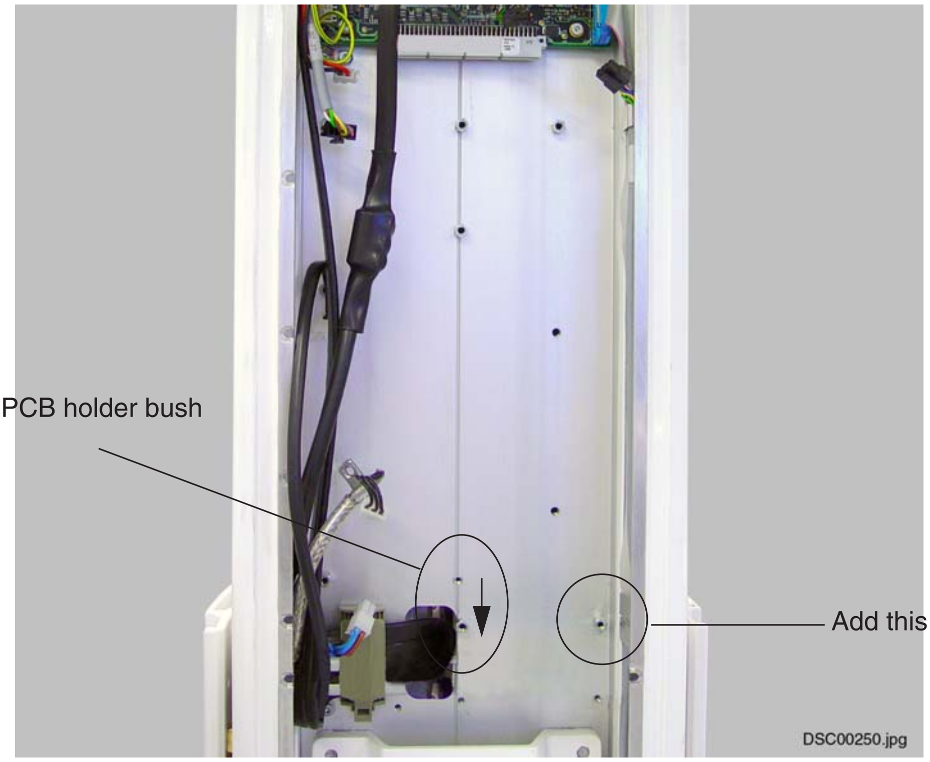


Figure 57

Installation of the new Power PCB (121-10-02, version G or later)

1) Install the new Power supply PCB as follows. Connect the Power supply PCB to the CPU PCB. Attach the Power supply PCB to its position with the eight attachment screws but do **NOT** tighten the attachment screws yet **(1)**.

NOTE **If the column motor cable was not attached with a PCB holder bush to the old Power supply PCB (5), there must be a ninth attachment screw in that location.**

2) Make sure that the metal clips are not between the heat sink and column, but they are located above and below the heat sink **(2)**. Make sure that the cables are not squeezed between the heat sink and column.
3) Before tightening the attachment screws push first the Power supply PCB lower edge towards the right side of the column so that the heat sink touches the column **(3)**. Tighten the **lowest** left attachment screw **(1a)**.
4) Then push the Power supply PCB upper edge towards the right side of the column so that the heat sink touches the column **(4)**. Tighten the **uppermost middle** attachment screw **(1b)**. **Firmly tighten the attachment screws of both the Power supply PCB and the CPU PCB.**
5) Connect all the cables to the Power supply PCB.
6) If the column motor cable was attached with a PCB holder bush to the old Power supply PCB, use the same bush and attachment screw when attaching the column motor cable to the new PCB **(5)**.
7) Replace the removed parts.

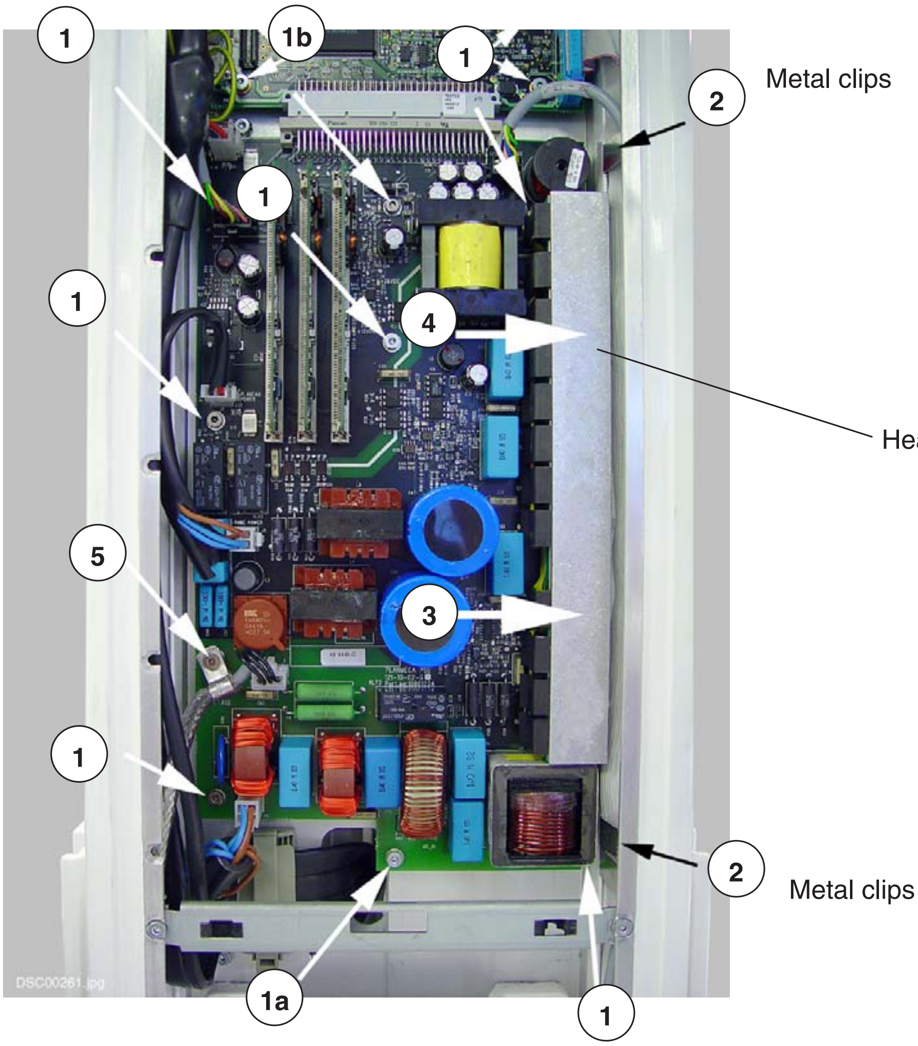


Figure 58

6.2 ETHERNET PCB and CPU PCB

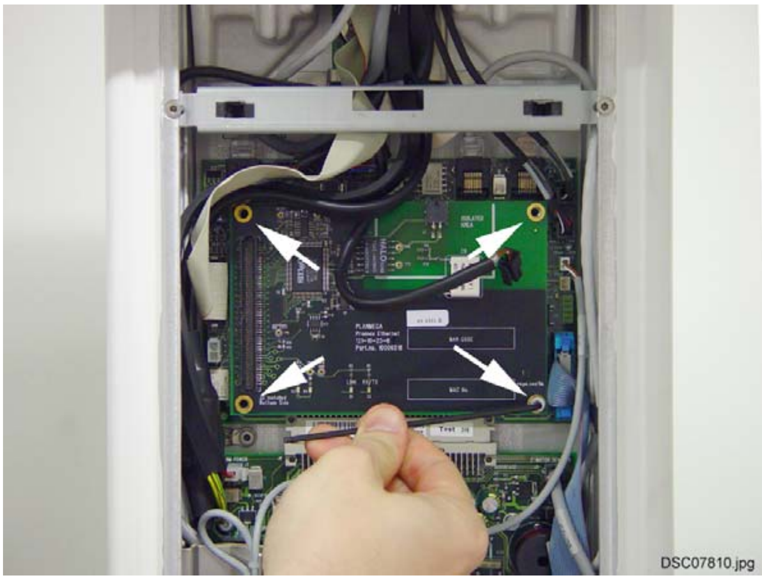
Remove the front cover plate according to the instructions given in section 2.1 “Removing the telescopic column upper front panel” on page G-8.

Disconnect all the cables that are connected to the Ethernet PCB and CPU PCB.

Detach the Ethernet PCB from the screws on every edge from the CPU PCB.

In case you are replacing the CPU PCB, unscrew the CPU PCB attachment screws with the 2.5mm Allen key and detach the CPU PCB from the Power PCB. Remove the CPU PCB.

Install the new PCB in reverse order. Note, that all the cable connectors are labeled.



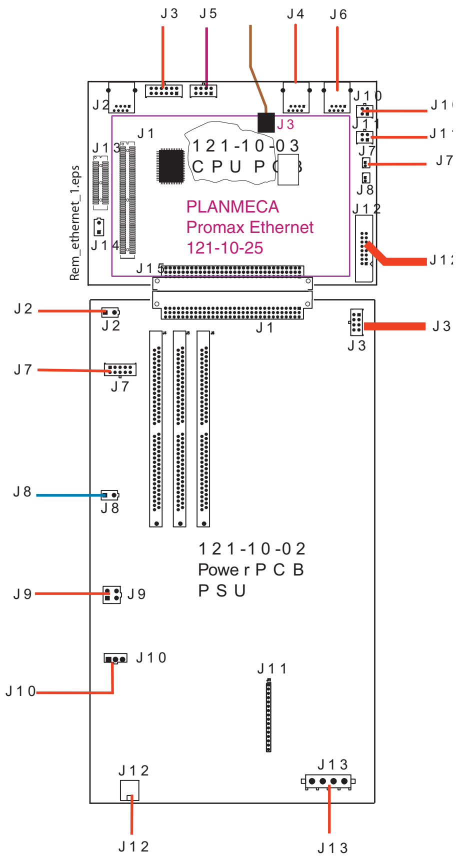


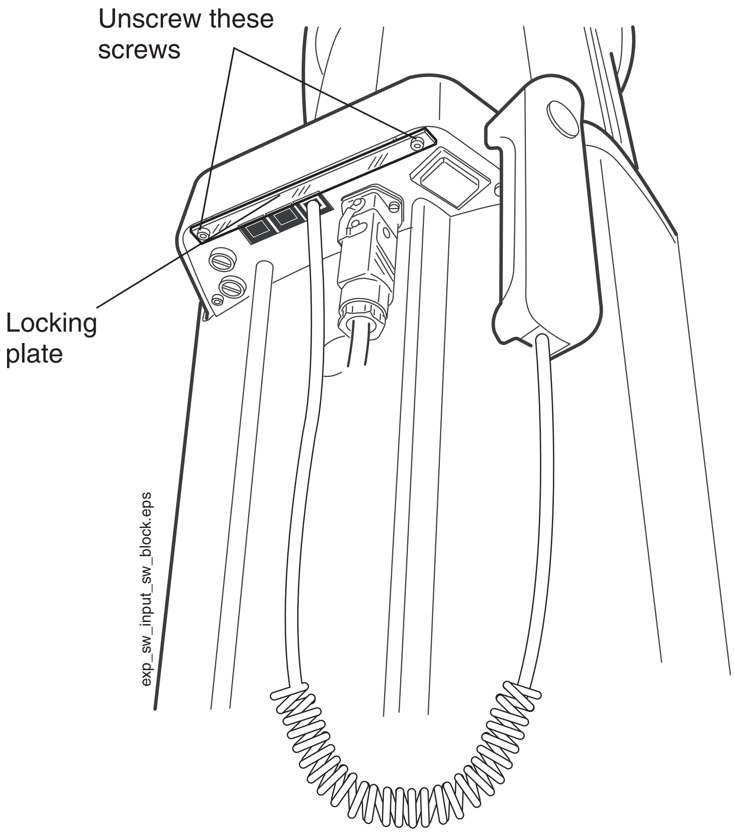
Figure 59

6.3 Input PCB

WARNING

The X-ray unit contains live mains voltage parts. Always unplug the unit from mains outlet before attempting to service the Input module.

Detach all the cables (e.g. power supply cable and exposure switch cable) from their Input module connectors. If the X-ray unit is equipped with a locking plate, it must be removed first. Unscrew the two **M4X12 DIN7984** screws on the plate with a 2.5 mm Allen key and remove the plate.



Unscrew the four M4x16 DIN 912 attachment screws of the column top cover with the 3mm Allen key and remove the cover (Fig. 60, 1).

Unscrew the four M4.8x19 torx 7981 attachment screws of the Input module and detach the module (Fig. 60, 2).

Disconnect all the cables that are connected to the Input PCB. Unscrew the two M4x16 DIN 912 screws with a 3mm Allen key from the Input PCB and remove the PCB (Fig. 60, 3).

Install the new PCB in reverse order.

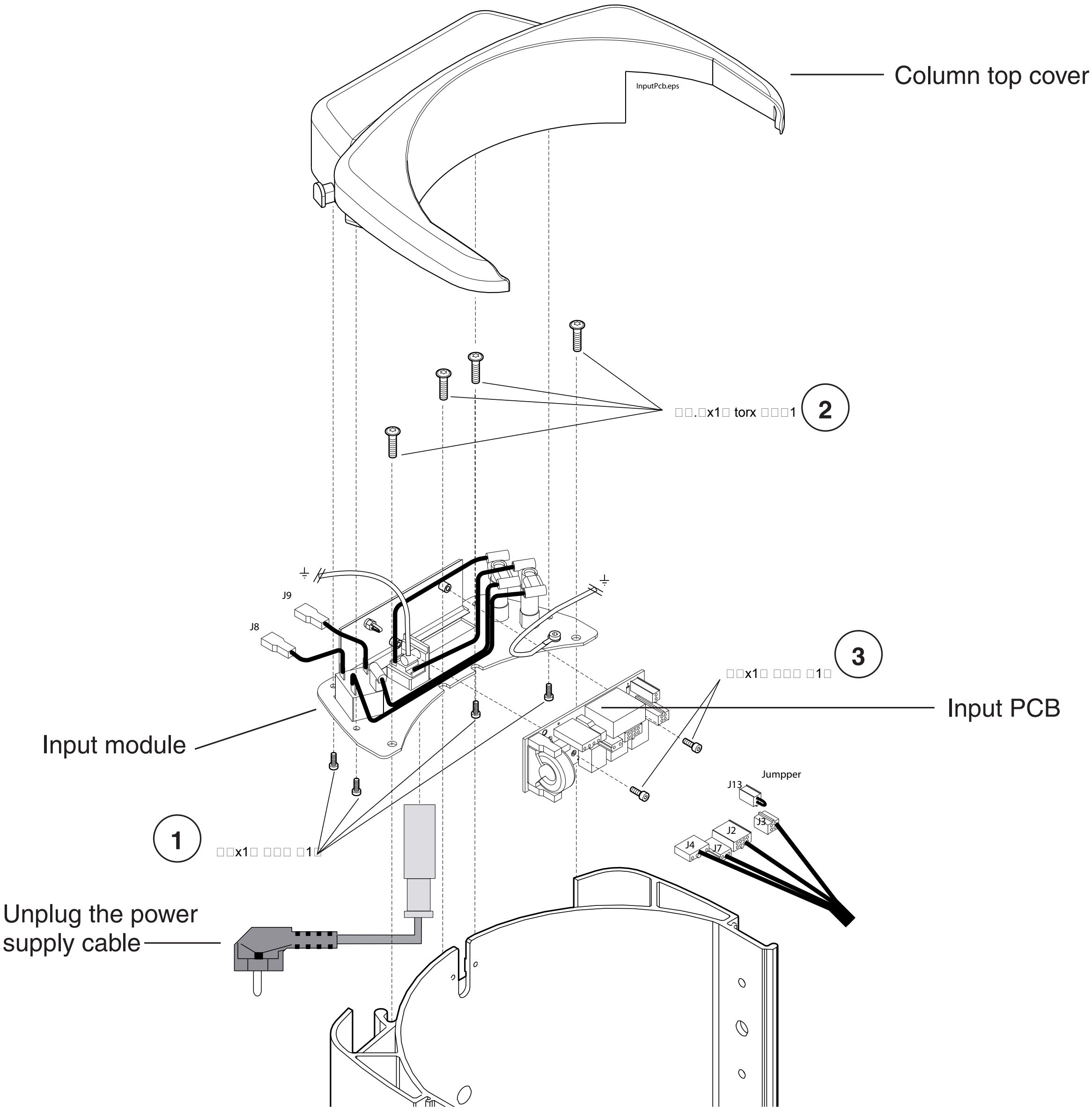


Figure 60

Chapter

H

CEPHALOSTAT

1 ADJUSTMENTS AND CALIBRATIONS

NOTE **During the adjustments write down the selected parameter values. After the cephalostat adjustment switch the X-ray unit off and on and then check that the new parameter values are stored into the memory.**

1.1 Required tools

- Ceph head support alignment tool (part number 00653126).

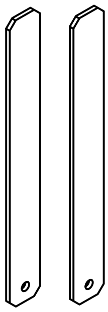


Figure 1

- Ceph head support alignment laser (part number 10004499). Used to check the position of the cephalostat head support.

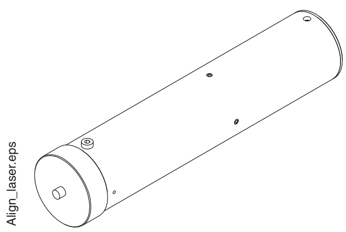


Figure 2

- Sensor head alignment tool (**Dimax4:** part number 10029167, **Dimax2/3:** part number 10002699). For attaching the beam alignment tool.

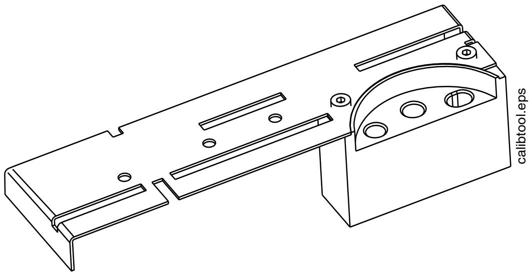


Figure 3

- Beam alignment tool (part number 50972). For checking the position of the X-ray beam.

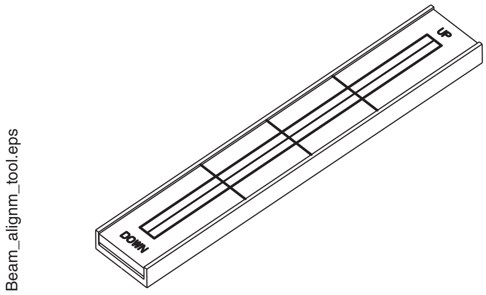


Figure 4

- Cephalostat calibration tool (part number 10004246). For calibrating the digital cephalostat.

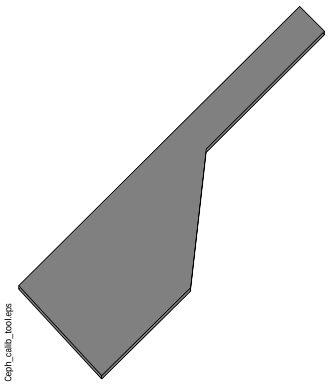


Figure 5

- 3D Flat Field calibration tool (part number 10017348).

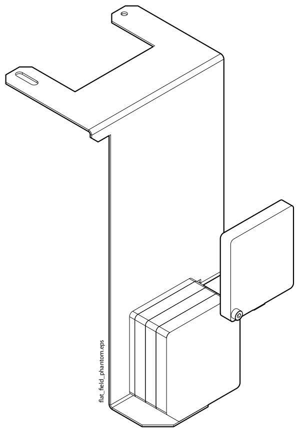


Figure 6

1.2 Preparations before adjustments

Switch the unit off. Remove the housing of the cephalostat head support, see section 4.1 “Removing the housings of the head support” on page H-64.

Remove the second primary collimator according to the instructions given in section 2 “REMOVING AND ATTACHING THE SECOND PRIMARY COLLIMATOR” on page H-55. Remove the tube head cover and the C-arm inner cover, refer to section 5 “REMOVING THE COVERS” on page E-77.

If the cephalostat is equipped with **movable sensor head**, detach the sensor head and remove the sensor head connector covers according to the instructions given in section 3.1 “Cephalostat with movable sensor head” on page H-57.

If the cephalostat is equipped with **fixed sensor head**, see section 3.2 “Cephalostat with fixed sensor head - removing and attaching the sensor head” on page H-61.

1.3 Checking and adjusting the sensor head and second primary collimator mutual position

The sensor head must be in line with the second primary collimator. Check the positions as follows.

Move the scanning mechanism to center position. For both the sensor head and the second primary collimator the right corner of the sledge must hit the circle on the digital cephalostat frame as shown in the figure below.

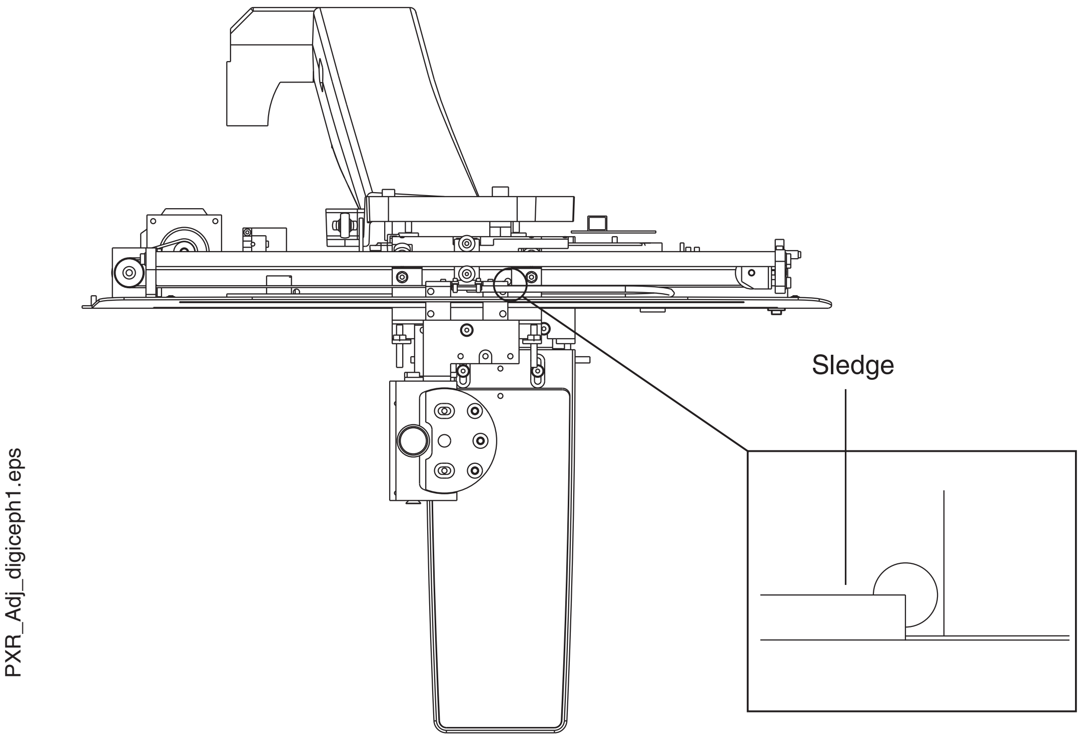


Figure 7

If the sensor head sledge does not hit the circle on the digital cephalostat frame at the same time as the second primary collimator sledge, the sensor head position must be adjusted.

To adjust the position loosen the three adjustment screws of the belt wheel with the 4mm Allen key (Fig. 9, 1 and 2). Lift the belt over the timing belt wheel so that the wheel does not rotate (Fig. 8) and move the collimator so that the right edge of the sledge hits the circle on the digital cephalostat frame.

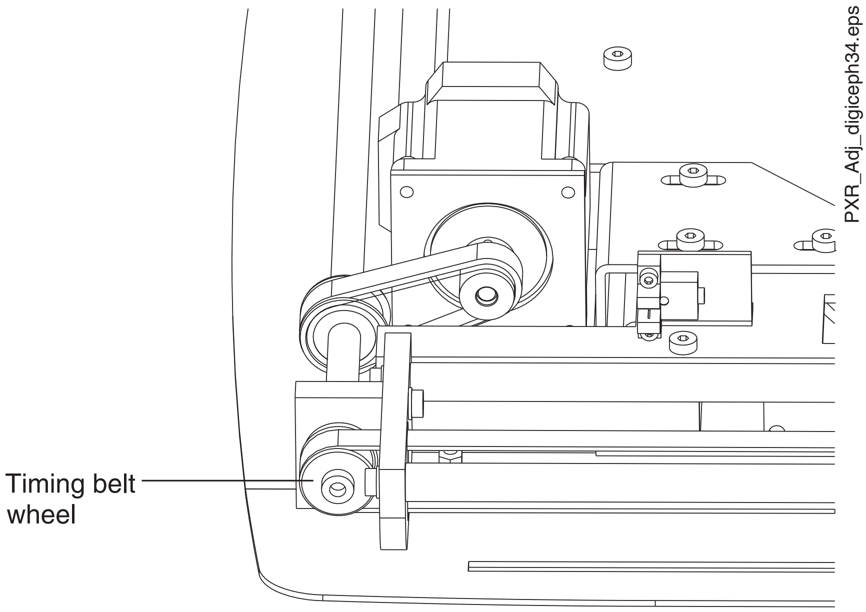


Figure 8

Tighten the outer adjustment screws of the belt wheel (Fig. 9, 1) so that the strain of the belt is appropriate so that it does not skip over the timing belt wheel, but the mechanism operates smoothly. Secure the belt wheel with the inner adjustment screw (Fig. 9, 2).

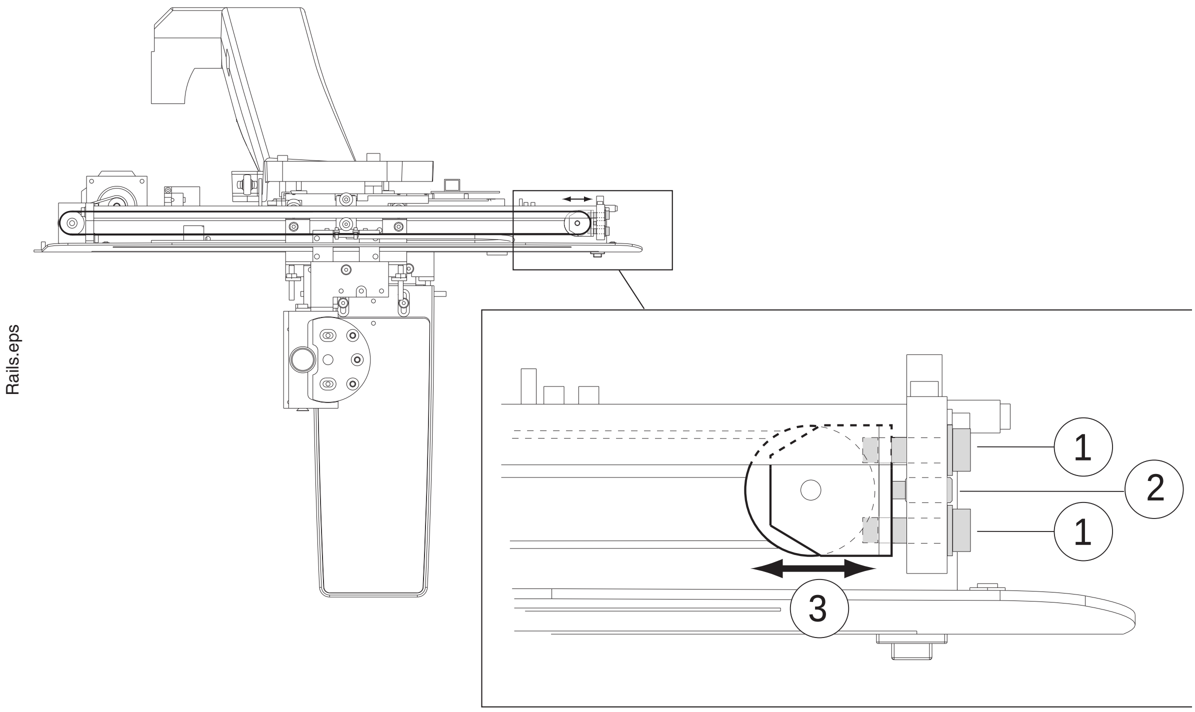


Figure 9

1.4 Adjusting the sensor and second primary collimator rails

The rails of both sensor head and second primary collimator must run parallel with the head support frame. Check the position of the rail using the spirit level. To adjust the rail loosen the attachment screws on the side of rail (Fig. 10, 1).

Adjust the rail position with the adjustment screw (Fig. 10,2) and tighten the attachment screws. Recheck the rail position.

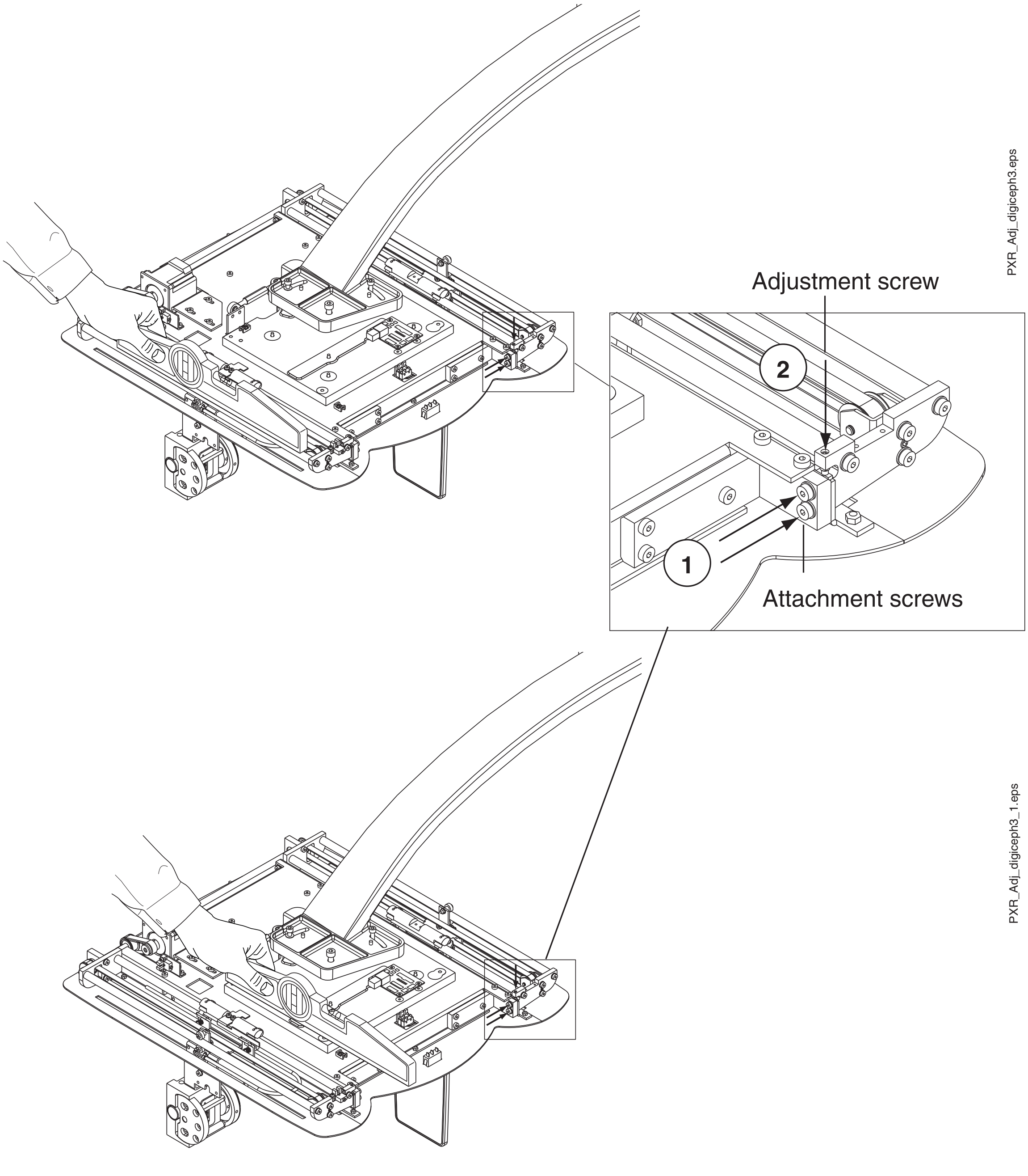


Figure 10

1.5 Adjusting the sensor head connector and sensor head positions

Connector adjustment

The sensor head connector must be perpendicular to the head support in both directions (sideways and in depth). Check the connector position in depth by using the spirit level as shown in Fig. 11 below.

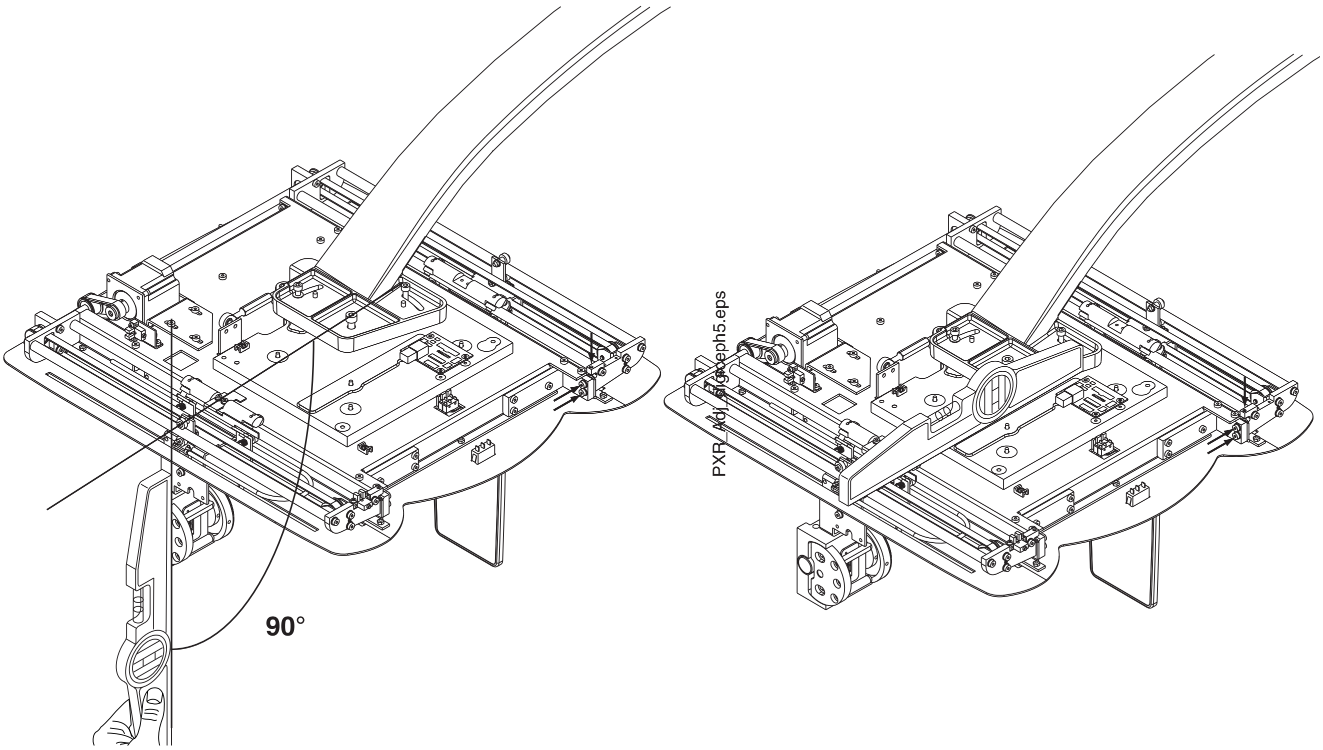


Figure 11

Loosen the three attachment screws of the connector.

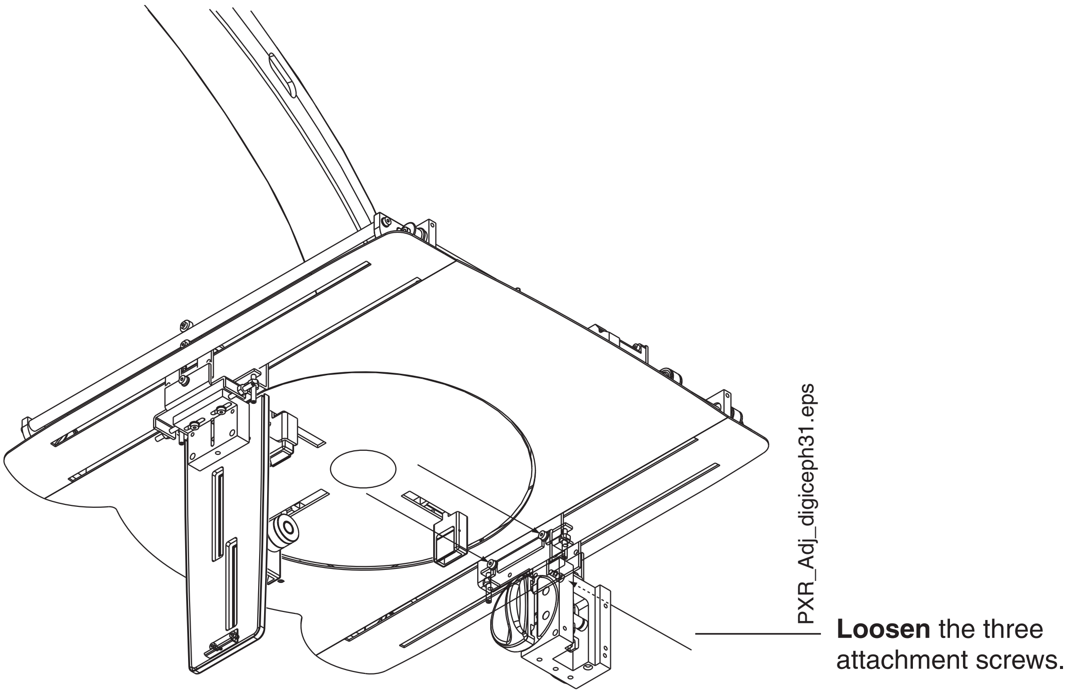


Figure 12

To adjust the connector position in depth rotate the two adjustment screws equally to the same direction.

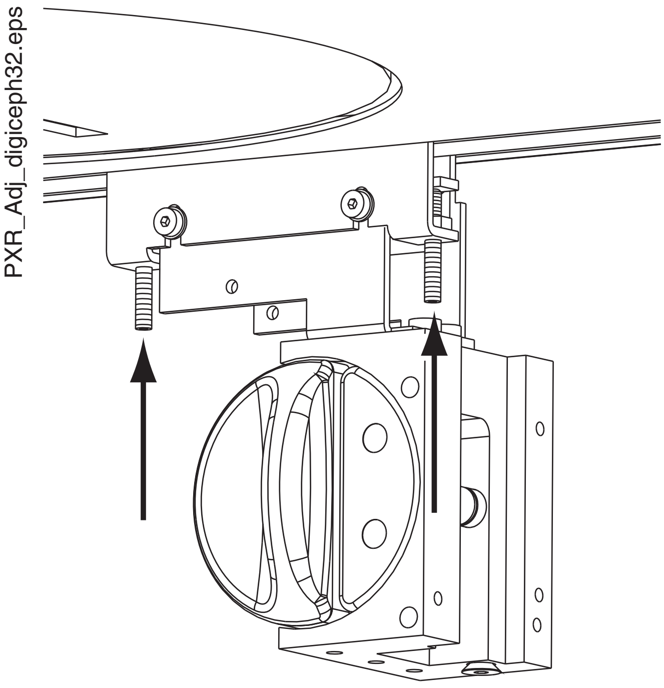


Figure 13

Check the connector sideways position by using the spirit level as shown in Fig. 14 below.

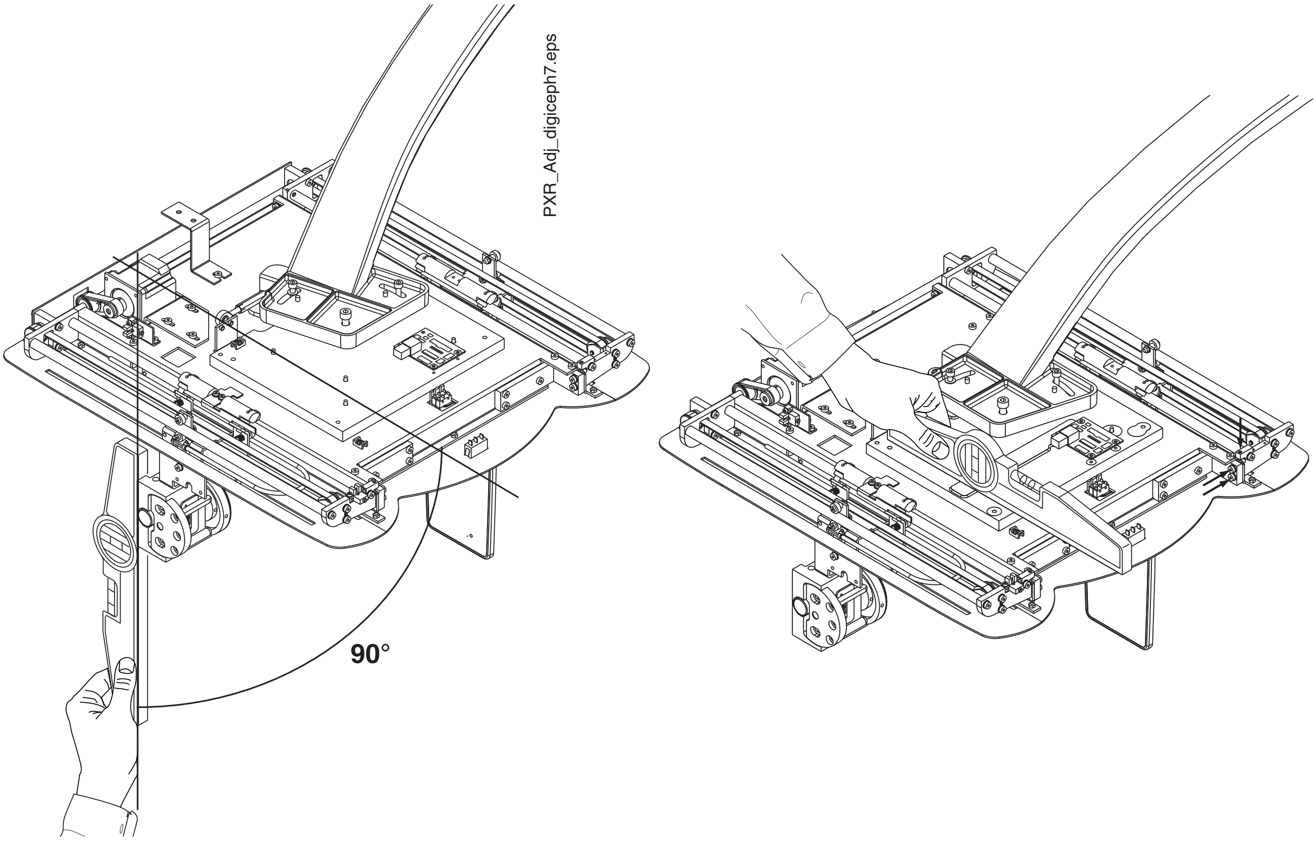


Figure 14

To adjust the connector position sideways tighten one screw to the same degree you loosen the other.

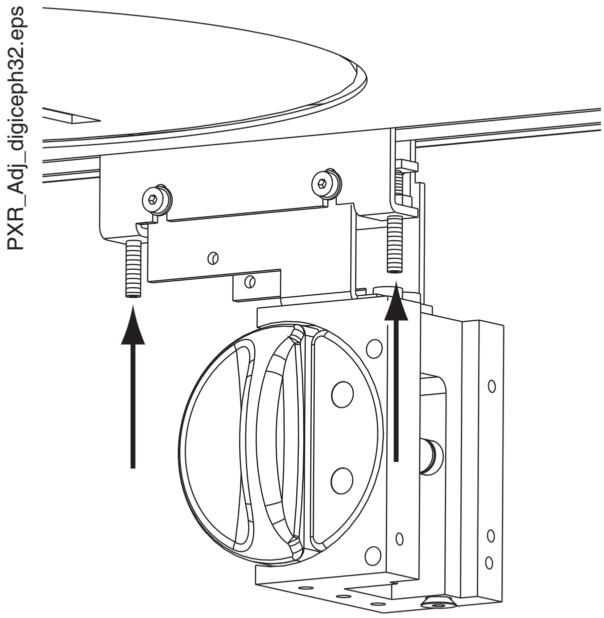


Figure 15

Check the adjustments and tighten the attachment screws.

Sensor head adjustment

The sensor head must be perpendicular to the sensor rail. Use a sprit level to check the sensor head position, i.e. the sensor alignment tool position. In case it is not perpendicular to the head support, the angle of the quick connector mechanism must be adjusted.

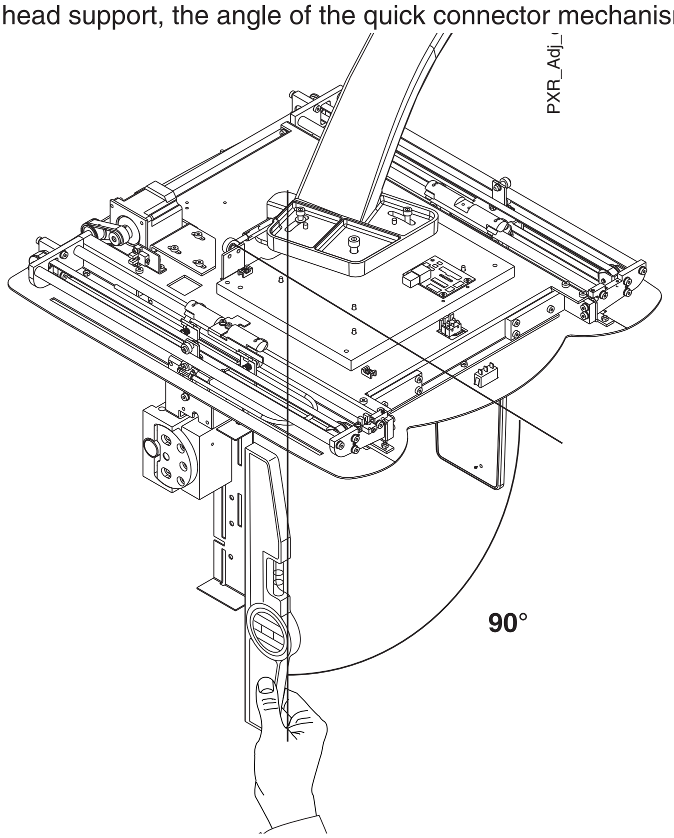


Figure 16

Attach the sensor alignment tool to the quick connector. Loosen the two screws located on the outer side of the mechanism with the 3mm Allen key.

Adjust the head support angle with the two screws located on the left side of the mechanism (use 3mm Allen key) so that the sensor alignment tool is perpendicular to the cephalostat head support.

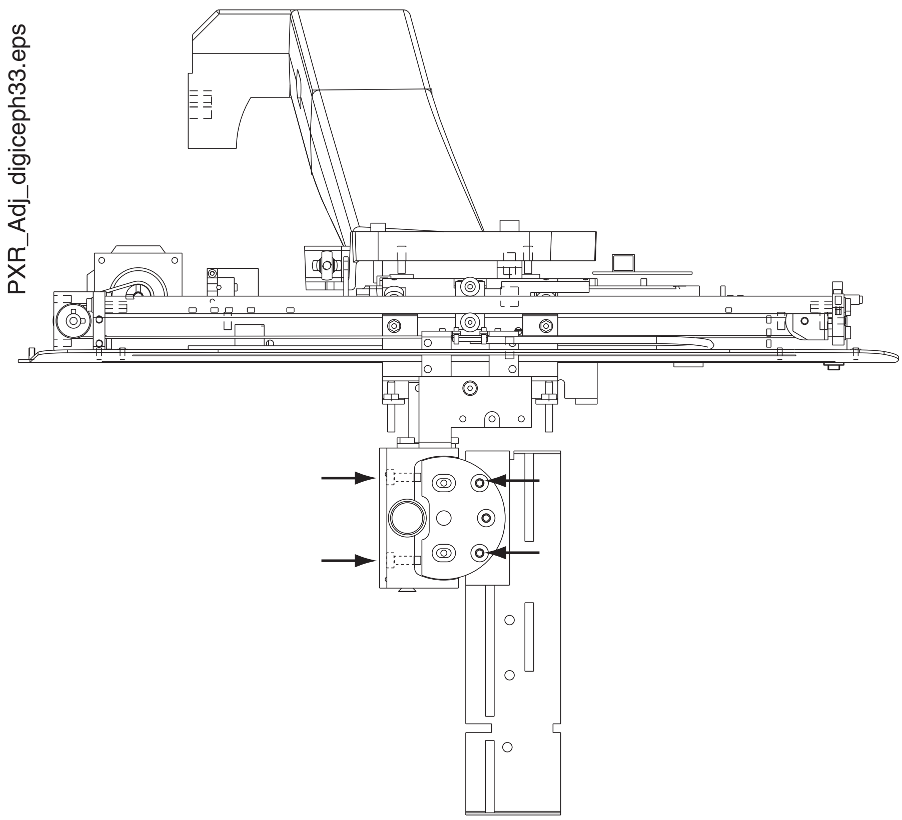


Figure 17

1.6 Adjusting the height of the cephalostat

The height of the cephalostat must be adjusted so that the bottom edge of the X-ray beam reaches the lower edge of the rectangle marked on the beam alignment tool when the beam alignment tool is positioned to the sensor alignment tool **upside down** to lower vertical position as shown in Fig. 18 below.

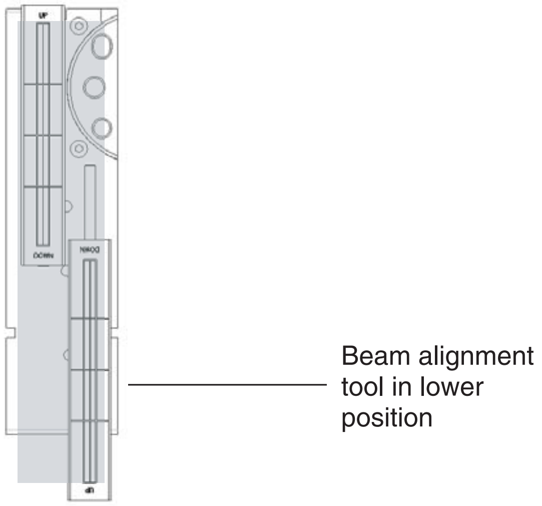


Figure 18

To select the cephalometric exposure first touch the **Prog.** field on the *Main* display and then select the cephalometric exposure by touching the **Ceph** field on the *Select program type* display.

Place the sensor head alignment tool to the sensor head connector. Place the beam alignment tool to the sensor alignment tool to the lower vertical position as shown on the Fig. 18 above. Select kilovolt and milliampere values high enough to enable the radiation beam to be seen in a darkened room. The actual values will depend on how dark the room is.

The sensor head and the first primary collimator must be moved to the center position by entering the Ceph mode X-collimator calibration mode as follows. To enter the calibration mode first touch the **i** field on the *Main* display. Select **Technical calibrations (i600)** from the list on the display. The password to the Technical calibrations mode is asked when the Technical calibrations mode is entered for the first time after switching the unit on. **The password is 1701.**

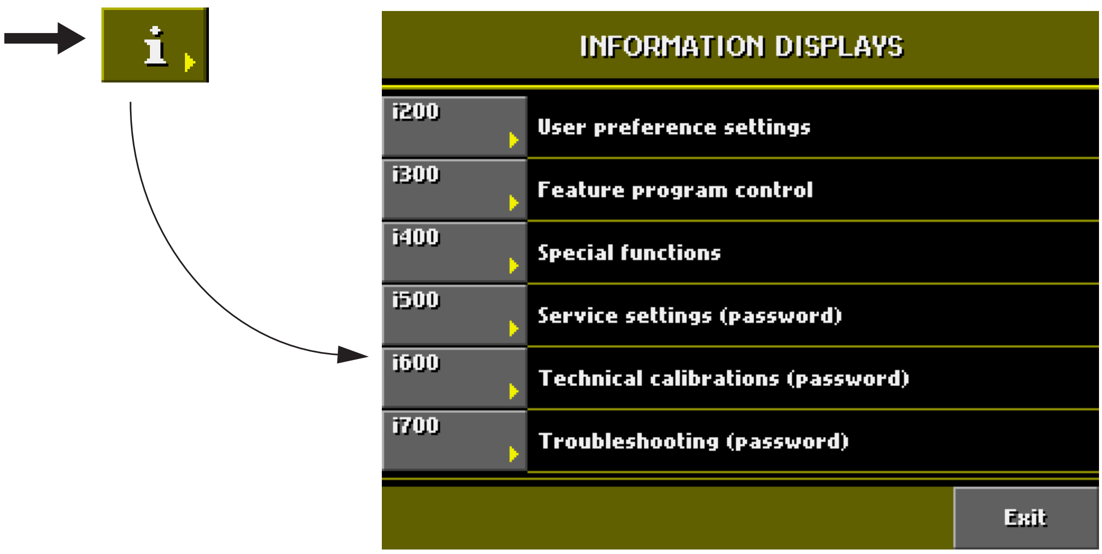


Figure 19

From the list on the *i600* display that appears select Primary collimator calibration (i610) and from the list on the *i610* display that appears select the *Ceph mode beam position (i616)*.

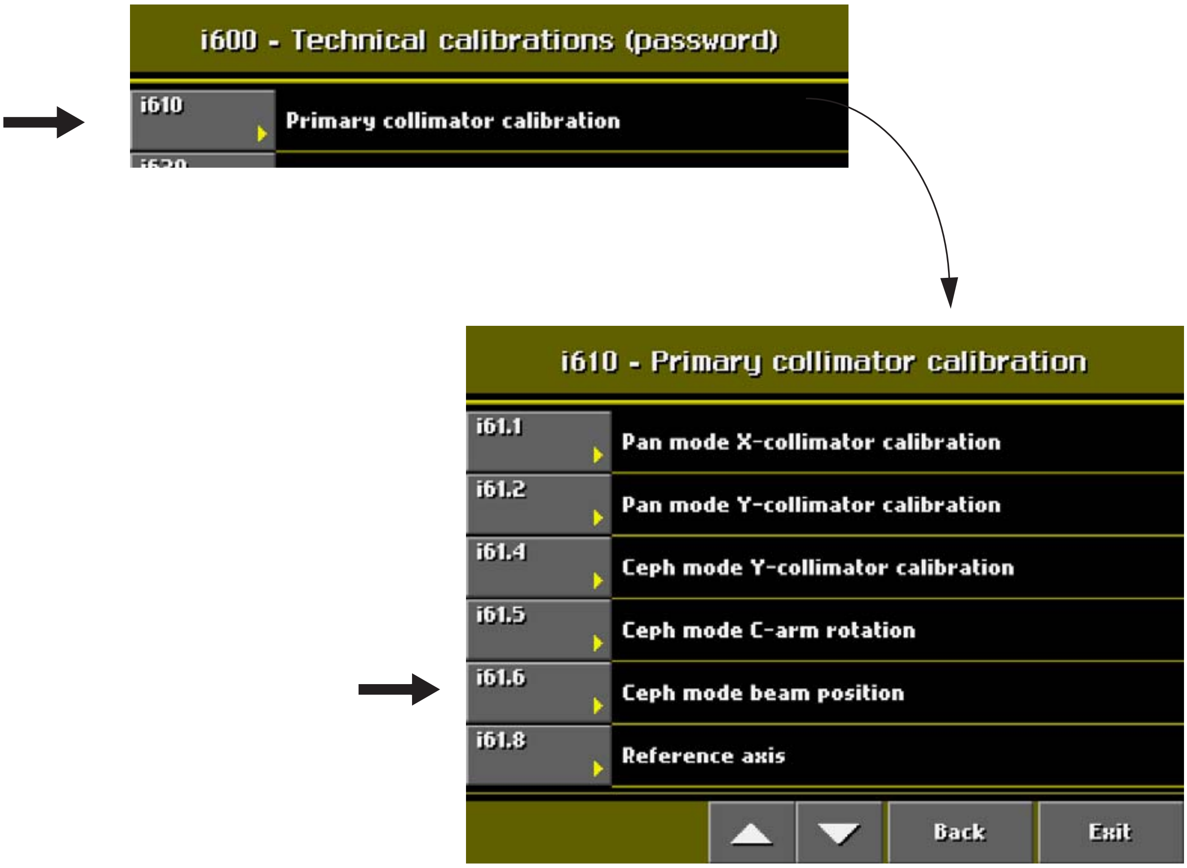


Figure 20

The *Ceph mode beam position* display appears. The sensor head and the first primary collimator will move to the centre position. Touch the **Test** field.

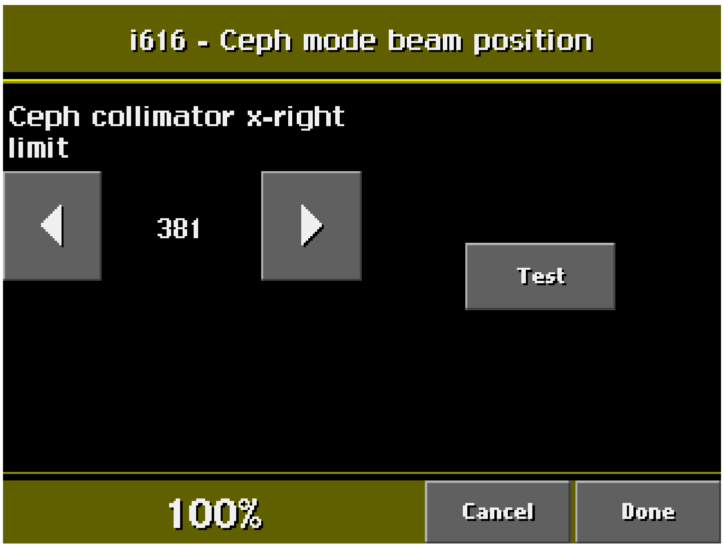


Figure 21

The lower blade of the primary collimator must be on level with the opening on the aluminum frame. To adjust the position of the lower blade rotate the Y-motor screw (Fig. 22, 1) and simultaneously move the lower blade (Fig. 22, 2).

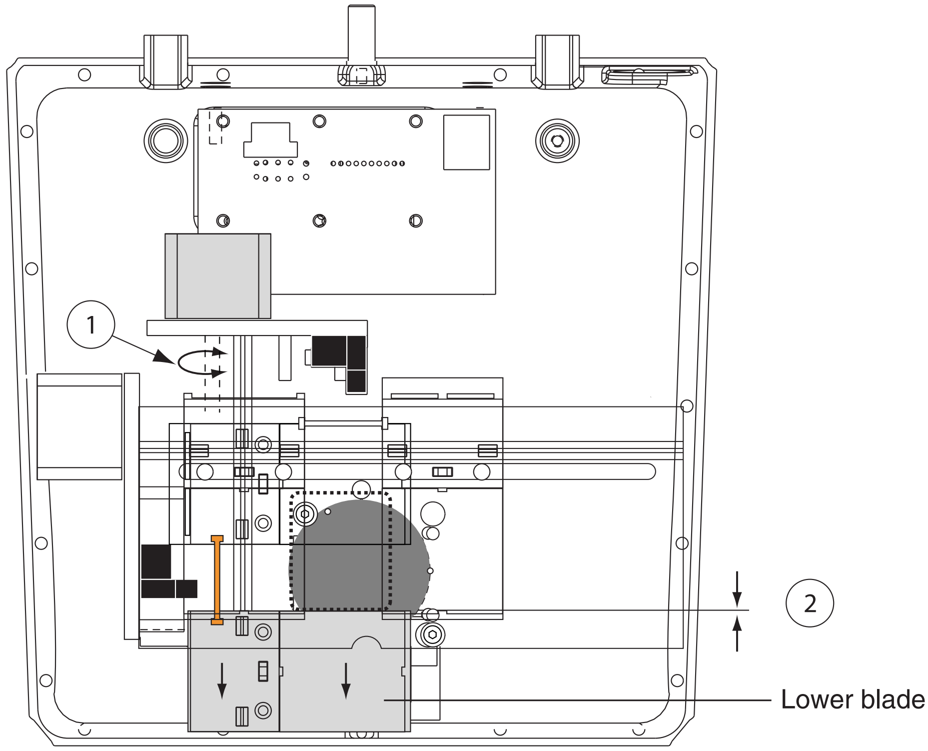


Figure 22

Stand behind the tube head and protect yourself from radiation. Press and hold down the exposure button. The image of the radiation beam will appear on the alignment tool.

Loosen the nuts of the attachment plate (Fig. 23, 1). Adjust the cephalostat height with the nut of the swing bolt (Fig. 23, 2) so that the bottom edge of the X-ray beam reaches the lower edge of the rectangle marked on the beam alignment tool when the beam alignment tool is positioned to the sensor alignment tool **upside down** to lower vertical position as shown in Fig. 18.

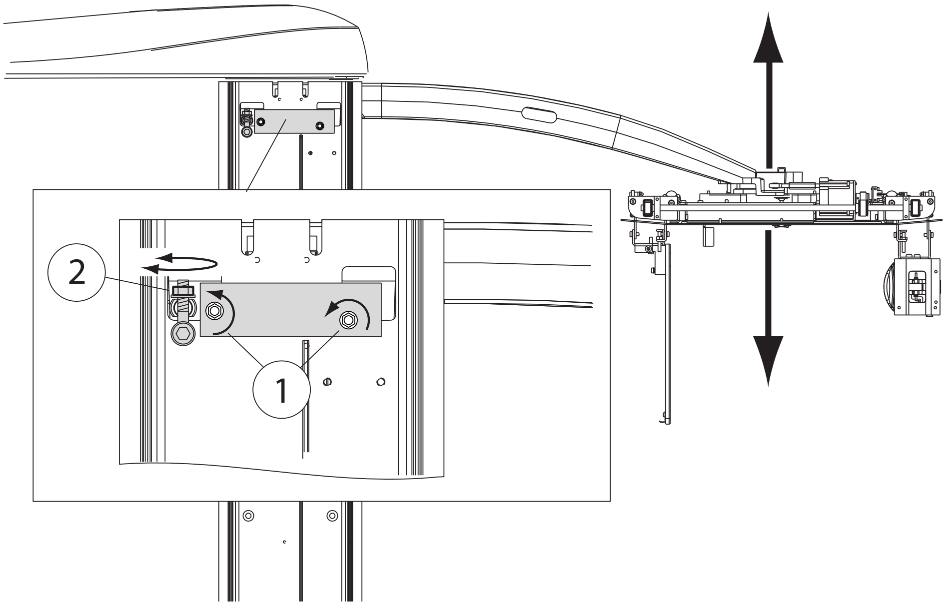


Figure 23 Adjusting the height of head support

Exit the *Ceph mode beam position* mode by touching the **Cancel** field.

1.7 Checking the cephalostat head support position

The head support frame must run parallel with the primary collimator. Make sure that the unit is in the cephalometric exposure mode (C-arm in position shown on the Fig. 25). Check the position of the head support by using the spirit level as shown on the Fig. 24. Adjust the head support in vertical direction, if needed. Refer to section “Adjusting the sensor head in vertical direction” on page H-18.

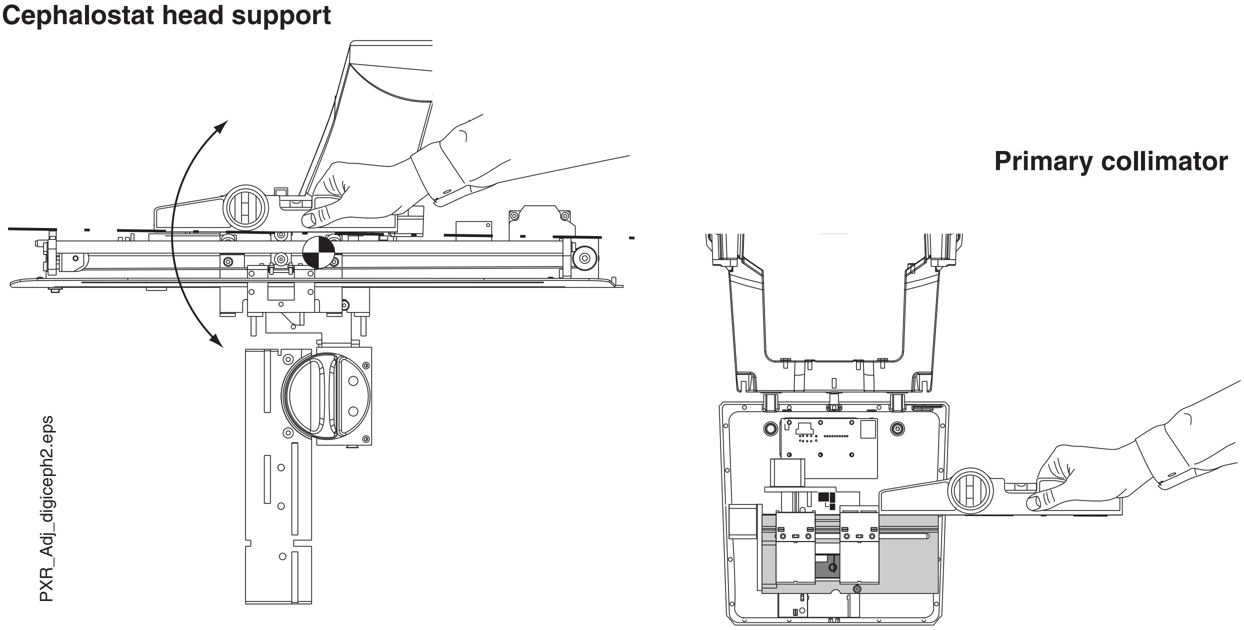


Figure 24

Place the ceph head support alignment tools in the ear post holders as far as they go. Rotate the head support to the 90° position. Position the laser tool between the alignment tools.

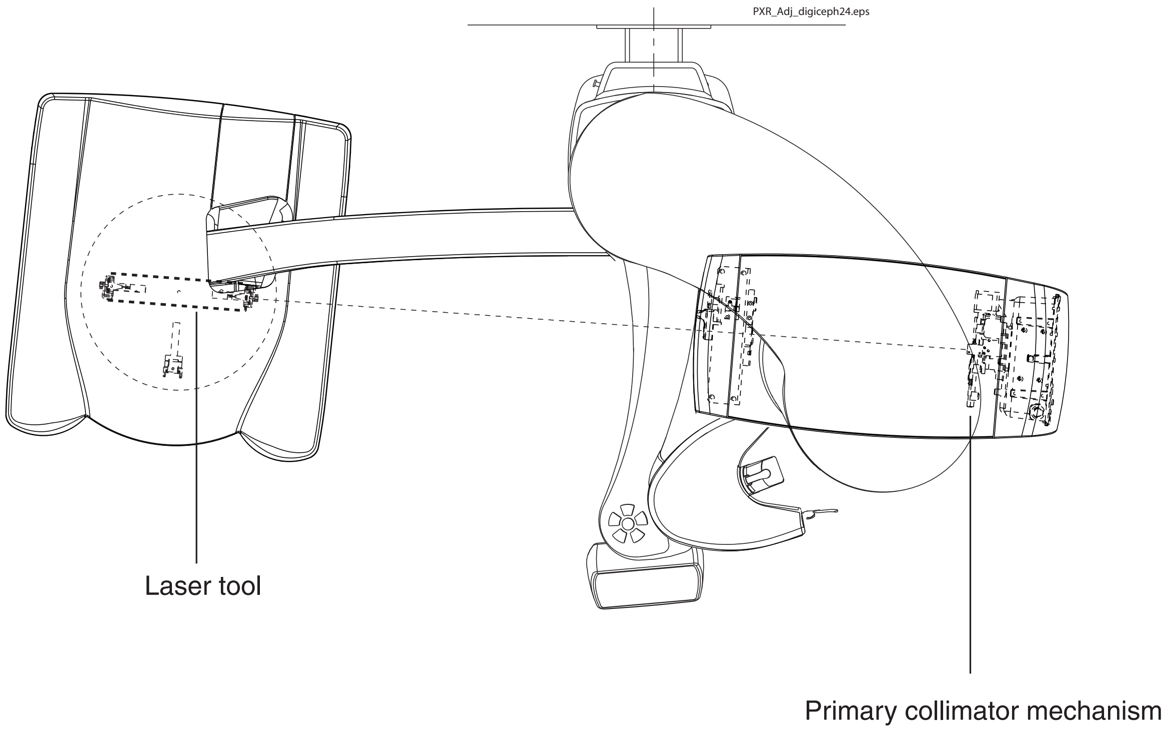


Figure 25

NOTE **Rotate the laser tool to check the laser tool calibration. If the laser point moves when rotating the laser tool body, use the center of the point movement as a reference point that must hit the lowest point of the calibration circle.**

The laser beam must hit the lowest point of the calibration circle located on the primary collimator mechanism.

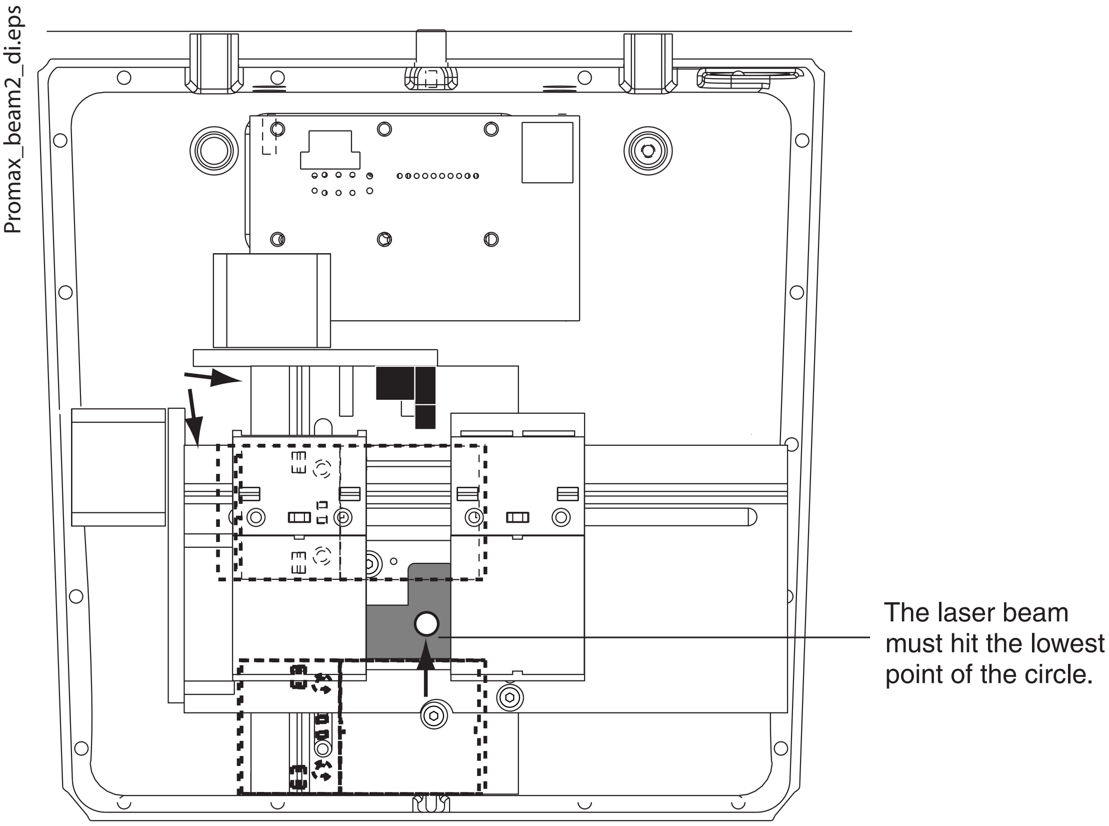


Figure 26

If the beam does not hit the circle, adjust both the head support position and the C-arm position (refer to sections 1.8 “Cephalostat head support position adjustment” on page H-16 and 1.9 “Calibrating the C-arm position” on page H-19).

Remove the laser beam and the ceph head support alignment tools from the head support.

1.8 Cephalostat head support position adjustment

Adjusting the ear posts in horizontal direction

Switch the unit off. Remove the cephalostat housings according to the instructions given in section 4 “REMOVING THE HOUSINGS AND COVERS” on page H-64.

Loosen the locking screw of the adjustment flange. Rotate the head support around its vertical axis to adjust the ear posts in horizontal direction as follows.

Loosen the head support attachment screws (Fig. 27, 1) and the alignment bar screw (Fig. 27, 2). Rotate the alignment bar until the head support is in correct position (Fig. 27, 3 and 4).

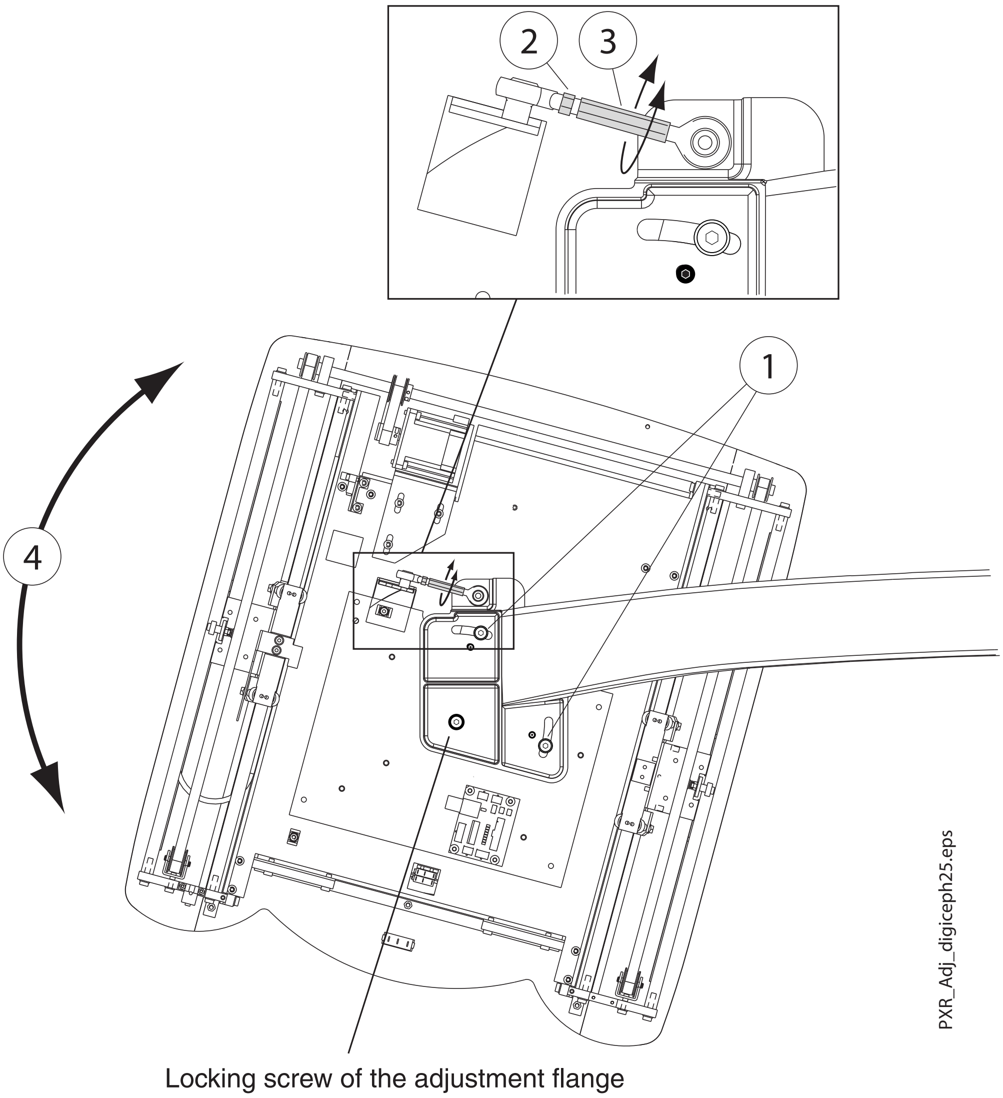


Figure 27 Adjusting the ear posts in horizontal direction

Adjusting the ear posts in vertical direction

Make sure that the locking screw of the adjustment flange (Fig. 28, 1) is loosened. To adjust the ear posts in vertical direction rotate the head support around its horizontal axis (Fig. 28, 4) with the two screws on the adjustment flange (Fig. 28, 2 and 3).

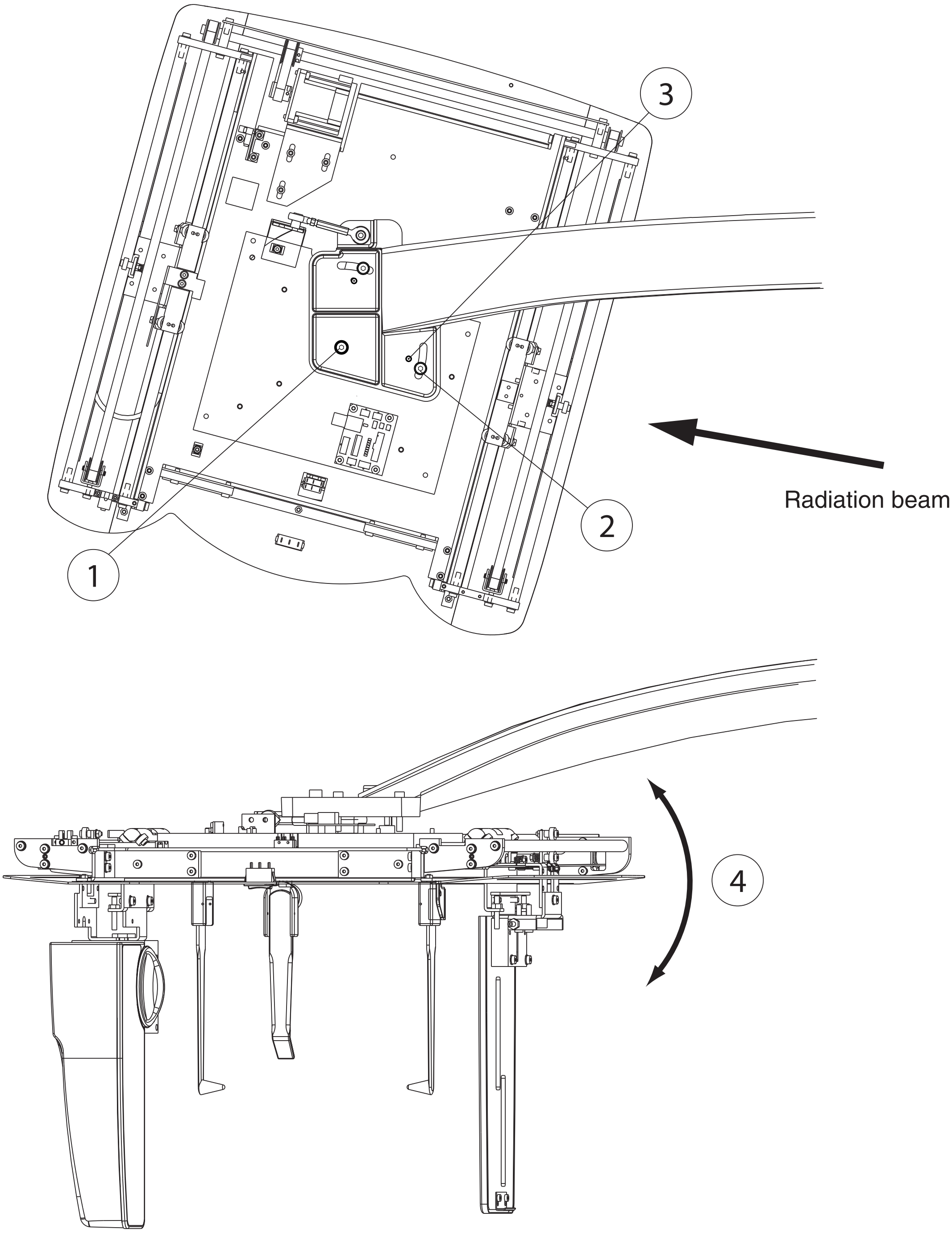


Figure 28 Adjusting the ear posts in vertical direction

Adjusting the sensor head in vertical direction

Make sure that the locking screw of the adjustment flange (Fig. 29, 1) is loosened. If the sensor head does not run parallel with the primary collimator, adjust the sensor head in vertical direction (Fig. 29, 4) with the two screws on the adjustment flange (Fig. 29, 2 and 3).

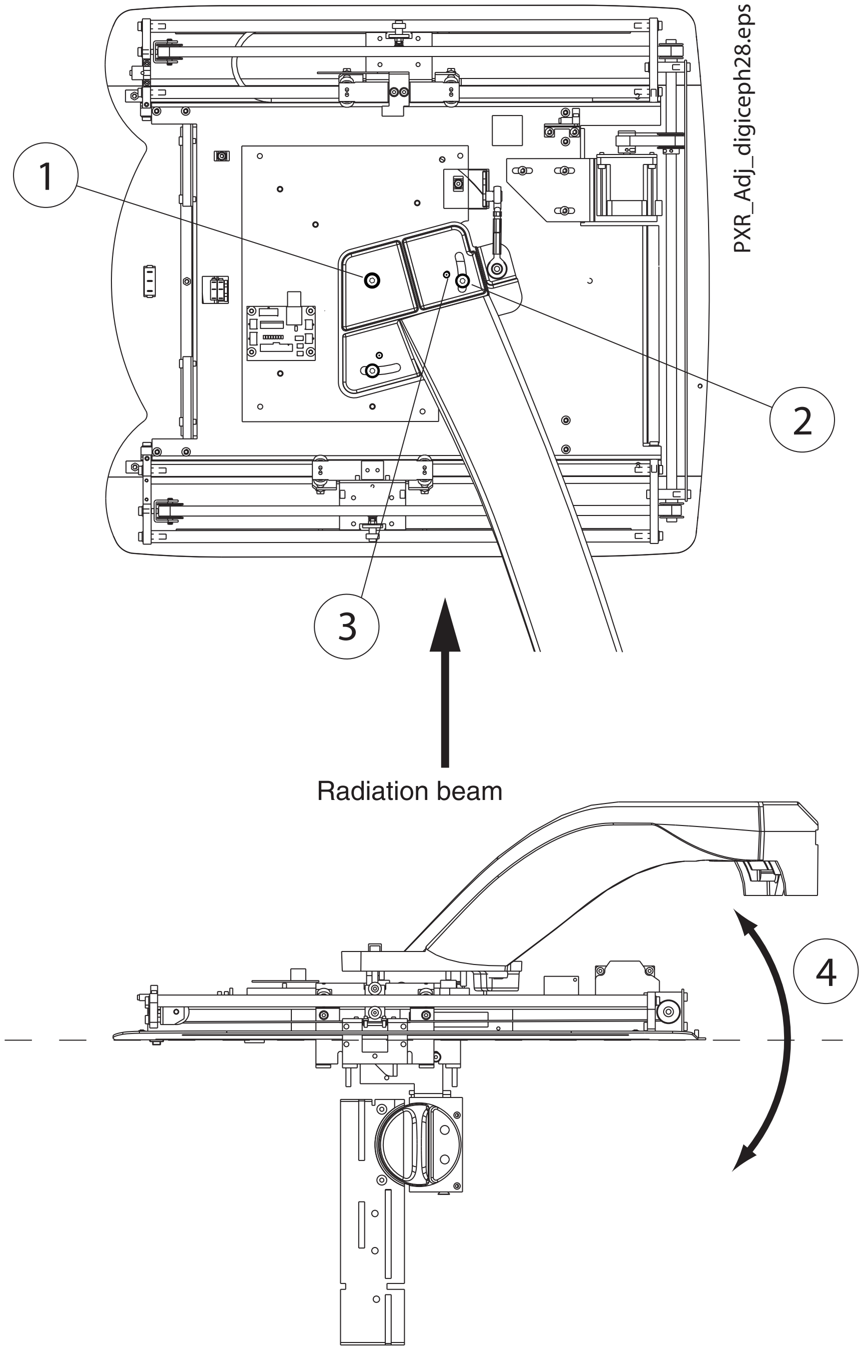


Figure 29 Adjusting the sensor head in vertical direction

1.9 Calibrating the C-arm position

Select kilovolt and milliampere values high enough to enable the radiation beam to be seen in a darkened room. The actual values will depend on how dark the room is.

To enter the calibration mode first touch the **i** field on the *Main* display. Select Technical calibrations (i600) from the list on the display. The password to the Technical calibrations mode is asked when the Technical calibrations mode is entered for the first time after switching the unit on. **The password is 1701.**

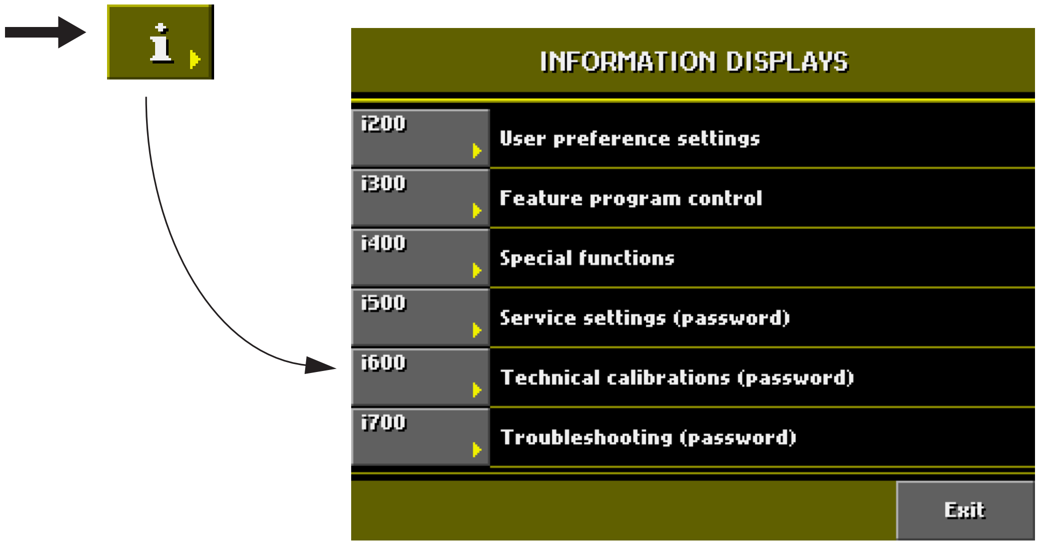


Figure 30

From the list on the *i600* display that appears select *Primary collimator calibration (i610).*

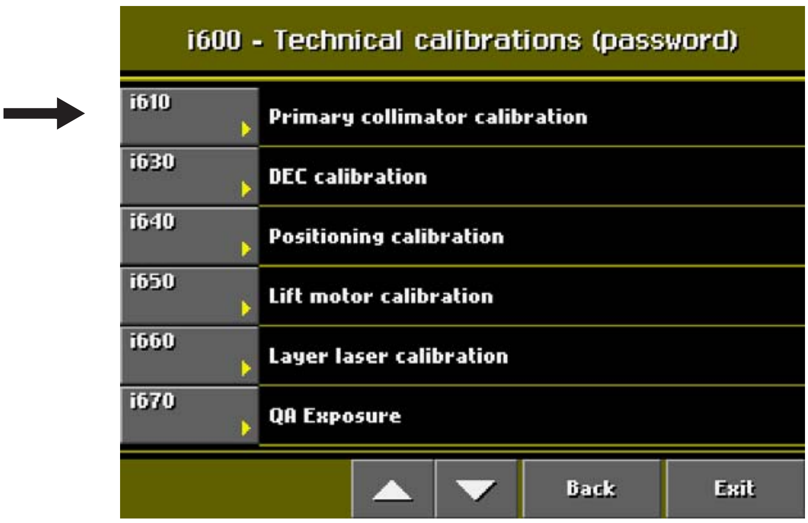


Figure 31

From the list on the *i610* display that appears select the *Ceph mode C-arm rotation (i61.5)*.

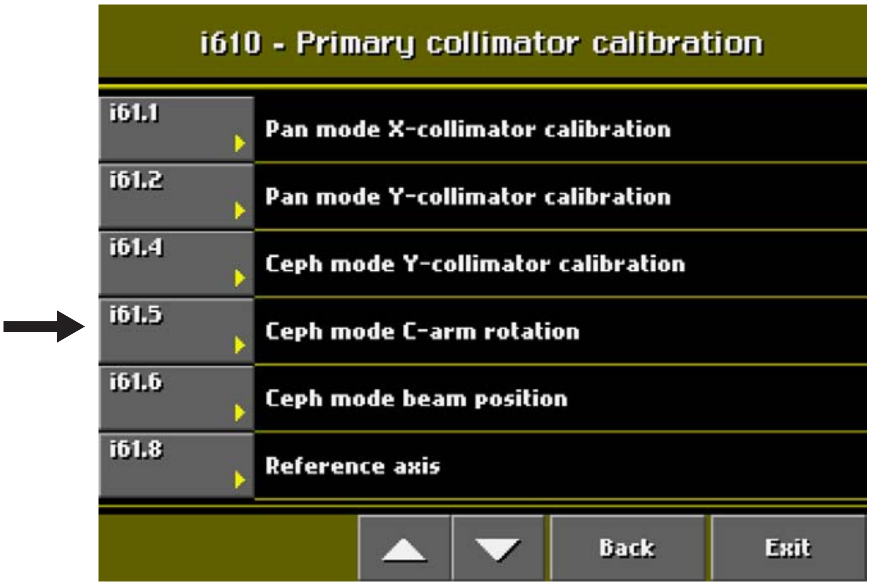


Figure 32

The *Ceph mode C-arm rotation* display appears.

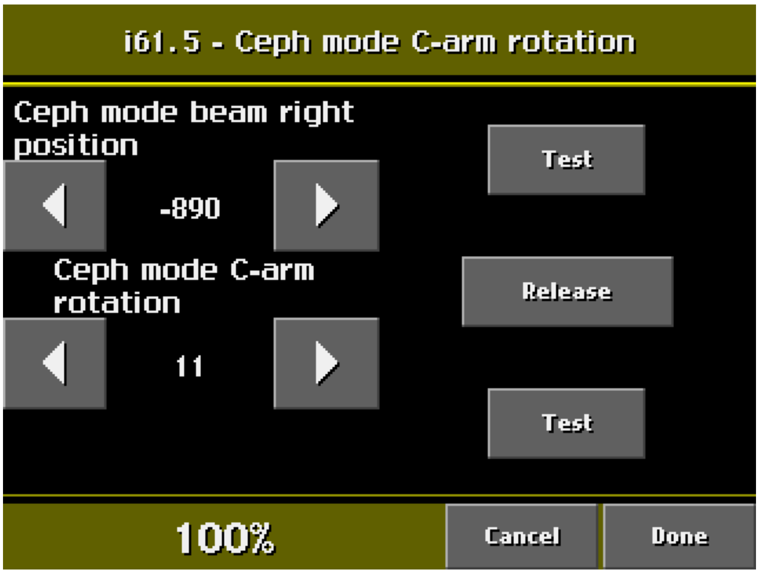


Figure 33

Ceph mode beam right position

NOTE This calibration must be performed in 3D X-ray units, but can also be performed in 2D X-ray units.

Place the sensor alignment tool to the **C-arm sensor head connector.** Place the beam alignment tool to the sensor alignment tool to a horizontal position (see the figure below). Secure the tool with tape.

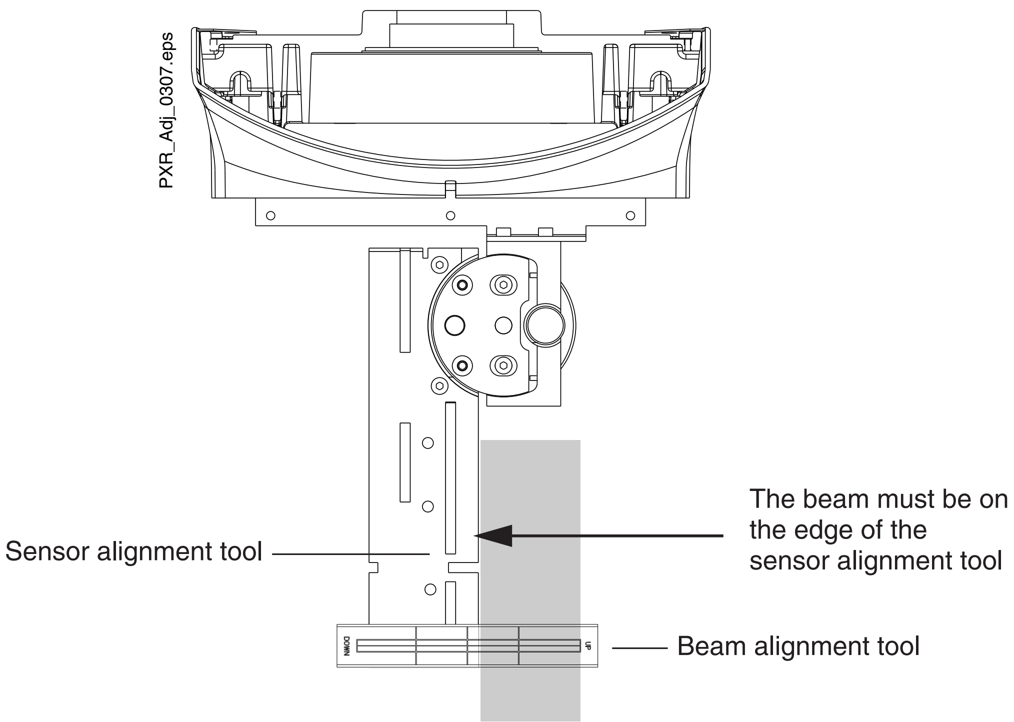


Figure 34

Touch the UPPER **Test** field.

Adjust the **C-arm position** value with the **Ceph mode beam right** arrow fields and drive the C-arm to the new position by touching the UPPER **Test** field.

Check the beam position.

The edge of the beam should be just outside the edge of the sensor alignment tool, see Fig. 34. **If it is not on the edge, the C-arm position must be adjusted.**

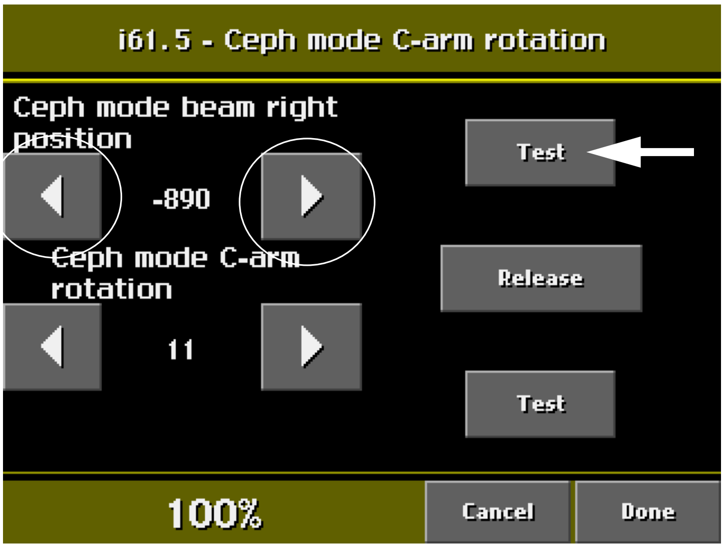


Figure 35

Stand behind the tube head and protect yourself from radiation. Press and hold down the exposure button. The image of the radiation beam will appear on the alignment tool.

Note that you can release the C-arm and shoulder arm motors by touching the **Release** field. After releasing the motors you can freely adjust the positions of the arms so that the X-ray field is clearly seen.

After the cephalostat beam right side is calibrated, perform calibration described below.

Ceph mode C-arm rotation

Move the sensor alignment tool to the **cephalostat sensor head connector.**

Place the beam alignment tool to the sensor alignment tool to a horizontal position (see the figure below).

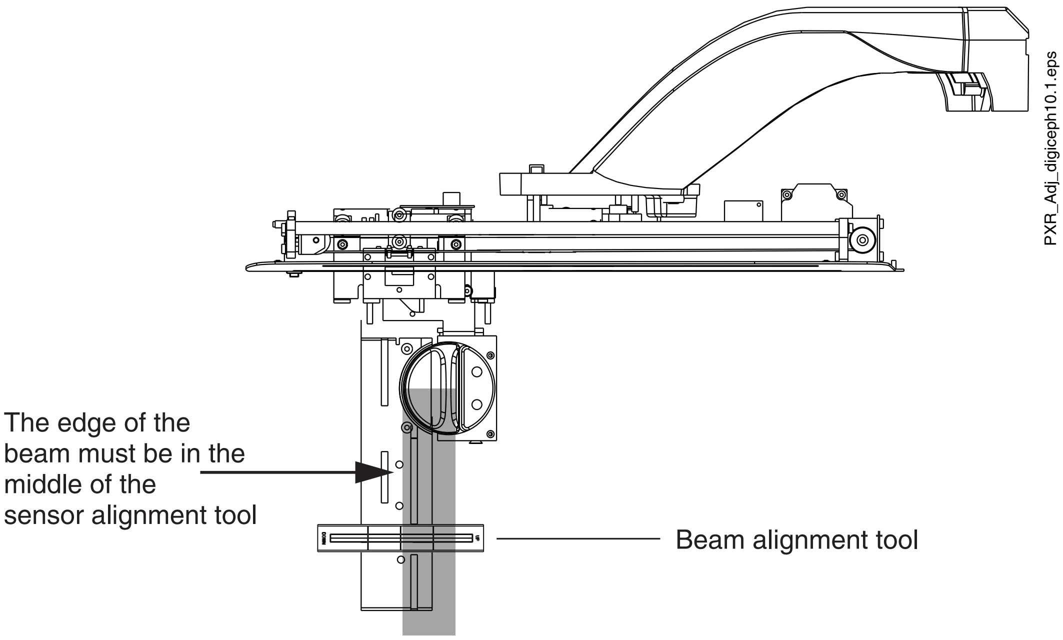


Figure 36

Touch the LOWER **Test** field to drive the C-arm back to correct position for the C-arm position calibration.

Adjust the **C-arm position** value with the **Ceph mode C-arm rotation** arrow fields and drive the C-arm to the new position by touching the LOWER **Test** field.

The **left** arrow field moves the C-arm **towards the ceph arm**, and the **right** arrow field moves the C-arm **away from the ceph arm.**

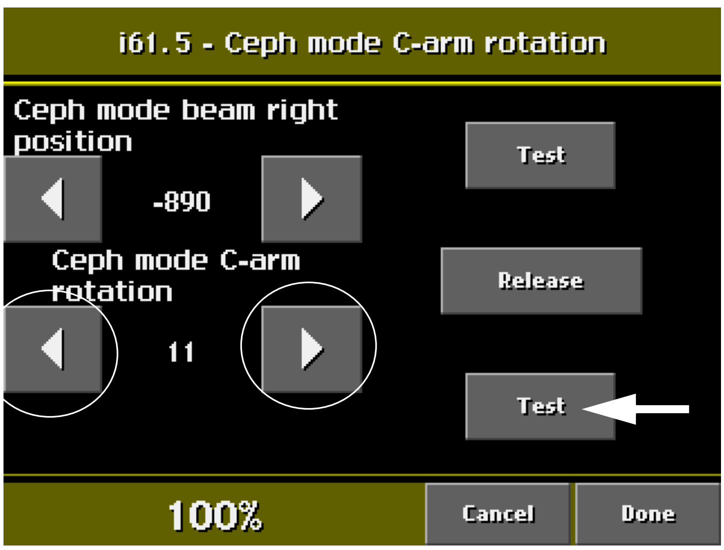


Figure 37

Check the beam position.

The edge of the beam must reach the middle line of the alignment tool. **If it does not, the C-arm position must be adjusted.**

Stand behind the tube head and protect yourself from radiation. Press and hold down the exposure button. The image of the radiation beam will appear on the alignment tool.

When the beam is correctly positioned, touch the **Done** field. The C-arm position is now calibrated. Check the head support position according to the instructions given in section 1.7 “Checking the cephalostat head support position” on page H-14.

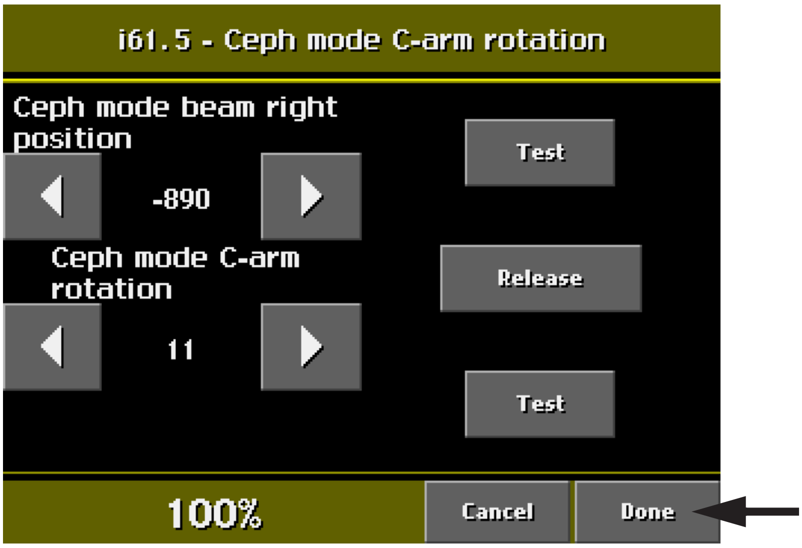


Figure 38

In case the X-ray beam cannot be correctly positioned by adjusting the C-arm position, the cephalostat head support position must be readjusted.

1.10 Synchronizing the scanning mechanism and first primary collimator

Select kilovolt and milliampere values high enough to enable the radiation beam to be seen in a darkened room. The actual values will depend on how dark the room is.

To enter the calibration mode first touch the **i** field on the *Main* display. Select Technical calibrations (i600) from the list on the display. The password to the Technical calibrations mode is asked when the Technical calibrations mode is entered for the first time after switching the unit on. **The password is 1701.**

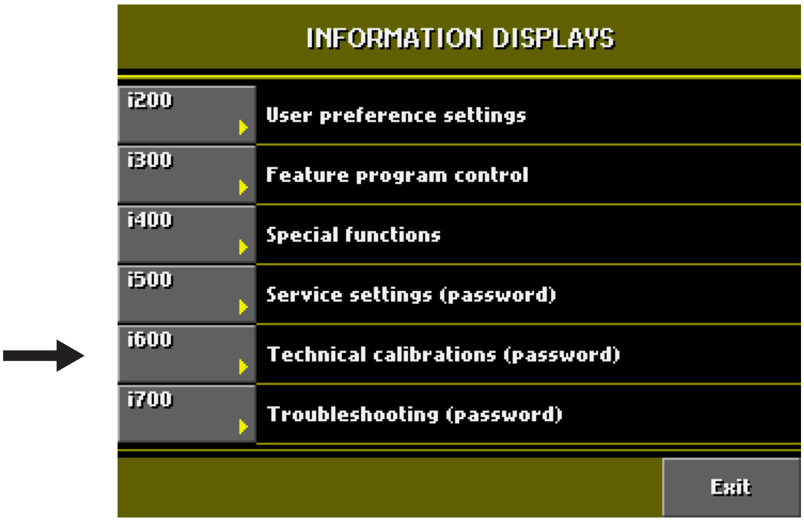


Figure 39

From the *i600* display that appears select Primary collimator calibration (i610) and from the *i610* display that appears select the Ceph mode beam position (i61.6).

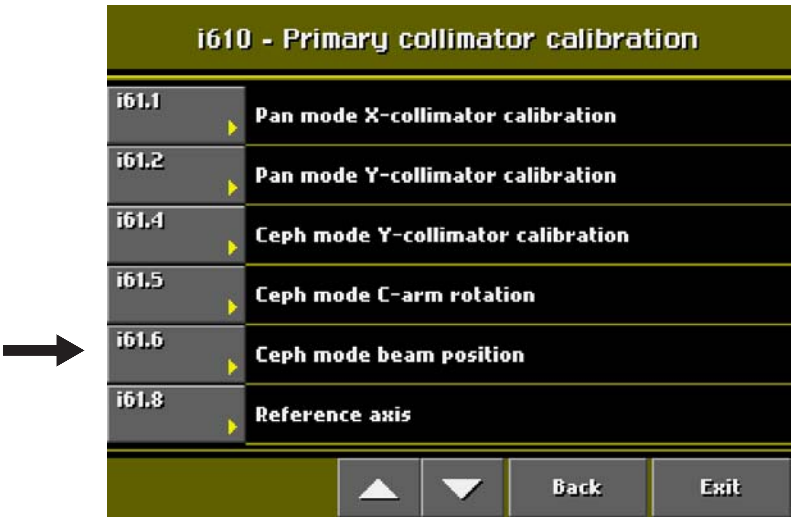


Figure 40

The *Ceph mode beam position* display appears. The sensor head and the first primary collimator will move to the centre position. Touch the **Test** field.

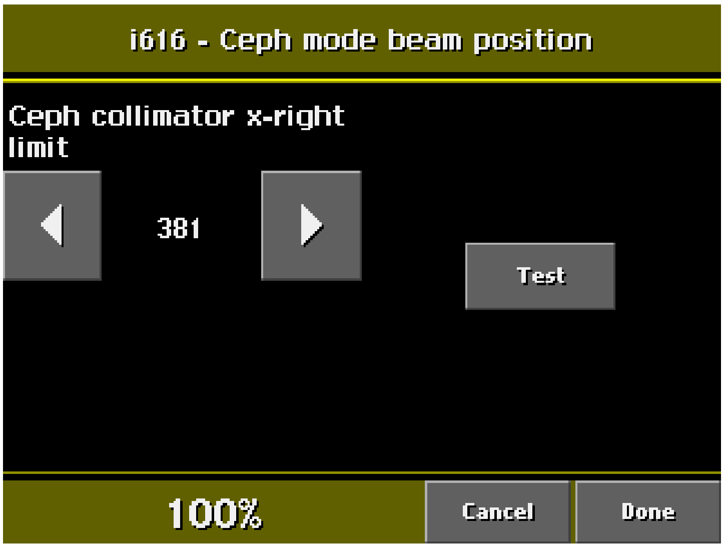


Figure 41

Place the beam alignment tool to the sensor alignment tool to **horizontal position** (see Fig. 42 below).

Stand behind the tube head and protect yourself from radiation. Press and hold down the exposure button. The image of the radiation beam will appear on the alignment tool.

The radiation beam **must appear symmetrically** on the beam alignment tool as shown on the Fig. 42 below. If it does not adjust the first primary collimator horizontal position.

PXR_Adj_digiceph12.eps

Beam alignment tool

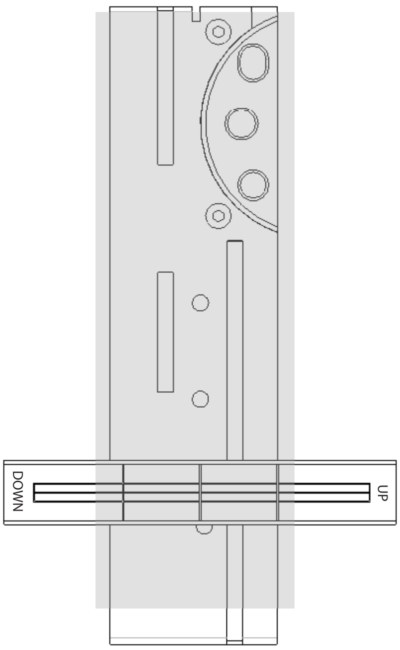


Figure 42

Adjust the limit values with the arrow fields on the display and drive the primary collimator to the selected position by touching the **Test** field. When the beam is correctly positioned, touch the **Done** field.

1.11 Adjusting the cephalometric beam vertical position

Select kilovolt and milliampere values high enough to enable the radiation beam to be seen in a darkened room. The actual values will depend on how dark the room is.

To enter the calibration mode first touch the **i** field on the *Main* display. Select Technical calibrations (i600) from the list on the display. The password to the Technical calibrations mode is asked when the Technical calibrations mode is entered for the first time after switching the unit on. **The password is 1701.**

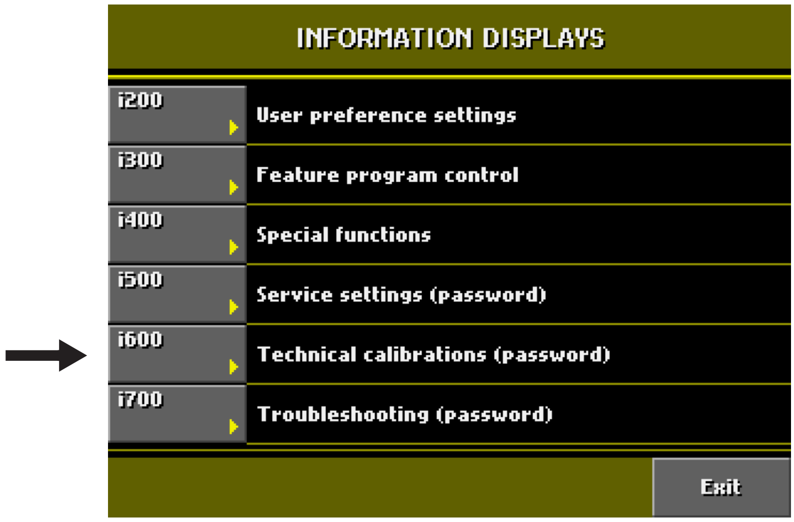


Figure 43

From the list on the *i600* display that appears select Primary collimator calibration (i610).

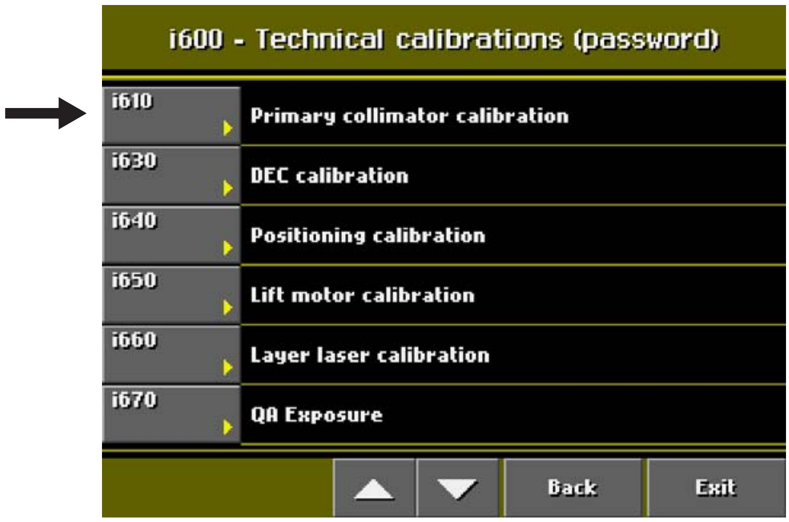


Figure 44

Bottom limit of the X-ray beam

To check the beam position in vertical direction place the beam alignment tool to the sensor alignment tool **upside down** to lower vertical position as shown on the Fig. 47 below.

From the list on the *i610* display select the Ceph mode Y-collimator calibration (i614).

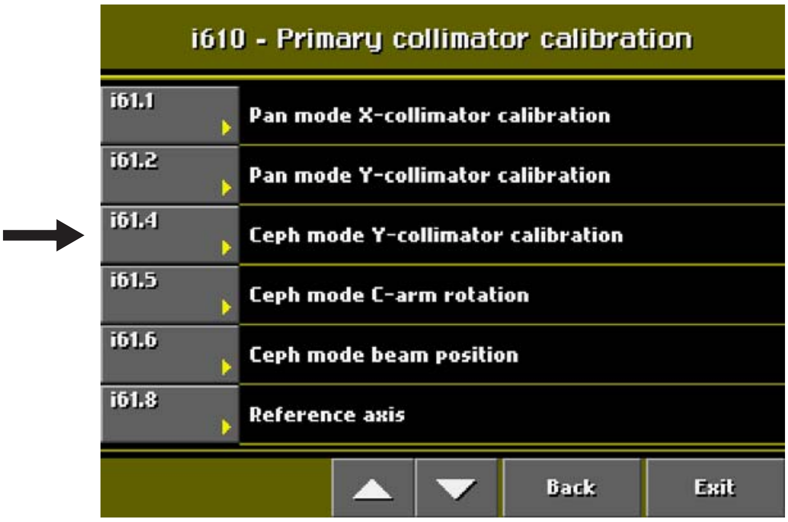


Figure 45

The *Ceph mode Y-collimator calibration* display appears. In this mode the vertical position of the X-ray beam is adjusted. Touch the **Test** field.

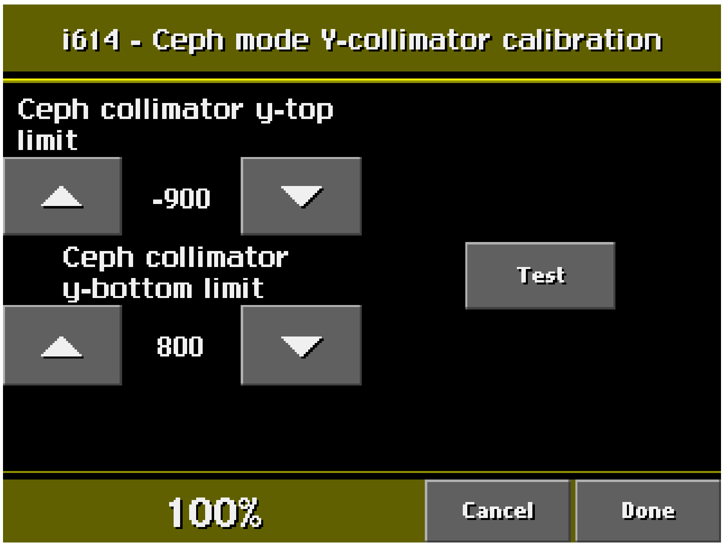


Figure 46

The bottom limit of the X-ray beam is adjusted first.

The radiation beam must reach the lower edge of the rectangle marked on the beam alignment tool. If it does not adjust the value of the **X-ray beam bottom limit** with the **Y-Pan collimator bottom limit** arrow fields on the display and drive the primary collimator to the selected position by touching the **Test** field.

The **left** arrow field on the display adjusts the beam **downwards**, and the right arrow field **upwards**.

Perform the fine adjustment by adjusting the first primary slot. When the bottom of the beam is correctly positioned, adjust the top limit.

PXR_Adj_digiceph13.eps

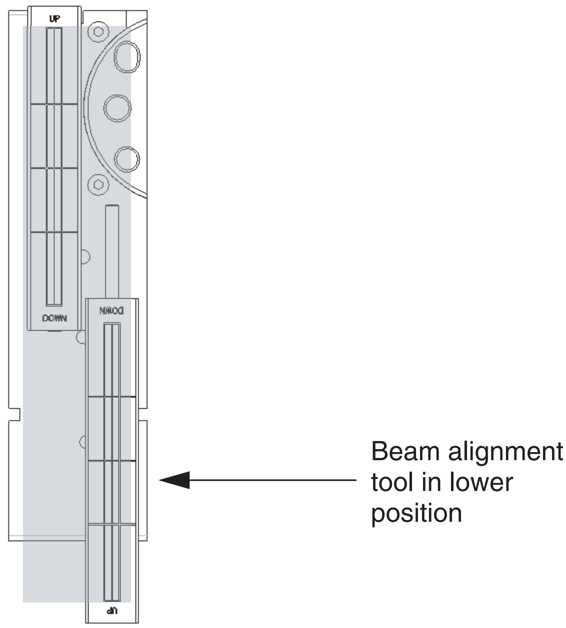


Figure 47

Top limit of the X-ray beam

The top limit of the X-ray beam is adjusted after the bottom limit. Move the beam alignment tool to the upper position on the sensor alignment tool as shown on the Fig. 48.

Stand behind the tube head and protect yourself from radiation. Press and hold down the exposure button. The image of the radiation beam will appear on the alignment tool.

The radiation **beam must reach the upper edge of the rectangle marked on the beam alignment tool.** If it does not adjust the value of the X-ray **beam top limit** with the **Y-Pan collimator top limit** arrow fields on the display and drive the primary collimator to the selected position by touching the **Test** field.

The **left** arrow field on the display adjusts the beam **downwards**, and the **right** arrow field **upwards**. When the top of the beam is correctly positioned, touch **Done**.

PXR_Adj_digiceph13.eps

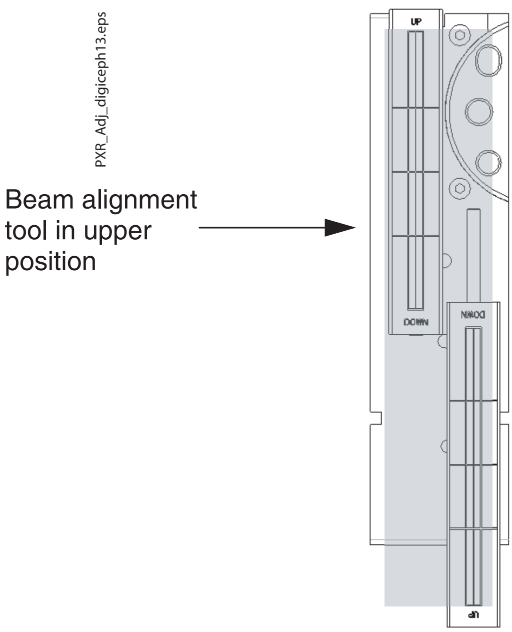


Figure 48

1.12 Checking the second primary collimator position

NOTE **You must now check the beam alignment with the second primary collimator in its position.**

Attach the second primary collimator plate to its position, refer to section 2 “REMOVING AND ATTACHING THE SECOND PRIMARY COLLIMATOR” on page H-55. Do not tighten the attachment screws yet.

Remove the sensor head and attach the sensor alignment tool to the cephalostat head support.

To enter the calibration mode first touch the **i** field on the *Main* display. Select Technical calibrations (i600) from the list on the display. The password to the Technical calibrations mode is asked when the Technical calibrations mode is entered for the first time after switching the unit on. **The password is 1701.**

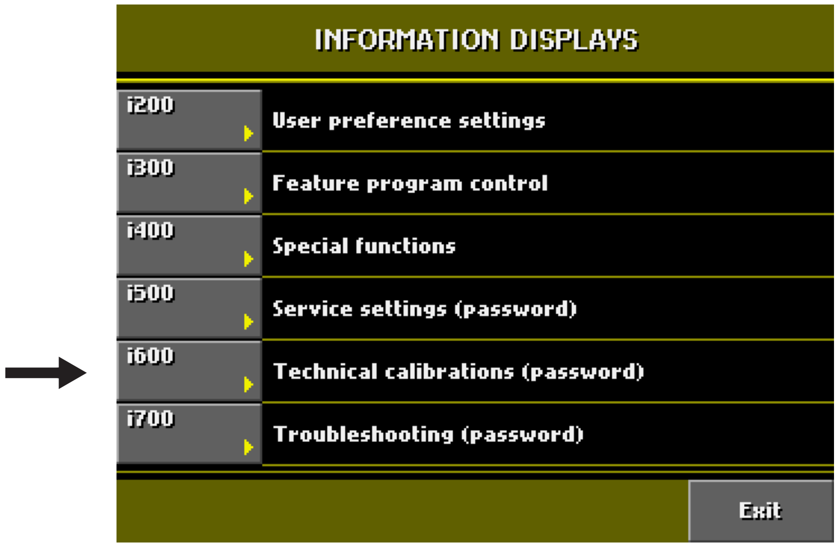


Figure 49

From the list on the *i600* display that appears select Primary collimator calibration (i610) and from the list on the *i610* display that appears select the Ceph mode beam position (i616).

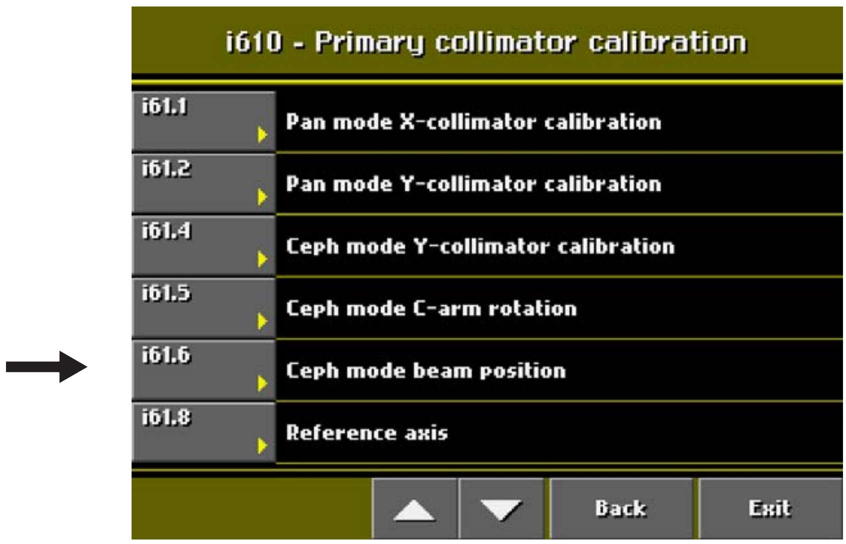


Figure 50

The *Ceph mode beam position* display appears. The sensor head and the first primary collimator will move to the centre position. Touch the **Test** field.

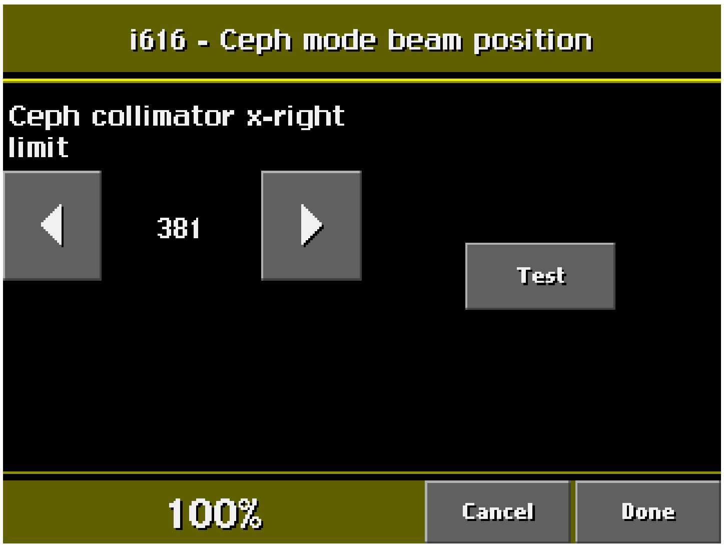


Figure 51

Place the beam alignment tool to the sensor alignment tool to lower vertical position as shown on the Fig. 52 below.

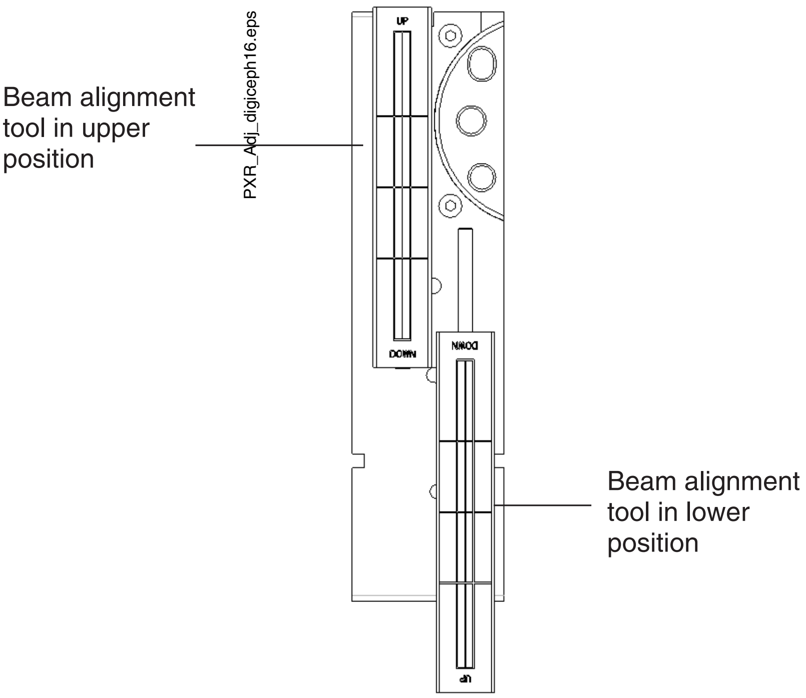


Figure 52

Stand behind the tube head and protect yourself from radiation. Press and hold down the exposure button. The image of the radiation beam will appear on the beam alignment tool.

The beam image should reach **but not overlap the lower edge of the rectangle** marked on the beam alignment tool, and **the beam must appear within the left and right borders** of the rectangle as shown in Fig. 53 below.

If it does not adjust the second primary slot position. Refer to section 1.13 “Adjusting the second primary collimator position” on page H-33.

NOTE **The upper limit of the beam may overlap the upper edge of the rectangle.**

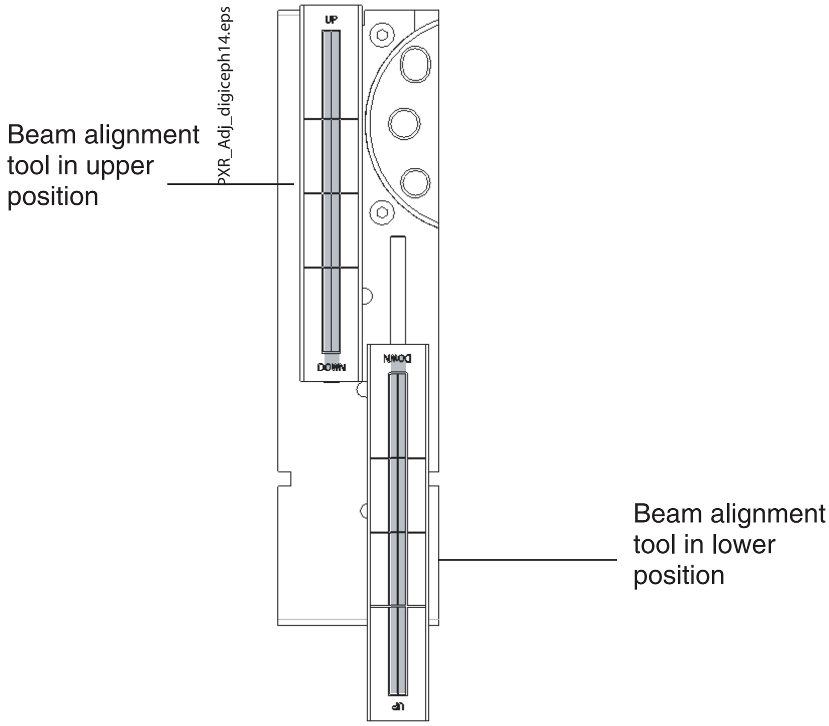


Figure 53

Move the beam alignment tool to the upper position on the sensor alignment tool as shown in the figure above.

Stand behind the tube head and protect yourself from radiation. Press and hold down the exposure button. The image of the radiation beam will appear on the alignment tool.

The beam image should appear within the borders of the rectangle marked on the beam alignment tool as shown in the figure above. If it does not adjust the second primary slot position. Refer to section 1.13 “Adjusting the second primary collimator position” on page H-33.

NOTE **The lower limit of the beam may overlap the lower edge of the rectangle.**

1.13 Adjusting the second primary collimator position

Second primary collimator angle adjustment

The second primary slot must be perpendicular to the head support in both directions. sideways and in depth. Check the collimator position in depth by using the spirit level as shown in Fig. 54 below.

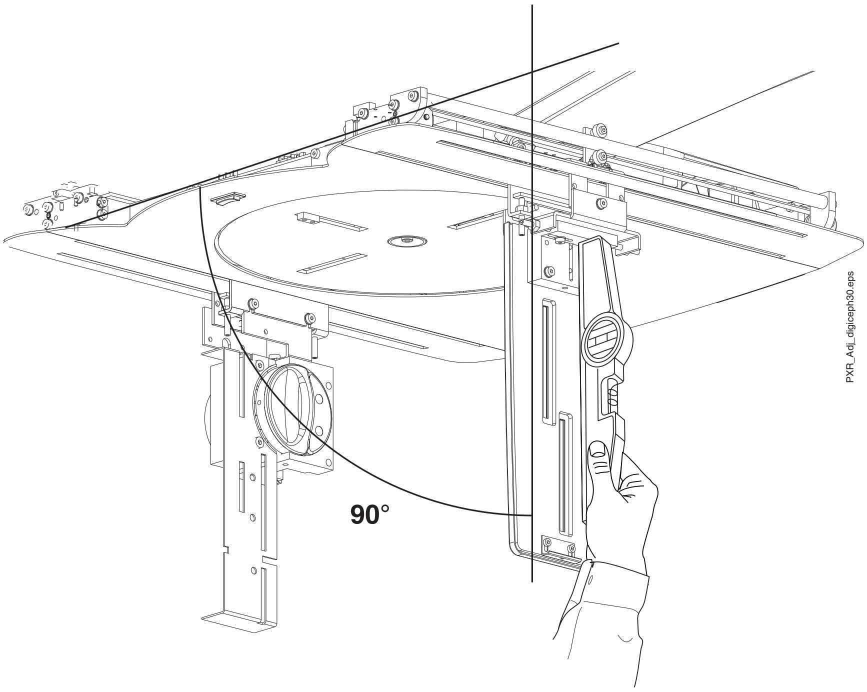


Figure 54

Loosen the three attachment screws of the collimator plate with 3mm Allen key, if needed.

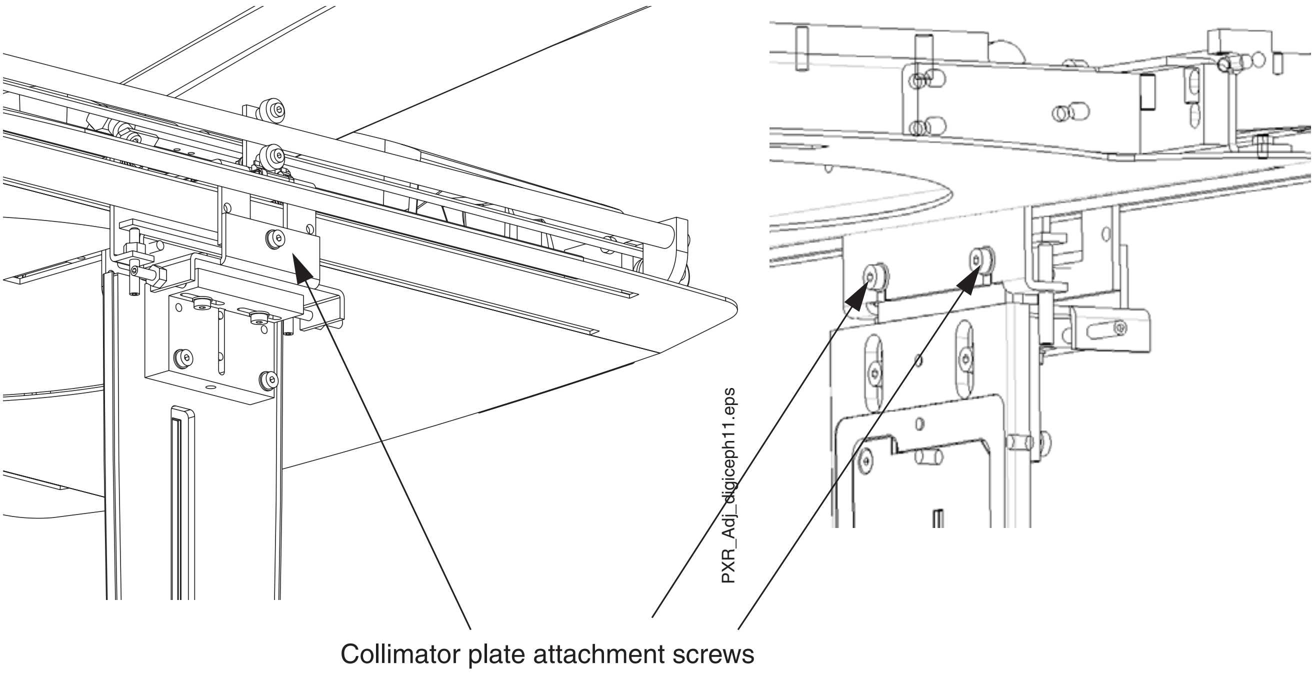


Figure 55

To adjust the collimator plate position in depth rotate the two angle adjustment screws **equally to the same direction**.

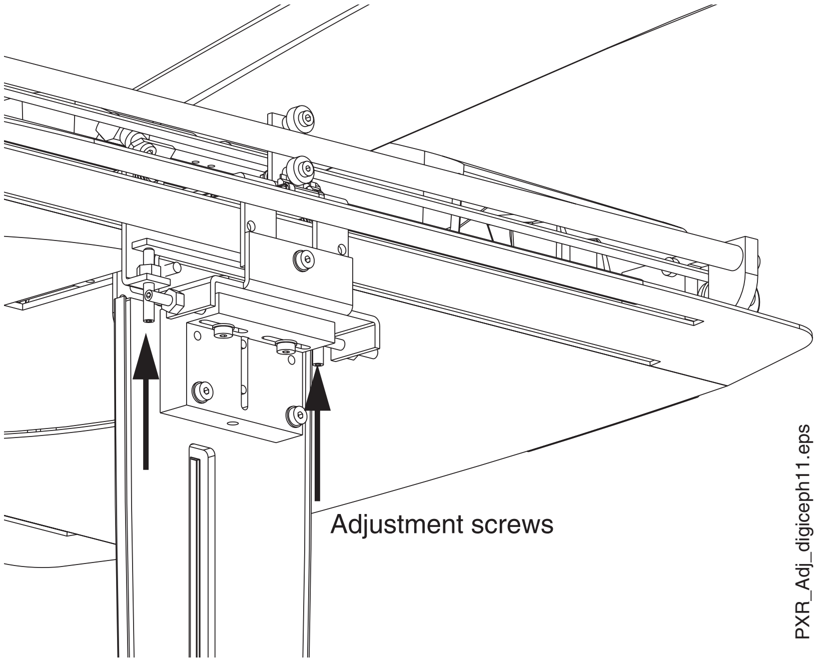


Figure 56

Check the collimator plate sideways position by using the spirit level as shown on the Fig. 57 below.

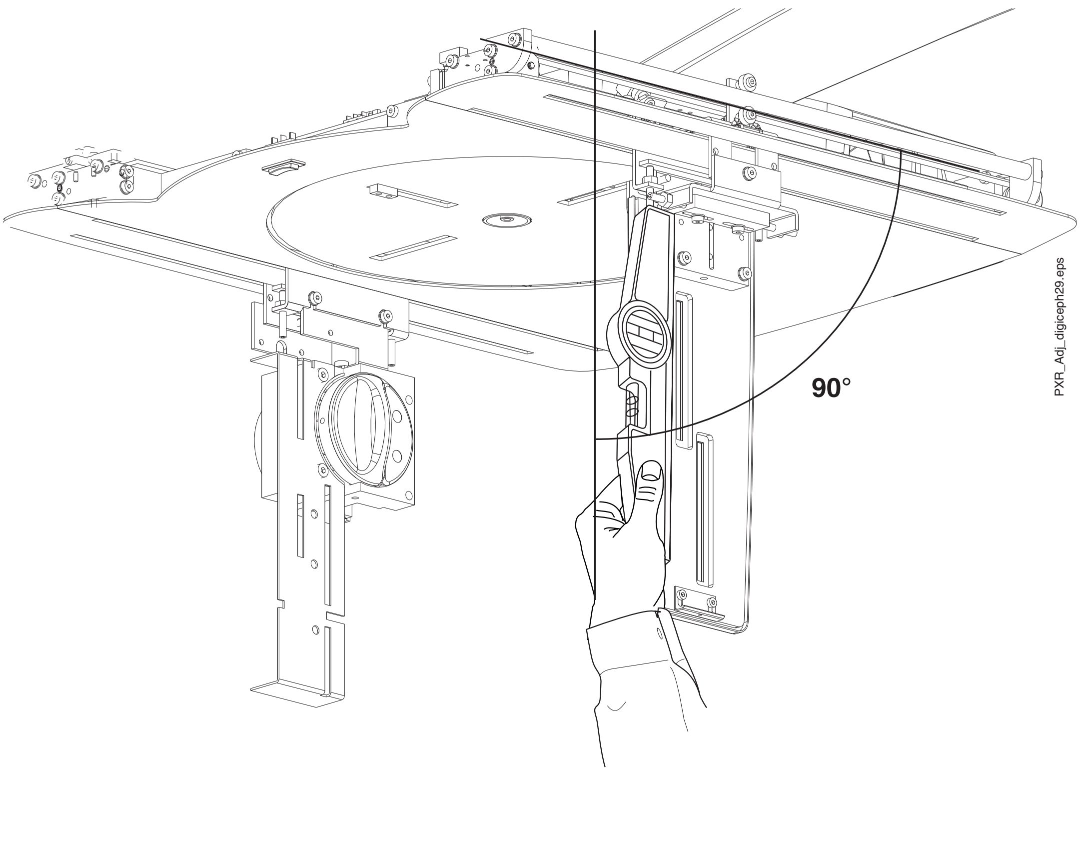


Figure 57

To adjust the collimator plate position sideways tighten one angle adjustment screw as much as you loosen the other one.

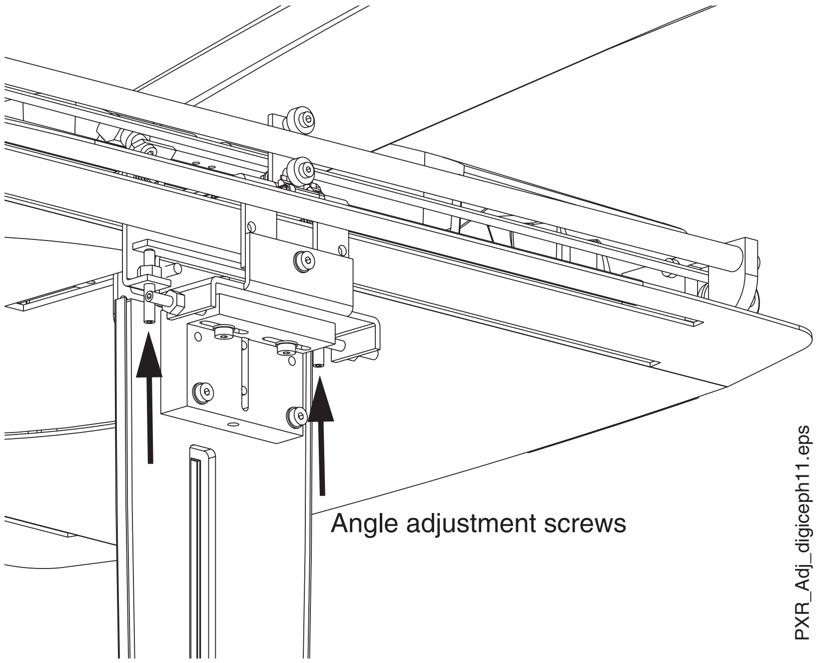


Figure 58

Check the adjustments and tighten the attachment screws.

Adjusting the vertical position of the second primary collimator

Loosen the two vertical adjustment locking screws with 3mm Allen key.

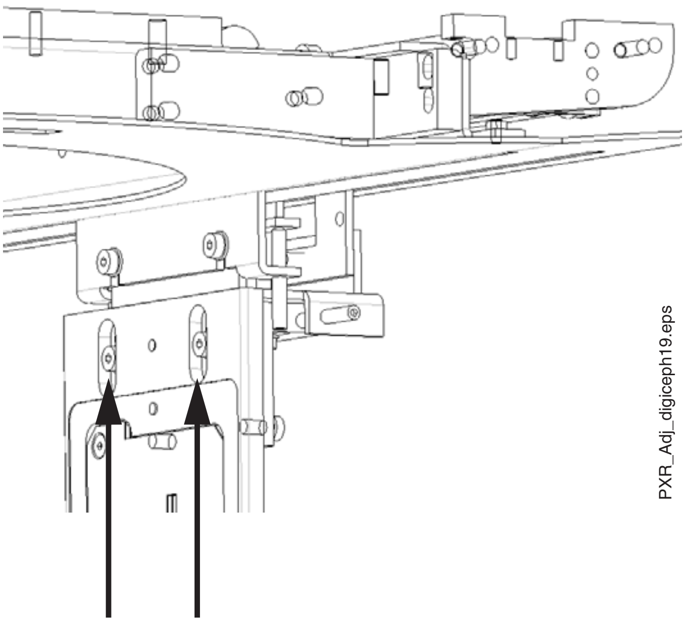


Figure 59

Adjust the vertical position of the collimator by rotating the adjustment screw located on the bottom of the collimator frame.

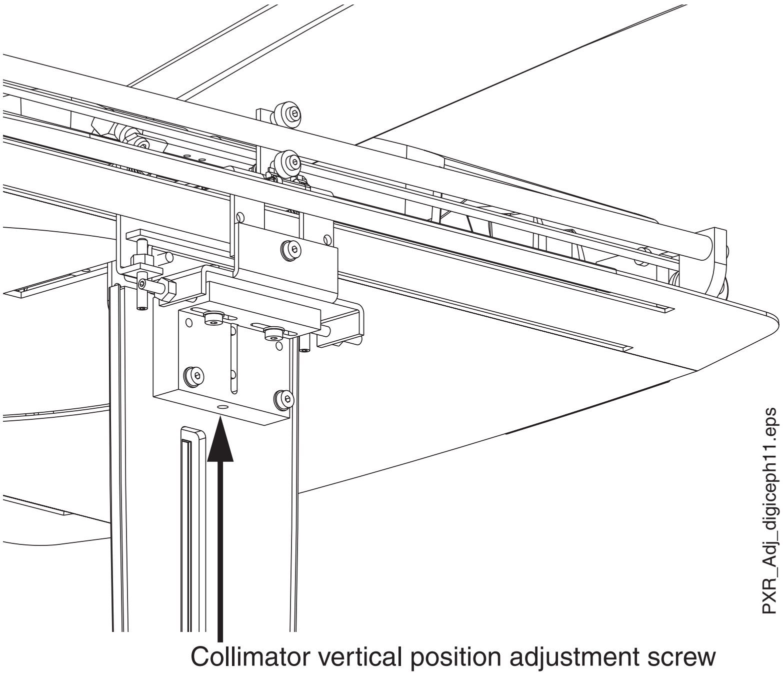


Figure 60

Adjusting the horizontal position of the second primary collimator

Loosen the two horizontal adjustment locking screws with 3mm Allen key and adjust the horizontal position of the collimator by rotating the adjustment screws **located on the both sides of the collimator frame**.

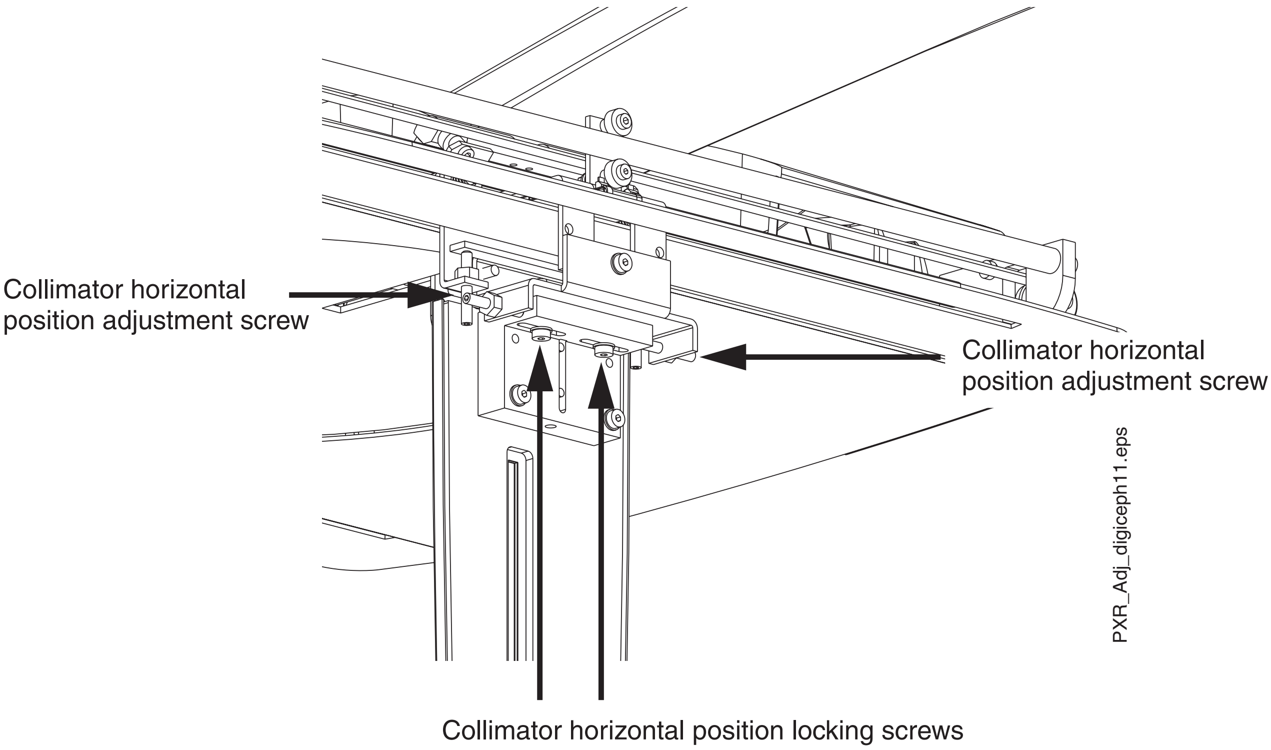


Figure 61

Attach the second primary collimator cover according to the instruction given in section 2.1 “Attaching the second primary collimator covers” on page H-56.

1.14 Beam check

This feature in the digital ProMax units allows the user to check that the X-ray unit is properly collimated.

NOTE **The X-ray beam must be adjusted and the sensor head calibrated before you start the Beam Check.**

To run the Beam Check test for a cephalostatic X-ray beam, proceed as follows:

Start the Beam Check program by clicking *Start* > *Programs* > *Planmeca.* Select *Beam Check* from the appearing list.

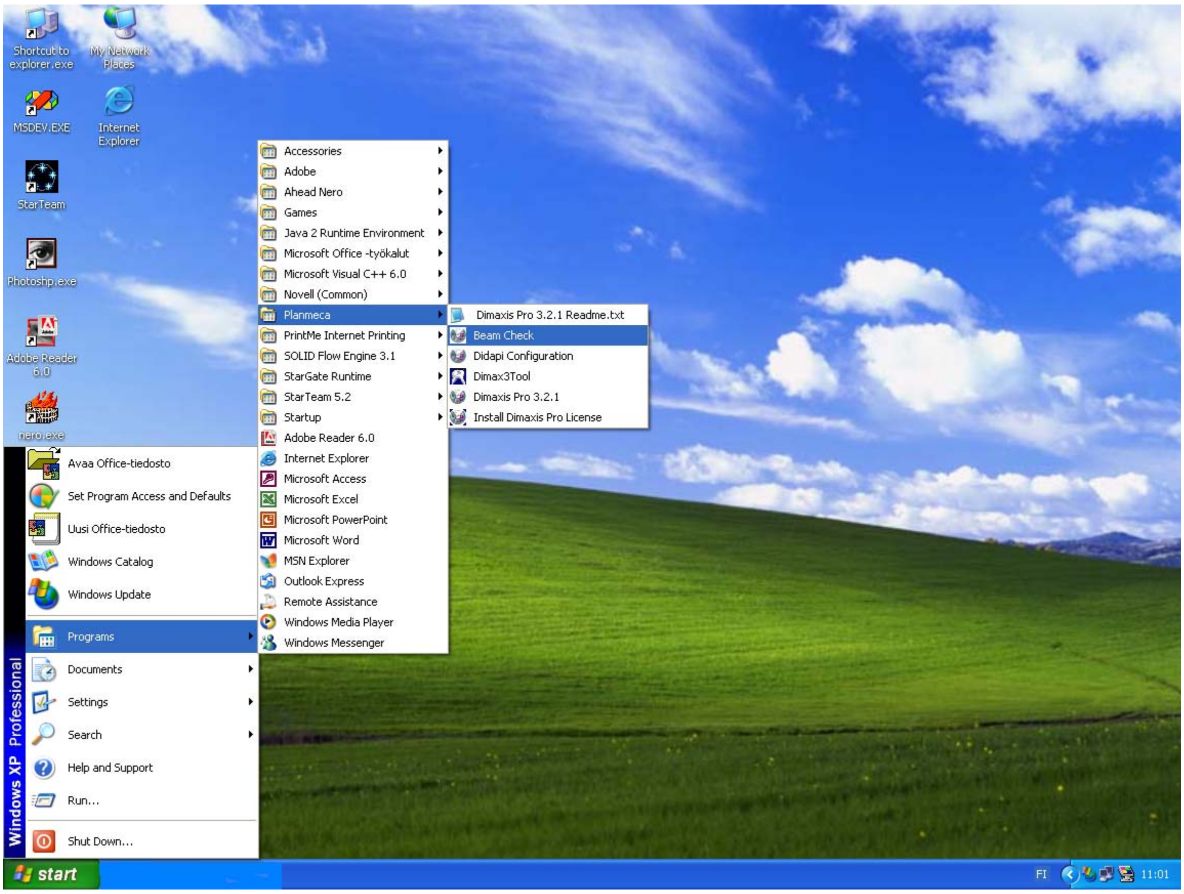


Figure 62

The window shown below appears on your computer. Select ProMax Ceph from the X-ray equipment list. Click **Take the Image** button.

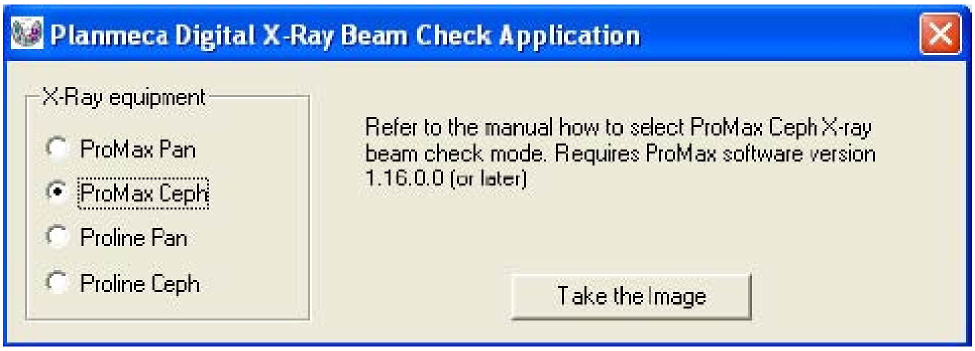


Figure 63

The following window appears.

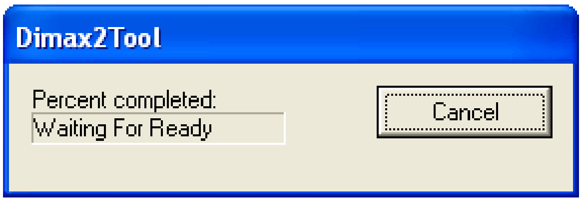
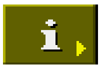


Figure 64



Select next to the *Special functions* on the ProMax control panel by clicking the i field on the left corner of the display. Select *i400 Special functions* from the appearing display.

Go to *i470 Beam Check* (see below).

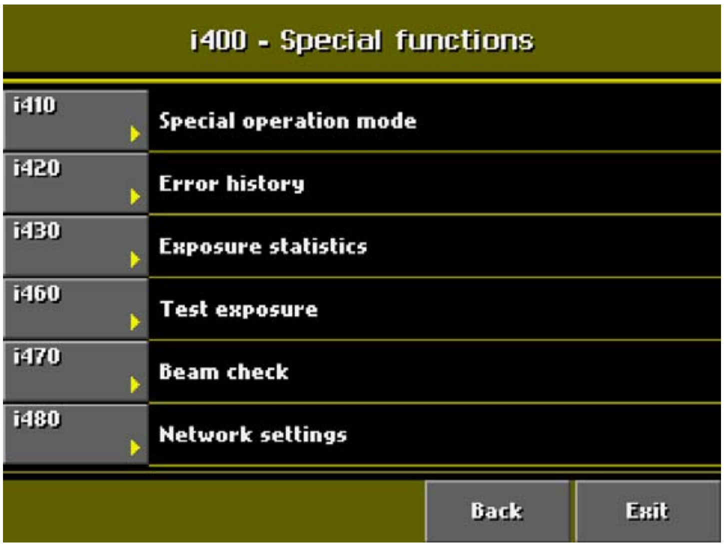


Figure 65

Select **i47.2** for Cephalometric program from the appearing window.

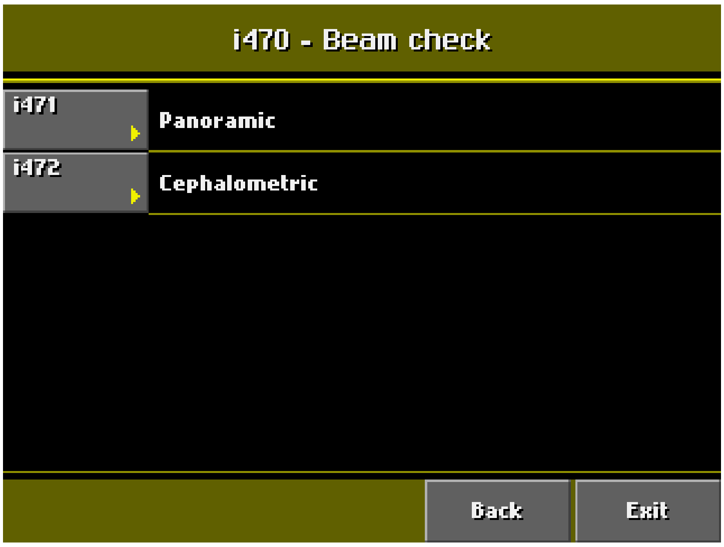


Figure 66

The system suggests default kV and mA values. Touch the **Ready** field.

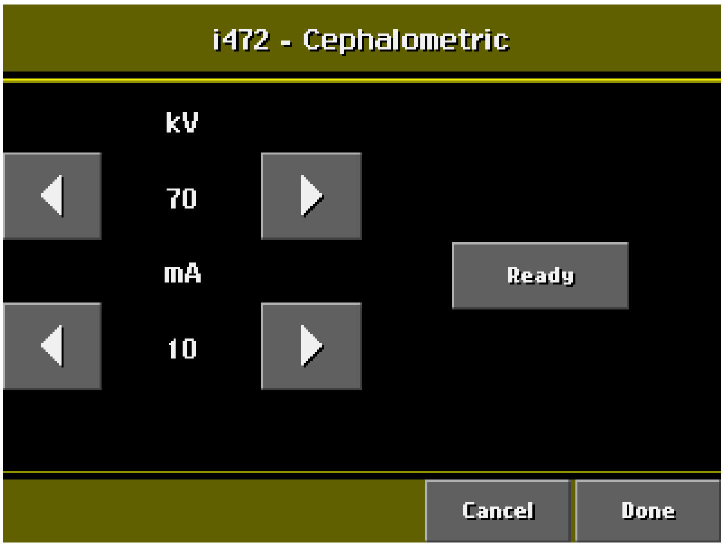


Figure 67

NOTE **In case the contrast on the exposure is not satisfactory, change the values by touching the arrow fields and take a test exposure.**

The following window appears on the computer screen.

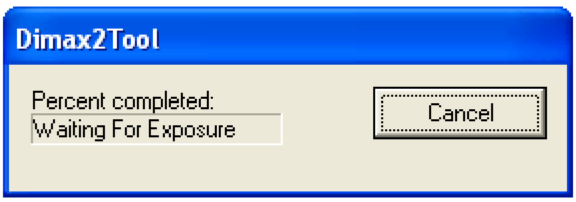


Figure 68

Protect yourself from radiation and press and hold down the exposure switch for the duration of the exposure cycle, i.e. three exposures. **Do NOT release the exposure switch during the exposure cycle.**

When the exposure cycle is completed the text **Complete** is shown on the *i 47.2* display. Touch the **Done** field.

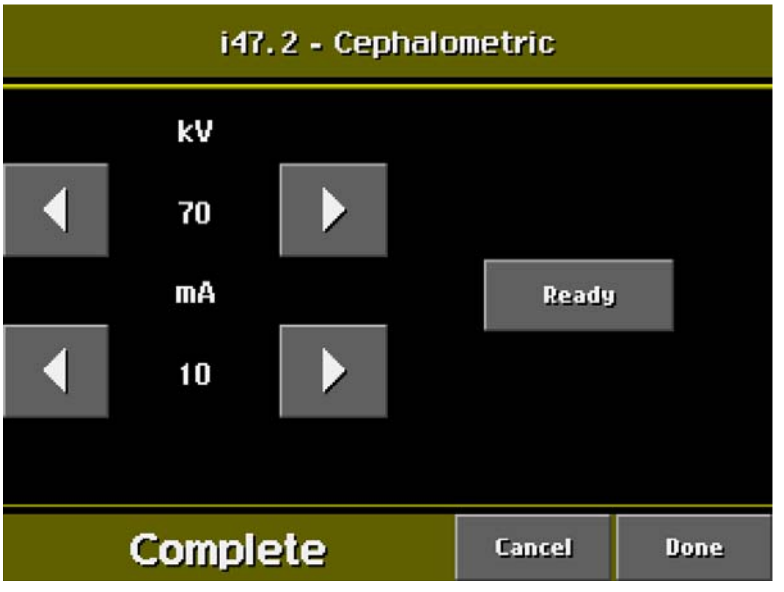


Figure 69

After the exposure is taken the following window appears.

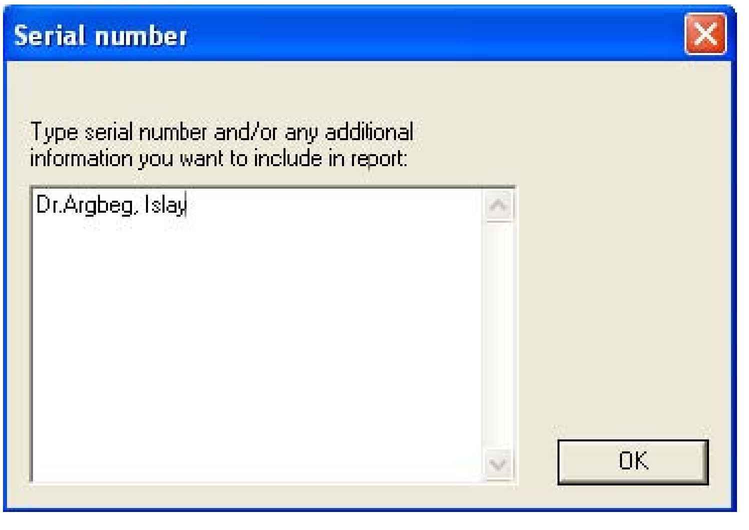


Figure 70

You can type any kind of additional information (e.g. name of the clinic) on this window. Confirm by clicking the **OK** button.

The test report appears automatically and is shown as html page (see below).

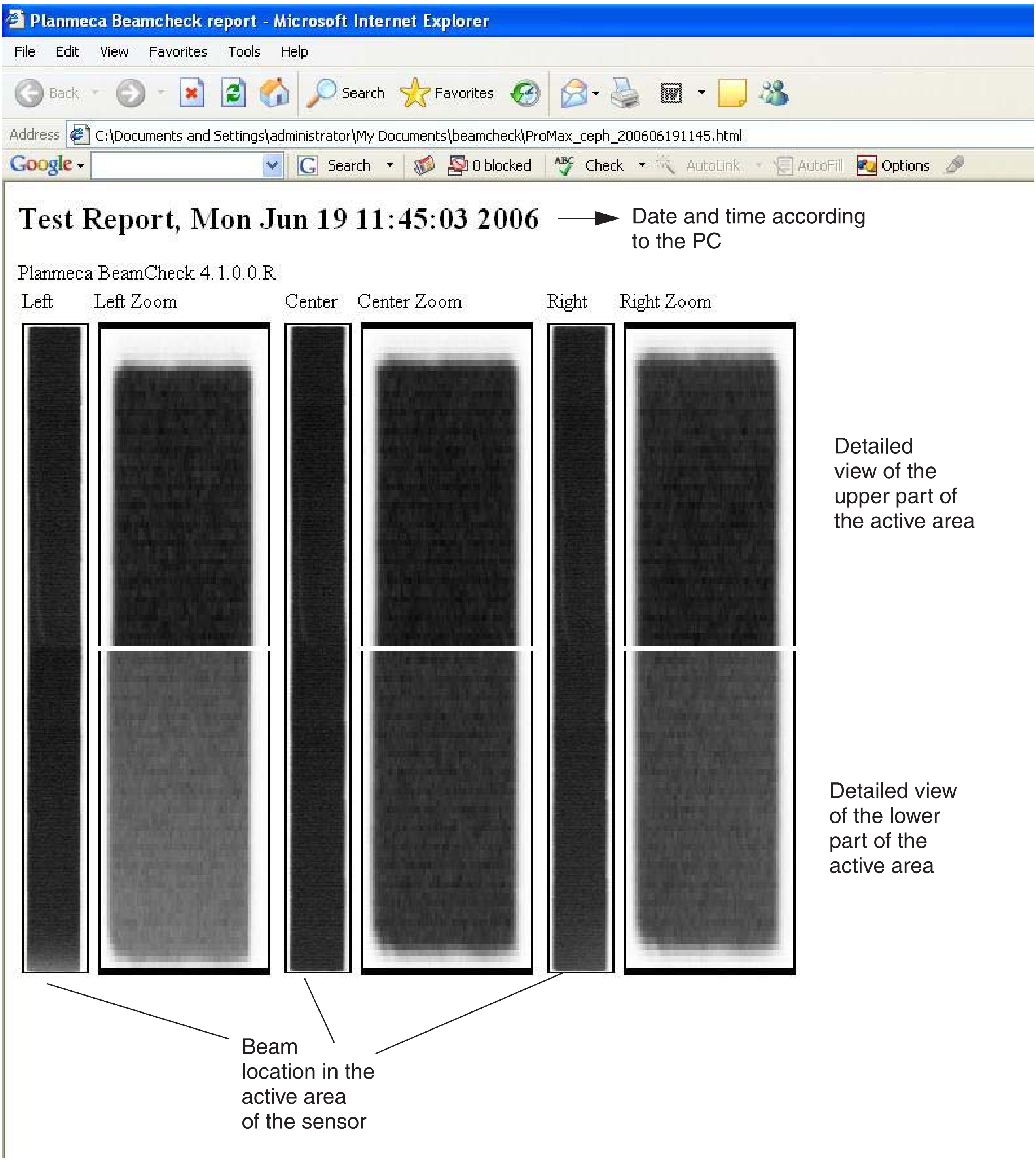


Figure 71

NOTE **The report can be printed or saved in the computer.**

Check that the radiation beam can be seen entirely on the image receptor in all three images. **The radiation beam should not exceed the receptor.**

If the radiation is not shown on the image receptor (one or more), calibrate the X-ray unit again and take another exposure.

If the test report shows that the radiation can be seen on the image receptor, you can exit the ProMax Beam Check program by selecting *Exit* from the *File* pull down menu.

1.15 Calibrating the cephalostat sensor head

Remove the sensor alignment tool from the cephalostat sensor head connector. Attach the sensor head to the connector.

Remove the nasial positioner and the ear posts from their holders. Attach the cephalostat calibration tool to the right-hand ear post holder (near the sensor head).

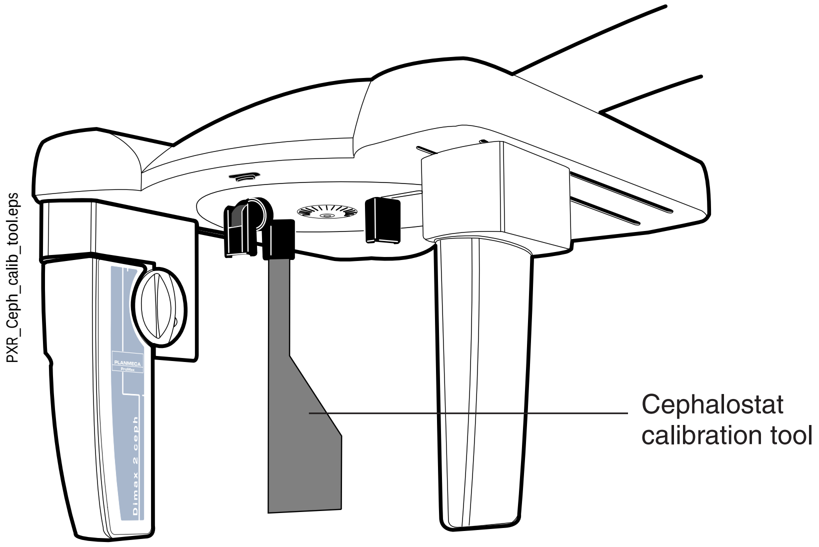


Figure 72

Make sure that the second primary collimator is in its position.

In the Main display select cephalometric program.

Start the Dimax calibration program **by double-clicking the Dimax2Tool.exe** program icon located in the Romexis program folder. The DimaxTool window appears.

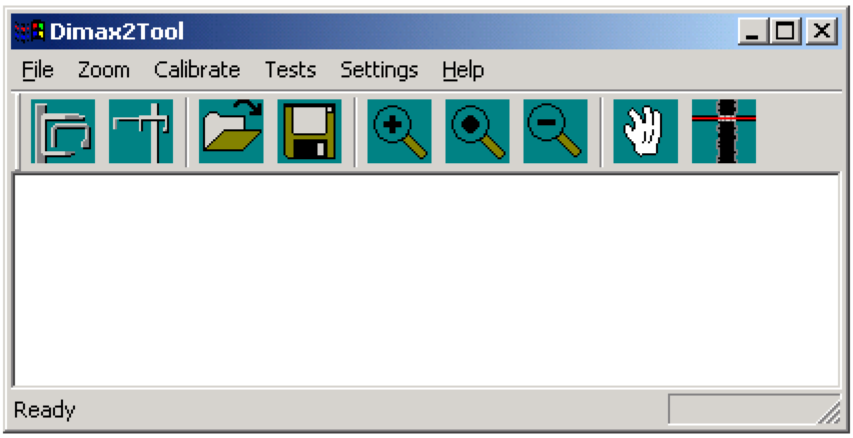


Figure 73

NOTE **The system automatically creates the calibration files into the same folder where the calibration program is located. The calibration files are named the following way according to the serial number of the ProMax unit.**
If the ProMax sensor head serial number e.g. is: RDX123456, then the calibration files are named as: RDX123456.p4.cal (p = Panoramic) and RDX123456.c4.cal (c = Cephalostat).

Calibrating the sensor head, manual procedure

NOTE **For the X-ray unit with Ethernet interface it is possible to calibrate both binnings at once. This procedure is described in section “Calibrating the sensor head, automatic procedure” on page H-47.**

The calibration must be performed with 3x3 (enhanced resolution) and 4x4 (normal resolution) binning. With enhanced resolution select a kilovolt value of 60 and a milliampere value of 7, and with normal resolution select 60 kV and 4 mA. The *image size and orientation* selection does not make any difference when calibrating the cephalostat sensor head.

If the high speed feature is used, select a kilovolt value of 70 and a milliampere value of 8 with enhanced resolution, and with normal resolution select 70 kV and 5 mA.

Select ProMax from the Settings / Type pulldown menu.

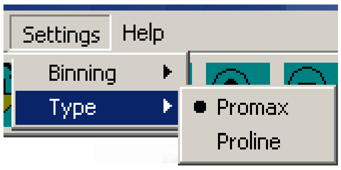


Figure 74

The calibration must be performed with both 3x3 (enhanced resolution) and 4x4 (normal resolution) binning. Select the binning from the Settings / Binning pulldown menu.

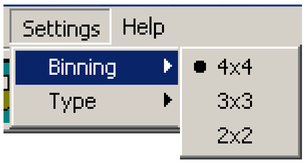


Figure 75

Click the Dimax3 cephalometric exposure button. The Dimax2Tool window with text “Waiting For Ready” appears.

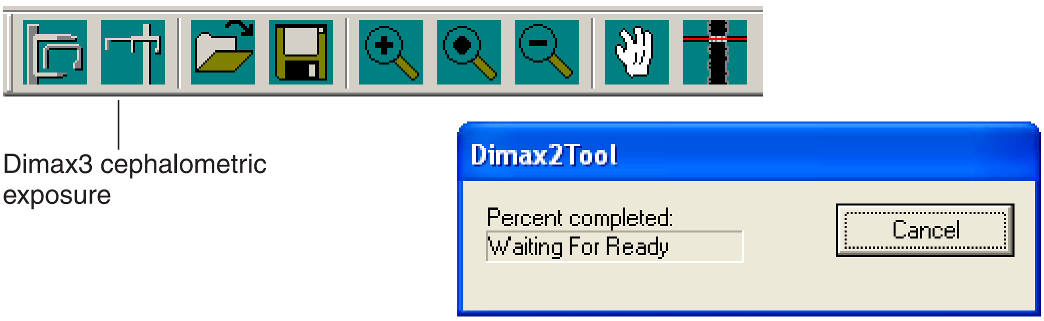


Figure 76

Touch the ready field to drive the X-ray to the exposure position.

The text “Waiting for Exposure” appears.

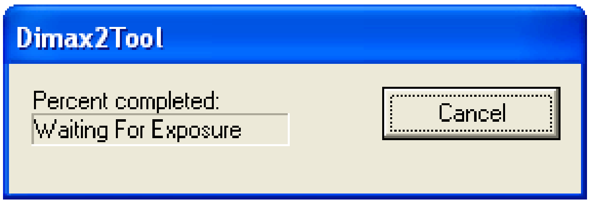


Figure 77

Take an exposure. The sensor head is now calibrated. After the exposure has been taken the image is shown in the Dimax2Tool window. The triangle on the image must be even, without any irregularities.

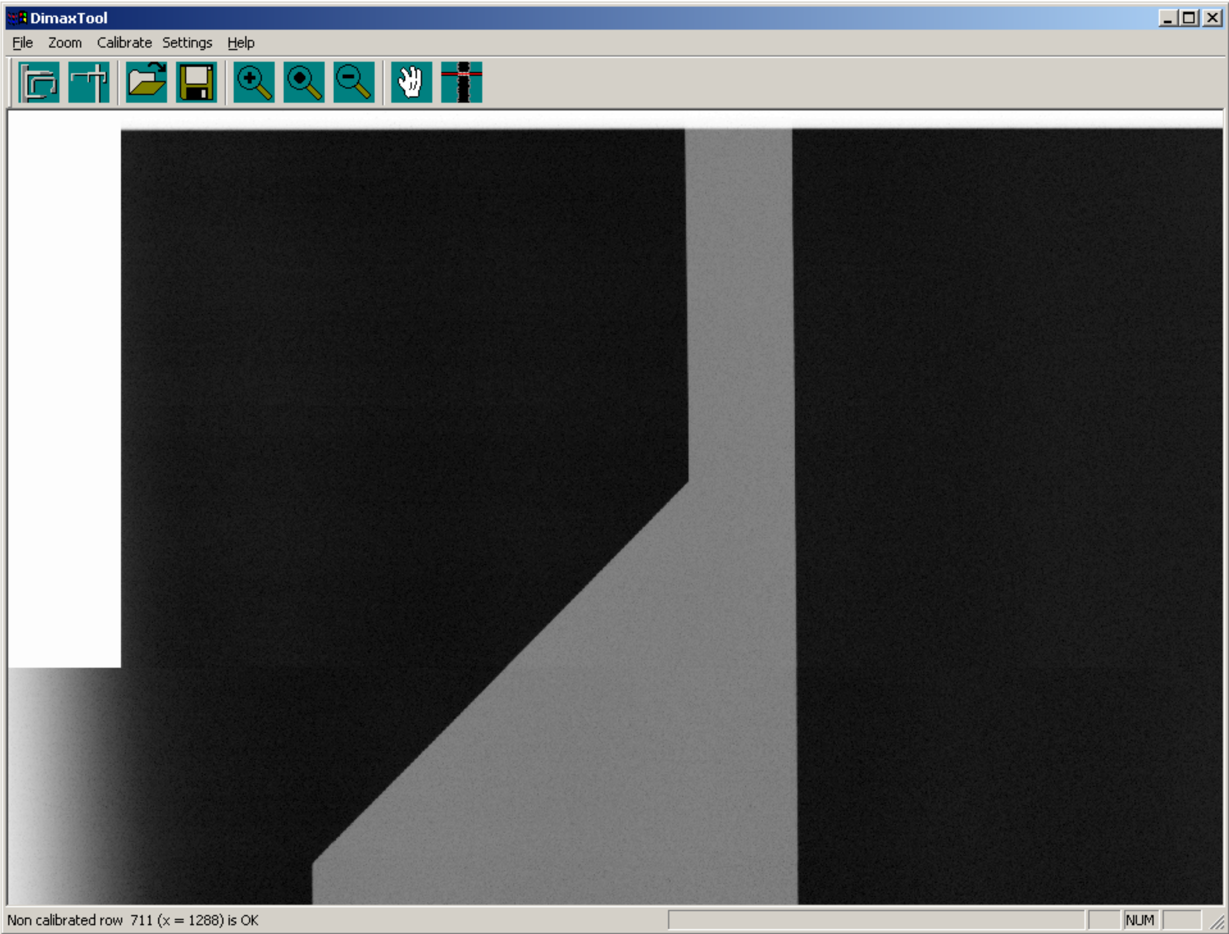


Figure 78

In case the triangle is not evenly shaped, it can be slightly edited. Enlarge the image if needed. The sensor joint is marked with the red lines when the keyboard's L-key is pressed. Move the lower part of the triangle with the keyboard's arrow keys as follows: the right edge of the triangle (vertical) can be adjusted with the right/left arrow keys and the left edge with the up/down keys.

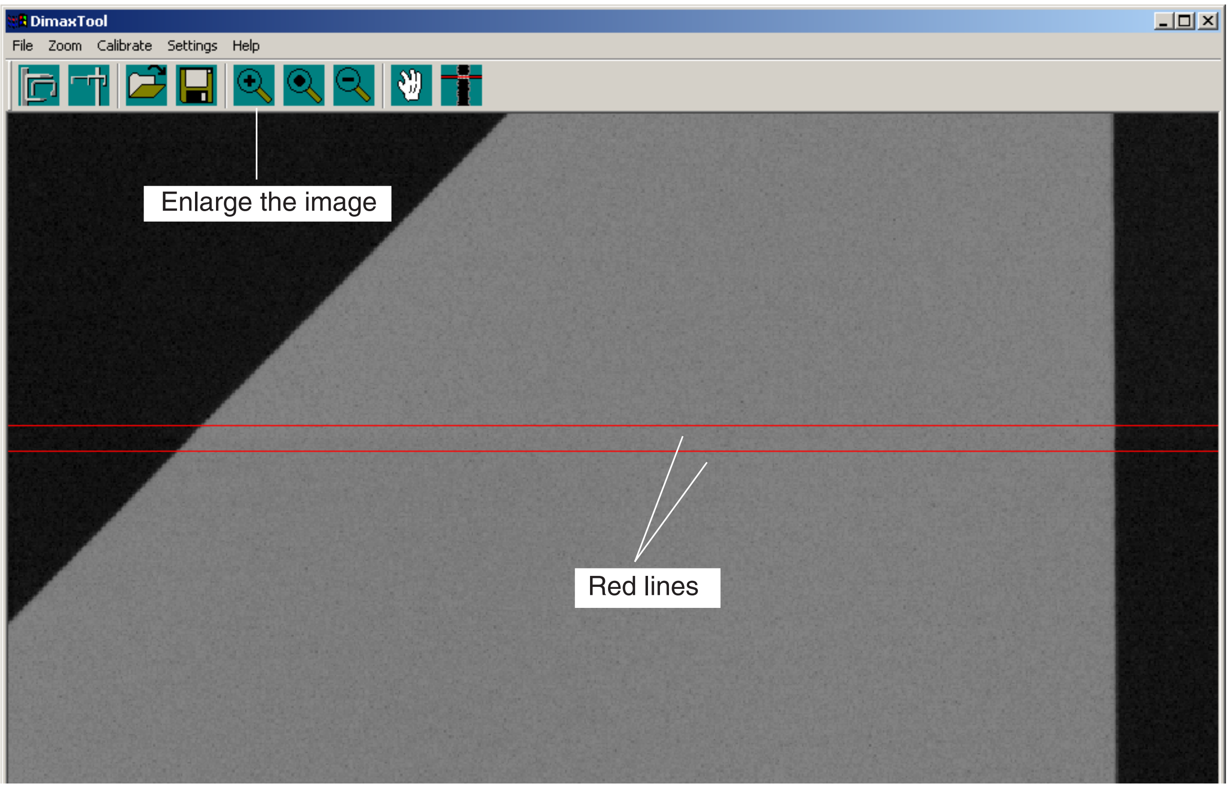


Figure 79

While editing the shape of the triangle the sensor is simultaneously re-calibrated.

If the evenly shaped triangle can not be reached, the second primary collimator position must be adjusted in vertical direction. Refer to the section "Adjusting the vertical position of the second primary collimator" on page H-35 for information on how to align it.

Checking the calibration

You can test whether the calibration succeeded as follows.

Take a test exposure by selecting Test Ceph Cal File from the Calibrate menu.

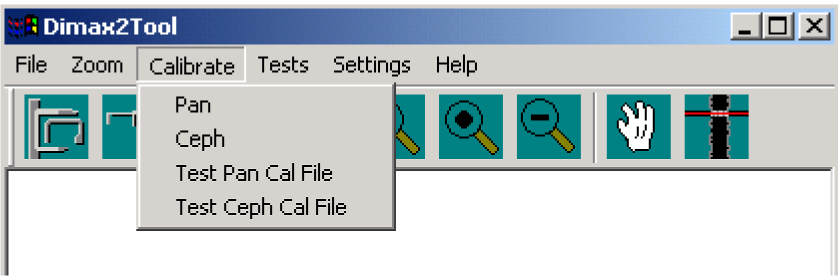


Figure 80

The Dimax2Tool window with text “Waiting For Ready” appears.

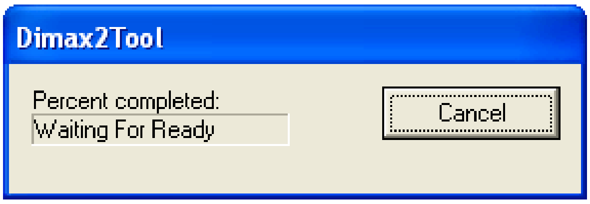


Figure 81

Touch the ready field to drive the X-ray to the exposure position.

The text “Waiting for Exposure” appears.

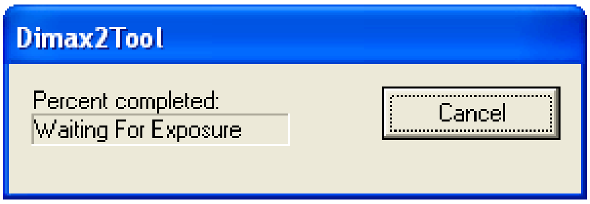


Figure 82

The triangle on the image must be even, without any irregularities. If it is not, recalibrate the sensor head. If recalibration does not help, check that the Romexis, DIDAPI and drivers you are using are all from the same CD rom. Check also the cephalostat adjustments by taking an exposure from the ear posts (see section 1.17 “Checking the adjustment” on page H-54).

Calibrating the sensor head, automatic procedure

NOTE **Use the high speed feature.**

Protect yourself from radiation and press the exposure button.

Select **Ceph All Binnings** from the Calibrate menu. Do not release the exposure button.

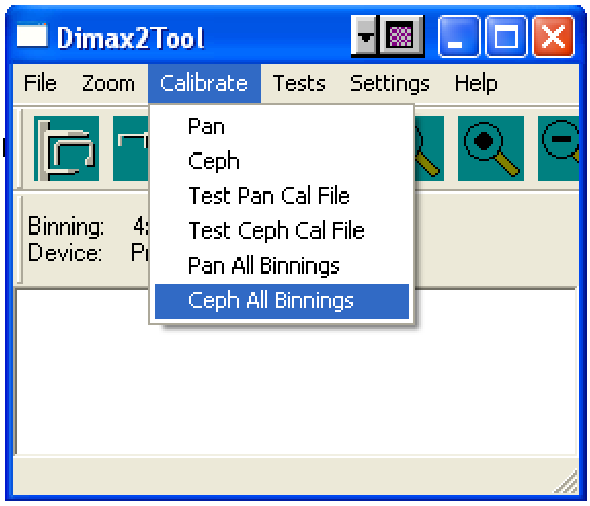


Figure 83

Press and hold down the exposure button for the duration of the exposure cycle. After the exposure cycle the image from the latest exposure (3x3; enhanced resolution) is shown in the Dimax2Tool window. The triangle on the image must be even, without any irregularities. If it is not, edit the triangle as described on page page H-45. The calibration must be performed with 4x4 (normal resolution) binning manually as described in section "Calibrating the sensor head, manual procedure" on page H-43.

Editing the calibration image

In case the calibration image contains horizontal stripes, the image can be edited, i.e. the selected row can be removed by marking it as "bad". You can enlarge the image with the zoom function if needed. The image can be moved with the Hand-tool.

Press the **Marking** tool button located on the right side of the toolbar and then click the row that you want to mark with the left mouse button. Note, that the row number is shown on the status bar at the bottom of the window.

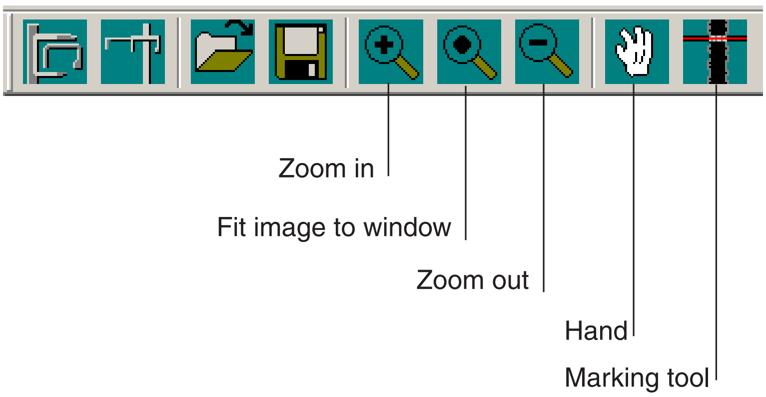


Figure 84

The message window shown below appears. Confirm the selection by clicking Yes, or cancel the selection by clicking No. While marking the row bad the sensor is simultaneously recalibrated.

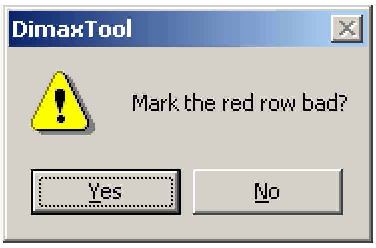


Figure 85

The cephalostat sensor consists of eight sensor chips, and normally the stripes are located in the chip boundaries. You can find the chip boundaries by checking the row numbers: the row numbering is not consecutive. The amount of sensor chip rows that can be marked bad is limited to six. In case you have already marked six rows, more rows cannot be marked and the following message window appears.

Figure 86

The row can be returned back to normal by clicking it with the right mouse button.

1.16 Calibrating the Cephalometric DEC

NOTE **Make sure that the cephalometric beam is correctly aligned before calibrating the cephalometric DEC.**
Note that you can also calibrate DEC with the AEC/DEC calibration tool, part number 10007501.

Use the long screws that hold the tube head front cover in position to attach the calibration tool:

Unscrew the long screws and place the Flat Field calibration tool (part number 10017348) in front of the collimator as shown. Position the calibration tool so that the long screw on the left (as seen from the front) touches the inner edge of the oval shaped screw hole as shown and the calibration tool is slightly tilted back. Tighten the long screws firmly to secure the calibration tool in position.

Use the 35mm aluminum filter for the calibration, that is, lift up one of the filters.

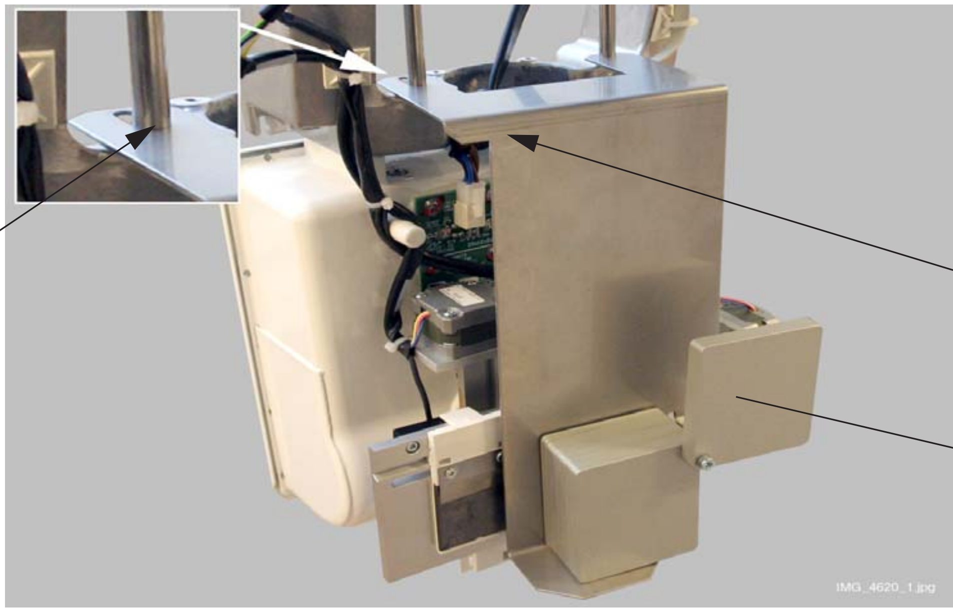


Figure 87

Select the vertical asymmetric image orientation as follows: Touch the **Image size** field on the Main display. *Select image size & orientation* display appears. Select the vertical asymmetric image orientation by touching the respective image icon on the display.

First write down the **current** values of DEC settings (i25.1). You have to restore these values after the DEC calibration. Then set the values to 100 as shown below.

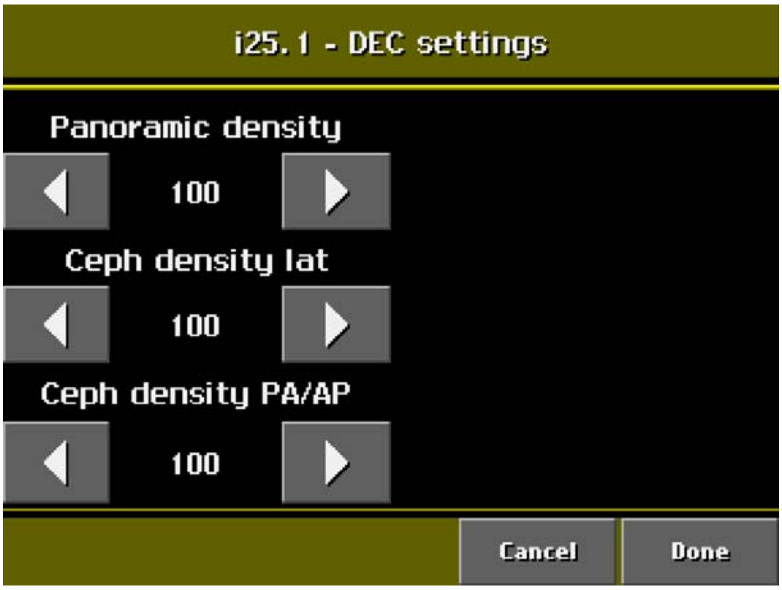


Figure 88

Touch the **i** field on the *Main* display. The list of Information displays appears.

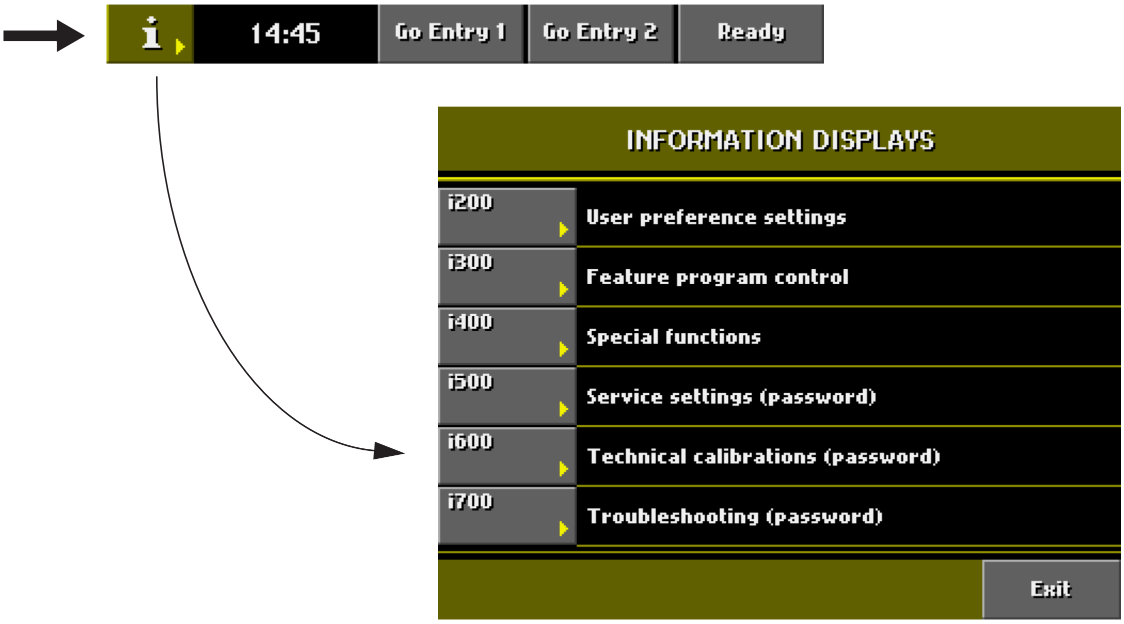


Figure 89

From the list of Information displays select *Technical calibrations (i600)*.

The Technical calibrations mode is password protected and the password is asked when the mode is entered for the first time after switching the unit on. **The password is 1701.**

Figure 90

From the list of Technical calibrations select *DEC calibration (i630).*

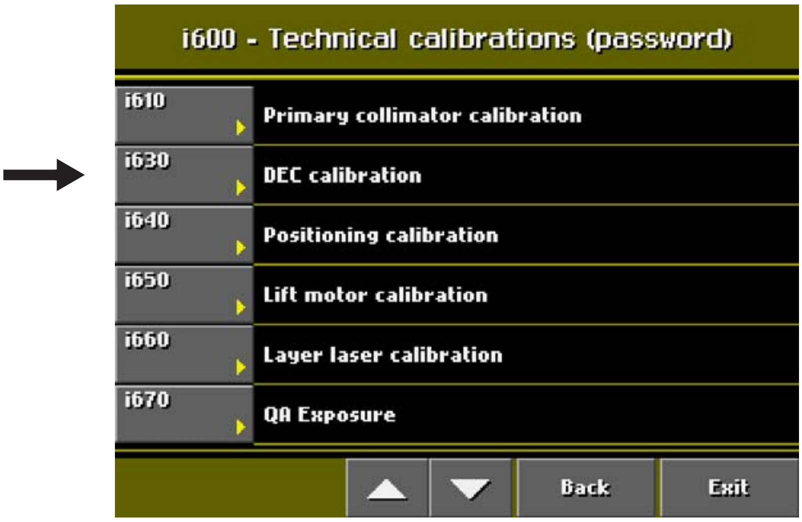


Figure 91

To calibrate the Cephalometric DEC select *Cephalometric DEC (i632*).

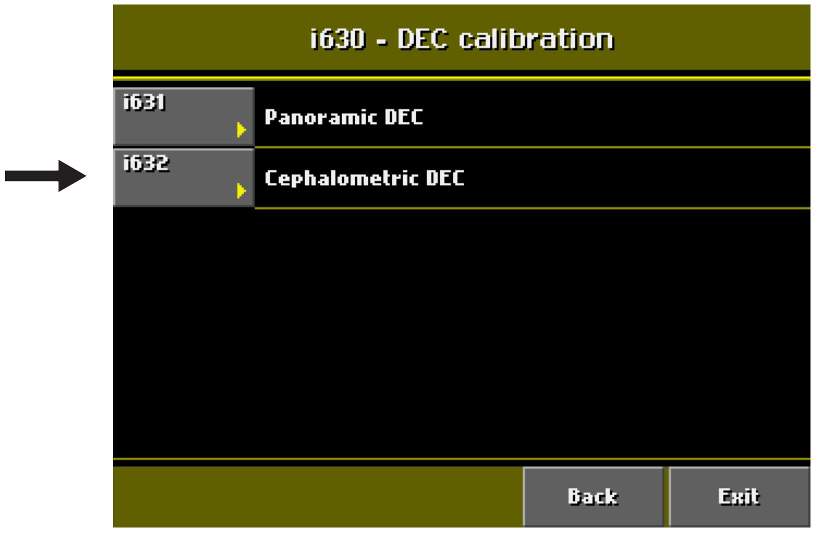


Figure 92

The *Cephalometric DEC* display appears. The exposure values suggested on this display are 66 kV value and 5 mA. **Use these values when taking an OD exposure.** Touch the **OD exposure** field.

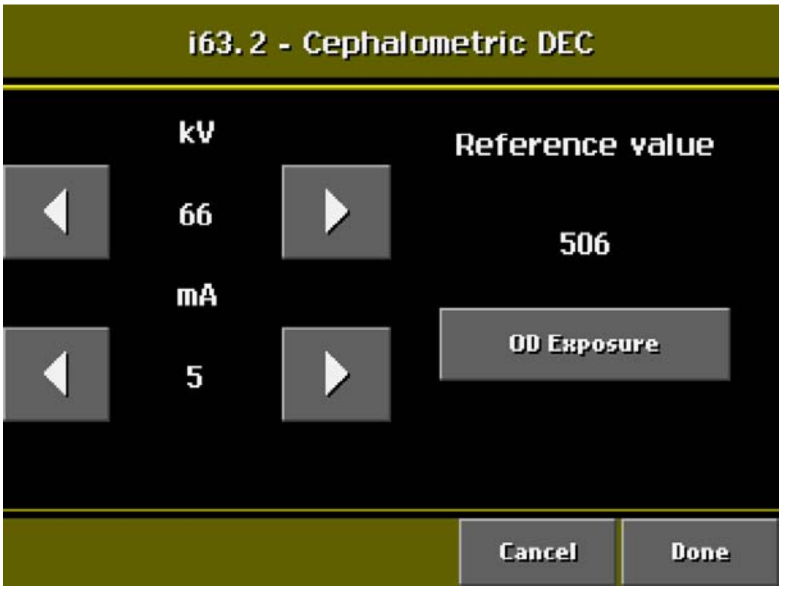


Figure 93

The X-ray unit will move to the ready position and the text **Wait** is shown on the *Panoramic DEC* display. When the unit is ready to start the DEC calibration the text **Ready** is shown on the display.

Figure 94

NOTE **Protect yourself from radiation and take an exposure.**

During the exposure the text **Calibrating** is shown on the *Panoramic DEC* display. **DO NOT RELEASE THE EXPOSURE BUTTON BEFORE THE TEXT COMPLETE IS SHOWN ON THE PANORAMIC DEC DISPLAY.**

Figure 95

When the exposure cycle is completed the text **Complete** is shown on the *Panoramic DEC* display.

Figure 96

NOTE **The reference value is recommended to be between 200-600.**

If the reference value is **greater than 600, decrease the mA value** and if the reference value is **smaller than 200, increase the mA value.** Then perform the OD exposure again.

NOTE **The altered exposure value (mA) is not automatically updated to the exposure value setting on the Main menu.**

NOTE **If the value is near zero, the cephalometric beam must be re-aligned and if the value is thousands, the AEC/DEC calibration tool does not properly cover the primary collimator opening.**

To accept the DEC parameters touch the **Done** field on the *Cephalometric DEC* display and **Exit** field on the *DEC calibration* display.

Take three test exposures from the AEC/DEC calibration tool as follows. Enter the **Main** display. Switch on the **DEC function** and select lateral exposure. **Select high speed feature.**

1) First exposure: Use the OD exposure mA and kV values. Take an exposure. Check in the Main display that the kV and mA values are not changed during the exposure.

2) Second exposure: Increase mA value by 4mA **from the original value**. Take an exposure and after the exposure check in the Main display that the kV and mA values have been decreased.

3) Third exposure: reduce mA value by 4mA **from the original value**. Take an exposure and after the exposure check in the Main display that the kV and mA values have been increased.

If the kV and mA values are not correctly adjusted during the exposure, perform the following checks:

1) Make sure that the DEC function is ON.

2) Check the cephalometric beam alignment (position and width) according to the instructions given in section 1 “ADJUSTMENTS AND CALIBRATIONS” on page H-1.

3) Check that the AEC/DEC calibration tool covers the primary collimator opening.

After the checks perform the DEC calibration again. Remove the AEC/DEC calibration tool and attach the removed covers.

1.17 Checking the adjustment

Rotate the head support to the 0° position and place the two ear posts into their holders if they are not already installed.

Embedded in the end of the left (V or L) ear post there is a metal ball and embedded in the end of the right ear post (O or R) is a metal ring. The images of these that appear on an exposed image are used to check the alignment of the ear posts.

Select exposure values of approximately 70 and a milliampere value of 10.

Stand behind the tube head, protect yourself from radiation and take an exposure.

On the image you will see the images of a metal ball and a metal ring. They must be concentric, or if not exactly concentric there must be a small gap between the edge of the ball and the inner edge of the circle.

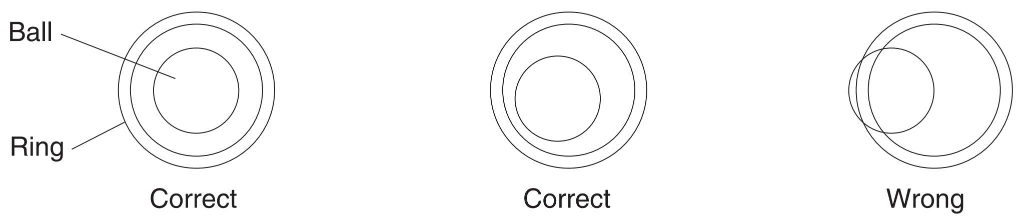


Figure 97

If the ball touches the ring the ear posts must be adjusted, refer to section 1.8 “Cephalostat head support position adjustment” on page H-16.

Check the cephalostat beam adjustments, refer to sections from 1.9 “Calibrating the C-arm position” on page H-19, to 1.6 “Adjusting the height of the cephalostat” on page H-11.

2 REMOVING AND ATTACHING THE SECOND PRIMARY COLLIMATOR

Unscrew the attachment screw with the 2mm Allen key of the collimator cover and remove the cover (Fig. 98, 1).

Unscrew the two attachment screws of the collimator cover box with the 4mm Allen key and slide it away from its position (Fig. 98, 2).

Unscrew the three attachment screws of the collimator with the 3mm Allen key and detach the collimator plate (Fig. 98, 3).

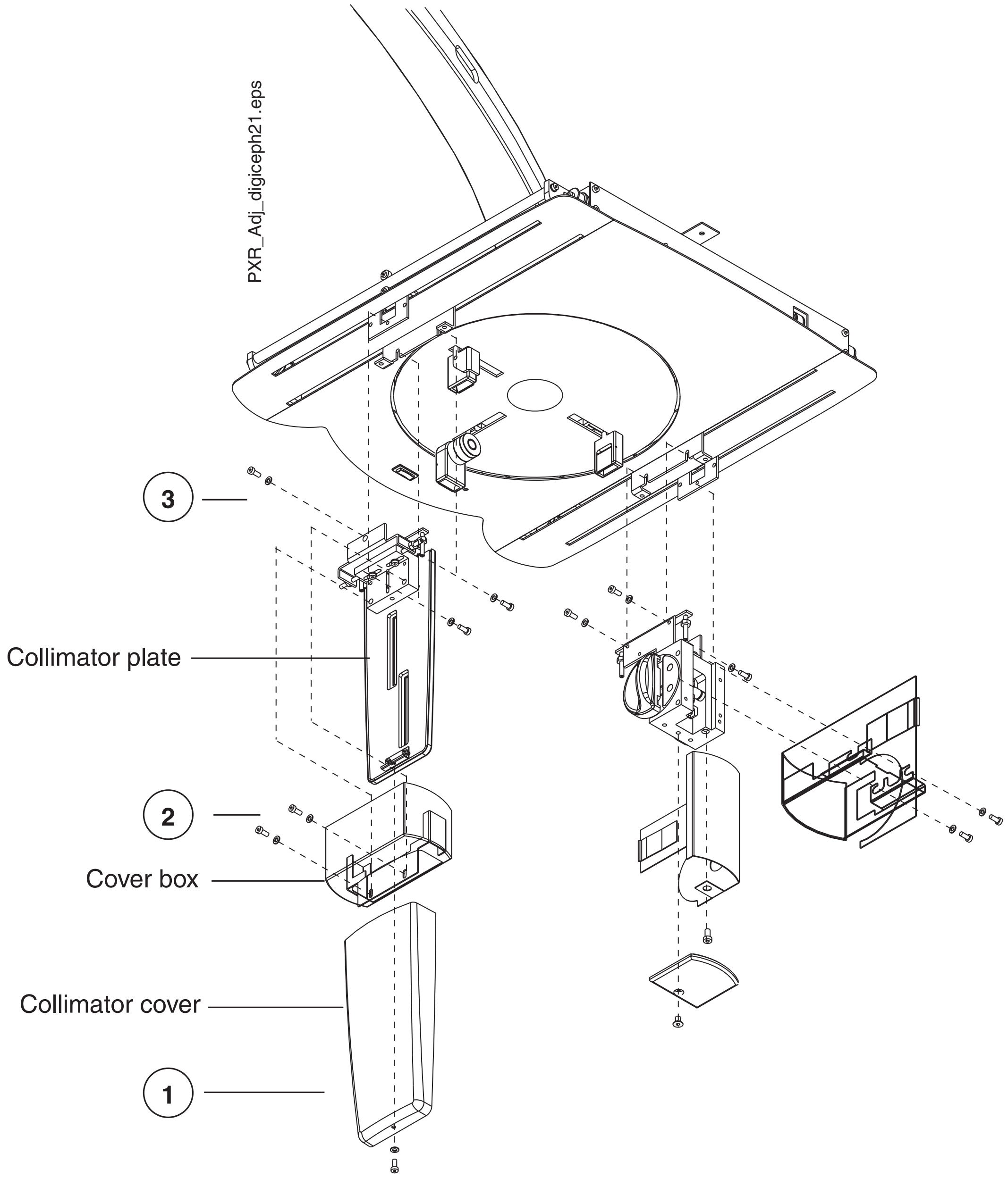


Figure 98

Attach the second primary collimator in reverse order.

2.1 Attaching the second primary collimator covers

Slide the collimator cover box to its position and attach it with the two attachment screws by using the 4mm Allen key (Fig. 99, 1).

Slide the collimator cover to its position and attach it with the attachment screw by using the 2mm Allen key (Fig. 99, 2).

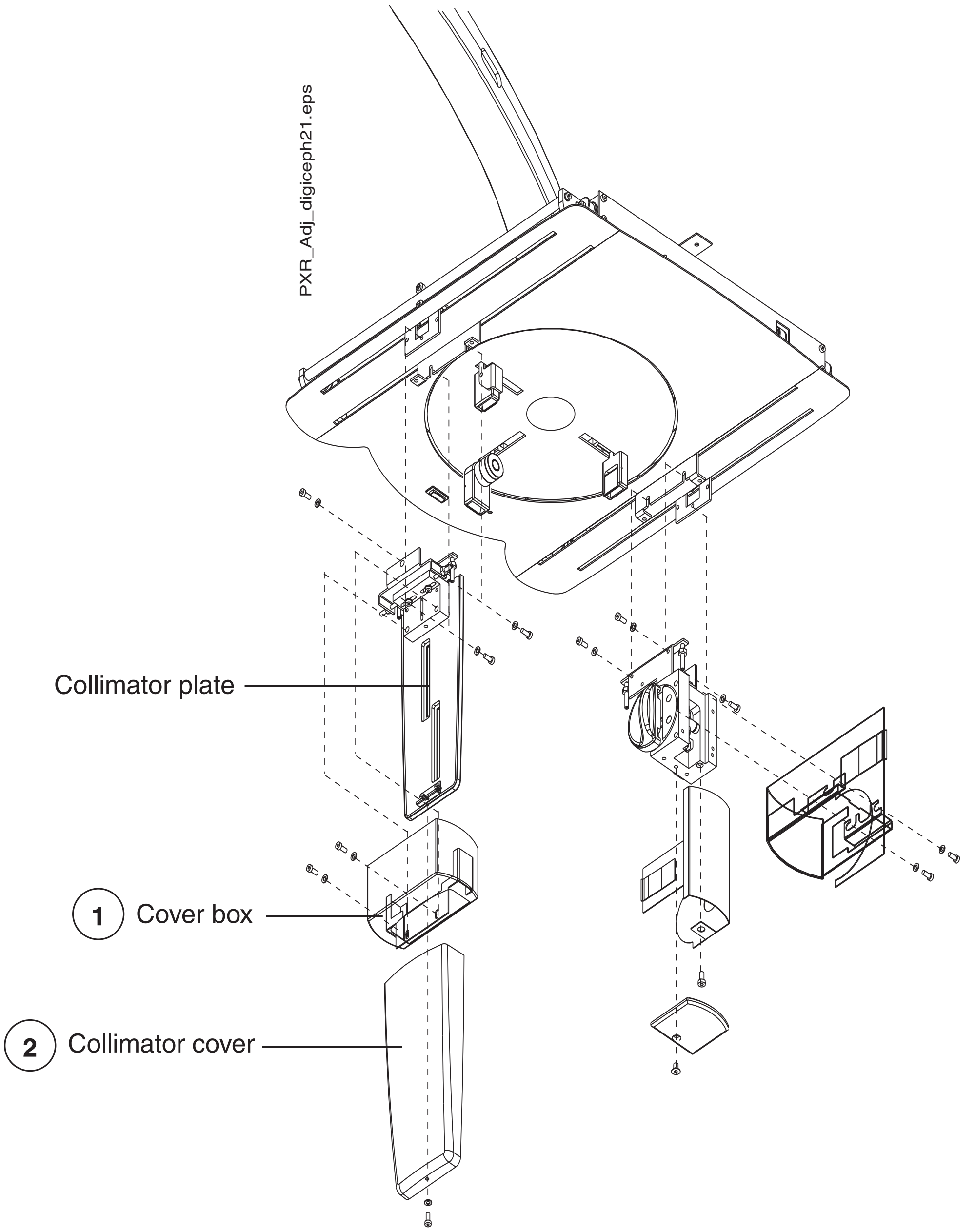


Figure 99

3 DETACHING AND ATTACHING THE SENSOR HEAD

3.1 Cephalostat with movable sensor head

Detaching the sensor head from the cephalostat

NOTE **The indicator light is lit when the Dimax3 sensor is in use. Removing the sensor head when the indicator light is lit might harm the sensor or cause image data loss.**

Push in the cephalostat electrical connector. This will disconnect the electrical connection between the sensor head and cephalostat.

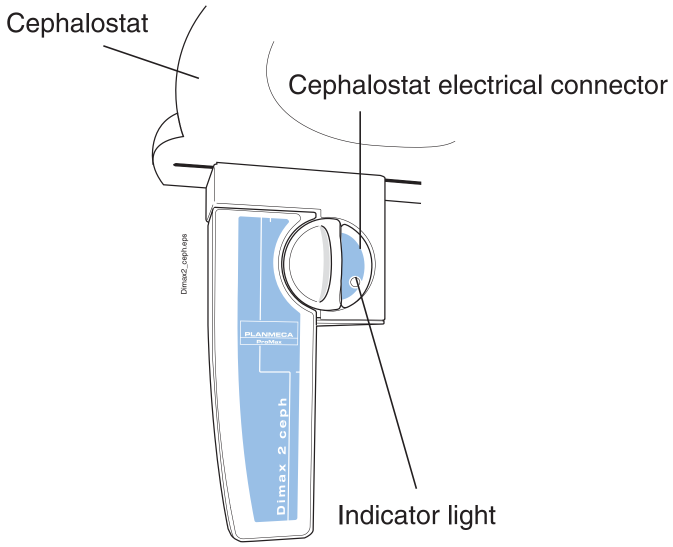


Figure 100

The locking knob can now be turned 180 degrees. This will release the sensor head locking mechanism.

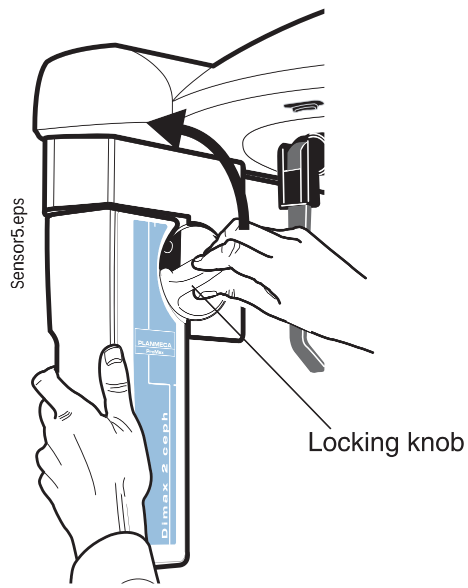


Figure 101

Carefully pull the sensor head out.

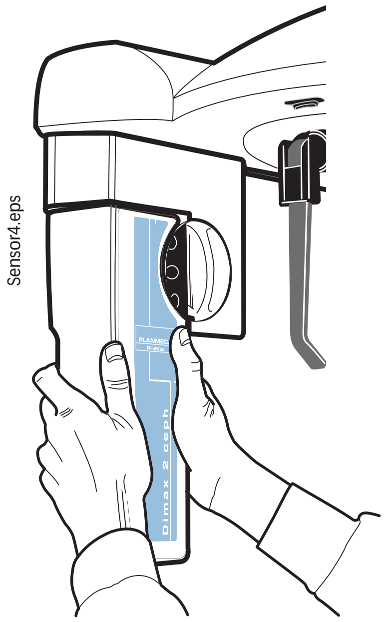


Figure 102

Attaching the sensor head to the cephalostat

Push the sensor head onto the connector on the cephalostat.

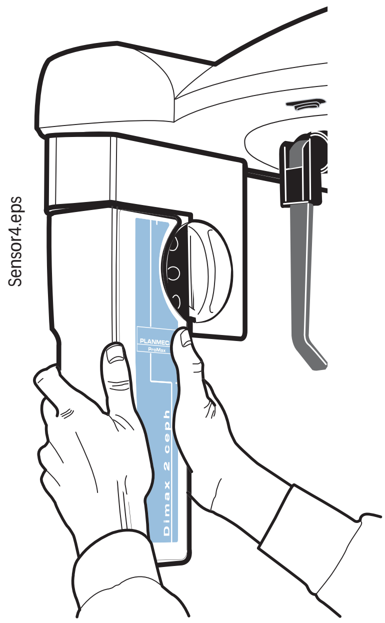


Figure 103

Turn the locking knob over the fastening mechanism. This will secure the sensor head in position.

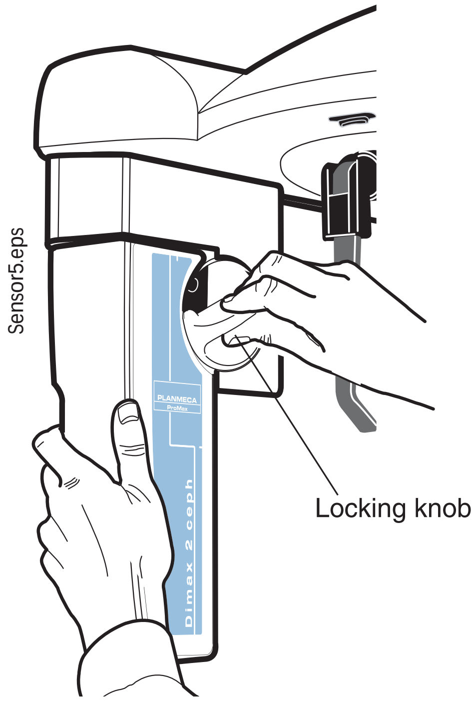


Figure 104

Push in the button of the cephalostat electrical connector behind the sensor head quick connector mechanism. This will secure the sensor head in position and make the electrical connection between the sensor head and cephalostat.

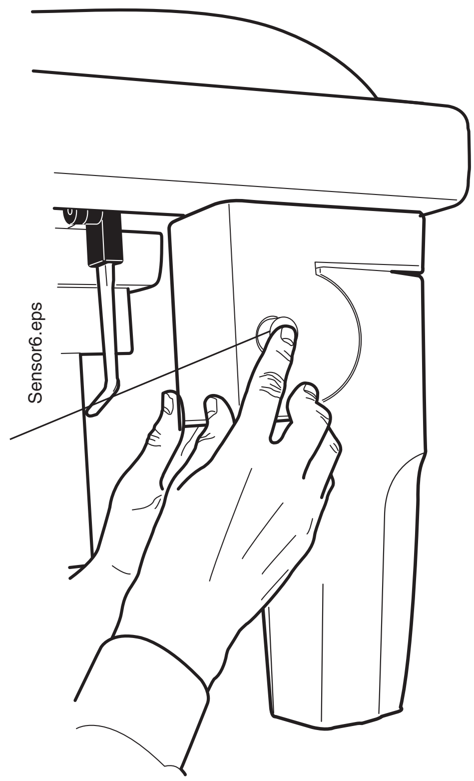


Figure 105

Removing the sensor head connector covers

Unscrew the bottom cover plate attachment screw with the 4mm Allen key and remove the cover plate (Fig. 106, 1).

Unscrew the attachment screw of the quick connector mechanism back cover with the 4mm Allen key and slide the cover away from its position (Fig. 106, 2).

Turn the lock disc approx. **90° counterclockwise**. Loosen the attachment screws of the front cover with the 4mm Allen key and slide the cover away from its position (Fig. 106, 3).

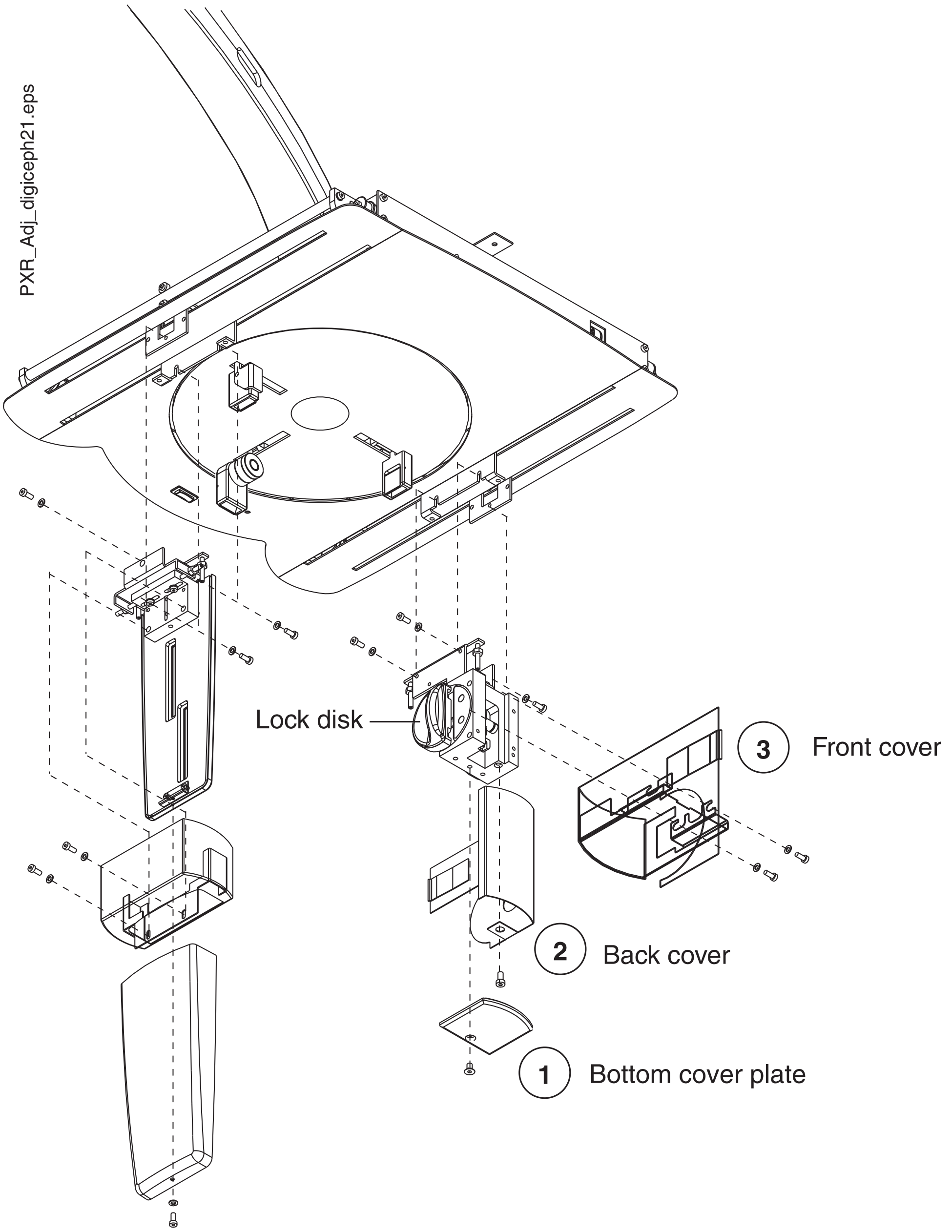


Figure 106

3.2 Cephalostat with fixed sensor head - removing and attaching the sensor head

Unscrew the bottom cover plate attachment screw with the 4mm Allen key and remove the cover plate.

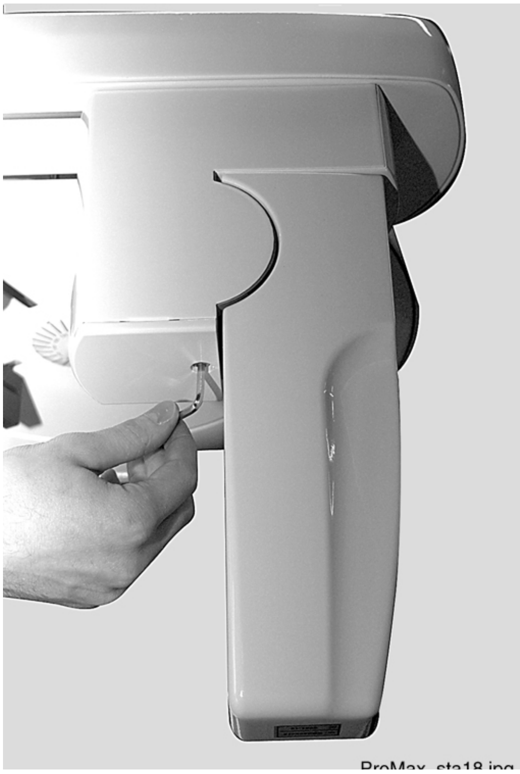


Figure 107

Unscrew the attachment screw of the back cover with the 4mm Allen key and slide the cover from its position.

Figure 108

Loosen the button axle attachment screw with 3mm Allen key and push the button axle outwards (Fig. 109, 1). Remove the locking plate from the connector (Fig. 109, 2).

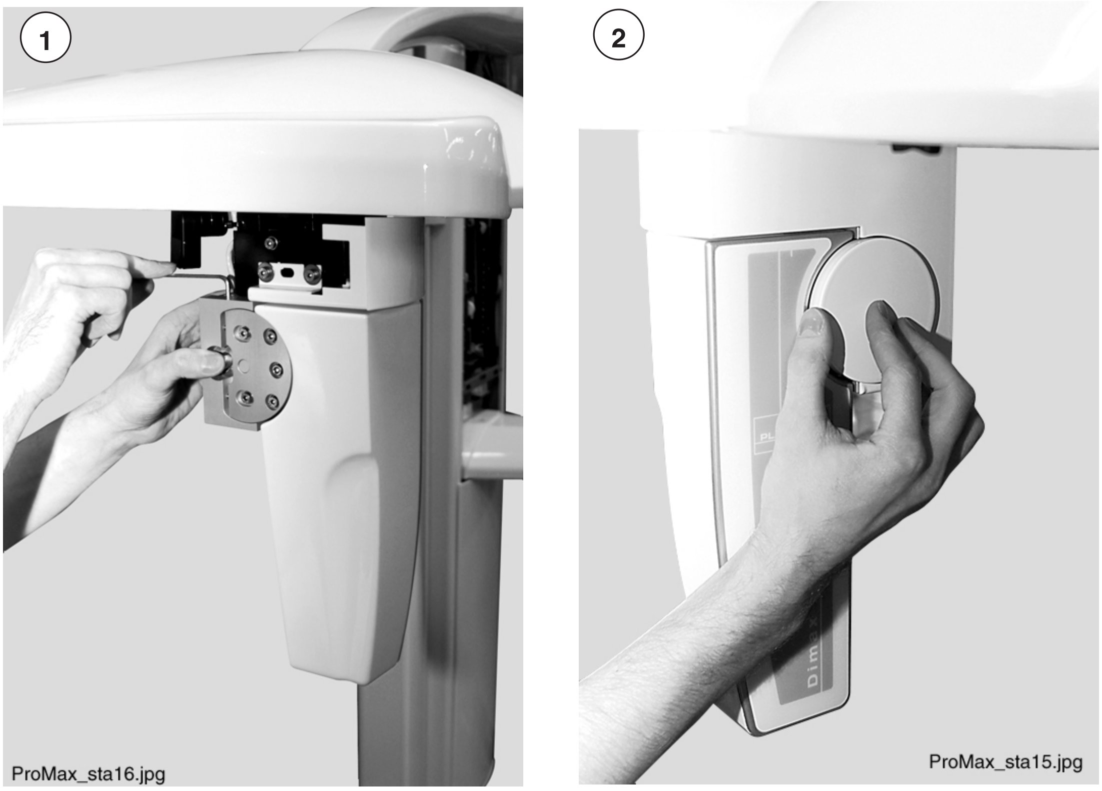


Figure 109

Unscrew the sensor head locking screws from the attachment pins with 3mm Allen key. Remove the screws and washers.

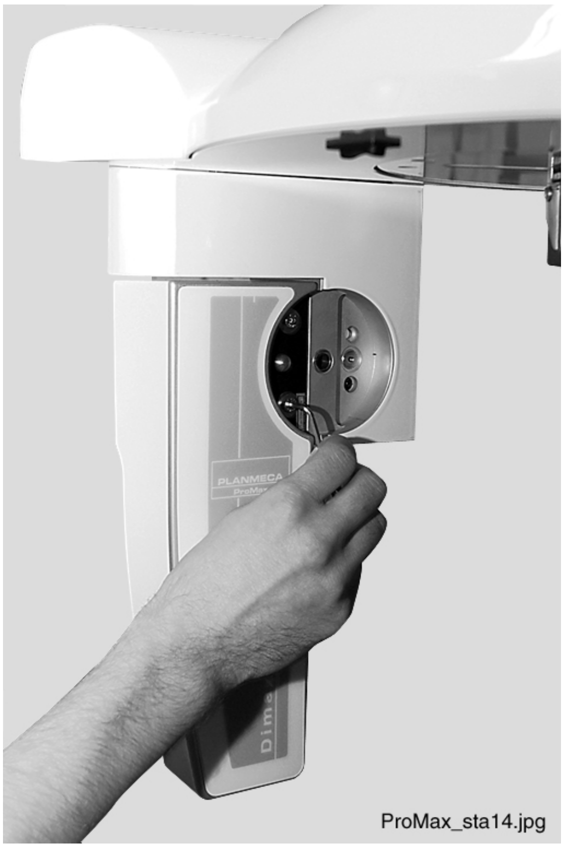


Figure 110

Remove the sensor head from its connector.

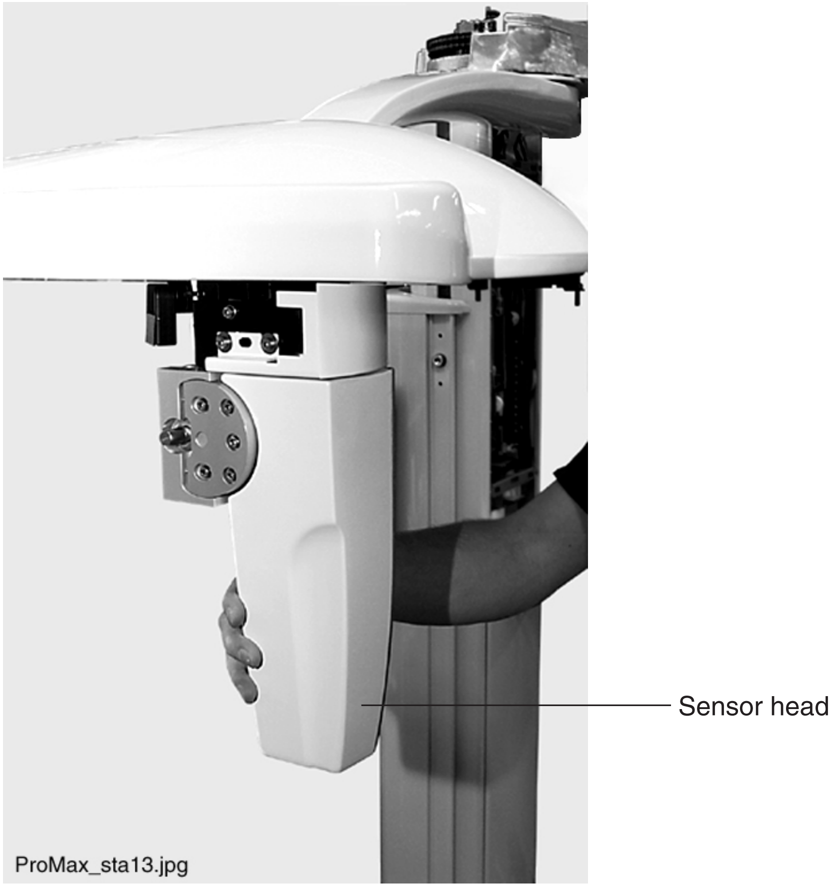


Figure 111

The sensor alignment tool can now be attached to the connector pins.

If needed, you can now detach the connector front cover by unscrewing the two attachment screws with 3mm Allen key and slide the cover from its position.

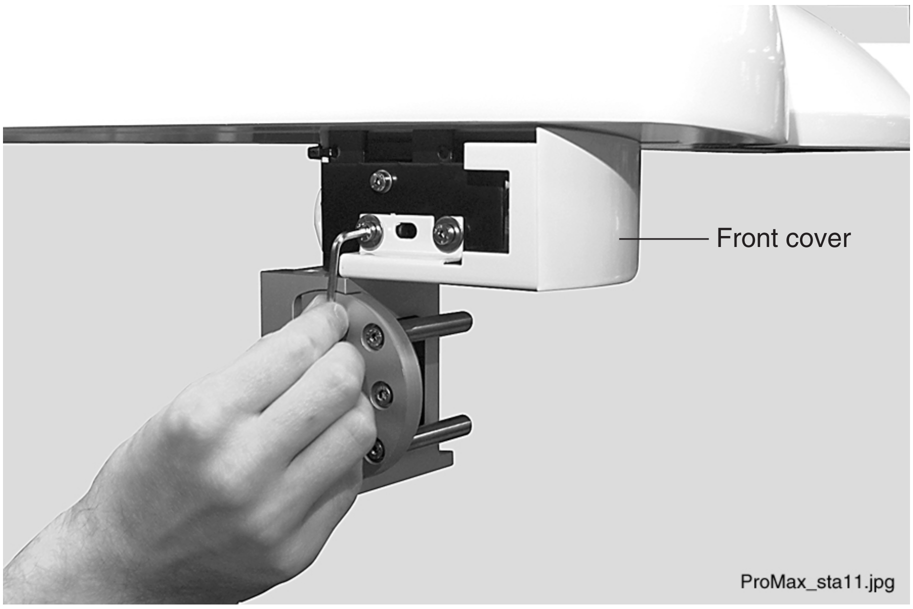


Figure 112

The sensor head is attached in reverse order.

4 REMOVING THE HOUSINGS AND COVERS

4.1 Removing the housings of the head support

The screws of cephalostat housings can be reached through the ear post holder attachment opening on the rotatable head support cover. Note that you have to rotate the rotatable head support to different positions to reach all the attachment screws. The back housing is attached with one M5x10 DIN 7984 screw (Fig. 113, 1), and the large front housing is attached to the head support with seven M5x10 DIN 7984 screws (Fig. 113, 2 - 8).

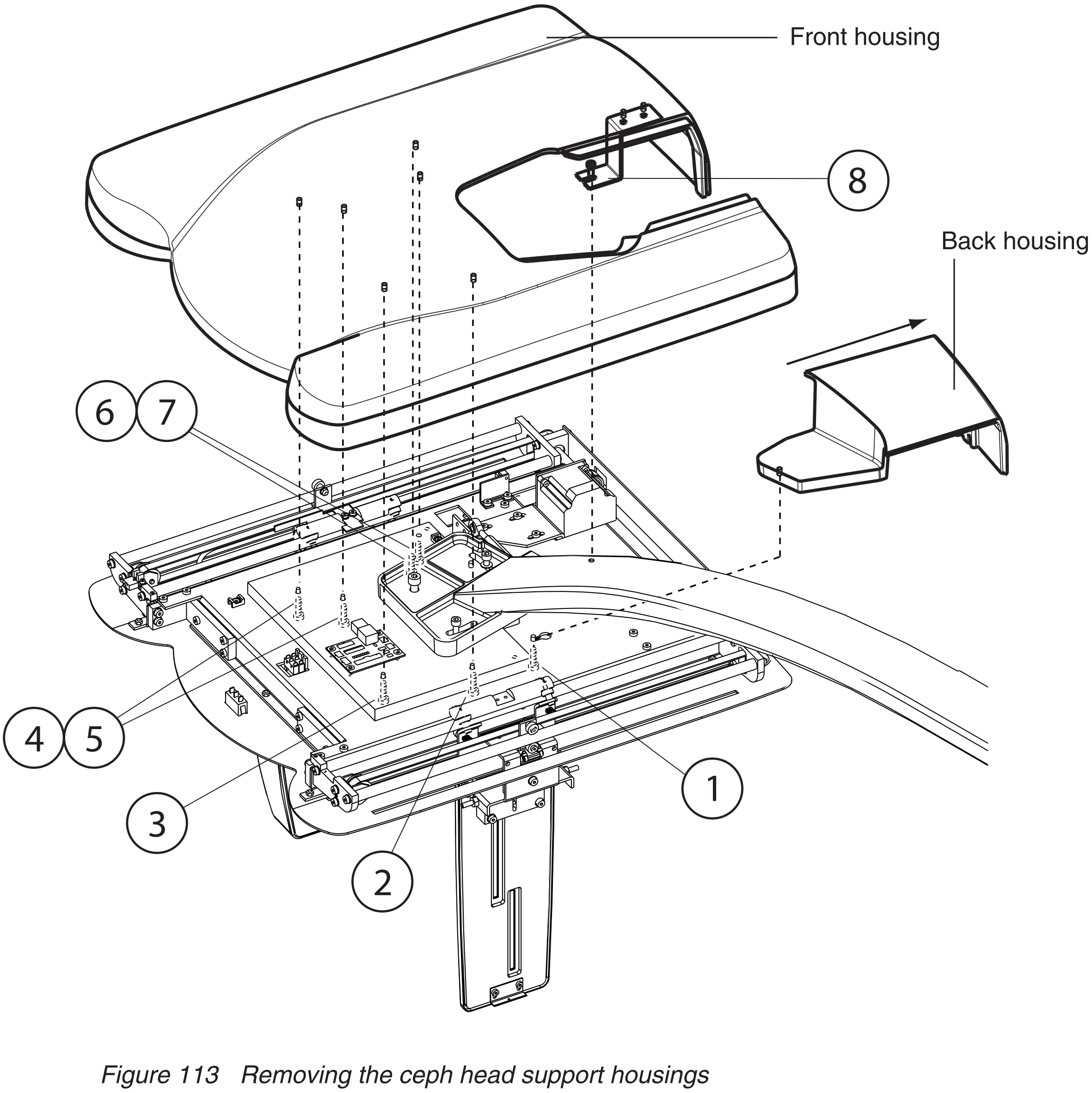


Figure 113 Removing the ceph head support housings

Rotate the head support to the 45° position as shown on the Fig. 114 below and unscrew the back housing attachment screw with the 3mm Allen key and remove the housing.

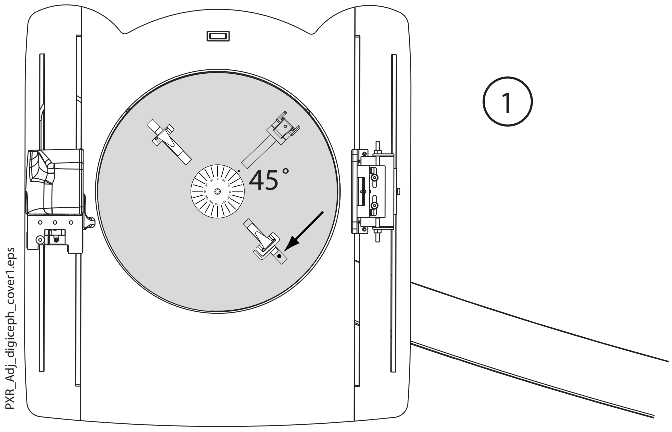


Figure 114

Rotate the head support to the 0° position as shown on the Fig. 115 below and unscrew the attachment screw number 2 with the 3mm Allen key.

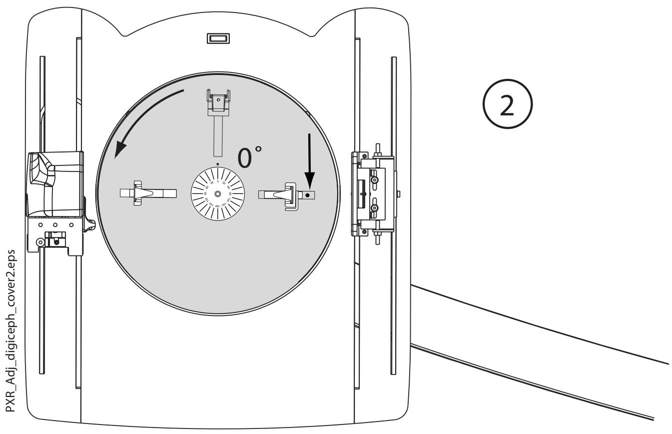


Figure 115

Rotate the head support to the 45° position as shown on the Fig. 116 below and unscrew the attachment screw number 3 with the 3mm Allen key.

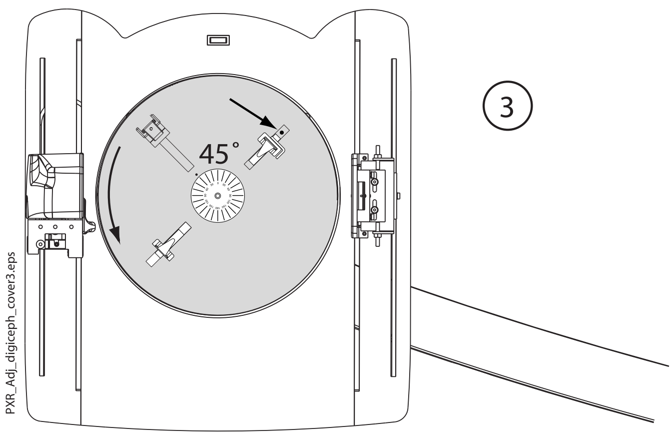


Figure 116

Rotate the head support to the 135° position as shown on the Fig. 117 below and unscrew the attachment screws number 4 and 5 with the 3mm Allen key.

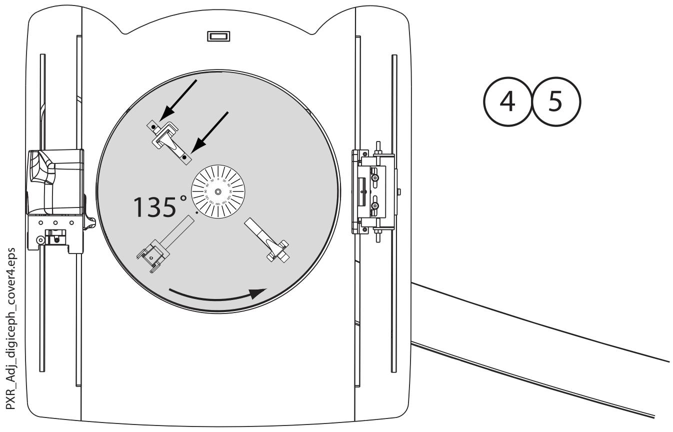


Figure 117

Rotate the head support to the 150° position as shown on the Fig. 118 below and unscrew the attachment screws number 6 and 7 with the 3mm Allen key.

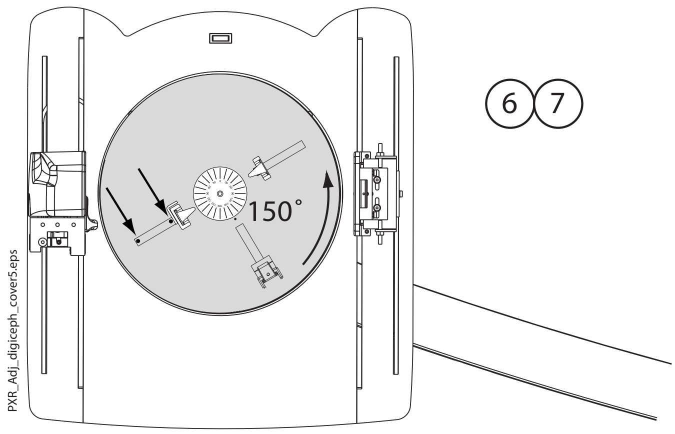


Figure 118

Loosen the attachment screw of the front housing mounting plate with the 3mm Allen key (Fig. 113, 8) and remove the housing.

Attach the housings to the cephalostat head support in reverse order.

5 REPLACING PCBS

5.1 Cephalostat connector PCB

Remove the head support housings according to the instructions given in section 4 “REMOVING THE HOUSINGS AND COVERS” on page H-64.

Disconnect all the cables that are connected to the Cephalostat connector PCB. Remove the PCB from its holders.

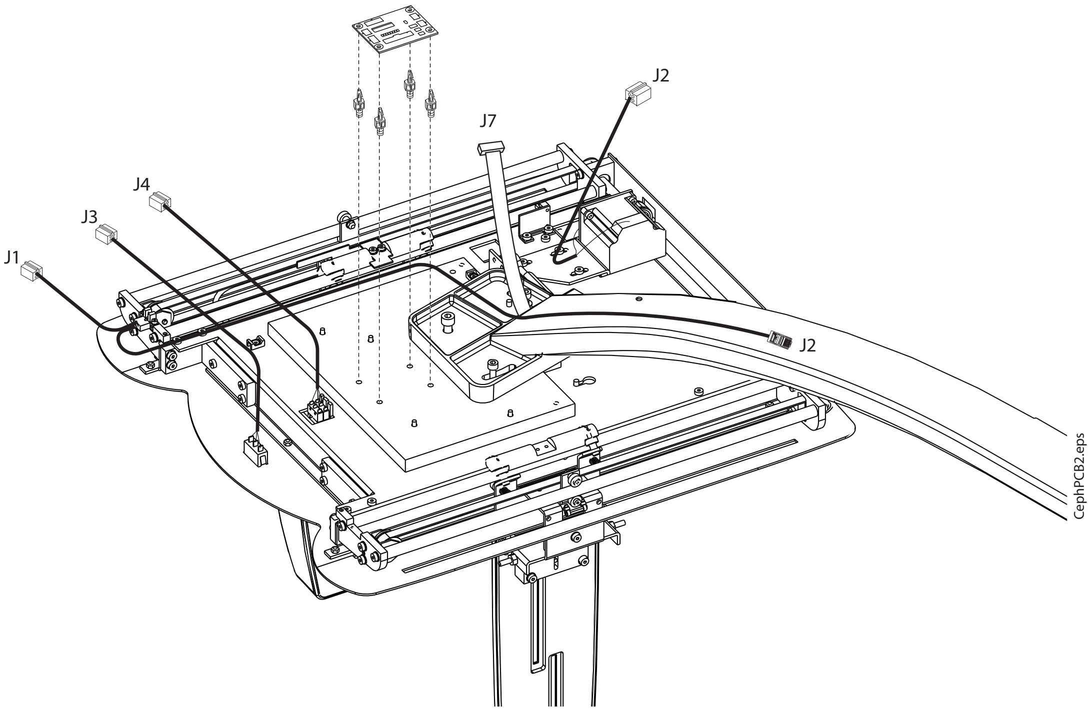


Figure 119

Install the new PCB in reverse order.

Chapter

I

PLANMECA PROCEPH

1 ADJUSTMENTS AND CALIBRATIONS

NOTE ***During the adjustments write down the selected parameter values. After the cephalostat adjustment switch the X-ray unit off and on and then check that the new parameter values are stored into the memory.***

1.1 Required tools

- Ceph head support alignment tool (part number 00653126).

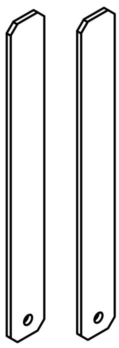


Figure 1

- Ceph head support alignment laser (part number 10004499). Used to check/calibrate the position of the cephalostat head support.

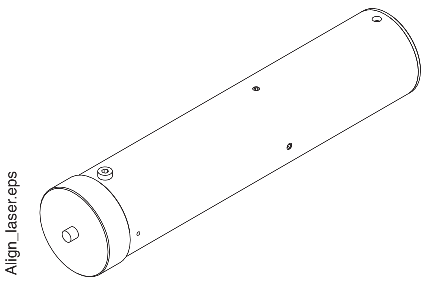


Figure 2

1.2 Removing the necessary covers

Remove the tube head cover (refer to section 2 “REMOVING THE HOUSINGS AND COVERS” on page I-18).

Remove the telescopic column rear cover plates, refer to section 2.2 “Removing the telescopic column rear cover plates” on page G-11.

Remove the cephalostat housings and covers, refer to section 2 “REMOVING THE HOUSINGS AND COVERS” on page I-18.

1.3 Parameter values and beam check exposure

Set C-arm rotation to 0, Y-collimator bottom to 404 and X-collimator left to 3520 as described below.

To enter the calibration mode first touch the i-field on the *Main* display. Select Technical calibrations (i600) from the list on the display. The password to the Technical calibrations mode is asked when the Technical calibrations mode is entered for the first time after switching the unit on. **The password is 1701.**

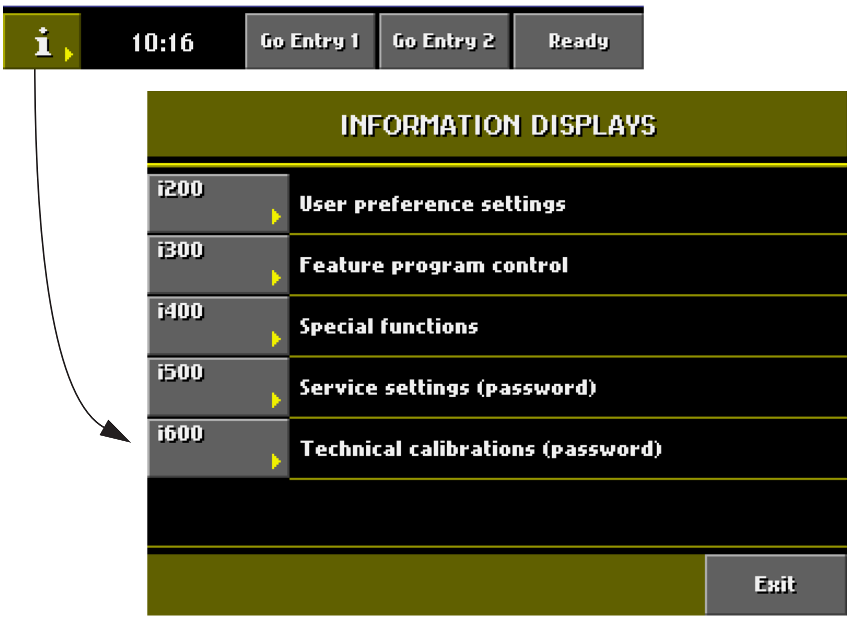


Figure 3

From the list on the *i600* display that appears select *Primary collimator calibration (i610).*

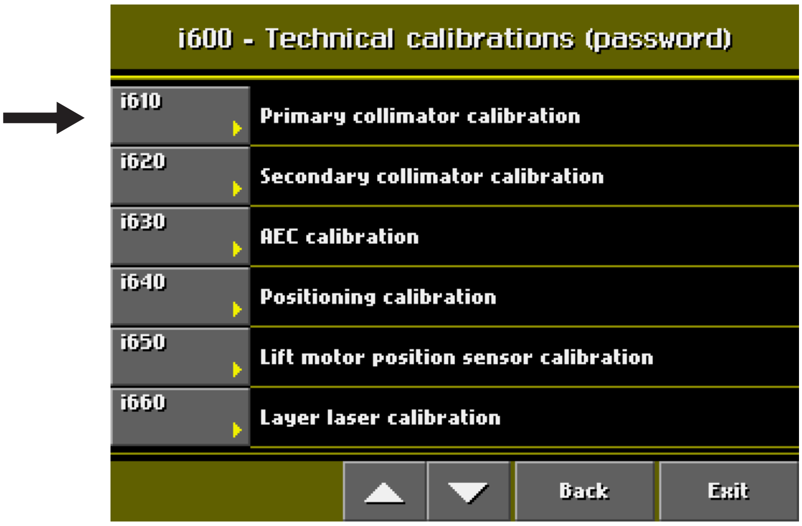


Figure 4

Set first the Ceph mode C-arm rotation value to zero (0). From the list on the *i610* display that appears select *Ceph mode C-arm rotation (i61.5)*.

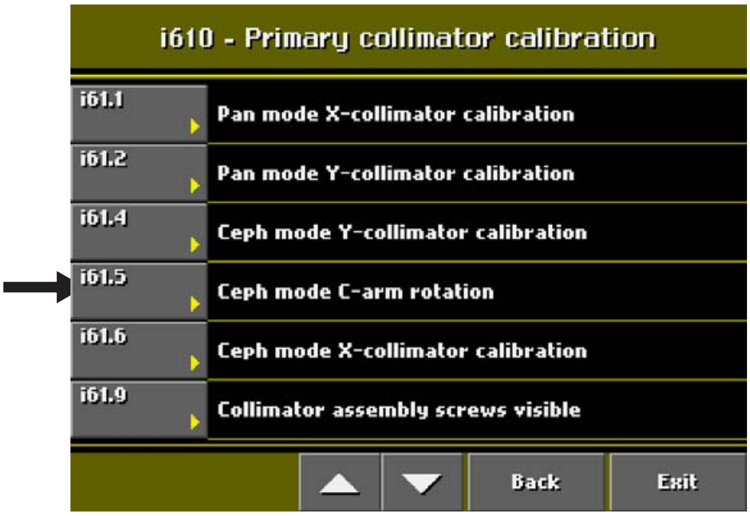


Figure 5

The *Ceph mode C-arm rotation* display appears. Set the value to zero (0).

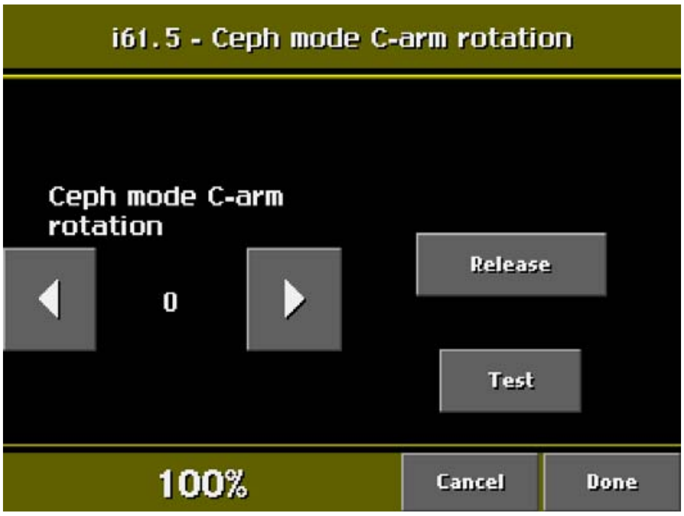


Figure 6

From the list on the *i610* display select the *Ceph mode X-collimator calibration* (i61.6). Set the left value to 3520.

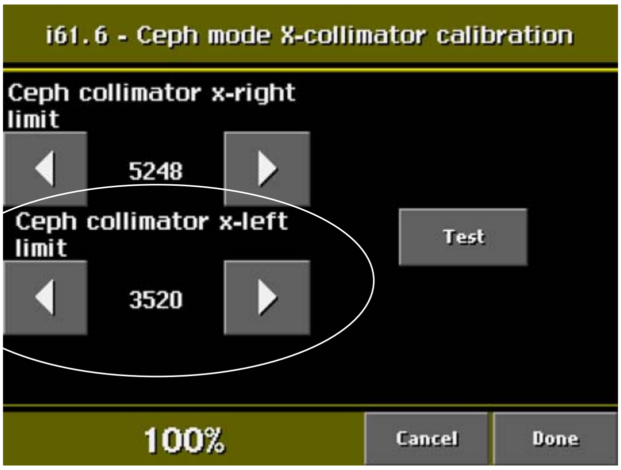


Figure 7

From the list on the *i610* display select the Ceph mode Y-collimator calibration (i61.4).

The *Ceph mode Y-collimator calibration* display appears. Set the y-bottom value to 404.

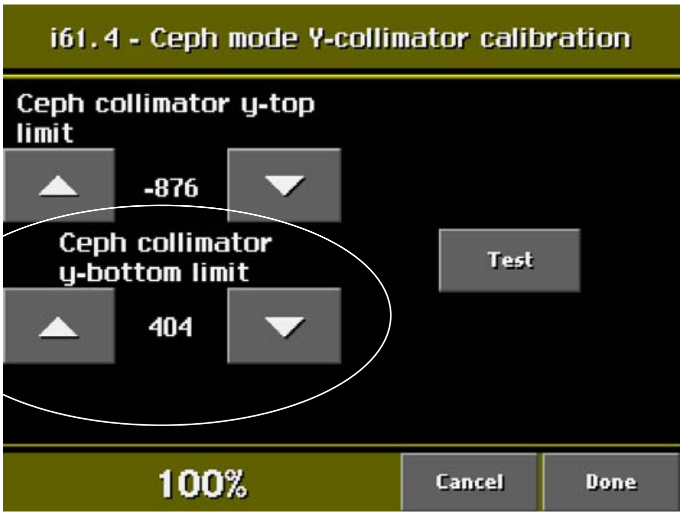


Figure 8

1.4 Adjusting the height of the cephalostat

Take a beam check exposure. Refer to the Planmeca Device Tool manual, publication number 10031558.

The height of the cephalostat must be adjusted so that the bottom border of the beam should be slightly lower or equal the bottom border of the sensor.

If the beam bottom border is not correct (see figure below) the height of the cephalostat must be adjusted.

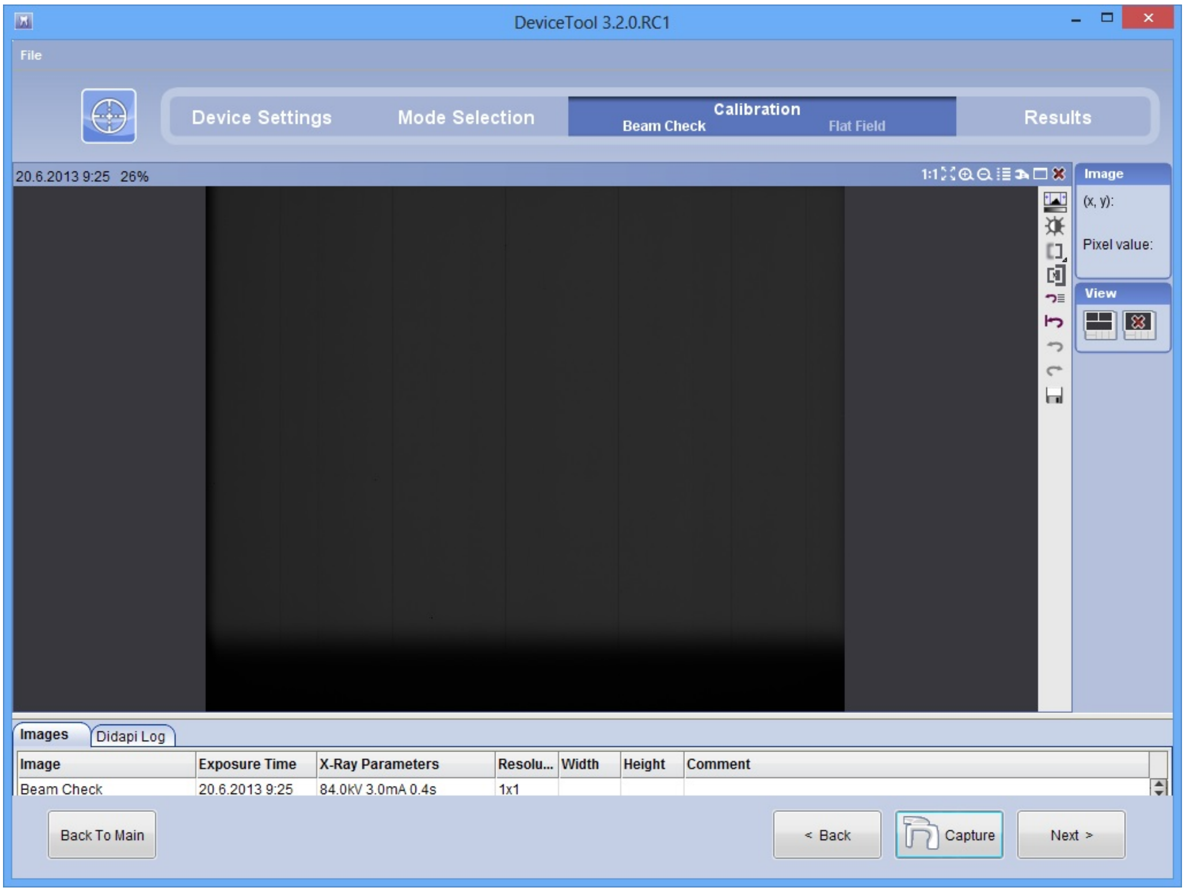


Figure 9

Loosen the nuts of the attachment plate (1). Adjust the cephalostat height with the nut of the swing bolt (2) so that a fade-out area of 2-3mm is seen in the bottom edge of the X-ray beam**.**

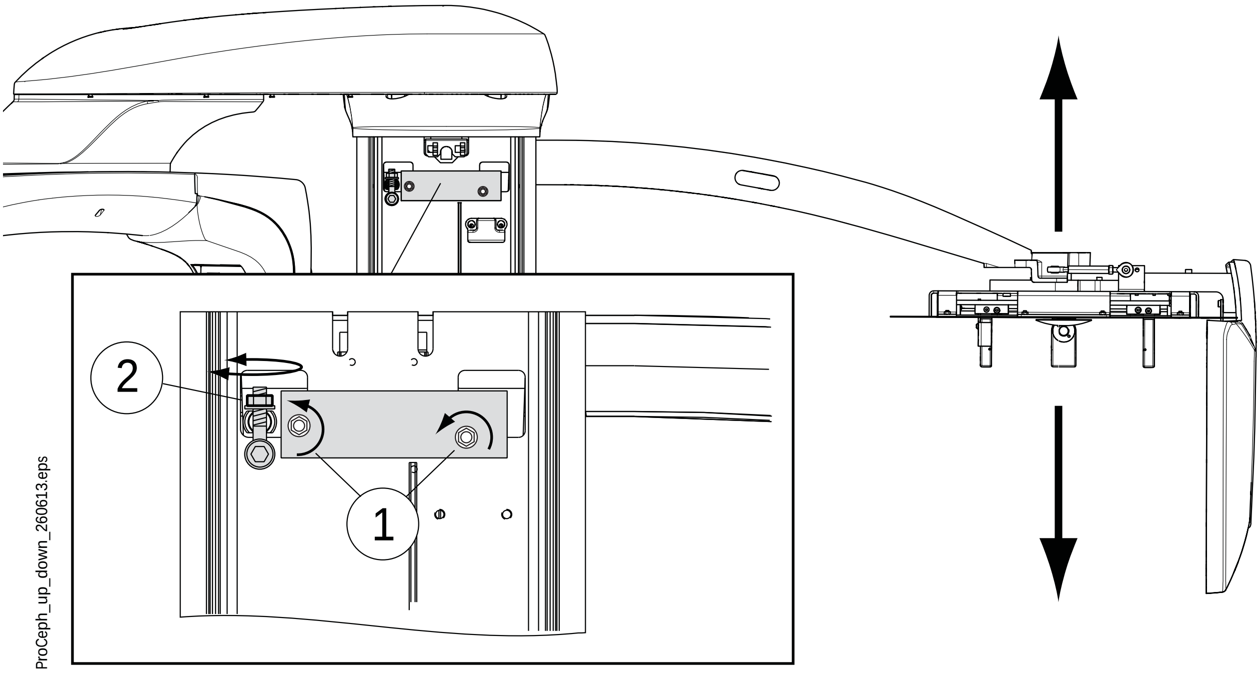


Figure 10

1.5 Checking the cephalostat head support position

To select the cephalometric exposure first touch the Prog. field on the Main display and then select the cephalometric exposure by touching the Ceph field on the Select program type display. Press Go Ceph to drive the equipment into ceph position.

The head support frame must run parallel with the primary collimator. Check the position of the head support by using the spirit level. Adjust the head support in vertical direction, if needed. Refer to section “Adjusting the sensor in vertical direction” on page I-13.

Place the ceph head support alignment tools in the ear post holders as far as they go. Rotate the head support to the 0° position. Position the laser tool between the alignment tools.

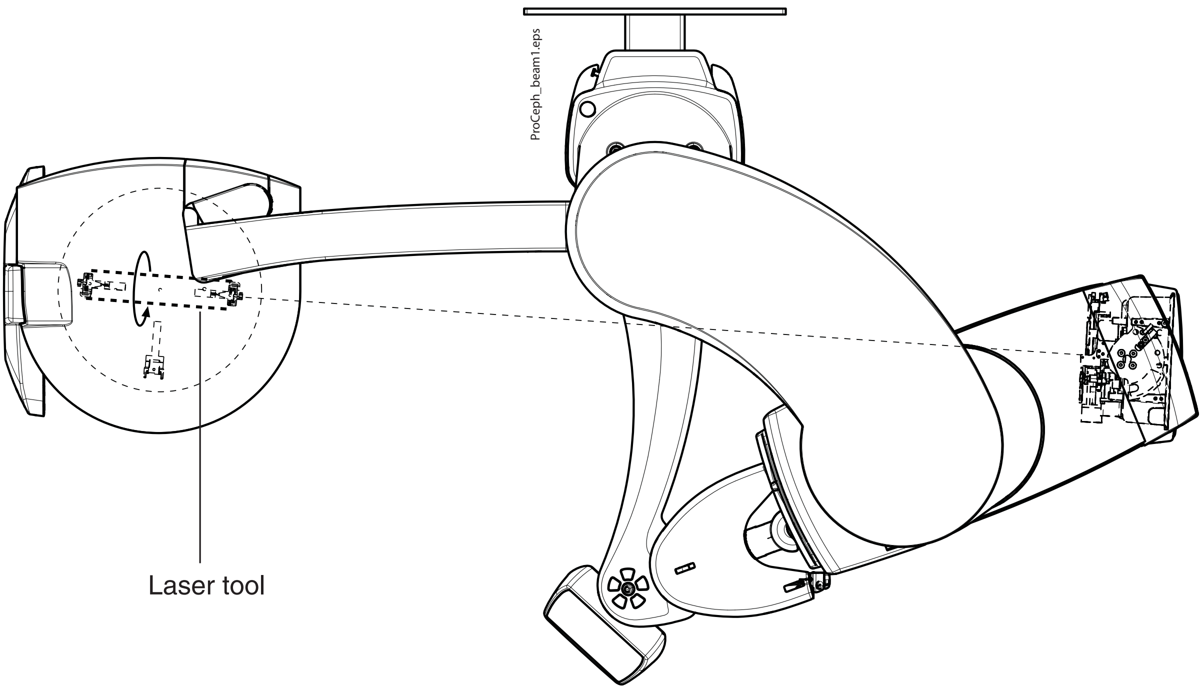


Figure 11

NOTE ***Rotate the laser tool to make sure of the laser tool calibration. The laser tool can be calibrated using the side screws of the tool. If the laser point moves when rotating the laser tool body, use the centre of the point movement as a reference point that must hit the lowest point of the calibration circle.***

Open the primary collimator mechanism by rotating the primary collimator screws located behind the blades. The laser beam must hit the lowest point of the calibration circle located on the primary collimator mechanism.

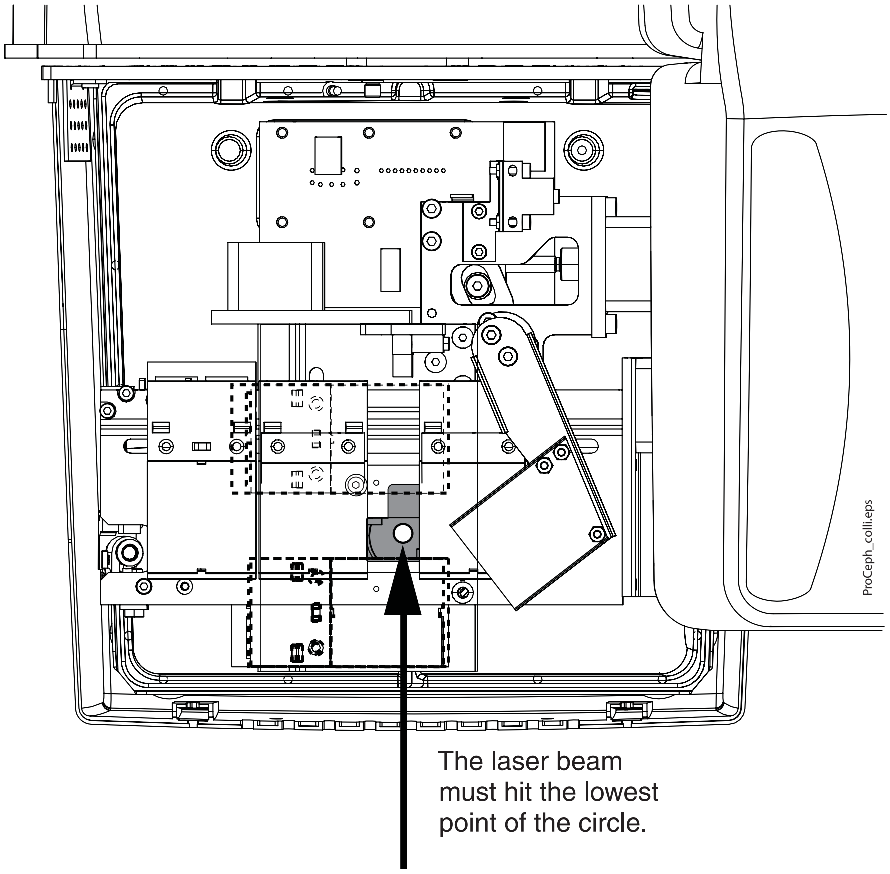


Figure 12

If the beam does not hit the circle, adjust the head support position, refer to section 1.7 “Cephalostat head support adjustments” on page I-11.

Remove the laser beam and the ceph head support alignment tools from the head support.

1.6 Calibrating the left side of the cephalometric X-ray beam

Take a beam check exposure. Refer to the Planmeca Device Tool manual, publication number 10031558. A fade-out area of 2-3mm must be seen in the left side of the X-ray beam. If needed, adjust the left side of the beam as follows.

From the list on the *i610* display select *Ceph mode C-arm rotation (i61.5)*.

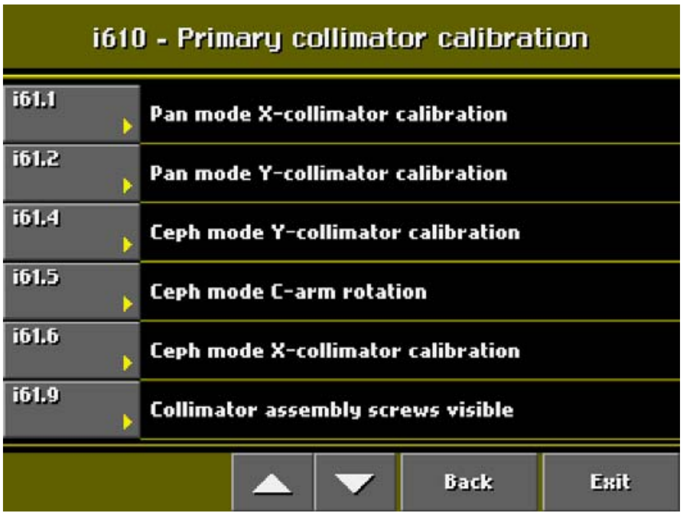


Figure 13

The *Ceph mode C-arm rotation* display appears.

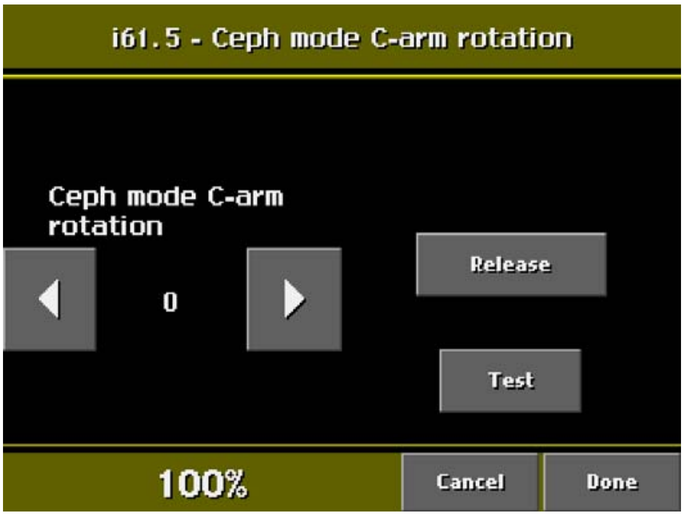


Figure 14

Adjust the C-arm position value with the Ceph mode C-arm rotation arrows and drive the C-arm to the new position by touching the Test field. The left arrow will move the X-ray beam towards the left side border of the sensor and the right arrow moves the X-ray beam towards the right side border of the sensor (seen from behind the tube head).

After touching the Test field wait a moment for the C-arm movement.

When the beam is correctly positioned, touch the Done field. The C-arm position is now calibrated.

NOTE ***The ceph head support position must always be checked after changing C-arm rotation. Check the head support position according to the instructions given in section 1.5 "Checking the cephalostat head support position" on page I-8.***

1.7 Cephalostat head support adjustments

Adjusting the ear posts in horizontal direction

Switch the unit off. Remove the cephalostat housings according to the instructions given in section 2 "REMOVING THE HOUSINGS AND COVERS" on page I-18.

Loosen the locking screw of the adjustment flange approx. 1/4 turns. Rotate the head support around its vertical axis to adjust the ear posts in horizontal direction as follows. Loosen the head support attachment screws (1) and the alignment bar screw (2). Rotate the alignment bar until the head support is in correct position (3 and 4).

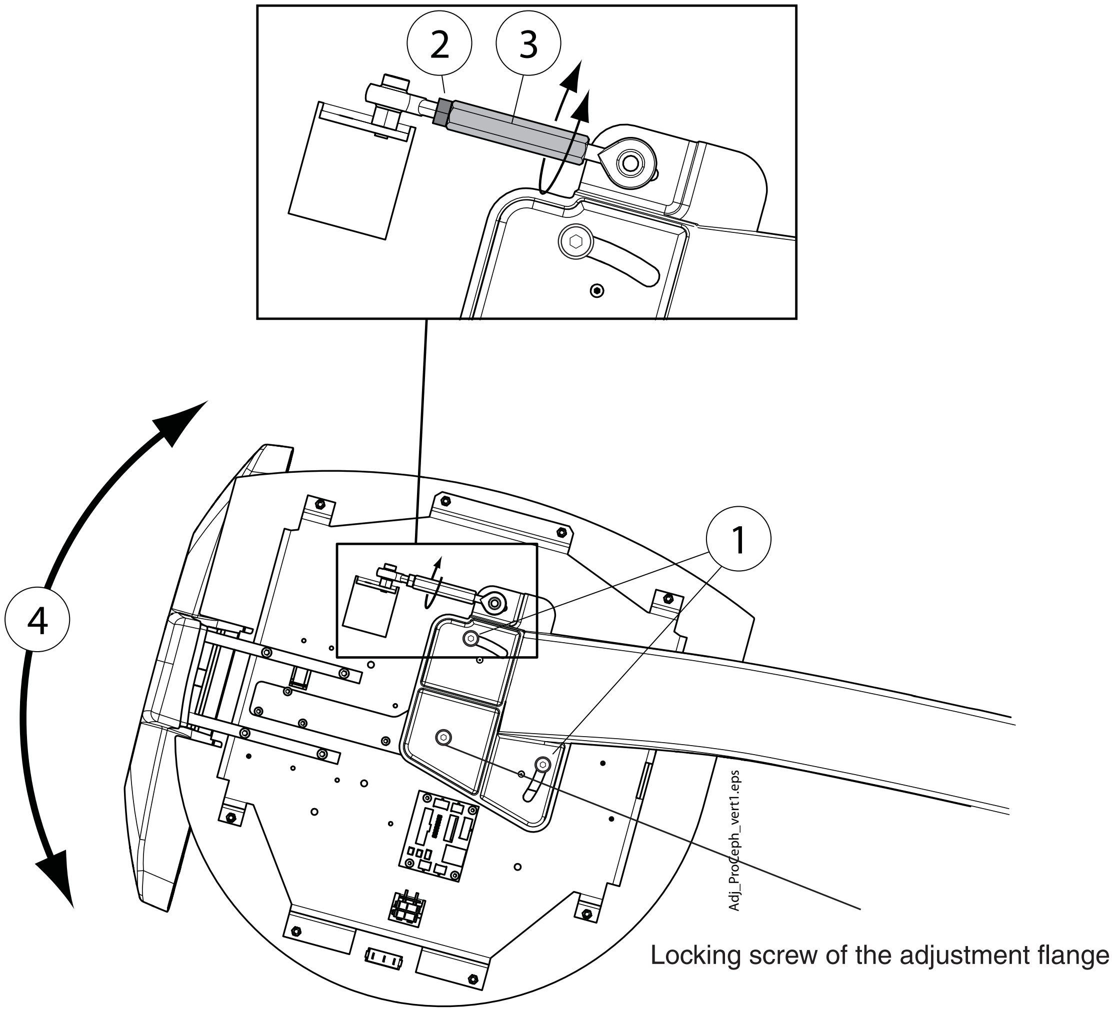


Figure 15

Adjusting the ear posts in vertical direction

Make sure that the locking screw of the adjustment flange (1) is loosened. To adjust the ear posts in vertical direction rotate the head support around its horizontal axis (4) with the two screws on the adjustment flange (2 and 3).

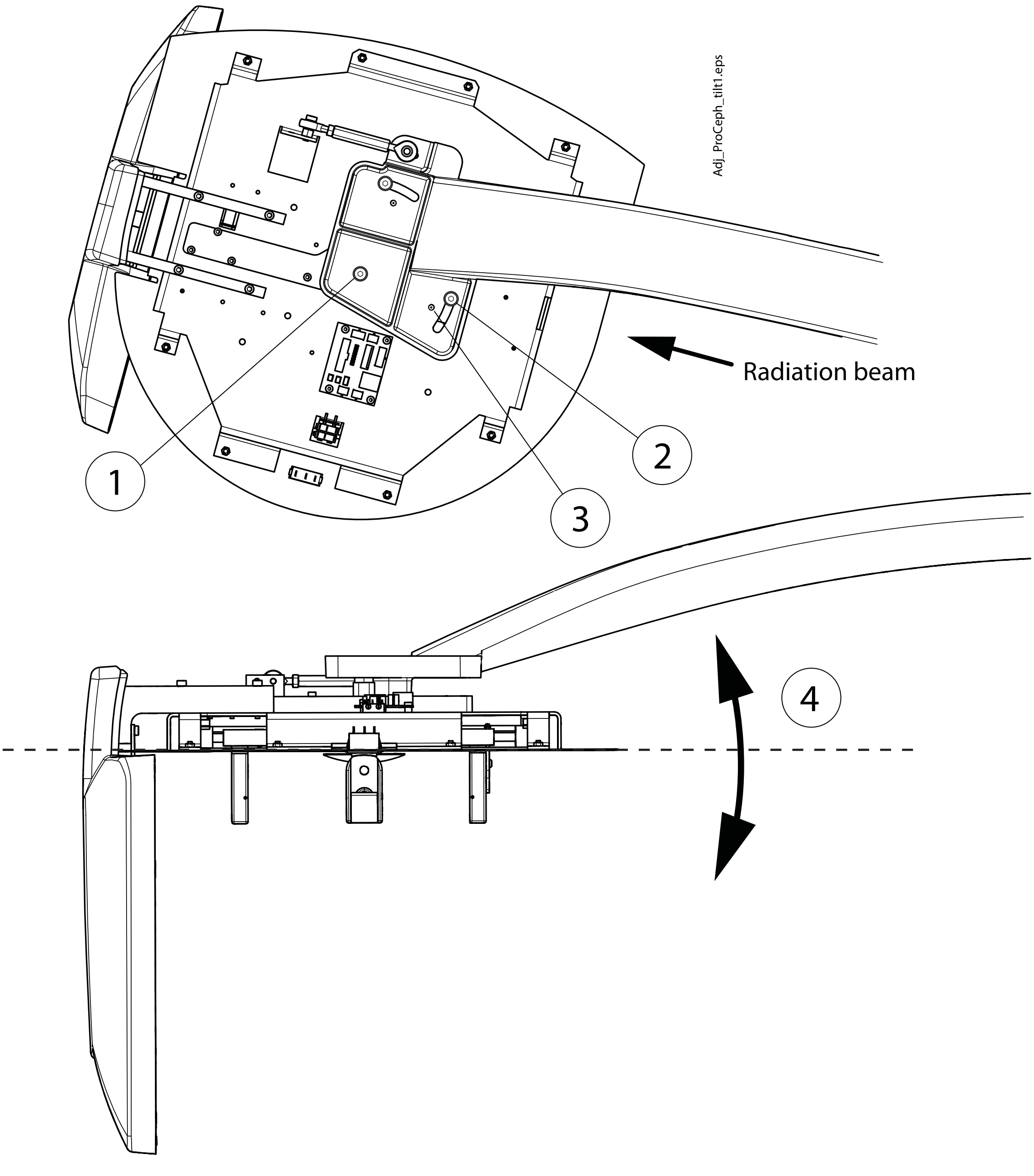


Figure 16

Adjusting the sensor in vertical direction

Make sure that the locking screw of the adjustment flange (1) is loosened. If the cephalostat sensor does not run parallel with the primary collimator, adjust the sensor in vertical direction (4) with the two screws on the adjustment flange (2 and 3).

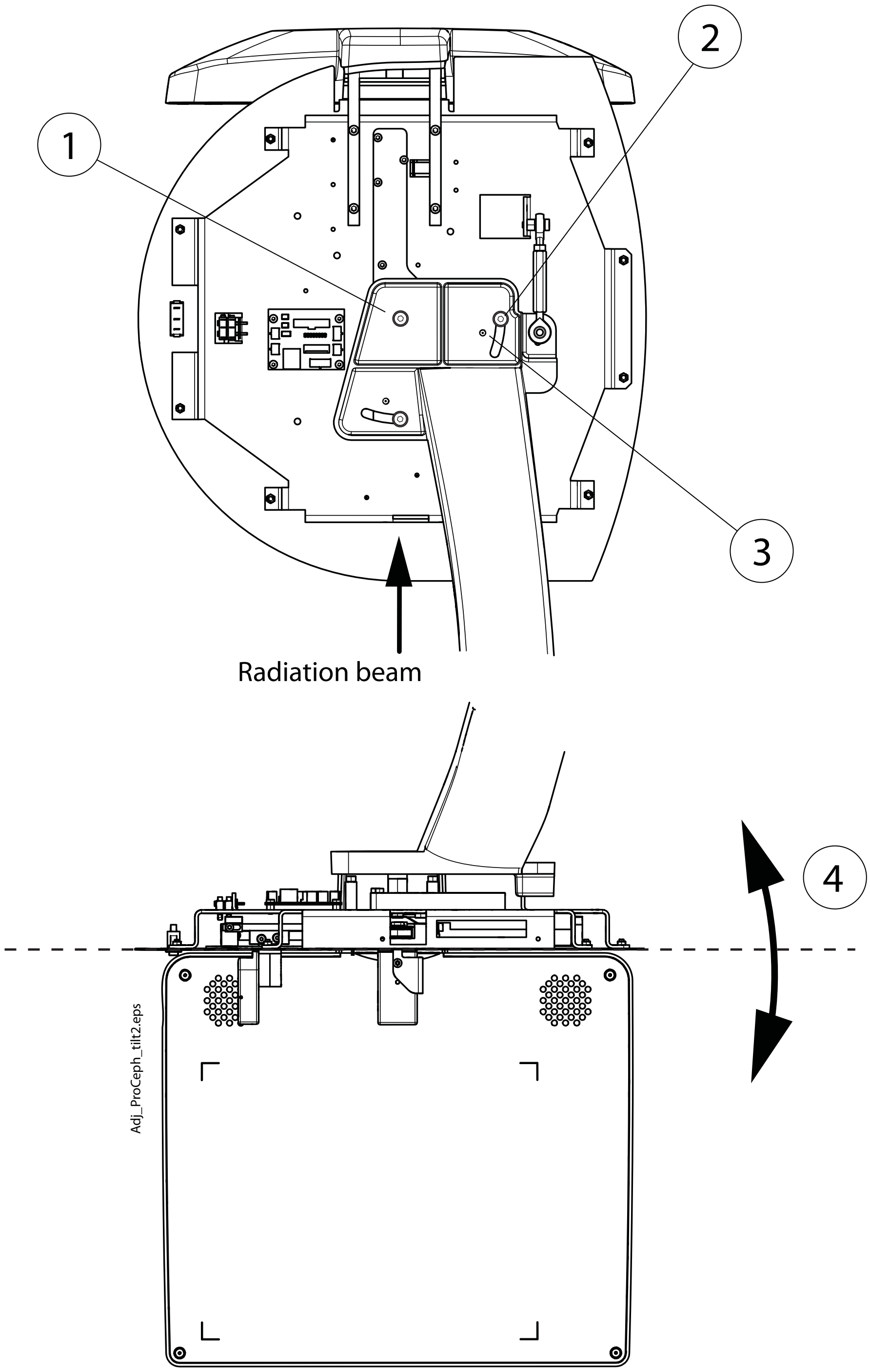


Figure 17

1.8 Adjusting the cephalometric beam top limit

Take a beam check exposure. Refer to the Planmeca Device Tool manual, publication number 10031558. A fade-out area of 2-3mm must be seen in all edges of the X-ray beam. Adjust the beam position as follows.

To enter the calibration mode first touch the i-field on the *Main* display. Select Technical calibrations (i600) from the list on the display. The password to the Technical calibrations mode is asked when the Technical calibrations mode is entered for the first time after switching the unit on. **The password is 1701.**

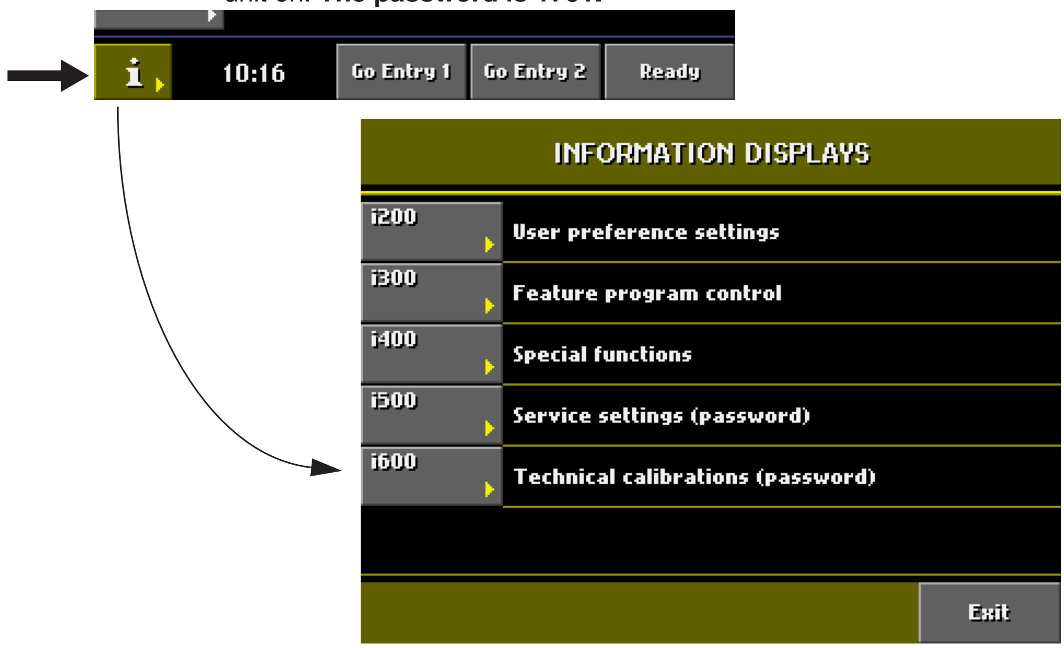


Figure 18

From the list on the *i600* display that appears select Primary collimator calibration (i610).

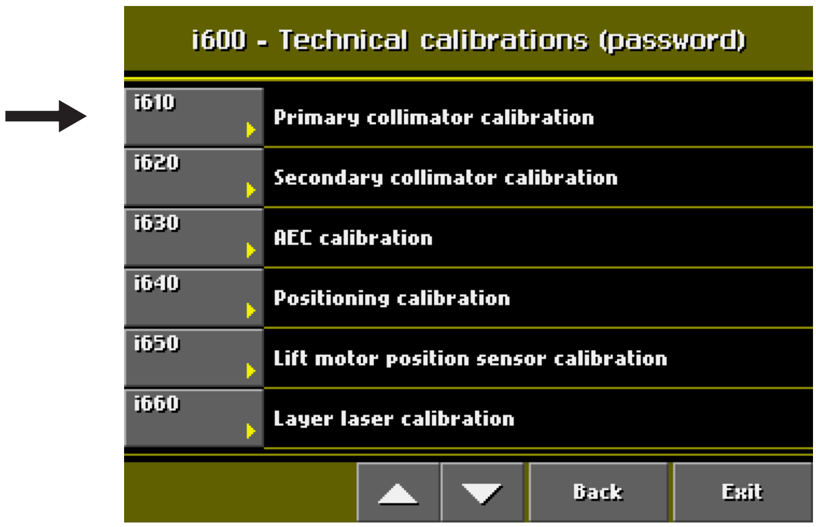


Figure 19

From the list on the *i610* display select the Ceph mode Y-collimator calibration (i61.4).

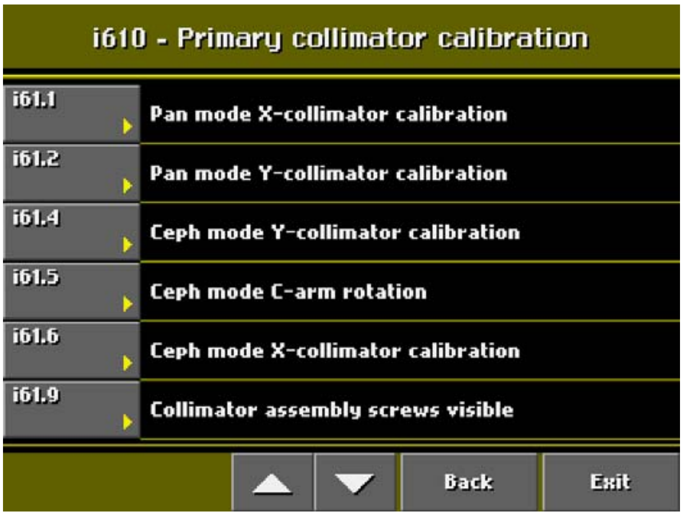


Figure 20

The *Ceph mode Y-collimator calibration* display appears. In this mode the vertical position of the X-ray beam is adjusted.

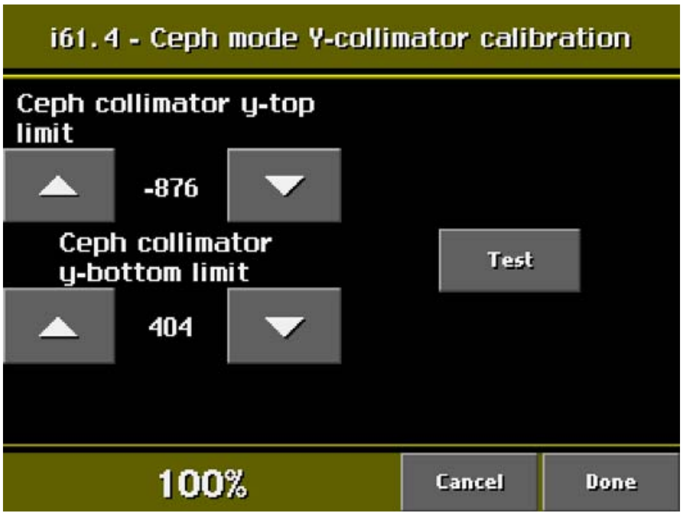


Figure 21

Take a beam check exposure. Refer to the Planmeca Device Tool manual, publication number 10031558.

Adjust the top limit value of the X-ray beam with the Y-top limit arrow fields and drive the primary collimator to the selected value by touching the Test field. Adjust the X-ray beam so that the fade-out area of 2-3mm is seen in the top edge of the X-ray beam.

When the top of the beam is correctly positioned, touch **Done**.

1.9 Calibrating the right side of the X-ray beam

From the list on the *i610* display select *Ceph mode X-collimator calibration (i61.5).*

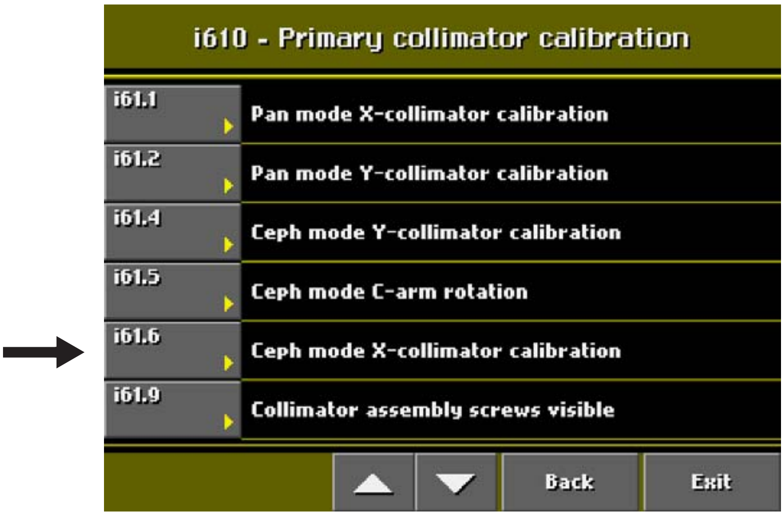


Figure 22

The *Ceph mode X-collimator calibration* display appears. In this mode the right side of the X-ray beam is adjusted.

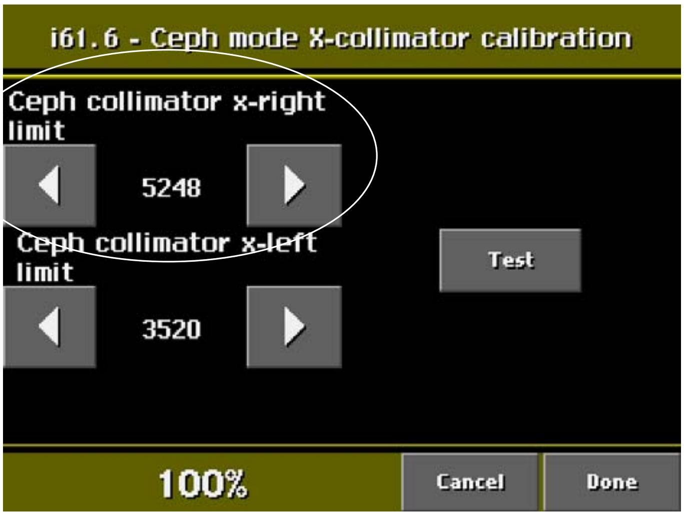


Figure 23

Take a beam check exposure. Refer to the Planmeca Device Tool manual, publication number 10031558.

Adjust the x-right limit value of the X-ray beam with the arrow fields and drive the primary collimator to the selected value by touching the Test field. Adjust the X-ray beam so that the fade-out area of 2-3mm is seen in the right side of the X-ray beam.

The **left** arrow field on the display adjusts the **beam to the left**, and the **right** arrow field to the **right.**

When the right side of the beam is correctly positioned, touch **Done**.

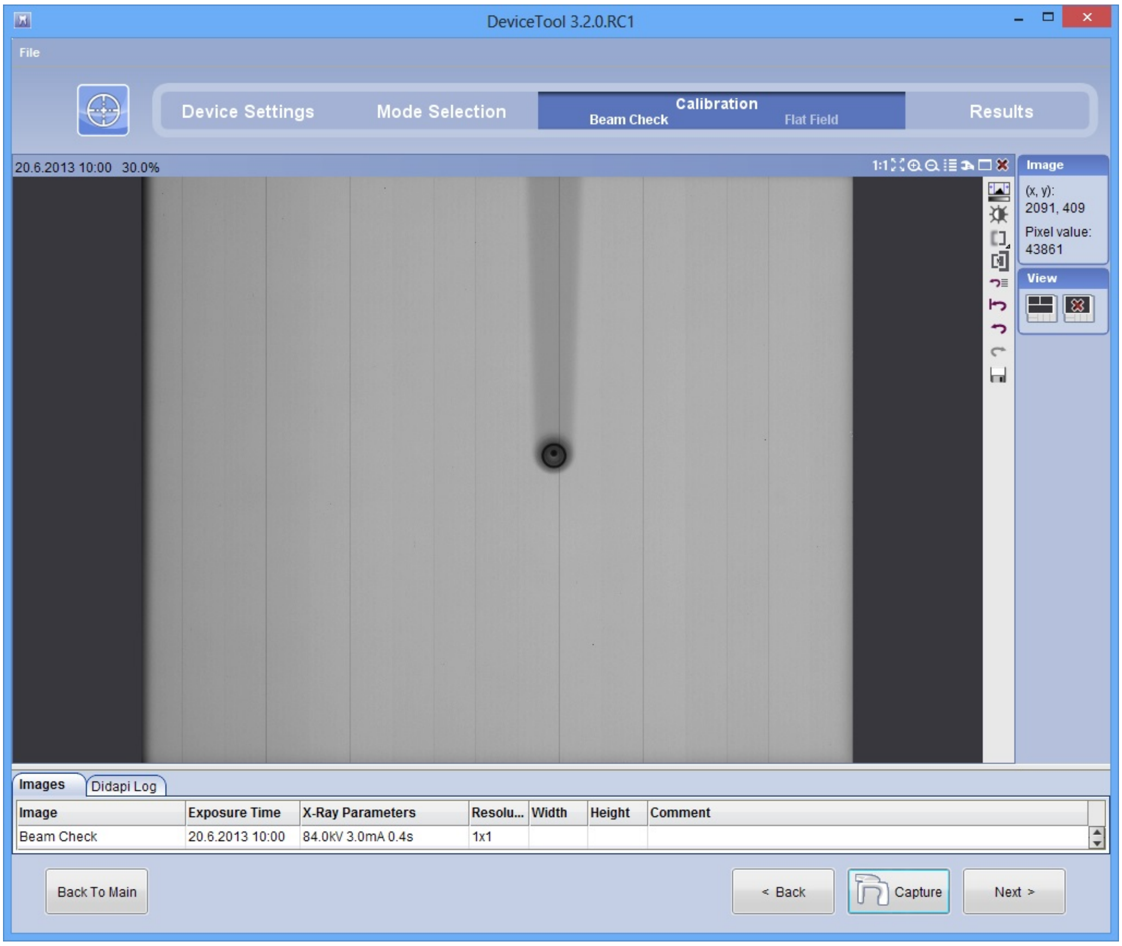
1.10 Checking the adjustment

Rotate the head support to the 0° position and place the two ear posts into their holders if they are not already installed.

Embedded in the end of the left (L) ear post there is a metal ball and embedded in the end of the right ear post (R) is a metal ring. The images of these that appear on an exposed image are used to check the alignment of the ear posts.

Take a beam check exposure. Refer to the Planmeca Device Tool manual, publication number 10031558.

On the image you will see the images of a metal ball and a metal ring. They must be concentric, or if not exactly concentric there must be a small gap between the edge of the ball and the inner edge of the circle.



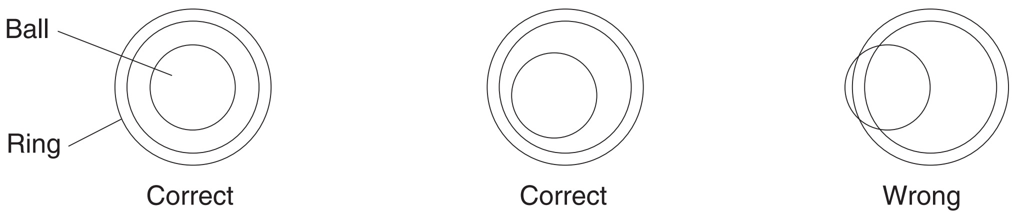


Figure 24

If the ball touches the ring the ear posts must be adjusted, refer to section 1.7 “Cephalostat head support adjustments” on page I-11.

2 REMOVING THE HOUSINGS AND COVERS

2.1 Removing the housings of the head support

The screws of cephalostat housings can be reached through the ear post holder attachment opening on the rotatable head support cover. The back housing is attached with one M5x10 DIN 7984 screw (1), and the large front housing is attached to the head support with four M5x10 DIN 7984 screws (2 - 5). Note that you have to rotate the rotatable head support to different positions to reach all the attachment screws.

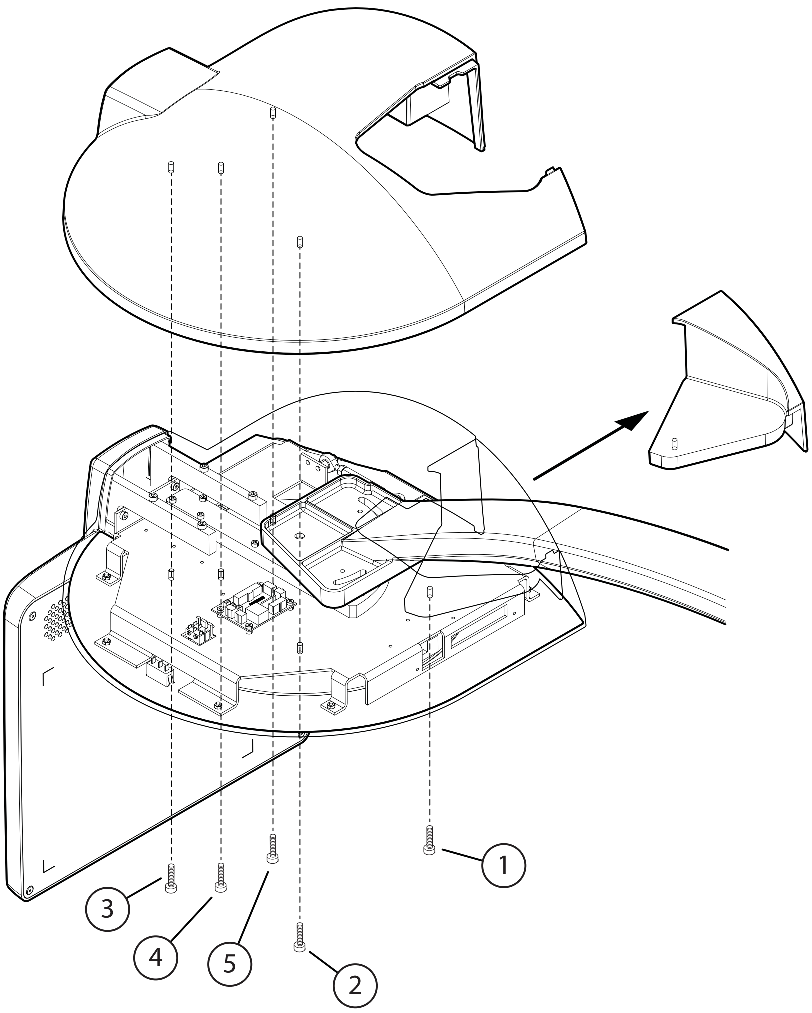


Figure 25

Rotate the head support to the 30° position as shown on the Fig. 26 below and unscrew the back housing attachment screw with the 3mm Allen key and remove the housing.

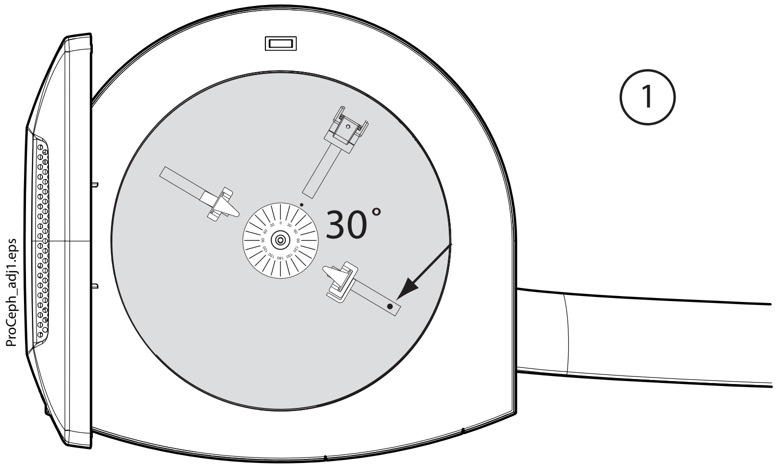


Figure 26

Rotate the head support to the 45° position as shown on the Fig. 27 below and unscrew the attachment screw number 2 with the 3mm Allen key.

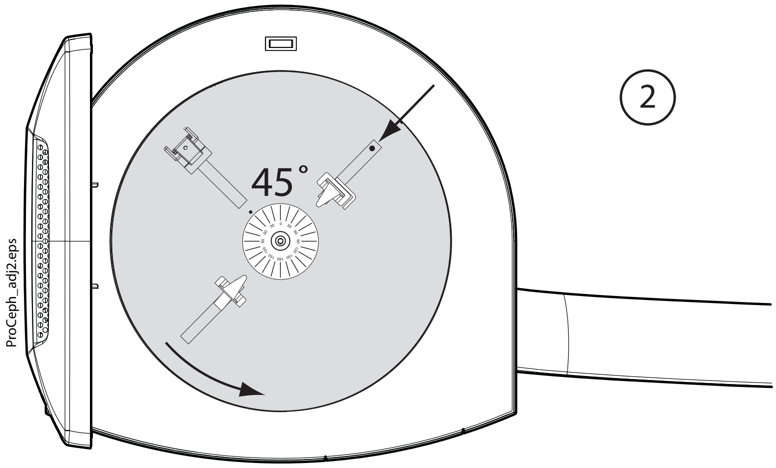


Figure 27

Rotate the head support to the 135° position as shown on the Fig. 28 below and unscrew the attachment screws number 3 and 4 with the 3mm Allen key.

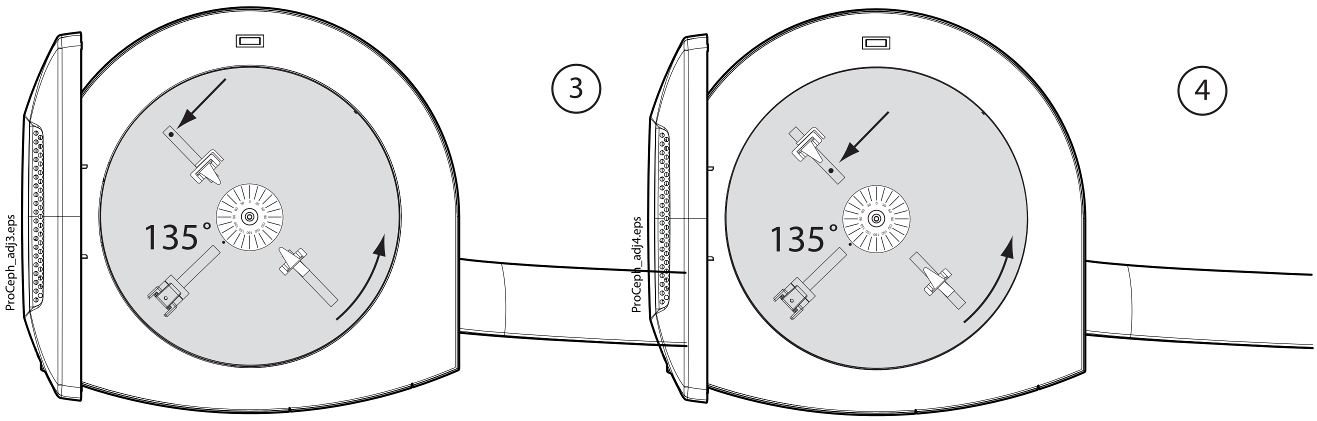


Figure 28

Rotate the head support to the 150° position as shown on the Fig. 29 below and unscrew the attachment screw number 5 with the 3mm Allen key. The front housing can now be lifted from its position.

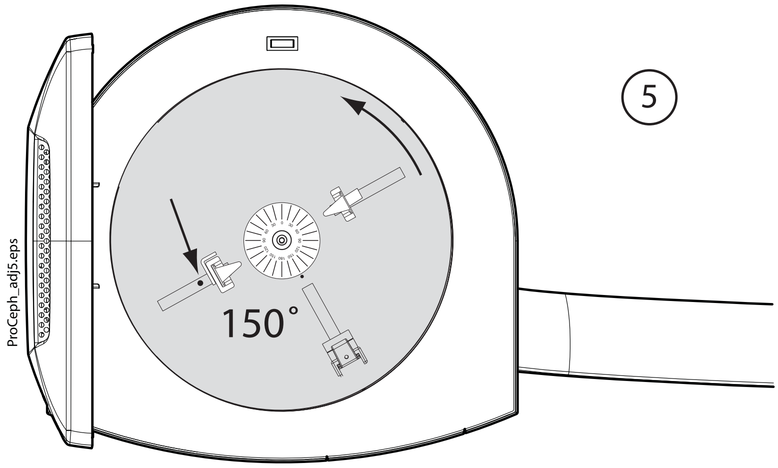


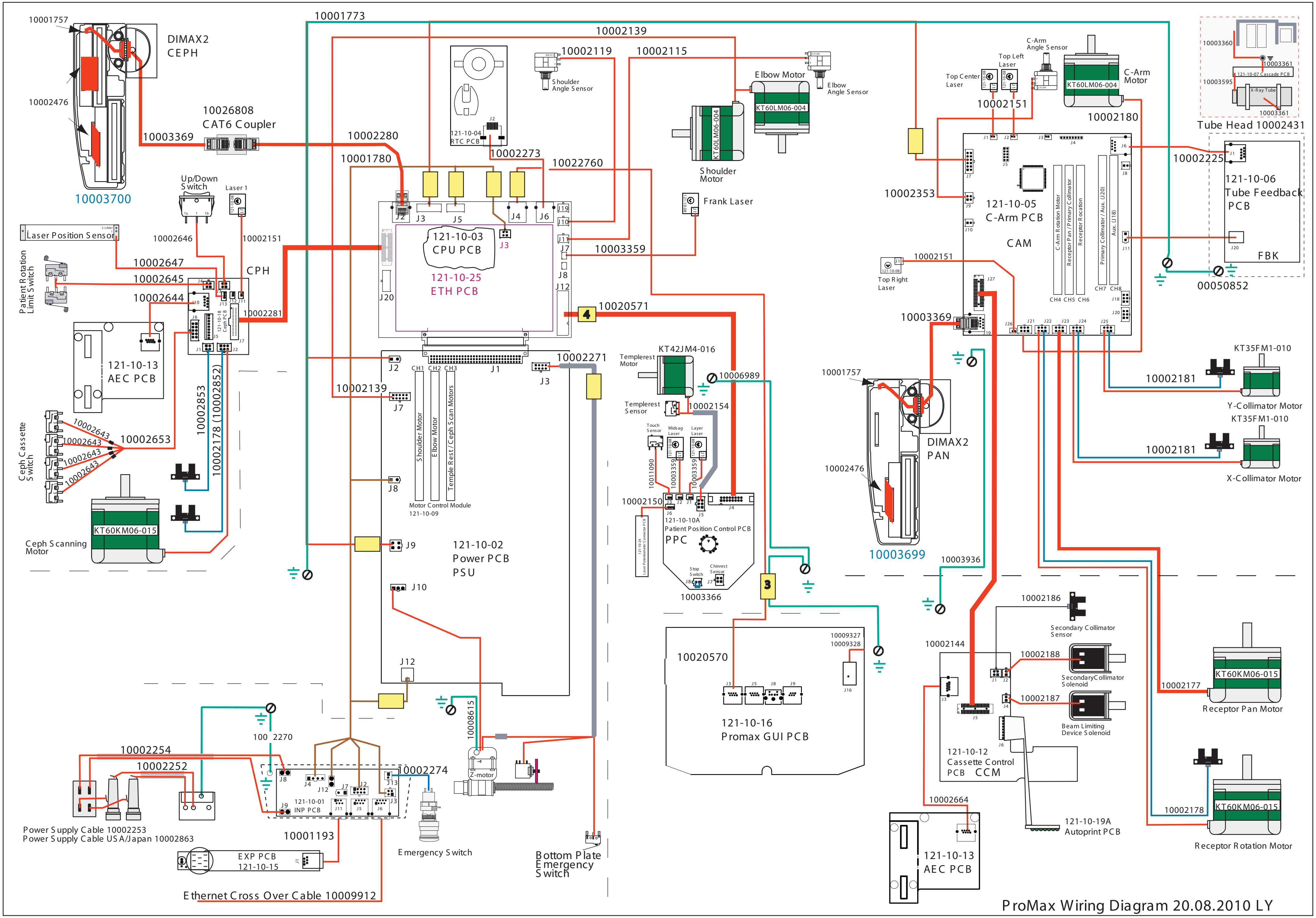
Figure 29

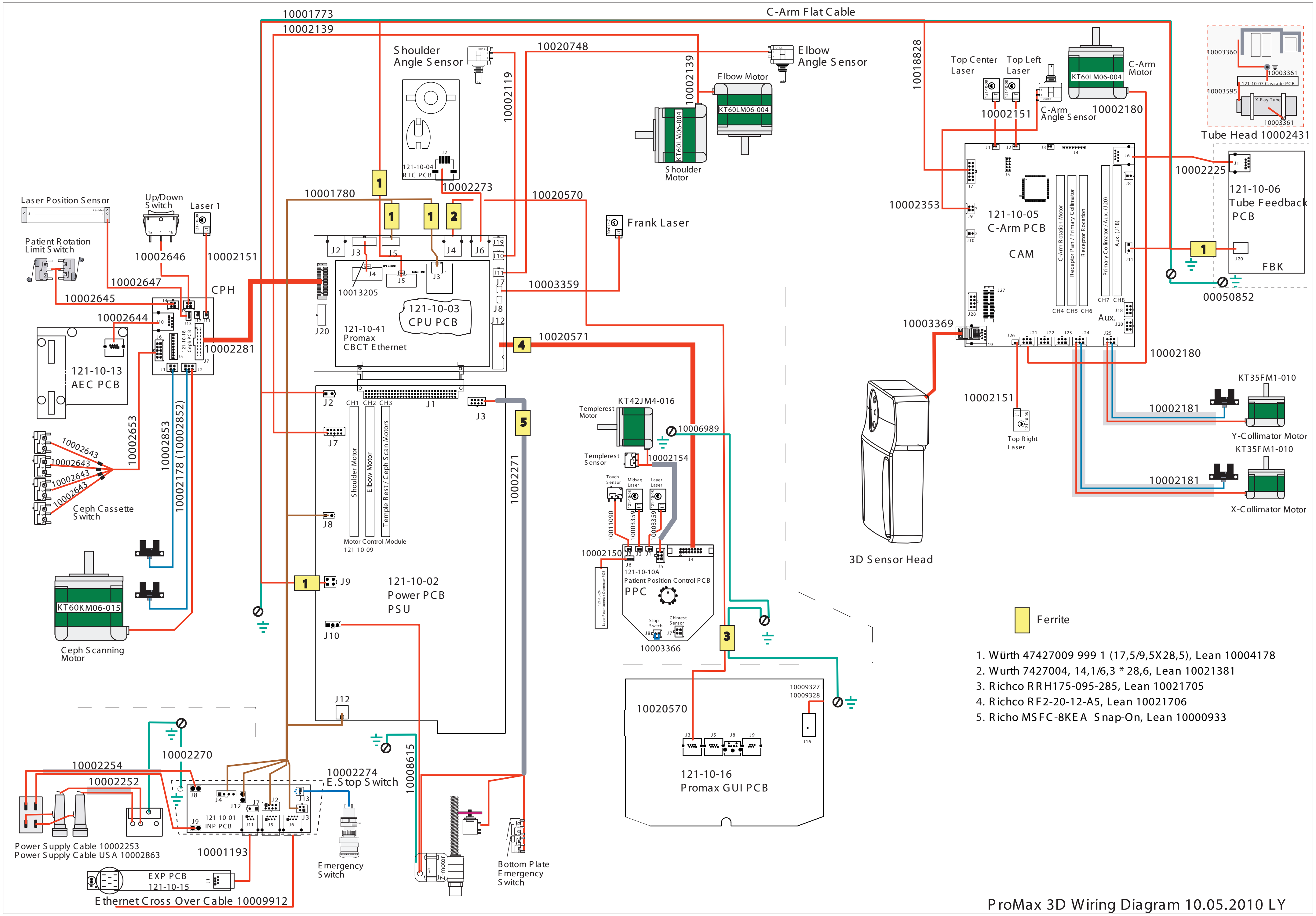
Attach the housings to the cephalostat head support in reverse order.

Chapter

J

DIAGRAMS

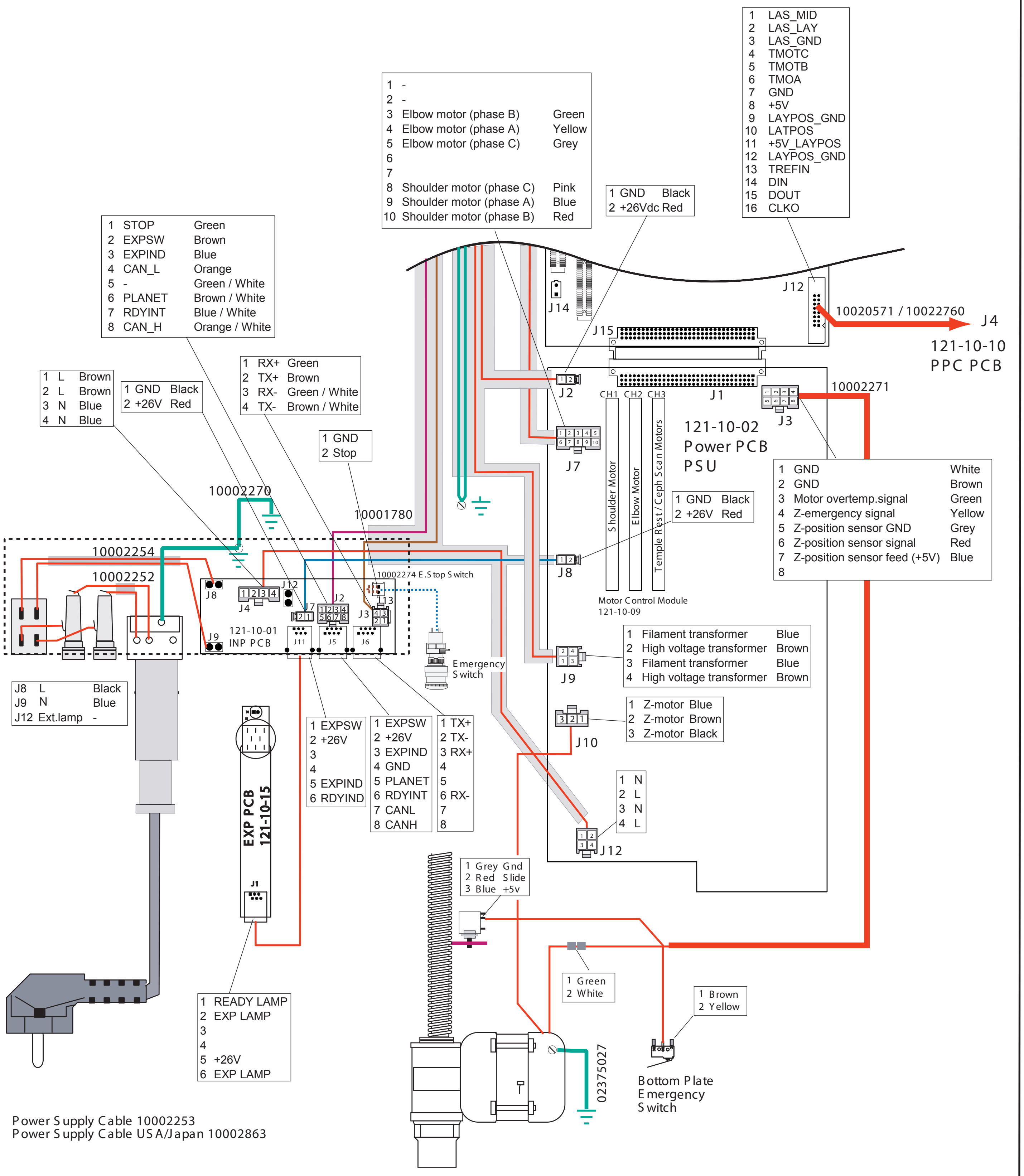

DIMAX2
CEPH
10001757
10002476
10003700
10026808
CAT6 Coupler
10003369
10001773
10002139
10002119
10002115
Shoulder Angle Sensor
Elbow Motor
Elbow Angle Sensor
KT60LM06-004
Shoulder Motor
Frank Laser
121-10-04 RTC PCB
10002280
10001780
10002273
10022760
121-10-03
CPU PCB
121-10-25
ETH PCB
10003359
10020571
Up/Down Switch
Laser 1
Laser Position Sensor
10002646
10002151
10002647
10002645
10002644
CPH
10002281
Patient Rotation Limit Switch
121-10-13
AEC PCB
10002853
10002178 (10002852)
Ceph Cassette Switch
10002643
10002653
Ceph Scanning Motor
KT60KM06-015
10002139
10002271
Motor Control Module 121-10-09
Shoulder Motor
Elbow Motor
Temple Rest / Ceph Scan Motors
121-10-02
Power PCB
PSU
J12
Templerest Motor
KT42JM4-016
10006989
Templerest Sensor
10002154
Touch Sensor
Midsag Laser
Layer Laser
10011090
10002150
121-10-10A
Patient Position Control PCB
PPC
Stop Switch
Chinrest Sensor
10003366
10008615
Z-motor
100 2270
10002254
10002252
10002274
121-10-01
INP PCB
Power Supply Cable 10002253
Power Supply Cable USA/Japan 10002863
10001193
EXP PCB
121-10-15
Emergency Switch
Bottom Plate Emergency Switch
Ethernet Cross Over Cable 10009912
10020570
121-10-16
Promax GUI PCB
C-Arm Angle Sensor
Top Left Laser
Top Center Laser
C-Arm Motor
KT60LM06-004
10002151
10002180
10003360
10003361
10003595
121-10-07 Cascade PCB
X-Ray Tube
Tube Head 10002431
10002225
121-10-06
Tube Feedback PCB
FBK
10002353
121-10-05
C-Arm PCB
CAM
C-Arm Rotation Motor
Receptor Pan / Primary Collimator
Receptor Rotation
Primary Collimator / Aux. (J20)
Aux. (J18)
Top Right Laser
00050852
10003369
10001757
DIMAX2
PAN
10002476
10003699
10003936
KT35FM1-010
10002181
Y-Collimator Motor
X-Collimator Motor
10002186
Secondary Collimator Sensor
10002144
10002188
Secondary Collimator Solenoid
10002187
Beam Limiting Device Solenoid
121-10-12
Cassette Control PCB CCM
10002664
121-10-13
AEC PCB
121-10-19A
Autoprint PCB
10002177
Receptor Pan Motor
KT60KM06-015
10002178
Receptor Rotation Motor
ProMax Wiring Diagram 20.08.2010 LY



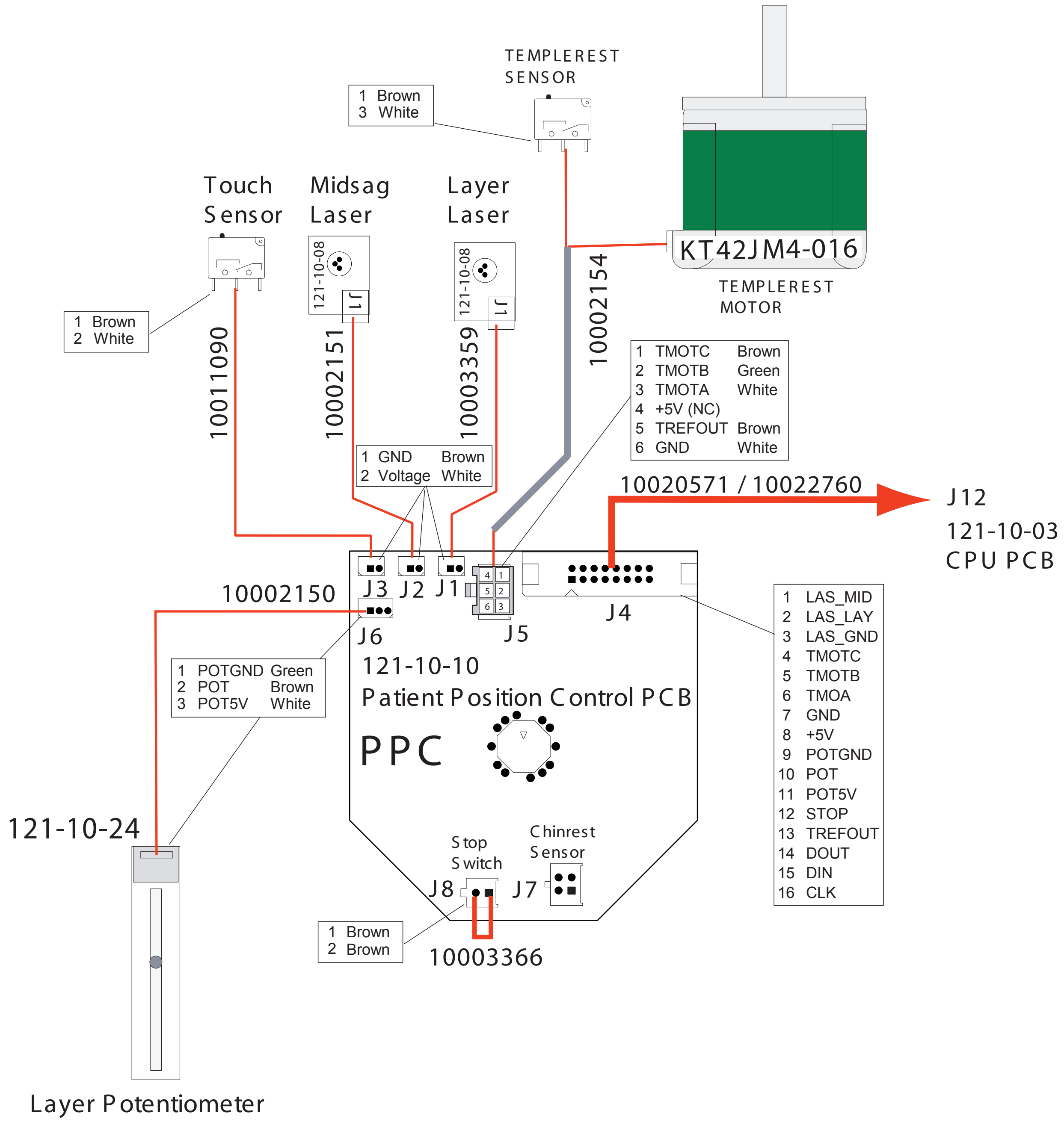
Ferrite

1. Würth 47427009 999 1 (17,5/9,5X28,5), Lean 10004178
2. Wurth 7427004, 14,1/6,3 * 28,6, Lean 10021381
3. Richco RRH175-095-285, Lean 10021705
4. Richco RF2-20-12-A5, Lean 10021706
5. Richo MSFC-8KEA Snap-On, Lean 10000933

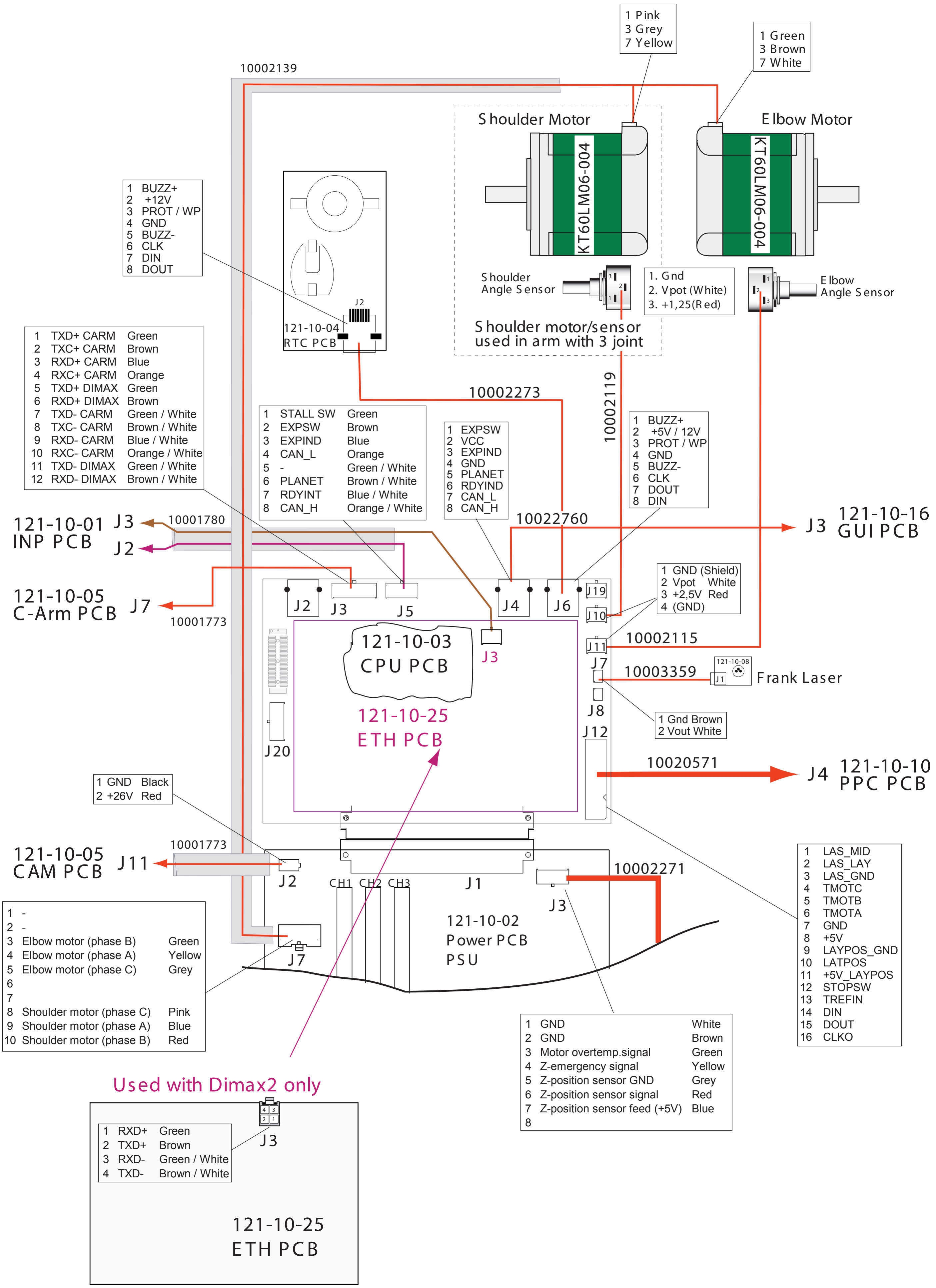
ProMax 3D Wiring Diagram 10.05.2010 LY



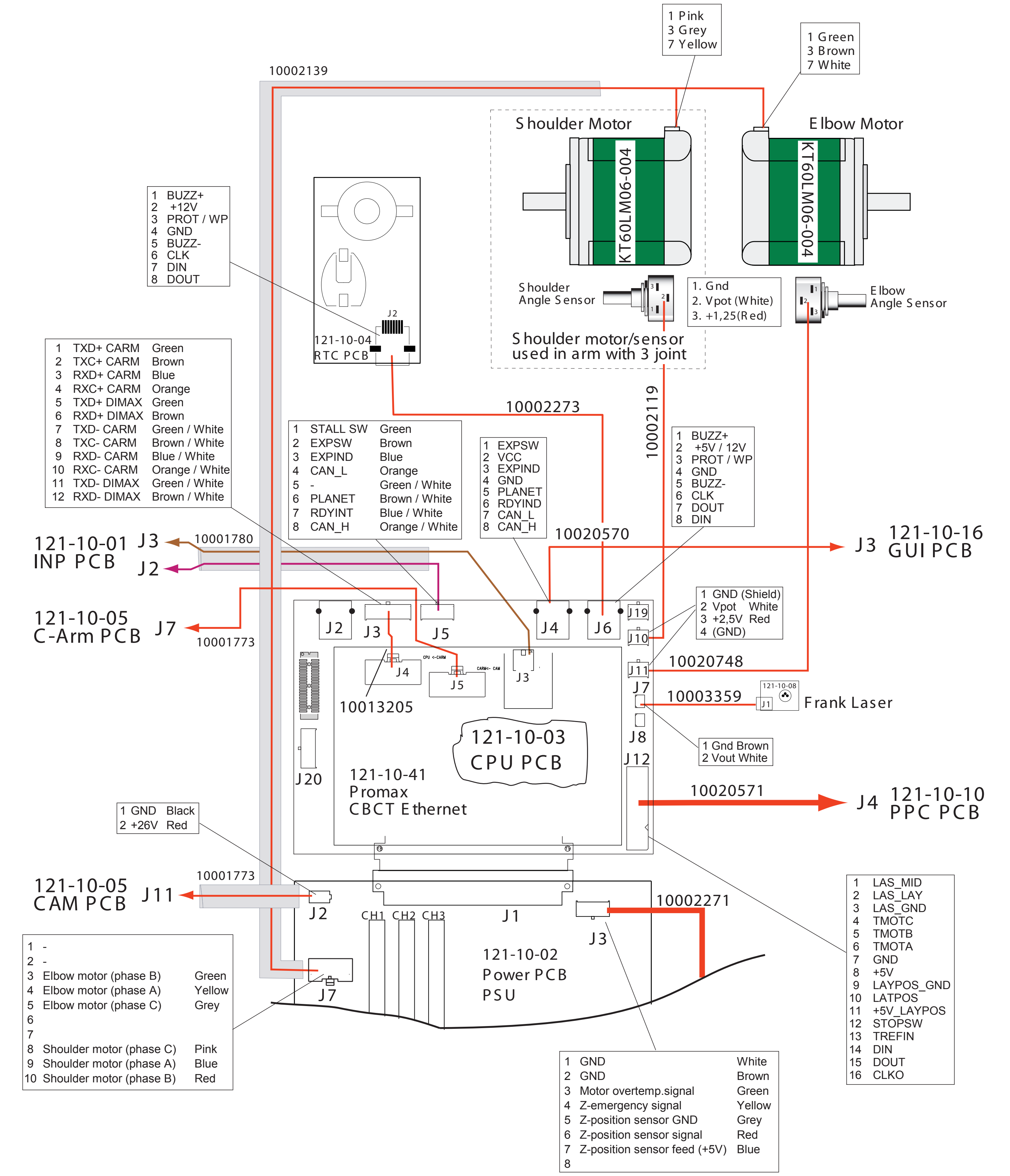
PLANMECA OY Asentajankatu 6 00810 Helsinki Finland	10.05.2010 LY	ProMax WIRING DIAGRAM Column



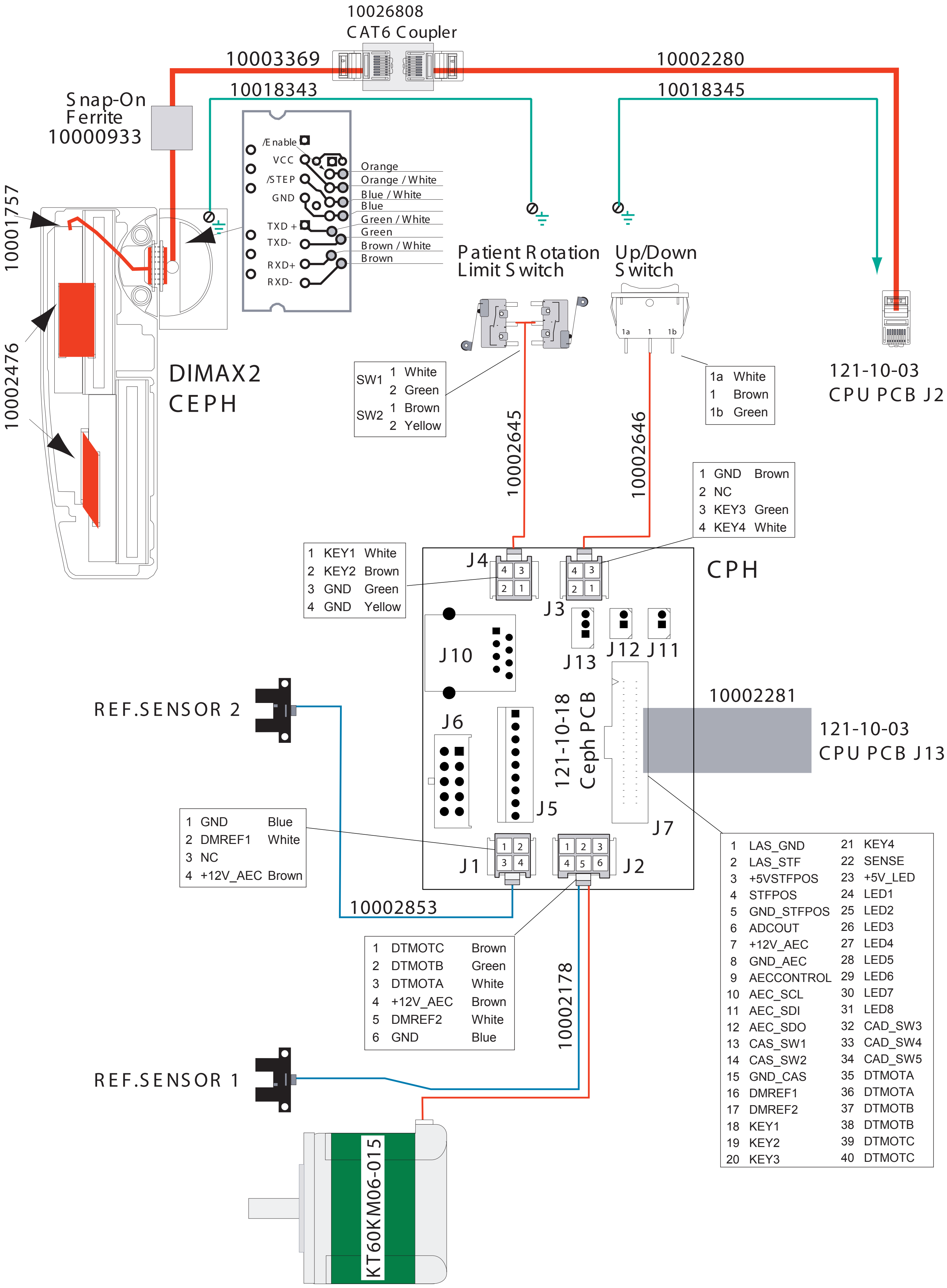
PLANMECA OY Asentajankatu 6 00810 Helsinki Finland	10.05.2010 LY	ProMax WIRING DIAGRAM Patient Support



ProMax CPU PCB / ETH PCB
10.05.2010 LY



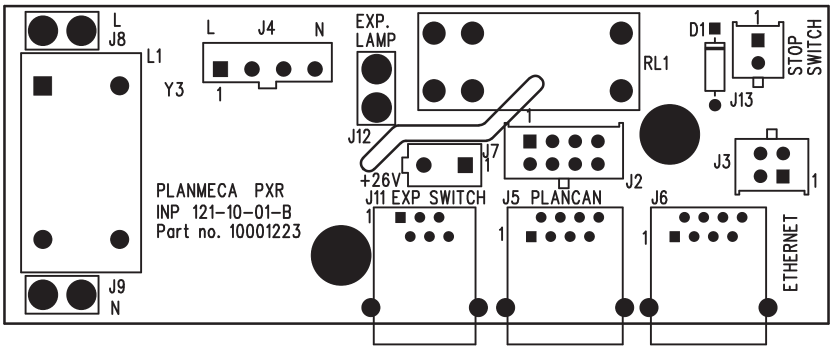
ProMax 3D CPU PCB / CBCT PCB
10.05.2010 LY



Ceph Scanning
Motor

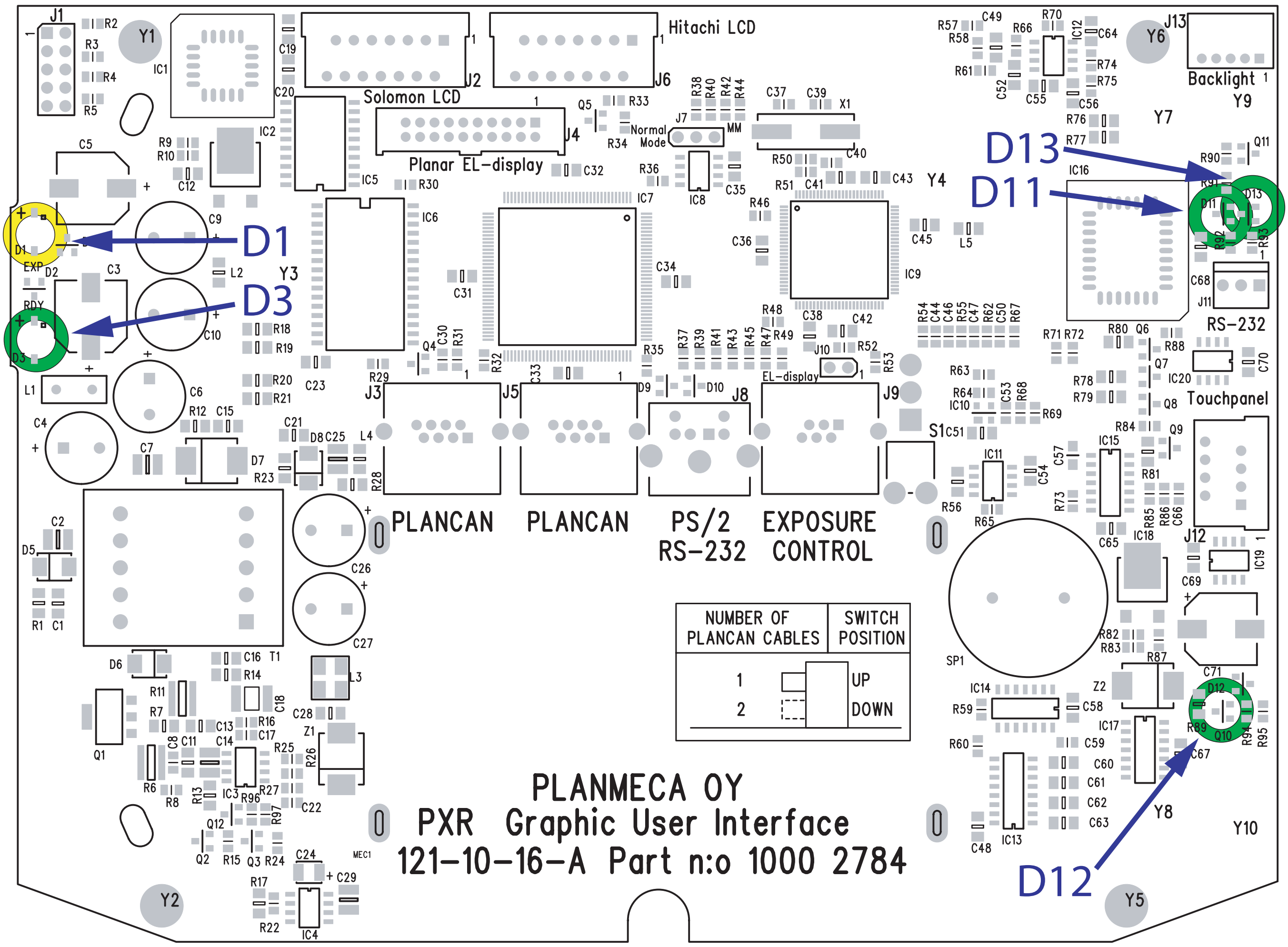
PLANMECA OY Asentajankatu 6 00810 Helsinki Finland	20.08.2010	ProMax WIRING DIAGRAM DIGICEPH
	L.Ylen	

ProMax INP (121-10-01), location of indicators



CONNECTORS & JUMPERS & SWITCHES			
Reference	Name	Normal usage	Details
J2	Plancan	-	-
J3	Ethernet	-	-
J4	Main power	-	
J5	Plancan	-	-
J6	Ethernet	-	-
J7	+26Vdc	-	-
J8,J9	Main switch	-	
J11	Exp.Switch	-	-
J12	Exp.lamp	-	-
J13	Stop switch	-	-

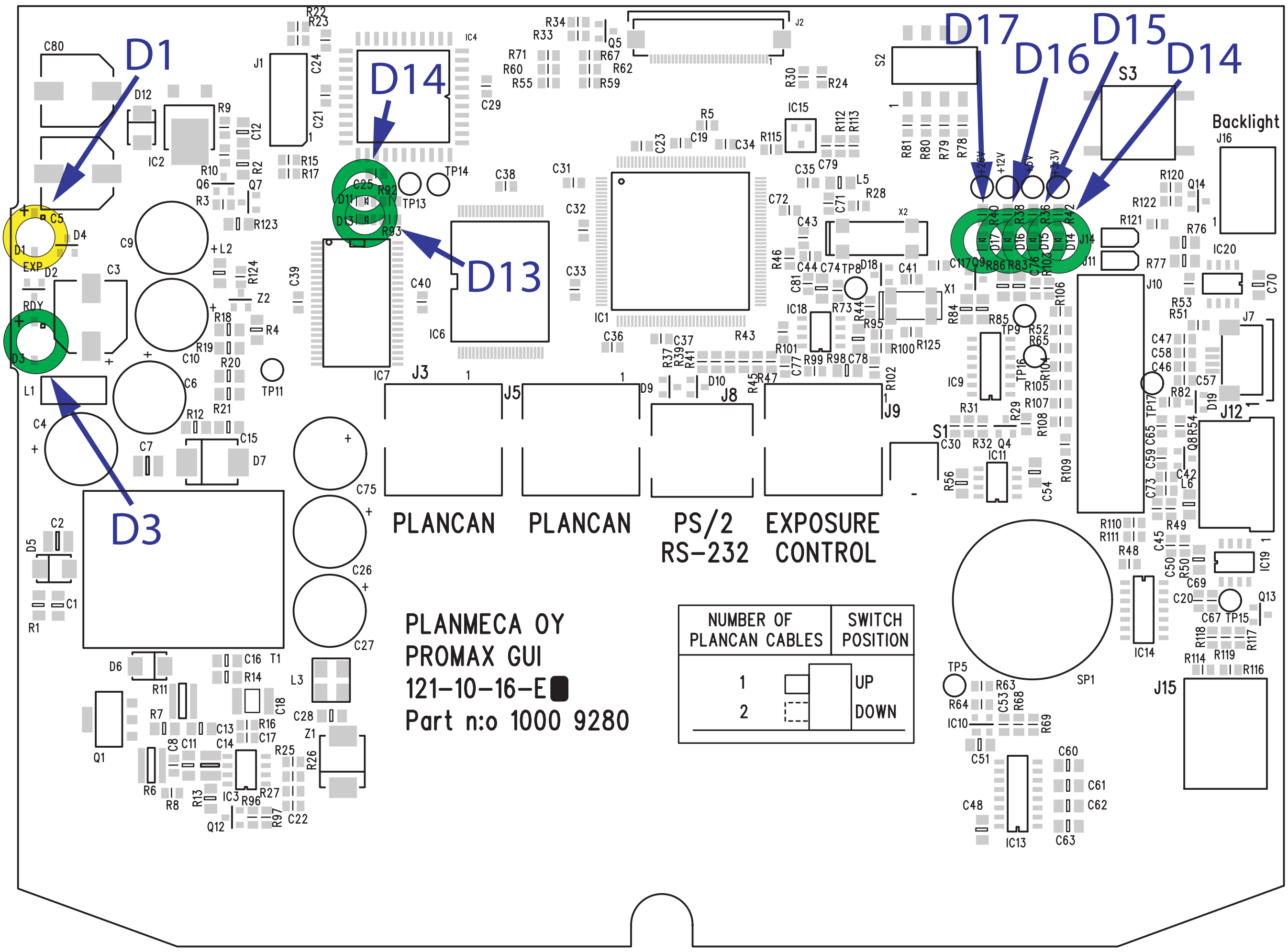
ProMax GUI, B/W (121-10-16), location of indicators



INDICATORS			
Reference	Name	Color / Normal status	Details
D1	EXPLMP	Yellow /off	lit when exp-key pressed
D3	RDYLMP	Green /on	lit when possible to radiate
D11	MEAS	Green /?	?
D12	+5Vdc_stby	Green /on	lit when +5V_STBY regulator delivering power
D13	MEAS	Green /...	?

CONNECTORS & JUMPERS & SWITCHES			
Reference	Name	Normal usage	Details
J1	EPC Config	-	-
J2	Solomon LCD	-	-
J3	Plancan	-	
J4	Planar EL-display	-	-
J5	Plancan	-	-
J6	Hitachi LCD	-	-
J7	EPC Config	-	
J8	PS/2 & RS232	-	-
J9	Exp.Switch	-	exposure switch
J10	EL Display	-	-
J11	Monitor mode	-	monitor mode RS232
J12	Touch Panel	always	-
J13	Backlight	always	-

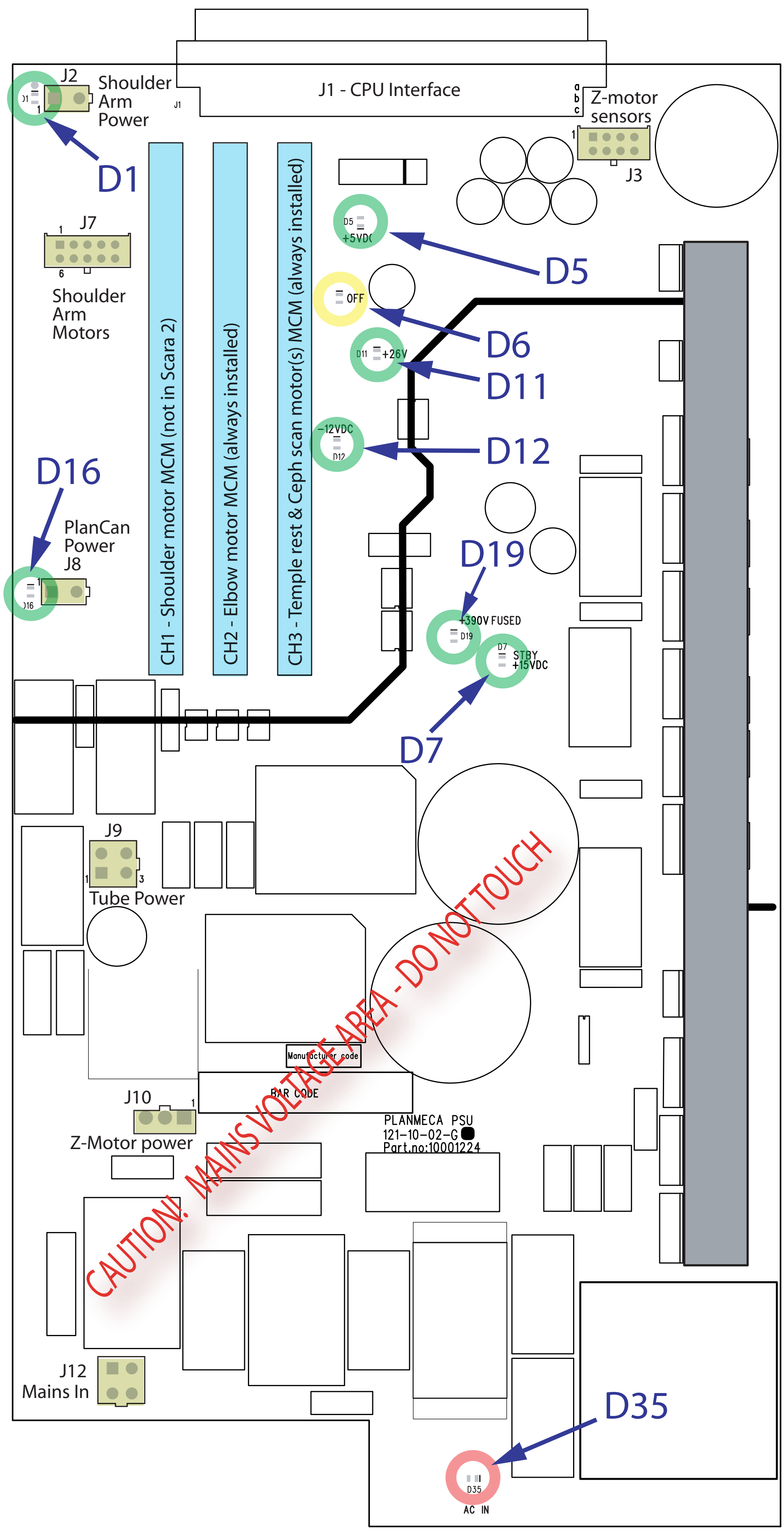
ProMax GUI, Color (121-10-16), location of indicators



INDICATORS			
Reference	Name	Color / Normal status	Details
D1	EXPLMP	Yellow / off	on during exposure
D3	RDYLMP	Green / off	on when possible to take an exposure
D11	-	Green / on	sw status led
D13	-	Green / blinking	sw status led
D14	+3,3V	Green / on	always on
D15	+5V	Green / on	normally on, off in sleep-mode
D16	+12V	Green / on	normally on, off in sleep-mode
D17	+26V	Green / on	normally on, dimmer in sleep-mode

CONNECTORS & JUMPERS & SWITCHES			
Reference	Name	Normal usage	Details
J1	JTAG to PLD	-	not installed
J2	Sharp TFT	-	-
J3	Plancan	-	-
J5	Plancan	-	-
J7	Touch Panel	-	4-Wire
J8	PS/2 & RS232	-	-
J9	Exp.Switch	-	-
J10	JTAG Interface	-	-
J11	Test Jumper	-	-
J12	Touch Panel	-	8-Wire
J14	Test Jumper	-	-
J15	SPI Interface	-	not installed
J16	TDK Backlight	-	-

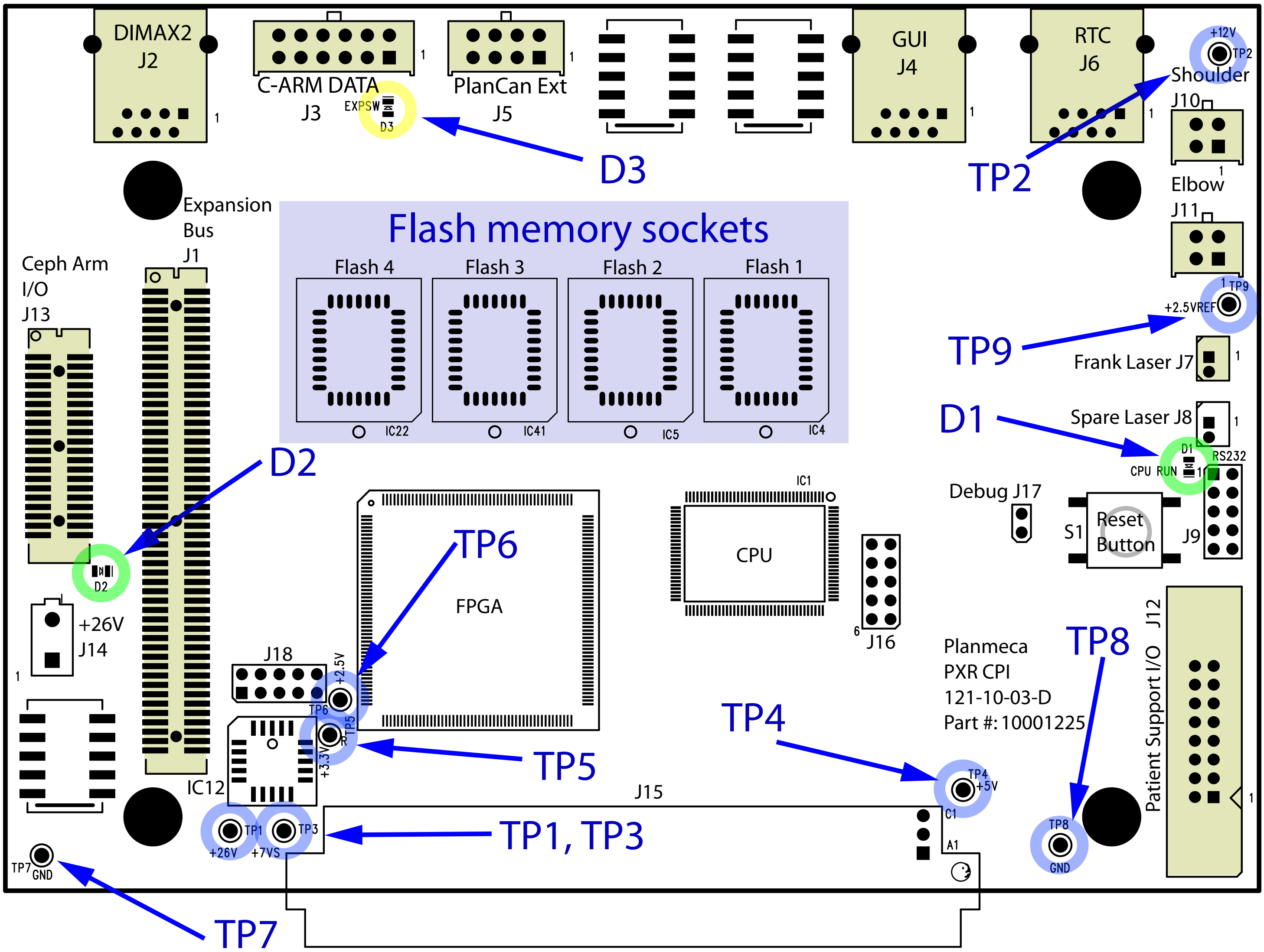
ProMax PSU (121-10-02)
Location of indicators, fuses and connectors



CONNECTORS & FUSES			
Reference	Name	Normal usage	Details
J1	CPU-interface	always connected to CPU PCB	Power & signals from/to CPU PCB
J2	Shoulder Arm Power	always connected	Power feed to CAM PCB and whole rotating part
J3	Z-motor sensors	always connected	Sensor signals from z-motor (position, temperature, eme. Stop.
J7	Shoulder Arm Motors	always connected	Power feed to shoulder & elbow motors
J8	PlanCan Power	always connected	Power feed to INP PCB for external GUI/NUI
J9	Tube Power	always connected	High voltage and filament power feed to x-ray tube
J10	Z-Motor Power	always connected	Power feed to lift motor
J12	Mains In	always connected	Switched mains input fron INP PCB

INDICATORS			
Reference	Name	Color / Normal idle status	Details
D1	Shoulder arm power	Green / normally on	Indicates +26Vdc feed to CAM PCB
D5	+5VDC	Green / normally on	Indicates +5Vdc feed to CPU PCB
D6	OFF	Yellow / normally OFF	Indicates power saving stanby operation when LIT
D7	+15VDC STBY	Green / normally on	Indicates existence of stanby power (not in all models)
D11	+26VDC	Green / normally on	Indicates +26V power supply operation
D12	+12VDC	Green / normally on	Indicates +12V power supply operation
D16	Plancan Power	Green / normally on	Indicates +26Vdc feed to INP PCB and external GUI/NUI
D19	+390 Fused	Green / normally on	Indicates that internal +385V busbar voltage is ok (<330Vdc)
D35	AC IN	Red / on whenewe AC power is on	Never remove or handle board if lit even dimly !

ProMax CPU (121-10-03)
Location of indicators, testpointnts and connectors



INDICATORS			
Reference	Name	Color / Normal status	Details
D1	CPU RUN	Green / normally on or blinking	CPU health indication
D2	[FPGA-status]	Green / normally on	FPGA health indication
D3	EXPWS	Green / on if EXPSW activated	Direct indication of external EXPSW.

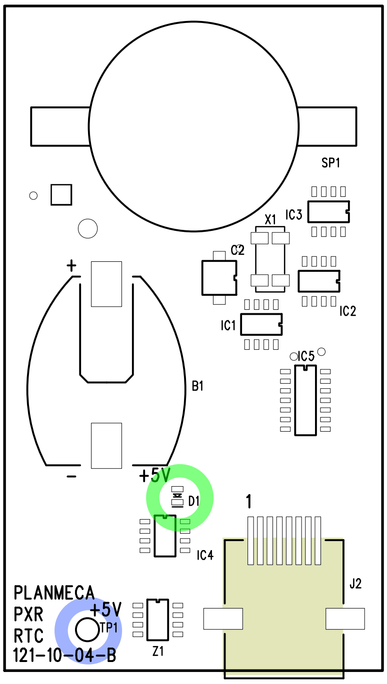
TESTPOINTS			
Reference	Name	Voltage at normal operation	Details
TP1	+26V	+24…+28 Vdc	during standby; 6V…9V
TP2	+12V	+11…+13 Vdc	during stanby; 0V
TP3	+7VS	+6…+9 Vdc	during power off; 0V
TP4	+5V	+4.75…+5.25 Vdc	CPU logic power supply
TP5	+3.3V	+3.15…3.45 Vdc	FPGA I/O power supply
TP6	+2.5V	+2.25…+2.75 Vdc	FPGA core power supply
TP7	GND	0V; system ground	same potential as chassis
TP8	GND	0V; system ground	same potential as chassis
TP9	+2.5Vref	+2.45…+2.55 Vdc	reference for angle sensor A/D's

CONNECTORS & JUMPERS & SWITCHES			
Reference	Name	Normal usage	Details
J1		only if expansion PCB installed	"piggyback" expansion bus
J2	DIMAX2	only in indigital ceph	DIMAX sensor interface cable
J3	C-Arm Data	always	data communication with CAM-PCB
J4	GUI	only if internal GUI/NUI	data & power to internal GUI/NUI
J5	PlanCan Ext	always	interface to external PlanCan
J6	RTC	always	data & power to RTC-PCB
J7	Frank laser	on	laser power feed
J8	Spare laser	not used (reserved)	laser power feed
J9	RS232	not used	used only for fatory testing
J10	Shoulder	only in Scara-3 models	shoulder angle sensor interfacing cable
J11	Elbow	always	elbow angle sensor interfacing cable
J12	Patient Support I/O	always	data & power to PPM-PCB
J13	Ceph Arm I/O	only in CA-ceph units	interface to ceph arm switches
J14	+26V	not used	reserved for future expansion
J15		always	Interface to/from PSU-PCB
J16		not used	reserved for factory testing
J17	Debug	not used (leave open)	reserved for factory testing
J18	Config	not used	reserved for factory testing
S1	Reset	not used	press for CPU reset without power off

IMPORTANT NOTES:

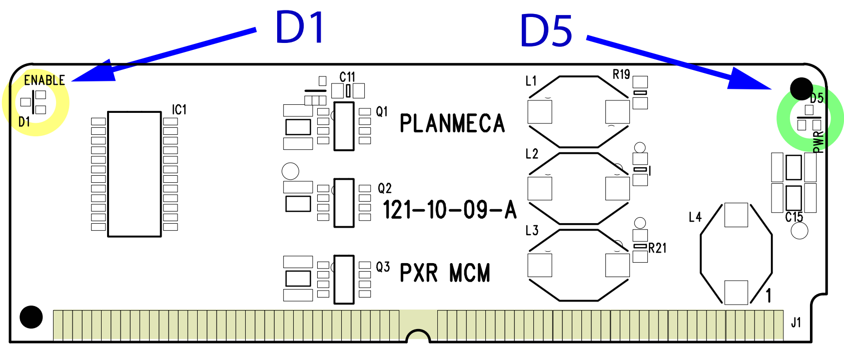
+ CAUTION: This board is sensitive to static electricity. Handel with care !
+ BEWARE: A short circuit at a test point can cause damage to the board !

ProMax RTC (121-10-04), location of indicators



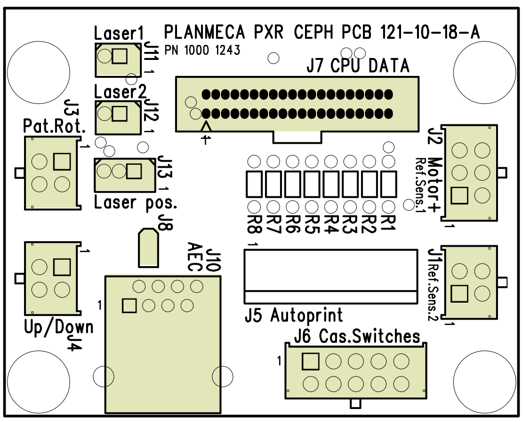
RTC - INDICATORS & TEST-POINTS			
Reference	Name	Color / Normal idle status	Details
D1	+5V	Green / normally on	Indicates that the RTC-PCB is connected and receives power
TP1	+5V	+4.75 … +5.25 Vdc	

ProMax MCM (121-10-09), location of indicators



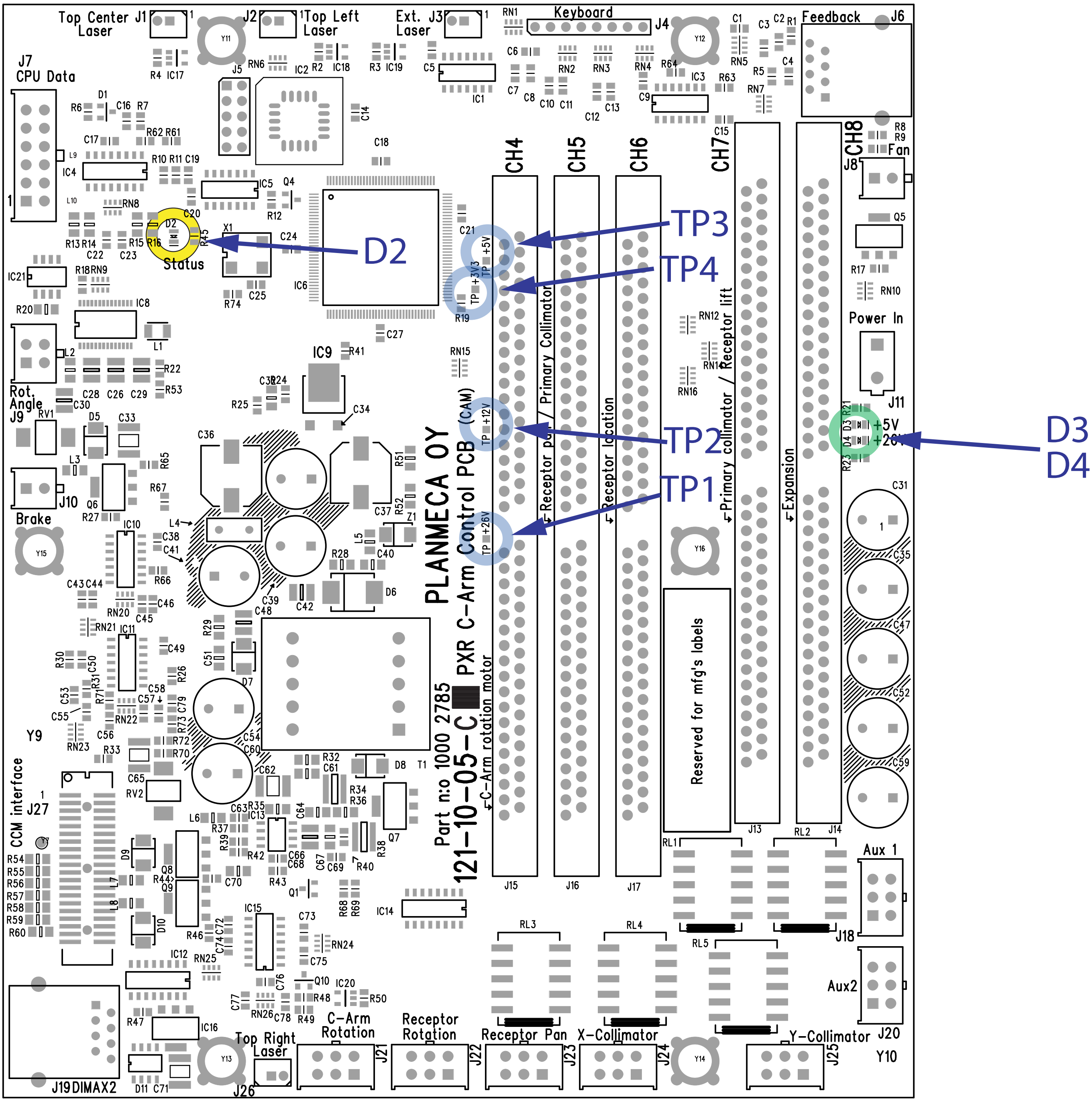
MCM - INDICATORS			
Reference	Name	Color / Normal idle status	Details
D1	Enable	Yellow / lit only when enabled	Indicates that module is enabled and the motor can receive power
D5	PWR	Green / normally on	Indicates that module reveices power from host PCB

ProMax CPH (121-10-18), location of indicators



CONNECTORS & JUMPERS & SWITCHES			
Reference	Name	Normal usage	Details
J1	Ref. Sensor 2	only in digital ceph	ceph scanning motor limit sensor
J2	Motor + ref. sensor 1	only in digital ceph	ceph scanning motor limit sensor
J3	Up/Dwn switch	always	
J4	Patient Rotation	always	patient rotation limit switches
J5	Autoprint	only with Autoprint	Autoprint marking head
J6	Casette switches	only in panceph	casette position
J7	Ceph Arm I/O	only in CA-ceph units	interface to ceph arm switches
J8	AEC ???????	only in panceph (optional)	
J9	-	-	
J10	AEC	only in panceph (optional)	
J11	Laser	always	patient position laser
J12	Laser	no connection	
J13	Laser	always	patient laser potentiometer

ProMax C-Arm (121-10-05), location of indicators

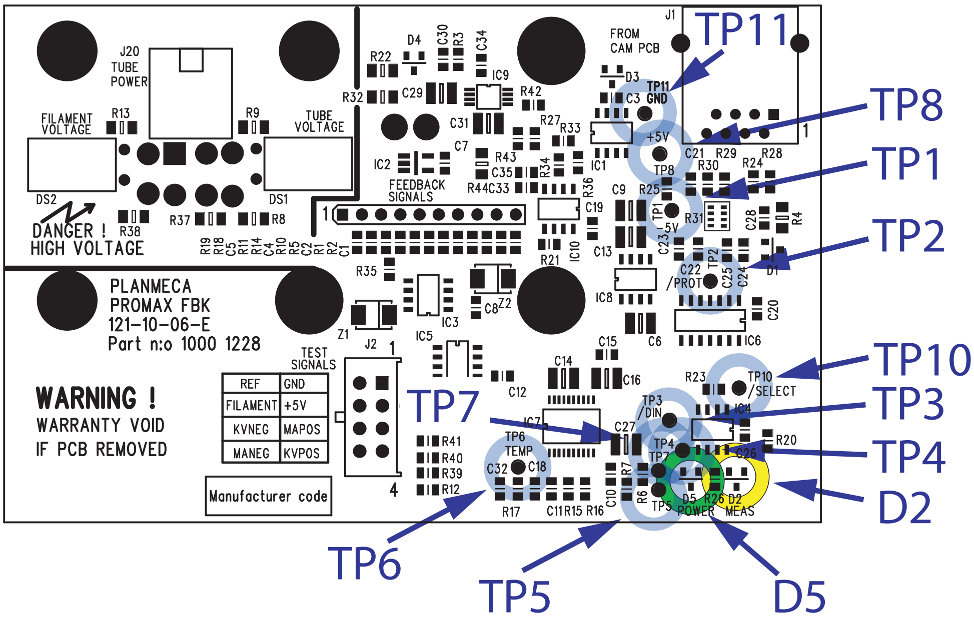


INDICATORS			
Reference	Name	Color / Normal status	Details
D2	CPU RUN	Yellow / normally on or blinking	CPU health indication
D3	[FPGA-status]	Green / normally on	+5V indication
D4	EXPWS	Green / normally on	+26V indication

TESTPOINTS			
Reference	Name	Voltage at normal operation	Details
TP1	+26V	+24…+28 Vdc	during standby; 6V…9V
TP2	+12V	+11…+13 Vdc	during stanby; 0V
TP3	+5V	+4.75…+5.25 Vdc	CPU logic power supply
TP4	+3.3V	+3.15…3.45 Vdc	FPGA I/O power supply

CONNECTORS & JUMPERS & SWITCHES			
Reference	Name	Normal usage	Details
J1	Top Center Laser	always	used only in tomographic mode
J2	Top Left Laser	always	used only in tomographic mode
J3	Ext. Laser	not used	
J4	Keyboard	-	-
J5	CPU Config	-	-
J6	Feedback	always	tube kV/mA feedback
J7	CPU Data	always	-
J8	Fan	not used	-
J9	Rotation Angle	always	C-Arm angle sensor
J10	Brake Solenoid	not used	-
J11	Power In	always	+26V in
J12	-	-	
J13	CH7 Slot	Primary Collimator / AUX.	MCM module only in film unit
J14	CH8 Slot	AUX. not used (reserved)	
J15	CH4 Slot	always	MCM for C-Arm Rotation Motor
J16	CH5 Slot	Rec. Pan/ Pri. Collimatr Motor	MCM module only in film unit
J17	CH6 Slot	Receptor Rotation	MCM module only in film unit
J18	AUX1	not used	reserved for future expansion
J19	Dimax2	only in indigital ceph	DIMAX sensor interface cable
J20	AUX2	not used	reserved for future expansion
J21	C-Arm Rot. Motor	always	
J22	Receptor Rot. Motor	only in film units	
J23	Receptor Pan Motor	always	
J24	X-Collimator Motor	always	Primary Collimator
J25	Y-Collimator Motor	always)	Primary Collimator
J26	Top Right Laser	not used	used only in tomographic mode
J27	CCM interface	only in film units	

ProMax FBK (121-10-06), location of indicators

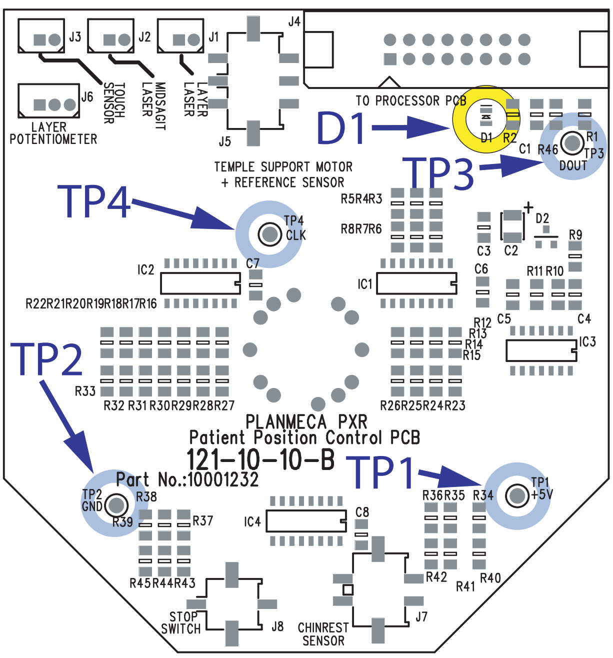


INDICATORS			
Reference	Name	Color / Normal status	Details
D2	MEAS	Yellow /...	-
D5	Power	Green /normally on	-

TESTPOINTS			
Reference	Name	Voltage at normal operation	Details
TP1	-5V	-	-
TP2	/protect	-	-
TP3	/DIN	-	-
TP4	/CLK	-	-
TP5	+test	-	-
TP6	Temp	-	-
TP7	-test	-	-
TP8	+5V	-	-
TP10	/select	-	-
TP11	Gnd	-	-

CONNECTORS & JUMPERS & SWITCHES			
Reference	Name	Normal usage	Details
J1	Digital control	always	-
J2	Analog test conn.	-	analog test signal outputs
J16	Feedback fromHV-board	-	
J20	Ethernet	always	to ethernet on input PCB

ProMax PPC (121-10-10), location of indicators

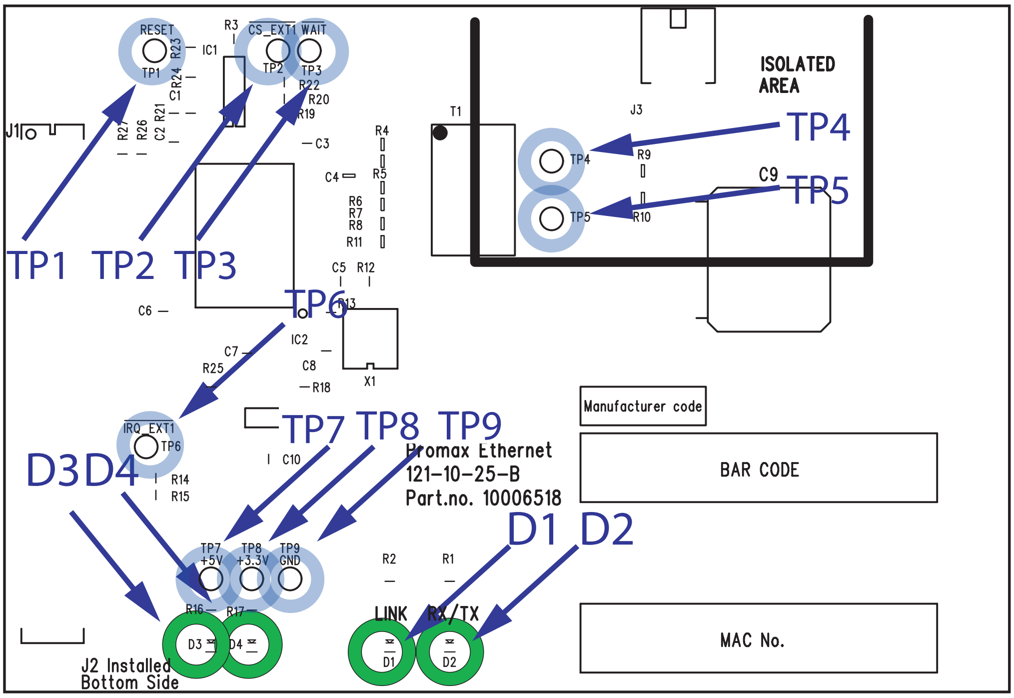


INDICATORS			
Reference	Name	Color / Normal status	Details
D1	+5V	Yellow / normally on	logic power supply

TESTPOINTS			
Reference	Name	Voltage at normal operation	Details
TP1	+5V	+4.75...+5.25 Vdc	logic power supply
TP2	Gnd	Gnd	-
TP3	DOUT	-	-
TP4	CLK	-	-

CONNECTORS & JUMPERS & SWITCHES			
Reference	Name	Normal usage	Details
J1	Layer laser	-	-
J2	Midsag laser	-	-
J3	Touch sensor	-	
J4	to processor PCB	-	-
J5	Temple support motor + ref sensor	always	-
J6	Layer potentiometer	always	-
J7	Chinrest sensor	not used	-
J8	Stop Switch	shortcircuit with connector	-

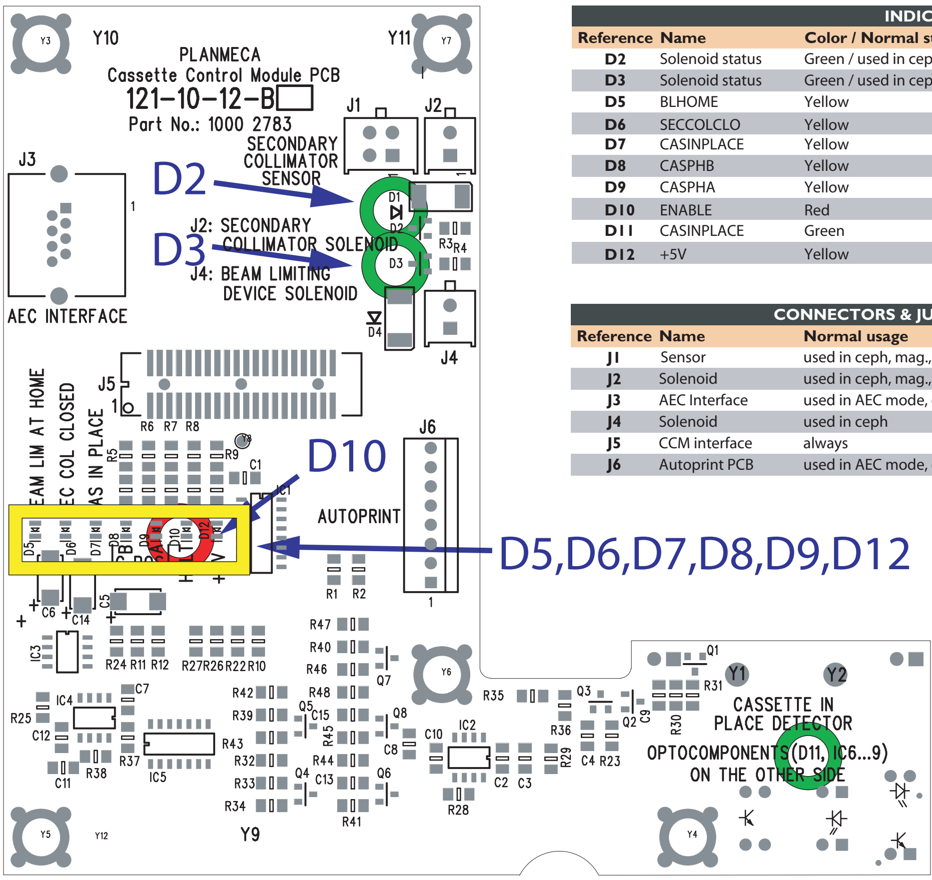
ProMax ETH (121-10-25), location of indicators



INDICATORS			
Reference	**Name**	**Color / Normal status**	**Details**
D1	LINK	Green / always	-
D2	RX/TX	Green / always when Ethernet Connected	-
D3	+5V	Green / always	-
D4	+3.3V	Green / always	-

TESTPOINTS			
Reference	**Name**	**Voltage at normal operation**	**Details**
TP1	RESET	-	-
TP2	CS_EXT1	-	-
TP3	WAIT	-	-
TP4	-	-	-
TP5	-	-	-
TP6	IRQ_EXT1	-	-
TP7	+5V	+5V	-
TP8	+3.3.V	+3.3.V	-
TP9	GND	-	-

ProMax CCM (121-10-12), location of indicators



INDICATORS			
Reference	**Name**	**Color / Normal status**	**Details**
D2	Solenoid status	Green / used in ceph, mag., tomo	Secondary collimator solenoid
D3	Solenoid status	Green / used in ceph	Primary protective shielding solenoid
D5	BLHOME	Yellow	BLHOME
D6	SECCOLCLO	Yellow	SECCOLCLO
D7	CASINPLACE	Yellow	CASINPLACE
D8	CASPHB	Yellow	CASPHB
D9	CASPHA	Yellow	CASPHA
D10	ENABLE	Red	?
D11	CASINPLACE	Green	Casette in place detector
D12	+5V	Yellow	?

CONNECTORS & JUMPERS & SWITCHES			
Reference	**Name**	**Normal usage**	**Details**
J1	Sensor	used in ceph, mag., tomo	Secondary collimator closed position
J2	Solenoid	used in ceph, mag., tomo	Secondary collimator solenoid
J3	AEC Interface	used in AEC mode, optional	
J4	Solenoid	used in ceph	Primary protective shielding solenoid
J5	CCM interface	always	-
J6	Autoprint PCB	used in AEC mode, optional	Autoprint Interface

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