PLANMECA

Planmeca Proline EC pan/ceph/Dimax3

TECHNICAL MANUAL

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Chapter

A

GENERAL & TECHNICAL DATA

1 WARNINGS

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 produces 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 could not be anymore 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 ***PROTECTION AGAINST MECHANICAL HAZARDS***

Before operating the equipment always verify that both of the Z-carriage support cables (steel cables in the grooves on both sides of the column) do not appear to be slack or jammed. Also, if the up/down movement appears to be abnormal, verify that the steel cables are in proper condition. Even though one cable is enough to prevent the equipment from falling down, there will be no security backup if the equipment is operated while one of the cables is broken.

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.

2 MANUAL VERSIONS

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

NOTE ***PLEASE NOTE THAT THIS TECHNICAL MANUAL IS VALID FOR SOFTWARE REVISIONS: FILM-BASED X-RAYS PK 6.50 AND PG 6.50 OR LATER, DIGITAL X-RAYS PK 5.50 AND PG 5.50 OR LATER). If you find that your X-ray unit doesn't have some keyboard functions, or its keyboard functions differs from procedures described in this manual, then either the software must be replaced with at least the above mentioned revision, or you have to relate to an older version of this manual. The former procedure is recommended.***

3 TECHNICAL SPECIFICATIONS

X-ray tube	Toshiba D-052SB
Focal spot size	0.5 x 0.5mm according to IEC 60336
Target angle	5°
Total filtration	min. 2.5 mm Al
Generator	Constant potential, microprocessor controlled, operating frequency 80 kHz
Anode voltage	60-80 kV ± 5%
Anode current	4-12 mA ±(5% + 0.5mA)
Exposure time	Panoramic: 4.9 - 18 s as indicated ±8% Cephalometric: 0.2 - 5 s ±8%
Cooling period	Automatically controlled
Film size (film-based X-ray)	Panoramic:15 x 30 cm Cephalometric: 18 x 24 cm and 8” x 10”

The unit equipped with ceph film size 18 cm x 24 cm

X-ray beam size on film in ceph mode (H x W)	230 mm x 170 mm (primary slots 4 and 5) 170 mm x 230 mm (primary slot 6)

The unit equipped with ceph film size 8 in. x 10 in.

X-ray beam size on film in ceph mode (H x W)	245 mm x 190 mm (primary slots 4 and 5) 190 mm x 245 mm (primary slot 6)
Cassette (film-based X-ray)	Flat
SID	Panoramic: 480 mm (19”) Cephalometric: 160 - 170 cm (63” - 67”)
Magnification	Panoramic: constant 1.2 Cephalometric: 1.08 - 1.13
Line voltage/ Mains frequency	100-132 / 50 or 60 Hz 180 - 240 V~ / 50 Hz
Apparent resistance	0.3 ohms 100 V~ / 0.8 ohms 230 V~
Regulation	Automatic ± 10%
Line current	max. 8A at 230V~, 15A at 100V~
Fusing	8FF 500 VAC at 180 - 240 V~ 16FF 500 VAC at 100 -132 V~
Maximum continuous heat dissipation	< 250W

Electrical classification

Class	I
Type	B

Mechanical data

Weight	Panoramic:108 kg / 238 lbs Pan/ceph 126 kg / 278 lbs
Dimensions	(HxDxW) 2200x930x890 mm, 86.6x36.6x35 inch
Color	RAL 9002

Environmental requirements

Ambient temperature	Operating	+5°C to +40°C
	Storage	-10°C to +50°C (film-based X-ray) 0°C to +50°C (Dimax3 digital X-ray system)
Humidity	25% - 75%	

Dimax3 digital X-ray system

CCD pixel size	33 μm
Image pixel size	130 μm normal resolution 99 μm enhanced resolution
Image size	2200x1000 pixels normal resolution 2940x1360 pixels enhanced resolution
Sensor active area size	Pan 9 x 136 mm Ceph 9 x 230 mm
Image field	Panoramic 14 x 30 cm (5.5 x 12 in.) Cephalometric 22.5 x 30 cm (9 x 12 in.)

External mains fuse recommendation

The recommendation for the external mains fuses are:

- units with 100 - 132 V~ voltage setting: 16A, time lag
- units with 180 - 240 V~ voltage setting: 8A, time lag

No other equipment should be connected to the same fused mains line as the x-ray unit. In some countries an additional external fault current guard is also required.

Manufacturer

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4 USER'S STATEMENT FOR PLANMECA PROLINE EC PANORAMIC X-RAY

Radiation leakage technique factors

The maximum-rated peak tube potential is **80 kVp** and the maximum rated continuous tube current is **12mA** for the maximum-rated peak tube voltage.

Minimum filtration

The Radiation port contains additional filtration of at least **1.5 mm aluminium**.

Total filtration min. **2.5 mmAl**.

When the X-ray beam is attenuated with the 3 mmAl the dose is reduced by factor **0.50-0.56**

Maximum attenuation equivalent of the front panel of the panoramic cassette holder

0.5 mmAl

Rated line voltage

100-132 V~, 180 - 240 V~. Line voltage regulation 10%.

Maximum line current

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

Technique factors that constitute the maximum line current condition

80kV / 12mA

Generator rating and duty cycle

1.5kW, 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

±(5% + 0.5mA)

Maximum deviation of exposure time from indicated value

±8%

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 measured high voltage mean value measured with a calibrated non-invasive kVp meter.

Tube current

Is defined using the resistance and voltage over the feedback resistor measured with a calibrated multimeter. The mA value is then the voltage divided by the resistance.

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

80 kV 12mA

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

12mA 80kV

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

80kV 12mA

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

80 kV 12mA - 1500W

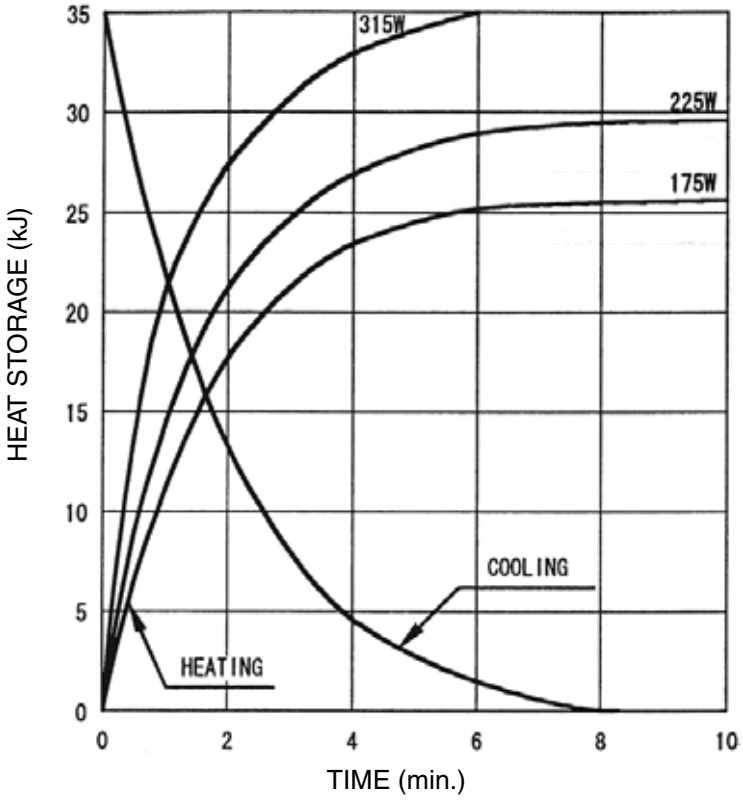
Nominal anode input power of the X-ray tube

1344 W

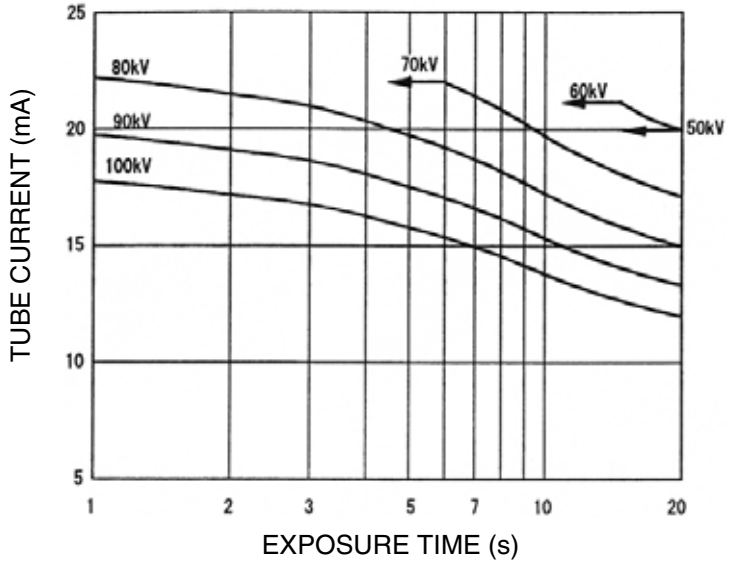
Maximum anode heat content of the X-ray tube

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

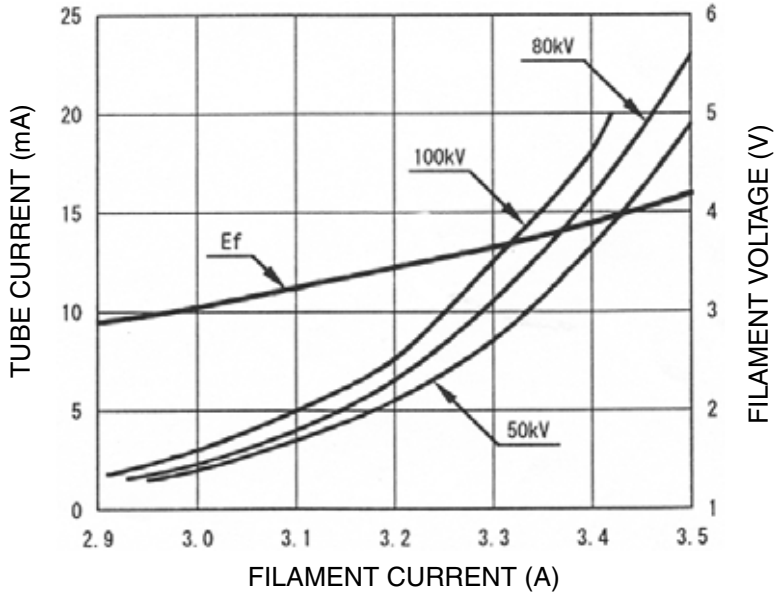
Target angle with respect to the reference axis

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

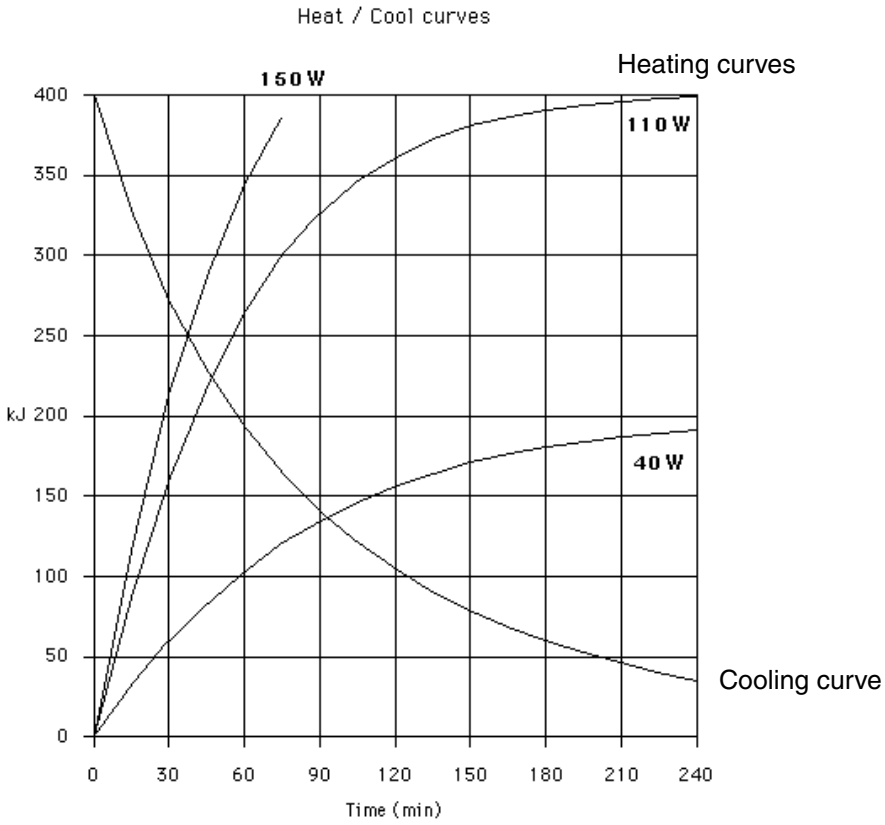
Emission & filament characteristics of the X-ray tube



Maximum X-ray tube assembly heat content

400 kJ

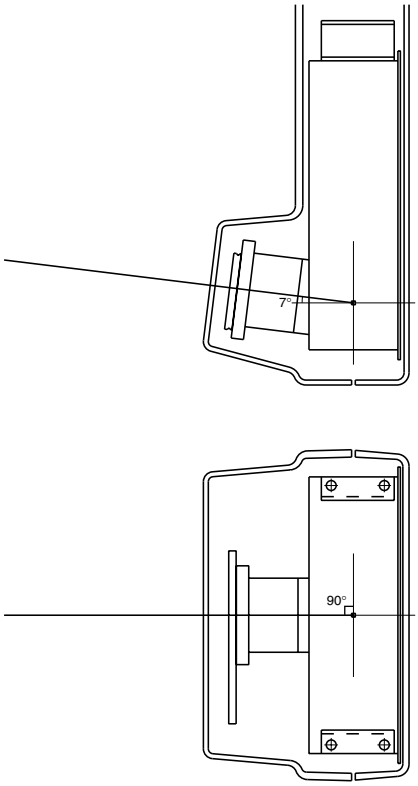
X-ray tube assembly heating/cooling curve



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



Target angle with respect to the reference axis

5°

Dimensions of the tube head assembly

(WxHxD) 245 mm x 275 mm x 135 mm

Weight of the tube head assembly

10.4 kg without collimator assembly
11.3 kg with collimator assembly

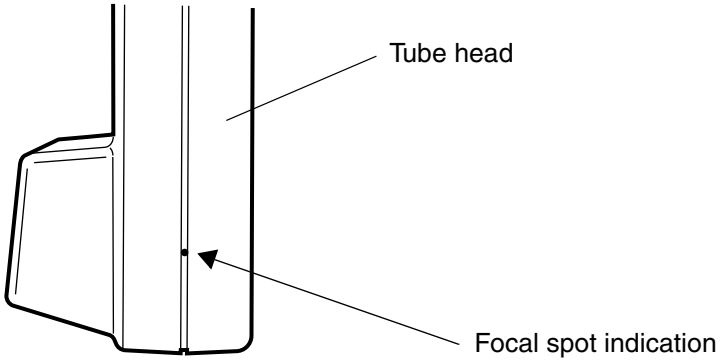
Values of loading factors concerning leakage radiation

80 kV, 12 mA

Tolerances of the focal spot on the reference axis

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

Indication of focal spot



5 EMC INFORMATION

WARNING 

Use of any accessories and cables other than those specified in Planmeca Proline EC X-ray unit's documentation, with 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 Proline EC X-ray unit should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the Planmeca Proline EC X-ray unit should be observed to verify normal operation in configuration which it will be used.

Guidance and manufacturer's declaration - electromagnetic emissions		
Planmeca Proline EC X-ray unit is intended for use in the electromagnetic environment specified below. The customer or the user of the Planmeca Proline EC 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 Proline EC 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 Proline EC 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 Proline EC X-ray unit is intended for use in the electromagnetic environment specified below. The customer or the user of Planmeca Proline EC 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 Proline EC X-ray unit requires continued operation during power mains interruptions, it is recommended that Planmeca Proline EC 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 Proline EC X-ray unit is intended for use in the electromagnetic environment specified below. The customer or the user of Planmeca Proline EC X-ray unit should assure that it is used in such an environment.			
Immunity test	**IEC 60601 test level**	**Compliance level**	**Electromagnetic environment-guidance**
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 Vrms	Portable and mobile RF communications equipment should be used no closer to any part of the Planmeca Proline EC X-ray unit, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance** $d = 1.2\sqrt{P}$ $d = 1.2\sqrt{P}$ 80 MHz to 800 MHz $d = 2.3\sqrt{P}$ 800 MHz to 2.5 GHz where **P** is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and **d** is the recommended separation distance in 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: 
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	
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 Proline EC X-ray unit is used exceeds the applicable RF compliance level above, Planmeca Proline EC 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 Proline EC X-ray unit. [b] Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.			

Recommended separation distances between portable and mobile RF communications equipment and Planmeca Proline EC X-ray unit			
Planmeca Proline EC 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 Proline EC X-ray unit can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the Planmeca Proline EC X-ray unit as recommended below, according to the maximum output power of the communications equipment.			
Rated maximum output power of transmitter **W**	**Separation distance according to frequency of transmitter** **m**		
	150 kHz to 80 MHz $d = 1.2\sqrt{P}$	**80 MHz to 800 MHz** $d = 1.2\sqrt{P}$	**800 MHz to 2.5 GHz** $d = 2.3\sqrt{P}$
0.01	0.2	0.2	0.3
0.1	0.4	0.4	0.7
1	1.2	1.2	2.4
10	4.0	4.0	8.0
100	12.0	12.0	24.0

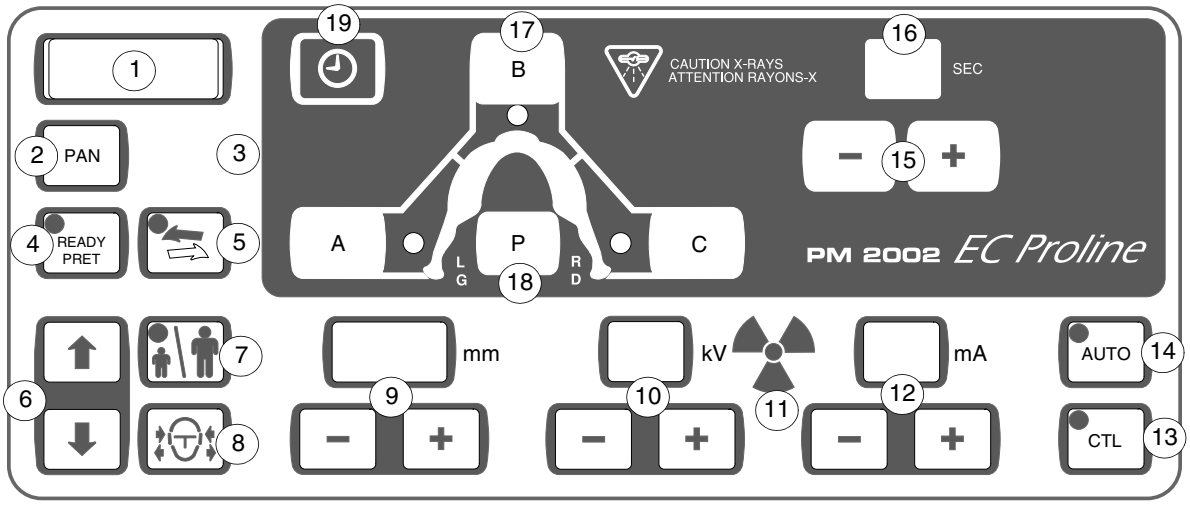
Chapter

B

KEYBOARD FUNCTIONS & MODES

1 KEYBOARD OVERVIEW

This chapter describes keyboard functions in normal and service modes. There are some special control and display modes that are not normally available but which can be entered by certain control sequences. In the following it is explained what operations can be achieved with the keys and which indications appear on the displays.



(1) Display; Time/Error-Help messages/ Tubehead temperature/Wait time

(2) Panoramic mode selection key

(3) Hidden key

(4) Ready key and indicator light

(5) Return key and indicator light lights

(6) Height adjusting keys

(7) Child mode selection key

(8) Temple support key

(9) Focal trough positioning keys and display

(10) kV setting keys and display

(12) mA setting keys and display

(13) Control (CTL) key and indicator light

(14) Auto key and indicator light

(15) Exposure time/Exposure mode selection keys

(16) Exposure time display

(17) Vertical sector selection keys and indicator lights

(18) Program key

(19) Clock key

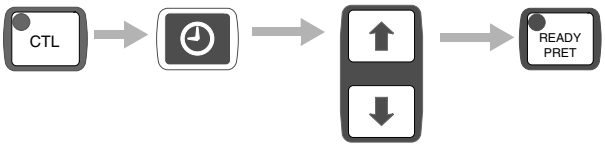
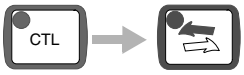
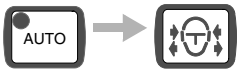
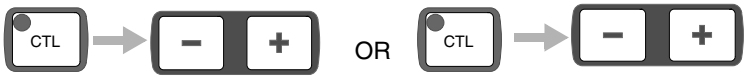
2 NORMAL MODE KEYBOARD FUNCTIONS

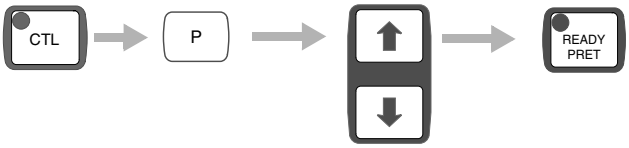
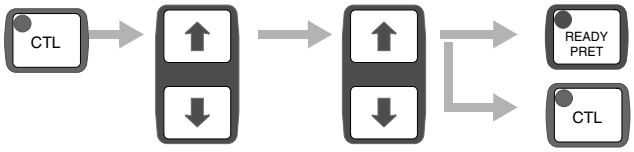
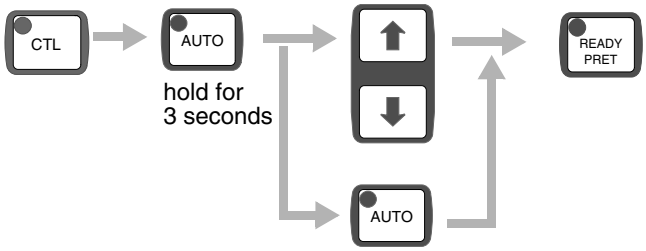
2.1 Normal user functions

The keyboard is always in the normal operating mode when the unit is turned on. Please refer to the Planmeca Proline EC Panoramic X-ray User's manual for descriptions for the normal keyboard operation and instructions for normal everyday use of the unit.

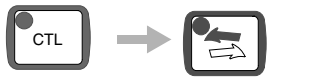
2.2 Special user settings

Press the control (CTL) key to enter the special function mode. The CTL-key's indicator light comes on. In the special function mode some of the keys have special functions, others do not operate in this mode. When the CTL-key or a special function key is pressed, the indicator light goes off and the keyboard is in the normal mode. In this section the special functions are explained.

USER SETTING	KEY SEQUENCE	FOR DETAILS, REFER TO
TIME & DATE ADJUSTMENT		"SETTING THE CLOCK" on page D-25
AUTOMATIC RETURN	 hold for 3 seconds	"Automatic return" on page B-3
TEMPLE REST MOTOR INACTIVATION	 hold for 4 seconds	"Temple rest motor inactivation" on page B-3
AUTOMATIC TEMPLE REST CLOSING INACTIVATION	 hold for 4 seconds	"Automatic temple rest closing inactivation" on page B-4
TEST MODE	 OR	"Test mode" on page B-4

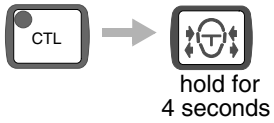
USER SETTING	KEY SEQUENCE	FOR DETAILS, REFER TO
WARNING SOUND TONE ADJUSTMENT		"EXPOSURE WARNING SIGNAL ADJUSTMENT" on page D-26
PARAMETER HISTORY DISPLAY		"Parameter history display" on page B-4
AUTOPRINT SETTINGS		"Autoprint settings" on page B-5

2.3 Automatic return



Press the CTL-key and then press and hold for 3 seconds the return- key to change the state of the automatic return function. The indicator light of the return key indicates whether the function is on or off. With the automatic return on the equipment will automatically return to cassette loading position after panoramic exposures.

2.4 Temple rest motor inactivation



The temple rest motor can be inactivated. Press the CTL-key and press and hold down for 4 seconds the temple support key. The text HLd 0 will appear on the display. Remove the supports, the unit can be used without them.

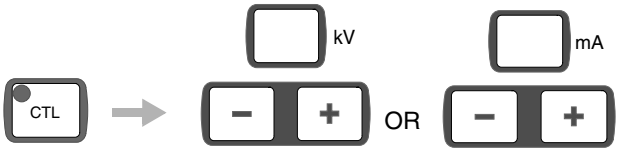
2.5 Automatic temple rest closing inactivation

The temple supports will automatically close when the ready key is pressed.

The automatic temple support closing can be switched off as follows: Press the auto key. The indicator light will come on. Press and hold down the temple supports key for four seconds. The text “hLr0” will appear briefly on the main display indicating that the automatic temple support closing is inactivated.

To switch the automatic temple support closing on repeat the above keying sequence. The text “hLr1” will appear briefly on the main display indicating that the automatic temple support closing is activated.

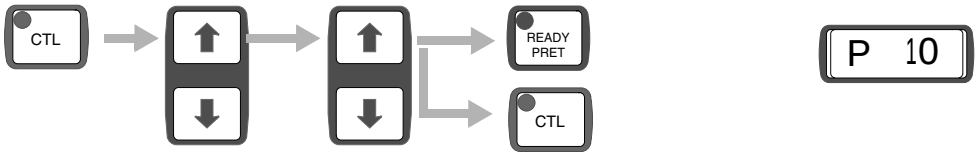
2.6 Test mode



The test mode enables the X-ray to be operated without radiation being generated. Press the CTL-key and press any of the kV selection and mA selection keys. The kV and mA displays will clear indicating that the X-ray tube has been switched off and that you have entered the test mode.

Repeat the above procedure to exit the test mode and switch the radiation on again. The mA and kV values will reappear on the display.

2.7 Parameter history display



The parameters of the 25 previously taken exposures are stored into the memory of the equipment and can be examined or taken into use if desired. Pressing CTL and then the UP or DOWN key activates this parameter history display mode showing the last taken exposure parameters. In this mode the keys ready, up, down and CTL only are operative. Operating the other keys does nothing. The functions of these keys are:

UP	Find next parameters (newer one)
DOWN	Find previous parameters (elder one)
READY	Take the parameters shown into use and exit to normal mode
CTL	Exit to normal mode

All displayed parameters (but the time display) indicate the parameters selected during the specific exposure. If the exposure time display is blinking, it indicates that the taken exposure was a cephalostatic one. Note that everything, including the special segment selections, double TMJ mode etc. are stored into the memory and can be restored with ready key.

NOTE ***The height adjustment is not restored.***

The time display indicates the used exposure mode, e.g. PAn, P 10, CPH4.

If less than 25 exposures have been taken the history does not go down to 25 but only to the amount of exposures taken.

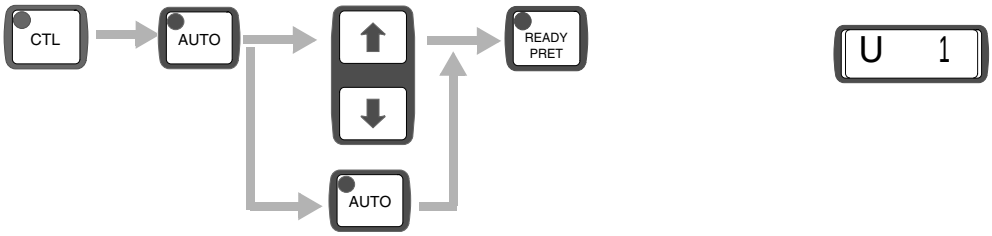
If the history parameters are not desired to be taken into use, there are two ways to exit this mode without altering the currently selected parameters.

When the CTL- key is pressed the equipment returns to normal mode.

When ready is pressed while the running number 00 is displayed the currently selected parameters are taken into use (no change).

Pressing ready changes the currently selected parameters to the ones that were displayed and returns the equipment into normal mode.

2.8 Autoprint settings



Pressing CTL- and then the auto key allows to change the setting of the Autoprint film marking system. The film viewing side and the date format can be changed. A letter and a number will appear on the display. The letter indicates the film viewing orientation and the date format, and the number the contrast of the text that will appear on the film.

Pressing the auto key switches from one film viewing side and date format to the other.

U is American film orientation. The image appearing on the film is a view of the patient's teeth seen as if you were standing behind the patient. The date will also be American format - month/day/year. The date will appear on the film with dashes between the day, month, and year (12-31-92).

E is European film orientation. The image appearing on the film is a view of the patient's teeth when looking directly at the patient. The date will also be European format - day/month/year. The date will appear on film with periods between the day, month, and year (31.12.92).

U1 is European orientation with the American date format.

Pressing the height adjusting keys changes the contrast of the text. There are eight contrast levels, 1 will give you the lightest text and 8 the darkest.

3 SERVICE MODE KEYBOARD FUNCTIONS

CAUTION ***Some of the functions in the service mode may be fatal to the unit's proper operation. Never use special service mode functions if you are not familiar with how they operate. The service mode is only intended for the trained technician.***

CAUTION ***Operating the exposure switch will immediately start the X-Ray generator.***

NOTE ***The operations of the rotation and cassette motors are disabled in this mode to allow generator operation without movements.***

For further diagnosis of the equipment operation a separate service mode has been provided. Various kinds of adjustments and calibrations can also be made in this operating mode. There are also some special control and display modes that are not normally available but which can be entered by certain control sequences. In this section it is explained what operations can be achieved with the keys and which indications appear on the displays.

3.1 How to enter/exit the service mode

Press the CTL-key and simultaneously press and hold down the hidden key (to the right of the panoramic mode selection key) until the temperature of the tubehead appears on the display (about four seconds). The ready key indicator light will start to flash. This indicates that you have entered the service mode.

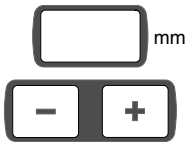
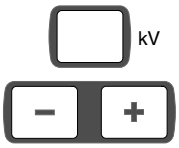
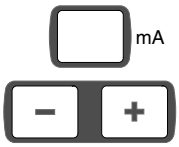
CAUTION ***Some of the functions in the service mode may be fatal to the unit's proper operation. Never use special service mode functions if you are not familiar with how they operate.***

To exit the service mode press the hidden key briefly.

3.2 Service mode keys, displays & indicator lights

Some of the keys, displays and indicator lights have different meanings in the service mode. In the special function mode some of the indicator lights have third meaning. The special function mode is entered by pressing the CTL-key.

KEYS AND DISPLAYS	FUNCTION	FOR DETAILS, REFER TO
	CTL key is used either to clear an error indication, when no further actions are taken, or to give the other keyboard keys special functions.	"Control (CTL) -key and indicator light" on page B-9
	The main display shows the tubehead temperature, an error code or waiting time (blinking).	"Main display" on page B-7

KEYS AND DISPLAYS	FUNCTION	FOR DETAILS, REFER TO
	Focal trough positioning keys are used to switch on the positioning lights and to move the patient. The rotation and cassette movements are not activated in the service mode.	"Focal trough positioning keys" on page B-8
	kV setting keys are used to change the kV-value. The display indicates the selected kV-value. During an exposure the display indicates the actual kV-value measured from the X-ray tube.	"kV keys and display" on page B-8
	mA setting keys are used to change the mA-value. The display indicates the selected mA-value. During an exposure the display indicates the actual mA-value measured from the X-ray tube.	"mA keys and display" on page B-8
	Exposure time display shows the selected type of the X-ray tube.	"Exposure time display" on page B-9

Main display

The main display in the upper left corner normally displays the tubehead temperature.

The seven segments on the right side of the display indicate the sensor(s) signal(s). When the sensor is active (magnet on the sensor) the segment is lit.

- Horizontal segments:
  upper segment: up/down motor limit sensor
  middle segment: temple rest motor limit sensor
  lower segment: layer adjust motor limit sensor
- Vertical segments:
  right upper segment: rotating arm end point limit sensor
  left upper segment: rotating arm start point limit sensor
  right lower segment: cassette holder end (return) point limit sensor
  left lower segment: cassette holder start (ready) point limit sensor

If the system has detected an error the main display indicates the error number occurred. The error is cleared by pressing CTL-key and the temperature display reappears. Also, similarly to the normal mode, if the tubehead temperature exceeds 60 °C the temperature display blinks and the exposures are not allowed and if it is not possible to make a new exposure due to the X - ray tube cooling characteristics the blinking count down time is displayed.

Sector A indicator light

The sector A indicator light is used to indicate the cassette holder carriage start (panoramic) point limit sensor operation. When the sensor is active (magnet on the sensor) this light is on. (Only in Planmeca Proline EC Pan/Ceph X-ray unit)

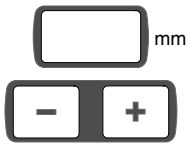
Sector C indicator light

The sector C indicator light is used to indicate the cassette holder carriage end (cephalometric) point limit sensor operation. When the sensor is active (magnet on the sensor) this light is on. (Only in Planmeca Proline EC Pan/Ceph X-ray unit)

Return key indicator light

The return key indicator light is used to indicate the primary slot limit sensor operation. When the sensor is active (something in the sensor slot) this light is on. When operated by the motor movement the active time of the sensor is rather short and is not necessarily always visible on this indicator. (Only in Planmeca Proline EC Pan/Ceph X-ray unit)

Focal trough positioning keys



The minus (-) key is used to switch on the positioning lights and to move the patient forward (focal trough backward) as it is done in the normal mode. The rotation and cassette movements are not activated in the service mode.

The plus (+) key is used to switch on the positioning lights and to move the patient backward (focal trough forward) as it is done in the normal mode. The rotation and cassette movements are not activated in the service mode.

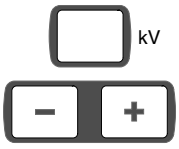
CAUTION ***To allow the seek of the limit sensor in the service mode there is no end stop before the mechanical end. The motor shall not be driven against the ends to prevent it from being damaged!***

CAUTION ***When operating the layer adjustment motor be sure that nothing gets between the moving handles and the groove ends.***

kV keys and display

The kV display indicates the selected kV - value (60 - 80 kV) of the X-ray tube.

NOTE ***During an exposure in the service mode this display does not indicate the selected kV-value but the actual kV-value measured across the X-ray tube.***



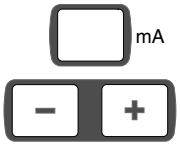
With the minus (-) key the kV - value can be decreased in steps of 2 kV. When kept down for more than 0.5 seconds an auto-repeat function activates.

With the plus (+) key the kV - value can be increased in steps of 2 kV. When kept down for more than 0.5 seconds an auto-repeat function activates.

mA keys and display

This display indicates the selected mA - value (2 - 12 mA) of the X-ray tube.

NOTE ***During an exposure in the service mode this display does not indicate the selected mA-value but the actual mA-value measured from the X-ray tube.***



With the minus (-) key the mA - value can be decreased in steps of 1 mA. When kept down for more than 0.5 seconds an auto-repeat function activates.

With the plus (+) key the mA - value can be increased in steps of 1 mA. When kept down for more than 0.5 seconds an auto-repeat function activates.

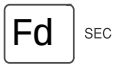
Control (CTL) -key and indicator light

The CTL - key does not activate any operations by itself. It is used either to clear an error indication, when no further actions are taken, or to give the other keyboard keys special functions. When the key is pressed once, the CTL indicator light comes on, indicating that the other keys have special functions if operated. If CTL is pressed while the indicator is on, the indicator goes off and the keyboard keys have their normal functions.

Exposure time display

In the service mode this display shows the type of the X-ray tube. The codes correspond to the following:

Toshiba D-052 SB focal spot 0.5 X 0.5 mm



If the letters Fd is shown on the display, it indicates that the system has not been adjusted for the filament parameters of the current tube and must be allowed to do this by pressing the exposure switch down.

During exposure in the service mode this display shows the measured tube filament voltage.

Ready key and indicator light

The ready key indicator is blinking continuously to indicate that the exposures can be started at any time by operating the exposure switch.

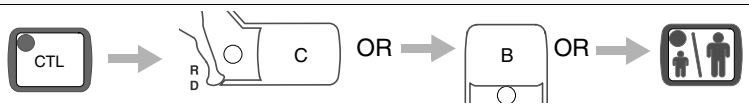
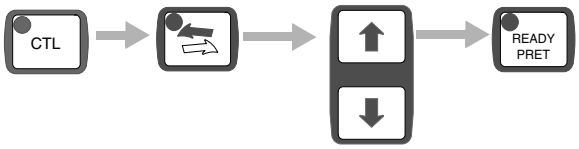
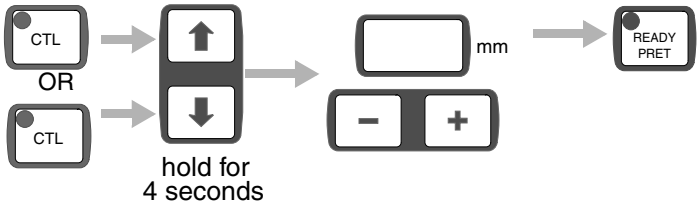
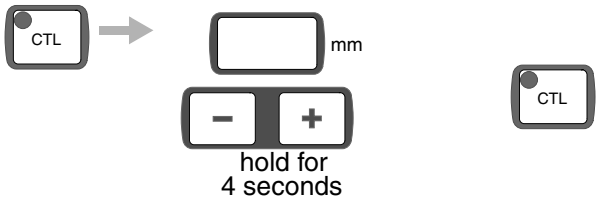
Exposure indicator light

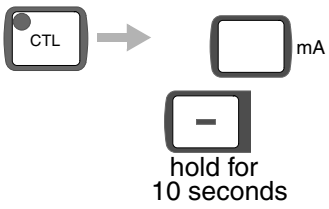
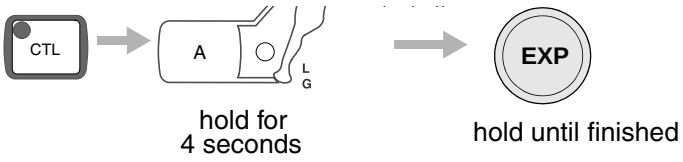
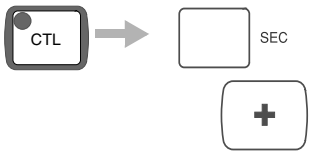
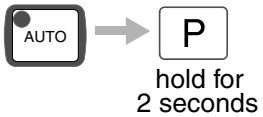
The yellow exposure indicator light is on whenever the X - ray generator is on and produces radiation.

3.3 Service mode settings

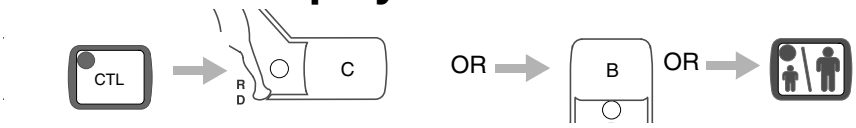
NOTE ***Make sure that the unit is in the service mode before performing the functions described in this section.***

Press the control (CTL) key to enter the special function mode. The CTL-key's indicator light comes on. In the special function mode some of the keys have special functions, others do not operate in this mode. When the CTL-key or a special function key is pressed, the indicator light goes off and the keyboard is in the normal mode. In the following the special functions are explained.

SERVICE MODE FUNCTION	KEY SEQUENCE IN SERVICE MODE	FOR DETAILS, REFER TO
DISPLAY EXPOSURE COUNTER		"Exposure counter display" on page B-12
DISPLAY ERROR HISTORY		"Error history display" on page B-12
UP/DOWN MOTOR SLOW SPEED ADJUSTMENT		"Up/down motor slow speed adjustment" on page B-13
EXPOSURE SWITCH SELECTION		"Exposure switch selection" on page B-14
PATIENT POSITIONING MECHANISM ADJUSTMENT		"Patient positioning mechanism adjustment" on page D-14 **Dimax3:** "Patient positioning mechanism adjustment" on page E-30

SERVICE MODE FUNCTION	KEY SEQUENCE IN SERVICE MODE	FOR DETAILS, REFER TO
MODEL SELECTION: EC/EC PROLINE		“Model selection” on page B-15
TUBE TYPE PROGRAMMING		“Tube type programming” on page B-14
PANORAMIC/ CEPHALOMETRIC SETUP (Only in Planmeca Proline EC Pan/Ceph X-ray unit)		“Panoramic/ cephalostatic setup” on page B-14
PRIMARY SLOT CALIBRATION (Only in Planmeca Proline EC Pan/Ceph X-ray unit)		“Primary slot adjustment, Planmeca Proline EC Pan/Ceph X-ray” on page D-8 **Dimax3:** “Radiation beam adjustment, Planmeca Proline EC Pan/Ceph X-ray” on page E-15
FACTORY PRESET		“Factory preset (recalling factory default quick exposure settings)” on page B-15

3.4 Exposure counter display



In the service mode it is possible to verify the amount of exposures taken. There are three counters in the system, one counting the normal panoramic exposures, one counting the cephalostatic exposures (only in Planmeca Proline EC Pan/Ceph X-ray unit) and one counting every exposure (also the ones made in the service mode). Exposures that caused an error and were interrupted are not counted. When one of the counters is wanted to be seen, after the right key sequence the counter is displayed in the main display for a few seconds after which the normal temperature display reappears. The key sequence always needs to be started with the CTL-key to get the indicator light on and the second key determines, which counter is displayed:

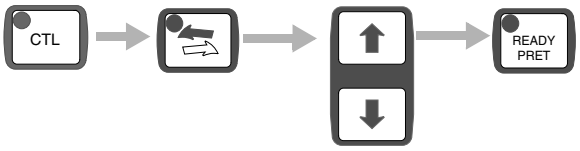
C	Total exposure counter
B	Panoramic exposure counter
CHILD MODE	Cephalometric exposure counter

Because the main display has only four numbers on it and is therefore capable of showing counts only up to 9999 a special method has been provided to be able to display counts up to 49 999. The two dots between the numbers indicate the amount of 10 000 to be added to the displayed number as follows:

Lower dot on	Add 10 000
Upper dot also on	Add 20 000
Lower dot blinking	Add 30 000
Upper dot also blinking	Add 40 000

When 50 000 exposures has been taken the counter is cleared to zero and starts to count the next 50 000.

3.5 Error history display



In order to make the equipment failure analysis easier an error history display has been provided. This error memory contains the 50 last errors occurred (not Er 00). The stack depth is not necessarily 50, if less errors have occurred. In this case only the amount of errors that have happened is displayed.

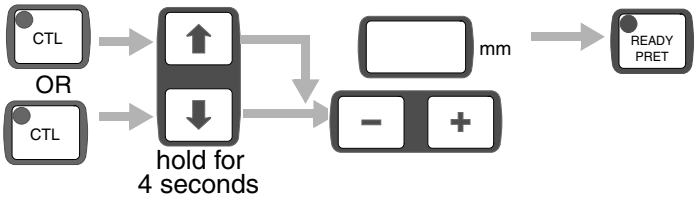
Press the CTL-key and the return key to enter this mode. The last error occurred (-01) is shown. If no errors were memorized the displays appear blank. In this mode all the indicator lights are undetermined and the numeric displays have a different function as is explained in the following:

kV-DISPLAY	Day of month when error occurred
mA-DISPLAY	Month when error occurred
MAIN DISPLAY	Hours and minutes when error occurred
EXPOSURE TIME DISPLAY	Error code number that occurred
mm-DISPLAY	Running number of this error in the stack (-01 - -50)

In this mode the keys READY, UP and DOWN only are operative. The functions of these keys are:

UP	Find next error (newer one, towards -01)
DOWN	Find previous error (elder one, towards -50)
READY	Exit to service mode

3.6 Up/down motor slow speed adjustment



The up/down motor first second speed can be adjusted individually to both directions to suit the various needs of the equipment operators and to compensate for the individual frictions and weight balances of the equipment.

Press the CTL and press and hold down the up key for 4 seconds to activate the adjustment mode for up-direction (CTL and down key for down-direction). In this mode the keys ready, up, down, mm- and mm+ only are operative. The functions of these keys are:

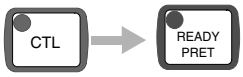
UP	Move the equipment into direction up
DOWN	Move the equipment into direction down
mm-	Adjust the speed slower
mm+	Adjust the speed faster
READY	Exit this mode and program the new speed into the memory

The main display indicates the direction to be adjusted and the relative percentage of the current speed with an arrowhead pointing up or down and the speed (00-99). The speed indication is relative, 00 meaning the minimum and 99 the maximum possible slow adjustment speed. 00 is not stop and 99 is about half of the maximum speed of the motor.

The adjustment is altered with the mm- and mm+ keys after which the speed can be checked by moving the equipment with UP or DOWN keys. Note that the direction under modification never accelerates to the full speed but continues at the slow speed to allow the proper verification of it. The opposite direction operates normally.

NOTE ***In this mode the end limit sensors are not checked to the direction under modification. This allows to get the Z-carriage easily in its normal operating range if it was for some reason jammed outside the limit sensor and had lost the right position information. See chapter UP/DOWN motor for information of the operating philosophy.***

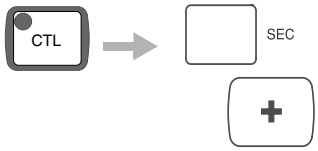
3.7 Exposure switch selection



The remote exposure switch type can be selected. The new type is equipped with a ready light that will come on when the unit is correctly se up and ready to take an exposure.

Press the CTL-key and the READY key to select the desired exposure switch type. When the switch type equipped with the ready light is selected, the ready light on the holder will come on. If there is not a ready light on the holder, the exposure indicator light will come on to indicate that the wrong type switch has been selected and you must select the other switch type. When the switch type without the ready light is selected, the ready light on the holder is off and indicates that the wrong type switch has been selected.

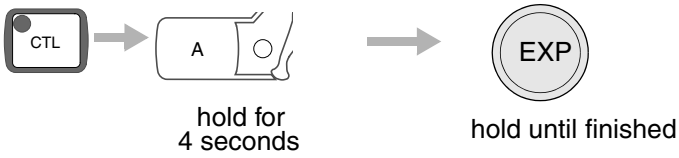
3.8 Panoramic/cephalostatic setup



The equipment software has been readily equipped with the functions needed for cephalostatic operation. In the service mode it is determined whether the equipment is equipped with a cephalostat.

Press the CTL-key and then press the Exposure time + key to change the mode of operation. The new state of operation is indicated for a few seconds in the main display, PA for panoramic operation and CE for panoramic/cephalostatic one.

3.9 Tube type programming



Press the CTL-key and press and hold the segment key A, B or C for 4 seconds, the tube filament definition will start. The display will now show Fd.

To prevent from accidental programming the segment key has to be held down for 4 seconds before it operates.

CAUTION ***Always program the tube type into the system when the generator processor board or the tubehead is replaced. Even if the new tube type is the same than the previous one, the filament characteristics are not exactly the same and must be reprogrammed. Failing to do this may damage the tubehead.***

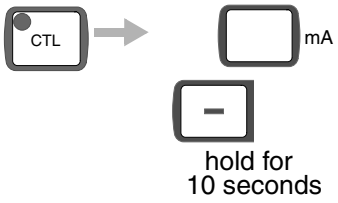
Pressing down the exposure key after the tube type programming starts the generator with 70 kV and 2 mA (the system adjusts for these values automatically). The system regulates the filament voltage to get the 2 mA tube current accurate, changes to 3 mA and so on till all tube current values up to 12 mA have been adjusted. After the learning procedure the generator stops and the tube type display stops blinking to indicate that the system is now ready for normal operation. If the exposure switch is released before the procedure is complete (about 2 minutes), it will be continued from that point on when the switch is operated again. If the power was switched off the procedure starts from beginning. When the tube filament definition is done the exposure time display will indicate “t.5” for Toshiba tube.

3.10 Model selection

NOTE ***Always check the model type when the Keyboard processor board is replaced.***

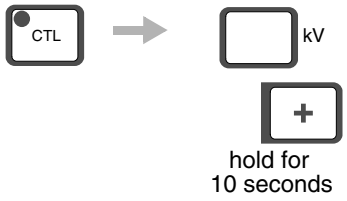
The equipment software has been equipped with the software for the PM 2002 CC, Planmeca Proline CC, PM 2002 EC and Planmeca Proline EC X-ray units. In the service mode it is determined what the equipment model is.

EC/ EC Proline



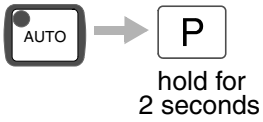
Press the CTL-key and press and hold the mA- -key for 10 seconds to change the model of the X-ray unit.The X-ray unit will restart and the software version number is shown on the main display, 3.00 or larger for the Planmeca Proline EC and 2.xx for the PM 2002 EC X-ray unit.

EC Proline/ CC Proline



Press the CTL-key and press and hold the kV+ -key for 10 seconds to change the model of the X-ray unit. The new model of the unit is indicated for a few seconds in the main display, EC for the Planmeca Proline EC and CC for the Planmeca Proline CC X-ray unit.

3.11 Factory preset (recalling factory default quick exposure settings)



Press the auto key and press and hold the program key for 2 seconds to recall the factory default quick exposure settings: A 62 kV/5 mA; B 64 kV/6 mA; C 68 kV/7 mA.

Chapter

C

HELP & ERROR MESSAGES

1 HELP MESSAGES

The following is a list of the help messages. These messages appear on the main display if a key is pressed that has no function, or if the function is not allowed for some reason. The help message disappear automatically when you release the key.

HELP CODE	HELP MESSAGE EXPLANATION
HE 0	The key has no function in this mode.
HE 1	The key has no function with the control key.
HE 2	The error code must first be cleared from the display by pressing the control key.
HE 6	The temple support motor has been inactivated. The temple support movement does not operate.
HE 8	The child mode can not be selected in double TMJ exposure mode.
HE 10	The X-ray unit is busy, wait until the previous function is completed.
HE 15	The X-ray unit is not communicating with the PC, e.g. the Dimaxis software is not running.
HE 16	The patient is not selected in the Dimaxis software.
HE 17	The sensor head is not in its position.
HE 18	In the cephalometric mode there is also a sensor head in the rotating unit in addition to the sensor head attached to the cephalostat. Remove the sensor head from the rotating unit.
HE 19	The unit exposure mode (panoramic/cephalometric) differs from the mode selected in the Dimaxis software.

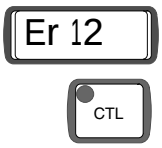
2 ERROR MESSAGES

The purpose of the error messages is to make fault-finding easier. The list of the last 50 error occurrences is of a great help. Please refer to the section “Error history display” on page B-12 how to display the error list.

ERROR CODE	ERROR MESSAGE EXPLANATION
Er 00	The exposure switch was released too early during exposure.
Er 01	Short loss of power or drop in line voltage.
Er 07	The rotating unit is not in the ready position.
Er 08	The wrong type sensor head (i.e. panoramic type) attached to the cephalostat.
Er 10	Overvoltage in tubehead.
Er 11	Sudden kilovolt drop.
Er 12	Tube filament initializing is not done.
Er 21	Up/down motor time out. The vertical carriage does not reach the limit sensor within a specified time.
Er 22	Temple rest motor time out.
Er 23	Layer adjust motor time out. The layer mechanism does not reach the limit sensor within a specified time.
Er 24	Primary slot motor time out. The slot mechanism does not reach the sensor in specified time.
Er 25	Cassette motor time out. The cassette holder mechanism does not reach the limit sensor within a specified time.
Er 26	Rotation motor time out. The rotating unit does not reach the limit sensor in the specified time.
Er 27	Cephalostat scanning mechanism time out.
Er 28	Panoramic sensor head motor time out. The sensor head does not reach the panoramic position in the specified time. Or the safety limit switch is pressed and the movement of the sensor head is prevented.
Er 30	kV value does not reach given value.
Er 31	mA value does not reach given value.
Er 32	Tube filament control inoperative.
Er 33	Tube filament control inoperative.
Er 40	The rotation does not reach the end limit sensor.
Er 41	Rotation goes over the end limit sensor.
Er 42	Secondary slot not in the position for the panoramic exposure.

ERROR CODE	ERROR MESSAGE EXPLANATION
Er 43	Secondary slot not in the position for the cephalometric exposure.
Er 44	The patient positioning mechanism zero point set incorrectly.
Er 50	The temperature of the tubehead is too low.
Er 51	Temperature sensor open.
Er 52	mA or kV feedback cable open.
Er 53	Up/down motor does not consume power.
Er 54	Up/down motor consumes too much power.
Er 57	Exposure button activated when the unit is turned on.
Er 60	Generator processor power too low.
Er 61	Processor communication error.
Er 62	Limit sensor power missing.
Er 64	The radiation reaching the AEC sensor is very low or missing completely.
Er 65	The radiation reaching the AEC sensor is too high.
Er 70	Processor communication error.
Er 71	Generator processor program memory failure.
Er 72	Keyboard processor program memory failure.
Er 73	Keyboard processor program error.
Er 74	Keyboard processor operating improperly.
Er 75	Keyboard processor operating improperly.
Er 80	Keyboard processor EEPROM failure.
Er 81	Generator processor EEPROM failure.
Er 82	Keyboard processor configuration error.
Er 83	Generator processor configuration error.
Er 84	Tube power generator time out.
Er 90	Keyboard processor EEPROM not activated.
Er 91	Keyboard processor stack overflow.
Er 99	Error code generation error.

3 ERROR MESSAGE EXPLANATIONS



The error code is displayed on the main display. Press the CTL-key to clear the error from the display. Please refer to the section “Error history display” on page B-12 how to display the error list. If you need further assistance with fault-finding, please refer to section “TROUBLE-SHOOTING” on page G-1.

3.1 Errors 00-07 (User related errors)

Er 00 Exposure switch was released too early during exposure

The exposure switch was released too early by the operator.

Exposure switch not making good contact or connecting cable broken.Try exposures in the service mode while moving the cables.

Er 01 Line voltage drop detected

Equipment has been switched off and immediately on again which is detected as a short line voltage drop by the equipment. After switching off the equipment, about 5 seconds should be waited before switching on.

Line voltage has dropped below - 10% from the nominal. This more often happens during the exposure when the full 1.5 kW power is drawn and if the mains wiring is not properly done. Measure the line voltage when loaded.

Er 07 The rotating unit is not in the ready position

The rotating unit is not in the ready position. Check that the program selection is completed. Press the ready key to move the rotating unit to the ready position and then take an exposure.

Er 08 The wrong type sensor head attached to the cephalostat

The wrong type sensor head (i.e. panoramic type) attached to the cephalostat. Remove the sensor head from the quick connector of the cephalostat and attach the cephalometric sensor head to the quick connector.

3.2 Errors 10-12 (recoverable errors)

Er 10 Overvoltage in tubehead (tube arching)

An individual overvoltage detector circuit, located on the generator processor board stops the generator when over 92 kV voltage is detected.

X-ray tube arching may trigger this circuit. This is the case when an audible ‘knock’ can be heard from the tubehead at the same time. It is quite normal that this happens every now and then and causes no extra actions to be taken. If this continues to happen more frequently, tubehead, generator processor or tube power generator is to be suspected in this order.

If this error indication appears after 1 second when the exposure switch was pressed (in the middle of the pre-heating) the generator is defective.

Er 11 Sudden kilovolt drop detected (tube arching)

kV feedback cable making bad contact

Tube arching. This is the case when an audible 'knock' can be heard at the same time. Quite normal but if it starts to appear more frequently, the tubehead is to be suspected.

Generator stops operating when the exposure is on. More likely the generator voltage drops and the undervoltage detector operates. Bad wiring or poor connections. Check generator voltage while operating.

Generator or tubehead defective. If this is the case the next exposures give indication 'kV does not rise'.

Er 12 Tube filament initializing not done

When first taken into use after tubehead or generator processor replacement the tube filament pre-heating values must be initialized. In the service mode this will be automatically done when exposure switch is continuously pressed till operation stops. If this is not done, an attempt to make a normal exposure will give this error indication.

3.3 Errors 21-26 (time out errors)

Er 21 Up / down motor time out

If this motor runs more than 30 seconds continuously this time out error is generated and all action is stopped.

If keyboard button was operated all the time the reason is either that the up/down motor cable is broken (no movement or sound) or the carriage is jammed (humming sound 200 Hz can be heard but no movement). If the carriage was moving but never stopped on the end limits the limit sensor is inoperative. Check sensor operation in service mode.

If the motor was running while the keyboard was not operated and no buttons operate, defective keyboard.

Er 22 Temple rest motor time out

If this motor runs more than 3 seconds continuously this time out error is generated and all action is stopped.

Motor or motor cables broken if motor is not running

Motor limit detector inoperative. Check in service mode.

Er 23 Layer adjust motor time out

If this motor runs more than 30 seconds continuously this time out error is generated and all action is stopped.

Motor or cables broken if motor is not running.

If keyboard button was operated all the time the reason is either that the layer motor cable is broken (no movement or sound) or the carriage is jammed (loud sound can be heard). If the carriage was moving but never stopped on the end limits the limit sensor is inoperative. Check sensor operation in service mode. End limits do not stop the motor in service mode, be careful not to break the mechanism!

If the motor was running while the keyboard was not operated and no buttons operate, defective keyboard.

Er 24 Primary slot motor time out

If this motor runs more than 30 seconds continuously this time out error is generated and all action is stopped.

Motor or cables broken if motor is not running.

The calibration sensor is inoperative. Check in service mode. Note that the sensor operating voltage is on only when the calibration sequence is performed in order to avoid aging of the sensor. In service mode the voltage is continuously on.

Er 25 Cassette motor time out

If this motor runs more than 30 seconds continuously this time out error is generated and all action is stopped.

Motor or cables broken if motor is not running.

The end limit detector(s) are inoperative or misplaced. Check in service mode. The sensor magnets should be placed in such a positions that it is not possible to move the cassette over the limits. Check both the cassette holder and the holder carriage limits.

Er 26 Rotation motor time out

If this motor runs more than 30 seconds continuously this time out error is generated and all action is stopped.

Motor or cables broken if motor is not running.

The start position sensor is inoperative or the rotating arm has been pushed over to wrong side of the limit sensor. Check in service mode and/or push the arm towards center.

Check that the friction drive is not slipping.

Er 27 Cephalostat scanning mechanism time out.

If this motor runs more than 25 seconds continuously this time out error is generated and all action is stopped. Check that the movement is not obstructed.

Limit sensor cable is loose or broken.

Motor or cables broken if motor is not running.

Er 28 Panoramic sensor head motor time out

If this motor runs more than 10 seconds continuously this time out error is generated and all action is stopped.

The wrongly installed Frankfort light or a cable prevents the sensor head from reaching the panoramic position.

The safety limit switch is pressed and the movement of the sensor head is prevented.

3.4 Errors 30-33 (generator errors)

Er 30 kV value does not reach given value

If the kV value remains more than 6 kV below the desired value (in service mode if kV does not exceed 35 kV) this error is indicated.

- kV feedback cable short circuit
- Defective tubehead
- Defective generator
- Defective generator processor board
- Check operating voltages and locate fault by replacing boards
- see Er 11

Er 31 mA value does not reach given value

If the mA value remains more than 1 mA below the desired value (in service mode if mA does not exceed 0.5 mA) this error is indicated.

- mA feedback cable short circuit
- Faulty tubehead filament power cables
- Faulty X-ray tube filament
- Power generator tube filament power supply inoperative
- Defective generator processor board
- Check operating voltages and locate fault by replacing boards
- If it appears between Er 11 and continuous Er 30, most likely defective tubehead.

Er 32 Tube filament control inoperative

If the mA value exceeds more than 1 mA the desired value during exposure this error is indicated.

Error during exposure:
- mA feedback opened during exposure (try new exposure Er 32)
- Filament power supply broken during exposure (try new exposure to see if Er 33 occurs)
- Generator processor board measuring circuits broken during exposure. (Try new exposure to see if Er 33 occurs)

Er 33 Tube filament control inoperative

After 2 seconds pre-heat period the tube filament voltage must be within 0.1V. If not, this error is indicated.

Error in the beginning of the exposure:
- Generator operating voltage missing (mains)
- Tube filament short circuit
- Generator board filament power supply defective (likely when after Er 11)
- Check operating voltages and locate fault by replacing boards.

3.5 Errors 40-44 (mechanical errors)

Er 40 Rotation remains short

At the end of the panoramic exposure the rotation end sensor must be reached. If not, this error is indicated.

- Friction drive slipping (surfaces, motor spring)
- Inoperative sensor
- Sensor misplaced
- Check in service mode and adjust if necessary

Er 41 Rotation too long

At the end of the panoramic exposure the rotation must not go over the end sensor. If so, the operation is stopped with this error indication.

- Friction drive slipping forward (centering spring drawing it to this forward direction)

- Inoperative sensor (giving pulses, not good signal)

- Check in service mode and adjust if necessary

ER 42 Secondary slot not locked

The secondary slot was not locked into position.

After returning from CEPH mode, the secondary slot did not engage with the slot on the top of the secondary slot. Return the unit to the CEPH mode and then back to PAN mode.

Enter the service mode. If the sector A indicator light is not on, the sensor magnet must be adjusted. If the sector A indicator light is on, the solenoid needs to be adjusted.

Er 43 Secondary slot out of position

The secondary slot is out of position in CEPH mode.

The secondary slot has moved with the soft tissue filter. This would cause the beam to be attenuated and possibly cause the patients nose to be cut of film when making a lateral CEPH exposure.

The magnet that hold the secondary slot in position or the sensor needs adjustment. Probably both.

Er 44 The patient positioning mechanism zero point set incorrectly

The patient positioning mechanism can not reach the -24 position.

Loosen the patient positioning mechanism screws and move the mechanism backwards. Try to calibrate the mechanism again. If the position -24 is not reached, remove the patient position mechanism from its place and file the holes in front of the mechanism so that the mechanism can be positioned back enough.

3.6 Errors 50-57 (connector or cable errors)

Er 50 Temperature sensor shorted

Before each exposure and after pressing READY or kV, mA adjustments the temperature of the tubehead is measured. If the result is too low it is assumed that the sensor is short circuiting.

Sensor broken. Measure the resistance that should be 1000 ohms at 25 °C. If not near, replace.

If disconnecting the cable to cassette end limit sensor board cures this error, then this cable and/or sensor board is partially shorting the + 15V.

Check in service mode the measured temperature. If still low with cables disconnected, faulty generator processor board.

Er 51 Temperature sensor open (overpressure when applicable)

Before each exposure and after pressing READY or kV, mA adjustments the temperature of the tubehead is measured. If the result is too high it is assumed that the sensor is open circuit. In some models there is an overpressure sensor in the tubehead, connected in series with the temperature sensor and breaking the circuit at overpressure. Also, if the tubehead and generator processor grounds are not properly connected to the protective earth this error will be indicated.

Check the earthing cables.

If seems ok by resistance measurement (about 1000 ohms at 25°C) then the generator processor board is faulty.

Er 52 mA or kV feedback cable open

Before each exposure and after pressing READY the kV and mA feedback signals are measured. If the result is too high it is assumed that the cables are not properly connected.

If seems ok by resistance measurement (kV about 16 kΩ, mA about 383R), measured at the generator processor board inputs while cables connected, the board is faulty.

Er 57 Exposure button activated

If the exposure circuit is activated when the unit is turned on or service mode is entered, Er 57 occurs. This is to prevent unintentional exposures.

3.7 Errors 60-61 (generator processor and AEC related errors)

Er 60 Supply voltage ± 15 too low

Generator processor board analog circuits have operating voltages of ±15V.

If these are below about 12.5V this error is indicated.

If disconnecting the cable to cassette end limit sensor board cures this error, then this cable and/or sensor board is shorting the + 15 V.

Otherwise faulty generator processor board.

Er 61 Generator processor does not respond

If the generator processor is not responding to the calls of the keyboard (master) processor operation is stopped with this error indication.

- +33 V operating voltage below 24 V.
- Serial communications cable broken
- No power to the generator processor
- One sensor is shorting the generator processor +5 V
- Faulty software EPROM in the generator processor
- Generator processor defective
- Measure voltages and cables to locate problem. Try to disconnect sensors and motors from generator processor. Replace EPROM.

Er 64 The radiation reaching the AEC sensor is very low or missing completely

Check that the cassette is AEC compatible, i.e. marked with text “AEC COMPATIBLE”. If the cassette type is correct, perform the AEC calibration, refer to section “AUTOMATIC EXPOSURE CONTROL (AEC) CALIBRATION” on page D-27. If the calibration does not correct the situation, change the AEC slide frame assembly.

Er 65 The radiation reaching the AEC sensor is too high

If the cassette is in the cassette carriage and the patient is positioned when this error occurs, perform the AEC calibration, refer to section “AUTOMATIC EXPOSURE CONTROL (AEC) CALIBRATION” on page D-27. If the calibration does not correct the situation, change the AEC slide frame assembly.

3.8 Errors 70-75 (software errors)

Er 70 Conflicting commands in communications line

If the generator processor is receiving conflicting commands from the keyboard processor (for example drive cassette back and forth at same time) the operation command is ignored, all activity is ceased and this error code is sent to the keyboard processor to be put on the display.

- Not matching software versions in generator and keyboard processors

- Faulty keyboard processor board

Er 71 Generator processor program memory failure

At power up the generator processor calculates a check sum from the program memory circuit (EPROM). If it doesn’t match all operation is ceased and an error code is sent to keyboard processor. If the EPROM is completely broken it is obvious that this kind of error code cannot be sent but more likely the Er 61 will be displayed. This error indication is merely meant to detect a single EPROM failure before complete break down.

- The generator processor EPROM is to be changed immediately

Er 72 Keyboard processor program memory failure

At power up the keyboard processor calculates a check sum from the program memory circuits (EPROM). If it doesn't match all operation is ceased and an error code is displayed. If the EPROM is (are) completely broken it is obvious that this kind of error code cannot be displayed but more likely the equipment does nothing. This error indication is merely meant to detect a single EPROM failure before complete break down.

- The keyboard processor EPROMs are to be changed immediately

Er 73 Keyboard processor program error

If the keyboard processor detects an illegal command (from EPROM) it will stop and give this error indication. Most likely faulty component on the keyboard processor board. A single hazardous code error is also possible.

- If appears more than once, replace keyboard processor board.

Er 74 Keyboard processor operating improperly

There is a so called watchdog circuit both in the generator processor and in the keyboard processor. If the microprocessor does not perform its program but is running wildly, this circuit will stop the operation within 0.1 second. If it was only a hazardous error the microprocessor will recover and indicate this error. If there is a serious problem on the keyboard processor board the equipment will most likely do nothing and blank the display after this kind of an error. Replace the keyboard processor board.

NOTE ***If the generator processor is not working properly the error is indicated by Er 61. In some cases it might happen that the improperly operating generator processor generates Er 74 by overloading the keyboard processor. Check by disconnecting generator processor.***

Er 75 Keyboard processor operating improperly

The keyboard processor has a peripheral IC called ASIC (PM 2002IC) which controls input and output functions of the CPU board. This chip has for some reason lost its configuration and the microprocessor has detected it. Replace the keyboard processor board.

- If appears more than once, replace keyboard processor board.

3.9 Errors 80-83 (microprocessor chip errors)

Er 80 Keyboard processor EEPROM failure

There is some non volatile memory for various parameters in the microprocessor chip itself. The writing of this memory is limited to a minimum of 10 000 times that is in practice 20 years of equipment life.

However, if this memory did fail, this error is indicated.

- Replace the microprocessor chip or the complete board.

Er 81 Generator processor EEPROM failure

There is some non volatile memory for various parameters in the microprocessor chip itself. The writing of this memory is limited to a minimum of 10 000 times that is in practice 20 years of equipment life.

However, if this memory did fail, this error is indicated.

- Replace the microprocessor chip or the complete board.

ER 82 Keyboard processor

The keyboard processor chip watchdog circuit is not activated.

-Change the keyboard processor board

ER 83 Generator processor

The generator processor watchdog circuit is not activated.

- Change the generator processor board

3.10 Errors 90-99 (other errors)

ER 90 Keyboard processor

Keyboard processor EEPROM not activated.

- Change keyboard processor board

ER 91 Keyboard processor

Keyboard processor stack overflow.

- Change the software on the keyboard processor board.

Er 99 Error code generation error

This error indication can only be result of non matching software versions on generator and keyboard processors or an indication of defective keyboard processor board.

- Check program version numbers and/or replace keyboard processor

Chapter

D

ADJUSTMENT & CALIBRATION

NOTE ***This chapter contains the information required to set up and calibrate the Planmeca Proline EC Panoramic X-ray. In case your unit is equipped with Dimax digital sensor head, perform the adjustments according to the instructions given in chapter "DIMAX DIGITAL SYSTEM ADJUSTMENT" on page E-1.***

Protect yourself from radiation when you are checking the beam alignment. Since radiation safety requirements vary from state to state and country to country it is the responsibility of the installer to ensure that the correct precautions are observed.

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

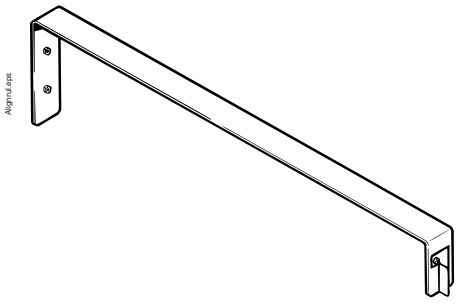
WARNING ⚠

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.

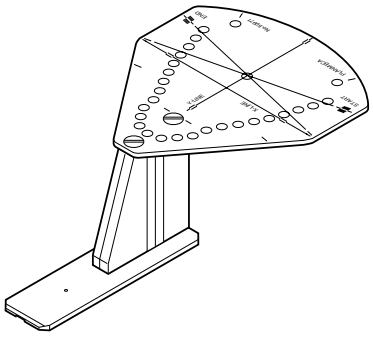
1 REQUIRED TOOLS

Panoramic mode calibration

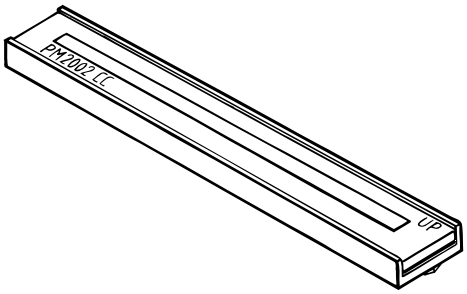
- Alignment ruler (part number 50973). For checking the position of the patient positioning mechanism.



- Ball phantom (part number 50971). For checking the position of the patient positioning mechanism and the positioning lights.



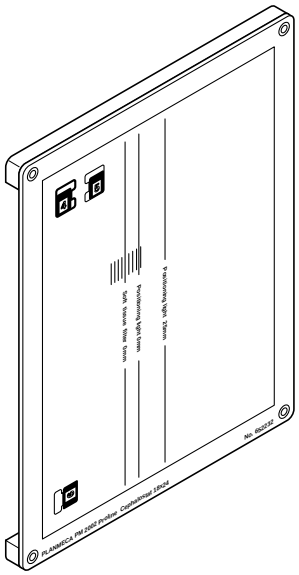
- Beam alignment tool (part number 50972). For checking the position of the panoramic X-ray beam.



Cephalometric mode calibration

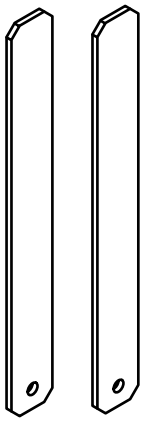
NOTE ***These tools are needed only when calibrating the Planmeca Proline EC Pan/Ceph X-ray unit.***

- Cephalometric beam alignment tool (18x24 cm, part number 652232; 8x10 in, part number 652233). Used to check the position of the cephalometric X-ray beam.



- Soft tissue filter positioning tool (part number 653121).

- Ceph head support alignment tools (part number 653126). The part number includes two pieces.



2 PANORAMIC X-RAY BEAM ADJUSTMENT

NOTE ***In case the X-ray unit is equipped with optional AEC (Automatic Exposure Control), the AEC calibration must be performed after the panoramic X-ray beam adjustment. See instructions given in section "AUTOMATIC EXPOSURE CONTROL (AEC) CALIBRATION" on page D-27.***

2.1 Checking the panoramic beam position

NOTE ***These instructions are valid for both the Planmeca Panoramic EC X-ray and Planmeca Panoramic EC Pan/Ceph X-ray.***

Before the X-ray is used the position of the radiation beam must be checked. Remove the inner cover from tubehead assembly. Four screws hold the tubehead cover in position, these are located at the rear of the tubehead assembly. The primary slot mechanism is located under the tubehead cover.

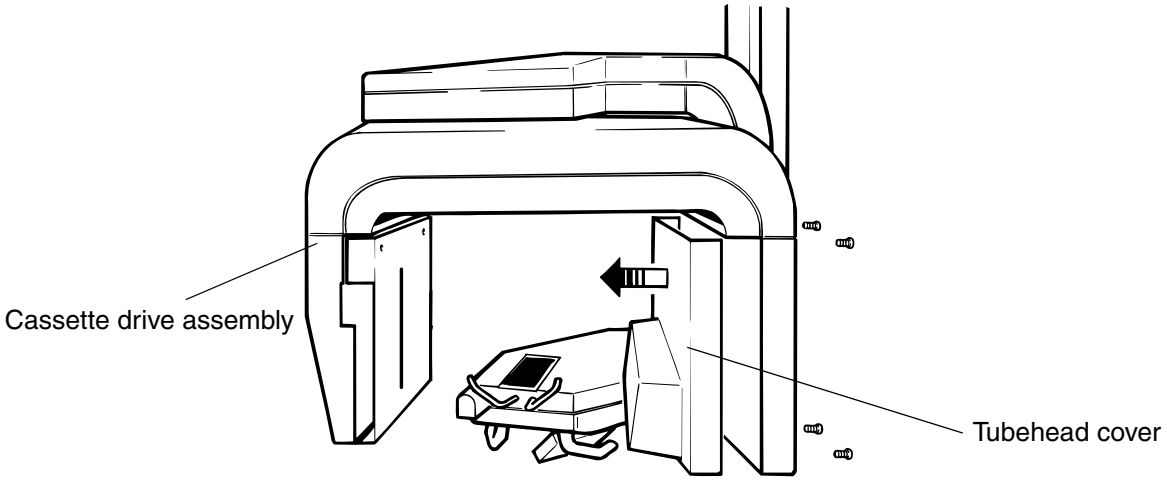
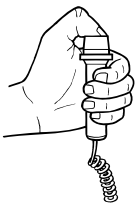


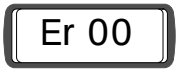
Figure 1

Switch the unit on. Enter the test mode (see section "Test mode" on page B-4).

Press the ready key to drive the X-ray into the exposure position. The rotating unit and cassette carriage will move to their respective ready positions. When the X-ray is ready the indicator light will come on.



Start to take a test exposure by pressing and holding down the exposure button on the remote control. Stop pressing the exposure button when the tubehead has rotated to a convenient position for viewing the secondary slot.



An error code will appear on the display and start to flash.

Press the CTL-key to clear the error code.

Place the beam alignment tool into the secondary slot. Note which way round it goes. It is advisable to leave the cassette in position as it will reduce the amount of scattered radiation.

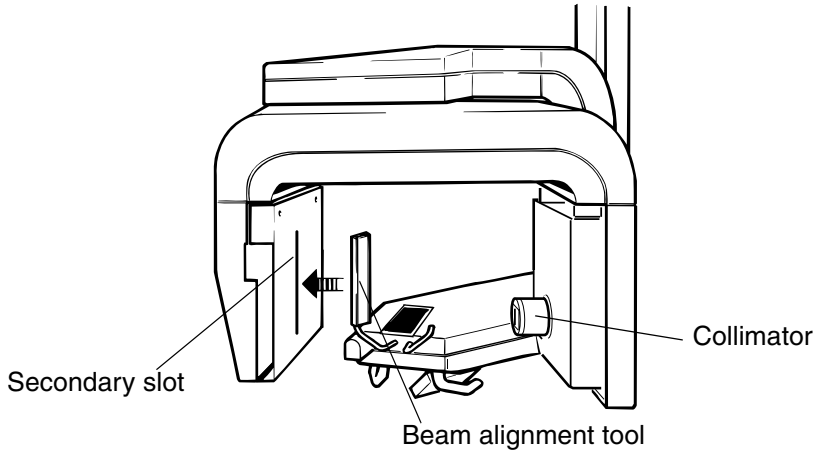


Figure 2

Enter the service mode (see section “How to enter/exit the service mode” on page B-6). The radiation beam from the first slot can now be checked without the rotating unit moving.

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.

4 mA

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

68 kV

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

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 appear within the borders of the rectangle marked on the alignment tool (if the beam is not correctly aligned see section “Primary slot adjustment, Planmeca Pro-line EC Panoramic X-ray” on page D-6).

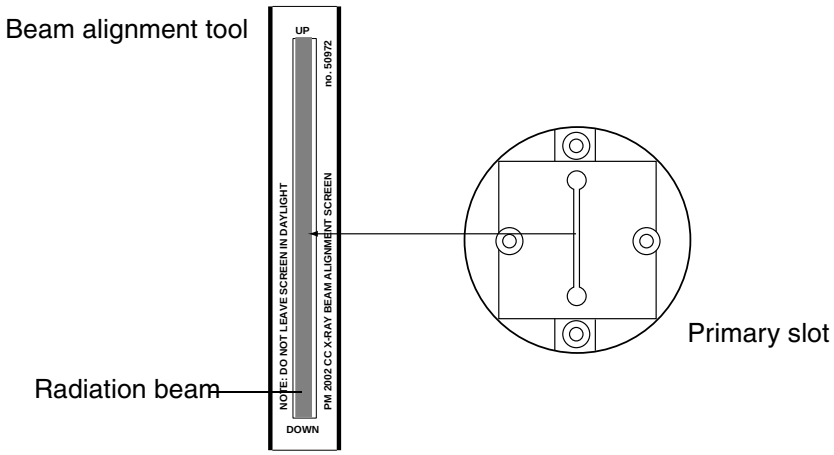


Figure 3

When the slot has been checked, and if necessary adjusted, exit the service mode and take a ball phantom exposure to check the position of the patient positioning mechanism, see section “PATIENT POSITIONING MECHANISM” on page D-11.

2.2 Primary slot adjustment, Planmeca Proline EC Panoramic X-ray

WARNING

DO NOT ADJUST THE POSITION OF THE PRIMARY SLOT 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 OPERATION.

Radiation beam too low or high

If the beam is too high or low loosen the two screws that hold the outer slot in position and adjust as necessary. Tighten the screws and recheck the beam. Repeat the above procedure until the beam is correctly positioned.

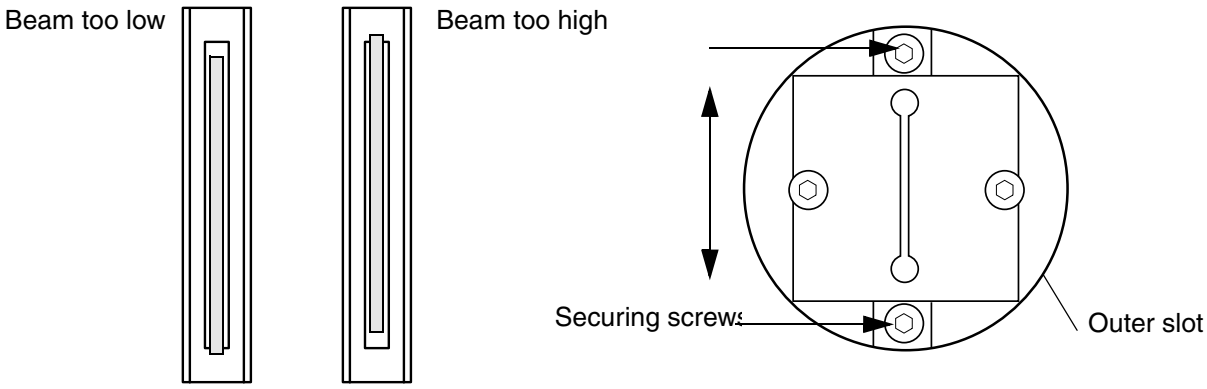


Figure 4

Radiation beam too far to the right or left

If the beam is too far to the left or right of the alignment rectangle loosen the two screws that hold the primary slot plate in position and move the plate until the beam is correctly positioned. Tighten the screws and recheck the beam. Repeat the above procedure until the beam is correctly positioned.

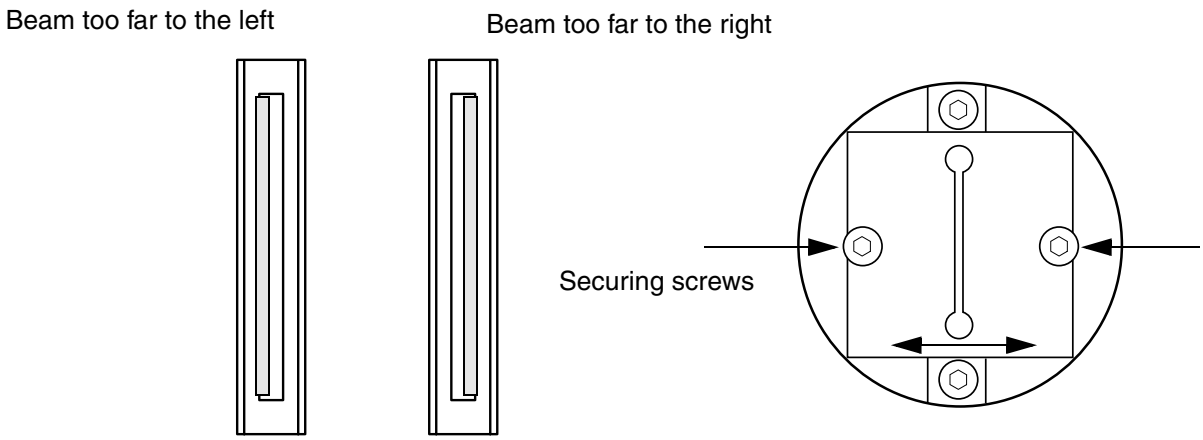


Figure 5

Radiation beam not vertical

If the beam is not vertical loosen the four screws that hold the slot frame in position and rotate the frame until the beam is correctly positioned. Tighten the screws and recheck the beam. Repeat the above procedure until the beam is correctly positioned.

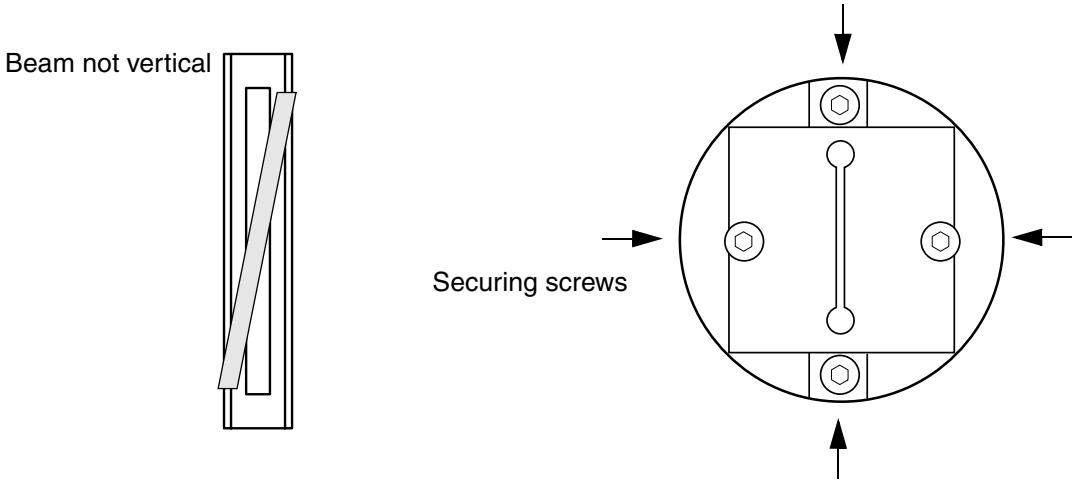


Figure 6

2.3 Primary slot adjustment, Planmeca Proline EC Pan/Ceph X-ray

WARNING

DO NOT ADJUST THE POSITION OF THE PRIMARY SLOT 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 OPERATION.

Radiation beam too low, high or not vertical

If the beams are too high or low loosen the two screws that hold the panoramic primary slot plate in position and adjust as necessary. Tighten the screws and recheck the beam. Repeat the above procedure until the beam is correctly positioned.

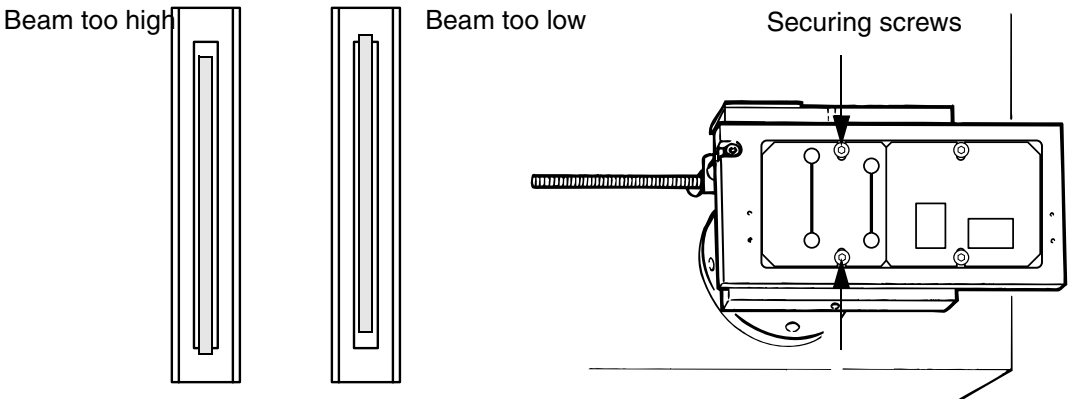


Figure 7

If the beam is not vertical loosen the two screws that hold the primary slot mechanism to the collimator tube and rotate the mechanism until the beam is correctly positioned. Tighten the screws and recheck the beam. Repeat the above procedure until the beam is correctly positioned.

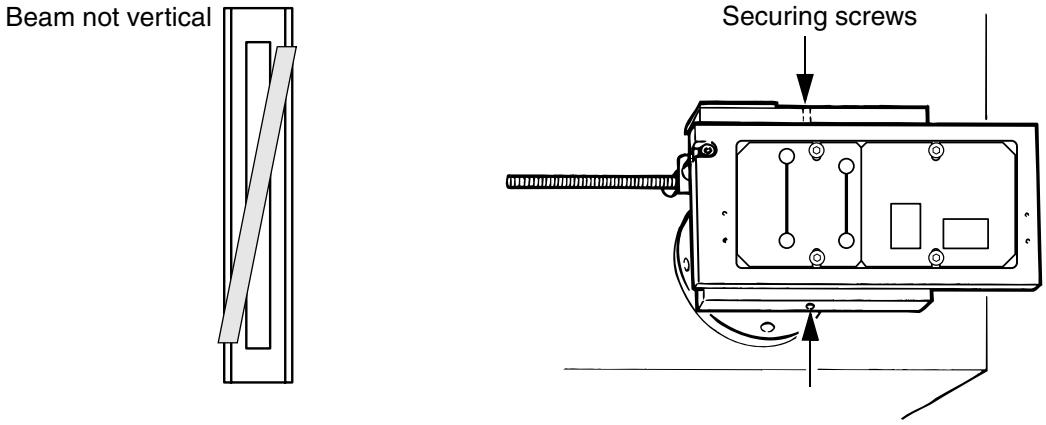
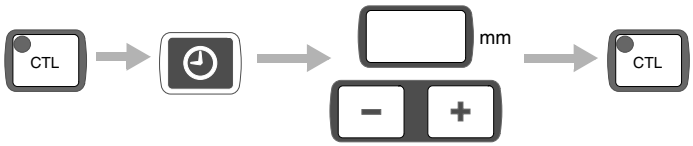


Figure 8

NOTE ***The ceph primary slots are also adjusted according to instructions given in this section.***

Radiation beam too far to the right or left



WARNING

WARNING: DO NOT ADJUST THE POSITION OF THE PRIMARY SLOT 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 OPERATION.

NOTE ***The ceph primary slots are also adjusted according to instructions given in this section.***

If the beam is too far to the left or right of the alignment rectangle it must be centered.

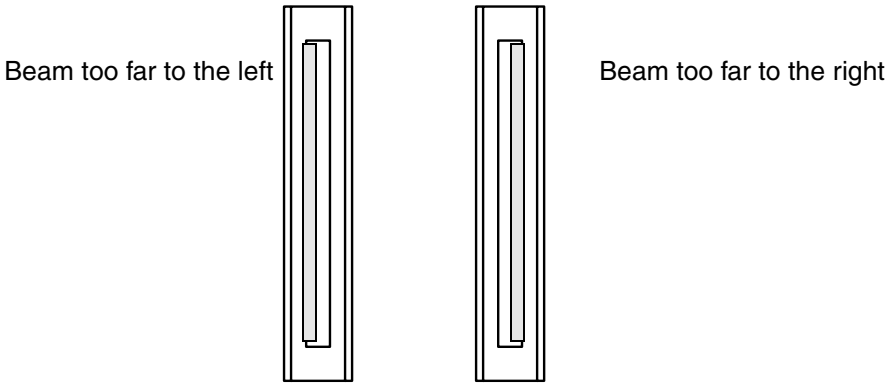


Figure 9

NOTE ***A microprocessor controlled motor determines the position of each slot. If the beam is readjusted to the left or right the new position must be reprogrammed into the memory.***

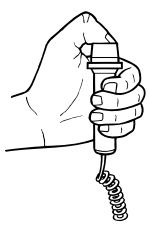
Enter the service mode if you are not already in it.

Press the CTL-key.

Press and hold down the clock key until the number of the slot that you are checking appears on the main display (SLO and the slot number) and starts to flash. You are now in the primary slot calibration mode.

For example, if you have just checked the position of the beam from the panoramic slot, the number 1 will appear on the display.

Adjust the position of the beam by pressing the patient positioning (mm) keys. The minus key will move the slot mechanism, and beam to the left, and the plus key will move the slot mechanism, and beam to the right.



Check the position of the beam again and, if necessary, repeat the above alignment procedure until the beam is within the alignment rectangle on the fluorescent screen.

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

NOTE ***Always use the plus (+) key for the final adjustment. This makes sure that the slot mechanism is correctly positioned by taking up the play between the draw nut and the positioning thread.***

For example, if you are adjusting the beam to the left by pressing the minus (-) key you should move the slot mechanism a little further to the left than necessary, and then press the plus (+) key to move it back to the right to the correct position.

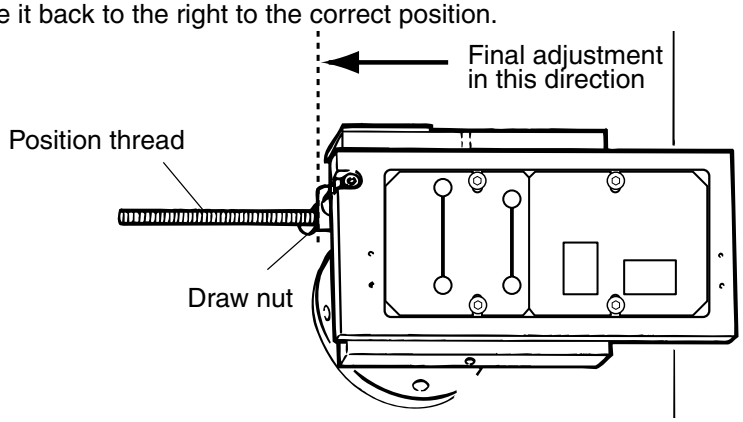


Figure 10

If you cannot adjust the beam far enough to the left using the method described above you may have to move the metal tab on the draw nut. Loosen the securing screw rotate the tab slightly and then tighten the screw. The slot position should then be rechecked.

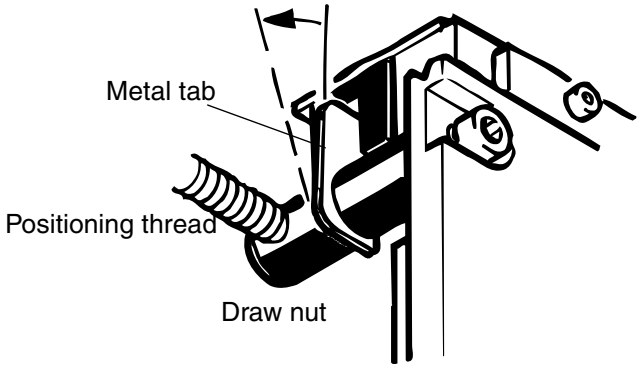


Figure 11

Press the clock key to store the slot position in the memory and move on to the next slot. The number of the next slot will appear on the main display and start to flash.

Repeat the alignment procedure described above for this slot and any other slots.

Exit the primary slot calibration mode and check the position of all the beams again. Realign if necessary.

Exit the service mode.

3 PATIENT POSITIONING MECHANISM

3.1 Checking the mechanism

You should take an exposure of the ball phantom to check that the patient positioning mechanism is correctly positioned.

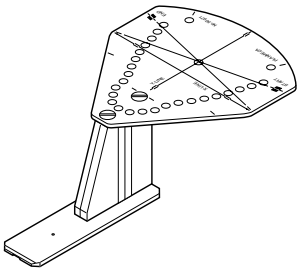
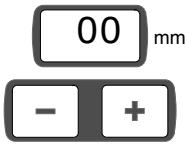


Figure 12

Move the cassette carriage to the loading position. The patient positioning lights will come on when the carriage stops moving.

Slide the ball phantom into the patient positioning mechanism.



Adjust the position of the patient positioning mechanism to 00.

In the darkroom open the cassette and place a film inside the cassette and then place a piece of paper the same size on top, the paper will reduce the radiation that reaches the film. Close the cassette.

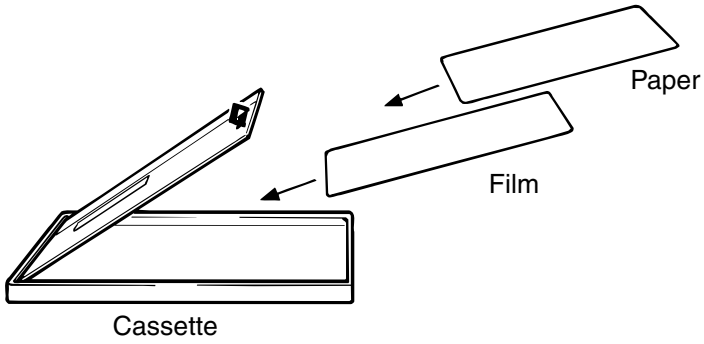
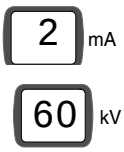


Figure 13

Slide the cassette into the cassette holder. Make sure that you push it all the way in.

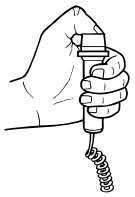
Enter the service mode.



Select a kilovolt value of 60 and a milliampere value of 2. Note that it is only possible to select these values in the service mode.

Exit the service mode.

Drive the X-ray unit to the exposure position. The rotating unit will turn to the start position and the indicator light will come on.



Take an exposure. Hold the exposure down for the duration of the exposure.

CAUTION ***Radiation is generated when exposure button is pressed.***

Press the return key to drive the cassette to the loading position, remove the cassette and process the film.

The images of 23 balls should appear on the film. They should be round, all the same size, and evenly spaced. Note that they will not necessarily be at the same vertical height. The distance from the center of the middle ball to the center of the tenth ball to the left and the tenth ball to the right should be 120mm ± 2mm. If this distance is correct then the patient positioning mechanism need not be adjusted, and you should then check the patient positioning lights (see section “FOCAL TROUGH POSITIONING LIGHT” on page D-23).

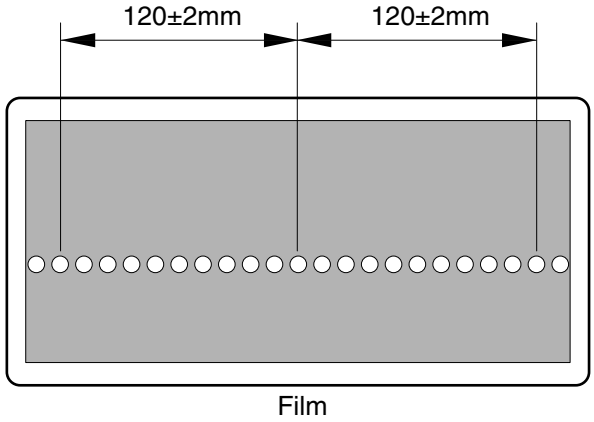


Figure 14

If these distances are not correct you will have to adjust the position of the patient positioning mechanism. The following diagrams are a rough guide as to how to position it correctly. Note that you may have to make more than one adjustment as the patient positioning mechanism could be incorrectly positioned in more than one direction. For example it may be too far forward and too near the column.

If the distance from the middle ball to the center of the tenth ball on the left-hand side is more than 122mm and on the right-hand side less than 118mm then the patient positioning mechanism must be moved away from the column.

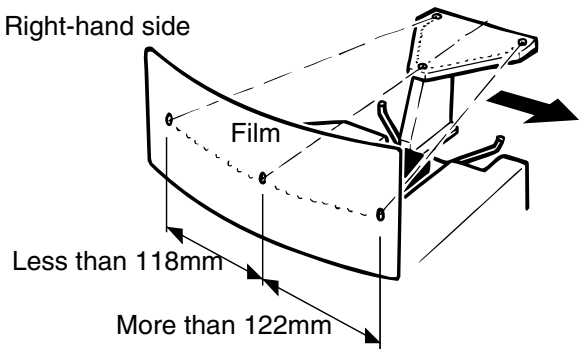


Figure 15

If the distance from the middle ball to the center of the tenth ball on the left-hand side is less than 118mm and on the right-hand side more than 122mm then the patient positioning mechanism must be moved towards the column.

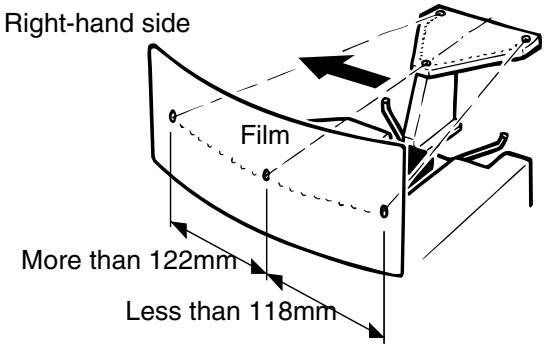


Figure 16

If the distances from the middle ball to the center of the tenth ball on both the right and left are more than 122mm then the patient positioning mechanism is too far backward and must be moved forwards.

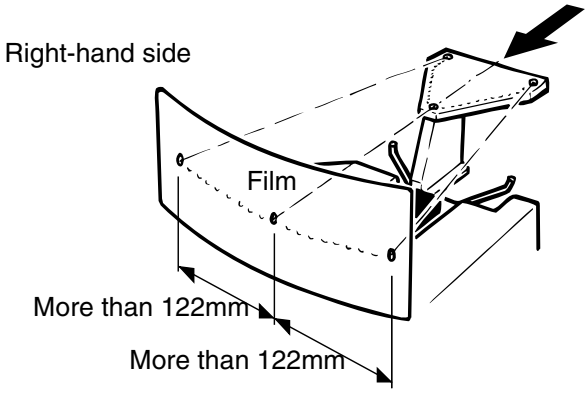


Figure 17

If the distances from the middle ball to the center of the tenth ball on both the right and left are less than 118mm then the patient positioning mechanism is too far forward and must be moved backwards.

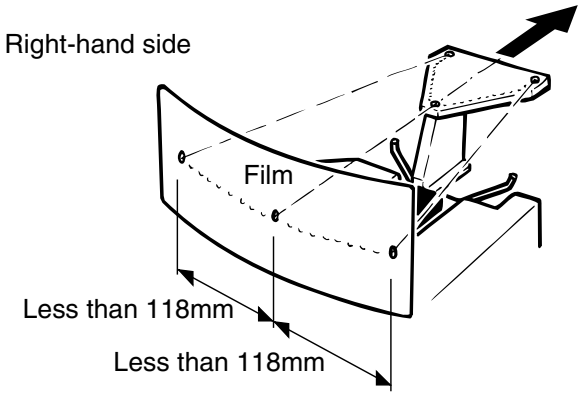


Figure 18

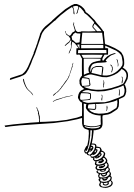
3.2 Patient positioning mechanism adjustment

If the patient positioning mechanism is too near or too far from the column it will have to be centered.

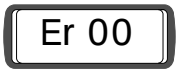
Remove the cover from the lower shelf. Replace the ball phantom tool.

Enter the test mode.

Press the ready key to drive the X-ray unit to the exposure position. When the X-ray is ready the indicator light will come on.



Start to take a test exposure by pressing and holding down exposure button on the remote control. Stop pressing the exposure button about halfway through the exposure cycle so that the rotating unit stops moving.



An error code will appear on the display. Clear the error code from the display by pressing the CTL-key.

Manually position the rotating unit so that the center line that runs through the tubehead and film cassette mechanism is parallel to the wall to which the X-ray is secured. Slide the alignment pin through the hole, nearest the column, in the top of the vertical carriage so that it goes into the positioning hole in the rotating unit.

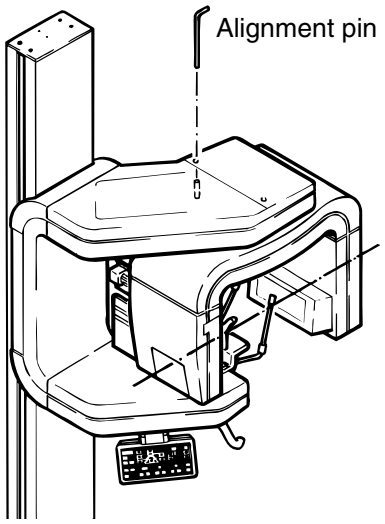


Figure 19

NOTE ***Adjust the position of the rotating unit by holding the cassette carriage. Never use the tubehead to adjust the position.***

Leave the ball phantom tool in position and place one end of the alignment ruler in the primary slot and the other end in the secondary slot.

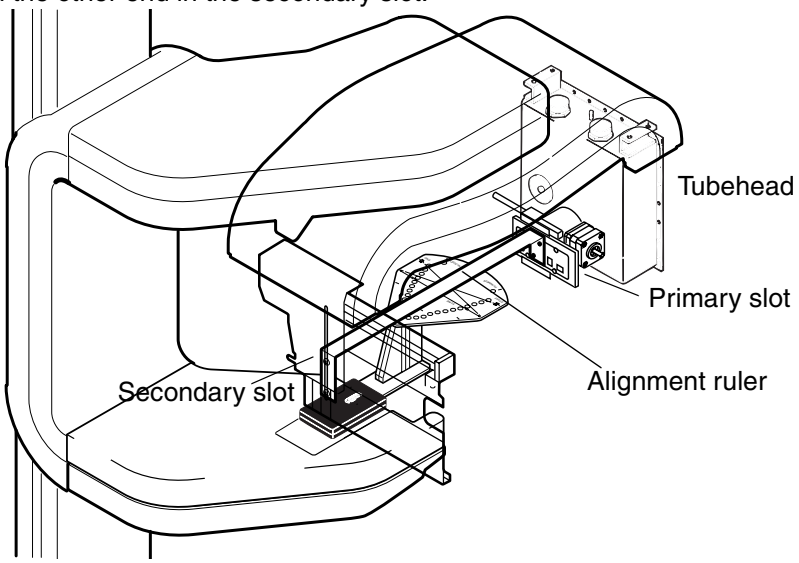


Figure 20

Loosen the four screws that hold the patient position mechanism in place and adjust its position to the left or right until the mechanism is centered.

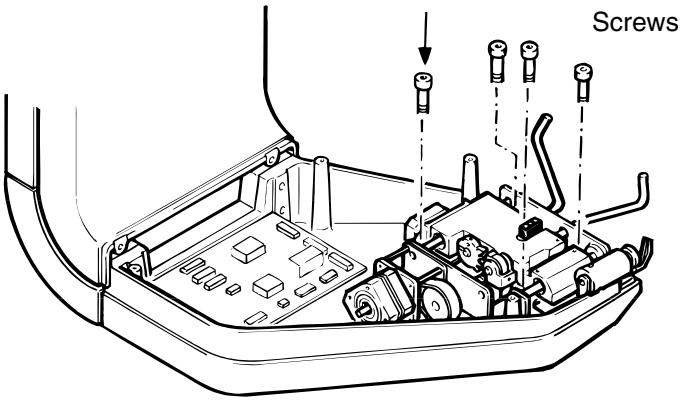


Figure 21

Make sure that the y-line on the ball phantom is parallel to the line on the underside of the alignment ruler. Note that the line on the ball phantom and the line on the alignment rule do not have to coincide, but they must be parallel.

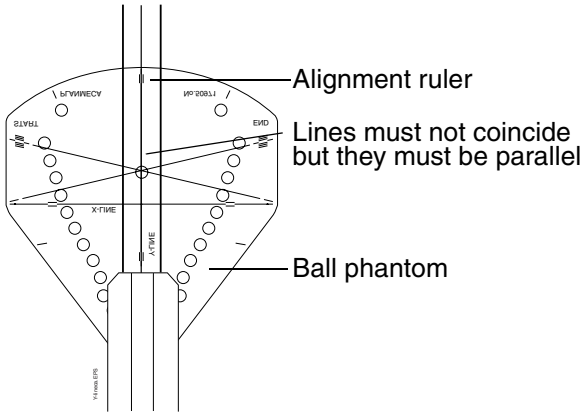


Figure 22

Tighten the screws, and remove the alignment pin.

Take another ball phantom picture to check the alignment again. Readjust if necessary.

If the patient positioning mechanism is too far forward or too far backwards the fore/aft position must be adjusted and the new position programmed into the memory.

Enter the test mode if you are not already in it.

Press the ready key to drive the X-ray unit to the exposure position. When the X-ray is ready the indicator light will come on.

Start to take a test exposure by pressing and holding down exposure button on the remote control. Stop pressing the exposure button after about two seconds so that the rotating unit stops moving.

An error code will appear on the display. Clear the error code with the CTL-key.

Manually position the rotating unit so that the center line that runs through the tubehead and film cassette mechanism is at a right angle to the wall. Slide the alignment pin through the hole in the top of the vertical carriage so that it goes into the positioning hole in the rotating unit.

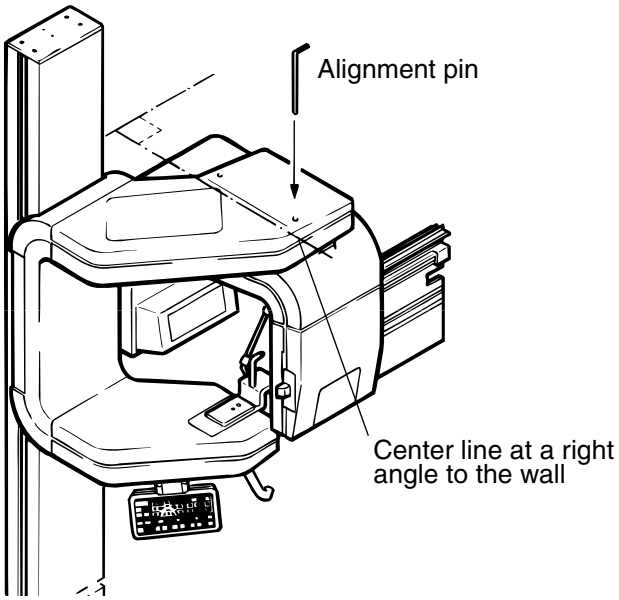


Figure 23

NOTE ***Adjust the position of the rotating unit by holding the cassette carriage. Never use the tubehead to adjust the position.***

Leave the ball phantom tool in position and place the alignment ruler in position between the primary slot and the secondary slot as described earlier. The line on the alignment rule must not line up with the line on the ball phantom but must be parallel to it. (If the two lines do line up it indicates that the patient positioning mechanism is correctly positioned).

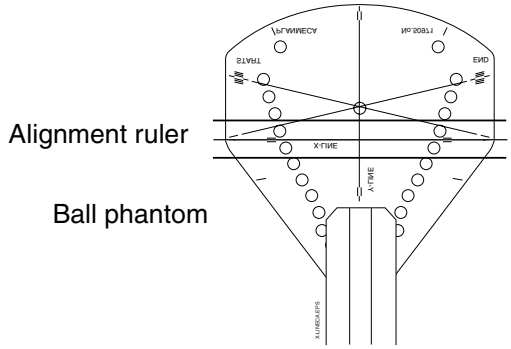
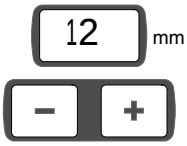


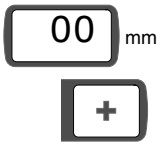
Figure 24

Enter the service mode.



Press either of the patient positioning keys once to switch the patient positioning lights on then a second time to adjust the position of the patient positioning mechanism until the line on the ball phantom lines up with the line on the alignment ruler. The position of the mechanism will appear on the display.

Press the CTL-key. The indicator light will come on.



Hold the patient positioning plus (+) key down (about five seconds) until you hear a signal and the millimeter display zeroes. This indicates that the new position of the patient positioning mechanism has been programmed into the memory.

Remove the alignment pin and exit the service mode.

Take another ball phantom picture to check the alignment again. Readjust if necessary.

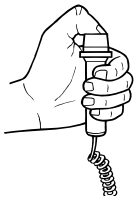
Checking the eccentricity of the rotation movement

The eccentricity of the rotation movement must be checked after the patient positioning mechanism adjustment. This is done by comparing the distances between the line on the alignment ruler and the x-line on the ball phantom in “0° position” and in “180° position”. If the deviation is more than ±1 mm, the position of the secondary slot should be adjusted.

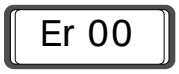
Entering the 180° position:

Enter the test mode.

Press the ready key to drive the X-ray unit to the exposure position. When the unit is ready the indicator light will come on.



Start to take a test exposure by pressing and holding down exposure button on the remote control. Stop pressing the exposure button after about 16 seconds so that the rotating unit stops moving (near the end position).



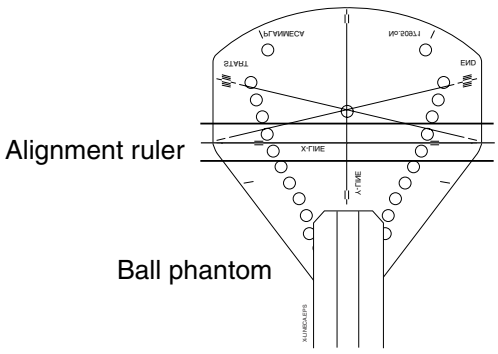
An error code will appear on the display. Clear the error code with the CTL-key.

Manually position the rotating unit so that the center line that runs through the tubehead and sensor head is at a right angle to the wall. Slide the alignment pin through the hole in the top of the vertical carriage so that it goes into the positioning hole in the rotating unit.

NOTE ***Adjust the position of the rotating unit by holding the sensor head. Never use the tubehead to adjust the position.***

Leave the ball phantom tool in position. Place the alignment ruler in position between the primary slot and the secondary slot as described earlier. Measure the distance between the line on the alignment ruler and the x-line on the ball phantom (Fig. 25). The distance must be less than 1mm.

Tubehead side



Secondary slot side

Figure 25 180° position

If the distance between the line on the alignment ruler and the x-line on the ball phantom is more than 1mm, the secondary slot position must be adjusted. Move the secondary slot towards the ball phantom’s x-line until the distance is less than 1 mm.

4 MECHANICAL ADJUSTMENT OF THE ROTATIONAL PART

When designing the unit we aimed at minimizing need for adjustments in connection with assembly and service. The technique used, particularly guidance electronics, has permitted us to eliminate most adjustments, but there are still certain adjustments to be done.

Some of the adjustments related to the mechanics of the unit cannot be done without special tools (alignment tools). It is important therefore to check that all special tools for assembling the unit are available, see “REQUIRED TOOLS” on page D-1.

4.1 Guiding profile and counterprofile

The clearance between the guidance profile and the counterprofile can be checked and adjusted if necessary when the loading spring of the drive wheel is removed. Also the drive wheel with transmission can be removed, but this is not necessary. Note that all major parts must be installed so that the rotational part has about its final weight.

Provided that these requirements are fulfilled the clearance can be observed by moving the rotating unit sidewards from both ends (see figure below). Note that the rotating unit has to be half way trough the rotating cycle. When moving the rotating unit parallelly sideways the longitudinal clearance appears as clearance.

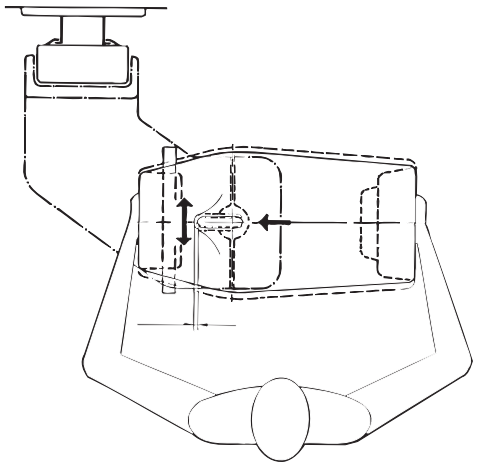


Figure 26

If there is any clearance it is eliminated by unscrewing screws (see figure below) and pushing the counterprofile towards the cassette mechanism. Do not use any tools to move the counterprofile. Tighten the screws by pressing the screw head with finger. Check once more that there is no clearance left but also that the contact between the counterprofile and the guidance profile is not tight. This can be done by carefully pushing the rotating unit from the cassette end using the same speed at which it moves when it is driven by the stepper motor and turn it approximately 45° to both directions. If there is too much tension, the movement is stiff and continually sticks in the middle area.

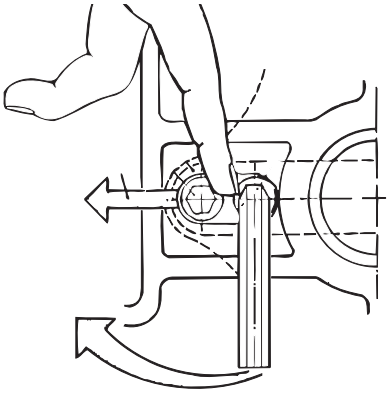


Figure 27

4.2 Adjustment of the guidance wheel

The guidance wheel can be adjusted if the driving wheel with gear is detached and clearance between guidance and counter profile and is correctly adjusted. The guidance wheel is attached to the rotating unit (1) through a flange (2). The flange is fixed to the rotating unit with screws (3) and a bolt pin (4). By unscrewing the screws (3) the flange can be turned around the bolt pin (4).

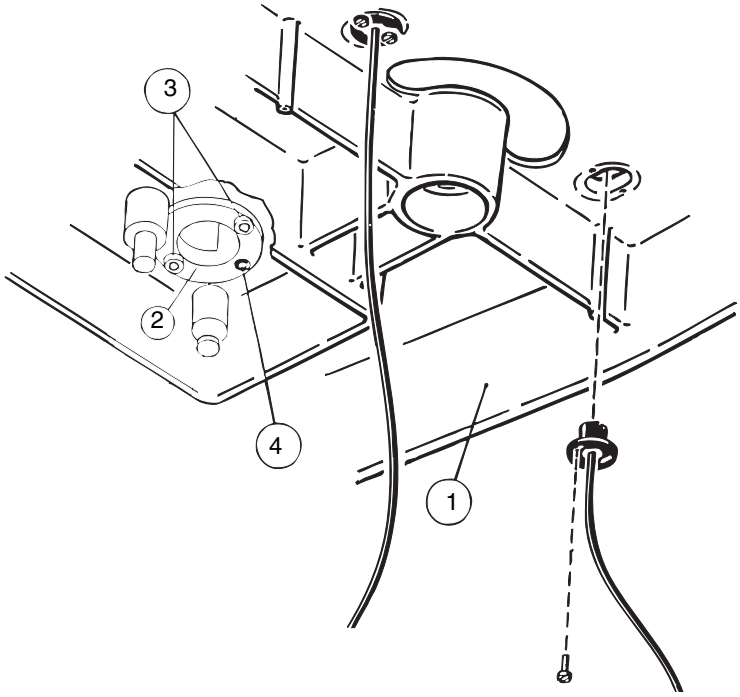


Figure 28

The guidance is adjusted when the rotating unit is in a position corresponding to the middle point of the exposure. In principle, the guidance wheel should be placed as near the inner edge of the groove as possible. For proper adjustment turn the rotating unit with both hands. Always turn the rotating unit from the cassette head end and move it throughout the rotating cycle calmly and at a speed corresponding to the actual speed. If the guidance wheel has been adjusted too far from the inner edge of the groove, a clack of the counter profile meeting the guidance profile can be heard when moving the unit from the start position to the middle position. If the guidance wheel has been adjusted too close to the inner edge of the driving groove the movement is sticky in an area corresponding to a 45° angle in relation to the central area. The adjustment can be found only by experimenting.

4.3 Rotation limits

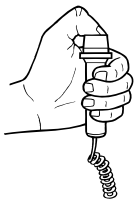
The rotating movement is controlled by two Hall detectors: one determines the start position and the other the end position. The latter has no importance for the normal function because the step motor drives the rotating unit according to the programmed number of steps The end limit is of great importance in case of abnormal function, because it informs the processor that the rotating unit has not reached the end position.

The start limit is adjusted so that the movement of the guidance wheel in the drawing groove is symmetric to the groove. The distance of the boss of the wheel from the end of the groove should be the same both when the movement starts and when it ends. The symmetricity of the movement has more importance to the quality of the radiograph than the absolute length of the movement which varies a little because of production tolerances.

Remove the necessary covers. Slide the ball phantom into the patient positioning mechanism. Check that the y-line on the ball phantom is parallel to the line on the underside of the alignment ruler according to instructions given in section “Patient positioning mechanism adjustment” on page D-14.

Remove the alignment pin. Enter the test mode if you are not already in it.

Press the ready key to drive the X-ray unit to the exposure position. When the X-ray is ready the indicator light will come on. Place the alignment ruler in position between the primary and secondary slot and write down the angle between the ball phantom “start”-line and the alignment ruler.



Start to take a test exposure by pressing and holding down exposure button on the remote control. Stop pressing the exposure button after about two seconds so that the rotating unit stops moving. Place the alignment ruler in position between the primary and secondary slot and write down the angle between the ball phantom “end”-line and the alignment ruler.

The positions corresponding to end and start positions should not differ more than ± 1 mm. The position of the start limit (Hall detector) can be changed by unscrewing the screws. This should be repeated until the tolerance area is reached.

The adjustment of the end position is done after the start position has been adjusted.

No special tools are needed. The end limit should activate about 5 mm before the end of the movement and it should activate even when the rotating unit is at 5 mm past the end position.

The indicator light shows this when the equipment is in the service mode.

5 FOCAL TROUGH POSITIONING LIGHT

5.1 Checking the light

The position of the focal trough light beam should be checked. Use the ball phantom for checking.

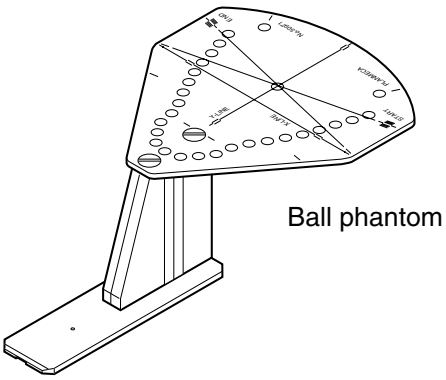
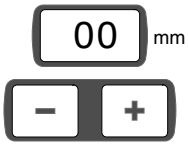


Figure 29



Press either of the focal trough positioning keys to switch the positioning light on and then a second time to drive the patient positioning mechanism to 00 if it is not already there.

The focal trough positioning light beam should be positioned so that it is on the black reference line on the side of the ball phantom.

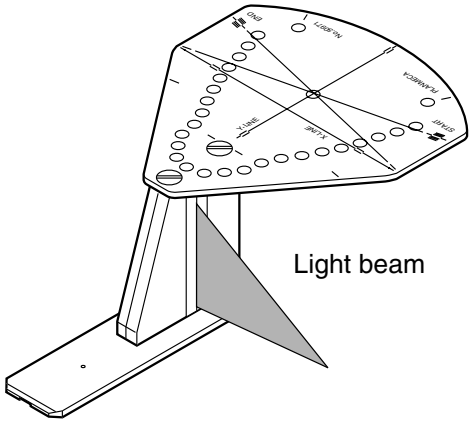


Figure 30

If the light beams do not coincide with the black lines or they are not in focus, they should be adjusted.

5.2 Positioning light adjustment

Bending the mirror bracket backwards or forwards will position the light beam.

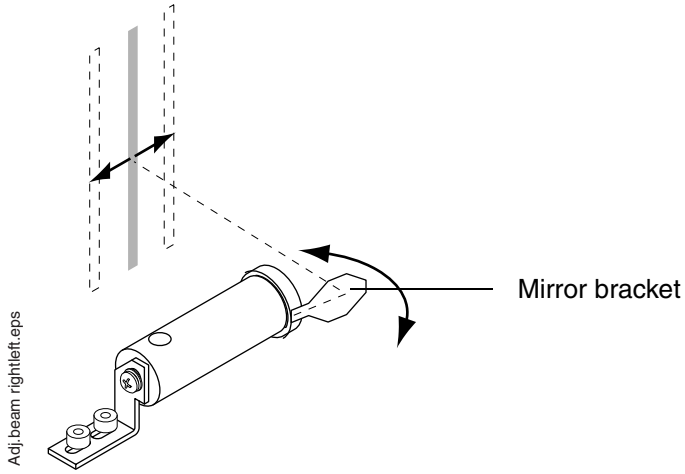


Figure 31

Rotating the mirror bracket will adjust the light beam in vertical direction.

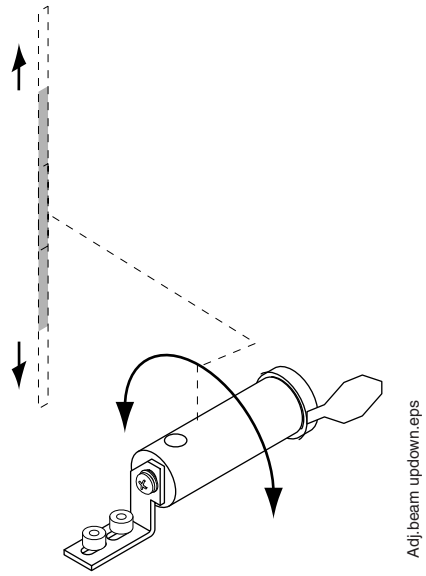
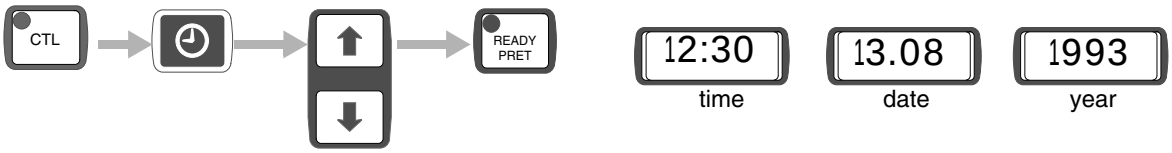


Figure 32

6 SETTING THE CLOCK



Press the CTL and then the CLOCK- key to enter into the calendar clock set mode. In this mode the keys CLOCK, READY, UP and DOWN only are operative. The functions of these keys are:

CLOCK	Go to the next number to be adjusted.
UP	Increase the number to be adjusted.
DOWN	Decrease the number to be adjusted.
READY	Exit the set mode and start the clock.

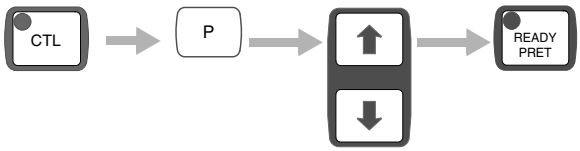
When first entered into this mode the time display unit minutes start blinking indicating that they can now be adjusted. Note that the clock is still running before the first actual adjustment is done and exiting this mode now with the READY-key does not modify the clock at all. Using the UP and DOWN keys the number can be modified, which also stops the clock.

Operating the CLOCK- key allows the setting of the next parameter in the following order:

Minutes (units)	0 - 9
Minutes (tens)	0 - 5
Hours	00 - 23
Day	01 - 31
Month	01 - 12
Year (thousands)	0 - 9
Year (hundreds)	0 - 9
Year (tens)	0 - 9
Year (units)	0 - 9

From unit years the setting returns to the unit minutes. The clock set mode can be exit from any point. To make it accurate a time signal should be waited and the clock set mode exit made at the very moment. Exiting this mode clears the seconds (that cannot be seen) and starts the clock.

7 EXPOSURE WARNING SIGNAL ADJUSTMENT



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 to be too loud, the tone (and loudness) can be adjusted. Pressing CTL and then the SINUS-key activates this adjustment mode turning the sound on continuously. In this mode the keys READY, UP and DOWN only are operative. Operating the other keys does nothing. The functions of these keys are:

UP	Adjust the tone higher
DOWN	Adjust the tone lower
READY	Exit this mode and program the new tone into the memory

8 AUTOMATIC EXPOSURE CONTROL (AEC) CALIBRATION

NOTE ***In case the X-ray unit is equipped with optional Automatic Exposure Control (AEC), the AEC calibration must be performed after the AEC retrofit kit installation and whenever the panoramic X-ray beam is adjusted. The AEC calibration is performed after the panoramic X-ray beam adjustment.***

Perform the AEC calibration in the following order:

1. Check/adjust the panoramic X-ray beam.

2. Adjust the positions of primary slots number 0 and 1 so that the AEC signal value is as large as possible.

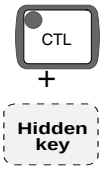
3. Adjust the base value so that the film density is 1.0 ±0.1 OD.

4. Adjust the AEC detector offset value (base signal) to value 8 ±2. The offset value is shown on the main display when the unit is in the AEC mode and no exposure is taken.

5. Adjust the AEC-signal value to approx. 60. During the exposure this AEC-signal value is shown on the main display.

6. Fine adjust the AEC-signal in normal mode.

8.1 Checking / adjusting the primary slot position



After the panoramic X-ray beam adjustment the AEC-signal must be checked. The position of the slot must be adjusted so that the AEC-signal value is as large as possible.

Enter the service mode: press the CTL-key and simultaneously press and hold down the hidden key (to the right of the PAN key) until the temperature of the tubehead appears on the display (about four seconds). The ready key indicator light will start to flash. This indicates that you have entered the service mode.

Enter the AEC mode by pressing and holding down the auto key until the indicator light will come on.

Place the AEC calibration filter to the front of the primary slot. Note, that in the panoramic X-ray unit you have to tape the AEC calibration to the primary slot mechanism. You will leave this filter in place for the entire AEC calibration procedure.

Panoramic X-ray unit **Pan/ceph X-ray unit**

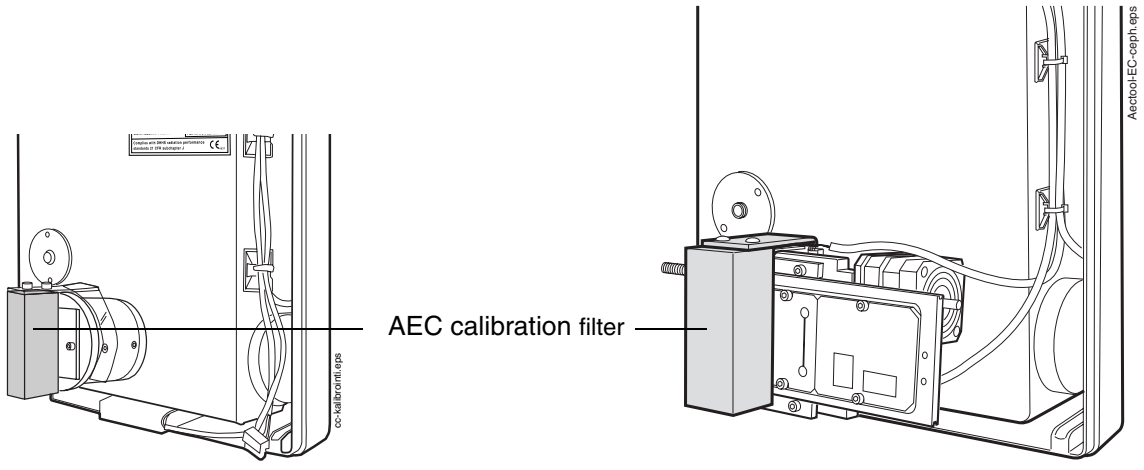


Figure 33

Load the cassette with a film and slide it into the cassette holder.

Protect yourself from radiation and press the exposure button.

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

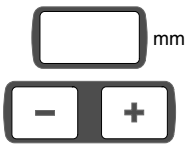
During the exposure the AEC-signal is shown on the main display. Adjust the slot position in horizontal direction until the signal reaches its maximum value as follows.

Planmeca Proline EC panoramic unit:
Adjust the primary slot position: loosen the two screws that hold the primary slot plate in position and move the plate until the beam is correctly positioned. The primary slot adjustment in horizontal direction is described in section “Radiation beam too far to the right or left” on page D-6.

Planmeca Proline EC pan/ceph unit:

hold for 4 seconds

Press the CTL and press and hold down the clock key for 4 seconds to enter the beam alignment mode.



Adjust the position of the beam by pressing the patient positioning (mm) keys. The minus key will move the slot mechanism, and beam to the left, and the plus key will move the slot mechanism, and beam to the right. The primary slot adjustment in horizontal direction is described in section “Radiation beam too far to the right or left” on page D-9.

Check the X-ray beam position with the beam alignment tool after the adjustment. If the beam image is not within the borders of the rectangle marked on the alignment tool, adjust the beam position slightly.

8.2 Base value adjustment

The default kilovolt value, i.e. the value that is used when the AEC exposure starts, is 68 kV. The film density is adjusted by changing the default milliampere value. The adjustment range is from -3 to +3. The density value 0 corresponds the mA value 8. Changing the density value will change the mA value as follows: one density step equals to one mA step. The negative value decreases the mA value from the value 8mA, whereas the positive value increases it.

kV	mA	Density value
68	5	-3
68	6	-2
68	7	-1
68	8	0
68	9	1
68	10	2
68	11	3

To find the exposure values that give the film density closest to value 1.0 ±0.1 OD the test exposures are taken. The films are either compared to the reference film which density is approx. 1.0 OD (supplied with the system), or the film density is measured using a film densitometer.

It is recommended to start with exposure values 68kV and 7mA and check the film density. In case other exposures are needed, decrease/increase the mA value until the correct film density is achieved.

Place the AEC calibration filter to the front of the primary slot.

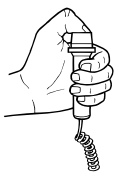
Move the cassette carriage to the loading position.

In the darkroom open the cassette and place a film inside the cassette. Close the cassette. Slide the cassette into the cassette holder.

NOTE ***The film density adjustment must be performed in normal panoramic mode. Make sure that the unit is <u>NOT</u> in the AEC mode.***

Select a kilovolt value of 68 and a milliampere value of 7.

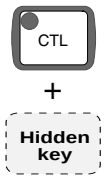
Drive the X-ray unit to the exposure position. The rotating unit will turn to the start position and the indicator light will come on.



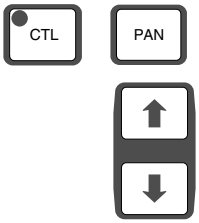
Take an exposure.

Press the return key to drive the cassette to the loading position, remove the cassette and process the film.

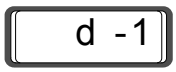
Compare the film to the reference film: the film must be as dark as the reference film. Repeat the procedure with different mA values until the correct film density is achieved, and then select the density value that gives the right mA value as follows.



Enter the service mode: press the CTL-key and simultaneously press and hold down the hidden key (to the right of the panoramic mode selection key) until the temperature of the tube-head appears on the display (about four seconds). The ready key indicator light will start to flash. This indicates that you have entered the service mode.



To change the density value enter the film density adjustment mode by pressing the control key and then press the pan key until the density value, indicated with “d”, is shown on the main display. Change the value with the height adjusting keys.



Select the density value that corresponds the mA value, e.g. if the mA value is 7mA, select the density value -1.

Exit the film density adjustment mode by pressing the ready key.

8.3 Adjusting the AEC-signals

NOTE ***Take five 10 seconds exposures in the service mode with a kilovolt value of 68 and a milliampere value of 7 before adjusting the AEC-signals.***

Make sure that the unit is in the service mode and that the AEC mode is selected. If needed, enter the AEC mode by pressing and holding down the auto key until the indicator light will come on.

U 8

In the service mode the AEC detector offset value (base signal) is shown on the main display when the unit is in the AEC mode and no exposure is taken. Set the offset to value 8 ±2 with the offset adjustment trimmer located on the Cassette limit PCB. Turning the trimmer clockwise increases the value and turning it counterclockwise decreases it.

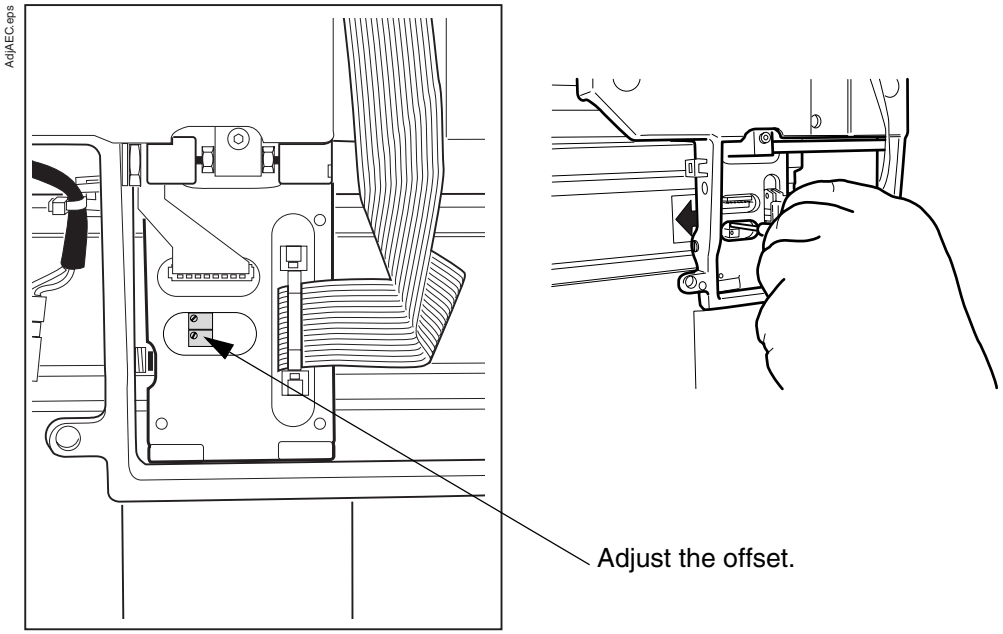


Figure 34

After the offset value is set the AEC-signal during the exposure is adjusted. Check that the AEC calibration filter is in the front of the primary slot.

In the darkroom open the cassette and place a film inside the cassette. Close the cassette. Slide the cassette into the cassette holder.

Protect yourself from radiation and press the exposure button.

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

U 60

During the exposure the AEC-signal value is shown on the main display. Set this value to approx. 60 with the gain trimmer located on the Cassette limit PCB. Turning the trimmer clockwise decreases the value and turning it counterclockwise increases it. Repeat the adjustment until the correct value has been reached.

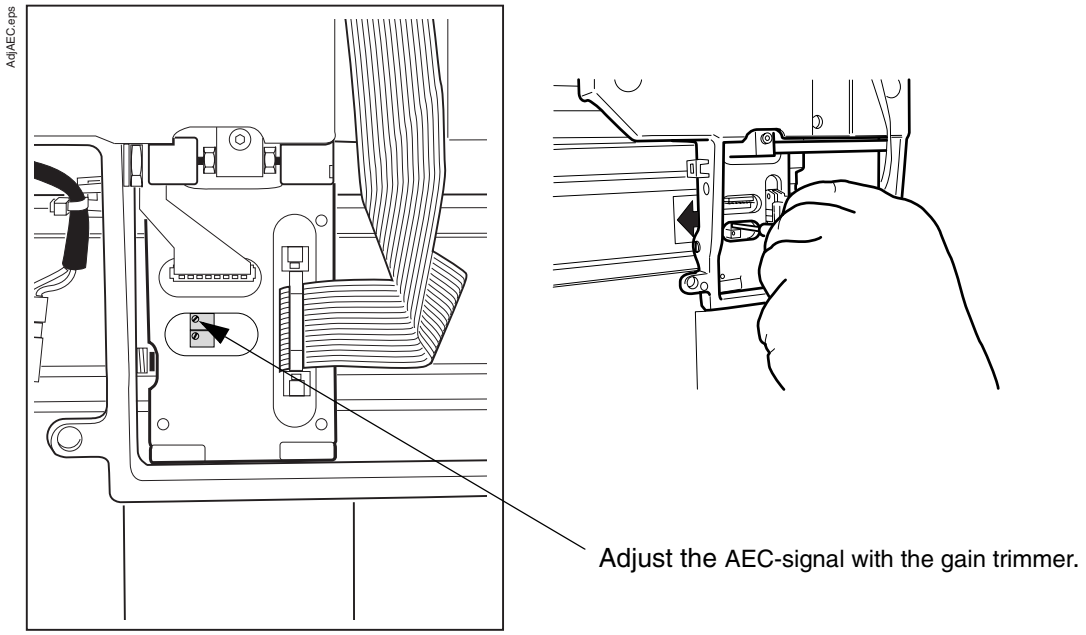


Figure 35

NOTE ***The final adjustment of the AEC-signal during the exposure must be done in the normal mode.***

Final adjustment in normal mode

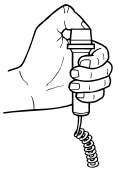
NOTE ***In the normal mode the AEC-signal is only shown on the main display if you previously were in the film density adjustment mode. In case the AEC-signal is not shown on the main display, enter the service mode and enter the film density adjustment mode. Then exit the film density adjustment and the service modes and the signal can be seen on the main display.***

Hidden key

To exit the service mode press the hidden key briefly.

READY PRET

Drive the X-ray unit to the exposure position by pressing the ready key.



Take an exposure. Note that you can stop radiation in the middle of the exposure (approx. 4 seconds after starting the exposure). An error code 00 will appear on the display and start to flash. Press the CTL-key to clear the error code.

After the exposure the difference between the offset value and the AEC-signal during the exposure is shown on the main display. Set this value to 51 ±1 with the gain trimmer located on the Cassette limit PCB. Repeat the adjustment until the correct value has been reached and check the value by taking at least two exposures.

NOTE ***In the service mode the difference between the offset value and the AEC-signal value of the latest exposure (taken in the normal mode) can be seen by pressing the CTL key. To exit this mode press the CTL key a second time.***

9 CEPHALOSTAT ADJUSTMENT

9.1 Removing the cassette holder cover

Loosen the two M4x8 BN 5950 bolts on the top of the cover with a 5.5 mm ring spanner. Loosen the two M4x4 DIN 7985 screws on the bottom of the cover. Pull the cover away from the cassette holder.

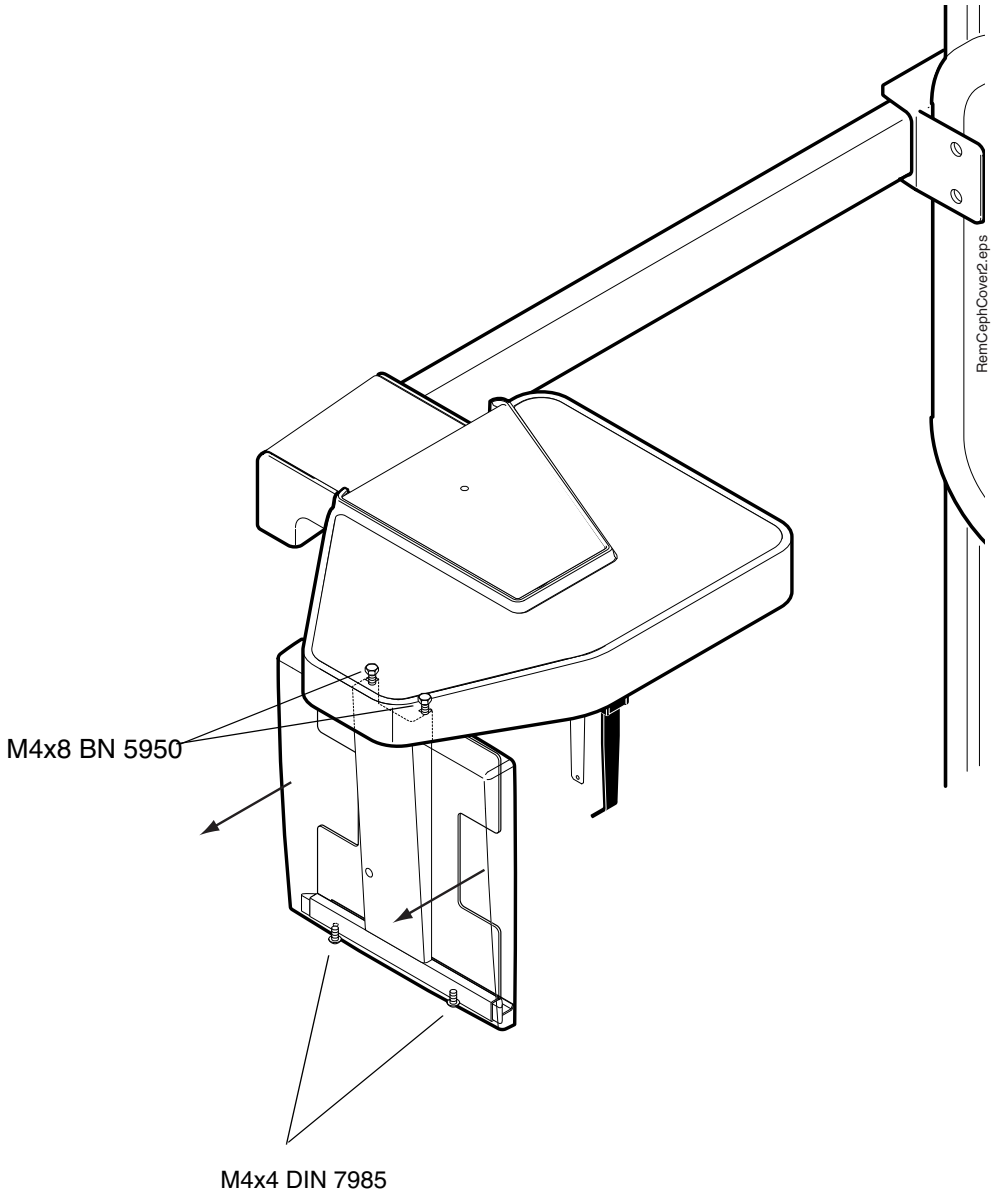


Figure 36

9.2 Checking the head support position

P

Press and hold the P key until you have heard two audible signals. The latest used exposure mode number starts to flash on the main display.

− +

Select the cephalometric exposure mode number 4 with the program selection keys (collimator number 4). The text CPH4 will appear on the main display. The rotating unit and cassette carriage will move automatically to the correct position for taking cephalometric exposures.

Remove the tubehead covers and cassette carriage covers (see sections “Tubehead covers” on page H-1, “Secondary slot cover” on page H-1 and “Cassette carriage back cover” on page H-1).

Place the ceph head support alignment tools in the ear post holders as far as they go (Fig. 37, 1). Rotate the head support to the 90° position.

Look through the opening on the cephalostat cassette holder and the opening on the head support alignment tools. The fourth primary slot is seen symmetrically if the adjustment is correct (Fig. 37, 2).

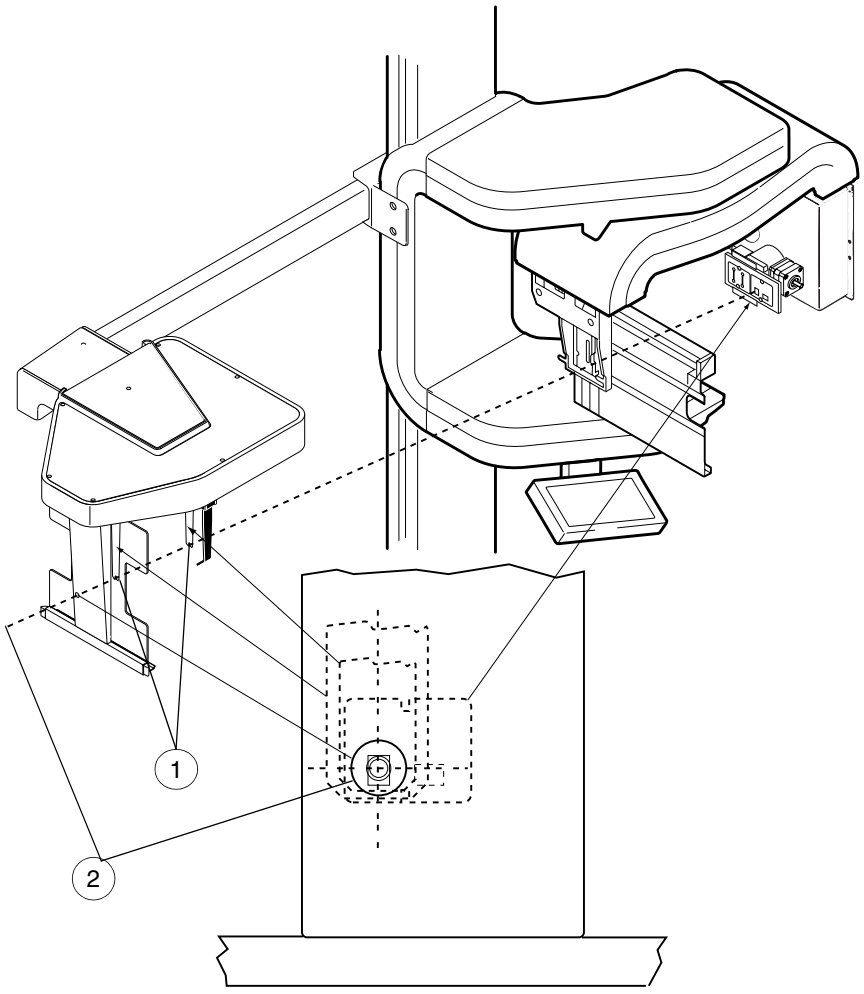


Figure 37

If the fourth primary slot is not seen symmetrically, the head support requires readjustment. See instruction given in section “Head support adjustment” on page D-35.

9.3 Head support adjustment

Switch the unit off. Remove the cephalostat arm upper cover, attachment casting cover and attachment mechanism cover.

Make sure that the locking screw of the adjustment flange is loosened (Fig. 38, 1). Adjust the head support position according to the Fig. 38. Rotate the head support around its vertical axis to adjust the ear posts in horizontal direction (Fig. 38, 2) and around its horizontal axis to adjust the ear posts in vertical direction (Fig. 38, 3).

If the cephalostat cassette holder does not run parallel with the primary slot, adjust the cassette holder in vertical direction (Fig. 38, 4).

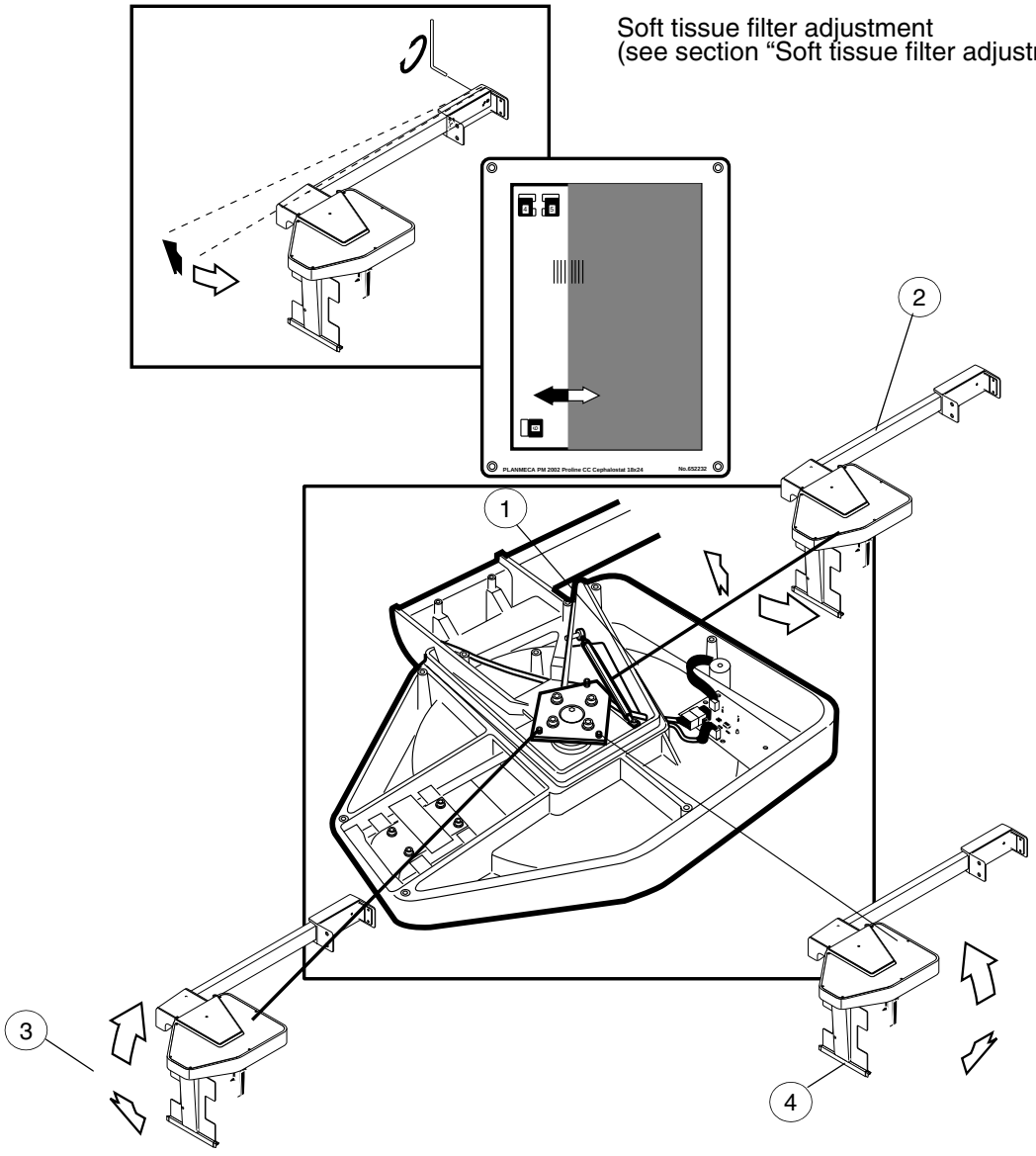


Figure 38

Fasten the loosened screws and replace the covers.

Remove the head support alignment tools and place the ear posts in the ear post holders.

Place a loaded cassette to the cassette holder.

Select low exposure parameters, e.g. 62 kV, 6mA and 0.4 sec.

Take an exposure and develop the film. If the ear posts are exposed concentrically the system is ready for use. Otherwise readjust the cephalostat arm. (See Fig. 39).

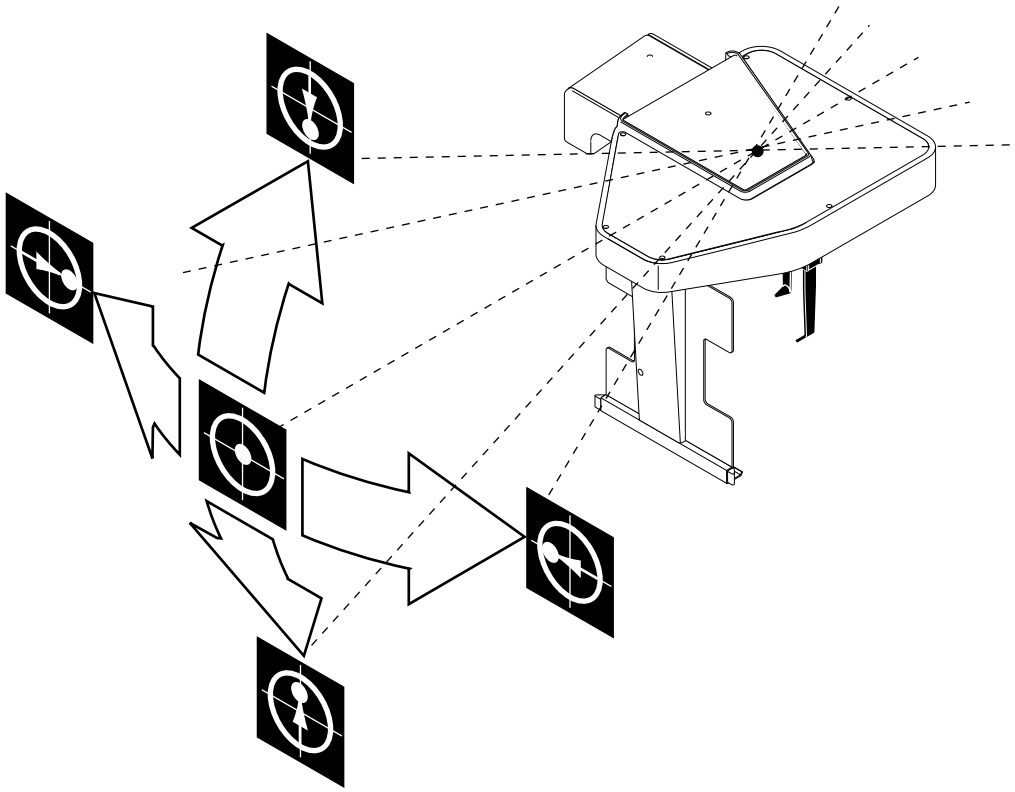


Figure 39

9.4 Checking the soft tissue filter

Clip the soft tissue filter positioning tool to the soft tissue filter which is at the end of the cassette carriage (Fig. 40). This will enable you to see the soft tissue filter when you check its position.

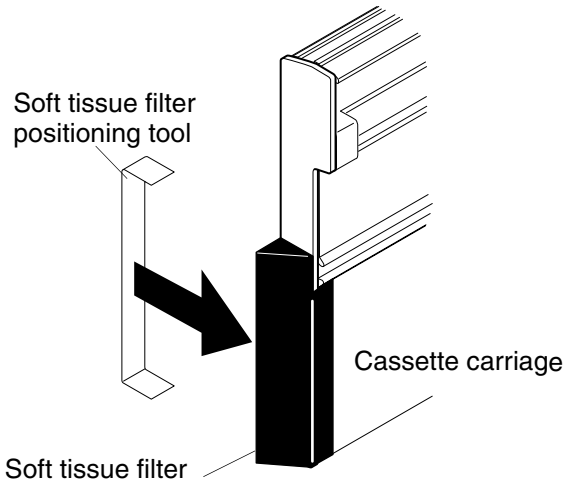


Figure 40

Enter the ceph mode. Press and hold the P key until you have heard two audible signals. The latest used exposure mode number starts to flash on the main display.

Select the cephalometric exposure mode number 4 (CPH4) with the program selection keys (collimator number 4).

Orientate the Cephalometric beam alignment tool so that it is vertical and then place it in the cephalometric cassette holder. Position it so that it is on the left of the cassette holder (lateral exposure position).

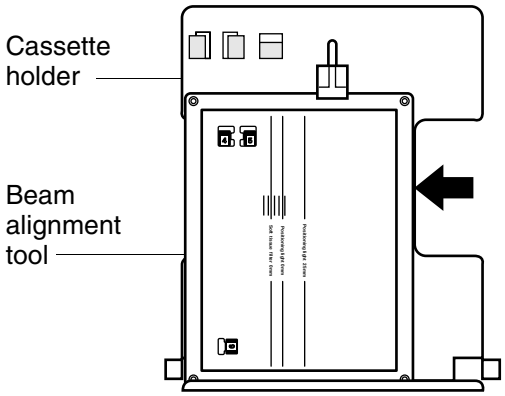


Figure 41

Select kilovolt and milliampere values high enough to enable the radiation beam to be seen in a darkened room for example 62kV and 6mA. The actual values will depend on how dark the room is.

Stand behind the tubehead and protect yourself from radiation. Press and hold down the exposure button. The image of the radiation beam from slot number 4 will appear on the alignment tool.

The radiation beam must appear within borders of the rectangle marked on the beam alignment tool and to the right of the line marked “Soft tissue filter 0mm”.

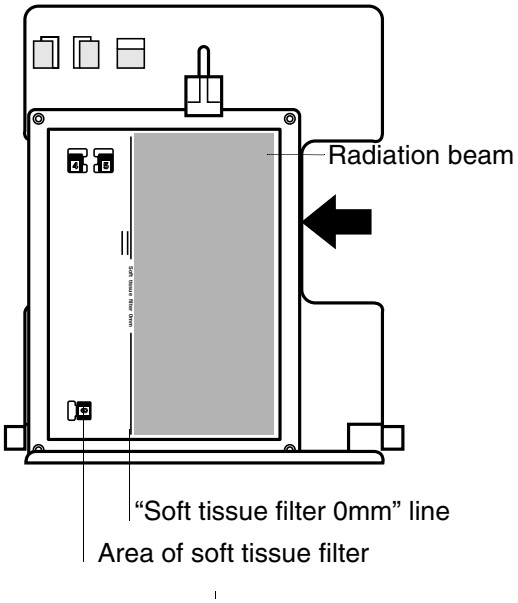


Figure 42

If the left-hand side of the radiation beam does not reach the line marked “Soft tissue filter 0mm” or extends passed the line the soft tissue filter is in the wrong position it must be repositioned. Refer to the section “Soft tissue filter adjustment” on page D-39.

9.5 Soft tissue filter adjustment

Check the radiation beam position according to instructions given in section “Checking the soft tissue filter” on page D-37. If the left side of the radiation beam is too far left or right the radiation beam must be repositioned.

Radiation beam too far left or right

Check the place of the radiation beam from the scale on the beam alignment tool (Fig. 43, 1).

Screw the cephalostat arm adjusting screw according to the table (Fig. 43, 2, 3).

For example: if the radiation beam extends 3mm passed the “0mm line”, screw the adjusting screw about 0.6 turn counterclockwise.

If the radiation beam does not reach the “0mm line”, the screw must be screwed counter-clockwise according to the same table.

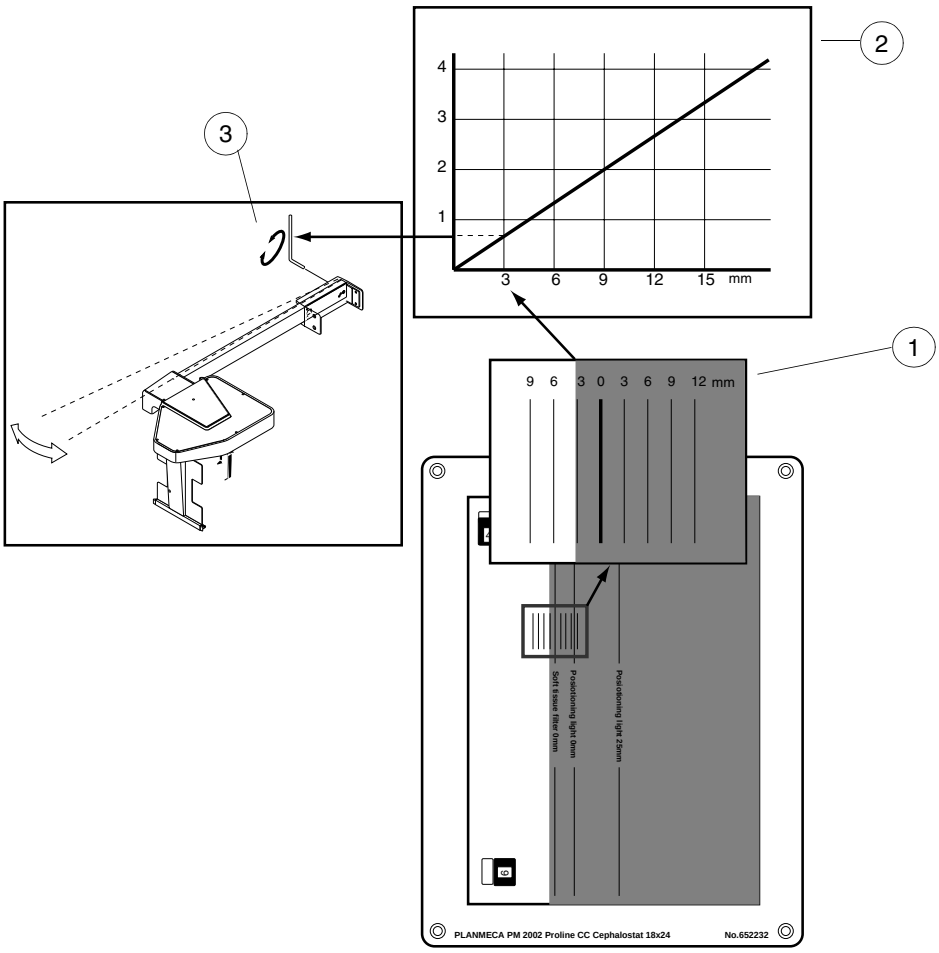


Figure 43

NOTE ***Place the ceph head support alignment tools in the ear post holders and check the cephalostat arm adjustment according to instruction given in section “Checking the head support position” on page D-34.***

9.6 Checking the cephalometric beam alignment

P

Enter the ceph mode. Press and hold the P key until you have heard two audible signals. The latest used exposure mode number starts to flash on the main display.

− +

Select the cephalometric exposure mode number 4 (CPH4) with the program selection keys. The rotating unit and cassette carriage will move automatically to the correct position for taking cephalometric exposures.

Enter the service mode, see section “How to enter/exit the service mode” on page B-6.

Orientate the cephalometric beam alignment tool so that it is vertical and then place it in the cephalometric cassette holder. Position it so that it is on the left of the cassette holder.

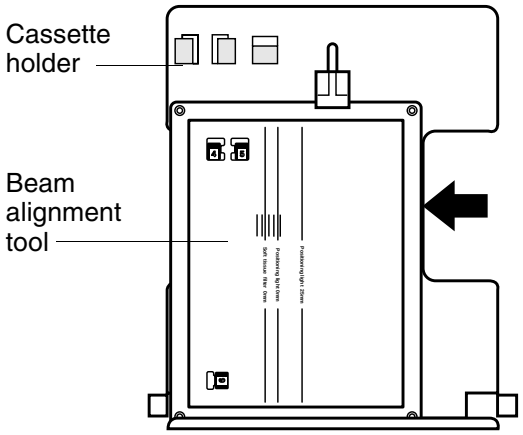


Figure 44

P

Press and hold the P key until you have heard two audible signals. The latest used exposure mode number starts to flash on the main display. Select the cephalometric exposure mode number 4 (third collimator slot) with the program selection keys. The text CPH4 will appear on the main display.

− +

Stand behind the tubehead and protect yourself from radiation. Press and hold down the exposure button. The image of the radiation beam from slot number 4 will appear on the alignment tool.

NOTE ***The soft tissue filter will filter a narrow area of the left side of the radiation beam.***

The radiation beam must appear within the borders of the rectangle marked on the alignment tool. If it does not refer to section“Primary slot adjustment, Planmeca Proline EC Pan/Ceph X-ray” on page D-8.

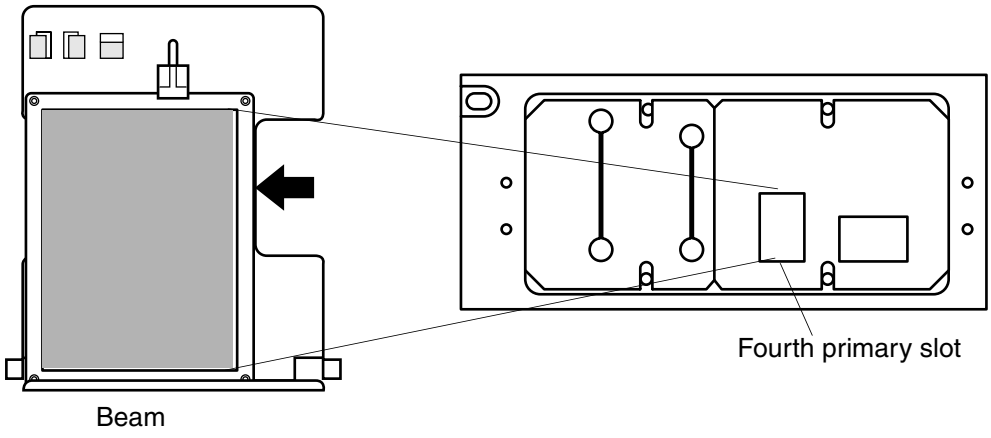


Figure 45

Slide the beam alignment tool to the right of the cassette holder.

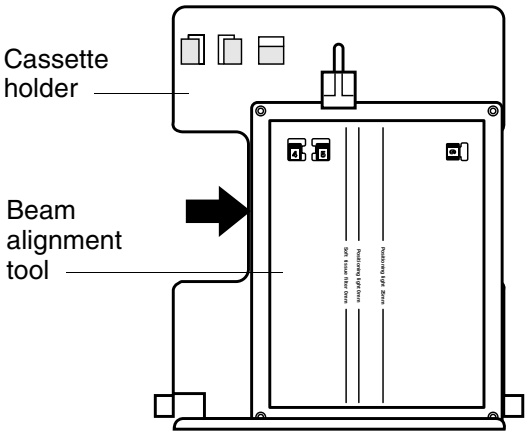
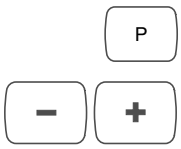


Figure 46



Press and hold the P key until you have heard two audible signals. Select the cephalometric exposure mode number 5 with the program selection keys. The text CPH5 will appear on the main display. Note that the third collimator slot (the first ceph slot) is used to take both vertical symmetric and vertical asymmetric exposures. The slot is moved slightly to accommodate the two exposure views.

Stand behind the tubehead and protect yourself from radiation. Press and hold down the exposure button. The image of the radiation beam from slot number 5 will appear on the alignment tool.

The radiation beam must appear within the borders of the rectangle marked on the alignment tool. If it does not refer to the section “Primary slot adjustment, Planmeca Proline EC Pan/ Ceph X-ray” on page D-8. The adjustment is performed in the same way as when adjusting the standard panoramic slot.

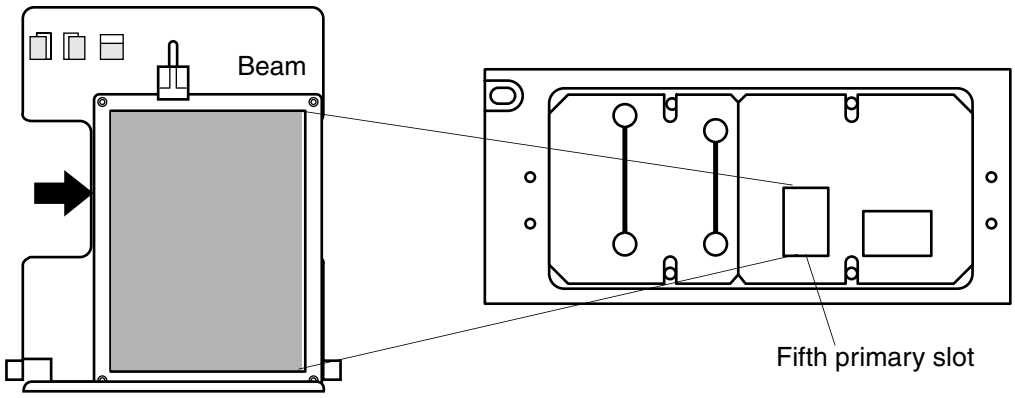


Figure 47

Turn the beam alignment tool so that it is horizontal.

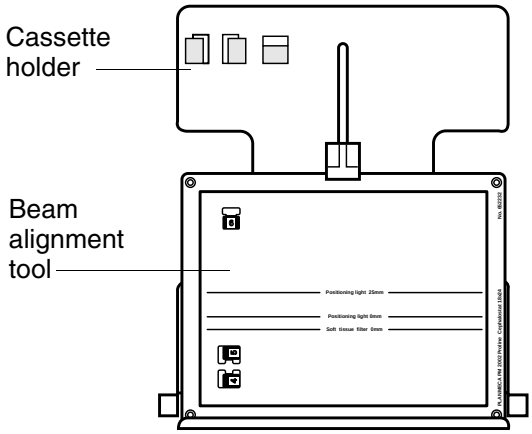
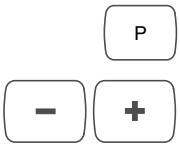


Figure 48



Press and hold the P key until you have heard two audible signals. Select the cephalometric exposure mode number 6 with the program selection keys (fourth collimator slot). The text CPH6 will appear on the main display.

Stand behind the tubehead and protect yourself from radiation. Press and hold down the exposure button. The image of the radiation beam from slot number 6 will appear on the alignment tool.

NOTE ***The soft tissue filter will filter a narrow area of the left side of the radiation beam.***

The radiation beam must appear within the borders of the rectangle marked on the alignment tool. If it does not refer to “Primary slot adjustment, Planmeca Proline EC Pan/Ceph X-ray” on page D-8. The adjustment is performed in the same way as when adjusting the standard panoramic slot.

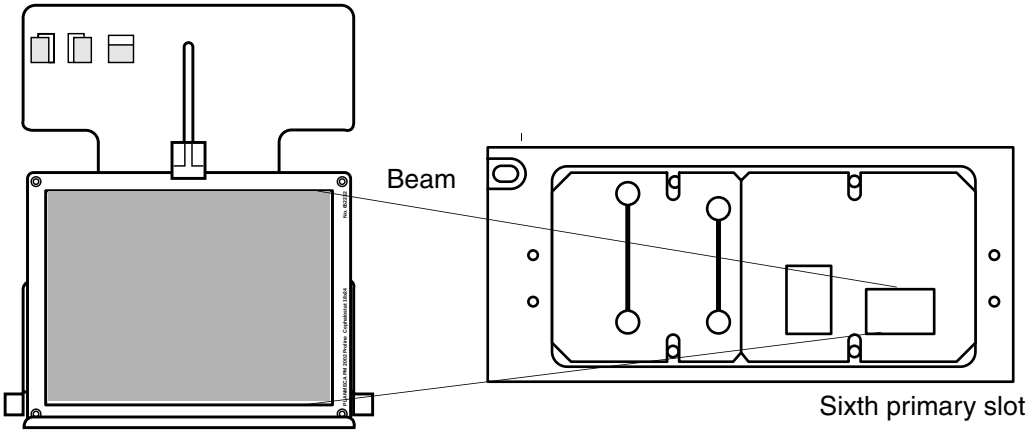


Figure 49

When all the slots have been checked, and if necessary adjusted, exit the service mode by pressing the hidden key.

Chapter

E

DIMAX3 DIGITAL SYSTEM ADJUSTMENT

NOTE ***This chapter contains the information required to set up and calibrate the Planmeca Proline EC Panoramic X-ray with Dimax3 sensor head. In case your unit is a film-based panoramic X-ray, perform the adjustments according to the instructions given in chapter "ADJUSTMENT & CALIBRATION" on page D-1.***

Protect yourself from radiation when you are checking the beam alignment. Since radiation safety requirements vary from state to state and country to country it is the responsibility of the installer to ensure that the correct precautions are observed.

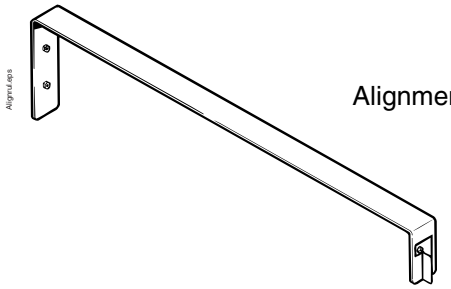
The display values shown in this guide are only examples and should not be interpreted as recommended values unless otherwise stated.

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.

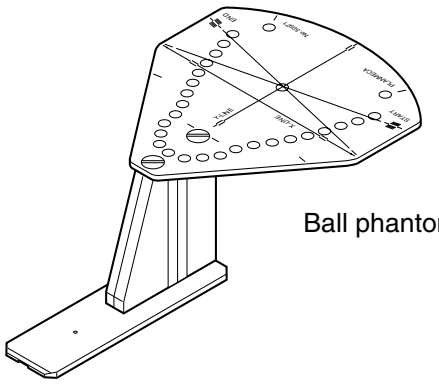
1 REQUIRED TOOLS

- Alignment ruler (part number 50973). For checking the position of the patient positioning mechanism.



Alignment ruler

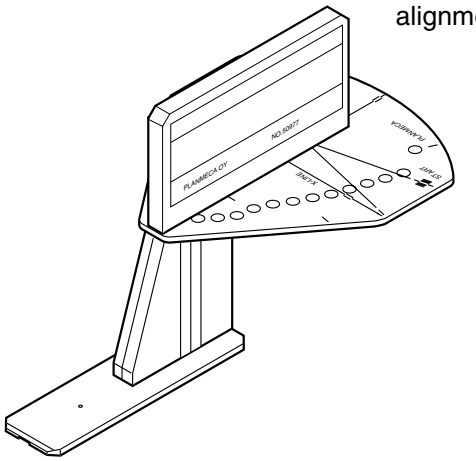
- Ball phantom (part number 50971). For checking the position of the patient positioning mechanism and the positioning lights.



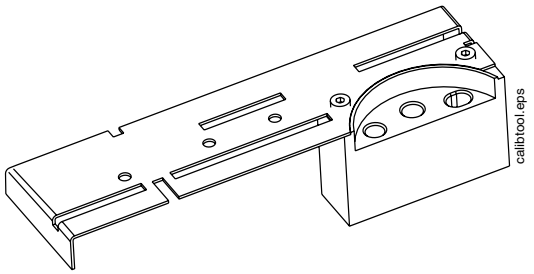
Ball phantom

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

Frankfort plane alignment tool

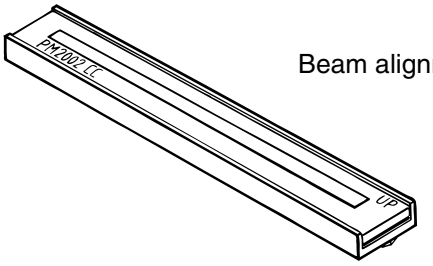


- Sensor alignment tool (part number 10002699).



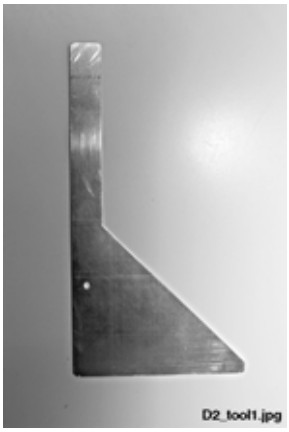
Sensor alignment tool

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

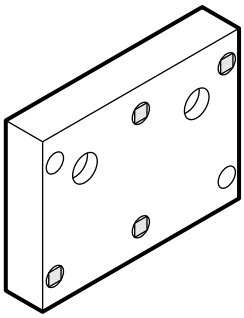


Beam alignment tool

- Cephalostat calibration tool (part number 10002935). For calibrating the cephalostat.



- Panoramic mode calibration block (part number 665413). For calibrating the panoramic sensor head.



2 PANORAMIC X-RAY BEAM ADJUSTMENT

NOTE ***Switch the unit off after all the checks and adjustments have been performed, before taking any patient exposures.***

2.1 Removing and attaching the fixed sensor head

Removing the sensor head

Unscrew the bottom cover plate attachment screw with the 4mm allen key and remove the cover plate.

Figure 1

Unscrew the two attachment screws of the quick connector mechanism cover with the 4mm allen screw and slide the cover from its position.

NOTE ***In case the X-ray is a pan/ceph unit with two fixed sensor heads, the cover is attached to two attachment pins. Unscrew the two attachment screws with the 2.5mm allen key and remove the cover by sliding it horizontally from its position.***

Figure 2

Loosen the four screws located on the lock disc.

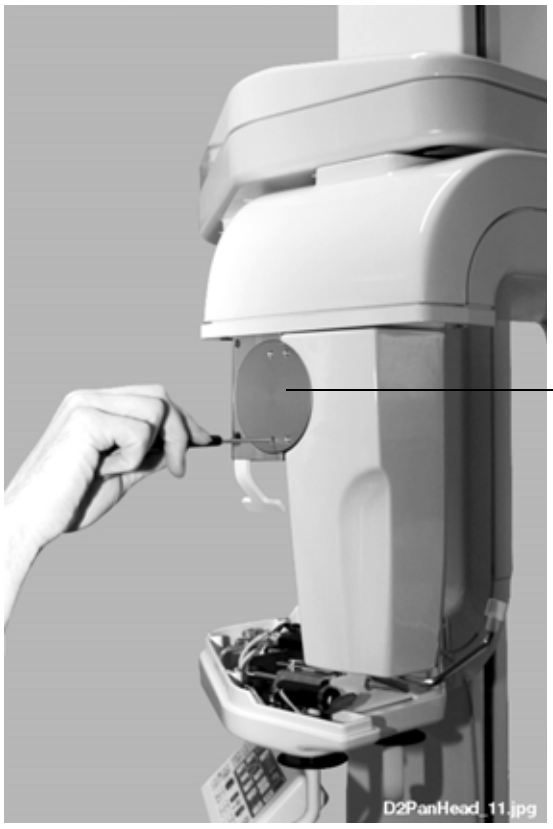


Figure 3

Loosen the lock disc attachment screw with the 3mm allen key (Fig. 4, 1) and remove the lock disc from the adapter (Fig. 4, 2).

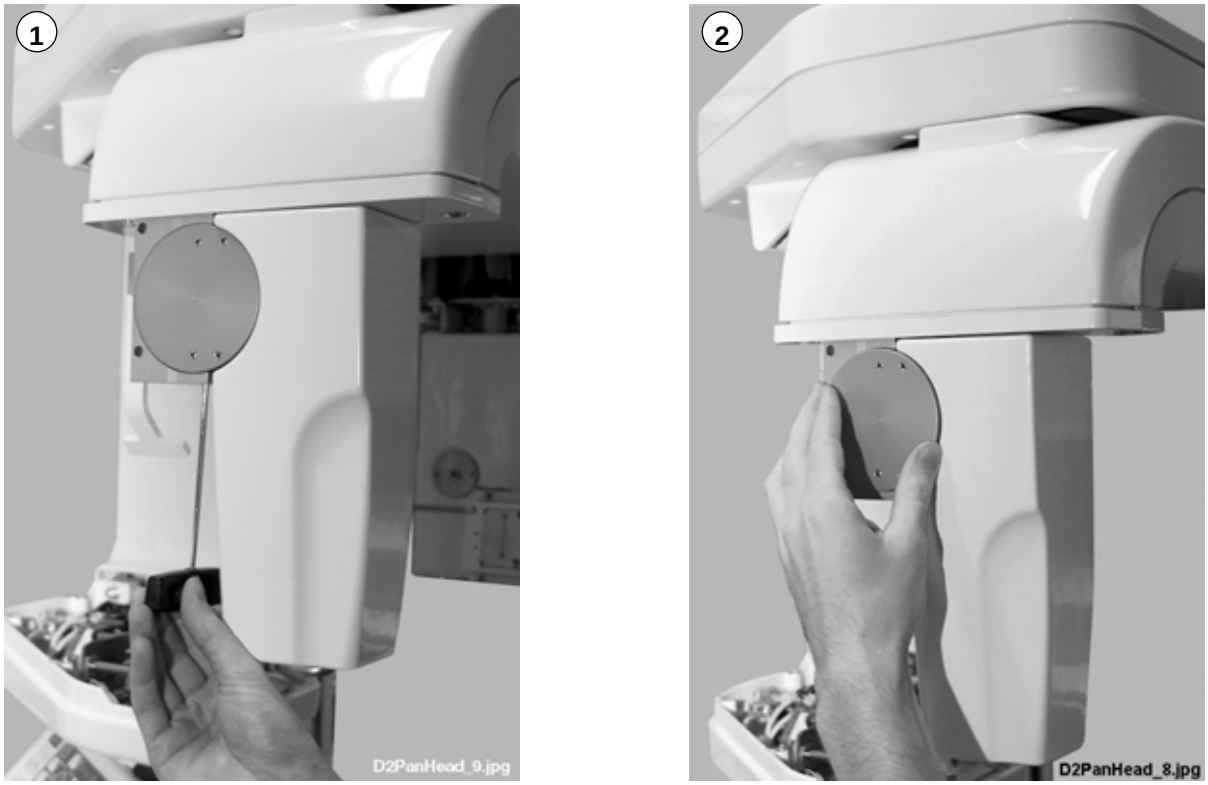


Figure 4

Push the button axle inwards and remove the sensor head from its adapter.

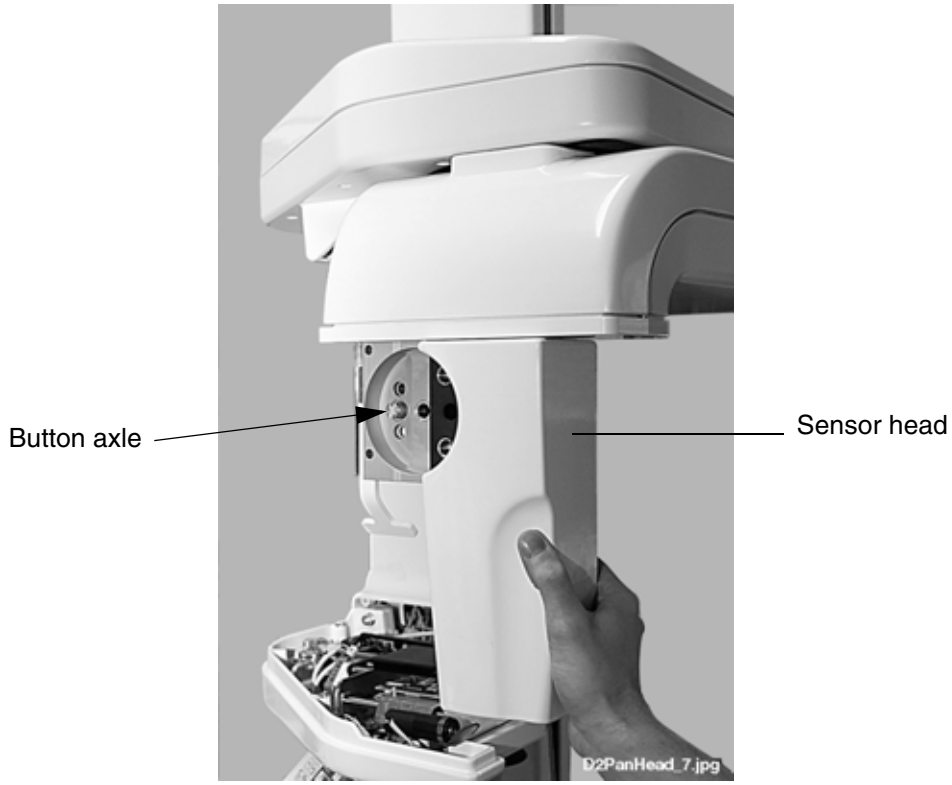


Figure 5

The sensor alignment tool can now be attached to the adapter pins.

Attaching the fixed sensor head to the adapter

Push the sensor head to its adapter.

Figure 6

Place the lock disc to the adapter (Fig. 7, 1) and tighten the attachment screw (Fig. 7, 2) with the 3mm allen key.

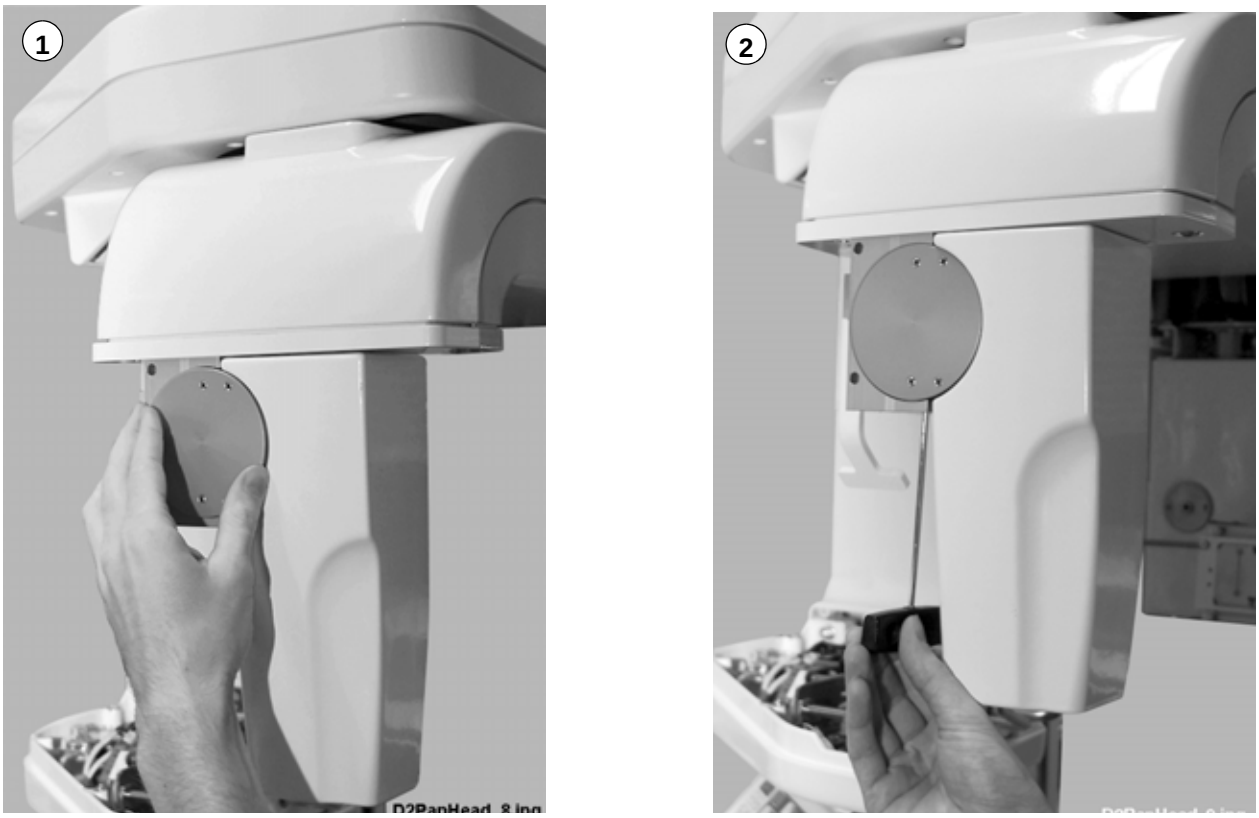


Figure 7

Push the button axle towards the lock disk. Make sure that the head of the axle goes into the hole on the lock disc and tighten the attachment screw with 3mm allen key.

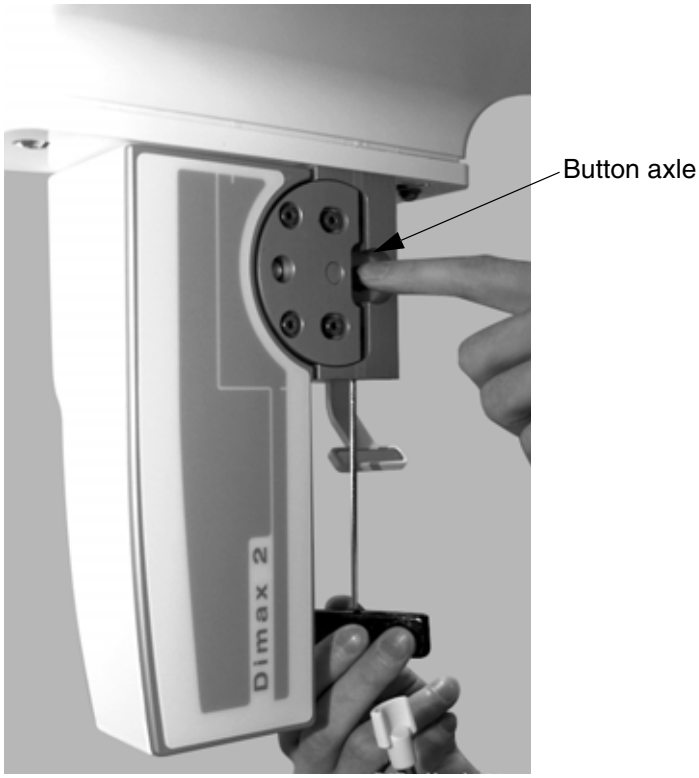


Figure 8

To remove the sensor head clearance tighten the four screws located on the lock disc slightly with 2.5mm allen key.

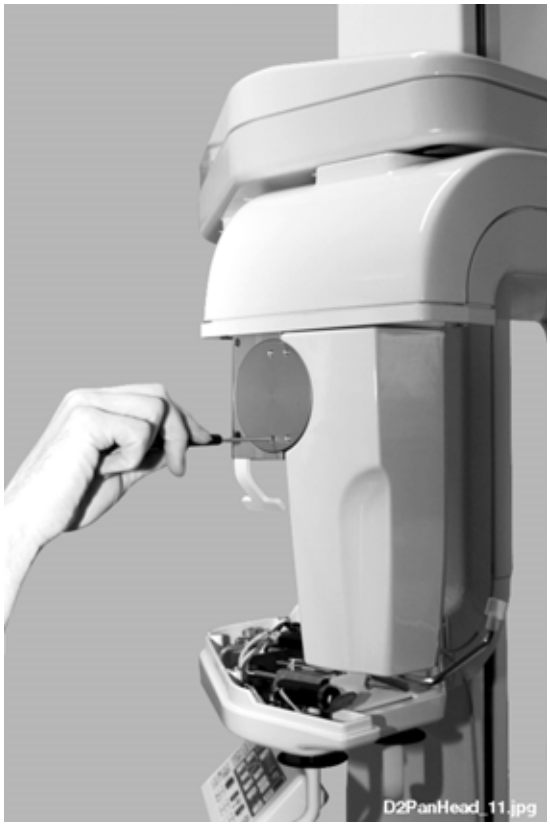


Figure 9

Attach the covers to the adapter.

2.2 Sensor head with quick connector mechanism - removing the covers

NOTE ***In certain market areas the movable sensor head is not available, in which case all cephalostat-equipped units have two fixed sensor heads.***

Unscrew the bottom cover plate attachment screw with the 4mm allen key and remove the cover plate.

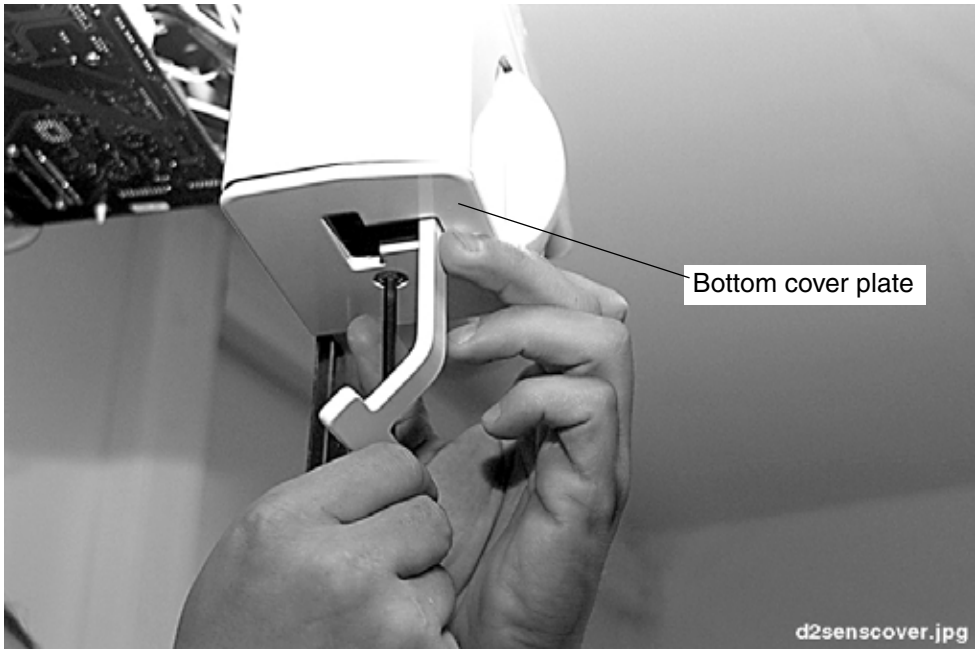


Figure 10

Turn the lock disc from above the locking plate and push in the quick connector mechanism locking knob. Unscrew the two attachment screws of the quick connector mechanism cover with the 4mm allen screw and slide the cover from its position.

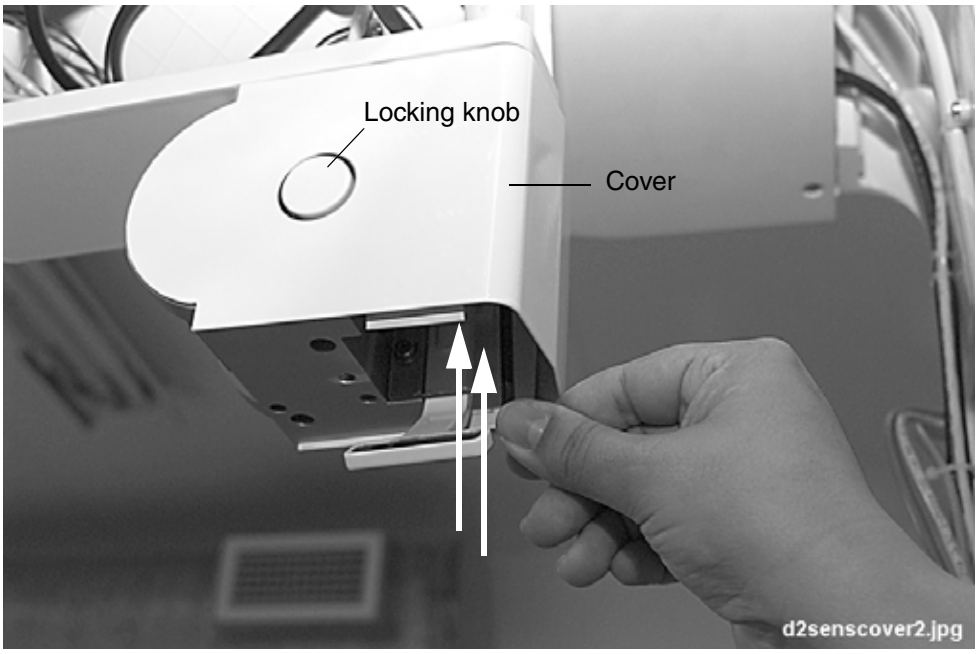


Figure 11

2.3 Checking the panoramic beam position

Before the X-ray is used the position of the radiation beam must be checked. Remove the inner cover from tubehead assembly. Four screws hold the tubehead cover in position, these are located at the rear of the tubehead assembly.

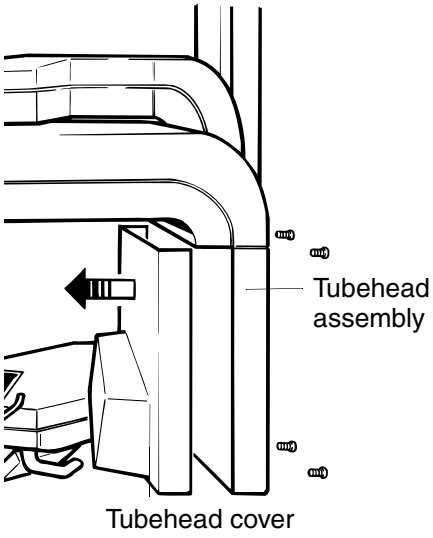


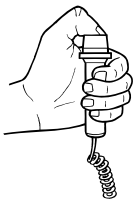
Figure 12

Remove the sensor head from the quick connector mechanism (see instructions given in Planmeca Proline EC panoramic X-rays user's manual), or remove the fixed sensor head from its adapter (refer to section "Removing and attaching the fixed sensor head" on page E-4). Attach the sensor alignment tool to the adapter. Place the beam alignment tool to the sensor alignment tool as shown on the Fig. 13. Note which way round it goes. Slide the beam alignment tool as up as it goes in this sensor alignment tool position.

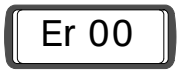
Figure 13

Switch the unit on. Enter the test mode (see section "Test mode" on page B-4).

Press the ready key to drive the X-ray into the exposure position. The rotating unit and cassette carriage will move to their respective ready positions. When the X-ray is ready the indicator light will come on.



Start to take a test exposure by pressing and holding down the exposure button on the remote control. Stop pressing the exposure button when the tubehead has rotated to a convenient position for viewing the secondary slot.

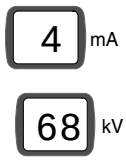


An error code will appear on the display and start to flash.

Press the CTL-key to clear the error code.

Enter the service mode (see section “How to enter/exit the service mode” on page B-6). The radiation beam from the first slot can now be checked without the rotating unit moving.

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.



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

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

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 appear within the borders of the rectangle marked on the alignment tool (if the beam is not correctly aligned see section “Radiation beam adjustment, Planmeca Proline EC Panoramic X-ray” on page E-12, or section “Radiation beam adjustment, Planmeca Proline EC Pan/Ceph X-ray” on page E-15).

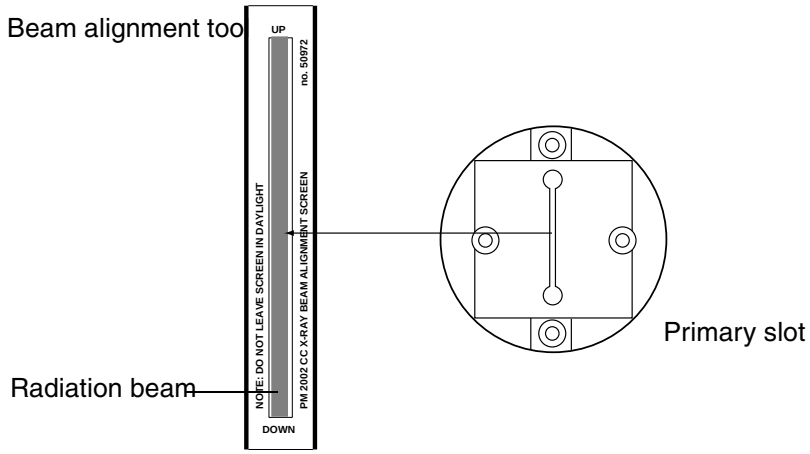


Figure 14

When the slot has been checked, and if necessary adjusted, exit the service mode and take a ball phantom exposure to check the position of the patient positioning mechanism, see section “PATIENT POSITIONING MECHANISM” on page E-26.

2.4 Radiation beam adjustment, Planmeca Proline EC Panoramic X-ray

NOTE ***In case the radiation beam is not correctly aligned first check the sensor head position by using a spirit level. The sensor head (i.e. the sensor alignment tool) must be perpendicular to the rotating unit (see Fig. 16 on page E-13), otherwise the angle of the quick connector mechanism must be adjusted according to the instructions given in section "Adjusting the sensor head position" on page E-12 below.***
After adjusting the sensor head position adjust the primary slot according to the instructions given in sections "Primary slot adjustment - radiation beam too low or high" on page E-13 and "Primary slot adjustment - radiation beam too far to the right or left" on page E-14, if needed. In case the X-ray unit is equipped with cephalostat follow the instructions given in section "Radiation beam adjustment, Planmeca Proline EC Pan/Ceph X-ray" on page E-15.

Adjusting the sensor head position

In case the sensor head is attached to the rotating unit, remove the sensor head from the quick connector mechanism (see instructions given in Planmeca Proline EC panoramic X-rays user's manual), or remove the fixed sensor head from its adapter (refer to section "Removing and attaching the fixed sensor head" on page E-4).

Remove the adapter covers. Refer to section "Removing and attaching the fixed sensor head" on page E-4 or to section "Sensor head with quick connector mechanism - removing the covers" on page E-9.

Attach the sensor alignment tool to the adapter.

Loosen the two screws located on the outer side of the mechanism with the 3 mm allen key (see Fig. 15 below).

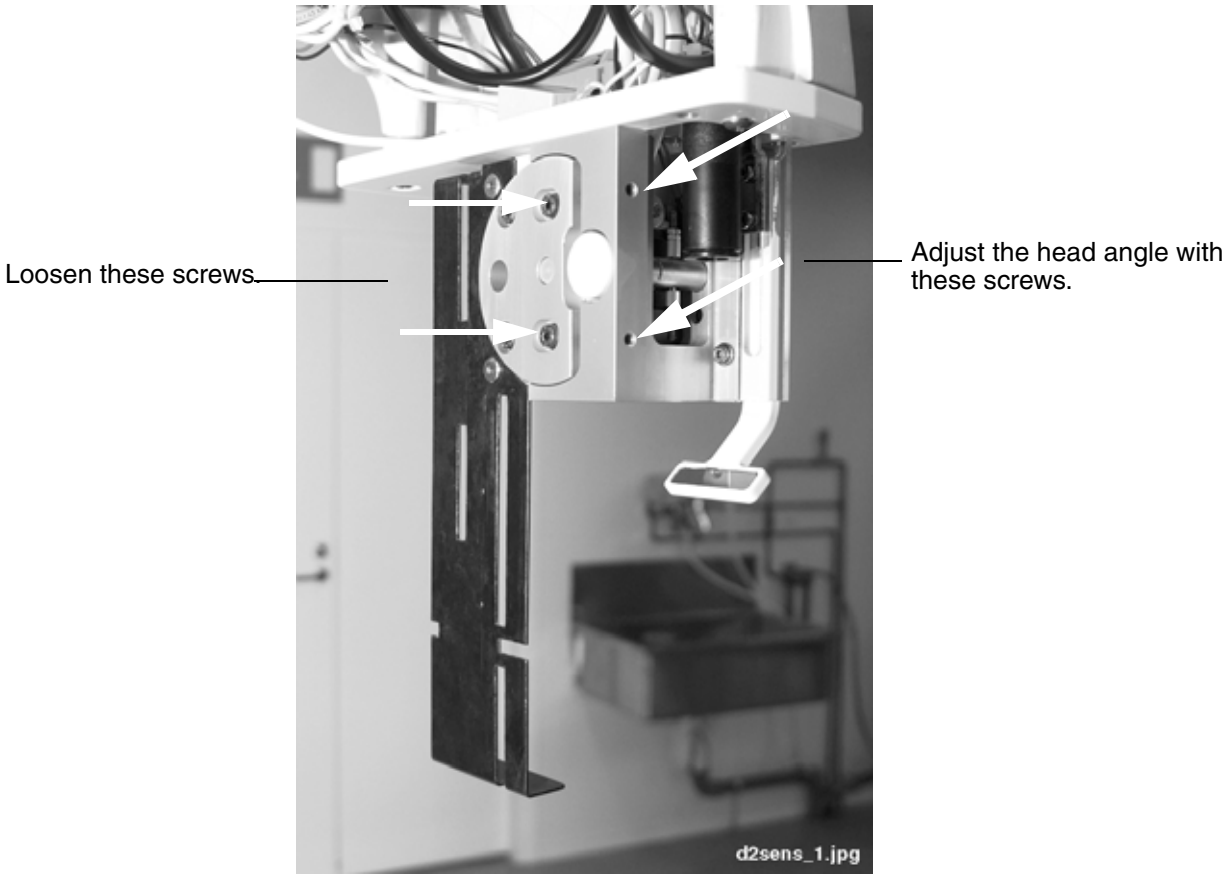


Figure 15

Adjust the head support angle with the two screws located on the left side of the mechanism (use 2.5mm allen key) (see Fig. 15 on page E-12 and Fig. 16 below).

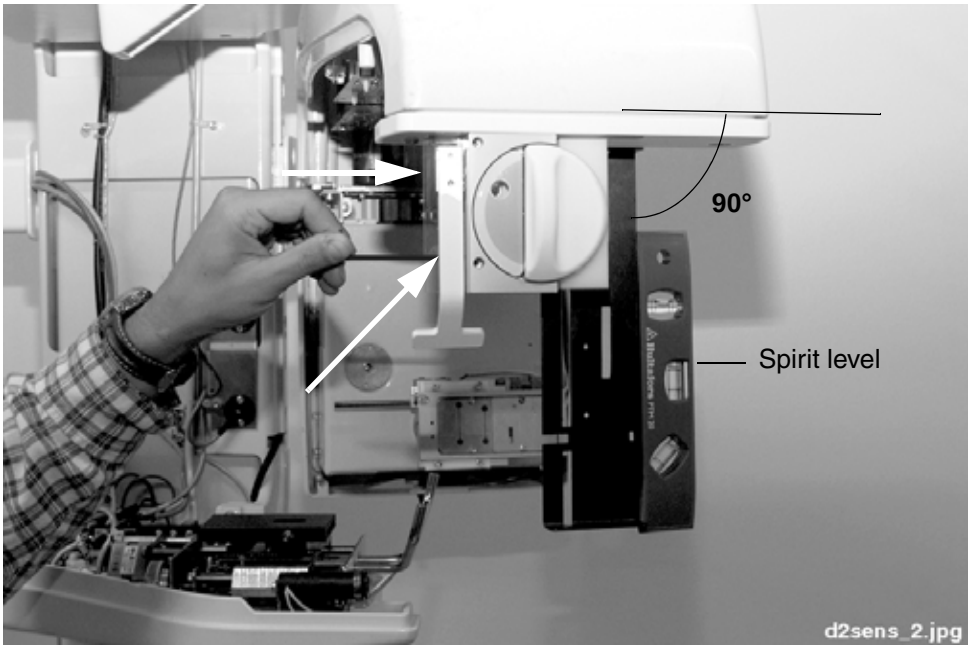


Figure 16

Attach the removed covers.

Primary slot adjustment - radiation beam too low or high

WARNING

DO NOT ADJUST THE POSITION OF THE PRIMARY SLOT 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 OPERATION.

If the beam is too high or low loosen the two screws that hold the outer slot in position and adjust as necessary. Tighten the screws and recheck the beam. Repeat the above procedure until the beam is correctly positioned.

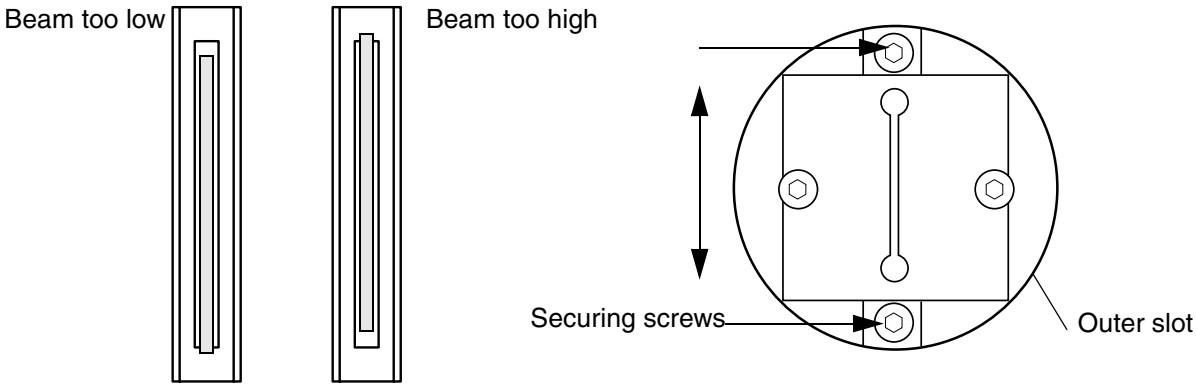


Figure 17

Primary slot adjustment - radiation beam too far to the right or left

If the beam is not vertical loosen the two screws that hold the primary slot plate in position and move the plate until the beam is correctly positioned. Tighten the screws and recheck the beam. Repeat the above procedure until the beam is correctly positioned.

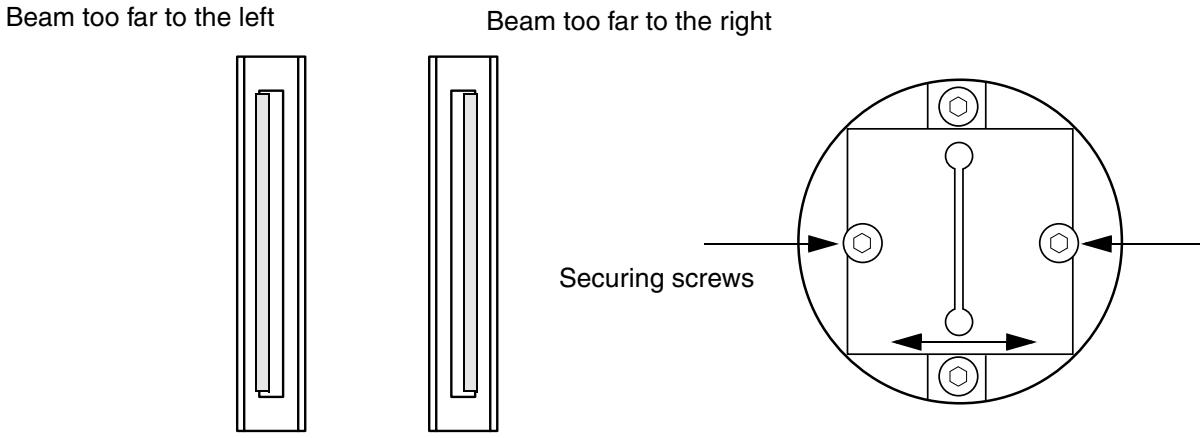


Figure 18

Radiation beam not vertical

If the beam is not vertical loosen the four screws that hold the slot frame in position and rotate the frame until the beam is correctly positioned. Tighten the screws and recheck the beam. Repeat the above procedure until the beam is correctly positioned.

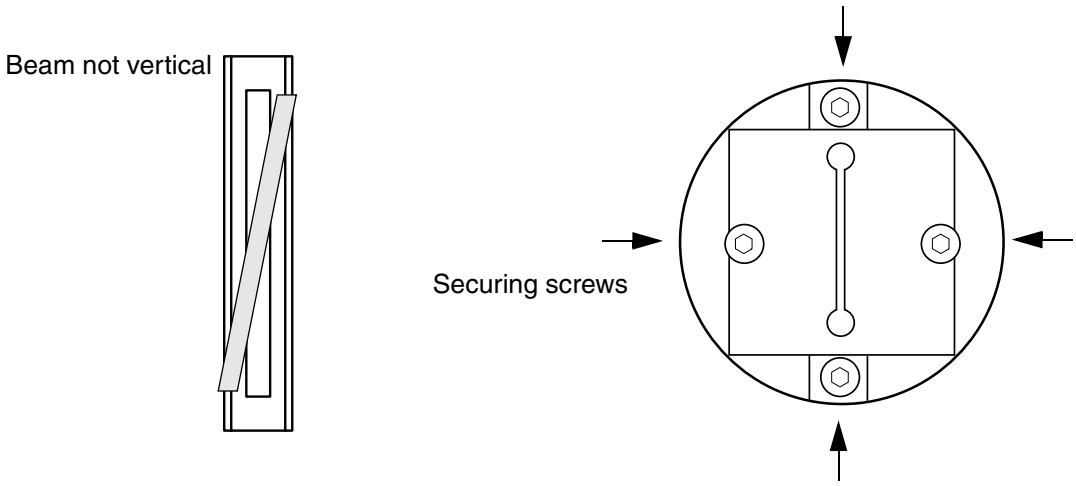


Figure 19

2.5 Radiation beam adjustment, Planmeca Proline EC Pan/ Ceph X-ray

NOTE ***In case the radiation beam is not correctly aligned <u>check first the sensor head position</u> before adjusting the primary slot. See instructions given in section "Adjusting the sensor head position" on page E-12.***

Primary slot adjustment - radiation beam too low, high or not vertical

WARNING 

DO NOT ADJUST THE POSITION OF THE PRIMARY SLOT 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 OPERATION.

If the beams are too high or low loosen the two screws that hold the panoramic primary slot plate in position and adjust as necessary. Tighten the screws and recheck the beam. Repeat the above procedure until the beam is correctly positioned.

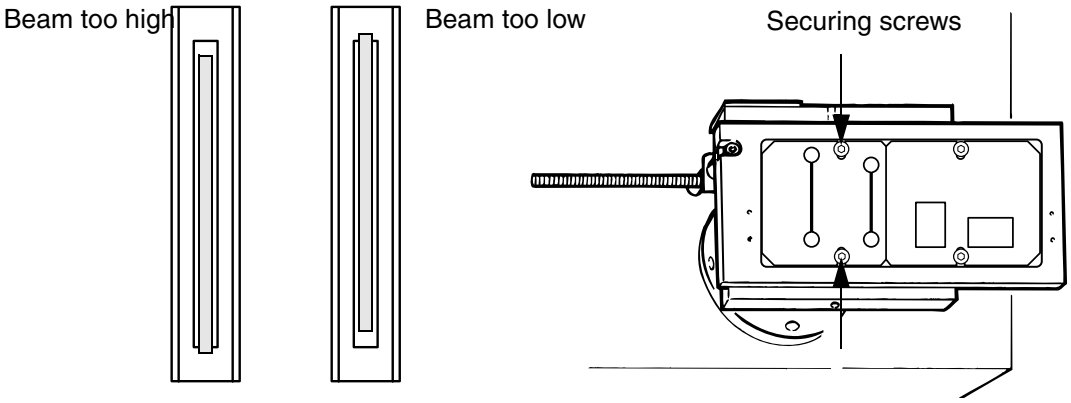


Figure 20

If the beam is not vertical loosen the two screws that hold the primary slot mechanism to the collimator tube and rotate the mechanism until the beam is correctly positioned. Tighten the screws and recheck the beam. Repeat the above procedure until the beam is correctly positioned.

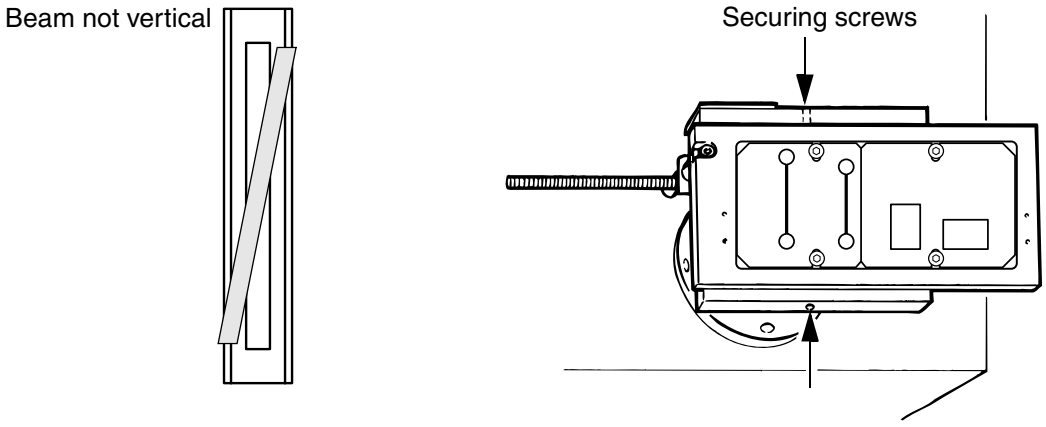
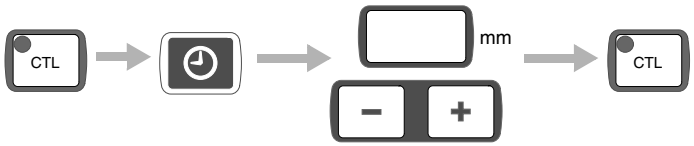


Figure 21

NOTE ***The ceph primary slots are also adjusted according to instructions given in this section.***

Primary slot adjustment - radiation beam too far to the right or left



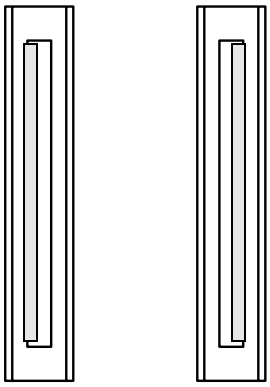
WARNING

WARNING: DO NOT ADJUST THE POSITION OF THE PRIMARY SLOT 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 OPERATION.

NOTE ***The ceph primary slots are also adjusted according to instructions given in this section.***

If the beam is too far to the left or right of the alignment rectangle they must be centered.

Beam too far to the left



Beam too far to the right

Figure 22

NOTE ***A microprocessor controlled motor determines the position of each slot. If the beam is readjusted to the left or right the new position must be reprogrammed into the memory.***

Enter the service mode if you are not already in it.

Press the CTL-key.

Press and hold down the clock key until the number of the slot that you are checking appears on the main display (SLO and the slot number) and starts to flash. You are now in the primary slot calibration mode.

For example, if you have just checked the position of the beam from the panoramic slot, the number 1 will appear on the display.

Adjust the position of the beam by pressing the patient positioning (mm) keys. The minus key will move the slot mechanism, and beam to the left, and the plus key will move the slot mechanism, and beam to the right.

Check the position of the beam again and, if necessary, repeat the above alignment procedure until the beam is within the alignment rectangle on the fluorescent screen.

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

NOTE ***Always use the plus (+) key for the final adjustment. This makes sure that the slot mechanism is correctly positioned by taking up the play between the draw nut and the positioning thread.***

For example, if you are adjusting the beam to the left by pressing the minus (-) key you should move the slot mechanism a little further to the left than necessary, and then press the plus (+) key to move it back to the right to the correct position.

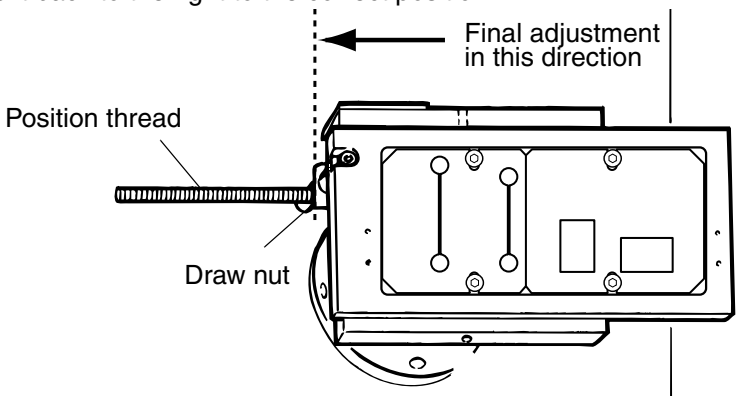


Figure 23

If you cannot adjust the beam far enough to the left using the method described above you may have to move the metal tab on the draw nut. Loosen the securing screw rotate the tab slightly and then tighten the screw. The slot position should then be rechecked.

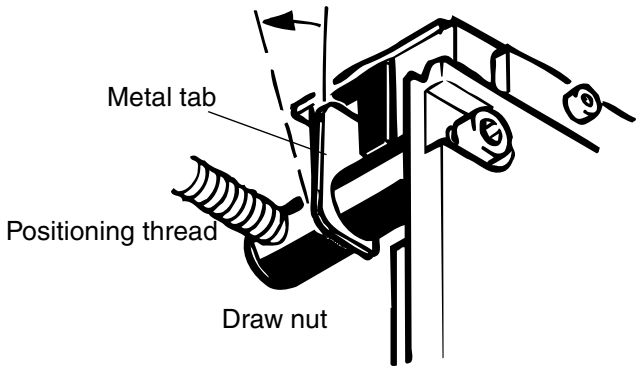


Figure 24

Press the clock key to store the slot position in the memory and move on to the next slot. The number of the next slot will appear on the main display and start to flash.

Repeat the alignment procedure described above for this slot and any other slots.

Exit the primary slot calibration mode and check the position of all the beams again. Realign if necessary.

Exit the service mode.

3 CALIBRATING PANORAMIC SENSOR HEAD

Make sure that the unit is in the panoramic mode.

10 mA

60 kV

The calibration must be performed with 2x2 (high resolution), 3x3 (enhanced resolution) and 4x4 (normal resolution) binning. With high resolution select a kilovolt value of 70 and a milliampere value of 12. With enhanced resolution select 70 kV and 6 mA, and with normal resolution select 66 kV and 4 mA. Note that these values must be selected to produce a clear exposure.

Remove the inner cover from tubehead assembly, if it is in position. Four screws hold the tubehead cover in position, these are located at the rear of the tubehead assembly.

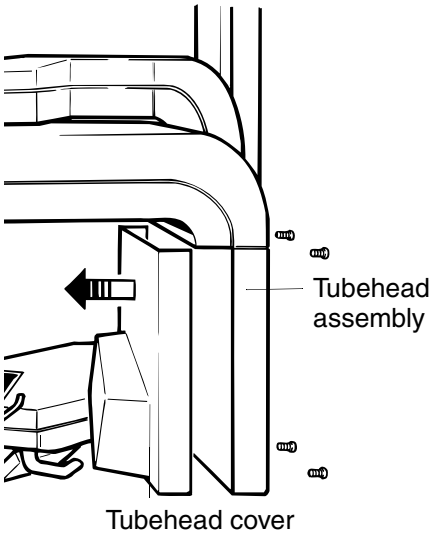


Figure 25

Place the calibration tool to the front of the primary slot.

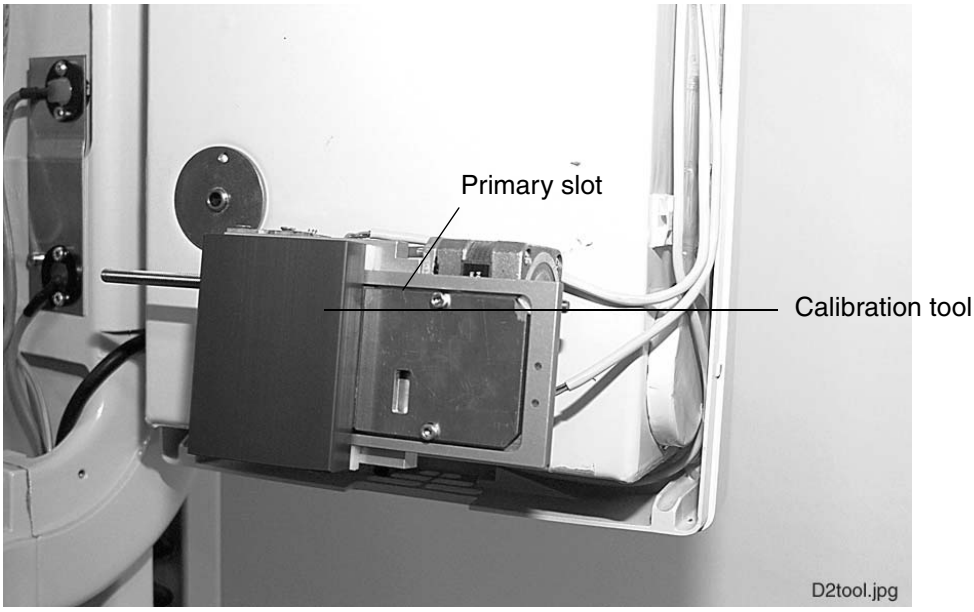


Figure 26

Start the Dimax3 calibration program by double-clicking the Dimax2Tool.exe program icon.

The Dimax2Tool window appears.

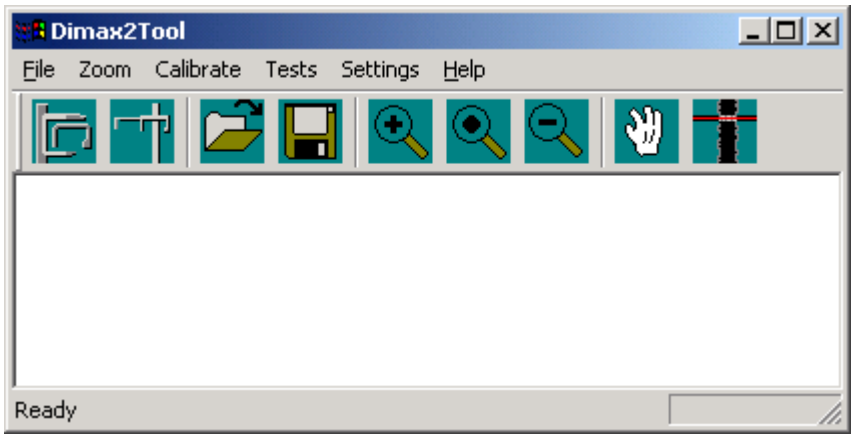


Figure 27

Calibrating the sensor head

Select Proline from the Settings / Type pulldown menu.

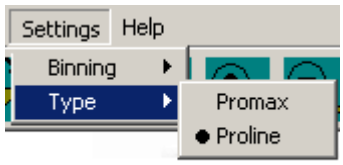


Figure 28

The calibration must be performed with both 3x3 (enhanced resolution) and 4x4 (normal resolution) binning. Select the binning from the Setting / Binning pulldown menu.

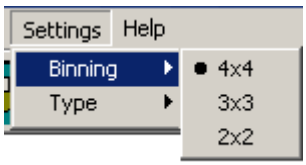


Figure 29

Click the Dimax3 panoramic exposure button. A dark current exposure (i.e. an exposure without radiation) must be taken first and a message window shown below appears.

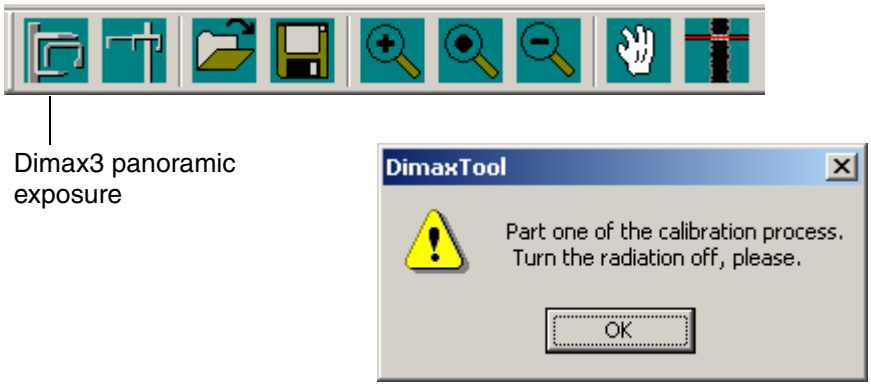


Figure 30

Press all the three sector keys to **SWITCH OFF** the radiation. The indicator lights will **COME ON**.

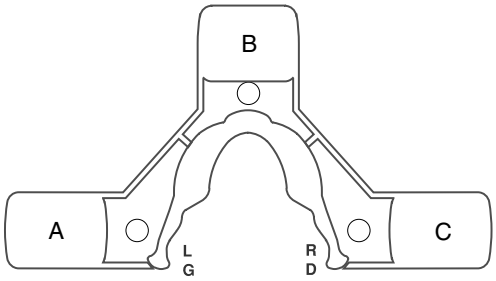


Figure 31

The pmpcal2 window with text Waiting appears.

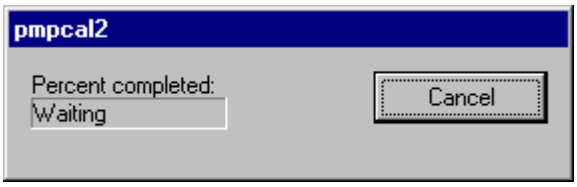


Figure 32

Press the ready key to drive the X-ray to the exposure position.

The text Exposure appears.

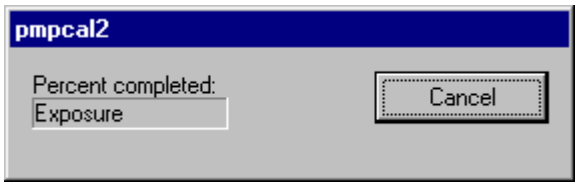


Figure 33

Take an exposure. After the exposure the message window shown below appears.

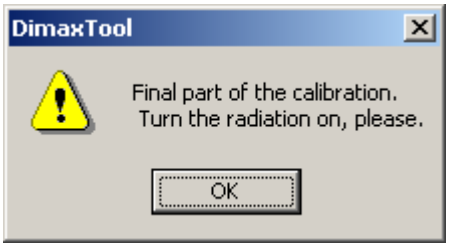


Figure 34

Press all the three sector keys to **SWITCH ON** the radiation. The indicator lights will **GO OUT**.

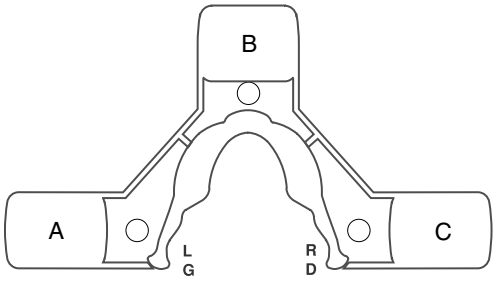


Figure 35

The pmpcal2 window with text Waiting appears.

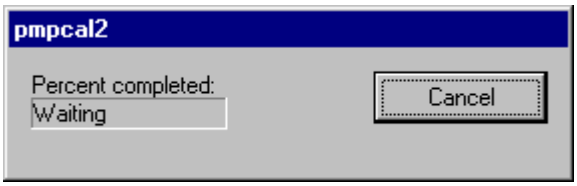


Figure 36

Press the ready key to drive the X-ray to the exposure position.

The text Exposure appears.

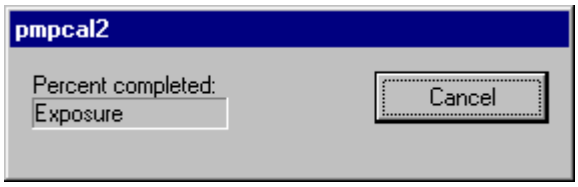


Figure 37

Take an exposure.

The sensor head is now calibrated. After the exposure has been taken the image is shown in the Dimax2Tool window.

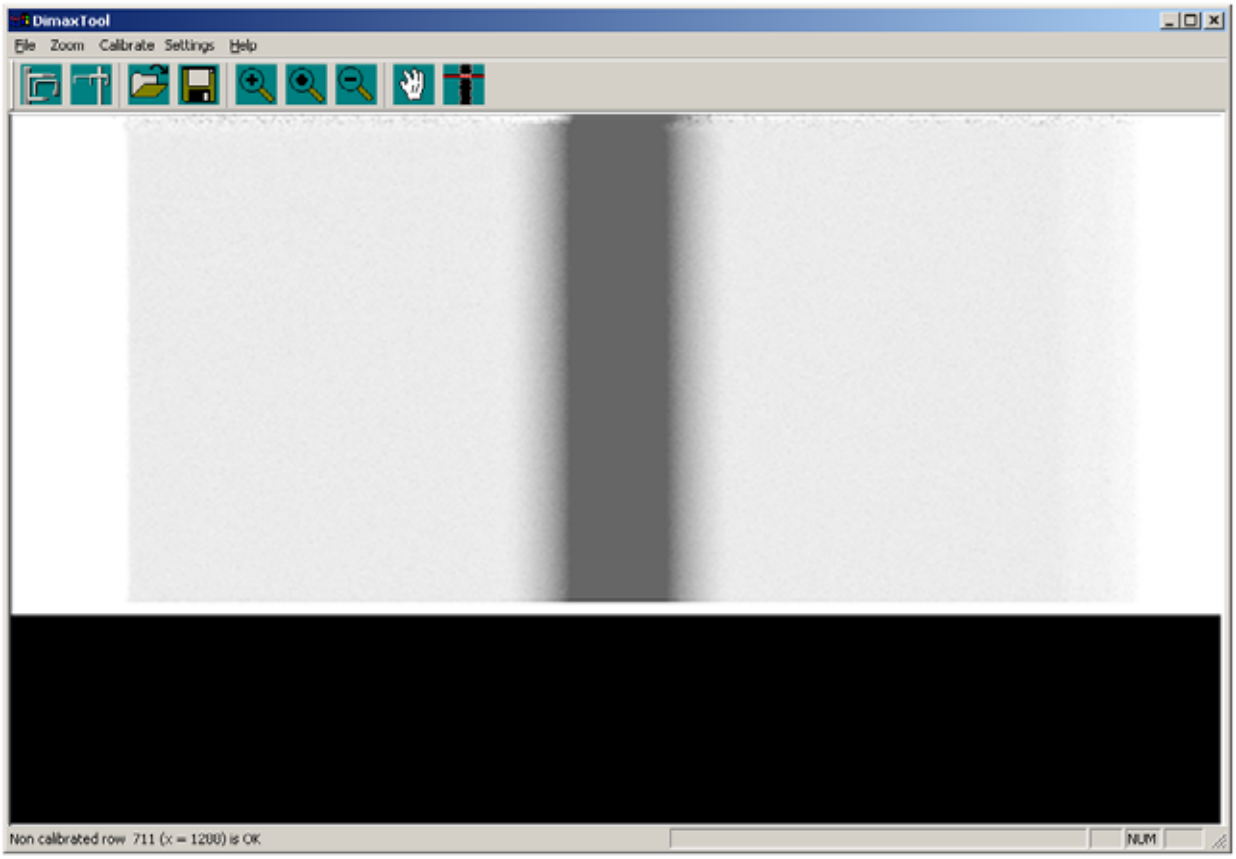


Figure 38

Checking the calibration

You can test whether the calibration succeeded as follows. Do not remove the calibration block from the sensor head.

Take a test exposure by selecting Test Pan Cal File from the Calibrate menu.

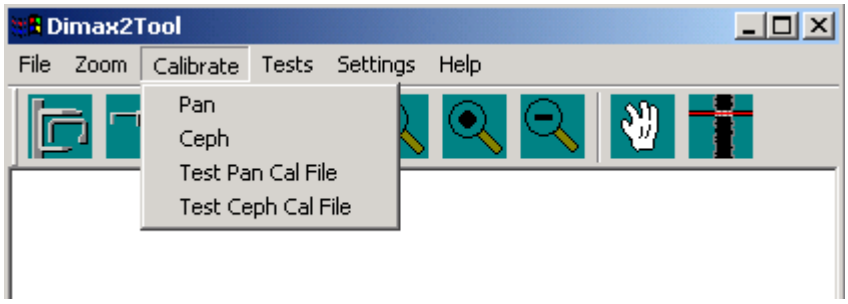


Figure 39

The pmpcal2 window with text Waiting appears.

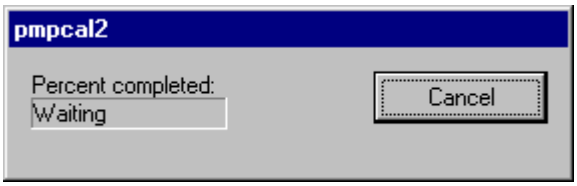


Figure 40

Touch the ready field to drive the X-ray to the exposure position.

The text Exposure appears.

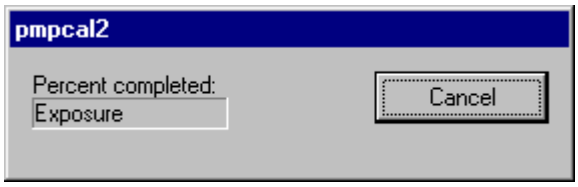


Figure 41

Take an exposure. The calibration block image should be evenly grey. If it is not, recalibrate the sensor head. If recalibration does not help, check that the Dimaxis, DIDAPI and drivers you are using are all from the same CD rom. Check also the X-ray beam and patient positioning mechanism adjustments by taking a ball phantom exposure.

Perform the calibration with the other binning values (resolution).

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.

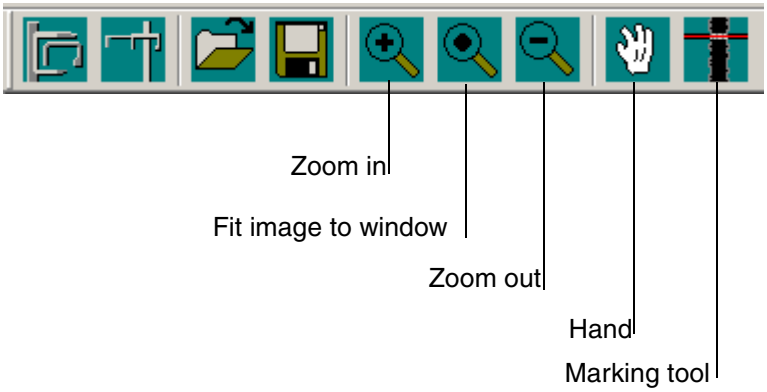


Figure 42

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 43

The panoramic sensor consists of four 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 44

The row can be returned back to normal by clicking it with the right mouse button.

Taking a ball phantom exposure

You can now check the adjustments by taking a ball phantom exposure either as described in section “Checking the mechanism” on page E-26 or using the Dimax2Tool program’s Tests / Ball Phantom command.

Slide the ball phantom into the patient positioning mechanism. Position the layer light beam so that it is on the black reference line on the side of the ball phantom. Select the standard panoramic exposure mode and Select a kilovolt value of 66 and a milliampere value of 2.

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

Select Ball Phantom from Tests menu.

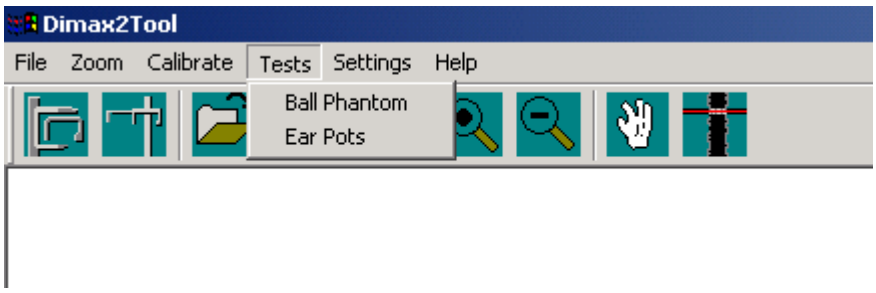


Figure 45

The pmpcal2 window with text Waiting appears.

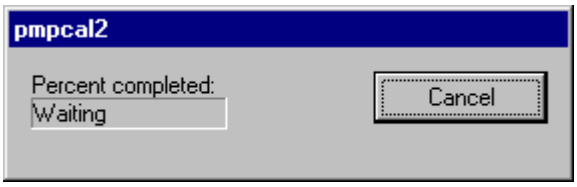


Figure 46

Press the ready key to drive the X-ray to the exposure position.

The text Exposure appears.

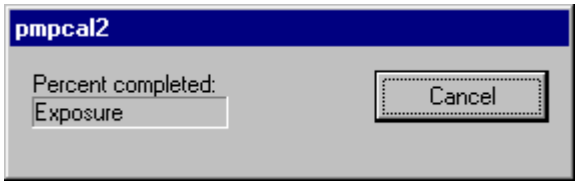


Figure 47

Take an exposure. The images of 23 balls should appear on the image. They should be round, all the same size, and evenly spaced.

Also the Results of the ball phantom test window appears. In this window the distances from the center of the middle ball to the center of the tenth ball on the right and left side, and the distance from the center of the middle ball to the center of the rear middle ball are given.

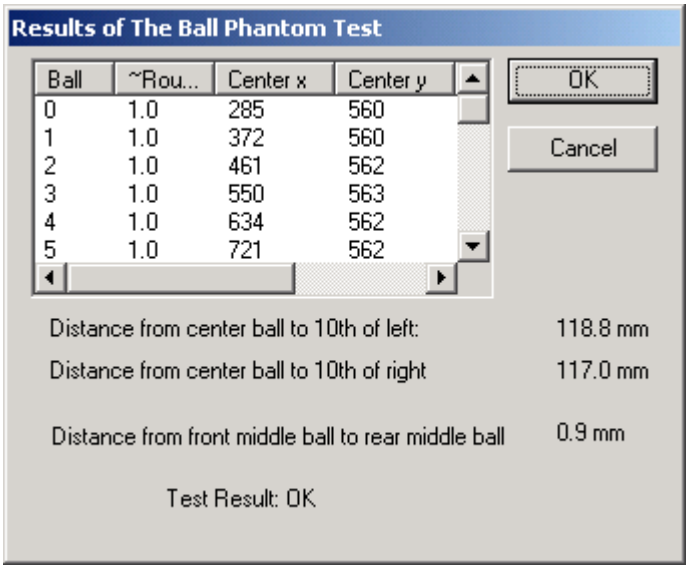


Figure 48

The outermost balls on the left and right sides should appear symmetrically. If the distance from the center of the middle ball to the center of the tenth ball on the right side differs more than 2mm from the corresponding distance on the left side, the rotation start limit must be adjusted (in the same way as in the film-based panoramic X-ray, see section “Rotation limits” on page D-22). Note, that the adjustment of the patient positioning mechanism must be performed first.

The distance from the center of the middle ball to the center of the rear middle ball should be less than 2mm. If the distance is not correct you will have to adjust the position of the patient positioning mechanism (see section “Patient positioning mechanism adjustment” on page E-30).

4 PATIENT POSITIONING MECHANISM

4.1 Checking the mechanism

You should take an exposure of the ball phantom to check that the patient positioning mechanism is correctly positioned.

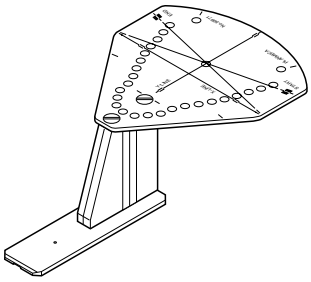
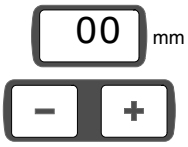


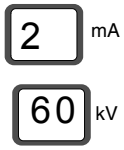
Figure 49

Remove the sensor alignment tool from the quick connector mechanism and attach the sensor head to the quick connector.

Slide the ball phantom into the patient positioning mechanism.



Adjust the position of the patient positioning mechanism to 00.



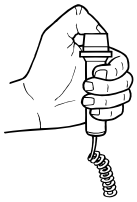
Enter the service mode.

Select a kilovolt value of 60 and a milliampere value of 2. Note that it is only possible to select this low mA-value in the service mode.

Exit the service mode.

Drive the X-ray unit to the exposure position. The rotating unit will turn to the start position and the indicator light will come on.

NOTE ***The ready indicator light will be flashing if the PC is not in the ready state. Refer to the Dimaxis user's manual on how to prepare the system ready for the exposure.***



Take an exposure. Hold the exposure down for the duration of the exposure.

CAUTION ***Radiation is generated when exposure button is pressed.***

The images of 23 balls should appear on the image (Fig. 50). They should be round, all the same size, and evenly spaced. Note that they will not necessarily be at the same vertical height. The outermost balls on the left and right sides should appear symmetrically. If the distance from the center of the middle ball to the center of the tenth ball on the right side differs more than 2mm from the corresponding distance on the left side, the rotation start limit must be adjusted (in the same way as in the film-based panoramic X-ray, see section “Rotation limits” on page D-22). Note, that the adjustment of the patient positioning mechanism must be performed first. The distance from the center of the middle ball to the center of the rear middle ball should be less than 2mm. If the distance is not correct you will have to adjust the position of the patient positioning mechanism (see section “Patient positioning mechanism adjustment” on page E-30).

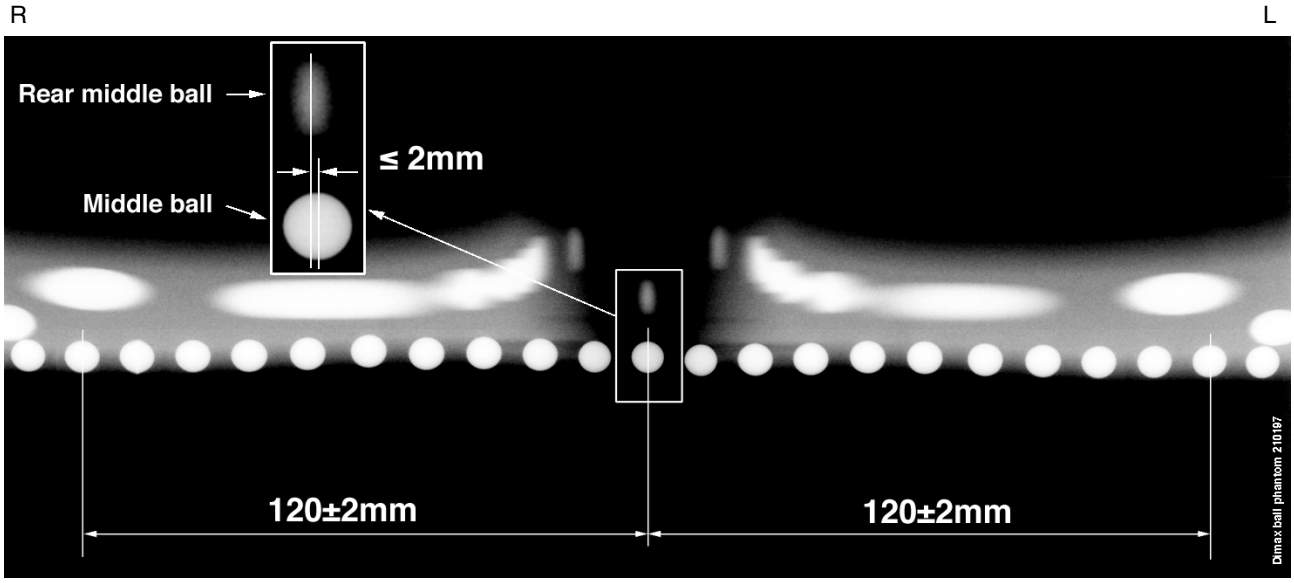


Figure 50

NOTE ***Before you can measure the true distance between the balls, you have to define a reference distance as follows:***
Click the CAL button and then draw a long horizontal line to the image by clicking the start point, releasing the mouse button and clicking the end point. The Reference distance window appears.
Calculate the line length using the formula A x 0.132mm = B, where A is the distance in pixels and B is distance in millimetres. Enter the value B (line length in millimetres) to the Reference distance window and click OK.
The distance from the center of the middle ball to the center of the tenth ball to the left and the tenth ball to the right can now be measured.

The distance from the center of the middle ball to the center of the tenth ball to the left and the tenth ball to the right should be 120mm ± 2mm. If this distance is correct then the patient positioning mechanism need not be adjusted, and you should then check the patient positioning lights (see section “PATIENT POSITIONING LIGHTS” on page E-36).

If these distances are not correct you will have to adjust the position of the patient positioning mechanism. The following diagrams are a rough guide as to how to position it correctly. Note that you may have to make more than one adjustment as the patient positioning mechanism could be incorrectly positioned in more than one direction. For example it may be too far forward and too near the column.

If the distance from the middle ball to the center of the tenth ball on the left-hand side is more than 122mm and on the right-hand side less than 118mm then the patient positioning mechanism must be moved away from the column (Fig. 51). Note, that the distance between the line on the underside of the alignment ruler and the y-line on the ball phantom must be less than ±1mm, see section “Adjustment in ball phantom’s y-direction” on page E-30.

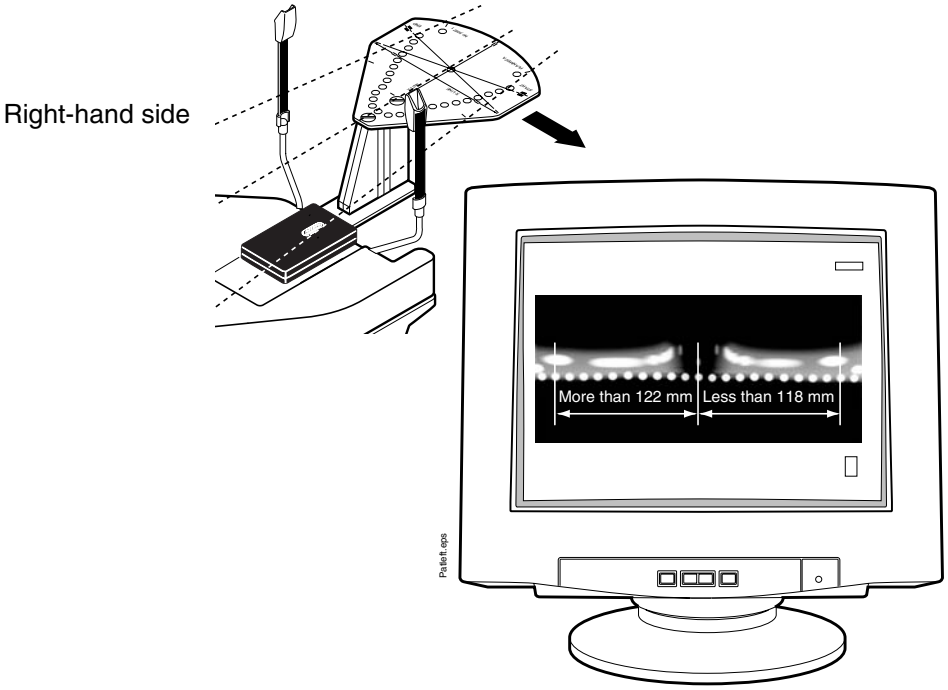


Figure 51

If the distance from the middle ball to the center of the tenth ball on the left-hand side is less than 118mm and on the right-hand side more than 122mm then the patient positioning mechanism must be moved towards the column (Fig. 52). Note, that the distance between the line on the underside of the alignment ruler and the y-line on the ball phantom must be less than ±1mm, see section “Adjustment in ball phantom’s y-direction” on page E-30.

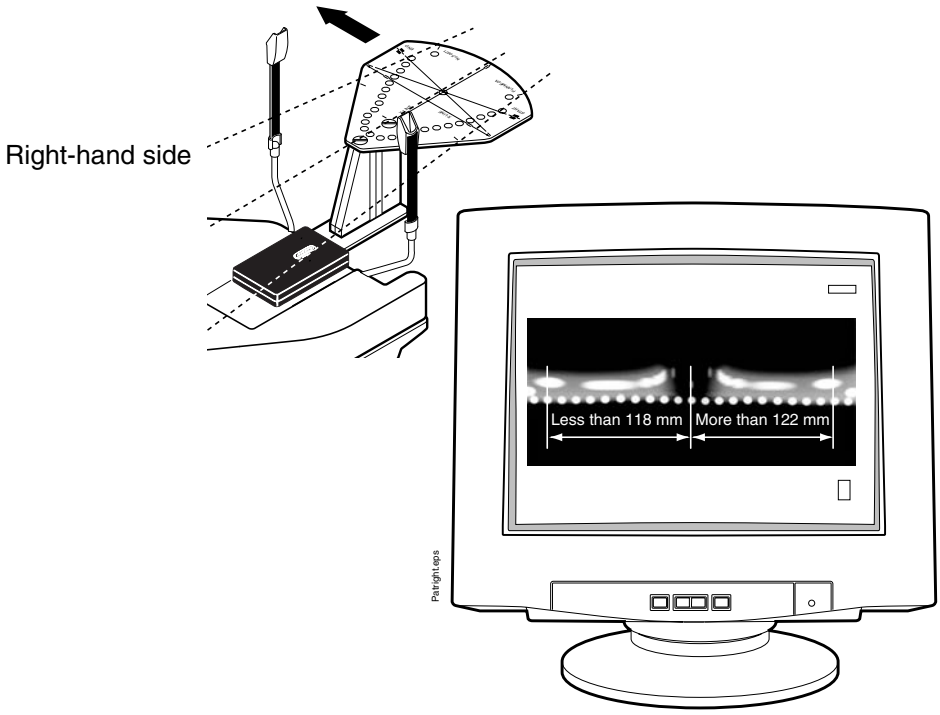


Figure 52

If the distances from the middle ball to the center of the tenth ball on both the right and left are more than 122mm then the patient positioning mechanism is too far backward and must be moved forwards (Fig. 53).

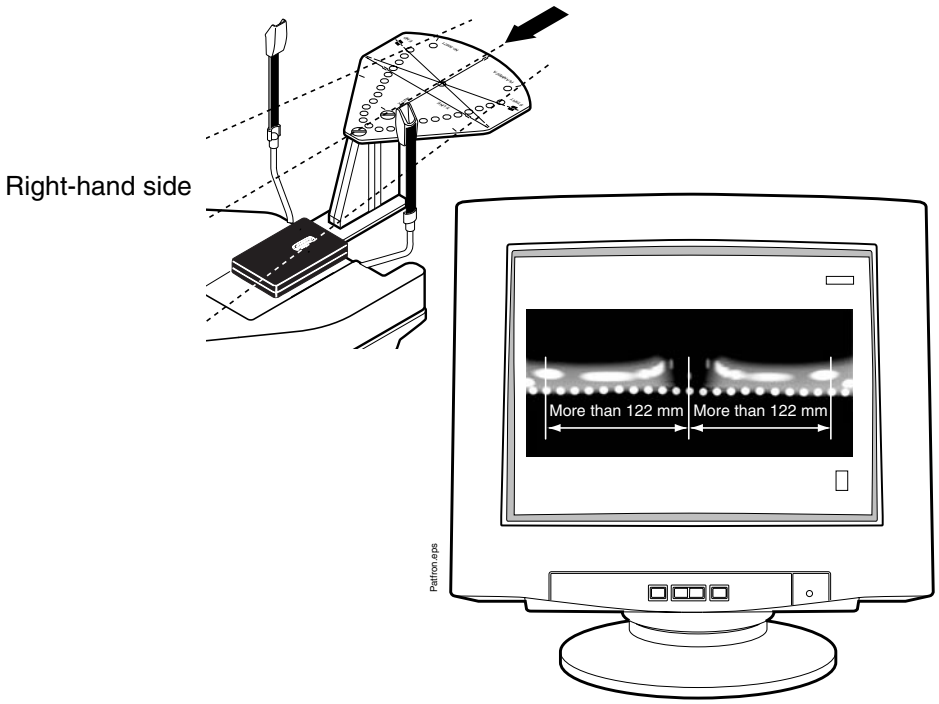


Figure 53

If the distances from the middle ball to the center of the tenth ball on both the right and left are less than 118mm then the patient positioning mechanism is too far forward and must be moved backwards (Fig. 54).

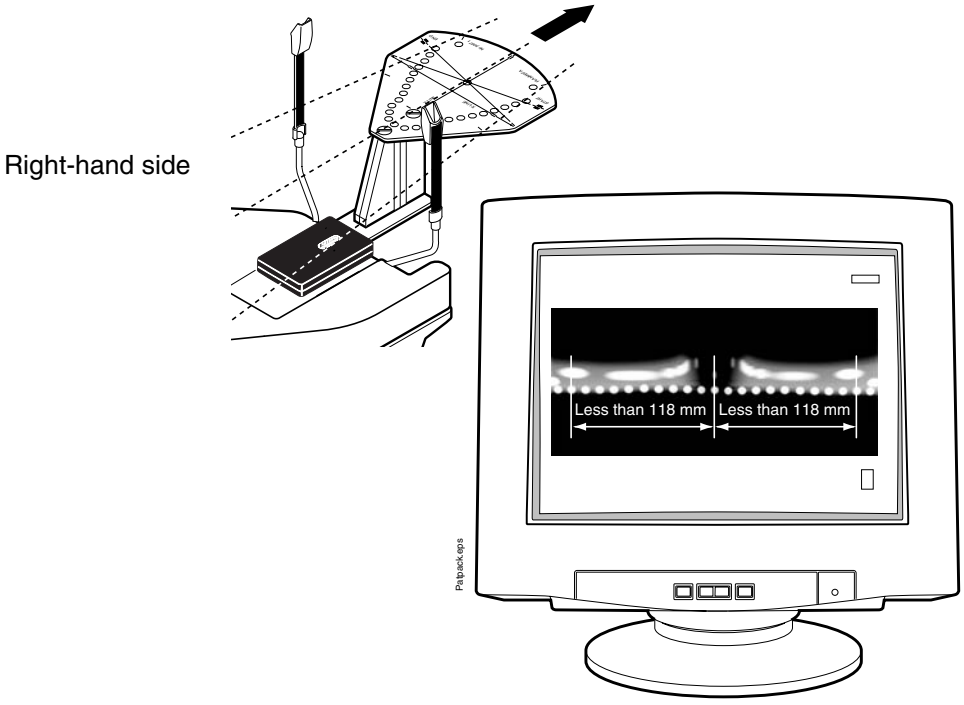


Figure 54

4.2 Patient positioning mechanism adjustment

Adjustment in ball phantom's y-direction

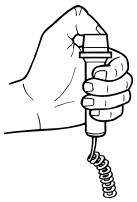
If the patient positioning mechanism is too near or too far from the column it will have to be centered.

Remove the cover from the lower shelf. Replace the ball phantom tool.

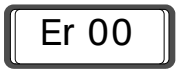
Remove the sensor head from the quick connector mechanism (see instructions given in Planmeca Proline EC panoramic X-rays user's manual). Attach the sensor alignment tool to the quick connector.

Enter the test mode.

Press the ready key to drive the X-ray unit to the exposure position. When the X-ray is ready the indicator light will come on.



Start to take a test exposure by pressing and holding down exposure button on the remote control. Stop pressing the exposure button about halfway through the exposure cycle so that the rotating unit stops moving.



An error code will appear on the display. Clear the error code from the display by pressing the CTL-key.

Manually position the rotating unit so that the center line that runs through the tubehead and sensor head is parallel to the wall to which the X-ray is secured. Slide the alignment pin through the hole, nearest the column, in the top of the vertical carriage so that it goes into the positioning hole in the rotating unit. (Fig. 55)

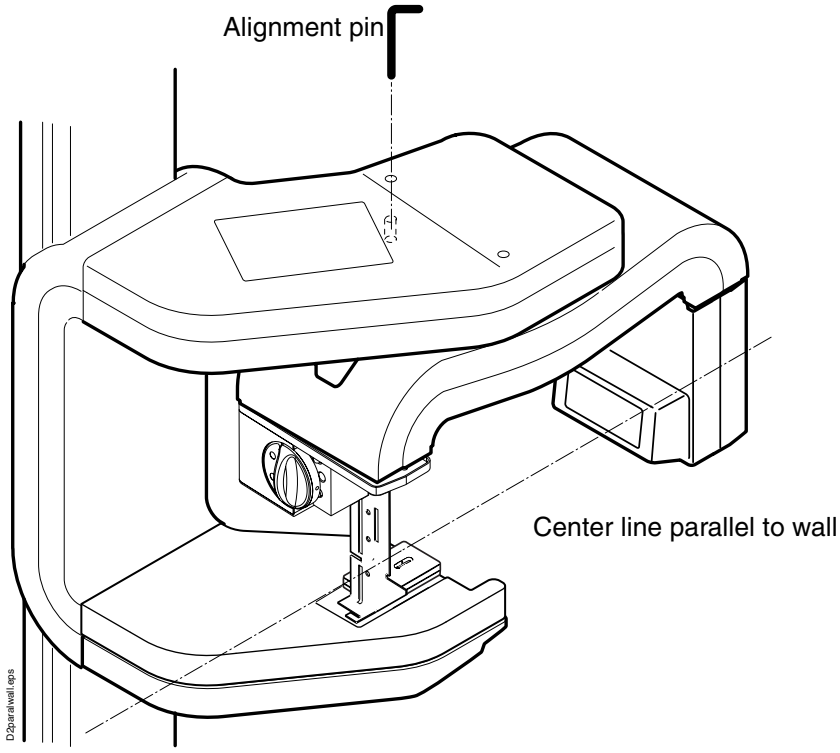


Figure 55

NOTE ***Adjust the position of the rotating unit by holding the sensor head. Never use the tube-head to adjust the position.***

Leave the ball phantom tool in position and place alignment tool adapter to the sensor head. Place one end of the alignment ruler in the first primary slot (the largest one) and the other end to the sensor alignment tool.

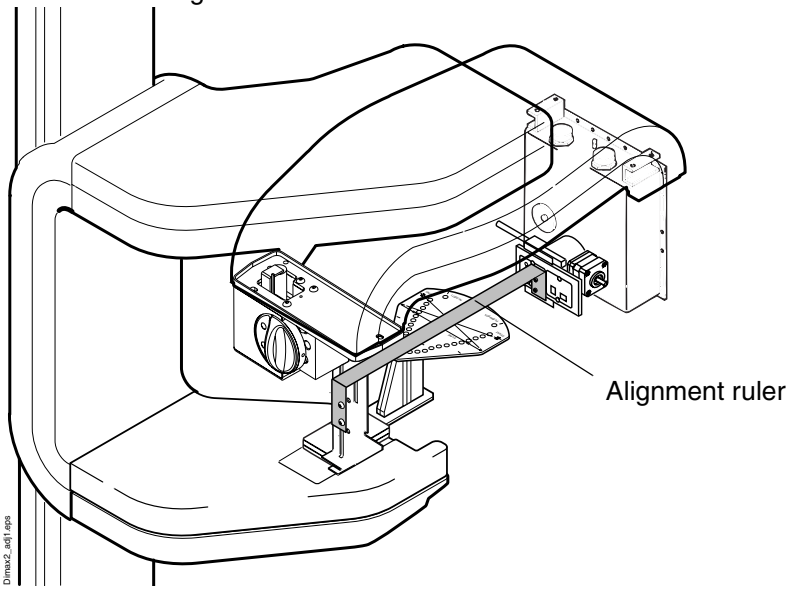


Figure 56

Loosen the four screws that hold the patient position mechanism in place and adjust its position to the left or right until the mechanism is centered.

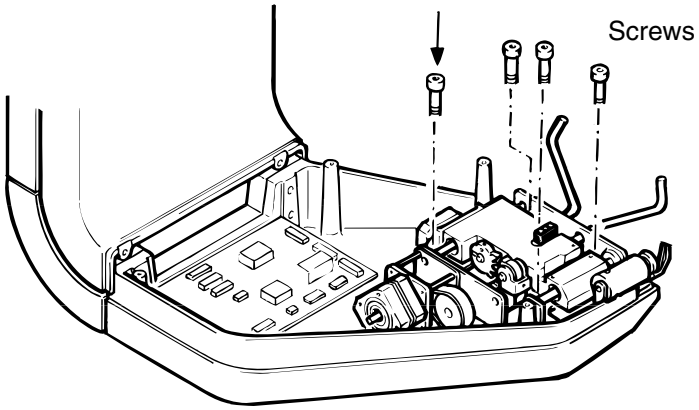


Figure 57

Make sure that the y-line on the ball phantom is parallel to the line on the underside of the alignment ruler. Note that the line on the ball phantom and the line on the alignment ruler do not have to coincide, but they must be parallel, the deviation may be ±1mm.

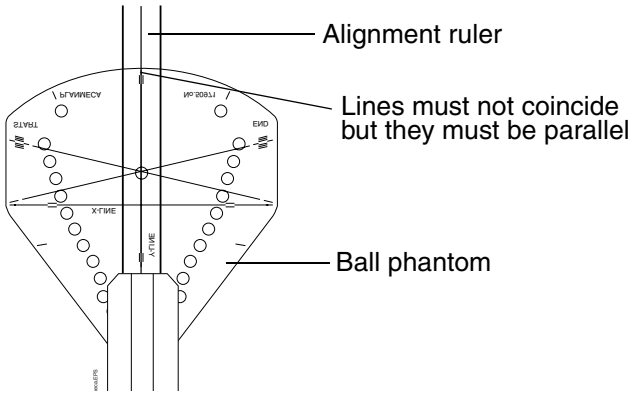


Figure 58

Tighten the screws, and remove the alignment pin.

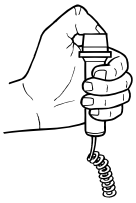
Take another ball phantom picture to check the alignment again. Readjust if necessary.

Adjustment in ball phantom's x-direction

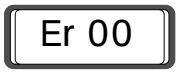
If the patient positioning mechanism is too far forward or too far backwards the fore/aft position must be adjusted and the new position programmed into the memory.

Enter the test mode.

Press the ready key to drive the X-ray unit to the exposure position. When the X-ray is ready the indicator light will come on.



Start to take a test exposure by pressing and holding down exposure button on the remote control. Stop pressing the exposure button after about two seconds so that the rotating unit stops moving.



An error code will appear on the display. Clear the error code with the CTL-key.

Manually position the rotating unit so that the center line that runs through the tubehead and sensor head is at a right angle to the wall. Slide the alignment pin through the hole in the top of the vertical carriage so that it goes into the positioning hole in the rotating unit. (Fig. 59).

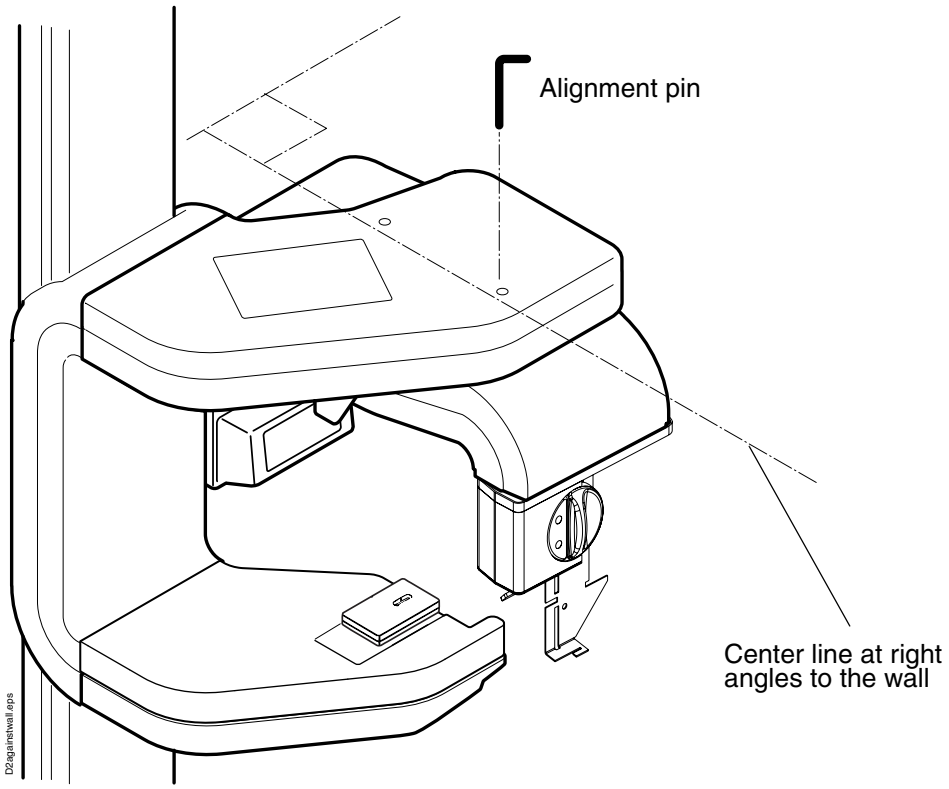


Figure 59

NOTE ***Adjust the position of the rotating unit by holding the sensor head. Never use the tubehead to adjust the position.***

Leave the ball phantom tool in position and place alignment tool adapter to the sensor head. Place the alignment ruler in position between the primary slot and the sensor alignment tool as described earlier.

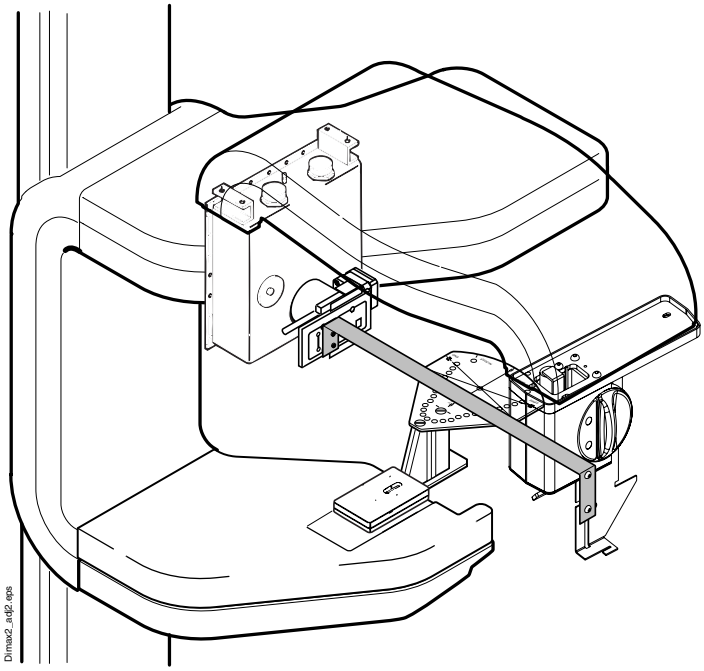


Figure 60

The line on the alignment ruler must line up with the x-line on the ball phantom (Fig. 61).

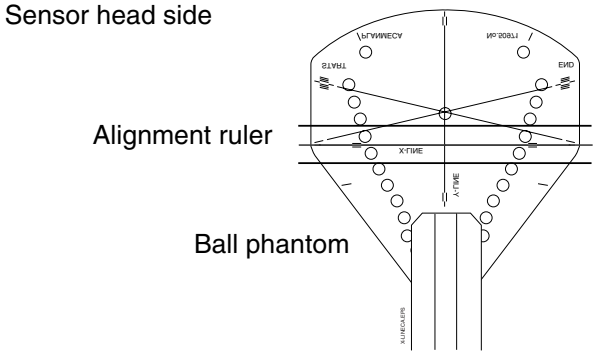
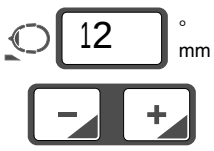


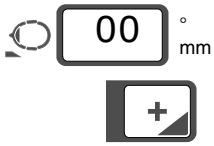
Figure 61 0° position

Enter the service mode.



Press either of the patient positioning keys once to switch the patient positioning lights on then a second time to adjust the position of the patient positioning mechanism until the line on the ball phantom lines up with the line on the alignment ruler. The position of the mechanism will appear on the display.

Press the CTL-key. The indicator light will come on.



Hold the patient positioning plus (+) key down (about five seconds) until you hear a signal and the millimeter display zeroes. This indicates that the new position of the patient positioning mechanism has been programmed into the memory.

Remove the alignment pin and exit the service mode.

Take another ball phantom picture to check the alignment again. Readjust if necessary.

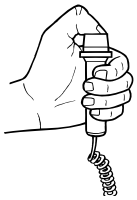
Checking the eccentricity of the rotation movement

The eccentricity of the rotation movement must be checked after the patient positioning mechanism adjustment. This is done by comparing the distances between the line on the alignment ruler and the x-line on the ball phantom in “0° position” and in “180° position”. If the deviation is more than ±1 mm, the position of the sensor head should be adjusted.

Entering the 180° position:

Enter the test mode.

Press the ready key to drive the X-ray unit to the exposure position. When the unit is ready the indicator light will come on.



Start to take a test exposure by pressing and holding down exposure button on the remote control. Stop pressing the exposure button after about 16 seconds so that the rotating unit stops moving (near the end position).

An error code will appear on the display. Clear the error code with the CTL-key.

Manually position the rotating unit so that the center line that runs through the tubehead and sensor head is at a right angle to the wall. Slide the alignment pin through the hole in the top of the vertical carriage so that it goes into the positioning hole in the rotating unit.

NOTE ***Adjust the position of the rotating unit by holding the sensor head. Never use the tubehead to adjust the position.***

Leave the ball phantom tool in position. Place the alignment ruler in position between the primary slot and the sensor alignment tool as described earlier.

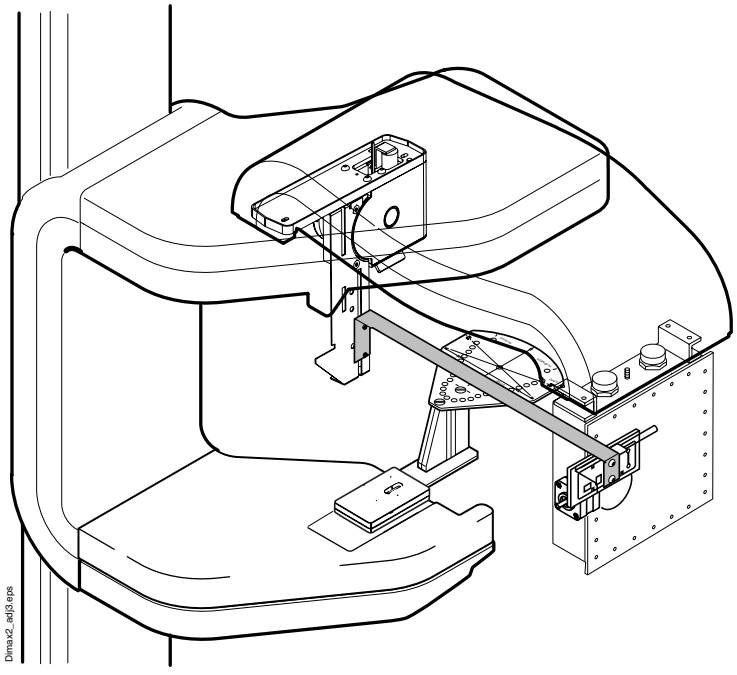


Figure 62

Measure the distance between the line on the alignment ruler and the x-line on the ball phantom (Fig. 63). The distance must be less than 1mm.

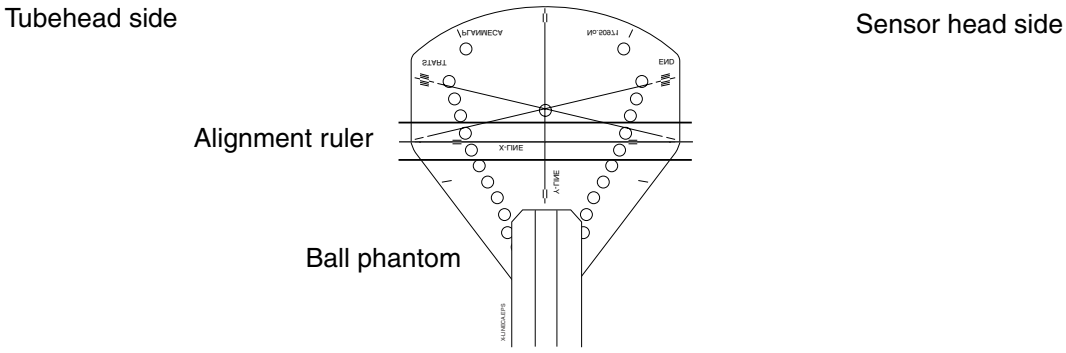


Figure 63 180° position

If the distance between the line on the alignment ruler and the x-line on the ball phantom is more than 1mm, the sensor head position must be adjusted. Adjust the sensor head towards the ball phantom's x-line until the distance is less than 1mm according to the instructions given in section "Adjusting the position of the sensor head" on page E-35. Correct only half of the deviation, so that the deviation will be the same in both the 180° and 0° positions.

4.3 Adjusting the position of the sensor head

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

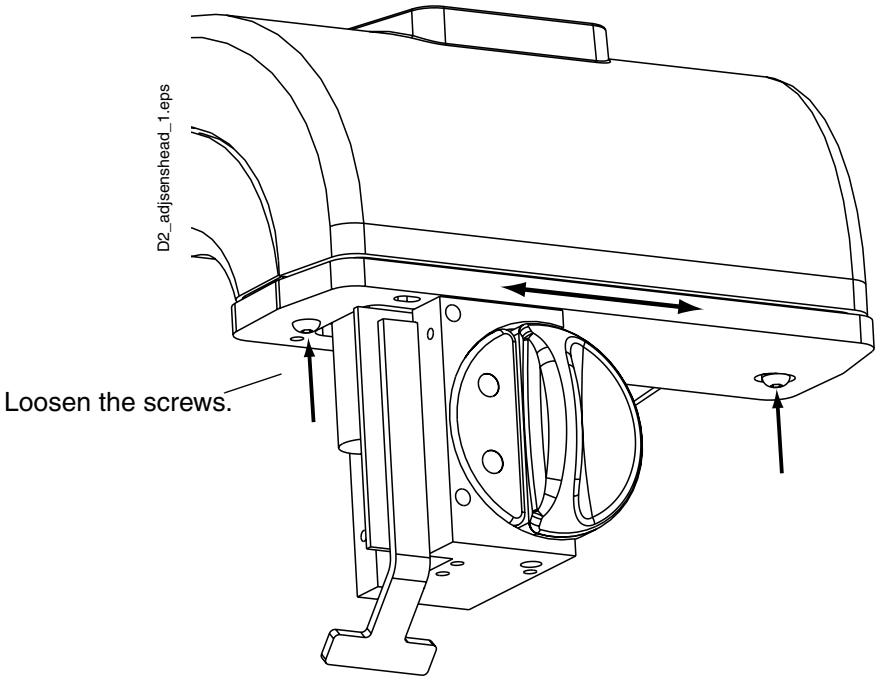


Figure 64

5 PATIENT POSITIONING LIGHTS

5.1 Checking the lights

The positions of the light beams from the two patient positioning lights should be checked.

Place the Frankfort plane alignment tool into position on top of the ball phantom.

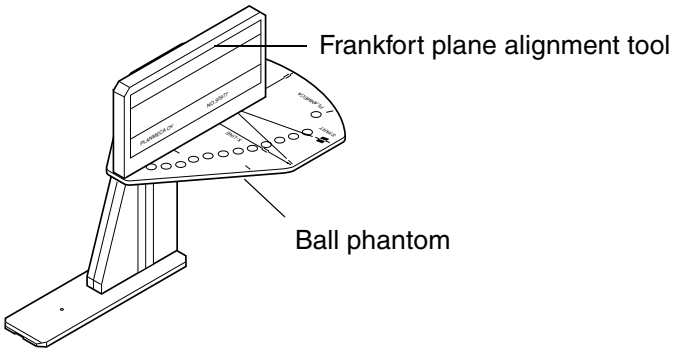
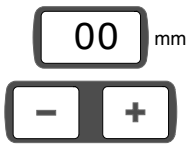


Figure 65



Press either of the patient positioning keys to switch the positioning lights on and then a second time to drive the patient positioning mechanism to 00 if it is not already there.

The Frankfort plane light beam should be located between the two black lines on the alignment tool. It should be horizontal.

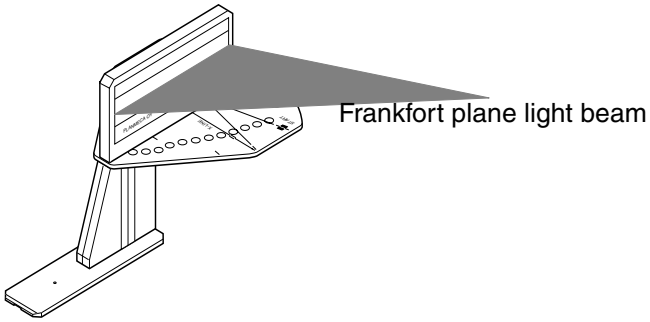


Figure 66

The focal trough positioning light beam should be positioned so that it is on the black reference line on the side of the ball phantom.

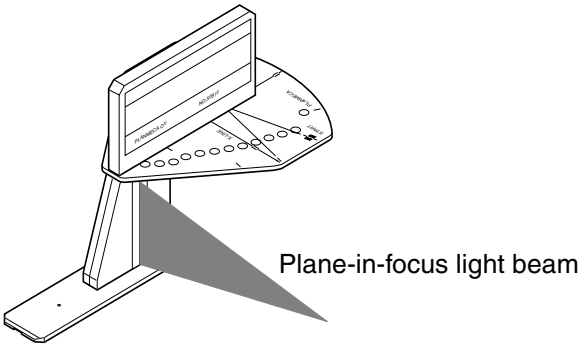


Figure 67

If the light beams do not coincide with the black lines or they are not in focus, they should be adjusted.

5.2 Positioning light adjustment

Bending the mirror bracket backwards or forwards will position the light beam.

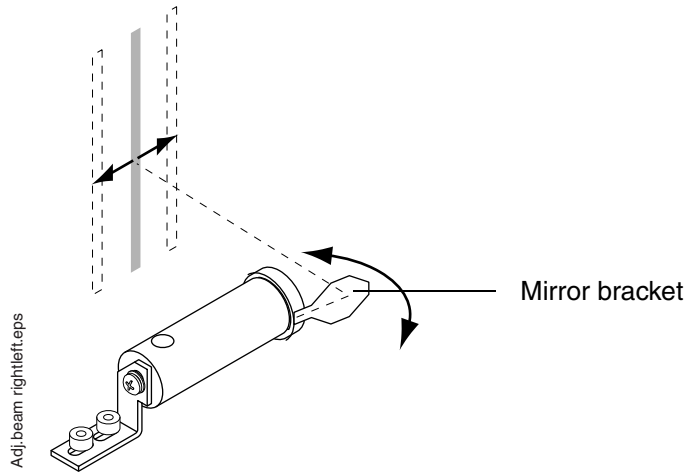


Figure 68

Rotating the mirror bracket will adjust the light beam in vertical direction.

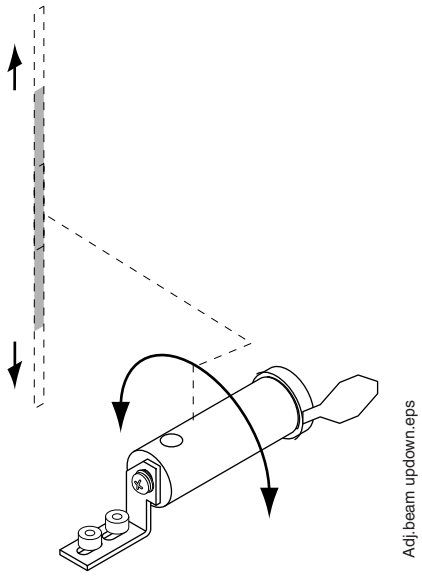


Figure 69

6 OTHER PANORAMIC MODE ADJUSTMENTS

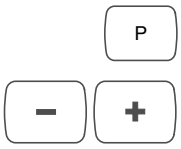
The following adjustments are performed according to the instructions given in chapter “ADJUSTMENT & CALIBRATION” on page D-1.

- **MECHANICAL ADJUSTMENT OR THE ROTATIONAL PART**, refer to section “MECHANICAL ADJUSTMENT OF THE ROTATIONAL PART” on page D-19.
- **TIME SETTING**, refer to section “SETTING THE CLOCK” on page D-25.
- **EXPOSURE WARNING SIGNAL ADJUSTMENT**, refer to section “EXPOSURE WARNING SIGNAL ADJUSTMENT” on page D-26.

7 CEPHALOSTAT ADJUSTMENT

NOTE ***Switch the unit off after all the checks and adjustments have been performed, before taking any patient exposures.***

7.1 Preparations before adjustments



Press and hold the P key until you have heard two audible signals. The latest used exposure mode number starts to flash on the main display.

Select the image area 4 with the program selection keys. The text CPH4 will appear on the main display. The rotating unit will move automatically to the correct position for taking cephalometric exposures.

Remove the inner cover from tubehead assembly. Four screws hold the tubehead cover in position, these are located at the rear of the tubehead assembly.

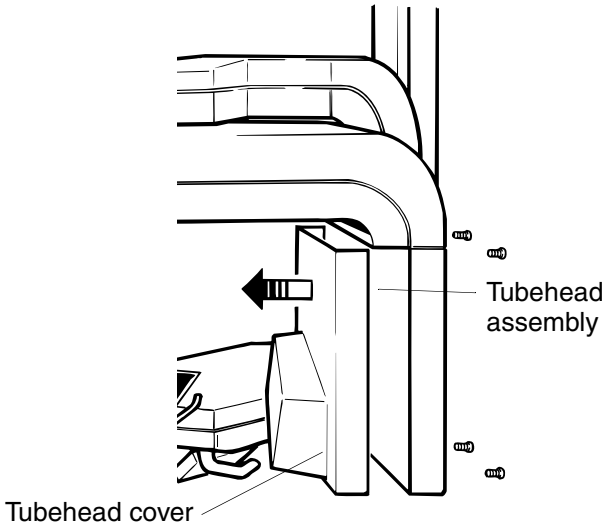


Figure 70

Rotate the cephalostat head support to the lateral ceph position. Remove the ear posts.

Removing the second primary slot

Remove the second primary slot from the cephalostat head support as follows. Unscrew the primary slot cover attachment screw with the 4mm allen key and remove the slot cover.

Figure 71

Unscrew the two slot attachment screws with the 4mm allen key and detach the slot plate.

Figure 72

Cephalostat sensor head with quick connector mechanism - removing the covers

Unscrew the bottom cover plate attachment screw with the 4mm allen key and remove the cover plate.

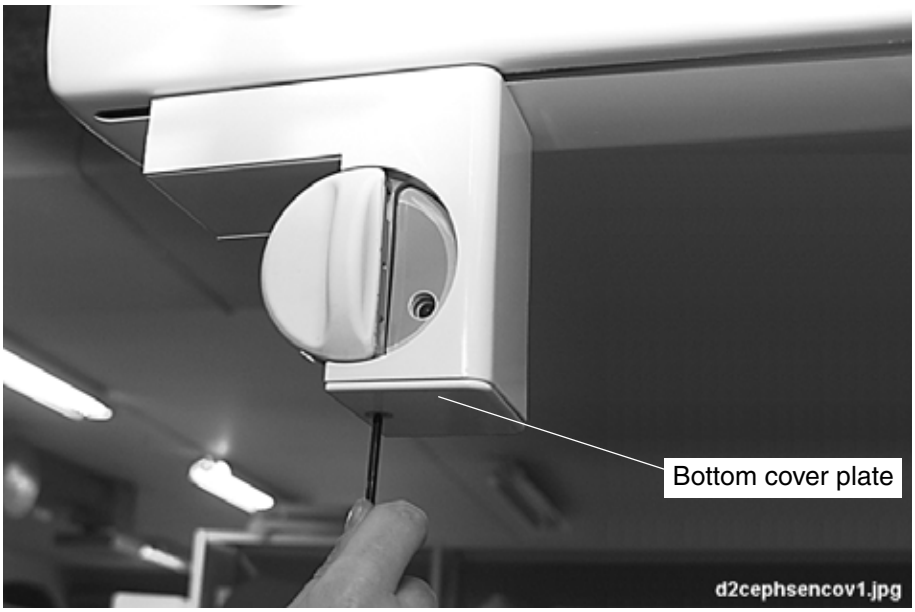


Figure 73

Turn the lock disc from above the locking plate and push in the quick connector mechanism locking knob. Unscrew the attachment screw of the quick connector mechanism cover with the 4mm allen key.

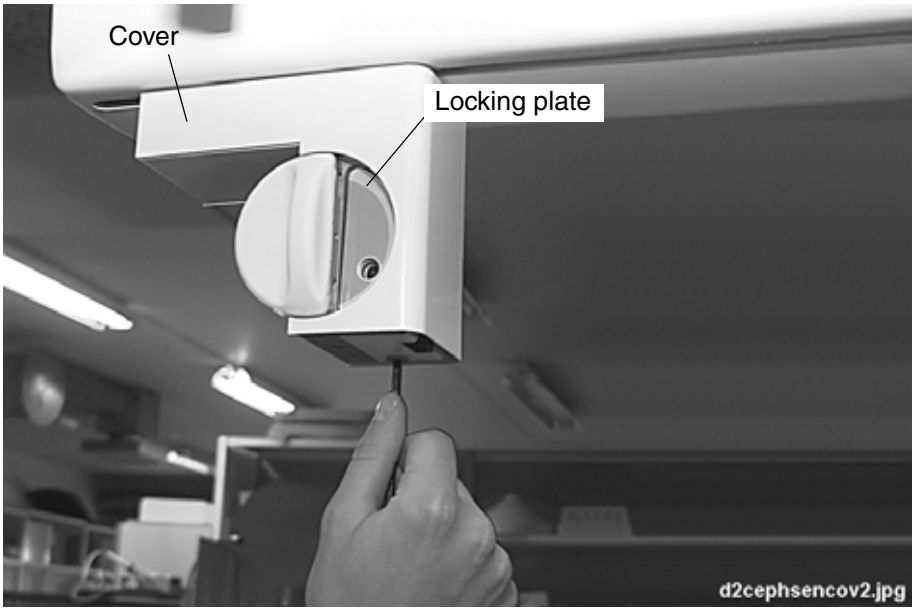


Figure 74

Slide the cover from its position.

Figure 75

Removing and attaching the fixed sensor head

Unscrew the bottom cover plate attachment screw with the 4mm allen key and remove the cover plate.

Figure 76

Unscrew the attachment screw of the adapter cover and slide the cover from its position.

Figure 77

Unscrew the upper cover attachment screw with the 4mm allen key and remove the cover.

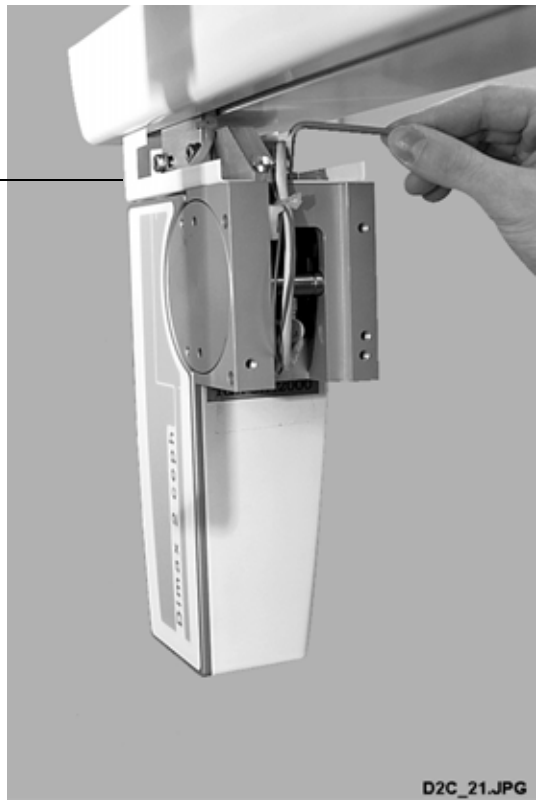


Figure 78

Loosen the four screws located on the lock disc.

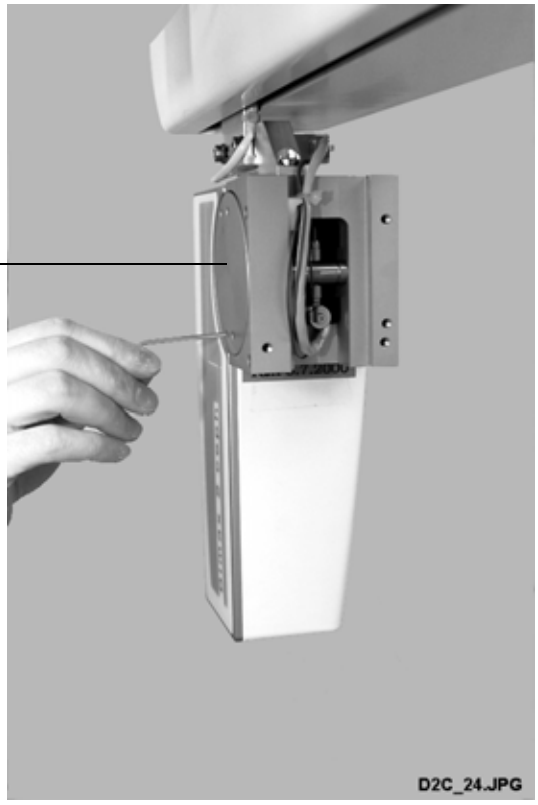


Figure 79

Loosen the lock disc attachment screw with the 3mm allen key and remove the lock disc.

Figure 80

Loosen the button axle attachment screw with the 3mm allen key and push the button axle inwards.

Figure 81

Remove the sensor head from its adapter.

Figure 82

The sensor alignment tool can now be attached to the adapter pins.

The sensor head is attached to its position in reverse order:

- Push the sensor head to its adapter.

- Place the lock disc to the adapter and tighten the attachment screw with the 3mm allen key.

- Push the button axle towards the lock disk. Make sure that the head of the axle goes into the hole on the lock disc and tighten the attachment screw with 3mm allen key.

- To remove the sensor head clearance tighten the four screws located on the lock disc slightly with 2.5mm allen key.

- Attach the covers.

7.2 Checking the sensor head position

The sensor head must be perpendicular to the head support. Use a sprit level to check the sensor head position, i.e. the sensor alignment tool position (see Fig. 84 on page E-47). In case it is not perpendicular to the head support, the angle of the quick connector mechanism must be adjusted.

In case the sensor head is attached to the cephalostat, remove the sensor head from the quick connector mechanism (see instructions given in Planmeca Proline EC panoramic X-rays user's manual). Remove the covers according to the instructions given in section "Cephalostat sensor head with quick connector mechanism - removing the covers" on page E-41.

In case the cephalostat is equipped with fixed sensor head, remove the covers and the sensor head according to the instructions given in section "Removing and attaching the fixed sensor head" on page E-42.

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.

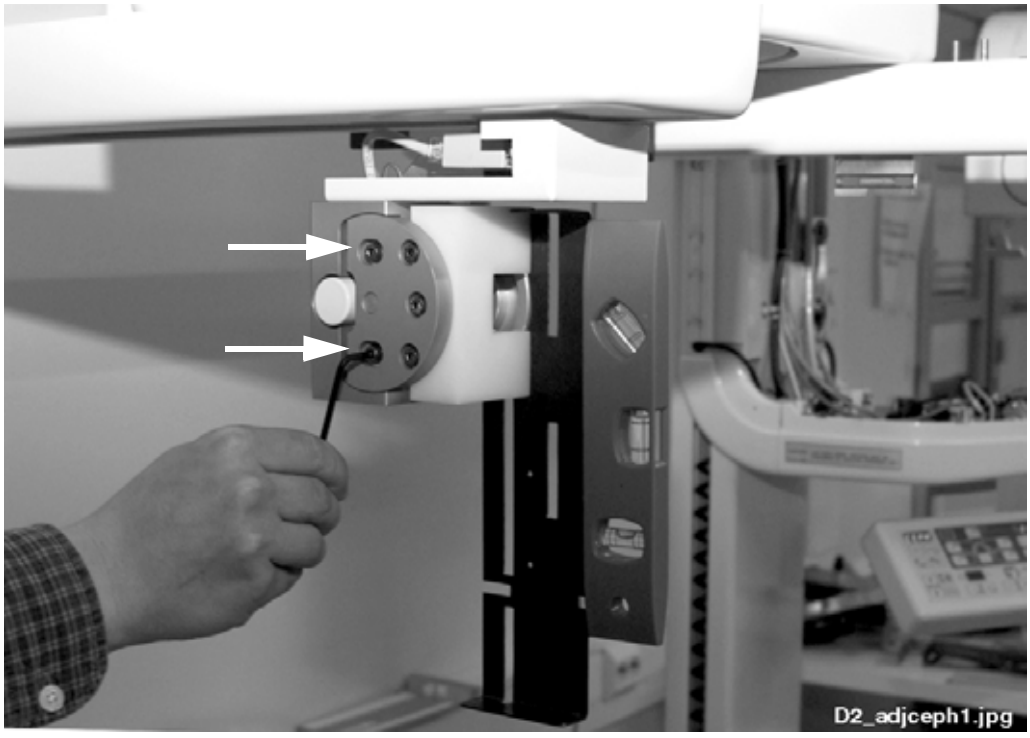


Figure 83

Adjust the head support angle with the two screws located on the left side of the mechanism (use 2.5mm allen key) (see Fig. 84) so that the sensor alignment tool is perpendicular to the cephalostat head support.

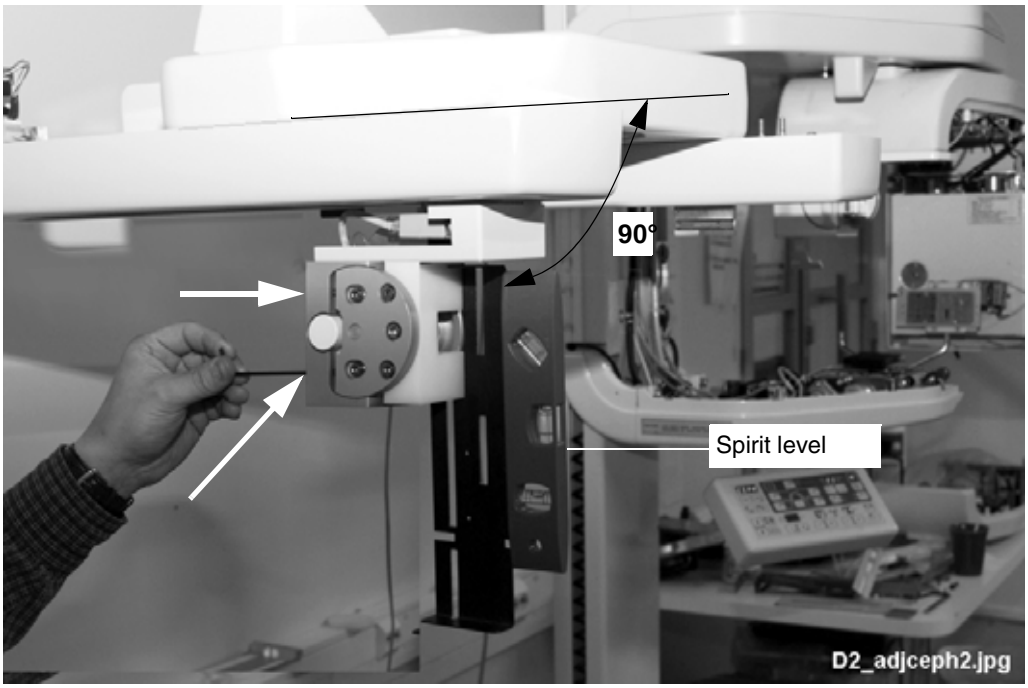


Figure 84

7.3 Checking the cephalometric beam alignment

Enter the service mode (see section “How to enter/exit the service mode” on page B-6). The radiation beam can now be checked without the sensor head moving.

Press the CTL-key.

Press and hold down the clock key until the number of the slot that you are checking appears on the main display (SLO and the slot number) and starts to flash. You are now in the primary slot calibration mode.

Repeatedly press the clock key until the letter “C” appears on the main display. This selection is used to check the position of the left side of the radiation.

Place the beam alignment tool to the sensor alignment tool to horizontal position (see figure below).

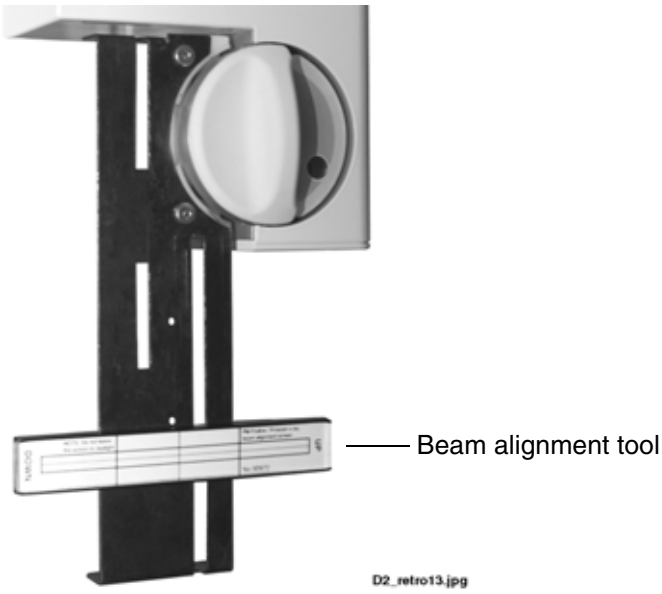


Figure 85

Select kilovolt and milliampere values high enough to enable the radiation beam to be seen in a darkened room for example 80kV and 12mA.

Stand behind the tubehead 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 radiation beam must appear on the beam alignment tool as shown on the figure below. It **must reach, but not overlap,** the middle line of the tool. If it does not, the cephalostat arm position must be adjusted. Note that the beam does not have to reach the right side line. Refer to the section “Adjusting the cephalostat arm position” on page E-51.

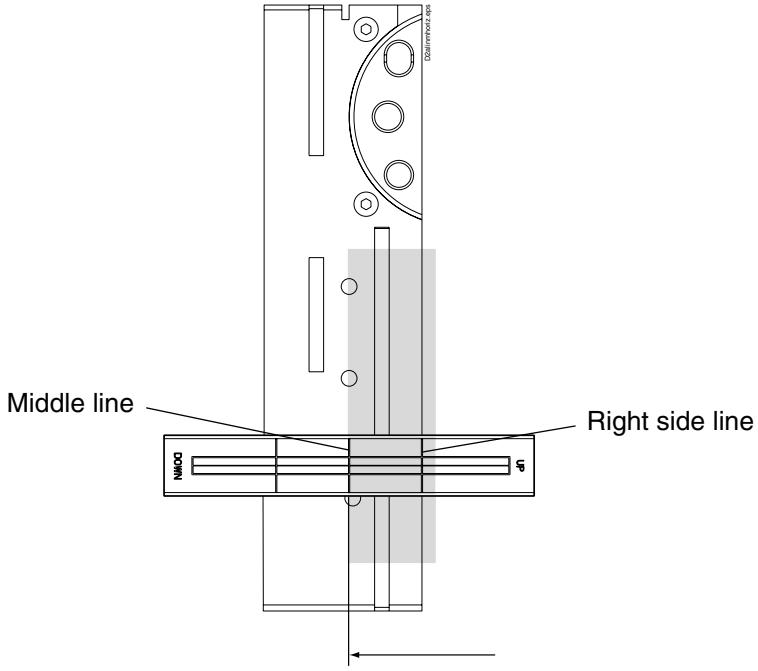


Figure 86

Press the clock key once. The letter “d” will appear on the main display.

Stand behind the tubehead 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 radiation beam must appear symmetrically on the beam alignment tool as shown on the figure below. If it does not refer to the section “Radiation beam adjustment, Planmeca Proline EC Pan/Ceph X-ray” on page E-15. The adjustment is performed in the same way as when adjusting the standard panoramic slot.

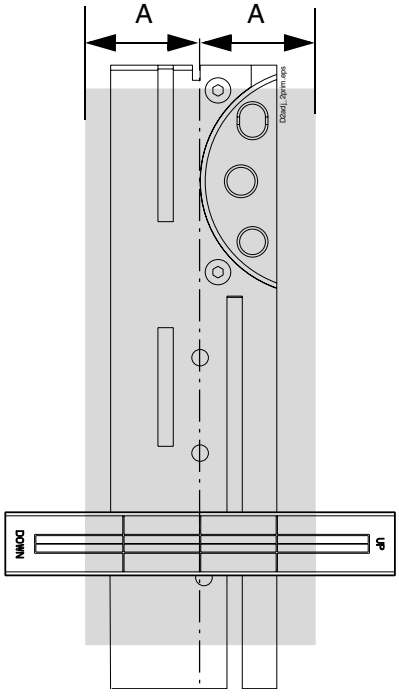


Figure 87

To check the beam position in vertical direction place the beam alignment tool to the sensor alignment tool to vertical position as shown on the Fig. 88 below.

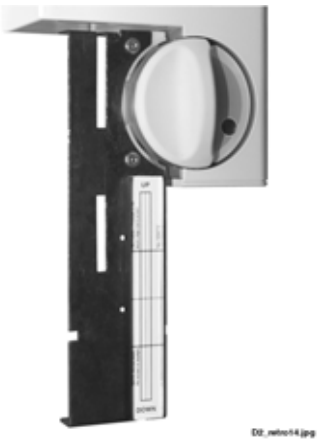


Figure 88

Stand behind the tubehead 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 radiation beam must reach the lower edge of the rectangle marked on the beam alignment tool. If it does not refer to “Radiation beam adjustment, Planmeca Proline EC Pan/Ceph X-ray” on page E-15. The adjustment is performed in the same way as when adjusting the standard panoramic slot.

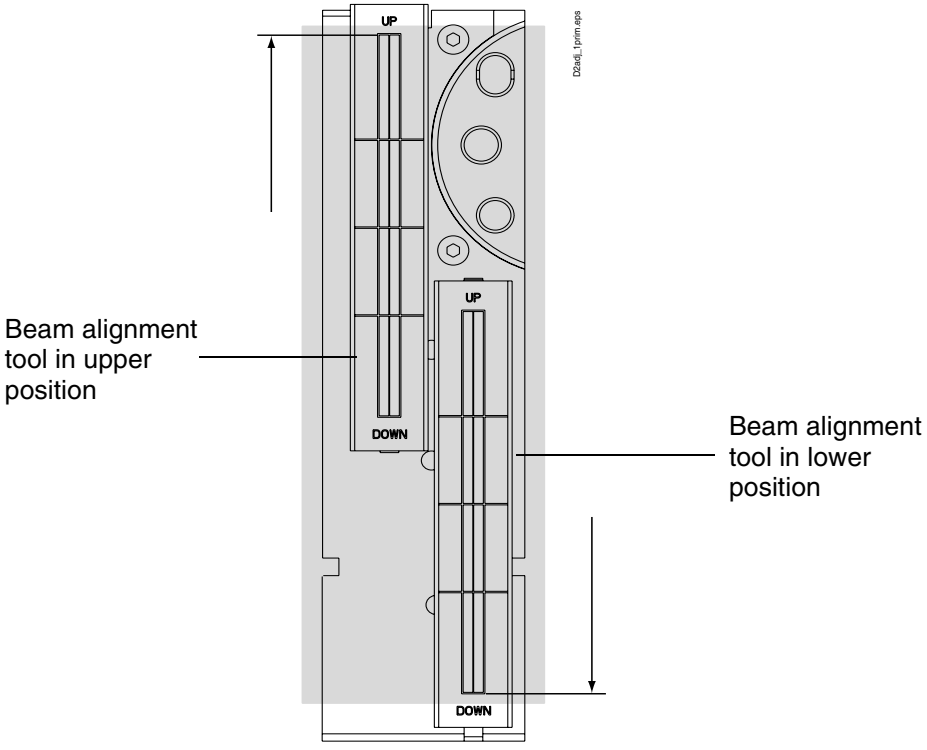


Figure 89

Move the beam alignment tool to the upper position on the sensor alignment tool as shown on the Fig. 89.

The radiation beam must reach the upper edge of the rectangle marked on the beam alignment tool (see figure above). If it does not refer to “Radiation beam adjustment, Planmeca Proline EC Pan/Ceph X-ray” on page E-15. The adjustment is performed in the same way as when adjusting the standard panoramic slot.

When all the slots have been checked, and if necessary adjusted, exit the service mode by pressing the ceph key.

7.4 Adjusting the cephalostat arm position

The left side of the radiation beam is checked as described in section “Checking the cephalometric beam alignment” on page E-48. If the left side of the radiation beam is too far left or right the cephalostat arm position must be adjusted.

Adjust the arm position by turning the two cephalostat arm adjusting screws. Turning the other screw clockwise with 4mm allen key will move the beam to the right, and turning the other screw clockwise with the 6mm allen key to the left.

Figure 90

If the cephalostat arm position adjustment does not enough correct the beam alignment, the position of the latch of the rotating unit locking solenoid must be adjusted. The adjustment is possible only when the rotating unit is in the end position.

Enter the test mode (see section “Test mode” on page B-4). Press the exposure button until the rotating unit has reached the end position. When the rotating unit is in this position you will be able to see a small recess in one side of the guide block which is located under the upper shelf.

Switch the unit off. Loosen the latch attachment screws with the 3mm allen key and move the latch to required direction.

Figure 91

7.5 Calibrating the cephalostat sensor head

Remove the sensor alignment tool from the cephalostat quick connector mechanism and attach the sensor head to the quick 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).

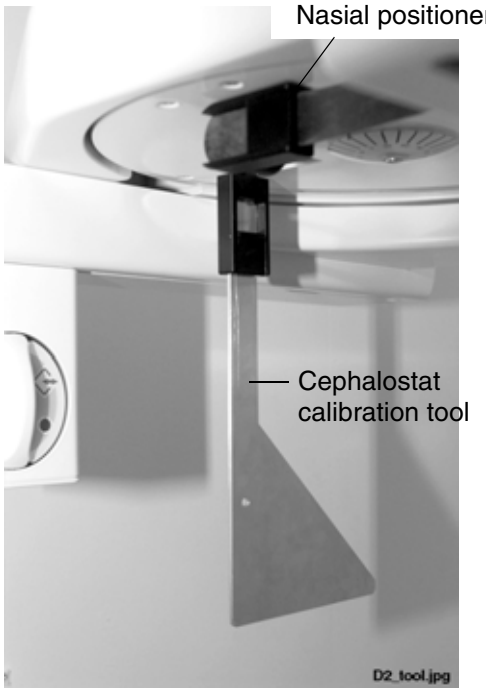
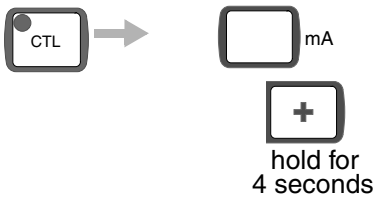


Figure 92

Make sure that the second primary slot is in its position.

The calibration with 4x4 binning (normal resolution) is performed with mA value lower than 4 mA. Because of this, the mA range must be changed before calibration. Enter the service mode as described in section “How to enter/exit the service mode” on page B-6.

Press the CTL-key and press and hold the mA+ -key for 4 seconds to change the mA range. The ranges are **default** 4-12 mA and **low** 2-12 mA. The mA range is indicated in the mA display, 04 is for default mA range and 02 for low mA range. Use the low mA range when calibrating the cephalostat sensor head.

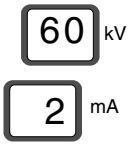


Exit the service mode.

CAUTION ***REMEMBER TO CHANGE THE mA RANGE BACK TO DEFAULT (4-12 mA) AFTER CALIBRATING THE CEPHALOSTAT SENSOR HEAD.***

Press and hold the P key until you have heard two audible signals. The latest used exposure mode number starts to flash on the main display.

Select the image area 6 with the program selection keys. The text CPH6 will appear on the main display. The rotating unit will move automatically to the correct position for taking cephalometric exposures.



The calibration must be performed with 3x3 (enhanced resolution) and 4x4 (normal resolution) binning. With enhanced resolution select **60** kV and **11** mA, and with normal resolution select **60** kV and **6** mA. Note that these values must be selected to produce a clear exposure.

Start the Dimax3 calibration program by double-clicking the Dimax2Tool.exe program icon located in the Dimaxis program folder. The Dimax2Tool window appears.

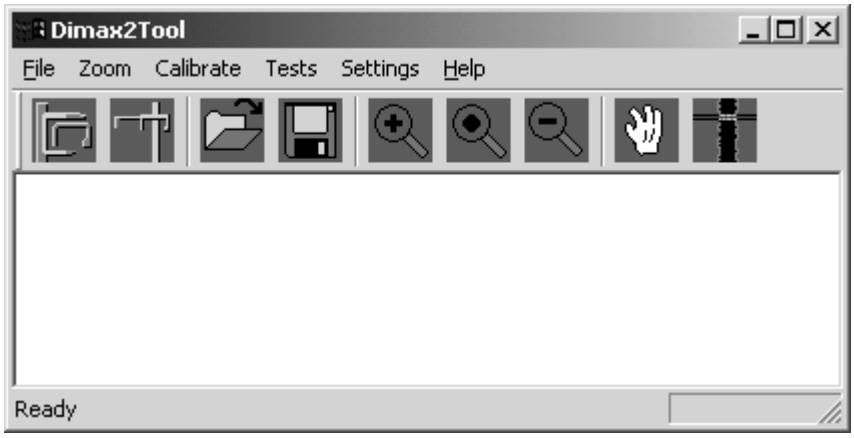


Figure 93

Calibrating the sensor head

Select Proline from the Settings / Type pulldown menu.

Figure 94

The calibration must be performed with both 3x3 (enhanced resolution) and 4x4 (normal resolution) binning. Select the binning from the Settings / Binning pulldown menu.

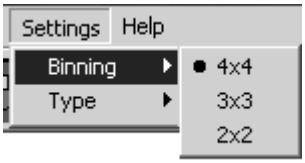


Figure 95

Click the Dimax3 cephalometric exposure button. The pmpcal2 window with text Waiting appears.

Dimax3 cephalometric exposure

Figure 96

Press the ready key to drive the X-ray to the exposure position.

The text Exposure appears.

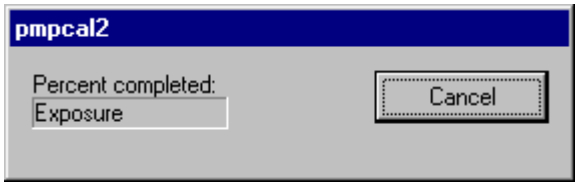


Figure 97

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.

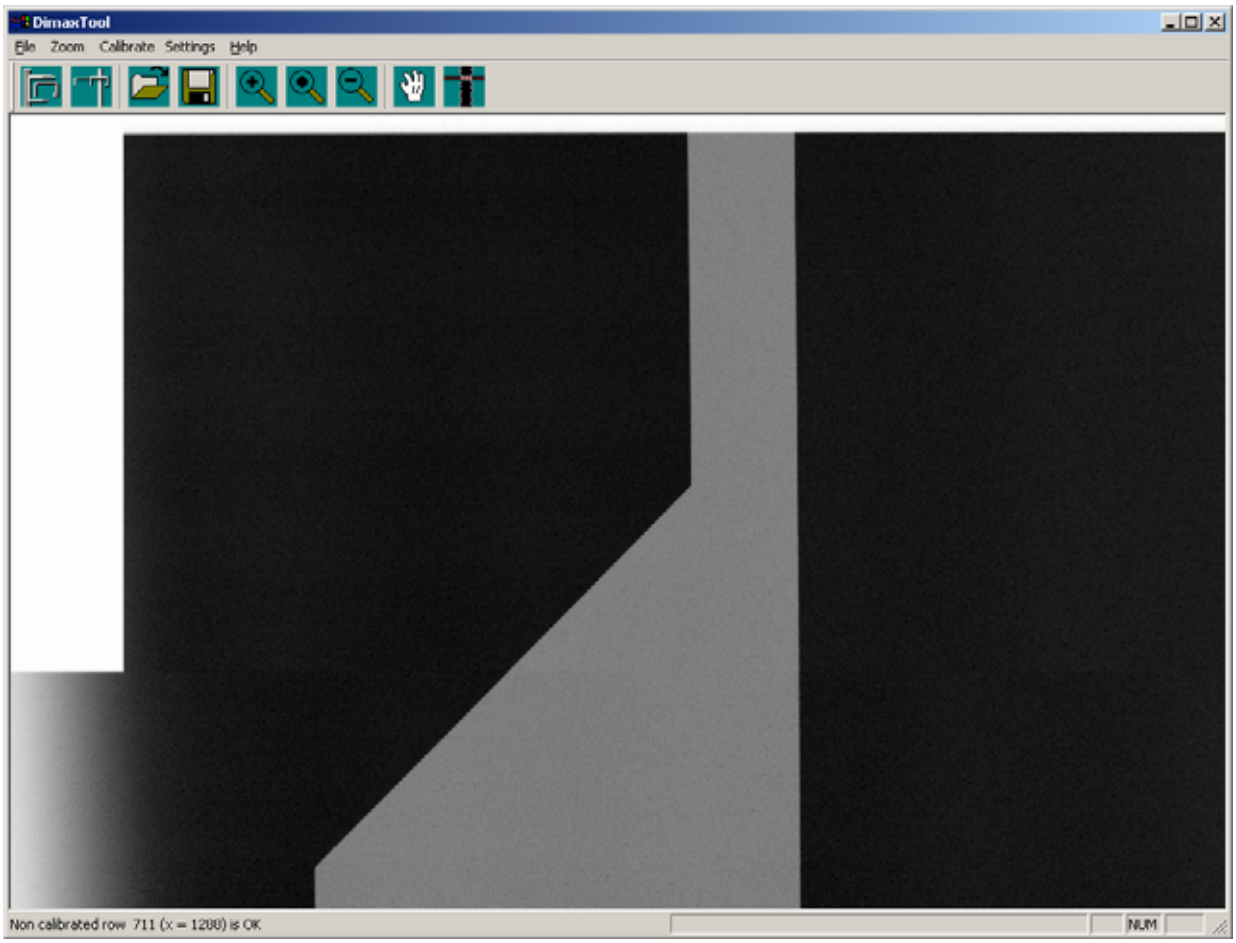


Figure 98

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.

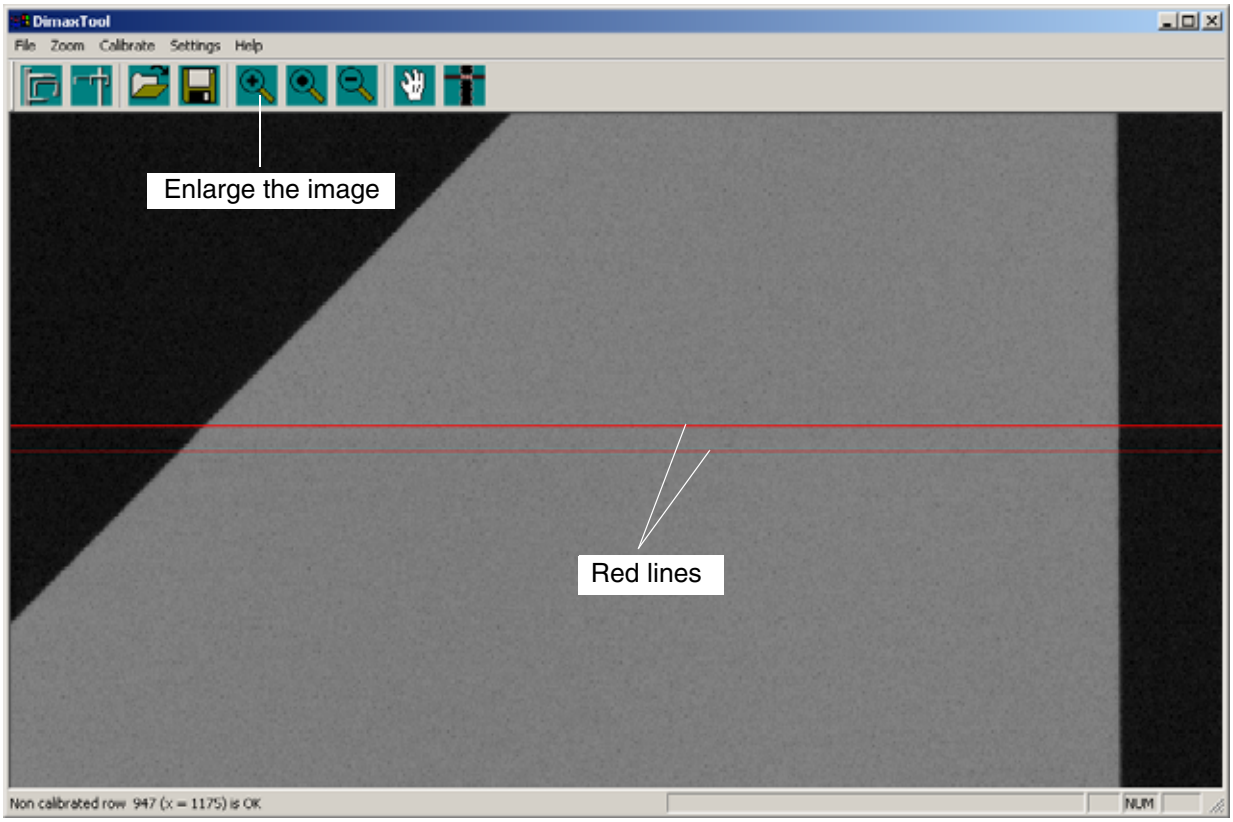


Figure 99

While editing the shape of the triangle the sensor is simultaneously recalibrated.

If the evenly shaped triangle can not be reached, the second primary slot position must be adjusted in vertical direction. Refer to the section "Second primary slot adjustment" on page E-64 for information on how to align it.

Checking the calibration

You can test whether the calibration succeeded as follows. Do not remove the calibration block from the sensor head.

Take a test exposure by selecting Test Ceph Cal File from the Calibrate menu.

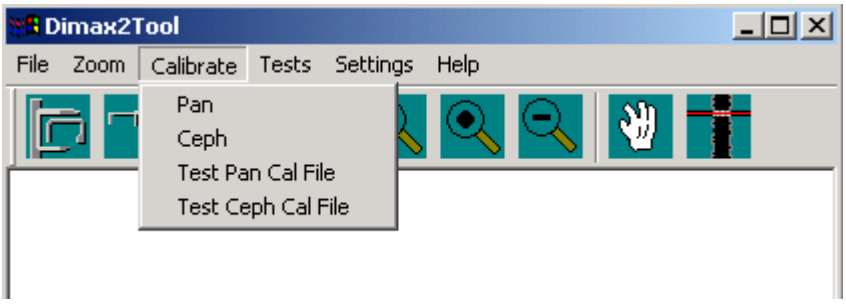


Figure 100

The pmpcal2 window with text Waiting appears.

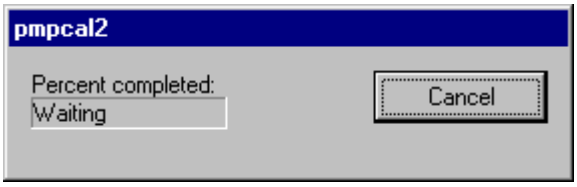


Figure 101

Press the ready key to drive the X-ray to the exposure position.

The text Exposure appears.

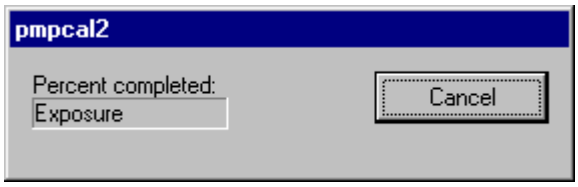


Figure 102

The calibration tool image should be evenly grey. If it is not, recalibrate the sensor head. If recalibration does not help, check that the Dimaxis, 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 “Checking the head support position” on page E-59).

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.

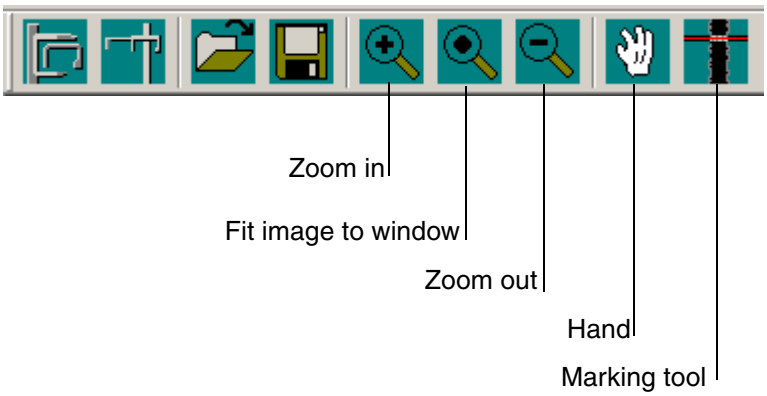


Figure 103

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 104

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 105

The row can be returned back to normal by clicking it with the right mouse button.

Taking an ear posts exposure

You can now check the adjustments by taking an ear posts exposure either as described in section “Checking the head support position” on page E-59 or using the Dimax2Tool program’s Tests / Ear posts command.

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 Ear posts from Tests menu.

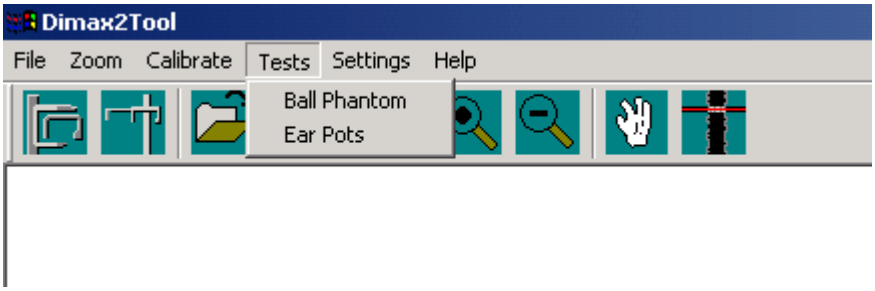


Figure 106

The pmpcal2 window with text Waiting appears.

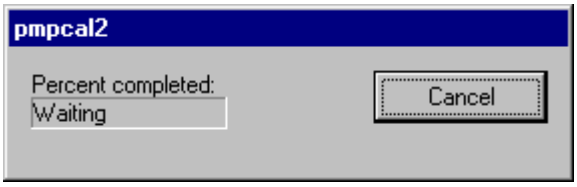


Figure 107

Touch the ready field to drive the X-ray to the exposure position.

The text Exposure appears.

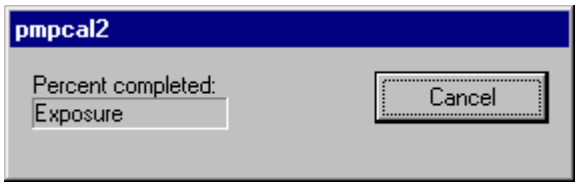


Figure 108

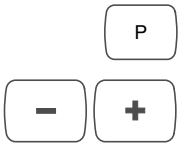
Take an exposure. On the image you will see the images of a metal ball and a metal ring. The must be concentric, or if not exactly concentric there must be a small gap between the edge of the ball and the inner edge of the circle. If the ball and ring are correctly positioned, the test image is accepted.

If the ball touches the ring the ear posts must be adjusted, refer to section “Head support adjustment” on page E-60.

CAUTION ***REMEMBER TO CHANGE THE mA RANGE BACK TO DEFAULT (4-12 mA) AFTER CALIBRATING THE CEPHALOSTAT SENSOR HEAD.***

7.6 Checking the head support position

Remove the sensor alignment tool and attach the sensor head to the cephalostat head support.



Press and hold the P key until you have heard two audible signals. The latest used image area number starts to flash on the main display.

Select the image area 6 with the program selection keys. The text CPH6 will appear on the main display. The rotating unit will move automatically to the correct position for taking cephalometric exposures.

Remove the sensor alignment tool from the cephalostat quick connector mechanism, if needed. Attach the sensor head to the quick connector.

Rotate the head support to the 90° position and place the two ear posts into their holders if they are not already installed.

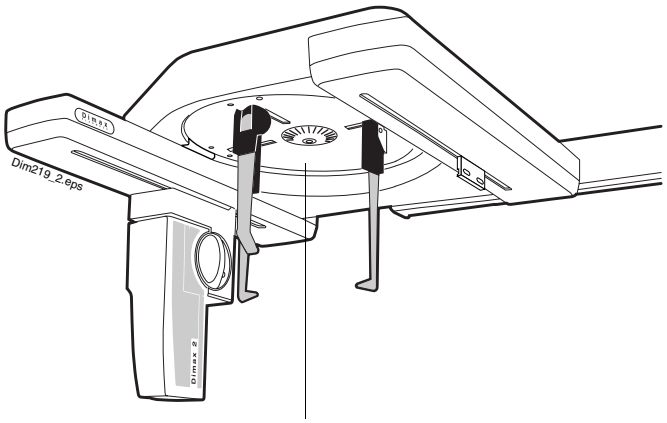


Figure 109

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 tubehead, protect yourself from radiation and take an exposure.

On the image you will see the images of a metal ball and a metal ring. The 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.

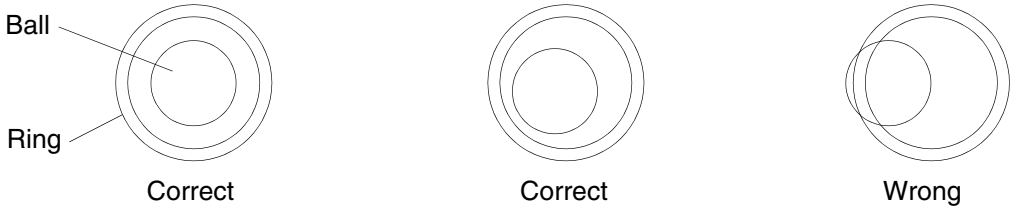


Figure 110

If the ball touches the ring the ear posts must be adjusted. Refer to section “Head support adjustment” on page E-60.

7.7 Head support adjustment

Switch the unit off. Remove the cover of cephalostat head support.

Make sure that the locking screw of the adjustment flange is loosened (Fig. 112, 1).

Adjust the head support position according to the Fig. 112. Rotate the head support around its vertical axis to adjust the ear posts in horizontal direction (Fig. 112, 2) and around its horizontal axis to adjust the ear posts in vertical direction (Fig. 112, 3).

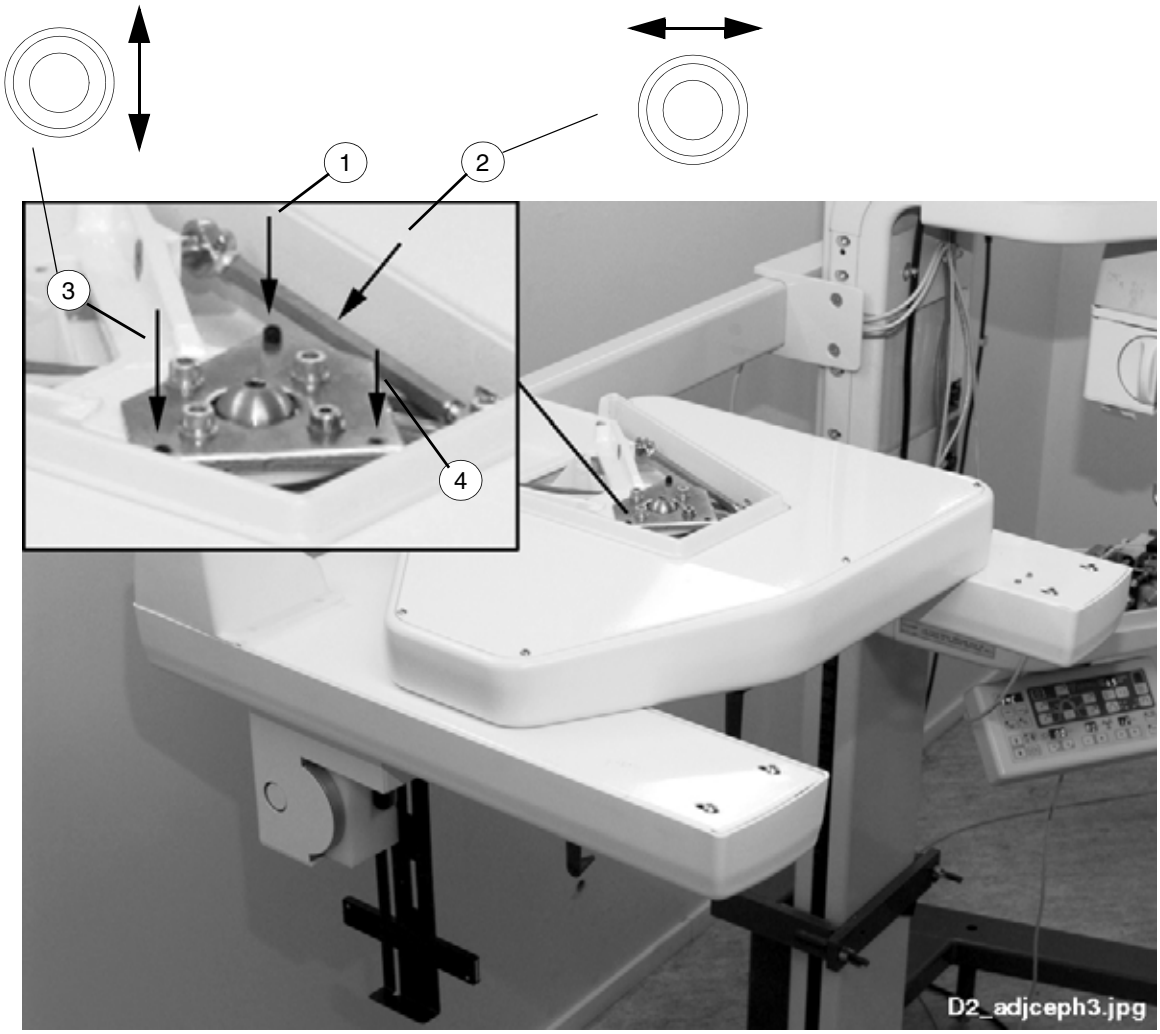


Figure 111

Adjust the cephalostat head support position to horizontal position, if needed (see Fig. 111, 4 and Fig. 112 below)

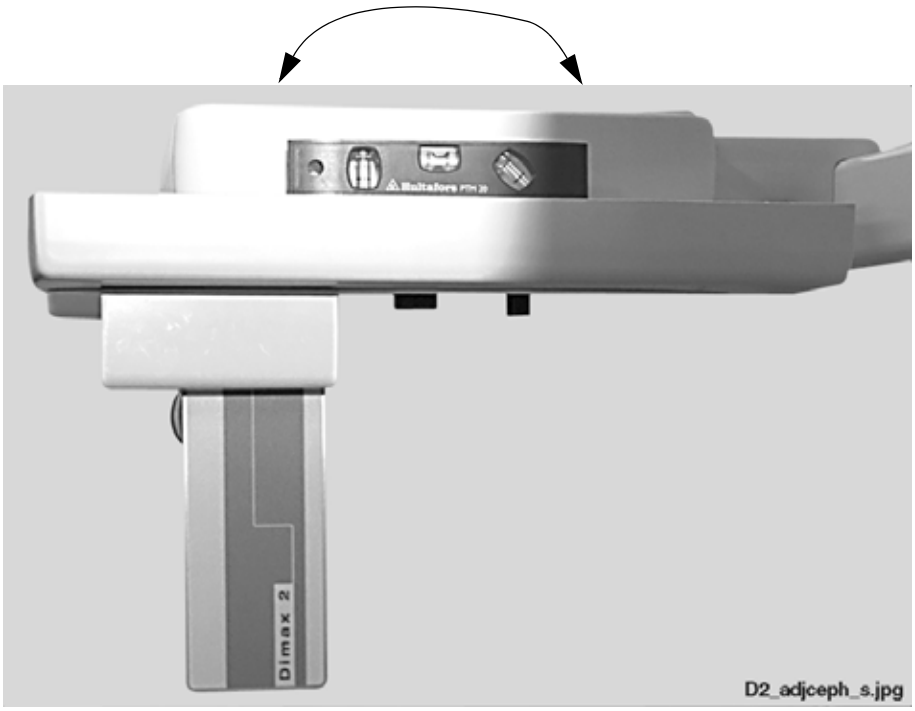


Figure 112

Fasten the loosened screws and replace the covers.

NOTE ***CHECK THE RADIATION BEAM ALIGNMENT ACCORDING TO THE INSTRUCTIONS GIVEN IN SECTION "Checking the cephalometric beam alignment" on page E-48 AFTER ADJUSTING THE HEAD SUPPORT POSITION. ADJUST THE BEAM, IF NEEDED. REPEAT THE BEAM AND HEAD SUPPORT ADJUSTMENTS UNTIL THE RADIATION BEAM POSITION AND HEAD SUPPORT POSITION ARE ACCEPTABLE.***

7.8 Checking the second primary slot position

NOTE ***You must now check the beam alignment with the second primary slot in its position. Attach the second primary slot to its position.***

Remove the sensor head and attach the sensor alignment tool to the cephalostat head support.

Enter the service mode (see section “How to enter/exit the service mode” on page B-6). The radiation beam can now be checked without the sensor head moving.

Press the CTL-key.

Press and hold down the clock key until the number of the slot that you are checking appears on the main display (SLO and the slot number) and starts to flash. You are now in the primary slot calibration mode.

Repeatedly press the clock key until the letter “d” appears on the main display.

Place the beam alignment tool to the sensor alignment tool to vertical position as shown on the figure below.

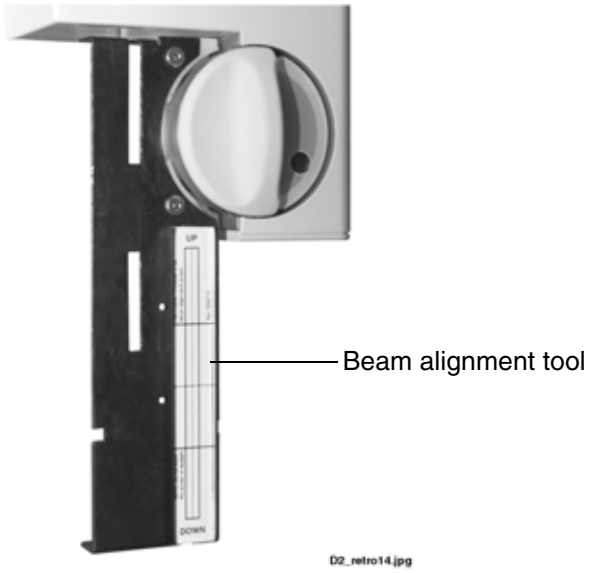


Figure 113

Stand behind the tubehead 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 appear within the borders of the rectangle marked on the beam alignment tool. If it does not adjust the second primary slot position. Refer to section “Second primary slot adjustment” on page E-64.

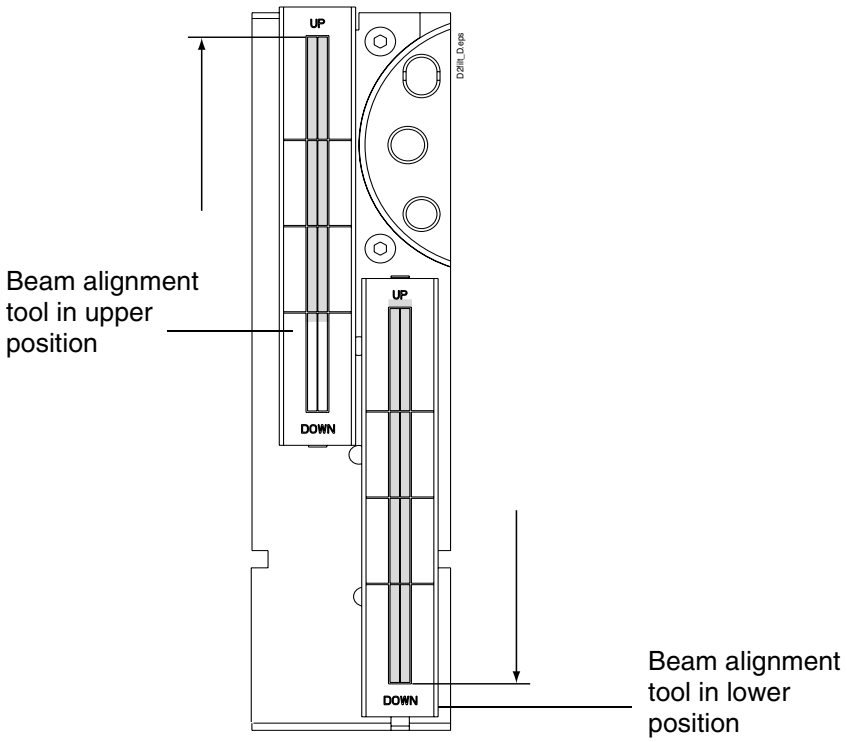


Figure 114

Move the beam alignment tool to the upper position on the sensor alignment tool as shown on the figure above.

Stand behind the tubehead 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 on the figure above. If it does not adjust the second primary slot position. Refer to section “Second primary slot adjustment” on page E-64.

NOTE ***After checking and adjusting the second primary slot position the cephalostat sensor head must be calibrated according to the instructions given in section “Calibrating the cephalostat sensor head” on page E-52.***

7.9 Second primary slot adjustment

Second primary slot in too low or high position

Loosen all the three screws located on the side of second primary slot with the 4mm allen key.

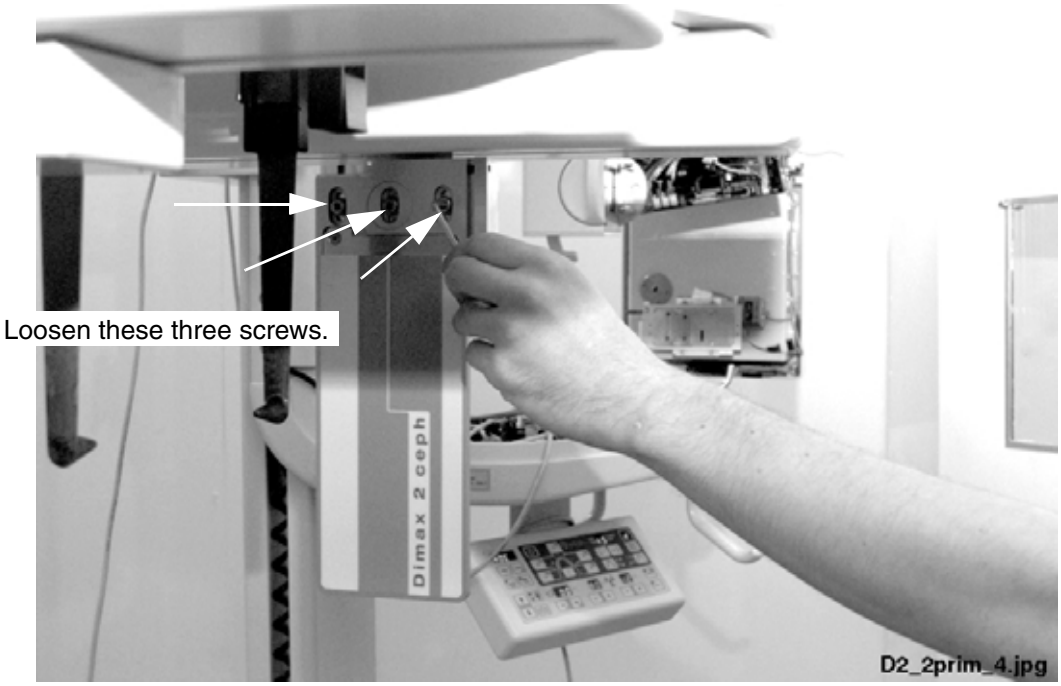


Figure 115

Move the second primary slot in vertical direction until the slot is correctly positioned. Tighten the loosened screws.

Second primary slot not vertical

Loosen the two screws located on the side of second primary slot.

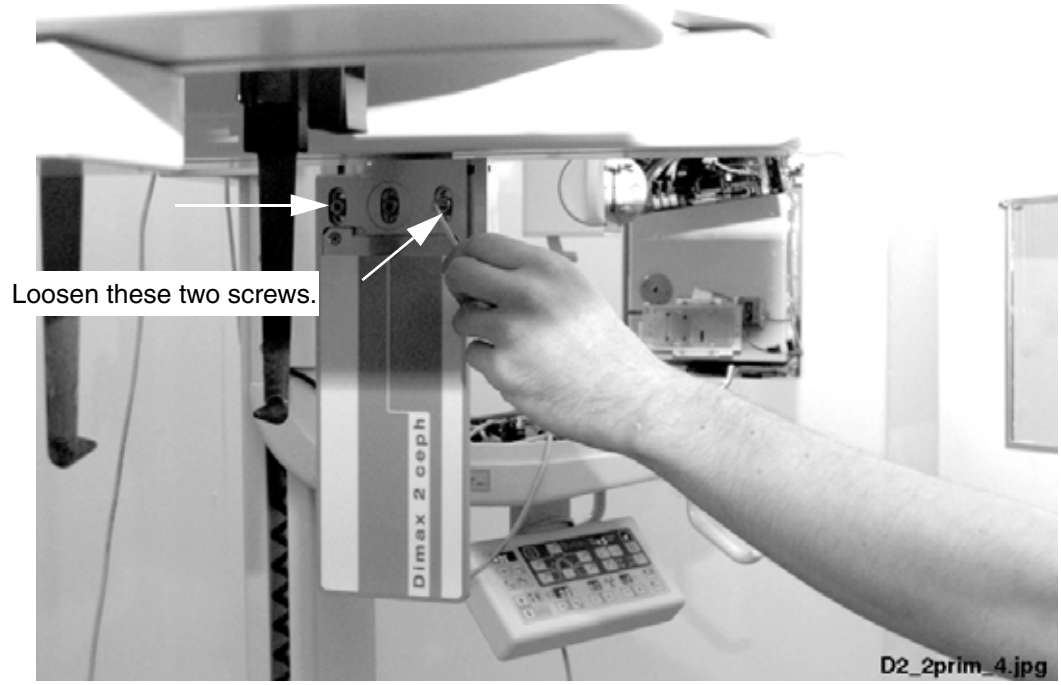


Figure 116

Rotate the second primary slot with the two screws located on the right side of the slot until the slot is correctly positioned (use the 2.5mm allen key).

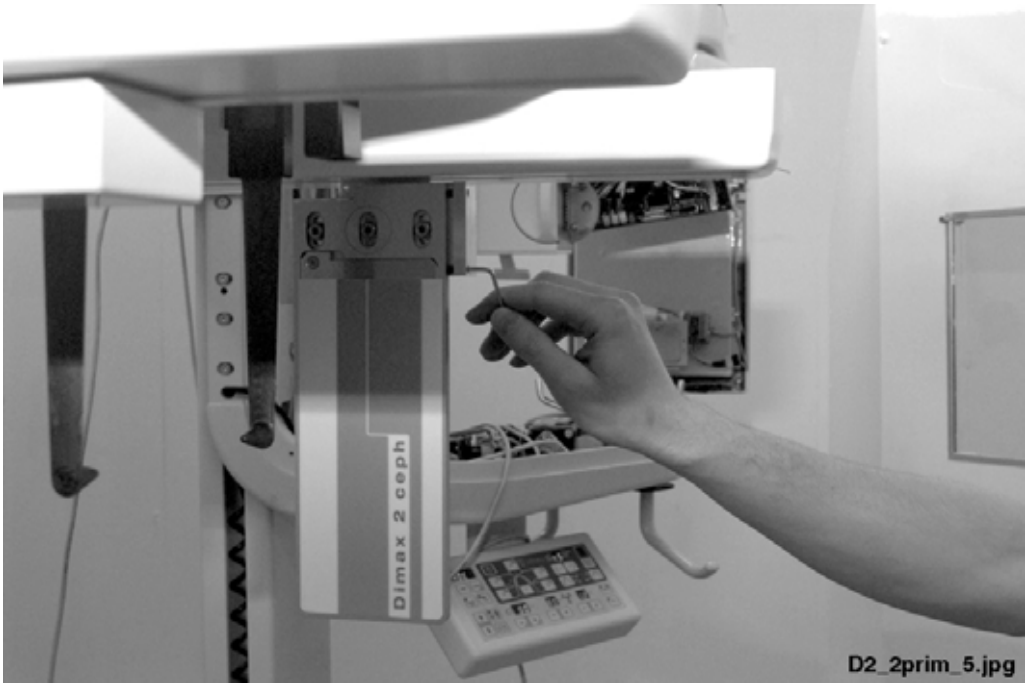


Figure 117

Second primary slot too far to the right or left

Loosen the attachment screws of second primary slot with the 4mm allen key and move the slot in horizontal direction.

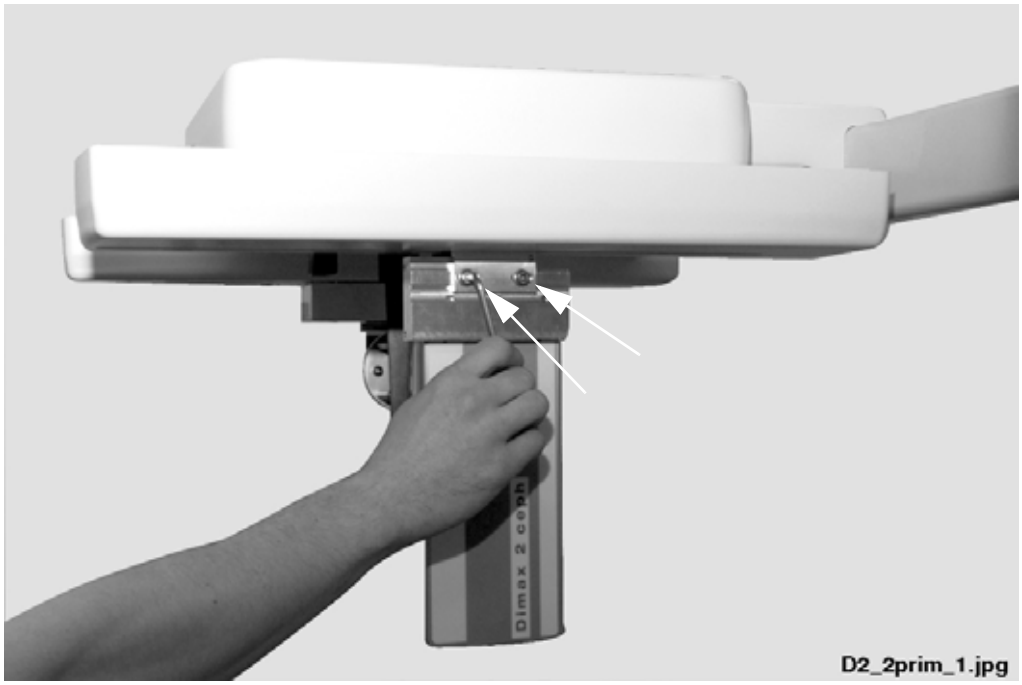


Figure 118

NOTE ***After checking and adjusting the second primary slot position the cephalostat sensor head must be calibrated according to the instructions given in section "Calibrating the cephalostat sensor head" on page E-52.***

8 IMAGE AREA SHIFTING

The image area has been too short for some larger patients. With these instructions the image area can be shifted forwards to avoid cutting the patient's nose in the image.

NOTE ***The Image area shifting is possible from software versions PK 5.12 and PG 5.12. Upgrade the software, if needed.***

8.1 Adjusting the position of the frame cover fastening flat spring

Remove the frame cover as follows. Unscrew the two attachment screws using the 2.5mm Allen key. Remove the attachment screws and the washers (figure below, 1). Pull the frame cover carefully downwards as shown on the figure below (2). Slide the frame cover away from the cephalostat head support (3).

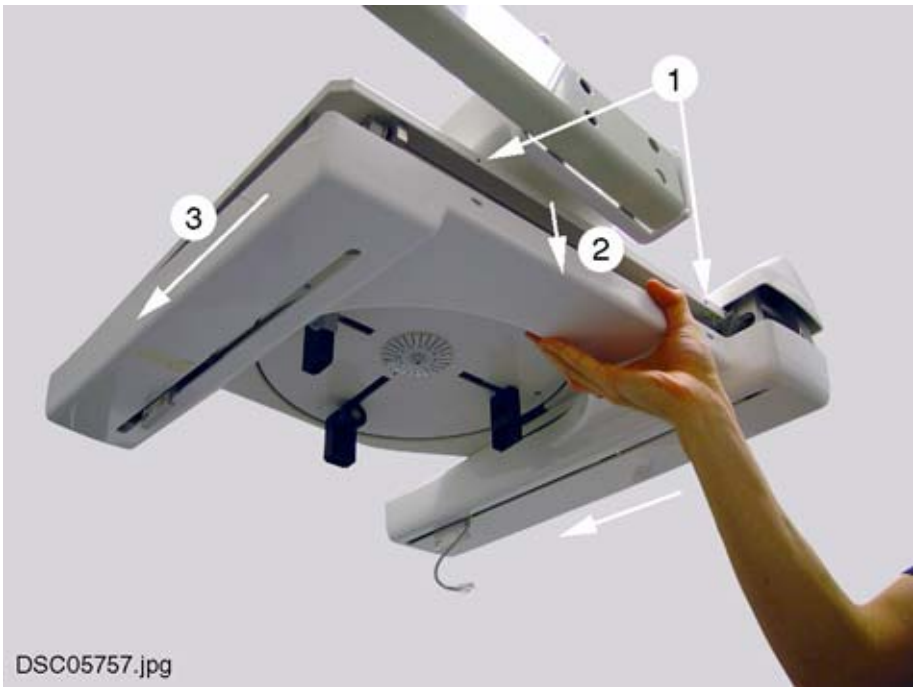


Figure 119

The frame cover fastening flat spring must be on the same level as the trail holder (see figure below, 1). If needed, loosen the attachment screws (2) and move the fastening flat spring. Tighten the attachment screws.

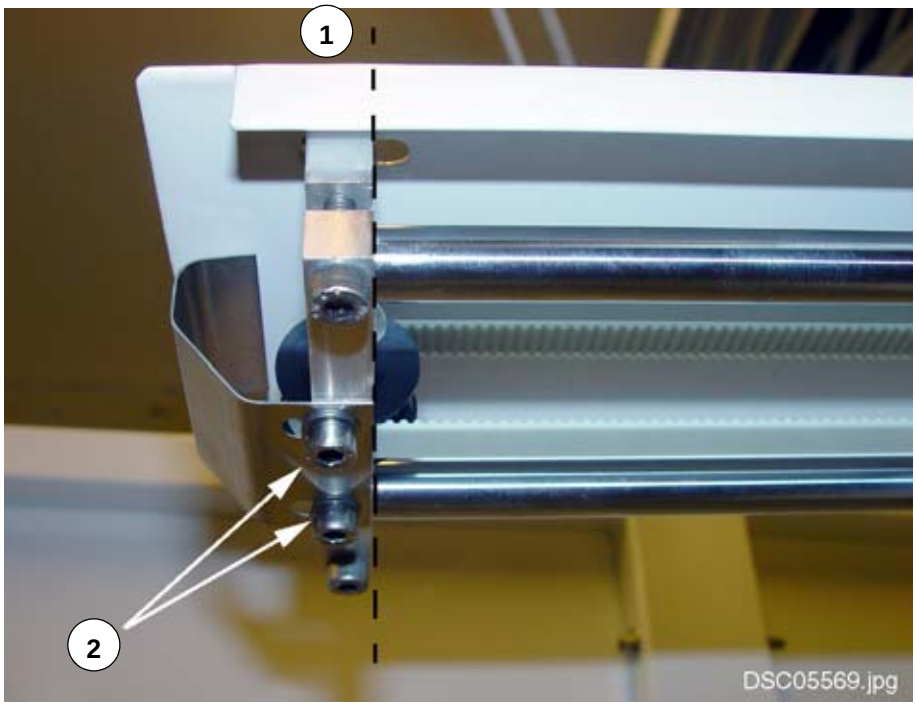


Figure 120

Attach the frame cover.

8.2 Shifting the image area

NOTE ***The Image area sifting is possible from software versions PK 5.12 and PG 5.12.***

In the lateral view (image area number 4 or 6) the image area on the patient's nasal side can be shifted backwards and forwards as shown on the figure below.

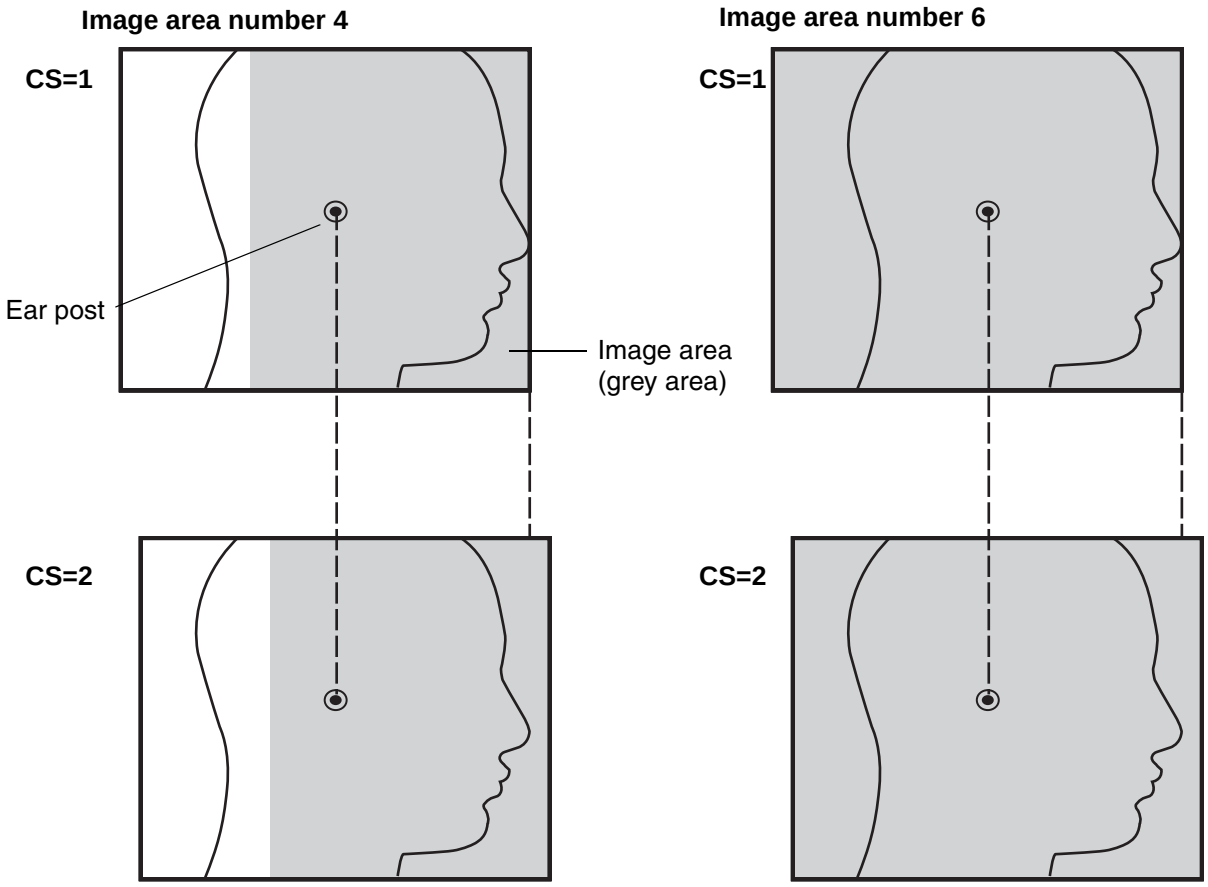
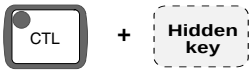


Figure 121

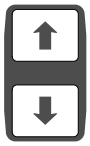
The image area is shifted in the service mode as follows.

Enter the service mode: Press the CTL-key and simultaneously press and hold down the hidden key until the temperature of the tubehead appears on the display (about four seconds). The ready key indicator light will start to flash. This indicates that you have entered the service mode.



Press the CTL-key and the PAN key until the text CS1 or CS2 appears on the display.

The parameter value CS1 indicates the “old” image area (moves the image area backwards). The parameter value CS2 moves the image area forwards approx. 14mm (0.55 in.) regarding to the image area with value CS1. Change the parameter value with the up/down keys.



To accept the parameter value press the Ready key.

To exit the service mode press the CEPH key briefly.

You have to adjust the cephalometric beam after changing the parameter value. Refer to the panoramic unit’s technical manual.

NOTE ***If you do not want to move the image area when upgrading the software from the revisions smaller than 5.12, select the parameter value CS=1. In that case you do not have to adjust the cephalometric beam.***

Chapter

F

PREVENTIVE MAINTENANCE

1 SYSTEM MAINTENANCE

1.1 Cleaning

CAUTION ***When disinfecting the unit surfaces, always disconnect the unit from the mains. The unit must not be exposed to gaseous disinfectants or explosive anesthetics. Never spill any liquids into the unit.***

The chin support and the Ceph cassette holder can be cleaned with NON-ALCOHOLIC disinfection solutions.

The bite piece of the chin rest can be removed and autoclaved. It can also be 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 Operator's checks

Exposure indicators

Confirm that the exposure indicator lights turn on in the control panel and in the remote control for the length of the exposure.

Exposure warning signal

Confirm that the buzzer comes on for the length of the exposure. If needed, adjust the tone of the signal, see section "EXPOSURE WARNING SIGNAL ADJUSTMENT" on page D-26.

Exposure switch

Confirm that the exposure switch requires continuous activation to maintain the exposure. Releasing the exposure switch during the radiation should produce the ER00 message on the displays (clear it by pressing the CTL-key once). Make a visual check that the exposure switch spiral cable is not damaged.

Labels

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

2 PREVENTIVE MAINTENANCE CHECKS

2.1 Electrical checks

Annually or after every 10 000 exposures whichever appears first the electrical exposure parameters of the Planmeca Proline EC Panoramic X-ray should be checked in order to maintain the initially accurate operation of the equipment despite of the possible long term component value alterations.

There are no adjustments in the equipment because of its' self-calibrating microprocessor based operation and therefore no actual parameter trimming of the kV, mA and exposure time can be done.If one of the parameters to be checked by this periodical preventive maintenance procedure is found to be beyond the limit values allowed, the corresponding electrical circuit board is to be changed in whole and sent back to the factory for recalibration that is done by replacing the faulty component.

The parameters to be checked are the following:

Before exposure:

- kV measurement circuit impedance
- mA measurement circuit impedance

During exposure:

- kV value
- mA value
- exposure time

In order to perform the calibration measurements the X-ray equipment must be powered off and the rotating arm bottom cover and Generator EMC-cover are to be removed. The cable connector is disconnected from PSU board connector J1. The multimeter is connected between the cable connector J1 and ground.

Before powering on the X-ray equipment the circuit impedance measurements should be performed in order to verify the condition of the measurement resistors in the tubehead.

Select resistor mode of the multimeter.

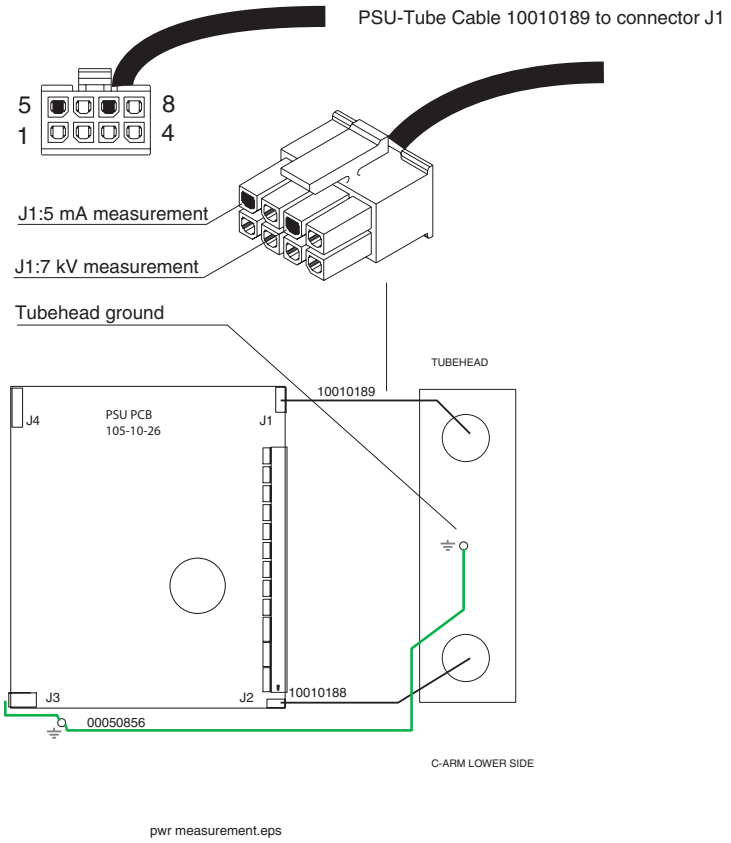
kV circuit impedance measurement

The multimeter is connected between the connector J1: 7 and tubehead ground. Read the multimeter display.

Acceptable value between J1: 7 and tubehead ground is from 18.60 kohms to 19.0 kohms.

mA circuit impedance measurement

The multimeter is connected between the connector J1: 5 and tubehead ground. Read the multimeter display.



Acceptable value between J1: 5 and tubehead ground is from 379 ohms to 387 ohms.

2.2 X-ray tube feedback system

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 Proline EC 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 in mm 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 2.5 mm Al at 80 kV) is to measure the air kerma rate first without any additional material in the radiation field, then add 2.5 mm Al to the radiation field, measure the air kerma rate again and check that the air kerma rate with additional 2.5 mm Al is **more** than one half of the one measured without the added material. That is,

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

This is sufficient to ensure that the HVL is at least 2.5 mm 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 cassette holder (or Dimax3 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 cassette holder in the middle of the radiation field, take an exposure and record the measured exposure time. When placing the sensor, note that if the unit is equipped with auto-ceph, the cassette size is automatically detected when the cassette is on its place and the area of radiation field is adjusted accordingly.

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. The analog feedback voltage signals can be measured with a calibrated multimeter. An oscilloscope is required if kV and mA waveforms need to be observed, for an example when determining the exposure time.

Peak tube potential (kVp) measurement

Select the voltage mode of the multimeter. Connect the positive plug of the multimeter to the Generator CPU board's connector P18:10 KVM-signal. Connect the negative plug of the multimeter to the Generator CPU board's connector P4:2 (GND). 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 = 17 467 * 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

Select the voltage mode of the multimeter. Connect the positive plug of the multimeter to the Generator CPU board's connector P18:11 MAM-signal. Connect the negative plug of the multimeter to the Generator CPU board's connector P4:2 (GND). 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) = 2.61 * 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 the Generator CPU board's connector P18:10 and oscilloscope ground to the Generator CPU board's connector P4:2 (GND). 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 KVM-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 should be 277 ± 30 mV with respect to the unit ground potential. The offsets should be measured in idle state (before exposure).

3 MECHANICAL CHECKS

Refer to the chapter "ADJUSTMENT & CALIBRATION" on page D-1.

Chapter

G

TROUBLESHOOTING

1 SERVICE MODE SIGNALS

Please refer to section “SERVICE MODE KEYBOARD FUNCTIONS” on page B-6 for details. This mode provides helpful information when tracing sensor and switch signals, since the signals can be viewed here.

2 ERROR MESSAGES

Please refer to sections “ERROR MESSAGES” on page C-2 and “ERROR MESSAGE EXPLANATIONS” on page C-4 for details. These error messages make fault finding easier. Also the list of the last 50 error occurrences is of great help, refer to section “Error history display” on page B-12 how to display the error list.

3 FLAT BATTERY

The equipment has two different types of parameter memories. The most critical parameters that are seldom changed are stored into an EEPROM-type memory that is non volatile but the amount of changes made is restricted to about 10’000 times per single data.

The other parameters that are not fatal if lost and which are altered more often are stored into a battery backup RAM-type memory on the keyboard processor board. This information is lost and substituted with minimum or less harmful ones if the battery goes flat.

When the equipment is powered on the battery is charged. A completely flat battery will be fully charged within about two hours. If the equipment is never switched on or just shortly after long intervals as may be the case when stock keeping it, the battery will last at least two months.

When the equipment is turned on with a flat battery the clock display and mm display are blinking all zeroes. In the following is explained, which information is lost and with which values it is substituted.

LOST INFORMATION	SUBSTITUTED INFORMATION
Calendar clock	All zeroes
Layer position	00
Exposure counters	All zeroes
kV value last used	60 kV
mA value last used	04 mA
Up/down motor on one end limit	Assumed to be not on an end position if not on sensor
Automatic return mode	Automatic return off
kV, mA pair select mode (AUTO)	Individual settings
Temple rests open/closed	Assumed to be open if not on sensor
Panoramic/Cephalostatic version	Panoramic

After detecting this kind of a situation the substituted information must be corrected by resetting the above listed parameters to actual ones.

The correct place of the layer positioning motor must be learned into the system by driving the motor in service mode twice past its reference sensor till the mm display ceases blinking. Take care not to drive the motor into the mechanical ends that may cause damage.

4 DISTURBANCES IN ROTATION

4.1 Rotation part does not move at all

SYMPTOM	POSSIBLE REASON	CORRECTIVE ACTION
Motor gets no guidance	Keyboard out of order	Replace the keyboard assembly
	Generator processor PCB out of order	Replace the PCB
	Rotation motor out of order or connector loose	Check the connections and/or replace the gear/motor assembly
The sound of the motor is audible	Transportation pins not removed	Remove the pins
	If the rotation part can be moved with hands, motor or generator processor PCB faulty or one motor cable loose	Check the connections and try with new generator processor PCB

4.2 Stop in the middle of the rotation

SYMPTOM	POSSIBLE REASON	CORRECTIVE ACTION
The Motor stops. If error code appears, see error code explanations.	No error code: Motor or Generator processor PCB defective or one cable loose.	Check the connections and/or replace the Generator processor PCB or replace the motor.
Driving wheel stops (motor stalls). If error code appears, see error code explanations.	Adjustment of guidance wheel erroneous.	Adjust the guidance wheel.
	The equipment is installed atilt.	Align the unit properly.
	Gear assembly damaged.	Replace the gear assembly.
	One of the step motor connections defective.	Check the connections.
	Cable guide stucks.	

SYMPTOM	POSSIBLE REASON	CORRECTIVE ACTION
Driving wheel glides (the motor rotates but the unit does not rotate). If error code appears, see error code explanations.	The equipment is installed atilt.	Align the unit properly.
	Adjustment of guidance wheel erroneous.	Adjust the guidance wheel.
	Driving surface detached.	
	Loading spring of driving wheel erroneously installed.	
	Grease in groove or driving wheel.	
	Gear assembly or clutch between motor and gear damaged.	
	Cable guide stucks.	

4.3 Rotation cycle gets stuck

SYMPTOM	POSSIBLE REASON	CORRECTIVE ACTION
Rotation cycle gets stuck	The equipment is installed atilt.	
	Adjustment of the guidance wheel erroneous.	
	Adjustment of the clearance of the guidance wheel erroneous.	
	Grease in groove or driving wheel.	
	Cable gets stuck.	
	Bad contact of motor cables	

4.4 Trembles during rotating cycle

SYMPTOM	POSSIBLE REASON	CORRECTIVE ACTION
According to speed of the rotation, step motors may produce normal trembling. Visible trembling during rotation is abnormal. It is caused either by rotation movement or cassette movement.	Wheel of driving surface dirty.	
	Damaged spiral gear.	
	Adjustment of the guidance wheel erroneous.	
	Adjustment of the guidance profile erroneous.	
	Cable guide gets stuck.	

4.5 Abnormal noise during rotation

SYMPTOM	POSSIBLE REASON	CORRECTIVE ACTION
Trembling from step motor generates resonance noise which is characteristic to the mechanism. Cables from the upper part of the Z-carriage may also generate noise. The noise besides these is abnormal.	Attachment of the driving surface to the groove.	
	Function of the cable guide.	

5 DISTURBANCES IN CASSETTE MOVEMENT

5.1 Cassette carriage does not move

SYMPTOM	POSSIBLE REASON	CORRECTIVE ACTION
Cassette motor is not running	Keyboard out of order	
	PCB defective	
	Motor defective or connector loose	

5.2 Cassette carriage stops suddenly

SYMPTOM	POSSIBLE REASON	CORRECTIVE ACTION
The motor stops running. If error code appears, see error code explanations.	Motor or PCB defective or motor cable loose.	
Motor stops/stalls	Gear assembly damaged.	
	One of the connectors loose.	
Motor/drawing wheel glides	Linear bearing gets stuck.	
	Cassette carriage gets stuck to secondary slot or another part of the mechanism.	
	Grease on driving wheel or driving surface.	

5.3 Trembles during movement

SYMPTOM	POSSIBLE REASON	CORRECTIVE ACTION
Trembles during movement	Dirt in linear bearings or driving surface.	
	Spiral gear damaged.	

5.4 Abnormal noise from the mechanism

SYMPTOM	POSSIBLE REASON	CORRECTIVE ACTION
Abnormal noise from the mechanism	Cassette carriage touches secondary slot or other constructions.	
	Inner secondary slot touches the outer secondary slot in connection with the step motor resonance.	
	Cassette glide/adhesive strips resonate.	

6 TROUBLES IN ADJUSTMENT OF FOCAL TROUGH MOVEMENT

6.1 Forwards/backwards movement does not function

SYMPTOM	POSSIBLE REASON	CORRECTIVE ACTION
Motor is not running	Keyboard out of order.	
	PCB out of order or connector loose.	
	Motor out of order or connector loose.	
Motor stalls	Drawing screw or nut damaged.	
	Obstruction in the mechanism.	
Motor is running but mechanism is immobile.	Cogged belt broken or loose.	
	Cogged belt wheel glides from the axle attachment.	
	Thread of drawing nut damaged.	

6.2 Movement area abnormal

SYMPTOM	POSSIBLE REASON	CORRECTIVE ACTION
Movement area abnormal	Position information has disappeared.	
	Reference hall sensor defective.	
	Reference magnet incorrectly installed.	

6.3 Erroneous position indication

The position indication is correct if the display shows 00 when the light meets the bite piece. Erroneous position indication may depend on the fact that the display has not been adjusted to zero after installing the reference Hall sensor or keyboard processor PCB or that the accumulator is empty.

7 DISTURBANCES IN TEMPLE SUPPORT MECHANISM

7.1 Temple supports do not move

SYMPTOM	POSSIBLE REASON	CORRECTIVE ACTION
Motor does not start	Keyboard out of order.	
	Motor out of order or connector loose.	
	PCB out of order or connector loose.	
Motor starts but supports immobile	Pin loose.	
	Drawing nut glides on motor axle.	
	Thread of drawing nut damaged.	

7.2 Temple supports function erroneously

SYMPTOM	POSSIBLE REASON	CORRECTIVE ACTION
Temple supports do not close properly	Attachment of quadrants to temple support cranks has yielded.	
	Adjustment of magnet and Hall sensor erroneous.	
Temple supports do not move symmetrically	Attachment of quadrants to temple support cranks has yielded.	
Temple supports have too much clearance.	Adjustment of clearance incorrectly done.	

8 DISTURBANCES IN Z-CARRIAGE UP/DOWN MOVEMENT

8.1 Z-carriage does not move

SYMPTOM	POSSIBLE REASON	CORRECTIVE ACTION
Motor does not function	Keyboard out of order.	
	PCB out of order or connector loose.	
	Cable out of order or connector loose.	
	Motor out of order or connector loose.	
Motor functions/stalls	Locking between secondary axle and bending wheels glides.	
	Counterweight or Z-carriage has stuck.	
	Transportation pins or locking screw of counterweight not removed.	
	Bearings of drawing bending wheels or bending wheels of Z-carriage damaged.	
	Cable dropped from bending wheels.	
	Drawing cable broken.	

8.2 Z-carriage moves only to one direction

SYMPTOM	POSSIBLE REASON	CORRECTIVE ACTION
Motor functions only to one direction	Keyboard out of order.	
	Reversing relay out of order.	
Motor rotates/stalls to both directions, but moves only to one direction	Wrong counterweight (ceph. version).	
	Creeping speed adjusted incorrectly.	

8.3 Z-carriage gets stuck

SYMPTOM	POSSIBLE REASON	CORRECTIVE ACTION
Z-carriage gets stuck	One of the steel cables broken.	
	Creeping speed adjusted incorrectly.	
	Cables or cable wheel damaged.	

8.4 Mechanism does not observe limits

SYMPTOM	POSSIBLE REASON	CORRECTIVE ACTION
Mechanism does not observe either of the limits	Hall sensor does not function.	
Mechanism does not observe one of the limits	One of the impulse magnets too far from the Hall sensor, installed to a wrong direction or completely missing.	

9 PROBLEMS IN RADIOGRAPHS

9.1 Disturbances in radiographs

Most often troubles are caused by other reasons, not by the equipment. Check that the fault on the radiograph does not result from defective patient positioning or fault in the film.

9.2 No radiograph

SYMPTOM	POSSIBLE REASON	CORRECTIVE ACTION
Exposure light and signal do not function. If error code appears, see error code explanations.	The equipment is in test mode.	

9.3 Exposure on - no picture

SYMPTOM	POSSIBLE REASON	CORRECTIVE ACTION
Film unexposed	Primary slot does not let in radiation to film.	
	In the developer the fixative and developer changed places.	
Film completely black	Light leakages to dark room.	
	Film otherwise exposed.	

9.4 Very light radiographs

SYMPTOM	POSSIBLE REASON	CORRECTIVE ACTION
Very light radiographs	Film cassette upside down in its holder.	
	Primary slot positioned so that the radiation beam goes trough the secondary slot.	
	Secondary slot moved.	
	Wrong film/intensifying film combination.	

9.5 Stripes on the film

SYMPTOM	POSSIBLE REASON	CORRECTIVE ACTION
Horizontal stripes	From developing machine.	
	Primary slot tilted so that part of the film meets secondary slot.	
	Patient has jewels, large fillings in teeth, etc.	
Vertical stripes	From rolls of developing machine.	
	Cassette mechanism gets tuck.	
	Generator working improperly.	

9.6 Exposed area incorrectly limited

Film has certain tolerance in the holder which causes considerable variations.

SYMPTOM	POSSIBLE REASON	CORRECTIVE ACTION
Radiograph incorrectly limited in vertical direction.	Child limit chosen by accident.	
	Primary slot limits adjusted incorrectly.	

Chapter

H

PARTS REPLACEMENT & REPAIR

1 COVERS

CAUTION ***The X-ray unit contains hazardous voltages. Always disconnect the unit from mains by removing the plug from the wall outlet, and wait for 2 minutes before starting to remove covers.***

1.1 Tubehead covers

Remove the front cover of the tubehead by unscrewing the 4 fixing screws at the back side.

Remove the back cover of the tubehead by unscrewing the 2 fixing screws that can be seen after removing the front cover.

1.2 Secondary slot cover

Remove the secondary slot cover by unscrewing the 4 screws at the cassette head.

1.3 Cassette carriage back cover

Remove the secondary slot cover.

Remove the back cover of the cassette head by unscrewing the two fixing screws behind the cover of the secondary slot.

1.4 Rotating arm cover

Remove the front cover of the tubehead.

Remove the cover of the secondary slot.

Push the cover to the shown direction all the way to the groove. Remove one end of the cover pulling to the shown direction. To remove the other end, keep it in this angle as it falls only to the collimator.

1.5 Lower shelf cover

a) Drive the head support to open position.
b) Drive the positioning mechanism to outmost position).
c) Remove the chin rest adaptor.
d) Remove the fixing screws under the lower shelf.
e) Remove the cover lifting up and turning counter clockwise.

1.6 Z-carriage cover

a) Remove the cover of the lower shelf.
b) Remove the connectors
c) Remove the lower shelf.
d) Remove the cover.

1.7 Upper shelf cover

a) Remove the rotating part.
b) Remove the connectors of the sagittal light.
c) Remove the fixing screws of the cover.
d) Remove the cover.

2 MOTORS

2.1 Z-motor

a) Lock the rotating unit and the Z-carriage with transportation pins
b) Place a support on the floor where you can tilt the machine.
c) Detach the unit from the wall and overturn it carefully on the support.
d) Pull the top trim cover out.
e) Remove the steel cables and connectors.
f) Slack the stop screws on the drawing side of the motor axle.
g) Slack the stop screw on the sliding side and pull the steel cable off.
h) Cut the panduit and pull the motor away.
i) Install a new motor.

2.2 Rotating motor & gear

a) Remove the cover of rotating part.
b) Remove the Generator processor PCB from its holders.
c) Remove the loading spring.
d) Remove the connector.
e) Remove the phillips screw from the end of the axle.
f) Remove the motor/gear package.
g) Remove the spring nipple and plastic bushing from the gear.

Changing motor to gear

a) Slack the stop screw of the rubber clutch
b) Remove the nuts going trough the rubber plate (4 pcs)
c) Remove the motor.
d) Detach the rubber clutch from the motor axle.
e)

2.3 Cassette motor/gear

a) Remove the outer secondary slot and back cover of the cassette head.
b) Remove the loading spring of the cassette motor.
c) Remove the connector.
d) Remove the attaching screw of the cassette motors attaching shaft.
e) Remove the motor.
f) Remove the spring nipple and attaching axle with bearings.

2.4 Positioning motors

a) Remove the cover of lower shelf.
b) Remove all the connectors.
c) Remove the handles.
d) Remove the attaching bolts of the positioning mechanism.
e) Remove the attaching mechanism.

Patient positioning mechanism motor

a) Remove the panduit beside the patient positioning mechanism motor
b) Remove the patient positioning mechanism motor with rubber plate.
c) Remove the rubber plate and cogged wheel from the motor.

Temple rest motor

a) Remove all the panduits
b) Remove the PCB.
c) Unscrew the motor axle out of the nut.
d) Unscrew two screws from the plate
e) Remove the motor.
f) Remove the shaft.

3 CIRCUIRT BOARDS

3.1 Power supply PCB

a) Remove the cover of the rotating part. Remove the EMC-cover of the PCB.
b) Detach all the connectors.
c) Unscrew the fixing screws.
d) Remove the board.

3.2 Keyboard processor PCB

Memory on the board

There are memory chips on the board and if you change the board, the information what is in the memory will be lost. Some of the information can be reprogrammed.

Information what will be lost:

- Exposure factors memory
- Exposure count memory
- Error history memory

If possible, at least the exposure count memory should be write to on a paper for the future use before replacing the board.

Information what must be reprogrammed:

- Time and date
- Exposure warning signal tone
- Up-down motor speed settings

Changing the board

a) Remove the lower shelf cover. If the unit has old version of covers the holder of the chin rest has to be removed before removing the cover.
b) Remove the old board and replace it with a new one.

3.3 Keyboard PCB

a) Unscrew four fixing screws in the bottom lid of the keyboard.
b) Lift the upper lid and remove the connector.
c) Replace with new lid including PCB and keyboard.

3.4 Layer hold limits

a) Open the cover of the lover shelf
b) Unscrew two fixing screws
c) Remove the connector
d) After installing new PCB check the limits and adjust if necessary

4 CHANGING THE TUBEHEAD

a) Remove the front cover of the tubehead by unscrewing the 4 fixing screws at the back side.
b) Remove the front cover of the tubehead.
c) Remove the back cover of the tubehead by unscrewing the 2 fixing screws that can be seen after removing the front cover
d) Remove the secondary slot cover by unscrewing the 4 screws at the cassette head.
e) Tilt the tubehead end of the cover downwards and the other end will be released. Be careful not to drop the cover on the collimator.
Remove the primary slot mechanism from the old tubehead.
f) Remove the damaged tubehead out from the X-ray unit. Then position the new tubehead to the X-ray unit.
g) Reconnect all the cables, except fan cables (you don't need to replace the covers yet).
h) Initialize the tubehead as described in section "Tube type programming" on page B-14.
i) Check and adjust the radiation field. This procedure is described in section "PANORAMIC X-RAY BEAM ADJUSTMENT" on page D-4.

NOTE ***If the first slot is adjusted mechanically by loosening the screws and turning the tube-head so that the beam is aligned in the middle, normally the other slots need no or only a small adjustment.***

Make the ball phantom test picture. Adjust if necessary (see section "PATIENT POSITIONING MECHANISM" on page D-11).

Install the covers.

Chapter

I

FUNCTIONAL DESCRIPTION

1 MECHANICAL CONSTRUCTION AND OPERATION

The equipment is attached to the column with steel cables and bearing brackets. The motor placed in the upper end of the column moves the equipment up and down along the column. Inside the column there is a counterweight which compensates the weight of the equipment. The counterweight and the equipment are connected to each other with steel cables through pulleys so that the movement of the counterweight is double related to the movement of the equipment. Therefore the weight of the counterweight is only one half of the weight of the equipment.

The equipment itself consists of the Z-carriage and the rotating unit. The upper horizontal part of the Z-carriage (upper support arm assembly) supports the rotating unit and contains mechanics determining the kinematics of the rotation movement. Low power supply with mains filter is also placed in the upper support arm assembly.

The vertical assembly of the Z-carriage contains the guidance wheels and pulleys of supporting cables. Mains switch, fuses and Hall detectors for up/down movement are also located in this assembly.

The lower horizontal assembly (lower shelf assembly) of the Z-carriage contains patient support mechanism, keyboard and keyboard processor.

The rotating unit consists of three main assemblies: rotating part, tubehead assembly and film cassette mechanism. The rotating part includes the rotating motor with gears, generator processor and X-ray generator.

The remote control switch is connected to the equipment with a cable.

1.1 Rotational mechanism

The rotating mechanism is designed so that the X-ray beam passes the patient's teeth and temporo-mandibular joints in an optimal way throughout the excursion.

The geometry of the driving groove of the block (Fig. 3, 4) is as follows. The groove has the shape of a curve of a circle symmetrically to both directions from the center the driving groove to ± 25° turning angle (point A being the center of the circle). From ± 25° turning angle to ± 85° turning angle, the radius of the shape of the groove varies and reminds of an evolvent curve. Thereafter the groove follows the tangent of the curve.

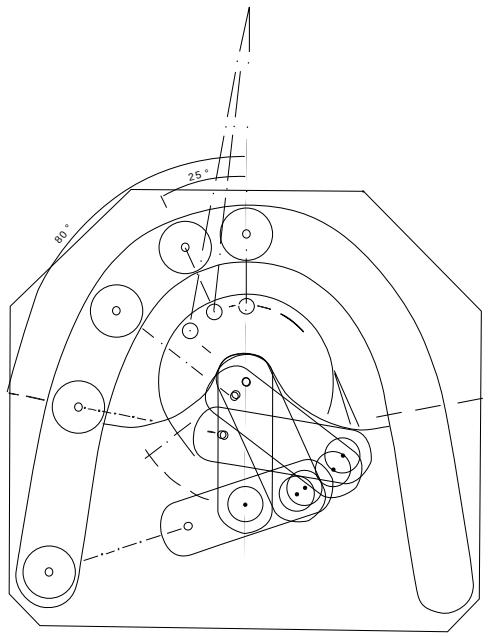


Figure 1

The rotating unit (Fig. 2, 7) is attached with bearings to the upper horizontal part by means of a cam (Fig. 2, 1). For both axles of the cam there are two angular contact ball bearings (Fig. 2, 2) which are preloaded without clearance by means of nuts (Fig. 2, 3).

The cam has two main tasks: Firstly, it transfers the weight of the rotating unit to the main block (Fig. 2, 4) through bearings. Secondly, it determines the path of the bearing point B during the rotating cycle. Apart from point B, the path of the rotating movement is also determined by drive / guide point C. On the main block (Fig. 2, 4) there is a U-groove and a guide wheel (Fig. 2, 5) rolls along the inner edge of the groove. The bearing point of the wheel is fixed in relation to the rotating unit (Fig. 2, 7). There is also a driving wheel (Fig. 2, 6) which is concentrically located in relation to the bearing point. The fixing point of the driving wheel (transmission) is located so that the driving wheel can move unhindered crosswise in relation to the groove.

The mechanism has a loading spring (Fig. 2, 8) which forces the driving wheel against the outer edge with great pressure.

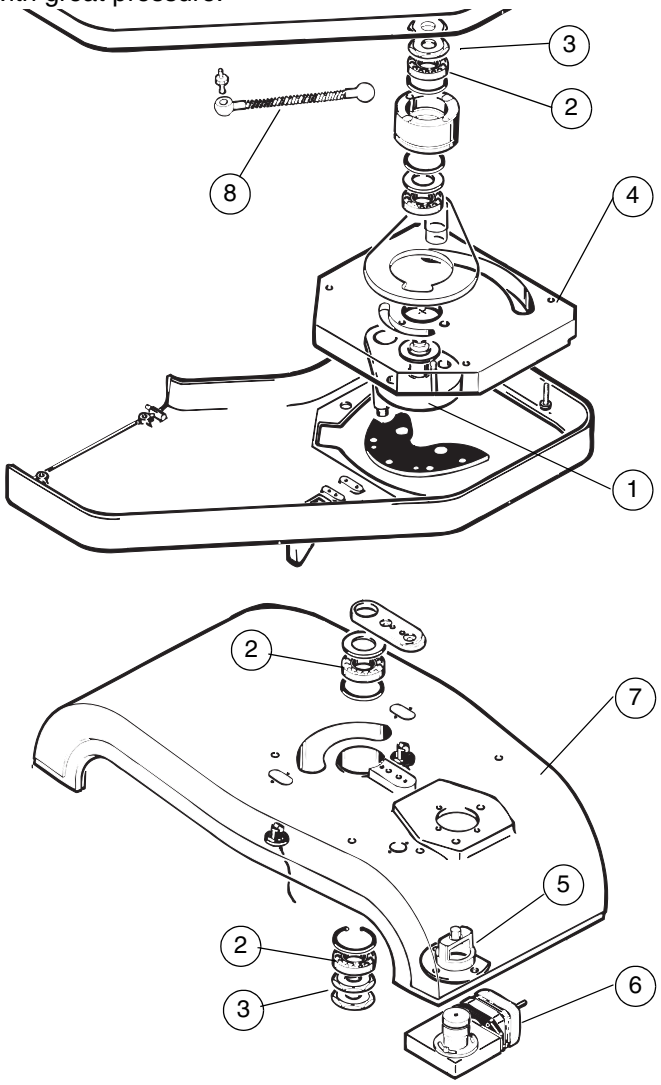


Figure 2

1.2 Cassette mechanism, Planmeca Proline EC Panoramic X-ray unit

The primary function of the cassette mechanism is to enable controlled linear movement of the film cassette across the radiation beam synchronically in relation to the rotation movement. Besides, the cassette mechanism has certain secondary functions such as secondary slot which prevents the radiation scattering from patient from exposing the film.

The assembly (Fig. 3, 1) is the frame of the cassette mechanism. The cassette holder (Fig. 3, 2) is attached with linear bearings to the secondary slot (Fig. 3, 3) through axle and support wheel. The cassette carriage is driven by an friction wheel (Fig. 3, 4) which is in contact with the top surface of the slot.

The lateral force caused by the cassette holder, the weight of the film cassette and the loading spring of the driving wheel is compensated by a support wheel in the slot. The cassette holder rolls against the support wheel. Commanded by the microprocessor a stepper motor (Fig. 3, 5) rotates the friction wheel analogically with the rotation mechanism through worm gear transmission.

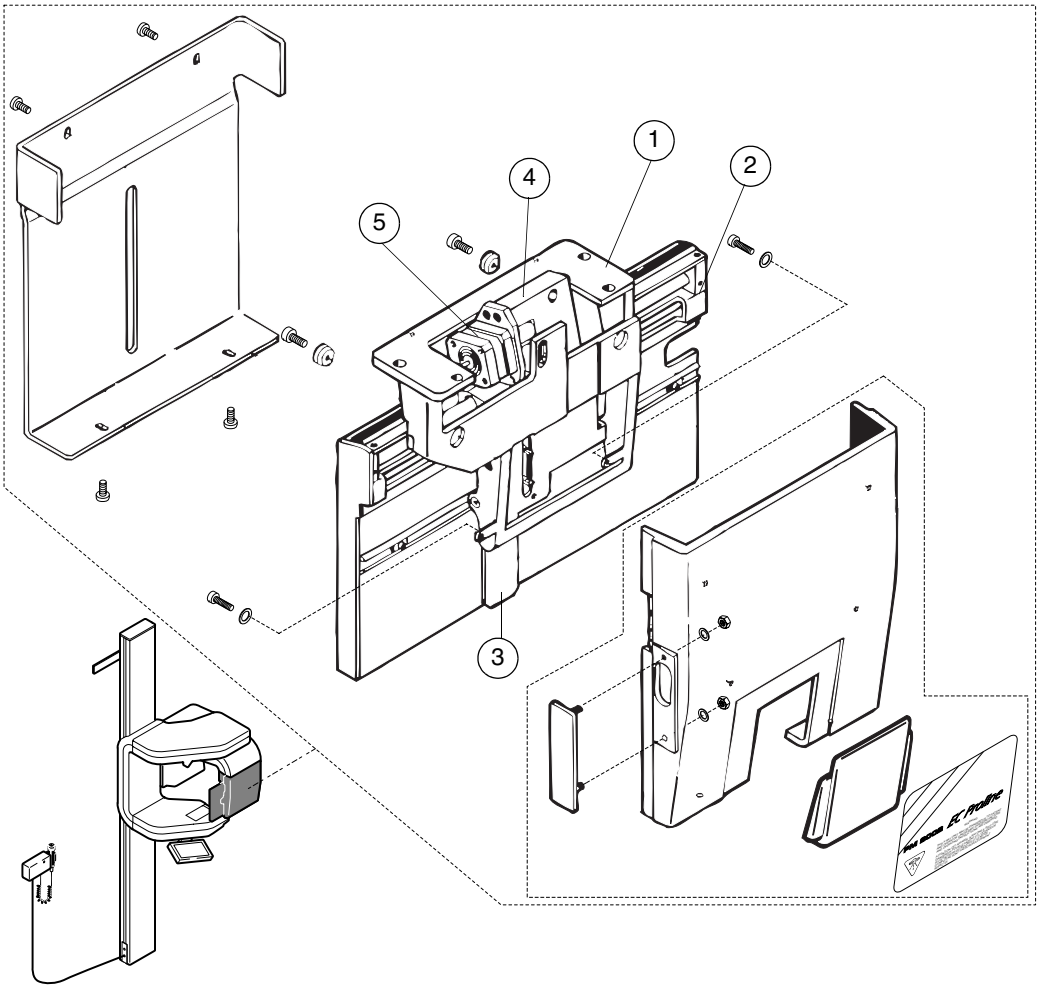


Figure 3

1.3 Cassette mechanism, Planmeca Proline EC Pan/Ceph X-ray unit

The primary function of the cassette mechanism is to enable controlled linear movement of the film cassette across the radiation beam synchronically in relation to the rotation movement. Besides, the cassette mechanism has certain secondary functions such as secondary slot which prevents the radiation scattering from patient from exposing the film and Frankfort positioning light reflector which produces a horizontal light beam to facilitate patient positioning.

The assembly (Fig. 4, 1) is the frame of the cassette mechanism. A carriage (Fig. 4, 2) is attached with bearings and axles (Fig. 4, 3 and 4) to the frame. The panoramic carriage is locked to the frame.

The cassette holder (Fig. 4, 5) is attached with linear bearings to the carriage through axle (Fig. 4, 6) and support wheel (Fig. 4, 7). The cassette carriage is driven by an friction wheel (Fig. 4, 8) which is in contact with the top surface of the carriage.

The lateral force caused by the cassette holder, the weight of the film cassette and the loading spring of the driving wheel is compensated by a support wheel in the carriage (Fig. 4, 2). The cassette holder rolls against the support wheel. The secondary slot (Fig. 4, 9) is attached to the carriage (Fig. 4, 2). Commanded by the microprocessor a stepper motor (Fig. 4, 10) rotates the friction wheel analogically with the rotation mechanism through worm gear transmission.

The cassette mechanism is shown below.

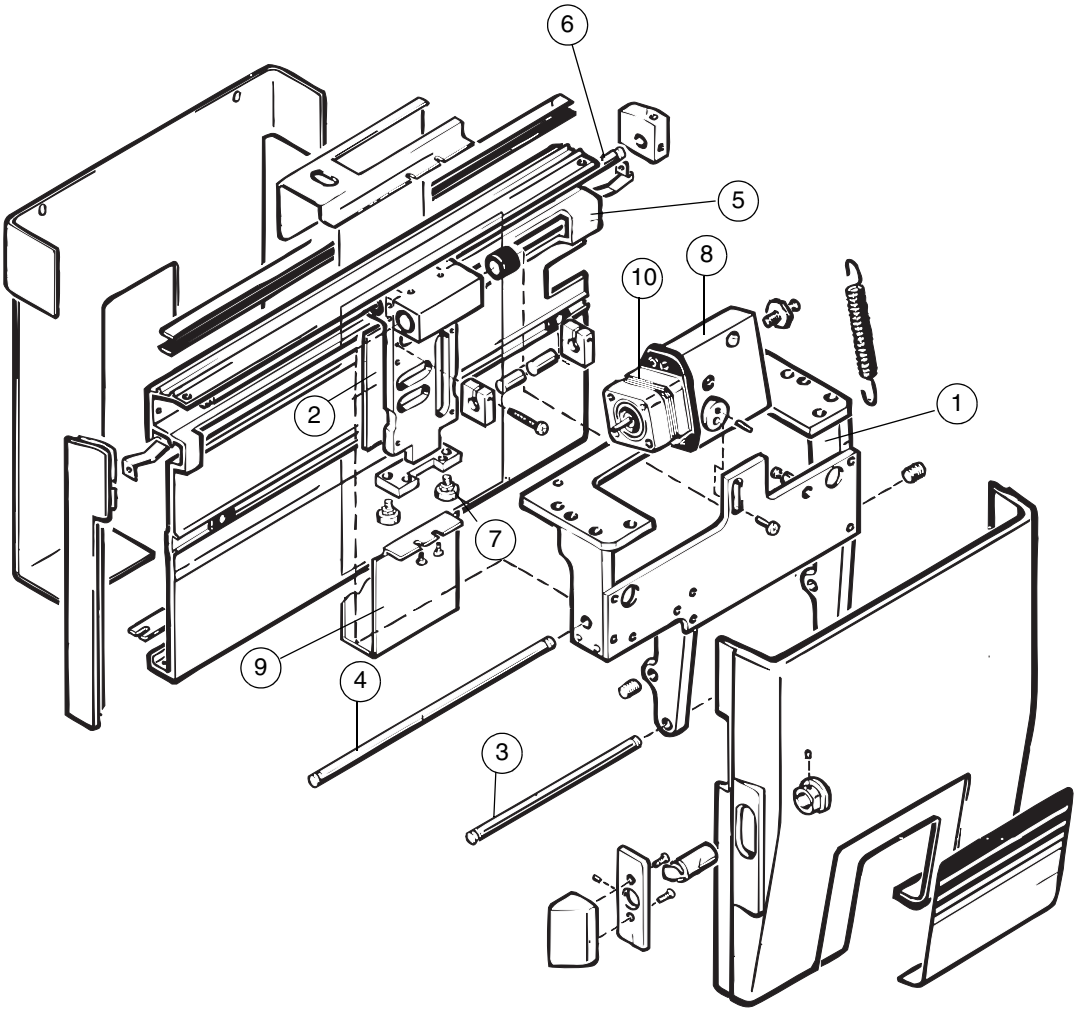


Figure 4

1.4 Tubehead

Tubehead tank itself has got no serviceable parts and must always be returned to the factory for repair.

For changing tubehead see section “CHANGING THE TUBEHEAD” on page H-5.

1.5 Collimator/primary slot mechanism, Planmeca Proline EC Panoramic X-ray unit

The collimator tube (Fig. 5, 1) is attached with screws to the radiation window frame. Under a nut there is an inner limiting slot sheet which consists of an aluminium filter plate and lead plates with holes. The lead plate reduces the radiation beam for the actual primary slot. The aluminium plate filters the harmful soft radiation.

In the outer part of the collimator tube there are a slot frame (Fig. 5, 2) and a outer limiting slot (Fig. 5, 3) which reduce secondary radiation scattering from the inner parts of the collimator tube.

The primary slot (Fig. 5, 4) is attached to a outer limiting slot (Fig. 5, 5) which is attached to the frame.

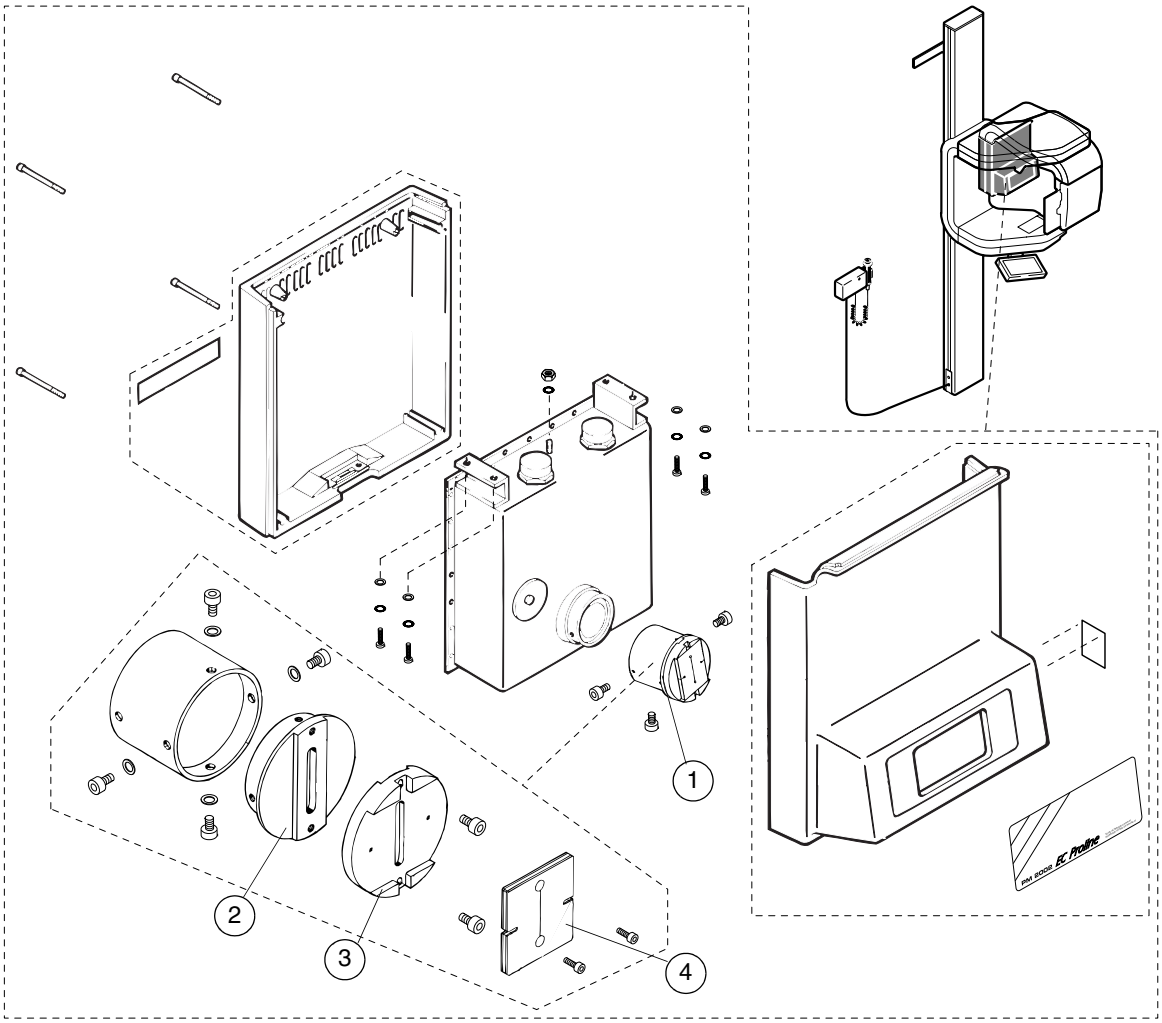


Figure 5

1.6 Collimator/primary slot mechanism, Planmeca Proline EC Pan/Ceph X-ray unit

The collimator tube (Fig. 6, 1) is attached with screws to the radiation window frame. Under a nut there is an inner primary slot sheet which consists of an aluminium filter plate and lead plates with holes. The lead plate reduces the radiation beam for the actual primary slot. The aluminium plate filters the harmful soft radiation. In the outer part of the collimator tube there is a second inner primary slot (Fig. 6, 2) which reduces secondary radiation scattering from the inner parts of the collimator tube.

Part (Fig. 6, 3) is the frame of the primary slot mechanism. The primary slot (Fig. 6, 4) is attached to a slot carriage (Fig. 6, 5) which is attached with bearings to the frame. The stepper motor draws the slot carriage through a screw (Fig. 6, 6) and a nut (Fig. 6, 7). The drive nut has a plate which together with an optic sensor (Fig. 6, 2) composes the place reference for the primary slot.

The microprocessor controls the stepper motor. Motor commandment is described in section “Motors” on page I-14.

The function of the PCB 105-10-08 is described in section “Circuit boards” on page I-12.

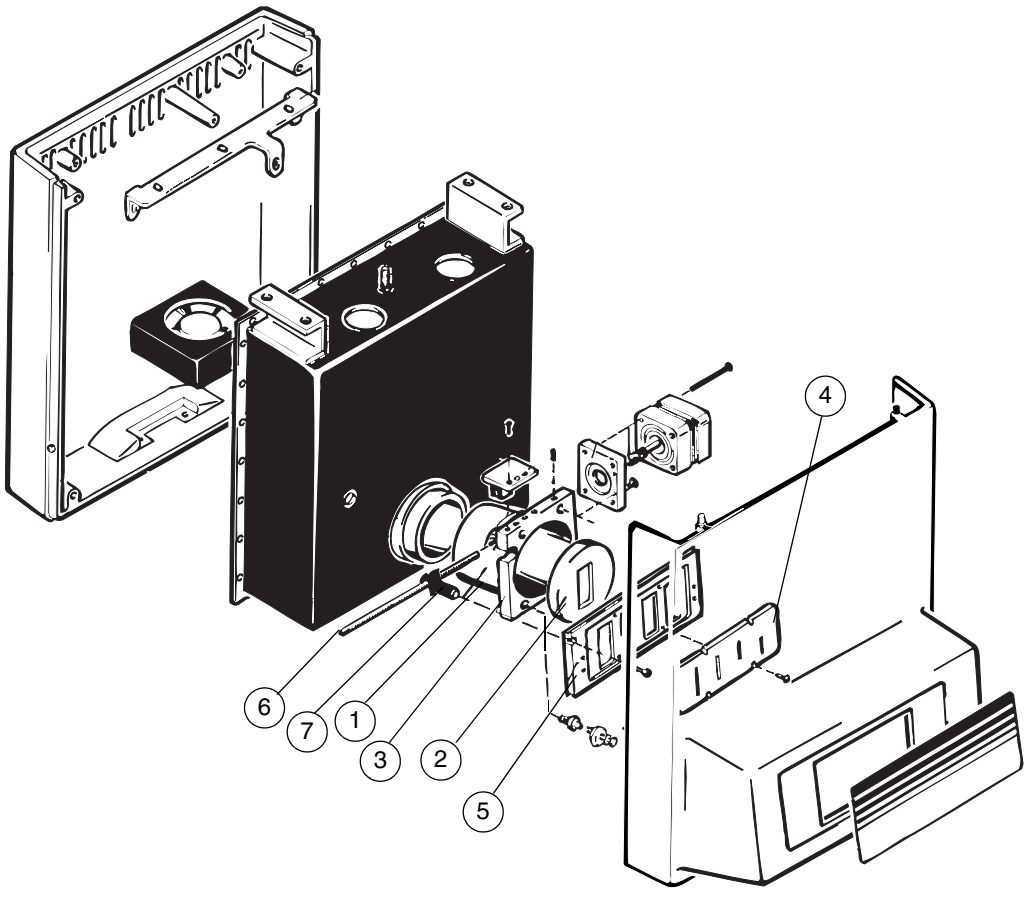


Figure 6

1.7 Positioning mechanism

The fixed frame of the mechanism is the installation plate (Fig. 7, 1), to which the mobile frame is attached with linear bearings through axes (Fig. 7, 2). All parts entering into contact with the patient, i.e. patient handles, chin and/or bite support/s (Fig. 7, 3 and 4) and temple supports (Fig. 7, 5) are fixed to the frame (Fig. 7, 6) so that they move together with the frame.

Linear movement is driven by a stepper motor. Primary drive is realized by cogged belt and secondary drive by a screw. The screw is connected to a drawing nut (Fig. 7, 7) attached to the frame (Fig. 7, 6). The adjustment of the linear movement position reference is realized with a Hall-detector. The detector is located on a PCB card (Fig. 7, 8) and the magnet is located on a bar attached to the installation plate (Fig. 7, 1). The microprocessor controls the linear movement.

The cranks (Fig. 7, 8) of the temple supports are attached with bearings to the frame (Fig. 7, 6) so that they can rotate freely. The movement of the cranks is synchronized to each other with gearwheel quadrants. Clearance of the quadrants is adjusted with an adjustment piece (Fig. 7, 9). The force closing the temple supports is produced with a spring. The force is transferred to the quadrant through lugs (Fig. 7, 10). The force opening the temple supports is produced with the step motor to a lever (Fig. 7, 11) through a drive screw (Fig. 7, 12) and a drive nut. The lever transfers the force over to the temple supports through an adjustment screw. The limit switch is the Hall detector on the PCB card (Fig. 7, 7). The detector gets an impulse from a magnet located on the lever (Fig. 7, 11).

The microprocessor commands the movement of the motor. The function of the command system is described in section “Circuit boards” on page I-12.

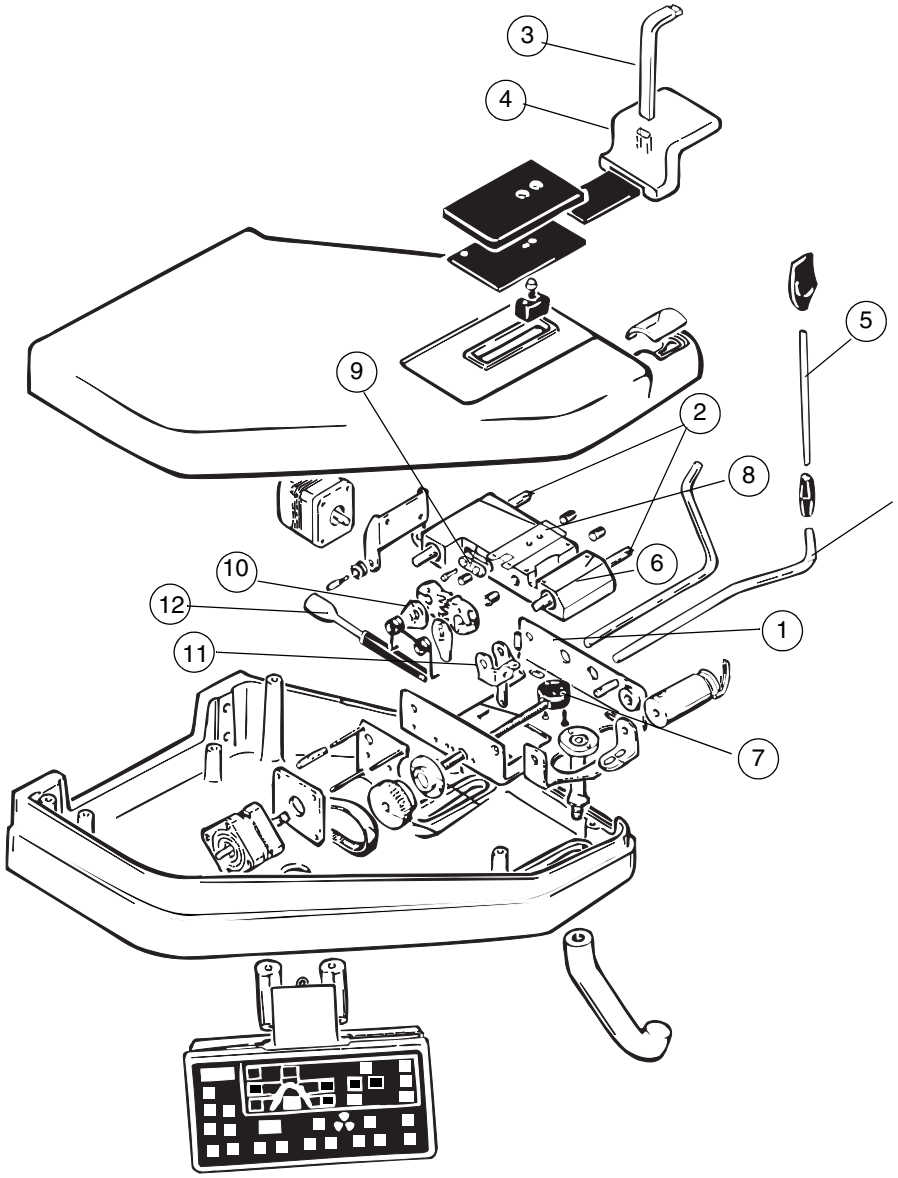


Figure 7

1.8 Height adjustment mechanism

The vertical part of the Z-carriage is supported to the groove of the column (Fig. 8, 1) with 8 wheels. Sideways it is supported with wheels (Fig. 8, 15). There are four more wheels (Fig. 8, 11) in 90 ° angle. In vertical direction the carriage is supported by wires through pulleys (Fig. 8, 12). In the upper part of the column there is a top trim cover (Fig. 8, 28) to the lugs (Fig. 8, 22) of which pulleys (Fig. 8, 27) are attached with bearings.

A direct-current motor (Fig. 8, 44) draws the drive pulleys through a worm gear transmission (Fig. 8, 10). In practice only one of the two pulleys is closely connected to the secondary axle of the transmission whereas the other is freely assembled with bearings. This means that one of the two cables (Fig. 8, 4) moves the Z-carriage while the other cable only partially carries the weight of the Z-carriage. One cable would be strong enough to carry the Z-carriage in case the other should break.

The counterweight (Fig. 8, 2) compensates the weight of the Z-carriage. Cables are connected to the counterweight through a compensating lever (Fig. 8, 7). The compensating lever compensates small differences in length of the cables and ensures that both cables can carry the weight of the Z-carriage. The counterweight is attached with four wheels (Fig. 8, 5) to the tracks of the column.

A Hall detector in the vertical part of the Z-carriage is the limit switch for the Z-carriage movement. The detector gets impulses from magnets (Fig. 8, 32) of the column. Commandment of height adjustment motor is described in section “Motors” on page I-14.

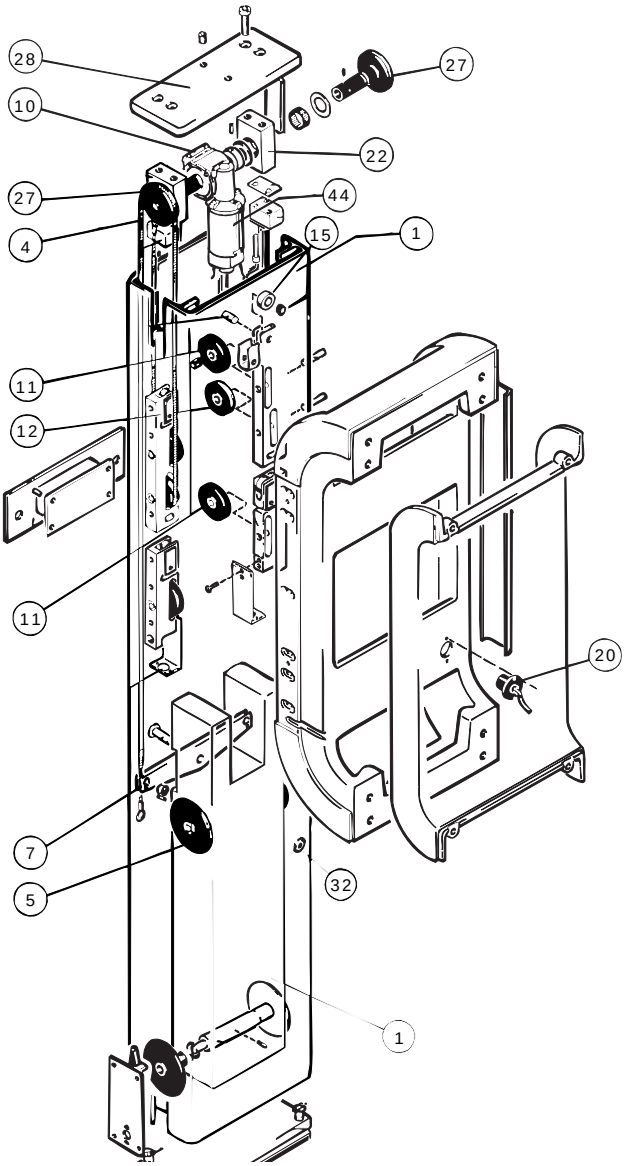


Figure 8

2 ELECTRICAL PARTS AND THEIR FUNCTIONS

The electronics of the equipment consists of the tubehead, ten printed circuit boards, six motors, three lights and the cables connecting these parts to each other. These parts are located in the equipment itself and in following it is explained where they are and what are their functions.

2.1 Tubehead

The tubehead is located at the other end of the rotating part.The function of it is to convert the high frequency power, supplied by the generator circuit board, into X-rays. The high voltage transformer and cascade circuit board in the tubehead rectify and multiply this power to a maximum of 80 kV DC to the X-ray tube which in turn generates the radiation. The metal case gives a radiation-proof hermetically closed housing to the X-ray tube. Because of the high voltage needed by the tube, the tubehead is filled with transformer oil to give successive insulation. The tubehead inner parts cannot be serviced in the field, because the opening of it needs extra clean environment and after opening the oil must be dried in vacuum, but the tubehead temperature sensor is located in the center of the connector P1 and can be replaced without removing the tubehead.

When the tubehead is replaced it must be correctly aligned and the tube type must be given to the system, after which the system must be allowed to learn the filament characteristics.

2.2 Circuit boards

There are nine circuit boards in the equipment. In the following their locations and functions are described as well as the actions that should be taken when replacing one. Also the on board fuse ratings are marked.

CAUTION ***When connecting or disconnecting cables and/or circuit boards the power must be switched off and a 10 second time must be allowed to the capacitors to discharge. Otherwise damage can be caused to the circuit boards.***

CAUTION ***To avoid damage caused by static discharge always discharge yourself by touching the earthed metal frame before touching the electrical parts.***

Cascade circuit board (105-10-01)

This circuit board is in the tubehead multiplying the high voltage to the X-ray tube. It cannot be seen or serviced in the field, because the opening of the tubehead needs extra clean environment, vacuum pumps etc.

Tube power supply (or simply PSU) (105-10-26)

This circuit board is in the horizontal section of the rotating part, nearest to the tubehead. It's function is to generate the X-ray tube filament power and the high frequency AC power to the tubehead high voltage transformer.

CAUTION ***Always turn off the mains switch before handling the board because the mains voltage comes onto this board. Always allow at least two minutes of time to the capacitors to discharge after the power has been on.***

Generator processor (105-10-28)

This circuit board is located beside the generator in the horizontal section of the rotating part. This is the circuit board that is nearer to the cassette end of the rotating part. Its function is to control the generator and to operate three stepper motors, the rotating part rotation motor, the film cassette transportation motor and the tubehead primary aperture motor. It also operates the tubehead cooling fan and the cephalostatic solenoids when applicable.

When this circuit board is replaced, the new one must be adapted to the system. This circuit board contains information about the primary aperture positions as well as the X-ray tube type and filament characteristics. Therefore the primary apertures must be aligned and the tube type must be programmed, after which the system must be allowed to learn the filament parameters.

Cassette limits (105-10-04)

This circuit board is located in the cassette end of the rotating part. It's function is to detect the end limits of the cassette motor movements and pass the information to the generator processor through a 20-pole flat cable.

When replaced, the four Hall-detector magnet adjustments are to be checked.

Keyboard processor (105-10-27)

This circuit board is located in the lower fixed part. It is the master microprocessor that controls everything in the equipment. It operates three motors, the up/down motor, the layer adjust motor and the patient temple rest motor. It also controls the operation of the generator processor and gives the operation commands to it via one serial communications cable. It operates the two relays on the low voltage power supply that give power to the generator and to the lamps. The keyboard and display are also controlled by this processor.

When this circuit board is replaced, the new one must be adapted to the system. This circuit board contains information about the warning signal pitch, up/down motor speed settings, layer adjust motor location and zero point, operational parameters (kV, mA, sectors, layer forms etc.), the exposure counters and the time. Also the error history and previous technical factors memories go along with this circuit board. There are two things that MUST be done before use when this board is replaced:

In the service mode pass twice the layer motor reference sensor to find the place.

Tell the system whether it is a panoramic or a cephalostatic one.

Layer/hold limits (105-10-07)

This circuit board is located at the layer adjust mechanism in the lower fixed part. Its function is to detect the layer adjust motor and the temple rest motor limits and pass the information to the keyboard processor via a 6-pole cable.

When replaced the layer adjust and temple rest motor operations should be checked.

Display/keyboard (105-10-30)

This circuit board is located in the keyboard housing below the lower fixed part. It's function is rather obvious, to drive the displays according to the information it receives from the keyboard processor and to pass the information of the keyboard states to the keyboard processor via a 6-pole cable.

This circuit board can be replaced without any further actions.

2.3 Motors

There are six motors in the equipment that perform all the movements needed. In the following is explained where the motors are, what they do, where they get their driving power from and what is the system how they are operated.

Five of the motors are stepper motors the operating method of which is different from the DC-motor. They have two coils with two wires to each and the current is flowing through the coils in both directions in turn with a phase difference that causes the rotation. Now, if the stepper motor is wrongly connected or one or two wires are broken the motor might run not at all, run with low torque, run to wrong direction, change the rotation direction by itself or run at double or half speeds. To check this the coil resistances should be about 5 ohms each and one coil connected to connector pins 1 and 2 and the other to pins 3 and 4. If it runs to wrong direction just reverse one coil polarity. Reversing both causes nothing. Measuring the voltages needs an oscilloscope because the motors are driven by about 40 kHz switch mode current regulated power supplies. Best to have a reference motor with or to cross connect two motors to check the driver circuit operations. If cross connecting, remember that the limit sensors operate wrongly.

Up/down motor

The up/down motor is located on the top of the column. It's function can clearly be seen, it is moving the actual X-ray part in vertical direction along the column. It is a DC brush motor with a worm gear of 1:72 and it gets it's drive from the keyboard processor first downwards along the spiral cable (on the left side seen from the front) and then upwards along a cable located inside the column.

When this motor is activated, it is first driven one second slowly and then accelerated softly to full speed. When the button is released the motor stops immediately if it was still in the slow mode, but slows down softly if it was running faster. If the motor is driven to the end of it's traverse path (limit sensor) the system performs a quick stop by using the motor as a brake (short circuit). The motor speed is controlled with pulse width control at 200 Hz frequency, that can be heard as a humming sound.

The slow speed can be adjusted independently to both directions to fulfill all needs.

When the motor is driven to the limit sensor and stopped, it will not start to that direction but only to the other. When started to the other direction it will run slowly as long as it gets back to the sensor and over it. To avoid hazards the system will speed up the motor if it doesn't reach the sensor within 5 seconds when the button is kept pressed, that normally is long enough, and ignore the sensor pulse. Therefore it should be noted that if for some reason the up/down movement is driven over the limit sensor and cannot be driven back within this time (jammed) the button should not be operated more than 4 seconds at a time while helping the motor by hand. If this is not taken care of, the system detects the sensor as if it was the sensor of the other end and never comes to the normal operating range.

In this case enter the slow speed adjustment mode to the direction you want to go and press the button. This mode ignores the sensor and enables you to reach the normal range between sensors. While in the normal range exit the adjust mode and then drive the motor to the other end sensor to get it operative again.

Layer adjust motor

This motor is located at the layer adjust mechanism in the lower fixed part. It's function is to move the bite block, temple rests and handles (and the patient) horizontally in order to get the patient's teeth in the right position relative to the layer positioning light. It is a stepper motor and it gets it's drive from the keyboard processor.

When this motor is activated, it will first drive one second at a slower speed and then accelerate to the full speed.

When it reaches one end of it's movement range it will slow down and stop in the end. When the operating button is released the motor stops immediately.When the motor is moving, it's coordinates are updated in the mm-display. They are calculated from the motor steps and show the position relative to the sharp layer (00) that is programmed during the alignment procedure. The position of the sharp layer relative to the motor movement range varies and is not the same for all equipment. For this reason the movement is not always from -30 to 09 but can be somewhat different. Still the full range is always 39 mm.

The motor has one reference sensor on the LAYER/HOLD LIMITS circuit board. Every time when the sensor is passed to the positive direction the position information is checked and corrected if necessary. If the layer adjust mechanism or the keyboard processor is replaced it may happen that the motor is not driving in correct range and cannot be driven past the sensor to find the reference point.

To solve this the system in the service mode does not stop the motor at the point it considers to be the mechanical end but continues at slow speed to enable you to drive it past the sensor in positive direction (to be sure pass it first in negative direction). Care must be taken not to drive the motor to the mechanical stop that may damage the gears.

Temple rest motor

The temple rest motor is located beside the layer adjust motor. It's function is to keep the patient centered in the right position during the exposure and release the patient after the exposure. It is a stepper motor and it gets it's drive from the keyboard processor.

When the motor is activated the system checks with a sensor on the LAYER/HOLD LIMITS board whether the temple rests are open or closed. If the sensor is active (near the magnet) it is detected as a closed position and the motor is driven into open direction a certain length. If the sensor was passive the motor is driven into closed direction as long as it finds the sensor. Note that opening is performed at full speed but closing is done more gently not to startle the patient.

Rotation motor

This motor is located in the rotating part beside the generator processor board. It is rotating the rotating part during the exposure and return. The drive to this stepper motor is delivered by the generator processor.

÷This motor cannot be operated independently but is activated by the system whenever the rotation is needed. The operating range of the rotation is controlled by two sensors fixed to the rotating part frame.

The rotation start sensor defines the starting point (home position) of the rotating arm. When pressed READY the system will continuously seek for the sensor and rotate the arm to it if it was pushed aside. Note that if the arm was pushed over to wrong side of the sensor (not towards center) the system tries to find the sensor by rotating the arm but in wrong direction. In this case the arm must be pushed over the sensor to the actual operating range and thus enable the system to find the sensor.

The rotation end sensor is polled in the end of the rotation. The rotation must stop on the sensor, otherwise an error is generated. If the sensor was reached and gone over the rotation is stopped immediately with an error.

Cassette motor

The cassette motor is located on the top of the cassette holder in the cassette end of the rotating part. It drives the cassette holder (and the film cassette) linearly across the X-ray beam during the exposure and back during return. In cephalostatic models it also takes care of opening the secondary slot wide enough and of moving the soft tissue wedge. It is a stepper motor and it gets it's drive from the generator processor.

The operating range of this motor is controlled by four sensors on the CASSETTE LIMITS circuit board. Two of them control the position of the secondary aperture (cassette holder carriage) and two the end limits of the cassette holder movements.

When driven to READY position the motor is operated till both the cassette holder and the cassette holder carriage start sensors are active. If the cassette is pushed aside the system will seek back for the sensors. When driven to the end direction normally a certain length is driven and no sensors are used. The exception is when the equipment is powered on with the cassette not on the start sensors. Then the cassette is driven all the way till it finds the end sensor of the cassette holder.

In panoramic models the end sensor of the cassette holder carriage is never used. It is used together with the end sensor of the cassette holder to detect the right position of the secondary aperture when in cephalostatic mode.

2.4 Lasers

To make it as easy as possible to position the patient rightly, three positioning lights are provided. All the lights are similar in construction. The light beam adjustment is done by bending the mirror rather than moving the bulb and therefore the bulb replacement does not necessarily need the adjustment procedure. It is good practice though to check the adjustments.

Layer positioning laser

This laser is located under the lower fixed part cover. It is reflecting a narrow light beam vertically to the face of the patient in order to indicate the horizontal layer where the imaging is at the sharpest. This is the most critical of all the lasers, because without this laser there is no indication of the actual sharp layer place.

Sagittal positioning laser

This laser is located in the upper fixed part. It is reflecting a narrow light beam vertically along the center line of the patient's face to help the centering of the patient.

Frankfurt positioning laser

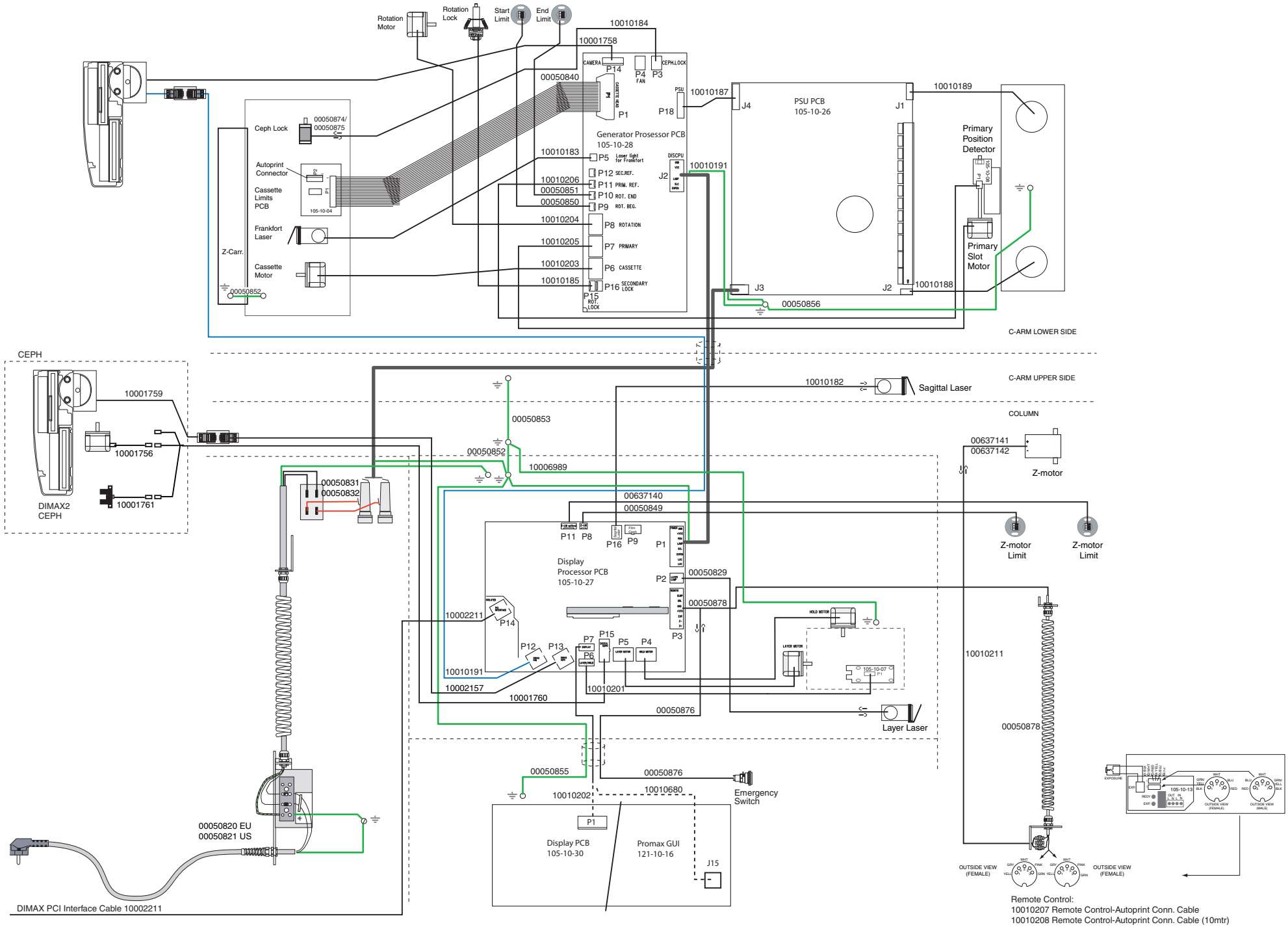
This laser can be found in the cassette end of the rotating part. It reflects a narrow horizontal light beam on the left cheek of the patient. It's vertical position can be altered by hand to correspond the patient's characteristics. The purpose of this laser is to help to position the patient's head to be horizontal.

Chapter

J

WIRING DIAGRAM

PM Proline EC Wiring Diagram 20.01.2005 LY



10010214 Planet Grabber Cable, 2 unit
10010448 Planet Grabber Cable, 1 unit

Remote Control:
10010207 Remote Control-Autoprint Conn. Cable
10010208 Remote Control-Autoprint Conn. Cable (10mtr)
10010209 Autoprint Conn. Cable (1,4mtr)
10010212 Remote Control-, Autoprint Connecting Cable (KMK kaap)

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