

ORTHORALIX® 9200

9200/Plus/Ceph

9200 DDE/Plus/Ceph

Panoramic X-ray



Gendex Dental Systems
901 West Oakton Street
Des Plaines, IL 60018 U.S.A.
Tel 1-888-275-5286
Fax 1-847-550-1322
www.gendex.com

Authorized Representative:
KaVo Dental GmbH
Bismarckring 39
88400 Biberach, Germany
www.gendex-dental.com
www.kavo.com

GENDEX
Imaging Excellence Since 1893



GENDEX
Imaging Excellence Since 1893

Introduction and technical data

Table of contents

A.1 Introduction.....A-2

A.1.1	Panoramic radiography (PAN).....	A-2
A.1.2	Cephalography (CEPH).....	A-2
A.1.3	Tomographic projections (Transcan).....	A-2
A.1.4	Phosphor Plate Extension (PPE).....	A-2
A.1.5	Automatic Exposure Control (A.E.C.).....	A-2
A.1.6	Motorised column.....	A-3
A.1.7	Real-time digital panoramic.....	A-3

A.2 System versions.....A-4

A.3 System identification.....A-5

A.4 System components.....A-5

A.4.1	Column.....	A-5
A.4.2	Z-Carriage.....	A-5
A.4.3	Rotating unit.....	A-5
A.4.4	Tubehead.....	A-5
A.4.5	Patient head rest.....	A-5
A.4.6	Ceph arm.....	A-5
A.4.7	Remote control box.....	A-6

A.5 Technical data.....A-6

A.5.1	Pre-installation.....	A-6
A.5.1.1	Preparing the installation site.....	A-6
A.5.1.2	Headroom.....	A-6
A.5.1.3	Floorspace.....	A-6
A.5.1.4	X-ray protection.....	A-6
A.5.2	Mechanical data.....	A-6
A.5.2.1	Driving system.....	A-6
A.5.3	Electrical data.....	A-7
A.5.3.1	Mains requirements.....	A-7
A.5.3.2	Mains voltage.....	A-7
A.5.3.3	Mains current.....	A-7
A.5.3.4	Mains frequency.....	A-7
A.5.3.5	Mains resistance.....	A-7
A.5.3.6	Electrical installation.....	A-7

A.5.4 Performance data.....A-8

A.5.4.1	Exposure geometry data (Pan mode).....	A-8
A.5.4.2	Exposure geometry data (Ceph mode).....	A-8
A.5.4.3	Image quality.....	A-8
A.5.4.4	X-ray tube.....	A-8
A.5.4.5	Tubehead.....	A-8
A.5.4.6	X-ray field dimensions.....	A-8
A.5.4.7	Power generation.....	A-8
A.5.4.8	Tube voltage.....	A-9
A.5.4.9	Tube current.....	A-9
A.5.4.10	"Dead man" function.....	A-9
A.5.4.11	X-ray tube protection.....	A-9
A.5.4.12	Anatomical programs.....	A-9
A.5.4.13	Exposure time.....	A-9
A.5.4.14	Back-up timer.....	A-9
A.5.4.15	Exposure control.....	A-10
A.5.4.16	Centering lights.....	A-10
A.5.4.17	Screen film sensibility selection.....	A-10
A.5.4.18	Service programs.....	A-10
A.5.4.19	Orthoralix 9200 CCD sensor.....	A-10
A.5.4.20	Laser projectors.....	A-10

A.5.5 Dimensions and weights.....A-11

A.5.6 IEC Classification.....A-11

A.5.7 Applicable standards.....A-11

A.5.8 Accessories and special tools.....A-11

A.5.9 Film cassettes.....A-11

A.5.10 Intensifying screens.....A-12

A.5.11 Disposables.....A-12

A.5.12 Environmental data.....A-12

A.6 Dimensions.....A-13

A.7 Labels.....A-14

A.8 Cooling data.....A-16

A.1 Introduction

The Gendex Orthoralix identifies a range of stand-alone dental systems, designed for the following radiographic purposes:

A.1.1 Panoramic radiography (PAN)

Panoramic radiography (also known as orthopantomography - OPTG) takes X-rays of the whole dento-maxillo-facial complex, with the following characteristics:

- **panoramic:** the entire dental and alveolar region including the rami and the temporo-mandibular joints (TMJ), are depicted on one radiograph.
- **orthogonal:** the trajectory of the movement is designed to keep the projection as orthogonal as possible to the object, in order to minimize overlapping between structures.
- **tomographic:** only a limited layer around the plane in focus is sharply depicted, while the surrounding structures are blurred by the tomographic movement.

The layer thickness is maximum at the sides and minimum at the centre.

The operator can select the following projections from the control panel:

- Standard panoramic projection,
- Child panoramic,
- Dentition only (with improved beam orthogonality),
- Right jaw,
- Left jaw,
- Maxillary sinus, frontal view,
- Right maxillary sinus, lateral view,
- Left maxillary sinus, lateral view,
- TMJ, frontal view,
- TMJ, lateral view (on the central part of the film),
- TMJ, lateral view (on the external part of the film).

(For the Orthoralix 9200 DDE versions only one TMJ lateral projection is available).

A.1.2 Cephalography (CEPH)

This operation mode provides X-rays of the skull at large focus film distance (FFD), under lateral or posterior-anterior projection.

The masticatory system of the skull is shown together with details of the soft tissue profile from chin to tip of nose.

Special devices are provided to help position the patient and to pre-set the geometry.

A.1.3 Tomographic projections (Transcan)

a) Orthoralix 9200 Plus

Eight tomographic projections are provided, each consisting of 3 views. They include:

- RR posterior layer width 3 mm
- RR posterior layer width 6 mm
- RR incisor layer width 3 mm
- RR incisor layer width 6 mm
- LL incisor layer width 6 mm
- LL incisor layer width 3 mm
- LL posterior layer width 6 mm
- LL posterior layer width 3 mm

b) Orthoralix 9200 DDE

Four scannographic projections are provided, each consisting of 3 views having a layer width of 8 mm. They include:

- RR posterior
- RR anterior
- LL posterior
- LL anterior

A.1.4 Phosphor Plate Extension (PPE)

A special version called Phosphor Plate Extension (PPE) is available: this consents to use a standard 24 x 30 cm cassette (as available for computer imaging phosphor plate in medical X-ray) instead of the current 15 x 30 cm panoramic cassette.

A.1.5 Automatic Exposure Control (A.E.C.)

The Automatic Exposure Control (A.E.C.) is based on the use of a feedback closed loop control on the technique factors influencing the exposure in order to automatically compensate little differences in patient absorption and obtain the proper optical density on the image receptor. In particular the radiation intensity is measured by an appropriate X-ray sensor during examination and, depending from the kind of projection, the system modulate the kV or modify the exposure time (only in Ceph versions without the digital sensor) in order to obtain the proper optical density for the film.

The purpose is to automatically compensate little differences in patient absorption around the three predefined patient profile (small, medium, large) and have all the same consistent film blackening in the region of interest, while exposing the patient to the smallest level of radiation.

In the following table is shown in which projections the A.E.C. is enabled and in which ones not.

PROJECTION	9200 AEC/PLUS	9200 DDE
STANDARD PANORAMIC	Enabled	Enabled
CHILD	Enabled	Enabled
ORTH. DENTITION	Enabled	Enabled
EMI ORTHOGONAL RIGHT	Disabled	Disabled
EMI ORTHOGONAL LEFT	Disabled	Disabled
FRONTAL DENTITION	Disabled	Disabled
RIGHT JAW	Enabled	Disabled
LEFT JAW	Enabled	Disabled
FRONTAL SINUS	Enabled	Enabled
RIGHT LATERAL SINUS	Enabled	Disabled
LEFT LATERAL SINUS	Enabled	Disabled
FRONTAL TMJ	Enabled	Disabled
LAT. TMJ CENTRAL	Enabled	Enabled
LAT. TMJ EXTERNAL	Enabled	Enabled
RR/LL INCISOR	Disabled	Disabled
RR/LL POSTERIOR	Disabled	Disabled
CEPH LL	Enabled	Enabled
CEPH AP/PA	Enabled	Enabled

At the end of any projection executed with the A.E.C., on the display is indicated the real kV value generated and the real exposure time.

The operator can select the A.E.C. mode by actuating the dedicated button on the operator panel; moreover, this function will be enabled only when any patient size is selected.

A.1.6 Motorised column

Instead of the manual vertical movement of the Z-carriage onto the column, is available a motorised column which allows automatic vertical movement of the Z-carriage. A motor is mounted in the top part of the column.

The operator will be able to move vertically the Z-carriage controlling this motor by:

- two up/down push buttons located on the operator panel
- one push button on the Ceph arm.

The operator must continue to push the buttons to maintain in movement the Z-carriage.

The buttons control the motor in the following way:

- one-shot short pressure (<500 msec) of the buttons will cause 1 mm movement
- prolonged pressure of the buttons will cause:
 - slow movement (3 mm/s), during the first 2 s; on release, a decelerating ramp is activated (time from Vmax to 0 is 300mS)
 - fast movement (20 mm/s), after 2 s.

The vertical movement is stopped by two end run optoswitches (upper and lower), placed on the front part of the column.



Do not move the Z-carriage along the column when the system is off: doing so it could damage the PC6 board.

A.1.7 Real-time digital panoramic

The Orthoralix 9200 DDE is a version of the Orthoralix 9200 family providing real-time digital image acquisition using a digital CCD sensor interconnected to a personal computer using an Ethernet connection.

The Orthoralix 9200 DDE operates in all the enabled projections, including the cephalometric projections in the versions with the ceph arm.

A.2 System versions

The Gendex Orthoralix system is available in different versions, identified as follows:

TYPE	DESCRIPTION
5105 0012DE	Orthoralix 9200 Plus (D)
5105 0012US	Orthoralix 9200 Plus (USA)
5105 0012WW	Orthoralix 9200 Plus
5105 0022DE	Orthoralix 9200 Plus Ceph (D)
5105 0022US	Orthoralix 9200 Plus Ceph (USA)
5105 0022WW	Orthoralix 9200 Plus Ceph
5105 0032DE	Orthoralix 9200 (D)
5105 0032US	Orthoralix 9200 (USA)
5105 0032WW	Orthoralix 9200
5105 0042DE	Orthoralix 9200 Ceph (D)
5105 0042US	Orthoralix 9200 Ceph (USA)
5105 0042WW	Orthoralix 9200 Ceph
5105 0052DE	Orthoralix 9200 Plus - PPE (D)
5105 0052WW	Orthoralix 9200 Plus - PPE
5105 0062DE	Orthoralix 9200 Plus Ceph - PPE (D)
5105 0062WW	Orthoralix 9200 Plus Ceph- PPE
5105 0072DE	Orthoralix 9200 - PPE(D)
5105 0072WW	Orthoralix 9200 - PPE
5105 0082DE	Orthoralix 9200 Ceph - PPE(D)
5105 0082WW	Orthoralix 9200 Ceph - PPE
5101 0092WW	Orthoralix 9200 AEC
5101 0102WW	Orthoralix 9200 AEC Ceph
5105 01051US	Orthoralix 9200 DDE (USA)
5105 01061US	Orthoralix 9200 DDE Plus (USA)
5105 0151WW	Orthoralix 9200 DDE
5105 0161WW	Orthoralix 9200 DDE Plus
5105 0171WW	Orthoralix 9200 DDE Ceph
5105 0181WW	Orthoralix 9200 DDE Plus Ceph
5105 0221US	Orthoralix 9200 DDE (USA - with ceph sensor)
5105 0221WW	Orthoralix 9200 DDE (ROW - with ceph sensor)
5105 0231US	Orthoralix 9200 DDE Plus (USA - with ceph sensor)
5105 0231WW	Orthoralix 9200 DDE Plus (ROW - with ceph sensor)
5105 0241WW	Orthoralix 9200 DMF
5105 0251WW	Orthoralix 9200 DMF Ceph
5105 0261WW	Orthoralix 9200 DMF AEC
5105 0271WW	Orthoralix 9200 DMF AEC Ceph

The different versions are composed of the following items:

TYPE	DESCRIPTION
9869 104 00602	Ceph Arm OO9200
9869 104 00702	Ceph Arm OO9200 (USA)
9869 104 01401	Ceph Arm OO9200 Plus
9869 104 01501	Ceph Arm OO9200 Plus (USA)
9869 104 02301	Ceph Arm OO9200 DDE
9869 104 02401	Ceph Arm OO9200 DDE with sensor
9869 401 00102	Z-carriage 9200 Plus
9869 401 00202	Z-carriage 9200
9869 401 00302	Z-carriage 9200 Plus - PPE
9869 401 00402	Z-carriage 9200 - PPE
9869 401 00702	Z-carriage 9200 Plus (D)
9869 401 00802	Z-carriage 9200 (D)
9869 401 00902	Z-carriage 9200 Plus - PPE (D)
9869 401 01002	Z-carriage 9200 - PPE (D)
9869 401 01801	Z-carriage 9200 DMF
9869 401 01901	Z-carriage 9200 DMF AEC
9869 401 02002	Z-carriage 9200 AEC (ROW)
9869 401 02102	Z-carriage 9200 AEC (D)
9869 401 02302	Z-carriage 9200 AEC (USA)
9869 401 02401	Z-carriage 9200 DDE
9869 401 02501	Z-carriage 9200 DDE Plus
9869 401 02601	Z-carriage 9200 DDE (ceph sensor)
9869 401 02701	Z-carriage 9200 DDE Plus (ceph sensor)
9869 401 02801	Z-carriage 9200 DDE DMF
9869 401 02901	Z-carriage 9200 DDE DMF(ceph sensor)
9869 401 01101	Motorized Column OO9200
9869 401 01201	Motorized Column OO9200 (USA)
9869 401 01501	Motorized Column OO9200 DDE
9869 401 01601	Motorized Column OO9200 DDE (USA)

A.3 System identification

For system identification please refer to the technical label at A-14.

A.4 System components

A.4.1 Column

The column is fixed to the wall with four bolts at the top and two at the bottom.

It includes the counterweights required to balance the Z-carriage. the Z-carriage is suspended by two steel cables with a balance mechanism, ensuring a security lock in case one of the steel cables breaks.

A sliding block on the front, to which the Z-carriage is bolted, moves vertically along the column.

On the front of the column is the mains power box, to which the mains power cable is connected.

A.4.2 Z-Carriage

The Z-carriage slides along the column to adjust to the height of the patient.

Movement is motorized driven manually by push buttons on the operator panel.

On the right there is the operator control panel, consisting of a flat membrane keyboard with alphanumeric display and indicator LEDs.

The internal mounting frame houses an electronic board that controls the operator interface and the various motor movements.

The kinematic assembly allows for composite movements on the X/Y plane by independent displacement of the X,Y blocks along bearings, controlled by gear motors.

Another gear motor is located on the top frame, controlling the rotational movement of the rotating unit.

A handgrip, bite block (or chin rest), and optical centering devices provided on the Z-carriage help to position the patient during exposures.

The bite block and chin rest are exchangeable.

On the right there is an attachment for mounting the Ceph arm.

A.4.3 Rotating unit

The rotating unit is suspended from the Z-carriage.

It carries:

- a) the tubehead
- b) the cassette drive system with the relevant gear motor
- c) the panoramic digital sensor (DDE versions only).

The tubehead is connected by a flange, which can be manually rotated for changeover from Pan mode to Ceph mode (not applicable for the DDE versions).

The power converter board, which supplies the high voltage and filament supply for the tubehead, is located on top of the rotating unit, on the tubehead side.

A.4.4 Tubehead

The tubehead contains the high voltage transformer and the filament

transformer with the X-ray tube.

Thanks to the high frequency operation the tubehead features are reduced in weight and size.

On the X-ray output window the X-ray collimator is mounted ; it is slit type for Pan, TMJ and transversal scannographic exposures and can be manually switched to a full size opening in case of Ceph exposures.

A.4.5 Patient head rest

The patient head rest is attached to the Z-carriage.

It is motorized and controlled by a pair of pushbuttons on the front operator panel.

A.4.6 Ceph arm

The Ceph arm is bolted to the right side of the Z-carriage, and comprises the cephalostat with cassette support.

In the DDE versions it includes:

- a) the cephalostat
- b) the ceph CCD digital sensor
- c) the secondary collimator
- e) the gear motor and related drive system to move the ceph CCD digital sensor and the secondary collimator.

A.4.7 Remote control box

The remote control box with exposure handswitch enables the operator to take an X-ray in a separate room.

It is equipped with a 20m cable for connection to the equipment, and incorporates an "X-ray ON" buzzer and indicator light.

A cable inlet is available on the bottom plate of the column.

There is a socket for connecting the handswitch coiled cable (1 m long) and a hook for hanging the same handswitch.



In order to comply with Federal regulations this remote box must be installed so the technique factors are visible to the operator from the remote location.

A.5 Technical data

A.5.1 Pre-installation

A.5.1.1 Preparing the installation site

Orthoralix 9200 is to be mounted on a normal masonry wall.

It takes three men to attach the column to the wall and to mount the Z-carriage to the column.

The remaining installation work can be done by one engineer, following the instructions given in section B of this manual.

Only the standard toolset is required.

Any special devices required for set up and adjustment are supplied as accessories with the unit.

The system is designed to be fixed to the wall by means of six bolts.

For this purpose screws M6 with metal expanders are suggested (supplied); they are only suitable for use with concrete walls type R300 and over (resistance to compressive load greater than 300 kg/cm²).

For other wall types, please refer to the detailed instructions given in section B.

Irregularities in the floor level, within a 2mm/m tolerance, can be compensated at installation time by means of levelling shims (supplied with the unit).

A.5.1.2 Headroom

The system height is 2310 mm high.

A minimum headroom of 2340 mm is required to install it.

To dismount the internal parts of the column, such as the slide block with ball bearings, a minimum headroom of 2650 mm is required.

A.5.1.3 Floorspace

For the system dimensions applicable to the different versions refer to A-13.

A.5.1.4 X-ray protection

The machine is intended for (indoor) dental practice without special X-ray protection in walls, floors and ceilings.

X-ray protection comes from the distance to be kept from the unit, proper X-ray beam collimation and inherent shielding implemented in the machine.

Primary X-ray beams are shielded by a lead plate, located at the rear of the cassette unit (thickness: 1.5 mm in Pan and Transcan mode, 1 mm in Ceph mode).

In the DDE versions, the X-ray beams are shielded by the sensor assembly, introducing a filtration equivalent to 1.5 mm of lead.

A.5.2 Mechanical data

The system is light-weight thanks to the manufacturing technology of the high tension transformer, which in turn allows more compact mechanical dimensioning of the rotary unit and the column.

A.5.2.1 Driving system

The Orthoralix system provides a microprocessor-controlled motor driving system, with use of stepping motors, for independent control of four separate movements:

- X-positioning of rotation centre
- Y-positioning of rotation centre
- rotation of rotating arm
- linear translation of film cassette
- linear translation of digital CCD sensor and secondary collimator (ceph DDE versions only).

In addition, the patient head rest and the column are also motorized.

Drive transmission is by means of tension belts.

A.5.3 Electrical data

A.5.3.1 Mains requirements

The equipment **must be** permanently connected to the mains. It requires a single (or double) phase mains supply with line and neutral, 50 or 60 Hz.



Check the correct phase-neutral polarity connection at the time of installation if single phase mains supply is available.

There is a mains connection box at the base of the column where the power cable (not provided) has to be connected at installation time.

Mains fuses are provided on each phase. In case of single phase, the fuse on the neutral is excluded by a jumper.

A.5.3.2 Mains voltage

The nominal mains voltage range is from 115 VAC to 250 VAC with a tolerance of $\pm 10\%$.

The system adapts automatically to the mains voltage applied by means of the internal electronic circuit.

The useful range is conveniently adjusted during X-ray exposure, to take into account the mains fall during load.

A.5.3.3 Mains current

The relevant mains currents are:

VOLTAGE	STAND-BY CURRENT	EXPOSURE	MAINS FUSE
115 VAC	1 A MAX	20 A MAX	15A F 250V
230 VAC	0.5 A MAX	10 A MAX	10A F 250V
250 VAC	0.5 A MAX	10 A MAX	10A F 250V

A.5.3.4 Mains frequency

The mains frequency required is 50 or 60 Hz, with excursion within the 48 to 62 Hz acceptable range.

The unit adapts to the local mains frequency, without any need for programming.

A.5.3.5 Mains resistance

The mains supply resistance, as measured at the line input connector, shall not exceed the following ranges:

VOLTAGE (VAC)	LINE RESISTANCE (OHM)
115	0.2 MAX
250	1.0 MAX

A.5.3.6 Electrical installation

The mains supply cord has to be provided and installed locally, with termination to the electrical connecting box provided on the front of the column.



The circuitry in the electrical connecting box is always live: before access to it, disconnect from the mains by means of the external mains circuit breaker.

The length and size of the mains supply cord have to be properly dimensioned in order not to exceed the limits foreseen on mains supply resistance.

Recommended wire size is AWG 14.

You are recommended to supply the mains to the Orthoralix via a dedicated magneto/thermal circuit breaker of 16 A max (with mains supply >150 VAC) or 20 A max (with mains supply <150 VAC), plus (depending on local regulations) an earth leakage circuit breaker with recommended leakage current of 30 mA.

A.5.4 Performance data

A.5.4.1 Exposure geometry data (Pan mode)

Distance from focal spot to mechanical rotational centre: 350 mm

Distance from focal spot to film: 505 mm

Distance from focal spot to secondary slit: 497 mm

Inclination of central X-ray with respect to horizontal: 5°

Occlusal plane height adjustment: 1000 - 1800 mm

Distance from focal spot to primary collimator: 94 mm

A.5.4.2 Exposure geometry data (Ceph mode)

Distance from focal spot to film: 1500 mm

Distance from focal spot to centre of cephalostat: 1350 mm

Height adjustment of ear center plane with respect to floor: 1000-1800 mm

Distance from secondary collimator to digital sensor: 375 mm (DDE versions only)

A.5.4.3 Image quality

Maximum resolution (at the centre of the focal through) in standard panoramic mode and using the recommended film-screen combination (Kodak Lanex Medium - Kodak T-MAT-G or equivalent) approximately 2.2 lp/mm.

PROJECTION	MAGNIFICATION FACTOR
Standard, Dentition only	1.25
Child	1.25
TMJ lateral view	1.25
TMJ frontal view	1.64
Maxillary sinus, frontal view	1.25
Right/left maxillary sinus, lateral view	1.25
Right/left jaw	1.25
Transcan	1.4
Transcan DDE	1.33
Ceph (all projections)	1.1
Frontal dentition	1.25
Half orthogonal right/left	1.25

PROJECTION	DEVIATION FROM ORTHOGONALITY (referred to standard jaw, in the premolar region)
Standard	24° max
Dentition only	12° max
Ceph	2° max
Ceph DDE versions	6.5° max

A.5.4.4 X-ray tube

Tube type: GX 100-20 DC

Focal spot size: 0.5 (IEC 336/1993)

Anode angle: 5°

Anode material: Tungsten in copper body

Rated peak tube potential: 100kVp

Anode heat storage: 25 kHU

Max anode heat dissipation rate: 12 kHU/min

For the cooling data see page A-15.

A.5.4.5 Tubehead

Weight: 10 kg. (4,1/2 lbs)

Duty cycle: 1/20, one exposure per 4 min, at full power operation.

Leakage radiation: less than 250 µGy/h (28 mR/h) at 1 m from focal spot in any direction.

Inherent filtration: 2.5 mm Al equivalent (minimum).

Reference current time product: 1.12 mAs at 84 kV.

Current time product: 0.48 mAs at 60 kV.

A.5.4.6 X-ray field dimensions

Please refer to the Operator's Manual.

A.5.4.7 Power generation

High tension and filament power generation is performed by means of solid state medium frequency converter technology (25 kHz).

All electronic parts are included in a single board.

The converter provides automatic stabilization with respect to mains fluctuations.

In addition it is protected against the following:

- Mains transients.
- Output short circuit (cabling, tube flashover, etc.), through current limitation to max. 11A.
- Open filament circuit
- Open kV feedback signal.
- Open mA feedback signal.
- Overheating of power electronics (>80°C).

A.5.4.8 Tube voltage

The kV range is 60-84 kV, with steps of 2 kV.



For legal / homologation requirements, in certain countries the kV range can be restricted to:

max kV value = 80

via internal firmware configuration (see Section F of this Service Manual, Service Programs paragraph).

The high tension converter includes the following chain of components: rectifier, filter, regulating chopper, inverter, high tension transformer.

The chopper unit operates at high frequency with the PWM principle, providing modulation of the DC supply to the inverter unit, depending on the kV selected by the operator.

The high tension transformer is driven by the impressed current inverter, operating at high frequency with fixed duty factor.

The high voltage is monitored by means of a voltage divider built into the high tension transformer, which provides direct feedback to the control loop circuit of the converter.

For measurement and accuracy details please refer to section D.

A.5.4.9 Tube current

The mA range is 3-15 mA, with steps of 1 mA.



For legal / homologation requirements, in certain countries the mA range can be restricted to:

from 4 to 14

via internal firmware configuration (see Section F of this Service Manual, Service Programs paragraph).

The power to the filament is controlled by a separate impressed voltage inverter, operating at high frequency with variable amplitude and fixed duty factor.

The filament is continuously preheated when the equipment is switched on, and additionally heated-up for 0.8 s before the exposure is initiated.

For details about measurement and accuracies refer to section D.

A.5.4.10 "Dead man" function

The exposure handswitch operates in "dead man" function, stopping exposure and movements as soon as the X-ray pushbutton is released.

A.5.4.11 X-ray tube protection

A heat storage calculator continuously checks the thermal state of the anode, inhibiting X-ray exposure when the maximum tube load is exceeded. The maximum duty factor is 1:20, giving a maximum wait time of 4 minutes.

A.5.4.12 Anatomical programs

Both for Pan and Ceph operation modes several sets of pre-programmed exposure factors are available, selected by patient size and projection mode keys, and by the film/screen speed setting: please refer to the Operator's Manual for further information.

A.5.4.13 Exposure time

The exposure time is controlled by the microprocessor.

For the applicable exposure times refer to the table below:

PROJECTION	EXPOSURE TIME (SEC)
Standard	12
Dentition only	9.6
Child	11
Right jaw	8
Left jaw	8
Maxillary sinus, frontal view	6.2
Frontal dentition	6.4
Half orthogonal right/left	6
Right maxillary sinus, lateral view	2.5
Left maxillary sinus, lateral view	2.5
TMJ lateral view, central	8
TMJ lateral view, external	8
TMJ frontal view	6
Transcan	4.6
Transcan DDE	5.2
Ceph (selectable)	0.16 - 0.20 - 0.25 - 0.32 - 0.40 - 0.50 - 0.63 - 0.80 - 1.00 - 1.25 - 1.60 - 2.00 - 2.50
Ceph DDE: LL max / AP max / PA max / LL H	8
Ceph DDE AP V / PA V / LL V:	6

For measurement and accuracy details please refer to section D.

A.5.4.14 Back-up timer

If the supply to the tubehead is not switched off by the main timer after completion of the preset exposure time, a back-up timer will terminate the X-rays.

The back-up timer operates after the selected exposure time plus 20%.

The back-up timer circuit is independent from the main timer circuit and is on the converter board PQ1.

Whenever the back-up timer intervenes, a diagnostic message "BACK UP TIMER" is displayed.

A.5.4.15 Exposure control

There is a single step exposure handswitch which commands the rotation start (Pan modes only) and the X-ray exposure.

A remote control box is available, to enable remote exposure command.

It includes a 20 m long cable provided with plug connector, for connection to the Z-carriage.

The handswitch plugs into the Z-carriage, or into the remote control box, via a flexible cord, 3 m long.

When not hand held, it is hung to a suitable hook of the Z-carriage, or at the remote control box.

A.5.4.16 Centering lights

The equipment is provided with three centering lights, generated by laser projectors:

1. the first is for the horizontal alignment at the Frankfurt plane and is projected on to the patient's face through the semi-transparent frontal mirror
2. the second, a mid-sagittal vertical light, detects lateral displacement and inclination of the patient's head and is projected on to the patient's face through the semi-transparent frontal mirror
3. the third is for the longitudinal alignment at the tip of the cuspids, and is projected on to the patient's face from the lamp projector on the Pan cassette carriage.



The position of laser sources are emphasised by mean of a warning label. Although compliant to the safety rules, it is a good practice for the operator to avoid to expose his eyes and patient's eyes directly to the laser beam.

A.5.4.17 Screen film sensibility selection

The operator can select the sensibility corresponding to the screen/film combination used by changing the default speed value (250 for the Kodak Lanex Medium - Kodak T-MAT-G or equivalent) via a software procedure.

Depending on the above selection the system will automatically adjust the mA value used during the X-ray exposure.

Please refer to the Operator's Manual for the different screen/film combinations that can be used and for more details about the software procedure.

This is not applicable for the Orthoralix versions having the digital sensor.

A.5.4.18 Service programs

The Orthoralix system incorporates diagnostic service software programs, which can be run either by the operator for a routine check of the machine before use, or by the service engineer for assessing system operation before starting any corrective maintenance.

The service program procedure is started up by pushing together the DUMMY RUN and PATIENT SIZE keys when switching on the machine: the keys must be kept pressed till the message WAIT disappears on the display.

The service programs consist of several selective tests, each one independent from the others.

The main tests allowed are as follows:

- selective test of X, Y, R and C movements
- tube calibration
- free exposure
- keyboard test
- X-ray alignment for DDE versions only.

Refer to Section F of this manual for more details about the service programs.

A.5.4.19 Orthoralix 9200 CCD sensor

Sensor active area:	147 X 6 mm Pan 220 X 6 mm Ceph
Sensor pixel size:	0.096 mm
Image size:	full panoramic 1536 x 2725 pixels full ceph 2304 x 2529 pixels
Cable length:	25 m from Orthoralix system to the LAN plug
Resolution:	4 lp/mm

A.5.4.20 Laser projectors

Class:	2, according to IEC 60825-1 (2001-8)
Wavelength:	650 nm
Beam divergence for collimated beam:	< 1 mrd
Pulse duration:	30 s
Maximum output:	< 1 mW

A.5.5 Dimensions and weights

The equipment is packed in three wooden crates containing all parts and accessories.

a) for Orthoralix 9200/Plus/Ceph

Crate (1) Column and counterweights:

PACKING DIMENSIONS	2350 x 300 x 550
PACKING WEIGHT	163 Kg
NET WEIGHT	121 K

Crate (2) Z-carriage, Tubehead and covers:

PACKING DIMENSIONS	1050 x 700 x 900
PACKING WEIGHT	130 Kg
NET WEIGHT	74 K

Crate (3) Ceph arm:

PACKING DIMENSIONS	1350 x 600 x 600
PACKING WEIGHT	55 Kg
NET WEIGHT	20 K

For the system dimensions see A-13.

b) for Orthoralix DDE/Ceph

Crate (1) Column and counterweights:

PACKING DIMENSIONS	2350 x 300 x 550
PACKING WEIGHT	163 Kg
NET WEIGHT	121 Kg

Crate (2) Z-carriage, Tubehead and covers:

PACKING DIMENSIONS	1050 x 700 x 900
PACKING WEIGHT	130 Kg
NET WEIGHT	74 K

Crate (3) Ceph arm:

PACKING DIMENSIONS	1200 x 700 x 740
PACKING WEIGHT	64 Kg
NET WEIGHT	22 K

For the system dimensions see A-13.

A.5.6 IEC Classification

- Class I
- Type B
- Ordinary equipment (enclosed equipment without protection against ingress of liquids)
- Equipment for use in environments where no flammable an-aesthetics and/or flammable cleaning agents are present.
- Equipment for continuous operation with intermittent loading.

A.5.7 Applicable standards

For a list of the applicable National and International Standards, please refer to the Operator's Manual.

A.5.8 Accessories and special tools

The following accessories and tools are delivered with the system (one piece each):

- Chin rest code 4519 128 20221
- Bite block code 4519 128 20213
- Image quality phantom code 4519 124 20471
- Chin rest for TMJ code 4519 128 21191
- Kit template for transcan see Q-list for codes

while the following are available on request from the Service department:

- Light beam phantom code 4519 190 00922

A.5.9 Film cassettes

Film cassettes available:

TYPE NUMBER	APPLICATION	DIMENSIONS
9868 820 00349	Pan exposures	15 X 30 cm
9868 820 09039	Ceph	18 x 24 cm
9868 820 09249	Ceph	"8"x10"

The cassette slot for Ceph projection can also accommodate 24 x 30 cm cassettes (not supplied).

A.5.10 Intensifying screens

The available intensifying screens are:

TYPE NUMBER	APPLICATION	DIMENSIONS
9869 007 10501	Pan	set of 2 screens 15x30 cm, green emitting, rare earth, type Kodak Lanex Medium
9869 007 10001	Ceph	set of 2 screens 18x24 cm, green emitting, rare earth, type Kodak Lanex Regular
9869 007 10601	Ceph	set of 2 screens 8"x10", green emitting, rare earth, type Kodak Lanex Regular
9868 825 92349	Pan	set of 2 screens 15x30 cm, green emitting, rare earth, type Kodak Lanex Regular

Refer to the Operator's Manual for information on preferred screen film combinations.

A.5.11 Disposables

The available disposables are:

CODE NUMBER	DESCRIPTION
4519 129 03601	set of 100 pcs hygienic bags for bite block
4519 128 20952	set of 280 pcs hygienic bags for ear plugs (only for Ceph)

A.5.12 Environmental data

The Orthoralix system complies with the following environmental classifications:

- indoor use, under conditions normally found in theatre and emergency rooms.
- locations/constructions and intended use with low vibration/shock levels.
- mains supply conditions.

Ambient temperature

operating:	+10° to +40° C (9200) +10° to +35° C (9200 DDE)
storage:	-40° to +70° C (9200) -20° to +70° C (9200 DDE)

Pressure

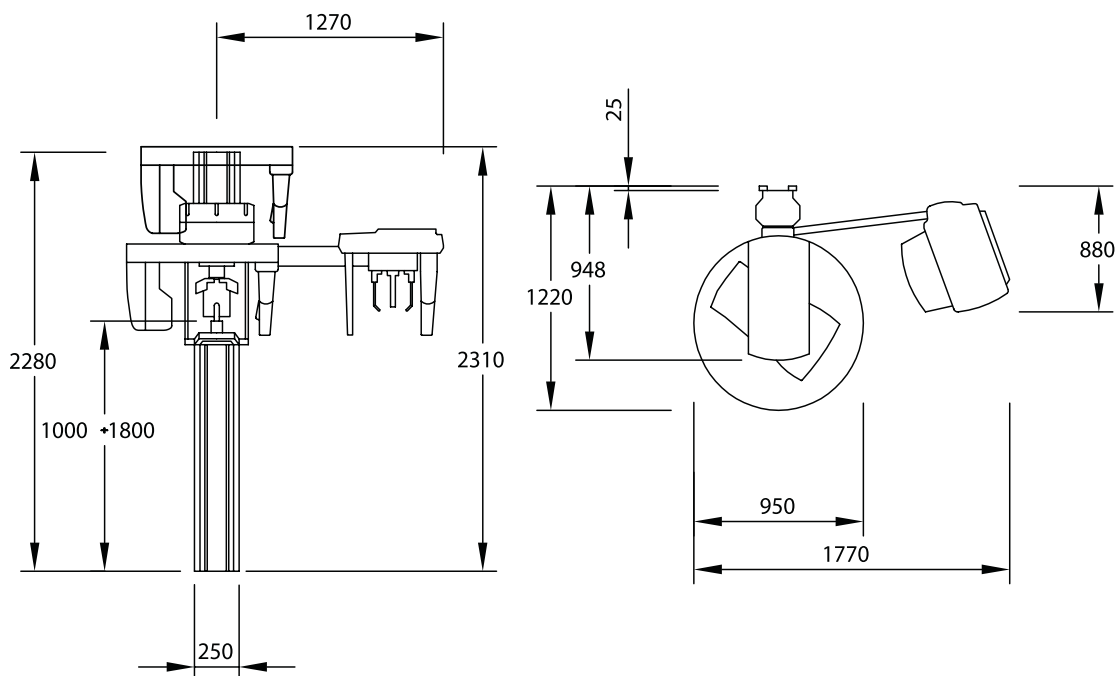
operating:	700 hPa to 1060 hPa
storage:	500 hPa to 1060 hPa

Relative humidity

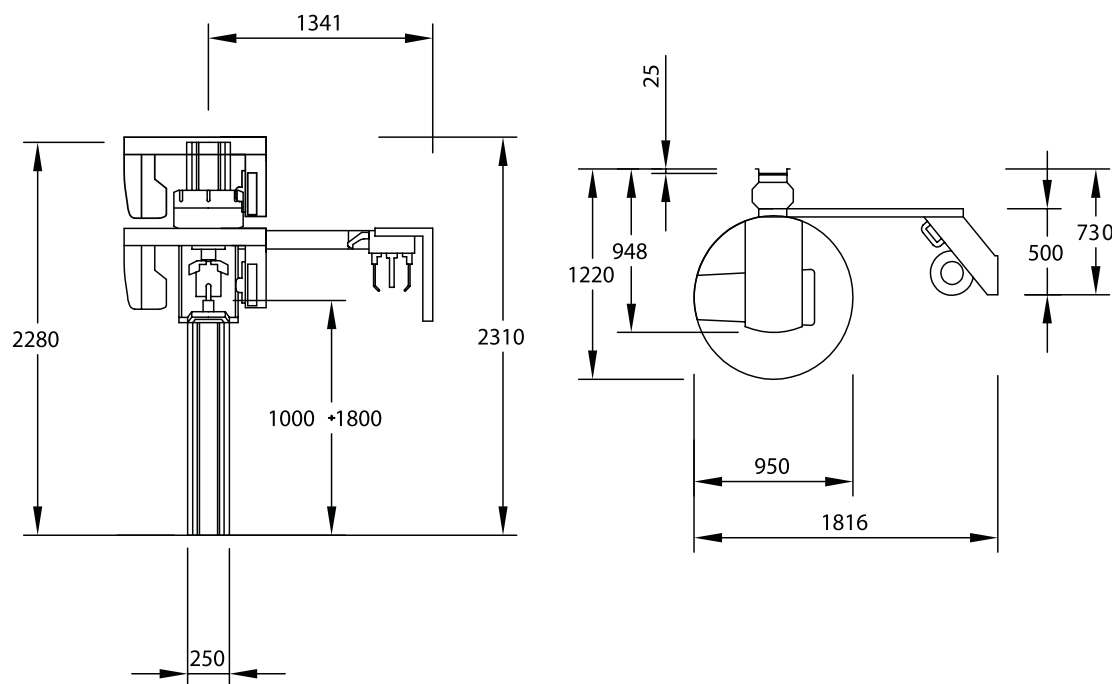
operating:	30%-90% (9200) 30%-90% (9200 DDE)
storage:	10%-100% (9200) 10%-100% (9200 DDE)

A.6 Dimensions

ORTHORALIX 9200 DDE

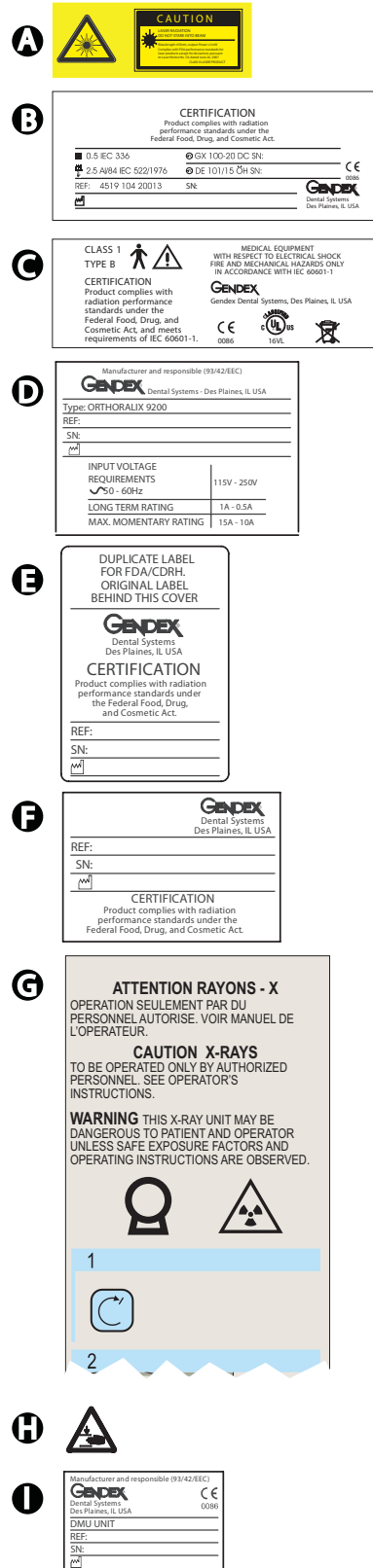
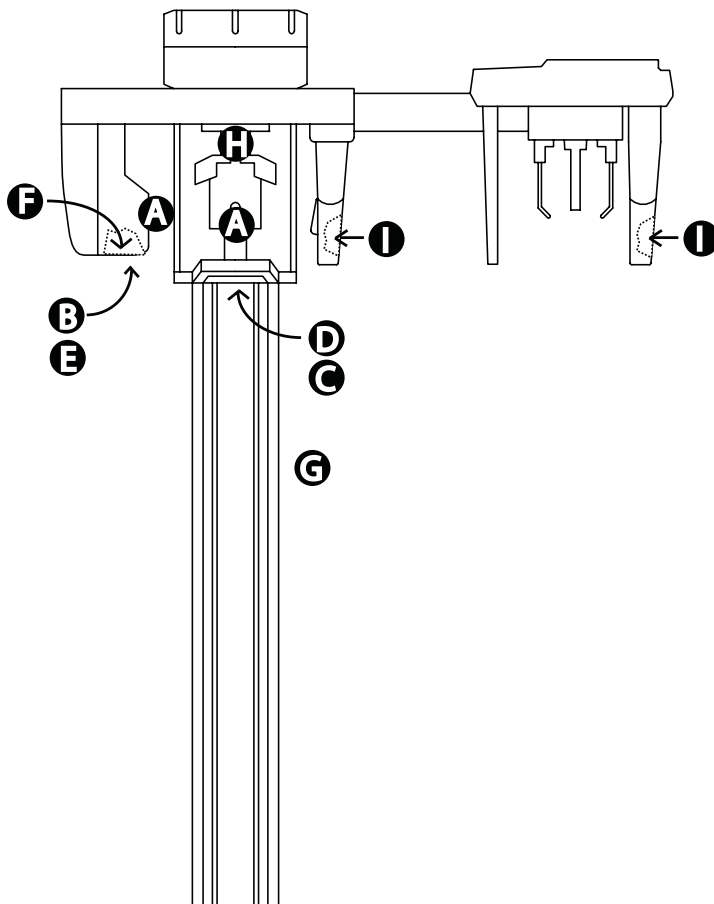


ORTHORALIX 9200

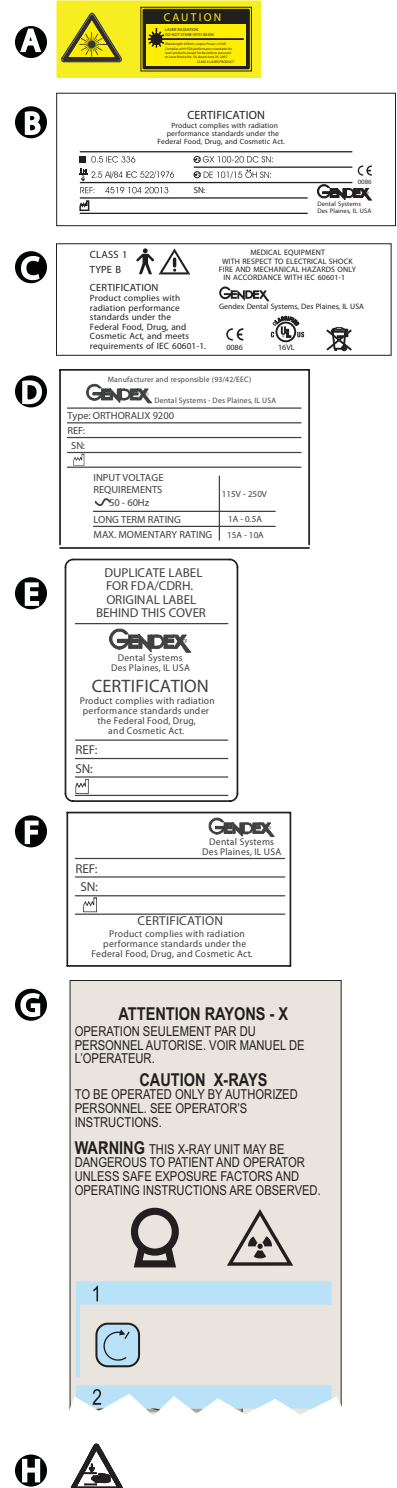
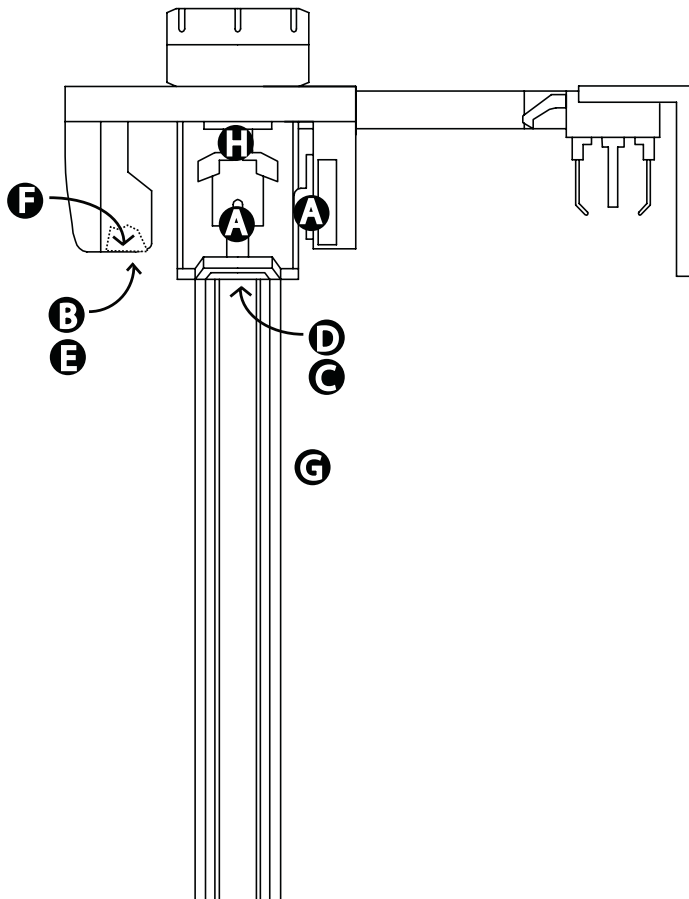


A.7 Labels

ORTHORALIX 9200 DDE

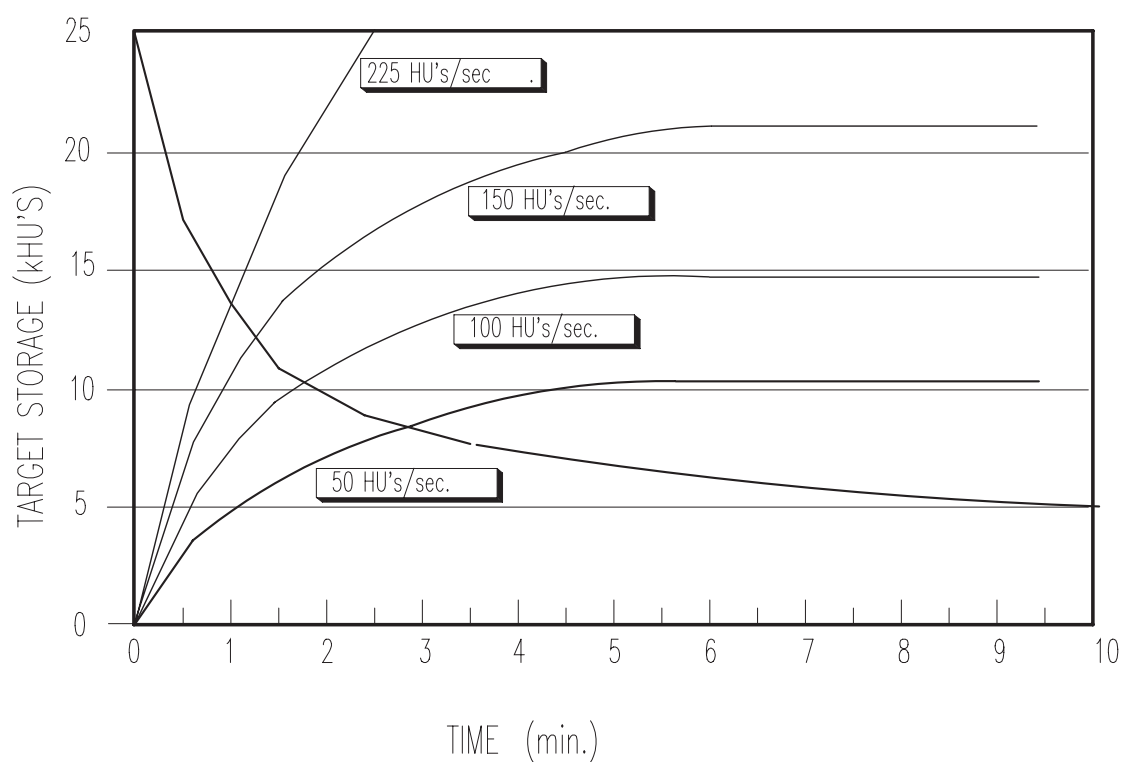


ORTHORALIX 9200



A.8 Cooling data

GENDEX GX 100-20 DC INSERT ANODE
HEATING & COOLING CHART



Installation

Table of contents

B.1 Introduction	B-2
B.2 Installation tools	B-2
B.3 Supply	B-2
B.3.1 Parts not supplied	B-2
B.4 Planning information	B-2
B.4.1 Headroom	B-2
B.4.2 Space required	B-2
B.4.3 Room preparation	B-2
B.4.4 Electrical pre-installation	B-3
B.4.5 X-Ray protection	B-3
B.5 Mechanical installation	B-4
B.5.1 Unpacking	B-4
B.5.2 Installing the column on the wall	B-5
B.5.3 Installing the z-carriage on to the column	B-8
B.5.4 Installing the ceph arm	B-10
B.5.4.1 Procedure for Orthoralix 9200	B-10
B.5.4.2 Procedure for Orthoralix 9200 DDE	B-11
B.5.5 Mounting the front panel with mirror	B-12
B.5.6 Mains voltage programming	B-13
B.5.7 Connection to the mains	B-13
B.5.8 Checking mains polarity	B-14
B.5.9 Installing the remote control box	B-15

B.5.10 Mounting the z-carriage covers	B-16
B.5.11 Creating a network connection for the Orthoralix 9200... ..	B-17
B.5.11.1 Orthoralix 9200 DDE/Ceph	B-17
B.5.12 Mounting the column covers and the quick reference guide	B-19
B.5.13 Installing the ceph formats	B-20
B.5.13.1 Orthoralix 9200/Plus/Ceph	B-20
B.5.13.2 Orthoralix 9200 DDE/Ceph	B-21
B.5.14 Installing the soft tissues filter	B-22
B.6 Upgrades	B-23
B.6.1 Field upgrading to the ceph version	B-23
B.6.2 Field upgrading to the transcan version	B-23
B.6.3 Field upgrading to the dmf version	B-23
B.6.4 Field upgrading to the "plus" version	B-24
B.7 Options	B-24
B.7.1 External lights connection	B-24
B.8 Column wall fixation	B-27
B.9 Check list	B-28
Column	B-28
Z-Carriage	B-28
Ceph arm	B-28
B.10 Grounding Connection	B-29

B.1 Introduction

This section provides details about the installation of the Orthoralix Panoramic and CEPH systems.

Most installation work can be performed by one man.

Three men are momentarily needed for raising and positioning the column, and for mounting the Z-carriage on to the column.

B.2 Installation tools

The standard service toolkit is required.

B.3 Supply

The systems supplied are composed of the following main parts:

- column,
- Z-carriage with rotating unit and tubehead,
- CEPH arm with cephalostat (when applicable),

Please refer to page B-32 for a list of the included items.

B.3.1 Parts not supplied

- Mains cable, (two poles with ground, recommended wire size AWG 14 - 2,11 mm²).
- Phantom for centering light, code 4519 190 00922.
- Screws with expensor.
- For Orthoralix 9200 DDE: PC with ethernet board.
- For Orthoralix 9200 DPI: PC with free PCI slot.

B.4 Planning information

The information given below is intended for the service staff or building contractor involved in preparing the installation site.

B.4.1 Headroom

The system height is 2310 mm.

To install the system, a minimum headroom of 2350 mm is required.

To conveniently dismount the internal column parts, such as the sliding block and ball bearings, a minimum headroom of 2650 mm is required.

B.4.2 Space required

For the dimensions of the various system versions see A-13.

B.4.3 Room preparation

The system is designed to be fixed to the wall by means of six bolts.

The maximum load applied to the wall is 25 kg, distributed over the top four attachment points.

Considering a safety factor of eight, each of the four attachment points has to be able to support pull and thrust loads of up to 50 kg.

For this purpose M6 screws with metal expanders are suggested (**supplied**); they are only suitable for use with concrete walls type R300 and over (resistance to compressive load higher than 300 kg/cm²).

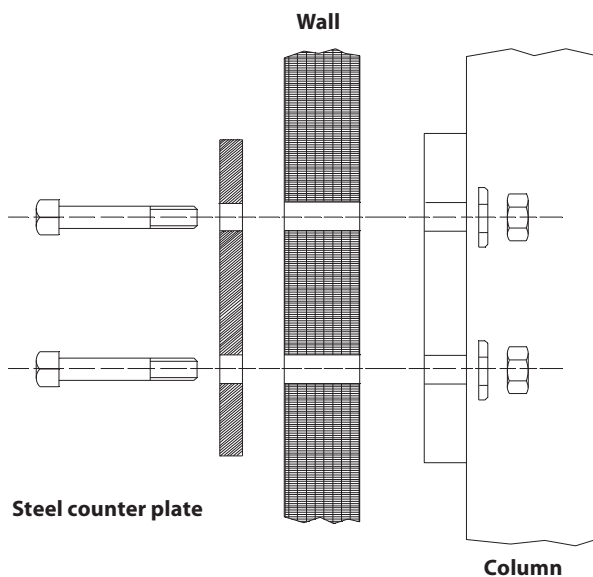


It is the installation engineer's responsibility to choose the proper attachment hardware according to the type of wall on which the column is to be mounted.



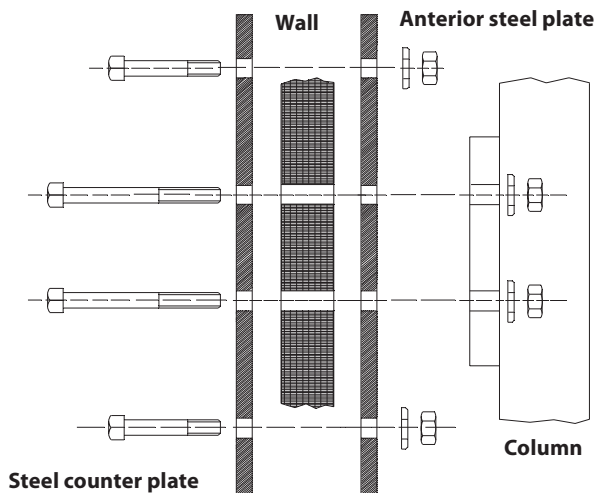
Insufficient wall or hardware strength may cause the wall-mounted column to detach itself from the wall and fall, with the risk of causing serious injury to the patient or operator.

For other strong types of wall (concrete with R not known, solid brick) we recommend using the "through the wall" method of attachment as shown in the fig. below, which uses a steel counter plate (2mm thick), of the same size as the column wall attachment, fixed with screws or stay bolts, ensuring a tightening torque on the bolts of 10 N/m.



In the case of other less resistant wall types (hollow bricks, wood) which, however, can bear the specified load without evident deformation, we recommend using the "through the wall" method of attachment of the fig. below, which uses a front steel reinforcement plate (2 mm thick) and a steel counter plate (2 mm thick) of a larger size than the column wall attachment, fixed with screws or stay bolts, ensuring a tightening force on the bolts of 10 N/m.

Doubling the surface of the steel plates with respect to the size of the column wall attachment, will halve the static load applied to the wall.



In the case of other very weak walls (wood, etc.) a steel construction is needed.

Irregularities in floor levels, within a 2mm/m tolerance, can be compensated at installation time by means of levelling shims supplied with the system.

For the preparation of the fixing holes in the wall please refer to B-28.

B.4.4 Electrical pre-installation

The Orthoralix requires a fixed electrical installation.

The mains cable required is two poles with ground (not supplied).

The mains cable inlet is at the rear of the column, and is provided with cable retainer.

Therefore a suitable outlet shall be provided on the wall behind the column, from where the mains supply cable has to be derived.

The remote control box is connected to the Z-carriage by a 20 m cable.

The cable inlet is at the rear of the column.

The mains supply cable has to be connected to the mains circuit connection points, accessible at the front of the column.



Total mains cable resistance must take the specified mains resistance limits into account (see table below)

VOLTAGE (VAC)	MAX. LINE RESISTANCE (OHM)
115	0.2 MAX
230	1.0 MAX
250	1.0 MAX

For calculation purposes a list of different wire sizes with related resistances is given:

SIZE	RESISTANCE / METER
AWG16 (1.35 mm ²)	0.03 (2 x 0.015) Ohm/m
AWG14 (2.11 mm ²)	0.0188 (2 x 0.0094) Ohm/m

B.4.5 X-Ray protection

The machine is intended for (indoor) dental practice without special X-ray protection in walls, floors and ceilings.

X-ray protection comes from the distance to be kept from the unit, proper X-ray beam collimation and inherent shielding implemented in the machine.

Primary X-ray beams are shielded by a lead plate, located in the rear of the cassette unit (thickness: 1.5 mm in Pan and Transcan, 1 mm in Ceph mode).

In the DDE versions, the X-ray beams are shielded by the sensor assembly, introducing a filtration equivalent to 1.5 mm of lead.

B.5 Mechanical installation

B.5.1 Unpacking

Open the two crates (three for the CEPH versions) and check the contents as specified in the CHECK LIST B-29.

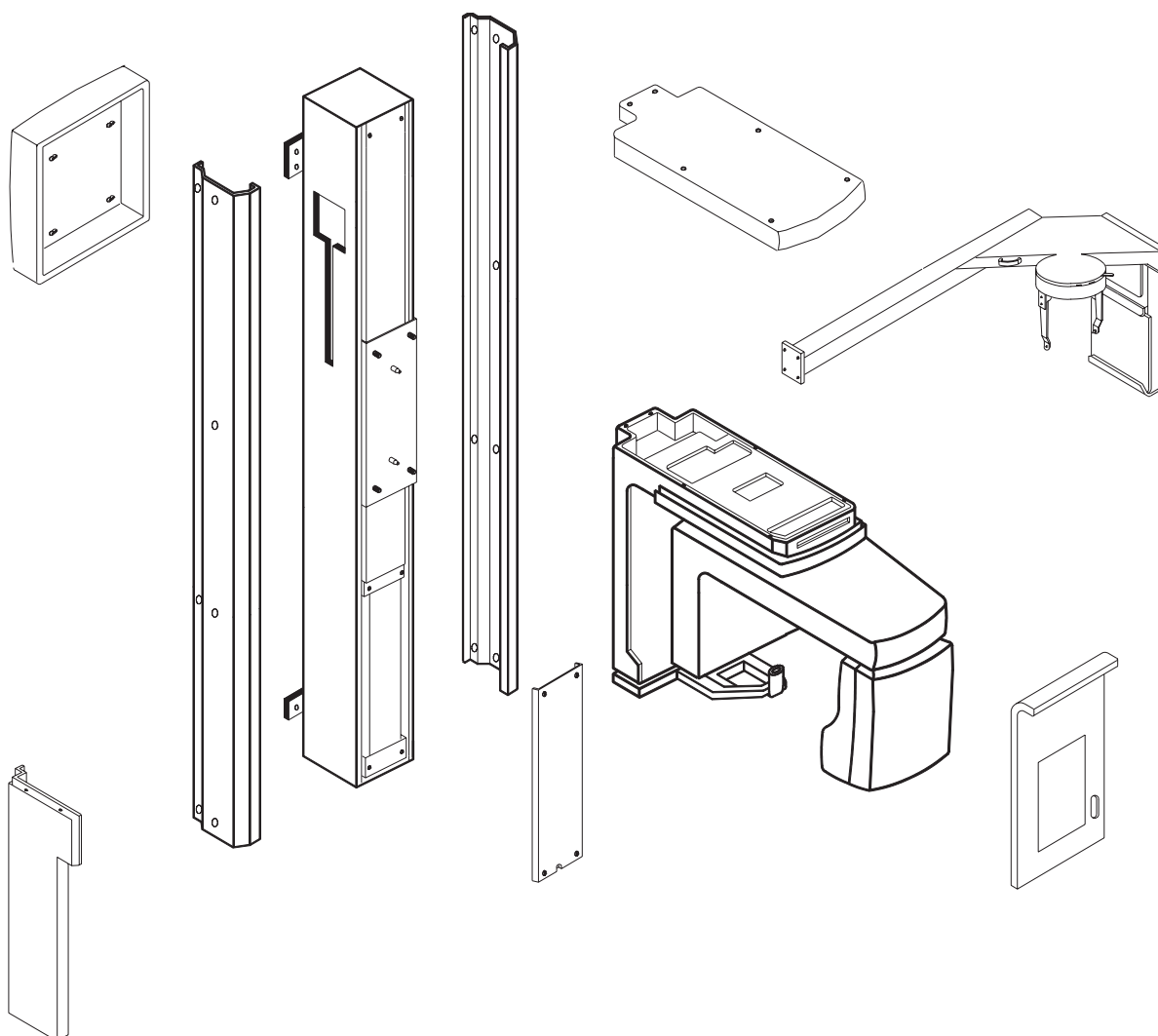
The unit has been adjusted and tested in our factory to reduce installation time.

Therefore assembly work is only required at the following points, which have been separated for transport purposes:

- column,
- Z-carriage with rotating unit and tubehead,
- CEPH arm (OPTION),
- some covers, as shown in the figure below.



In the Ceph version, the additional counterweight is contained in the Ceph arm crate.



B.5.2 Installing the column on the wall

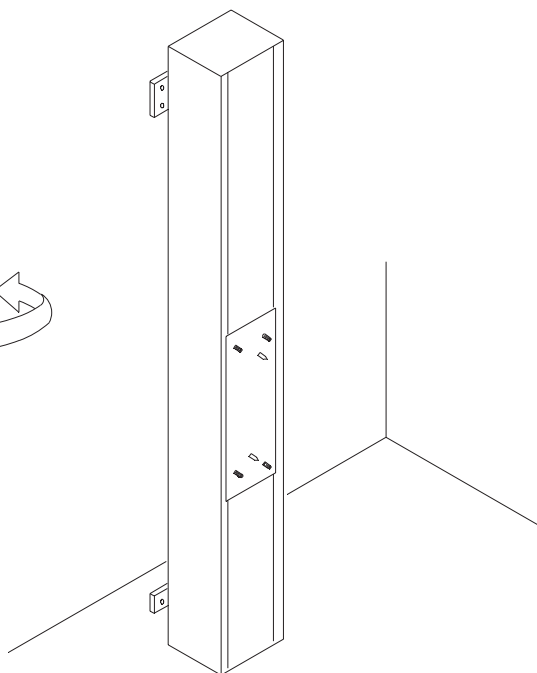
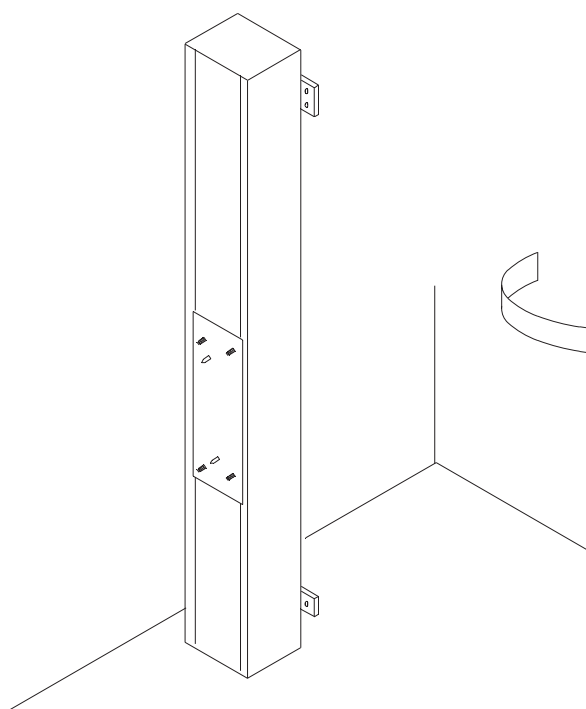
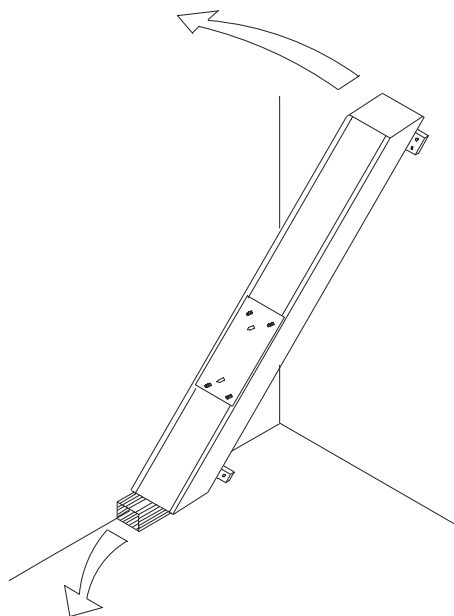
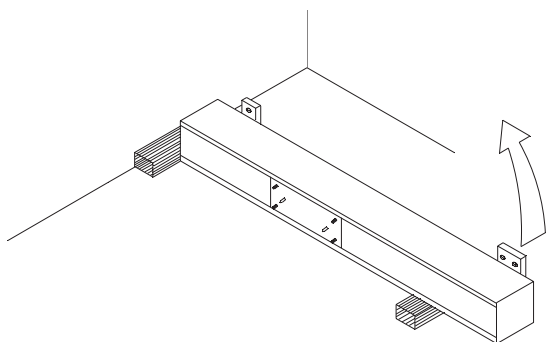
To take out the column from the crate and transport it on the desired installation site, two ropes are provided. Use adequate gloves to protect the hand.



The column is heavier than 20 kg and so during the installation it must be handled with care by three men, avoiding any risk of injury.

To install the column on the wall proceed as follows:

1. Position the column horizontally on the floor.
2. Raise it and place on the desired installation site.



3. Case A: Without bracket, concrete/brick walls.

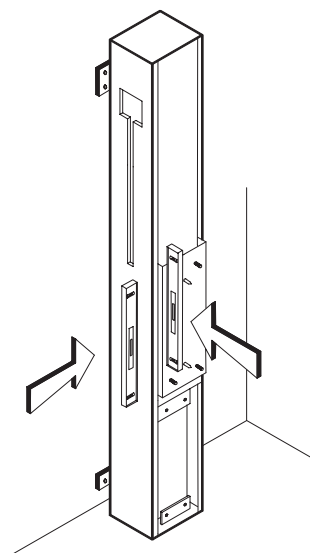
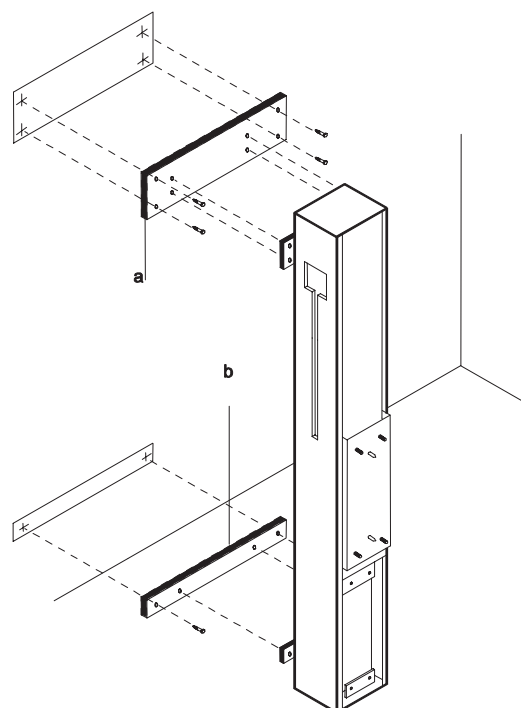
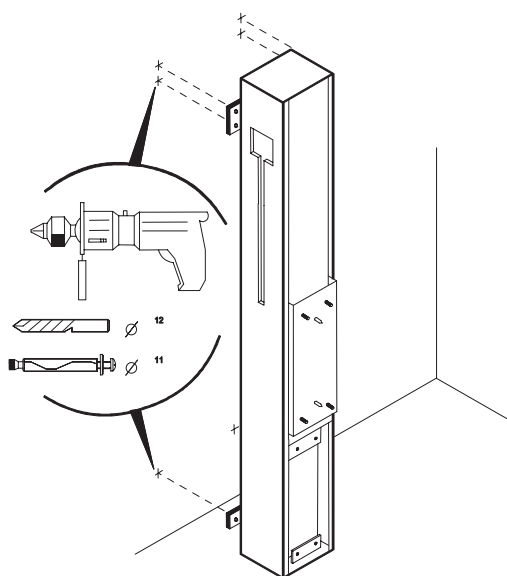
Mark the six fixation points on the wall, having checked that the column is level.

- Move the column sideways.
- Drill the holes.
- Fix the column to the wall making sure that it is level.
- Correct if required with shimming plates supplied.

Case B: With bracket, not concrete walls.

Fix the wall plate (a) to the top of the column by means of four screws and fix the wall plate (b) to the bottom of the column by means of two screws.

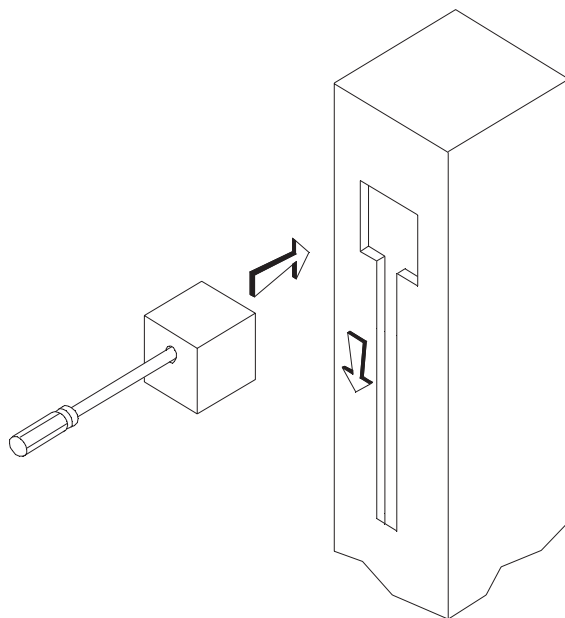
- Mark the six fixation points on the wall, having checked that the column is level.
- Move the column sideways.
- Drill the holes.
- Fix the column to the wall making sure that it is level.
- Correct if required with shimming plates supplied.



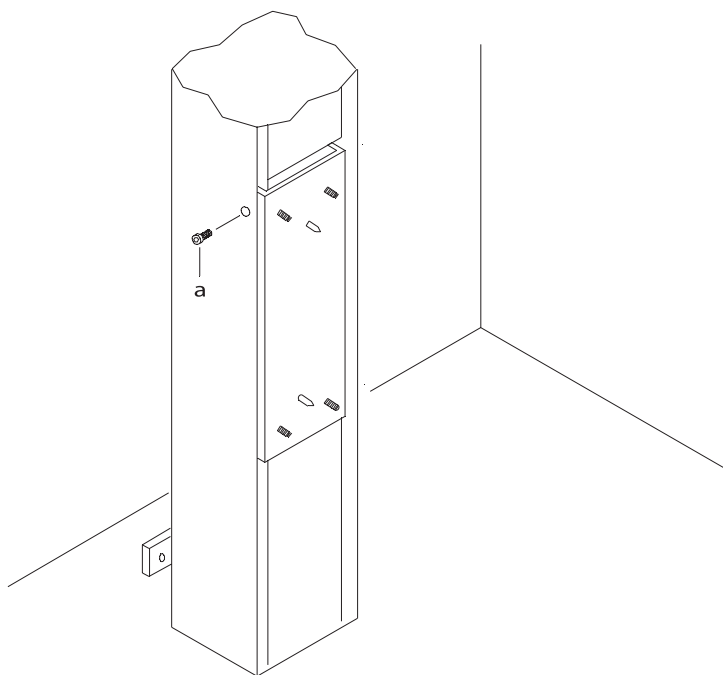
4. Feed two counterweights (a) (three for CEPH version - the additional counterweight is in the Ceph arm crate) through the hole provided in the top left column side.

Orthoralix 9200 DDE Ceph only:

In the DDE Ceph arm crate there are also two additional small counterweights to be inserted in the column.



5. Remove the Allen screw (a) locking the carriage of the column.



B.5.3 Installing the z-carriage on to the column

The Z-carriage is delivered assembled with rotating unit and tubehead and shipped turned upside down.

The rotating unit and the Z-carriage are connected by a fixing bracket. The following covers are disassembled in the packing:

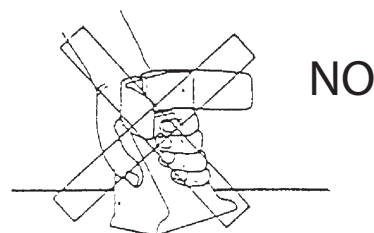
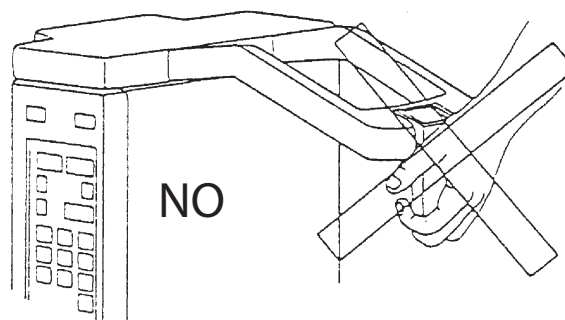
- top cover,
- front cover with mirror,
- rear cover of cassette unit (not present in the Orthoralix 9200 DDE versions).



The Z-carriage is heavier than 20 kg so, to handle it safely, three men are needed, two at the sides and one at the front. Grasp the handles at the bottom and at the front of the top Z-carriage frame.

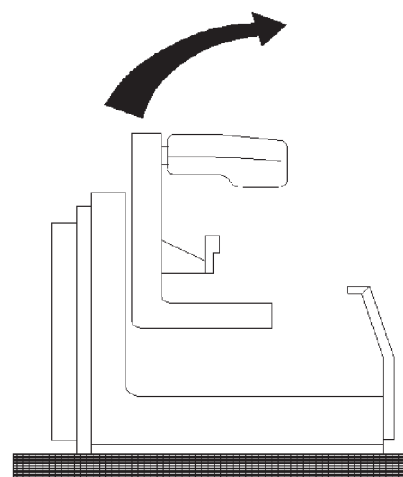
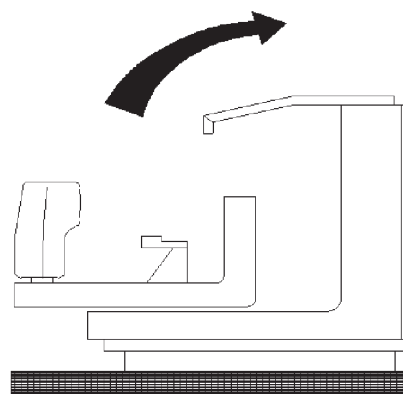


Do not handle the Z-carriage by the patient hand-grip, the headrest or the tubehead.

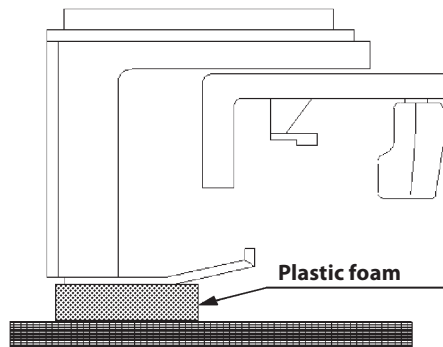


To install the Z-carriage on the column, proceed as follows:

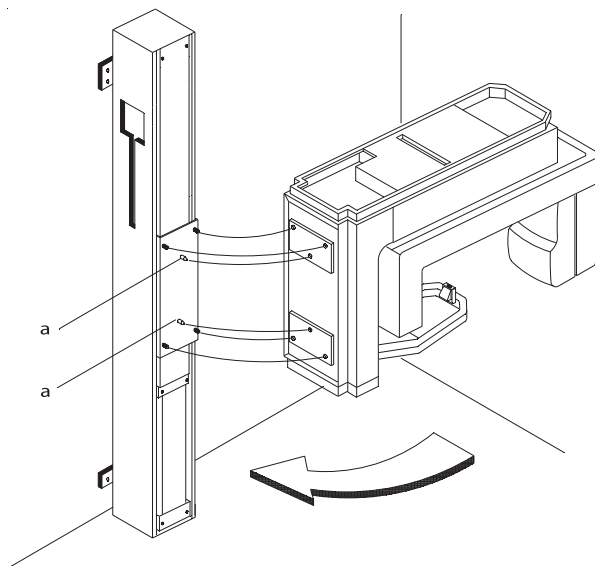
1. Rotate the Z-carriage upside down, by turning around the rear side, and move it close to the base of the column.



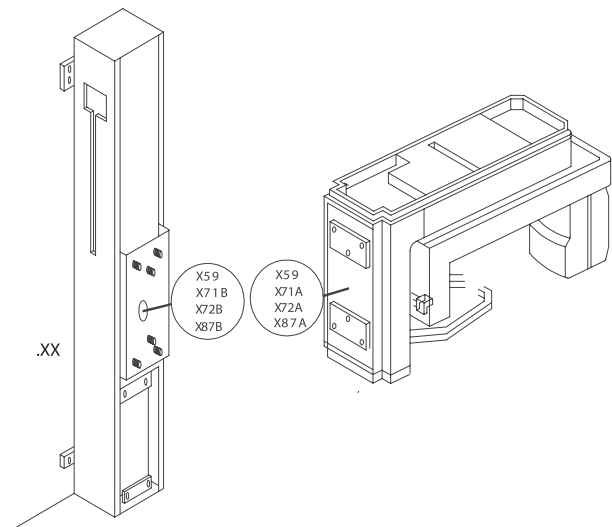
In order to do not damage the mains switch (it is located under the patient handgrip) put the Z-carriage momentarily on the two spacers located under the patient handgrip: the Z-carriage must be kept in position by one person.



2. Use three men to raise the Z-carriage and fit it on to the two driving pins (a).



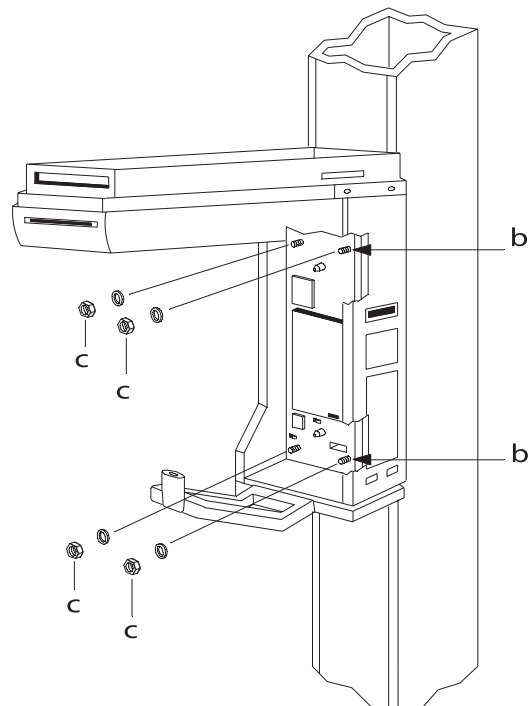
3. Connect free cable connector X59 to the relevant socket located on the sliding block, to power the Z-carriage from the mains supply.
4. Connect the connectors X72A with X72B and X71A with X71B to power the motor of the column.
5. For Orthoralix 9200 DDE only: feed the connector X11 into the Z/Carriage.



6. The men at the front keep the Z-carriage pushed against the column.
One man at the sides fixes the Z-carriage to the screw studs (c) of the sliding block, by means of the four ring lock-washers and nuts supplied.



Apply max. torque 15 Nm.

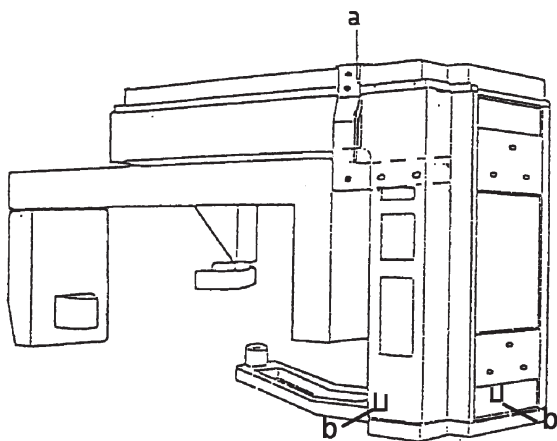


7. Remove the bracket (a) fixing the rotating unit to the Z-carriage.
Turn the rotary unit 90° to allow easier access to the electronic board.

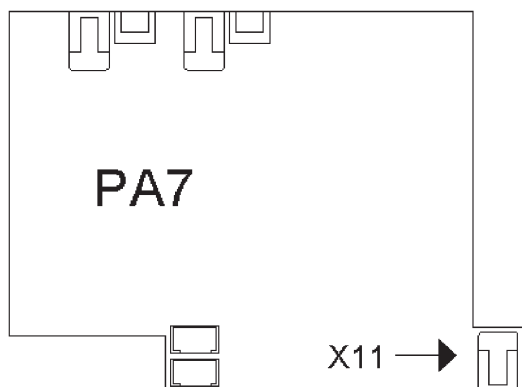


To rotate the rotating unit manually, move it gently by hand.

8. Remove the two spacers (b) from the patient handgrip.



9. For Orthoralix DDE only: connect the connector X11 to the auxiliary board PA7.

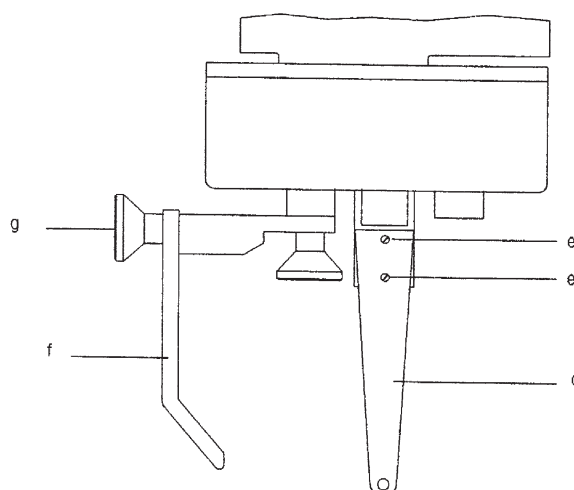
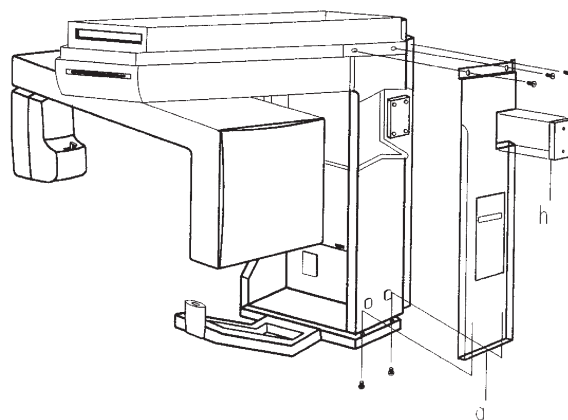


B.5.4 Installing the ceph arm

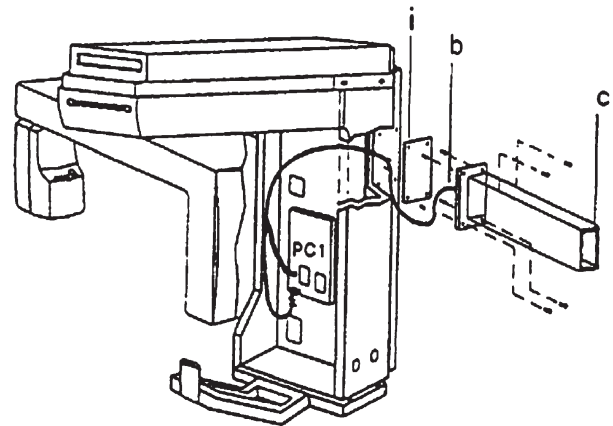
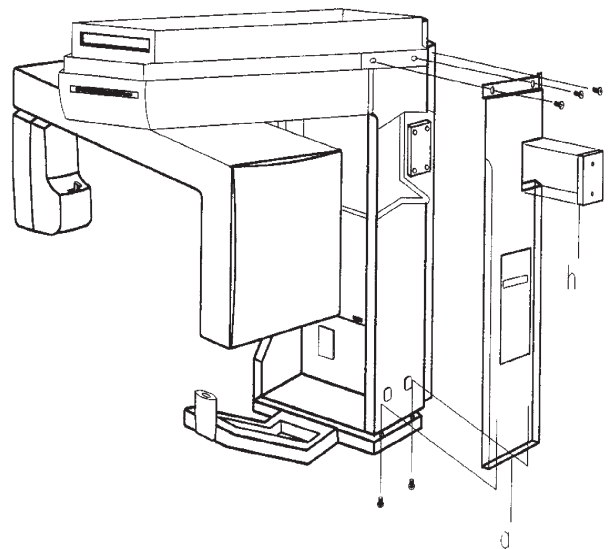
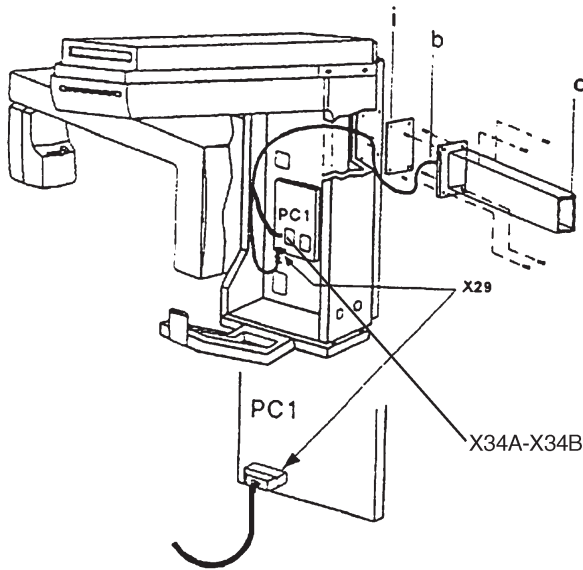
B.5.4.1 Procedure for Orthoralix 9200

To install the ceph arm with Cephalostat follow the procedure below (applicable only for the CEPH versions):

1. Remove the right-hand cover (a) of the Z-carriage by unscrewing five screws.
2. Prepare the ceph arm close to the Z-carriage.
3. Remove the metallic plate (i) by removing the four fixation screws.
4. Feed the free cable connector (b) from the arm through the hole provided and connect to socket X29 of the host computer board PC1. The wire must pass in the rear side of the metal plate where the PC1 is mounted.
5. If the AEC option is present connect the connector X34A from the ceph arm to the X34B of the Z-Carriage.



6. Fix the ceph arm (c) to the Z-carriage by means of the four hexagonal head screws (M8x25) and rings supplied.
7. Remove the panel (h) from the right-hand cover (a).
8. Replace the right-hand cover (a) of the Z-carriage.
9. Mount the ear plug support (d) into the cephalostat by means of the two screws (e). The ear plug support has two vertical mounting positions: please ask to the user which position in more convenient.
10. Mount the nasion rest (f) into the pin and fix it with knob (g).



B.5.4.2 Procedure for Orthoralix 9200 DDE

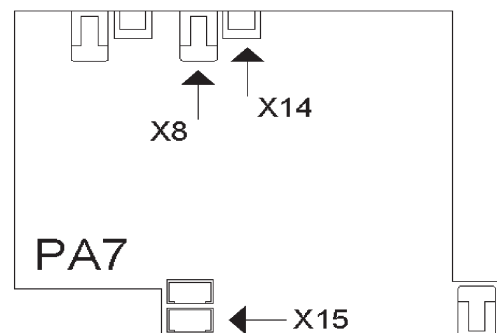
To install the ceph arm with Cephalostat follow the procedure below (applicable only for the CEPH versions):

1. Remove the right-hand cover (a) of the Z-carriage by unscrewing five screws.
2. Prepare the ceph arm close to the Z-carriage.
5. Connect the connectors coming from the ceph arm X8- X14- X15 to the auxiliary board PA7.

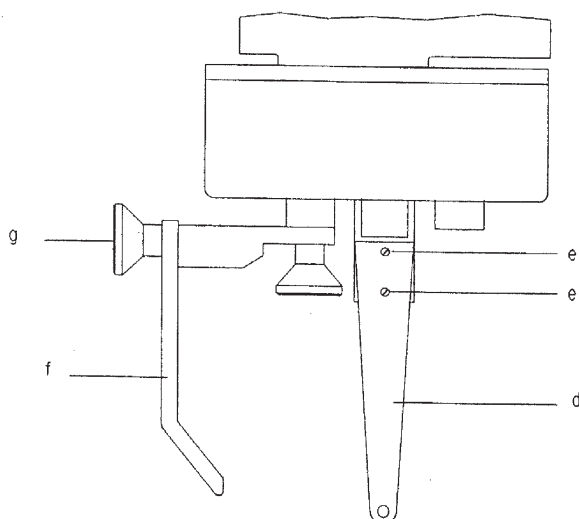


During the installation of the ceph arm, do not handle it by the secondary collimator.

3. Remove the metallic plate (i) by removing the four fixation screws.
4. Feed the free cable connector (b) from the arm through the hole provided and connect to socket X29 of the host computer board PC1. The wire must pass in the rear side of the metal plate where the PC1 is mounted.



6. Remove the connector X37 from the host computer board PC1 and disconnect the connector connected to the red and black wires (power supply for the lateral laser). Then, connect the connector X37 coming from the ceph arm to the PC1 and connect also the connector to the new red and black wires.
7. Fix the ceph arm (c) to the Z-carriage by means of the four hexagonal head screws (M8x25) and rings supplied.
8. Remove the panel (h) from the right-hand cover (a).
9. Replace the right-hand cover (a) of the Z-carriage.
10. Mount the ear plug support (d) into the cephalostat by means of the two screws (e). The ear plug support has two vertical mounting positions: please ask to the user which position in more convenient.
11. Mount the nasion rest (f) into the pin and fix it with knob (g).



12. Install the toroid supplied with the ceph arm on the wires of the connector X8 of the PA7 board.
13. Install the toroid supplied with the ceph arm on the wires of the connectors X10 and X15 (one toroid for both connectors) of the PA7 board.



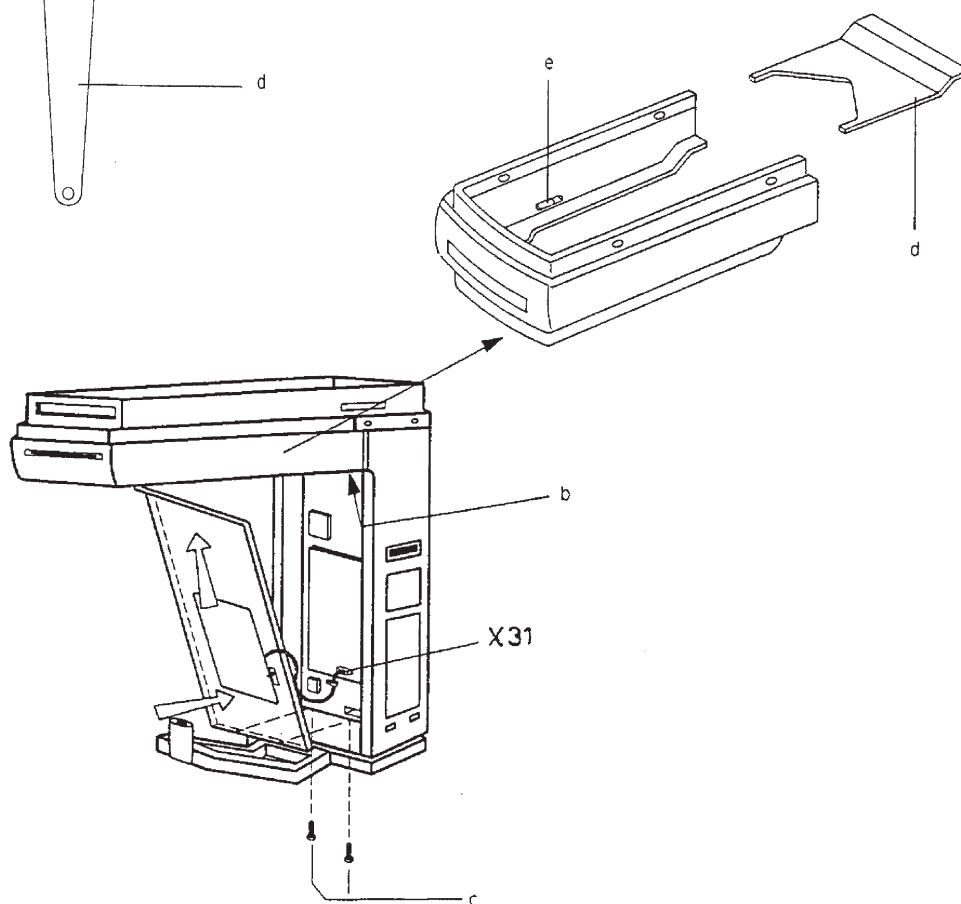
Do not install the top cover of the ceph arm till all the ceph alignments are done (see Section C and Section F of this Service Manual).

B.5.5 Mounting the front panel with mirror

The front panel with mirror is supplied disassembled from the Z-carriage.

To mount it proceed as follows:

1. Turn the rotating arm to the 90° position and move it in order to have adequate access to the electronic rack.
2. Fit the top of the front panel with mirror into the slot (b) of the Z-carriage.
3. Connect the two centering lights (laser projectors) to connector X31 of the system control board PC1.
4. Check the proper insertion of cover (d) into the springs (e).
5. Lastly, close the front panel and fix it by means of the two Allen screws M5x15 (c) provided.



B.5.6 Mains voltage programming

The Orthoralix 9200 system can operate with a nominal mains voltage in the 115 VAC to 250 VAC range.

The voltage range is selected automatically by the internal electronic circuit.

For the detailed mains requirements please refer to Section A Electrical data.

B.5.7 Connection to the mains

The system is selected for a single phase mains supply.

If the mains supply available is less than 150 VAC, replace the fuses F1-F2 10A on the mains filter board, with the 15A fuses supplied.



Before connecting to the mains, ensure that no dangerous voltages are present.

Case A: Single phase mains supply

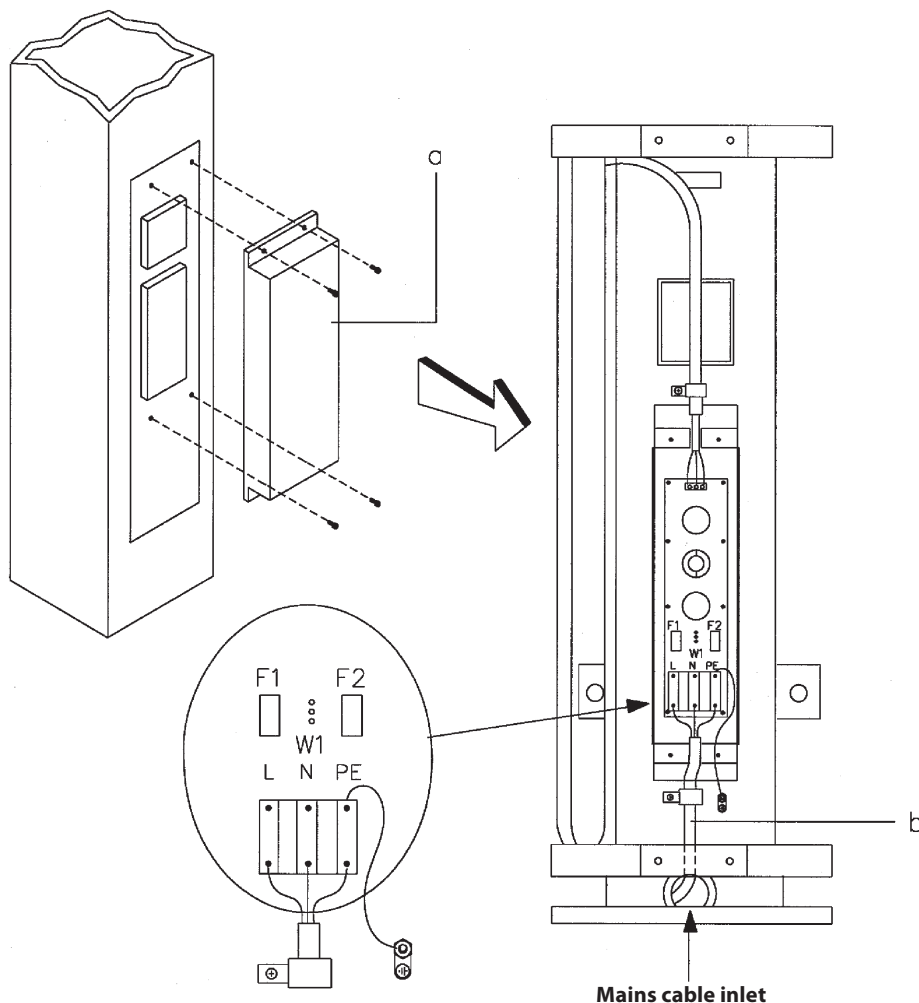
For the connection to the mains proceed as follows:

1. Remove the cover (a) from the column (4 screws).
2. Feed the mains supply cable (b) through the hole provided into the column.
3. Connect the hot wire (L), the neutral wire (N), and the ground wire (Y/G) to the mains connection points (see figure below) of the mains filter board.

Case B: Double phase mains supply

If only a double phase mains supply is available, proceed as follows:

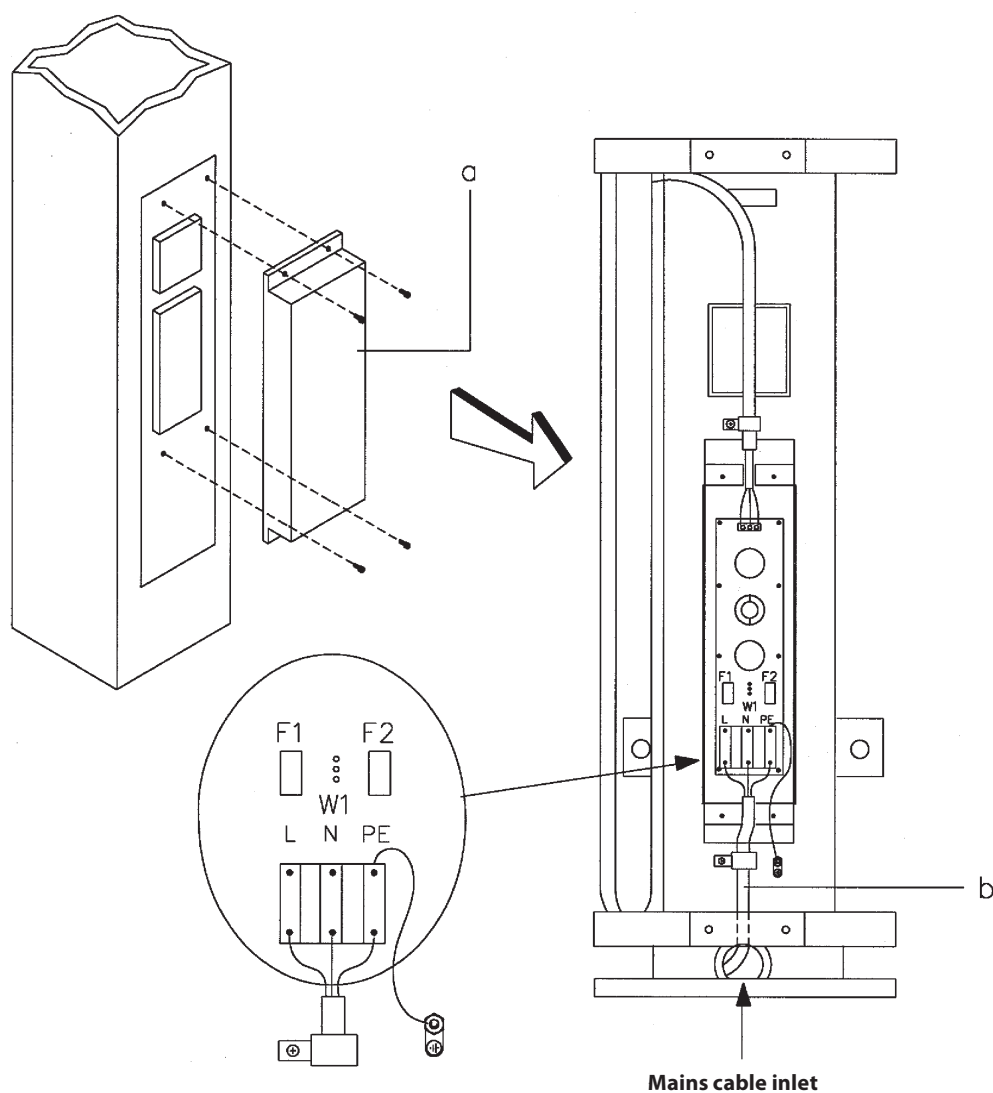
1. Remove the cover (a) from the column (4 screws).
2. Feed the mains supply cable (b) through the hole provided into the column.
3. Locate jumper W1 on the mains filter board: remove it in order to insert the second mains fuse F2.
4. Connect the hot wire (L), the neutral wire (N), and the ground wire (Y/G) to the mains connection points (see figure below) of the mains filter board.



B.5.8 Checking mains polarity

To check the proper electrical polarity of live and neutral wires, proceed as follows:

1. Connect an AC voltmeter between the live terminal of mains connection points and the protective ground screw.
2. Turn on the room supply and check that the full line voltage is measured: if not, reverse the mains connection points and repeat.
3. Also check that in the same conditions no voltage is present between the neutral terminal of the mains connection points and the protective ground screw.
4. Mount the cover (a) on the column.



B.5.9 Installing the remote control box

A remote control box is available for the Orthoralix 9200 system, to be installed on the wall.

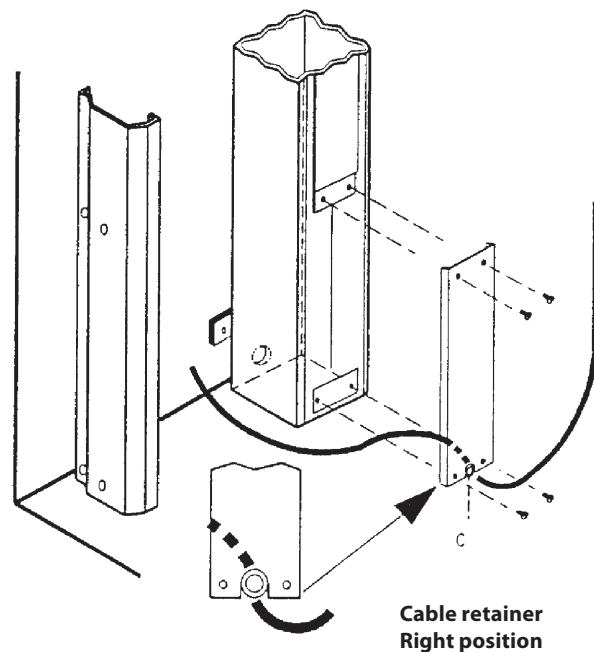
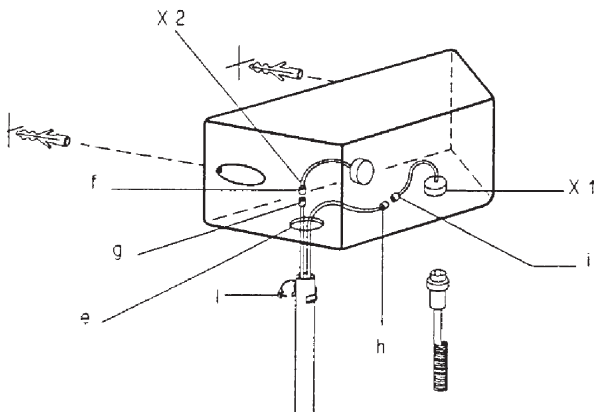
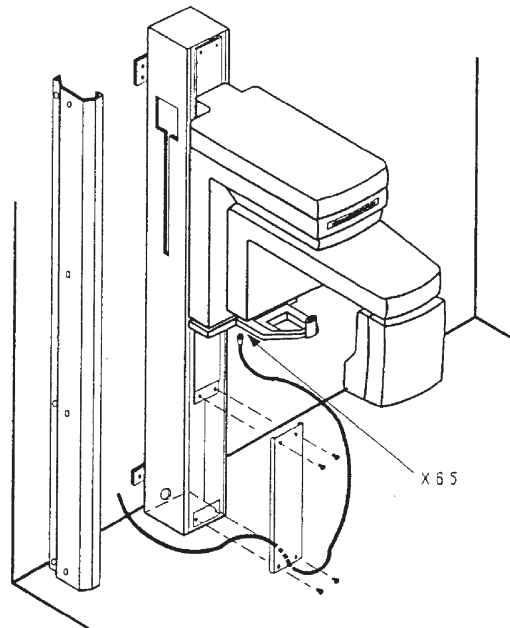
A 20 m. cable is supplied, to connect the control box to the Z-carriage.

To mount the remote control box proceed as follows:

1. Feed the connecting cable through the cable inlet at the rear of the column.
2. Check that the cable retainer (c) is at the end of the coiled cable.
3. Plug the coiled end of the connecting cable into socket X65 of the Z-carriage.
4. Place the remote control box on the desired installation site on the wall and mark the fixing holes.
5. Drill the holes and fit the expanders.
6. Feed the connecting cable through the hole (e) of the remote control box.
7. Connect (f) to (g) (X2) and (h) to (i) (X1).
8. Fit the cable retainer (l) on the connecting cable and push it into the hole (e).
9. Fix the remote box to the wall with two screws.
10. Connect the exposure handswitch to socket X1 of the remote control box and hang it on the hook provided.



In order to comply with Federal regulations this remote box must be installed so the technique factors are visible to the operator from the remote location.



B.5.10 Mounting the z-carriage covers



Before finally mounting the covers it is advisable to complete the actions described in section C "Setting to work", where free access to the internal parts of the system may be required.

To complete the mechanical installation, the Z-carriage covers must be mounted, as follows:

1. Mount the top cover (a) of the Z-carriage with six screws.

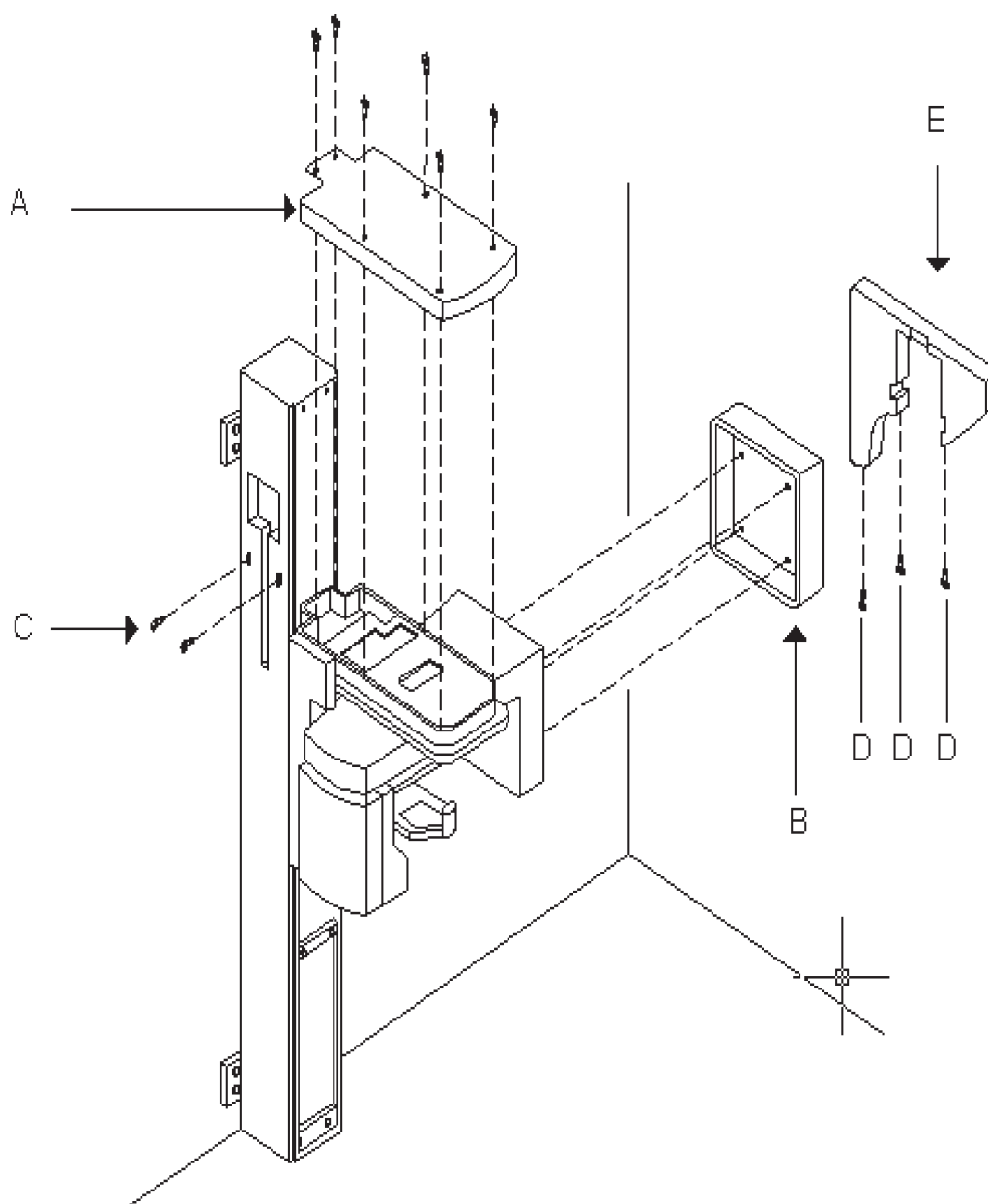
2. Mount the rear cover (b) of the cassette unit by simply pushing it into the spring latches provided.

For the Orthoralix 9200 DDE versions, install the back rear cover of the DMU holder (e), by pushing it into the spring latches provided and by fixing it with the three screws (d).

3. Remove the two screws (c) locking the counterweight carriage.



Do not move the Z-carriage along the column when the system is off: doing so it could damage the PC6 board.



B.5.11 Creating a network connection for the Orthoralix 9200

B.5.11.1 Orthoralix 9200 DDE/Ceph

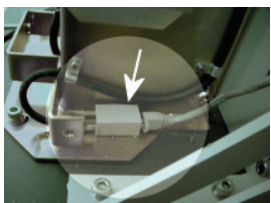





Contact an office administrator to determine the static IP address that should be assigned to the Orthoralix 9200 before the configuration steps are performed.

To create a network connection for the Orthoralix 9200, there are two options: directly to a PC or through a networking device (router, hub, switch, etc.). If you will connect the 9200 directly to a PC, you must use a crossover cable. A 10 m. (32 ft.) crossover cable is supplied, but a crossover cable that is no longer than 25 m. (82 ft.) can be used. If you will be using a networking device, an ordinary CAT-5 Ethernet cable is used. A 10 m. (32 ft.) Ethernet cable is supplied, but an Ethernet cable that is no longer than 25 m. (82 ft.) can be used.

Before you begin these steps, make sure you have a PC set up and positioned to be used as the workstation that will receive images from the 9200. This PC must have a working Ethernet Network Interface Card (NIC) already installed. Perform the following steps to configure the 9200 network connection:

Connecting directly to a PC (static IP address)


1. Connect the crossover cable from the PC's NIC to the Ethernet port at the base of the 9200 column next to the mains power switch.
 
2. Install the imaging application software on the PC.
3. Insert the GxPicture CD-ROM into the PC's CD-ROM drive and install the ActiveX driver for the Orthoralix 9200. Refer to the GxPicture Quick Installation Guide for more information regarding this software. An icon will appear on your PC's desktop that can be used to launch the Configuration Manager.
4. Insert the supplied CD-ROM and install the necessary sensor.dat file. An icon for the Orthoralix 9200 will appear in the system tray near the clock on your PC's desktop. This icon can be used to launch the Orthoralix DDE Setup Screen.
5. Turn off the Orthoralix 9200.
6. Press and hold the No Radiation  and Patient Selection  buttons on the 9200 control panel. While holding them, turn on the power. This will start Service Mode.
7. Press the Anterior Carriage Movement  button several times until the IP address appears on the display. If you need to change the IP address, use the following buttons:


kV Decrease and Increase: Use these to change the first set of numbers (ex. XXX.16.137.180)

mA Decrease and Increase: Use these to change the second set of numbers (ex. 172.XXX.137.180)

s Increase or Decrease: Use these to change the third set of numbers (ex. 172.16.XXX.180)

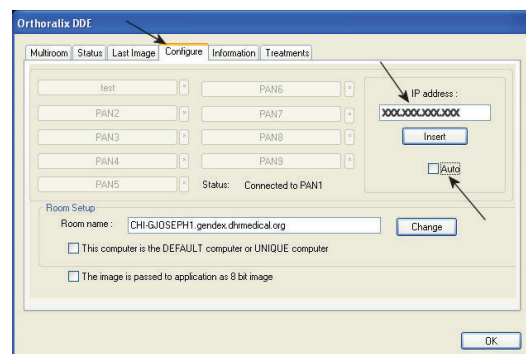
Projection Browsing: Use these to change the fourth set of numbers (ex. 172.16.137.XXX)

When you are finished making any changes, press and hold the No Radiation  button to save the new IP address.

8. Press the Anterior Carriage Movement  button until the Subnet Mask is displayed. To change the Subnet Mask, use the same buttons that were used when changing the IP address. When you are finished, press and hold the No Radiation button to save the new Subnet Mask.
9. Turn the 9200 off and then on.
10. Click Windows **Start**, **Run**, type `cmd`, and then click **OK**. Type `ipconfig` and press Enter. This will display the IP information of your computer which you will need to know in the next step.
11. Click the DDE Pan icon in the system tray.



12. Click the Configure tab and then deselect Auto.

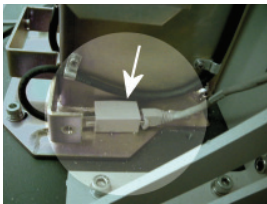


13. Type the IP address from the Command window, click **Insert**, and then click **OK**.
14. Press the Reset button on the 9200 control panel.

If any of the network information does not match between the PC and the 9200, perform the following steps:

1. Click Windows **Start** and then **Run**.
2. Type `cmd` and click **OK**.
3. Type `ping x.x.x.x` (where x.x.x.x is the IP address) and press Enter.
4. Repeat Steps 6 through 10 of the installation instructions.

Connecting to a networking device (dynamic IP address)

1. Connect the Ethernet cable from an available Ethernet port on the networking device to the Ethernet port at the base of the 9200 column.
 
2. Install the imaging application software on the PC.
3. Insert the GxPicture CD-ROM into the PC's CD-ROM drive and install the ActiveX driver for the Orthoralix 9200. Refer to the GxPicture Quick Installation Guide for more information regarding this software. An icon will appear on your PC's desktop that can be used to launch the Configuration Manager.
4. Insert the supplied CD-ROM and install the necessary sensor.dat file. An icon for the Orthoralix 9200 will appear in the system tray near the clock on your PC's desktop. This icon can be used to launch the Orthoralix 9200 Settings Manager.
5. Turn off the Orthoralix 9200. If you only have one machine to install, please proceed to Step 10. Continue to Step 6 if you have more than one machine to install or already installed.
6. Press and hold the No Radiation and Patient Selection buttons on the 9200 control panel. While holding them, turn on the power. This will start Service Mode.
7. Press the Anterior Carriage Movement button several times until the IP address appears on the display. The default IP address of 10.10.10.1 is set in the factory. If you have more than one 9200 or need to change the IP address for some other reason, use the following buttons:

kV Decrease and Increase: Use these to change the first set of numbers (ex. XXX.16.137.180)

mA Decrease and Increase: Use these to change the second set of numbers (ex. 172.XXX.137.180)

s Increase or Decrease: Use these to change the third set of numbers (ex. 172.16.XXX.180)


Projection Browsing: Use these to change the fourth set of numbers (ex. 172.16.137.XXX)

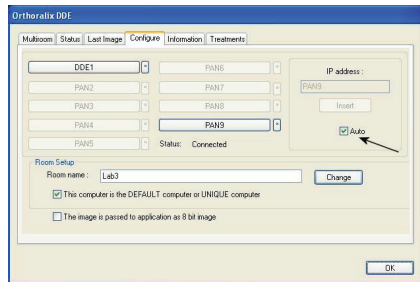


Note: If you have more than one 9200, you only need to change the last set of numbers in the IP address to something between 2 and 9 (i.e. 10.10.10.7).

When you are finished making any changes, press and hold the No Radiation button to save the new IP address.

8. Press the Anterior Carriage Movement button until the Subnet Mask is displayed. The default Subnet Mask is If you need to change the Subnet Mask, use the same buttons that were used when changing the IP address. When you are finished, press and hold the No Radiation button to save the new Subnet Mask.
9. Turn the 9200 off and then on.

10. Click the DDE Pan icon in the system tray.
 

11. Click the Configure tab, make sure Auto is selected, and then click **Insert**.
 

12. Press the Reset button on the 9200 control panel.

If any of the network information does not match between the PC and the 9200, perform the following steps:

1. Click Windows **Start** and then **Run**.
2. Type `cmd` and click **OK**.
3. Type `ping x.x.x.x` (where x.x.x.x is the IP address) and press Enter.
4. Repeat Steps 6 through 10 of the installation instructions.



Note: Whenever you replace the PC104 board within the 9200, you must restart the PC is is connected to.

Icon Status

The following descriptions indicate the various states of the Settings Manager icon in the system tray.

Blue and Green: There is a good connection between the PC and the DDE.

Red: That is no connection between the PC and the DDE. Verify your settings and redo the installation instructions.

Yellow X: There is a connection, but another user is in control of the DDE. To change this, go to the Orthoralix DDE Setup Screen, click the Multiroom tab, and then click Take Control. It may take a few moments before control is transferred.

Red X: There is a connection but the Sensor.dat file is missing. Re-install the file from the Installation CD-ROM.

B.5.12 Mounting the column covers and the quick reference guide

To mount the covers of the column proceed as follows:

1. Switch on the system and raise the Z-carriage to the highest position.



Do not move the Z-carriage along the column when the system is off; doing so it could damage the PC6 board

2. Mount the bottom front cover (a) of the column by means of four screws (b).



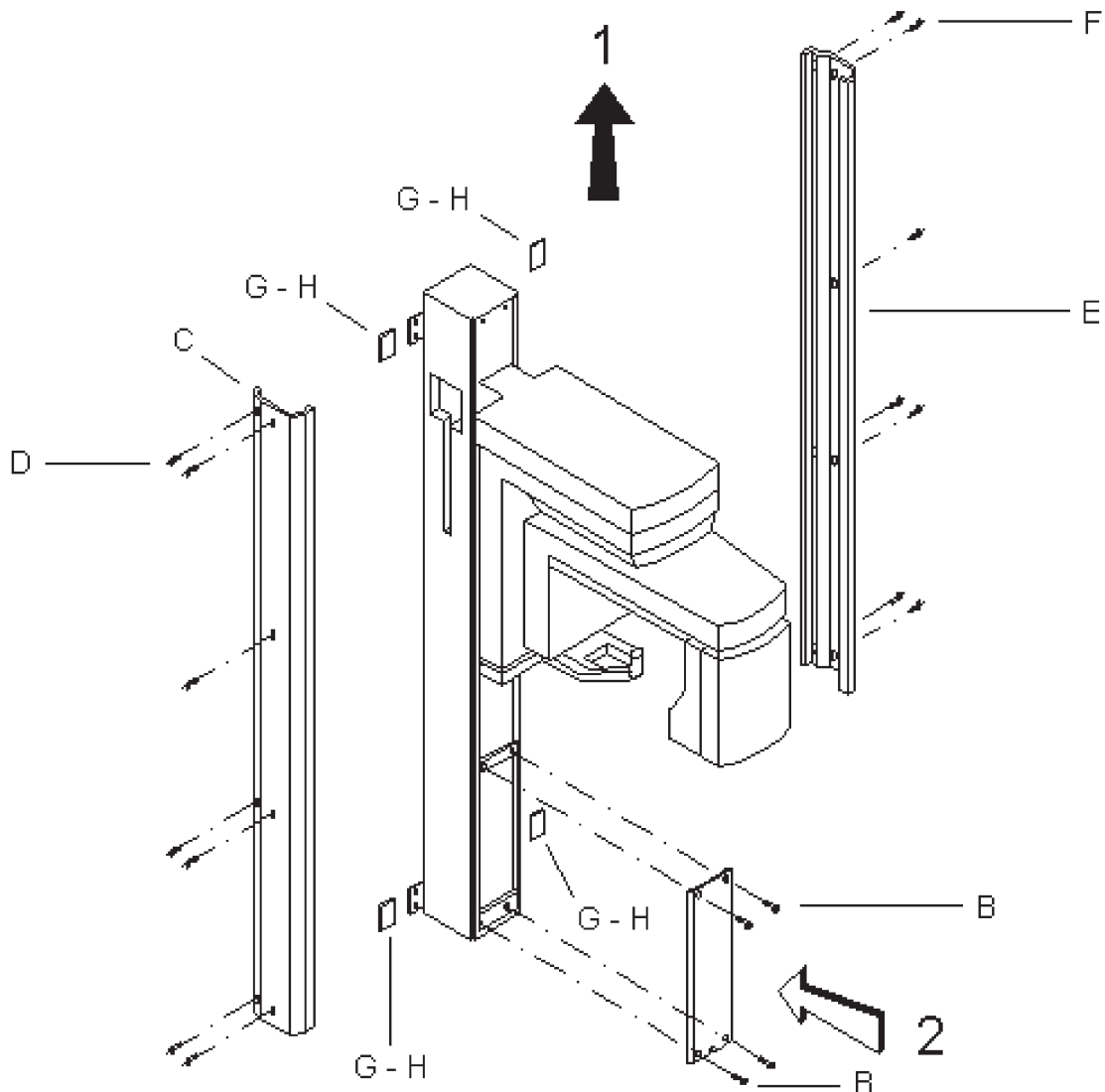
Be sure that the cable retainer of the X-ray command cable is in the right position.

3. Mount the four covers (g) on the four column wall brackets, by means of two screws (h) for each one.
4. Mount the right lateral cover (e) of the column by means of seven screws (f).
5. Mount the left lateral cover (c) of the column by means of seven screws (d).



Be sure that the mains cable and the remote control cable pass through the correct cable inlets.

6. With the system are available two Quick Reference Guide labels, one for the Orthoralix 9200/Plus and the other one for the Orthoralix 9200/Plus/DDE; select the correct one and install it on the right cover of the column, so that the lower edge of the label is at about 1 m from the floor.



B.5.13 Installing the ceph formats

B.5.13.1 Orthoralix 9200/Plus/Ceph

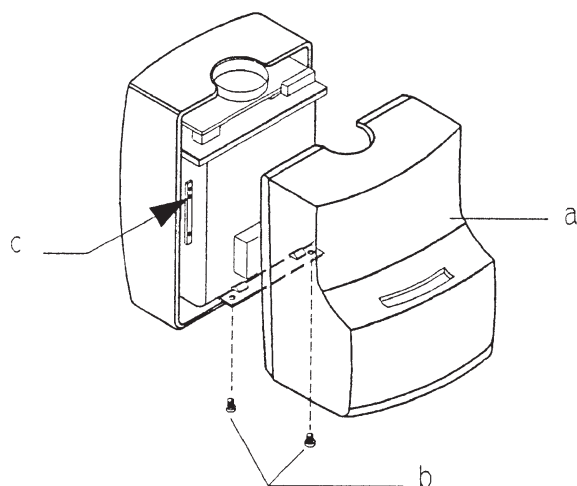
The following lead plates supplied with the system allow for different Ceph X-rays formats:

- a) 24 x 18 cm vertical asymmetric for latero-lateral projection
- b) 18 x 24 cm horizontal for latero-lateral projection
- c) 24 x 18 cm vertical symmetric for antero-posterior or postero-anterior projection
- d) 30 x 24 cm vertical symmetric for all projections

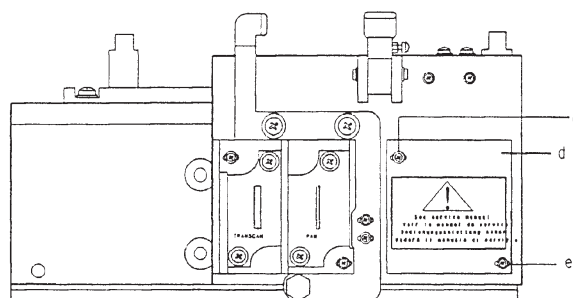
Two of the above listed formats can be installed, normally one for the latero-lateral projection and one for the antero-posterior/postero anterior projection.

To install the selected formats on the collimator, proceed as follows:

1. Remove the front cover (a) of the tubehead by unscrewing the two screws (b) and by disengaging the spring latches from the rear cover (c).



2. Remove the plate (d) from the collimator by unscrewing the two screws (e).



3. Install the lead plate guide (f) on the collimator, using the two screws provided.

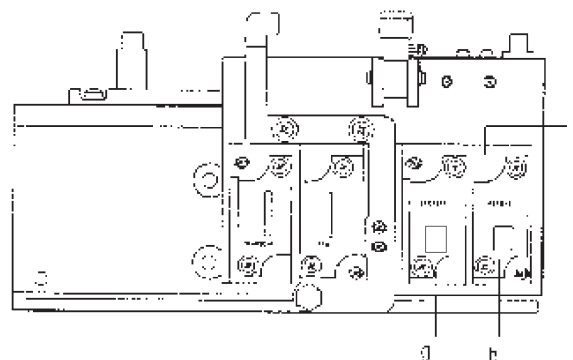


If different screws are used instead of the one supplied, it is possible:

- to damage the thread.
- to have interference between the fixed and the mobile parts of the collimator.

4. Two lead plates are already mounted on the plate:
 - the 24 X 18 cm vertical asymmetric for the latero-lateral projection in the position (g).
 - the 24 X 18 cm vertical symmetric for antero-posterior or postero-anterior projection in the position (h).

Please ask to the user which ceph formats are more convenient among the available and, if necessary, replace the one (s) already mounted.



Before remounting the tubehead front cover, adjust the X-ray field of the Ceph formats as described in the Section C.

B.5.13.2 Orthoralix 9200 DDE/Ceph

Two lead plates are supplied with the system to allow all the following Ceph X-rays formats:

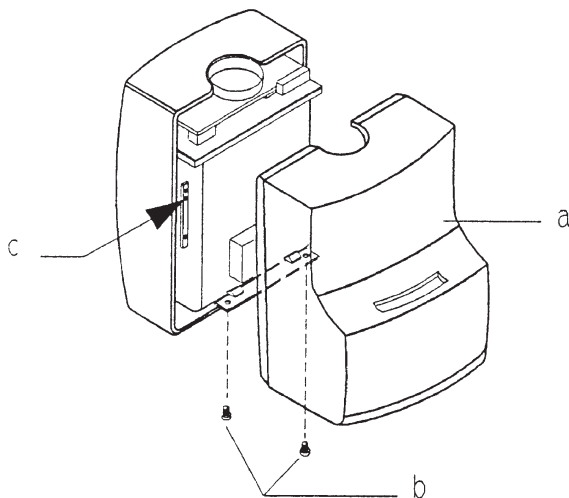
- a) one lead plate height 18 cm (H 18 written on the lead plate) suitable for:
 - latero-lateral horizontal projection 18 x 24 cm
- b) a second lead plate height 22 cm (H 22 written on the lead plate) suitable for:
 - latero-lateral vertical projection 22 x 18 cm
 - latero-lateral max. projection 22 x 24 cm
 - antero-posterior vertical projection 22 x 18 cm
 - antero-posterior max. projection 22 x 24 cm
 - postero-anterior vertical projection 22 x 18 cm
 - postero-anterior max. projection 22 x 24 cm



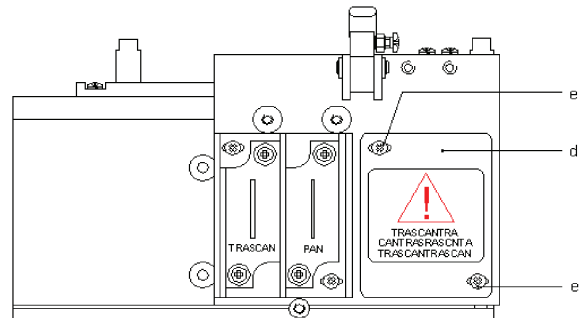
Do not install the lead plates on the collimator till all the ceph alignments are done (see Section C and Section F of this Service Manual).

These lead plates are already installed on the lead plate guide supplied with the ceph arm; this lead plate must be installed on the collimator by following the procedure below:

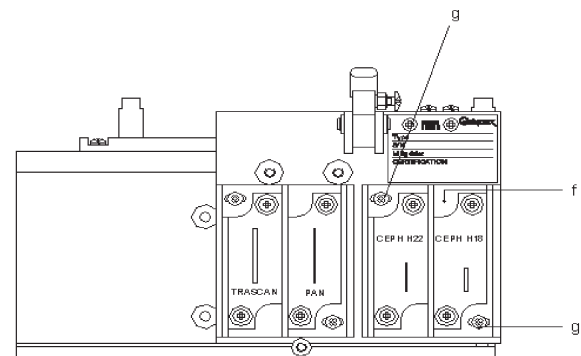
1. Remove the front cover (a) of the tubehead by unscrewing the two screws (b) and by disengaging the spring latches from the rear cover (c).



2. Remove the plate (d) from the collimator by unscrewing the two screws (e).



3. Install the lead plate guide (f) on the collimator, using the two screws (g) provided.



If different screws are used instead of the one supplied, it is possible:

- to damage the thread.
- to have interference between the fixed and the mobile parts of the collimator

Before remounting the tubehead front cover, adjust the X-ray field of the Ceph formats as described in the Section C.

B.5.14 Installing the soft tissues filter

The soft tissues filter must be mounted after the centering of the cephal X-ray field as described in the section C and F of this manual.

For the mounting of the soft tissues filter see the following procedure:

1. Put the position adjusting lever (a) in the vertical position: in this way the soft tissues filter is corresponding to the position 2 (see the reference label placed on the tubehead front cover).
2. Mount the soft tissues filter (c) on the position lever using the two screws (b), so that the distance between the middle position of the filter and the opposite side of the lead plate is:
 - 7 mm for the 24 X 18 cm vertical asymmetric
 - 10.5 mm for the 18 X 24 cm horizontal asymmetric or 30 X 24 cm.

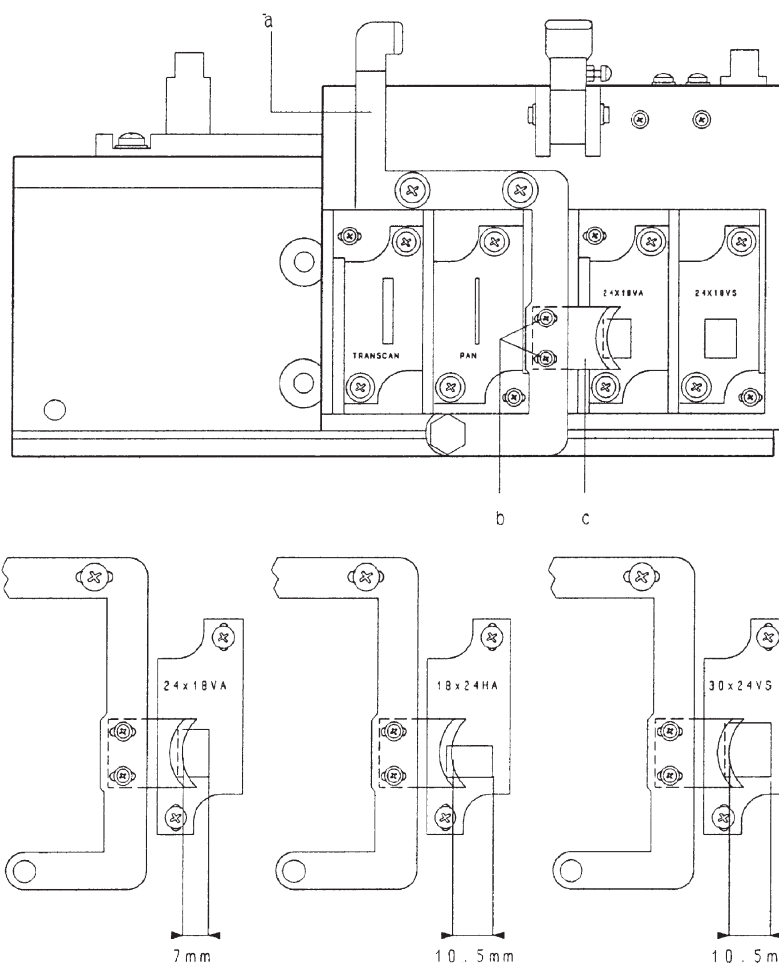
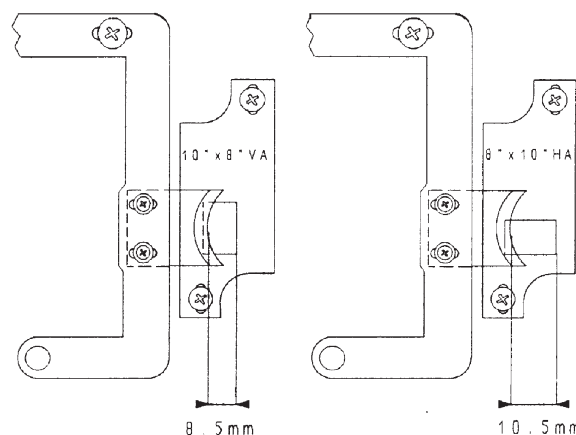
Do not change the position of the adjusting lever during the measurement.



In the Orthoralix 9200 DDE Ceph, the soft tissues filter is not present: the filtration for the soft tissues is done during the image acquisition.

For the USA versions, the distance between the middle position of the filter and the opposite side of the lead plate is:

- 8.5 mm for the 10" x 8" vertical asymmetric.
- 10.5 mm for the 8" x 10" horizontal asymmetric.



B.6 Upgrades

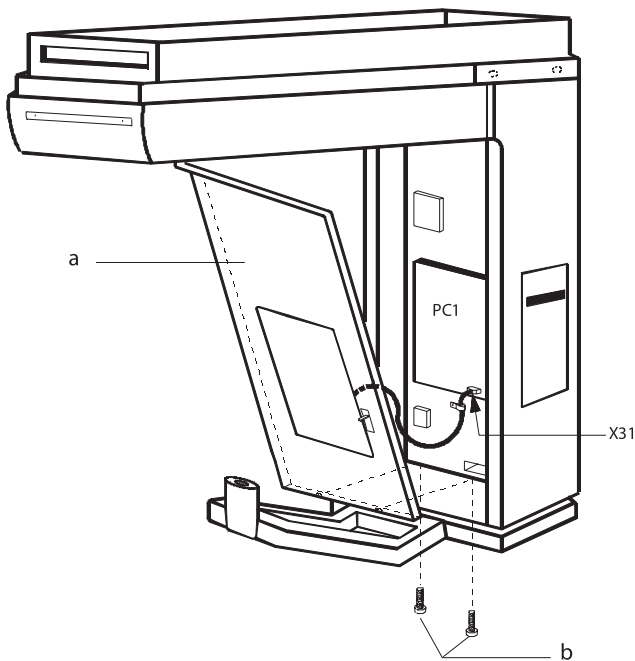
B.6.1 Field upgrading to the ceph version

For field upgrading to the CEPH version refer to the relevant Service Manual supplied with the Ceph arm for detailed installation instructions.

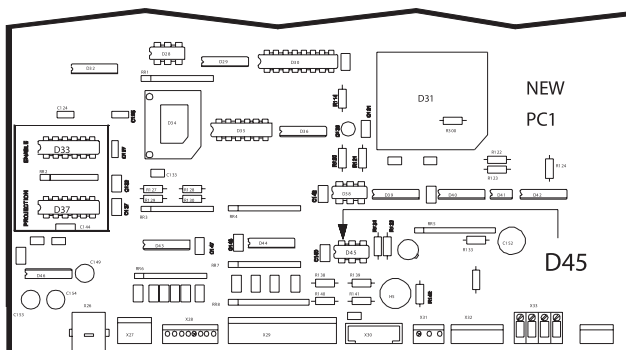
B.6.2 Field upgrading to the transcan version

For the field upgrading to the Transcan version, follow the instructions below:

1. Switch off the system.
2. Remove the panel with the mirror (a) by unscrewing the screws (b) and disconnect the connector X31.



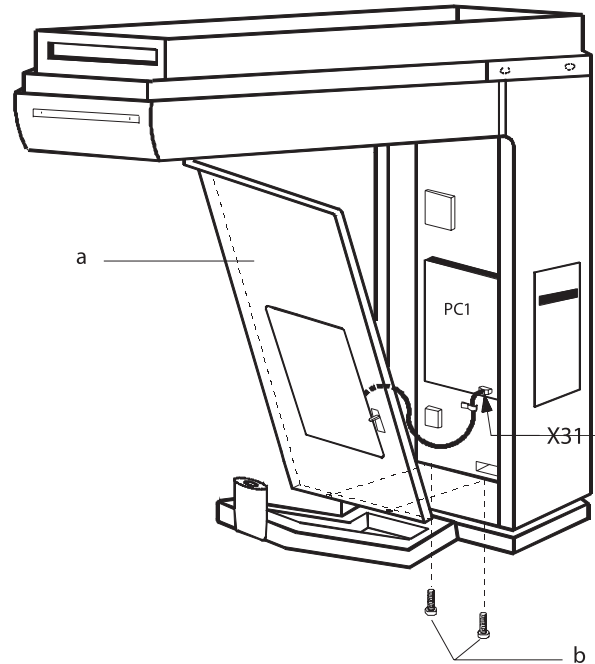
3. Install the integrated circuit that enables the Transcan projections (supplied with the kit) on the PC1 control board into the socket D33 or D37 indifferently.



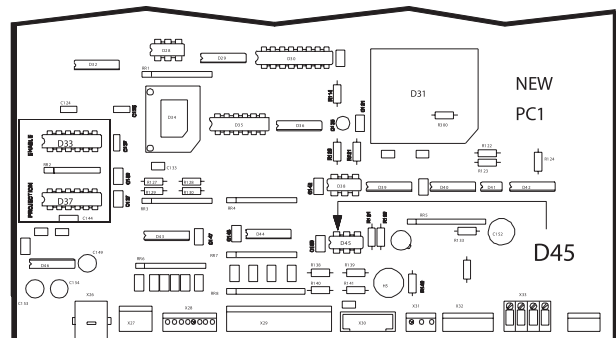
B.6.3 Field upgrading to the dmf version

For field upgrading to the DMF (Dento-maxillo facial) version, follow the instructions below.

1. Switch off the system.
2. Remove the panel with the mirror (a) by unscrewing the screws (b) and disconnect the connector X31.



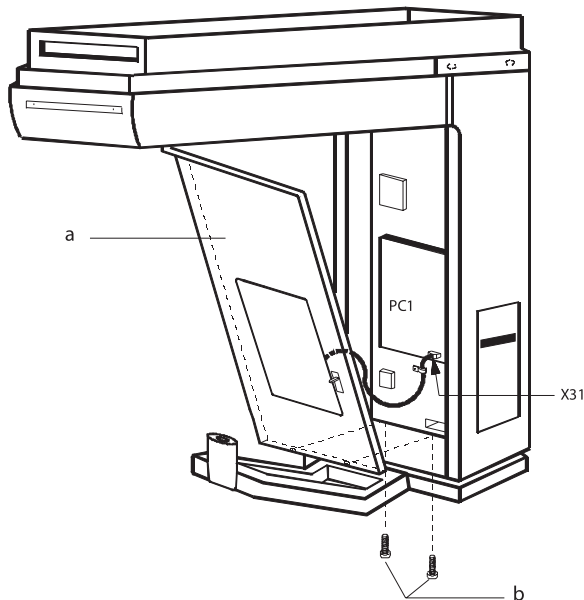
3. Install the integrated circuit that enables the DMF projections (supplied with the kit) on the PC1 control board into the socket D33 or D37 indifferently.



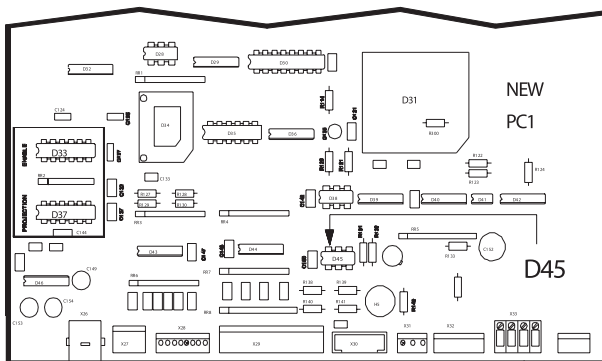
B.6.4 Field upgrading to the "plus" version

For field upgrading to the PLUS version, follow the instructions below:

1. Switch off the system.
2. Remove the panel with the mirror (a) by unscrewing the screws (b) and disconnect the connector X31.



3. Install the two integrated circuits (one enabling the DMF projections and one enabling the Transcan projections) supplied with the kit on the PC1 control board into the socket D33 and D37 indifferently.



B.7 Options

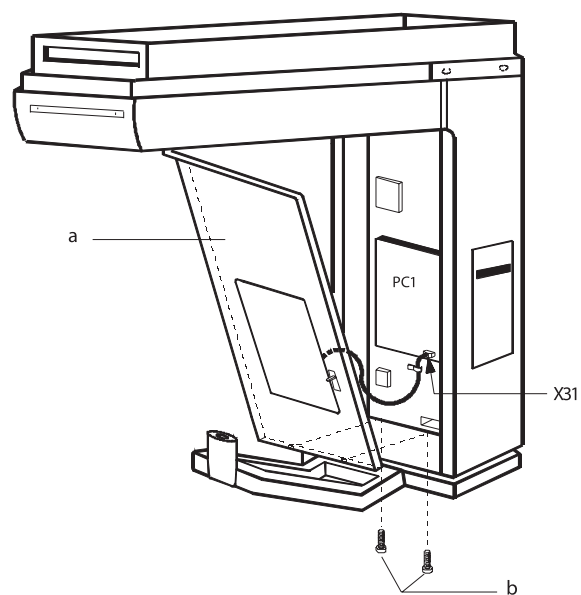
B.7.1 External lights connection

A kit code 4519 105 20691 is available for external light connection.

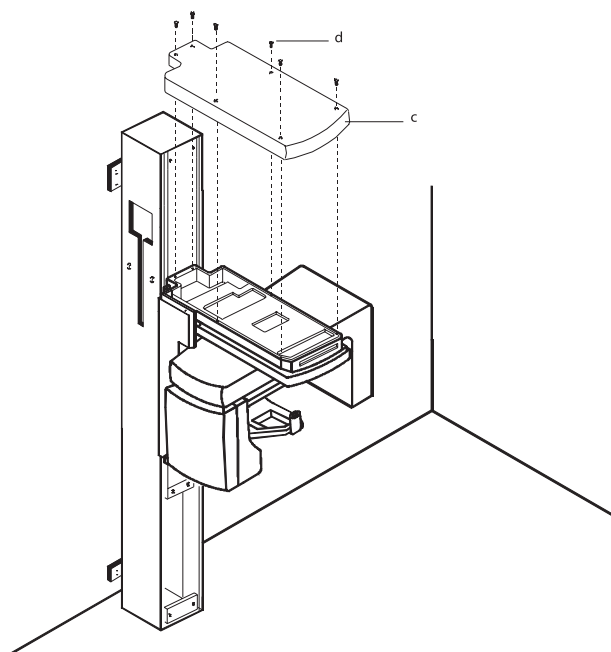
The kit is providing control signals for two lights that must be mounted externally to the room: one light is used to show the system ready condition (stand-by condition) and the second one is turned on during the X-ray exposure time.

Follow the instructions below for the mounting of the option:

1. Remove the front panel with the mirror (a) by unscrewing the two screws (b), and disconnect the connector X31.

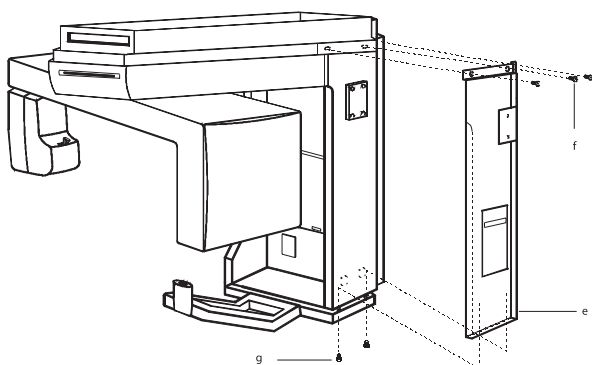


2. Move down the Z-carriage and remove the top cover (c) by unscrewing the six screws (d).

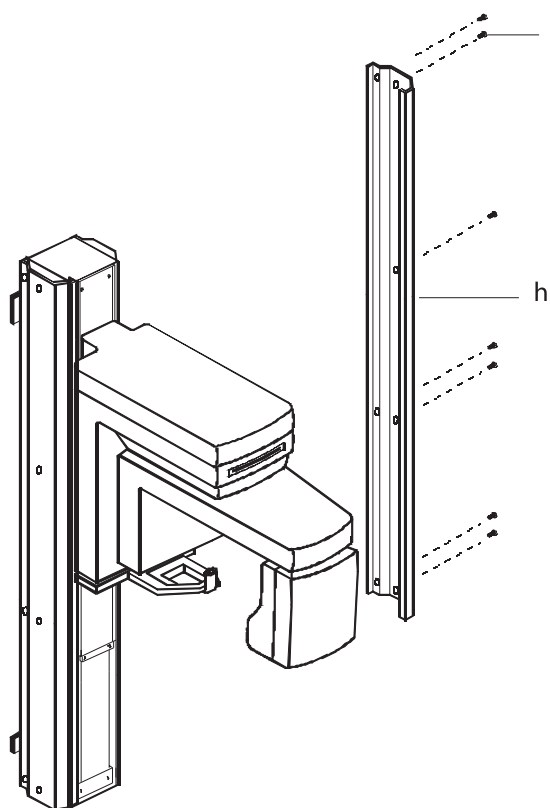


Do not move the Z-carriage along the column when the system is off: doing so it could damage the PC6 board.

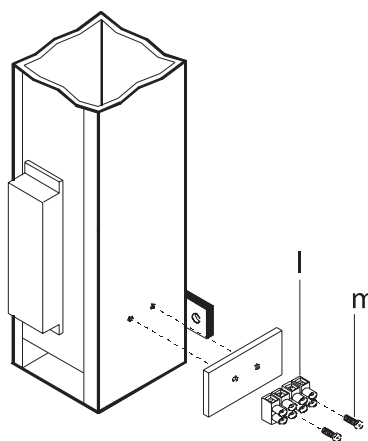
3. Remove the cover of the keyboard (e) by unscrewing the three screws (f) and the two screws (g).



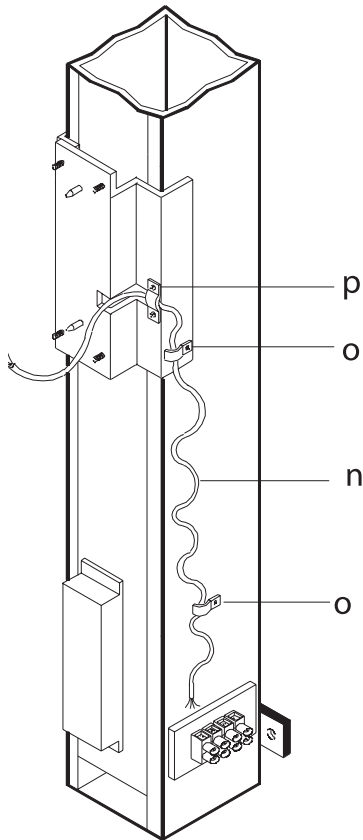
4. Remove the right lateral column cover (h) by unscrewing the seven screws (i).



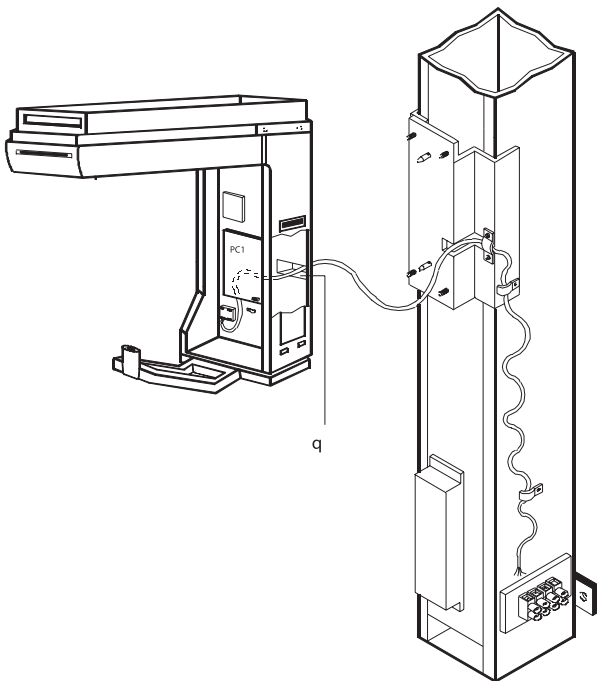
5. Mount the plate with the terminal block (l) on the column by fixing it with two screws (m).



6. Fix the cable (n) on the column by using the cable retainers (o) and (p) supplied.



7. Feed the spiral cable in the Z-carriage through the hole (q) provided.



8. Connect the cable to the connector X33 of the PC1 board:
- | | |
|-------|-------------|
| X33-1 | RED WIRE |
| X33-2 | BLACK WIRE |
| X33-3 | WHITE WIRE |
| X33-4 | YELLOW WIRE |

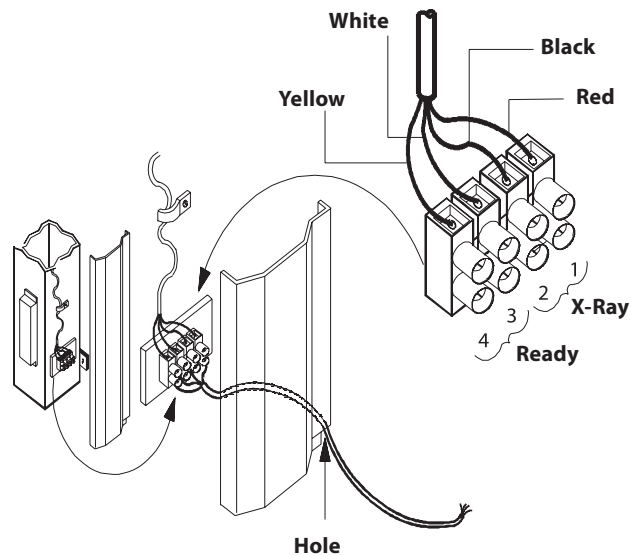
9. Connect the cable to the terminal block of the column, as shown in the figure below.

10. Connect the external lights to the terminal block of the column (for more information see also the principle diagram (Z-15)).

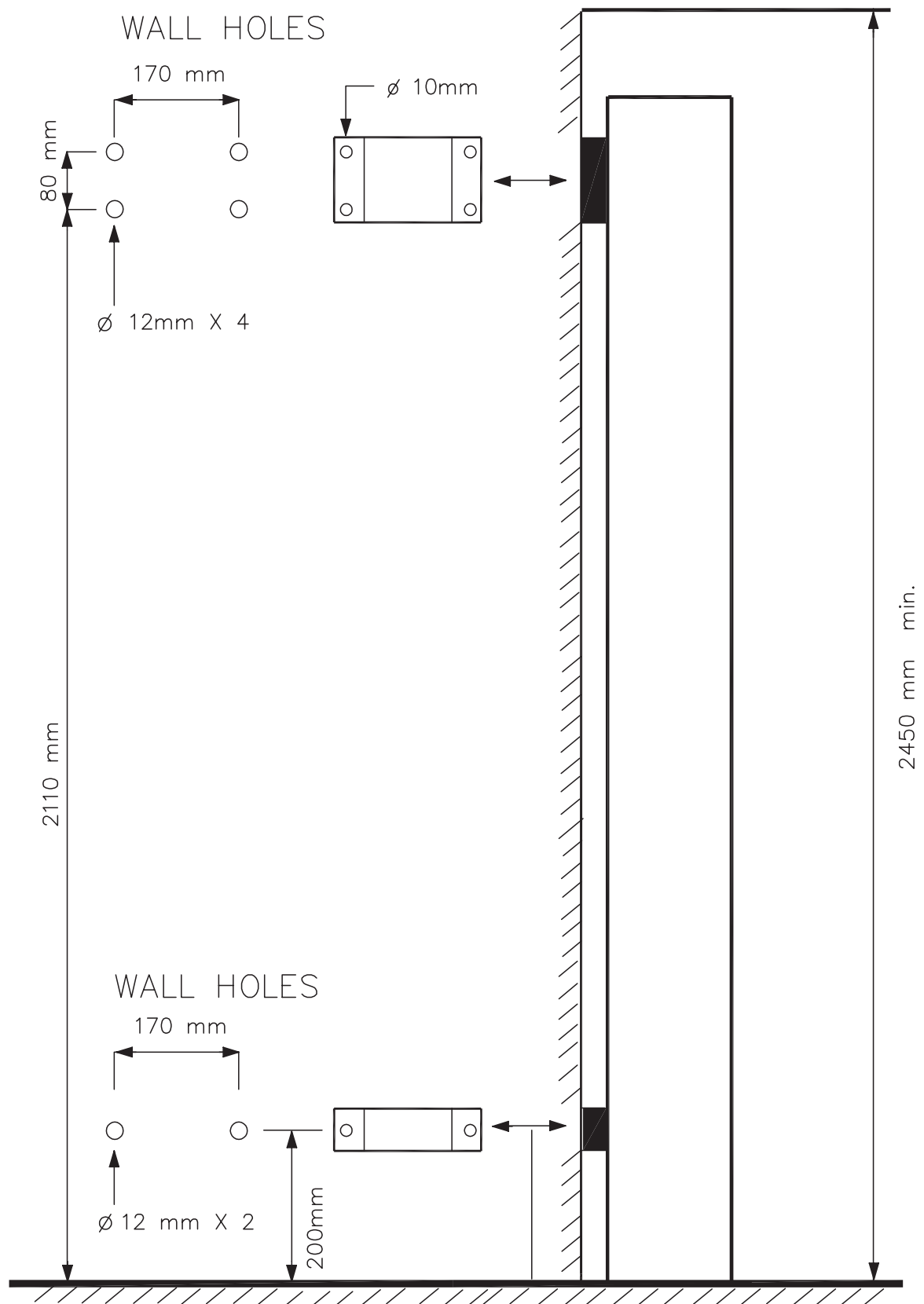
11. Mount back the right lateral column cover taking care to feed the external light cable connection through the hole provided (see figure below).

12. Mount back the following covers:

- top cover Z-carriage
- keyboard cover
- front panel with mirror (connect the connector X36 to the PC1 system control board).



B.8 Column wall fixation



B.9 Check list

The following parts are included in the delivery:

Column

Counterweight	2
Bolts for wall fixation	6
Additional bracket for wall fixation	4
Nuts M10	4
Lock washer	4

Z-Carriage

Front cover with mirror	1
Top cover	1
Cassette driver cover	1
Chin rest	1
Chin rest for TMJ	1
Alignment tool for TMJ	1
Bite block	1
Hygienic bags for bite block	100
Knob	2
Image quality phantom	1
Exposure handswitch	1
Remote control box	1
Fuses: T2A, T1A, T500mA, F1.25A, F1A, F8A	1 for each
Fuses: F15A, T3.15A, F10A	2 for each
Fuse F1A	5
Screw M5x12	8
Washer	2
Lock washer	8
X-ray cassette 15x30 cm with Kodak Lanex Medium (not for DDE versions)	1
X-ray films Kodak Ektavision G (not for DDE versions)	1 box of 10
Service Manual	1
Operator's Manual	1
Transcan positioning kit (only for Plus versions)	1
Quick reference guide	2
Crossover Ethernet cable (DDE versions only)	1
Cat.5 Ethernet cable (DDE versions only)	1
VixWin CD-rom (DDE versions only)	1

Ceph arm

Assy nasion	1
Ear plugs	2
Hygienic bags for ear plug	280
Counterweight	1
Additional counterweight (DDE versions only)	2
Soft tissue filter (not for DDE versions)	1
Lead plate 18x24 HA (not for DDE versions)	1
Lead plate 24x30 VS (not for DDE versions)	1
Lead plate H18 (DDE versions only)	1
Lead plate H24 (DDE versions only)	1
X-ray cassette 18x24 cm with Kodak Lanex Regular (not for DDE versions)	1
Screw M3x8	2
Lock washer	2

B.10 Grounding Connection

Supplemental Installation Instructions (Orthoralix® 9200):

Grounding Connection to AC Service in Patient

Care Area

The following method shall be used to ground AC Service to the Orthoralix 9200 in patient care areas. These instructions supplement the installation instructions provided in the Orthoralix 9200 Service Manual, Section B.

Electrical connections to the equipment are made at the base of the column assembly. Remove hex bolts from left side and front column covers to obtain access to the electrical service area.

1. Create an opening for AC service to the equipment in the angled section of the left column side cover at the base of the column (see Figure 1). Size the opening in accordance with the type and size of the AC service being provided (e.g. metal conduit)

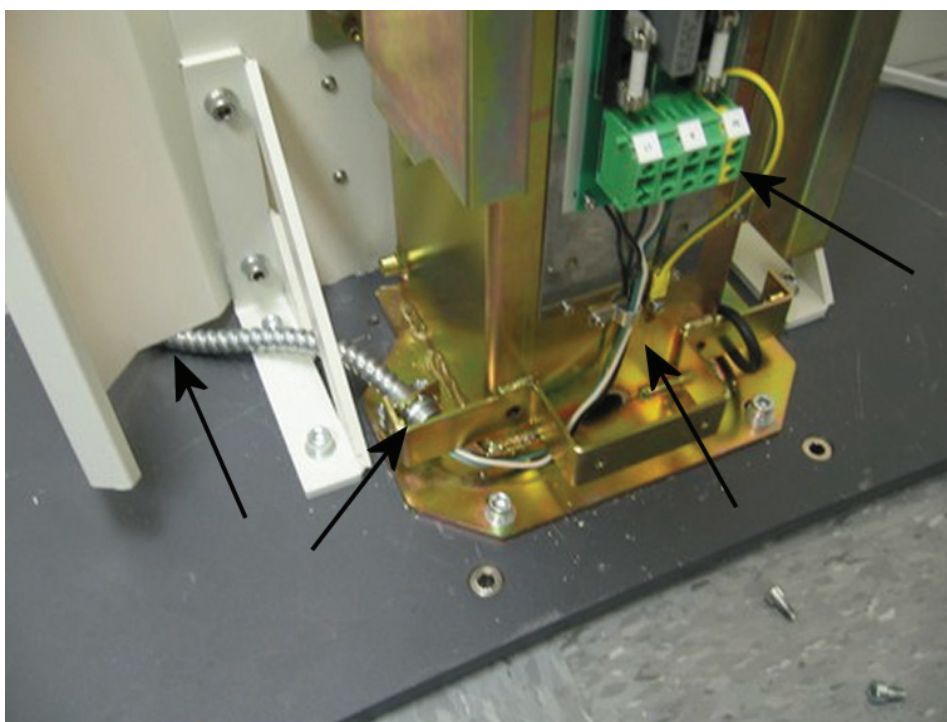


Figure 1: Column side cover (w/ indicated hole position), conduit clamp, strain relief, terminal strip

2. Route AC service through opening in the column side cover.

3. Ground AC service to L-bracket using an electrician supplied fitting listed for grounding, or other approved method in accordance with the local electrical code (see Figure 2). A 0.875" hole is provided in the bracket suitable for 1/2" conduit.

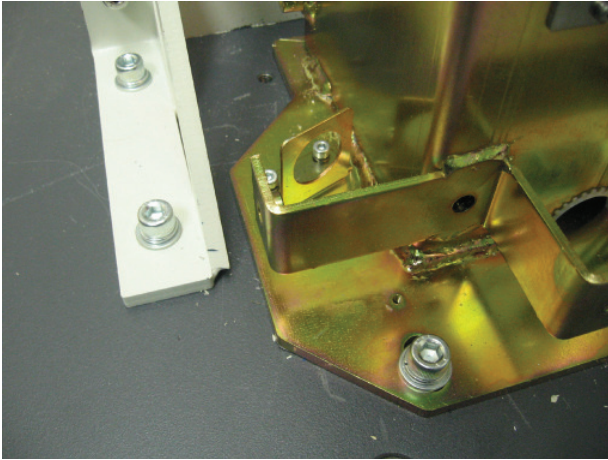


Figure 2: 'L' Bracket

4. Route Line, Neutral, and Earth Ground Conductors under side cover bracket and under front column cover bracket (see Figure 3).

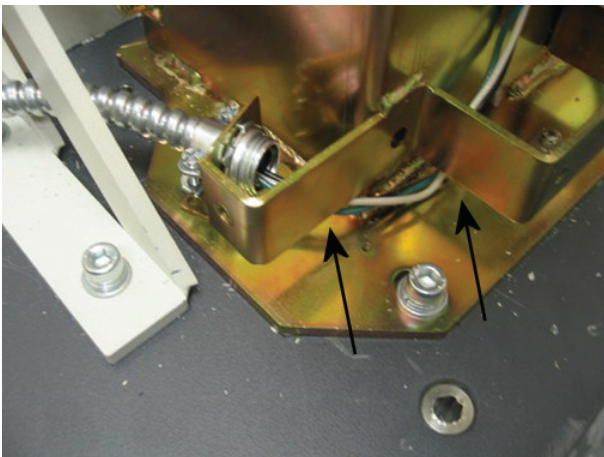


Figure 3: Routing under brackets

5. Terminate the conductors in the terminal strip and strain relief using the cable clamp located below the terminal strip (see Figure 1 for location of terminal strip and cable clamp).

6. Attach the front column cover assuring the wiring routes through the opening provided in the bottom left corner (see Figure 4).

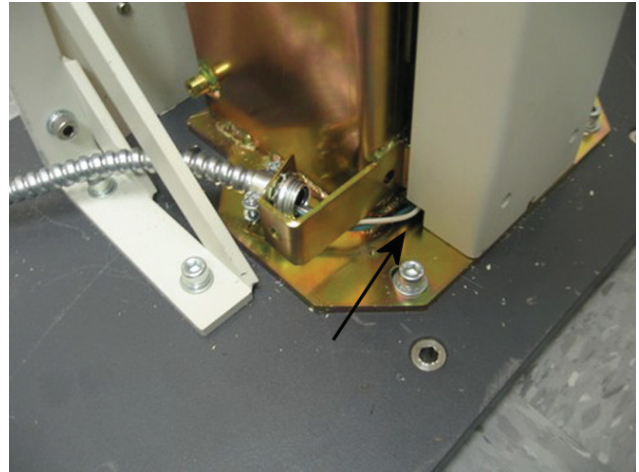


Figure 4: Front cover in place; arrow shows where wiring will route.

7. Attach the side cover to the column.

Setting to work



Table of contents

C.1 Introduction	C-1
C.2 Tools and instruments required	C-1
C.3 Controls and indicators	C-2
C.4 System initialization.....	C-3
C.4.1 Power on and default condition	C-3
C.4.2 Reset and dummy run.....	C-3
C.4.3 Conditioning the x-ray tube	C-3
C.5 Adjustments and checks	C-3
C.5.1 Alignment of x-ray field pan mode.....	C-3
C.5.1.1 Orthoralix 9200/Plus/Ceph.....	C-3
C.5.1.2 Orthoralix 9200 DDE.....	C-4
C.5.2 Alignment of x-ray field transcan mode	C-5
C.5.2.1 Orthoralix 9200/Plus/Ceph.....	C-5
C.5.2.2 Orthoralix 9200 DDE.....	C-6
C.5.3 Testing the centering of the system	C-7
C.5.4 Alignment of X-ray field ceph mode.....	C-8
C.5.4.1 Orthoralix 9200/Plus/Ceph.....	C-8
C.5.4.2 Orthoralix 9200 DDE.....	C-8
C.5.5 Checking the centering lights with light beam phantom.....	C-9
C.5.6 Aec ceph calibration.....	C-10
C.5.7 Configuration chart.....	C-10
C.5.8 AEC Calibration with Denoptix	C-10
C.6 Functional test.....	C-10
C.6.1 Performance test.....	C-10
C.6.2 Customer test.....	C-10
C.7 Configuration chart	C-11

C.1 Introduction

This section details the adjustment and test procedures to be followed for setting up the Orthoralix systems.

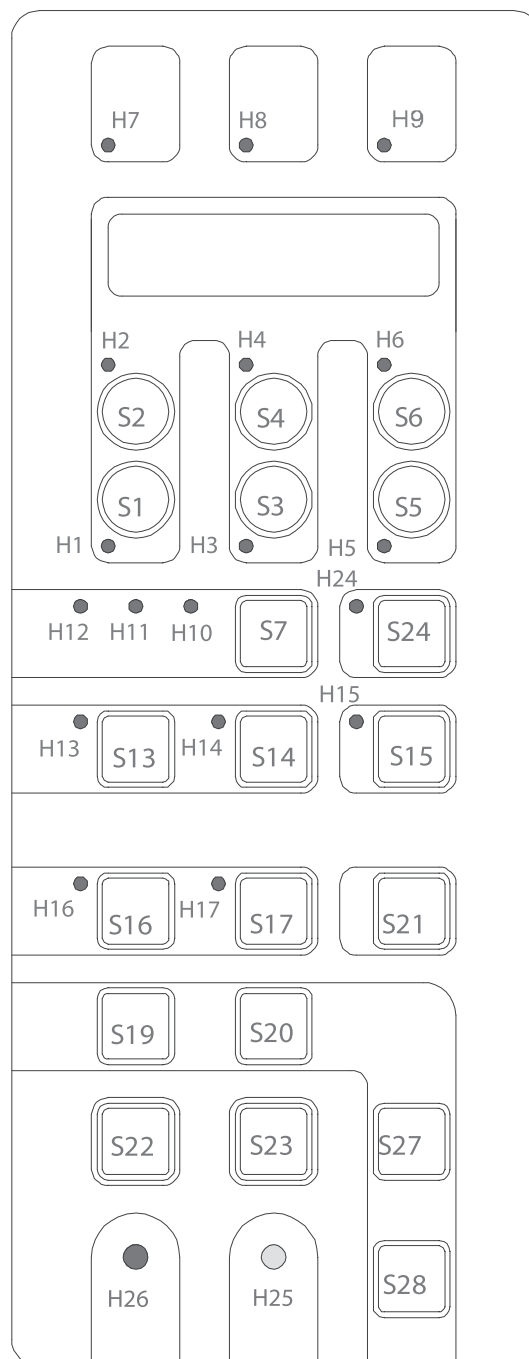
C.2 Tools and instruments required

- Standard service tools.
- Digital voltmeter.
- Image quality phantom (supplied).
- Light beam phantom (not supplied - code 4519 190 00922).
- Intraoral films.
- Panoramic films (not for Orthoralix DDE).
- Ceph films (not for Orthoralix DDE).
- Panoramic cassette without intensifying screens (not for Orthoralix DDE).

C.3 Controls and indicators

For a survey of the controls and indicators of the system see the tables below:

CONTROLS AND INDICATORS ON OPERATOR PANEL		
FUNCTION	INDICATOR	CONTROL
kV +	H2	S2
kV -	H1	S1
mA +	H4	S4
mA -	H3	S3
Exposure time +	H6	S6
Exposure time -	H5	S5
Layer position + (also soft tissue filter position for DDE only)	H17	S17
Layer position - (also soft tissue filter position for DDE only)	H16	S16
Patient size		S7
Projection +	H14	S14
Projection -	H13	S13
Standard panoramic	H15	S15
Open headrest		S20
Close headrest		S19
Reset		S22
Dummy run		S23
Centering laser lights ON		S21
A.E.C.	H24	S24
Ready for exposure	H26	
Exposure ON	H25	
Pan selected	H9	
Ceph selected	H7	
Transcan selected	H8	
Small patient	H10	
Medium patient	H11	
Large patient	H12	
Column up		S27
Column down		S28



C.4 System initialization

C.4.1 Power on and default condition

Switch on the unit with the mains ON/OFF switch and check the following default condition:

- The buzzer sounds for a few seconds.
- The following default values appear on the display:

STND PANORAMIC
74kV 10mA 12s

- For the Orthoralix 9200 DDE the following message appears:

STND PANORAMIC
DMU NOT READY

C.4.2 Reset and dummy run

Press the RESET and DUMMY RUN pushbuttons to check that the relevant movements are smooth and without noise.

C.4.3 Conditioning the x-ray tube

After prolonged storage (six months), it may be necessary to condition the X-ray tube; proceed as follows:

- a) For PAN versions: select the FREE EXPOSURE procedure of the Service Programs (see Section F for more details).
- b) For CEPH versions: the exposure times can be freely selected on the control panel.
- c) For the DDE versions: select the X-RAY ALIGNMENT procedure of the Service Programs (see Section F for more details).

The following steps require X-ray exposure. Take all the necessary radiation precautions.



2. Select the exposure factors.
3. Perform repeated exposures, with a minimum interval of 10 sec between each exposure, following the sequence indicated in the table below:

MODE	N. EXPOSURE	kV	mA	SEC
PAN	5	60	4	0.63
WAIT 2 min				
PAN	5	70	10	0.80
WAIT 2 min				
PAN	5	80	10	0.80

4. If, when breaking-in the tube, you also want to check the kV and the mA, see the procedure described in section D.

C.5 Adjustments and checks

The system is completely adjusted and tested in the factory.

Consequently, the following checks will generally not require any further adjustment.

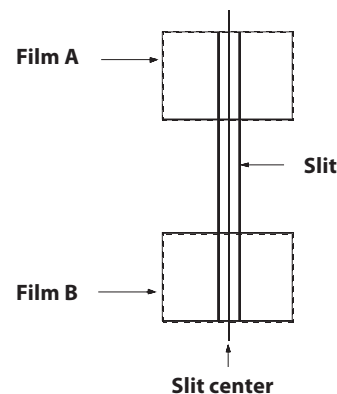
If adjustments are necessary however, please refer to Section F for more details.

C.5.1 Alignment of x-ray field pan mode

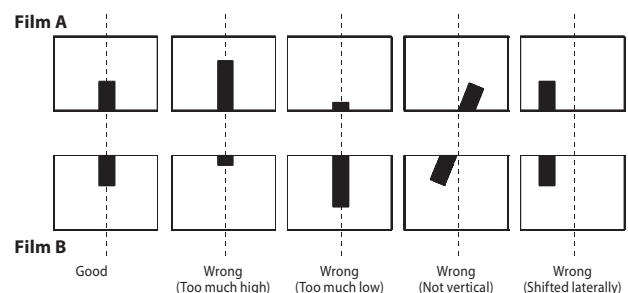
C.5.1.1 Orthoralix 9200/Plus/Ceph

To check the alignment of the X-ray field in panoramic mode proceed as follows:

1. Take two dental films and draw a line on their centre with a sharp pencil.
2. Mark the films with A and B and place them over the secondary slit, so that the centre lines of the films coincide with the centre of the slit, the upper edge of A coincides with the upper edge of the slit, the lower edge of B coincides with the lower edge of the slit.



3. Select the FREE EXPOSURE procedure of the Service Programs Utilities (see Section F for more details), select 60 kV, 10 mA, 0.80 s and make an exposure.
4. Develop the films and check that the X-ray field lies symmetrically on the centre of the films, without touching the edges corresponding to the slit.



5. Exit the Service Programs by switching off the system.

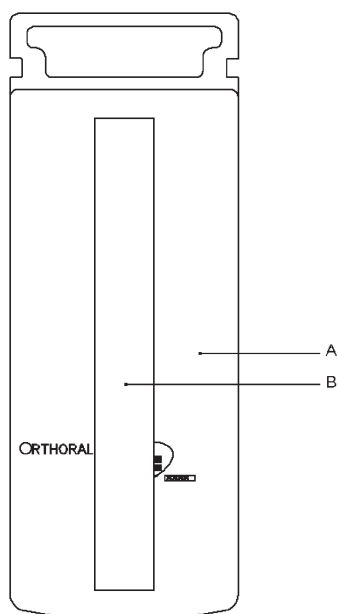


The vertical dimension of the X-ray field measured on a panoramic film is 131mm ± 3mm.

C.5.1.2 Orthoralix 9200 DDE

To check the alignment of the X-ray field in panoramic mode proceed as follows:

1. Switch on the unit entering the Service Programs.
2. Select the program **X-ray alignment** and press Dummy Run; select 70 kV, 9 mA and 0.16 s: the unit is now ready to make a static exposure.
3. Select the panoramic position on the collimator and on the operator panel.
4. Fix the copper filter (b) supplied on the front part of the DMU (a), in order to cover completely the digital sensor, by using adhesive tape.

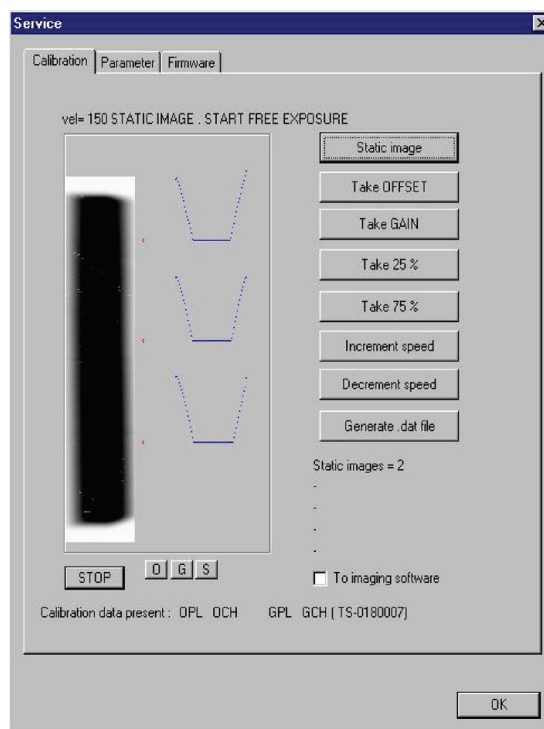


5. Switch on the PC where the Orthoralix 9200 DDE is connected to.
6. Access to the DDE icon in the system tray: when on it, with the cursor of the mouse, click with the right mouse pushbutton; four options will be displayed:
 - Remote
 - Service
 - Reconnect
 - Preview
7. Select Service by clicking on it.
8. Select Static image by clicking on it.

9. Now, make an exposure; after the preview, the following will appear on the monitor:

- a white rectangle corresponding to the digital sensor (the vertical dimension is compressed)
- a black rectangle corresponding to the X-ray field
- on the right, three grey sections showing the position of the X-ray field respect to the digital sensor.

The purpose is to have the black rectangle in the middle of the white rectangle, with a white uniform unexposed area all around. Look at the following example.



The grey sections may help in understanding the correct or wrong alignment and how much the lead plate must be adjusted.

If an adjustment (horizontal or vertical) is required, please refer to the paragraph **Adjusting the X-ray collimator** of the Section F of this Service Manual.

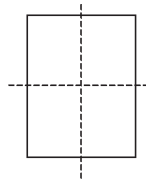
10. If additional exposures are necessary, click on *Stop* and then on *Static image*.
11. To leave the *Service* function, click on *Stop* and then on *OK*.
12. Exit the *Service* Programs by switching off the system.

C.5.2 Alignment of x-ray field transcan mode

C.5.2.1 Orthoralix 9200/Plus/Ceph

To check the alignment of X-ray field in the transcan mode proceed as follows:

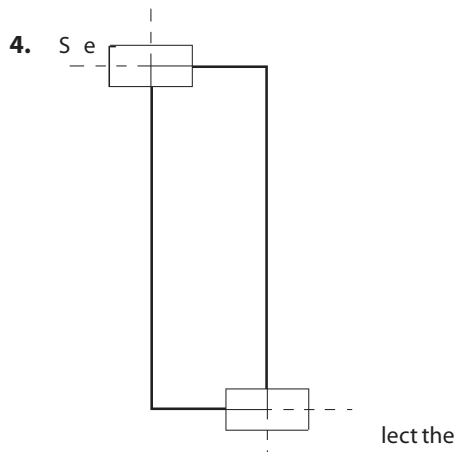
1. Select the transcan position on the collimator, on the secondary slit and on the operator panel.
2. Take two dental films and draw two lines so that the film is divided in four equal parts.



3. Mark the films with A and B and place them over the secondary slit as shown in the figure.

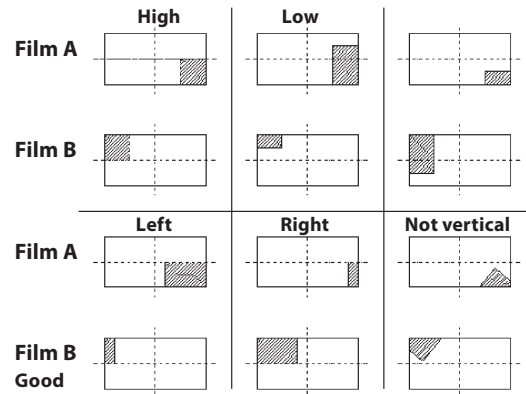
Film A

Film B



FREE EXPOSURE procedure of the Service Programs Utilities (see Section F for more details), select 60 kv, 10 mA, 0.80 s and make an exposure.

5. Develop the films and check that the X-ray field lays symmetrically on the two films.

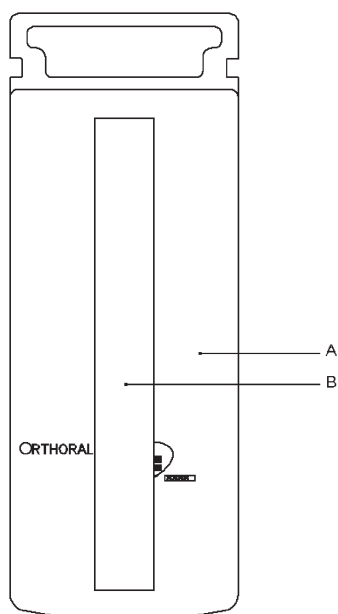


6. Exit the Service Programs by switching off the system.

C.5.2.2 Orthoralix 9200 DDE

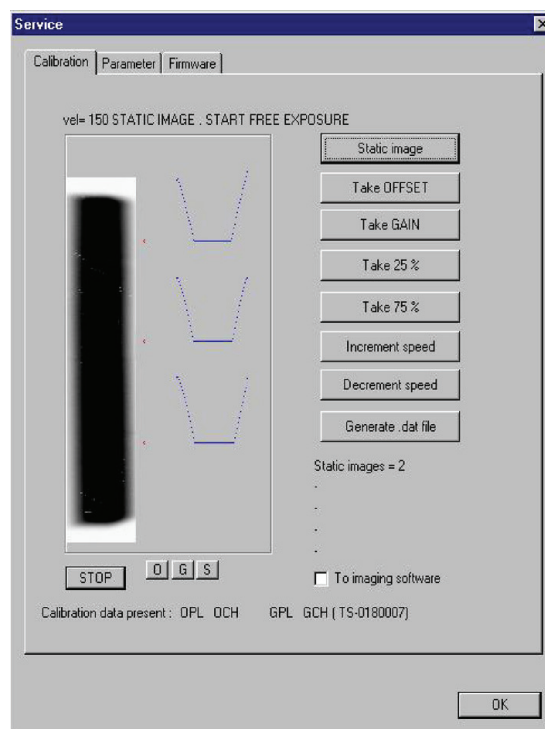
To check the alignment of the X-ray field in transcan mode proceed as follows:

1. Switch on the unit entering the Service Programs.
2. Select the program **X-ray alignment** and press Dummy Run; select 70 kV, 9 mA and 0.16 s: the unit is now ready to make a static exposure.
3. Select the transcan position on the collimator and on the operator panel.
4. Fix the copper filter (b) supplied on the front part of the DMU (a), in order to cover completely the digital sensor, by using adhesive tape.



5. Switch on the PC where the Orthoralix 9200 DDE is connected to.
6. Access to the DDE icon in the system tray: when on it, with the cursor of the mouse, click with the right mouse pushbutton; four options will be displayed:
 - Remote
 - Service
 - Reconnect
 - Preview
7. Select Service by clicking on it.

8. Select Static image by clicking on it.
9. Now, make an exposure; after the preview, the following will appear on the monitor:
 - a white rectangle corresponding to the digital sensor (the vertical dimension is compressed)
 - a black rectangle corresponding to the X-ray field
 - on the right, three grey sections showing the position of the X-ray field respect to the digital sensor.



The purpose is to check only the vertical position of the X-ray field (the horizontal position is determined by the centering made for the panoramic X-ray field alignment), so that above and below the black rectangle is visible a white uniform unexposed area; if an adjustment is required, please refer to the paragraph **Adjusting the X-ray collimator** of the Section F of this Service Manual.

10. If additional exposures are necessary, click on *Stop* and then on *Static image*.
11. To leave the Service function, click on *Stop* and then on *OK*.
12. Exit the Service Programs by switching off the system.

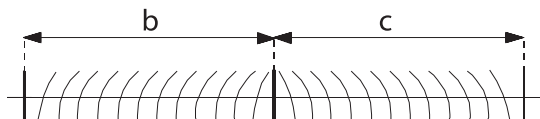
C.5.3 Testing the centering of the system

To test the centering of the system a specific phantom has been designed (Image Quality Phantom).

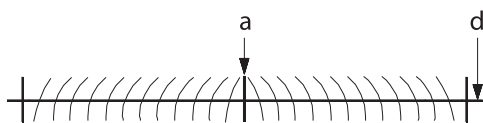
The test must be done selecting the standard projection technique.

Proceed as follows:

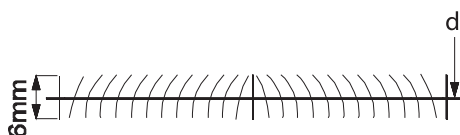
1. Switch on the unit and return to the reset position with the RESET key.
 2. Select the standard projection mode.
 3. Ensure that the Y movement is at the default position ($Y = -7 \text{ mm}$, 7 mm on the display).
 4. Install the image quality phantom on the panoramic (transparent) chin rest and insert it in the bite block holder and check that it is horizontal with a spirit level.
 5. If a cassette without intensifying screens is not available:
 - take two films
 - expose them to the light
 - develop the films: they will be totally black
 - put the two black films in the cassette and in between the film to be exposed (in this way the effect of the intensifying screens is limited).
- If a cassette without intensifying screens is available, put the film to be exposed into it.
6. Select 80 kV, 14 mA, make a panoramic exposure and develop the film.
 7. Check the developed film as follows:
 8. Check that the semi-projections $b = c \pm 4 \text{ mm}$ (nominal value with the central vertical line well focused = $80 \pm 1 \text{ mm}$)



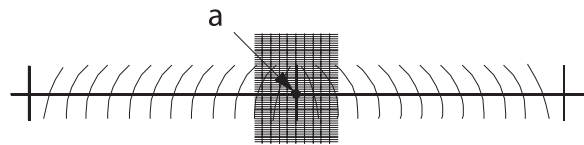
9. Check that line "a" is vertical $\pm 3^\circ$ with respect to the horizontal line "d".



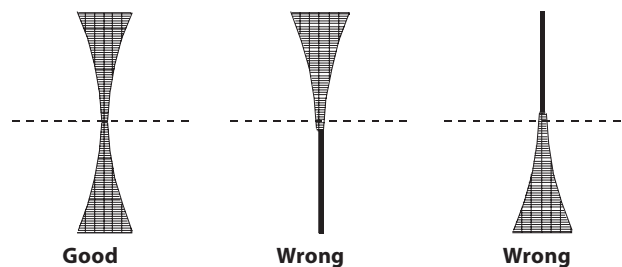
10. Check that line "d" is horizontal and flat within a band of 6 mm.



11. Check that the darkened area is centered with respect to the central vertical line "a" with a tolerance of $\pm 2^\circ \text{ mm}$.



12. Check that the central vertical line "a" is well focused: the layer in focus must be in the middle of the central vertical line.



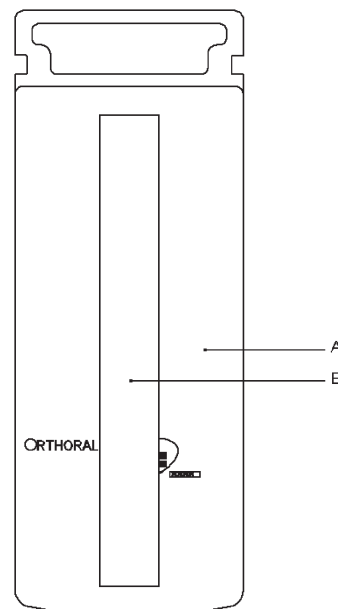
13. If the results do not comply, please refer to the Section F.



A copy of the films obtained during the final test done in the factory, is inserted in this Service Manual, to compare the results obtained in the field.

Orthoralix 9200 DDE

1. Fix the copper filter (b) supplied on the front part of the DMU (a), in order to cover completely the digital sensor, by using adhesive tape.



2. Make an exposure by using the minimum exposure parameters (60 kV, 3 mA).
3. Make the checks as described above by using the VixWin program.

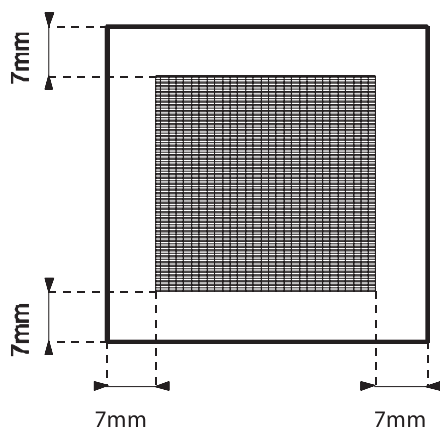
If the results do not comply, please refer to the Section F.

C.5.4 Alignment of X-ray field ceph mode

C.5.4.1 Orthoralix 9200/Plus/Ceph

To check the alignment of the X-ray field in CEPH mode proceed as follows:

1. Check that the metal ear rings are present on the earplugs.
2. Set the earplugs in the middle position.
3. Select 60 kV, 10 mA, 0.80 sec, insert a loaded film cassette, make an exposure and develop the film.
4. Check that the X-ray field limits lie at a distance of about 7 mm from the film edges. If not, adjust the X-ray collimator as described in Section F.



5. Check that the images of the ear rings are concentric on the film (the smallest depicted ring is the closest to the cassette). If not, adjust the earplugs as described in Section F.
6. Repeat the tests for the other film formats foreseen.

C.5.4.2 Orthoralix 9200 DDE

The alignment procedure for the CEPH mode is divided in two steps:

1. alignment of the ceph secondary collimator respect to the DMU.
2. alignment of the ceph lead plates (on the primary collimator) respect to the ceph secondary collimator.

These alignments are done by using the **X-ray alignment** Service Program: please refer to the procedure described in the paragraph **Adjusting the X-ray collimator** in the Section F of this Service Manual.

Finally, it is necessary to check the alignment of the ear rings:

1. Check that the metal ear rings are present on the earplugs.
2. Select one of the available ceph projections and make an exposure; once the image appears on the monitor, check that the ear rings are concentric on the image (the smallest depicted ring is the closest to the sensor).

If not, adjust the earplugs as described in the Section F of this Service Manual.

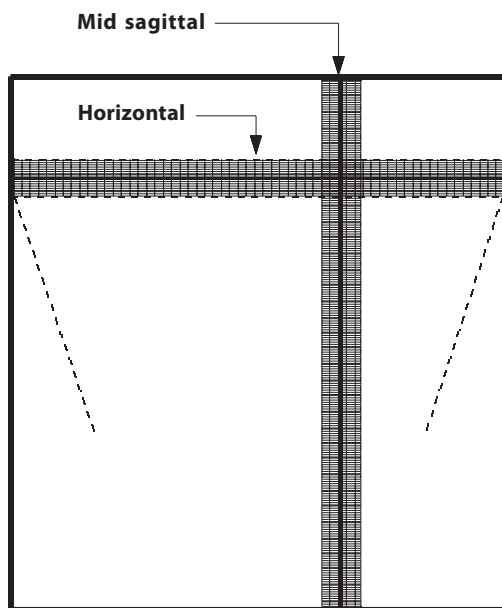
C.5.5 Checking the centering lights with light beam phantom



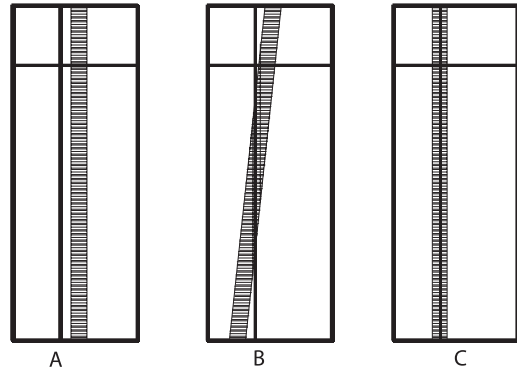
During the adjustment procedure, avoid to expose the eyes directly to the laser beam.

Check the adjustment of the centering lights with light beam phantom (code 4519 190 00922) as follows:

1. Install the light beam phantom into the bite block holder.
2. Switch on the lights and move the horizontal light until it corresponds with the black line of the phantom.
3. Check that it is sharply depicted. If not, adjust the horizontal projector as described in Section **F: Adjustment of the light projectors**.
4. Check that the vertical mid-sagittal light corresponds with the vertical black line of the phantom.
5. Check that it is sharply depicted. If not, adjust the vertical mid-sagittal projector as described in Section **F: Adjustment of the light projectors**.



6. Make sure that the system is at the reset position ($Y = -7$ mm) and switch on the lights.
7. Check that the lateral vertical light is sharply depicted on the vertical black line of the phantom (see fig. C) and that it is vertical. If not (see fig A - B), adjust the lateral vertical projector on the cassette carriage as described in Section **F: Adjustment of the light projectors**.
8. Check the alignment also at $Y = 0$ mm and $Y = 14$ mm.



C.5.6 Aec ceph calibration

This check is not applicable for the Orthoralix 9200 DDE versions.

The parameter used for the calibration of the ceph AEC sensor and cassette/screens is written on a label should be stuck on the ceph lead plate, placed on the rear side of the ceph cassette carriage, where the following information are present:

S/N	is the S/N of the PA5 board
Cassette	is the cassette and screens used for the calibration (they are the ones delivered with the ceph arm)
C	is the calibration parameter for the AEC
Date	date of the calibration

The ceph AEC sensor and cassette are already calibrated in factory, but the calibration parameter (C) must be stored using the service program AEC Ceph tune: see the Section F of this Service Manual for more details.

Please record this calibration parameter also in the Configuration Chart.

C.5.7 Configuration chart

Please fill in the Configuration Chart (at the end of this Section C of the Service Manual) with the necessary information: this could be useful in the future (i.e. replacement of the X-ray tubehead, software replacement/upgrading, etc.).

C.5.8 AEC Calibration with Denoptix

When the Denoptix system is used in combination with an Orthoralix 9200 having the AEC option, the calibration of the AEC sensor (panoramic and/or ceph) with the cassette(s) provided with the Denoptix, must be done.

In this case, the brass filter (code 4519 122 25571) used in the AEC calibration procedure, is supplied with the Denoptix system.

To perform the AEC calibration follow the instructions given in the Section F of this Service Manual.

C.6 Functional test

C.6.1 Performance test

1. Switch on the system with the mains ON/OFF switch.
2. Press the reset key, and check the automatic reset positioning, either in PAN or CEPH mode.
3. Check all the operator functions with the help of the User Manual.
4. Select panoramic mode operation, satisfy all the pre-conditions for panoramic exposure and check that the green "READY" lamp is on.
5. Select transcan mode operation, satisfy all the pre-conditions for transcan exposure and check that the green "READY" lamp is on.
6. Select CEPH mode operation, by rotating the tubehead and collimator (for the Orthoralix 9200 DDE versions is not necessary to rotate the tubehead).
7. Press the reset key, check the reset positioning in CEPH mode and check that the green "READY" lamp is on.



The following tests require X-ray exposure. Take all the necessary radiation precautions.

8. Move away from the radiation area and perform an exposure by means of the handswitch. Check that the X-ray buzzer sounds and the X-ray yellow lamp is on, and that no alarm indication is generated.
9. Make a new exposure and release the X-ray pushbutton before the end of the exposure: check that the X-rays and the rotation movement are immediately stopped, as required by the "dead-man" function.
10. Simulate and check the functioning of the "COLLIMATOR" and "TUBEHEAD" operator alarms described in section F.

C.6.2 Customer test

To prove to the customer that the system complies with the standards perform the tests described in section D: Acceptance.

C.7 Configuration chart

1. Start position of the movements: they could be changed (if necessary) during the checking of the centering of the system with the Image Quality Phantom

	DEFAULT VALUE	NEW VALUE
X movement start position	0	
Y movement start position	0	
R movement start position	0	
C movement start position	0	

2. Tube calibration: the values used for the tube calibration are already stored in the "Vf tube editing" Service Program, so enter these values in the table below (the same values are written on the front part of the tubehead)

mA	CALIBRATION VALUE
4	
9	
14	

3. 80 kV limit:

DEFAULT CONDITION: NO	ACTUAL CONDITION
-----------------------	------------------

4. Language of the messages:

ENGLISH (default)	
FRANCAIS	
ITALIANO	
DEUTSCH	
ESPANOL	

5. Exposure counter: in case of tubehead replacement, please take note of the exposures made, Pan and Ceph

PANORAMIC	CEPH	DATE

6. AEC Pan Tune

7. AEC Ceph Tune

8. Exposure factors: it is possible to alter individually each one of the present exposure factors in any of the projection modalities and patient sizes (see the Operator Manual for more details). The values in the table are the default ones for the Orthoralix 9200 Plus (for the others versions they can be different).

	SMALL PATIENT				MEDIUM PATIENT				LARGE PATIENT			
	kV	mA	kV	mA	kV	mA	kV	mA	kV	mA	kV	mA
PANORAMIC	70	10			74	10			78	10		
CHILD	62	10			66	10			70	10		
ORTHOGONAL DENTITION	68	10			72	10			76	10		
LATERAL TMJ CENTRAL	70	10			74	10			78	10		
LATERAL TMJ EXTERNAL	70	10			74	10			78	10		
RIGHT JAW	70	10			74	10			78	10		
LEFT JAW	70	10			74	10			78	10		
FRONTAL SINUS	72	10			76	10			80	10		
LATERAL SINUS RIGHT	70	10			74	10			78	10		
LATERAL SINUS LEFT	70	10			74	10			78	10		
FRONTAL TMJ	72	10			76	10			80	10		
HALF ORTHOGONAL RIGHT	68	10			72	10			76	10		
HALF ORTHOGONAL LEFT	68	10			72	10			76	10		
FRONTAL DENTITION	68	10			72	10			76	10		
RR POSTERIOR 3 mm	62	10			66	10			70	10		
RR POSTERIOR 6 mm	62	10			66	10			70	10		
RR INCISOR 3 mm	62	10			66	10			70	10		
RR INCISOR 6 mm	62	10			66	10			70	10		
LL INCISOR 3 mm	62	10			66	10			70	10		
LL INCISOR 6 mm	62	10			66	10			70	10		
LL POSTERIOR 3 mm	62	10			66	10			70	10		
LL POSTERIOR 3 mm	62	10			66	10			70	10		
CEPH L.L.	66	6			70	6			74	6		
CEPH AP/PA	78	6			80	6			84	6		

Acceptance

Table of contents

D.1 Introduction.....	D-1
D.2 Equipment required.....	D-1
D.3 Standards compliance tests	D-1
D.3.1 Labels, indicators and warnings.....	D-1
D.3.2 Tube current accuracy.....	D-2
D.3.3 kV Accuracy.....	D-2
D.3.4 Timer accuracy.....	D-2
D.3.5 Radiation dose rate.....	D-3
D.3.6 Reproducibility	D-3
D.3.7 Radiation leakage.....	D-3
D.3.8 Earth resistance.....	D-3
D.3.9 Earth leakage.....	D-3
D.4 Acceptance checklist.....	D-4

D.1 Introduction

This section explains how to perform the tests that demonstrate to the customer that the Orthoralix system complies with the specified standards.

D.2 Equipment required

- Bonding Tester
- Oscilloscope
- Multimeter
- Dosimeter

D.3 Standards compliance tests

D.3.1 Labels, indicators and warnings

1. Check that the Certification, Identification, Place and Date of Manufacture label on the Z-carriage is permanently affixed, legible and readily accessible to view.
2. Check that the technique factors indicated on the Z-carriage label on the column comply with the specifications.

D.3.2 Tube current accuracy

The tube current is defined as the average value of the stationary current which settles during the exposure.

The mA range is 3-15 mA, with steps of 1 mA.

The tube current accuracy is $\pm 7\%$ (the accuracy of the instrument used for the measurement is excluded).

The measuring method is by the feedback circuit of the converter board.

The measurement procedure is the following:

1. Inhibit the movements during the exposure by selecting the Free Exposure Service Program (see Section F of this Service Manual).
2. Connect a multimeter to test points TP 16 (mA feedback signal) and TP 20 (GND) of Converter board PQ 1.
3. Select V - DC on the multimeter.
4. Start the exposure selecting standard projection. After the stabilization time (about 2 sec.), record the voltage readout on the multimeter and stop the exposure.
5. Check that the tube current conforms to the specification.

The relation between mA and feedback signal on TP 16 is indicated in the table below:

mA	NOMINAL VALUE (V) FEEDBACK TP16	ACCEPTANCE RANGE (V)	
3	1.57	1.49	1.65
4	2.09	1.98	2.19
5	2.62	2.49	2.75
6	3.14	2.98	3.30
7	3.66	3.48	3.84
8	4.19	3.98	4.40
9	4.71	4.47	4.94
10	5.24	4.99	5.50
11	5.76	5.47	6.05
12	6.28	5.97	6.59
13	6.81	6.47	7.15
14	7.33	6.97	7.70
15	7.86	7.47	8.25

D.3.3 kV Accuracy

The peak tube potential is defined as the average peak value of the high voltage (except single spurious peaks).

The kV setting on the operator panel determines the absolute maximum kV value during the exposure.

In some projections, the kV are automatically adjusted during the exposure to compensate the variation in the object thickness (see table below): in these cases only the part of the exposure where the kVp is at the maximum value must be considered for the measurement.

PROJECTION	MAX kV MODULATION RESPECT TO THE SELECTED VALUE
STANDARD PANORAMIC	- 6 %
CHILD	- 7 %
DENTITION ONLY	- 8 %
RIGHT JAW	-10 %
LEFT JAW	-10 %

The kV range is 60-84 kV, with steps of 2 kV.

The high voltage accuracy is ± 3 kV.

The measuring method is by the feedback circuit of the converter board.

The measurement procedure is the following:

1. Inhibit the movements during the exposure.
2. For the measurement connect a multimeter to test points TP 13 (kV feedback signal) and TP 20 (GND) of Converter board PQ1.
3. Select V - DC on the multimeter.
4. Start the exposure selecting standard projection. After the stabilization time (about 2 sec.), record the voltage readout on the multimeter and stop the exposure.
5. Check that the high voltage conforms to the specification.

The relation between kV and feedback signal on TP 13 is indicated in the table below:

kV	NOMINAL VALUE (kV) FEEDBACK TP13	ACCEPTANCE RANGE (V)	
60	6.0	5.70	6.30
62	6.2	5.90	6.50
64	6.4	6.10	6.70
66	6.6	6.30	6.90
68	6.8	6.50	7.10
70	7.0	6.70	7.30
72	7.2	6.90	7.50
74	7.4	7.10	7.70
76	7.6	7.30	7.90
78	7.8	7.50	8.10
80	8.0	7.70	8.30
82	8.2	7.90	8.50
84	8.4	8.10	8.70

D.3.4 Timer accuracy

The exposure time is defined as the time during which the envelope of the X-ray producing mA is over 25% of its maximum and steady value.

The exposure time accuracy is ± 0.020 second or $\pm 1\%$, whichever is the greater.

To measure exposure time, a timer counter can be used connected at the mA feedback TP 16 on the converter board PQ1.

Alternatively, a radiation monitor can be used; in this case the basic accuracy for exposure time measurement of the radiation monitor must be considered.

Measure the following exposure times:

MODE	EXPOSURE TIME (s)
PAN (STANDARD)	12
CEPH	0.16
CEPH	1.00
CEPH	2.50
CEPH (DDE ONLY)	6
CEPH (DDE ONLY)	8

Inhibit the movements during the exposures.

Check that the results conform to the specification.

D.3.5 Radiation dose rate

Measure the radiation dose at a distance of 20 cm from the focus.

Inhibit movements during the exposures.

Dismount the collimator and place the dosimeter at 20 cm from the focus.

Using the parameters listed in the table below, make three exposures and multiply the value read on the dosimeter by 60 to have the dose rate in R/min.

kV	mA	s	DOSE RATE	
			$\mu\text{Gy/s}$	R/m
60	10	1	6.1	42
70	10	1	8.3	57
80	10	1	10.2	70

Check that the results conform to the specification, with a tolerance of $\pm 30\%$.

D.3.6 Reproducibility

To perform the reproducibility test proceed as follows:

1. Dismount the collimator.
2. Place the dosimeter at 20 cm from the focus.
3. Inhibit the movements during the test exposures.
4. Select 70 kV - 10 mA - 0.80 s
5. Make a series of 10 exposures within a 1 hour period and take note of the value of the radiation dose after each exposure.

D.3.7 Radiation leakage

Measure radiation leakage at 100 cm from the focus in any direction, and check that the dose rate values for the combination tubehead and collimator are lower than $250 \mu\text{Gy/h}$ (28 mR/h) as specified.



The prescribed duty cycle factor (1/20) shall be taken into account in the calculations, in order to obtain the correct dose rate figure.

D.3.8 Earth resistance

The Orthoralix system requires a fixed installation, therefore the resistance between any exposed conductive part and the earth terminal of the mains input contactor has to be lower than 0.1 Ohm.

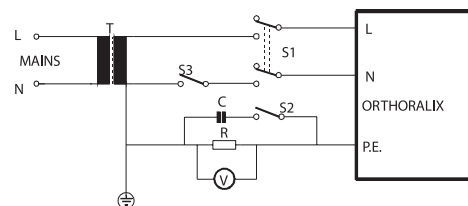
Disconnect the unit from the mains and measure with the Bonding tester.

D.3.9 Earth leakage

Measure the earth leakage currents in all conditions, using the circuit arrangement shown below.

Check that the results conform to the table below:

S1	S2	S3	MAX. LEAKAGE CURRENT (mA)
OFF	OFF	ON	< 5
OFF	ON	ON	< 5
ON	OFF	ON	< 5
ON	ON	ON	< 5
OFF	OFF	OFF	< 10
OFF	ON	OFF	< 10
ON	OFF	OFF	< 10
ON	ON	OFF	< 10
during exposure			< 10



V = Digital voltmeter input impedance $E = 10 \text{ M OHM}$

R = $1\text{K OHM} \pm 1\%$

C = $0.15 \mu\text{F} \pm 5\%$

T = K1 insulation transformer

L = Line terminal

N = Neutral terminal

D.4 Acceptance checklist

CUSTOMER	
INSTALLATION SITE	
TECHNICIAN	

R / S	ACTION	MEASUREMENTS	REMARKS
	1. General inspection		
	3.1. Labels, indicators, warning		
R	3.2. Tube current accuracy		
R	3.3. kV pk accuracy		
R	3.4. Timer accuracy		
R	3.5. Radiation dose rate		
R	3.6. Reproducibility		
R	3.7. Radiation leakage		
	3.8. Earth resistance		
	3.9. Earth leakage		
NOTES			
DATE			

Preventive maintenance

Table of contents

E.1 Introduction.....	A-1
E.2 Requirements.....	A-1
E.3 Maintenance.....	A-2
E.4 Mechanical checks.....	A-2
E.5 Electrical checks	A-3
E.6 Functional checks	A-5
E.7 Measuring list	A-5
E.7.1 Verify the anodic current	A-5
E.7.2 Verify the kv	A-5
E.7.3 Verify the dose rate	A-5
E.7.4 Verify the exposure time.....	A-5
E.7.5 Verify the reproducibility	A-6
E.7.6 Verify the radiation leakage	A-6
E.7.7 Verify the earth resistance.....	A-6
E.7.8 Verify the leakage current.....	A-6

E.1 Introduction

This section gives details about the preventive maintenance of the Orthoralix systems.

The following pages list all the preventive maintenance actions and at the end of the Section there is a checklist summarizing the scheduled time/actions to be performed.

Legenda:

R-S An R before the preventive maintenance instruction indicates the need to have an X-ray exposure: all the adequate precautions must be taken.

An S before the preventive maintenance instruction indicates that the instruction concerns a safety aspect of the machine, installation, etc.

INSTR. TYPE The number written before the preventive maintenance instruction represents the preventive maintenance frequency in months (if not specified in another manner).



Do not move the Z-carriage along the column when the system is off. Doing so it could damage the PC6 board.

E.2 Requirements

Cleaning materials:

- mild detergent
- soft lint-free cloth

Lubricants:

- spray grease
- service lubricants:
- oil Tellus 46
- grease Molikote Longterm W2
- grease Molub Alloy MID 2

E.3 Maintenance

1. Remove the following covers:
 - column covers
 - top cover of the Z-carriage
 - top covers of the rotating arm

S12 2. Checking the two steel cables



It is essential to check, clean, lubricate and replace (latest 96 months) the steel cables to guarantee the safety of the system.

Steel cable replacement may have a different frequency, depending on the use of the machine.

Clean the steel cables using a soft cloth.

Check that the two steel cables are not worn and have no broken strands. Pay particular attention to the fixation points.

Lubricate the two steel cables using Tellus 46 oil and then grease with Molikote Longterm W2.

After lubrication, check that the Z-carriage moves smoothly up and down, along the whole column.

S96 Replace the two steel cables and balance mechanism following the procedure below:

- a) remove the front and side covers of the column
- b) lock the counterweight carriage using the two fixation screws
- c) disconnect the steel cables from the column (two Allen screws)
- d) remove the two plates from the top cover (with the pulleys) of the column
- e) remove the top cover with the pulleys and the motor from the column; disconnect the connector X74 for the motor power supply
- f) screw the M6 screw (supplied with the new steel cable) into the coupling pin of the balance mechanism
- g) extract the coupling pin
- h) remove the old steel cables with the balance mechanism and mount the new one.

- 12 3. Clean the whole system.
- 12 4. Clean the roller guide along the column.
- 12 5. Lubricate the bushes and rotation gears of the step-motors using spray grease.
- 12 6. Grease the following parts (with Molub Alloy MID 2):
 - the converter cable and the multipole cable inside the rotation hub
 - levers for the ear pins and for the nasion rest in the cephal arm
- 10.000 cycles 7. Change the converter cable and the multipole cable.
- 60 8. Change the headrest belt.
- 12 9. Check the mains cable for wear.

E.4 Mechanical checks

- S12 1. Column
 - check the attachment to the wall
- 12 2. Z-Carriage
 - check the proper rotation of the converter cable and the multipole cable inside the hub of the rotating arm
 - check that all the movement optoswitches are activated by the relevant cams
 - check that the shaft of the rotation motor is vertical
 - check the belts tension
 - check the headrest symmetry

E.5 Electrical checks



Tests 5.7 to 5.12 are intended for standard compliance certification.

- R12** 1. Check the anodic current (setpoint, feedback, waveform) on converter board PQ1 (0V reference at TP 20).

mA	NOMINAL VALUE (V) FEEDBACK TP16	ACCEPTANCE RANGE	
3	1.57	1.49	1.65
4	2.09	1.98	2.19
5	2.62	2.49	2.75
6	3.14	2.98	3.30
7	3.66	3.48	3.84
8	4.19	3.98	4.40
9	4.71	4.47	4.94
10	5.24	4.99	5.50
11	5.76	5.47	6.05
12	6.28	5.97	6.59
13	6.81	6.47	7.15
14	7.33	6.97	7.70
15	7.86	7.47	8.25

Enter the values in the Measuring List.

Connect the probe of a storage oscilloscope at TP 13 (feedback signal) and TP 20 (GND). Set 0.5V/div., 10msec time base.

Select 80kV, 14mA, make an exposure and check that the overshoot on the tube current waveform is lower than 10% of the final steady value and lasts less than 20msec. Check also that the tube current stabilizes within 50msec.

- R12** 2. Check the kV (setpoint, feedback, waveform) on the converter board PQ1 (0V reference at TP20).

kV	NOMINAL VALUE (kV) FEEDBACK TP13 SETPOINT TP18	ACCEPTANCE RANGE (V)	
60	6.0	5.70	6.30
62	6.2	5.90	6.50
64	6.4	6.10	6.70
66	6.6	6.30	6.90
68	6.8	6.50	7.10
70	7.0	6.70	7.30
72	7.2	6.90	7.50
74	7.4	7.10	7.70
76	7.6	7.30	7.90
78	7.8	7.50	8.10
80	8.0	7.70	8.30
82	8.2	7.90	8.50
84	8.4	8.10	8.70

Enter the values in the Measuring List.

- 12** 3. Press the push button on the operator panel controlling the motor of the column (up and down) and check:
- That the Z-carriage moves freely along the column
 - That the movement is stopped by the limit opto-switches when the top and bottom positions are reached.

- R12** 4. Check the dose rate.

Disable the rotatory movement of the Z-carriage (Service Programs: Free exposure).

Dismount the diaphragm.

Place a dosimeter at 20 cm from the focus: the positioning must be accurate due to the reduced opening of the X-ray beam. Make three exposures using the following parameters:

kV	mA	s	DOSE RATE	
			μGy/s	R/m
60	10	1	6.1	42
70	10	1	8.3	57
80	10	1	10.2	70

The dose measured must be multiplied by 60 to have the R/min. (tolerance ± 30%).

Enter the values in the Measuring List.

- R12** 5. Check that the buzzer sounds during the exposure.

R12 6. Check the exposure time.

The exposure time can be measured with the oscilloscope using the solar cell or monitoring the mA feedback signal (TP16): in both cases the time must be calculated when the signal reaches 25 % of the maximum value (raising and falling edges); tolerance: 20 ms or $\pm 1\%$ (whichever the larger).

Enter the values in the Measuring List.

R12 7. Check reproducibility.

Dismount the collimator.

Place the dosimeter at 20 cm. from the focus.

Inhibit the movements during the exposures.

Select 70 kV 10 mA 0.80 s.

Make a series of 10 exposures within a 1 hour period and enter the value of the radiation dose after each exposure in the Measuring List.

R12 8. Check the radiation leakage.

Measure radiation leakage at 1 mt. from the focus in any direction, and check that the dose rate values for the combination tubehead and collimator are lower than 250 $\mu\text{Gy/h}$ (28mR/h) as specified.



The prescribed duty cycle factor (1/20) shall be taken into account in the calculations, in order to obtain the correct dose rate figure.

Enter the values in the Measuring List.

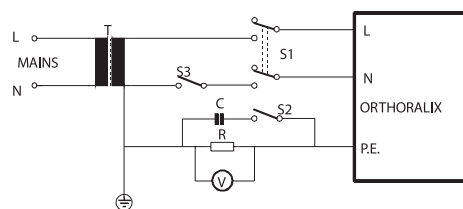
S12 9. Check the earth resistance.

Orthoralix requires a fixed installation, therefore the resistance between any exposed conductive part and the earth terminal of the mains input contactor has to be lower than 0.1 Ω . Disconnect the unit from the mains and measure with the Bonding tester.

Enter the value in the Measuring List.

S/R12 10. Check the earth leakage.

Measure the earth leakage current in all conditions, using the circuit arrangement shown in the fig. below:



V = digital voltmeter input impedance = 10M

R = 1K $\pm 1\%$

C = 0.15 F $\pm 5\%$

L = line terminal

N = neutral terminal

PE = protective earth terminal

T = K1 insulation transformer

Check that the results conform to the table below:

S1	S2	S3	MAX. LEAKAGE CURRENT (mA)
OFF	OFF	ON	< 5
OFF	ON	ON	< 5
ON	OFF	ON	< 5
ON	ON	ON	< 5
OFF	OFF	OFF	< 10
OFF	ON	OFF	< 10
ON	OFF	OFF	< 10
ON	ON	OFF	< 10
during exposure			< 10

Enter the values in the Measuring List.

E.6 Functional checks

12 1. Check the reset position.**R12 2.** Check the centering of the X-ray beam on the secondary slit.**R12 3.** Check during the exposure, on the system and on the remote control, that the X-ray lights are on and that the buzzers sound.**R12 4.** Check the centering of the system making a panoramic exposure with the image quality phantom.**12 5.** Check the adjustment of the centering lights.**R12 6.** Check the ceph centering (X-ray field and ear plugs).

E.7 Measuring list

E.7.1 Verify the anodic current

mA	NOMINAL VALUE (V)	MEASURED VALUE (V)
3	1.57	
4	2.09	
5	2.62	
6	3.14	
7	3.66	
8	4.19	
9	4.71	
10	5.24	
11	5.76	
12	6.28	
13	6.81	
14	7.33	
15	7.86	

E.7.2 Verify the kv

kV	NOMINAL VALUE (V)	MEASURED VALUE (V)
60	6.0	
62	6.2	
64	6.4	
66	6.6	
68	6.8	
70	7.0	
72	7.2	
74	7.4	
76	7.6	
78	7.8	
80	8.0	
82	8.2	
84	8.4	

E.7.3 Verify the dose rate

kV	mA	s	DOSE RATE	
			μGy/s	R/m
60	10	1		
70	10	1		
80	10	1		

E.7.4 Verify the exposure time

SELECTED TIME (s)	MEASURED TIME (s)
0.16	
1.0	
2.50	
12 (Standard Panoramic)	

E.7.5 Verify the reproducibility

EXPOSURE N°	MEASURED DOSE	
	R / MIN	μGy / s
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

E.7.6 Verify the radiation leakage

RADIATION LEAKAGE	MAX 250 μGy/h (28mR/h) A 1 m
MEASURED RADIATION	

E.7.7 Verify the earth resistance

EARTH RESISTANCE	MAX 0,1 Ohm
MEASURED RESISTANCE	

E.7.8 Verify the leakage current

S1	S2	S3	EARTH LEAKAGE CURR. (mA)	
			MAX.	MEASURE
OFF	OFF	ON	< 5	
OFF	ON	ON	< 5	
ON	OFF	ON	< 5	
ON	ON	ON	< 5	
OFF	OFF	OFF	< 10	
OFF	ON	OFF	< 10	
ON	OFF	OFF	< 10	
ON	ON	OFF	< 10	
during exposure			< 10	

Corrective maintenance

Table of contents

F.1 Introduction	F-2
F.2 Equipment required	F-2
F.3 Diagnostic messages	F-2
F.3.1 Over temperature	F-2
F.3.2 Cooling down	F-3
F.3.3 Operator released	F-3
F.3.4 Movement halted	F-4
F.3.5 X-Ray break	F-4
F.3.6 Handswitch error	F-4
F.3.7 Cassette	F-4
F.3.8 Fault opto film	F-5
F.3.9 Collimator	F-5
F.3.10 Tubehead	F-5
F.3.11 Optoswitches collimator fail	F-6
F.3.12 Optoswitches tubehead fail	F-6
F.3.13 Secondary slider	F-7
F.3.14 VLM conv. alarm	F-7
F.3.15 -15V conv. alarm	F-7
F.3.16 +5V conv. alarm	F-8
F.3.17 +15V conv. alarm	F-8
F.3.18 +31V conv. alarm	F-8
F.3.19 +14V under range	F-9
F.3.20 +14V over range	F-9
F.3.21 +42V under range	F-10
F.3.22 +42V over range	F-10
F.3.23 kV out of range	F-11
F.3.24 mA out of range	F-11
F.3.25 I CHP out range	F-12
F.3.26 Over kV	F-12
F.3.27 CHP. over current	F-12
F.3.28 Converter: inv. over current	F-12
F.3.29 Back up timer	F-13
F.3.30 No Start/Stop HW	F-13
F.3.31 Reset -X- failed	F-14
F.3.32 Reset -Y- failed	F-14
F.3.33 Reset -R- failed	F-15
F.3.34 Reset -C- failed	F-15
F.3.35 Console: link failure	F-16
F.3.36 Converter: link failure	F-16
F.3.37 Conv. link fail 2	F-16
F.3.38 No communication	F-16
F.3.39 PA5 board link failure	F-17
F.3.40 PH3 Ceph alarm	F-17
F.3.41 PH3 Pan alarm	F-17
F.3.42 PA7 Bridge alarm	F-17
F.3.43 Software error	F-18
F.3.44 System cpu fail: e2prom checksum	F-18
F.3.45 System cpu fail: e2prom not ready	F-18
F.3.46 Ceph bay rotated	F-18
F.3.47 DMU misplaced	F-19
F.3.48 DMU not present	F-19
F.3.49 DMU not ready	F-19
F.3.50 DMU busy	F-19
F.3.51 CEPH collimator	F-19
F.3.52 DMU fault	F-20
F.3.53 No connection	F-20
F.3.54 DMU not detected	F-20
F.3.55 Transfer error	F-20
F.3.56 HW fault 153	F-21
F.3.57 HW fault 154	F-21
F.3.58 HW fault 181	F-21
F.3.59 HW fault 200	F-21

F.3.60 Host unavailable	F-21
F.3.61 Host busy	F-21
F.4 Service programs	F-22
F.4.1 General	F-22
F.4.2 Test start up	F-22
F.4.3 Test procedures	F-22
F.4.3.1 X movement test and adjustment	F-22
F.4.3.2 Y movement test and adjustment	F-22
F.4.3.3 R movement test and adjustment	F-23
F.4.3.4 C movement test and adjustment	F-24
F.4.3.5 IP address	F-25
F.4.3.6 Subnet mask	F-25
F.4.3.7 Host input read	F-26
F.4.3.8 Pan PA5 menu	F-26
F.4.3.9 Ceph PA5 menu	F-26
F.4.3.10 Converter input read	F-27
F.4.3.11 Pan and Ceph PH3 input read	F-27
F.4.3.12 Exposure counter	F-27
F.4.3.13 Software version	F-27
F.4.3.14 PA7/PH3 software version	F-27
F.4.3.15 Ceph arm	F-27
F.4.3.16 X-ray enable	F-27
F.4.3.17 80 kV limit	F-28
F.4.3.18 X-ray alignment	F-28
F.4.3.19 Still ceph	F-28
F.4.3.20 Free exposure	F-28
F.4.3.21 Still panoramic	F-28
F.4.3.22 Still transcan	F-29
F.4.3.23 Limit test	F-29
F.4.3.24 Vt tube editing	F-29
F.4.3.25 Tube calibration	F-30
F.4.3.26 Console test	F-30
F.4.3.27 Retry readout	F-30
F.4.3.28 AEC Pan tune	F-31
F.4.3.29 AEC Ceph tune	F-31
F.4.3.30 AEC Slope	F-32
F.4.3.31 Default EEPROM	F-32
F.4.3.32 Reset EEPROM	F-32
F.5 Replacement procedures	F-33
F.5.1 Replacing multipole cable	F-33
F.5.2 Replacing converter cable	F-35
F.5.3 Replacing the steel ropes	F-37
F.5.4 Replacing optoswitches	F-38
F.5.5 Replacing the drive belts	F-39
F.5.6 Replacing the tubehead	F-44
F.5.7 Replacing the PC1 control board	F-45
F.5.8 Replacing the mains relay	F-47
F.5.9 Replacing the PN1 power unit board	F-48
F.5.10 Replacing the PA5 aec control board	F-49
F.5.11 Replacing the PH3 unit interface board	F-49
F.6 Adjustment procedures	F-50
F.6.1 Verify the centering of the system with the image quality phantom	F-50
F.6.2 Tension adjustment of the drive belts	F-52
F.6.3 Adjusting the x-ray collimator	F-54
F.6.4 Adjusting the light projectors	F-61
F.6.5 Adjusting patient headrest (PAN)	F-65
F.6.6 Adjusting patient headrest (CEPH)	F-66
F.6.7 Adjusting tube current	F-67
F.6.8 AEC calibration	F-68
F.7 Host inputs read	F-71
F.8 Converter inputs read	F-73
F.9 PH3 Inputs read	F-74

F.1 Introduction

This section details the corrective maintenance for the Orthoralix 9200 systems.

In general, the defective part is located by means of diagnostic messages, self-test information or by the principle diagrams.

In the event of electronic defects, repairs are made by replacing one of the following exchangeable units:

- tubehead,
- operator control panel PC7,
- converter board PQ1,
- host computer board PC1,
- power supply board PN1,
- mains EMI filter PA3,
- motorized column PC6,
- AEC control board PA5,
- auxiliary board PA7 (Orthoralix 9200 DDE only),
- DMU interface board PH3 (Orthoralix 9200 DDE only).



If the converter board PQ1 or the tubehead need to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information)



If the host computer PC1 needs to be replaced, remember to remove the EEPROM D38 from the old board and mount it on the new one, otherwise all the following parameters will be lost:

- tube calibration
- X, Y, R and C movement start positions
- language of the messages
- customized exposure parameters (kV and mA)
- AEC calibration and configuration.

If you forget to do this, recover the information from the System Configuration Chart (see Section C).



If the auxiliary board PA7 needs to be replaced, the IP address and the Subnet Mask must be stored in the new PA7 by using the Service Programs (see the relevant paragraphs of this section for more information).

In the event of mechanical or motor defects, the following assemblies can be replaced:

- the headrest assembly,
- the geared motor assemblies.



Do not move the Z-carriage along the column when the system is off: doing so it could damage the PC6 board.

F.2 Equipment required

To perform corrective maintenance on Orthoralix 9200 systems the following equipment is required:

- standard toolset,
- storage oscilloscope,
- digital multimeter.

F.3 Diagnostic messages

While the Orthoralix 9200 system is running, a number of messages may be generated on the display, to warn the operator of equipment irregularities or to indicate that some fault has occurred.

In the latter case a diagnostic message will help to find the fault.

The meaning of each message is given, together with an explanation about the electrical circuit involved with the defective function.

If more than one alarm is detected, the first one acknowledged is displayed and the others are stored: by pressing the RESET pushbutton on the operator panel it is possible to visualize all the alarms acknowledged.

F.3.1 Over temperature

This alarm indicates that the temperature measured over the power transistors (by a PTC sensor) of the converter board has exceeded the limit ($>80^{\circ}\text{C}$).

The microcontroller on the converter board PQ1 acknowledges the alarm, temporarily disables the converter electronics and communicates the alarm to the host board PC1.

The host provides a diagnostic message on the display and waits for the alarm to self-reset before starting a new exposure sequence.

Check whether the LED H11 is ON (ON=OK, OFF=NOT OK).

Possible causes:

1. ambient temperature too high
2. converter board defective
3. temperature sensor defective
4. power transistors defective.



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

The alarm is captured and stored as soon as it is detected.

Press the RESET pushbutton on the control panel to cancel the alarm (if expired).

F.3.2 Cooling down

This alarm message appears on the display when the maximum load admissible for the tubehead has been reached.

The host computer board PC1 keeps a constant check on the load applied to the tubehead and when the maximum limit is reached, it disables the possibility of making another exposure and displays the cooling down time (in seconds).

The message appears on the display at the end of the reset cycle and will disappear automatically when the count down is extinguished.

If the alarm stays on it may mean:

1. host computer board PC1 damaged
2. flash memory of the host computer board damaged.



If the host computer PC1 needs to be replaced, remember to remove the EEPROM D38 from the old board and mount it on the new one, otherwise all the following parameters will be lost:

- tube calibration
- X, Y, R and C movement start positions
- language of the messages
- customized exposure parameters (kV and mA).
- AEC calibration and configuration.

If you forget to do this, recover the information from the System Configuration Chart (see Section C).

F.3.3 Operator released

This alarm message appears on the display when the X-ray command has been released during a working cycle but out of the X-ray phase (i.e. when the rotating arm is in the acceleration phase and the exposure has not yet started).

Press any pushbutton of the control panel to cancel the alarm.

If the alarm is generated outside the above mentioned conditions, it may mean:

1. host computer board PC1 damaged
2. X-ray command damaged
3. bad connection between host computer board PC1 and X-ray command



If the host computer PC1 needs to be replaced, remember to remove the EEPROM D38 from the old board and mount it on the new one, otherwise all the following parameters will be lost:

- tube calibration
- X, Y, R and C movement start positions
- language of the messages
- customized exposure parameters (kV and mA).
- AEC calibration and configuration.

If you forget to do this, recover the information from the System Configuration Chart (see Section C).

F.3.4 Movement halted

This alarm message appears on the display when the reset cycle has been stopped by pressing the DUMMY RUN pushbutton on the operator console, or when the dummy run cycle has been stopped by releasing the DUMMY RUN pushbutton.

Press any pushbutton of the control panel to cancel the alarm.

If the alarm is generated outside the above mentioned conditions it may mean:

1. host computer board PC1 damaged
2. X-ray command damaged
3. bad connection between host computer board PC1 and X-ray command



If the host computer PC1 needs to be replaced, remember to remove the EEPROM D38 from the old board and mount it on the new one, otherwise all the following parameters will be lost:

- tube calibration
- X, Y, R and C movement start positions
- language of the messages
- customized exposure parameters (kV and mA).
- AEC calibration and configuration.

If you forget to do this, recover the information from the System Configuration Chart (see Section C).

F.3.5 X-Ray break

This alarm message appears on the display when the X-ray command has been released during the X-ray exposure.

Press the RESET pushbutton on the control panel to cancel the alarm.

If the alarm is generated outside the above mentioned conditions it may mean:

1. bad connection between host computer board PC1 and converter board PQ1, connector X30
2. converter board PQ1 damaged
3. X-ray command damaged
4. bad connection between host computer board PC1 and X-ray command.



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

F.3.6 Handswitch error

This alarm appears on the display in the following conditions:

- a) when the X-ray command is pressed during the switching on of the system.
- b) when the X-ray command is kept pressed for more than 6 s after the end of the exposure cycle.

The alarm disappears automatically when the X-ray command is released.

If the alarm stays on it may mean:

1. X-ray command damaged
2. host computer board PC1 damaged
3. bad connection between host computer board PC1 and X-ray command.



If the host computer PC1 needs to be replaced, remember to remove the EEPROM D38 from the old board and mount it on the new one, otherwise all the following parameters will be lost:

- tube calibration
- X, Y, R and C movement start positions
- language of the messages
- customized exposure parameters (kV and mA).
- AEC calibration and configuration.

If you forget to do this, recover the information from the System Configuration Chart (see Section C).

F.3.7 Cassette

This warning message appears on the display in the following conditions:

- a) at the end of the Reset cycle
- b) when the X-ray command is pressed

and the cassette is not inserted in the cassette carriage (panoramic and ceph).

Press any pushbutton of the control panel to cancel the alarm.

If the alarm stays on (so with the cassette properly inserted in the cassette carriage) it may mean:

1. wiring of the optoswitch S16 damaged (panoramic cassette present)
2. wiring of the microswitch S23 damaged (ceph cassette present)
3. converter board PQ1 defective.



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

F.3.8 Fault opto film

This alarm message is always related to the optoswitch S16 that recognizes the insertion of the panoramic cassette in the cassette carriage, as the alarm Cassette (see the description in this section of the Service Manual) but it indicates that the optoswitch is broken.

Press the RESET pushbutton on the control panel to cancel the alarm.

F.3.9 Collimator

The position of the collimator is detected by three optoswitches (S21,S22 and S30) as listed in the table below:

S21	S22	S30	MESSAGE /CONDITION
ON	ON	ON	Optoswitches collimator fail
ON	ON	OFF	Optoswitches collimator fail
ON	OFF	ON	Optoswitches collimator fail
ON	OFF	OFF	Collimator in Ceph position
OFF	ON	ON	Collimator in Pan position
OFF	ON	OFF	Collimator in Tscan position
OFF	OFF	ON	Optoswitches collimator fail
OFF	OFF	OFF	Collimator

This alarm is generated when the collimator is in an intermediate position, i.e. between transcan and panoramic, while it is moved to change its position according to the projection desired (panoramic, transcan, teleradiography).

When the correct position is reached, the alarm is automatically reset.

The alarm is also generated if the collimator is in the transcan position but the transcan option is not present in the system.

If the alarm stays on it may mean:

1. one of the collimator optoswitches S21, S22, S30 is damaged (see principle diagram Z1-11)
2. wiring between the collimator and the PQ1 converter board damaged (see principle diagram Z1-11)
3. PQ1 converter board damaged.



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

F.3.10 Tubehead

The position of the tubehead is detected by two optoswitches (S19 for the teleradiographic position and S20 for the panoramic/transcan position) as listed in the table below:

S19	S20	CONDITION	MESSAGE
OFF	ON	Tubehead in Pan/tscan position	None
ON	OFF	Tubehead in Ceph position	None
ON	ON	Error condition	Optoswitches tubehead fail
OFF	OFF	Error condition	Tubehead

This alarm is generated when the position of the tubehead is not congruent with the position of the collimator.

When the correct position is reached, the alarm is automatically reset.

If the alarm is always present:

1. one of the tubehead optoswitches S19 or S20 is damaged (see principle diagram Z1-11)
2. wiring between the optoswitches S19 - S20 and the converter board damaged (see principle diagram Z1-11)
3. PQ1 converter board damaged.



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

F.3.11 Optoswitches collimator fail

Three optoswitches (S21, S22 and S30) are mounted on the collimator to detect the different positions selected, as listed in the table below:

S21	S22	S30	MESSAGE /CONDITION
ON	ON	ON	Optoswitches collimator fail
ON	ON	OFF	Optoswitches collimator fail
ON	OFF	ON	Optoswitches collimator fail
ON	OFF	OFF	Collimator in Ceph position
OFF	ON	ON	Collimator in Pan position
OFF	ON	OFF	Collimator in Tscan position
OFF	OFF	ON	Optoswitches collimator fail
OFF	OFF	OFF	Collimator

The alarm appears on the display when one of the following conditions is detected:

1. S21 or S22 or S30 damaged
2. wiring of the connector X50(collimator)-X45(converter board PQ1) damaged
3. converter board PQ1 damaged.



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

To reset the alarm, switch the system OFF and then ON again.

F.3.12 Optoswitches tubehead fail

The position of the tubehead is detected by two optoswitches (S19 for the teleradiographic position and S20 for the panoramic/transcan position) as listed in the table below:

S19	S20	CONDITION	MESSAGE
OFF	ON	Tubehead in Pan/Tscan position	None
ON	OFF	Tubehead in Ceph position	None
ON	ON	Error condition	Optoswitches tubehead fail
OFF	OFF		Tubehead

The alarm appears on the display when one of the following conditions is detected:

1. S19 or S20 damaged
2. wiring of the connector X47(converter board PQ1-S19) damaged
3. wiring of the connector X46(converter board PQ1-S20) damaged
4. converter board PQ1 damaged.



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

To reset the alarm, switch the system OFF and then ON again.

F.3.13 Secondary slider

Two optoswitches (S31 and S32) are mounted on the panoramic cassette carriage to detect the position of the secondary slit, panoramic or transcan, as listed in the table below:

S31	S32	CONDITION	MESSAGE
ON	OFF	Secondary slit pan position	None
OFF	ON	Secondary slit tscan position	None
ON	ON	Error condition	Secondary slider
OFF	OFF	Transition from pan to tscan or vice versa	Secondary slider
OFF	ON	Error condition	Secondary slider
ON	OFF	Error condition	Secondary slider

The alarm appears on the display when one of the following conditions is detected:

1. S31 or S32 damaged
2. wiring between S31 and AEC control board PA5 (X81) damaged
3. wiring between S32 and AEC control board PA5 (X82) damaged
4. PA5 board damaged
5. wiring between PA5 board (X83) and PQ1 converter board (X50) damaged
6. PQ1 converter board damaged.



The PA5 board controlling the two optoswitches is the one mounted in the panoramic cassette assembly.

*If one or both optoswitches are damaged, it is possible to disable the PA5 board, so that the alarm disappears: the AEC function is disabled, but the system can be used selecting manually the exposure parameters; see the explanation of the **Pan PA5 menu** service programs for more details.*

To reset the alarm it is necessary to switch OFF and then ON the system.



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

F.3.14 VLM conv. alarm

The power supply for the converter board PQ1 (400 VDC) is out of range (tolerance $\pm 10\%$).

The microcontroller on the converter board PQ1 recognizes the alarm, temporarily disables the converter electronics and communicates the alarm to the host board PC1.

The host provides a diagnostic message on the display and waits for the alarm to self-reset before starting a new exposure sequence.

Possible causes:

1. converter board PQ1 defective
2. PFC board PN1 defective
3. mains supply out of range.



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

The alarm is captured and stored as soon as it is detected.

Press the RESET pushbutton on the control panel to cancel the alarm (if expired).

F.3.15 -15V conv. alarm

The converter board PQ1 -15V power supply is out of range (tolerance $\pm 10\%$).

The microcontroller on the converter board PQ1 recognizes the alarm, temporarily disables the converter electronics and communicates the alarm to the host board PC1.

The host provides a diagnostic message on the display and waits for the alarm to self-reset before starting a new exposure sequence.

Check the power supply value on test points TP10 and TP8 (GND) using a digital multimeter (VDC) and by checking the LED H7 (ON=OK, OFF=NOT OK).

Check whether the common power supply +400VDC is out of range, on the connector X41 pins 1-2 of the converter board.

Check the reference voltage of the A/D converter (+5V) on TP19 and TP8 (GND): adjust if necessary by acting on potentiometer P1 (**is mandatory to use an high resolution, 4digits multimeter**).

Possible causes:

1. check whether fuse F4 has blown
2. converter board PQ1 defective.



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

The alarm is captured and stored as soon as it is detected.

Press the RESET pushbutton on the control panel to cancel the alarm (if expired).

F.3.16 +5V conv. alarm

The converter board PQ1 +5V power supply is out of range (tolerance $\pm 10\%$).

The microcontroller on the converter board PQ1 recognizes the alarm, temporarily disables the converter electronics and communicates the alarm to the host board PC1.

The host provides a diagnostic message on the display and waits for the alarm to self-reset before starting a new exposure sequence.

Check the value of the power supply on the test points TP7 and TP8 (GND) using a digital multimeter (VDC) and by checking the LED H8 (ON=OK, OFF=NOT OK).

Check whether the common power supply +400VDC is out of range, on the connector X41 pins 1-2 of the converter board.

Check the reference voltage of the A/D converter (+5V) on TP19 and TP8 (GND): adjust if necessary by acting on potentiometer P1 (**is mandatory to use an high resolution, 4digits multimeter**).

Possible causes:

1. check whether fuse F3 has blown
2. converter board PQ1 defective.



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

The alarm is captured and stored as soon as it is detected.

Press the RESET pushbutton on the control panel to cancel the alarm (if expired).

F.3.17 +15V conv. alarm

The converter board PQ1 +15V power supply is out of range (tolerance $\pm 10\%$).

The microcontroller on the converter board PQ1 acknowledges the alarm, temporarily disables the converter electronics and communicates the alarm to the host board PC1.

The host provides a diagnostic message on the display and waits for the alarm to self-reset before starting a new exposure sequence.

Check the power supply value on test points TP3 and TP8 (GND) using a digital multimeter (VDC) and by checking the LED H6 (ON=OK, OFF=NOT OK).

Check whether the common power supply +400VDC is out of range, on the connector X41 pins 1-2 of the converter board.

Check the reference voltage of the A/D converter (+5V) on TP19 and TP8 (GND): adjust if necessary by acting on potentiometer P1 (**is mandatory to use an high resolution, 4digits multimeter**).

Possible causes:

1. check whether fuse F3 has blown
2. converter board PQ1 defective.



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

The alarm is captured and stored as soon as it is detected.

Press the RESET pushbutton on the control panel to cancel the alarm (if expired).

F.3.18 +31V conv. alarm

The converter board PQ1 +31V power supply is out of range (tolerance $\pm 1,5\%$).

The microcontroller on the converter board PQ1 recognizes the alarm, temporarily disables the converter electronics and communicates the alarm to the host board PC1.

The host provides a diagnostic message on the display and waits for the alarms to self-reset before starting a new exposure sequence.

Check the power supply value on test points TP5 and TP8 (GND) using a digital multimeter (VDC) and by checking the LED H5 (ON=OK, OFF=NOT OK).

Check whether the common power supply +400VDC is out of range, on the connector X41 pins 1-2 of the converter board.

Check the reference voltage of the A/D converter (+5V) on TP19 and TP8 (GND): adjust if necessary by acting on potentiometer P1 (**is mandatory to use an high resolution, 4digits multimeter**).

Possible causes:

1. check whether fuse F2 has blown
2. converter board PQ1 defective.



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

The alarm is captured and stored as soon as it is detected.

Press the RESET pushbutton on the control panel to cancel the alarm (if expired).

F.3.19 +14V under range

The system control board PC1 +14V power supply is out of range, less than 12V (if it is less than 10V, the system control board is off). In the range between 12V and 16V no alarms are generated.

This power supply is coming from the PFC board PN1 and it is controlled by the microprocessor of the system control board PC1.

Verify the value of the power supply on the test points TP4 and TP2 (GND) on the PFC board PN1; on the test points TP7 and TP1 (GND) on the system control board PC1; by checking the LED H1 (ON=OK, OFF=NOT OK) always on the system control board PC1.

Possible causes:

1. check if fuses F3 and F1 on the PFC board PN1 are blown.
2. PFC board PN1 defective.
3. system control board PC1 defective.



If the host computer PC1 needs to be replaced, remember to remove the EEPROM D38 from the old board and mount it on the new one, otherwise all the following parameters will be lost:

- tube calibration
- X, Y, R and C movement start positions
- language of the messages
- customized exposure parameters (kV and mA).
- AEC calibration and configuration.

If you forget to do this, recover the information from the System Configuration Chart (see Section C).

The alarm is captured and stored as soon is detected.

Press the RESET pushbutton on the control panel to cancel the alarm (if expired).

F.3.20 +14V over range

The system control board PC1 +14V power supply is out of range, over than 16V. In the range between 12V and 16V no alarms are generated.

This power supply is coming from the PFC board PN1 and it is controlled by the microprocessor of the system control board PC1.

Verify the value of the power supply on the test points TP4 and TP2 (GND) on the PFC board PN1; on the test points TP7 and TP1 (GND) on the system control board PC1.

Possible causes:

1. PFC board PN1 defective.
2. system control board PC1 defective.



If the host computer PC1 needs to be replaced, remember to remove the EEPROM D38 from the old board and mount it on the new one, otherwise all the following parameters will be lost:

- tube calibration
- X, Y, R and C movement start positions
- language of the messages
- customized exposure parameters (kV and mA).
- AEC calibration and configuration.

If you forget to do this, recover the information from the System Configuration Chart (see Section C).

The alarm is captured and stored as soon is detected.

Press the RESET pushbutton on the control panel to cancel the alarm (if expired).

F.3.21 +42V under range

The system control board PC1 +42V power supply is under range. This power supply it is used to energize the step motors.

This power supply is coming from the PFC board PN1 and it is controlled by the microprocessor of the system control board PC1.

Verify the value of the power supply on the test points TP1 and TP7 (GND) on the PFC board PN1; by checking the LED H3 (ON=OK, OFF=NOT OK) on the system control board PC1; by checking the LED V5 (ON=OK, OFF=NOT OK) on the PFC board PN1.

Possible causes:

1. check if fuse F2 on the PFC board PN1 is blown.
2. PFC board PN1 defective.
3. system control board PC1 defective.



If the host computer PC1 needs to be replaced, remember to remove the EEPROM D38 from the old board and mount it on the new one, otherwise all the following parameters will be lost:

- tube calibration
- X, Y, R and C movement start positions
- language of the messages
- customized exposure parameters (kV and mA).
- AEC calibration and configuration.

If you forget to do this, recover the information from the System Configuration Chart (see Section C).

The alarm is captured and stored as soon is detected.

Press the RESET pushbutton on the control panel to cancel the alarm (if expired).

F.3.22 +42V over range

The system control board PC1 +42V power supply is over range. This power supply it is used to energize the step motors.

This power supply is coming from the PFC board PN1 and it is controlled by the microprocessor of the system control board PC1.

Verify the value of the power supply on the test points TP1 and TP7 (GND) on the PFC board PN1.

Possible causes:

1. PFC board PN1 defective.
2. system control board PC1 defective.



If the host computer PC1 needs to be replaced, remember to remove the EEPROM D38 from the old board and mount it on the new one, otherwise all the following parameters will be lost:

- tube calibration
- X, Y, R and C movement start positions
- language of the messages
- customized exposure parameters (kV and mA).
- AEC calibration and configuration.

If you forget to do this, recover the information from the System Configuration Chart (see Section C)

The alarm is captured and stored as soon is detected.

Press the RESET pushbutton on the control panel to cancel the alarm (if expired).

F.3.23 kV out of range

The kV feedback from the tubehead is monitored by a comparator circuit on the converter board PQ1 and its output is connected to the interrupt line of the microcontroller.

When the value of the kV feedback signal is outside the set operating range (nominal value $\pm 3\text{kV}$), the microcontroller disables the converter electronics and communicates the alarm to the host board PC1; in consequence of that, the X-ray emission is stop by disactivating the START_XRAY line. It waits for a reset before starting a new exposure sequence.

If the kV generated are really too high (more than 90) also the alarm **Over kV** may be generated.

The kV feedback signal can be monitored with a multimeter connected on TP13 and TP8 (GND) on the converter board PQ1 (see Section D for more details).

Possible cause:

1. converter board PQ1 defective.
2. tubehead defective.
3. wiring between converter board PQ1 and tubehead defective.



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

The alarm is captured and stored as soon as it is detected.

Press the RESET push button on the control panel to cancel the alarm.

F.3.24 mA out of range

The mA feedback coming from the tubehead is monitored by a comparator circuit on the converter board PQ1 and its output is connected to the interrupt line of the microcontroller.

When the value of the mA feedback signal is outside the set operating range (nominal value $\pm 5\%$), the microcontroller disables the converter electronics and communicates the alarm to the host board PC1; in consequence of that, the X-ray emission is stop by disactivating the START_XRAY line. It waits for a reset before starting a new exposure sequence.

The mA feedback signal can be monitored with a multimeter connected on TP16 and TP8 (GND) on the converter board PQ1 (see Section D for more details).

Possible causes:

1. fuse F5 blown on the converter board PQ1
2. converter board PQ1 defective.
3. tubehead defective.
4. wiring between converter board PQ1 and tubehead defective.



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

The alarm is captured and stored as soon as it is detected.

Press the RESET push button on the control panel to cancel the alarm.

F.3.25 I CHP out range

The current passing through the power transistors mounted on the converter board PQ1 is measured by a Hall sensor, connected to the microcontroller of the converter board itself.

When the current is outside the set operating range, the microcontroller disables the converter electronics, and communicates the alarm to the host board PC1; in consequence of that, the X-ray emission is stop by disactivating the START_XRAY line. It waits for a reset before starting a new exposure sequence.

If the current is really high, also the alarm **Chp.over current** may be generated.

Possible causes:

1. converter board PQ1 defective.
2. tubehead defective.



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

The alarm is captured and stored as soon as it is detected.

Press the RESET pushbutton on the control panel to cancel the alarm.

F.3.26 Over kV

The kV feedback from the tubehead is monitored by a comparator circuit on the converter board PQ1 and its output is connected to the interrupt line of the microcontroller.

If the kV generated are more than 90, the microcontroller disables the converter electronics and communicates the alarm to the host board PC1; in consequence of that, the X-ray emission is stop by disactivating the START_XRAY line. It waits for a reset before starting a new exposure sequence.

The kV feedback signal can be monitored with a multimeter connected on TP13 and TP8 (GND) on the converter board PQ1 (see Section D for more details).

Possible causes:

1. converter board PQ1 defective.
2. tubehead defective.



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

The alarm is captured and stored as soon as it is detected.

Press the RESET pushbutton on the control panel to cancel the alarm.

F.3.27 CHP. over current

The current passing through the power transistors mounted on the converter board PQ1 is measured by a Hall sensor, connected to the microcontroller of the converter board itself.

The relevant circuitry corrects the kV control loop and, in case of excessive current, temporarily inhibits the converter electronics and generates an alarm to the interrupt line of the microcontroller.

The microcontroller disables the converter electronics, and communicates the alarm to the host board PC1; in consequence of that, the X-ray emission is stop by disactivating the START_XRAY line. It waits for a reset before starting a new exposure sequence.

Possible cause:

1. converter board PQ1 defective
2. tubehead defective.



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

The alarm is captured and stored as soon as it is detected.

Press the RESET pushbutton on the control panel to cancel the alarm.

F.3.28 Converter: inv.over current

The current passing through the power transistors mounted on the converter board PQ1 is measured by a Hall sensor, connected to the microcontroller of the converter board itself.

When the absolute maximum current limit has been exceeded, the converter electronics are immediately and permanently inhibited (latched condition) and a system OFF/ON sequence is required to cancel the alarm.

During the error condition, the alarm message is displayed on the display and the control panel is disabled.

Possible causes:

1. converter board PQ1 defective
2. tubehead defective.



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

To reset the alarm, switch the system OFF and then ON again.

F.3.29 Back up timer

The back-up time is counted by the microcontroller mounted on the converter board PQ1.

The host board PC1 informs the microcontroller on the converter board about the actual exposure time.

The microcontroller on the converter board sets itself to an exposure time limit about 20 % longer.

When the DEAD_MAN line is on (exposure command by the operator), the integration of the effective X-ray time is enabled, by counting the time during which START_XRAY is on.

If the limit is exceeded, the microcontroller on the converter board disables the converter electronics stopping the X-ray emission and communicates the alarm to the host board.

The host board deactivates the START_XRAY line, resets the alarm, and waits for the DEAD_MAN command to be released, before a new exposure sequence is started.

Possible causes:

1. converter board PQ1 defective
2. host board PC1 defective.



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).



If the host computer PC1 needs to be replaced, remember to remove the EEPROM D38 from the old board and mount it on the new one, otherwise all the following parameters will be lost:

- tube calibration
- X, Y, R and C movement start positions
- language of the messages
- customized exposure parameters (kV and mA).
- AEC calibration and configuration.

If you forget to do this, recover the information from the System Configuration Chart (see Section C).

The alarm is captured and stored as soon as it is detected.

Press the RESET pushbutton on the control panel to cancel the alarm (if expired).

F.3.30 No Start/Stop HW

The microprocessor of the PC1 system control board is sending the X-ray on start signals (one is a digital signal, the other one is an analog signal) to the converter board PQ1; the sequence of signals is the following:

1. Dead man (positive - analog signal)
2. on the serial communication channel are transferred information about set point of kV, mA and duration of the exposure time
3. X-ray start (negative - digital signal)

If the PQ1 is receiving a wrong sequence of signals, the alarm **No start/stop hw** is generated.

Possible causes:

1. PC1 system control board defect
2. PQ1 converter board damaged
3. wiring between PQ1 (X44) and PC1 (X30) board damaged or bad connection.



If the host computer PC1 needs to be replaced, remember to remove the EEPROM D38 from the old board and mount it on the new one, otherwise all the following parameters will be lost:

- tube calibration
- X, Y, R and C movement start positions
- language of the messages
- customized exposure parameters (kV and mA).
- AEC calibration and configuration.

If you forget to do this, recover the information from the System Configuration Chart (see Section C).



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

The alarm is captured and stored as soon as it is detected.

Press the RESET pushbutton on the control panel to cancel the alarm (if expired).

F.3.31 Reset -X- failed

Every movement (X,Y, R and C) has a maximum time (about 20 s) to reach the reset position after pressing the RESET pushbutton on the control panel.

If the X movement does not reach its reset position in time, the alarm is generated.

Possible causes:

1. X movement step motor defective
2. belt of the X movement step motor damaged or belt tension incorrect
3. X movement blocked
4. X movement step motor +42V power supply is not correct on the PC1 system control board: this power supply comes from the PFC board PN1.

Check the power supply value on test points TP1 and TP7 (GND) on the PFC board PN1; by checking the LED H3 (ON=OK, OFF=NOT OK) on the system control board PC1; by checking the LED V5 (ON=OK, OFF=NOT OK) on the PFC board PN1.

Check whether fuse F2 on the PFC board PN1 has blown.
PFC board PN1 defective.

System control board PC1 defective.

5. wiring damaged between PC1 system control board and X movement step motor (see principle diagram Z1-10)
6. X movement reset position optoswitch S15 damaged
7. PC1 system control board does not recognize the X movement reset position optoswitch S15 (PC1 board defective)
8. wiring damaged between optoswitch S15 and PC1 system control board (see principle diagram Z1-11).



If the host computer PC1 needs to be replaced, remember to remove the EEPROM D38 from the old board and mount it on the new one, otherwise all the following parameters will be lost:

- tube calibration
- X, Y, R and C movement start positions
- language of the messages
- customized exposure parameters (kV and mA).
- AEC calibration and configuration.

If you forget to do this, recover the information from the System Configuration Chart (see Section C).

The alarm is captured and stored as soon as it is detected.

Press the RESET pushbutton on the control panel to cancel the alarm.

F.3.32 Reset -Y- failed

Every movement (X,Y, R and C) has a maximum time (about 20 s) to reach the reset position after pressing the RESET pushbutton on the control panel.

If the Y movement does not reach its reset position in time, the alarm is generated.

Possible causes:

1. Y movement step motor defective
2. belt of the Y movement step motor damaged or belt tension incorrect
3. Y movement blocked
4. Y movement step motor +42V power supply is not correct on the PC1 system control board: this power supply comes from the PFC board PN1.

Check the power supply value on test points TP1 and TP7 (GND) on the PFC board PN1; by checking the LED H3 (ON=OK, OFF=NOT OK) on the system control board PC1; by checking the LED V5 (ON=OK, OFF=NOT OK) on the PFC board PN1.

Check whether fuse F2 on the PFC board PN1 has blown.
PFC board PN1 defective.

System control board PC1 defective.

5. wiring damaged between PC1 system control board and Y movement step motor (see principle diagram Z1-10)
6. Y movement reset position optoswitch S13 damaged
7. PC1 system control board is not recognizing the Y movement reset position optoswitch S13 (PC1 board defective)
8. wiring damaged between optoswitch S13 and PC1 system control board (see principle diagram Z1-11).



If the host computer PC1 needs to be replaced, remember to remove the EEPROM D38 from the old board and mount it on the new one, otherwise all the following parameters will be lost:

- tube calibration
- X, Y, R and C movement start positions
- language of the messages
- customized exposure parameters (kV and mA).
- AEC calibration and configuration.

If you forget to do this, recover the information from the System Configuration Chart (see Section C).

The alarm is captured and stored as soon as it is detected.

Press the RESET pushbutton on the control panel to cancel the alarm.

F.3.33 Reset -R- failed

Every movement (X,Y, R and C) has a maximum time (about 20 s) to reach the reset position after pressing the RESET pushbutton on the control panel.

If the R movement does not reach its reset position in time, the alarm is generated.

Possible causes:

1. R movement step motor defective
2. belt of the R movement step motor damaged or belt tension incorrect
3. R movement blocked
4. R movement step motor +42V power supply is not correct on the PC1 system control board: this power supply comes from the PFC board PN1.

Check the power supply value on test points TP1 and TP7 (GND) on the PFC board PN1; by checking the LED H3 (ON=OK, OFF=NOT OK) on the system control board PC1; by checking the LED V5 (ON=OK, OFF=NOT OK) on the PFC board PN1.

Check whether fuse F2 on the PFC board PN1 has blown.

PFC board PN1 defective.

System control board PC1 defective.

5. wiring damaged between PC1 system control board and R movement step motor (see principle diagram Z1-10)
6. R movement reset position optoswitches S11 and S10 damaged
7. PC1 system control board does not recognize the R movement reset position optoswitches S11 and S10 (PC1 board defective)
8. wiring damaged between optoswitches S11 - S10 and PC1 system control board (see principle diagram Z1-11).



If the host computer PC1 needs to be replaced, remember to remove the EEPROM D38 from the old board and mount it on the new one, otherwise all the following parameters will be lost:

- tube calibration
- X, Y, R and C movement start positions
- language of the messages
- customized exposure parameters (kV and mA).
- AEC calibration and configuration.

If you forget to do this, recover the information from the System Configuration Chart (see Section C).

The alarm is captured and stored as soon as it is detected.

Press the RESET pushbutton on the control panel to cancel the alarm.

F.3.34 Reset -C- failed

Every movement (X,Y, R and C) has a maximum time (about 20 s) to reach the reset position after pressing the RESET pushbutton on the control panel.

If the C movement does not reach its reset position in time, the alarm is generated.

Possible causes:

1. C movement step motor defective
2. belt of the C movement step motor damaged or belt tension incorrect
3. C movement blocked
4. C movement step motor +42V power supply is not correct on the PC1 system control board: this power supply comes from the PFC board PN1.

Check the power supply value on test points TP1 and TP7 (GND) on the PFC board PN1; by checking the LED H3 (ON=OK, OFF=NOT OK) on the system control board PC1; by checking the LED V5 (ON=OK, OFF=NOT OK) on the PFC board PN1.

Check whether fuse F2 on the PFC board PN1 has blown.

PFC board PN1 defective.

System control board PC1 defective.

5. wiring damaged between PC1 system control board and C movement step motor (see principle diagram Z1-10)
6. C movement half run position optoswitch S17 damaged
7. PC1 system control board is not recognizing the C movement half run position optoswitch S17 (PC1 board defective)
8. wiring damaged between optoswitch S17 and PQ1 converter board (see principle diagram Z1-11)
9. wiring damaged between PQ1 converter board and PC1 system control board (see principle diagram Z1-11).

DDE version only:

10. C movement reset position optoswitch S42 damaged
11. PH3 Ceph DMU interface board is not recognizing the C movement reset position optoswitch S42 (PH3 board defective)
12. wiring damaged between optoswitch S42 and PH3 Ceph DMU interface board X95.



If the host computer PC1 needs to be replaced, remember to remove the EEPROM D38 from the old board and mount it on the new one, otherwise all the following parameters will be lost:

- tube calibration
- X, Y, R and C movement start positions
- language of the messages
- customized exposure parameters (kV and mA).
- AEC calibration and configuration.

If you forget to do this, recover the information from the System Configuration Chart (see Section C).

The alarm is captured and stored as soon as it is detected.

Press the RESET pushbutton on the control panel to cancel the alarm.

F.3.35 Console: link failure

The host computer board PC1 has detected a protocol error in the communication with the operator console control board PC7: as soon the correct communication is restored, the PC1 advise the PC7 of the problem occurred and the alarm Console link failure appears on the display.

Possible causes:

1. host computer board PC1 damaged
2. operator console control board PC7 damaged
3. wiring between PC1(X28) and PC7(X4) damaged.



If the host computer PC1 needs to be replaced, remember to remove the EEPROM D38 from the old board and mount it on the new one, otherwise all the following parameters will be lost:

- tube calibration
- X, Y, R and C movement start positions
- language of the messages
- customized exposure parameters (kV and mA).
- AEC calibration and configuration.

If you forget to do this, recover the information from the System Configuration Chart (see Section C).

To reset the alarm it is necessary to switch OFF and then ON the system.

F.3.36 Converter: link failure

This alarm is generated when the host computer board PC1 is unable to communicate with the converter board PQ1.

Possible causes:

1. 400VDC not present on the converter board PQ1 (PQ1switched off - fuse F6 defective)
2. converter board PQ1 damaged
3. wiring between PQ1(X44) and PC1(X30) damaged.



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

To reset the alarm, switch the system OFF and then ON again.

F.3.37 Conv.link fail 2

The converter board PQ1 has detected a protocol error in communication with the host computer board PC1: as soon the correct communication is restored, the PQ1 advises the PC1 of the problem that has occurred and the alarm Conv.link fail 2 appears on the display.

Possible cause:

1. wiring between the converter board PQ1(X44) and the host computer board PC1(X30) damaged or bad connection.
2. host computer board PC1 damaged.



If the host computer PC1 needs to be replaced, remember to remove the EEPROM D38 from the old board and mount it on the new one, otherwise all the following parameters will be lost:

- tube calibration
- X, Y, R and C movement start positions
- language of the messages
- customized exposure parameters (kV and mA).
- AEC calibration and configuration.

If you forget to do this, recover the information from the System Configuration Chart (see Section C).

Press the RESET pushbutton on the control panel to cancel the alarm.

F.3.38 No communication

This alarm is generated by the operator console control board PC7 when there is no communication with the host computer board PC1.

Possible causes:

1. host computer board PC1 damaged
2. operator console control board PC7 damaged
3. wiring between PC1(X28) and PC7(X4) damaged.



If the host computer PC1 needs to be replaced, remember to remove the EEPROM D38 from the old board and mount it on the new one, otherwise all the following parameters will be lost:

- tube calibration
- X, Y, R and C movement start positions
- language of the messages
- customized exposure parameters (kV and mA).
- AEC calibration and configuration.

If you forget to do this, recover the information from the System Configuration Chart (see Section C).

To reset the alarm it is necessary to switch OFF and then ON the system.

F.3.39 PA5 board link failure

The host computer board PC1 has detected a protocol error in the communication with the PA5 AEC control board.

Possible causes:

1. host computer board PC1 damaged
2. AEC control board PA5 damaged
3. For ceph version: wiring between PC1(X28) and PA5 (X83) damaged
4. for panoramic version:
 - wiring between the converter board PQ1 (X50) and PA5 (X83) damaged
 - converter board PQ1 damaged.



If the host computer PC1 needs to be replaced, remember to remove the EEPROM D38 from the old board and mount it on the new one, otherwise all the following parameters will be lost:

- tube calibration
- X, Y, R and C movement start positions
- language of the messages
- customized exposure parameters (kV and mA).
- AEC calibration and configuration.

If you forget to do this, recover the information from the System Configuration Chart (see Section C).



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

To reset the alarm it is necessary to switch OFF and then ON the system.

This alarm can be generated by another condition: if in the Service Programs PAN PA5 MENU or CEPH PA5 MENU the PA5 control board is (are) enabled but it (they) is (are) not mounted, the alarm is generated as soon as the system is switched on. This is not an error condition, but a wrong setting of the system.

Also in this case, to reset the alarm it is necessary to switch OFF and then ON the system.

F.3.40 PH3 Ceph alarm

The host computer board PC1 has detected a protocol error in the communication with the Ceph DMU interface board PH3.

Possible causes:

1. Ceph DMU interface board PH3 damaged
2. wiring between PH3 (X92) and PA7 (X15) damaged.

To reset the alarm it is necessary to switch OFF and then ON the system.

F.3.41 PH3 Pan alarm

The host computer board PC1 has detected a protocol error in the communication with the Pan DMU interface board PH3.

Possible causes:

1. Pan DMU interface board PH3 damaged
2. wiring between PH3 (X92) and PQ1(X50) damaged.

To reset the alarm it is necessary to switch OFF and then ON the system.

F.3.42 PA7 Bridge alarm

The host computer board PC1 has detected a protocol error in the communication with the Auxiliary board PA7.

Possible causes:

1. Auxiliary board PA7 damaged
2. wiring between PA7 (X10) and connector X34A damaged
3. wiring between PC1 (X28) and connector X34B damaged.



If the auxiliary board PA7 needs to be replaced, the IP address and the Subnet Mask must be stored in the new PA7 by using the Service Programs (see the relevant paragraphs of this section for more information).

To reset the alarm it is necessary to switch OFF and then ON the system.

F.3.43 Software error

The microprocessor of the PC1 system control board is checking the parameters corresponding to the movements of the different projections stored in the Eprom while they are being used (so during any movement, such as reset cycle, panoramic projection, etc.).

If these parameters are not the ones expected, the alarm Software error is generated.

Possible causes:

1. Eprom D31 on the PC1 system control board defective
2. PC1 system control board defective.



If the host computer PC1 needs to be replaced, remember to remove the EEPROM D38 from the old board and mount it on the new one, otherwise all the following parameters will be lost:

- tube calibration
- X, Y, R and C movement start positions
- language of the messages
- customized exposure parameters (kV and mA).
- AEC calibration and configuration.

If you forget to do this, recover the information from the System Configuration Chart (see Section C).

The alarm is captured and stored as soon as it is detected.

Press the RESET pushbutton on the control panel to cancel the alarm.

F.3.44 System cpu fail: e2prom checksum

At the system power on, the microprocessor of the PC1 system control board tests the EEPROM memory: if an error in the memory is detected, the alarm System CPU fail: E2prom checksum is generated.

Possible causes:

1. EEPROM memory not readable
2. PC1 system control board defective.

Before replacing the PC1 system control board, try to reset the EEPROM by using the Reset EEPROM Service Program (for more details refer to the Service Programs paragraph of this Section F): if after the reset the alarm still persists, replace the PC1 system control board.



If the host computer PC1 needs to be replaced, remember to remove the EEPROM D38 from the old board and mount it on the new one, otherwise all the following parameters will be lost:

- tube calibration
- X, Y, R and C movement start positions
- language of the messages
- customized exposure parameters (kV and mA).
- AEC calibration and configuration.

If you forget to do this, recover the information from the System Configuration Chart (see Section C).

F.3.45 System cpu fail: e2prom not ready

At the system power on, the microprocessor of the PC1 system control board tests the presence of the EEPROM memory. If an error in the memory is detected, the alarm System CPU fail: E2prom not ready is generated.

Possible causes:

1. PC1 system control board defective
2. EEPROM not present.



If the host computer PC1 needs to be replaced, remember to remove the EEPROM D38 from the old board and mount it on the new one, otherwise all the following parameters will be lost:

- tube calibration
- X, Y, R and C movement start positions
- language of the messages
- customized exposure parameters (kV and mA).
- AEC calibration and configuration.

If you forget to do this, recover the information from the System Configuration Chart (see Section C).

F.3.46 Ceph bay rotated

The DMU bay for the cephalometer can be rotated of 90° to make the DMU insertion easier.

The position of the DMU bay is detected by the optoswitch S41: when the DMU bay is not in the correct position to start an exposure (i.e. it is rotated), the alarm message Ceph bay rotated appears on the display; to reset it, it is enough to rotate the DMU bay in the correct position.

If the alarm message still persists, this can be due to one of the following possible causes:

1. optoswitch S41 broken
2. wiring between optoswitch S41 and the cephalometer DMU interface board PH3, connector X93 damaged
3. cephalometer DMU interface board PH3 damaged.

F.3.47 DMU misplaced

This alarm message appears when the DMU is in the panoramic position and the collimator is in one of the ceph positions.

To reset it, it is enough to move the collimator to the panoramic or transcan position.

If the alarm message still persists, this can be due to one of the following possible causes:

1. one of the optoswitches S21, S22 or S30 (used to detect the panoramic, transcan or ceph position of the collimator) is damaged
2. wiring of the connector X50(collimator)-X45(converter board PQ1) damaged
3. converter board PQ1 damaged.



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

F.3.48 DMU not present

This alarm message appears in one of the following conditions:

- a) the system is ready to make a panoramic/transcan exposure but the DMU is not inserted in the panoramic bay
- b) the collimator is in the panoramic position but the DMU is in the ceph bay.

To reset the alarm is enough to restore the proper working condition.

If the alarm message still persists, this can be due to one of the following possible causes:

1. one of the optoswitches S21, S22 or S30 (used to detect the panoramic, transcan or ceph position of the collimator) is damaged
2. wiring of the connector X50(collimator)-X45(converter board PQ1) damaged
3. converter board PQ1 damaged.



If the converter board PQ1 needs to be replaced, the service programs Tube calibration and Vf tube editing must be performed (see the relevant paragraphs of this section for more information).

F.3.49 DMU not ready

This message appears on the display when the system is switched on, during the booting time (duration about 30 s) of the Auxiliary board PA7.

If after the booting time the message is still present on the display, the PA7 board is damaged.



If the auxiliary board PA7 needs to be replaced, the IP address and the Subnet Mask must be stored in the new PA7 by using the Service Programs (see the relevant paragraphs of this section for more information).

F.3.50 DMU busy

This message appears on the display when the system has acquired an image but this image is not yet downloaded to the personal computer.

If the alarms persists, check the connection between the auxiliary board PA7 and the LAN network.



If the auxiliary board PA7 needs to be replaced, the IP address and the Subnet Mask must be stored in the new PA7 by using the Service Programs (see the relevant paragraphs of this section for more information).

F.3.51 CEPH collimator

The reset position of the secondary ceph collimator is detected by the optoswitch S40.

When the secondary ceph collimator is in the reset position, this position must be congruent with the reset position of the DMU ceph bay, defined by the optoswitch S42.

If the optoswitch S42 is active (DMU ceph bay in reset position) but the optoswitch S40 is not active, then the alarm **Ceph collimator** appears on the display.

Possible causes:

1. optoswitch S40 defective
2. wiring between optoswitch S40 and the ceph DMU interface board PH3 connector X94 damaged
3. check if the actuator of the optoswitch S40 is in the middle of the optoswitch, when the secondary ceph collimator is in the reset position; if not, adjust the position of the actuator (for more details refer to the paragraph **Adjusting the X-ray collimator** of this section of the Service Manual).

F.3.52 DMU fault

This message appears on the display when in the auxiliary board PA7 the electronic part controlling the communication with the DMU is not able to communicate with the DMU.

To reset the alarm it is necessary to switch OFF and then ON the system.

If the alarm persists, the auxiliary board PA7 is defective.



If the auxiliary board PA7 needs to be replaced, the IP address and the Subnet Mask must be stored in the new PA7 by using the Service Programs (see the relevant paragraphs of this section for more information).

F.3.53 No connection

The physical connection between the Personal Computer, or the hub, or the switch and the Orthoralix is lost.

Possible causes:

1. Ethernet cable defective
2. Ethernet cable not connected (Orthoralix side - PC/ hub/ switch side)
3. Ethernet cable in the Orthoralix column defective
4. connector X11 not connected to the auxiliary board PA7
5. connector X11 on the auxiliary board PA7 broken
6. auxiliary board PA7 damaged.



If the auxiliary board PA7 needs to be replaced, the IP address and the Subnet Mask must be stored in the new PA7 by using the Service Programs (see the relevant paragraphs of this section for more information).

Press the RESET pushbutton on the control panel to cancel the alarm.

F.3.54 DMU not detected

The auxiliary board PA7 is not able to read the serial number of the DMU.

Possible causes:

1. cable X8 connected to connector X6 of the auxiliary board PA7, or vice versa.

2. cables X8 and/or X6 not connected properly on the auxiliary board PA7
3. connectors X8 and/or X6 broken on the auxiliary board PA7
4. auxiliary board PA7 damaged
5. cable X6 from auxiliary board PA7 to panoramic DMU connector interface PA6 board damaged
6. cable X8 from auxiliary board PA7 to ceph DMU connector interface PA6 board damaged
7. panoramic or ceph DMU connector interface PA6 board damaged
8. DMU damaged.



If the auxiliary board PA7 needs to be replaced, the IP address and the Subnet Mask must be stored in the new PA7 by using the Service Programs (see the relevant paragraphs of this section for more information).

Press the RESET pushbutton on the control panel to cancel the alarm.

F.3.55 Transfer error

When a transmission error between the Orthoralix and the Personal Computer occurs, the auxiliary board PA7 is automatically making a resend of the image. If after three resend the transmission error is not recovered, then the alarm message Transfer error will appear on the display.

1. bad connections in the Ethernet cable between the Orthoralix and PC/hub/switch
2. bad connections in the Ethernet cable in the Orthoralix column
3. bad connections in the connector X11 on the auxiliary board PA7
4. auxiliary board PA7 damaged.



If the auxiliary board PA7 needs to be replaced, the IP address and the Subnet Mask must be stored in the new PA7 by using the Service Programs (see the relevant paragraphs of this section for more information).

Press the RESET pushbutton on the control panel to cancel the alarm.

F.3.56 HW fault 153

This alarm message is indicating an hardware fault in the PLD registers of the auxiliary board PA7.

Press the RESET pushbutton on the control panel to cancel the alarm.

If after the RESET the alarm is still present, replace the auxiliary board PA7.



If the auxiliary board PA7 needs to be replaced, the IP address and the Subnet Mask must be stored in the new PA7 by using the Service Programs (see the relevant paragraphs of this section for more information).

F.3.59 HW fault 200

This alarm message is indicating an hardware fault in the internal timers of the auxiliary board PA7.

Press the RESET pushbutton on the control panel to cancel the alarm.

If after the RESET the alarm is still present, replace the auxiliary board PA7.



If the auxiliary board PA7 needs to be replaced, the IP address and the Subnet Mask must be stored in the new PA7 by using the Service Programs (see the relevant paragraphs of this section for more information).

F.3.57 HW fault 154

This alarm message is indicating an hardware fault in the internal communication bus of the auxiliary board PA7.

Press the RESET pushbutton on the control panel to cancel the alarm.

If after the RESET the alarm is still present, replace the auxiliary board PA7.



If the auxiliary board PA7 needs to be replaced, the IP address and the Subnet Mask must be stored in the new PA7 by using the Service Programs (see the relevant paragraphs of this section for more information).

F.3.60 Host unavailable

This alarm message is generated when in the menu Config (enabled by clicking on the Orthoralix 9200 DDE icon in the system tray of Windows) is not done the correct configuration:

1. in the multiroom mode is not selected a default Personal Computer
2. in the single Personal Computer connection, it was not selected the unique Personal Computer.

To restore the proper working condition, do the correct selection in the menu Config.

Press the RESET pushbutton on the control panel to cancel the alarm.

F.3.61 Host busy

This alarm message is generated when the Personal Computer connected to the Orthoralix 9200 DDE is not ready to acquire the images from the Orthoralix.

This may happen when in the Personal Computer others software applications are running or when the Orthoralix 9200 DDE activex driver is not correctly installed.

Press the RESET pushbutton on the control panel to cancel the alarm.

F.3.58 HW fault 181

This alarm message is indicating that a panoramic DMU is inserted in the ceph bay.

Install the correct DMU and press the RESET pushbutton on the control panel to cancel the alarm.

F.4 Service programs

F.4.1 General

The Orthoralix system incorporates diagnostic service software programs, which can be run either by the operator for routine machine checks before use, or by the service engineer to assess system operations before taking corrective maintenance action.

F.4.2 Test start up

The service program procedure is started by pushing together the DUMMY RUN and PATIENT SIZE keys when switching on the machine: the keys must be kept pressed till the message WAIT disappears from the display.

The following message will appear on the display:

```
SERVICE PROGRAMS
Pls press Y- Y+
```

where Y- and Y+ are keys S16 and S17 on the keyboard (used to move the rotating arm along the Y axis, to center the patient with respect to the lateral vertical light).

By pressing the above mentioned keys, you can select the desired service program.

To return to normal operations, switch off the system.

F.4.3 Test procedures

The service programs consist of several selective tests, each independent from the others.

The test sequence is as follows:

F.4.3.1 X movement test and adjustment

By selecting this service program you can check the functioning of the X movement (step motor, wiring and power supply from the host computer board PC1) and change the relevant start position of the rotating cycle.

The following message will appear on the display:

```
-X- TEST & ADJ.
+0 +0 XYRABC
```

where:

- the first number indicates the actual position of the movement with respect to the reset position
- the second number the correction introduced to modify the start position of the movement

- XYRABC the status of the optoswitches related to the movements :

- X = start position of the X movement
- Y = start position of the Y movement
- RAB = start position of the rotation movement (2 optoswitches)
- C = start position of the cassette movement

If a capital letter is visualized (XYRABC) the related optoswitch has been activated; if a small letter is visualized, the related optoswitch has not been activated.

There are three different tests:

1. Constant speed test.

By pressing the keys mA+ and mA- on the keyboard, the step motor is supplied so as to have a constant speed.

By releasing the key, the movement is stopped.

2. Variable speed test.

By pressing the keys kV+ and kV- on the keyboard, the step motor is supplied with a variable speed, starting from the lowest and reaching the maximum. When the key is released, the speed decreases from the speed reached to zero.



Be careful during these two tests that the electrical start position is not recognized: avoids reaching the mechanical end stop with the step motor still rotating.

3. Modify the movement start position.

With this procedure you can modify the start position of the movement via software, instead of by changing the actuator of the relevant optoswitch.

Pressing keys s+ and s- will change the number indicating the start position (default = 0).

The correspondence between the number displayed and the shift in mm is the following:

$$\text{mm} = 0.0728 \times n^{\circ} \text{ displayed}$$

This procedure is useful when you need to change the start position of the X movement after having checked the system with the image quality phantom (see the paragraph "Verify the centering of the system with the image quality phantom" in this section).

F.4.3.2 Y movement test and adjustment

By selecting this service program you can check the functioning of the Y movement (step motor, wiring and power supply from the host computer board PC1) and change the relevant start position of the rotating cycle.

The following message will appear on the display:

```
-Y- TEST & ADJ.
+0 +0 XYRABC
```

where:

- the first number indicates the actual position of the movement with respect to the reset position
- the second number the correction introduced to modify the start position of the movement
- XYRABC the status of the optoswitches related to the movements :
 - X = start position of the X movement
 - Y = start position of the Y movement
 - RAB = start position of the rotation movement (2 optoswitches)
 - C = start position of the cassette movement

If a capital letter is visualized (XYRABC) the related optoswitch has been activated; if a small letter is visualized, the related optoswitch has not been activated.

There are three different tests:

1. Constant speed test.
By pressing keys mA+ and mA- on the keyboard, the step motor is supplied so as to have a constant speed.
By releasing the key, the movement is stopped.
2. Variable speed test.
By pressing keys kV+ and kV- on the keyboard, the step motor is supplied with a variable speed, starting from the lowest and reaching the maximum. When the key is released, the speed decreases from the speed reached to zero.



Be careful during these two tests that the electrical start position is not recognized: avoids reaching the mechanical end stop with the step motor still rotating.

3. Modify the movement start position.
With this procedure you can modify the start position of the movement via software, instead of by changing the actuator of the corresponding optoswitch.
Pressing keys s+ and s- will change the number indicating the start position (default = 0).
The correspondence between the number displayed and the shift in mm is the following:
$$\text{mm} = 0.0728 \times n \text{ displayed}$$

This procedure is useful when you have to change the start position of the Y movement after having checked the system with the image quality phantom (see the paragraph "Verify the centering of the system with the image quality phantom" in this section).

F.4.3.3 R movement test and adjustment

By selecting this service program you can check the functioning of the R (rotation) movement (step motor, wiring and power supply from the host computer board PC1) and change the relevant start position of the rotating cycle.

The following message will appear on the display:

```
-R- TEST & ADJ.
+0 +0 XYRABC
```

where:

- the first number indicates the actual position of the movement with respect to the reset position - the second number the correction introduced to modify the start position of the movement
- XYRABC the status of the optoswitches related to the movements :
 - X = start position of the X movement
 - Y = start position of the Y movement
 - RAB = start position of the rotation movement (2 optoswitches)
 - C = start position of the cassette movement

If a capital letter is visualized (XYRABC) the related optoswitch has been activated; if a small letter is visualized, the related optoswitch has not been activated.

There are three different tests:

1. Constant speed test.
By pressing the keys mA+ and mA- on the keyboard, the step motor is supplied in such a way to have a constant speed.
Releasing the key, the movement is stopped.
2. Variable speed test.
By pressing the keys kV+ and kV- on the keyboard, the step motor is supplied with a variable speed, starting from the lowest and reaching the maximum. When the key is released, the speed decreases from the speed reached to zero.



Be careful during these two tests that the electrical start position is not acknowledged: avoids reaching the mechanical end stop with the step motor still rotating.

3. Modify the movement start position.
With this procedure you can modify the start position of the movement via software, instead of by changing the actuator of the relevant optoswitch.
Pressing keys s+ and s- will change the number indicating the start position (default = 0).
The correspondence between the number displayed and the shift in degrees is the following:
$$\text{degrees} = 0.0272 \times n \text{ displayed}$$

This procedure is useful when you need to change the start position of the R movement after having checked the system with the image quality phantom (see the paragraph "Verify the centering of the system with the image quality phantom" of this section).

F.4.3.4 C movement test and adjustment

A) For Orthoralix 9200 /Plus /Ceph versions:

By selecting this service program you can check the functioning of the C (cassette) movement (step motor, wiring and power supply from the host computer board PC1) and change the relevant start position of the rotating cycle.

The following message will appear on the display:

```
-C- TEST & ADJ.  
+0 +0 XYRABC
```

where:

- the first number indicates the actual position of the movement with respect to the reset position
- the second number the correction introduced to modify the start position of the movement
- XYRABC the status of the optoswitches related to the movements :
 - X = start position of the X movement
 - Y = start position of the Y movement
 - RAB = start position of the rotation movement (2 optoswitches)
 - C = start position of the cassette movement

If a capital letter is visualized (XYRABC) the related optoswitch has been activated; if a small letter is visualized, the related optoswitch has not been activated.

There are three different tests:

1. Constant speed test.

By pressing keys mA+ and mA- on the keyboard, the step motor is supplied so as to have a constant speed.

By releasing the key, the movement stops.

2. Variable speed test.

By pressing keys kV+ and kV- on the keyboard, the step motor is supplied with a variable speed, starting from the lowest and reaching the highest. When the key is released, the speed decreases from the speed reached to zero.



Be careful during these two tests that the electrical start position is not acknowledged: avoid reaching the mechanical end stop with the step motor still rotating.

3. Modify the movement start position.

With this procedure you can modify the start position of the movement via software, instead of by changing the actuator of the relevant optoswitch.

Pressing keys s+ and s- will change the number indicating the start position (default = 0).

The correspondence between the number displayed and the shift in mm is the following:

$\text{mm} = 0.0728 \times n$ displayed

This procedure is useful when you have to change the start position of the C movement after having checked the system with the image quality phantom (see the paragraph "Verify the centering of the system with the image quality phantom" in this section).

B) For Orthoralix 9200 DDE Ceph versions:

By selecting this service program you can check the functioning of the cephal movement (step motor, wiring and power supply from the host computer board PC1) and change the relevant start position of the cephal scanning cycle.

The following message will appear on the display:

```
-C- TEST & ADJ.  
+0 +0 XYRABC
```

where:

- the first number indicates the actual position of the movement with respect to the reset position
- the second number the correction introduced to modify the start position of the movement
- XYRABC the status of the optoswitches related to the movements :
 - X = start position of the X movement
 - Y = start position of the Y movement
 - RAB = start position of the rotation movement (2 optoswitches)
 - C = start position of the cassette movement

If a capital letter is visualized (XYRABC) the related optoswitch has been activated; if a small letter is visualized, the related optoswitch has not been activated.

There are three different tests:

1. Constant speed test.

By pressing keys mA+ and mA- on the keyboard, the step motor is supplied so as to have a constant speed.

By releasing the key, the movement stops.

2. Variable speed test.

By pressing keys kV+ and kV- on the keyboard, the step motor is supplied with a variable speed, starting from the lowest and reaching the highest. When the key is released, the speed decreases from the speed reached to zero.



Be careful during these two tests that the electrical start position is not acknowledged: avoid reaching the mechanical end stop with the step motor still rotating.

3. Modify the movement start position.

With this procedure you can modify the start position of the movement via software, instead of by changing the actuator of the relevant optoswitch.

Pressing keys s+ and s- will change the number indicating the start position (default = 0).

The correspondence between the number displayed and the shift in mm is the following:

$\text{mm} = 0.0728 \times n \text{ displayed}$

This procedure is useful when you have to change the start position of the C movement after having checked the system with the image quality phantom (see the paragraph "Verify the centering of the system with the image quality phantom" in this section).

F.4.3.5 IP address

This service program is applicable only for the Orthoralix 9200 DDE versions.

By selecting this service program it is possible to check and to change the IP (Internet Protocol) address of the Orthoralix 9200 DDE when it is connected to the LAN network. The IP address is made of four numbers, having a range from 0 to 255. A default address is stored: it is possible to modify it by:

1. pressing keys kV + and kV - for the first number on the left
2. pressing keys mA + and mA - for the second number on the left
3. pressing keys s + and s - for the third number on the left
4. pressing keys program + and program - for the last number

The following message will appear on the display:

IP ADDRESS:
PLEASE WAIT

Please take note that the address appears on the display only when the connection to the LAN network is done properly: it takes approximately 60 s from the system switching on and during this time the message "PLEASE WAIT" is shown on the display.

After the modification of the IP address, to store it in the system, press Dummy Run: for about 5 s on the display will appear "PLEASE WAIT" and then the new IP address.



In case of PA7 board replacement, the IP address must be stored in the new PA7 board by using this Service Program.

F.4.3.6 Subnet mask

This service program is applicable only for the Orthoralix 9200 DDE versions.

By selecting this service program it is possible to check and to change the Subnet Mask address of the Orthoralix 9200 DDE when it is connected to the LAN network. The Subnet Mask address is made of four numbers, having a range from 0 to 255. A default address is stored: it is possible to modify it by:

1. pressing keys kV + and kV - for the first number on the left
2. pressing keys mA + and mA - for the second number on the left
3. pressing keys s + and s - for the third number on the left
4. pressing keys program + and program - for the last number

The following message will appear on the display:

SUBNET MASK:
PLEASE WAIT

Please take note that the address appears on the display only when the connection to the LAN network is done properly: it takes approximately 60 s from the system switching on and during this time the message "PLEASE WAIT" is shown on the display.

After the modification of the Subnet Mask address, to store it in the system, press Dummy Run: for about 5 s on the display will appear "PLEASE WAIT" and then the new Subnet Mask address.



In case of PA7 board replacement, the Subnet Mask address must be stored in the new PA7 board by using this Service Program.

F.4.3.7 Host input read

With this service program you can visualize the status of the hardware inputs of the host computer board PC1, with four hexadecimal numbers.

In this way you can check whether the host computer board recognizes the right inputs signals.

The correspondence between the hexadecimal numbers and the status of the hardware inputs is shown in pages F-71 and F-72.

F.4.3.8 Pan PA5 menu

With this service program is possible to enable/disable the detection of the Pan PA5 board by the host computer board PC1 at the system start up.

It is also possible to check the status of the optoswitches mounted on the secondary slit.

The following message will appear on the display:

```
PAN PA5 MENU
XX SLD=nW ENA<Y>
```

where:

- XX = if the AEC sensor is present on the PA5 board, this value should be from 0 to 10; if the AEC sensor is not present on the PA5 board, this value is FF
- SLD = nW = status of the secondary slit optoswitches
- N = narrow collimator (panoramic projections)
- W = wide collimator (transcan)

When the optoswitches are activated, the letters are in capital; when they are not activated the letters are smaller.

- ENA<Y> = by pressing the Program + or Program - keys on the keyboard, it is possible to enable (Y) or disable (N) the PA5 board detection at the start up. The board should be always enabled (Y). In case of activation of the service program **Default EEPROM**, the PA5 board is disabled and should be enabled again.

Suggestions:

1. The status of the optoswitches can be:
nW= wide collimator selected
Nw= narrow collimator selected
nw= transition from narrow to wide collimator or vice versa
NW= error condition: in this case the alarm Secondary slider is generated (see the alarm explanation for more details).
2. If one or both optoswitches are damaged, it is possible to disable the PA5 board, so that the alarm disappears, the AEC function is disabled, but the system can be used selecting manually the exposure parameters.

F.4.3.9 Ceph PA5 menu

With this service program is possible to enable/disable the detection of the Ceph PA5 board by the host computer board PC1 at the system start up.

The following message will appear on the display:

```
CEPH PA5 MENU
XX ENA<Y>
```

where:

- XX= if the AEC sensor is present on the PA5 board, this value should be from 0 to 10; if the AEC sensor is not present on the PA5 board, this value is FF
- ENA<Y>= by pressing the Program + or Program - keys on the keyboard, it is possible to enable (Y) or disable (N) the PA5 board detection at the start up. The board should be always enabled (Y).

In case of activation of the service program **Default EEPROM**, the PA5 board is disabled and should be enabled again. If the Orthoralix system is without the ceph arm, the Ceph PA5 board must be disabled.

F.4.3.10 Converter input read

With this service program you can visualize the status of the hardware inputs of the converter board PQ1, with four hexadecimal numbers.

In this way you can check whether the PH3 boards are recognizing the right inputs signals.

The correspondence between the hexadecimal numbers and the status of the hardware inputs is shown in page F-73.

F.4.3.11 Pan and Ceph PH3 input read

This service program is applicable only for Orthoralix 9200 DDE versions.

With this service program you can visualize the status of the hardware inputs of the panoramic PH3 and ceph PH3 boards, with four hexadecimal numbers.

In this way you can check whether the converter board is recognizing the right inputs signals.

The correspondence between the hexadecimal numbers and the status of the hardware inputs is shown in page F-74.

The following message will appear on the display:

```
PH3 PAN : CEPH READ
X XX: X XX
```

The first two numbers are related to the panoramic PH3 board and the second two are related to the ceph PH3 board.

F.4.3.12 Exposure counter

By selecting this service program you can visualize the number of exposures made.

The following message will appear on the display:

```
EXPOSURE COUNTER
P=XXXXX C=XXXXX
```

where the number after the P indicates the panoramic exposure made and the number after the C the teleradiographic ones.

F.4.3.13 Software version

With this service program you can check the software version mounted on converter board PQ1, on host computer board PC1 and on keyboard control board PC7.

The following message will appear on the display:

```
SOFTWARE VERSION
H=XX CV=XX CS=XX
```

where the number after H indicates the software version of the host computer board PC1, after CV the software version of the converter board PQ1 and after CS the software version of the keyboard control board PC7.

F.4.3.14 PA7/PH3 software version

This service program is applicable only for Orthoralix 9200 DDE versions.

With this service program you can check the software version mounted on the Auxiliary board PA7, on Panoramic DMU Interface board PH3 and on Ceph DMU Interface board PH3.

The following message will appear on the display:

```
PA7/PH3s SW.VER.
A=XX HP=XX HC=XX
```

where:

- a) the number after A indicates the software version of the Auxiliary board PA7
- b) the number after HP indicates the software version of the Panoramic DMU Interface board PH3
- c) the number after HC indicates the software version of the Ceph DMU Interface board PH3.

F.4.3.15 Ceph arm

This service program is applicable only for Orthoralix 9200 DDE versions.

This service program indicates if the ceph arm has been properly recognized by the host computer board PC1.

The following message will appear on the display:

```
CEPH ARM Y/N
< NO >
```

where < NO > is the default condition.

When the ceph arm is installed, at the first system switching on, the host computer board PC1 is detecting the presence of the ceph arm and automatically changes the setting from NO to YES.

Please take note that, if the ceph arm is removed, in this service program will remain the setting YES: this can generate error messages when the system is switched on. So, in this case, modify manually the setting from YES to NO by pressing the keys projection+ or projection- on the keyboard.

F.4.3.16 X-ray enable

With this service program you can have a complete X-ray cycle but without X-ray emission.

This could be useful for example during an exhibition, or in any other case where you require a complete simulation but without X-ray.

The following message will appear on the display:

```
XRAYS ENABLE Y/N
< YES >
```

where < YES > is the default condition.

1. modify the condition (YES / NO) by pressing the keys projection+ or projection- on the keyboard.
2. the new condition will be stored when the system is switched off.

F.4.3.17 80 kV limit.

With this service program you can limit (when required) the maximum value of the kV generated at 80, instead of 84 and the maximum value of the mA at 14, instead of 15.

The following message will appear on the display:

```
80 kV LIMIT Y/N
< NO>
```

where < NO > is the default condition.

1. modify the condition (YES / NO) by pressing the keys projection+ or projection- on the keyboard.
2. the new condition will be stored when the system is switched off.

F.4.3.18 X-ray alignment

This service program is applicable only for Orthoralix 9200 DDE versions.

By using this service program it is possible:

1. to align the panoramic and transcan collimator respect to the DMU digital sensor
2. to align the cephalic collimator respect to the secondary cephalic collimator and respect to the DMU digital sensor
3. to make the conditioning of the X-ray tube, having the possibility to select kV, mA and exposure time and to make an exposure without movements.

The following message will appear on the display:

```
X-RAY ALIGNMENT
Press DUMMY RUN to go
```

Then:

1. for the panoramic and transcan alignment, please refer to the paragraph **Adjusting the X-ray collimator (Orthoralix 9200 DDE panoramic and transcan alignment)** of this section of the Service Manual.
2. for the cephalic alignment, please refer to the paragraph **Adjusting the X-ray collimator (Orthoralix 9200 DDE cephalic alignment)** of this section of the Service Manual.
3. for the conditioning of the X-ray tube, please refer to the paragraph **Conditioning the X-ray tube** of the section C of the Service Manual.
4. switch off the system to leave the service program.

F.4.3.19 Still cephalic

This service program is applicable only for Orthoralix 9200 DDE versions.

With this program you can have an X-ray emission with the parameters of the cephalic technique, without having the cephalic scanning; the rotating arm and the cephalic DMU (Digital Module Unit) can be in any position (so it is not necessary to reach the reset position); the READY LED on the operator panel is always ON, enabling always the exposure even if the cephalic DMU is not inserted.

This is useful whenever you need to have a cephalic exposure without movements (i.e. measurement of kV and mA, measurement of the dose emitted).

The following message will appear on the display:

```
STILL CEPH
Press DUMMY RUN to go
```

1. Press the DUMMY RUN key on the keyboard
2. select the desired exposure parameters (kV, mA and s)
3. make an exposure
4. switch off the system to leave the service program.

F.4.3.20 Free exposure

This service program is not applicable for Orthoralix 9200 DDE versions.

With this program you can have an X-ray emission with the parameters of the cephalic technique, without having rotation; the rotating arm can be in any position (so it is not necessary to reach the reset position); the READY LED on the operator panel is always ON, enabling the exposure even if the cassette is not inserted.

This is useful whenever you need to have an exposure without rotation (i.e. centering the panoramic/transcan X-ray beam on the secondary slit, measurement of kV and mA, measurement of the dose emitted).

The following message will appear on the display:

```
FREE EXPOSURE
Press DUMMY RUN to go
```

1. Press the DUMMY RUN key on the keyboard
2. select the desired exposure parameters (kV, mA and s)
3. make an exposure
4. switch off the system to leave the service program.

F.4.3.21 Still panoramic

With this program you can have an X-ray emission with the parameters of the panoramic technique, without having rotation; the rotating arm can be in any position (so it is not necessary to reach the reset position); the READY LED on the operator panel is always ON, enabling the exposure even if the cassette is not inserted.

This is useful whenever you need to have an exposure without rotation (i.e. centering the panoramic/transcan X-ray beam on the secondary slit, measurement of kV and mA, measurement of the dose emitted).

The following message will appear on the display:

```
STILL PANORAMIC
Press DUMMY RUN to go
```

1. Press the DUMMY RUN key on the keyboard
2. select the desired exposure parameters (kV and mA)
3. make an exposure
4. switch off the system to leave the service program.

F.4.3.22 Still transcan

With this program you can have an X-ray emission with the parameters of the transcan technique, without having rotation; the rotating arm can be in any position (so it is not necessary to reach the reset position); the READY LED on the operator panel is always ON, enabling the exposure even if the cassette is not inserted.

This is useful whenever you need to have an exposure without rotation (i.e. centering the panoramic/tscan X-ray beam on the secondary slit, measurement of kV and mA, measurement of the dose emitted).

The following message will appear on the display:

STILL TRANSCAN
Press DUMMY RUN to go

1. Press the DUMMY RUN key on the keyboard
2. select the desired exposure parameters (kV and mA)
3. make an exposure
4. switch off the system to leave the service program.

F.4.3.23 Limit test

With this program it is possible to make a mechanical test of the rotating arm using a special projection:

1. all the movements are tested respect to the maximum mechanical limit of each movement
2. all the movements are tested using the 93% of the maximum torque of each motor.

The purpose is to verify if there are some mechanical problems during the rotation and to verify that the motors are able to supply the maximum torque.

The following message will appear on the display:

LIMIT TEST
Press DUMMY RUN to go

1. Press the DUMMY RUN key on the keyboard
2. the standard panoramic exposure program is entered
3. select the program LIMIT EDGE PATH among the various projections available (child, orthogonal dentition, etc) by pressing the keys S13 or S14 (projection - or projection +) on the operator panel
4. press the RESET key on the keyboard
5. press dummy run to run the limit test projection
6. switch off the system to leave the service program.

F.4.3.24 Vf tube editing

With this program you can modify the parameters for the tube calibration stored in the EEPROM.

This may be necessary if, for any reason, you have to reset the EEPROM (see **Default EEPROM** service program) or replace the host computer board PC1 and it is not possible to use the old EEPROM D38 on the new board.

If the System Configuration Module (see Section C) is not available, perform the tube calibration using the **Tube calibration** service program (in this case the parameters are automatically stored in the EEPROM at the end of the procedure following the **Adjusting the tube current** procedure explained in this section of the Service Manual).

Three parameters can be modified: one is related to a tube current of 4 mA, one to 9 mA and the last one to 14 mA.

The following message will appear on the display:

Vf TUBE EDITING
Press DUMMY RUN to go

1. Press the DUMMY RUN key on the keyboard
2. three values will appear on the display:

XX YY ZZ

where:

- XX is the value referred to 4 mA: it could be changed by pressing the kV+ / kV- keys on the operator panel
- YY is the value referred to 9 mA: it could be changed by pressing the mA+ / mA- keys on the operator panel
- ZZ is the value referred to 14 mA: it could be changed by pressing the s+ / s- keys on the operator panel

3. enter the parameters obtained with the **Tube calibration** service program
4. press the DUMMY RUN key to store the new parameters and to exit the service program.

F.4.3.25 Tube calibration

With this service program you can perform the tube calibration by making three exposures with 70 kV, lasting 500 ms and with 4, 9 and 14 mA.



*Before proceeding with tube calibration, be sure that the filament of the X-ray tube is at the right temperature: so, execute at least three panoramic exposures (74kV, 10 mA) respecting the duty cycle, before entering the **Tube calibration** service program.*

The following message will appear on the display:

TUBE CALIBRATION
Press DUMMY RUN to go

1. Press the DUMMY RUN key on the keyboard
2. the following will appear on the display:
70 kV 4 mA 0.5 s
3. make an exposure, then the following will appear:
70 kV 9 mA 0.5 s
4. make an exposure, then the following will appear:
70 kV 14 mA 0.5 s
5. at the end of the third exposure, the **Vf Tube Editing program** is automatically entered, showing the tube calibration parameters obtained at the end of the tube calibration; take note that these parameters are already stored, and the old ones are lost
6. record the values in the System Configuration Module (See Section C)
7. press the DUMMY RUN key on the keyboard to leave the **Vf Tube Editing** service program.

For more information concerning the tube calibration, refer to the paragraph **Adjusting tube current** of this section of the Service Manual.

F.4.3.26 Console test.

With this service program you can start a test of the keyboard and of the display.

The following message will appear on the display:

CONSOLE TESTS
Press DUMMY RUN to go.

After pressing the DUMMY RUN key on the keyboard, the following message will appear on the display:

CONSOLE TESTS
keys to press 20

The first part of the test is a check on every key of the keyboard: when a key is pressed, the relevant LED indicator (if present) turns on and decrements the counter of the key, which must be pressed again.

The counter starts from 20, because there are 20 keys on the keyboard and every key is recognized only at the first pressure (so if a key is pressed more than once, the counter does not decrement).

Every time a key is pressed an audible message ("beep") is generated.

When all the keys have been pressed, an automatic display test starts, showing all the ASCII characters (letters, numbers and special symbols).

At the end, it automatically enters the selection of the service programs and turns off all the LEDs on the keyboard.

F.4.3.27 Retry readout

In case of detection of a protocol error in the communication among the electronics board, several alarms are generated; they are:

Converter: Link failure	when the host computer board PC1 has detected a communication error with the converter board PQ1
Conv. link fail 2	when the converter board PQ1 has detected a communication error with the host computer board PC1
Console: link failure	when the host computer board PC1 has detected a communication error with the operator console control board PC7
No communication	when the operator console control board PC7 has detected a communication error with the host computer board PC1
PA5 board link failure	when the host computer board PC1 has detected a communication error with the PA5 AEC control board.
PH3 Ceph alarm	when the host computer board PC1 has detected a communication error with the PH3 Ceph DMU interface board.
PH3 Pan alarm	when the host computer board PC1 has detected a communication error with the PH3 Pan DMU interface board.
PH3 Bridge alarm	when the host computer board PC1 has detected a communication error with the PA7 auxiliary board.

These alarms are generated if after three attempts (retry) of communication, the proper communication protocol is not restored.

There are two software counters associated to each board (PQ1, PC7, PA5, PA7, PH3 PAN and PH3 CEPH) that are counting the communication faults occurred: with the **Retry readout** service program it is possible to check the contents of these software counters.

The following message will appear on the display:

RETRY READOUT
DUMMY RUN TO GO

By pressing the DUMMY RUN key on the keyboard, the following message will appear:

```
RETRY READOUT
PQ1 X zz nX yy
```

where:

- PQ1 = this means that the two software counters are related to the converter board PQ1
- X = communication errors during the X-ray cycle
- zz = number of communication errors occurred during the X-ray cycle
- nX = communication errors out from the X-ray cycle
- yy = number of communication errors occurred out from the X-ray cycle

By pressing the mA+ or kV+ or s+ keys on the keyboard, it is possible to check the counters associated to the PC7, PA5, PA7, PH3 PAN and PH3 Ceph boards.

The following messages will appear on the display:

```
RETRY READOUT
PC7 X zz nX yy
```

for the operator console control board PC7:

```
RETRY READOUT
PA5 X zz nX yy
```

for the PA5 AEC control board

```
RETRY READOUT
PA7 X zz nX yy
```

for the auxiliary board PA7

```
RETRY READOUT
H3P X zz nX yy
```

for the PH3 pan DMU interface board

```
RETRY READOUT
H3C X zz nX yy
```

for the PH3 ceph DMU interface board.

With the mA- or kV- or s- it is possible to select the software counters related to the previous board.

At the end of the boards sequence, a reset option will be selected, to reset all the software counters; on the display will appear the following message:

```
RETRY READOUT
RESET OR <DRUN>
```

If the RESET key on the keyboard is now pressed, all the software counters are reset and the Retry readout service program is automatically ended.

If the DUMMY RUN key on the keyboard is now pressed, the Retry readout service program is automatically ended and all the software counters are not reset.

F.4.3.28 AEC Pan tune

With this service program is possible to insert/modify the parameter used for the calibration of the panoramic AEC sensor and cassette/screens. This parameter is obtained using the service program AEC slope.

The panoramic AEC sensor and cassette are already calibrated in factory, so the calibration parameter is already stored:

please record this calibration parameter in the Configuration Chart of the Section C of this Service Manual.

This calibration parameter is also written on a label glued on the rear of the PA5 board, where the following information are present:

S/N	is the S/N of the PA5 board
Cassette	is the cassette and screens used for the calibration (they are the ones delivered with the system)
C	is the calibration parameter for the AEC
Date	date of the calibration

The following message will appear on the display:

```
AEC PAN TUNE
NEW=XX OLD=ZZ
```

where:

- XX = is the actual calibration parameter
- ZZ = is the old calibration parameter

To modify the calibration parameter, use the Program +/Program - keys on the keyboard (possible range from -200 to +50) and press DUMMY RUN key on the keyboard to store the new parameter and to exit from the program.

If the service programs **Default EEPROM** or **Reset EEPROM** are used, this calibration parameter is reset to 0.

F.4.3.29 AEC Ceph tune

With this service program is possible to insert/modify the parameter used for the calibration of the ceph AEC sensor and cassette/screens. This parameter is obtained using the service program AEC slope.

The ceph AEC sensor and cassette are already calibrated in factory, but the calibration parameter must be stored using this program; please record this calibration parameter also in the Configuration Chart of the Section C of this Service Manual.

The calibration parameter is written on a label glued on the ceph lead plate, placed on the rear side of the of the ceph cassette carriage, where the following information are present:

S/N	is the S/N of the PA5 board
Cassette	is the cassette and screens used for the calibration (they are the ones delivered with the ceph arm)
C	is the calibration parameter for the AEC
Date	date of the calibration

The following message will appear on the display:

```
AEC CEPH TUNE
NEW=XX OLD=ZZ
```

where:

- XX = is the actual calibration parameter
- ZZ = is the old calibration parameter

To modify the calibration parameter, use the Program +/-Program - keys on the keyboard (possible range from -200 to +50) and press DUMMY RUN key on the keyboard to store the new parameter and to exit from the program.

If the service programs **Default EEPROM** or **Reset EEPROM** are used, this calibration parameter is reset to 0.

F.4.3.30 AEC Slope

With this service program it is possible to obtain the calibration values for the AEC sensor mounted on the PA5 board, both panoramic and cephalometric.

The calibration must be done without and with the cassette.

For more details see the paragraph **AEC calibration** in this section of the Service Manual.

The sequence of the messages that appear on the display is the following:

AEC SLOPE
DUMMY RUN TO GO

1. Press the DUMMY RUN key on the keyboard
2. the following message appear on the display
60kV 9mA 0.80s
3. press the RESET key on the keyboard
4. make an exposure, then the following will appear:

60kV 15mA 0.80s

5. make an exposure, then the following will appear:

aXX bXX SL=XX.X

these parameters are used to calculate the correction values for the AEC calibration: for more details see the paragraph **AEC calibration** in this section of the Service Manual.

6. switch off the system to leave the service program.

F.4.3.31 Default EEPROM

With this service program you can reset the information held in the EEPROM (correction of X-Y-R-C movements, tube calibration, X-ray enable, 80kV limit, AEC calibration) to the default condition.

The exposure counter, the customized exposure parameters and the language of the messages will not be reset.



Any undesired start-up of this program will cause loss of information, such as the start position of the X, Y, R and C movements, AEC calibration and calibration of the tube: in such a case, service programs must be performed for tube and AEC calibrations and for start position of the movements.

F.4.3.32 Reset EEPROM

This program is enabled only when entering the Service Programs procedure the PC1 system control board is detecting an EEPROM checksum error (i.e. during a replacement of the software).

To restore the normal operation and to cancel the alarm, it is necessary to enter the **Reset EEPROM** program by pressing the dummy run pushbutton on the operator panel.



The start-up of this program will cause loss of the following information:

1. the start position of the X, Y, R and C movements
2. tube calibration
3. customized exposure parameters
4. screen/film speed
5. language of the messages
6. programming of the 80kV limit
7. programming of the X-ray enable
8. AEC tune pan ceph
9. DPI configuration

In this case, to restore the desired configuration, follow the instructions contained in Section F of this manual (i.e. service programs must be performed for tube calibration, AEC calibration and for start position of the movements), and the instructions in the paragraph System customization of the Operator Manual (i.e. for the setting of the language of the messages, screen/film speed and customization of the exposure parameters).

F.5 Replacement procedures

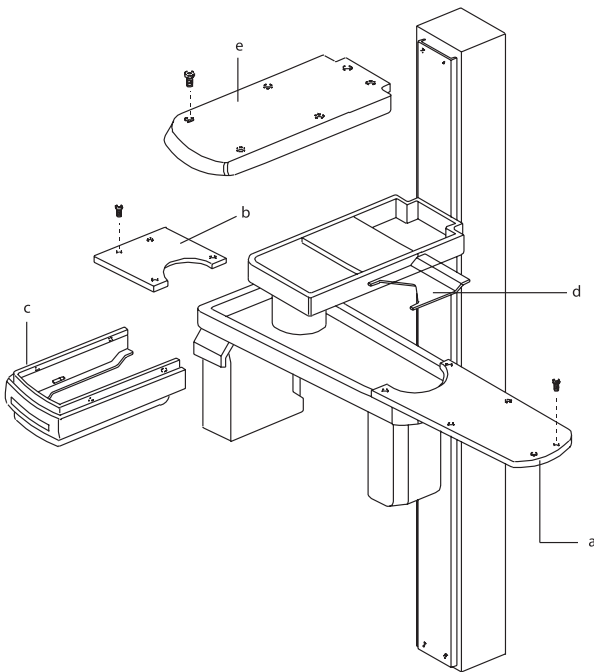
F.5.1 Replacing multipole cable

For the replacement of the multipole cable follow the procedure below:

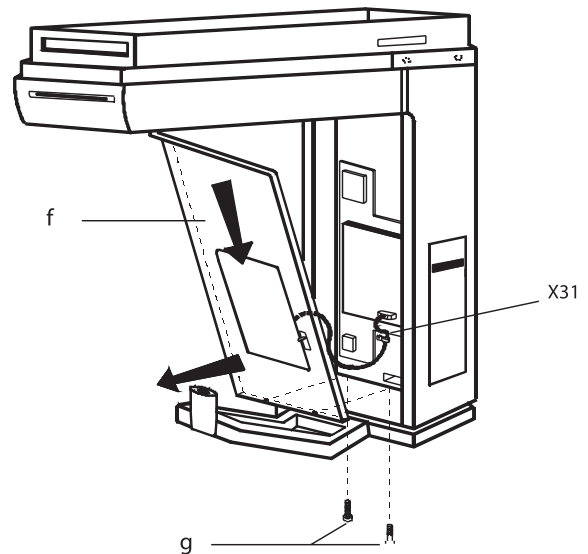


Before starting the replacement of the multipole cable, be sure that no dangerous voltages are present.

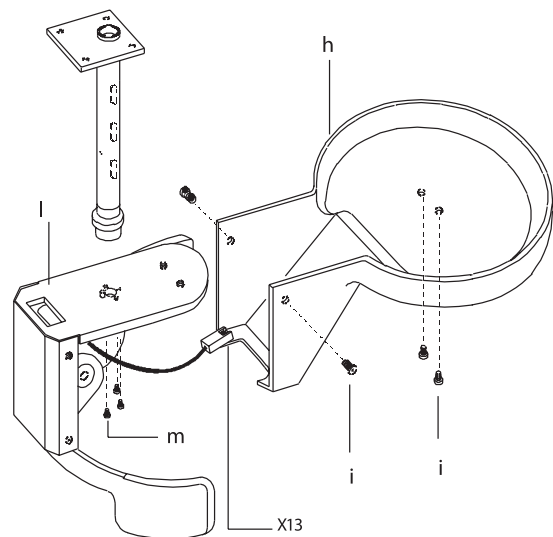
1. Remove the top longer cover (a) of the rotating arm by unscrewing the six screws and the top short cover (b) by unscrewing the four screws.
2. Remove the top cover (e) of the Z-carriage by unscrewing the six Allen screws.
3. Remove the lower cover (c) of the Z-carriage by unscrewing the four screws.
4. Remove the central cover (d).



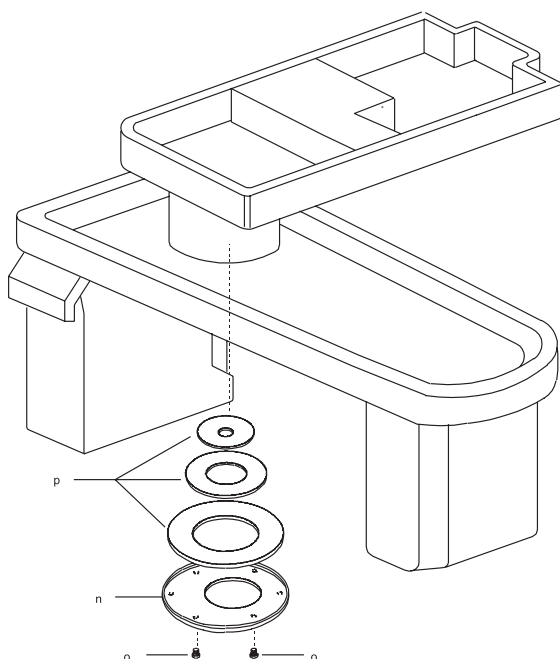
5. Remove the front panel with mirror (f) by unscrewing the two screws (g) and disconnect the centering lights connector X31 from the PC1 control board.



6. Remove the headrest cover (h) by unscrewing the four screws (i).
7. Disconnect the connector X13 from the headrest.
8. Remove the headrest assembly (l) by unscrewing the three Allen screws (m).



9. Remove the plastic disk (n) by unscrewing the six screws (o) and then remove the three plastic rings (p).



Before disconnecting all the connectors of the multipole cable, sign two reference marks on the old multipole cable:

1. one at the entrance of the cable into the hole for the rotation
2. one at the exit from the hole

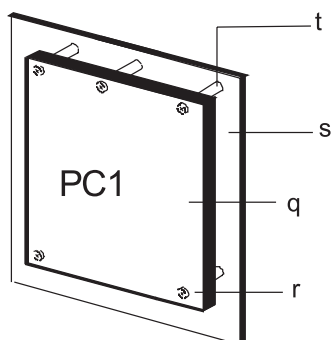
This to ensure the right cable length inside the rotation part (see figure in the next page).

10. Disconnect all the connectors from the PC1 board and from the PA7 board.

NOTE

pay attention not to damage the connectors and the wiring

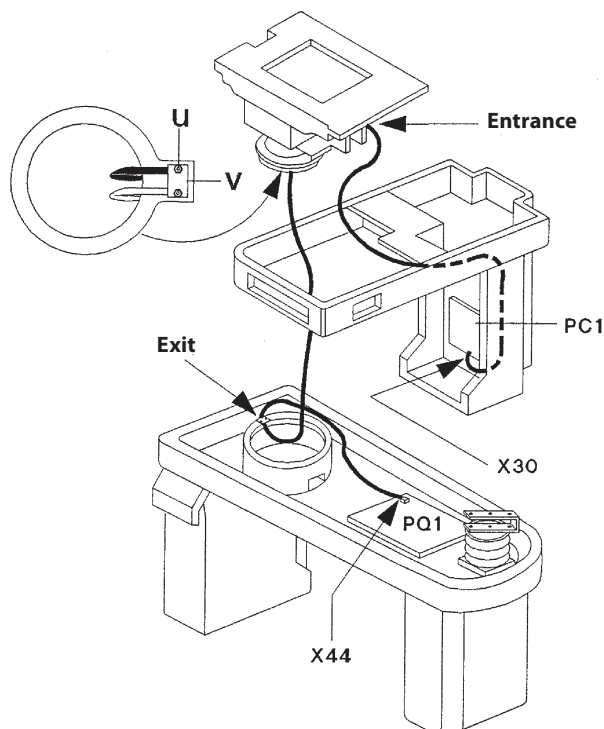
11. Remove the PC1 board (q) by unscrewing the five screws (r); remove the PA7 board from the PC1 board by unscrewing the three screws
12. Dismount the support plate (s) by unscrewing the five screws (t).
13. Disconnect connector X44 from PQ1 converter board.



14. Loosen the two screws (u) of the cable retainer (v).
15. Remove all the necessary cable retainers of the multipole cable; disconnect all the necessary connectors and finally remove the multipole cable itself.
16. Take the new multipole cable, lay it down near the old one and sign on it the same reference marks placed on the old one.
17. Mount the new multipole cable and fix it in the same fixation points.
18. Proceed backwards for remounting.



After the mounting of the headrest, verify the centering as explained in the paragraph *Adjustment of patient headrest (pan)* in this Section of the Service Manual.



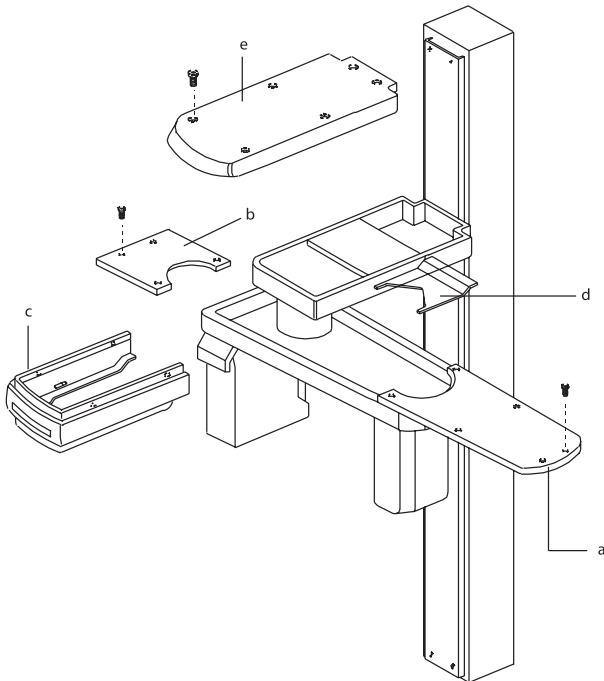
F.5.2 Replacing converter cable

For the replacement of the converter cable follow the procedure below:

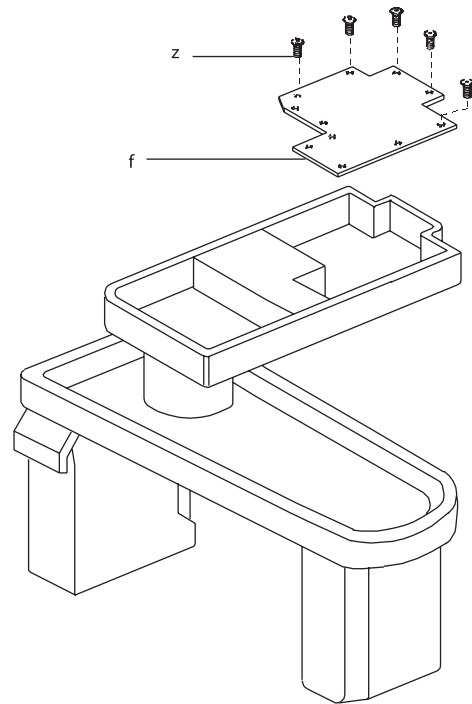


Before starting the replacement of the converter cable, be sure that no dangerous voltages are present.

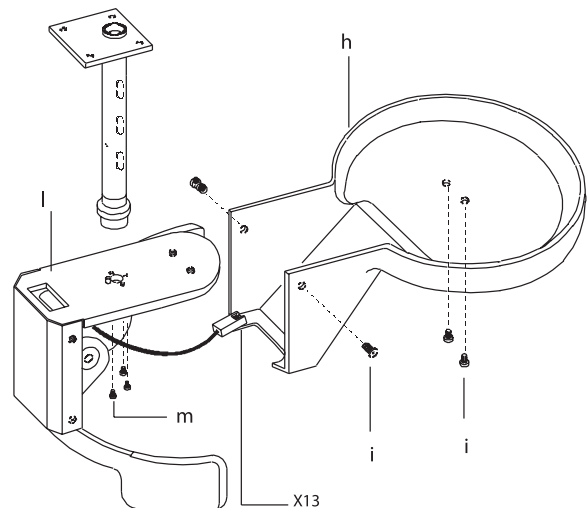
1. Remove the top longer cover (a) of the rotating arm by unscrewing the six screws and the top short cover (b) by unscrewing the four screws.
2. Remove the top cover (e) of the Z-carriage by unscrewing the six Allen screws.
3. Remove the lower cover (c) of the Z-carriage by unscrewing the four screws.
4. Remove the central cover (d).



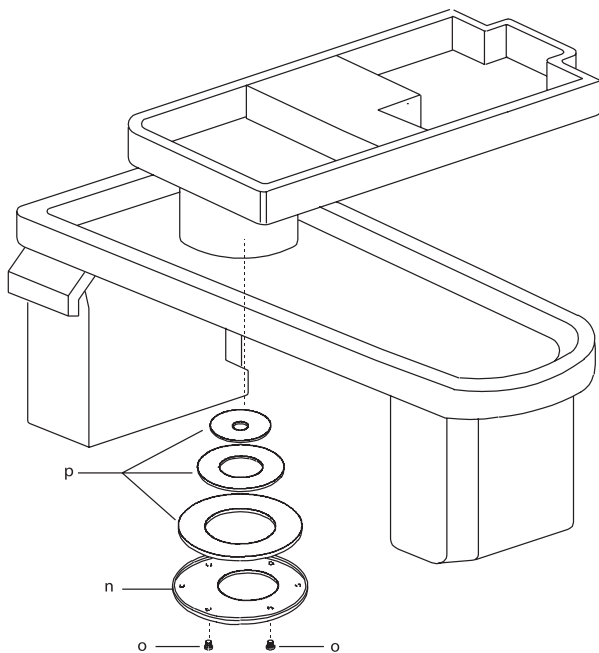
5. Remove the metallic protection (f) of the PN1 board by removing the eleven screws (z).



6. Remove the headrest cover (h) by unscrewing the four screws (i).
7. Disconnect the connector X13 from the headrest.
8. Remove the headrest assembly (l) by unscrewing the three Allen screws (m).



9. Remove the plastic disk (n) by unscrewing the six screws (o) and then remove the three plastic rings (p).



Before disconnecting the converter cable, sign two reference marks on the old converter cable:

1. one at the entrance of the cable into the hole for the rotation
2. one at the exit from the hole

This to ensure the right cable length inside the rotation part (see figure in side).

10. Disconnect connector X5 from the PN1 board.
11. Remove the plate (x) by removing the two Allen screws (w).
12. Disconnect wires X41:1 and X41:2 from PQ1 converter board.
13. Loosen the two screws (u) of the cable retainer (v).

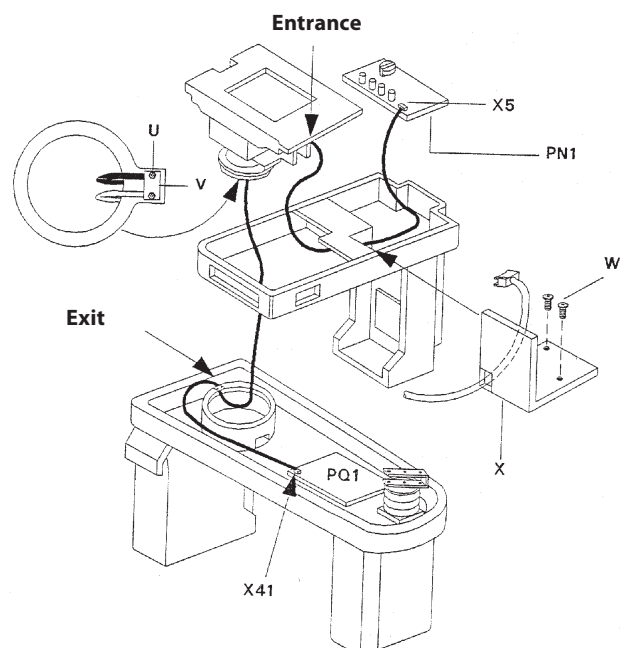
14. Remove all the necessary cable retainers of the converter cable and remove the converter cable itself.
15. Take the new converter cable, lay it down near the old one and sign on it the same reference marks placed on the old one.
16. Mount the new converter cable and fix it in the same fixation points.
17. Proceed backwards for remounting.



After the mounting of the headrest, verify the centering as explained in the paragraph *Adjustment of patient headrest (pan)* in this Section of the Service Manual.



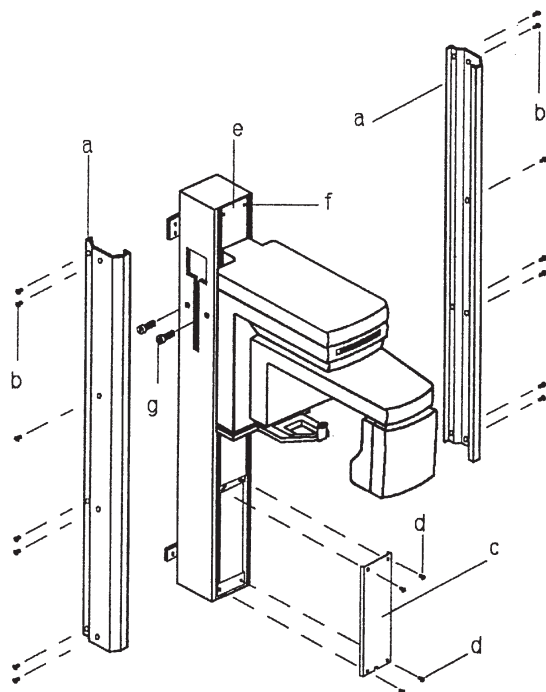
Take care to restore the proper connections of the wires X41:1 and X41:2; a reverse connection may damage the PN1 board and the PQ1 board.



F.5.3 Replacing the steel ropes

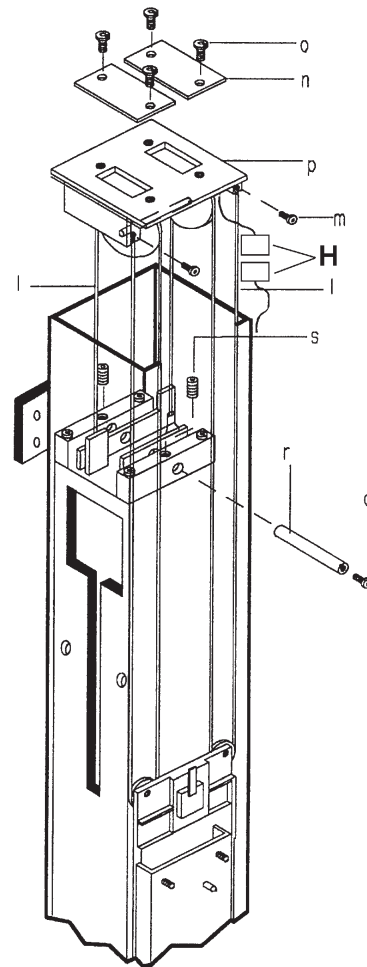
For the replacement of the steel ropes, proceed as follows:

1. Switch on the system.
2. Remove the two lateral column covers (a) each one is fixed with seven screws (b).
3. Remove the lower front column cover (c) by unscrewing the four screws (d).
4. Remove the high front column cover (e) by unscrewing the four screws (f).
5. Lower the Z-carriage and lock the counterweight carriage using the two fixation screws (g).
6. Switch off the system.



7. Disconnect the steel cables (l) from the column, by removing the two Allen screws (m).
8. Remove the two plates (n) from the top cover of the column, by removing four screws (o).
9. Disconnect the connector (H) for the power supply from the motor.

10. Remove the top cover (p) with the pulleys from the column.
11. Screw the M6 screw (q) (supplied with the new steel cables) into the coupling pin (r) of the balance mechanism.
12. Unlock the two dowels (s) fixing the coupling pin (r), accessing from the top of the column.
13. Extract the coupling pin (r) from the balance mechanism.
14. Remove the old steel cables with the balance mechanism.



15. Proceed backwards to mount the new steel cables.

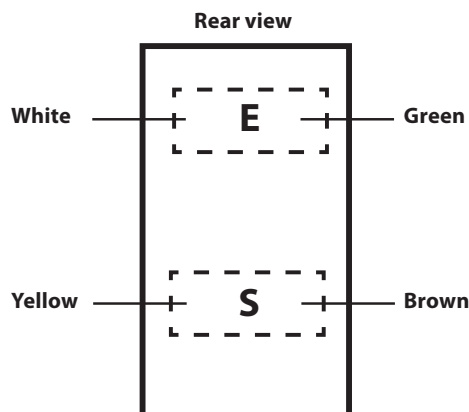
F.5.4 Replacing optoswitches

Two types of optoswitches could be mounted in the system:

Type 1

looking at the optoswitch from the front it is possible to see two letters printed on it: an E and a S.

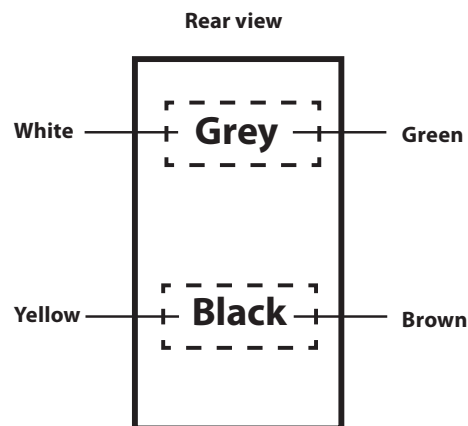
For the replacement, the wires must be connected as shown in the figure below:



Type 2

Looking at the optoswitch from the front it is possible to see that one part is grey and the other one is black.

For the replacement, the wires must be connected as shown in the figure below:



No other special precautions are required for replacement of the optoswitches, as they are mounted at fixed positions.

After replacement of the X, Y, or R movements optoswitches proceed with the relevant cam adjustment, verifying the centering of the system using the image quality phantom (see Section C and Section F of this Service Manual).

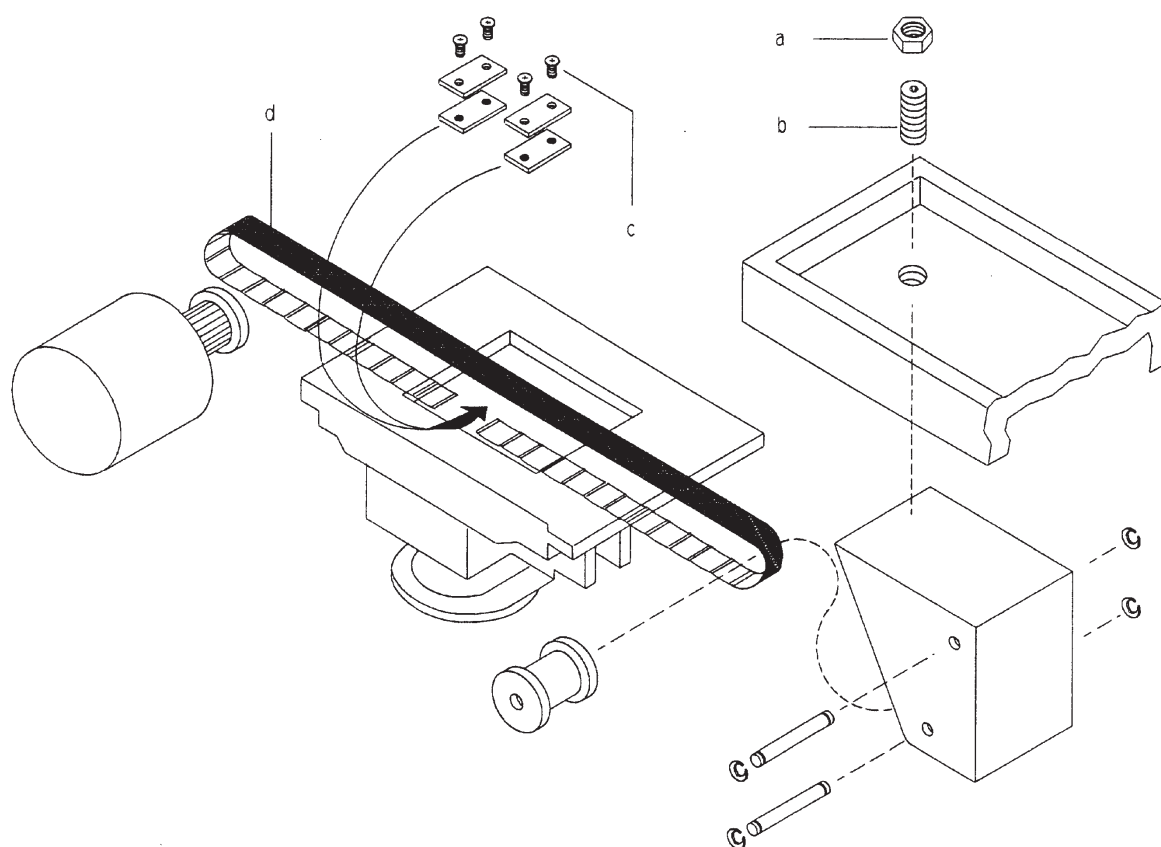
If a collimator optoswitch is defective, it is necessary to replace the optoswitch board PA2: verify then that the three positions of the collimator (panoramic, transcan and ceph) are correctly selected by the optoswitches.

F.5.5 Replacing the drive belts

The belts for all the movements (X, Y, R and Cassette) are the same, only the length is different; as spare part, a belt 1 meter long is supplied: it is a task of the service engineer to cut the belt at the right length, comparing the new one with the old one.

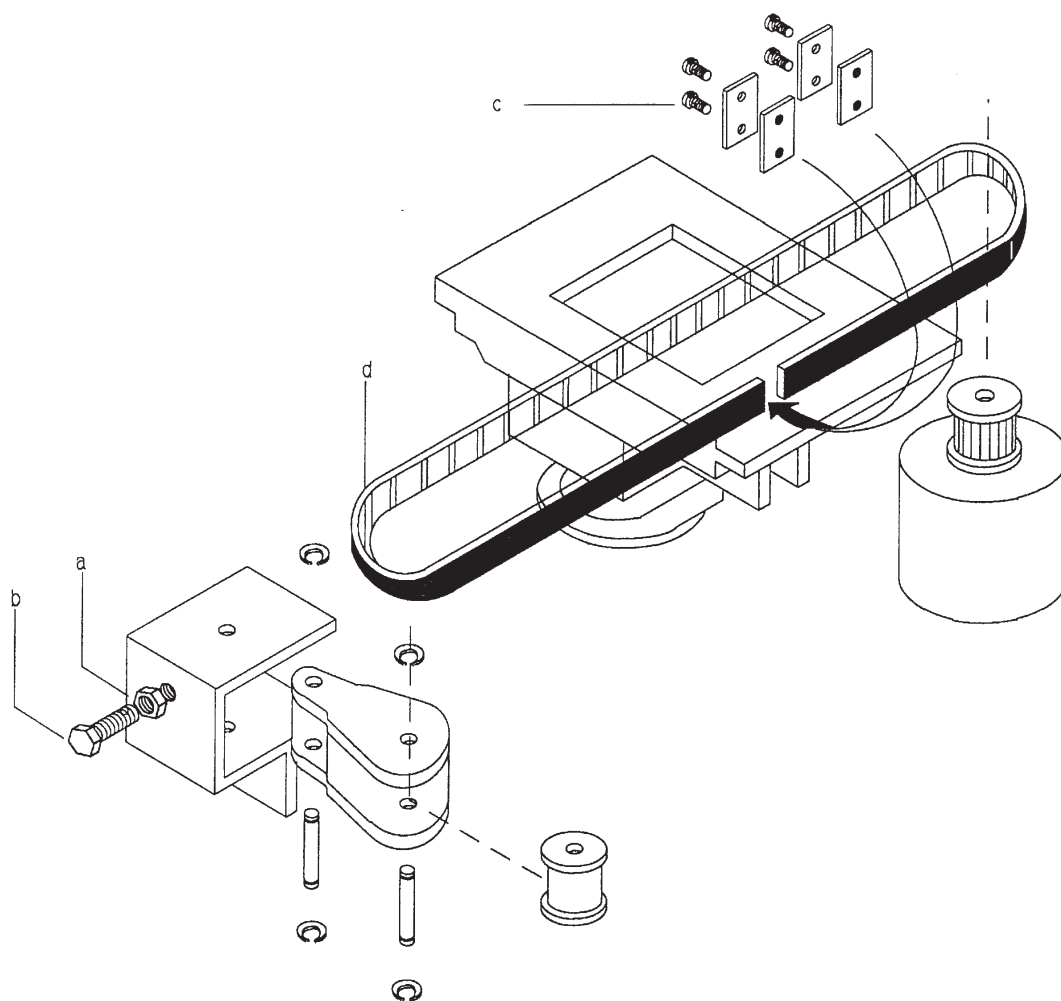
For the replacement of the X drive belt proceed as follows:

1. Loosen the belt stretcher by unscrewing the nut (a) and then screw (b).
2. Remove the screws (c) with plates and replace the belt (d).
3. Ensure that the plates are properly accommodated on the teeth of the new belt, then fix them with securing screws (c).
4. For the adjustment of the belt tension refer to paragraph Tension adjustment of the drive belts of this Section F.



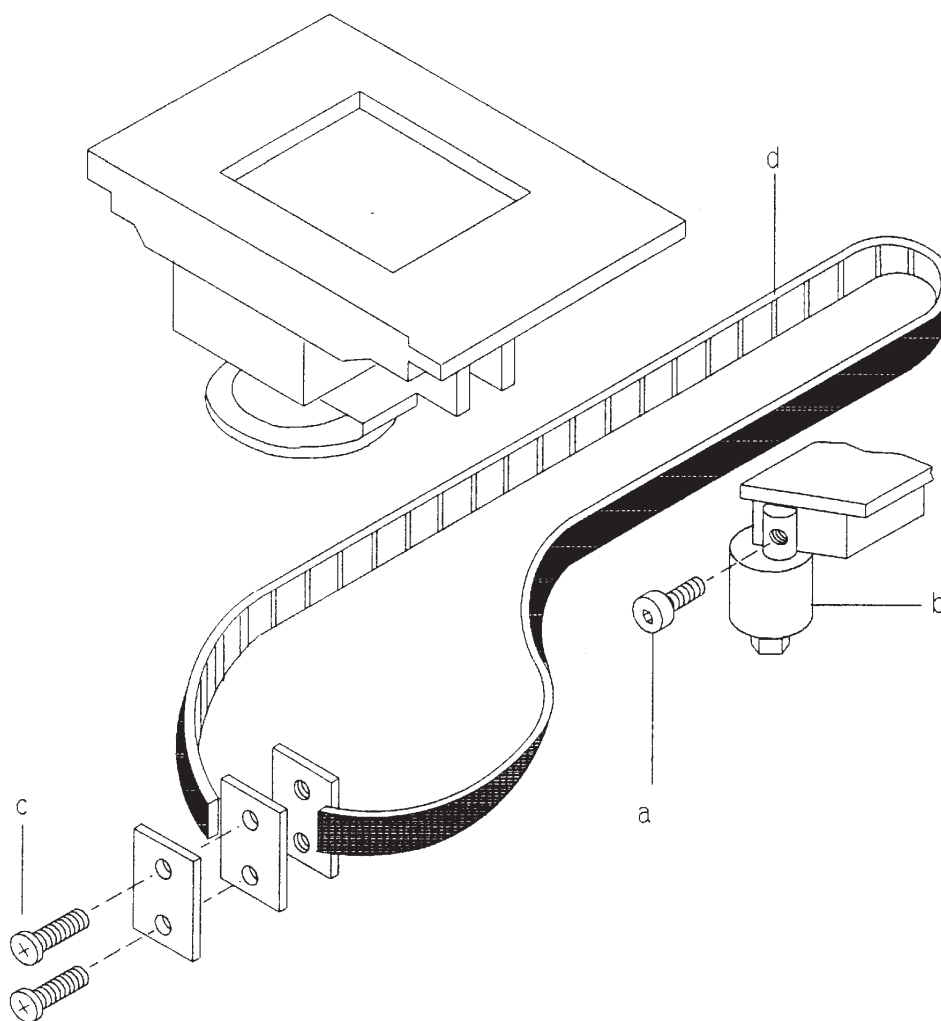
For the replacement of the Y drive belt proceed as follows:

1. Loosen the belt stretcher by unscrewing the nut (a) and then bolt (b).
2. Remove the screws (c) with plates and replace the belt (d).
3. Ensure that the plates are properly accommodated on the teeth of the new belt, then fix them with securing screws (c).
4. For the adjustment of the belt tension refer to paragraph **Tension adjustment of the drive belts** of this Section F.



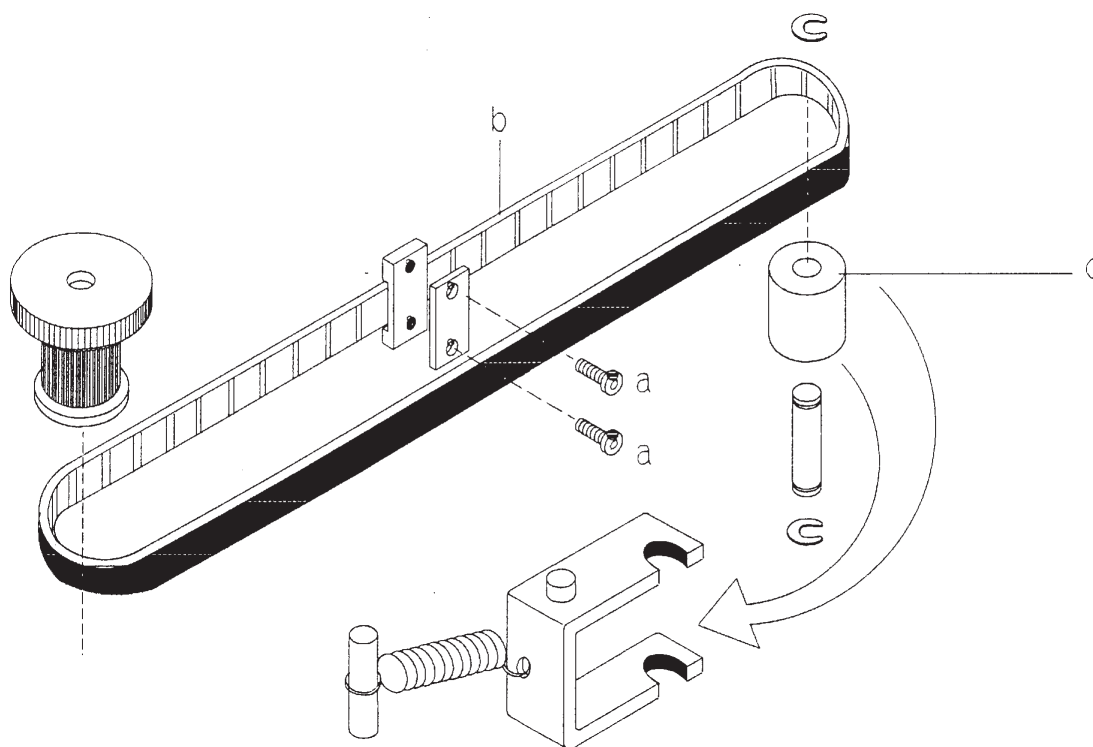
For the replacement of the R drive belt proceed as follows:

1. Loosen the dowel (a) and by turning the eccentric (b) with an open wrench reduce the tension of the belt.
2. Remove the screws (c) with plates and replace the belt (d).
3. Ensure that the plates are properly accommodated on the teeth of the new belt, then fix them with screws (c).
4. For the adjustment of the belt tension refer to paragraph **Tension adjustment of the drive belts** of this Section F.



For the replacement of the Cassette drive belt proceed as follows:

1. Remove the screws (a) with plates and replace the belt (b), taking care that when the belt is unlocked, the roller (c) of the tension mechanism may fall down.
2. Ensure that the plates are properly accommodated on the teeth of the new belt, then fix them with screws (c).
3. For the checking of the belt tension refer to paragraph **Tension adjustment of the drive belts** of this Section F.



In the cephalometric arm for the Orthoralix 9200 DDE versions, others three belts (used to move the cephalometric secondary collimator and the Digital Module Unit DMU) are present.

To replace them proceed as follows:

A) Belt for the DMU movement

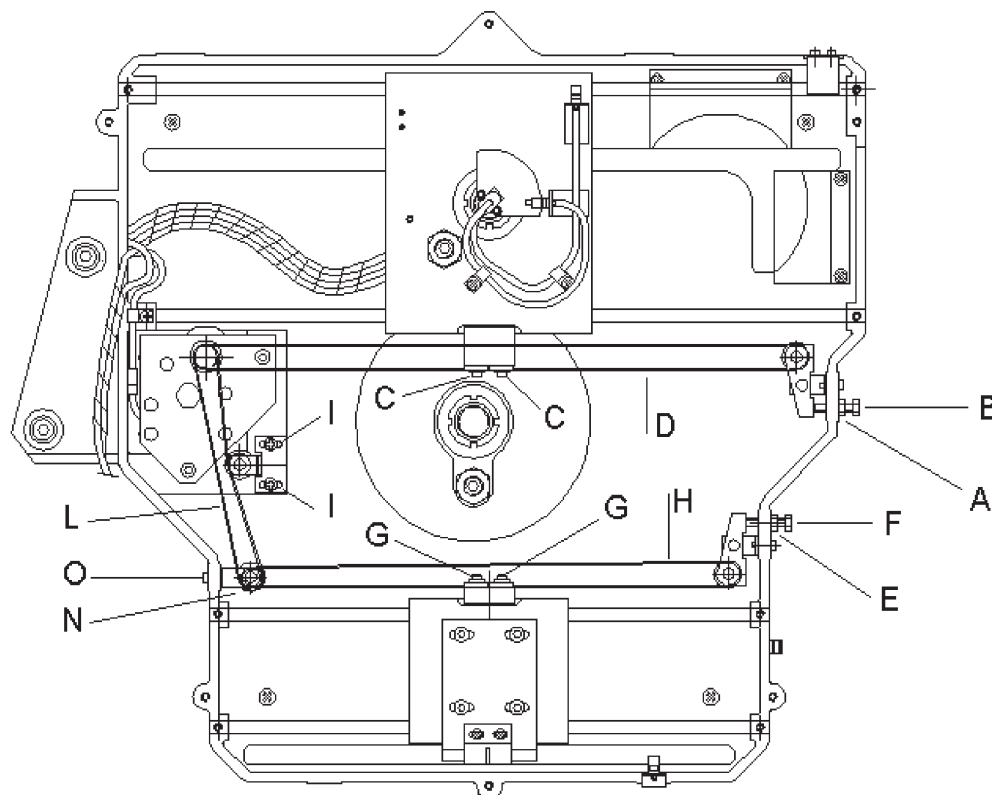
1. Loosen the belt stretcher by unscrewing the nut (a) and then bolt (b).
2. Remove the screws (c) with plates and replace the belt (d). Cut the new belt at the right length, comparing the new one with the old one.
3. Ensure that the plates are properly accommodated on the teeth of the new belt, then fix them with securing screws (c).
4. For the adjustment of the belt tension refer to paragraph **Tension adjustment of the drive belts** of this Section F.

B) Belt for the cephalometric secondary collimator movement

1. Loosen the belt stretcher by unscrewing the nut (e) and then bolt (f).
2. Remove the screws (g) with plates and replace the belt (h). Cut the new belt at the right length, comparing the new one with the old one.
3. Ensure that the plates are properly accommodated on the teeth of the new belt, then fix them with securing screws (g).
4. For the adjustment of the belt tension refer to paragraph **Tension adjustment of the drive belts** of this Section F.

C) Belt from the motor to the cephalometric secondary collimator movement

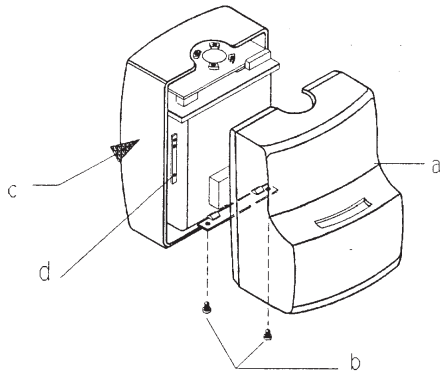
1. Loosen the belt stretcher by unscrewing the two screws (i).
2. Remove the belt (l) from the gears of the motor (m).
3. Loosen the belt stretcher by unscrewing the nut (e) and then bolt (f).
4. Remove the screws (g) and one fixing plate so that it is possible to remove the belt (h) from the roller (n).
5. Remove the roller assembly (n) by unscrewing the two screws (o); then remove the roller from the pin and finally remove the belt (l) from the roller.
6. Proceed backwards for the mounting of the new belt.
7. When mounting back the belt (h), ensure that the plate is properly accommodated on the teeth of the belt, then fix it with securing screws (g).
8. For the adjustment of the belt tension refer to paragraph **Tension adjustment of the drive belts** of this Section F.



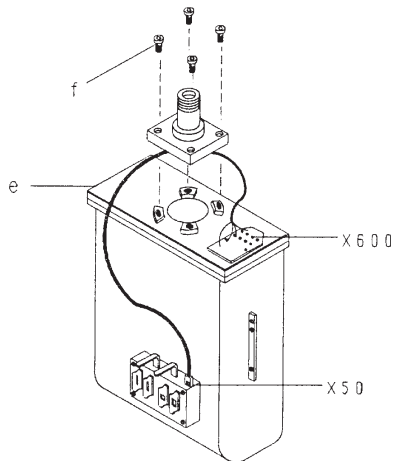
F.5.6 Replacing the tubehead

For the replacement of the tubehead proceed as follows:

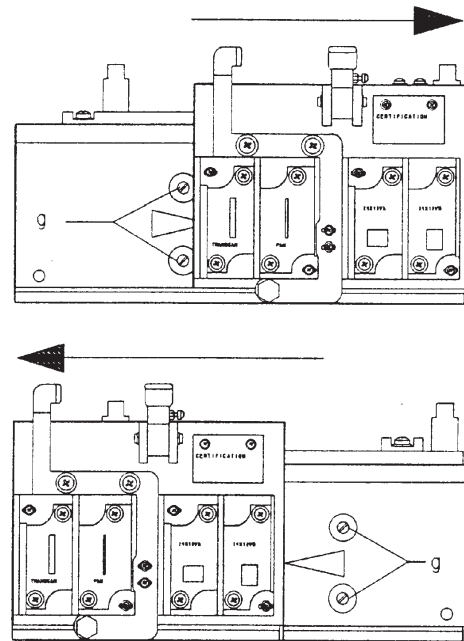
1. Remove the front cover (a) of the tubehead by unscrewing two screws (b) and by disengaging the spring latches from the rear cover (c).
2. Remove the rear cover (c) by unscrewing the four Allen screws (d).



3. Disconnect the wires from the terminal block 600 of the tubehead.
4. Disconnect the ground cable from the tubehead.
5. Disconnect connector X50 from the collimator.



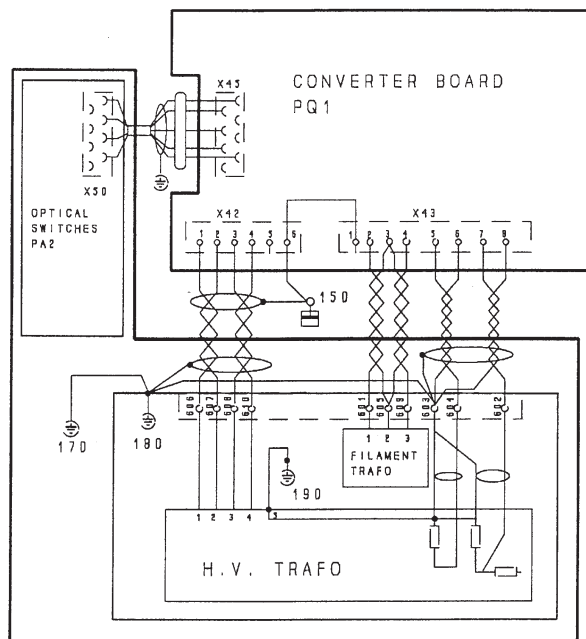
6. Remove the collimator assembly from the tubehead, by unscrewing the four screws (g).



7. Remove the tubehead (e) by unscrewing four hexagonal head screws (f).
8. Proceed backwards for remounting.

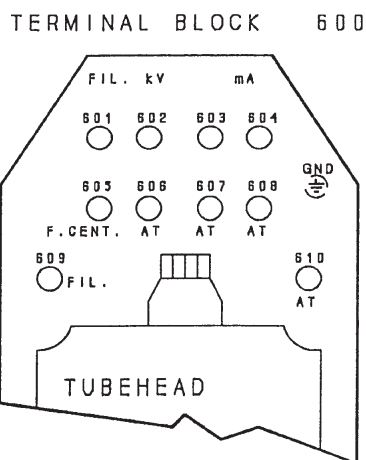
9. During the mounting of the new tubehead, please take note of the following:

- refer to the following wiring diagram for the wires connections on the terminal block 600
- do not tight too much the nuts for the fixation of the wires on the terminal block 600, otherwise there is the possibility to unlock the internal connections.



10. After the replacement of the tubehead, the following adjustments are necessary:

- adjustment of the tube current (see Section F)
- adjustment of the X-ray collimator (PAN, TSCAN and CEPH version - see Section C and F).
- verify the centering of the system using the image quality phantom (see Section C and F).



F.5.7 Replacing the PC1 control board

A) For Orthoralix 9200/Plus/Ceph

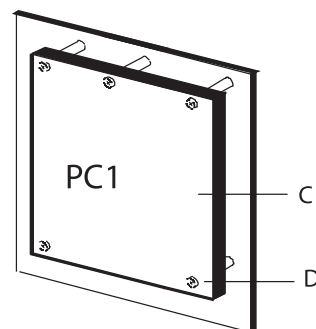
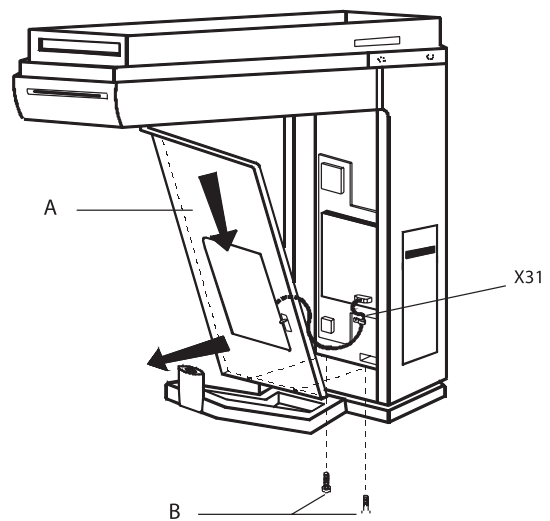
To replace the PC1 control board, proceed as follows:

1. remove the mirror panel (a) by unscrewing the two Allen screws (b).
2. disconnect the connector X31 from the PC1 board.

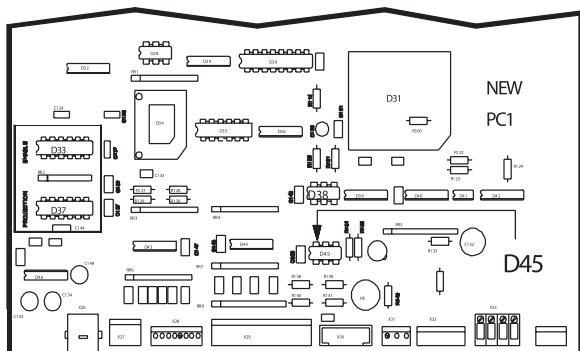


Pay attention to do not damage the connectors and the wiring.

3. disconnect all the others connectors from the PC1 board.
4. remove the PC1 board (c) by unscrewing the five screws (d).



5. from the old PC1 board remove:
 - the EEPROM D38
 - if present, remove the integrated circuits D33 and D37 (one to enable the TSCAN option the other one to enable the DMF (dento maxillo facial option).



6. replace the EEPROM D38 on the new PC1 with the one removed from the old PC1.
7. take the two integrated circuits D33 and D37 previously removed from the old PC1 and mount them on the new PC1 into the sockets D33 and D37 indifferently.
8. mount the new PC1 on the metallic plate by means of the five screws.
9. restore all the connections to the new PC1.

B) For Orthoralix 9200 DDE/Ceph

To replace the PC1 control board, proceed as follows:

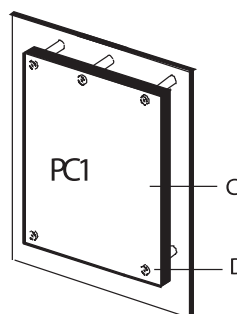
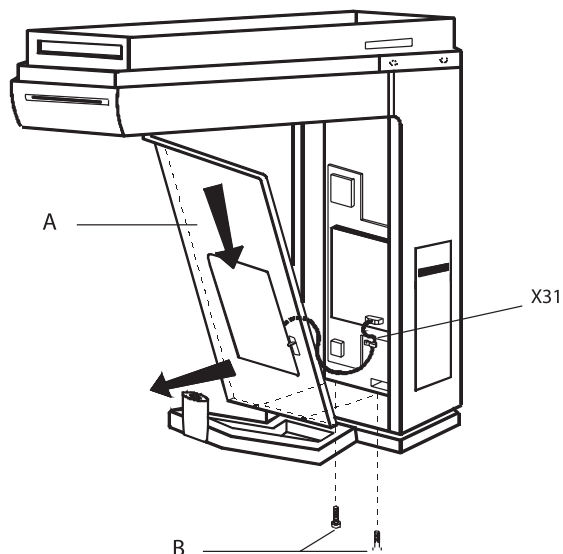
1. remove the mirror panel (a) by unscrewing the two Allen screws (b).
2. disconnect the connector X31 from the PC1 board.
3. disconnect all the connectors from the PA7 board.



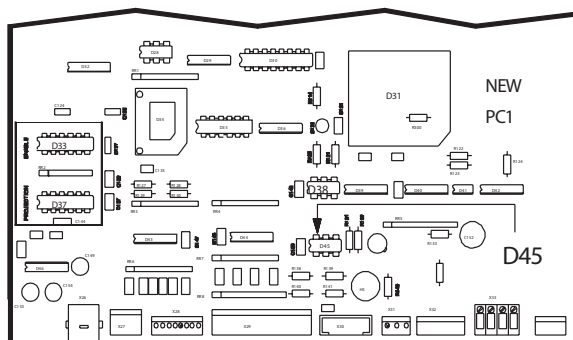
Pay attention to do not damage the connectors and the wiring.

4. disconnect all the others connectors from the PC1 board.

5. remove the PC1 board (c) by unscrewing the five screws (d); remove the PA7 board from the PC1 board by unscrewing the three screws.



6. from the old PC1 board remove:
 - the EEPROM D38
 - if present, remove the integrated circuits D33 and D37 (one to enable the TSCAN option the other one to enable the DMF (dento maxillo facial option).



7. replace the EEPROM D38 on the new PC1 with the one removed from the old PC1.
8. take the two integrated circuits D33 and D37 previously removed from the old PC1 and mount them on the new PC1 into the sockets D33 and D37 indifferently.
9. proceed backwards for remounting.

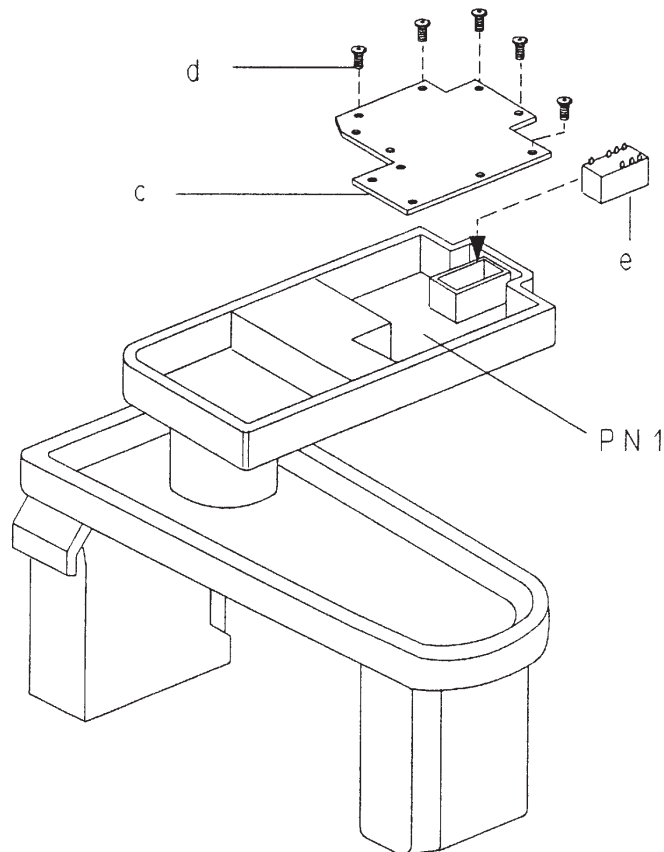
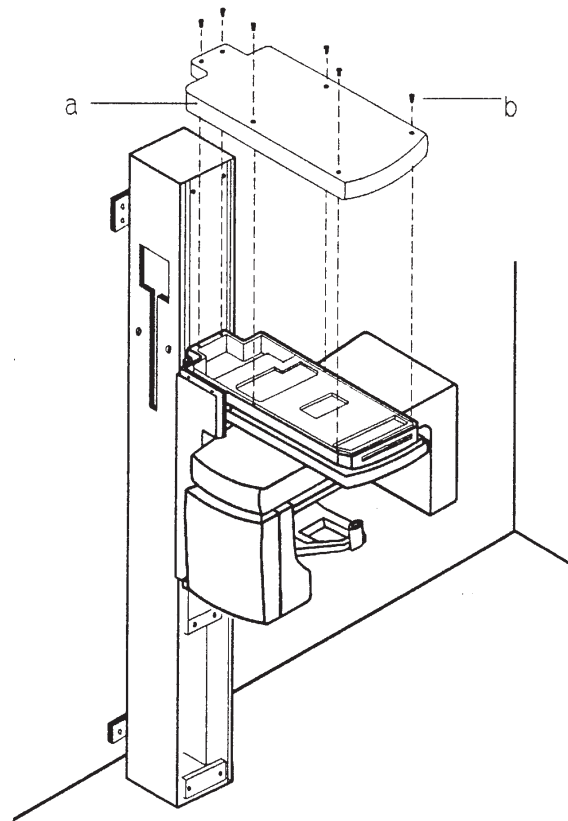
F.5.8 Replacing the mains relay

To replace the mains relay, proceed as follows:

1. Disconnect the system from the mains supply.
2. Remove the top cover (a) of the Z-carriage by unscrewing the six screws (b).
3. Remove the metallic protection (c) (and plastic protection, only USA version) of the PN1 board by removing the eleven screws (d).
4. Disconnect the wires from the mains relay (e), taking care of their position.
5. Remove the mains relay by unscrewing the two fixation screws.
6. Mount the new mains relay and restore the connections.
7. Proceed backwards for the remounting.



In this case, the PN4 board supplied with the mains relay is not used, because is already mounted on the PN1 board code 4519 101 00105.



F.5.9 Replacing the PN1 power unit board

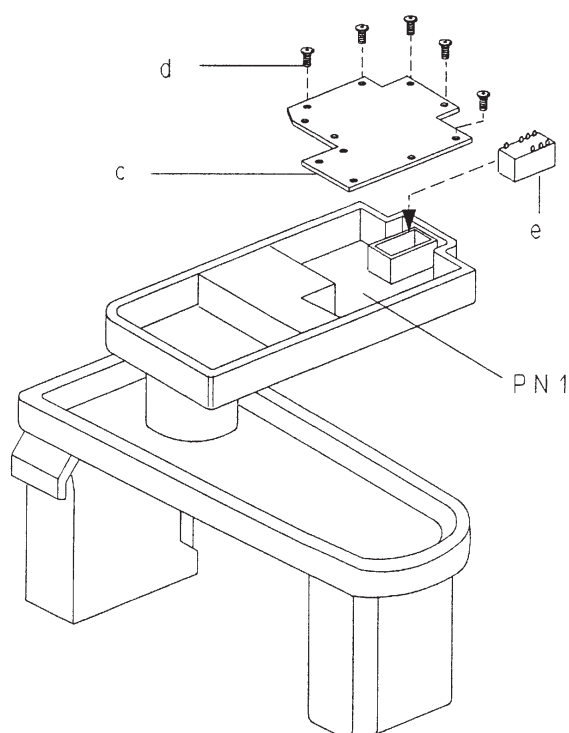
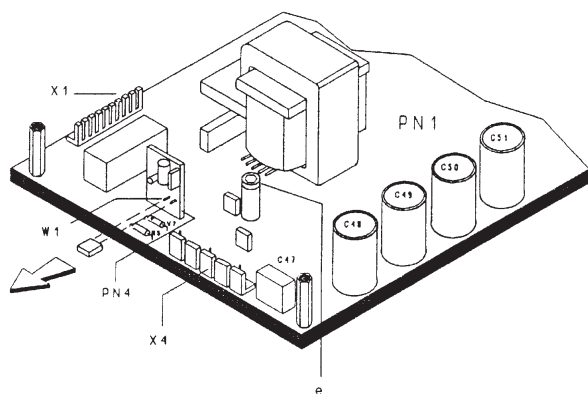
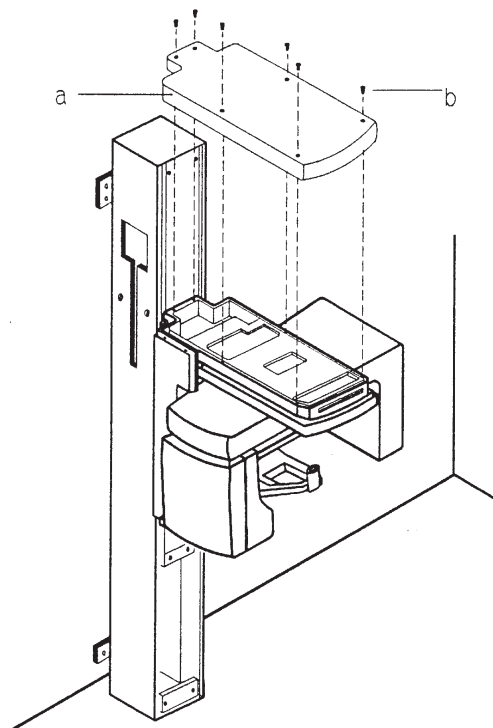
To replace the PN1 board, proceed as follows:

1. Disconnect the system from the mains supply.
2. Remove the top cover (a) of the Z-carriage by unscrewing the six screws (b).
3. Remove the metallic protection (c) (and plastic protection, only USA version) of the PN1 board by removing the eleven screws (d).
4. Disconnect all the connectors from the PN1 board.
5. Remove the PN1 board by unscrewing the two Allen fixation nuts.
6. Install the new PN1 board and restore the connections.



Check that jumper W1 of PN4 board is not inserted.

7. Proceed backwards for the remounting.

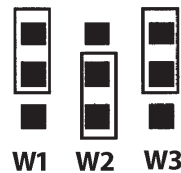


F.5.10 Replacing the PA5 aec control board

After the replacement of the PA5 AEC control board, follow the instructions herewith given:

Case (A): PAN PA5

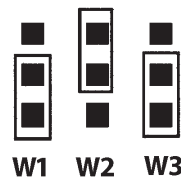
1. verify the jumper configuration: see the figure below.



2. perform the pan AEC calibration using the service program AEC slope (see the related paragraph in this Section F for more details)
3. enter the pan AEC calibration parameter using the service program AEC pan tune (see the related paragraph in this Section F for more details)
4. record this calibration value in the Configuration Chart of the Section C
5. record this calibration value also on the label glued close to the PA5 board, erasing the old value (C).

Case (B): CEPH PA5

1. verify the jumper configuration: see the figure below.



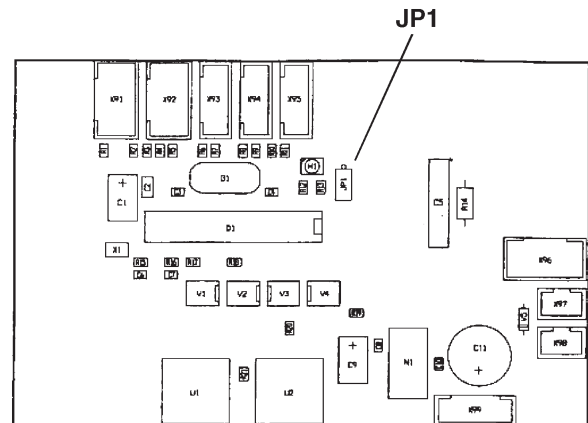
2. perform the ceph AEC calibration using the service program AEC slope (see the related paragraph in this Section F for more details)
3. enter the ceph AEC calibration parameter using the service program AEC ceph tune (see the related paragraph in this Section F for more details)
4. record this calibration value in the Configuration Chart of the Section C
5. record this calibration value also on the label glued on the lead plate placed on the rear side of the ceph cassette carriage, erasing the old value (C).

F.5.11 Replacing the PH3 unit interface board

After the replacement of the PH3 unit interface board, it is necessary to set the jumper JP1 for the proper configuration of the PH3 board.

If the new PH3 board is replacing the pan PH3, the jumper JP1 must not be installed; if the new PH3 board is replacing the ceph PH3, the jumper JP1 must be installed.

To locate the jumper JP1, see the figure below.



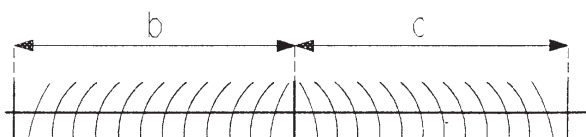
F.6 Adjustment procedures

F.6.1 Verify the centering of the system with the image quality phantom

If the results obtained making a panoramic projection with the image quality phantom are not in the tolerance (during the procedure to test the system centering as explained in the Section C of this Service Manual paragraph Testing the centering of the system), it is necessary to change the start position of the movements following the procedure below:

1) *simmetry not correct*

the semi-projections "b" and "c" must be equal, with a tolerance of ± 4 mm (nominal value with the central vertical line well focused = 80 mm); if not, the start position of the X movement must be changed.

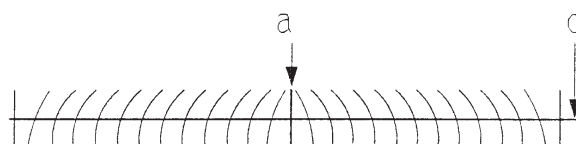


This is possible by entering the Service Programs and changing the start position using the X movement test and adjustment program (see paragraph 4.3.1. of this Section F of the Service Manual).

If the semi-projection on the right side (letter R on the film) is bigger than the left side, introduce negative correction number by pressing the key s- on the operator panel (max -99).

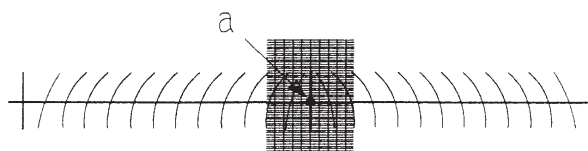
If the semi-projection on the right side (letter R on the film) is smaller than the left side, introduce positive correction number by pressing the key s+ on the operator panel (max +99).

Take note that in case of a big error in the simmetry, even the central vertical line "a" could be not vertical with respect to the horizontal line "d": by adjusting the start position of the X movement, also this problem will be solved.



2) *dark area not centered*

the dark area must be centered with respect to the central vertical line "a" with a tolerance of ± 2 mm; if not, the start position of the R movement must be changed.

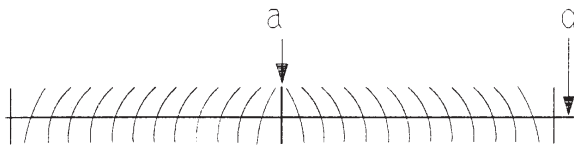


This is possible by entering the Service Programs and changing the start position using the R movement test and adjustment program (see paragraph 4.3.3. of this Section F of the Service Manual).

If it is necessary to increase the right side of the dark area, introduce negative correction number by pressing the key s- on the operator panel (max -99).

If it is necessary to increase the left side of the dark area, introduce positive correction number by pressing the key s+ on the operator panel (max +99).

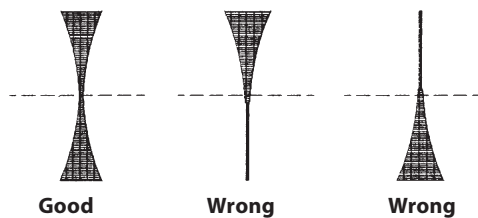
Take note that in case of a big error in the position of the dark area, even the central vertical line "a" could be not vertical with respect to the horizontal line "d": by adjusting the start position of the R movement, also this problem will be solved.



3) layer in focus not in the right position (image too small or image too wide)

the position of the layer in focus must be in the middle of the central vertical line "a".

If not, the result is a too small or a too wide image (in the panoramic the nominal value of the semi-projection is 80 mm) and this could be corrected by changing the start position of the Y movement.



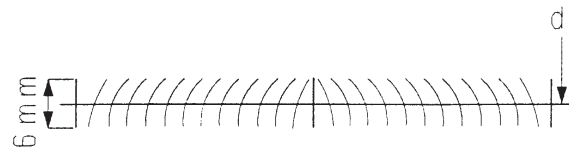
This is possible by entering the Service Programs and changing the start position using the Y movement test and adjustment program (see paragraph 4.3.2. of this Section F of the Service Manual).

If the image is too wide, introduce negative correction number by pressing the key s- on the operator panel (max -99).

If the image is too small introduce positive correction number by pressing the key s+ on the operator panel (max +99).

4) horizontal line not flat

the line "d" must be horizontal and flat within a band of 6 mm.



If not, verify:

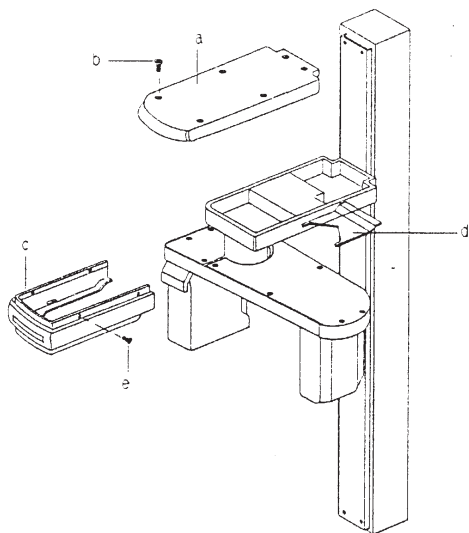
- a) that the phantom is correctly mounted on the chin rest
- b) that the chin rest is correctly inserted in the byte block holder (and this means that the phantom is horizontal)
- c) that the byte block holder is not damaged (resulting in a not horizontal phantom).

Take note that small undulation of the line "d" should be considered as normal, due to the manufacturing way of the phantom itself.

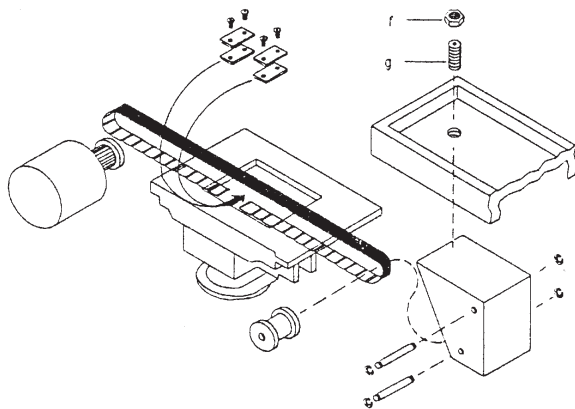
F.6.2 Tension adjustment of the drive belts

For the tension adjustment of the drive belts, proceed as follows:

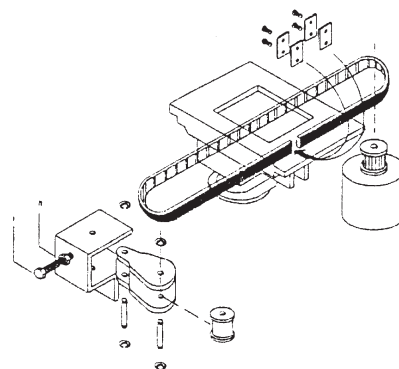
1. Remove the top cover (a) of the Z-carriage by unscrewing the six Allen screws (b).
2. If it is necessary to adjust the tension of the rotation belt, remove also the lower cover (c) and the central cover (d), by removing the four screws (e).



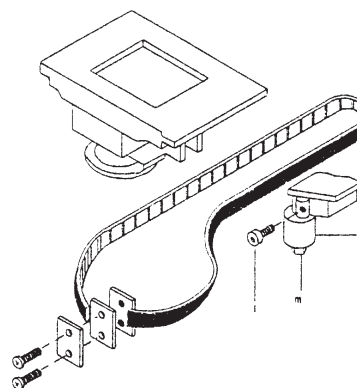
3. Adjust the belt of the X movement by loosening the nut (f) of the belt stretcher and by turning the dowel (g).



4. Adjust the belt of the Y movement by loosening the nut (h) of the belt stretcher and by turning the bolt (i).



5. Adjust the belt of the R movement by loosening the dowel (l) and, with an open wrench, by turning the nut (m) of the eccentric pin (n).



6. Check the belt tension by applying a force in the centre of the longest free span of each drive belt and by measuring the relevant displacement. Refer to the table below for the correct values:

MOVEMENT	BELT TENSION (N)	DISPLACEMENT (mm)
X	14	5
Y	7,5	5
R	14	5
C	5	5



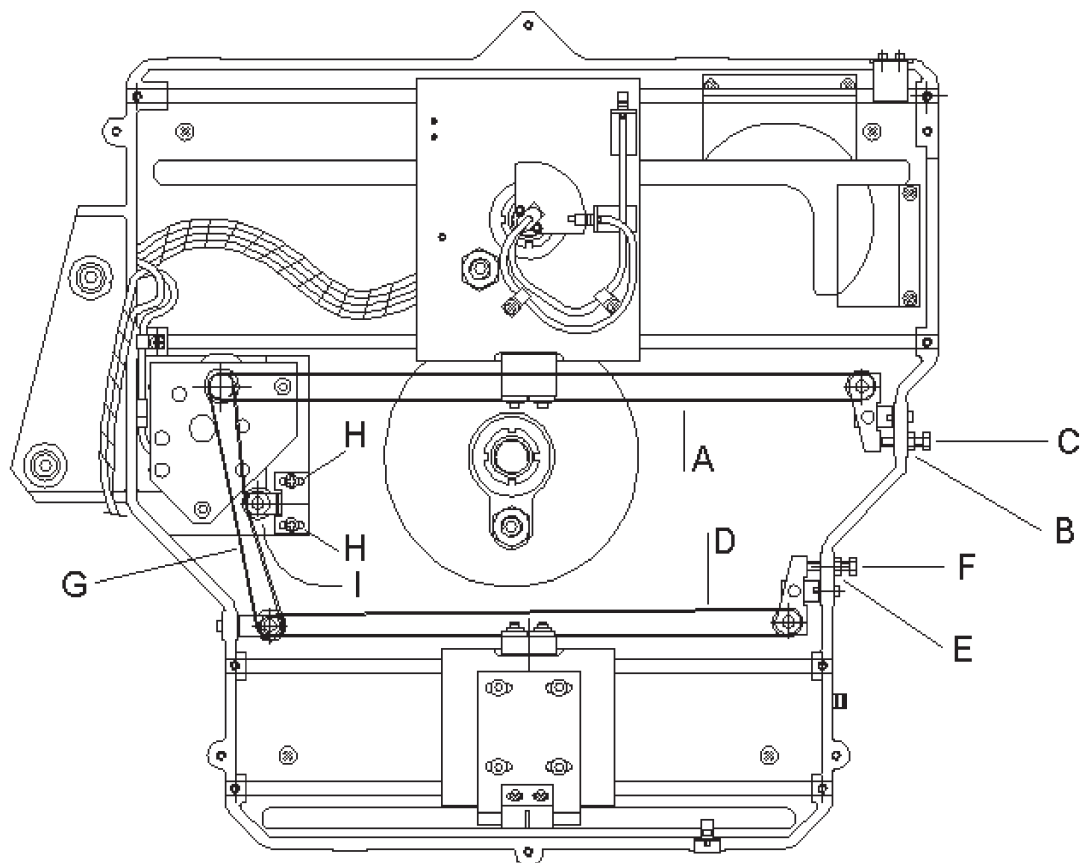
The tension of the cassette belt is not adjustable. Verify the belt tension by applying a force of 5 N in the centre of the longest free span to have a displacement of 5 mm.

If the belt tension is out of specification, replace the belt or the spring.

Orthoralix 9200 DDE Ceph only

For the tension adjustment of the drive belts in ceph arm of the Orthoralix 9200 DDE, proceed as follows:

1. for the belt (a) (from the motor to the DMU (Digital Module Unit), unlock the nut (b) of the belt stretcher and turn the bolt (c).
2. for the belt (d) (moving the ceph secondary collimator), unlock the nut (e) of the belt stretcher and turn the bolt (f).
3. for the belt (g), unlock the two screws (h) and push or pull the roller (i).



F.6.3 Adjusting the x-ray collimator

(A) Orthoralix 9200/Plus/Ceph

The X-ray collimator is moveable, with four selectable positions:

- panoramic
- transcan
- latero-lateral
- antero-posterior/postero-anterior

To adjust the X-ray collimator, proceed as follow:

1. Adjustment of the panoramic and transcan lead plates.

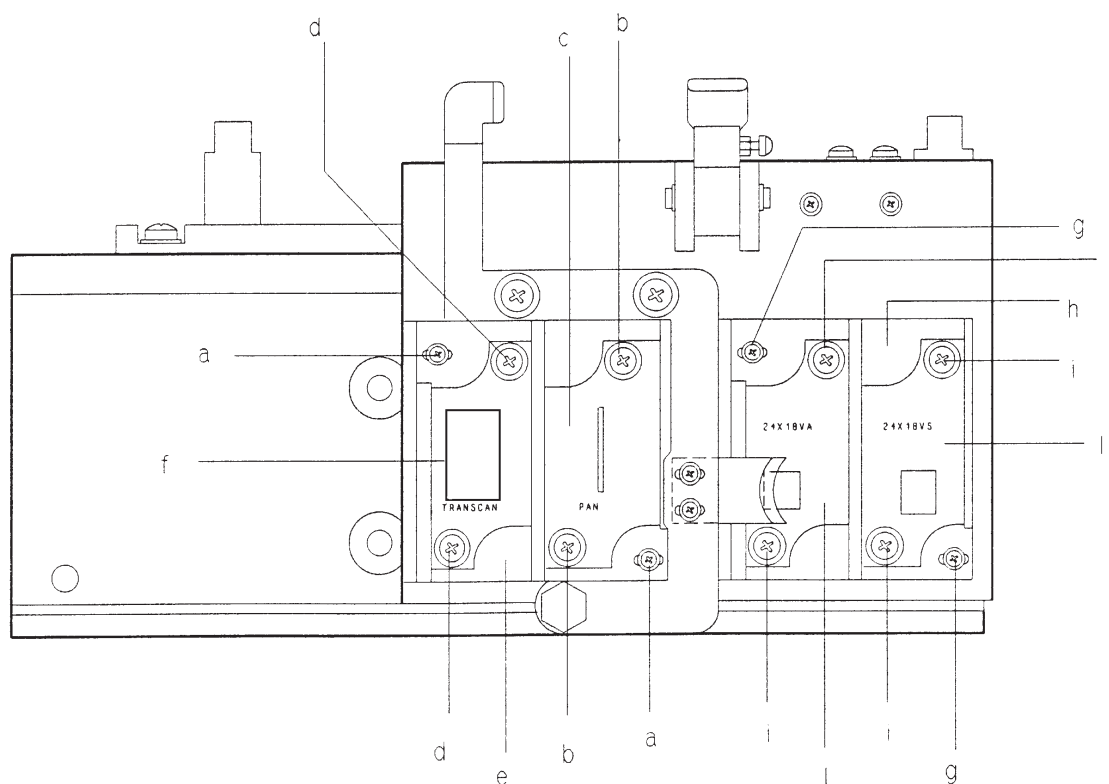
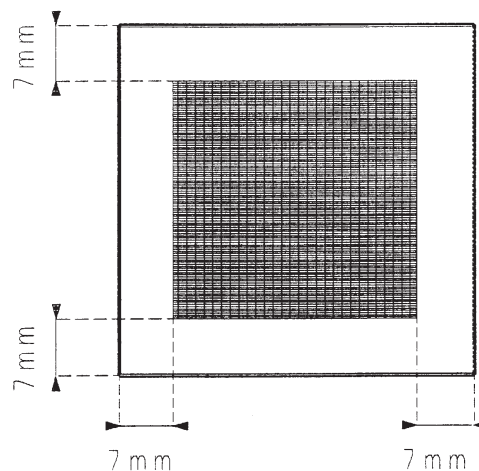
The X-ray field in panoramic and transcan mode shall be horizontally adjusted so that they lie symmetrically respect to the centre of the secondary slit: to do this, unlock the two screws (a) and adjust the horizontal position of the leads support plate (e) (1 mm of shift of the plate is corresponding to 3 mm on the secondary slit).

If it is necessary to change the vertical position of the X-ray fields, unlock the two screws (b) and change the vertical position of the lead plate (c) to adjust the vertical position of the panoramic X-ray field; unlock the two screws (d) and change the vertical position of the lead plate (f) to adjust the vertical position of the transcan X-ray field.

2. Adjustment of the ceph lead plates.

The X-ray fields in ceph mode (for the different formats available) shall be horizontally adjusted so that they lie at a distance of about 7 mm from the film edges : to do this, unlock the two screws (g) and adjust the horizontal position of the leads support plate (h) (1 mm of shift of the plate is corresponding to 15 mm on the ceph cassette).

If it is necessary to change the vertical position of the X-ray fields, unlock the two screws (i) and change the vertical position of each lead plate (l) independently, so that they lie at a distance of about 7 mm from the film edges.



B) Orthoralix 9200 DDE/Ceph

The X-ray collimator is moveable, with four selectable positions:

- panoramic
- transcan
- latero-lateral
- antero-posterior / postero-anterior

The X-ray collimator must be aligned:

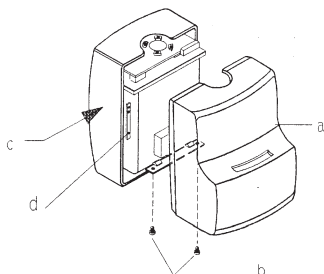
- respect to the DMU (Digital Module Unit) in case of the panoramic and transcan projections
- respect to the ceph secondary collimator and respect the DMU in the ceph projections.

To help the technician in these operations, a dedicated Service Program and a dedicated function in the Vixwin program are available.

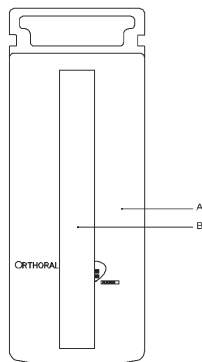
Panoramic and transcan adjustment

To adjust the panoramic and transcan lead plates, proceed as follow:

1. Switch on the unit entering the Service Programs.
Select the program **X-ray alignment** and press Dummy Run; select 70 kV, 9 mA and 0.16 s: the unit is now ready to make an exposure.
2. Remove the front cover (a) of the tubehead by unscrewing two screws (b) and by disengaging the spring latches from the rear cover (c), to access to the X-ray collimator.

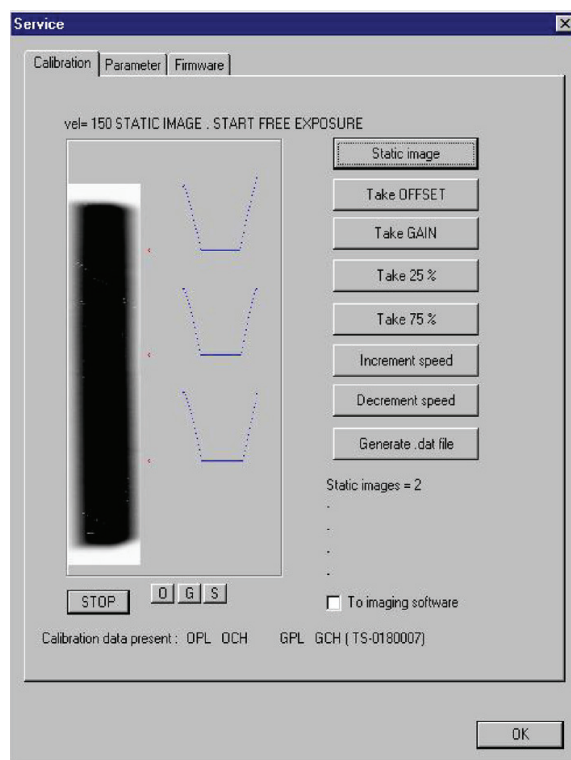


3. Select the panoramic position on the collimator and on the operator panel.
4. Fix the copper filter (b) supplied on the front part of the DMU (a), in order to cover completely the digital sensor, by using adhesive tape.



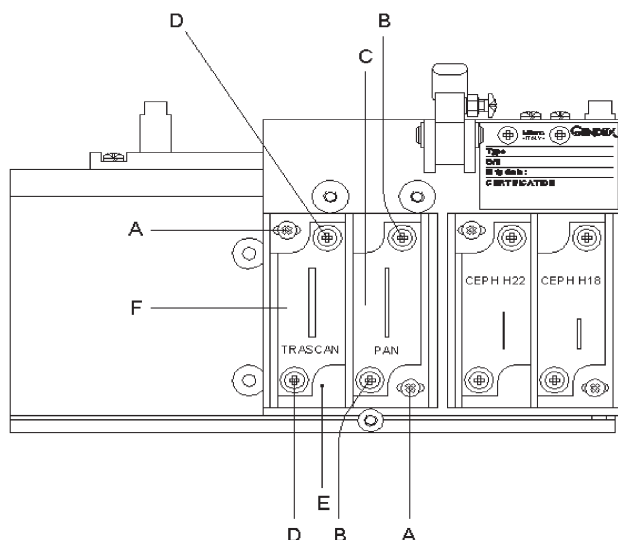
5. Switch on the PC where the Orthoralix 9200 DDE is connected to.
6. Access to the DDE icon in the system tray: when on it, with the cursor of the mouse, click with the right mouse pushbutton; four options will be displayed:
 - Remote
 - Service
 - Reconnect
 - Preview
7. Select Service by clicking on it.
8. Select Static image by clicking on it.
9. Now, make an exposure; after the preview, the following will appear on the monitor:
 - a white rectangle corresponding to the digital sensor (the vertical dimension is compressed)
 - a black rectangle corresponding to the X-ray field
 - on the right, three grey sections showing the position of the X-ray field respect to the digital sensor.

The purpose is to have the black rectangle in the middle of the white rectangle, with a white uniform unexposed area all around. Look at the following example.



The grey sections may help in understanding the correct or wrong alignment and how much the lead plate must be adjusted.

10. If the panoramic X-ray field shall be horizontally adjusted, unlock the two screws (a) and adjust the horizontal position of the leads support plate (e) (1 mm of shift of the plate is corresponding to 3 mm on the secondary slit).
11. If it is necessary to change the vertical position of the X-ray field, unlock the two screws (b) and change the vertical position of the lead plate (c).



12. After the adjustment, make another exposure to check the result: to do it, click first on Stop and then click on Static image.
13. Once the panoramic X-ray field adjustment is done, repeat the procedure for the transcan X-ray field by selecting the transcan position on the collimator and on the operator panel. The horizontal alignment is already correct (due to the fact that the transcan lead plate is installed on the same support of the panoramic lead plate) but the vertical alignment must be checked: unlock the two screws (d) and change the vertical position of the lead plate (f).
14. At the end of the procedure switch off the unit, remove the copper filter from the DMU, install back the front cover of the tubehead and leave the Service function by clicking first on Stop and then on OK.

Ceph adjustment

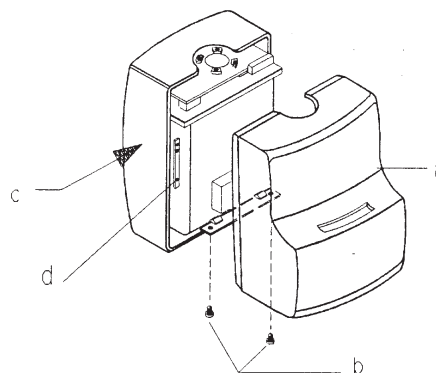
In this case the alignment procedure is divided in two steps:

1. alignment of the ceph secondary collimator respect to the DMU.
2. alignment of the ceph lead plates (on the primary collimator) respect to the ceph secondary collimator.

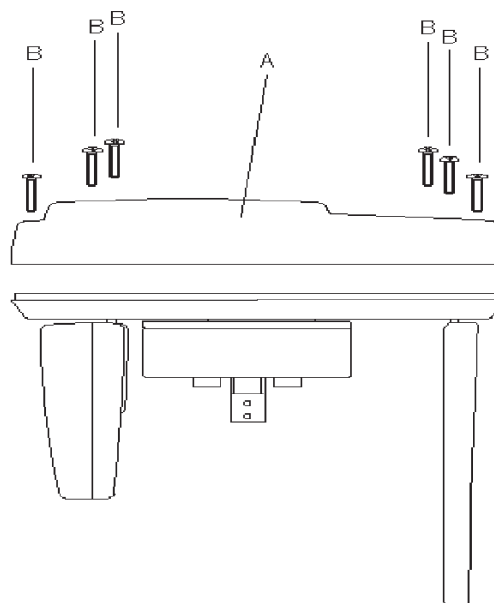
Step (1):

To adjust the ceph secondary collimator respect to the DMU, proceed as follow:

1. Remove the front cover (a) of the tubehead by unscrewing two screws (b) and by disengaging the spring latches from the rear cover (c), to access to the X-ray collimator: be sure that the ceph lead plates support is not installed on the collimator.

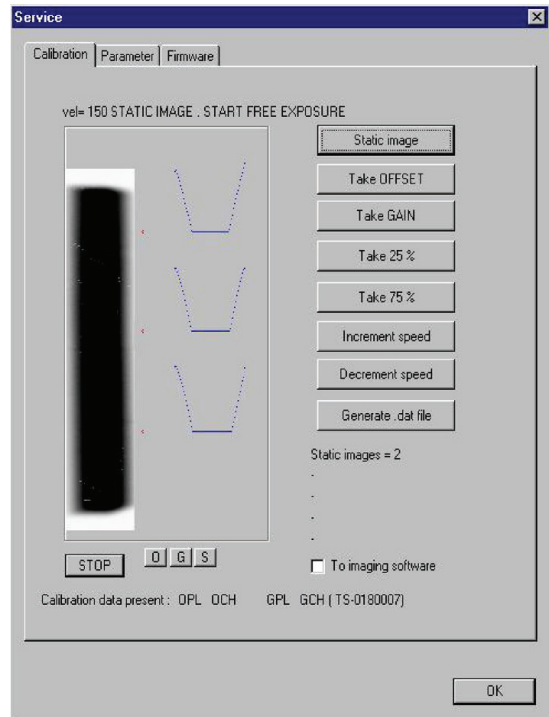


2. Move the collimator in one of the two ceph positions.
3. Remove the top cover (a) of the ceph arm by removing the six Allen screws (b).



4. Switch on the unit entering the Service Programs.
5. Be sure that the DMU is installed in the cephalometric arm.
6. Select the program **X-ray alignment** and press Dummy Run; select 60 kV, 3 mA and 0.16 s.
7. Press the patient size selection pushbutton on the operator panel to select the medium patient and press reset: the unit will automatically move the rotating arm, the secondary cephalometric collimator and the DMU in the middle of the cephalometric projection.
8. Switch on the PC where the Orthoralix 9200 DDE is connected to.
9. Access to the DDE icon in the system tray: when on it, with the cursor of the mouse, click with the right mouse pushbutton; four options will be displayed:
 - Remote
 - Service
 - Reconnect
 - Preview
10. Select **Service** by clicking on it.
11. Select **Static** image by clicking on it.
12. Now, make an exposure; after the preview, the following will appear on the monitor:
 - a white rectangle corresponding to the digital sensor (the vertical dimension is compressed)
 - a black rectangle corresponding to the X-ray field
 - on the right, three grey sections showing the position of the X-ray field respect to the digital sensor.

The purpose is to have the black rectangle in the middle of the white rectangle, with a white uniform unexposed area all around. Look at the following example.

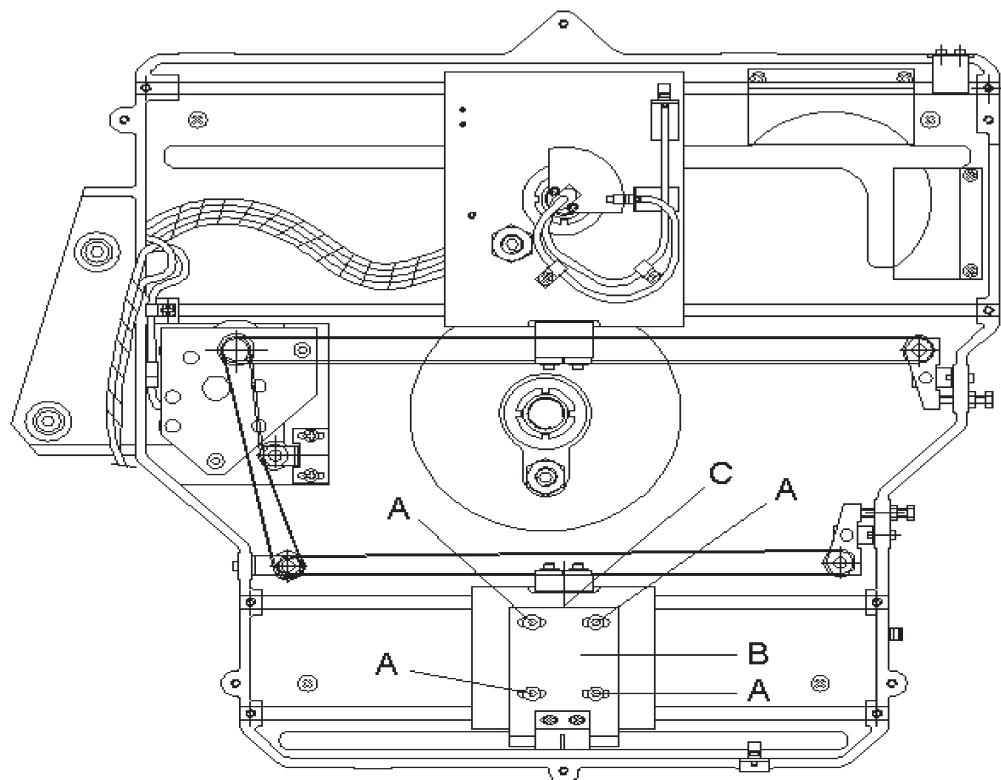


The grey sections may help in understanding the correct or wrong alignment and how much the lead plate must be adjusted.

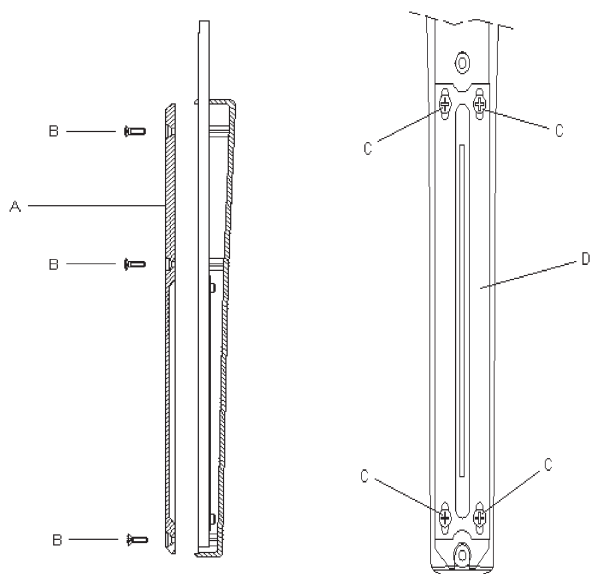
13. If the X-ray field shall be horizontally adjusted, unlock the four Allen screws (a) in the ceph arm and move the ceph secondary collimator assembly (b) in the desired direction.



If during the horizontal adjustment of the secondary collimator, the alarm *Ceph collimator* appears on the display, see Step (2) point (14).



14. If the X-ray field shall be vertically adjusted, remove first the rear cover (a) and then the front cover of the ceph secondary collimator, unlock the four screws (b) and move the lead plate (c) in the vertical desired position.



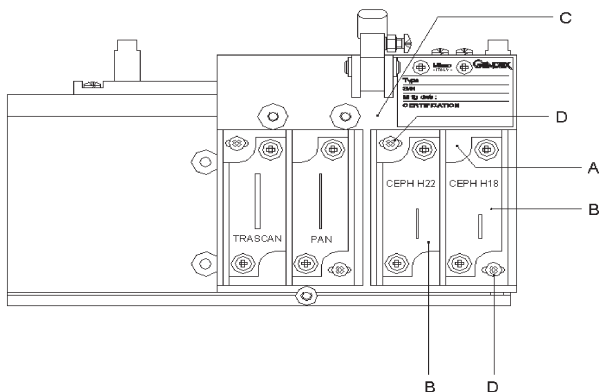
15. After the adjustment, make another exposure to check the result: to do it, click first on Stop and then click on Static image.
16. Once the adjustment is done in the middle position of the ceph projection, the adjustment must be checked also in the positions corresponding to the start and to the end of the ceph projection.
So, in the Service Program **X-ray alignment**, after the selection of the exposure parameters, press the patient size pushbutton on the operator panel to select the small patient and press reset: the unit will automatically move the rotating arm, the secondary ceph collimator and the DMU to the start position of the ceph projection.
17. Make an exposure and check the X-ray field alignment.
18. Repeat the check by selecting the big patient (and then press reset) in the Service Program **X-ray alignment**, so that the unit will automatically move the rotating arm, the secondary ceph collimator and the DMU to the end position of the ceph projection.

Step (2):

After the alignment of the ceph secondary collimator respect to the DMU, it is necessary to align the ceph lead plates (installed on the primary collimator) respect to the ceph secondary collimator,

proceeding as follow:

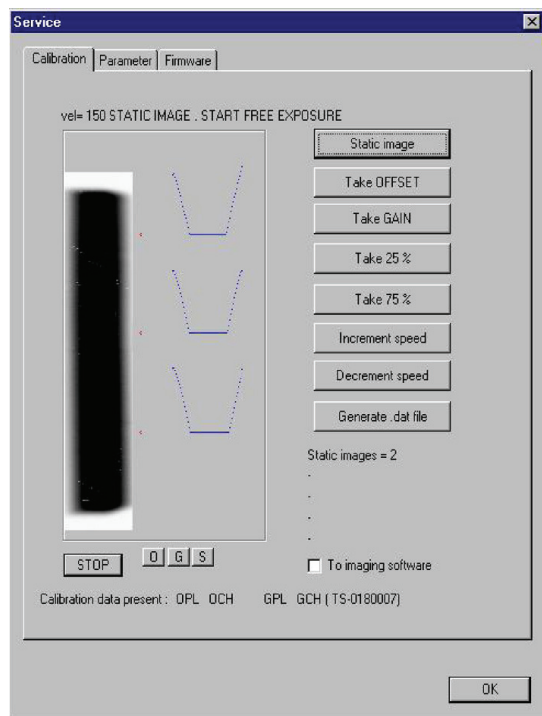
1. Install the ceph lead plates support (a) (with the two ceph lead plates (b)) on the collimator(c), by means of the two screws (d): be sure to install the support in the middle position of the possible horizontal travel.
2. Move the collimator in order to select the H22 lead plate.



3. In the Service Program **X-ray alignment** press the patient size selection pushbutton on the operator panel to select the medium patient and press reset: the unit will automatically move the rotating arm, the secondary ceph collimator and the DMU in the middle of the ceph projection.

4. Now, make an exposure; after the preview, the following will appear on the monitor:
 - a white rectangle corresponding to the digital sensor (the vertical dimension is compressed)
 - a black rectangle corresponding to the X-ray field
 - on the right, three grey sections showing the position of the X-ray field respect to the digital sensor.

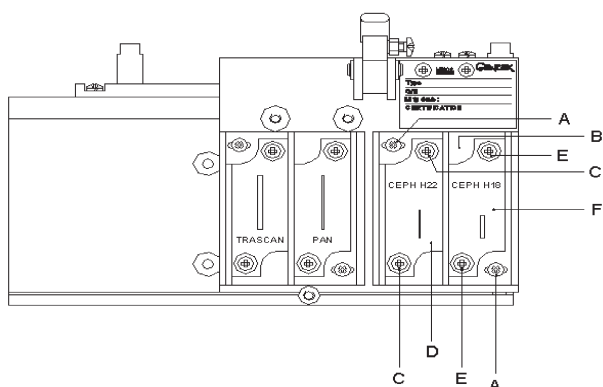
The purpose is to have the black rectangle in the middle of the white rectangle, with a white uniform unexposed area all around. Look at the following examples.



The grey sections may help in understanding the correct or wrong alignment and how much the lead plate must be adjusted.

5. If the X-ray field shall be horizontally adjusted, unlock the two screws (a) on the collimator and move the ceph lead plates support (b).
6. If the X-ray field shall be vertically adjusted, unlock the two screws (c) and move the lead plate (d) in the vertical desired position.
7. After the adjustment, make another exposure to check the result: to do it, click first on Stop and then click on Static image.
8. Then, move the collimator in order to select the H18 lead plate.
9. Make an exposure and check the vertical X-ray field alignment.

10. If the X-ray field shall be vertically adjusted, unlock the two screws (e) and move the lead plate (f) in the vertical desired position (no horizontal adjustment is necessary because the H18 lead plate is installed on the same support of the H22 lead plate, adjusted before).



The vertical dimension of the H18 X-ray field is not covering completely the vertical dimension of the sensor, and so a white part is visible above and under the X-ray beam. The vertical alignment is correct when most of the white part is above the X-ray field and only a small part is visible under the X-ray field.

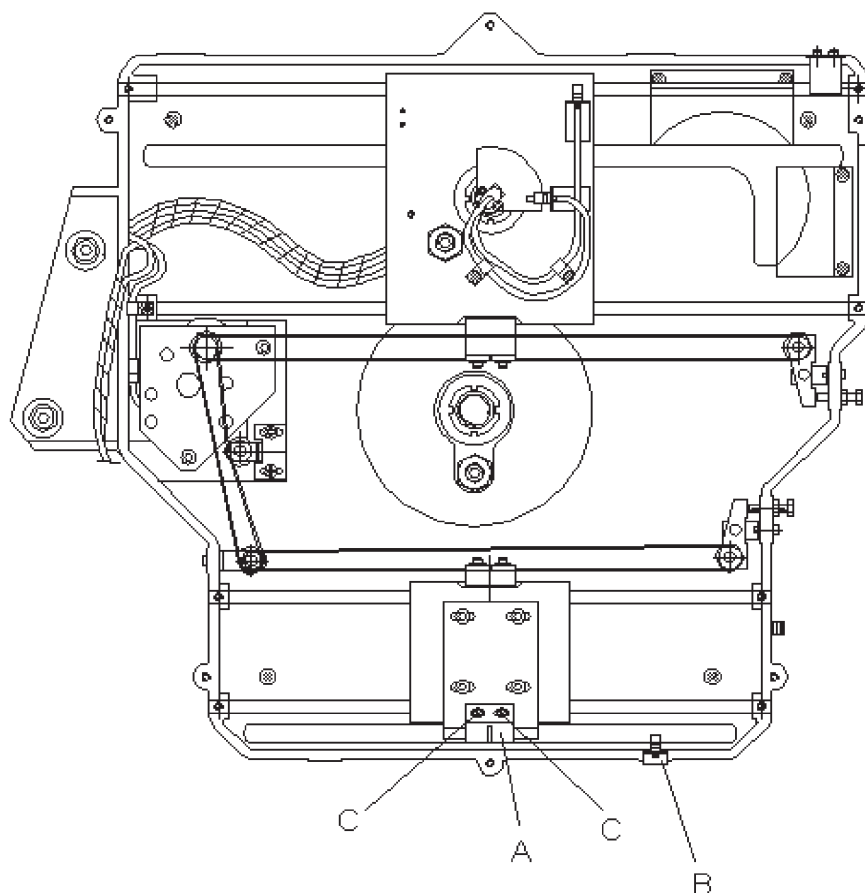
11. Switch off the system to exit the Service Programs.
 12. Switch on the system.
 13. Enter the ceph modality (by moving the collimator in one of the ceph positions) and press reset.
 14. Check that the actuator (a) of the optoswitch (b) (used to recognize the start position of the ceph secondary collimator) is exactly in the middle of the optoswitch itself: if necessary, adjust the position of the actuator (a) by unlocking the two screws (c).

If the actuator is not correctly aligned, the alarm message Ceph collimator will be displayed on the display when the ceph projection is entered.

15. At the end of the procedure, switch off the system and install back all the covers:

- frontal tubehead cover
- top cover ceph arm
- ceph secondary collimator cover

and leave the Service function by clicking on Stop and then on OK.



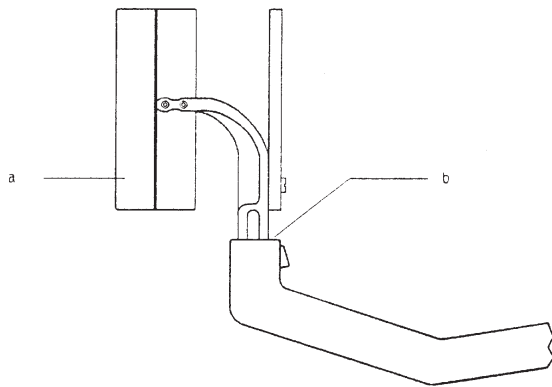
F.6.4 Adjusting the light projectors



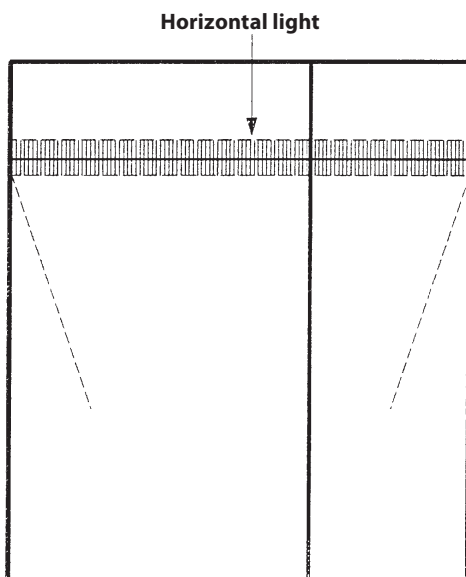
During the adjustment procedure, avoid to expose the eyes directly to the laser beam.

To adjust the horizontal light projector, proceed as follows:

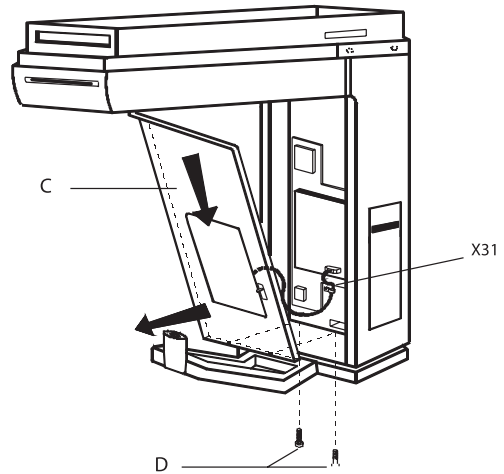
1. Make sure that the system is in the reset position.
2. Insert the light phantom (a) (code 4519 190 00922) into the bite block holder (b).



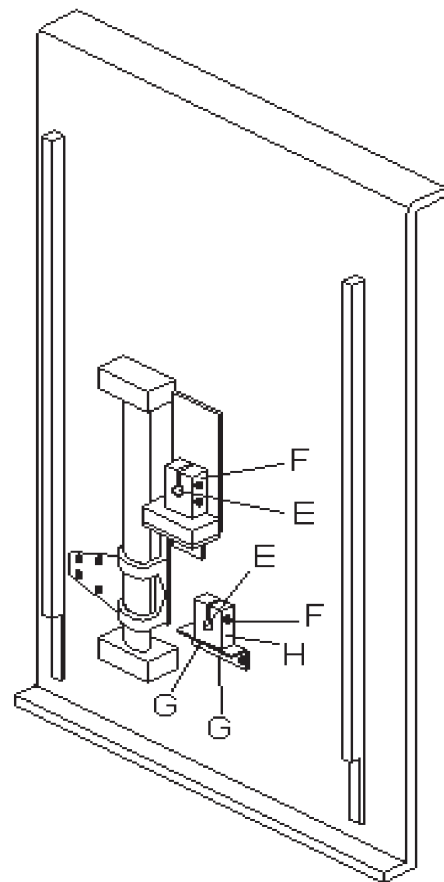
3. Switch on the light and verify that the horizontal light is sharply depicted over the whole horizontal black line of the phantom.



4. If the light beam is not horizontal, remove the mirror panel (c) by unscrewing two Allen screws (d).
5. Disconnect the connector X31 from the PC1 control board.

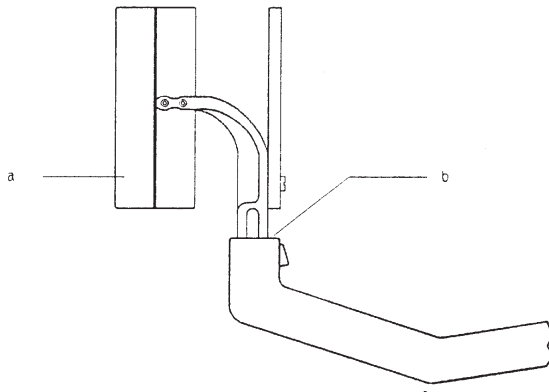


6. Access to the horizontal light projector (e) and unlock the screw (f): then rotate the light projector to correct the horizontal position of the light beam.
7. Reinstall the mirror panel (c) and verify if the horizontal light is adjusted (if not, repeat the procedure from point (4) to (6)).

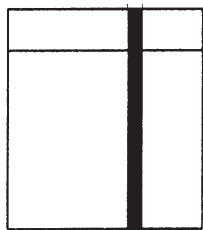


To adjust the mid-sagittal vertical light projector, proceed as follows:

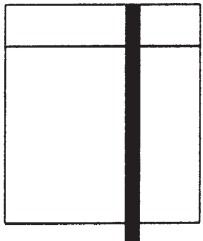
1. Make sure that the system is in the reset position.
2. Insert the light phantom (a) (code 4519 190 00922) into the bite block holder (b).



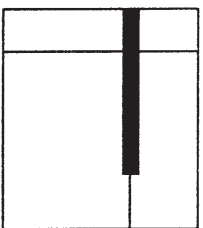
3. Switch on the light and verify that the mid-sagittal vertical light is vertical and that the lower edge of the light beam corresponds with the lower edge of the phantom.



Right

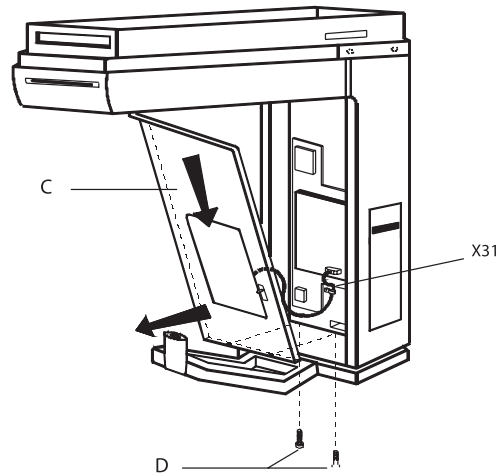


Wrong

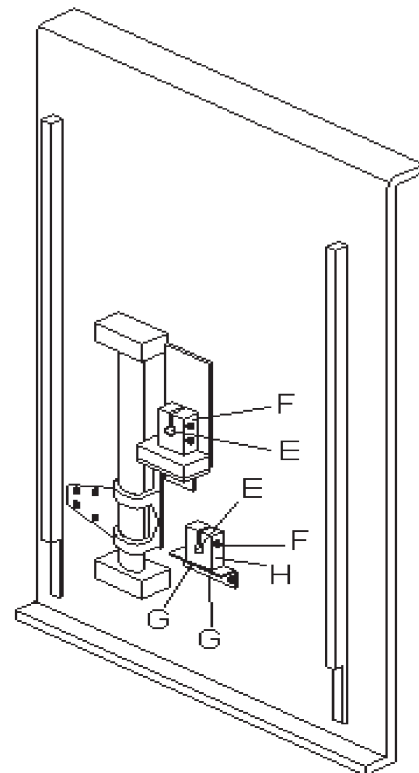


Wrong

4. If not, remove the mirror panel (c) by unscrewing two Allen screws (d).
5. Disconnect the connector X31 from the PC1 control board.



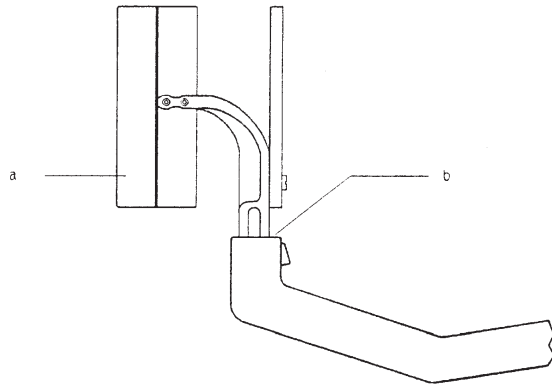
6. Access to the mid-sagittal vertical light projector (e) and:
 - unlock the screw (f) to rotate the light projector to correct the verticality of the light beam
 - unlock the two screws (g) to move the light beam laterally, by moving the whole light projector assembly (h).
7. Reinstall the mirror panel (c) and verify if the mid-sagittal vertical light beam is adjusted (if not repeat procedure from point (3) to (5)).



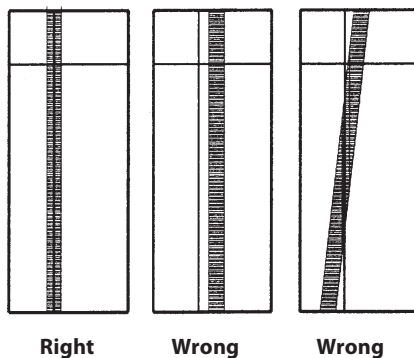
To adjust the lateral vertical light projector, proceed as follows:

For Orthoralix 9200/Plus

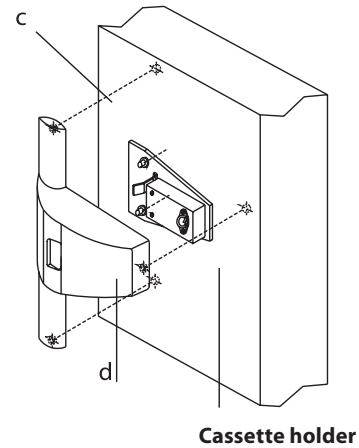
1. Make sure that the system is in the reset position.
2. Insert the light phantom (a) (code 4519 190 00922) into the bite block holder (b).



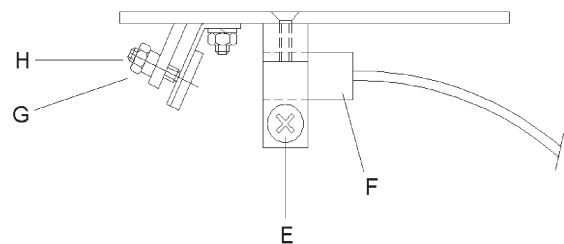
3. Switch on the light and verify that lateral vertical light is horizontally adjusted respect the vertical black line of the phantom



4. If not, remove the cover (d) of the light projector by unscrewing three screws (c), accessible from the rear side of the panoramic cassette carriage.



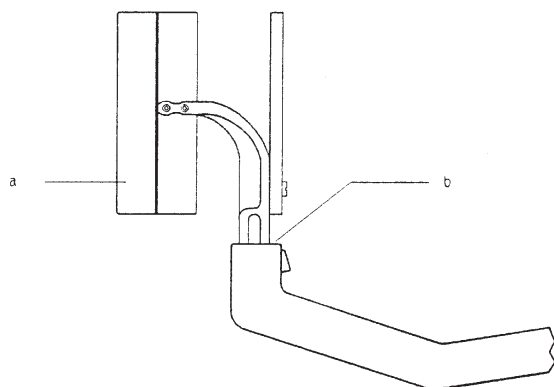
5. Access to the lateral vertical light projector and:
 - adjust the angle of the reflecting mirror (unlock the nut (g) and act on the screw (h)) to center the horizontal position of the light beam
 - to change the verticality of the light beam, unlock the screw (e) and rotate the light projector (f).



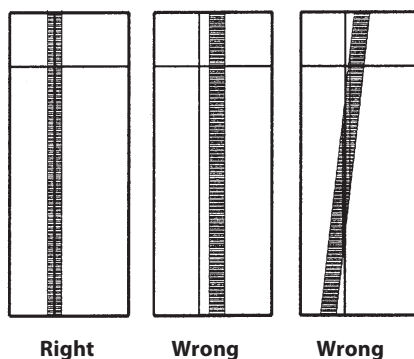
6. Reinstall the cover (c) of the light projector.

For Orthoralix 9200 DDE/Ceph

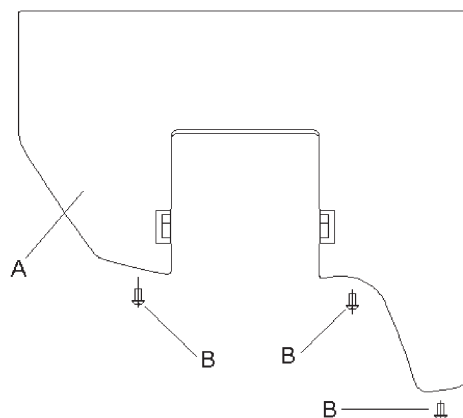
1. Make sure that the system is in the reset position.
2. Insert the light phantom (a) (code 4519 190 00922) into the bite block holder (b).



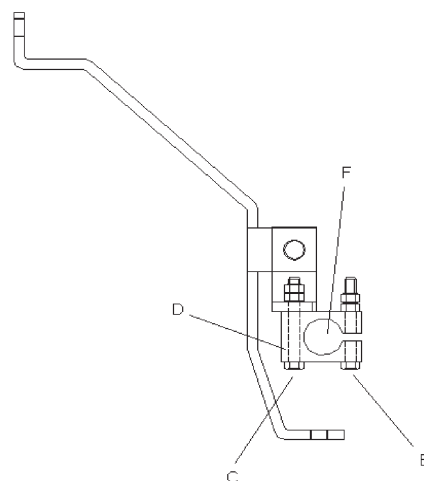
3. Switch on the light and verify that lateral vertical light is horizontally adjusted respect the vertical black line of the phantom



4. If not, remove the cover (a) by removing the three screws (b) and then pull it out to disengage from the spring latches.



5. Access to the lateral vertical light projector and:
 - to change the verticality of the light beam, unlock the Allen screw (e) and rotate the light projector (f)
 - to change the horizontal position of the light beam, unlock the Allen screw (c) and move the whole light projector assembly (d).



6. Reinstall the cover (c).

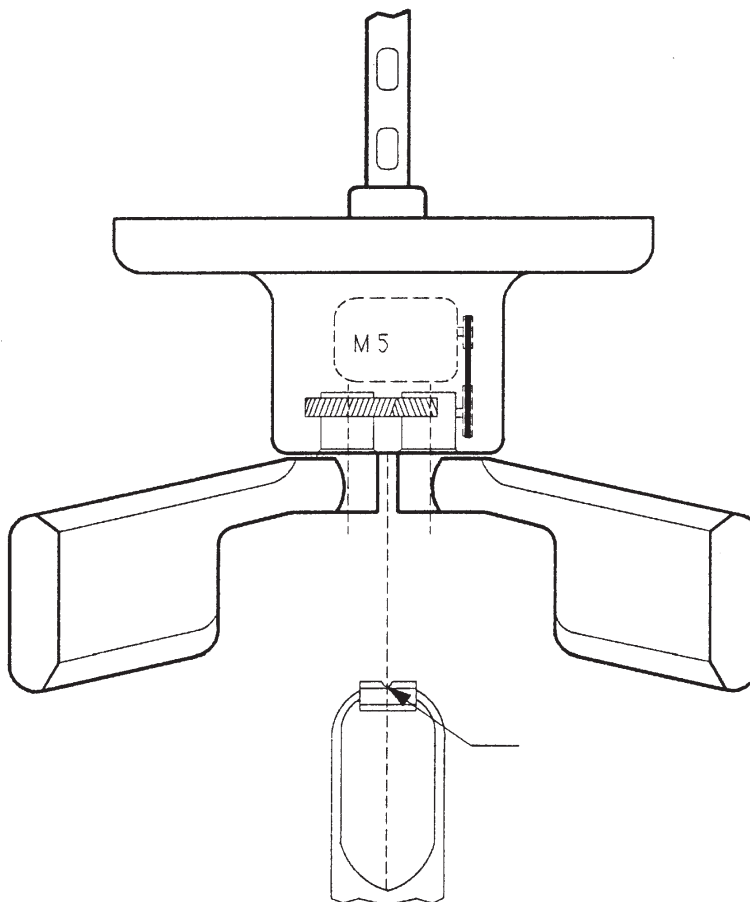
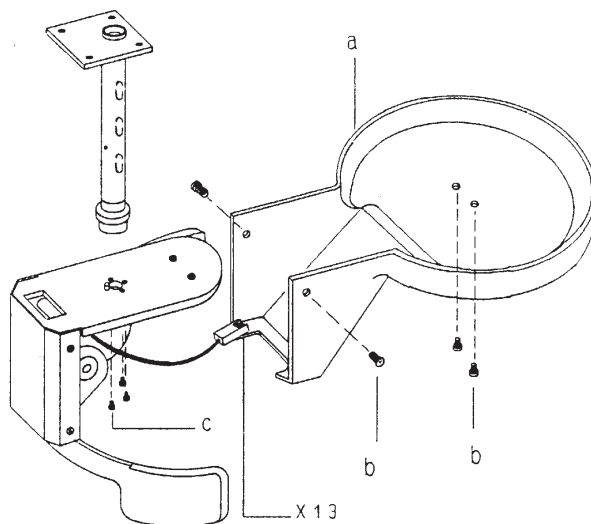
F.6.5 Adjusting patient headrest (PAN)

Using a plumb line, verify that the middle position of the headrest assembly is aligned with the middle position of the bite block (see reference middle line on the bite block itself and the figure below).

If the headrest assembly is not aligned with the bite block, proceed as follows:

1. Remove the cover (a) of the headrest by unscrewing the four screws (b).
2. Unlock the three fixation Allen screws (c).
3. Adjust the headrest assembly in the proper position and tight the three fixation Allen screws.
4. Mount back the cover (a).

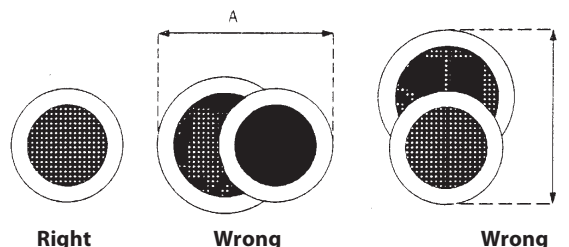
Reference middle line



F.6.6 Adjusting patient headrest (CEPH)

To adjust the patient headrest of the cephalostat proceed as follows:

1. Check that the metal rings (a) are mounted on the ear plugs.
2. Set the ear plugs in the middle position acting on the lever (b).
3. Fix the internal ear plug (the one close to the cassette) so that it is vertical, taking care to be in the middle position of the vertical possible travel.
4. Place a spirit level below the two ear plugs and fix the external one (the one far away from the cassette) when the spirit level is horizontal.
5. Insert a cassette with film and screens.
6. Make an exposure with 62 kV - 0.16 s.
7. Develop the film and verify that the two ear rings (a) are aligned (the smaller depicted ring is closest to the film). See the figure below:

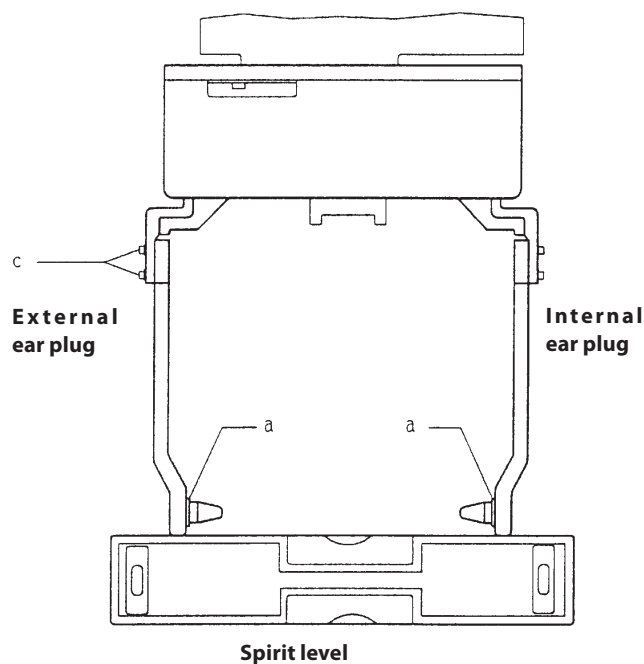
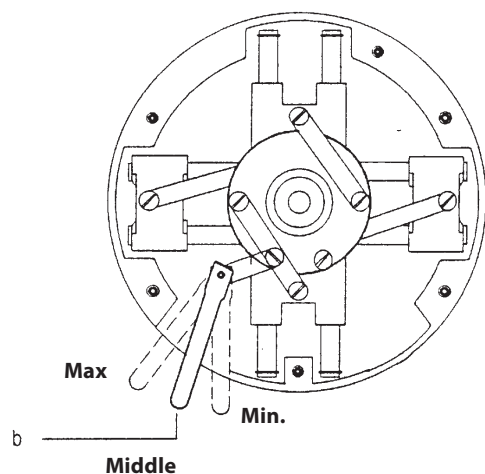


A = Horizontal Misaligned
B = Vertical Misaligned

If adjustments are necessary, adjust the position of the external ear plug by loosening the screws (c).

Orthoralix 9200 DDE/Plus/Ceph

The procedure is as described above, but the checks have to be done on the ceph image that will appear on the monitor of the computer.



F.6.7 Adjusting tube current



After a replacement of the converter board PQ1 and of the tubehead, it is mandatory to perform the mA calibration.

Proceed as follows:

1. Switch on the unit and wait for 5 min.
2. make three panoramic exposures (74 kV, 4 mA) respecting the duty cycle.
3. switch off the unit.
4. switch on the unit entering the Service Programs, by keeping pressed the PATIENT SIZE and the DUMMY RUN keys of the operator panel while switching on the unit.
Keep pressed the two keys till the message WAIT disappears from the display.
5. The following message will appear on the display:

SERVICE PROGRAMS
Pls press Y- Y+

where:

- Y- and Y+ are keys S16 and S17 on the keyboard (used to move the rotating arm along the Y axis, to center the patient with respect to the lateral vertical light).

By pressing the above mentioned keys, select the Service program **Vf Tube editing**.

6. The following message will appear on the display:

VF TUBE EDITING
Press DUMMY RUN to go

7. Press the DUMMY RUN key on the keyboard; three values will appear on the display:

XX YY ZZ

where:

- XX is the value referred to 4 mA: it could be changed by pressing the kV+ / kV- keys on the operator panel
- YY is the value referred to 9 mA: it could be changed by pressing the mA+ / mA- keys on the operator panel
- ZZ is the value referred to 14 mA: it could be changed by pressing the s+ / s- keys on the operator panel.

8. set the first two numbers (XX - YY) -10 and set the last number (ZZ) to -20, by using the above mentioned keys on the operator panel.
9. press the DUMMY RUN key to store the new parameters and to exit from **Vf Tube editing** service program.

10. enter the **Tube calibration** service program.

11. The following message will appear on the display:

TUBE CALIBRATION
Press DUMMY RUN to go

12. Press the DUMMY RUN key on the keyboard; the following will appear on the display:

70 kV 4 mA 0.5 s

13. make an exposure, then the following will appear:

70 kV 9 mA 0.5 s

14. make an exposure, then the following will appear:

70 kV 14 mA 0.5 s

15. at the end of the third exposure, the **Vf Tube Editing program** is automatically entered, showing the tube calibration parameters obtained at the end of the tube calibration; take note that these parameters are already stored, and the old ones are lost.

16. record the values on a piece of paper.

17. press the DUMMY RUN key on the keyboard to leave the **Vf Tube Editing** service program.

18. repeat the procedure from point (10) to point (17) till the values obtained at the end of the calibration are stable; for example:

first calibration	-15	-22	-33
second calibration	-12	-18	-27
third calibration	-11	-18	-26

the third calibration can be considered ok.

When the calibration is ok, decrease the values by 10. For example:

good calibration	-11	-18	-26
corrected values	-21	-28	-36

The values can be decreased using the **Vf Tube Editing** service program.

19. record the final values obtained in the System Configuration Module.

20. switch off the unit.



*If during the first calibration the alarm kV out of range or mA out of range is shown on the display, enter the **Vf Tube editing** service program and set the values to -10 (ten) and repeat the calibration.*

*If the alarm appears again, enter again the **Vf Tube editing** service program and continue to reduce the values of a step of -10 (ten) till the alarm disappears*

F.6.8 AEC calibration

The calibration of the AEC must be done in the following situations:

1. replacement of the pan PA5 AEC control board
2. replacement of the ceph PA5 AEC control board
3. a new cassette (panoramic or ceph) has to be used
4. new intensifying screens (panoramic or ceph) have to be used
5. a new cassette (panoramic or ceph) with new intensifying screens have to be used.



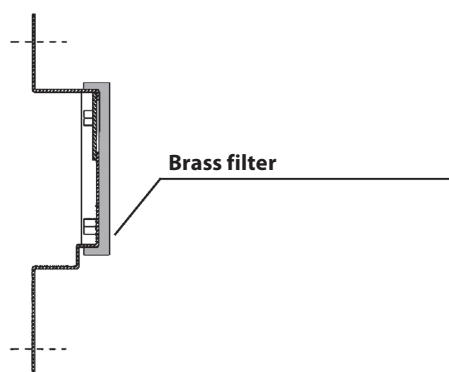
It is important to remember that only the cassettes (with the own intensifying screens installed), one for the panoramic and one for the ceph, which are calibrated following this procedure can be used with the AEC. Using the AEC with cassettes and intensifying screens that are not calibrated can generated images with poor quality

The calibration is divided in two steps:

1. calibration of the sensor mounted on the PA5 AEC control board: this calibration is necessary to determine if the sensor is working in the useful range, and these parameters can be used in the future to check that the sensor is working properly
2. calibration of the sensor plus the cassette/intensifying screens used: this is the real AEC calibration and the parameters obtained during this phase must be stored in the system.

Case (A): Panoramic AEC calibration

1. Remove the rear cover of the panoramic cassette carriage.
2. Mount the brass filter (code 4519 122 25571) on the PA5 AEC control board so that it covers the AEC sensor; see the figure below.



3. Check that no cassette is inserted in the panoramic cassette carriage and remount the rear cover of the panoramic cassette carriage.
4. Switch on the unit entering the Service Programs, by keeping pressed the PATIENT SIZE and the DUMMY RUN keys of the operator panel while switching on the unit.
Keep pressed the two keys till the message WAIT disappears from the display.
5. The following message will appear on the display:

SERVICE PROGRAMS
Pls press Y- Y+

where:

- Y- and Y+ are keys S16 and S17 on the keyboard (used to move the rotating arm along the Y axis, to center the patient with respect to the lateral vertical light).

By pressing the above mentioned keys, select the service program **AEC Slope**.

6. The following message will appear on the display:

AEC SLOPE
DUMMY RUN TO GO

7. Press the DUMMY RUN key on the keyboard; the following message appears on the display:

60kV 9mA 0.80s

8. Press the RESET key on the keyboard.
9. Reduce the mA value from 9 to 3 using the mA- key on the keyboard.
10. Make an exposure, then the following will appear:

60kV 15mA 0.80s

11. Reduce the mA value from 15 to 6 using the mA- key on the keyboard.
12. Make an exposure, then the following will appear:

aXX bXX SL=XX.X

Write these parameters on a piece of paper.

13. Switch off the unit.
14. If one of the two parameters a and b is greater than 255, repeat the steps from (4) to (13) reducing the value of the mA of the second exposure till the parameters a and b are lower than 255. Then, write the three parameters a, b and sl on the label of the PA5 board.
15. Switch on the unit entering the Service Programs and select again AEC slope.

16. Insert the panoramic cassette (with the own intensifying screens installed) in the panoramic cassette carriage.
17. Press the DUMMY RUN key on the keyboard; the following message appears on the display:

60kV 9mA 0.80s

18. Press the RESET key on the keyboard.
19. Make an exposure, then the following will appear:

60kV 15mA 0.80s

20. Make an exposure, then the following will appear:

aXX bXX SL=XX.X

Write these parameters on paper.

21. Switch off the unit.
22. If one of the two parameters a and b is greater than 255, repeat the steps from (16) to (22) reducing the value of the mA of the two exposures till the parameters a and b are lower than 255.
23. Using the following formula, calculate the correction parameter C:

$$C = 64 - (750 / SL)$$

Where:
SL is the parameter obtained in step (20).
Do not consider the decimal part of the parameter: i.e. 24.3 it must be considered 24. If the parameter is higher than 50, it must be considered 50; if the parameter is lower than -200 (i.e. -201, -202 etc.), it must be considered -200.

24. Switch on the unit entering the Service Programs and select **AEC pan tune**.

The following message will appear on the display:

AEC PAN TUNE
NEW=XX OLD=ZZ

where:

- XX = is the actual correction parameter
- ZZ = is the old correction parameter

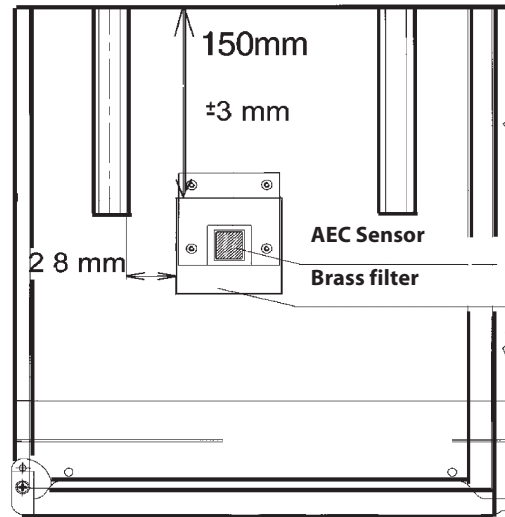
The correction parameter that must be stored is the value C calculated in the step (23).

To modify the correction parameter, use the Program +/- Program - keys on the keyboard (possible range from -200 to +50) and press DUMMY RUN key on the keyboard to store the new parameter and to exit from the program.

25. The panoramic AEC calibration is done.
26. Remove the brass filter.

Case (B): CEPH AEC calibration

1. Mount the brass filter (code 4519 122 25571) on the ceph cassette carriage so that it covers the AEC sensor of the PA5 AEC control board; see the figure below.



2. Check that no cassette is inserted in the ceph cassette carriage.
3. Switch on the unit entering the Service Programs, by keeping pressed the PATIENT SIZE and the DUMMY RUN keys of the operator panel while switching on the unit. Keep pressed the two keys till the message WAIT disappears from the display.
4. The following message will appear on the display:

SERVICE PROGRAMS
Pls press Y- Y+

where:

- Y- and Y+ are keys S16 and S17 on the keyboard (used to move the rotating arm along the Y axis, to center the patient with respect to the lateral vertical light).

By pressing the above mentioned keys, select the service program **AEC Slope**.

5. The following message will appear on the display:

AEC SLOPE
DUMMY RUN TO GO

6. Press the DUMMY RUN key on the keyboard; the following message appears on the display:

60kV 9mA 0.80s

7. Rotate the tubehead in the cep position and move the collimator in the AP/PA position.
8. Press the RESET key on the keyboard.
9. Reduce the mA value from 9 to 3 using the mA- key on the keyboard.
10. Make an exposure, then the following will appear:

60kV 15mA 0.80s

11. Reduce the mA value from 15 to 6 using the mA- key on the keyboard.
12. Make an exposure, then the following will appear:

aXX bXX SL=XX.X

Write these parameters on a piece of paper.

13. Switch off the unit.
14. If one of the two parameters a and b is greater than 255, repeat the steps from (3) to (12) reducing the value of the mA of the second exposure till the parameters a and b are lower than 255. Then, write the three parameters a, b and sl on the label of the PA5 board.
15. Switch on the unit entering the Service Programs and select again AEC slope.
16. Insert the cep cassette (with the own intensifying screens installed) in the cep cassette carriage.
17. Press the DUMMY RUN key on the keyboard; the following message appears on the display:

60kV 9mA 0.80s

18. Press the RESET key on the keyboard.
19. Make an exposure, then the following will appear:

60kV 15mA 0.80s

20. Make an exposure, then the following will appear:

aXX bXX SL=XX.X

Write these parameters on a piece of paper.

21. Switch off the unit.
22. If one of the two parameters a and b is greater than 255, repeat the steps from (15) to (20) reducing the value of the mA of the two exposures till the parameters a and b are lower than 255.
23. Using the following formula, calculate the correction parameter C:
- $$C = 64 - (820 / SL)$$

Where:

SL is the parameter obtained in step (20).

Do not consider the decimal part of the parameter: i.e. 24.3 it must be considered 24.

If the parameter is higher than 50, it must be considered 50; if the parameter is lower than -200 (i.e. -201, -202 etc.), it must be considered -200.

24. Switch on the unit entering the Service Programs and select **AEC cep tune**.

The following message will appear on the display:

AEC CEPH TUNE
NEW=XX OLD=ZZ

where:

- XX = is the actual correction parameter
- ZZ = is the old correction parameter

The correction parameter that must be stored is the value C calculated in the step (23).

To modify the correction parameter, use the Program +/- program - keys on the keyboard (possible range from -200 to +50) and press DUMMY RUN key on the keyboard to store the new parameter and to exit from the program.

25. The cep AEC calibration is done.
26. Remove the brass filter.

F.7 Host inputs read

A) Orthoralix 9200

On the display the following message will appear:

HOST INPUTS READ
8X 8Y 8W 8Z

where the numbers X, Y, W and Z may have the following values, corresponding to the different status of the PC1 system control board.

X			
NU	S4-2	OPTO C	OPTO R B
1	0	0 = no reset	1 = obsc
1	1	1 = reset obsc	0 = not

Y			
NU	S4-1	NU	OPTO R A
1	0	1	0 = no reset
1	1	1	1 = reset

W			
NU	BRAKE OFF UP	OPTO Y	CASS CEPH
1	0 = off up	0 = reset	0 = ins
1	1 = on	1 = no reset	1 = not ins

Z			
DEAD	BRAKE OFF DOWN	OPTO X DOWN	DEAD MAN
0 = on	0 = off	0 = reset down	0 = on
1 = off	1 = on	1 = no reset	1 = off

Legenda:

NU =	NOT USED
S4-2 =	dip switch S4-2 on the PC1 board
OPTO C =	optoswitch used to identify the half run position of the panoramic cassette carriage
OPTO R B =	optoswitch used to reduce the speed of the R movement
S4-1 =	dip switch S4-1 on the PC1 board
OPTO R A =	optoswitch used to identify the reset position of the R movement
BRAKE OFF UP =	pushbutton to release the brakes pushed to the upper position
OPTO Y =	optoswitch used to identify the reset position of the Y movement
CEPH CASS =	microswitch used to identify whether the ceph cassette is inserted or not
DEAD MAN =	X-ray command S4
BRAKE OFF DOWN =	pushbutton to release the brakes pushed to the lower position
OPTO X =	optoswitch used to identify the reset position of the X movement
OBSC =	optoswitch obscured

Examples:

DISPLAY INDICATION				CONDITION
8E (8 - 1110)	8F (8 - 1111)	8D (8 - 1101)	8D (8 - 1101)	Rotating arm in reset position Ceph cassette not inserted
8E (8 - 1110)	8F (8 - 1111)	8C (8 - 1100)	8D (8 - 1101)	Rotating arm in reset position Ceph cassette inserted
8E (8 - 1110)	8F (8 - 1111)	89 (8 - 1001)	8D (8 - 1101)	Rotating arm in reset position Brake release pushbutton in the upper position
8E (8 - 1110)	8F (8 - 1111)	8D (8 - 1101)	89 (8 - 1001)	Rotating arm in reset position Brake release pushbutton in the lower position
8E (8 - 1110)	8E (8 - 1110)	8D (8 - 1101)	8D (8 - 1101)	X-Y-C movements in reset position R movement not in reset position Ceph cassette not inserted

If the values displayed are not congruent with the table above, there is a malfunctioning of the optoswitches, of the wiring or of the PC1 board.

B) Orthoralix 9200 DDE

On the display the following message will appear:

HOST INPUTS READ
XX YY WW ZZ

where:

- the XX, YY, WW and ZZ are four byte (2 Hex) corresponding to the different status of the PC1 system control board as specified as follows:

bit position:

7 6 5 4 3 2 1 0

Byte XX

BIT	CONDITION
0	optoswitch Rb: 1= obscured, 0= not obscured
1	Not used
2	Not used
3	Not used
4	Not used
5	0= over voltage clamp on; 1=ok
6	Not used
7	start X-ray feedback to converter board PQ1

Byte YY

BIT	CONDITION
0	optoswitch Ra: 1= obscured, 0= not obscured
1	Not used
2	Not used
3	Not used
4	Not used
5	Not used
6	Not used
7	start X-ray feedback to converter board PQ1

Byte WW

BIT	CONDITION
0	optoswitch Ceph cassette: 1= not inserted, 0= inserted
1	optoswitch Y: 0= reset, 1= no reset
2	Not used
3	Not used
4	Not used
5	Not used
6	Not used
7	start X-ray feedback to converter board PQ1

Byte ZZ

BIT	CONDITION
0	Dead Man: 0= ON, 1= OFF
1	optoswitch X: 0= reset, 1= no reset
2	Not used
3	Not used
4	Not used
5	Not used
6	Not used
7	start X-ray feedback to converter board PQ1

F.8 Converter inputs read

A) Orthoralix 9200

On the display the following message will appear:

```
CONV INPUTS READ
XY 0 0 21
```

where the numbers X and Y may have the following values, corresponding to the different status of the inputs of the PQ1 converter board:

X = 1	when the tubehead is in the panoramic position
X = 2	when the tubehead is in the cephal position
X = 3	when rotating the tubehead from panoramic to cephal position or viceversa
Y = 8	when the collimator is in the transcan position and the panoramic cassette is inserted in the carriage
Y = 9	when the collimator is in the transcan position and the panoramic cassette is not inserted in the carriage
Y = A	when the collimator is in the panoramic position and the panoramic cassette is inserted in the carriage
Y = B	when the collimator is in the panoramic position and the panoramic cassette is not inserted in the carriage
Y = 4	when the collimator is in the cephal position and the panoramic cassette is inserted in the carriage
Y = 5	when the collimator is in the cephal position and the panoramic cassette is not inserted in the carriage
Y = 0	when moving the collimator from one position to another (i.e. from panoramic to cephal) and the panoramic cassette is inserted in the carriage
Y = 1	when moving the collimator from one position to another (i.e. from panoramic to cephal) and the panoramic cassette is not inserted in the carriage

B) Orthoralix 9200 DDE

On the display the following message will appear:

```
CONV INPUTS READ
XY 0 0 22
```

where the numbers X and Y may have the following values, corresponding to the different status of the inputs of the PQ1 converter board:

X = 0	when in ERROR
X = 1	when the tubehead is in the old cephal position (error condition)
X = 2	when the tubehead is in the panoramic position
X = 3	when rotating the tubehead from panoramic to cephal position or viceversa
Y = 0 or 1	when moving the collimator from one position to another
Y = 4 or 5	when the collimator is in the cephal position
Y = 8 or 9	when the collimator is in the Transcan position
Y = A or B	when the collimator is in the panoramic position

F.9 PH3 Inputs read

On the display the following message will appear:

PH3 PAN : CEPH READ
XX YY WW ZZ

where:

- the numbers XX, YY, WW and ZZ are four byte (2 hex) corresponding to the different status of the inputs of the PH3 boards as specified here follow:

bit position:

7 6 5 4 3 2 1 0

Byte XX (for PH3-Pan) = 0

Byte WW (for PH3-Ceph)

BIT	CONDITION
0	Ceph bay position optoswitch: 1= normal position
1	Secondary collimator position optoswitch: 1= reset position
2	Ceph bay reset optoswitch: 1= DMU is in movement
3	Not used
4	Positioning pushbutton on ceph keyboard: 1= pressed
5	Reset pushbutton on ceph keyboard: 1= pressed
6	Not used
7	Not used

Byte YY (for PH3-Pan) or ZZ (for PH3-Ceph)

BIT	CONDITION	
0	STEADY STATES	DYNAMIC STATES
1	0= DMU not present	1, 4= Release keys debounce
2	3= DMU in position	2= Power switch test
3	15= Power switch fail	5= Coils activation
4	DMU logic power	1= power will be available; 0= power off anyway
5	DMU connected	1= ready in place; 0= otherwise
6	Not used	
7	Not used	

Examples

XX	YY	WW	ZZ	CONDITION
0	10 or 0	x	0	DMU not present with collimator in pan position
0	23	x	0	DMU in pan position with power LED off
0	33	x	0	DMU in pan position with power LED on
0	5	x	x	Pan coils active
0	x	0	x	3 optoswitches obscured
0	x	3	x	Ceph in reset position
0	x	2	x	Ceph in reset position and bay rotated
0	x	7	x	All optoswitches in light (during ceph projection)
0	x	x	10 or 0	DMU not present with collimator in ceph position
0	x	x	23	DMU in ceph position with power LED off
0	x	x	33	DMU in ceph position with power LED on
0	x	x	5	Ceph coils active

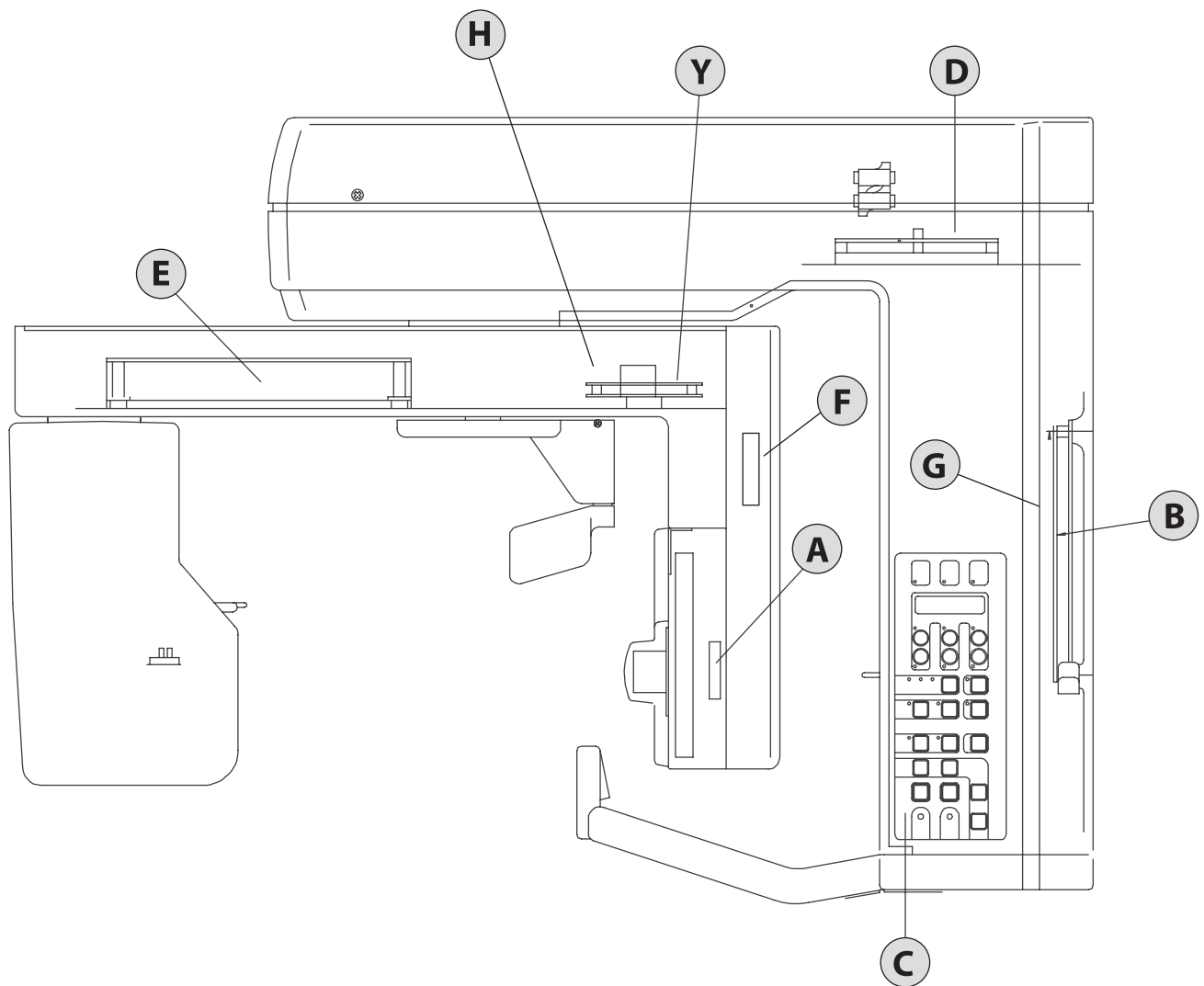
Spare parts lists

Explanation of the Spare parts list

- Column 1 =** Diagram or drawing No.
- Column 2 =** Index of items
/ up to and including
(the details belong to the same assy.
) the items have the same description.
- Column 3 =** Description of material
- Column 4 =** Technical data
C : complete assembly
P : poles
D : details of assembly
- Column 5 =** Code number (order No.)
(.....) for the series indicated this code number
is delivered until the stock level is zero.
- Column 6 =** Series numbers
(x) this part only to be used from serial number
indicated

Disposal of spare parts

- NOTE 1** Orthoralix contains non environmental friendly substances, in particular approx. 2.45 Kg of dielectric oil in the tubehead. Therefore disposal of discarded spare parts must be done via a company specialized in industrial wastes.
- NOTE 2** In case of oil leakage from the tubehead, handle the tubehead with care and, in particular, protect hands, face and eyes with adequate protection hardware (gloves, protective glasses, etc.) in order to avoid the contact of the dielectric oil with the skin.



Survey of electrical parts (part 1 of 2)

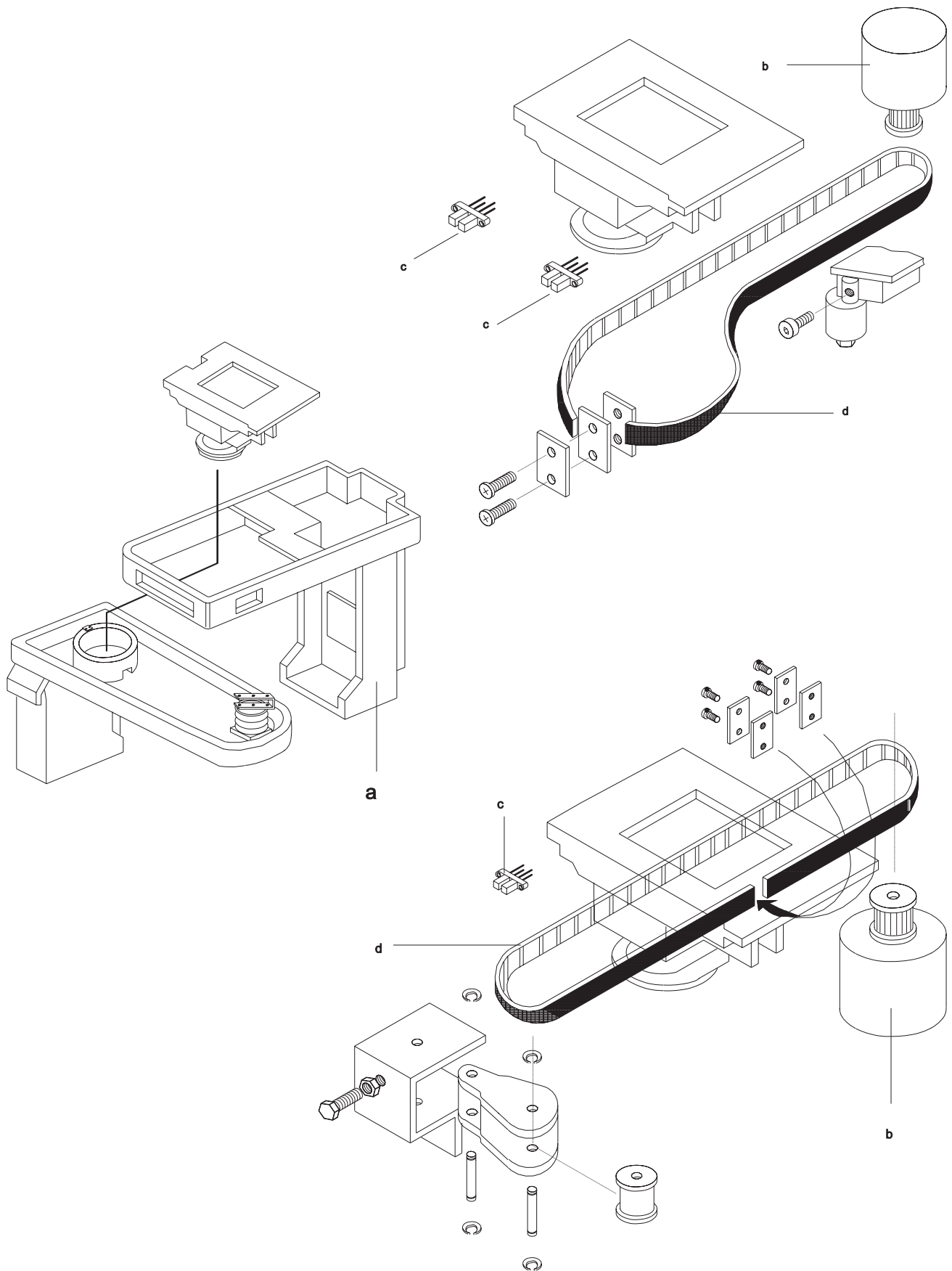
1- PAGE	2- ITEMS	3- DESCRIPTION	4- TECHNICAL DATA	5- CODE NUMBER	6- From series		
Z3-2	PA3 (	Emi Filter	C	4519 101 01405	X		
	F1/F2 (	Fuse	D F15A-250V-6,3x32	2422 551 00002	X		
	F1/F2 (	Fuse	D F10A-250V-6,3x32	2422 086 10138	X		
Q2-a	PA5	AEC Control board		4519 101 03803	X		
		without AEC		4519 101 04401	X		
Q2-f	PA6	DMU connector interface	DDE versions only	4519 101 10701	X		
Q2-g	PA7	Auxiliary board	DDE versions only	4519 190 02111	X		
Q2-b	PC1 ()	System Control Board	C	4519 101 00506	X		
	PC1-D34	Firmware 4.6	D	4519 107 20656	X		
	PC1-D34	Firmware 1.5	D DDE versions only	4519 107 21815	X		
Z3-9	PC6	Motorized column control board		4519 101 03604	X		
Q2-c	PC7	Control operator panel		4519 105 20811	X		
Q2-h	PH3B	DMU interface	DDE versions only	4519 101 10201	X		
Q2-d	PN1	Power Unit	C	4519 101 00106	X		
	F1/F3 ()	Fuse	D F1A-250V-5x20	2422 086 10185	X		
	F2/F4 ()		D T3.15A-250V-5x20	2422 086 10485	X		
	F5 ()		D F1A-600V-10x38	2422 551 00004	X		
	F6 ()		D F8A-600V-10X38	2422 551 00005	X		
Q2-y	PN5	Power supply board	DDE versions only	4519 101 04601	X		
Q2-e	PQ1 ()	Converter Unit	C	4519 101 00406	X		
	F1 ()	Fuse	D F1A-250V-5x20	2422 086 10185	X		
	F2/F5 ()		D T2A-250V-5x20	2422 086 00476	X		
	F3 ()		D T1A-250V-5x20	2422 086 00493	X		
	F4 ()		D T500mA-250V-5x20	2422 086 10014	X		
	PQ1-D9 (	Firmware 2.2	D	4519 107 20382	X		
not shown	DMU PAN	Panoramic Digital Module Sensor	DDE versions only	9869 103 20101	X		
not shown	DMU CEPH	Ceph Digital Module Sensor	DDE versions only	9869 103 20201	X		

Intentionally left blank

Survey of electrical parts

(part 2 of 2)

1- PAGE	2- ITEMS	3- DESCRIPTION	4- TECHNICAL DATA	5- CODE NUMBER	6- From series		
Z2-1	K1)	Mains Relay		4519 190 02051	X		
Z2-1	M1, M2, M3, M4	Geared motor	4x	4519 190 01901	X		
Z2-1	M5	Geared motor for column		4519 124 21641	X		
Z2-1	S1	Mains switch		2423 550 00008	X		
Z2-1	S3)	Push button for up/down column		2422 550 00002	X		
Z2-1	S4)	Exposure switch		4519 190 01461	X		
Z2-2		DMU magnetic lock	DDE versions only 4x	4519 105 20911	X		
Z2-1	S10, S11, S13, S15, S16, S17, S19, S20, S31, S32, S33, S34	Optoswitch	12x	2422 129 16001	X		
Z2-1	X30, X44, X37, X57)	Multipole cable	from s/n 03701001	4519 103 27421			
		Multipole cable	till s/n 03701000	4519 103 27021			
Z2-1	X43, X600)	Feedback cable		4519 103 20521	X		
Z2-1	X43, X600)	Filament cable		4519 103 20511	X		
Z2-1	X5, X41)	Cable assy	For PQ1 converter board up to 4519 101 00405	4519 103 27011			
	X5, X41)	Cable assy	For PQ1 converter board from 4519 101 00406	4519 103 27392			
Z2-1		Mains cable		4519 103 20912	X		
		Mains cable	for USA versions	4519 103 20462	X		
Z2-1	X42, X600	Tubehead cable		4519 103 20501	X		
Z2-1	)	Headrest cable		4519 103 27151	X		
Z2-1	X17	Reset R optoswitch cable		4519 103 27231	X		
Z2-1	X16	Slow R optoswitch cable		4519 103 27171	X		
Z2-1	X18	Reset Y optoswitch cable		4519 103 27041	X		
Z2-1	X19	Reset X optoswitch cable		4519 103 27201	X		
Z2-1	X24-Y	Geared motor Y cable		4519 103 27181	X		
Z2-1	X24-R	Geared motor R cable		4519 103 27161	X		
Z2-1	X24-X	Geared motor X cable		4519 103 27131	X		
Z2-1	X72b, X71b, X2, X1	Cable PC6 - PC1		4519 103 27251	X		
Z2-2		Ethernet crossover cable	DDE versions only	4519 103 21291	X		
Z2-2		Ethernet patch cable cat.5	DDE versions only	4519 103 21281	X		
Z2-2	PA7 X11	Ethernet column cable	DDE versions only	4519 103 20991	X		
Z2-2	X912, X6	Cable PA6 - PA7 PAN	DDE versions only	4519 103 27401	X		
Z2-2	X912, X8	Cable PA6 - PA7 CEPH	DDE versions only	4519 103 21111	X		
Z2-2	X3, X13	Cable PN5 - PA7	DDE versions only	4519 103 27411	X		



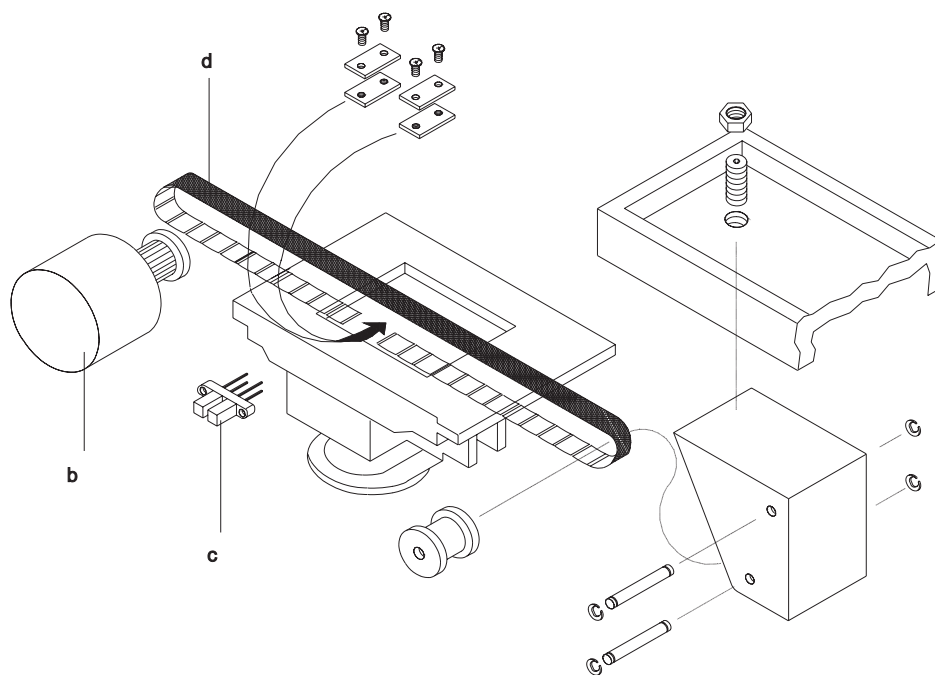
Z-Carriage Kinematic assy (part 1 of 3)

1- PAGE	2- ITEMS	3- DESCRIPTION	4- TECHNICAL DATA	5- CODE NUMBER	6- From series		
Q6-a		Z-carriage without tubehead	C	4519 190 01324	X		
Q6-b	M1, M2, M3	Geared motor	3x	4519 190 01901	X		
Q6-c	S10, S11, S13, S15	Optoswitches	4x	2422 129 16001	X		
Q6-d		Belt	1m 3x	4519 128 20771	X		

*Belt for **X** - direction length = 0.610 m*

*Belt for **Y** - direction length = 0.505 m*

*Belt for **R** - direction length = 0.835*

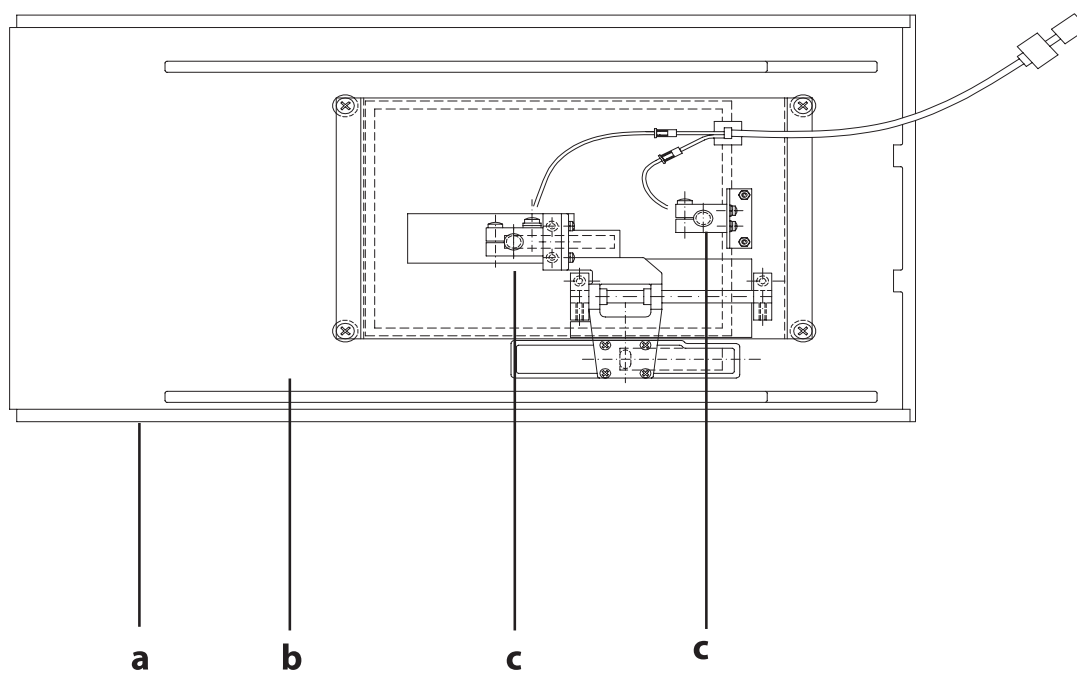


Z-Carriage

Front panel with mirror and centering lights

(part 2 of 3)

1- PAGE	2- ITEMS	3- DESCRIPTION	4- TECHNICAL DATA	5- CODE NUMBER	6- From series		
Q8-a	(	Front cover with mirror	C	4519 124 22332	X		
Q8-b	(	Front cover only	D	4519 128 21951	X		
Q8-c	(	Laser projector	D 2X	4519 105 20902	X		

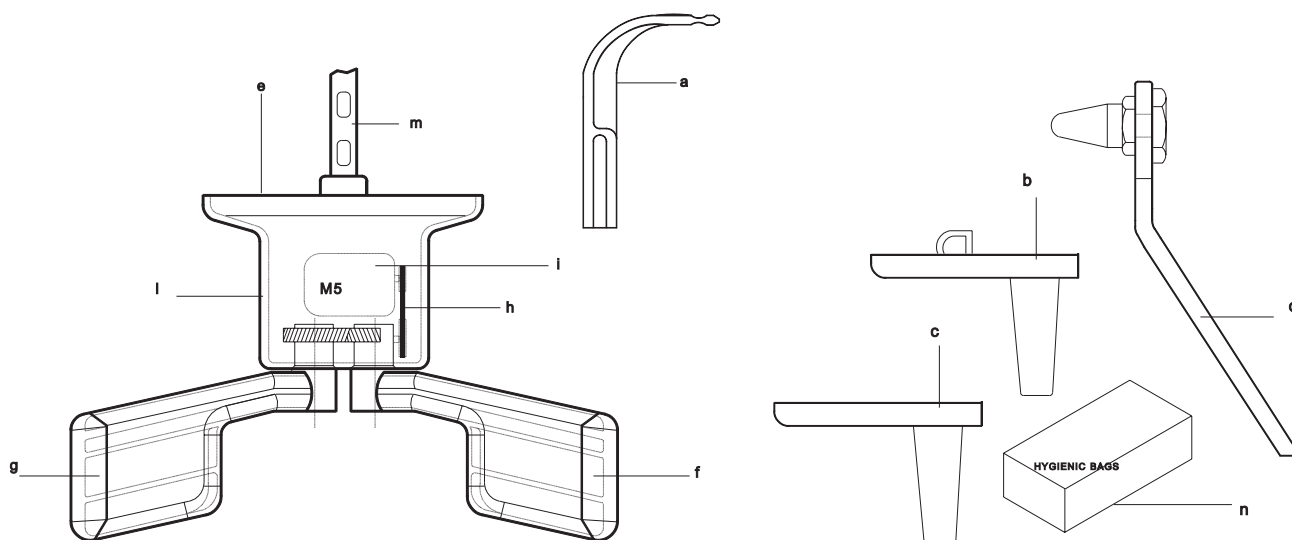


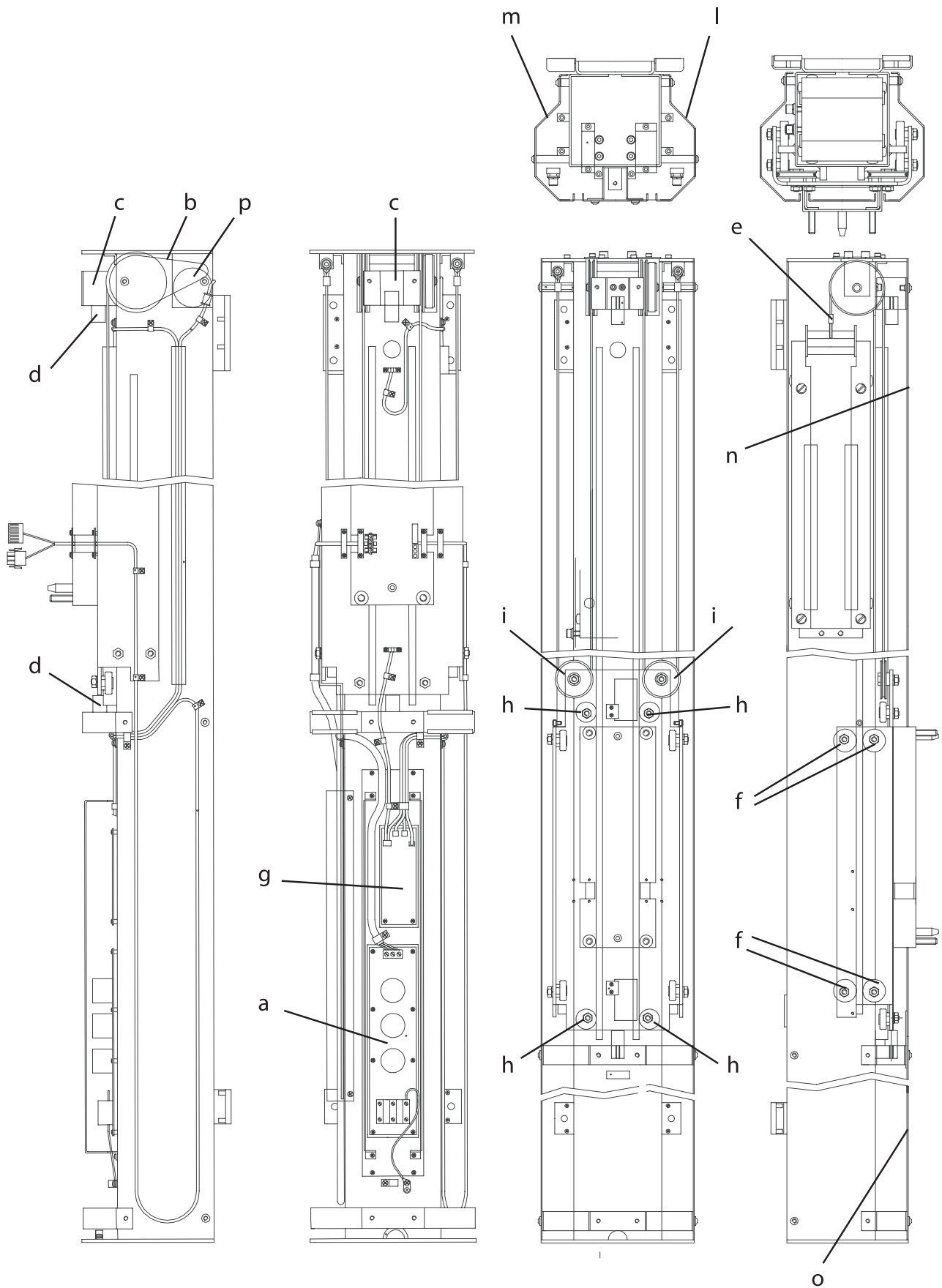
Z-Carriage

Patient positioning tools

(part 3 of 3)

1- PAGE	2- ITEMS	3- DESCRIPTION	4- TECHNICAL DATA	5- CODE NUMBER	6- From series		
Q9-a		Bite block		GXP 20211	X		
Q9-b	)	Chin rest		4519 128 20221	X		
Q9-c	)	Chin rest for TMJ		4519 128 21191	X		
Q9-d		Gauge for TMJ		4519 124 21352	X		
Q9-e	(	Patient head rest		4519 124 27122	X		
Q9-f	(	Right holder	C	4519 128 27382	X		
Q9-g	(	Left holder	D	4519 128 27373	X		
Q9-h	(	Belt	D	4519 190 01881	X		
Q9-i	M5 (	Motor	D	4519 190 01891	X		
Q9-l	(	Cover	D	4519 128 21451	X		
Q9-m		Support for patient headrest		4519 124 21511	X		
Q9-n		Hygienic bags for bite block	100x	4519 129 04211	X		



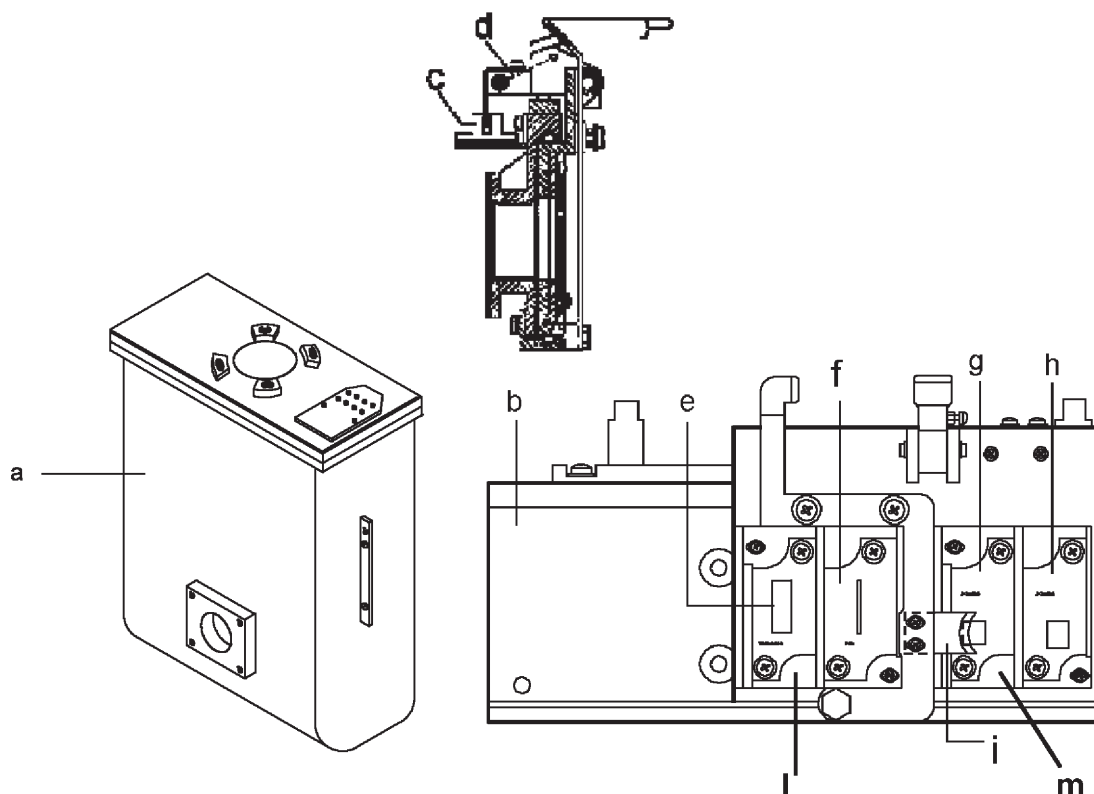


Column

1- PAGE	2- ITEMS	3- DESCRIPTION	4- TECHNICAL DATA	5- CODE NUMBER	6- From series		
Q10-a	PA3	Emi filter		4519 101 01404	X		
Q10-b		Belt		4519 122 25491	X		
Q10-c		End stop bracket		4519 122 24231	X		
Q10-d		Rubber bumper	2x	4519 120 62591	X		
Q10-e		Steel ropes with balance	C	4519 124 21031	X		
Q10-f		Ball bearing assy	8x	4519 124 21151	X		
Q10-g	PC6	Motorized column control board	C	4519 101 03604	X		
Q10-h		Roller	4x	4519 124 21161	X		
Q10-i		Pulley	2x	4519 124 21131	X		
Q10-l		Right side cover		4519 122 25512	X		
Q10-m		Left side cover		4519 122 25521	X		
Q10-n		Higher cover column		4519 122 25531	X		
Q10-o		Lower cover column		4519 122 21641	X		
Q10-p		Geared motor for column		4519 124 21641	X		

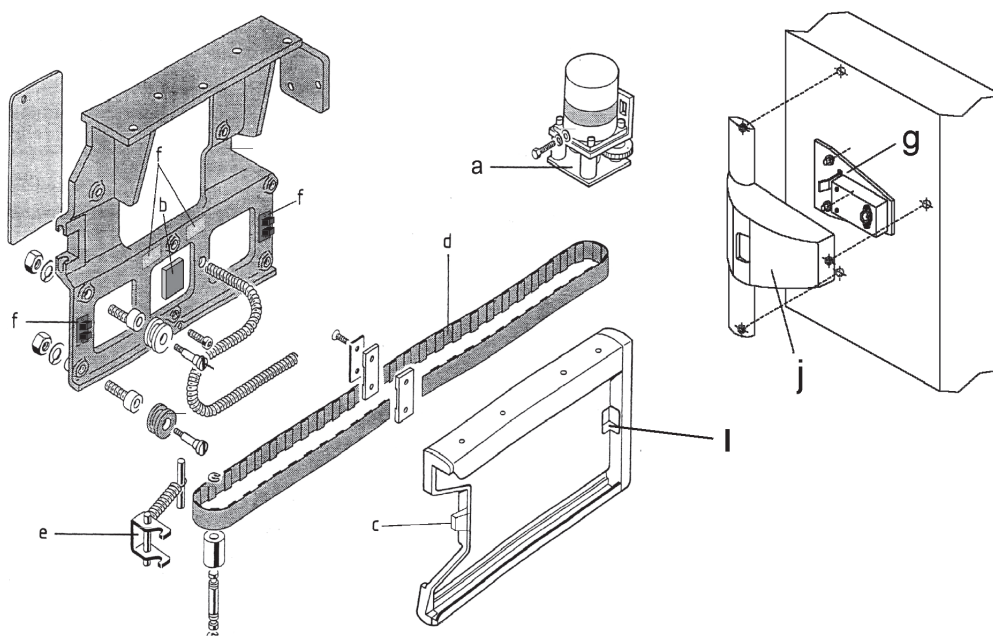
Tubehead with collimator

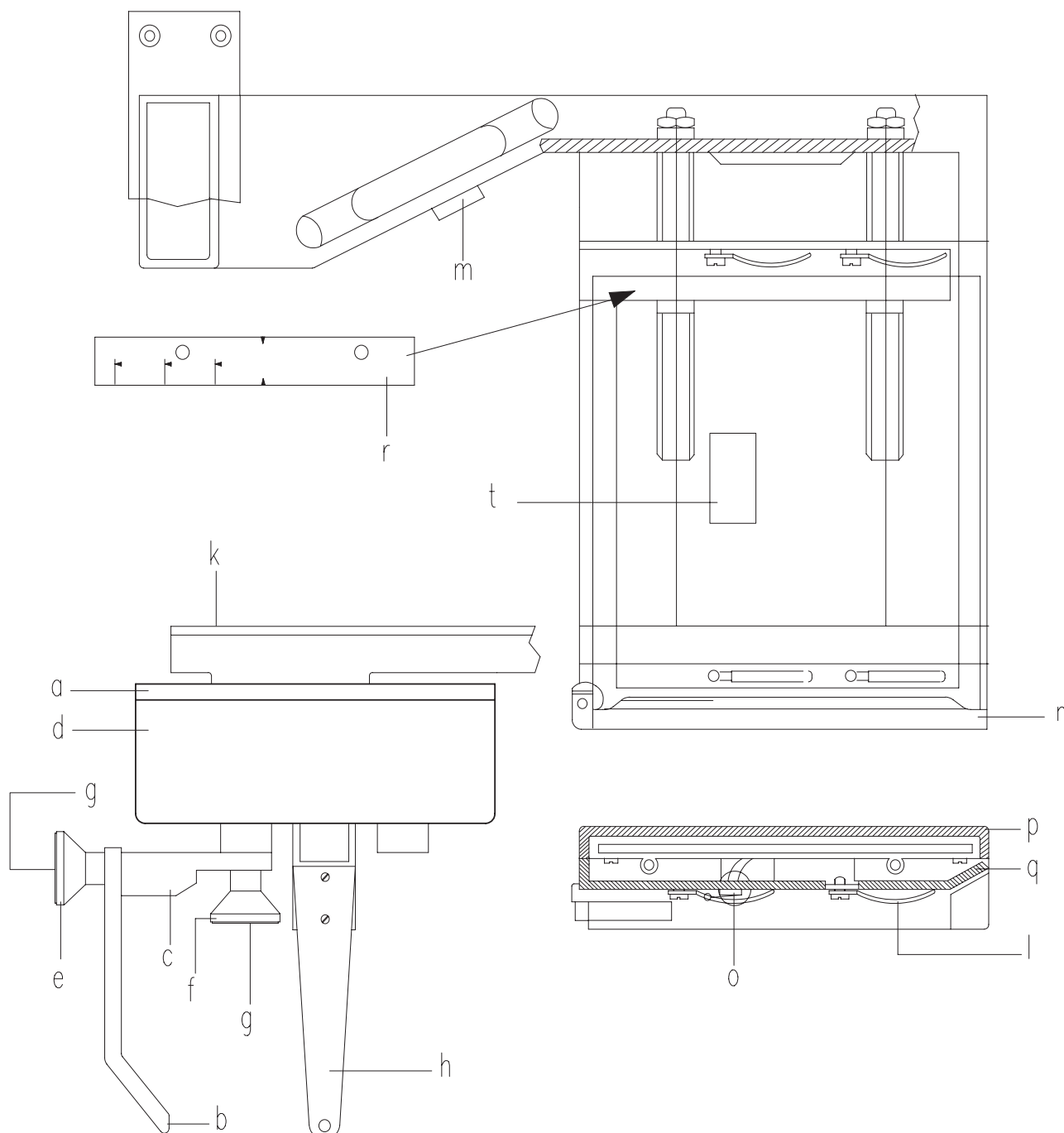
1- PAGE	2- ITEMS	3- DESCRIPTION	4- TECHNICAL DATA	5- CODE NUMBER	6- From series
Q12-a		Tubehead assy	C	4519 190 01131	X
Q12-b	(	Collimator	C DDE versions only	4519 124 22341	X
	(	Collimator	C	4519 124 21792	X
Q12-c	PA2	Optical switch board	D	4519 101 00901	X
Q12-d	(	Spring	D	4519 122 21571	X
Q12-e	()	Lead plate TRANSCAN	D	4519 122 24742	X
	()	Lead plate TRANSCAN	D DDE versions only	4519 122 24781	X
Q12-f	()	PAN	D	4519 122 24643	X
Q12-g	()	(24x18) vertical asymm.	D	4519 122 24683	X
	()	(18x24) horizontal asymm.	D Option	4519 122 24663	X
	()	"(10"x8") vertical asymm."	D for USA	4519 122 24713	X
	()	"(8"x10") horizontal asymm."	D for USA	4519 122 24723	X
	()	H 22	DDE versions only	4519 122 24761	X
Q12-h	()	(24x18) vertical symm.	D	4519 122 24673	X
	()	(30x24) vertical symm.	D Option	4519 122 24693	X
	()	"(10"x8") vertical symm."	D for USA	4519 122 24703	X
	()	H 18	DDE versions only	4519 122 24771	X
Q12-i		Soft tissues filter		4519 122 24582	X
Q12-l		Pan lead plate support		4519 122 24791	X
Q12-m		Ceph lead plate support		4519 122 24801	X



Cassette holder

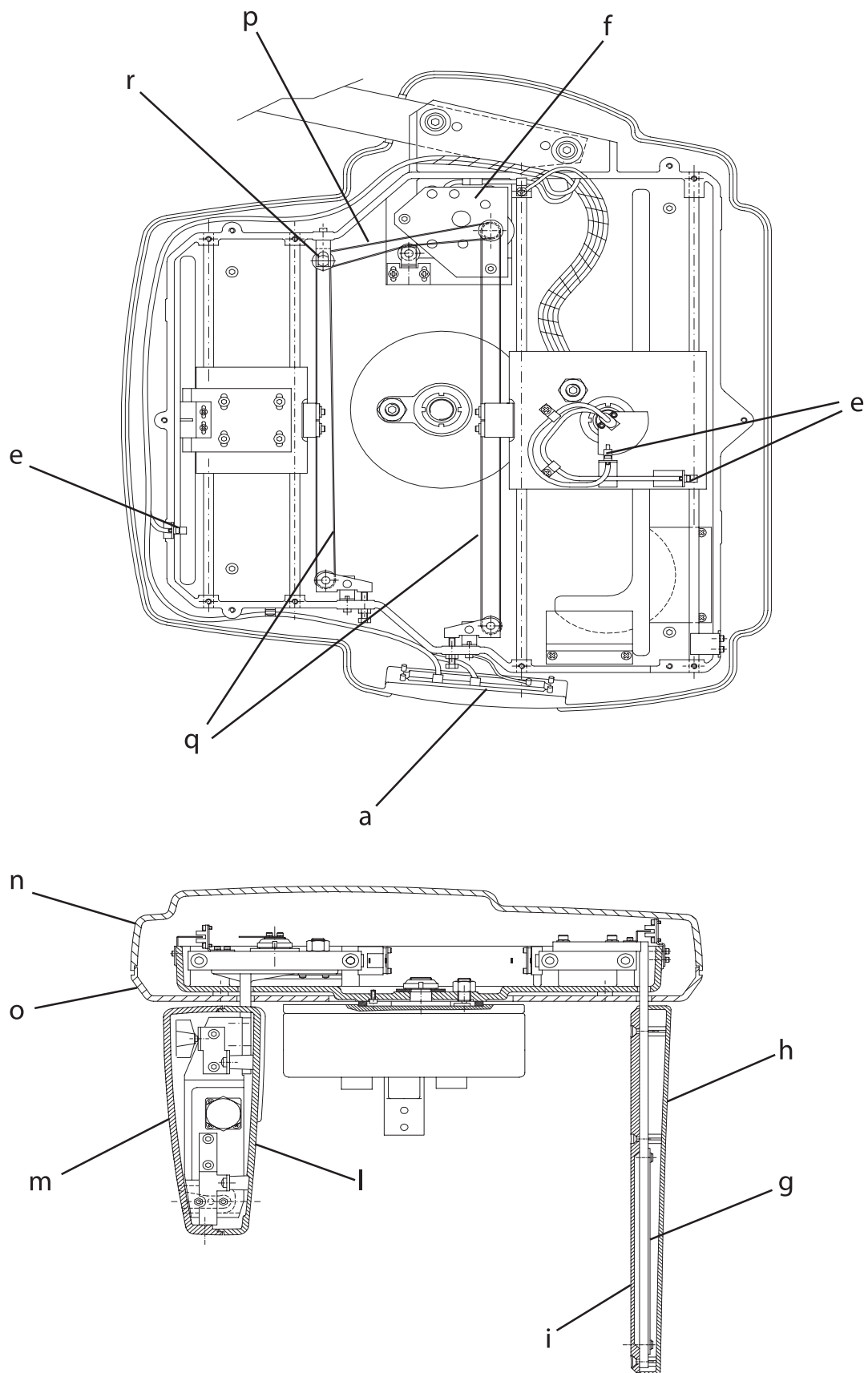
1- PAGE	2- ITEMS	3- DESCRIPTION	4- TECHNICAL DATA	5- CODE NUMBER	6- From series		
Q13-a	M4	Geared motor	C	4519 190 01901	X		
Q13-b	PA5	AEC control	C	4519 101 03803	X		
		Without AEC	C	4519 101 04401	X		
Q13-c		End stop cassette		4519 190 01911	X		
Q13-d		Belt	1m	4519 128 20771	X		
Q13-e		Belt stretcher assembly	C	4519 124 20761	X		
Q13-f	S16, S17	Optoswitch	2x	2422 129 16001	X		
Q13-g	()	Laser projector	C	4519 105 20902	X		
Q13-j	)	Cover		4519 128 22081	X		
Q13-l		Cassette present switch		4519 190 02071	X		





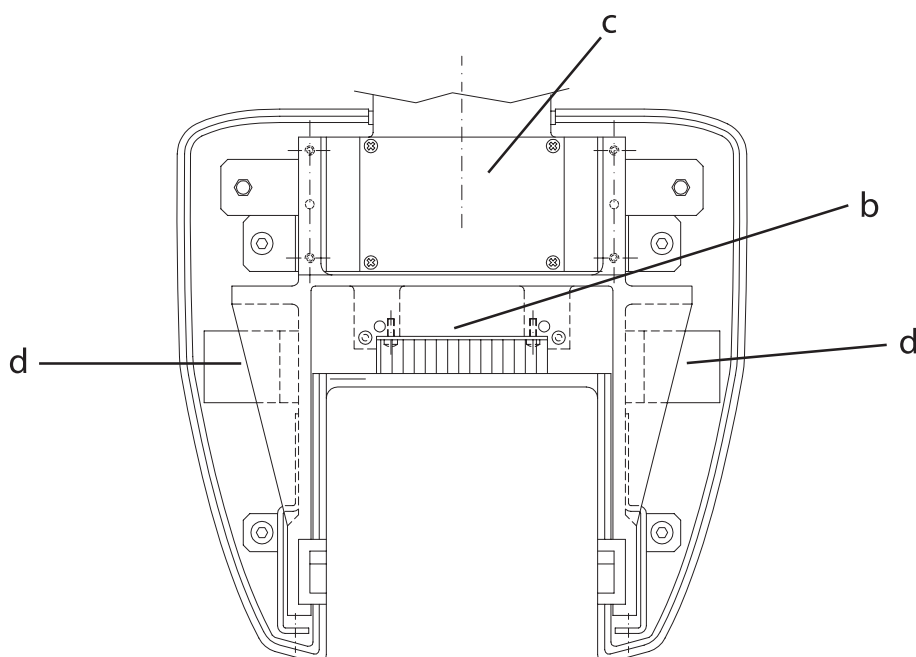
Ceph arm with Cephalostat and Cassette holder

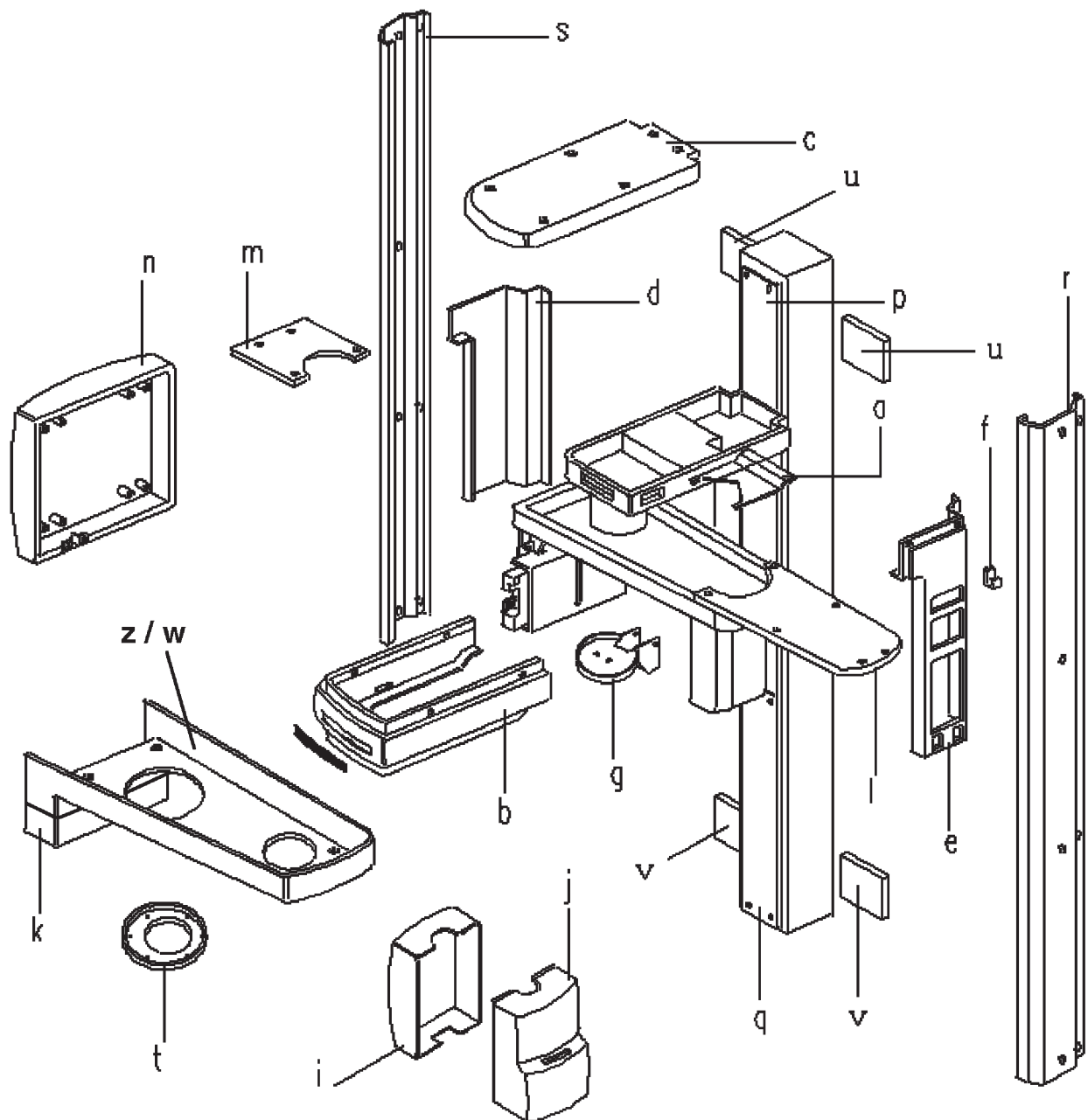
1- PAGE	2- ITEMS	3- DESCRIPTION	4- TECHNICAL DATA	5- CODE NUMBER	6- From series		
Q14-a	(	Complete cephalostat	C	4519 124 22381	X		
Q14-b	(	Nasion rest	D Vert. 0-40 mm	4519 128 20722	X		
Q14-c	(	Nasion support with friction	D	4519 190 01081	X		
Q14-d	(	Cover	D	4519 122 25261	X		
Q14-e	()	Knob	D	4519 122 22411	X		
Q14-f	()		D	4519 122 22031	X		
Q14-g	(	Snap out cap	D 2x	4519 120 73852	X		
Q14-h	(	Ear plug support	CD 2x	4519 190 30582	X		
Q14-k		Cover		4519 122 25251	X		
Q14-l		Spring	6x	4519 122 20611	X		
Q14-m	S3	Push button for z-carriage vertical movement		2422 550 00002	X		
Q14-n	(	Support for cassette with microswitch	C	4519 190 01611	X		
Q14-o	S23 (	Microswitch	D 5A / 125V	2419 131 02003	X		
Q14-p		Rear cover cassette holder		4519 128 22041	X		
Q14-q		Front cover cassette holder		4519 128 22031	X		
Q14-r		Label	ROW	4519 126 20492	X		
			USA	4519 126 20532	X		
		Hygienic bags for ear plugs	280 x	4519 128 20952	X		
Q14-t	PA5	AEC control	C	4519 101 03803	X		



DDE Ceph arm with Cephalostat and Digital Sensor

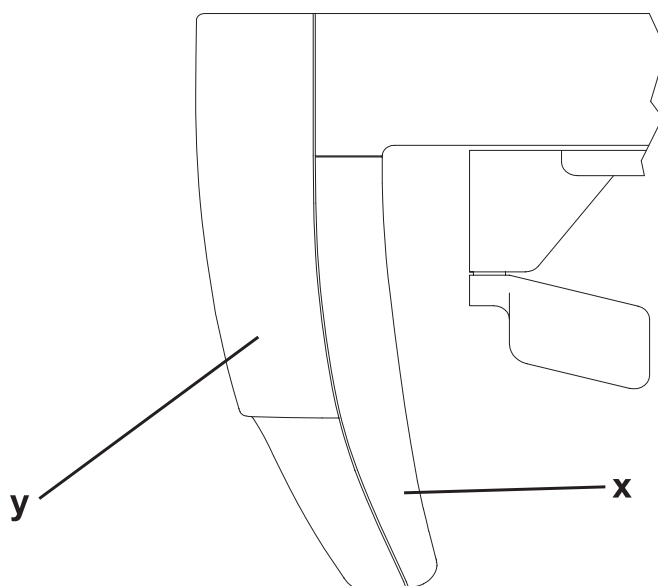
1- PAGE	2- ITEMS	3- DESCRIPTION	4- TECHNICAL DATA	5- CODE NUMBER	6- From series		
Q16-a	PC8	Ceph keyboard		4519 101 11101	X		
Q17-b	PA6b	DMU connector interface		4519 101 10701	X		
Q17-c	PH3	DMU interface		4519 101 10201	X		
Q17-d		Magnetic lock	2x	4519 105 20911	X		
Q16-e	S40, S41, S42	Optoswitch	3x	2422 129 16001	X		
Q16-f	M4	Geared motor		4519 124 22351	X		
Q16-g		Secondary collimator lead plate		4519 122 26001	X		
Q16-h		Secondary collimator front cover		4519 128 22541	X		
Q16-i		Secondary collimator rear cover		4519 128 22551	X		
Q16-l		Ceph DMU bay front cover		4519 128 22561	X		
Q16-m		Ceph DMU bay rear cover		4519 128 22571	X		
Q16-n		Top cover		4519 128 22521	X		
Q16-o		Bottom cover		4519 128 22531	X		
Q16-p		Belt		4519 126 22291	X		
Q16-q		Belt	2x	4519 126 22301	X		
Q16-r		Gears assembly		4519 190 02121	X		





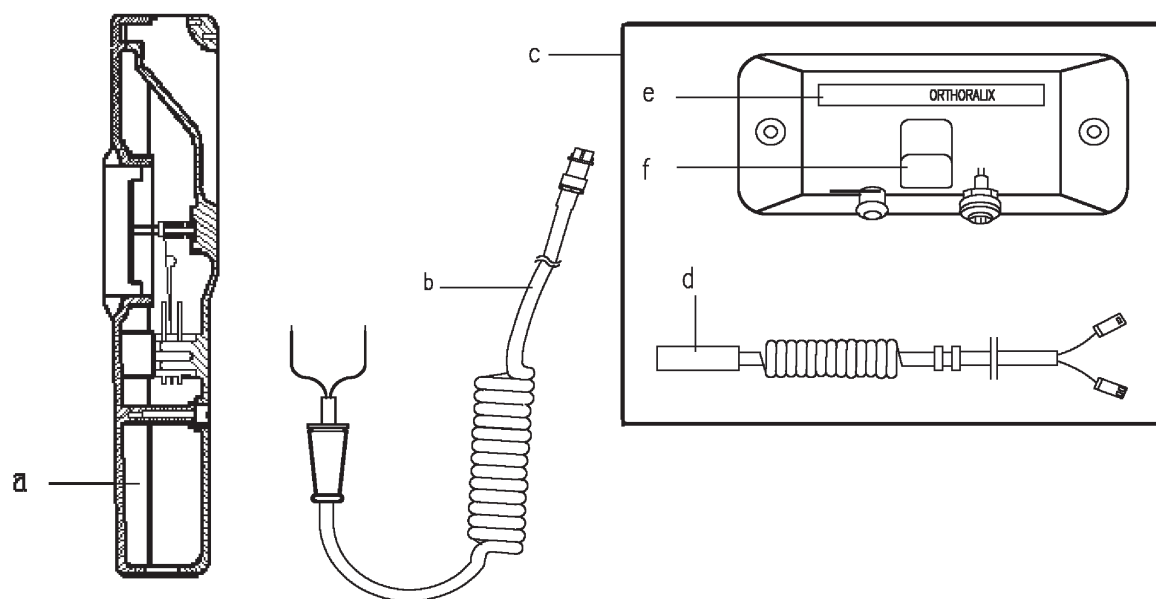
Covers

1- PAGE	2- ITEMS	3- DESCRIPTION	4- TECHNICAL DATA	5- CODE NUMBER	6- From series		
Q18-a		Lower cover Z-carriage		4519 128 21971	X		
Q18-b		Front cover Z-carriage		4519 128 21981	X		
Q18-c		Top cover Z-carriage		4519 128 21991	X		
Q18-d		Left side cover Z-carriage		4519 128 21961	X		
Q18-e		Right side cover Z-carriage	C	4519 128 22051	X		
Q18-f		Hook for exposure handswitch	D	4519 100 54592	X		
Q18-g		Front cover headrest		4519 128 21451	X		
Q18-i		Rear cover tubehead		4519 128 22021	X		
Q18-j		Front cover tubehead		4519 128 22071	X		
Q18-j		Front cover tubehead	DDE versions only	4519 128 22731	X		
Q18-z		Lower cover rotating arm	till s/n 03701000	4519 128 22011			
Q18-k		Lower cover rotating arm (lower part)	from s/n 03701001	4519 128 22511			
Q18-w		Lower cover rotating arm (upper part)	from s/n 03701001	4519 128 22501			
Q18-l		Top long cover rotating arm	till s/n 03701000	4519 124 21771			
		Top long cover rotating arm	from s/n 03701001	4519 124 22321			
Q18-m		Top short cover rotating arm	till s/n 03701000	4519 122 25221			
		Top short cover rotating arm	from s/n 03701001	4519 122 26321			
Q18-n		Rear cover cassette drive		4519 128 22001	X		
Q18-p		Higher cover column		4519 122 25531	X		
Q18-q		Lower cover column		4519 122 25541	X		
Q18-r		Right side cover		4519 122 25512	X		
Q18-s		Left side cover		4519 122 25521	X		
Q18-t		Cover		4519 190 01841	X		
Q18-u		Column upper wall bracket cover	2X	4519 128 22131	X		
Q18-v		Column lower wall bracket cover	2X	4519 128 22141	X		
Q19-x		Pan DMU bay front cover	DDE versions only	4519 128 22581	X		
Q19-y		Pan DMU bay rear cover	DDE versions only	4519 128 22591	X		



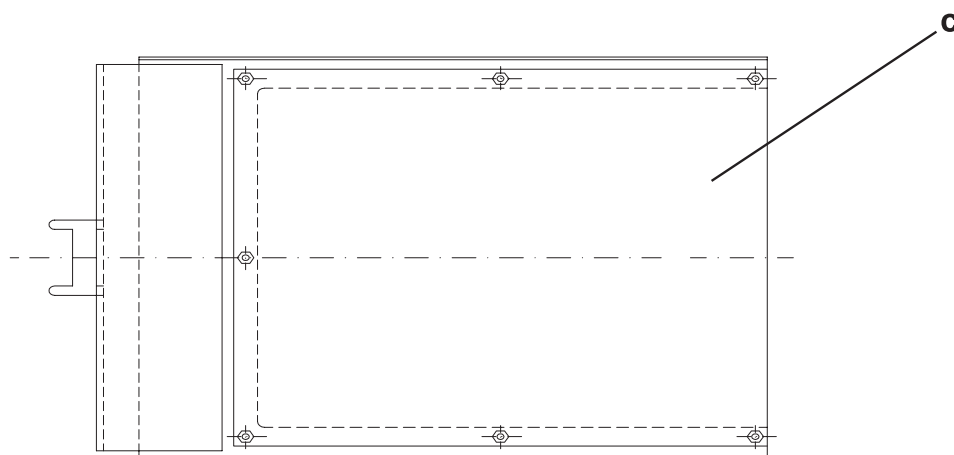
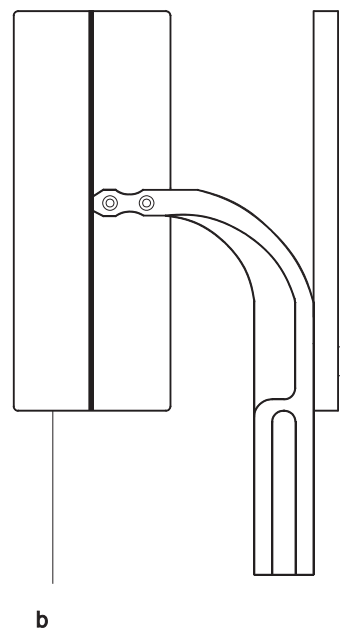
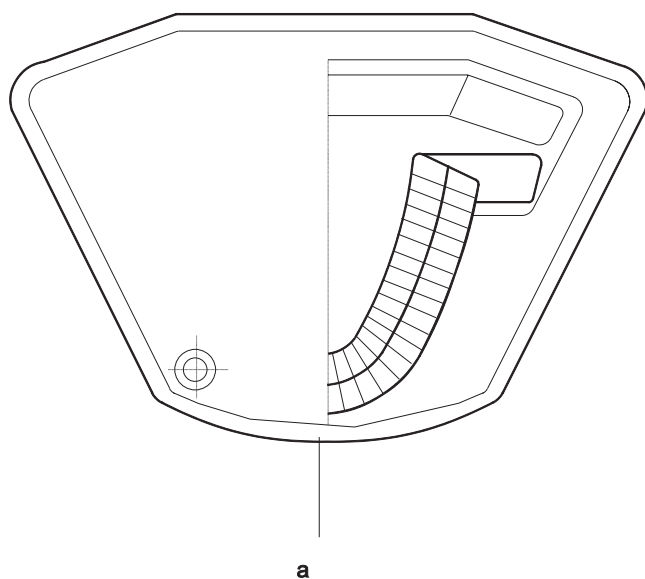
Exposure Handswitch and Remote Control Box

1- PAGE	2- ITEMS	3- DESCRIPTION	4- TECHNICAL DATA	5- CODE NUMBER	6- From series		
Q20-a		Exposure handswitch without cable	C	4519 190 01461	X		
Q20-b		Coiled cable with plug		4519 103 20942	X		
Q20-c	(	Remote control box	C	4519 105 20092	X		
Q20-d	(	Coiled cable	D 20m	4519 190 01771	X		
Q20-e	(	Label	D	4519 126 20911	X		
Q20-f	(	Hook for exposure handswitch	D	4519 100 54592	X		



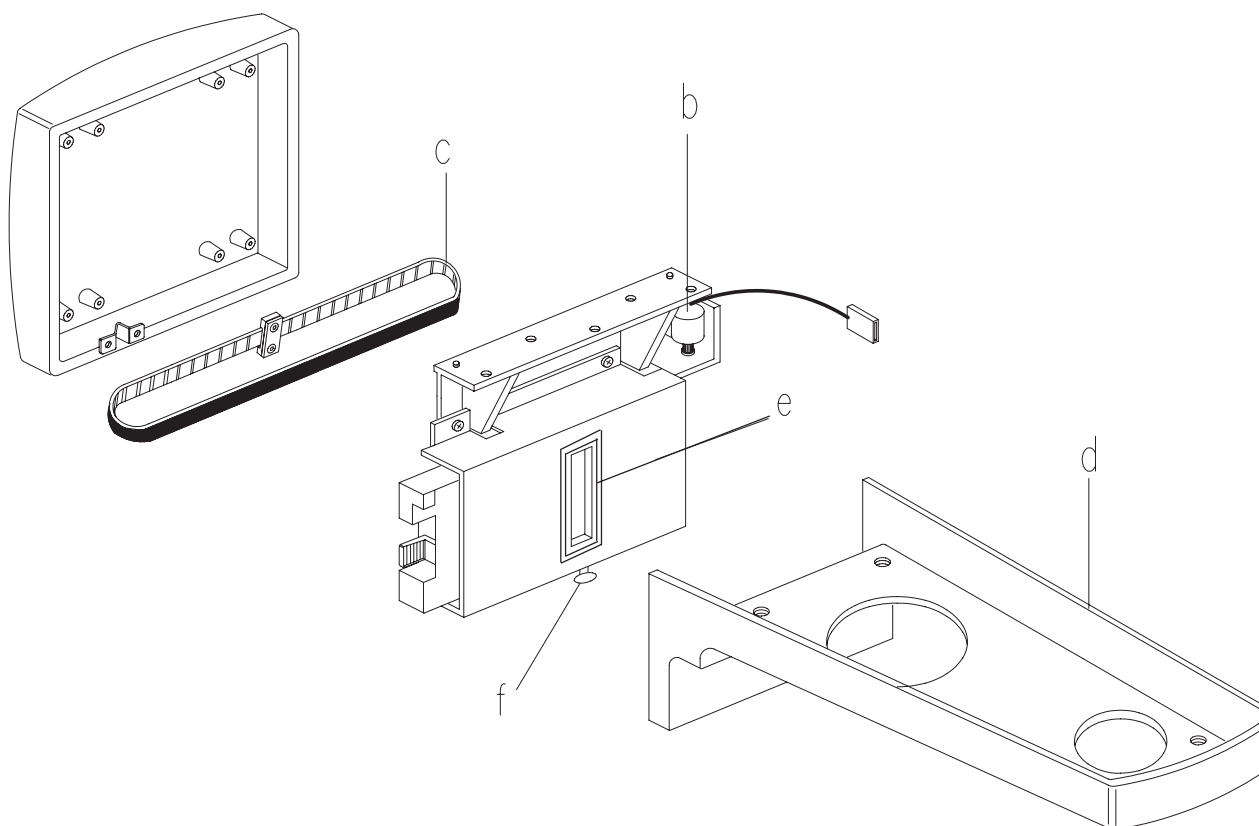
Special tools Carpo positioning device

1- PAGE	2- ITEMS	3- DESCRIPTION	4- TECHNICAL DATA	5- CODE NUMBER	6- From series		
Q21-a		Image quality phantom		4519 124 20471	X		
Q21-b		Light beam phantom		4519 190 00922	X		
Q21-c		Carpo positioning device - plexiglass plate		4519 122 26731	X		



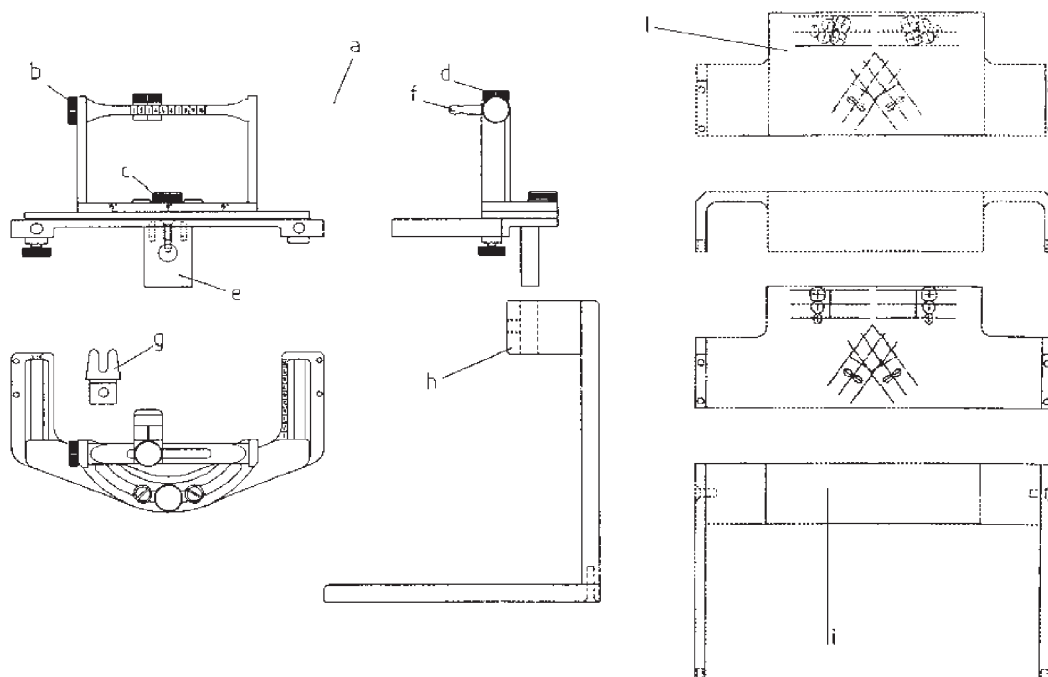
Phosphor plate extension

1- PAGE	2- ITEMS	3- DESCRIPTION	4- TECHNICAL DATA	5- CODE NUMBER	6- From series
Q22-b	M4 (	Motor	D	4519 124 21471	X
Q22-c	(	Belt	D	4519 128 21901	X
Q22-d		Lower cover rotating arm		4519 128 22091	X
Q22-e		Pan adapter		4519 122 25611	X
Q22-f		Knob		4519 128 27351	X



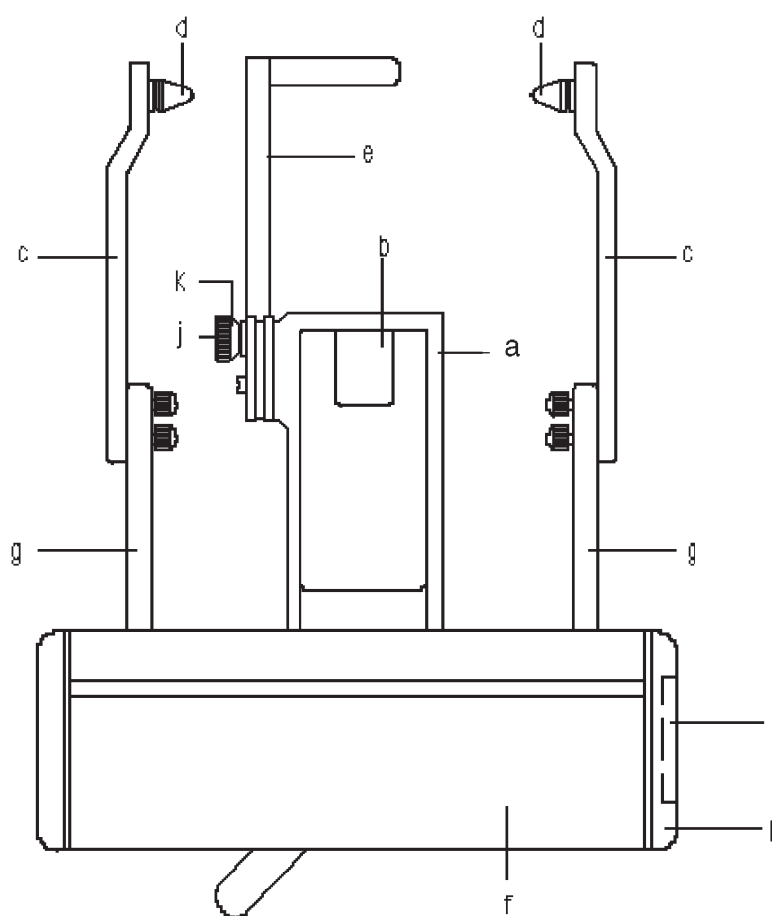
Transcan

1- PAGE	2- ITEMS	3- DESCRIPTION	4- TECHNICAL DATA	5- CODE NUMBER	6- From series		
Q23-a	(	Positioning device assembly		4519 124 21553	X		
	(	Positioning device assembly	DDE only	4519 124 21691	X		
Q23-b	(	Knob		4519 128 22331	X		
Q23-c	(	Knob		4519 122 25171	X		
Q23-d	(	Knob		4519 128 22401	X		
Q23-e	(	Positioner coupling		4519 128 22271	X		
Q23-f	(	Bite block		4519 128 22431	X		
Q23-g	(	Tray coupling		4519 128 22421	X		
Q23-h		Holder		4519 128 22362	X		
Q23-i		Upper transparent positioning device guide		4519 128 22342	X		
		Upper transparent positioning device guide	DDE only	4519 128 22451	X		
Q23-l		Lower transparent positioning device guide		4519 128 22352	X		
		Lower transparent positioning device guide	DDE only	4519 128 22461	X		



Cephalostat for TMJ projections

1- PAGE	2- ITEMS	3- DESCRIPTION	4- TECHNICAL DATA	5- CODE NUMBER	6- From series		
Q24-a	(	Mounting frame	C	4591 122 23083	X		
Q24-b	(		D	4519 190 01521	X		
Q24-c	(	Ear plug support	C 2x	4519 128 20732	X		
Q24-d	(	Ear plug	D 2x	4519 128 20742	X		
Q24-e		Nasion for headrest centering		4519 124 21421	X		
Q24-f		Cover assembly		4519 124 20852	X		
Q24-g		Support ear centering	2x	4519 128 21641	X		
Q24-h		Cover	2x	4519 128 21221	X		
Q24-i	)	Snap out cap	2x	4519 120 73852	X		
Q24-j	)			4022 006 61831	X		
Q24-k		Knob		4519 122 23272			
		Hygienic bags for ear plug	280x	4519 128 20952			



Drawings

Table of content

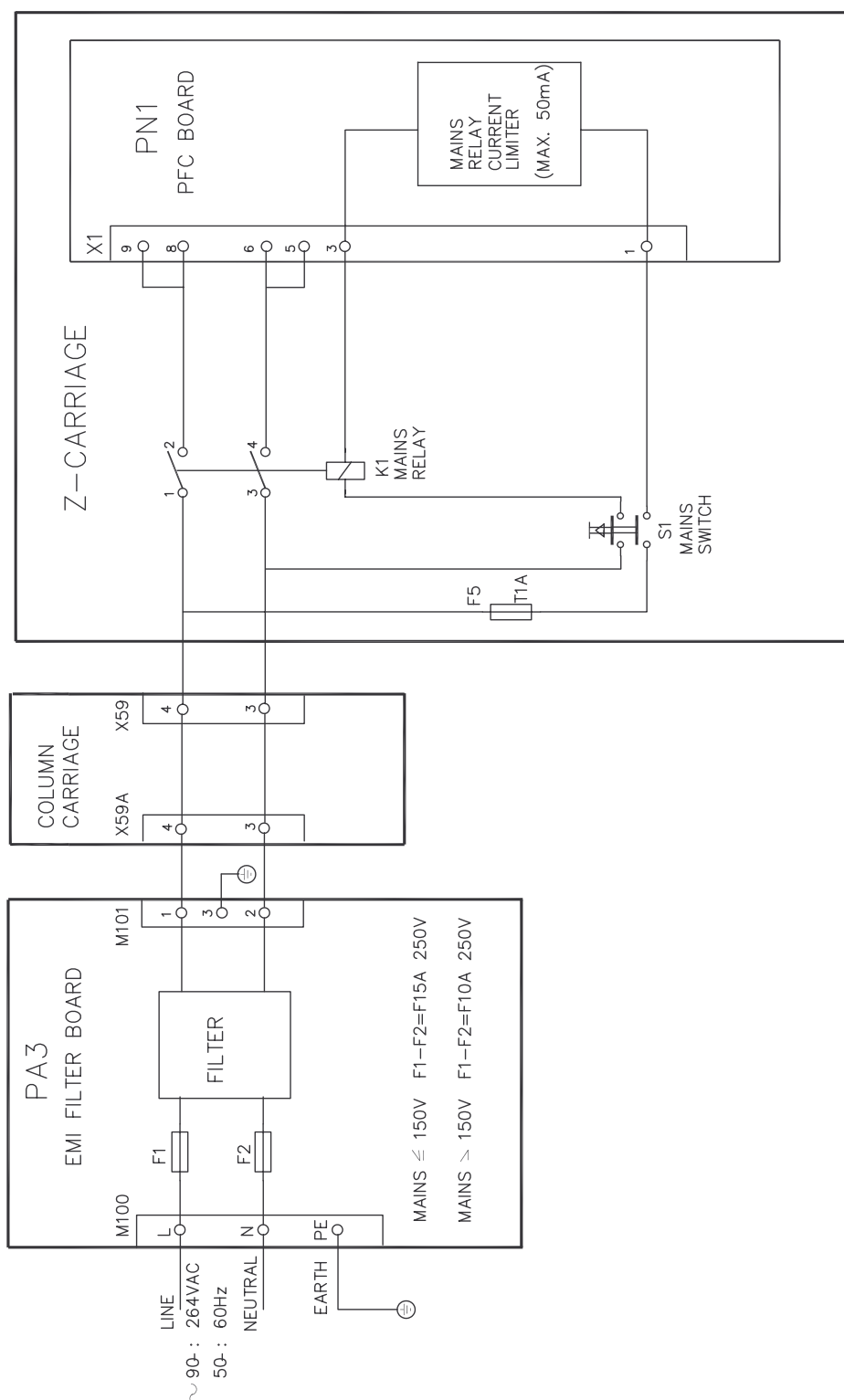
Principle diagrams	z-2
Mains connection.....	Z-2
Power factor correction & switching supply.....	Z-3
Converter board auxiliary supplies.....	Z-4
System control board auxiliary supplies.....	Z-5
High tension generation & control	Z-6
mA generation & filament supply	Z-7
Centering lights	Z-8
Headrest circuit	Z-9
Step motors	Z-10
Microswitch & optoswitches part 1	Z-11
Microswitch & optoswitches part 2	Z-12
Operator interface.....	Z-13
Exposure control.....	Z-14
External lights connection	Z-15
Motorised column.....	Z-16
Automatic exposure control (a.e.c.)	Z-17

Wiring Diagram.....	z-18
Wiring diagram.....	Z-18
Wiring diagram (dde only).....	Z-19

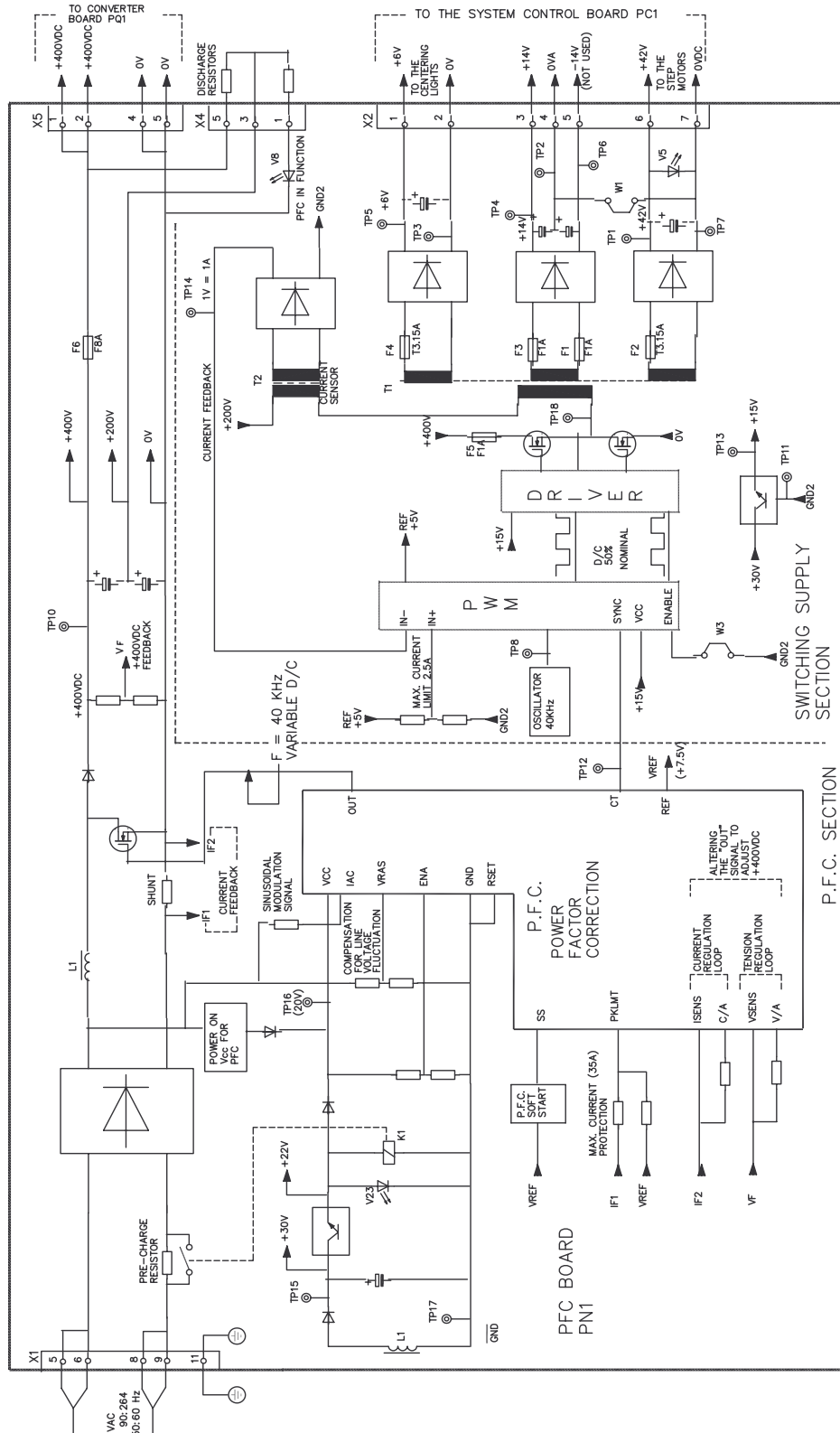
Printed circuit boards layout	z-20
Optical switches collimator	PA2.....Z-20
EMI filter	PA3.....Z-21
System control board	PC1.....Z-22
Control operator panel	PC2.....Z-23
Control operator panel	PC7.....Z-24
Power unit	PN1.....Z-25
Converter board	PQ1.....Z-26
AEC control board	PA5.....Z-27
Motorized column	PC6.....Z-28
Ceph keyboard	PC8.....Z-29
DMU connector interface	PA6.....Z-30
Auxiliary board	PA7.....Z-31
DMU Interface	PH3B.....Z-32
DDE power supply board	PN5.....Z-33

Principle diagrams

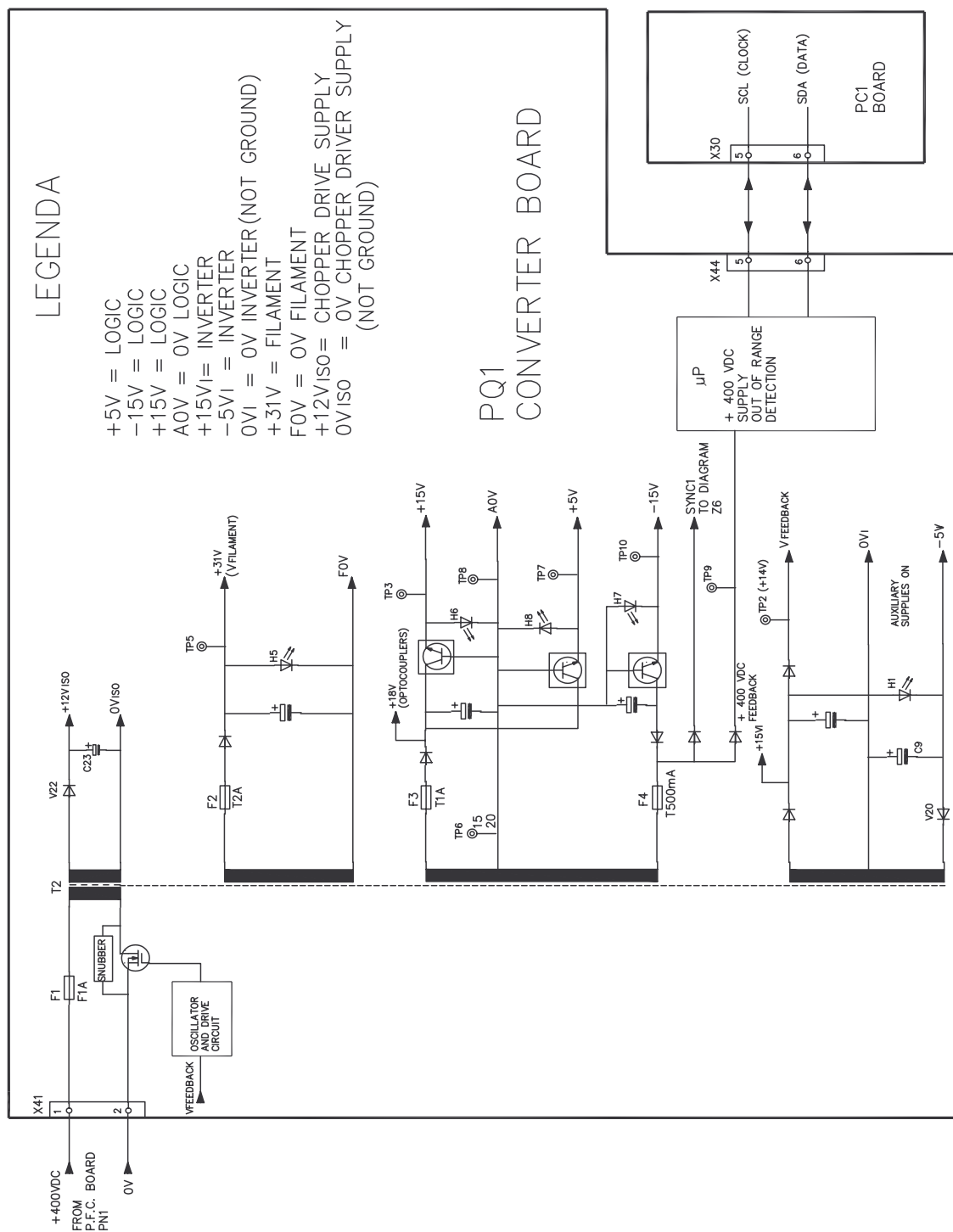
Mains connection



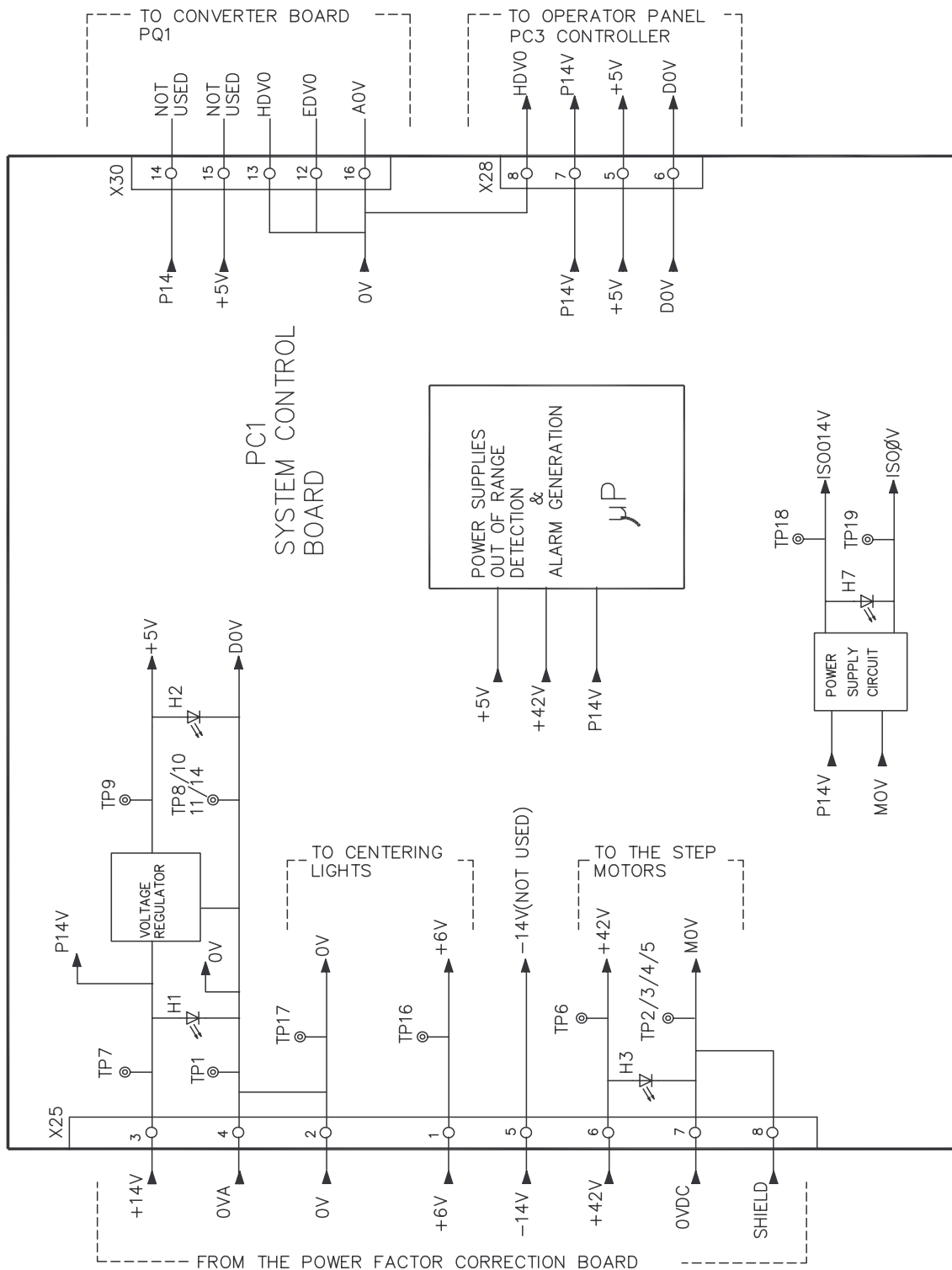
Power factor correction & switching supply



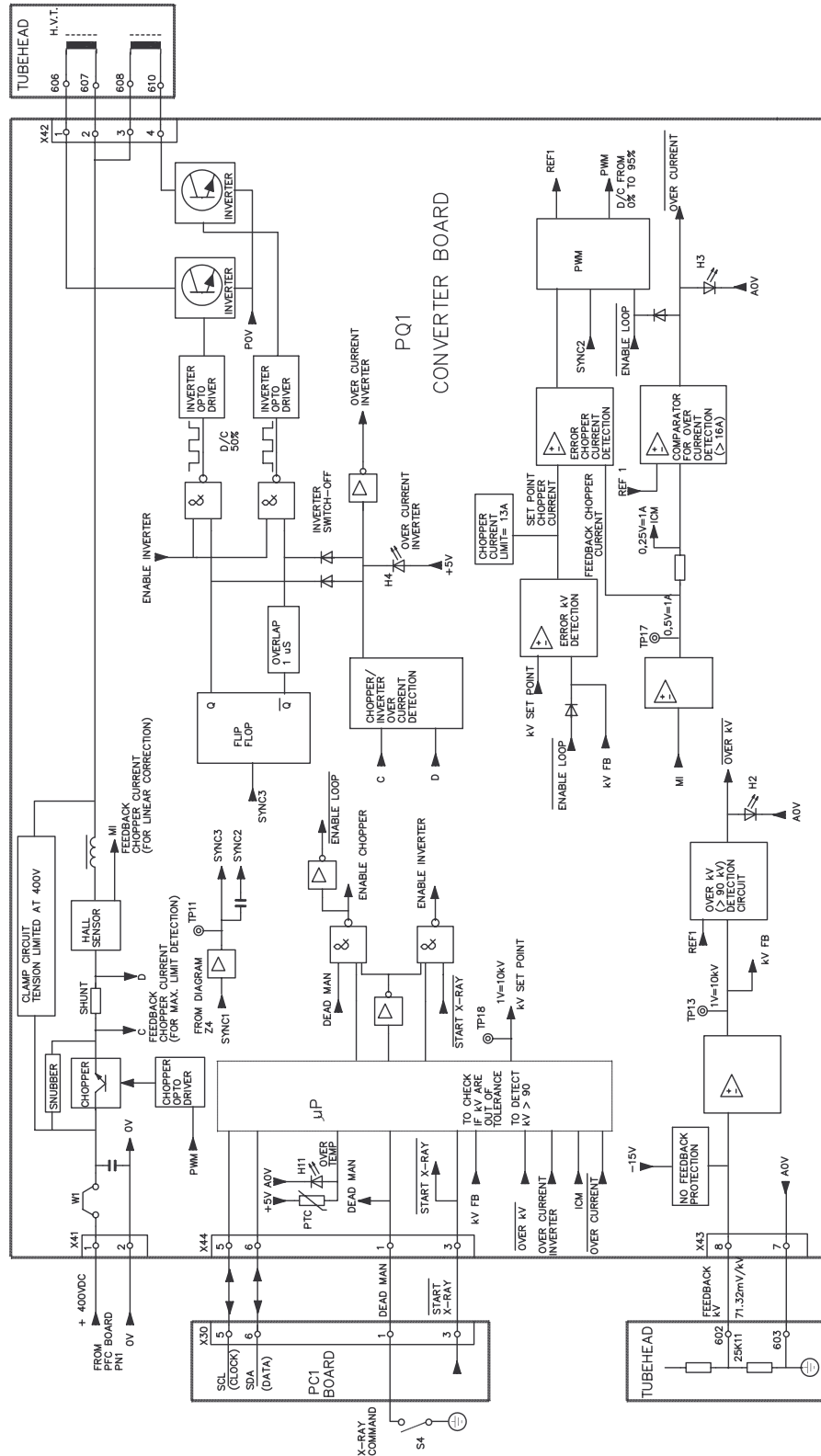
Converter board auxiliary supplies



System control board auxiliary supplies



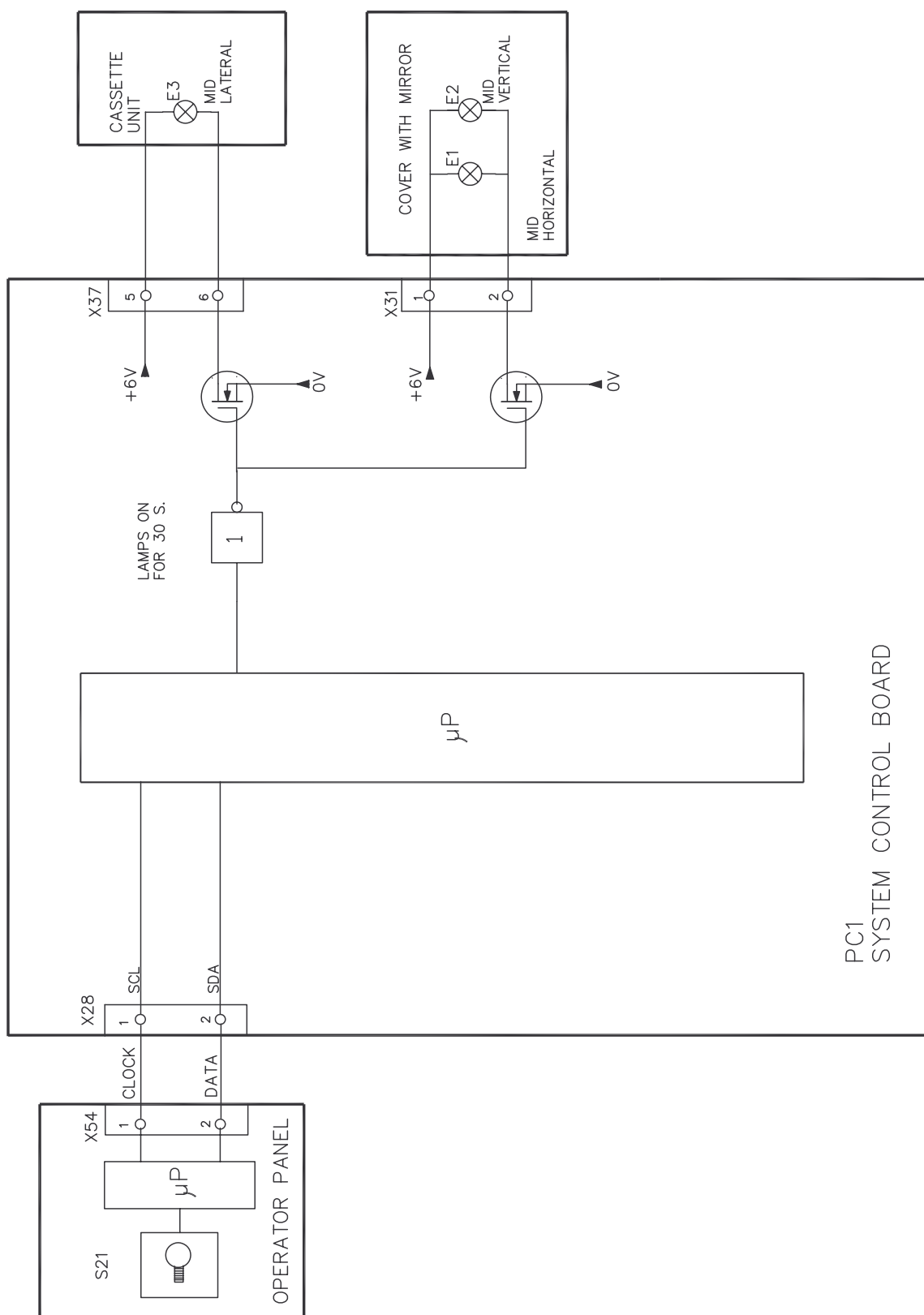
High tension generation & control



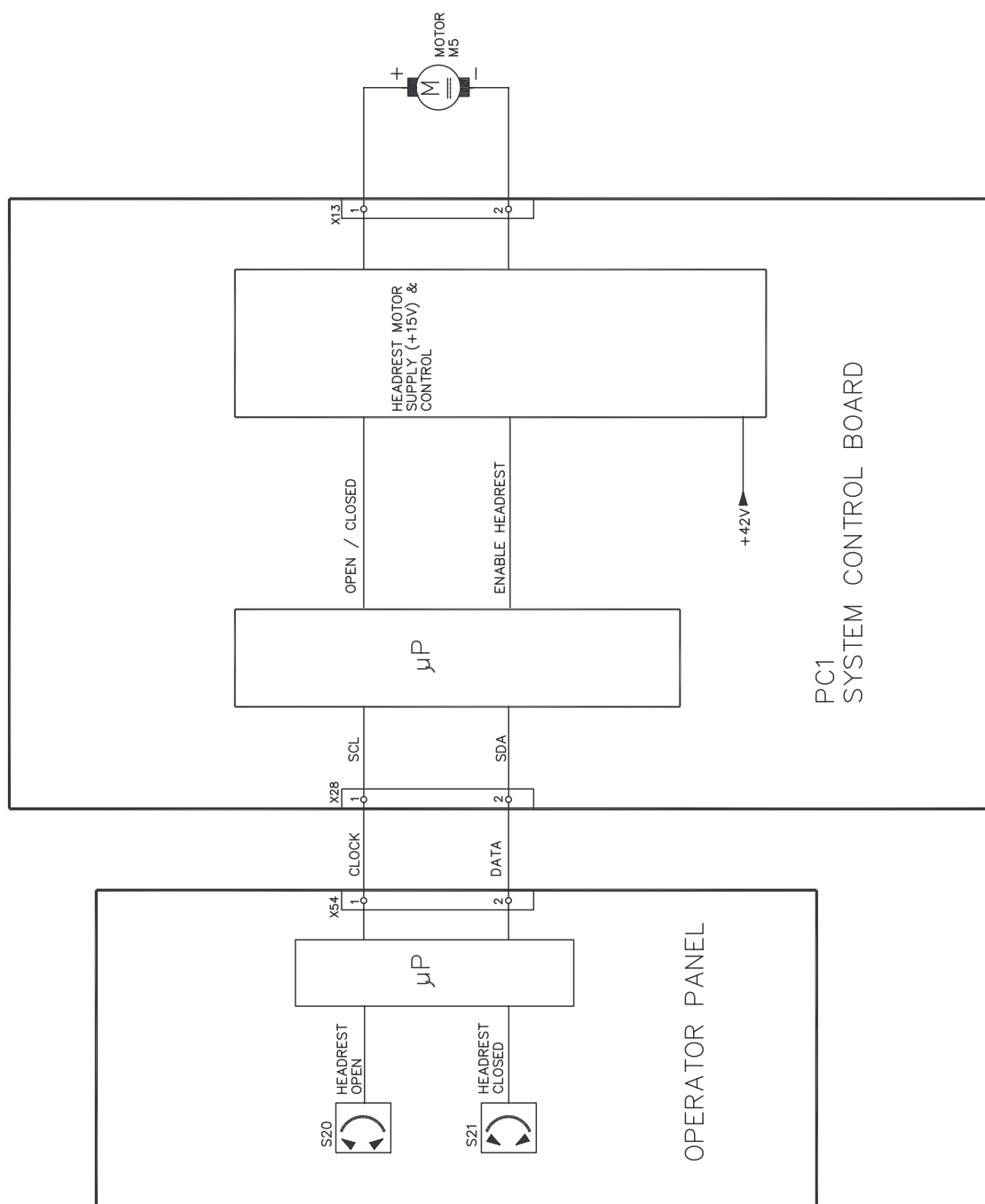
Gendex Dental Systems 4519-190-71193-7



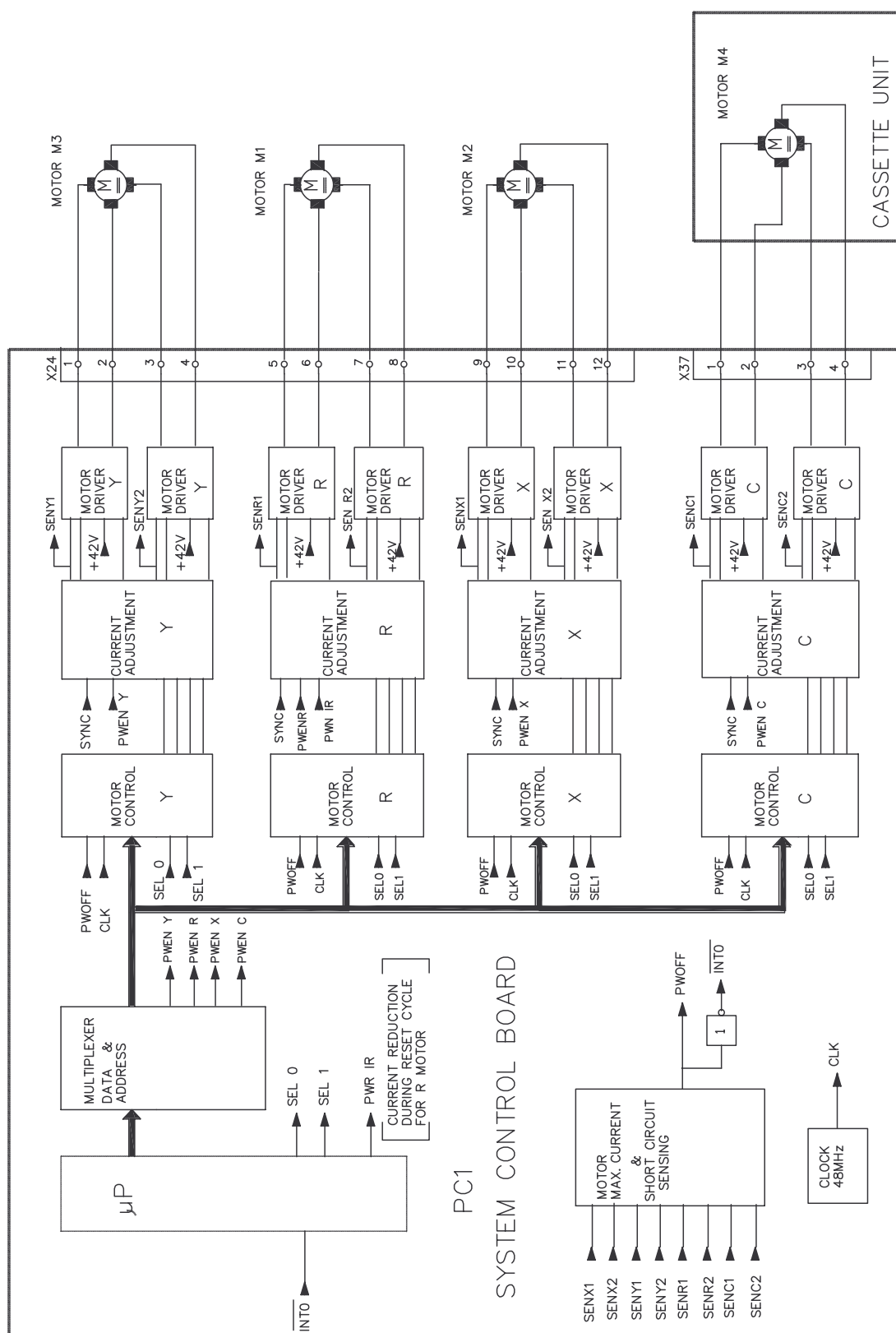
Centering lights



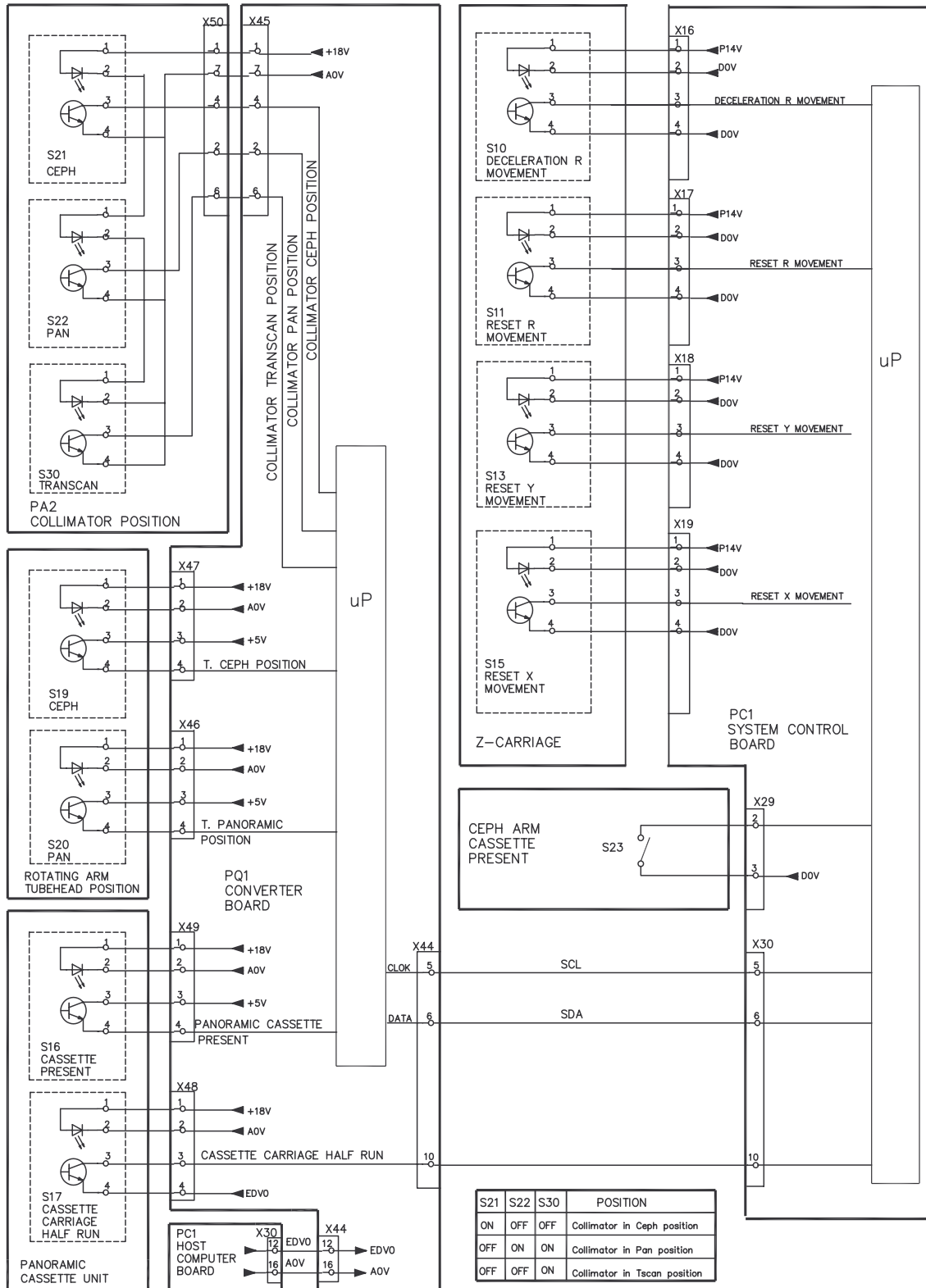
Headrest circuit



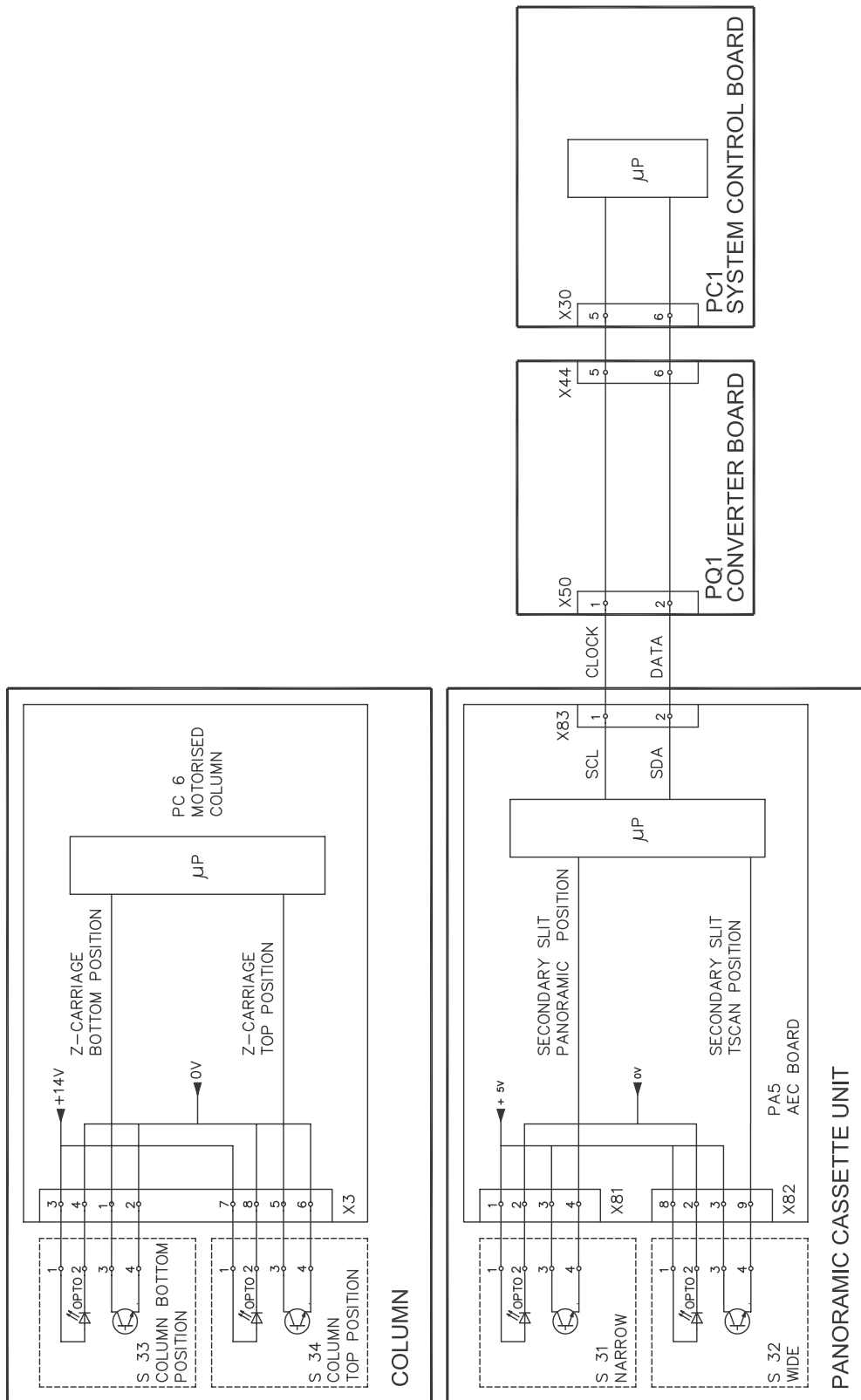
Step motors



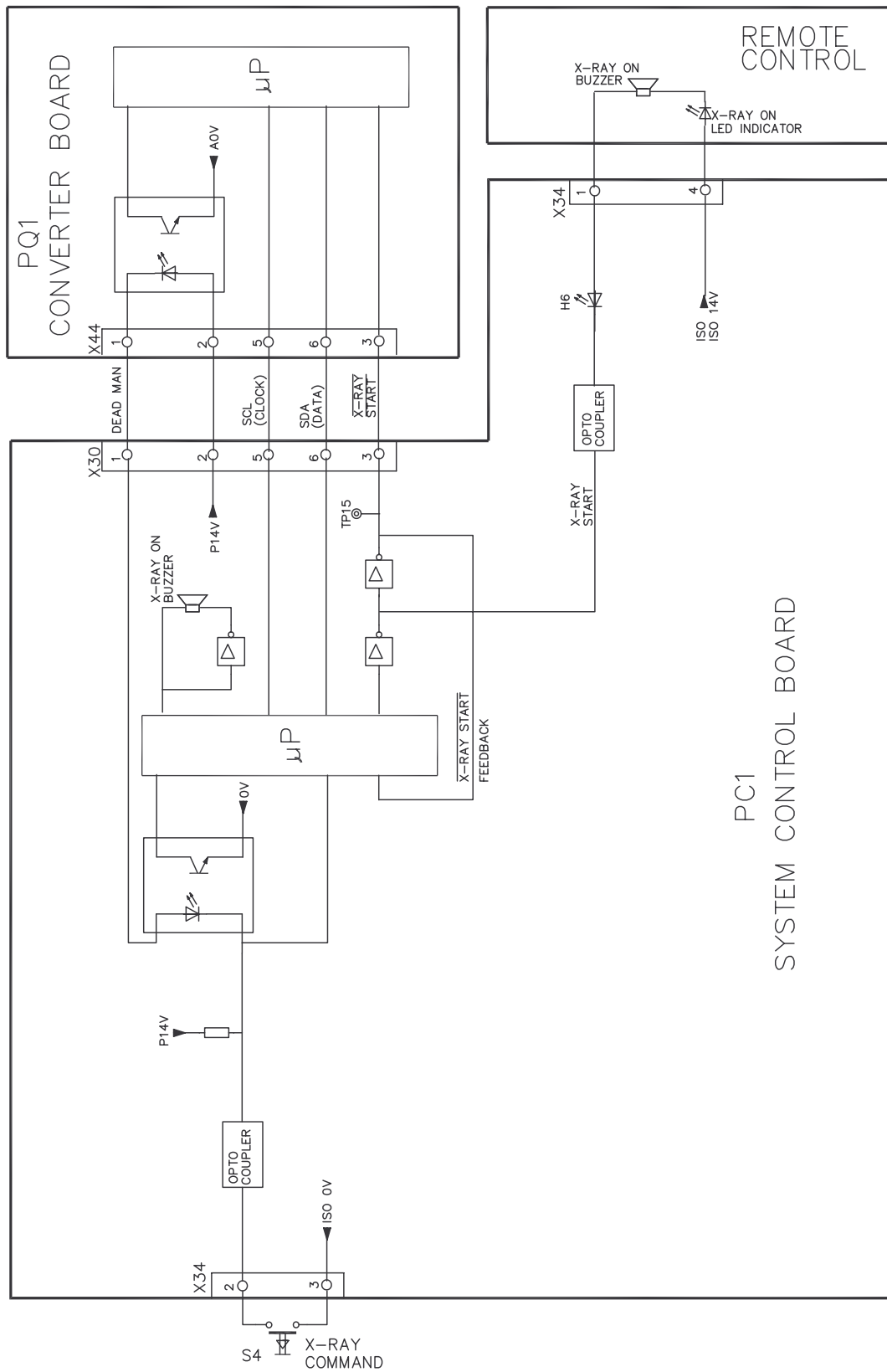
Microswitch & optoswitches part 1



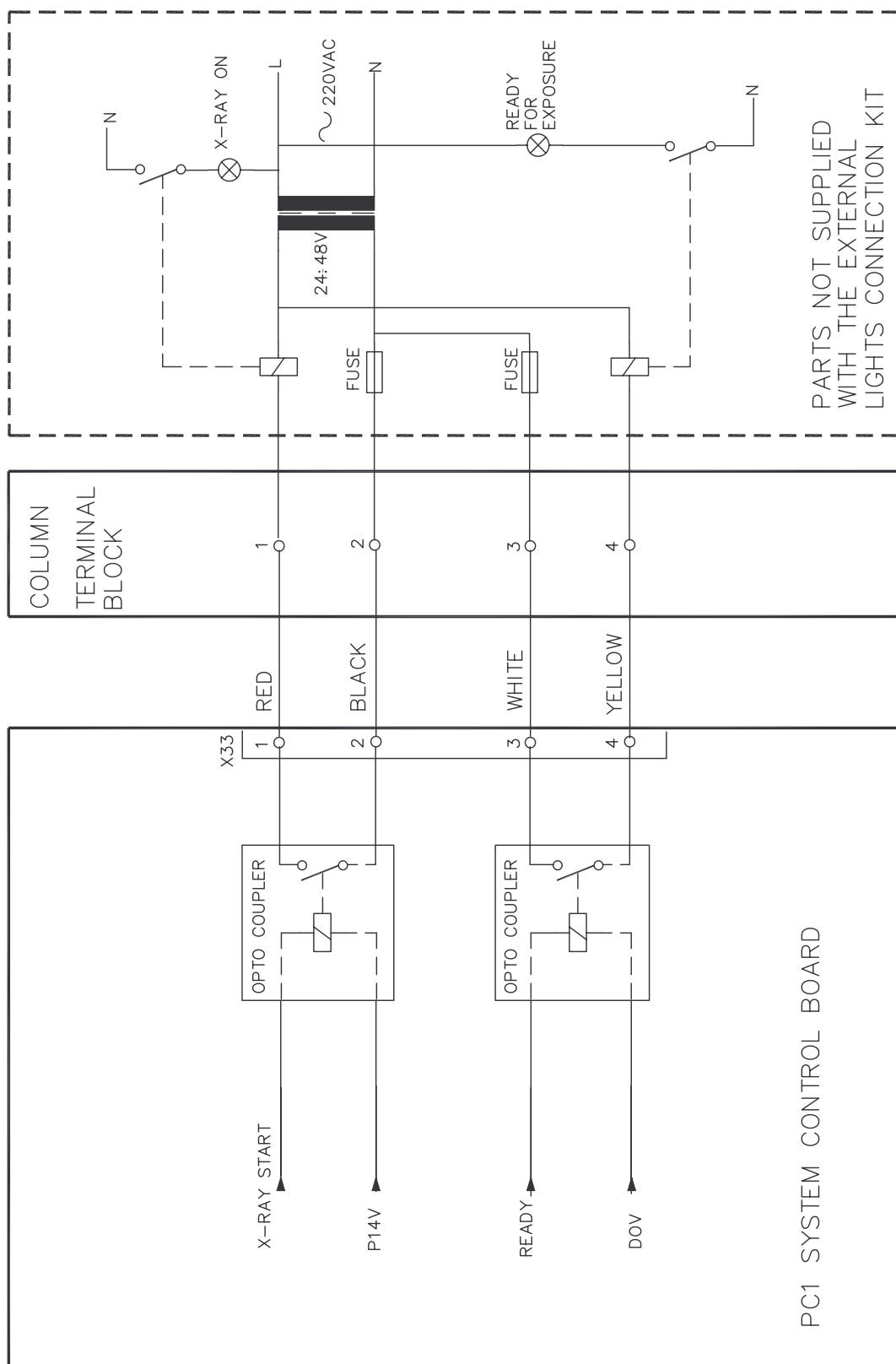
Microswitch & optoswitches part 2



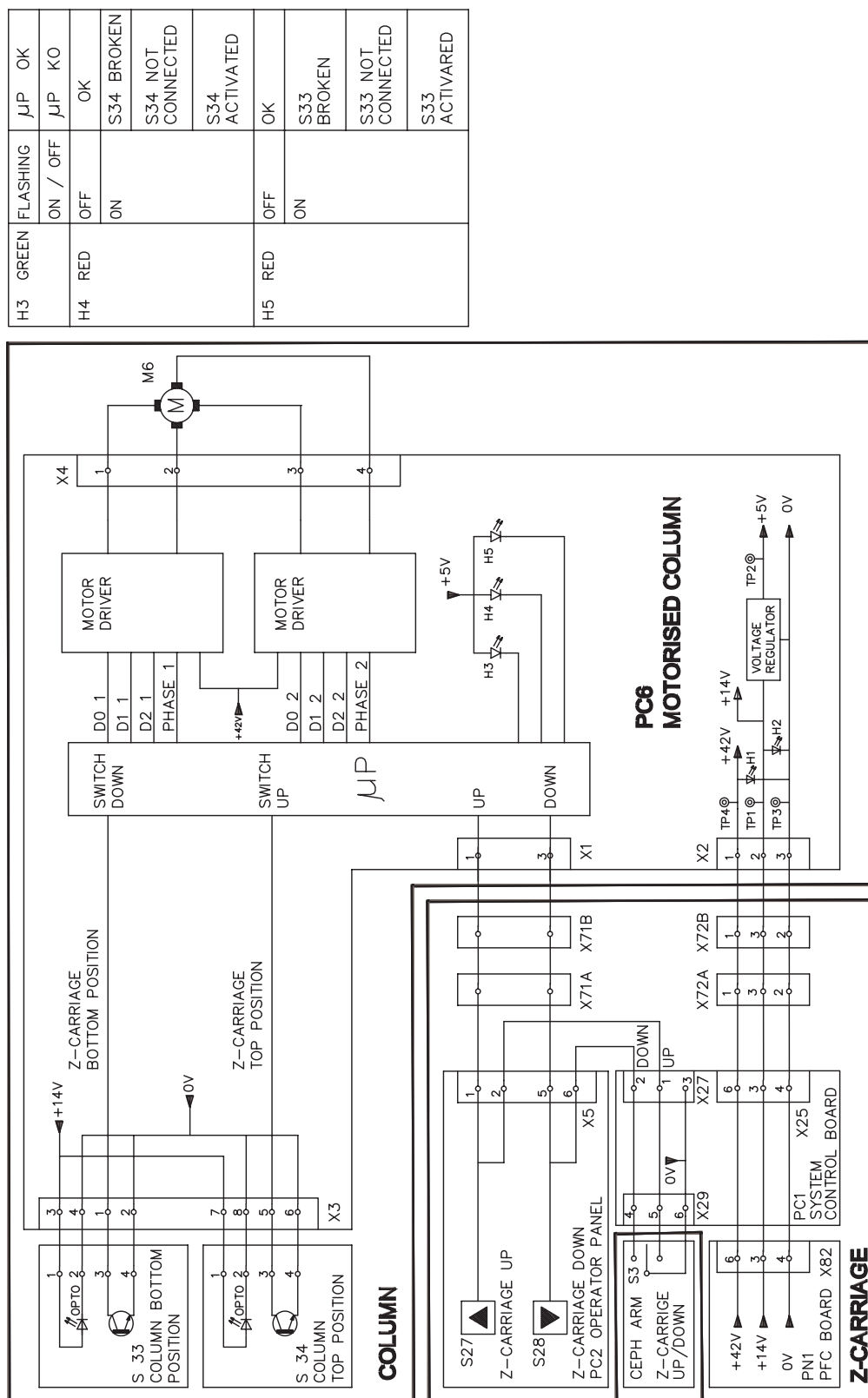
Exposure control



External lights connection

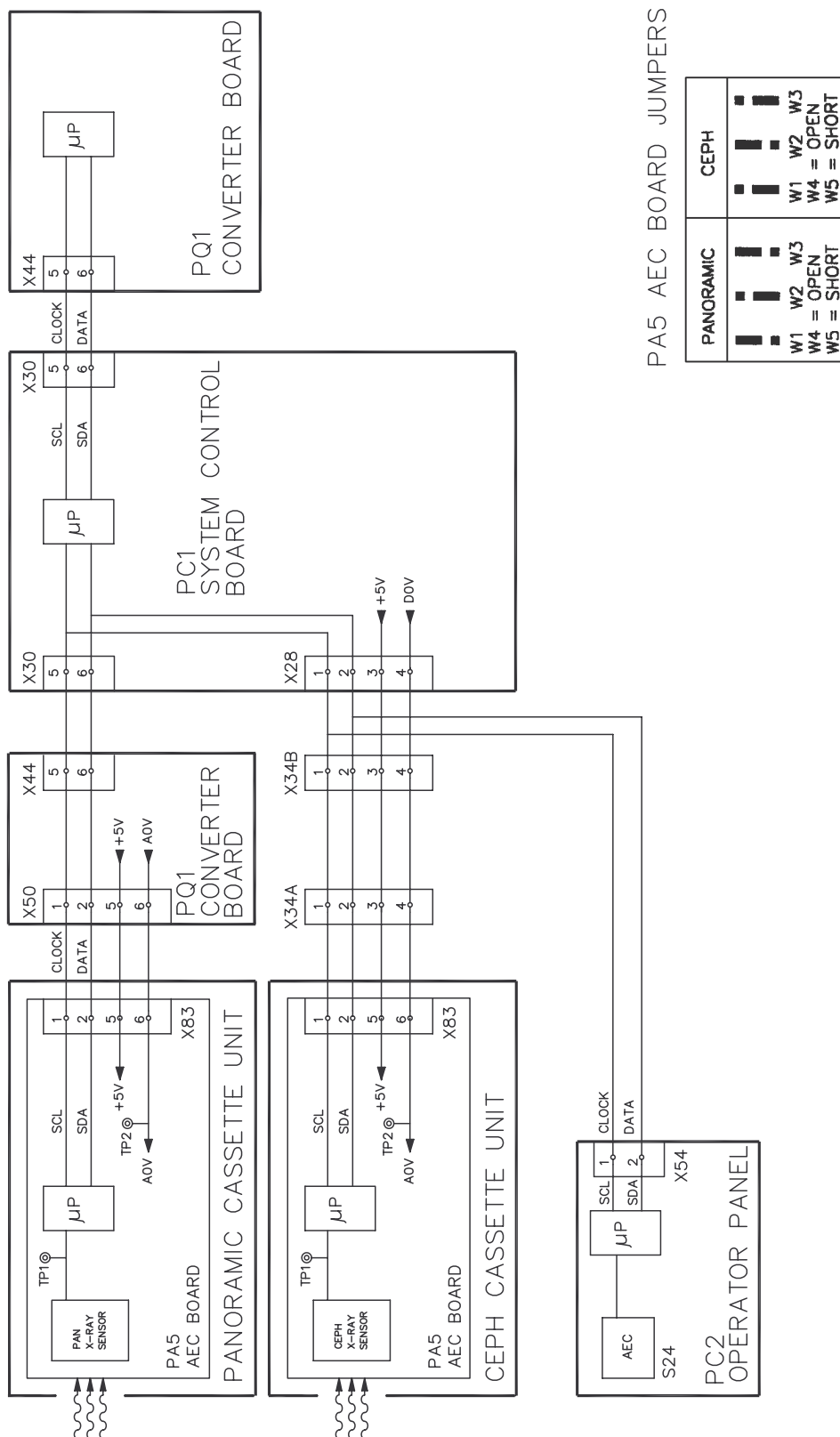


Motorised column



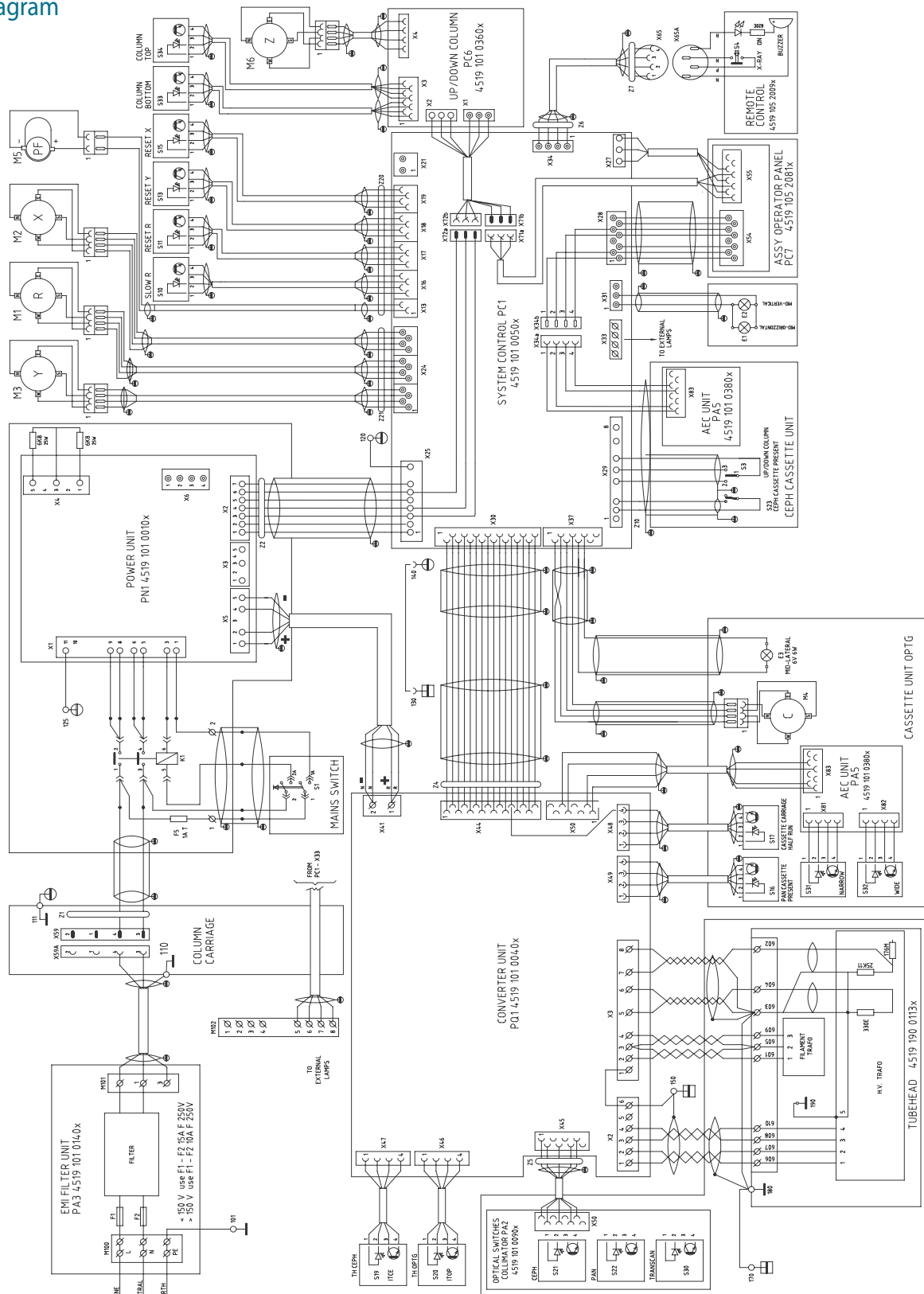
H3 GREEN	FLASHING	μP OK
H4 RED	ON / OFF	μP KO
	OFF	OK
	ON	S34 BROKEN
		S34 NOT CONNECTED
		S34 ACTIVATED
H5 RED	OFF	OK
	ON	S33 BROKEN
		S33 NOT CONNECTED
		S33 ACTIVATED

Automatic exposure control (a.e.c.)

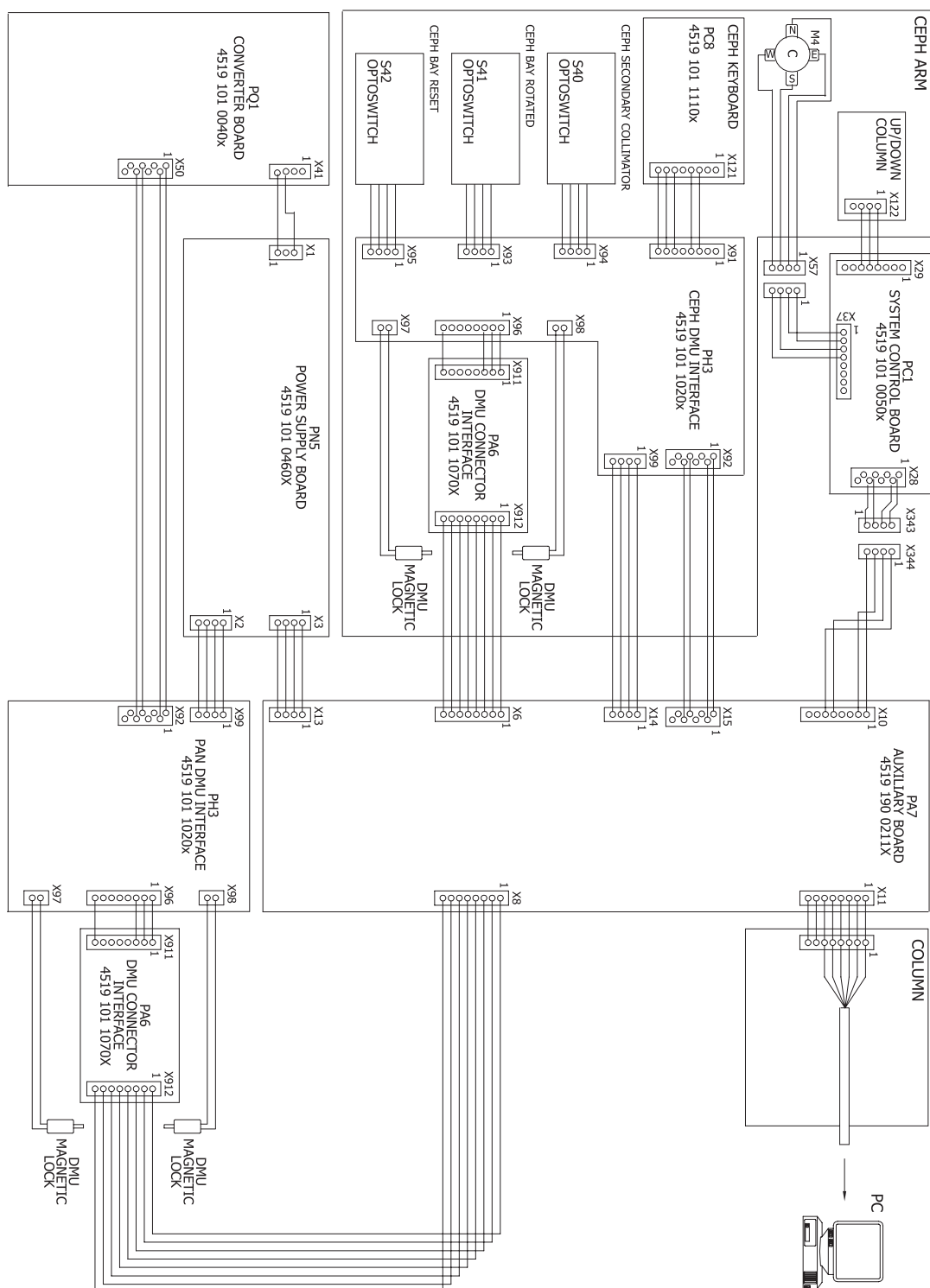


Wiring Diagram

Wiring diagram



Wiring diagram (dde only)

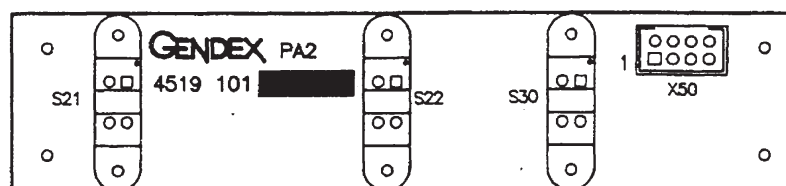


Printed circuit boards layout

Optical switches collimator

PA2

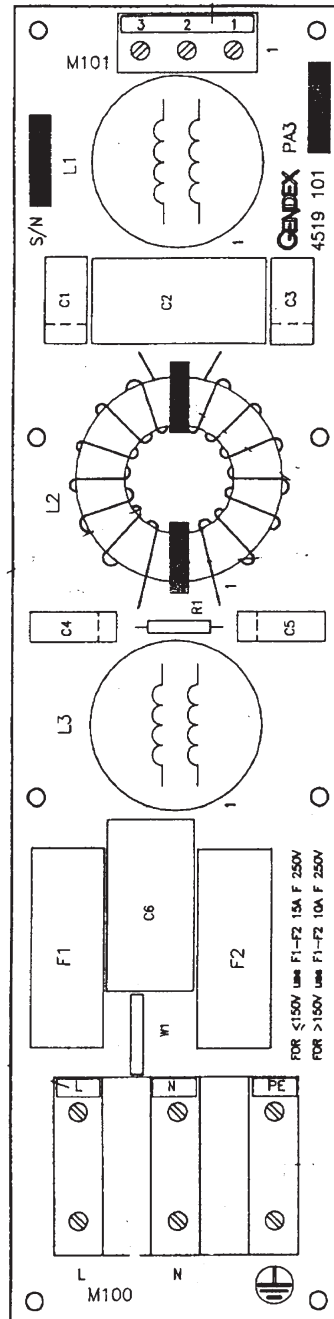
CODE 4519 101 00901



EMI filter

PA3

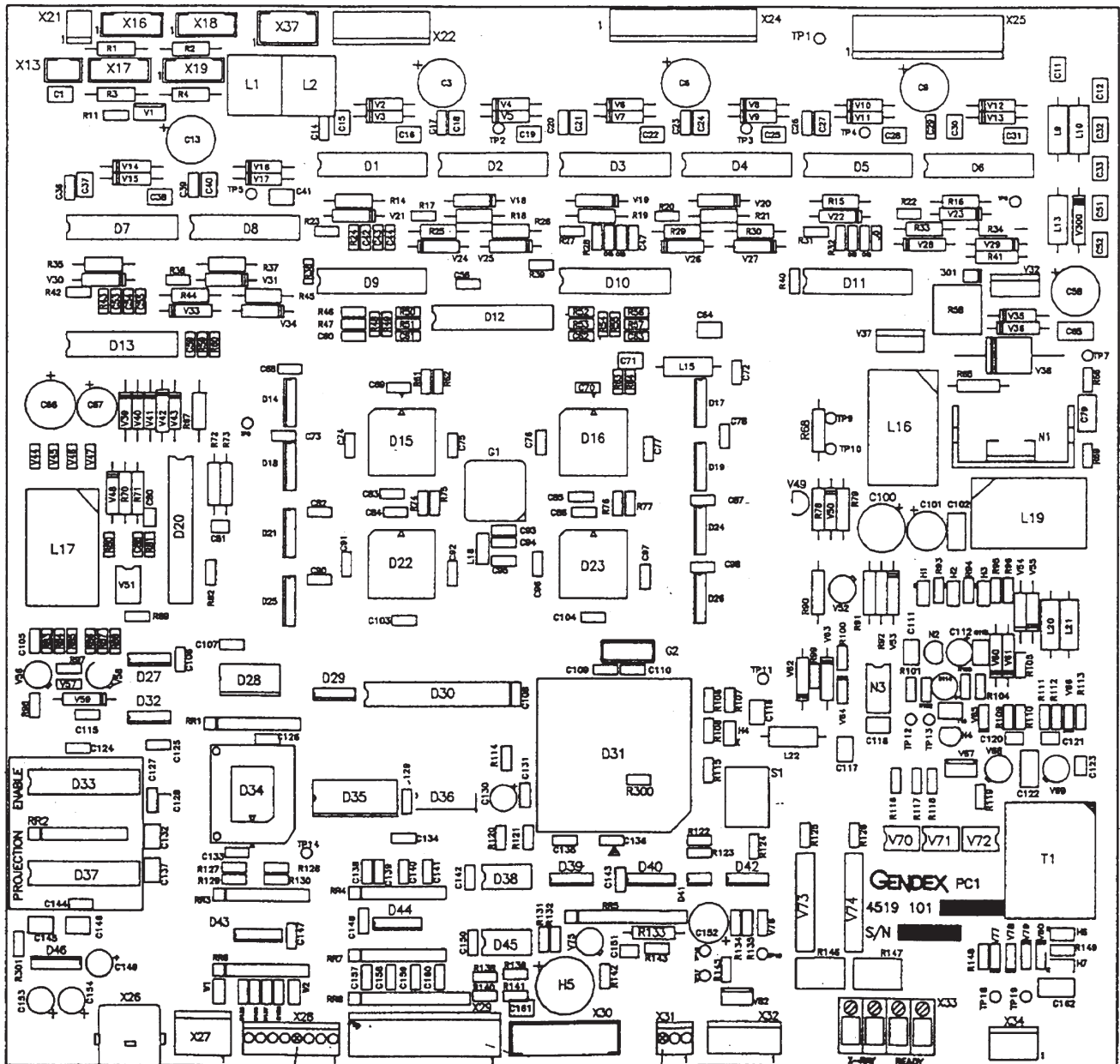
CODE 4519 101 01405



System control board

PC1

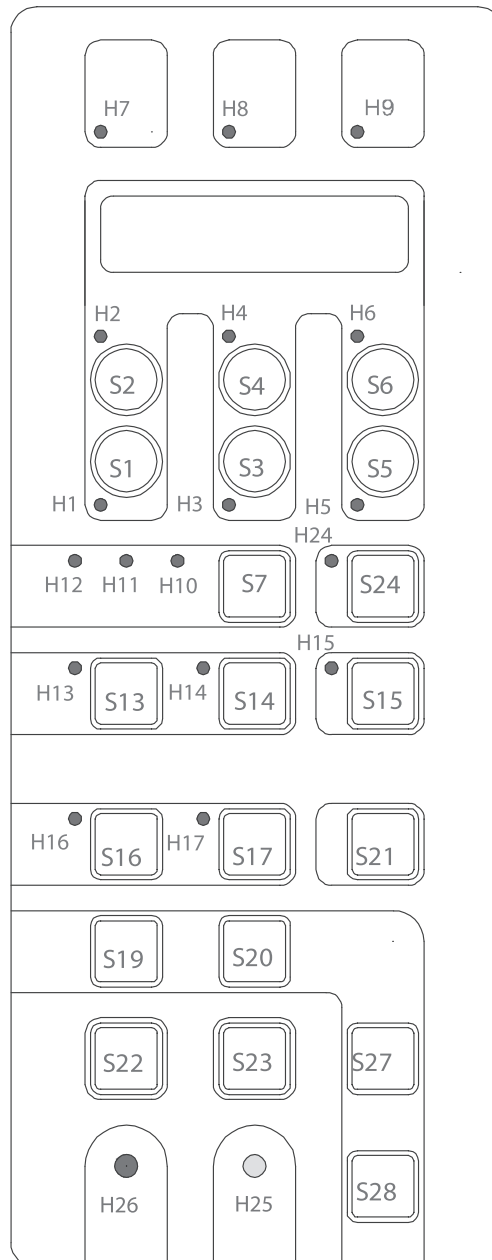
CODE 4519 101 00506



Control operator panel

PC2

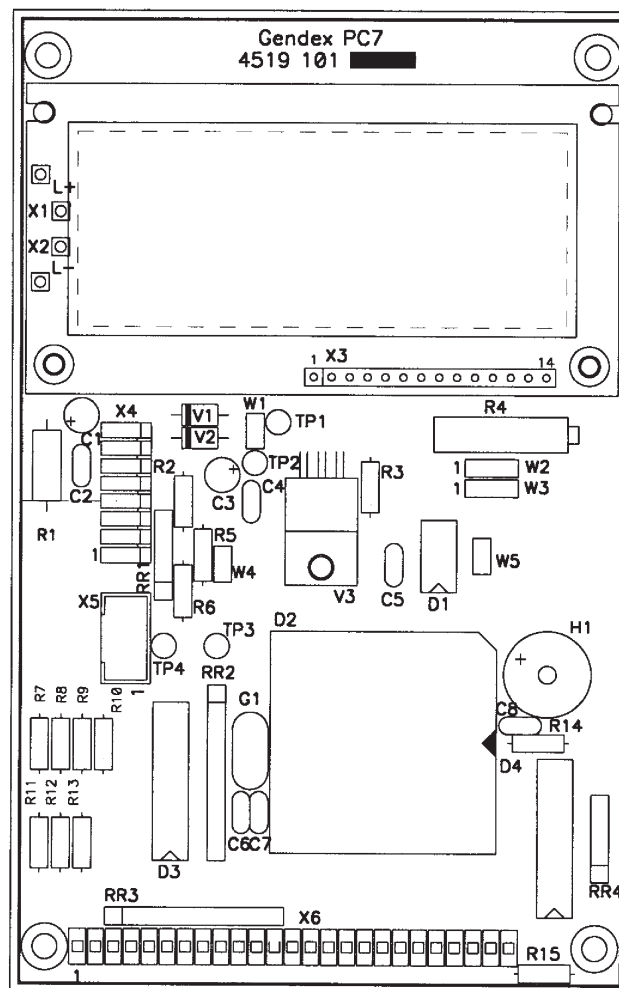
CODE 4519 105 20811



Control operator panel

PC7

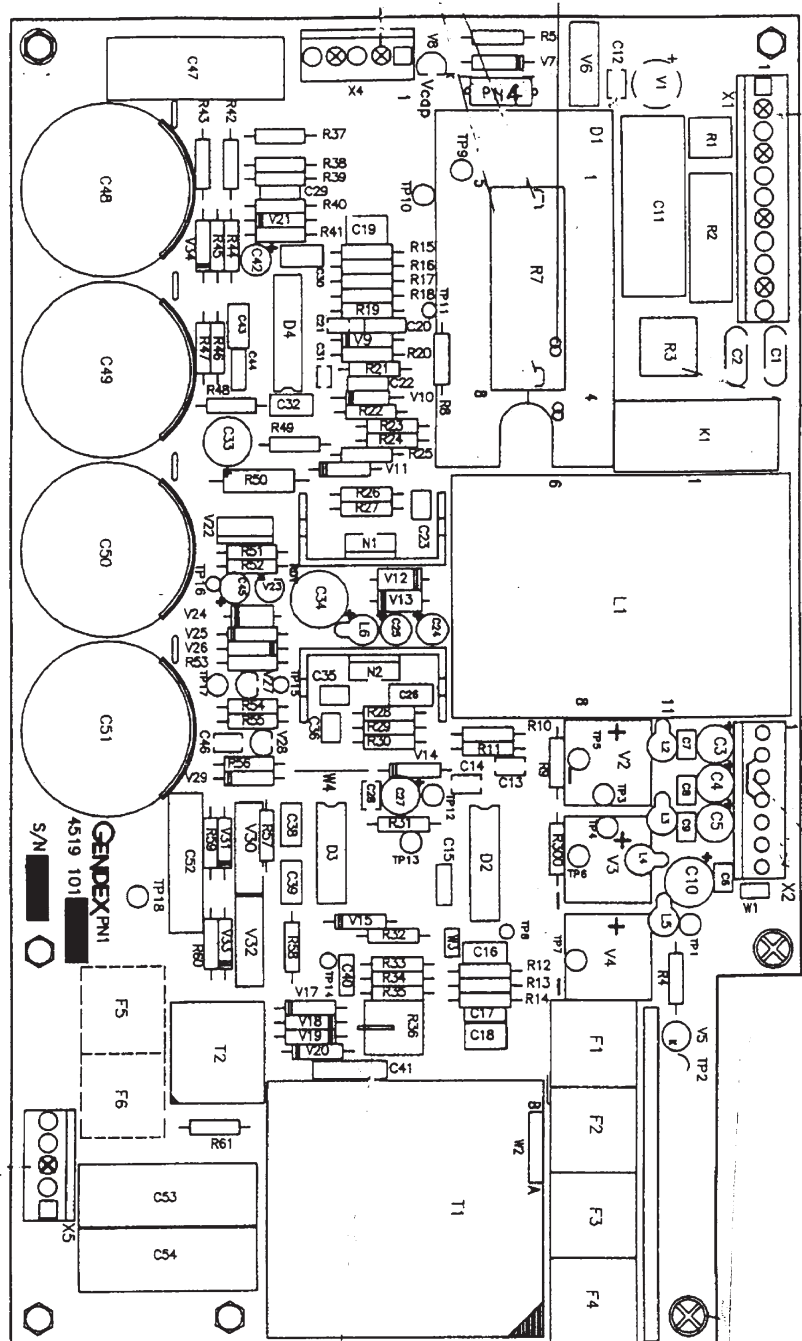
CODE 4519 101 20811



Power unit

PN1

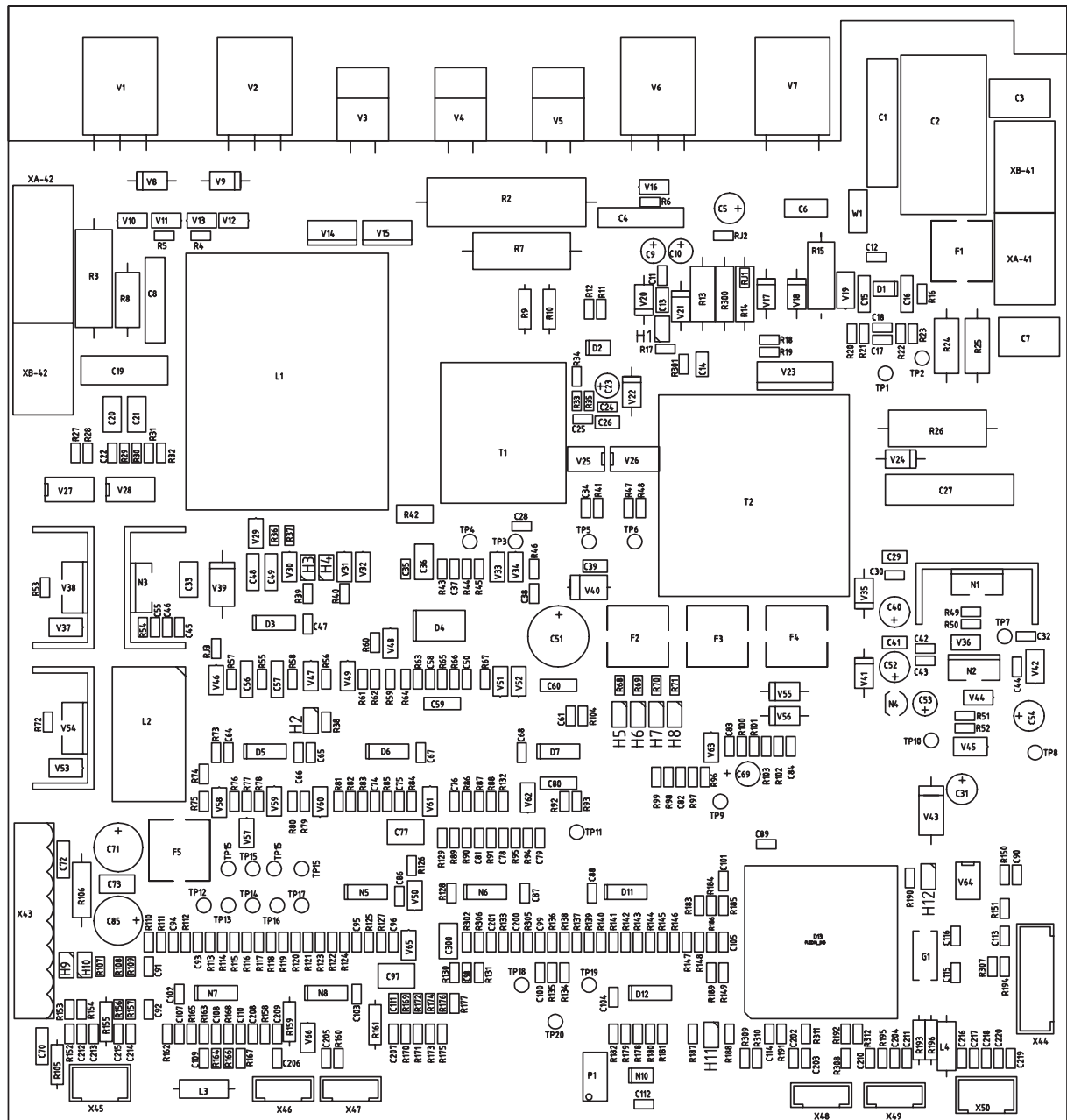
CODE 4519 101 00106



Converter board

PQ1

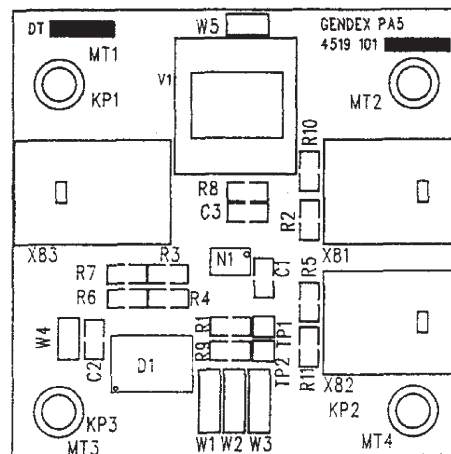
CODE 4519 101 00406



AEC control board

PA5

CODE 4519 101 03803

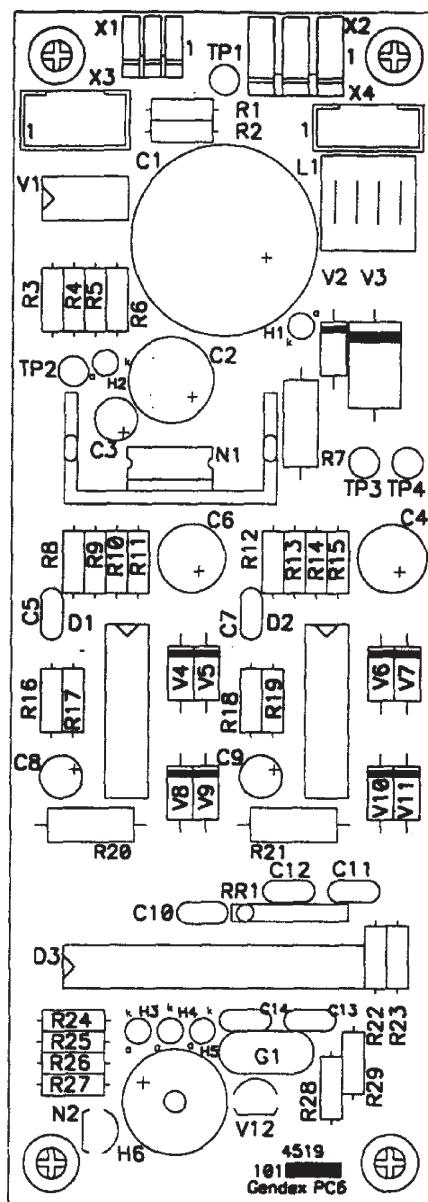


PANORAMIC			CEPH		
! (up)	! (up)	! (up)	! (up)	! (up)	! (up)
! (down)	! (down)	! (down)	! (down)	! (down)	! (down)
W1	W2	W3	W1	W2	W3
W4 = OPEN			W4 = OPEN		
W5 = SHORT			W5 = SHORT		

Motorized column

PC6

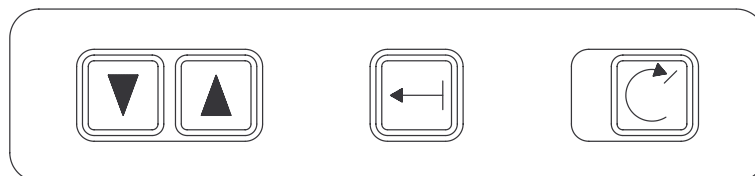
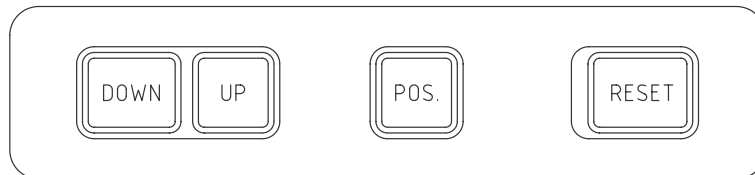
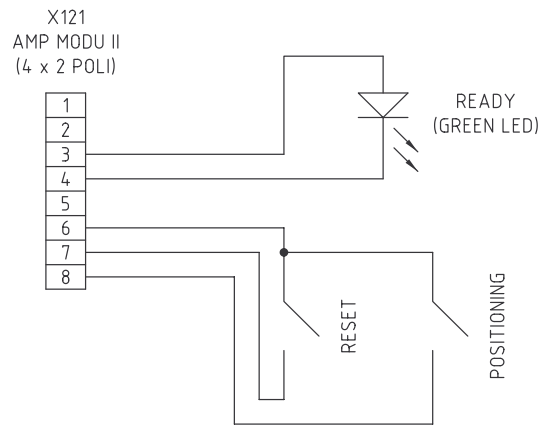
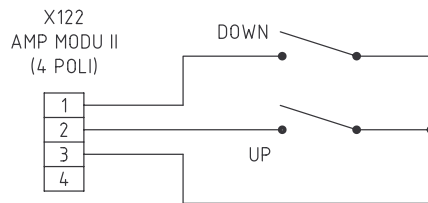
CODE 4519 101 03604



Ceph keyboard

PC8

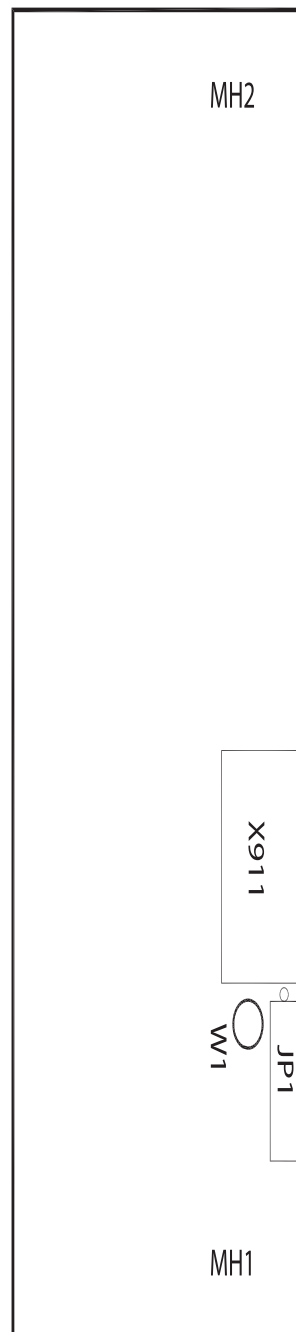
CODE 4519 101 11101



DMU connector interface

PA6

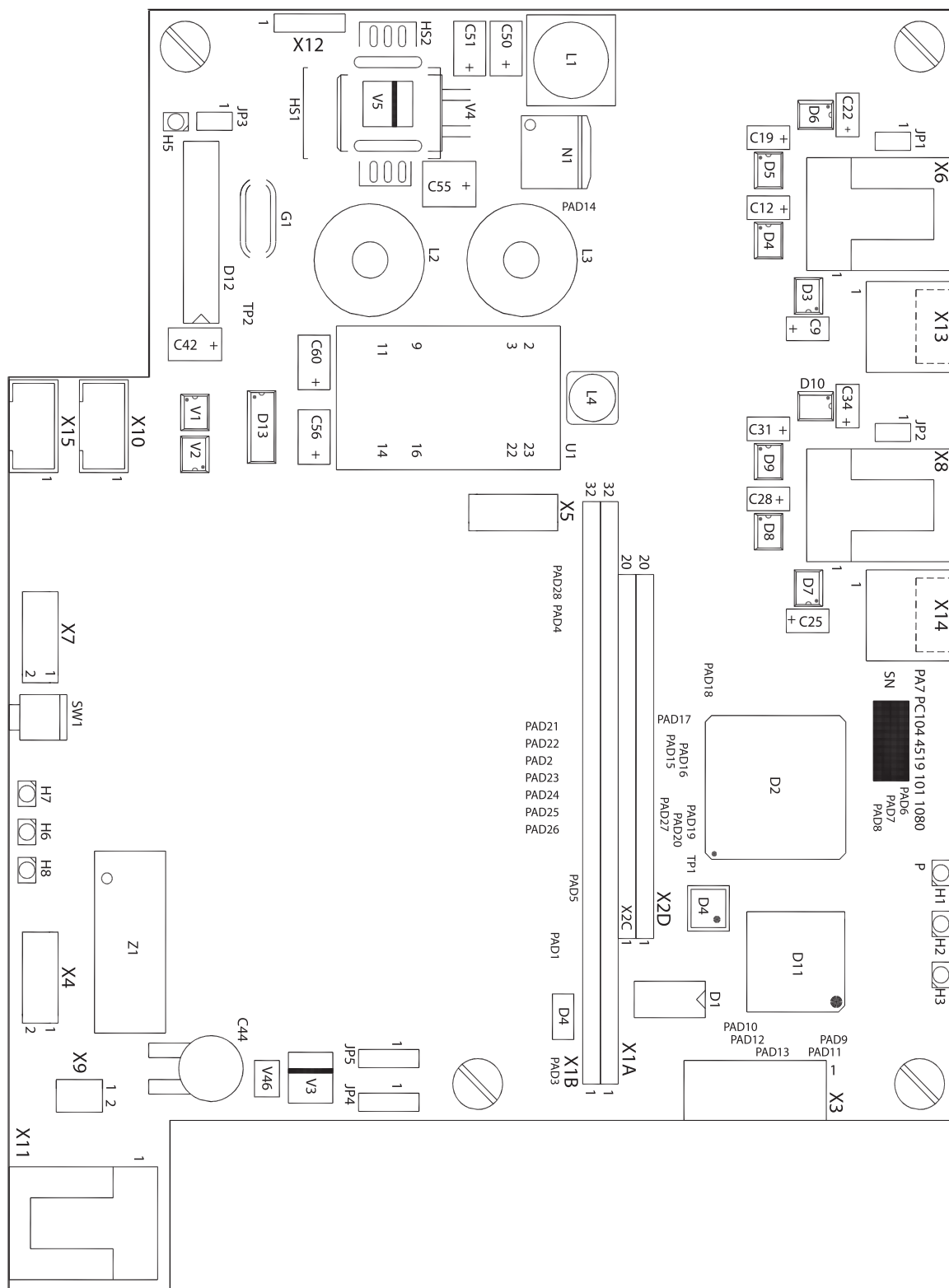
CODE 4519 101 10701



Auxiliary board

PA7

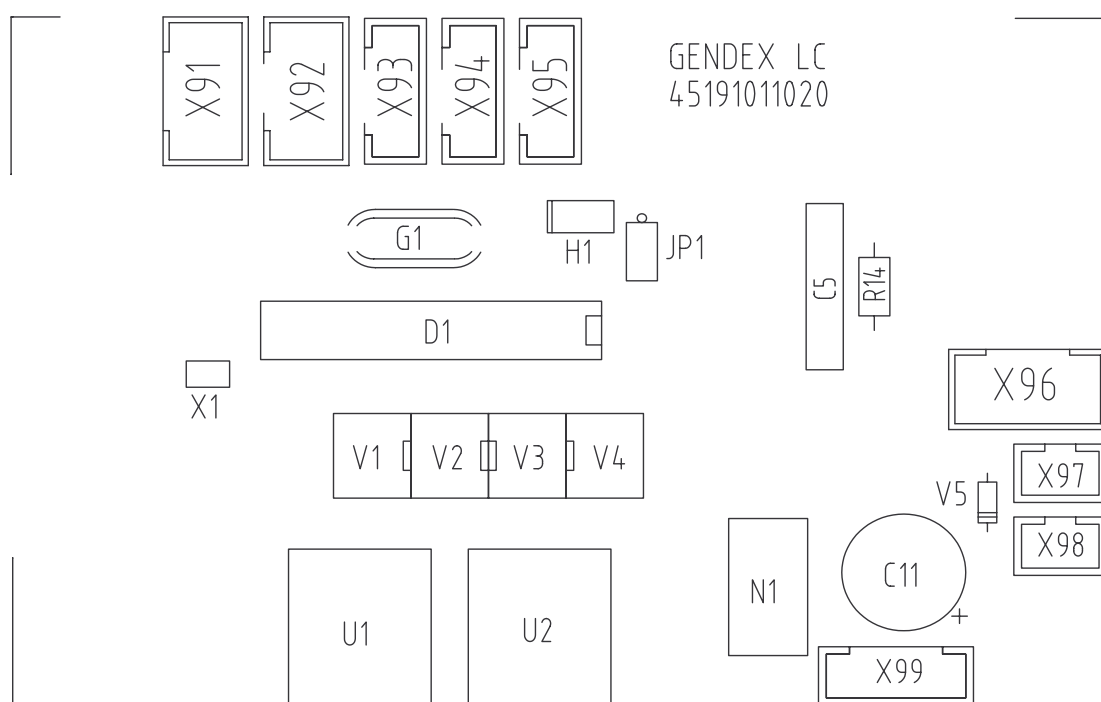
CODE 4519 190 02111



DMU Interface

PH3B

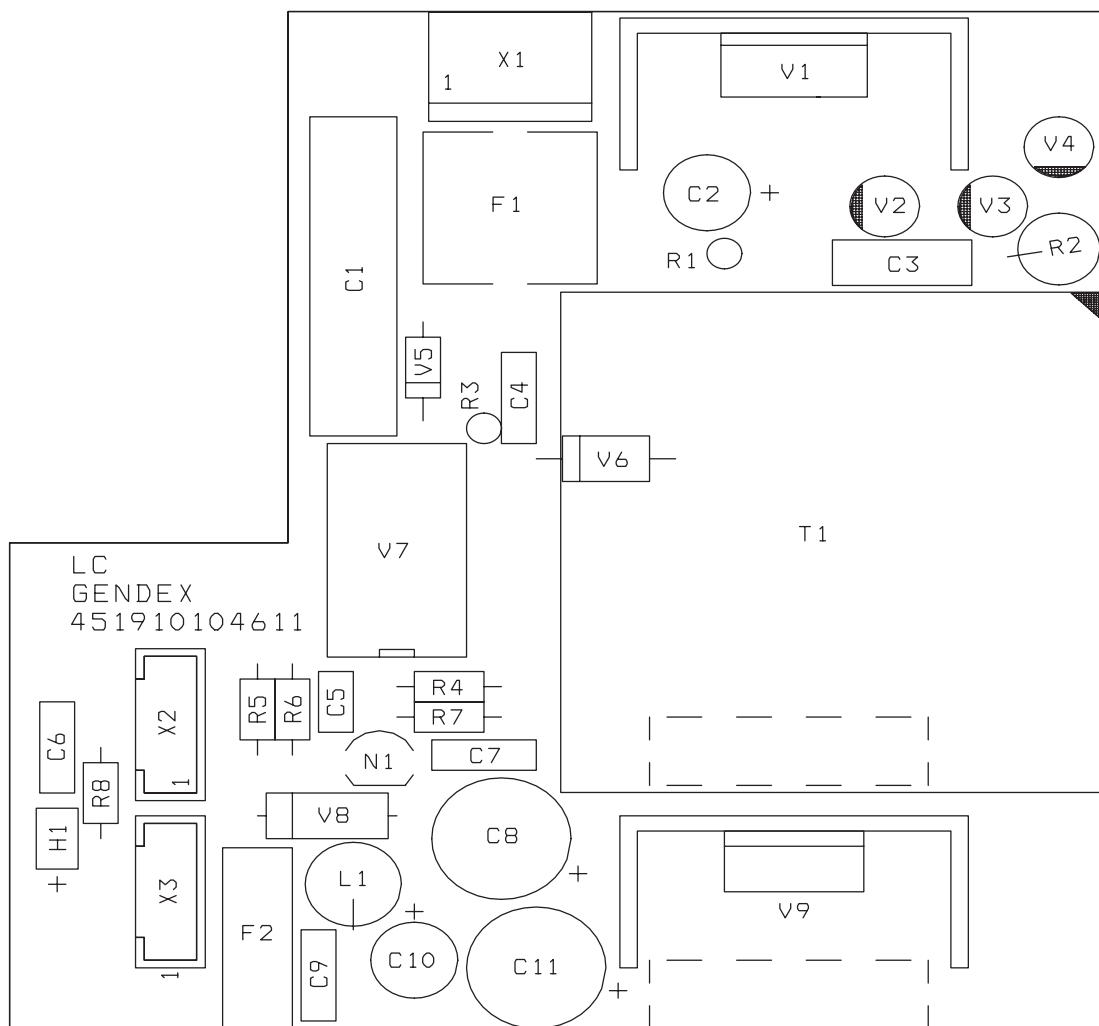
CODE 4519 101 10201



DDE power supply board

PN5

CODE 4519 101 04601



This page intentionally left blank.