СТОМАРТ
DENTAL SOLUTIONS

X MIND prime

X-MIND prime 3D ceph version Service Manual

ACTEON

Contents

Note

This manual in English is the original Manual version.

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1. INTRODUCTION

Note

The present manual is updated for the product it is sold with in order to grant an adequate reference in performing diagnostics and repair operations normally carried out by the service engineer.
The manual may not reflect changes to the product not impacting service operations.

This manual provides the instructions for proper and safe installation and maintenance of the appliance by technical personnel.

This manual is limited to the description of the radiographic equipment; the instructions for the image acquisition, manipulation and processing are given in the user manual supplied with the imaging software used with the X-MIND prime 3D unit.

Warning

- The X-MIND prime 3D is an electro-medical device and it can be used only under the supervision of a physician or of highly qualified personnel, with the necessary knowledge on X-ray protection.
- The device must be used in compliance with the procedures described, and never be used for purposes different from those herewith indicated.
- The user is liable with regards to the legal fulfilment related to the installation and the operation of the device.
- Service engineers who install and maintain the device need knowledge of radiation protection and must read the Service Manual prior to use the X-ray equipment. They must be qualified and authorized by Acteon.

Note

For installation in USA, a report of assembly (Form FDA 2579) must be filled out to certify that the medical equipment was assembled according to the instructions provided by the manufacturer, and meets the requirements of the applicable Federal standards contained in 21 CFR 1020.30 through 1020.33.
Reports must be filed with FDA's Center for Devices and Radiological Health (CDRH) within 15 days of completion of the assembly. The report must be filled in according to the methods provided in:

https://www.fda.gov/industry/fda-esubmitter/diagnostic-x-ray-reports-assembly

(remember to check the updated web address since this may change over time)

1.1. Icons appearing in the manual

This icon indicates a "NOTE": please read the items marked by this icon thoroughly.

This icon indicates a "WARNING": the items marked by this icon refer to safety aspects of the patient and/or operator.

1.2. How to contact Technical Service

For any technical queries please contact the following:

- Telephone number +39 0331 376 762
- E-mail: imaging.italysupport@acteongroup.com

If a technical service intervention is required it is mandatory to provide Technical Service the following information:

- Unit Serial Number
- Unit firmware&driver version: MCU, CCU, HF(XCU), ASP (Acteon System Package), AIS
- Other software version used with X-MIND prime 3D
- Problem description including: condition/unit-state, sequence in which the anomaly occurs and how it can be reproduced.
- If one or more errors messages are displayed:
  - Errors messages numbers.
  - Results of all the errors troubleshooting tests.
  - Part codes to be replaced (if required by the troubleshooting tests).
  - Additional information or data required by the troubleshooting of the displayed errors.

2. SAFETY INFORMATION

Warning
Please read this chapter thoroughly.

Acteon designs and manufactures its devices in compliance with safety requirements; furthermore, it supplies all information necessary for correct use, and warnings related to dangers associated with X-ray generating units.

Acteon cannot be held liable for:

- Use of X-MIND prime 3D other than its intended use
- Damage to the unit, the operator or the patient, caused both by installation and maintenance procedures other than those described in this Manual and in the Service Manual supplied with the unit, and by erroneous operations
- Mechanical and/or electrical modifications performed during and after the installation, other than those described in the Service Manual.

Installation and any technical operations must only be performed by qualified technicians authorised by Acteon.

Only authorised personnel may remove the covers and/or have access to live components.

Warning
In compliance with the IEC 60601-1 standard, the modification of the equipment or its parts is strictly prohibited.

2.1 Warnings

The device must be used in compliance with the procedures described and never be used for purposes different from those herewith indicated.
Before performing any maintenance operation, disconnect the unit from the power supply using the provided circuit breaker.
X-MIND prime 3D is an electro-medical device and therefore it can be used only under the supervision of suitably qualified medical personnel, with the necessary knowledge on X-ray protection.
The user is responsible for the fulfilment of the legal requirements regulating the ownership, installation and use of the equipment itself.
This device has not been designed to be used in environments where vapours, anaesthetic mixtures flammable with air, or oxygen and nitrous oxide, can be detected.
Do not let water, or other liquids, into the device, as this could cause short-circuits and corrosion.
Before cleaning the device, be sure that the main power supply has been disconnected from the equipment. Pushing the ON/OFF button of the equipment, it mustn't switch on.
Wherever necessary, use the appropriate accessories, such as the leaded aprons, to protect the patient from radiation.
While performing the radiography, no-one, apart from the operator and the patient, must remain in the room.
X-MIND prime 3D has been built to support a continuous operation at intermittent load; therefore please follow the described use cycles to enable the device to cool down.
X-MIND prime 3D must be switched off while using electrosurgical devices or similar apparatus.

Warning
For safety reasons, it is prohibited to abnormally overload the patient support arm, for example by leaning on it. The traction force on the handle shall be less than 16kg.

Warning
To avoid risk of electric shock, this equipment must only be connected to a supply mains with protective earth.

Please clean and disinfect, when necessary, all parts that can be in contact with the patient.
The centering bite or the bite protective sleeve and the ear pin covers must be replaced after each examination in which they were used.
Never try to rotate the moving arm manually when the unit is switched on, to avoid permanent damage to the unit.
Movement is only possible in case of Error 362 because motors are disabled to permit the patient exit.

Note
When the unit is switched on, do not move the rotating arm or the tube-head or secondary collimator or the pan/ceph sensor).

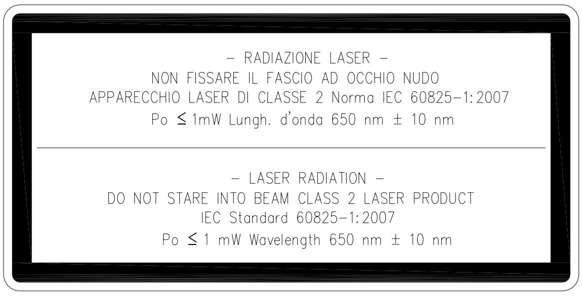
Warning for free standing floor mounted unit
In case the unit shall be moved for service or other extraordinary operation, maximum caution shall be taken to prevent the unit from tilting and falling to the ground.

2.1.1 Precautions while using laser centring devices

For patient positioning, X-MIND prime 3D uses two laser diodes with optical power on the working surface < 1 mW.

The directive CEI-EN 60825-1 defines the laser as "any device that produces or amplifies electromagnetic radiation in a coherent manner which includes a wave lengths from 180 nm to 1 mm by means of a stimulated emission". In reference to this directive, the lasers present on the X-MIND prime 3D are parts of class 2.

A laser in class 2 can be potentially dangerous if the ray is reflected into not protected eyes by a mirror, watch, a ring etc.
The warning label below is affixed to X-MIND prime 3D to indicate a laser in class 2 is mounted internally and caution is advised:



Warning

- Always keep the room well lit.
- Do not look into the output windows of laser centring units.
- Do not stare at the reflections of laser pointers.
- Instruct the patient to keep his/her eyes closed as long as the laser pointers are active.
- Before starting an exam, the patient must remove earrings, glasses, necklaces and any other item that could reflect the laser beam or be impressed on the radiographic image.
- Do not clean the openings of laser centring devices with tools that could modify the optics. Any cleaning must only be performed by authorized technicians.
- Operations other than those indicated could cause the emission of dangerous non-ionizing radiation.

2.2 Protection against radiation

Although the dose supplied by dental X-ray units is quite low and distributed on a fairly small surface, the operator must adopt precautions and/or suitable protection for the patient and himself, during radiography.

Warning
Protection against radiation is regulated according to law.
The equipment may only be used by specialised personnel.

It is advisable to control the X-ray emission from a protected area, by remote control. If it is necessary to operate near the patient, stay as far as the remote control cable allows, or at least 2 m both from the X-ray source and from the patient, as shown in the following figure.

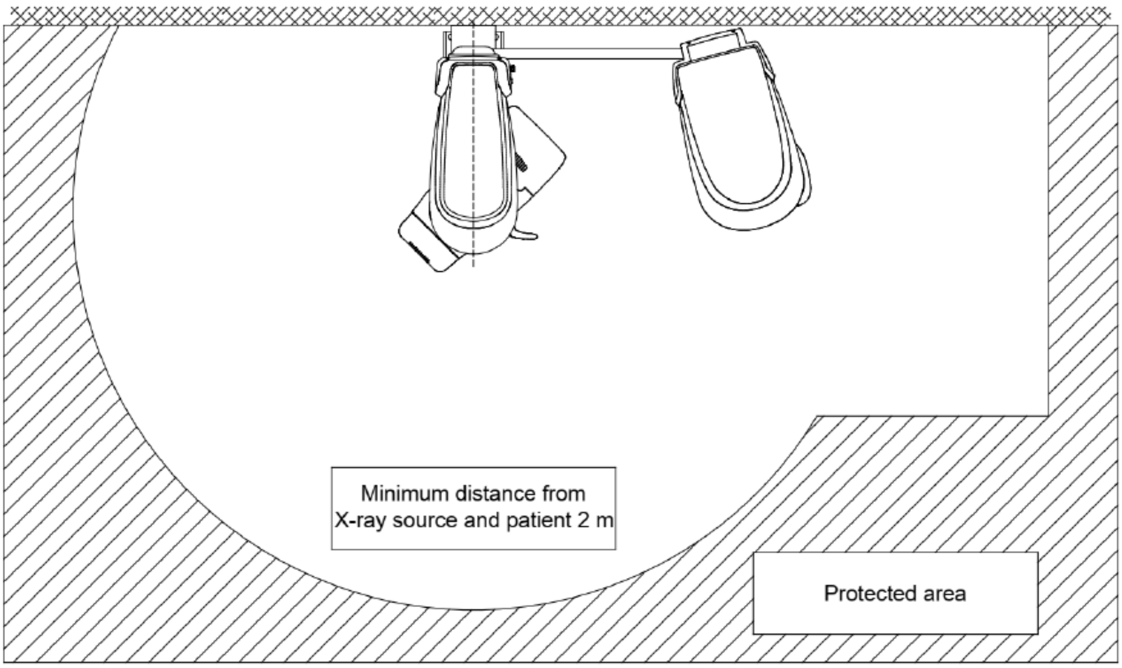


Figure 1

2.3 Information about Electromagnetic Compatibility

Medical electrical equipment needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided in the accompanying documents.

Portable and mobile RF communications equipment can affect medical electrical equipment.

The equipment can be installed both in professional buildings (e.g. hospitals or clinics) and in residential buildings. Residential buildings, according to IEC 60601-1-2 4th edition, are intended to be connected to dedicated power supply system (normally fed by separation transformers).
For the purpose of EMC environment classification according to IEC 60601-1-2 4th edition, both installations are classified as "Professional healthcare facility environment".

The EMISSIONS characteristics of this equipment make it suitable for use in industrial areas and hospitals (CISPR 11 class A). If it is used in a residential environment (for which CISPR 11 class B is normally required) this equipment, even if it is usually permanently installed in X-Ray shield locations, might not offer adequate protection to radio-frequency communication services. If abnormal performance is observed, such as degradation of essential performance in the form of lack of accuracy of exposure parameters and lack of reproducibility of exposure parameter, additional measures may be necessary, such as re-orienting or relocating the device.

Warning
The use of cables other than:

- Ethernet cable CAT 6 L=5 m - code 5007090100
- Ethernet cable CAT 6 L=10 m - code 5007090300

with the exception those sold by the manufacturer of the equipment or system as replacement parts for internal components, may result in increased emission or decreased immunity of the equipment or system.

Warning
X-MIND prime 3D should not be used adjacent to or stacked with other equipment; if adjacent use is necessary, X-MIND prime 3D has to be observed to verify if it operates in a normal way.
Interference may occur in the vicinity of equipment marked with the symbol  .

Warning

Portable and mobile RF communications equipment should be used no closer to any part of X-MIND prime 3D, including cables. Minimum distance 30 cm.

2.3.1 Electromagnetic emissions

In accordance with the IEC 60601-1-2 Ed4 standard, X-MIND prime 3D is suitable for use in the electromagnetic environment specified below.
The customer or user of the system must ensure that it is used in the said environment.

Emissions test	Compliance	Electromagnetic environment
RF emissions CISPR 11	Group I	X-MIND prime 3D uses RF energy only for its internal function. Therefore, its R.F. emissions are very low and are not likely to cause any interference in nearby electronic equipment.
	Class A	X-MIND prime 3D is suitable for use in all establishments other than domestic and those directly connected to the public low voltage power supply network that supplies buildings used for domestic purposes.
Harmonics emissions IEC 61000-3-2	Class A	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	

2.3.2 Electromagnetic immunity

In accordance with the IEC 60601-1-2 Ed4 standard, X-MIND prime 3D is suitable for use in the electromagnetic environment specified below.
The customer or user of the system must ensure that it is used in the said environment.

Immunity test	IEC 60601-1-2 test level	Compliance level	Electromagnetic environment
Electrostatic discharge (ESD) IEC 61000-4-2	8 kV contact 2/4/8/15 kV air	IEC 60601-1-2 Test level	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%
Radiated electromagnetic field IEC 61000-4-3	3 V/m 80 MHz to 2.7 GHz	IEC 60601-1-2 Test level	Portable and mobile RF communications equipment should be used no closer to any part of X-MIND prime 3D including cables. Minimum distance 30 cm
Electrical fast transient/burst IEC 61000-4-4	2 kV for power supply lines 1 kV for input/output lines > 3 m	IEC 60601-1-2 Test level	Mains power quality should be that of a typical commercial or hospital environment
Surge IEC 61000-4-5	0.5/1 kV differential mode 0.5/1/2 kV common mode	IEC 60601-1-2 Test level	Mains power quality should be that of a typical commercial or hospital environment
Conducted disturbances induced by RF fields IEC 61000-4-6	3 V 150 kHz to 80 MHz 6 V ISM frequencies	IEC 60601-1-2 Test level	Portable and mobile RF communications equipment should be used no closer to any part of X-MIND prime 3D, including cables. Minimum distance 30 cm

Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	10 ms – 0 % a 0°, 45°, 90°, 135°, 180°, 225°, 270°, 315° 20 ms – 0% a 0° 500 ms – 70% a 0° 5 s – 0%	IEC 60601-1-2 Test level	Mains power quality should be that of a typical commercial or hospital environment. If the user of X-MIND prime 3D requires continued operation during power mains interruptions, it is recommended that X-MIND prime 3D be powered from an uninterruptible power supply or a battery
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	30 A/m	IEC 60601-1-2 Test level	Power frequency magnetic fields should be at levels characteristics of a typical location in a typical commercial or hospital environment

2.4 Cybersecurity measures

Like all computer-based systems, X-MIND prime 3D might be exposed to Cybersecurity threats.
X-MIND prime 3D is equipped with hardware provisions that make sure that no unwanted X-ray exposure, laser radiation or motorized movements can be activated even in case of cyber-attack or software failure.
Nevertheless, in order to minimize the possibility of cyber-attacks, it is user responsibility to make sure that the following protection measures are followed.

- The initial software installation and system set-up shall be done by authorized and trained personnel only and using the software provided with the machine.
- Any software or firmware upgrade of the equipment shall be done by authorized and trained personnel only.
- After any software or firmware upgrade, or any other maintenance operation, image quality checks shall be performed to ensure the system is working as expected. Instructions are given in User Manual, chapter 7.
- Password-protect each user account on the Windows login. Passwords shall be strong enough (at least made of 8 alphanumeric characters), shall be safely managed by every user (for example they have not been written down), and should be periodically changed (if the system is supplied with a PC, the Windows user is password-protected, but it is user responsibility to change the default password and set new ones for all the different users that will have access to the system).
- Activate a screensaver that requires a password to be unblocked after a timeout of 5-10 minute, giving this way an automatic timed method to terminate sessions, preventing an unauthorized access to the computer when it is not used (if the system is supplied with a PC, the screen saver is activated by default).

- Install an antivirus software and keep virus definitions up to date.
- Activate the windows firewall on the host PC (if the system is supplied with a PC, the Windows firewall is activated by default).
- It is recommended to activate a hardware firewall on the WAN router/modem used for internet connection, if present.
- Make sure that all other PCs in the network are protected by an anti-virus.
- Make a virus scan of USB pen drive or CD/DVD media before using them to check they are free from viruses, malware or any dangerous software.
- Avoid installation of an unknown or untrusted software since it may undermine performance and safety of the computer and the equipment.
- Keep the Windows operating system up to date by installing all security patches.
- Make regular copies (backup) of all your valuable data and store them in a safe place, separately from the host PC.

2.5 Environmental risks and disposal

Some parts of the device contain materials and liquids that, at the end of the unit's lifecycle, must be disposed of at appropriate disposal centres.
In particular, the device contains the following materials and/or components:

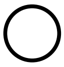
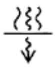
- Tube-head: dielectric oil, copper, iron, aluminium, glass, tungsten, lead.
- Collimator: lead
- Other parts of the device: non-biodegradable plastic materials, metal materials, printed circuits, iron-plastic materials, lead.

Note
Information for users of the European Community according to 2011/65/EU Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

The symbol of the crossed waste container on the equipment or packaging shows that the product, at the end of its lifecycle, must be collected separately from other types of waste.
The separate collection of this equipment at the end of its lifecycle is organised and managed by the manufacturer. Users who need to dispose of this equipment should therefore contact the manufacturer and follow the procedure adopted by the manufacturer for the separate collection of the equipment at the end of its lifecycle.
Proper separate collection for subsequent recycling, treatment and compatible environmental disposal of equipment helps avoid possible negative effects on the environment and on health and encourages the reuse or recycling of materials the equipment is made from.
Illegal disposal of the product by the owner of the equipment will result in administrative sanctions, as provided for by applicable regulations.

2.6 Symbols used

In this manual and on X-MIND prime 3D itself, apart from the symbols indicated on the keyboard, the following icons are also used:

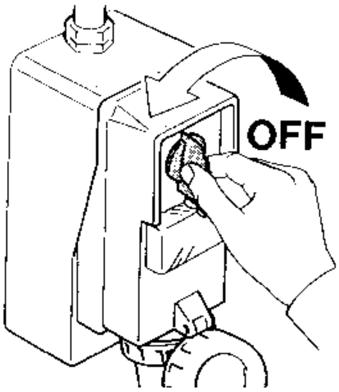
Symbols	Description
	Device with type B applied parts
	Some parts of the device contain materials and liquids that, at the end of the unit's lifecycle, must be disposed of at appropriate disposal centres.
~	A.C. voltage
N	Connection point to the neutral conductor
L	Connection point to the line conductor
	Protection grounding
	Functional grounding
	OFF; device not connected to the mains
|	ON; device connected to the mains
	Laser
	Dangerous voltage
REF	Product identification code
SN	Serial number
	Manufacturing date (year and month)
	Name and address of the manufacturer
	Filtration
	Tube-head
	X-Ray tube

Symbols	Description
	Focal spot according to IEC 60336
	Follow instructions for use
CE 0051	Conformity to the Directive 93/42/EEC and its revised version and all other applicable Directives
	Exposure enabled status (the corresponding green LED is on)
	Ceph sensor properly connected
	X-Ray emission (the corresponding yellow LED is on)
	Electronic instructions for use symbol for medical devices, according to EN ISO 15223-1: 2016

3. CLEANING AND DISINFECTION

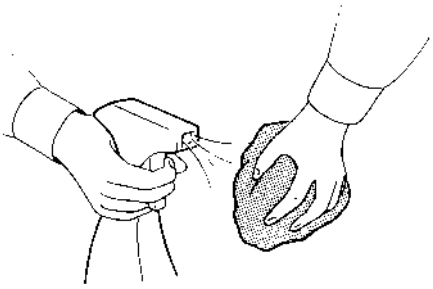
In order to guarantee a good level of hygiene and cleaning, it is necessary to carry out the following procedures.

Warning
Disconnect the unit from the mains before performing any cleaning.



Do not let water or other liquids penetrate the unit, as these could cause corrosion or short circuits.

Use only a wet cloth and a mild detergent to clean the painted surfaces, accessories and connection cables and then wipe with a dry cloth; do not use corrosive, abrasive solvents (alcohol, benzine, trichloroethylene).



The centring bite or the bite protective sleeve and the cephalometric ear pin sleeves must be replaced after each exam.
Thoroughly clean the chin support, resting handles, temple clamps, ceph rods, nasion reference and carpus plate whenever they are used.
The chin support, resting handles temple clamps, ceph rods, nasion reference and carpus plate should be disinfected (when considered necessary) with a solution of 2% glutaraldehyde.

Note
To ensure a greater level of hygiene the handles of the equipment are covered with a special antibacterial paint which, thanks to the emission of silver ions, prevents the development of micro-organisms.

4. DESCRIPTION

4.1 Functions, models and versions

X-MIND prime 3D, manufactured by de Götzen, is a complete panoramic X-ray system that can perform the following exams:

- Panoramic adult or child exams, with 3 sizes and 3 types of biting for a total of 18 combinations with automatic selection; with manual selection, it is possible to select a high voltage between 60kV and 86kV, in 2kV steps and anodic current from 2 mA to 12.5 mA in the R20 scale steps.
- Sinus mode makes it possible to take exams of the paranasal sinuses with front projection (postero/anterior).
- TMJ closed/open mouth in lateral projection.
- Right or Left Half Panoramic, to be used when the patient is known to have a problem only on one side of the arch, in order to reduce radiation.
- Low dose Panoramic, which reduces the dose radiated by excluding the TMJ's ascending rami from the radiograph.
- Frontal dentition, for a radiograph of the front part (roughly from canine to canine).
- Ortho Rad Panoramic with improved orthogonality, which reduces teeth overlap, thereby improving the diagnosis of interproximal decay.
- Bitewing Left or Right, for lateral dentition (generally from eighth to fourth) with a trajectory that reduces teeth overlap.
- Bilateral Bitewing (Left and Right), which sequentially performs both bitewings, showing them on the same image.
- 3D Full Dentition (FOV 85 x 93 mm) with 3 sizes for a total of 6 combinations with automatic selection; with manual selection, it is possible to select a high voltage between 60kV and 86kV, in 2kV steps and anodic current from 2 mA to 12.5 mA in the R20 scale steps.
- 3D Single Jaw (FOV 85 x 50 mm) with two different FOV positions (Maxillary, Mandibular), and 3 sizes for a total of 12 combinations with automatic selection; with manual selection, it is possible to select a high voltage between 60kV and 86kV, in 2kV steps and anodic current from 2 mA to 12.5 mA in the R20 scale steps.
- 3D Mandibular Teeth (FOV 50 x 50 mm) with five different FOV positions (Frontal, Pre-Molars and Molars), and 3 sizes for a total of 30 combinations with automatic selection; with manual selection, it is possible to select a high voltage between 60kV and 86kV, in 2kV steps and anodic current from 2 mA to 12.5 mA in the R20 scale steps.
- 3D Maxillary Teeth (FOV 50 x 50 mm) with five different FOV positions (Frontal, Pre-Molars and Molars), and 3 sizes for a total of 30 combinations with automatic selection; with manual selection, it is possible to select a high voltage

between 60kV and 86kV, in 2kV steps and anodic current from 2 mA to 12.5 mA in the R20 scale steps.

- 3D TMJ (FOV 85 x 93 mm) with two different FOV positions (R or L), 3 sizes for a total of 12 combinations with automatic selection; with manual selection, it is possible to select a high voltage between 60kV and 86kV, in 2kV steps and anodic current from 2 mA to 12.5 mA in the R20 scale steps.
- 3D Sinus (FOV 85 x 93 mm) with 3 sizes for a total of 6 combinations with automatic selection; with manual selection, it is possible to select a high voltage between 60kV and 86kV, in 2kV steps and anodic current from 2 mA to 12.5 mA in the R20 scale steps.

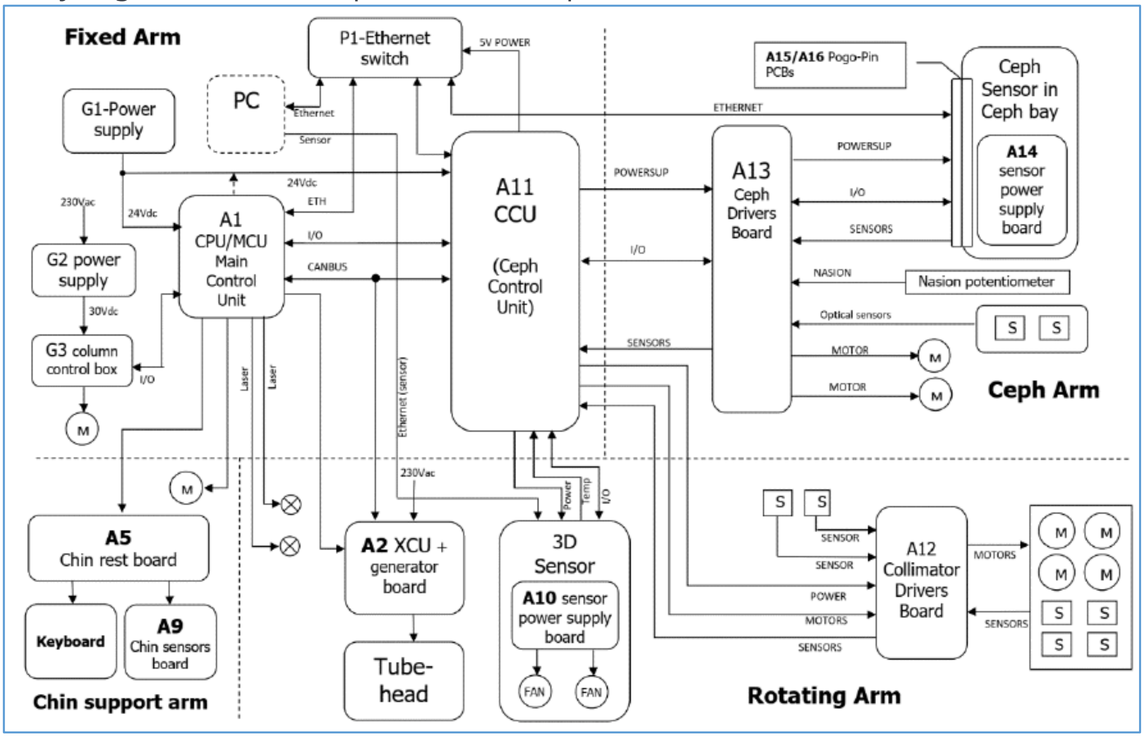
- 3D Extended Volumes (FOV 116 x 103 mm) with 3 sizes for a total of 6 combinations with automatic selection; with manual selection, it is possible to select an high voltage between 60 kV and 86 kV, in 2 kV steps and anodic current from 2 mA to 12.5 mA in the R20 scale steps.
- 3D Airways (FOV 116 x 103 mm) with 3 sizes for a total of 6 combinations with automatic selection; with manual selection, it is possible to select a high voltage between 60 kV and 86 kV, in 2 kV steps and anodic current from 2 mA to 12.5 mA in the R20 scale steps.
- Cephalometric L-L projections in the formats 18x24, 24x24, 30x24 and 18x18, 24x18, 30x18; the selection between HS High Speed and HD High Definition is available.
- Cephalometric A-P projections in the format 24x24 and 24x18 the selection between HS High Speed and HD High Definition is available.
- Carpus Projection in the format 18x24, only in HD High Definition mode.

Note of cephalometric image formats:

For user convenience, the ceph projections are named following the conventional format of the film-cassettes (24 cm), although the vertical active area of the cephalometric sensor is 22.8 cm.

4.2 Block diagram

This paragraph provides a brief description, at block diagram level, of the X-MIND prime 3D. Aim of this paragraph is to provide a brief description of the system. More details about the electronic circuits which compose the system can be obtained by analyzing the schematics provided in chapter 12.



MCU board A1 is the main board that manages directly all the components of the unit.

It is connected to the following components:

- Power supply assembly (G1)
- Chin Rest motor
- Zero position sensors
- X-ray button
- External signal board (A8)
- Lift motors control box (G3)
- Generator board XCU (A2) ---> (Tubehead)
- Ceph Control Board (CCU, A11)
- Collimator driver board (A12)
- Ceph Driver board (A13)
- Ceph Sensor power supply board (A14)
- Overlay keyboard
- 3D sensor Power board (A10)
- 3D Sensor ---> (PC) Ethernet 1
- Ceph sensor and host PC via a 5-ports ethernet switch

MCU board, CCU board and HF board are equipped with a local microcontroller that shares information using a CANbus transmission line and protocol.
An additional power supply assembly (G2) is directly connected to the column driver.

4.2.1 Power supply circuit

It is positioned in the top part of the unit and it is mainly composed by mains switch (S1), line filter (Z1), a 24Vdc 7.5A switching mode power supply (G1), located under the MCU board which supplies 24 Vdc to the logic boards, a 30Vdc power supply (G2) that supplies the lift motor.

- G2 power supply provides power to the motor control box (G3) which dirves the up/down motor (M1). located in the lower part of the unit.
- Safety switch S2 located in the top side of the unit (red button) cuts power to the up/down motor in case of malfunction
- Mains voltage is also provided to the Generator Board A2 used to generate High voltage to the tube head.

Note

The S2 emergency switch **doesn't cut power to the X-ray generator** or to other circuits, **therefore mains voltage is still present** in the unit even when the S2 emergency switch has been pressed.

The unit is delivered in an open range voltage configuration which makes it compatible with both 115 Vac and 230 Vac mains electricity. (See paragraph 7.2)

4.2.2 MCU board (A1)

It is located on top of the unit.
Main tasks are:

- General controlling of the unit, receiving the signals from the keyboard and from the different optical sensors.
- Communicating to the PC via ethernet connection.
- Driving of the stepper motors of Rotation, Y axis and chin rest.
- Monitoring the functioning of the motors through the analysis of the signals (zero position) coming from the zero position light sensors.
- Driving of the HF group (Generator board and tubehead) in order to provide the X-ray doses set by the operator on the PC (kV and mA set point) and in the meantime, check the functioning of this group through the managing of the relevant alarm signals.
- Driving of the x-ray button signal and the digital sensor board used to synchronize sensor acquisition with X-ray emission.
- Activation of the 2 laser centering devices.
- Managing of the alarms that can be generated by anomalous conditions present in the unit and caused by the operator or by a fault. These signals are sensed by the local MCUs and signal led using specific CANBus messages and reading temperature sensor placed on the 3D sensor power board.

MCU includes also the configuration and calibration data stored in the EEPROM memory and the HW key to activate the optional XP exam package and extended volumes package.

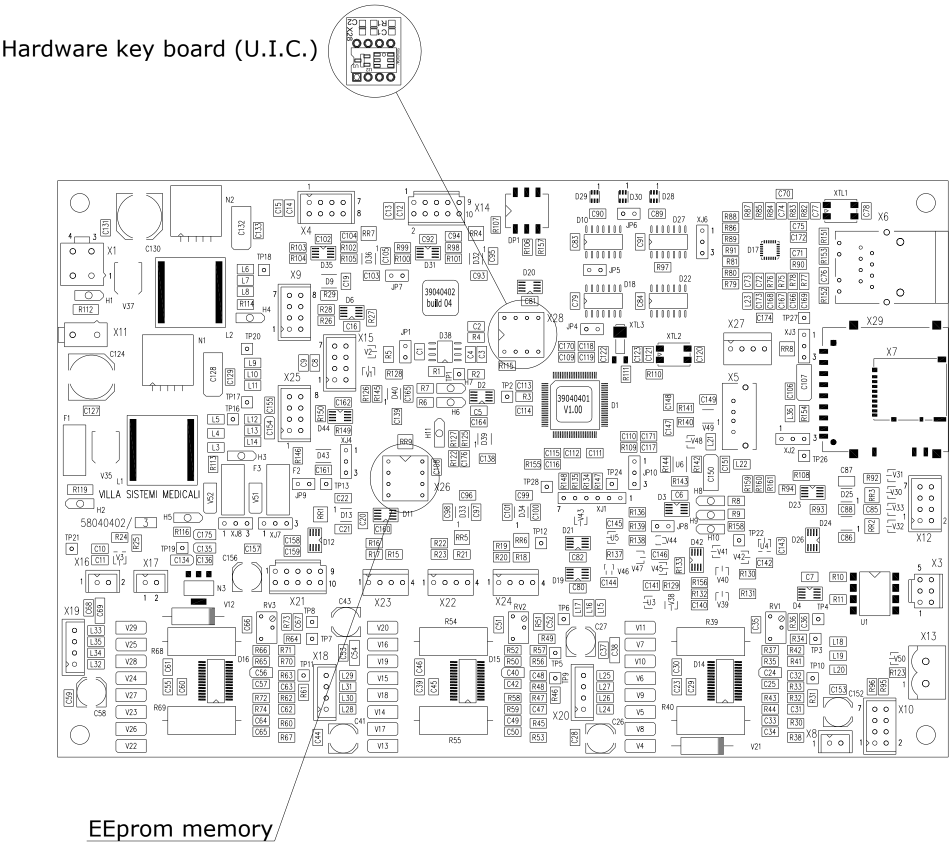

Hardware key board (U.I.C.)
EEprom memory
VILLA SISTEMI MEDICALI

Figure 2

4.2.2.1 MCU board DIP Switches

The following table shows the different modalities of DIP Switches present on the MCU board.

Code (*)	1	2	3	Function
0	**ON**	**ON**	**ON**	Normal mode
1	**OFF**	**ON**	**ON**	EEPROM reset (see paragraph 9.2.2.1)
2	**ON**	**OFF**	**ON**	Exhibition demo mode: allows rotation without X-ray emission (see paragraph 7.16.2)
4	**ON**	**ON**	**OFF**	- Axis alignment service mode: used to check laser centering rotating between the arm 0°, 90° and 180° positions by pressing >0<.
5	**OFF**	**ON**	**OFF**	- MCU bootloader forced by DIP switches

** It is possible to see this code by keeping the MCU SD card log (see paragraph 11.2.1.2)*

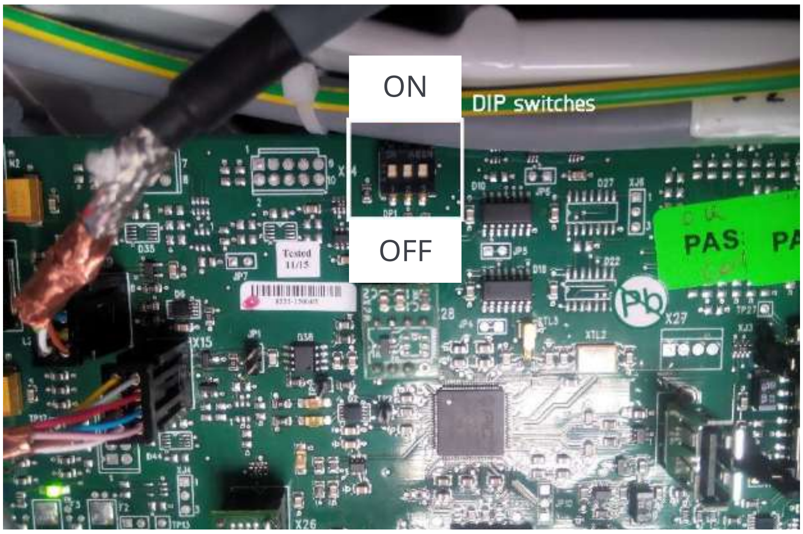


Figure 3

4.2.3 Generator board (A2) and Tubehead

The Generator board and the tubehead are located on the rotating arm. The power supply voltage is directly provided by the mains line.
Generator board includes a µprocessor which communicates with the MCU board (A1) through the CANBus cable (X15-X32). This cable also has a dedicated wire to bring the X-ray button signal to this board, so the "dead man switch" method is generated directly on the board.

The high frequency (HF) circuit is based on an inverter circuit working at the frequency about 100kHz, which drives the tubehead through an output stage based on IGBT components.

The Generator board receives the signals concerning the X-ray dose to provide (kV and mA), from the MCU board through CANBus messages; it is the Generator µprocessor that generates the commands used for the X-ray emission. The Generator board provides to the tubehead the voltages that drive the high voltage transformers that then drive anode and filament of the X-ray tube, also giving the relevant timing.

The tubehead is composed by the X-ray tube (CEI OPX 105-12) inserted in a sealed container, together with the high voltage transformers, filled with dielectric oil.

The Generator board controls the X-ray emission parameters feedbacks, generated by the tubehead. Any anomalies are then communicated to the MCU board (A1) which generates error codes to alert the operator.

4.2.4 3D Sensor Power board (A10)

It is located behind the 3D sensor support.
The main tasks are:

- Give the power supply (9V) to the 3D Sensor.
- Give to the MCU the temperature of the 3D Sensor, through which the system can manage the switching ON / OFF of fans and the 3D sensor power supply.
- Allows the transmission of the 3D exams clock signal from the Generator board (A2) through the MCU to the 3D Sensor.

4.2.5 CCU Ceph Control Board (A11)

Its main tasks are:

- Monitoring the functioning of these motors through the analysis of the signals (zero position) coming from the zero position light sensors.
- Managing the potentiometer on the nasion

- Managing the passage of the 3D sensor from pano/3D position to ceph position.
- Driving of the HF group (Generator board and tubehead) for the ceph exams, in order to provide the X-ray doses set by the operator on the PC (kV and mA set point)
- Managing of the alarms that can be generated by anomalous conditions present in the cephalometric arm and collimator.

4.2.5.1 CCU board DIP Switches

The following table shows the different modalities of DIP Switches present on the MCU board.

Code (*)	1	2	3	Function
0	ON	ON	ON	Normal mode
1	OFF	ON	ON	CCU bootloader forced by DIP switches

** It is possible to see this code by keeping the CCU SD card log (see paragraph11.2.1.3)*

4.2.6 Collimator Driver Board (A12)

It is located in the rotating arm just above the collimator itself.
On this board there are the stepper motor drivers of the 4 blade collimator.
It is also an interconnection board to route the cables of collimator zero sensors and 3D detector open/close position sensors to the Control Units Boards.

4.2.7 Ceph Driver Board (A13)

It is located in the bottom part of ceph unit. It can be accessed after removing a dedicated cover in the bottom part of the ceph device.

- On this board there are the stepper motor drivers of the cephalometric arm.
- It is also an interconnection board to route the cables (power supply, signals and zero sensors) from the machine to the cephalometric arm.

4.2.8 Ceph sensor power supply board (A14)

It is located Inside the ceph sensor enclosure.
The main tasks are:

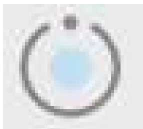
- Give the power supply (12V) to the Ceph Sensor.

- Give to the CCU the temperature of the Ceph Sensor, which communicates to the MCU, which can manage the switching ON / OFF of its power supply through the CCU.

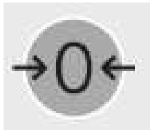
4.3 Keyboard - Description and functions

Figure 4 shows a general view of X-MIND prime 3D control Interface.

Figure 4 - Keyboard

Label	Description	
1	The up/down movement of the column is controlled by the corresponding keys. The movements are enabled during equipment setting. Column movement is not possible if the emergency button is pressed.	
2	The "Luminous centring device" key turn the laser centring devices ON/OFF, allowing the correct positioning of the patient.	
3	Light indicator of "Machine Ready" status: • Green fixed, alerts the user that by pressing the X-ray button, X-ray emission will start • Green blinking slowly, indicates that by pressing >0< button, axis reset will start • Green blinking fast, indicates the equipment cooling status.	

4	Light indicator "X-Ray Emission" status. It indicates the emission of X-rays.	

Label	Description	
5	Light indicator of "Computer connection" status: • Blue fixed, computer connection established • Blue blinking slowly, waiting for computer connection. No X-ray emission available • Blue blinking fast, the equipment is in error state. Refer to the GUI for error description.	
6	The "Centring/Patient Entrance" key is used to: • Start/Stop the exam procedures • Put the rotation arm in the patient entrance position at the end of the exam.	
7	Temple clasps closing/release knob.	
8	Chin rest control LED: • White fixed, the chin rest is correct for the selected exam • White blinking, the chin rest is not present or not correct for the selected exam	

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5. TECHNICAL CHARACTERISTICS

General features	
Type	X-MIND prime 3D
Manufacturer	de Götzen S.r.l. 21057 Olgiate Olona (VA) - Italy
Class	Class I with type B applied parts according to IEC 60601-1 classification.
Protection degree	IPX0 standard device
Line voltage	99-264 V
Rated line voltage	110-240V
Line frequency	50/60Hz
Maximum line current	14.5 A @115V 50/60Hz 6 A @ 230V 50/60Hz
Technical factors for maximum line current	86kV, 12.5mA
Power consumption	1.8kVA @ 115V 50/60Hz 1.4kVA @ 230V 50/60Hz
Protection fuse (F1)	20 A T 250V 6.3x32 mm 10kA@125V 8 A T 250V 6.3x32 mm 200A@250V
Column protection fuse (F2)	4 A T 250V 6.3x32 mm 10kA@125V 2.5 A T 250V 6.3x32 mm 100A@250V
Maximum line apparent resistance	0.2 Ω (96-197 V) 0.5 Ω (197-264 V)
Rated output voltage (kVp)	60 – 86kVp, with 2 kVp steps
Anodic current	2 – 12.5mA, with R20 scale steps (2, 2.2, 2.5, 2.8, 3.2, 3.6, 4, 4.5, 5, 5.6, 6.3, 7.1, 8, 9, 10, 11, 12.5)
Additional filtration	≥ 2 mm Al eq.

Exposure times	
Panoramic exam (PAN)	14 s Adult / 12.8 s Child
Half panoramic exam	7.7 s Adult / 7.1 s Child
Ortho Rad panoramic exam	11.5 s Adult / Child
Low dose panoramic exam	11.6 s Adult / 10.4 s Child
Frontal dentition	4.1 s Adult / Child
Bitewing Right, Bitewing Left	3.1 s Adult / Child
Bitewing Right & Left	6.2 s Adult / Child
TMJ mouth closed/open	10.6 s for left and right joint in open and closed condition
TMJ single phase	5.3 s
Sinus P/A projection	9 s
3D exams (except TMJ 3D)	7 s
TMJ 3D	6.2 s
Latero lateral 18x24 and 18x18 cephalometric exam	9.1 s HD / 4.4 s HS
Latero lateral 24x24 and 24x18 cephalometric exam	12.1 s HD / 5.8 s HS
Latero lateral 30x24 and 30x18 cephalometric exam	15.1 s HD / 7.3 s HS
Antero posterior 24x24 and 24x18 cephalometric exam	12.1 s HD / 5.8 s HS
Carpus	4.5 s
Exposure time accuracy	± 5 % or ± 20ms whichever is greater

Exam modes	
Exam selection	• Automatic selection for Adult and Child, 3 Sizes • 3 biting modes (Panoramic exam) • Manual selection
Panoramic exam	• Standard panoramic • Half panoramic Left/Right • Ortho Rad panoramic • Low dose panoramic • Frontal dentition • Bitewing Left/Right • Bitewing Left and Right
TMJ (Temporal Mandibular Joint) exam	TMJ open and closed mouth
Sinus	Sinus P/A projection

Volumetric 3D exams	Automatic selection for Adult and Child, 3 sizes chosen between: entire Dentition, Mandibular Dentition, Maxillary Dentition, Small Volumes (frontal, premolar, molar), TMJ Left, TMJ Right, Sinus

3D Dentition reconstructed volume	
Entire volume (*)	85 mm x 93 mm (Diameter x Height)
Mandibular and Maxillary volume (*)	85 mm x 50 mm (Diameter x Height)
Small volumes	50 mm x 50 mm (Diameter x Height)
Extended volumes	116 mm x 103 mm (Diameter x Height)
Cephalometric exams	
Lateral projections	formats 18x24 cm, 24x24 cm, 30x24 cm and 18x18 cm, 24x18 cm, 30x18 cm
Antero-posterior projections	format 24x24 cm and 24x18 cm
Carpus exam	format 18x24 cm

Note of cephalometric image formats:

For user convenience, the ceph projections are named following the conventional format of the film-cassettes (24 cm), although the vertical active area of the cephalometric sensor is 22.8 cm.

(*) In case collimator kit code 6604061200 is present,"In case the 80x80 limitation is set, the values will change to: Entire volume 80 mm x 80 mm (Diameter x Height); Mandibular and Maxillary volume 80 mm x 50 mm (Diameter x Height).)

Image magnification	**Geometric magnification**	**Magnification after software correction**
Adult / Child standard Panoramic	1 : 1.28 (constant over dentition part)	1 : 1 (*)
TMJ open/closed mouth	1 : 1.25 (nominal)	1 : 1 (*)
Sinus	1 : 1.27 (nominal)	1 : 1 (*)
Cephalometric exams	1 : 1.1 (nominal)	1 : 1 (*)
Carpus exam	1 : 1.06 (nominal)	1 : 1 (*)

(*) Warning
The declared image magnification value is valid after proper software calibration.

Note

X-MIND prime 3D is based on a standard dentition and ascending rami shape. This shape, based on statistical studies, establishes a form for the dentomaxillofacial complex, adopted as "standard".
X-MIND prime 3D follows a rototranslation path which maintains the magnification factor as stated in the Technical Characteristics of each type of exam as constant along this "standard" shape only along the dentition area. The patient's anatomy can differ significantly from the statistical model, so the magnification factor is not maintained and may be different from the value stated. Based on experience and competence, the user has to judge this variation. In any case, TMJ radiography cannot be used to perform calculations of distances, angles etc. on the film.

Tube-head characteristics	
Model	MPV 05
Manufacturer	de Götzen S.r.l. 21057 Olgiate Olona (VA) - Italy
Maximum tube voltage	86 kVp
kVp accuracy	± 8 %
Maximum anodic current	12.5 mA
Anodic current accuracy	± 10 %
Duty cycle	1 : 16
Reference loading conditions related to maximum energy input to the anode	2812.5 mAs/h @ 86 kVp
Nominal power	1.075 kW (86 kVp – 12.5 mA)
Total filtration	≥ 2.5 mm Al eq. @ 86 kVp
HVL (Half value layer)	> 3.2 mm Al eq. @ 86 kVp
Transformer insulation	Oil bath
Target angle and reference axis	See Figure 5
Cooling	By convection
Leakage radiation at 1 m	< 0.5 mGy/h @ 86 kVp – 12.5 mA – 3s duty cycle 1/16
Tube-head maximum thermal capacity	310kJ

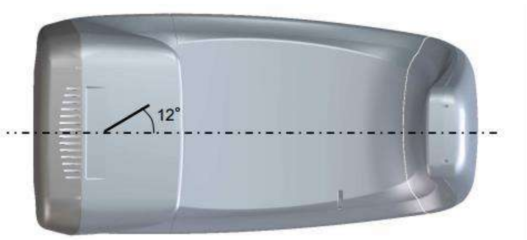


Figure 5: Tube-head target angle (view from the bottom)

X-ray tube characteristics	
Manufacturer	CEI
Type	OPX 105-12
Nominal focal spot	0.5 EN 60336
Inherent filtration	0.5 mm Al eq.
Anode tilt	12°
Anode material	Tungsten

Nominal maximum voltage	110 kVp
Filament max current	4 A
Filament max voltage	6.7 V
Anode thermal capacity	30 kJ
Anode thermal capacity during continuous operation	300 W
Laser centering devices	
2 laser beams are used for patient positioning; beams that align the sagittal and Frankfurt planes (please refer to relevant paragraphs for a detailed explanation).	
Wave length	650 nm
Divergence	< 2.0 mRad
Optical power on the working surface	< 1 mW
Laser class	Class 2 laser product according to IEC standard 60825-1:2007
3D Digital sensor	
Detector type	CMOS flat panel
Sensitive Area (H x L)	144 x 118.6 mm
Pixel dimensions	120 µm 240 µm (2x2 binning)
Number of pixels (H x L)	1200 x 988 600 x 494 (2x2 binning)
Voxel dimensions	175 µm HD mode 87.5 µm XD mode
Grey levels	65536 (16 bit)
Resolution	4.16 lp/mm (non binning mode)
Sensor cover attenuation equivalent	< 0.4 mm Al eq.
Cephalometric Digital sensor	
Detector type	CMOS sensor
Sensitive Area (H x L)	228 x 6.7 mm
Pixel dimensions	99 µm 198 µm (2x2 binning)
Number of pixel (H x L)	2304 x 68 (non-binning mode)
Grey levels	16384 (14 bit)
Resolution (spatial frequency at CTF=5%)	5 lp/mm (non-binning mode)
Sensor cover attenuation equivalent	< 0.4 mm Al eq.

Mechanical characteristics	
Focal spot to image receptor distance (panoramic and 3D)	52 cm (20")
Focal spot to image receptor distance (cephalometric)	165 cm (65")
Telescopic motorised column run	70 cm (27"1/2)
Maximum total height	223 cm (88")
Weight	123 kg (271 lbs)
Environmental conditions	
Minimum room size (please refer to the Service Manual)	186 x 121 cm (75"x49")
Recommended room size (please refer to the Service Manual)	200 x 130 cm (80"x52")
Working temperature range	+ 10°C ÷ + 35°C
Working relative humidity (RH) range	30% ÷ 75%
Working atmospheric pressure range	700 ÷ 1060 hPa
Temperature range for transport and storage	- 20°C ÷ + 70°C
Humidity range for transport and storage	< 95% without condensation
Minimum atmospheric pressure for transport and storage	630 hPa

Note
The handles of the equipment are covered with a special antibacterial paint which, thanks to the emission of silver ions, reduces the development of micro-organisms.

5.1 Dimensions

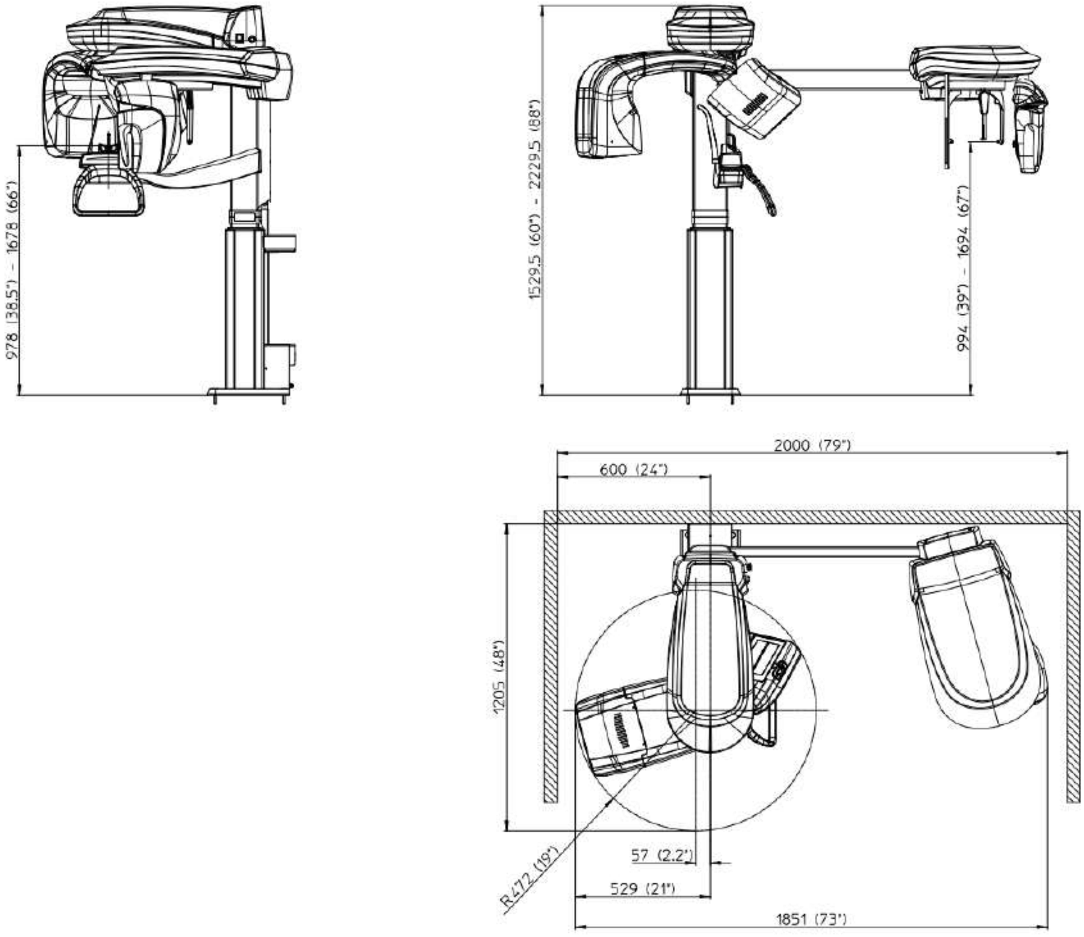


Figure 6: X-MIND prime 3D dimensions – Floor-Wall mounted versions

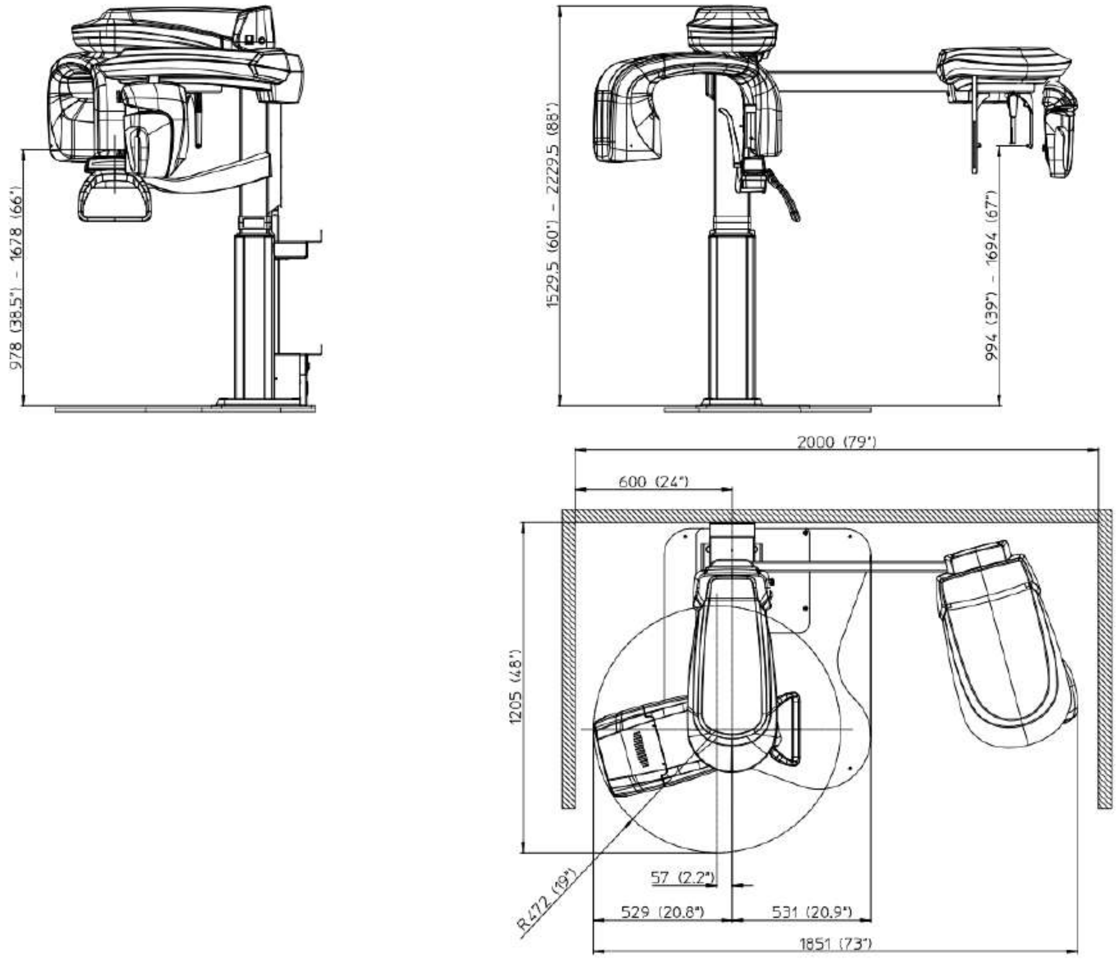


Figure 7: X-MIND prime 3D dimensions – Free-standing version

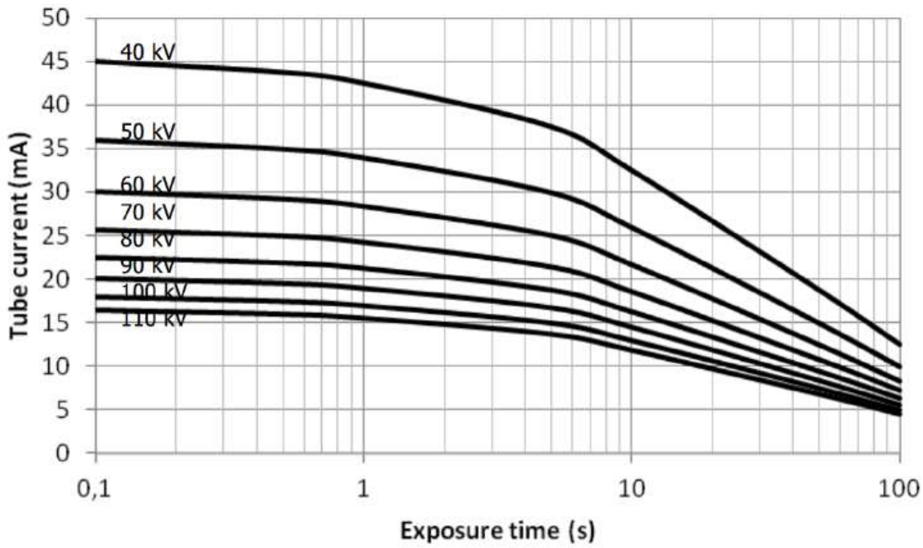
Warning for free standing floor mounted unit

In case the unit shall be moved for service or other extraordinary operation, maximum caution shall be taken to prevent the unit from tilting and falling to the ground.

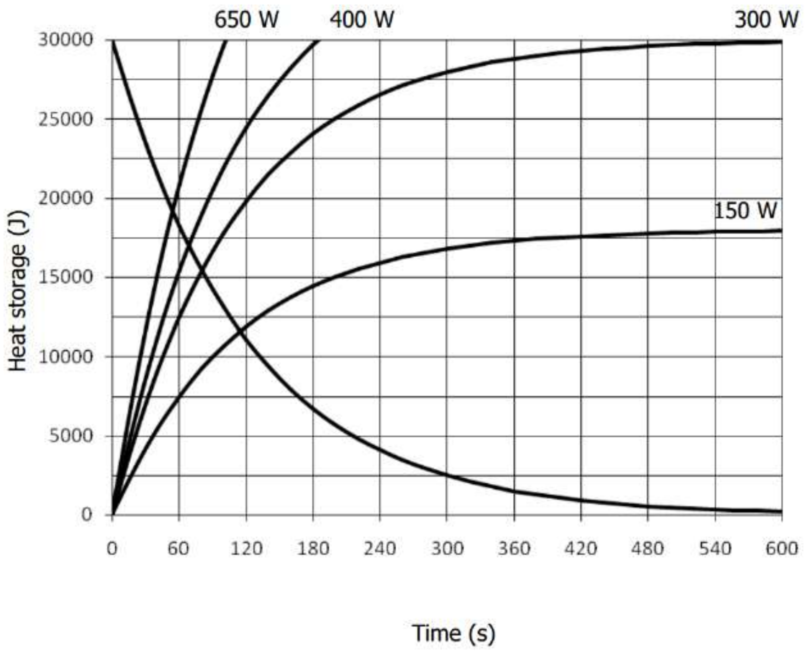
5.2 Tube loading curves, anode heating and cooling curves

Tube “CEI OPX 105-12” (0.5 IEC 336)

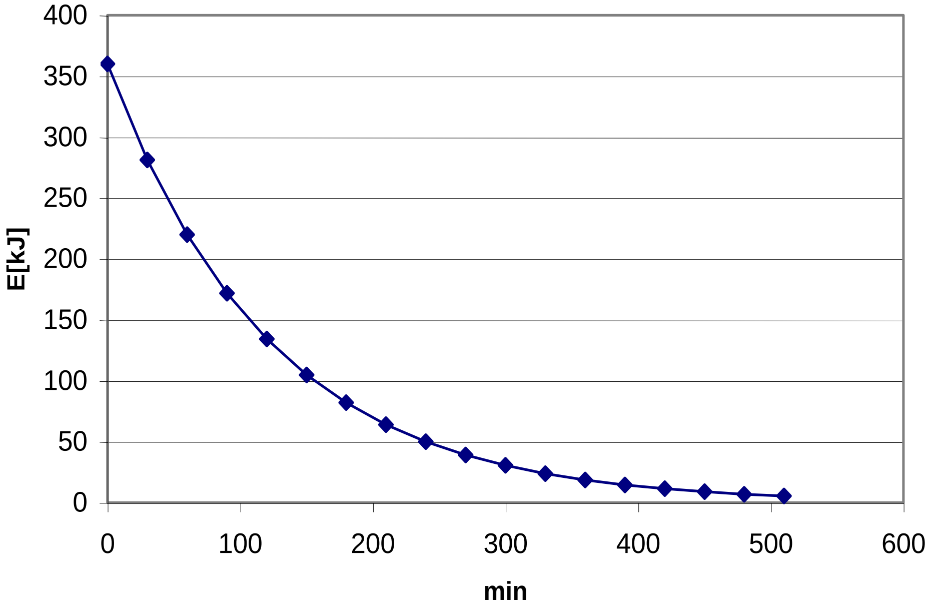
Tube loading curves



Anode heating and cooling curves



Tube head cooling curve



5.3 Characteristics of the supplied workstation

The workstation supplied with the equipment has the following characteristics:

- Processor Intel Core i7 (4 cores 8 threads) 3 GHz or higher.
- 8 GB RAM.
- Hard drive 1 TB.
- DVD recorder.
- GPU card with the following specifications (NVIDIA® QUADRO® P2000):
  - chipset Nvidia
  - Global memory ≥ 4 GB
  - Capability (=architecture) ≥ Maxwell.
- Operating System Windows 10 - 64 bit.

Monitor characteristics:

- Resolution: 1920 x 1080 pixels
- Colour depth: 16M of colour
- Contrast: 1000:1
- Luminosity: 250 cd/m^2

5.4 Software

The equipment Graphical User Interface can be run with the software provided with the machine or integrated in a third party imaging and database software that complies with the following specifications: it has to be CE marked as medical device of class IIa and integrate the equipment SDK according to what stated in the document PANOW3D API programmer's guide Vn (n is the document revision), contact Acteon to have the latest revision of the programmer's document.

The 3D exams can be viewed with any software that can import, view and manage 3D volumes saved in DICOM slices with the following maximum dimensions:

- Normal resolution full volume: 532 slices, 492x492 pixels per slice, 12 or 16 bits, for a total of 484 kB/slice;
- Full resolution 80x50 volume: 542 slices, 984x984 pixels per slice, 12 or 16 bits, for a total of 968 kB/slice.

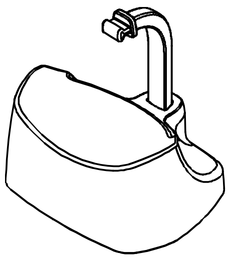
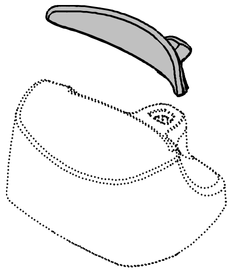
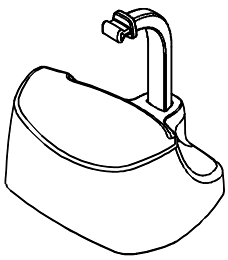
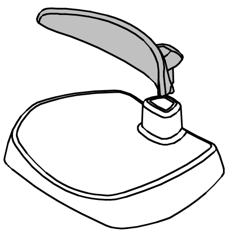
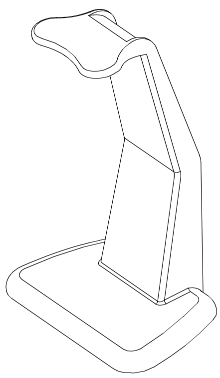
5.5 X-MIND prime 3D – PC communication

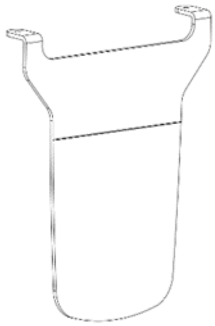
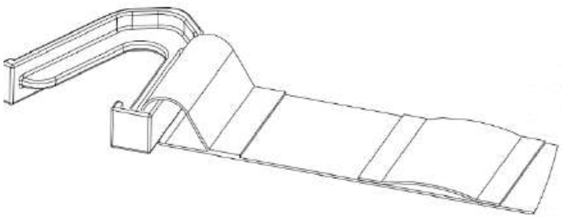
X-MIND prime 3D requires connection to a host PC to transfer images and to exchange the machine status. The communication between X-MIND prime 3D and computer requires two dedicated Giga-Ethernet channels that are provided by the dual port Network Interface Card supplied with the unit.
The information flow from X-MIND prime 3D includes image data and system status messages that are exchanged only with the host PC via a point-to point connection separated from the rest of the network. The communication requires fixed IP addresses for the unit and the pan-ceph sensor. The 3D sensor has a dynamic IP address.
The two Ethernet cables from the unit must be connected to such ports for the unit to operate correctly.
In order to properly operate the unit, follow carefully the instructions reported in the Service Manual at paragraph 7.6.
The system is provided with 2 Ethernet Cat 6 cables in order to permit the PC connection. In case of replacement, cables of the same or superior category have to be used.
If the communication between X-MIND prime 3D and PC is not properly set problems in unit connection causing impossibility of acquisition or loss of frames causing distortion and artefacts on the images can occur.

Note
X-MIND prime 3D is not intended to transmit or receive information to/or from other equipment through network/data couplings.

5.6 Separate parts supplied with X-MIND prime 3D

X-MIND prime 3D comes with the following removable accessories:

Chin rest for standard panoramic (code 6104011519 + 5407098200), supplied with removable appendix for edentulous patients (code 5407098119)	 
Reduced height chin rest for standard panoramic (code 6104011719 + 5407098200)	
Lowered chin rest for 2D and 3D Sinus and 3D TMJ, made by lowered chin rest (code 6104011619) and appendix for edentulous patients (code 5407098119)	
Standard TMJ positioning support (code 6107099800)	

Hand plate support for carpus exam (code 6104081300)	
Head strips for 3D exams (code 5404012500)	
Bites (code 6107110300), bite protective sleeves (code 6107110700) and TMJ positioner protective sleeves (code 6107110800)	Disposable and unsterilized parts. Replace after every use.

Note

These removable parts are considered “type B applied parts”, in accordance with IEC 60601-1, 3rd edition.

Some of these parts do not carry identification codes due to their small size. The use of these parts on other devices is not possible, since they are parts designed specifically for the X-MIND prime 3D.

5.7 Reference standard

Medical electrical equipment for extra-oral dental radiography X-MIND prime 3D complies with:

IEC 60601 1: 2005 (3rd ed.)
Medical electrical equipment – Part 1: General requirements for basic safety and essential performance

IEC 60601 1: 2005 (3rd ed.) + Am1:2012
Medical electrical equipment – Part 1: General requirements for basic safety and essential performance

IEC 60601-1-6:2010 (3rd Ed.)
Medical electrical equipment – Part 1-6: General requirements for safety – Collateral Standard: Usability including IEC 62366: Application of usability engineering to medical devices.

IEC 60601-1-6:2010 (3rd Ed.) + Am1:2013
Medical electrical equipment – Part 1-6: General requirements for safety – Collateral Standard: Usability including IEC 62366: Application of usability engineering to medical devices.

IEC 60601-1-2:2007 (3rd Ed.)
Electromagnetic compatibility – Requirements and tests.

IEC 60601-1-2:2014 (4th Ed.)
Electromagnetic disturbances – Requirements and tests.

IEC 60601-1-3:2008 (2nd Ed.)
Medical electrical equipment – Part 1-3: General Requirements for Radiation Protection in Diagnostic X-Ray Equipment.

IEC 60601-1-3:2008 (2nd Ed.) + Am1:2013 (ed. 2.1)
Medical electrical equipment – Part 1-3: General Requirements for Radiation Protection in Diagnostic X-Ray Equipment.

IEC 60601-2-63:2012 (1st ed.)
Medical electrical equipment – Part 2-63: Particular requirements for the basic safety and essential performance of extra-oral dental X-ray equipment.

IEC 60601-2-63:2012 (1st ed.) + Am1:2017 (ed. 1.1)
Medical electrical equipment – Part 2-63: Particular requirements for the basic safety and essential performance of extra-oral dental X-ray equipment.

IEC 62366:2007 (1st Ed.)
Medical devices – Application of usability engineering to medical devices.

IEC 62366:2007 (1st Ed.) + Am1:2013
Medical devices – Application of usability engineering to medical devices.

IEC 62304:2006 (1st Ed.) + Ac:2008
Medical devices software – Software life-cycle processes.

IEC 62304:2006 (1st Ed.) + Am1:2015 (ed. 1.1)
Medical devices software – Software life-cycle processes.

IEC 60825-1:1993 (1nd ed.)
Safety of laser product – Part 1: equipment classification and requirements.

IEC 60825-1:2007 (2nd ed.)
Safety of laser product – Part 1: equipment classification and requirements.

EN-ISO 14971:2012
Medical Devices – Application of Risk Management to Medical Devices.

CAN/CSA-C22.2 No 60601-1:08
Canadian National deviations to IEC 60601-1.

CAN/CSA-C22.2 No 60601-1:14
Canadian National deviations to IEC 60601-1.

ANSI/AAMI ES60601-1:2005/A2:2010
US National differences to IEC 60601-1.

ANSI/AAMI ES60601-1:2005/I2012 and A1:2012
US National differences to IEC 60601-1.

CFR 21
Code Federal Regulation. Sub Chapter J.

CE 0051 Guarantees the compliance of X-MIND prime 3D with Directives 93/42/EEC (as amended), 2011/65/EU, 2006/42/EC.

Classifications

X-MIND prime 3D is an electrical medical X-ray device classified as class I type B according to EN 60601-1, with continuous operation at an intermittent load.

According to 93/42/EEC Medical Devices Directive, the equipment is classified as class II B.

According to Canadian MDR, the equipment belongs to class II.

According to FDA 21 CFR, the equipment belongs to class II.

6. PRE-INSTALLATION

The instructions indicated in this chapters and in the following ones enable to perform a correct installation in order to allow a regular operation of X-MIND prime 3D.
The supplier can provide the assistance and the necessary technical advice for pre-installation, all masonry works and the pre-installation phase are at the customer's charge and must be performed complying with the indications given below.

The requirements for a correct installation of X-MIND prime 3D are:

- minimum height of the room: 2.5 m (8.20') and a surface variable according to the configuration of X-MIND prime 3D to be installed
- No heating devices in close proximity of the unit
- the entries in the room, for the transport of the unit (after unpackaging), must have a minimum width of 65 cm (25.6").

6.1 Electrical setting up

The main electrical characteristics of X-Mind Prime 3D are:

- Single-phase grounding supply 110-240 V ~
- Frequency 50/60 Hz
- Power consumption 1.8 kVA (at 115 V)
  1.4 kVA (at 230 V)
- Current consumption 14.5 A (at 115 V)
  6 A (at 230 V)
- Apparent line resistance 0.2 Ω (96-197 V)
  0.5 Ω (197-264 V)
- Line voltage regulation < 3 % at 99 V

Warning
The unit is classified as **"Permanently Installed"** according to EN 60601-1, meaning that the mains cable shall be permanently connected to the mains line.
DO NOT connect the unit to the power using a detachable plug , to avoid compromising the electrical safety.

Warning
The unit is classified as **"IPX0"** according to EN 60529, meaning that the units provides **NO protection against the ingress of liquids**

The unit must be connected to a differential magneto-thermal switch, to separate the unit from the mains line in case of maintenance operations. This switch must comply with the electrical regulations in force in the country of installation.

The unit comes equipped with a 3-meters mains connection cable (13 AWG, 2.63 mm^2) already connected to the unit mains terminals.

The installer is responsible for verification of the mains line characteristics in the installation site. The minimum recommended wire gauge is:

- 1.5 mm^2 (16 AWG) for 200-240Vac nominal range power supply input.
- 2.63 mm^2 (13 AWG) for 110-200Vac nominal range power supply input.

The general grounding must comply with the rules in force; a wrong quality of the grounding could be dangerous for the patient and operator's safety and might cause malfunction of the unit.

Other than the power supply, X-Mind Prime 3D provides the following connections. All connections are located in the base of the unit and are protected by a metallic cover.

- **RJ45 Ethernet connection for 3D detector**: dedicated line for point-to-point connection from the 3D detector to the host PC. A Cat 6 cable (5m long) is supplied with the unit. In case a longer cable is needed, make sure the cable is Cat 6 or better.
- **RJ45 Ethernet connection for ceph detector and system interface**: point-to-point connection from the unit to the host PC. A Cat 6 cable (5m long) is supplied with the unit. In case a longer cable is needed, make sure the cable is Cat 6 or better.
- **READY light**: The signal is active when the unit is ready to perform the exam. Normally Open dry Contact, maximum load 24V, 40W. Contacts X11-1 and X11-2
- **X-RAY ON light**: The signal is active during X-Ray emission. Normally Open dry Contact, maximum load 24V, 40W. Contacts X11-3 and X11-4

The unit only provides dry contacts relative to the above mentioned functions. Power supply for the relevant devices has to be provided externally, making sure not to exceed the indicated ratings.

- **Remote X-RAY button**: An external pushbutton can be connected so that the operator can start exposure from outside the exam room. It is mandatory to use a **MOMENTARY pushbutton** in order to guarantee “dead man” operation. The standard X-ray button supplied with the unit has the above characteristic. Contacts X51-3 and X51-4. Only a dry contact shall be connected to this input.

Warning

It is installer’s responsibility to check the characteristics of the remote X-ray button.

No current or voltage must pass through remote control hand switch.

Wrong connections may damage the unit.

See paragraph 7.3 for details of the connections.

6.2 Packaging

The unit is delivered on one pallet containing three cardboard boxes

Contents	Packing dimension	Weight	
		Net	Gross
Complete unit	150x100x H145 cm (59.1"x39.4"x57.1")	143 kg (315 lbs)	198 kg (436 lbs)
Main unit	122x100x H63 cm (48"x39.4"x24.8")	101 kg (223 lbs)	130 kg (287 lbs)
Ceph arm	150x92x H66 cm (59.1"x39.4"x26")	22 kg (48 lbs)	26 kg (57 lbs)
Workstation	100x26x H63 cm (39.4"x10.3"x26")	20 kg (44 lbs)	22 kg (48 lbs)

Note
A shock detector is applied to the packaging.

Upon receipt of the unit, check that the sensor has not been activated.
In case the sensor has been activated, immediately notify the forwarder and sign the delivery note as “Provisionally accepted”.

Warning
Acteon will not bear any responsibility for damages caused to the equipment due to improper unpackaging procedure, and for the relevant costs.

Note
The package will be used as a tool during the initial steps of the installation. Do not discard the packaging until installation has been completed and unit is fully operational.

6.3 Space requirements

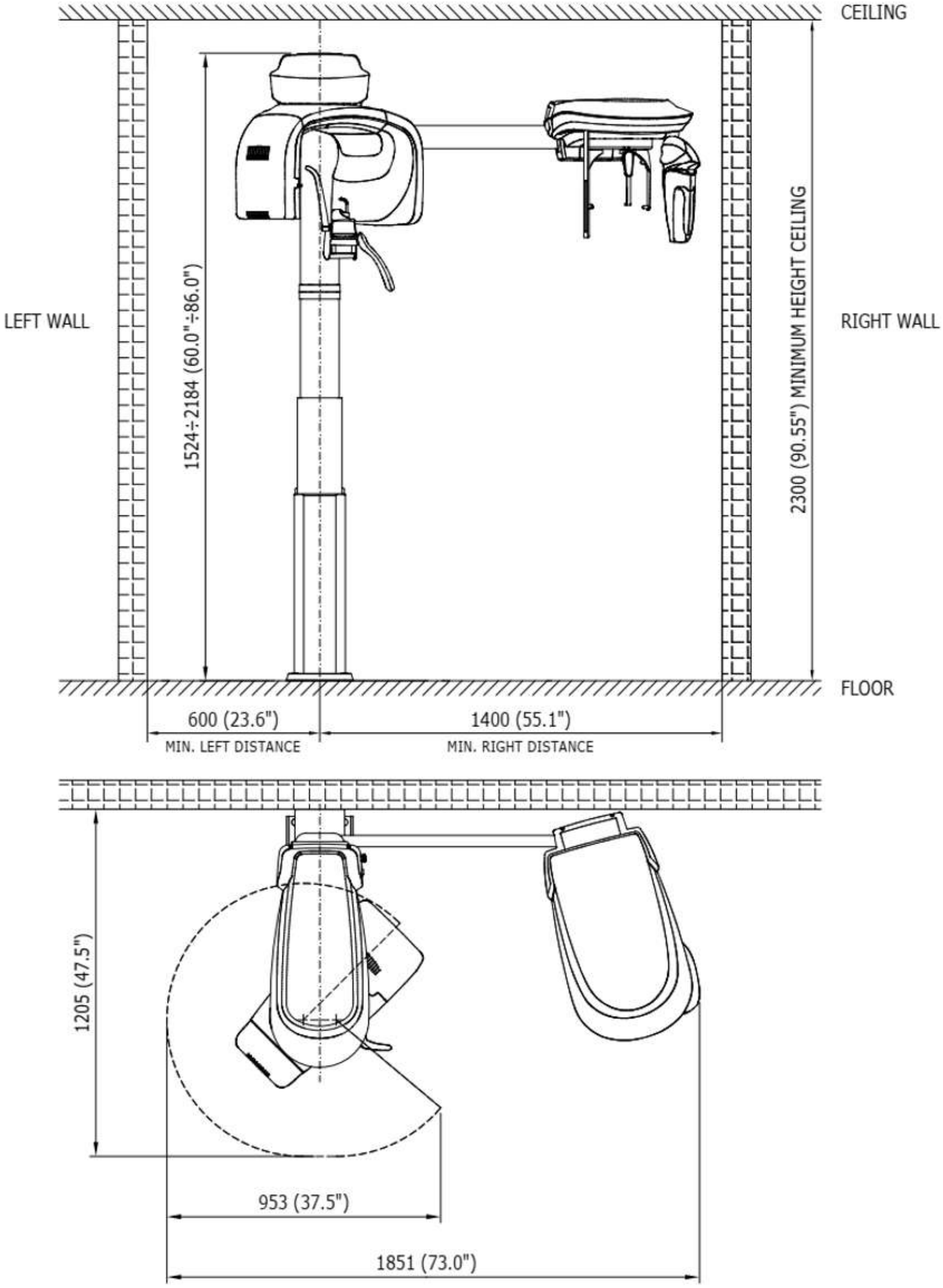


Figure 8

6.4 Drilling templates

Note

Although it is recommended to use the package as a tool to install the X-Mind Prime 3D, here following the indication of the drill layout for the standard height in case it is necessary to prepare the room before you receive the unit.

The unit can be fixed in different ways:

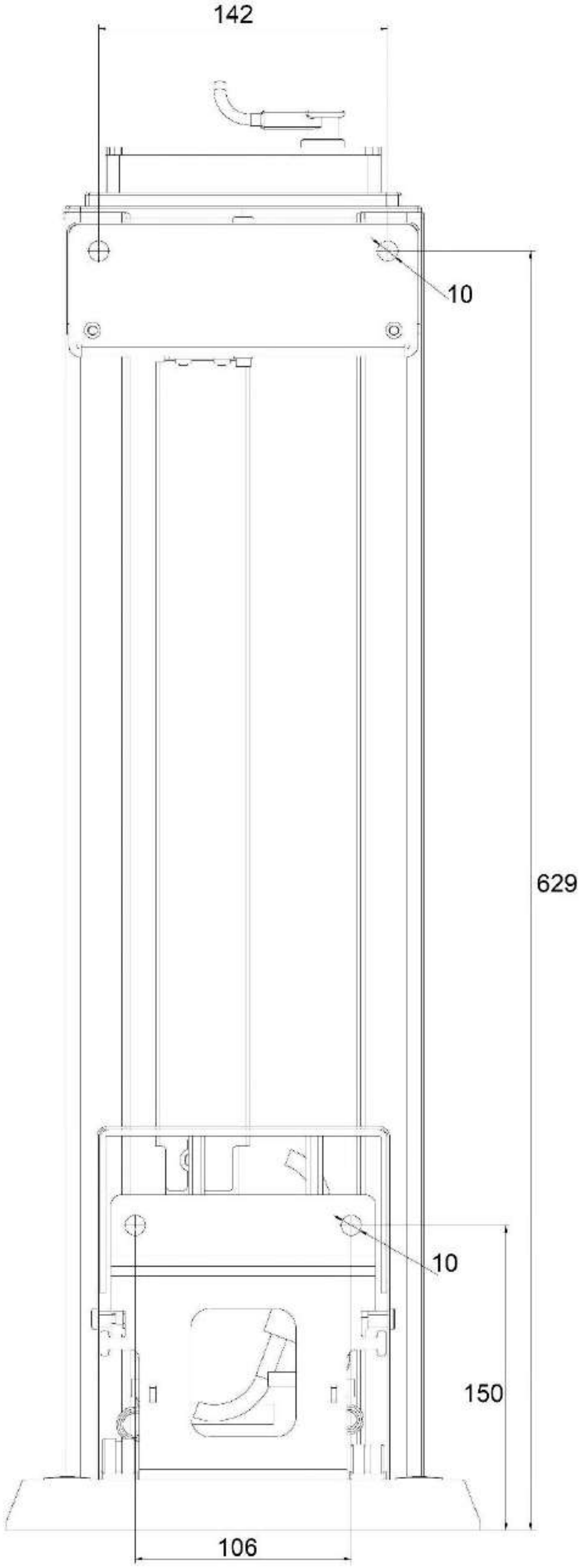
- To the wall only, using the upper bracket (2 screws) and lower bracket (2 screws)
- To the wall and floor using the upper bracket (2 screws), lower bracket (2 screws) and the floor plate (4 screws). This installation is recommended when the wall strength is uncertain.
- A 16” bracket adapter is available for dual-stud installation on wooden walls.

Note

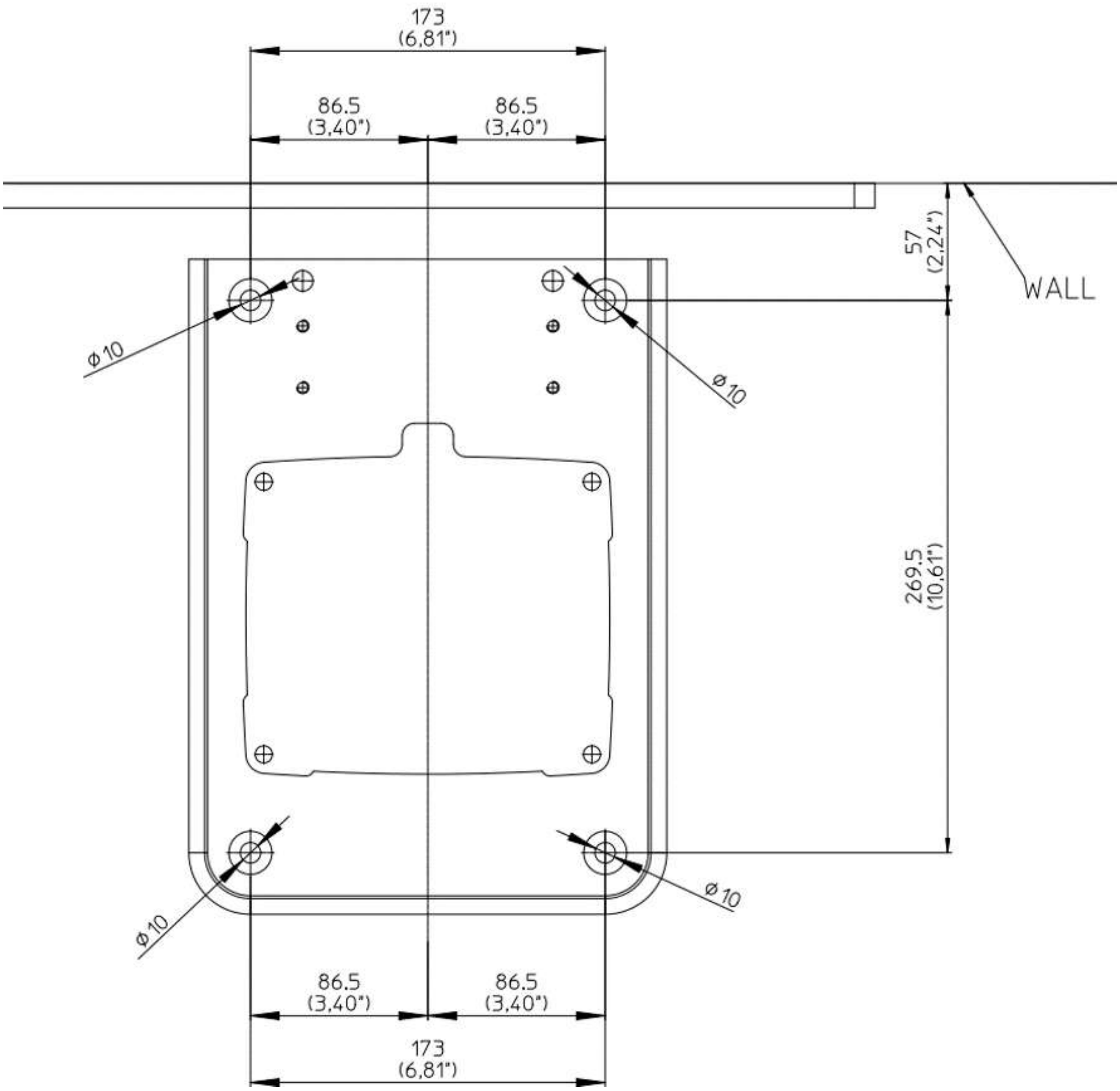
A free-standing floor plate is also available for installations where drilling holes in the walls is not possible. Although this kind of installation provides the necessary structural safety, the unit might have higher vibrations and oscillations.

Warning for free standing floor mounted unit

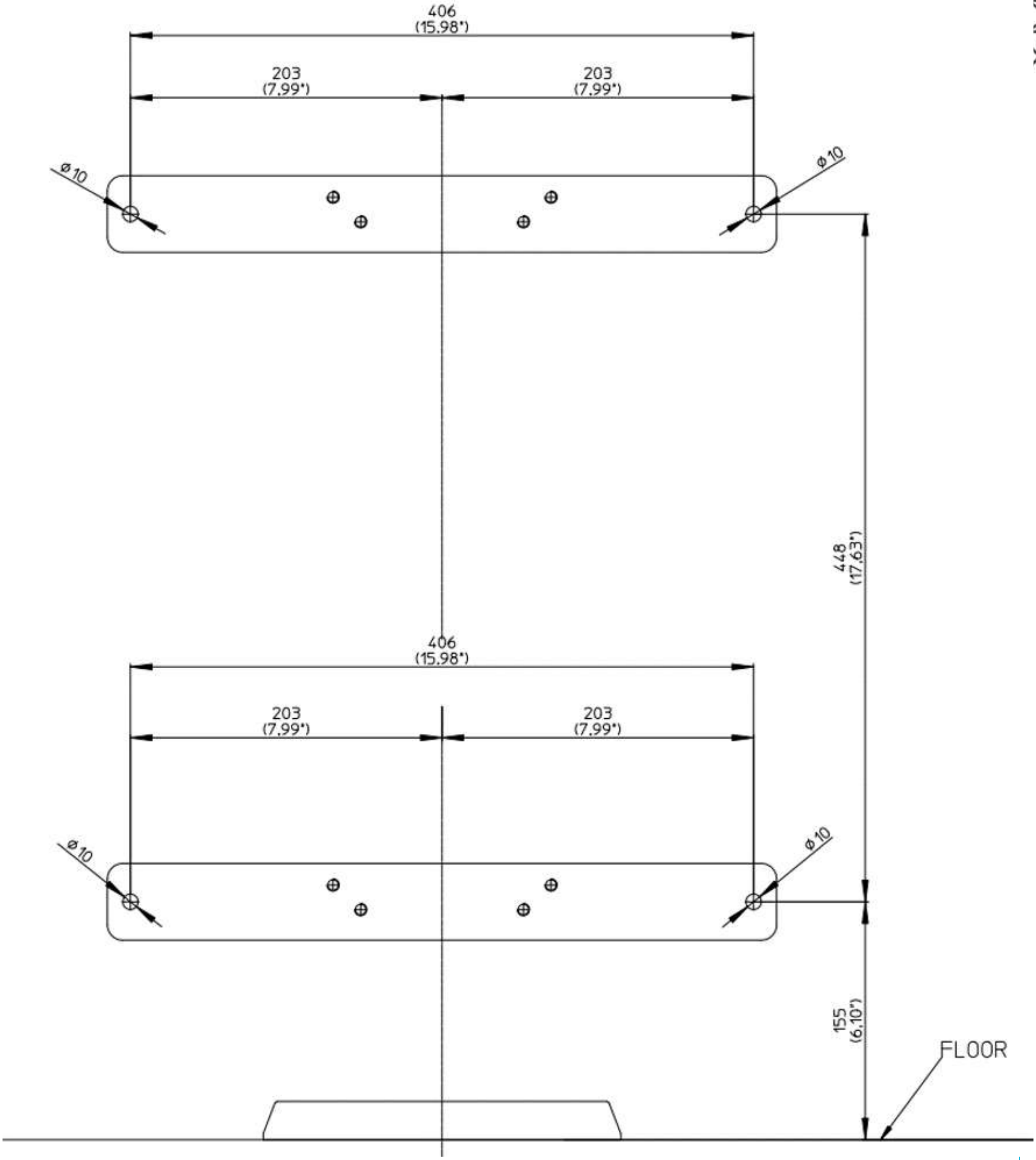
In case the unit shall be moved for service or other extraordinary operation, maximum caution shall be taken to prevent the unit from tilting and falling to the ground.



Standard Wall mount



Floor plate mount



Wall mount with 16" adapter

Warning

It is responsibility of the installer to verify the type of wall and use the correct fixing anchor.

Here following some suggestion that can help installer to find the correct method depending on wall and installation type.

- **Standard wall installation .** Unit is fixed using two screws on the upper bracket and two screws on the lower bracket. Extraction force on each anchor is about **55 kg**.
  - In case of full concrete (class C20/C25 thickness >200mm): drill with Ø8 + Fischer Anchor FAZ II 8/10 (ordering code 6604100100). Tightening force 20Nm.
  - In case of full bricks: drill Ø14 + chemical Anchors FIS V-BOND 300T + Steel Insert FIS E 11X85 M6 + screws M6x25 (ordering code 6604100200). This solution permit to avoid the use of threated bars. Tightening force 4Nm.
  - In case of hollow brick: drill Ø16 + chemical Anchors FIS V-BOND 300T Plastic anchor FIS H 16X85 K + Steel Insert FIS E 11X85 M6 (ordering code 6604100200). This solution permit to avoid the use of threated bars. Tightening force 2Nm.

- **Wall-floor installation. This installation is recommended when the wall strength is uncertain.** Unit is fixed using two screws on the upper bracket, two screws on the lower bracket and four screws on the base plate. Extraction force on wall anchors is about **46 kg** and on floor anchors is **73 kg**.
  - In case of full concrete (class C20/C25 thickness > 200mm): drill with Ø8 + Fischer Anchor FAZ II 8/10 (ordering code 6604100100). Tightening force 20Nm.
  - In case of full bricks: drill Ø14 + chemical Anchors FIS V-BOND 300T + Steel Insert FIS E 11X85 M6 + screws M6x25 (ordering code 6604100200). This solution permit to avoid the use of threated bars. Tightening force 4Nm.
  - In case of hollow brick: drill Ø16 + chemical Anchors FIS V-BOND 300T Plastic anchor FIS H 16X85 K + Steel Insert FIS E 11X85 M6 (ordering code 6604100200). This solution permit to avoid the use of threated bars. Tightening force 2Nm.

- **Wall installation with 16” adapter brackets (optional kit, p/n 6104101200).** Unit is fixed using two screws on the upper bracket and two screws on the lower bracket. Extraction force on each anchor is about **25 kg**.
  - Anchors shall be chosen according to the wall stud material.

- **Free-standing floor plate (optional kit p/n 6104103000)**. No fixation is necessary.

Warning

Installation using only the 4 base plate holes doesn't provide structural stability and is STRICTLY FORBIDDEN

7. INSTALLATION

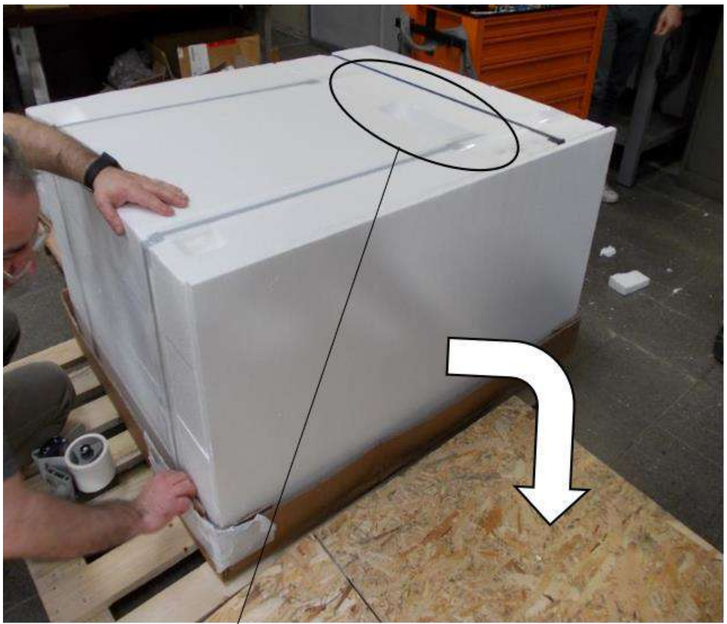
Note
The mechanical mounting consists in fixing the unit to the wall, install the ceph arm and complete the installation with few operations. Most of the adjustments are carried out at the factory.
In some installation phases it’s recommended to be in two techniciansi.

7.1 Mechanical installation

1. Remove the straps and place the packaging of the Ceph arm on the floor **(Warning! Don’t overturn the box to avoid damaging the contents)** This should be done by two operators.

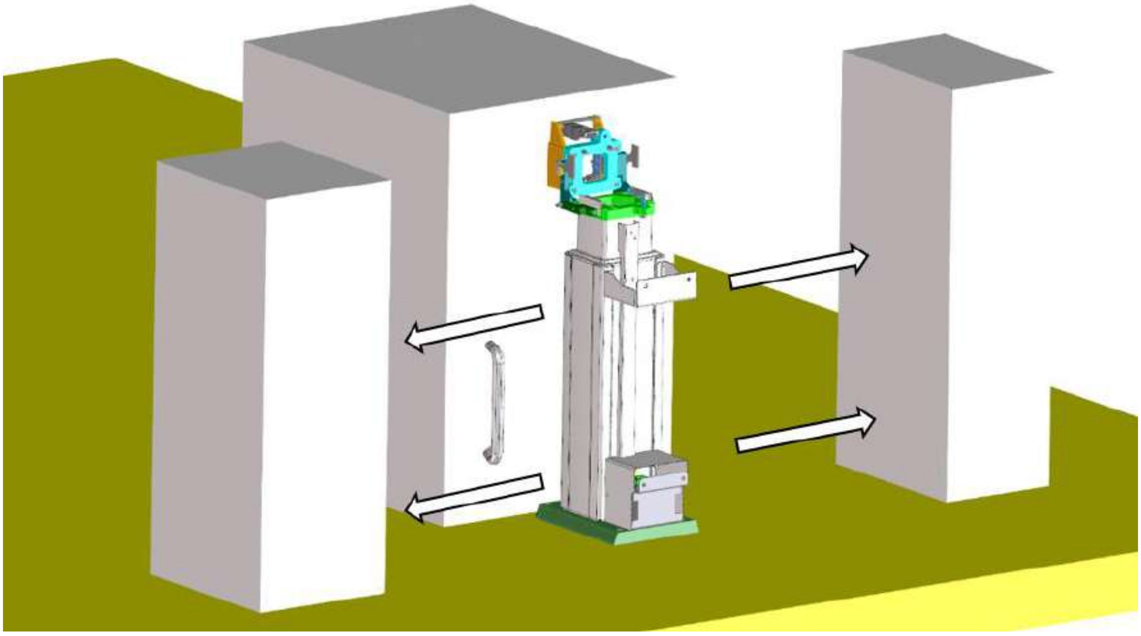
Warning
Pay attention to the box containing the workstation.

2. Remove the carton box from the packaging of the Pan machine and turn the package in the direction of the arrow, leaning on the floor.

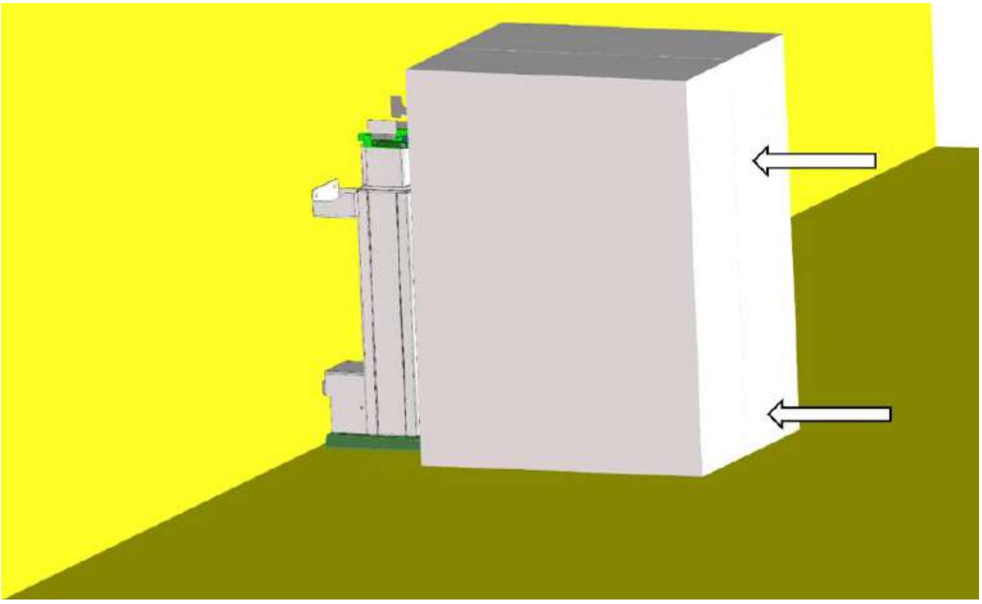


Warning! The handle compartment must be downwards after tilting

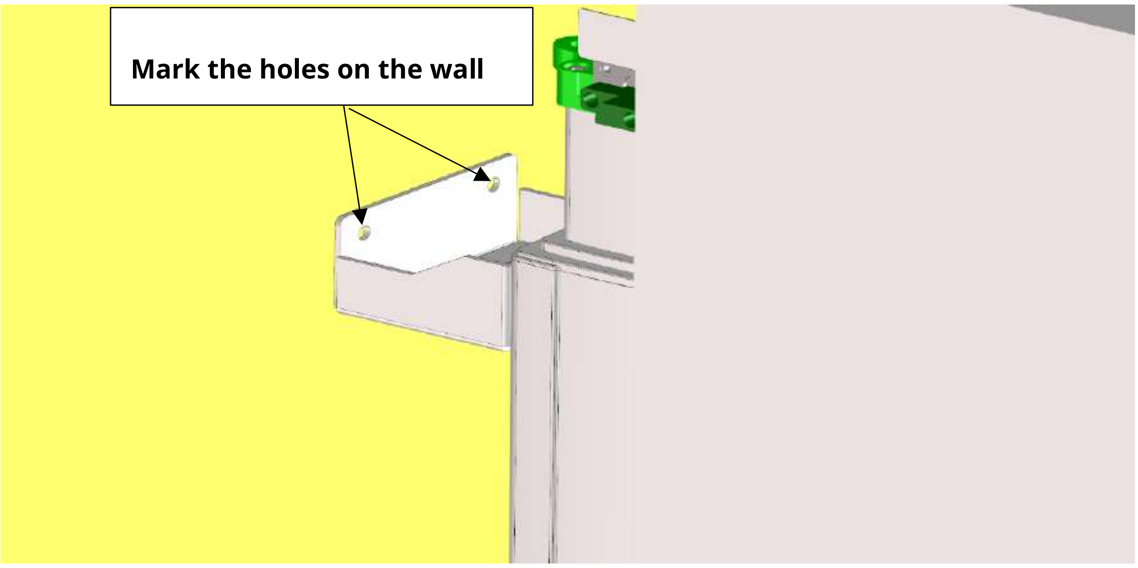
3. Cut the straps and remove the polystyrene rear sections

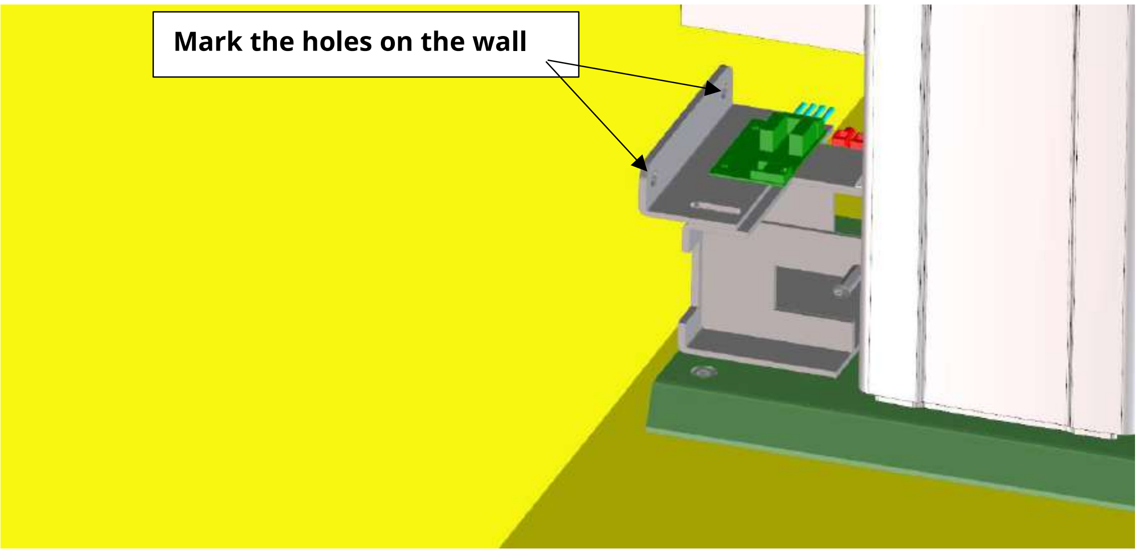


4. Slide the packaging to the wall in the position where the Unit will be installed

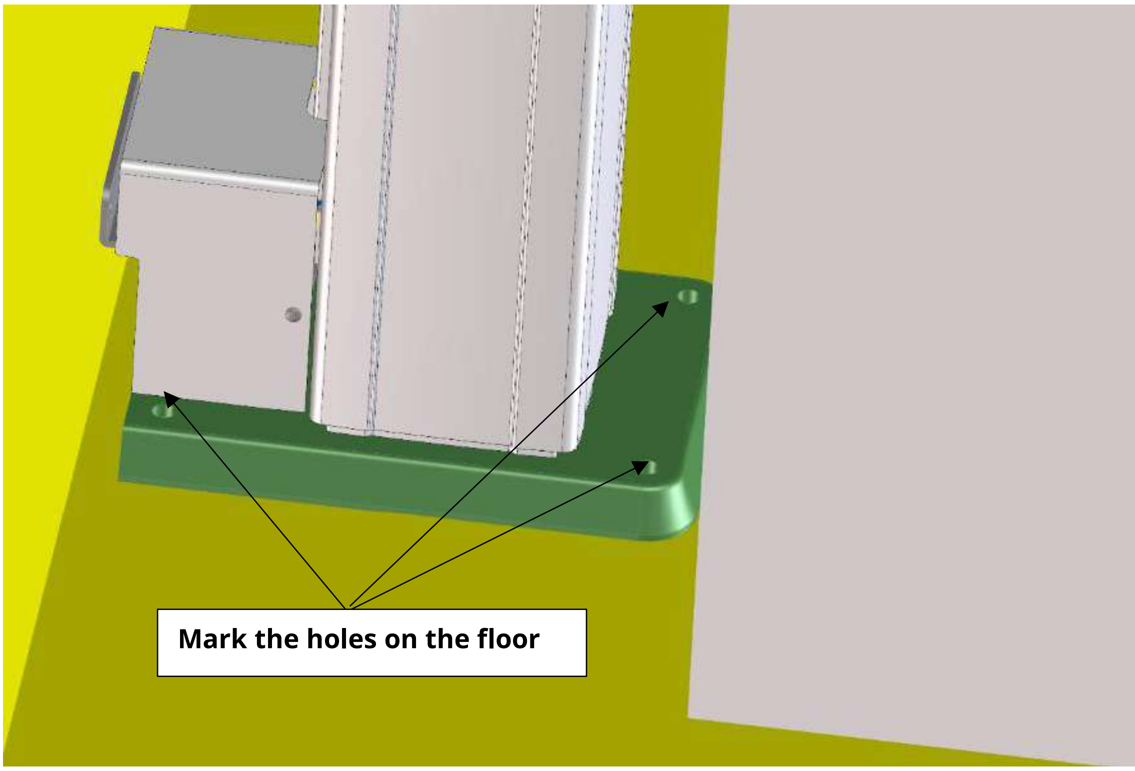


5. Push the package until the upper and lower wall bracket of the system are in contact with the wall, then mark the position of the screw holes on the wall, alternatively, use the appropriate template to mark the holes. Note: the standard fixing includes the upper and lower wall brackets, alternatively you can fix using the upper bracket and the holes in the floor base.

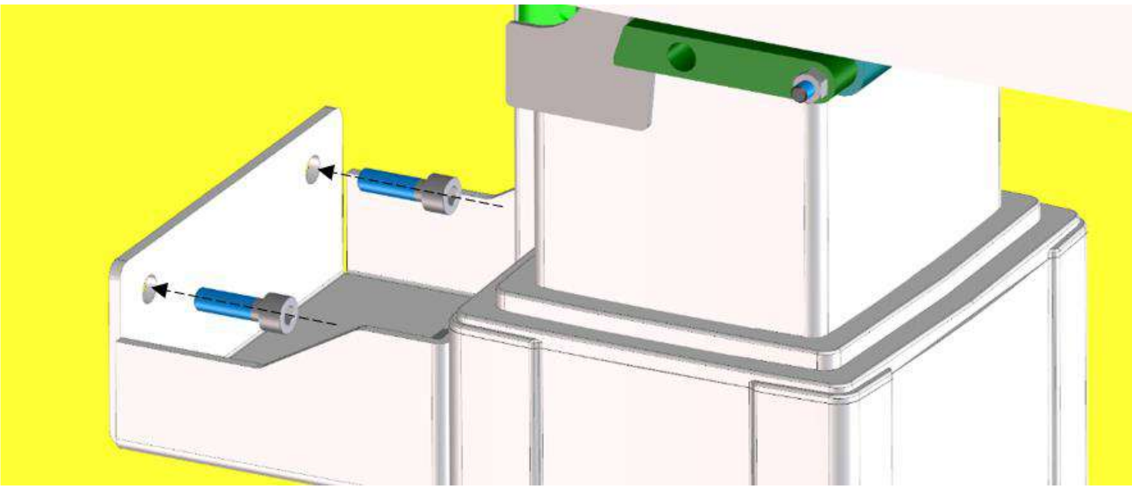


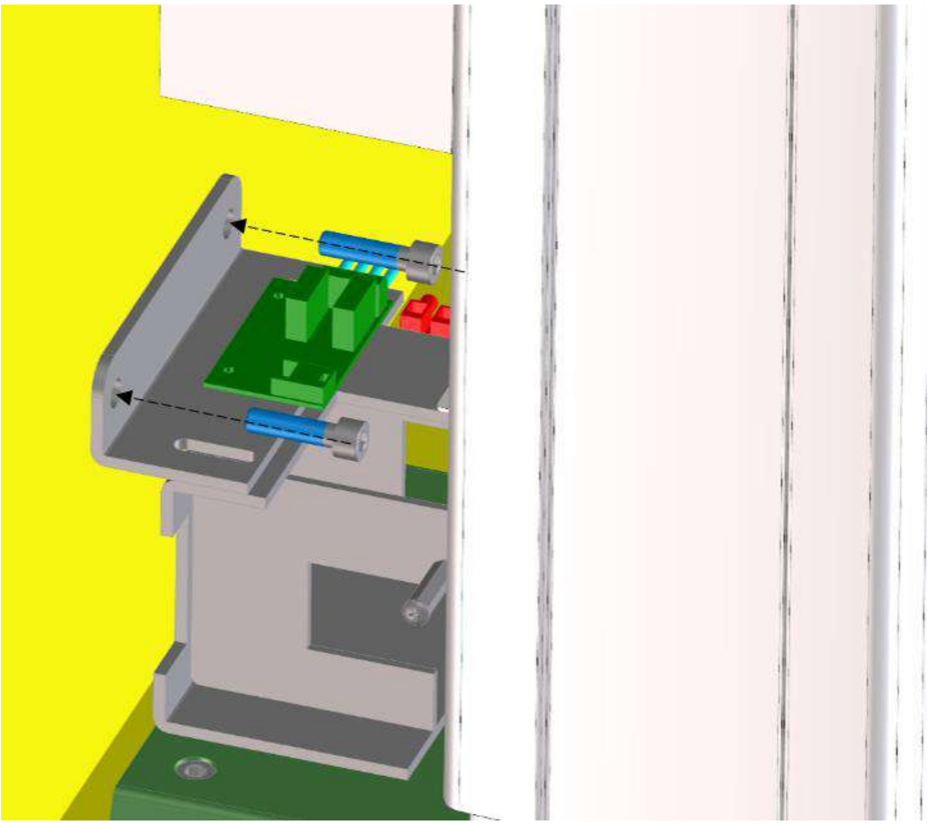


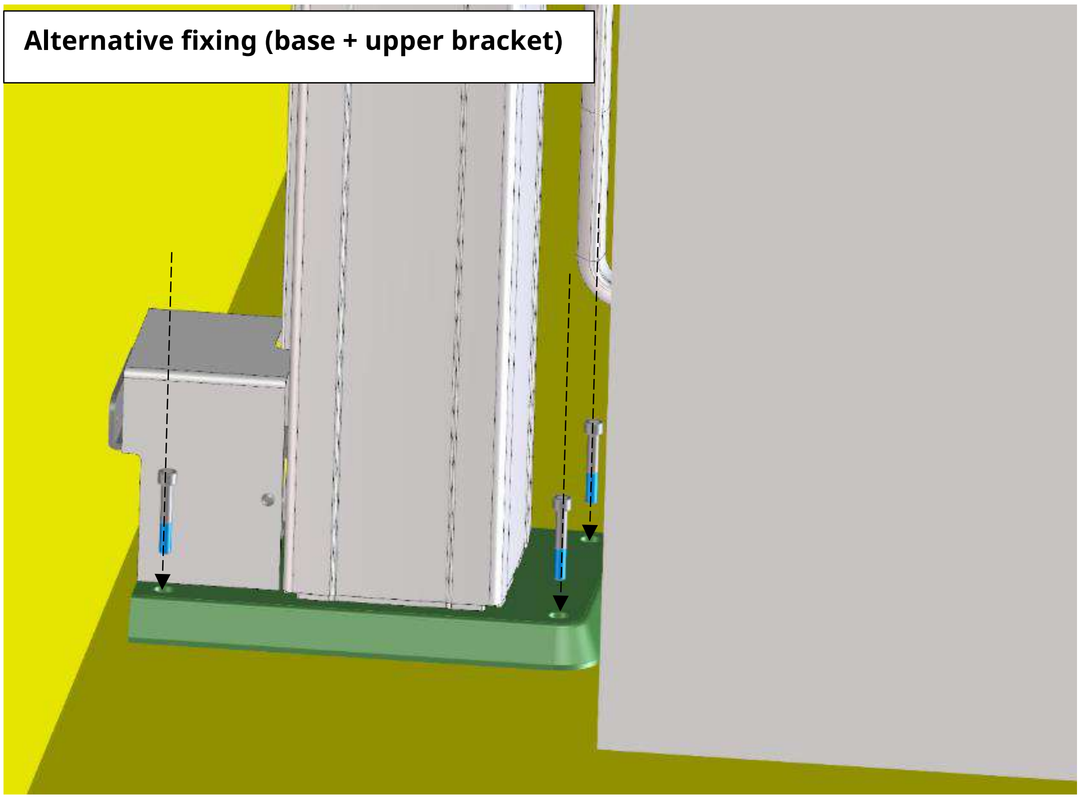
6. If necessary, mark the holes for fixing the base to the floor.



7. Move back the packaging, drill the wall and, if necessary, the floor, put the dowels, reposition the packaging against the wall and secure the wall bracket and the base plate with the screws.





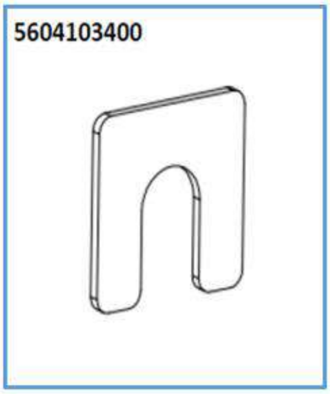

Alternative fixing (base + upper bracket)

Note

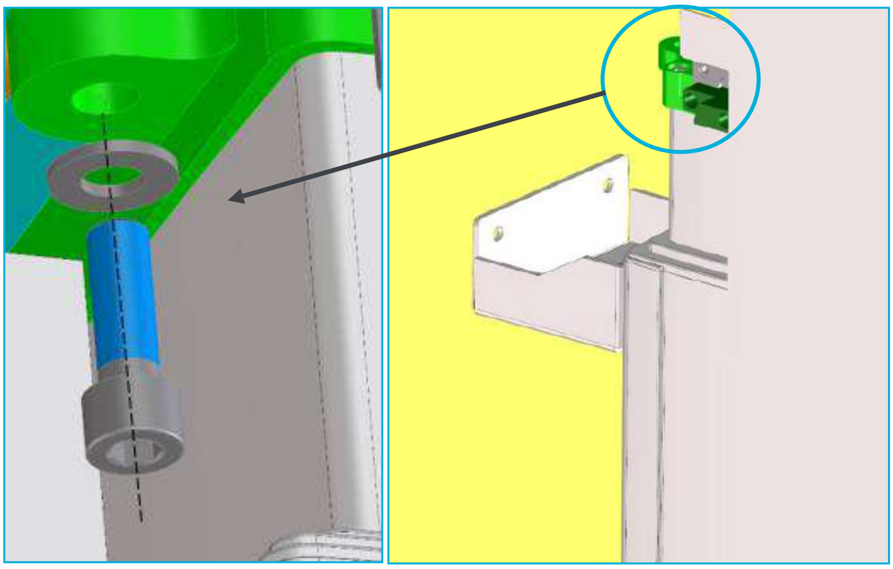
The theoretical distance of the ceph arm from the wall is 11mm. In the presence of irregular wall it's good to prescribe the use of a C washer (code 5604103400) before attaching the ceph arm to the machine. One C washer is already glued from factory.

Supplied with Prime Ceph there are 2 C washers (code 5604103400) to tilt the fixing of the column and move the ceph arm away from the wall (each mm on the column moves the ceph about 1 cm away).

The C shape allows it to be applied even when the column is already screwed to the wall.



8. Remove the screw behind the column.



9. Grab the package and lift until the coupling system has engaged the locking bars on both sides, (see *Figure* **9**, *Figure* **10**, *Figure* **11**).
   NOTE : The force necessary to lift the unit is about 20kg, so that a single technician can be enough to install the unit

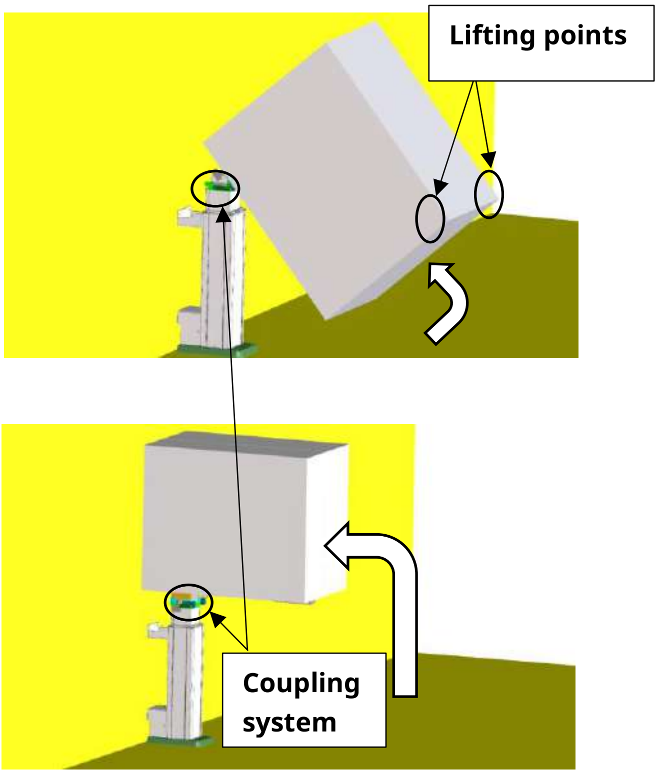


Figure 9

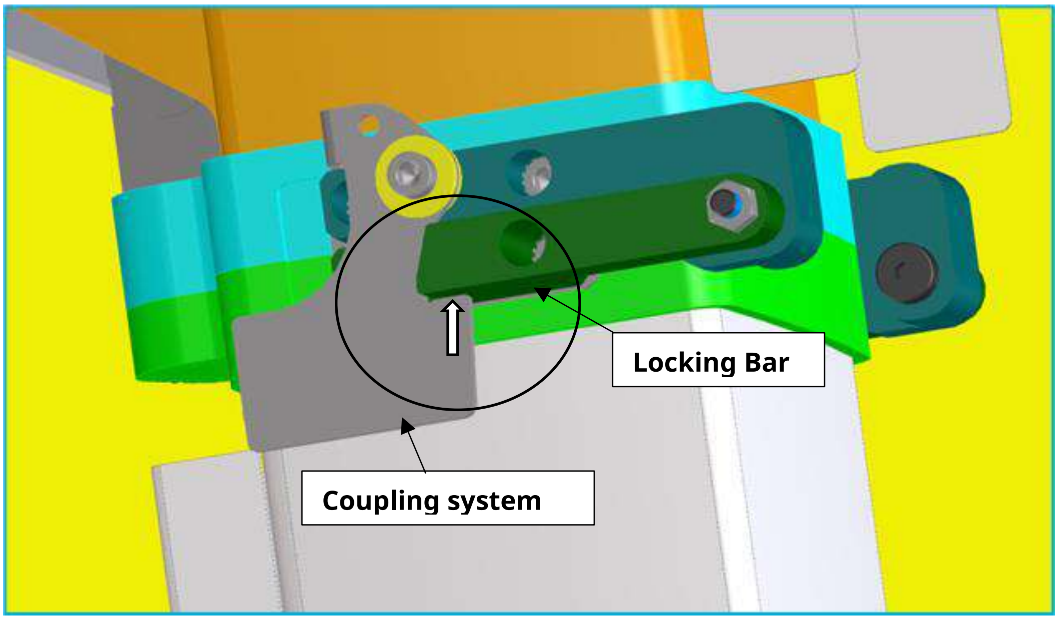


Figure 10

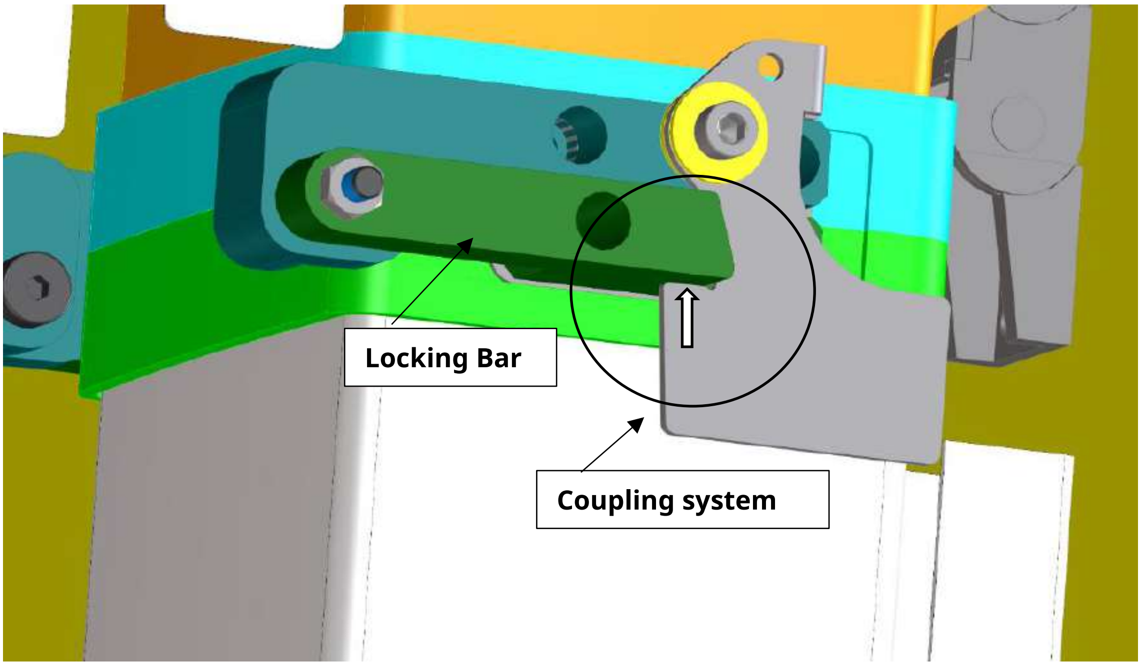


Figure 11

10. Lock the tilting movement of the machine head of the column with the appropriate screw

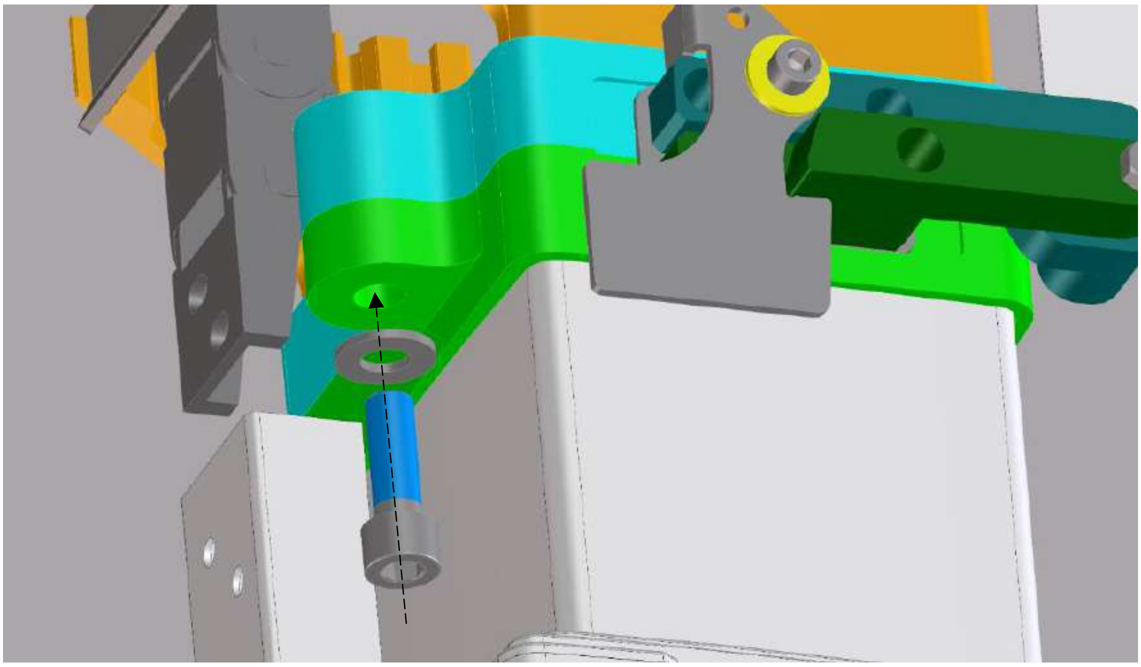


Figure 12

11. Cut the straps that join the two polystyrene elements and remove them. WARNING : inside the polystyrene elements, you can find the accessories of the machine and the wall plate cover)

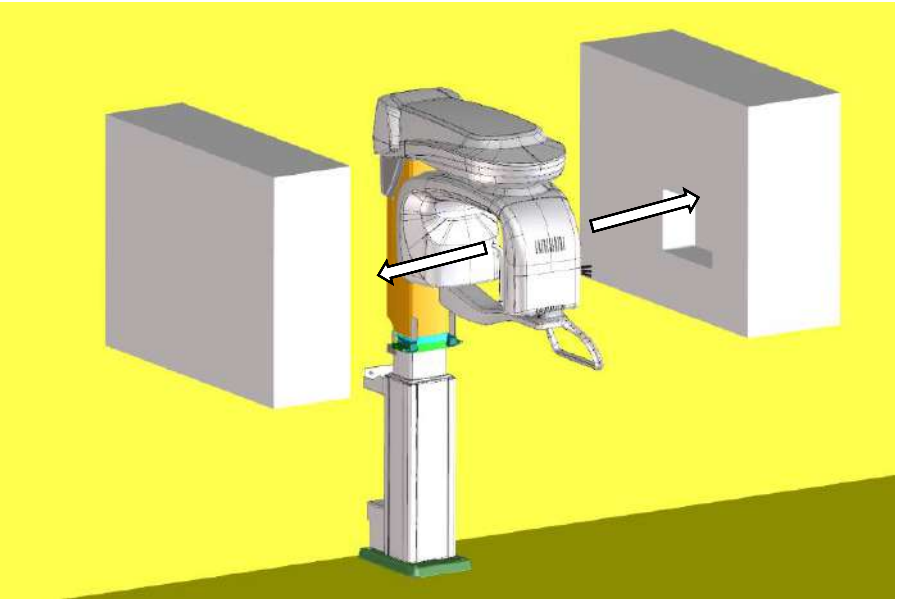


Figure 13

12. Remove the two hinges from the machine and store them in the upper fixing bracket of the column.

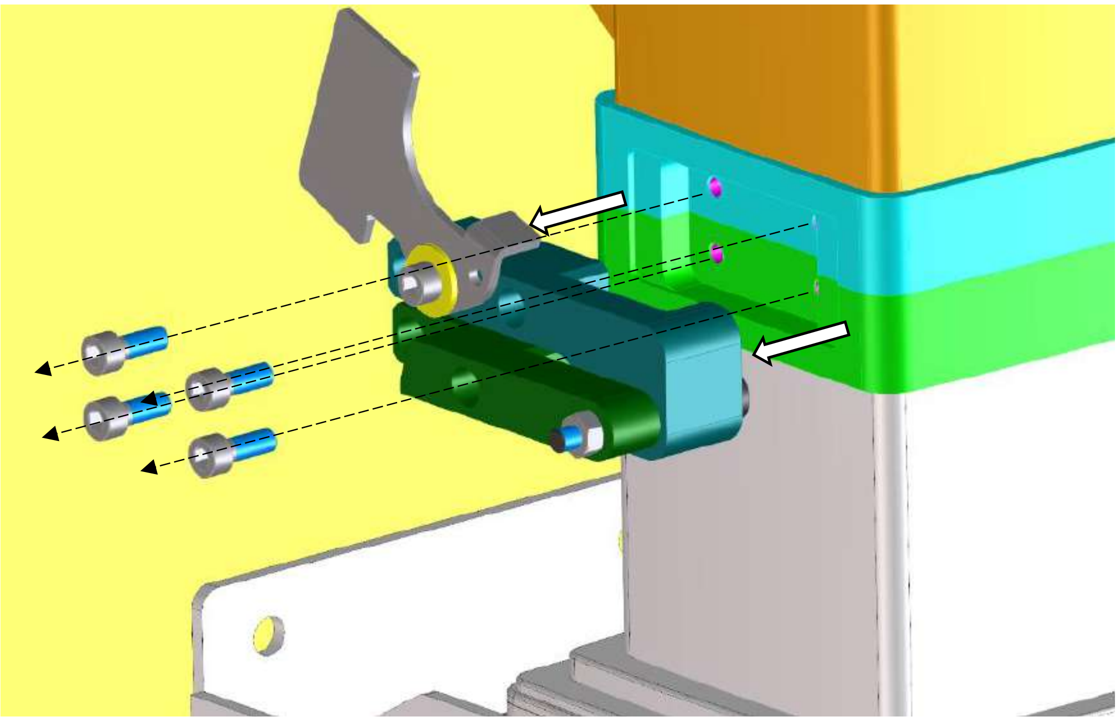


Figure 14

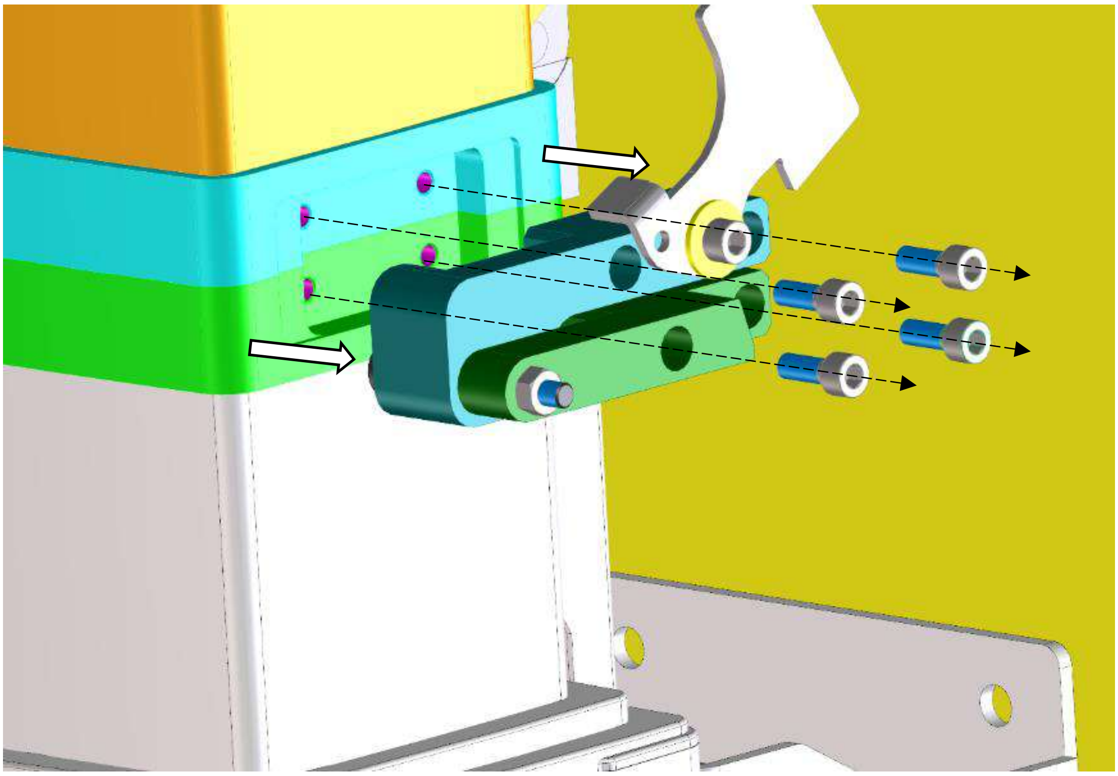


Figure 15

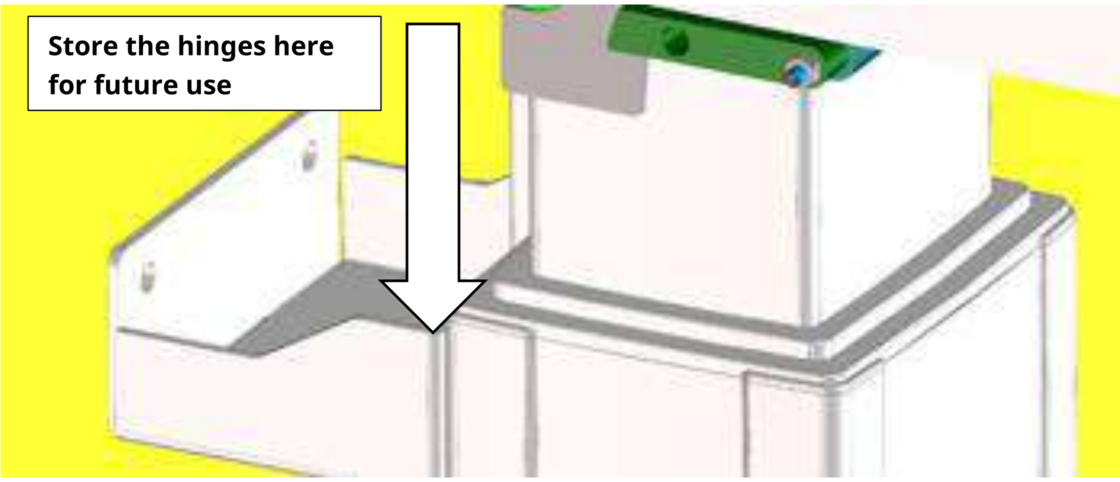


Figure 16

13. Fit the two joint locking plates using the same screws that fix the hinge.

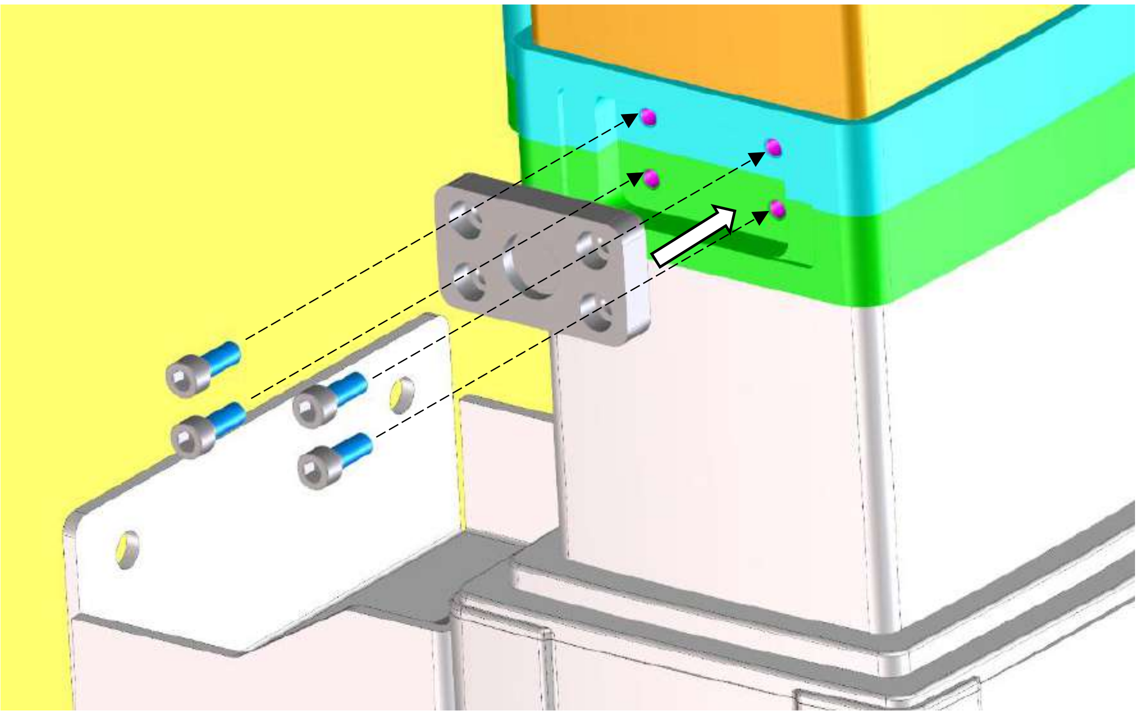


Figure 17

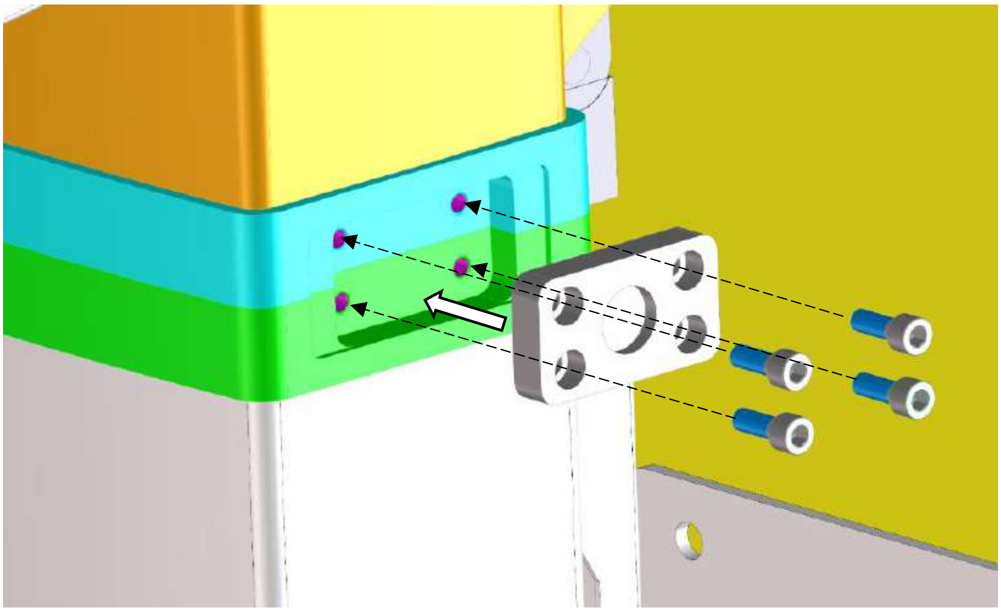


Figure 18

14. Apply the two covers on the locking plates by means of the magnets

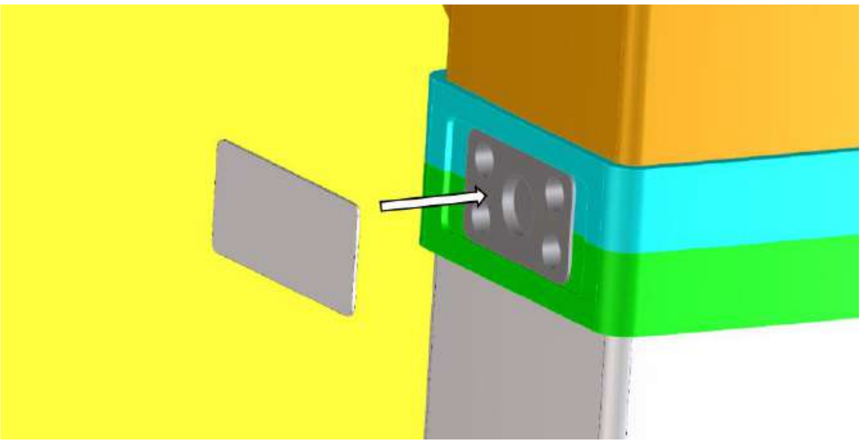


Figure 19

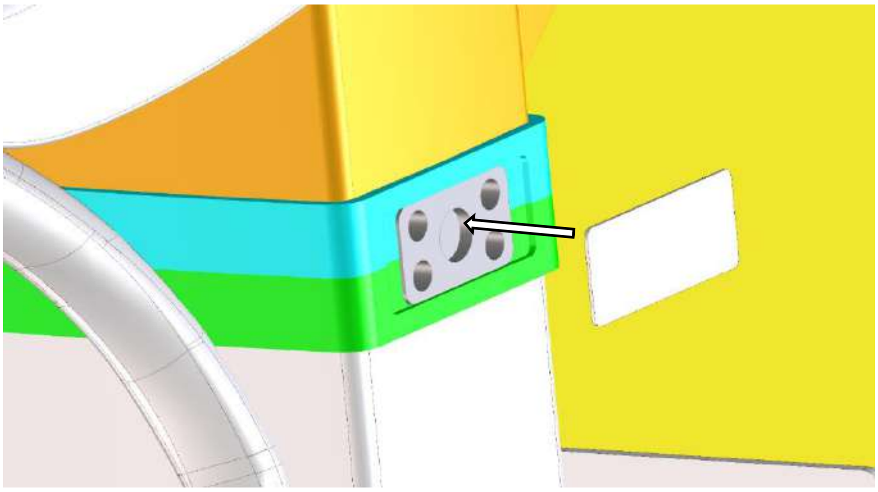


Figure 20

15. Remove the upper machine cover

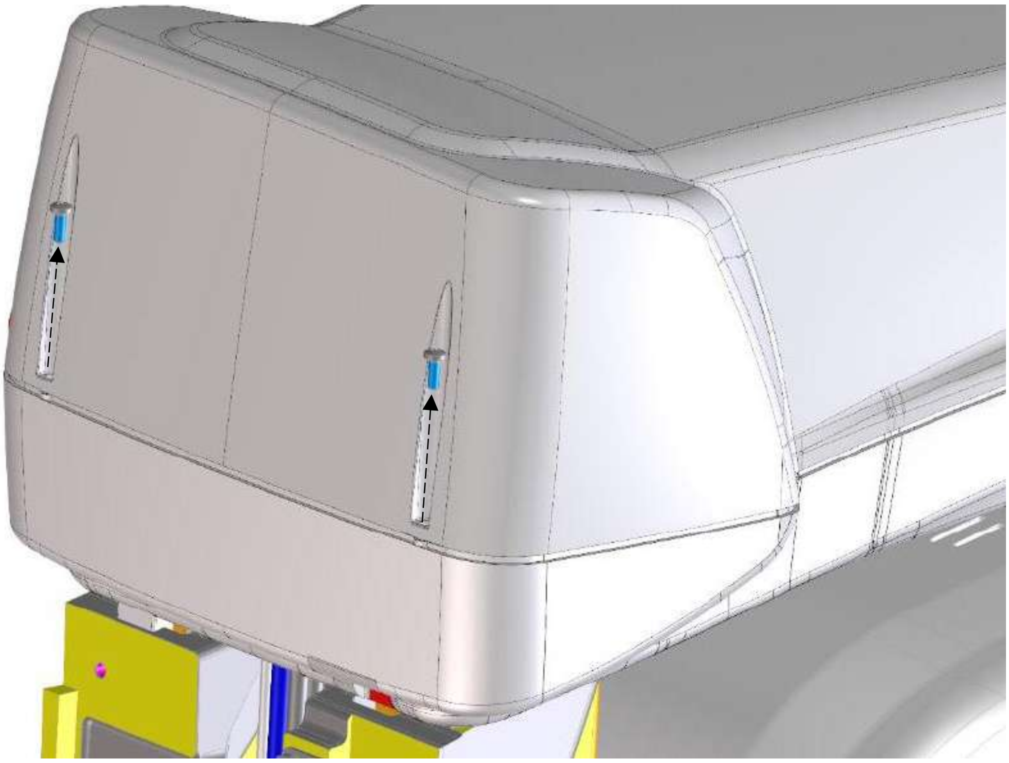


Figure 21

16. Remove the rotation locking bracket **being careful not to hit the optical sensor near here.**

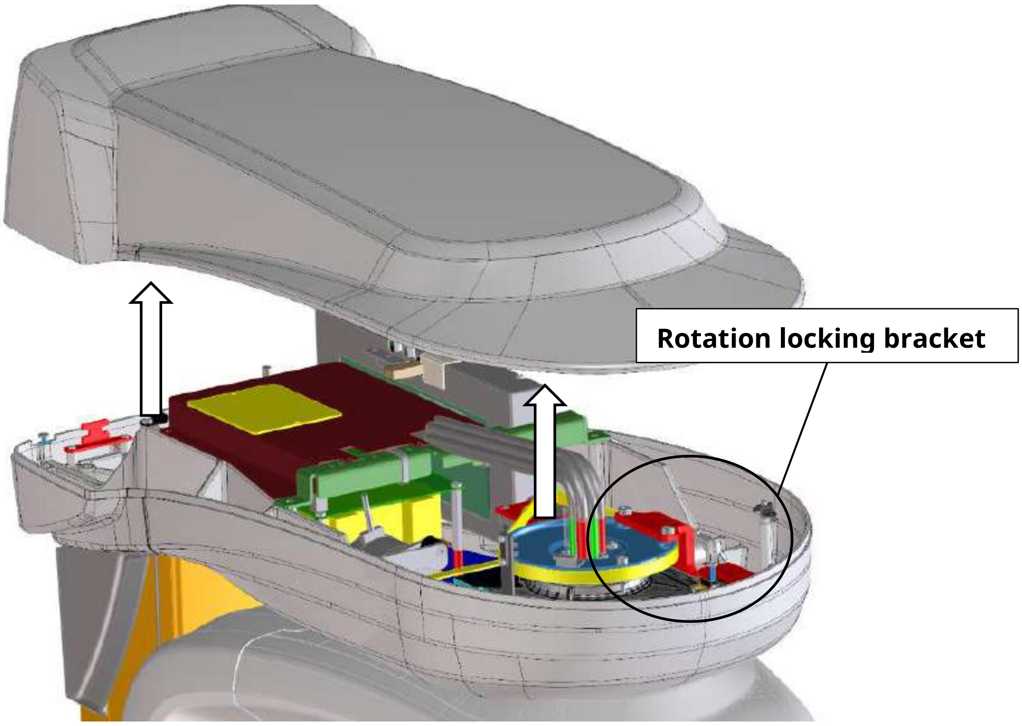


Figure 22

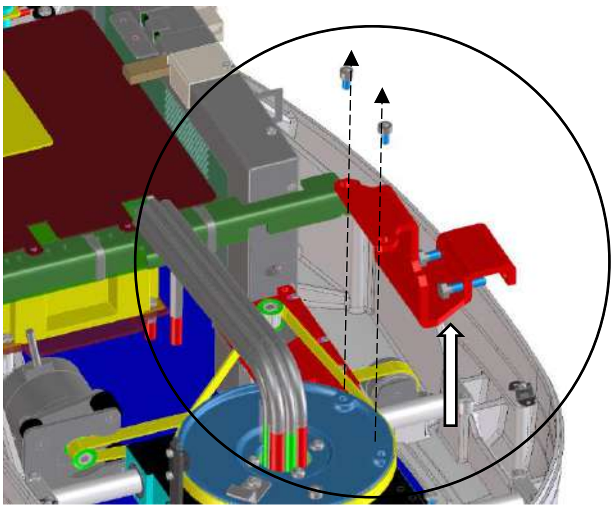


Figure 23

17. Remove the carton box from the Ceph package and remove the 2D sensor from the special seat in the polystyrene packaging.

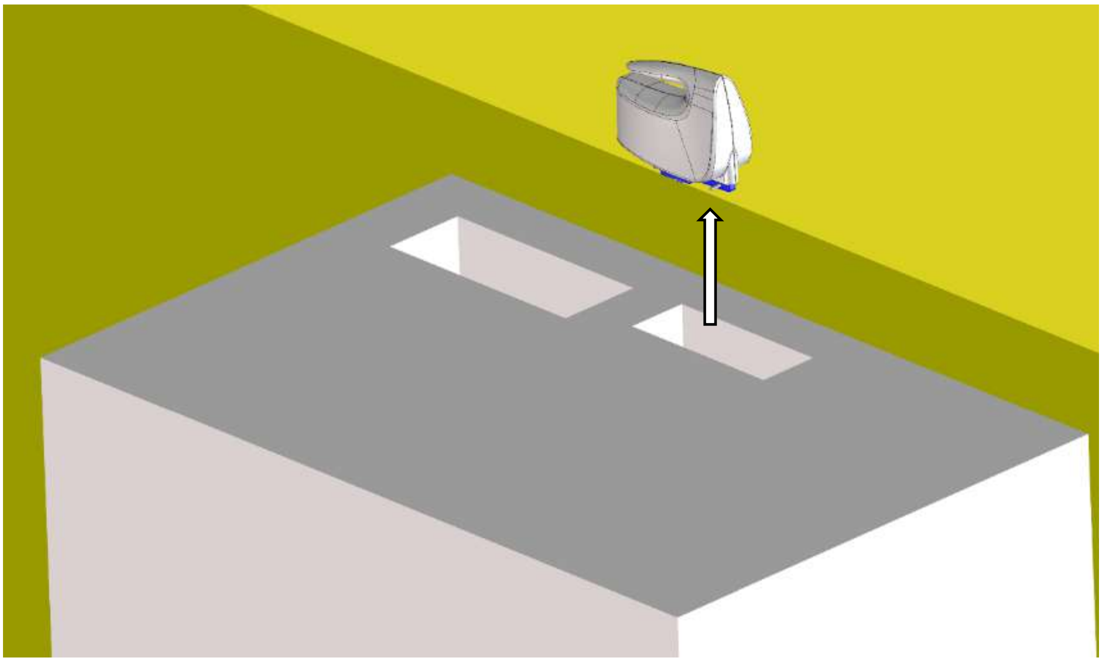


Figure 24

18. Open the packaging and remove the Ceph arm using the handle and the support arm as gripping points. **DO NOT GRAB THE CEPH DEVICE IN ANY OTHER POINT**.
    This should be done by two operators

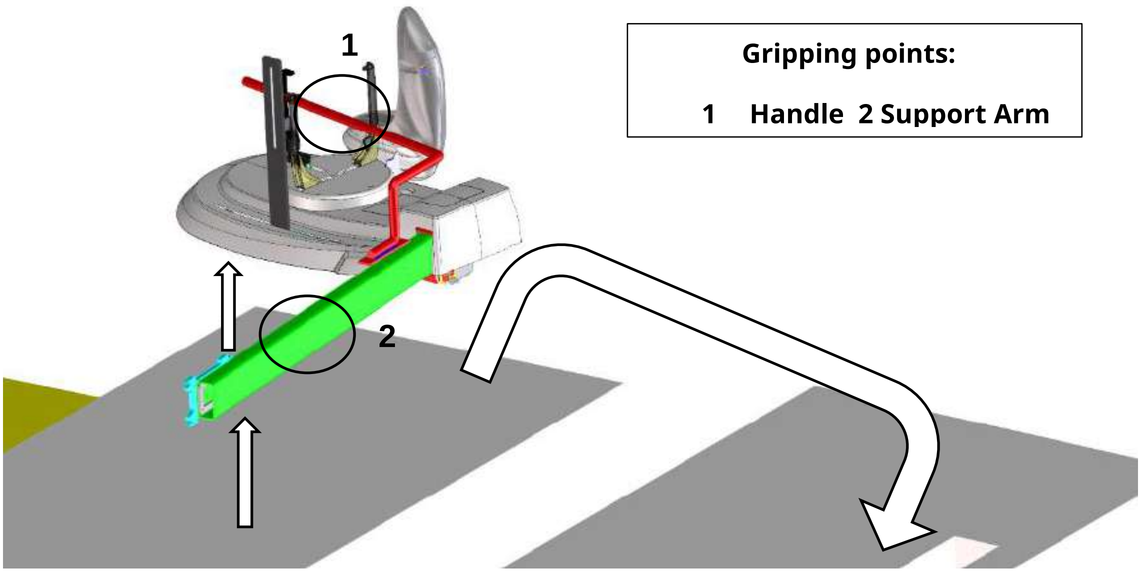


Figure 25

19. Using the handle and the support arm as gripping points, lift and rotate by 180 ° the Ceph arm approaching the rear of the machine. **(Warning! don't grab the arm from ceph clamps, secondary collimator and sensor holder)**

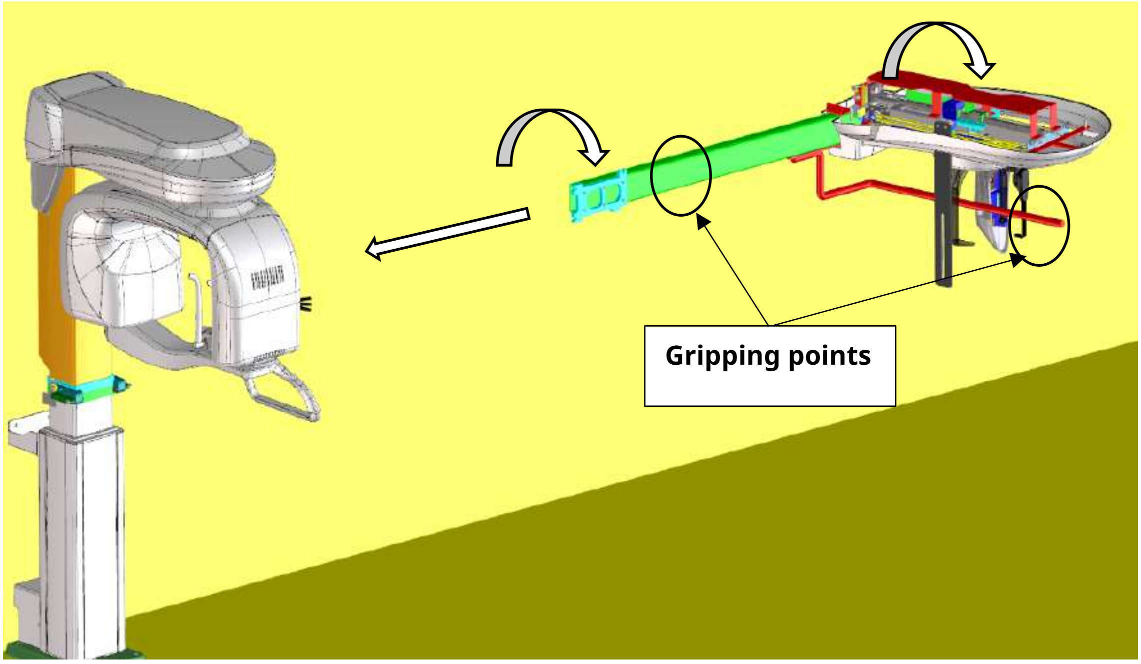
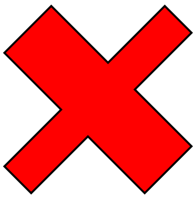
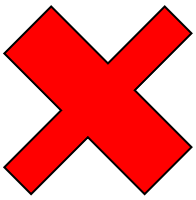


Figure 26





20. Insert the Ceph arm in its seat making the movement described in the following images

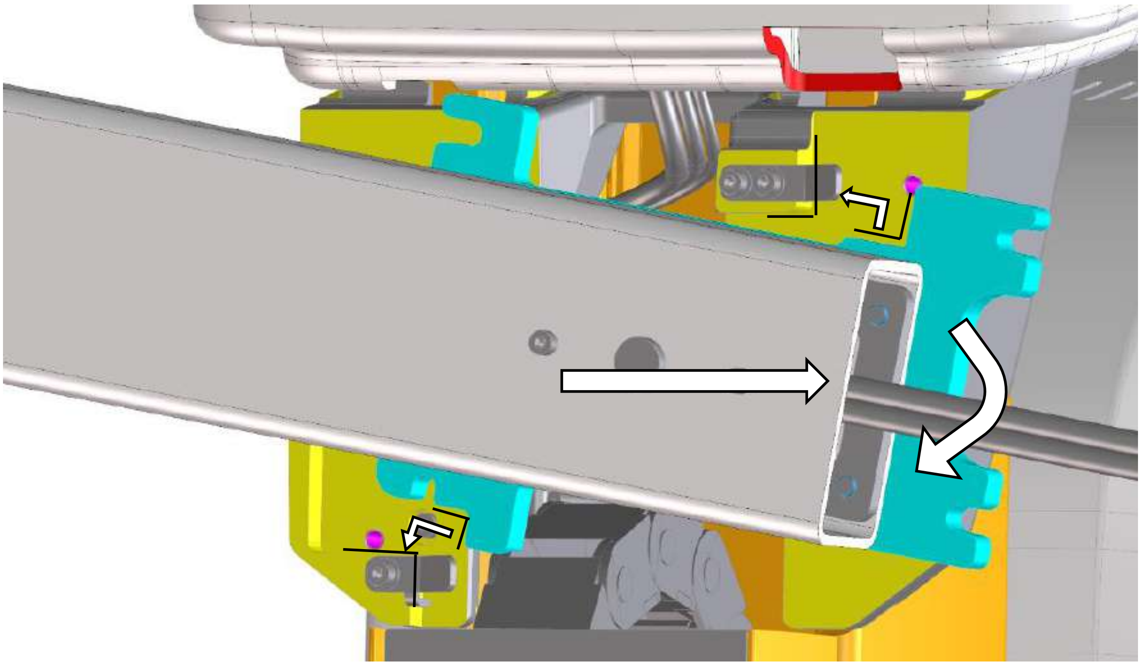


Figure 27

21. Put the Ceph arm in contact with the appropriate supports, then fix very well the Ceph arm to the machine with the screws and washers.

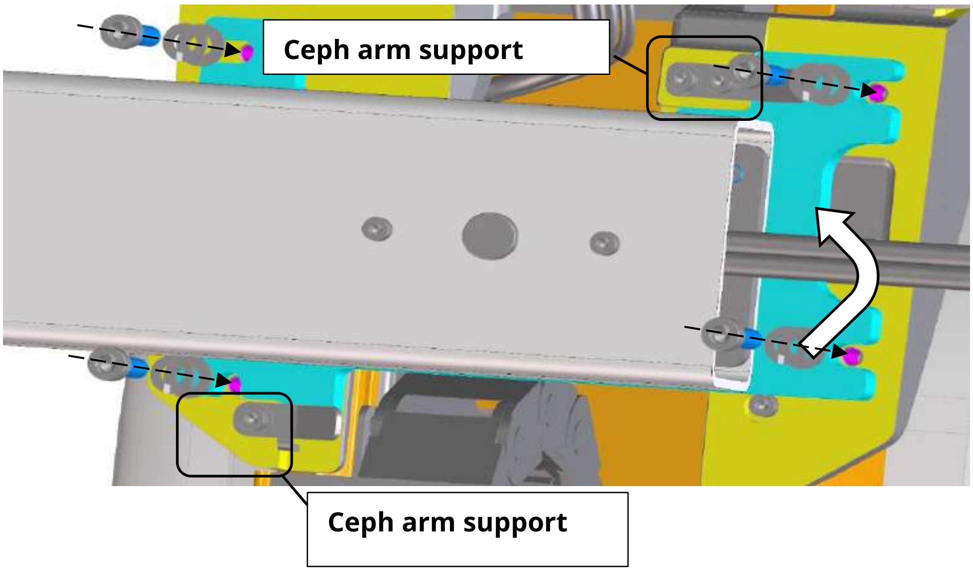


Figure 28

22. Remove the metallic protection plate on top of the electronic boards.

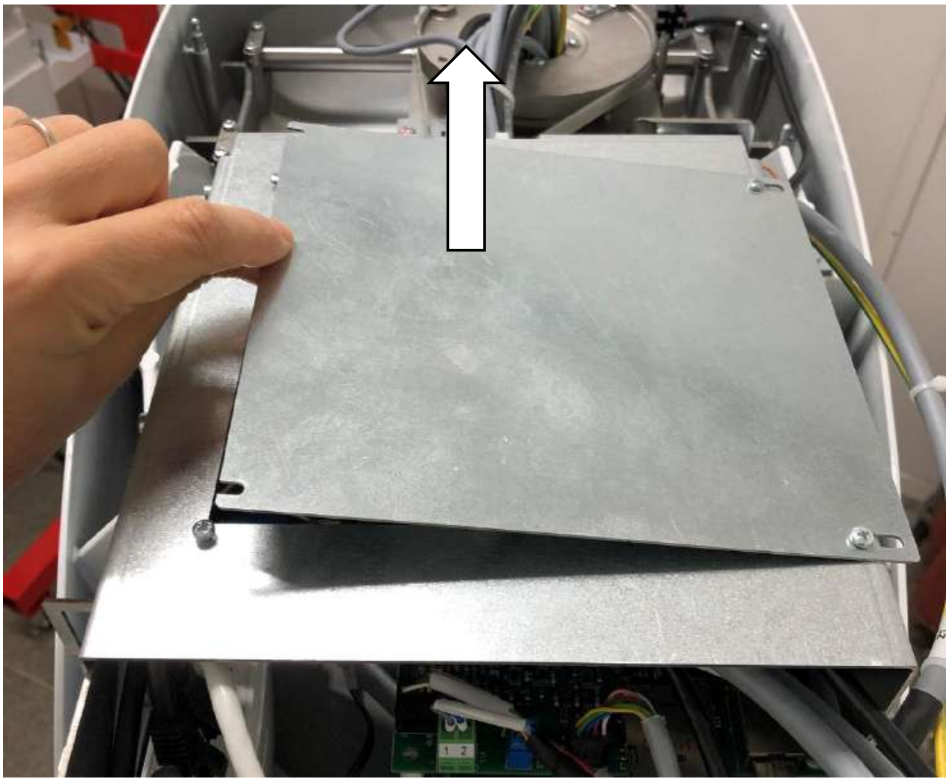


Figure 29

23. Pass the cables through the opening on the upper structure

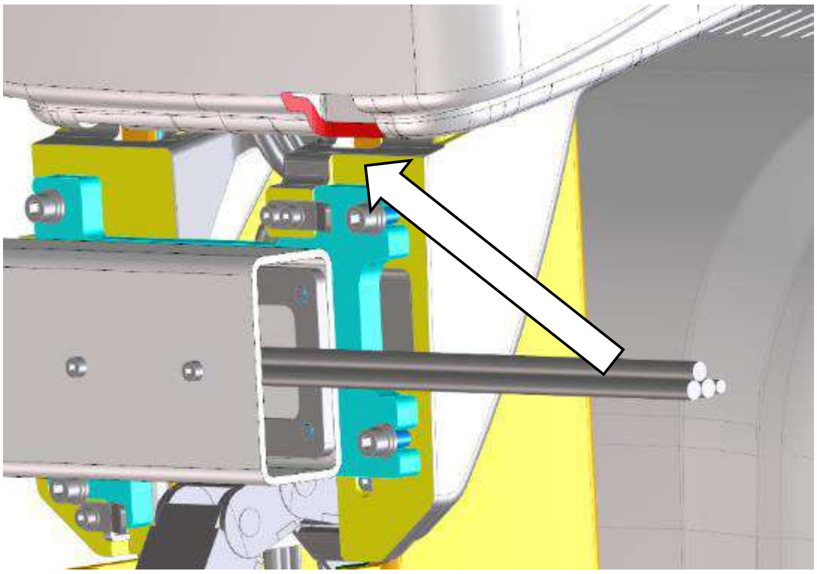


Figure 30

24. Connect the cables inside the fixed arm as follows:
    - X53, X54, X58 to the CCU board (A11)
    - The ethernet cable to the Ethernet switch
    - The ground cable to the main grounding point

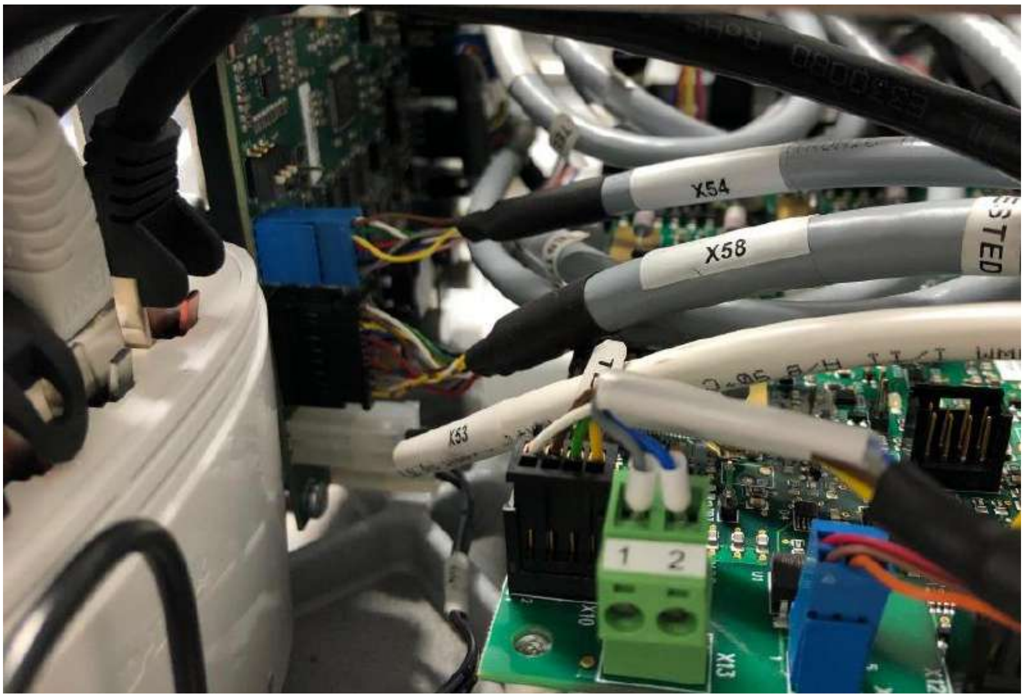


Figure 31

25. Reinstall the fire protection plate on top of the electronic boards. If the screws are not well tightened they can create vibrations.

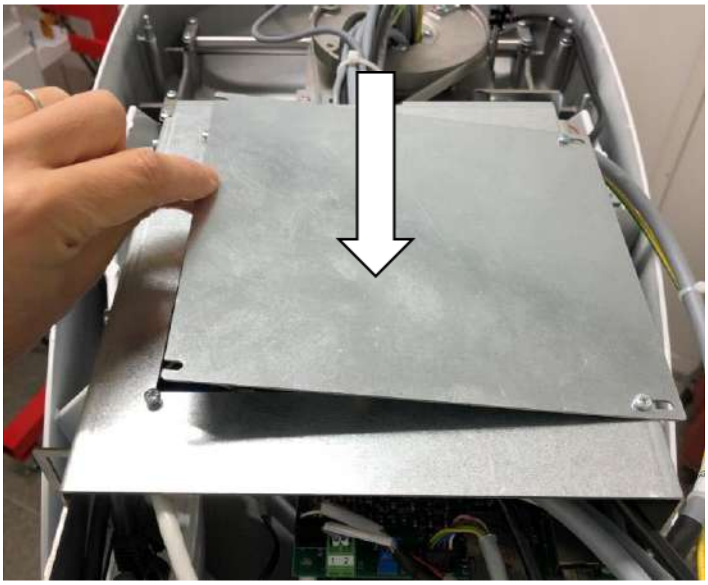


Figure 32

26. Remove the transport handle and the transport protection plate **being careful not to hit the optical sensor near here**.

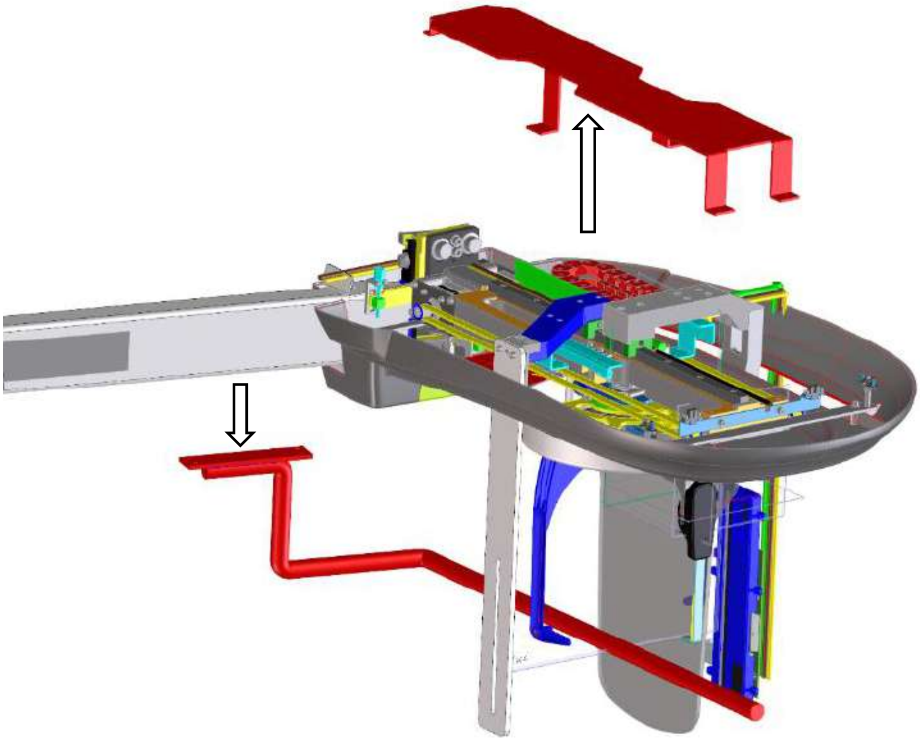


Figure 33

7.2 Fuses installation

X-MIND prime 3D is delivered in an open range voltage configuration which makes it compatible with both 115 Vac and 230 Vac mains electricity. In order to allow the correct operation of the unit, it is necessary to install the right fuses according to the mains electricity of the country of installation.

The system is delivered with 5 bags: 4 bags for fuses F1 and F2 (2 bags related to installation in 110 – 200 Vac voltage range input and 2 bags for 200-240 Vac environment) and 1 bag for fuse-holder caps.

The fuses holder is placed on top of X-MIND prime 3D as shown on Figure 34 (to have access to this part, it is required to remove the top cover as described in the parts 14 and 15 of the paragraph 7.1):

Figure 34

For X-MIND prime 3D unit, the technician shall take care to pick the right fuses from the bags according to the following table:

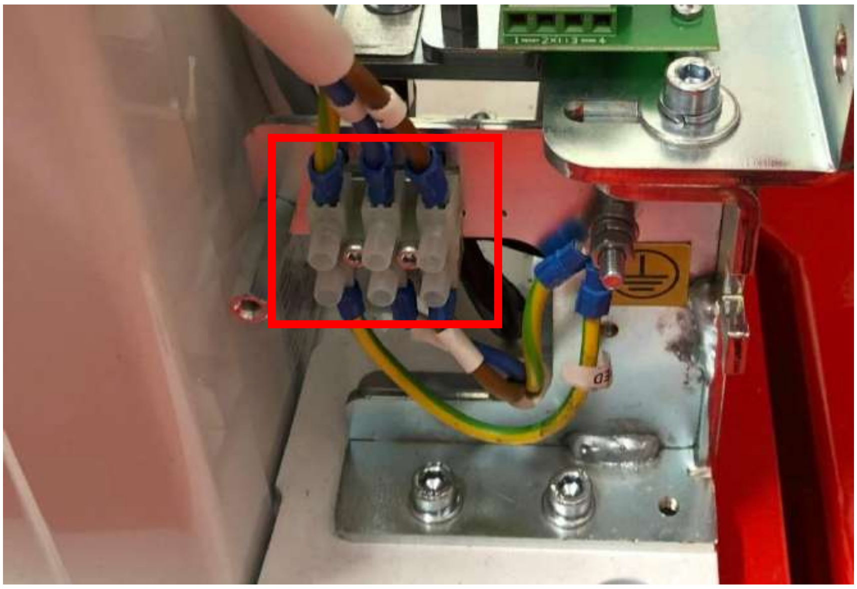
Voltage range input	Fuses
110 – 200 Vac	F1: 20 A T F2: 4 A T
200 – 240 Vac	F1: 8 A T F2: 2,5 A T

7.3 Electrical connections

All external connections are located in the base of the unit.

Mains Power Supply:
The mains line shall be connected to the terminal block on the right side of the unit. The power supply cable is already connected inside the X-Mind Prime 3D. It is only necessary to connect it to the dedicated power supply line.

Note
Before to connect main power supply, be sure that the main provided by the Customer is according to specification in terms of voltage, line resistance and safety protections (see paragraph 6.1).



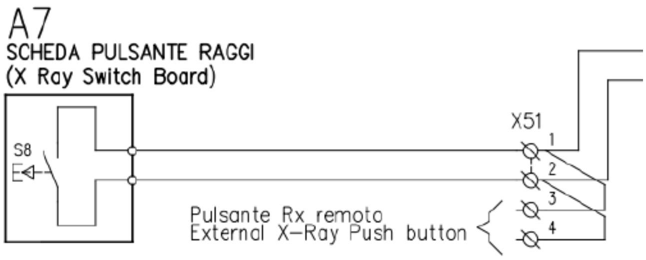
X-RAY buttons

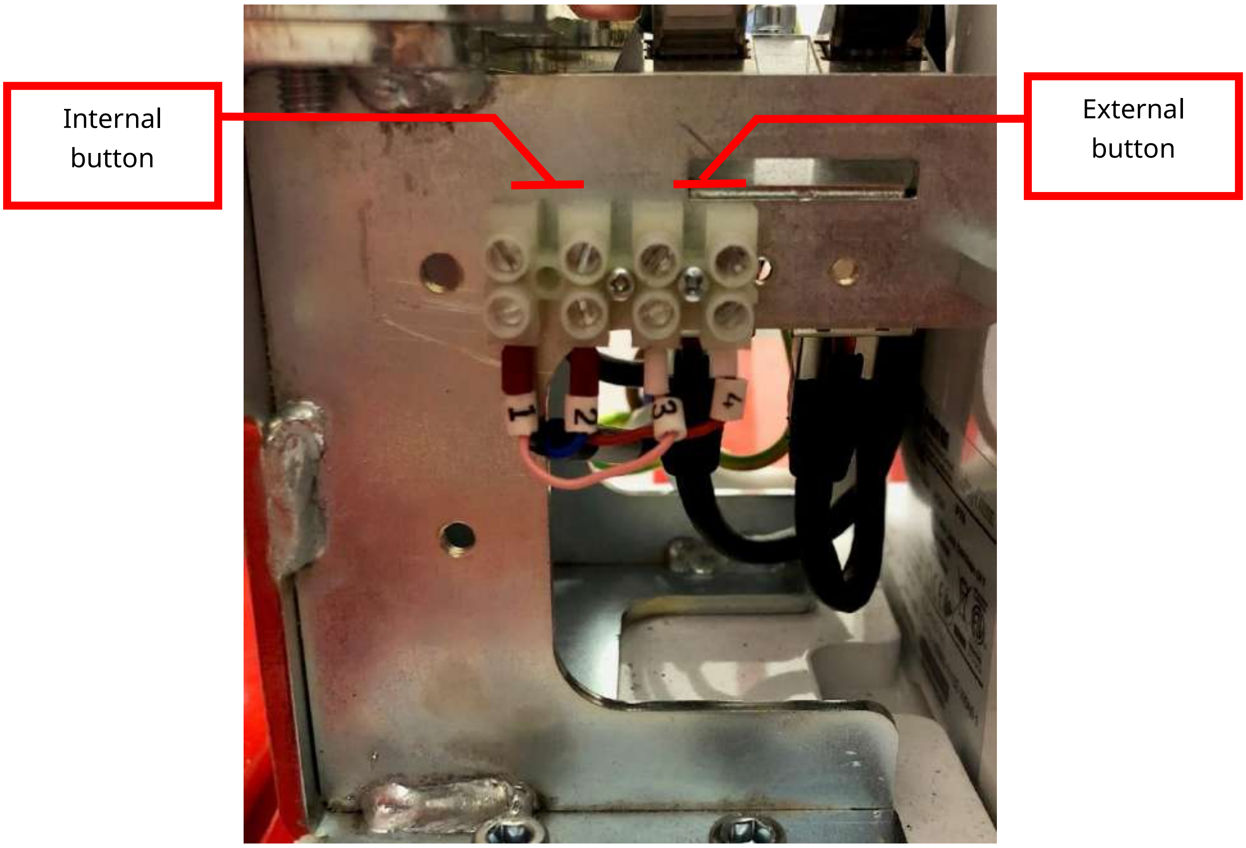
Connections are located on the left side of the unit.
The main x-ray button shall be connected to X51-1 and X51-2.

An external pushbutton can be connected so that the operator can start exposure from outside the exam room. It is mandatory to use a **MOMENTARY pushbutton** in order to guarantee "dead man" operation. The standard X-ray button supplied with the unit has the above characteristic. Contacts X51-3 and X51-4. Only a dry contact shall be connected to this input.

Warning

It is installer's responsibility to check the characteristics of the remote X-ray button.
No current or voltage must pass through remote control hand switch.
Wrong connections may damage the unit.



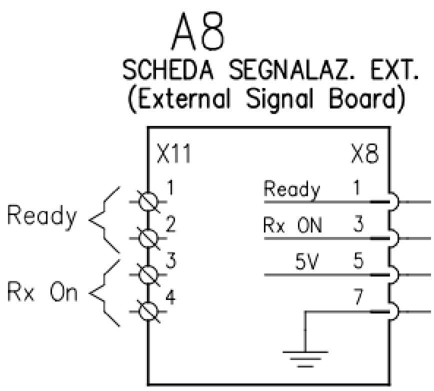


External signalling lights

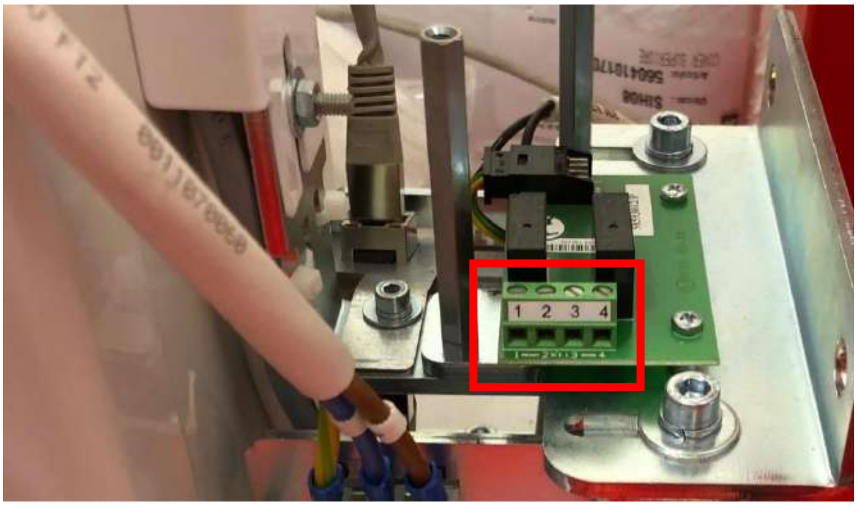
Connections are located on the right side of the unit.

- **READY light**: The signal is active when the unit is ready to perform the exam. Normally Open dry Contact, maximum load 24V, 40W. Contacts X11-1 and X11-2
- **X-RAY ON light**: The signal is active during X-Ray emission. Normally Open dry Contact, maximum load 24V, 40W. Contacts X11-3 and X11-4

The unit only provides dry contacts only. Power supply for the relevant devices has to be provided externally, making sure not to exceed the indicated ratings.



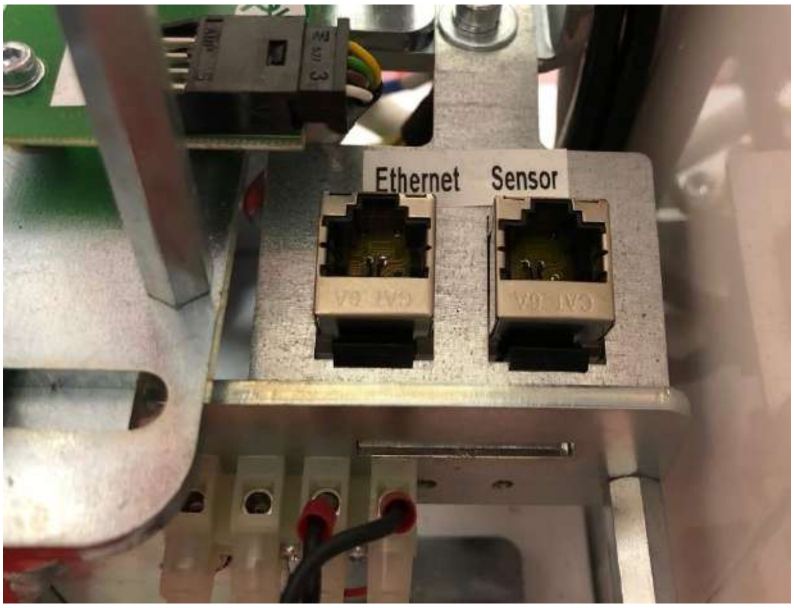
- X11-1 / X11-2 contact closed when unit is ready
- X11-3 / X11-4 contact closed during X-ray emission



Warning lights connections, located on the right side of the unit base.

Ethernet connections to the PC
There are two RJ45 ethernet connections to the host PC.
Connections are located on the left side of the unit.

- **3D detector (labelled "SENSOR"):** dedicated line for point-to-point connection from the 3D detector to the host PC.
- **Ceph detector and system interface (labelled "ETHERNET"):** point-to-point connection from the unit and the panceph sensor to the host PC.



Two Cat 6 cables (each 5m long) are supplied with the unit. In case longer cables are needed, make sure the cables are Cat 6 or better.

Note

The ethernet cables shall be connected **DIRECTLY** the corresponding ethernet ports on the host PC. Connecting the cables to the local area network or to ethernet hubs will compromise the unit functionality.

7.4 How to mount the covers

Note
Cover mounting is easier with the unit powered ON, mainly to move lift.

7.4.1 Wall plate cover

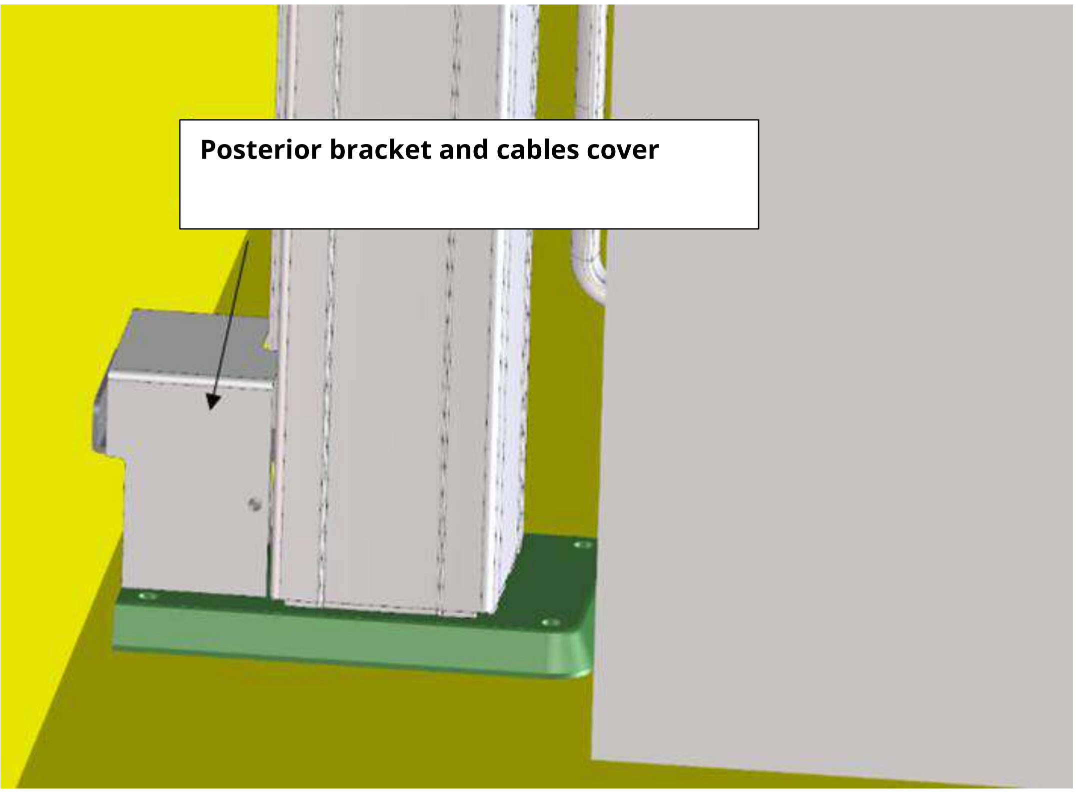


Figure 35

7.4.2 Upper cover

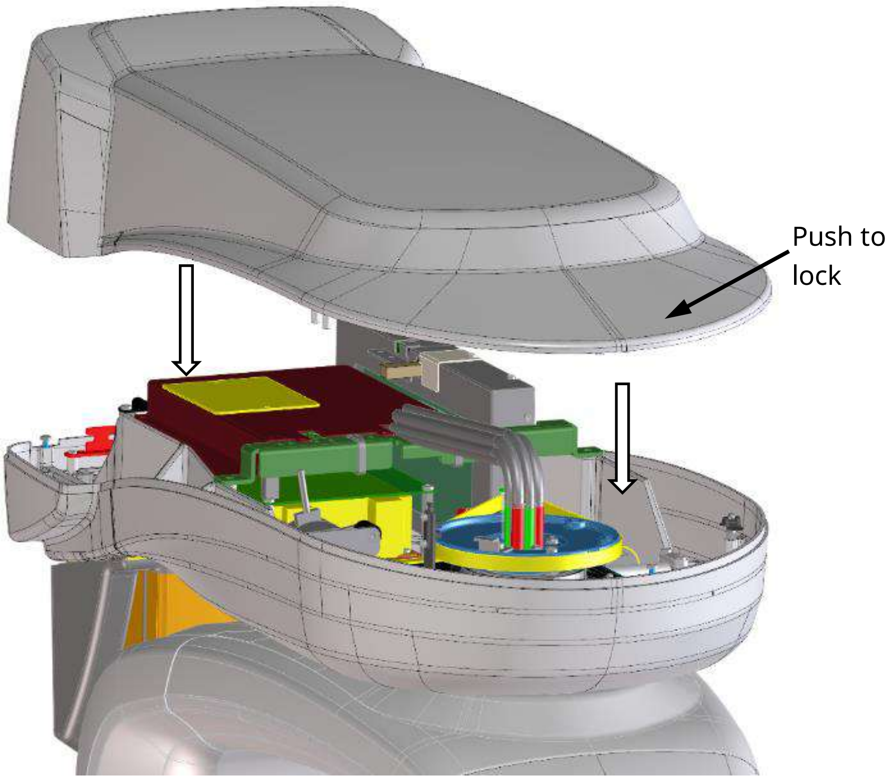


Figure 36

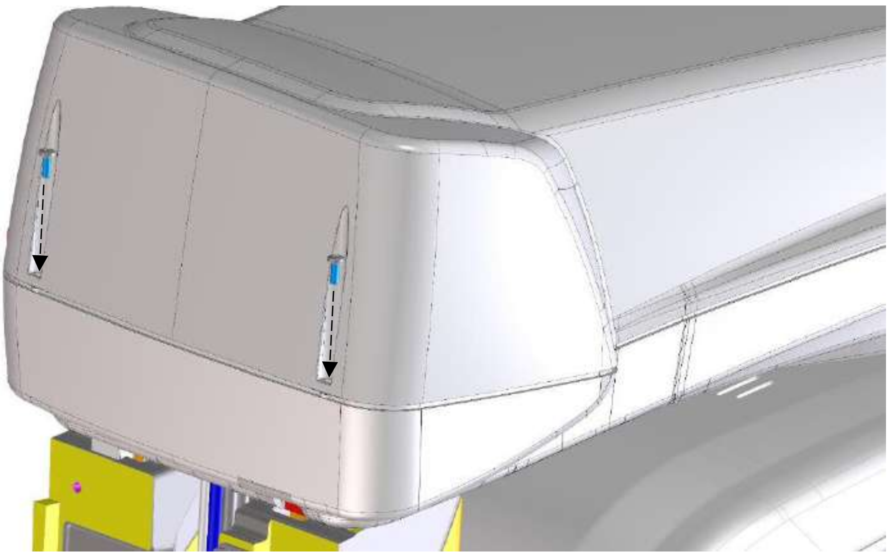


Figure 37

7.4.3 Ceph arm covers

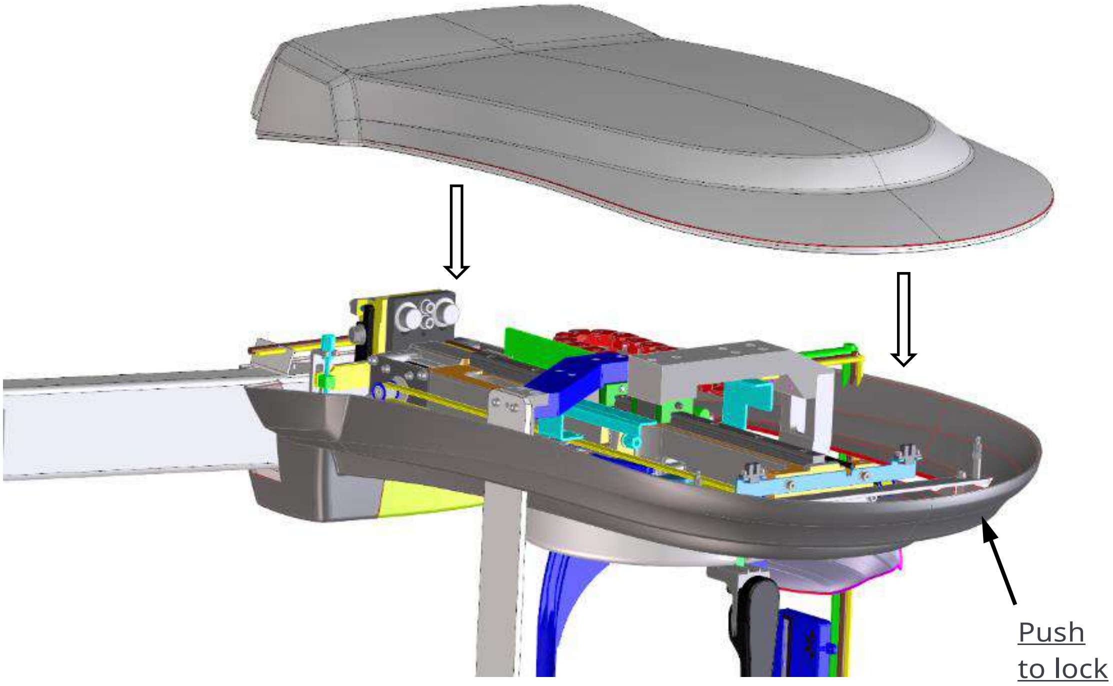


Figure 38

The posterior cover is simply attached by magnets.

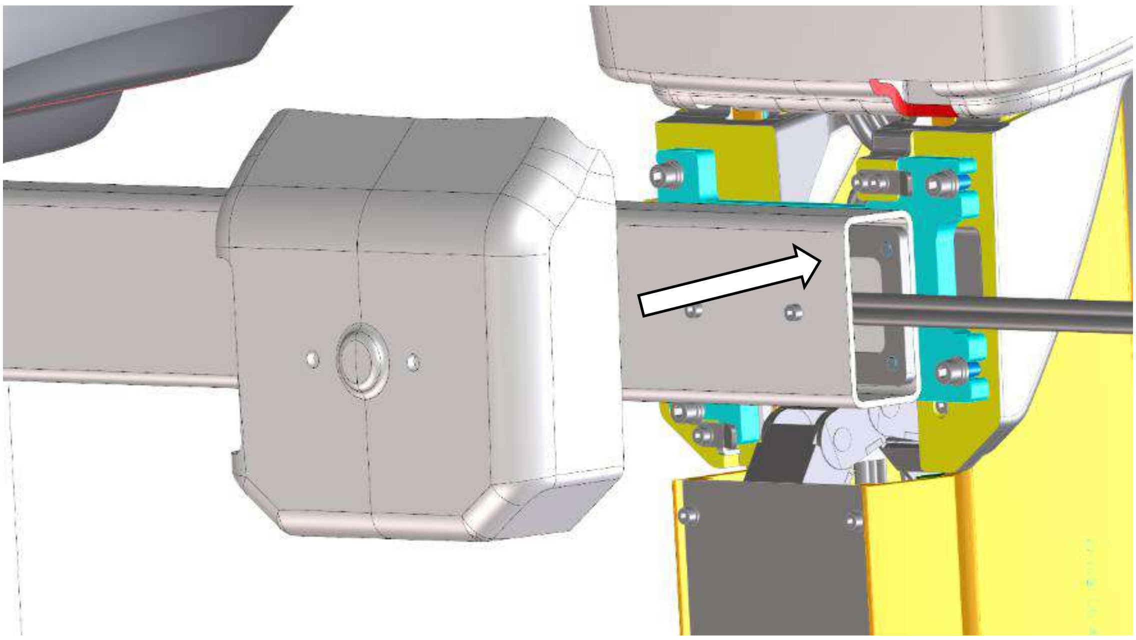
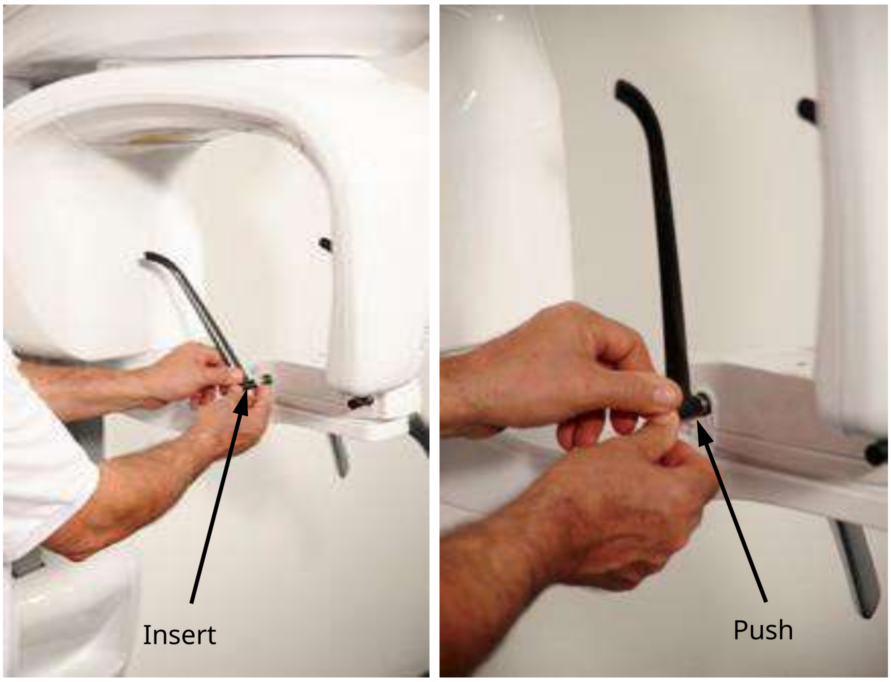


Figure 39

7.4.4 Temple supports



Make sure that the convex side of the temple wands are facing inside and in contact with the patient.

7.5 Unit full installed

7.6 How to position the cables

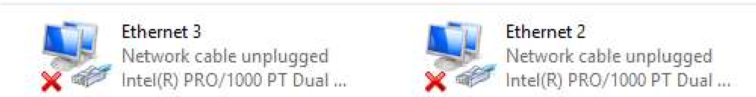
The cables output are from lower side of the X-MIND prime 3D so that it's possible to position them in a single cable channel on the wall.

7.7 PC configuration

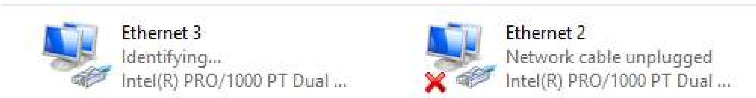
7.7.1 Network Interface board configuration

The equipment is supplied with a dedicated dual port Network Interface Card (NIC). In order to connect the X-MIND prime 3D to the PC it is necessary to configure the properties of the dedicated NIC following the procedure described below.

1. Go to *Control Panel* > *Network and Internet* > *Network and Sharing Center* > *Change adapter settings*. The network adapters are labelled with the NIC model that is either Intel I350-T2 or Intel PRO/1000.

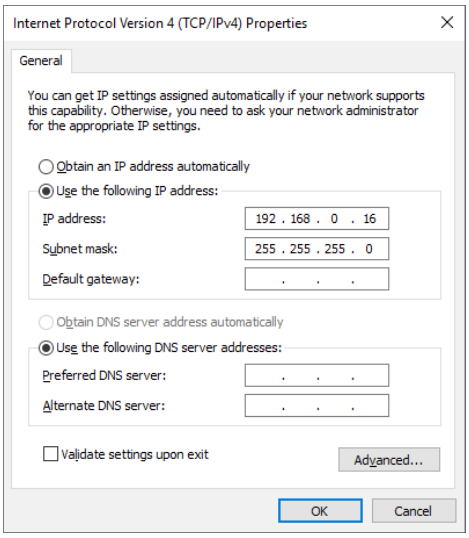


2. Plug the MCU board Ethernet cable i.e. the one connected to the machine port labelled with “Ethernet” to the left port of the NIC.
3. Switch on the unit. The network adapter connected to the MCU will become active.



4. Right click on it and select “Properties”.
5. Select the item “Internet Protocol Version 4” and click on “Properties”. Configure the IP address as follows:
   - IP address: 192.168.0.16
   - Subnet Mask: 255.255.255.0

   and then click “OK”.



Note

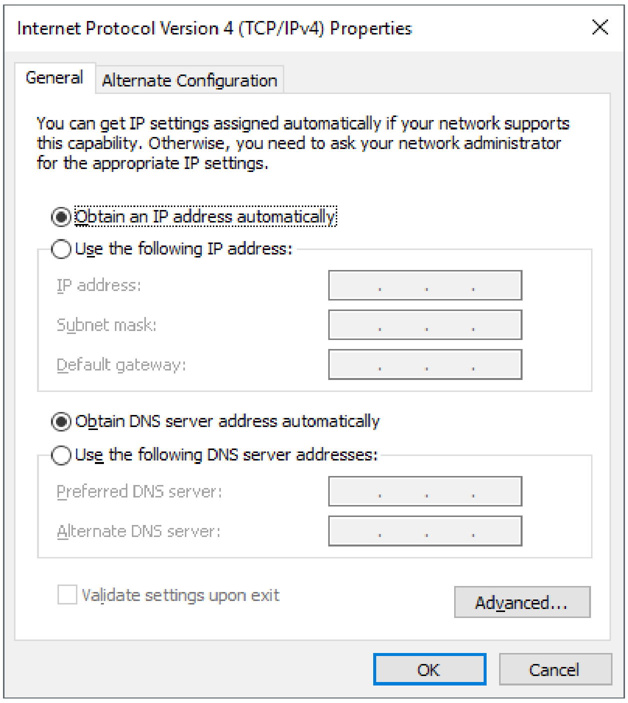
In any case to set the network card IP address avoid using the following values:

- 192.168.0.10 and 192.168.0.11 that are dedicated to the bootloader of MCU and CCU boards
- 192.168.0.211 dedicated to MCU board.
- 192.168.0.99 dedicated to ceph detector

- Plug the 3D Sensor Ethernet cable i.e. the one connected to the machine port labelled with “Sensor” to the right port of the NIC. The second network adapter corresponding to the dual port NIC will become active.

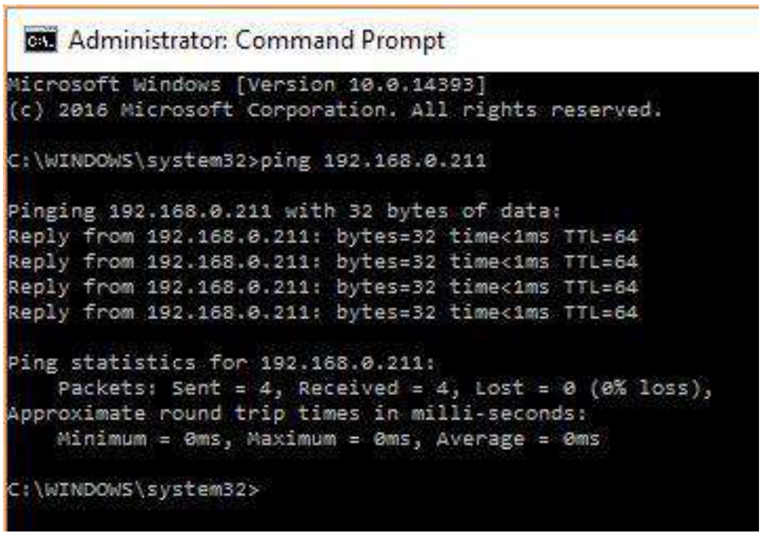
6. Right click on it and select “Properties”.

7. Select the item “Internet Protocol Version 4” and click on “Properties”. Select “Obtain an IP address automatically”.

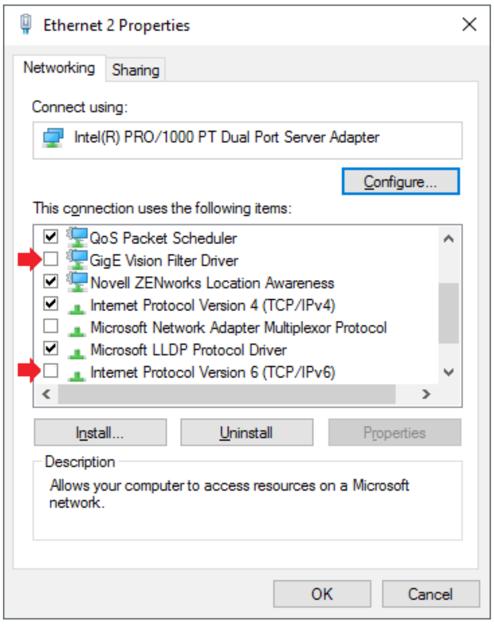


Confirm with OK.

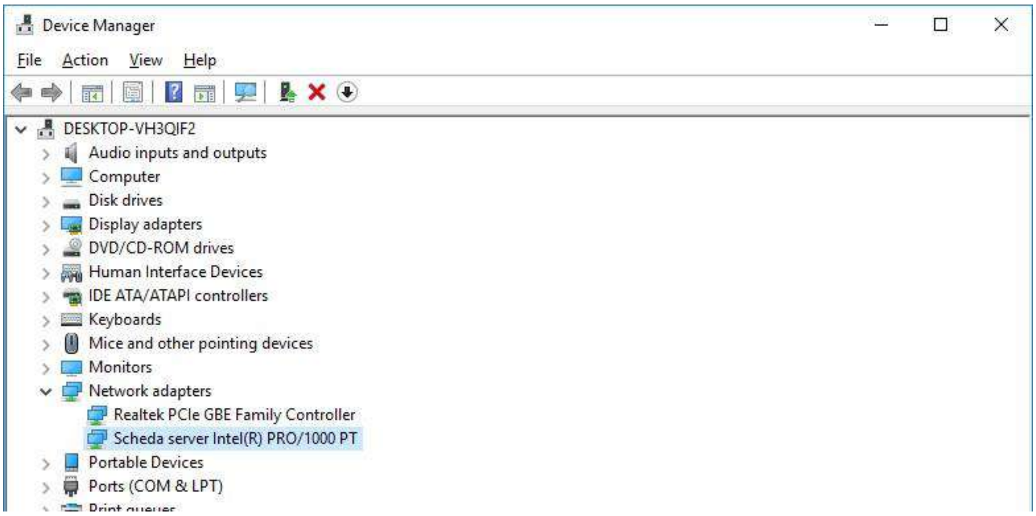
8. To check that the connections are properly configured, with the unit ON, run a command prompt and type “ping 192.168.0.211”. Press Enter and verify that the unit reply to the ping as shown in the figure below.



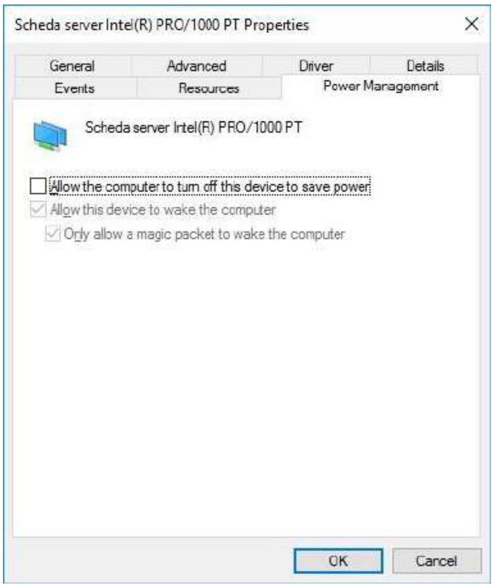
If the ping does not reply, swap the two network cables on the NIC ports and repeat the ping test.
If the problem is still present, unflag the items “GigE Vision Filter Driver” and “Internet Protocol Version 6” from the properties of all the network adapters.



9. Open the Device Manager, double click on “Network adapters” to see the list of devices.



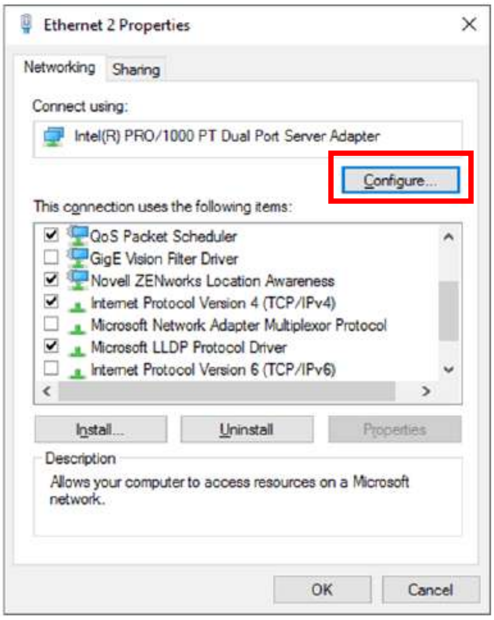
10. Double click on the dedicated dual port NIC (Intel I350-T2 or Intel PRO/1000). Select the “Power Management” tab and unflag the box “Allow the computer to turn off the device to save power”.



7.7.2 3D sensor Network Interface board configuration

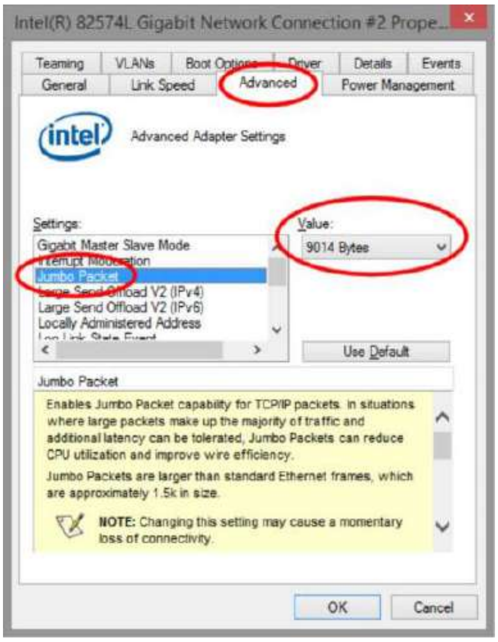
It is required to set the Interface Card (NIC) connected to the 3D sensor with the configuration explained in the following setting procedure:

1. Open the “Network Settings” menu of the Ethernet board connected to the 3D sensor by right clicking on its icon and select “Property”.
2. On the Ethernet board property window click on “Configure...”:

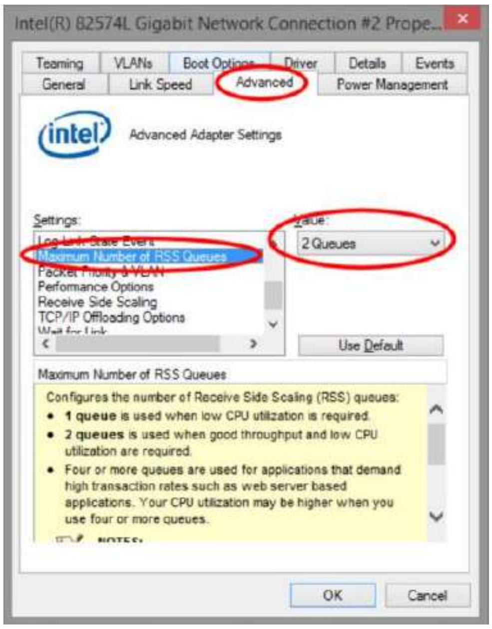


3. Select the “Advanced” sheet on the network board configuration window.
4. Set the following network settings (see Figures below):
   - Interrupt Moderation = Disabled

- Jumbo Packet = 9014 Bytes

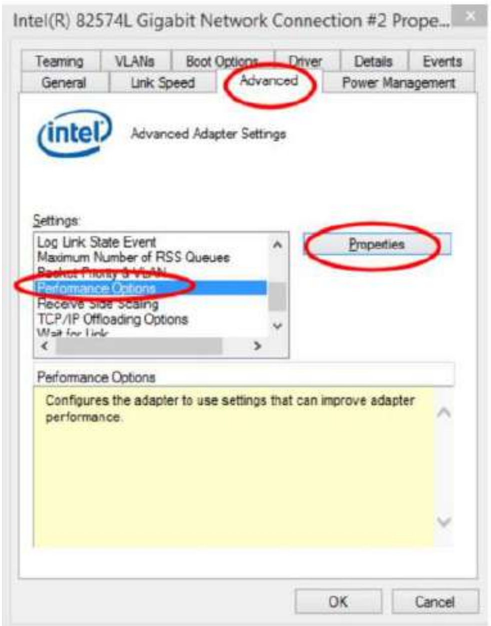


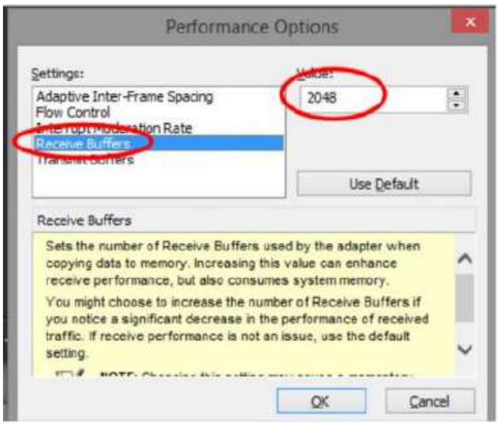
- Maximum Number of RSS Queues = 2 Queues



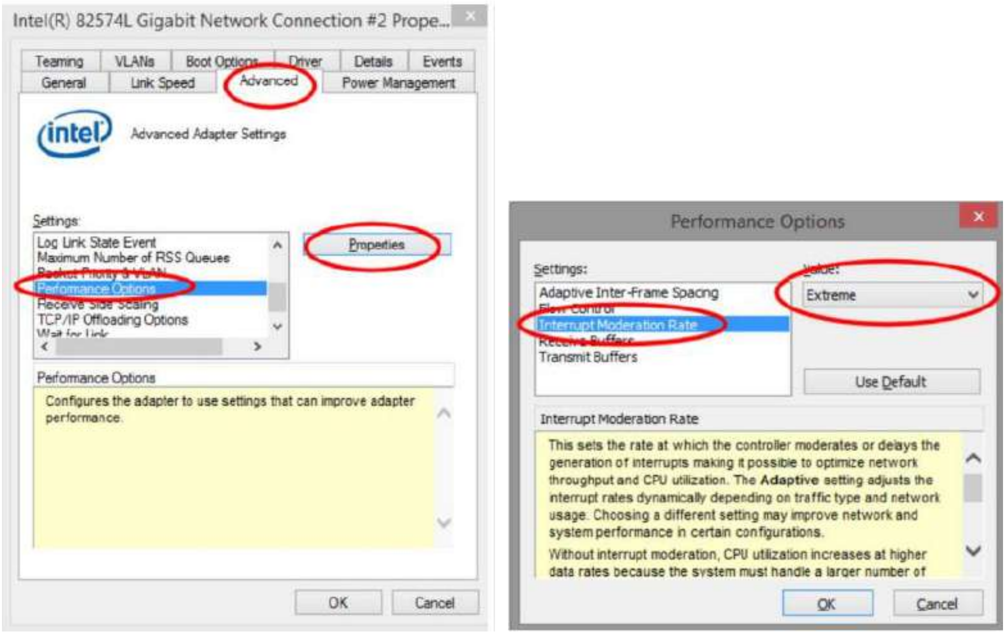
- Packet Priority &VLAN = Packet Priority Enabled

- Performance Options→Properties→Received Buffers = 2048





- Performance Options→Properties→Interrupt Moderation Rate = Extreme



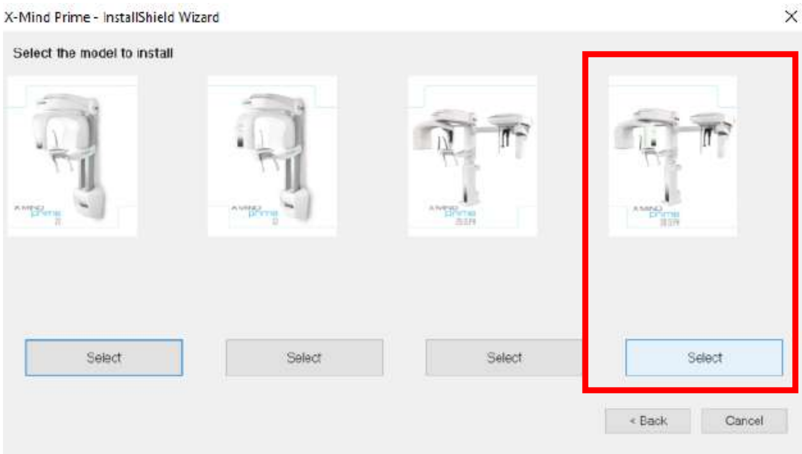
5. Restart the computer.

7.8 Software installation

Note

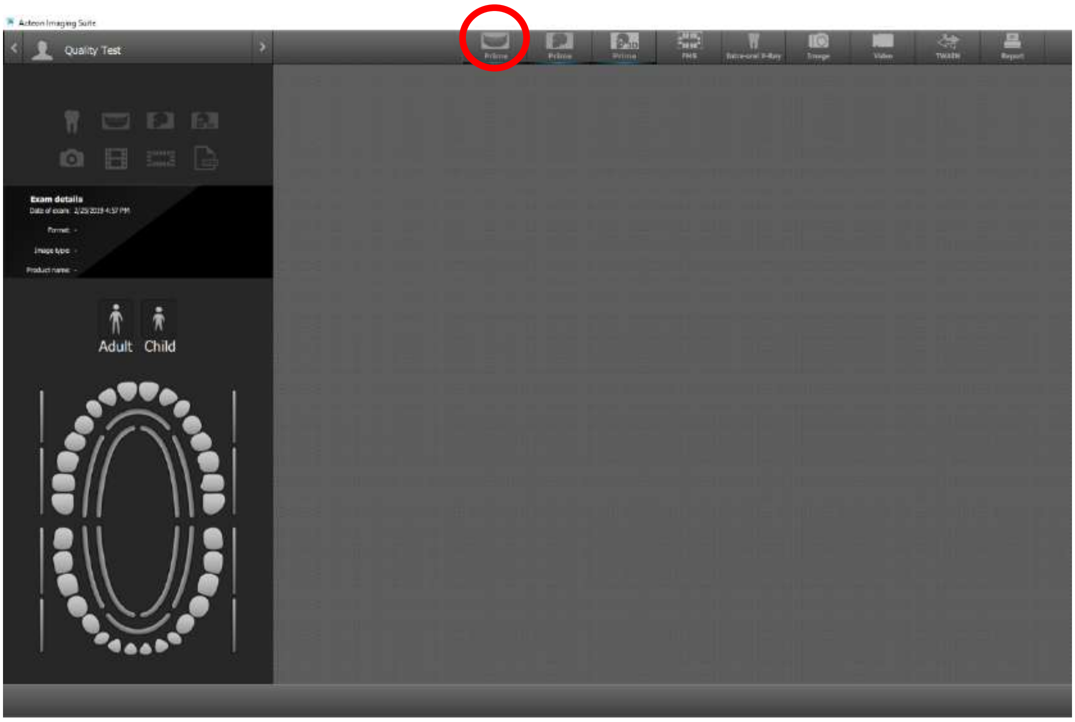
The windows user must have an administrator profile.
AIS requires that Windows 10 is already installed on your computer and correctly configured.

1. Close all the running applications.
2. Insert the USB pen drive or CD/DVD media.
   In case of USB pen drive, open the partition “SETUP” and double click on “Autorun.exe”.
   In case of CD/DVD, the Installation wizard starts automatically, if this does not happen, double click on “Autorun.exe” at the root of the disc.
   In both cases, install AIS software (refer to AIS installation guide) and then the window below opens:



3. Select “X-Mind Prime 3D ceph” and follow the wizard.

4. To check that the installation is correctly completed, open AIS, click on “Mouth” symbol (see arrow) and then on keyboard symbol (see circle) to open Virtual Keyboard of the unit.



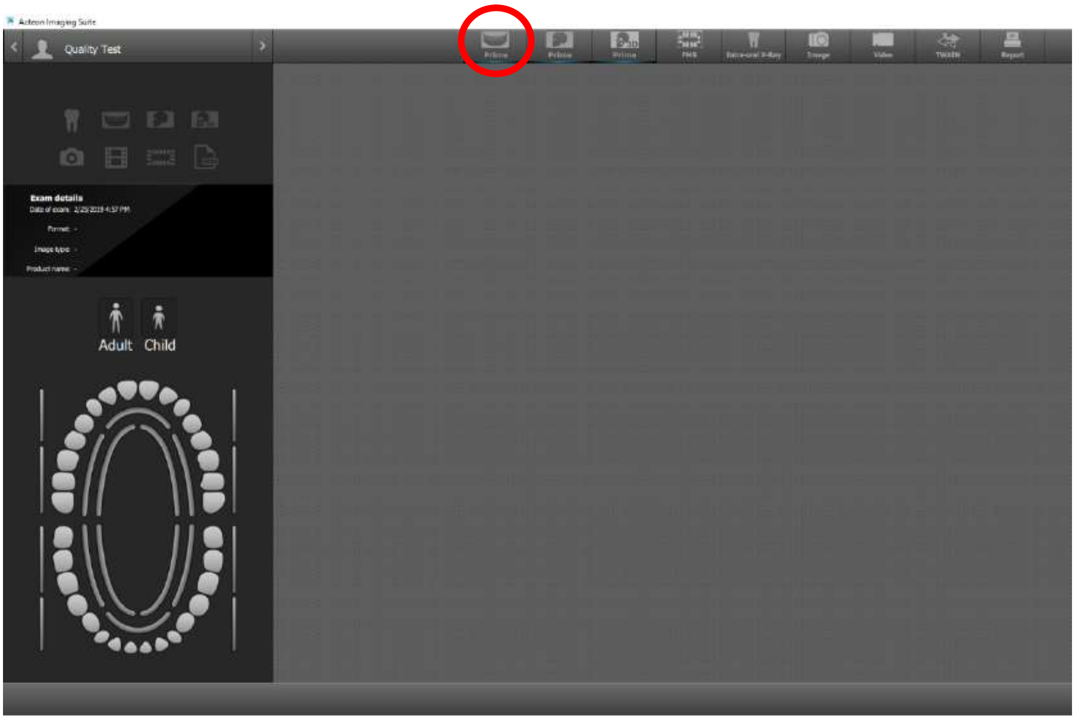
7.9 Detector Calibration files installation

Before starting unit operation, it is necessary to copy all the detector calibration files in the PC.
Insert the USB pen drive or CD/DVD media containing the detector calibration files and open it.
In case of USB pen drive, open the partition “CALIBRATION” and double click on “Install.bat”. In case the automatic copy fails, copy all the files inside the folder “Calibration” in the directory *C:\ProgramData\Acteon Imaging\Panoramic X-Mind Prime Ceph\Calibration* (create the directory “Calibration” if not present).
In case of CD/DVD, copy all the files contained in the media support and paste them in the directory *C:\ProgramData\Acteon Imaging\Panoramic X-Mind Prime Ceph\Calibration* (create the directory “Calibration” if not present).

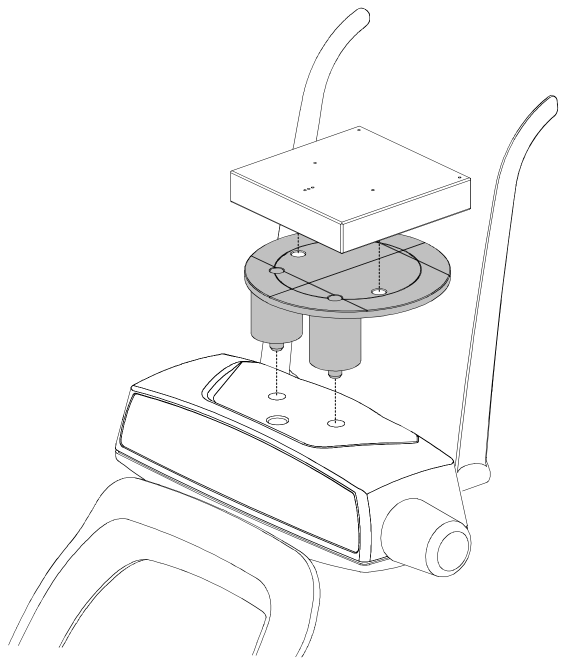
7.10 Verification of the PANORAMIC function

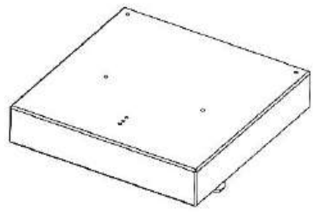
Warning
X-rays will be emitted during the performance of the following operations. Authorized Technicians are therefore recommended to use the greatest caution and to comply with the safety regulations and laws of their country.

1. Switch ON the unit and when the green LED starts blinking, press >0< button to perform axis reset.
2. Open AIS software and open the patient “Quality Test”. If not present, create a new patient (Name: “Quality”; Family name: “Test”).
3. From the “ACQ” toolbar, select the GUI icon to open the virtual keyboard

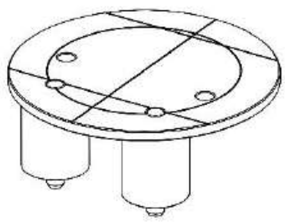


4. Mount the centering tool on the support plate and place it on the chin rest support.





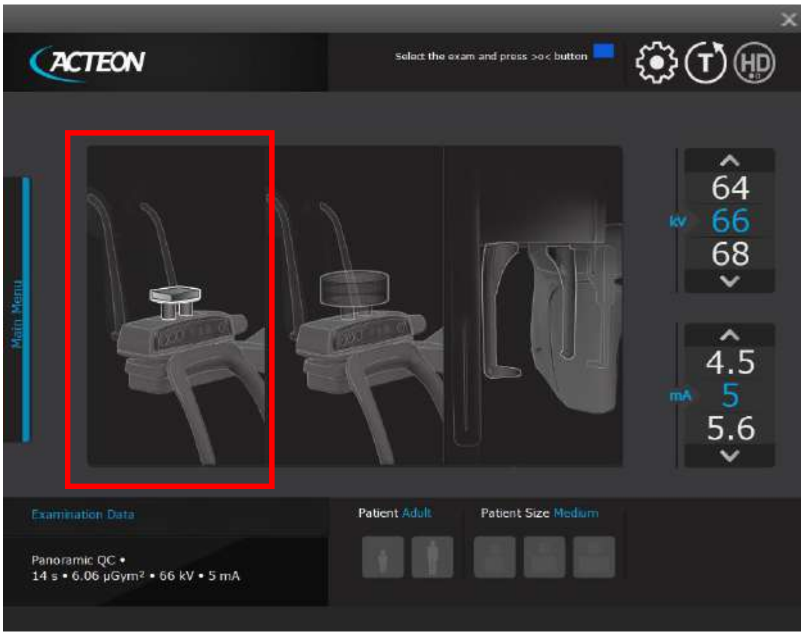
Centring tool (P/N 6195170200)



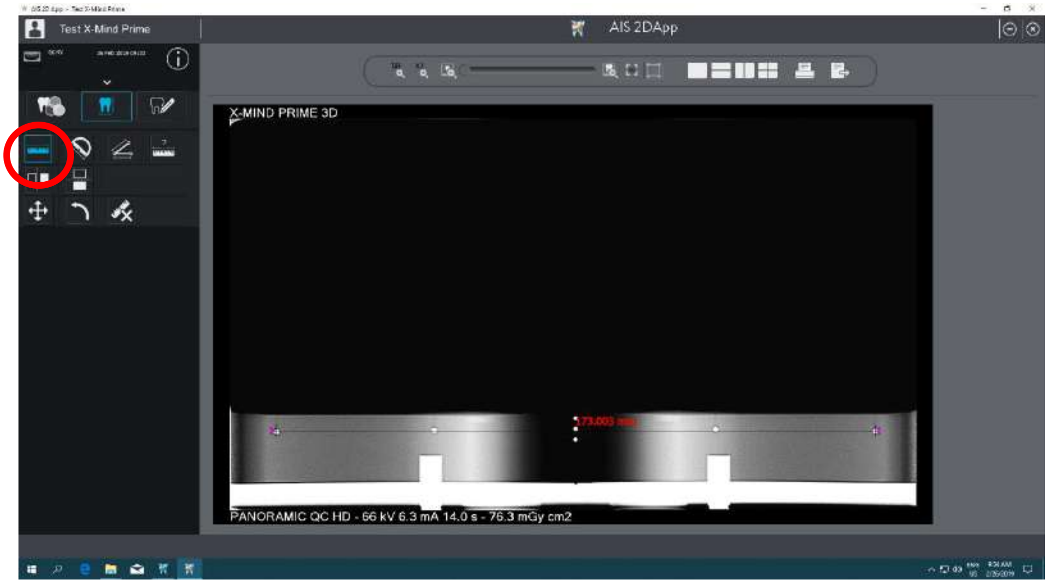
Support plate (P\N 6195170100)

Figure 40: Support plate and centering tool positioning

5. On the main menu of the virtual interface, select “Quality Test” exam, the following image will be displayed:



6. Select “Panoramic QC” exam clicking on the left area of the virtual interface.
7. Make an exposure at 66kV, 6.3mA (see User’s Manual – chapter 9).
8. Select the “Ruler” icon and measure the distance between the two external spheres; this value must be 170mm ± 2mm.



9. If distance is outside the tolerance range, open “PhD_C_Test.exe” and adjust the Y axis offset (see paragraph 8.4) accordingly. Repeat the exposure.
10. Measure also the two halves of the image in order to check symmetry. The difference has to be max. 2mm.
11. If distance is outside the tolerance range, perform the following test:
    - Visually check that the rotation offset is properly configured. This can be done by checking the laser alignment with the support plate as described in the User Manual, paragraph “Laser Alignment check”
    - If the rotation offset is correct, open “PhD_C_Test.exe” and adjust the chin rest offset (see paragraph 8.4).

    Repeat the exposure.

Note
If the legislation in your country requires a white border around the image, you can change the collimator offsets (see paragraph 11.2.9).

7.11 Verification of 3D function

1. From the “ACQ” toolbar, select the GUI icon to open the virtual keyboard.

2. Insert the support plate on the chin rest, place the centering cylinder in the middle of the plate.

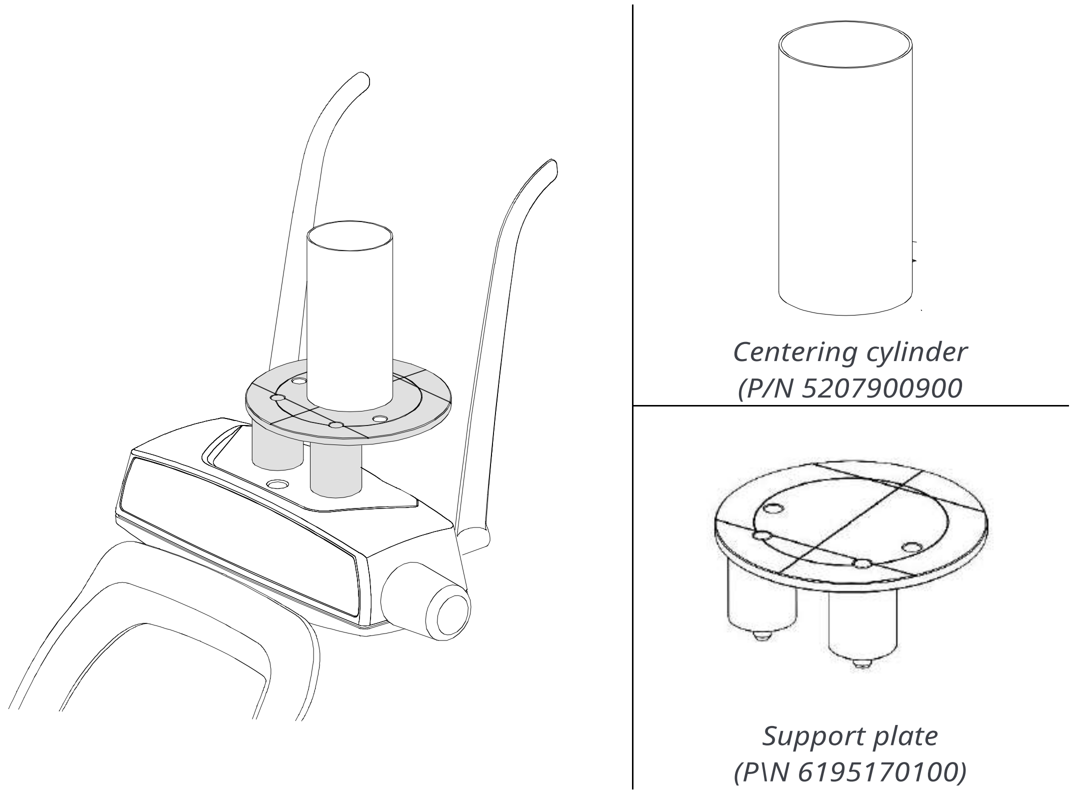
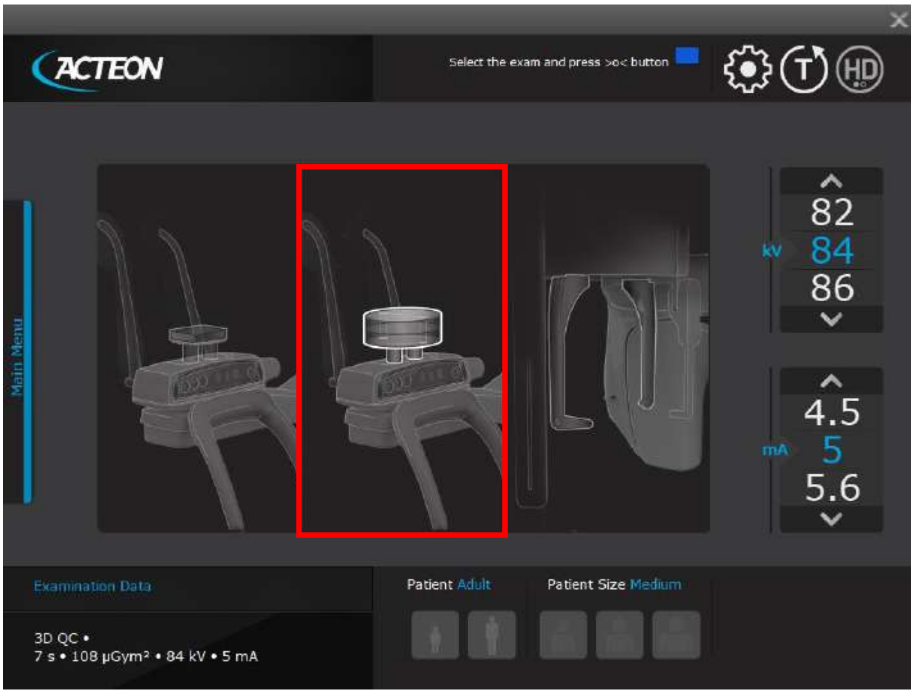
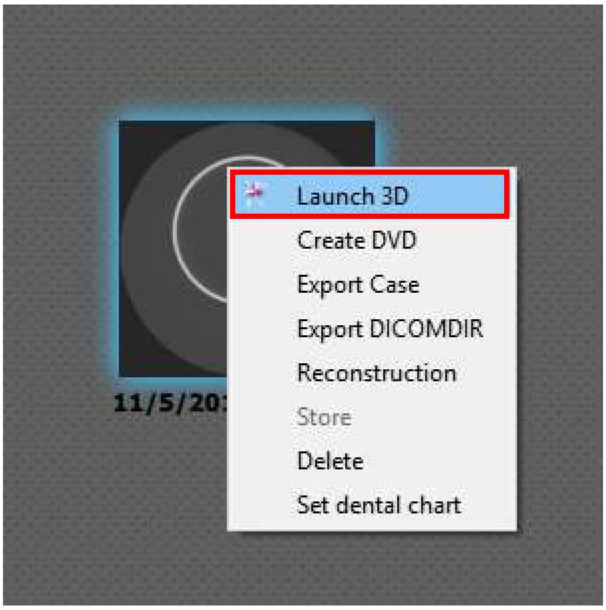


Figure 41: Support plate and centering cylinder positioning

3. On the main menu of the virtual interface, select "Quality Test" exam, the following image will be displayed:



4. Select "3D QC" exam clicking on the central area of the virtual interface.
5. Make an exposure at 60kV, 5mA (see User's Manual – chapter 9).
6. At the end of the acquisition, right click on the exam icon and select "Launch 3D".



7. Scroll the slices: the image has to provide a continuous line as shown in *Figure 42*.

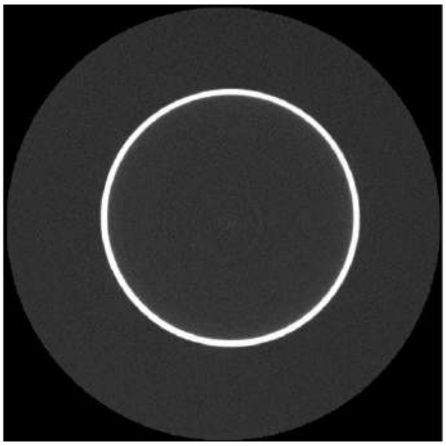


Figure 42

8. In case the reconstruction is not correct (as shown in *Figure 43*) it will be necessary to follow the procedure described in paragraph 11.2.10.

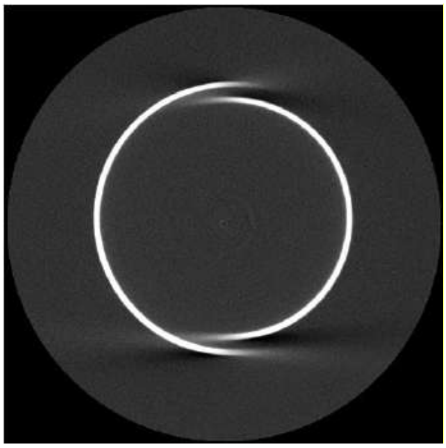


Figure 43

7.12 Verification of CEPH function

For adjustments of ceph device, see paragraph 11.2.11.

Warning
X-rays will be emitted during the performance of the following operations. Authorized Technicians are therefore recommended to use the greatest caution and to comply with the safety regulations and laws of their country.

1. Switch ON the unit and when the green LED starts blinking, press >0< button to perform axis reset.

2. Rotate the ceph head support in the lateral position

3. Open "PhD_C_Test.exe" service program (C:\Program Files (x86)\Acteon Imaging\Panoramic X-Mind Prime Ceph)

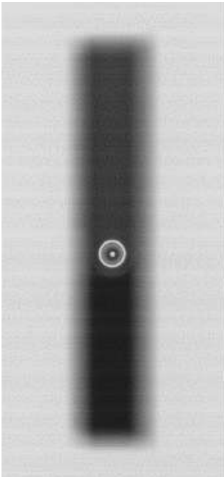
4. Select the following parameters:

   - ID Centring ceph
   - Format: Height Custom
   - Resolution: High
   - Param1: View of Primary collimator field
   - 70kV 8mA

5. In the image processing menu select: “Dynamic adjustment”

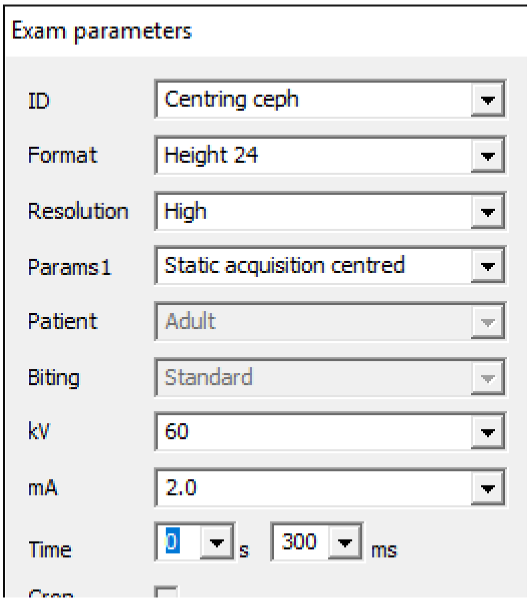
6. Prepare the unit to take the ceph exam and then press the X-Ray button until the end of the exposure

7. Save the image as “Rotation.bmp”

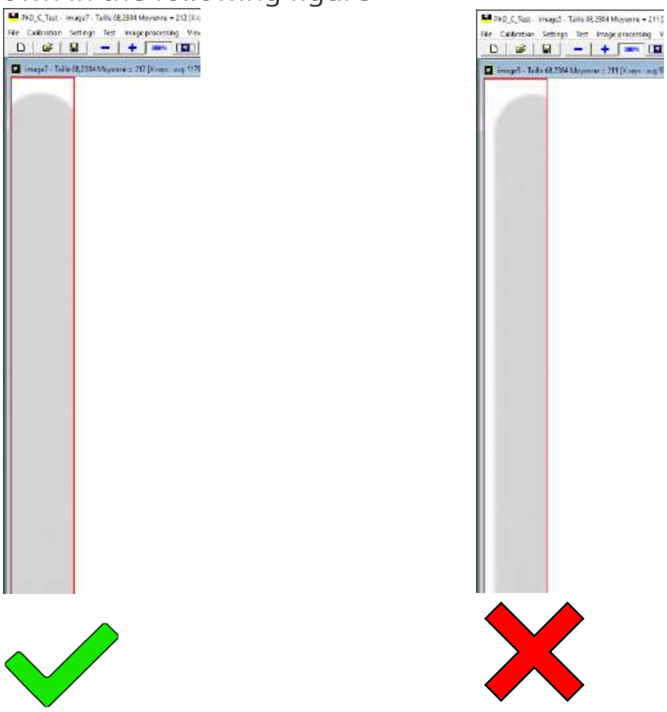


8. Verify that the that the **dot and ring projections are centred to the primary collimator beam** (if not refer to paragraph 11.2.11.4)

9. Then in Exam parameters window select: ID: Centring Ceph; Format: Height 24; Resolution High; Params1: Static Acquisition Centered; kV; 60; mA: 2; time: 300ms



10. Take an X-ray emission and verify that the x-ray field is centered in the sensor area as shown in the following figure

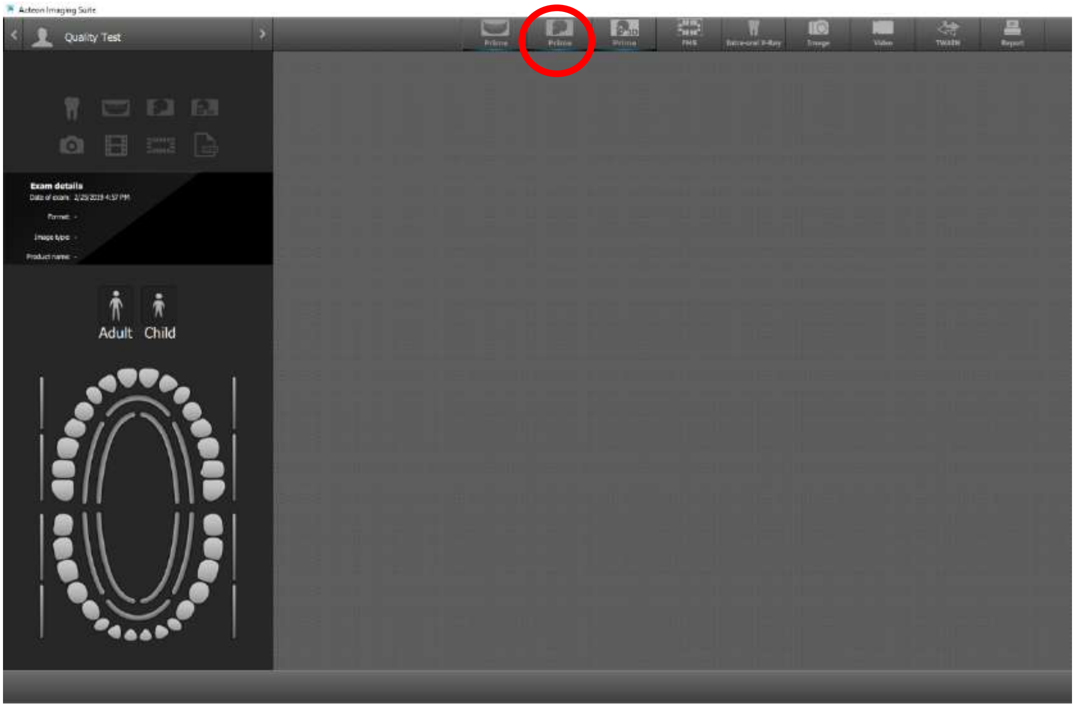


NOTE to better view the sensor area,zoom in by clicking 2 times on the + icon in the program bar

11. If not centered adjust the offset according to paragraph.11.2.11.

12. If the x-ray beam is properly centered open AIS software and open the patient "Quality Test". If not present, create a new patient (Name: "Quality"; Family name: "Test").

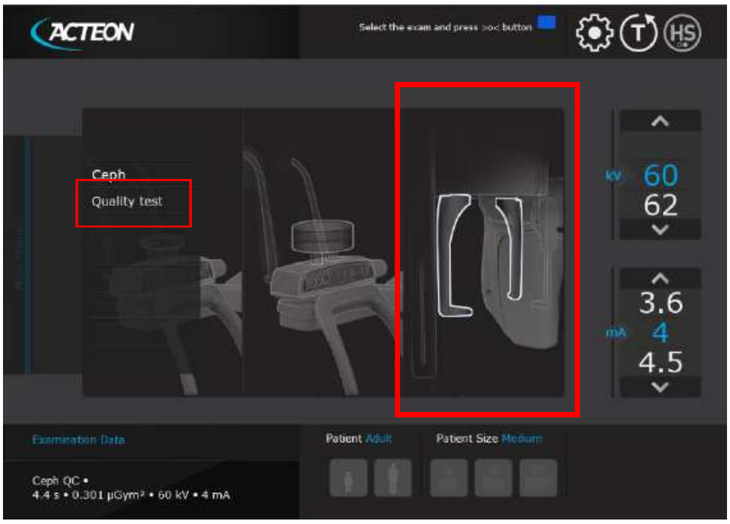
13. From the "ACQ" toolbar, select the GUI icon to open the virtual keyboard.



14. Remove any object (e.g. centering tool) from the chin rest.

15. Rotate the ceph head support in the lateral position.

16. On the main menu of the virtual interface, select "Quality test" exam, the following image will be displayed:



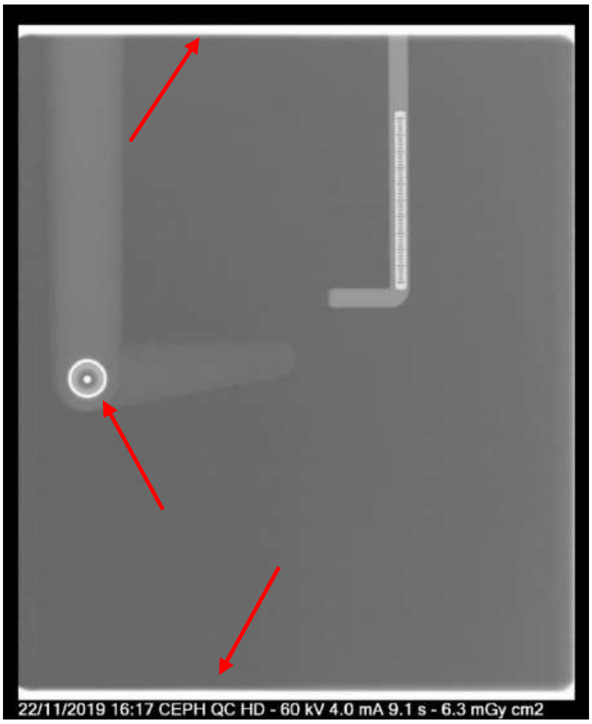
17. Select "Ceph" exam.

18. Prepare the machine to take a ceph exam.

19. Take an exposure at 60kV, 4mA.

20. In the acquired image using the AIS ruler verify:

- In the ear centering pin: that the misalignment between the inner dot and the outer circle is not more than 1.5 mm
- that the unexposed upper and lower border is 3mm +/-2mm



21. If distance is outside the tolerance range or the x-ray field is not correctly irradiated (*Figure 44*), enter the service menu (see paragraph 11.2.11) to correct the problem (see paragraph 11.2.12).

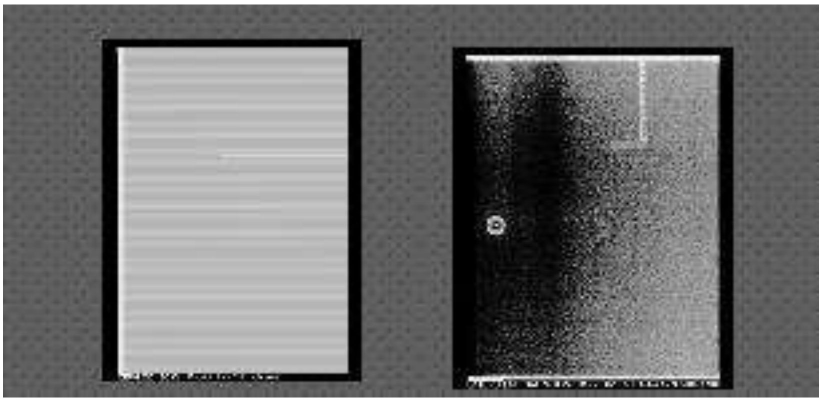


Figure 44

7.13 Verification of exposure parameters

The exposure parameters (kV, time and dose) can be checked using two different methods:

- **"invasive method"** based on the measurement of the test points on HF board (require the use of multimeter and oscilloscope for time) This method is typical used during verification done by technical service engineers

- **"non-invasive method"** based on measurement with Dose meter. This is the typical method used by Phisician to verify periodically the unit

In order to make easier the exposure parameters measurements, X-MIND prime 3D has a dedicated modality that allows X-ray exposure without rotating the arm and without exposure parameters modulation that typically occurs in a standard exam.

7.13.1 Verification of Exposure parameters with invasive method

The exposure parameters (kV, mA and exposure time) can be measured directly on the Generator board (A2); this method has higher accuracy than the so-called non-invasive mode. The system accuracy is guaranteed by this measuring method.

Warning

By removing the HF group covers, internal parts where high voltage is present become accessible.
The Generator board has a working voltage of about 400V.

The exposure parameters can be checked with the following procedure:

1. Turn OFF the system.
2. Remove the cover on the back of the generator and remove the protection grid of the HF board.
3. Identify the test point XJ8.

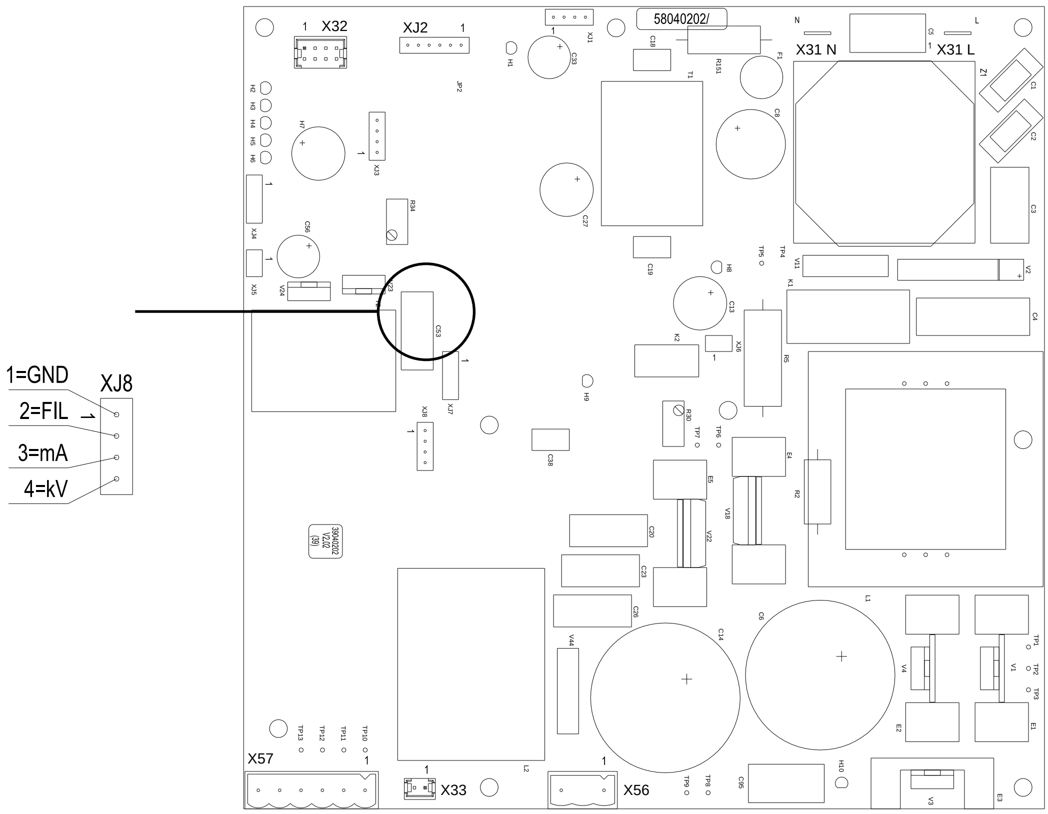
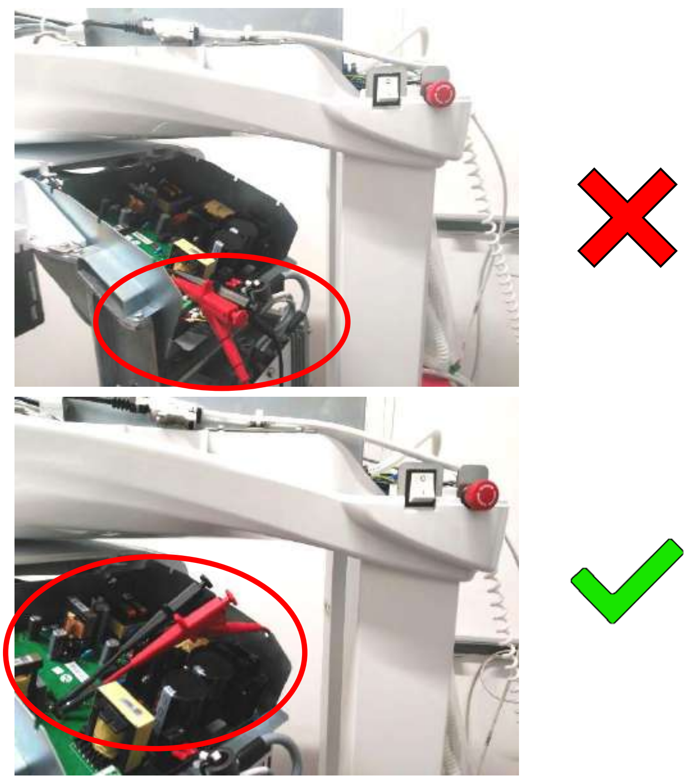


Figure 45

4. Place the clips of the instrument on the relevant pins according to the measurement to be performed as described in the following table, having care to avoid short circuits.

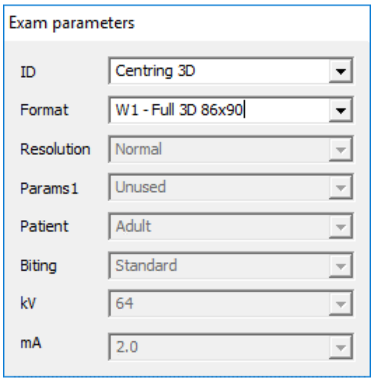
Parameter	Instrument	XJ8 pins
kV	Multimeter or oscilloscope	PIN 1 → GND PIN 4 → kV feedback
mA	Multimeter or oscilloscope	PIN 1 → GND PIN 3 → mA feedback
time	Oscilloscope	PIN 1 → GND PIN 3 → mA feedback

Warning
Beware that the probes do not interfere with columns during the rotation of the arm.



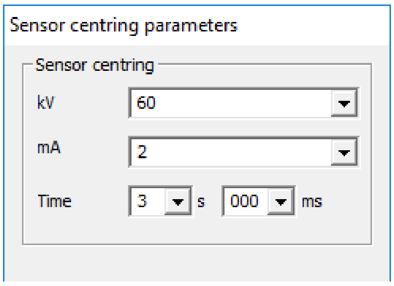
5. Switch ON the system and as soon as the green led starts blinking, press >0< for initialization.
6. Open the PhD_C_Test software (located at C:\Program Files (x86)\Acteon Imaging\Panoramic X-Mind Prime Ceph) and check that the unit is connected to the PC (the message "MCU is connected" is displayed in the bottom left corner of the program window).

7. From the "Exam parameters" panel select the ID as "Centring 3D". Select format as "W1 - Full 3D 86x90".



Note
The "Centring 3D" choice allows you to carry out the dosimetry test without the rotation of the tube-head arm.

8. In the "Sensor centring parameters" panel set the following exposure parameters: 60kV, 2mA, 3s.



Warning
The following operations involve the emission of X-rays, so the Authorized Technician must pay the greatest attention and respect the protection regulations in force in that country.

9. Press the X-ray button to take an exposure and verify that the measured values are in the acceptance limits listed in the Table at point 10.

10. Take a second exposure setting the following parameters: 86 kV, 12 mA, 3 s and verify that the measured values are in the acceptance limits listed in the following table.

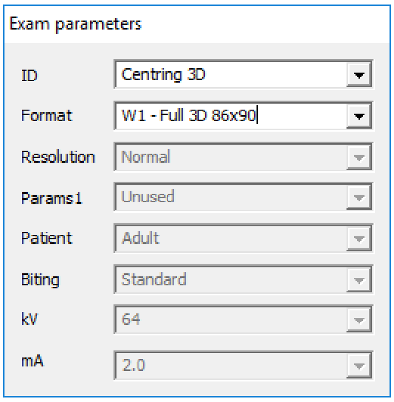
Parameter			Acceptance range		
kV	mA	t (s)	kV feedback (± 8%)	mA feedback (± 10 %)	Time (± 5 %)
60	2	3	2.76 to 3.24 V	0.9 to 1.1 V	2.85 to 3.15 s
86	12	3	3.96 to 4.64 V	3.6 to 4.4 V	2.85 to 3.15 s

11. In case the test fails (results do not match the indicated values), perform the following actions according to which parameter is out of the acceptance range:
    - kV out of range: follow the instructions described at paragraph 9.2.7.2
    - mA out of range: follow the instructions described at paragraph 9.2.7.4
    - time out of range: replace the generator board.

7.13.2 Verification of Exposure parameters with NON invasive method

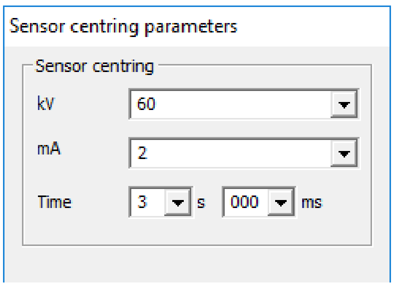
The exposure parameters (kV, time and dose) can also be verified using the so called “non-invasive method”.
The exposure parameters can be checked with a non-invasive instrument by performing the following procedure:

1. Place the probe of the dosimeter on the center of the sensor area (black rectangle on the sensor plastic cover).
2. Open the PhD_C_Test software (located at C:\Program Files (x86)\Acteon Imaging\Panoramic X-Mind Prime Ceph) and check that the unit is connected to the PC (the message “MCU is connected” is displayed in the bottom left corner of the program window).
3. From the “Exam parameters” panel select the ID as “Centring 3D”. Select format as “W01 –Full 3D 86x90”.



Note
The “Centring 3D” choice allows you to carry out the dosimetry test without the rotation of the tube-head arm.

4. In the “Sensor centring parameters” panel set the following exposure parameters: 60 kV, 2 mA, 3 s.



5. Press the X-ray button to take an exposure and verify that the measured values are in the acceptance limits listed in the Table at point 6.

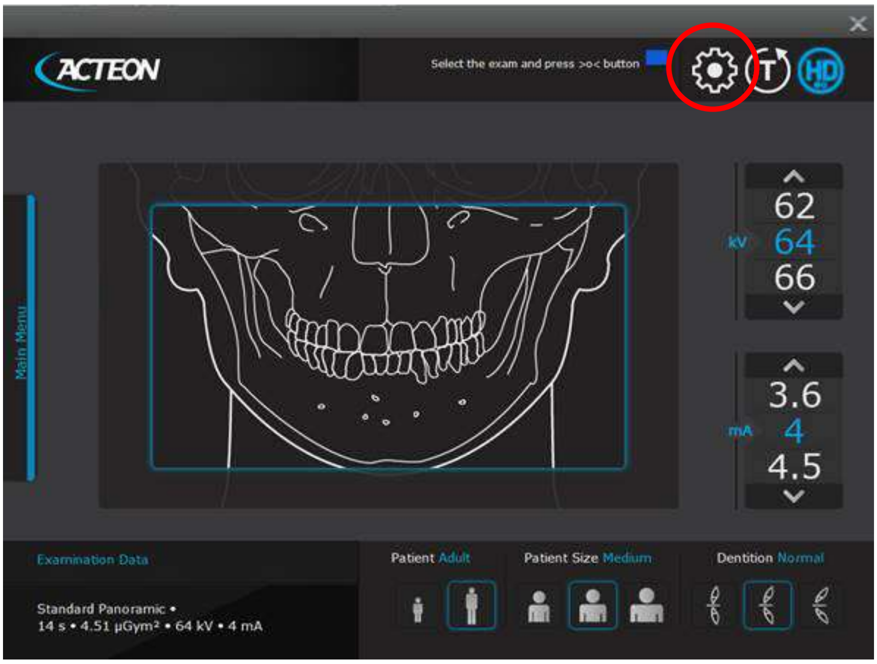
6. Take a second exposure setting the following parameters: 86 kV, 12 mA, 3 s and verify that the measured values are in the acceptance limits listed in the following table.

Parameter			Acceptance range	
kV	**mA**	**t (s)**	**kV acceptance limits**	**Time acceptance limits**
60	2	3	55.2 to 64.8 kV	2.85 to 3.15 s
86	12	3	79.1 to 92.8 kV	2.85 to 3.15 s

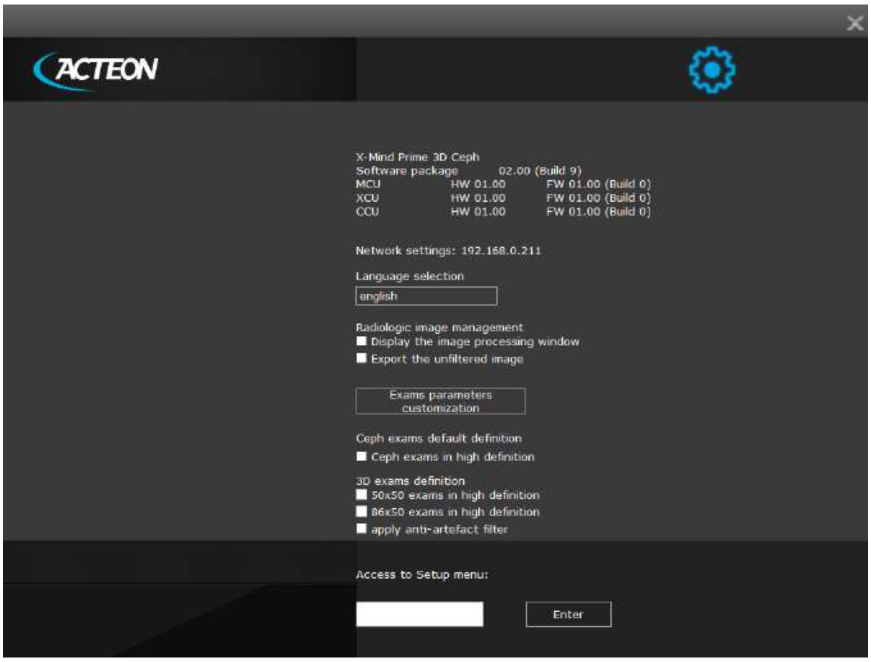
7. In case the test fails (result do not match the indicated values), proceed with the following actions:
   - Check the probe position and repeat the test
   - If the values are still out of range, perform the test using the invasive method as described in paragraph 7.13.1.

7.14 Storing of automatic exposure parameters

The preset exposure parameters of each specific exam can be modified according to the user's needs.
In order to modify the default exposure parameters, from the Main Menu select the symbol GEAR (configuration).



The following window will be displayed:



Select the button “Exam parameter customization”.

On the displayed window, use the buttons on the left to select the exam family and the tables to the right to customize the default parameters for each exam type, patient type and size.

At any time, it is possible to restore the factory preset for all the exams, clicking on the button on the bottom of the window “Reset all exams to factory values”.

Note

Parameter changes for each exam type, patient type and size are stored on the PC and not saved in the unit. So if you replace your PC, you need to set them up again.

7.14.1 Table of pre-set anatomic parameters

Default exposure values in 2D Panoramic modes				
	Adult Patient (14 seconds)		Child Patient (12.8 seconds)	
	kV	mA	kV	mA
Small	76	9	66	8
Medium	80	9	68	8
Large	82	9	70	8

Default exposure values in 2D Sinus mode				
	Adult Patient (9 seconds)		Child Patient (9 seconds)	
	kV	mA	kV	mA
Small	68	8	64	8
Medium	72	8	66	8
Large	74	8	68	8

Default exposure values in 2D TMJ mode				
	Adult Patient (10,6 seconds)		Child Patient (10,6 seconds)	
	kV	mA	kV	mA
Small	70	8	64	8
Medium	74	8	66	8
Large	78	8	68	8

Exposure values in 3D Full Dentition, 3D Extended Volumes and 3D Airways				
	Adult Patient (7 seconds)		Child Patient (7 seconds)	
	kV	mA	kV	mA
Small	84	4	64	6.3
Medium	84	5	66	6.3
Large	84	6	68	6.3

Exposure values in 3D Single Jaw, 3D Maxillary and Mandibular Teeth modes Normal resolution				
	Adult Patient (7 seconds)		Child Patient (7 seconds)	
	kV	mA	kV	mA
Small	84	4	64	6.3
Medium	84	5	66	6.3
Large	84	6	68	6.3

Exposure values in 3D Single Jaw, 3D Maxillary and Mandibular Teeth modes High resolution				
	Adult Patient (7 seconds)		Child Patient (7 seconds)	
	kV	mA	kV	mA
Small	84	8	64	8
Medium	84	10	66	8
Large	84	12.5	68	8

Exposure values in 3D TMJ mode				
	Adult Patient (6,2 seconds)		Child Patient (6,2 seconds)	
	kV	mA	kV	mA
Small	82	5	64	6.3
Medium	82	6	66	6.3
Large	82	7	68	6.3

Exposure values in 3D Sinus mode				
	Adult Patient (7 seconds)		Child Patient (7 seconds)	
	kV	mA	kV	mA
Small	78	8	64	6.3
Medium	78	9	66	6.3
Large	78	10	68	6.3

Exposure values in Ceph LL mode				
	Adult Patient (from 4.4 to 15.1 seconds)		Child Patient (from 4.4 to 15.1 seconds)	
	kV	mA	kV	mA
Small	74	8	72	7.1
Medium	76	8	74	7.1
Large	78	8	76	7.1

Exposure values in Ceph AP mode				
	Adult Patient (5.8 or 12.1 seconds)		Child Patient (5.8 or 12.1 seconds)	
	kV	mA	kV	mA
Small	76	12.5	74	11
Medium	78	12.5	76	11
Large	82	12.5	78	11

Exposure values in Carpus mode		
	Child Patient (4.4 seconds)	
	kV	mA
Small	62	8
Medium	62	8
Large	62	8

Note
The exam parameters set as the default are values to be taken as the starting point. Users can optimise the parameters according to their needs.

Note
The type of biting does not affect the kV and mA values, but it affects the position of the focus layer, by adapting rototranslation movement to the patient's anatomy.

7.15 Data backup

At the end of installation process, make sure that the following information and data are safely archived:

- IP address of the X-MIND prime 3D unit
- Setup Parameter Table containing the factory configuration

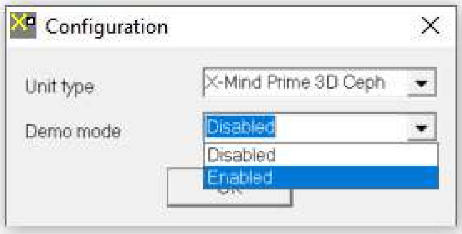
7.16 Exhibition mode setup

The X-MIND prime 3D system (unit and graphical user interface) provides three different demonstration modes in case it is to be used as demo (exhibitions or show room) where the X-ray emissions are not allowed.

7.16.1 Graphical User Interface (G.U.I.) demo (without unit connected)

The following procedure allows the demonstration of the Graphical Unit Interface (G.U.I.) without connection to the unit.

1. Open “PhD_C_Conf.exe” program in C:\Program Files (x86)\Acteon Imaging\Panoramic X-Mind Prime Ceph
2. On the “Configuration” window select “Demo mode” as “Enabled”:



   Confirm with “OK”.

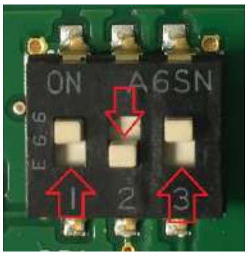
3. Start AIS program and open the G.U.I. The user interface (G.U.I.) will work normally without the unit connected.

Note
In order to restore the normal functioning of the unit interface: close the G.U.I., open “PhD_C_Conf.exe” program and select “Demo mode” as “Disabled”; confirm with “OK” to restore the normal functioning of the interface.

7.16.2 Unit movements demo (without PC connection)

The following procedure allows the simulation of the panoramic exam movements without connection with the PC.
With this setting is possible to perform a single exam simulation or activate an automatic continuous movements program.

Set the MCU DIP-Switches to “Exhibition demo mode”: ON-OFF-ON (see paragraph 4.2.2.1)



Note
In this mode the X-ray emissions are disabled and it is not possible to connect the unit to a PC.

7.16.2.1 Single Panoramic or Ceph exam simulation

1. Switch ON the unit.
2. When the keyboard green LED blinks slowly (one pulse per second), press the >0< button and wait the end of the axis reset.
3. To take a panoramic simulation press the >0< button and wait the end of the movements. (Make sure that the 3D sensor is closed in 3D panoramic position)
4. Press the X-ray button until the end of the panoramic rotation.
5. At the end of the rotation press the >0< button and the unit come back to the start position ready for another panoramic exam simulation.
6. To take a ceph simulation open the sensor press the x-ray button to open the 3D sensor and then rotate it into the ceph exam position, press the >0< button and wait the end of the movements.
7. Press the >O< button and wait the end of the movements.
8. Press the X-ray button until the end of the ceph exam simulation.
9. At the end the machine returns back to the patient entry position.
10. If you want to perform a new ceph simulation repeat the steps from 7 to 9. If you want to perform a panoramic exam, close the 3D sensor to panoramic 3D

position and then repeat the steps from 3 to 5. Otherwise if you want to start the Automatic program go to next paragraph

7.16.2.2 Automatic continuous movements program (Exhibitions)

1. Switch ON the unit.
2. When the keyboard green LED blinks slowly (one pulse per second), press the >0< button and wait the end of the axis reset.
3. Press together the column up and column down buttons on the keyboard. (Make sure that the 3D sensor is closed in 3D panoramic position).
4. After 5 second release both buttons to start the automatic demo sequence.
5. The unit then keeps on doing a demo sequence of a panoramic roto-translation, a ceph movement and a column movement.
6. In order to stop the movements, switch OFF the unit.

Note
To stop the columns movements, press the red emergency button located on the upper part of the unit, near the power switch.

7.16.2.3 Unit and G.U.I. full demonstration (X-Ray emission permanently disabled)

The following procedure allows a full simulation of the unit and G.U.I. functioning without X-Ray emission (connection the PC required).

1. Enter service menu (see chapter 8).
2. Select the “Exposition” page (see paragraph 8.2).
3. Check “Disable permanently X-ray emission” box.
4. Click on the gear and save the new configuration in the EEPROM memory.
5. Wait the unit reboot and use the G.U.I. and unit normally; the system will perform the exam without the X-Ray emission.

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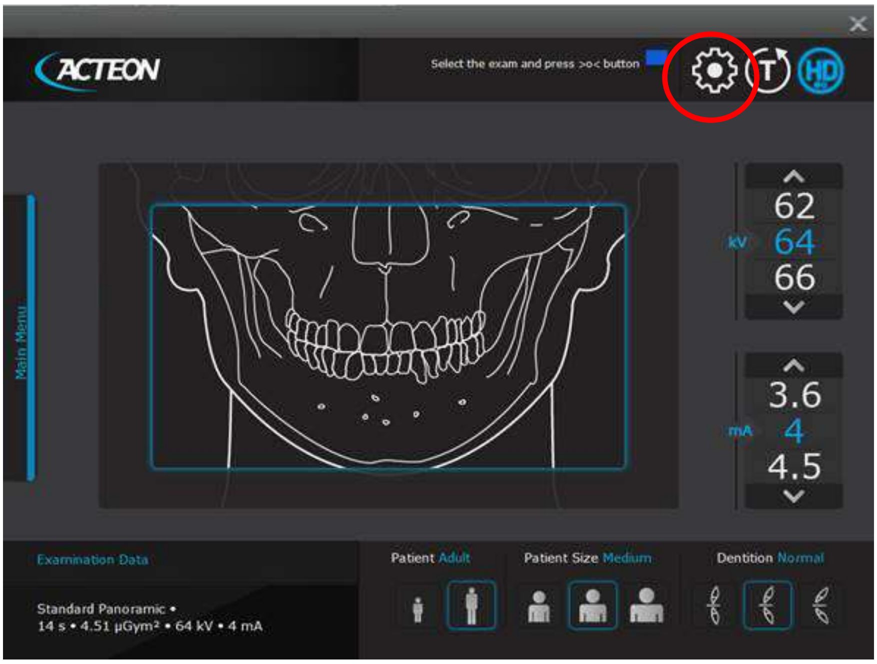
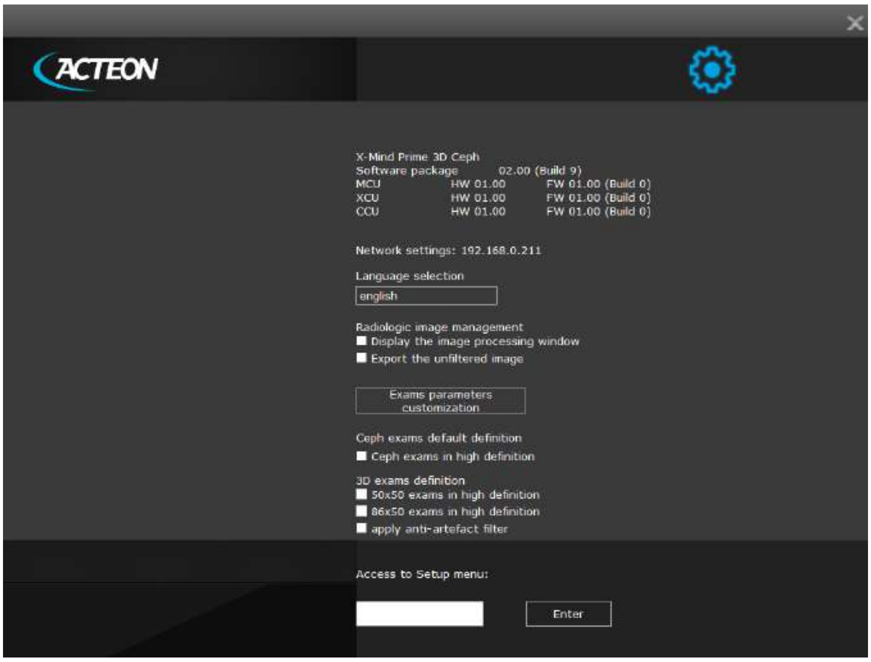
8. SERVICE PROGRAMS DESCRIPTIONS

In order to access Service Programs, from the main menu select the symbol GEAR (configuration).



The first page of the configuration window shows the SW versions present in the unit. This is useful in case it is required to know the current versions. This page doesn't require any password.



In order to enter in Configuration menu, type the password "TechAccess" in "Access to Setup menu" filed and press Enter.

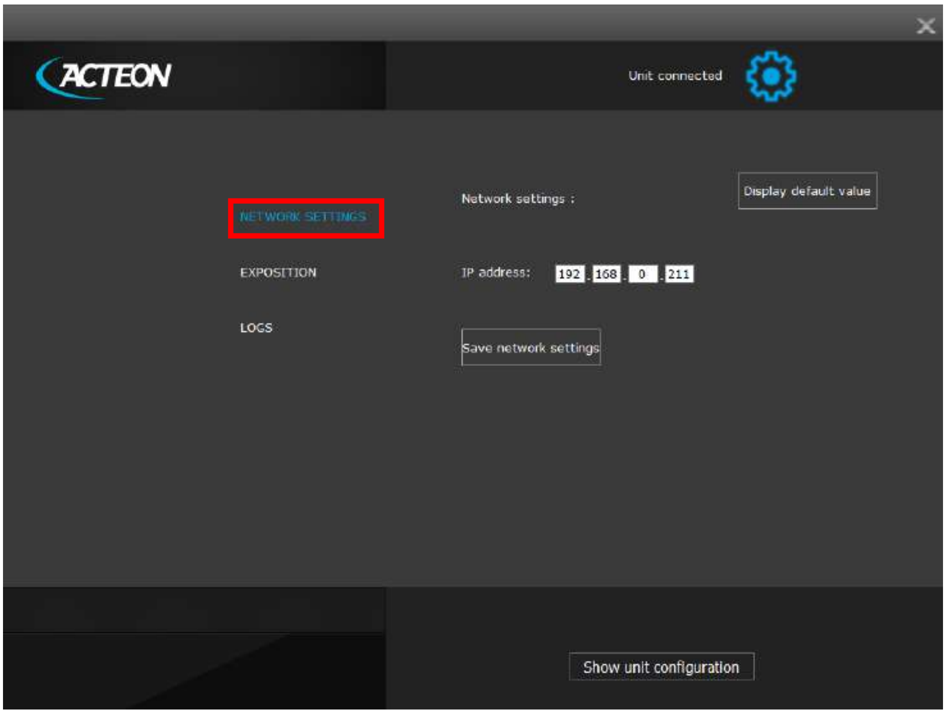
This page is reserved only to authorized technicians: it allows access to the different functional parameters, as following:

- ***Network Setting:*** allows to set the IP address of the unit (see paragraph 8.1)
- ***Exposition:*** allows to disable the x-ray emission permanently (see paragraph 8.2)
- ***Logs:*** this page displays the exam counters (see paragraph 8.3)

Each time a parameter is modified, the unit will provide a confirmation window.

8.1 Network setting

Selecting “Network Setting” it is possible to modify the IP address used to communicate with the X-MIND prime 3D (see paragraph 11.2.8).

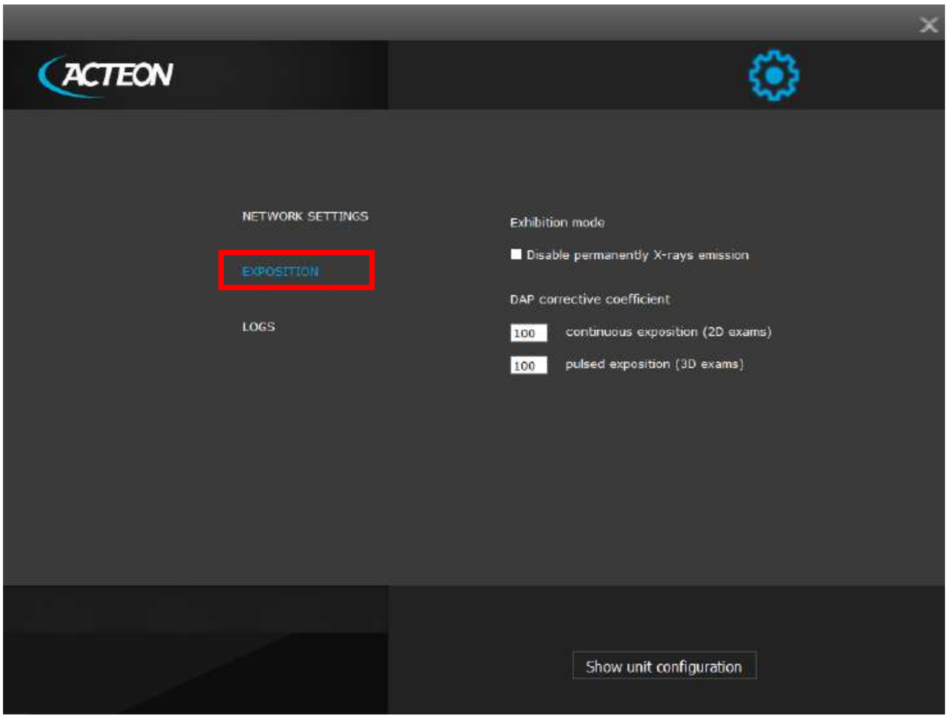


If necessary, change the IP Address according with the one present on the PC (same IP, but last 3 digits different; same Subnet mask).

8.2 Exposition

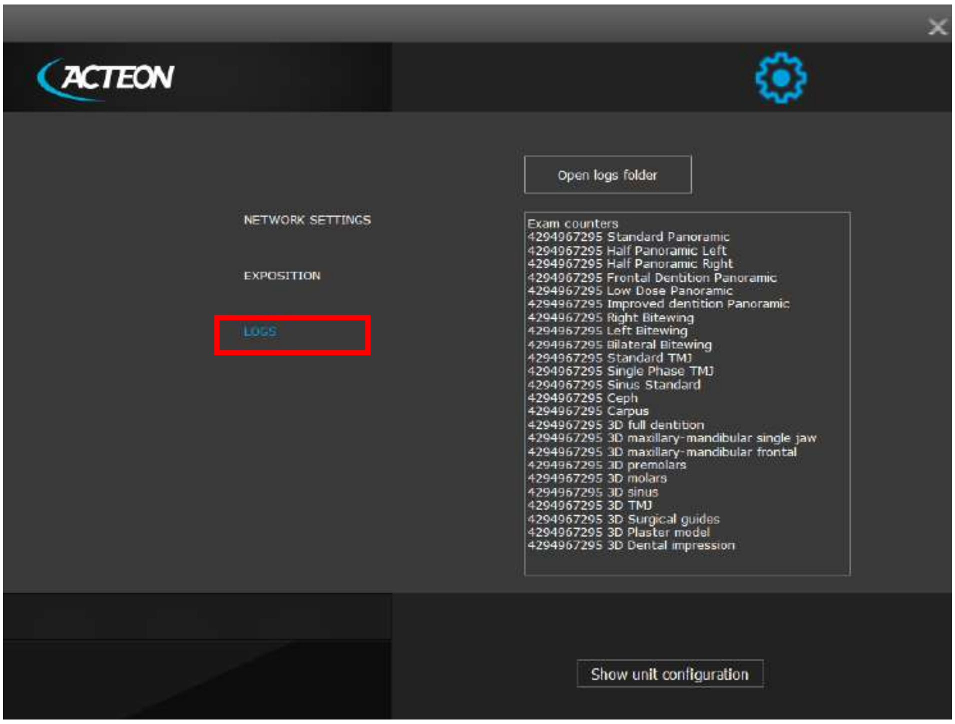
This function allows:

- to disable X-ray emission permanently checking the box to disable X-rays;
- to set a corrective factor – in % - on the displayed DAP dose per area value.



8.3 Logs

In this page it is possible to see the exam counters and access the machine logs folder.



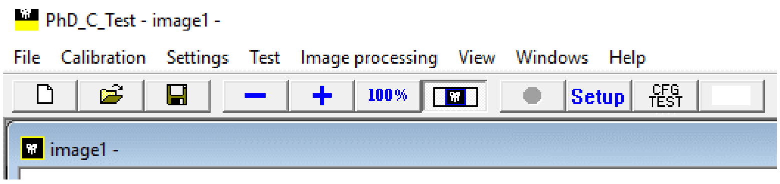
In order to keep the unit logs, refer to paragraph 11.2.1.

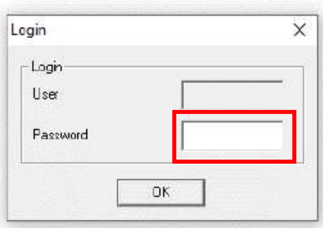
8.4 Machine configuration and setup

In addition to the Service Programs available in the Graphical User interface, other Service Programs and the machine configuration can be done by running the **"PhD_C_Test"** program located in the directory C:\Program Files (x86)\Acteon Imaging\Panoramic X-Mind Prime Ceph.

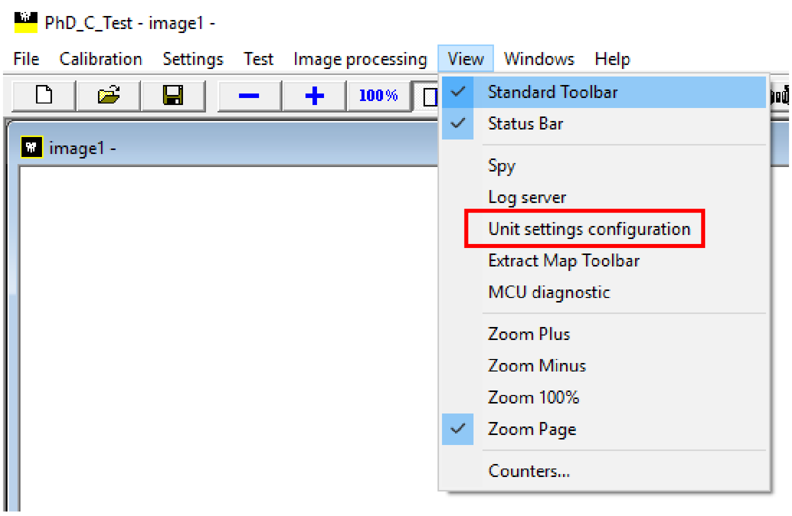
To access the machine configuration:

- Run the software "PhD_C_Test"
- Click on the SET-UP button and in the windows that will open type the password **PhdAccess**





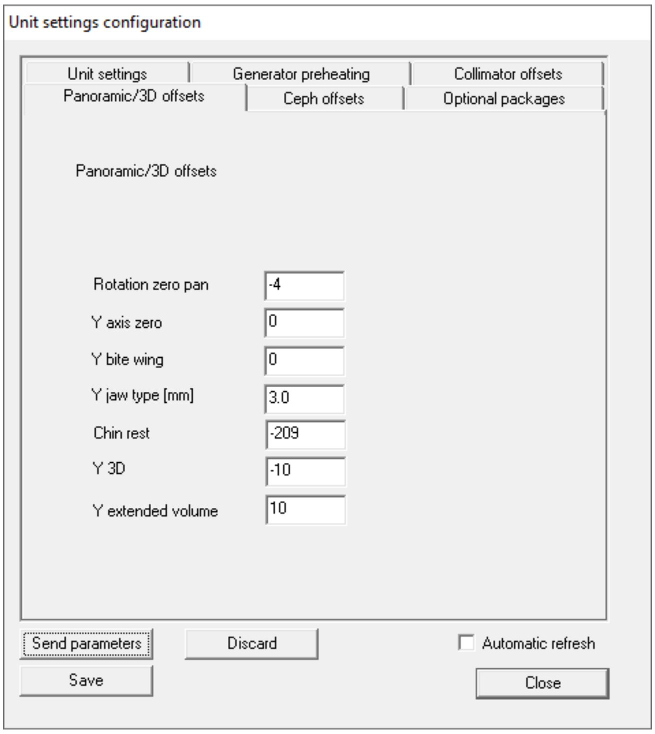
- In the View menu select Unit Setting configuration

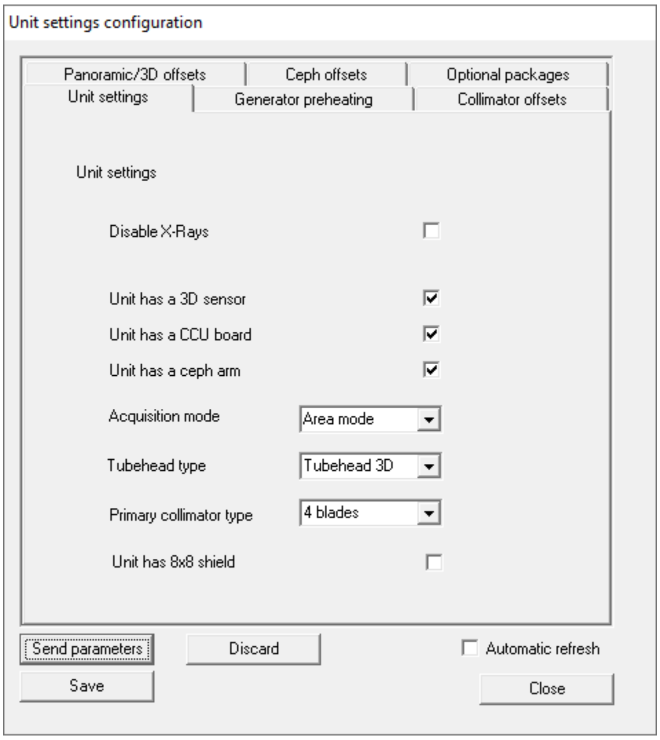


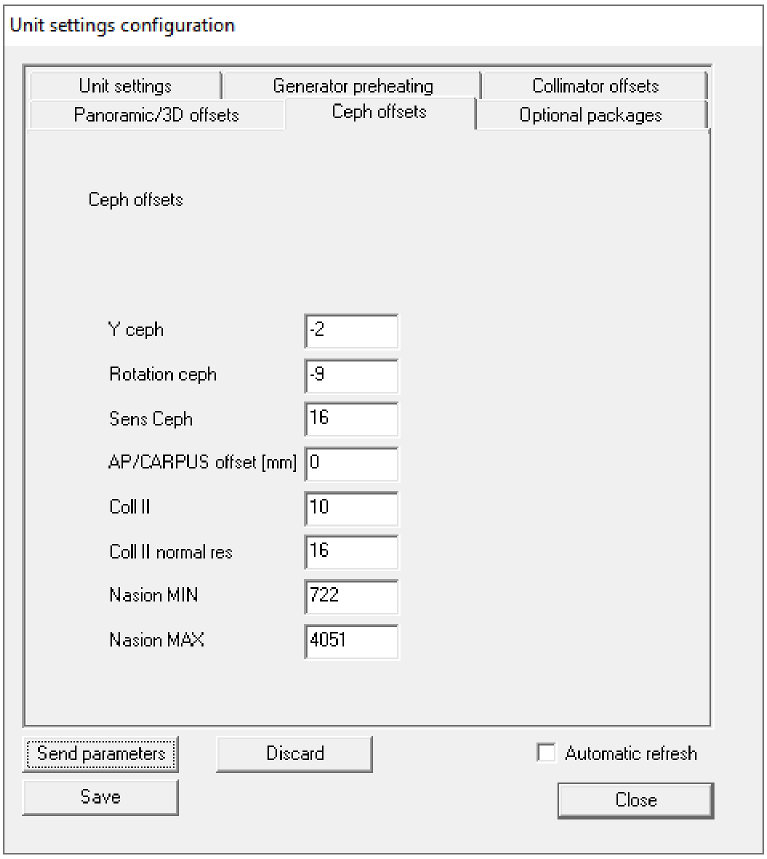
- The following window will open; there are several different tabs for different system settings
-

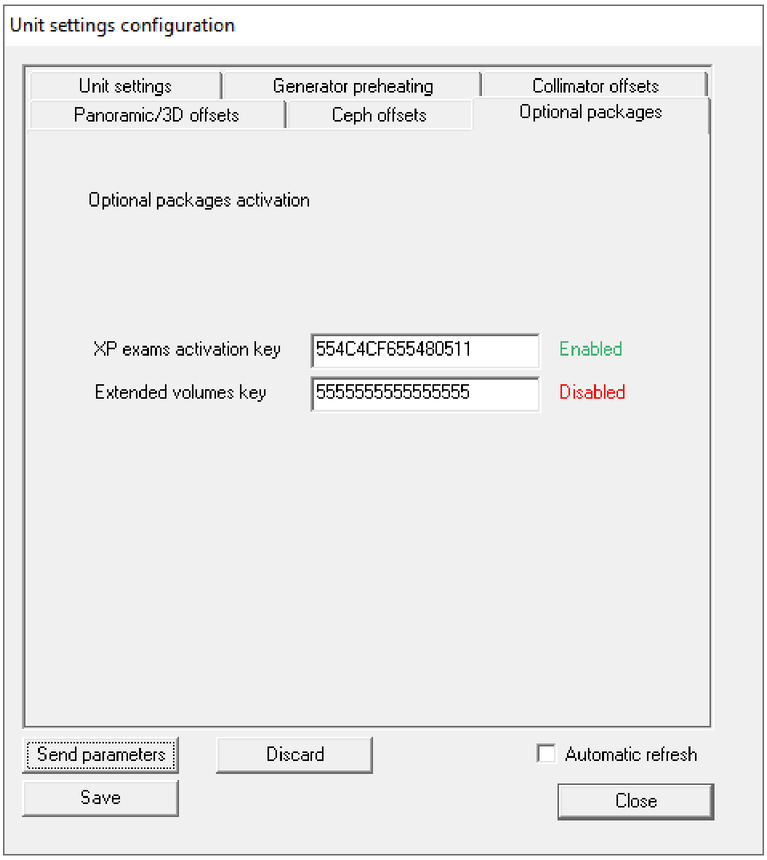
Note

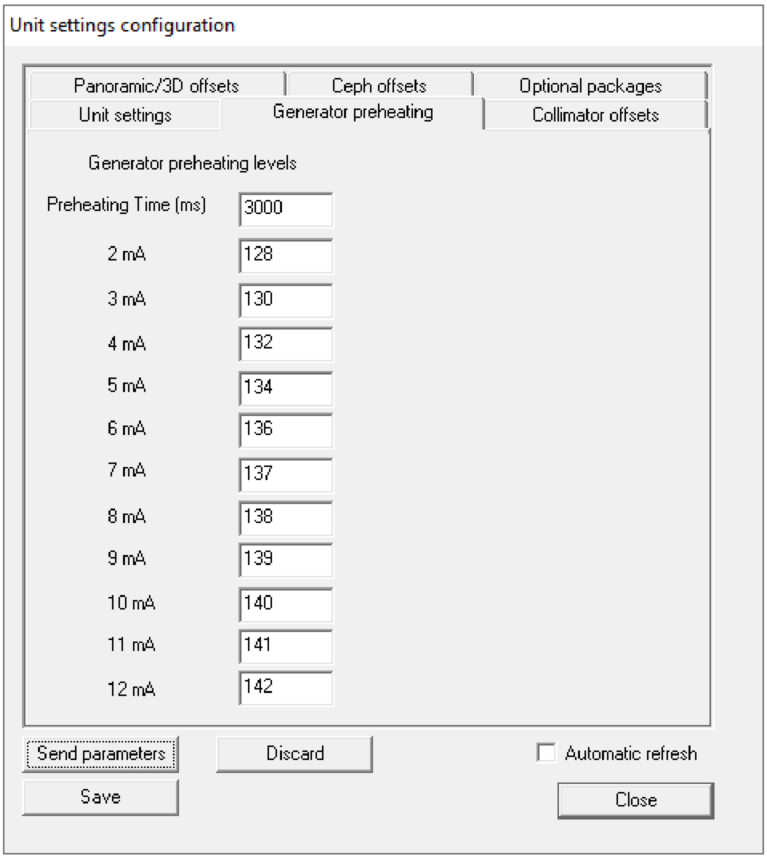
To change a parameter you must: change the parameter, press “Send parameters” and then “Save”. It is not necessary to exit the SETUP if you want to do a x-ray test exam and if you press “Close” you don’t exit from the SETUP mode. To exit the SETUP mode you must either press the SETUP button or close Phd_c_Test. When you exit the SETUP the unit will perform a reboot (indicated by the flashing of the keyboard LED) and that all parameters sent and not saved will be discarded.

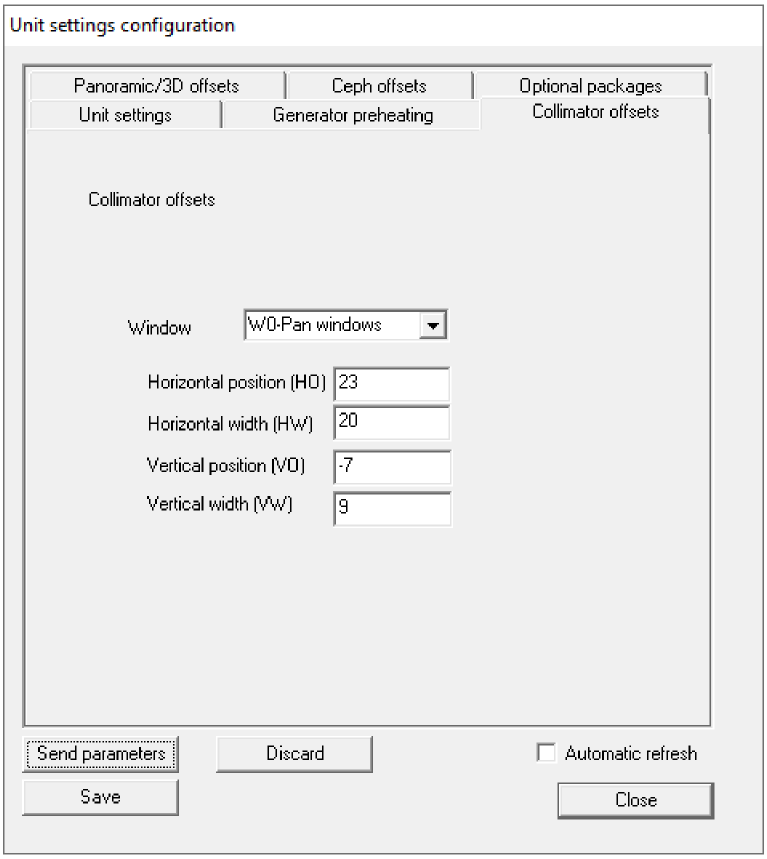



Unit settings configuration
Panoramic/3D offsets
Ceph offsets
Optional packages
Unit settings
Generator preheating
Collimator offsets
Unit settings
Disable X-Rays
Unit has a 3D sensor
Unit has a CCU board
Unit has a ceph arm
Acquisition mode
Area mode
Tubehead type
Tubehead 3D
Primary collimator type
4 blades
Unit has 8x8 shield
Send parameters
Discard
Automatic refresh
Save
Close


Unit settings configuration
Unit settings
Generator preheating
Collimator offsets
Panoramic/3D offsets
Ceph offsets
Optional packages
Ceph offsets
Y ceph
-2
Rotation ceph
-9
Sens Ceph
16
AP/CARPUS offset [mm]
0
Coll II
10
Coll II normal res
16
Nasion MIN
722
Nasion MAX
4051
Send parameters
Discard
Automatic refresh
Save
Close


Unit settings configuration
Unit settings
Generator preheating
Collimator offsets
Panoramic/3D offsets
Ceph offsets
Optional packages
Optional packages activation
XP exams activation key
554C4CF655480511
Enabled
Extended volumes key
5555555555555555
Disabled
Send parameters
Discard
Automatic refresh
Save
Close


Unit settings configuration
Panoramic/3D offsets
Ceph offsets
Optional packages
Unit settings
Generator preheating
Collimator offsets
Generator preheating levels
Preheating Time (ms)
3000
2 mA
128
3 mA
130
4 mA
132
5 mA
134
6 mA
136
7 mA
137
8 mA
138
9 mA
139
10 mA
140
11 mA
141
12 mA
142
Send parameters
Discard
Automatic refresh
Save
Close


Unit settings configuration
Panoramic/3D offsets
Ceph offsets
Optional packages
Unit settings
Generator preheating
Collimator offsets
Collimator offsets
Window
W0-Pan windows
Horizontal position (HO)
23
Horizontal width (HW)
20
Vertical position (VO)
-7
Vertical width (VW)
9
Send parameters
Discard
Automatic refresh
Save
Close

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9. TROUBLESHOOTING

Note

If components have to be replaced or technical support is required, contact Technical Service providing the mandatory information listed on paragraph 1.2 and the additional information required by the specific error description.

9.1 LEDs

9.1.1 MCU board A1 LEDs

The following table shows the LEDs that are present on MCU board A1, their functions and the recommended corrective actions in case of defects. To locate the LEDs, refer to the layout of the MCU board A1 (see chapter 12 – drawing 2).

Led	Colour	Working status	Failure status	Main function	Corrective action
H1	Green	ON	OFF	+24V	See paragraph 11.2.3
H2	Green	ON	OFF	+24V Motors and power supply	See paragraph 11.2.3
H3	Green	ON	OFF	+5V	Check cables: X22, X23, X24, X36, X15, X10, X25, X9
H4	Green	ON	OFF	+ 3V Micro controller power supply	
H5	Green	ON	OFF	Laser power supply	Check the laser cables X16 and X18
H6	Green	Flashing / lit weakly	Steady ON/OFF = error on CANbus	Can Bus communication	See Error E670 and E671 (paragraph 9.2.6.11)
H7	Red	Flashing / lit weakly	Steady ON/OFF= error on CANbu s	Can Bus communication	See Error E670 and 671 (paragraph 9.2.6.11)
H8 **H9** **H10**	Green	OFF		These three LEDs when blinking	

				indicate the MCU programming status	
H11	Green	OFF=X-ray button not pressed ON=X-ray button pressed	OFF=X-ray button pressed ON=X-ray button not pressed	X-ray button activation	See Errors E360 and E760 (paragraphs 9.2.4.1 and 9.2.7.11)

9.1.2 Generator board A2 LEDs

The following table shows the LEDs that are present on the Generator board, their functions and the recommended corrective actions in case of defects. To locate the LEDs, refer to the layout of the Generator board (see chapter 12, drawing 3).

Led	Colour	Working status	Failure status	Main function	Corrective action
H1	Green	ON	OFF = Failure	+5Vdc	See Error E750 (paragraph 9.2.7.1)
H2	Green	OFF=X-ray button not pressed ON=X-ray button pressed	OFF=X-ray button pressed ON=X-ray button not pressed	X-Ray button activation	See Error E760 (paragraph 9.2.7.11)
H3	Green	Flashing / lit weakly	Steady ON/OFF= error on CAN-bus	CANbus communication	See Error E670 and E671 (paragraph 9.2.6.11)
H4	Green	Flashing / lit weakly	Steady ON/OFF= error on CAN-bus	CANbus communication	See Error E670 and E671 (paragraph 9.2.6.11)
H5	Red	OFF	ON	ON if during exposure there is a: - Filament failure - Backup timer intervention	See Errors: E751, E753, E754 , E758, E760 (paragraphs 9.2.7.2, 9.2.7.4, 9.2.7.5, 9.2.7.9, 9.2.7.11)

				- Bad mA / kV feedback - X-ray button release	
H6	Yellow	OFF during stand-by ON during X-ray	ON during stand-by OFF during X-ray	X-ray emission active	
H8	Green	ON	OFF	Auxiliary power supply	See Error E750 (paragraph 9.2.7.1)
H9	Red	OFF	ON	X-ray exposure too long (backup timer intervention)	See Error E755 (paragraph 9.2.7.6)
H10	Green	ON	OFF	Main power supply	See Error E750 (paragraph 9.2.7.1)

9.1.3 3D Power Sensor board A10 LEDs

The following table shows the LED that is present on the 3D Power Sensor board (A10), its function and the recommended corrective action in case of defect. To locate the LED, refer to the layout of the A10 board (see chapter 12 – drawing 4).

Led	Colour	Working status	Failure status	Main function	Corrective action
H2	Green	ON	OFF	8/9V 3D sensor power supply	See Error E1402 (paragraph 9.2.10.2)

9.1.4 CCU Ceph Control Board A11 LEDs

The following table shows the LEDs that are present on the CCU Ceph Control Board (A11), their function and the recommended corrective action in case of defect. To locate the LED, refer to the layout of the A11 board (see chapter 12 – drawing 5).

Led	Colour	Working status	Failure status	Main function	Corrective action
H1, H2	Green, Red	Flashing/ lit weakly	Steady ON/OFF= error on CANbus	CANbus communication	Check cable X9

H3, H4, H5	Green	OFF		These three LEDs when blinking indicate the CCU programming status	
H6	Green	ON	OFF	+24V input	Check 24V on cable X62. See also Error E750 (paragraph 9.2.7.1)
H7	Green	ON	OFF	+5V)	Check 24V on cable X62. If present, replace CCU board
H8	Green	ON	OFF	+3V)	Check 24V on cable X62. If present, replace CCU board
H9	Green	ON	OFF	+24 V output to collimator (A12) board	Check 24V on cable X62. See also Error E750 (paragraph 9.2.7.1)

9.1.5 Collimator Driver Board A12 LED

The following table shows the LED that is present on the Collimator Driver Board (A12), its function and the recommended corrective action in case of defect. To locate the LED, refer to the layout of the A12 board (see chapter 12 – drawing 6).

Led	Colour	Working status	Failure status	Main function	Corrective action
H1	Green	ON	OFF	+5V input	Check 24V on cable X62 of CCU board. See also Error E750 (paragraph 9.2.10.2)

9.1.6 Ceph Driver Board A13 LEDs

The following table shows the LEDs that are present on the Ceph Driver Board (A13), their function and the recommended corrective action in case of defect. To locate the LED, refer to the layout of the A13 board (see chapter 12 – drawing 7).

Led	Colour	Working status	Failure status	Main function	Corrective action
H1	Green	ON	OFF	+24V output	Check 24V on cable X62 on CCU board. See also Error E750 (paragraph 9.2.10.2)
H2	Green	ON	OFF	+24Vinput	Check 24V on cable X62 on CCU board. See also Error E750 (paragraph 9.2.7.1)

9.1.7 Ceph sensor power supply board A14 LED

The following table shows the LED that is present on the Ceph Sensor Power board (A14), its function and the recommended corrective action in case of defect. To locate the LED, refer to the layout of the A10 board (see chapter 12 – drawing 8).

Led	Colour	Working status	Failure status	Main function	Corrective action
H1	Green	ON	OFF	+12V sensor power supply	Check 24V on cable X62 on CCU board. Check connection X76 to CCU board.See also Error E750 (paragraph 9.2.7.1). Check pogo-pins connections)

9.2 Displayed messages

The X-MIND prime 3D operative states and any detected errors are signalled by the different activation of the three keyboard LEDs (see User Manual keyboard description) and by the displayed operational and error messages on the PC interface-G.U.I. (Graphical User Interface):

- **Operational messages**: are instructions which guides the operator in the correct use of the unit.
- **Error messages**: are displayed by the GUI and describe the last occurred error. There are two kind of errors messages:
  1. Messages that require a reset by clicking on OK button on the GUI and by pressing the >0< button on the unit keyboard.
  2. Messages that can only be reset after the turning OFF and ON of the unit.

The error messages are divided into different areas that can be distinguished by the error number; the following table contains the different errors with meanings.

Main MCU board		
Code	**Error description**	**Reference paragraph**
001 / 003	Internal MCU errors	**9.2.1**
500 ÷ 505	MCU Ethernet errors	**9.2.5**
MCU EEPROM configuration		
Code	**Error description**	**Reference paragraph**
100 / 101	Configuration area parameter doesn't match the expected one	**9.2.2.1**
102	Wrong version number in configuration area	**9.2.2.2**
103 / 104	Timeout error occurred during an Eeprom erase/write operation	**9.2.2.3**
Rotation motor		
Code	**Error description**	**Reference paragraph**
200	Zero position optical sensor of rotation axis always activated	**9.2.3.1**
201	Zero position optical sensor never activated	**9.2.3.1**

202 / 203	Zero position optical sensor of rotation still active after exiting from zero sensor	**9.2.3.1**
204	Unexpected activation of rotation optical sensor	**9.2.3.2**
205	Timeout on rotation	**9.2.3.1**

Y translation motor

Code	Error description	Reference paragraph
240	Zero position micro Y always active	**9.2.3.3**
241	Zero position micro Y never active	**9.2.3.3**
243	Timeout on Y axes	**9.2.3.3**

Chin rest

Code	Error description	Reference paragraph
265	Zero position micro chin rest always active	**9.2.3.4**
266	Zero position micro chin rest never active	**9.2.3.4**
268	Chin rest timeout	**9.2.3.4**

Hardware key board (U.I.C.)

Code	Error description	Reference paragraph
270 / 271	Hardware key fault	**9.2.3.5**

X-ray Controls

Code	Error description	Reference paragraph
360	RX button pressed on start-up or before exam	**9.2.4.1**
362	RX button released during emission	**9.2.4.2**

Sensor ready

Code	Error description	Reference paragraph
370	Sensor ready lost during exposure	**9.2.4.3**
371	Sensor not ready	**9.2.4.4**

CCU Board

Code	Error description	Reference paragraph

600/601/ 605	CCU malfunctioning errors	**9.2.6.1**
602÷ 604	Ceph operative errors	**9.2.6.1**
606	Nasion calibration error	**Currently not implemented**
611	Internal CCU error	**9.2.6.1**
623 / 624	CCU eeprom errors	**9.2.6.7**
630 ÷ 635	Sensor movement errors	**9.2.6.8**
640 ÷ 645	Secondary collimator movement errors	**9.2.6.9**
650 ÷ 661	4 blade collimator movement errors	**9.2.6.10**
670 / 671	Can Bus errors	**9.2.6.11**

680	Ceph exam aborted	**Restart the exam**

Generator Board

Code	Error description	Reference paragraph
750	Generator board initialization error	**9.2.7.1**
751	Alarm “overvoltage kV”	**9.2.7.2**
752	Alarm “overload on filament” on Generator board	**9.2.7.3**
753	Alarm “overload anodic current”	**9.2.7.4**
754	Alarm “filament not OK”	**9.2.7.5**
755	Alarm “backup timer”	**9.2.7.6**
756	Alarm “PFC not OK”	**9.2.7.7**
757	Alarm “Brown OUT”	**9.2.7.8**
758	Alarm “NO X-ray”	**9.2.7.9**
759	Alarm “unexpected emission”	**9.2.7.10**
760	Alarm “NO RX button command”	**9.2.7.11**
761	Alarm “NO X-ray emission”	**9.2.7.9**
762	Bad unit status: emission flag detected unexpectedly	**9.2.7.12**
763	kV analog feedback out of range	**9.2.7.13**

Generator Board

Code	Error description	Reference paragraph

764	mA analog feedback out of range	9.2.7.13
765	Filament analog feedback out of range	9.2.7.13
766	Generator board reset due to a brown out	9.2.7.13
767	Generator board reset due to low voltage detection	9.2.7.13
768	Generator board reset due to a watchdog timeout	9.2.7.13
769	Generator board reset due to a stack overflow	9.2.7.13
770	Mismatch between generator board (A2) and MCU board (A1) types (2D / 3D)	9.2.7.14

Keyboard

Code	Error description	Reference paragraph
850	One or more keycodes are pressed	9.2.8.1
852	Button >0< pressed during movements	9.2.8.2

PC software user interface (GUI)

Code	Error description	Reference paragraph
1201	Setup menu: write data EEPROM failure	9.2.9.1
1202	Unexpected value detected by the software	9.2.9.2
1203	Software allocation failure	9.2.9.1
1204	Exposure parameters failure	9.2.9.2
1205	Image buffer allocation failure	9.2.9.2

PC driver interface (ASP)

Code	Error description	Reference paragraph
1401	Sensor connection lost during exam	9.2.10.1
1402	Sensor communication failure	9.2.10.2
1403	Software watchdog error	9.2.10.3
1404	Sensor does not detect X-rays during exam	9.2.10.4
1405	Sensor frame lost during exam	9.2.10.1

9.2.1 Errors with code from E001 to E003

These errors are related to the MCU board and its firmware.

Power OFF the unit and, after 1 minute delay, power it ON again; if the error is displayed again, replace the MCU board and report the error and when it occurred to the technical service.

9.2.2 Errors with code from E100 to E104

These are errors related to the MCU board EEPROM memory.

9.2.2.1 E100: Configuration area parameter (CRC-16) doesn't match the expected one / E101: Configuration area parameter (magic number) doesn't match the expected one

These errors are shown when a corrupted configuration area parameter is found by the firmware of the X-MIND prime 3D.

1. Verify that on the MCU board the EEPROM memory is well inserted (Figure 2).
2. If the error is still present, reset the EEPROM memory as listed below:

⚠ **Warning**
All the factory calibrations offset will be lost.
Before performing this procedure, make sure that the equipment parameters table (supplied as paper copy with the unit documentation – see paragraph 14.1) with the factory setting offsets is available.

---

a. Remove the MCU board metallic cover.
b. Set the DIP-switch position on OFF-ON-ON (see paragraph 4.2.2.1).
c. Switch ON the unit. The three keyboard LED blinks three times in sequence.
d. The two alignment laser blinks three times.
e. At this stage, if you press the X-ray button until 5 seconds, the EEPROM memory reset will be performed. The correct reset of the EEPROM is indicated by the laser blinking.
f. Switch OFF the unit and restore the normal mode DIP-switch position (ON-ON-ON).
g. Restore the MCU metallic cover.
h. Switch ON the unit, open PhD_c_Test and wait the unit connection
i. Enter in SETUP mode (see Paragraph 8.4),modify the EEPROM parameter 0x001E from 0 to 1 (see paragraph 11.2.5) and restore the factory setting

offsets reported in the equipment parameters table (see paragraph 14.1) following the procedures present on paragraph 8.4.

3. If the error persists, replace MCU board complete of EEPROM (see paragraph 11.3.2). Manually restoring of the unit configuration data will be requested as explained in the above points.

***Technical Service additional information required**: MCU SD card log (see paragraph 11.2.1.2).*

9.2.2.2 E102: Wrong version number in configuration area

This error is shown when the version number of the configuration area doesn't match the MCU board firmware version.

1. Verify that the code printed on the MCU board match code 5804040700/XX. If it does not match, replace the MCU board with a correct one (see paragraph 11.3.2).
2. Contact Technical Service to verify that the MCU firmware version is compatible with the unit configuration. If it is not, upload the MCU firmware with a compatible one (see paragraph 11.1.1).
3. If the problem is still present, reset the EEPROM following the procedure described in paragraph 9.2.2.1, point 2.

***Technical Service additional information required**: MCU SD card log (see paragraph 11.2.1.2).*

9.2.2.3 E103: Timeout error occurred during an EEPROM erase operation / E104: Timeout error occurred during an EEPROM write operation

These errors are shown when a timeout occurred during an EEPROM erase or write operation.
Power OFF the unit and, after 1 minute delay, power it ON again and verify the correct functioning of the unit.
If a new error is displayed, refer to the specific error paragraph description to fix the issue.

9.2.3 Errors with code from E200 to E299

These errors codes are concerning problems related to the movement axis of the unit.

9.2.3.1 E200: Zero position optical sensor of rotation always active / E201: Zero position optical sensor of rotation never active / E202 and E203: Zero position optical sensor of rotation still active after exiting from zero sensor / E205: Timeout on rotation

These errors are signalling a problem on the rotation axis movement.
The position of rotation is controlled by the optical sensor B1, that is activated during the rotation axis reset movement; if this sensor is found active at the start up phase, and it is never sensed de-activated, the E200 message error is displayed, meaning that the sensor itself is broken or that the motor is not running.
In case that it is never sensed activated, the E201 is displayed, and the reasons are the same.
E202 or E203 is displayed when the rotation zero sensor B1 is still active after exiting from axis zero position.
E205 means that the optical sensor is never activated during the rotation axis reset.

In all cases, the optical sensor functionality can be checked placing an opaque thin material in the optical path and using a multimeter, verify that the voltage between pin X22-2 and pin X22-4 on the MCU board is about 5V when the optical path is covered by the thin material and about 0V when the optical path is not covered.

1. If there is no variation and the arm does not move or moves with difficulty or jumps:
    a. check the belt and verify that it is not broken; if the belt is loose, adjust its tension
    b. check cable X18 of motor M3; there can be a short circuit or a broken wire; check also for a loosen contact. In case of short circuit, replace the cable, verifying also that no damage has been caused to the motor driver on the MCU.

Note
In the event of a short circuit on the X18 cable, the MCU board fuse F1 may be blown (the 24V power supply LED H2 OFF) and / or the motor driver (on the MCU board) may be damaged: if it is the case, replace the fuse F1 and then the MCU board.

2. If the arm moves but no variation of the signals is detected, replace the optical sensor B1 and if the problem is still present, the MCU board A1.

Technical Service additional information required:
- *Audio / Video with the global view of the unit movement*
- *Audio / Video of the view of the rotation motor group movement (with unit top cover removed)*

9.2.3.2 E204: Unexpected activation of zero position rotation sensor

This message means that there was an unexpected activation of the rotation optical sensor B1 during the exam or another movement. Typically, the problem is due to a contact of the rotation arm with an object or patient shoulder.

1. Verify if the unit had an interference with the patient or an object external to the unit; in this case remove all the object from the unit work space or instruct the patient to do not move during the exam.

Note
In the event of patient collision, it is recommended to perform a TEST examination without X-ray, with the patient in the correct exam position (see User's Manual – "Patient positioning" chapter), before performing another X-ray examination.

2. If the interference is not external to the unit (point 1.): remove the unit top cover, perform a panoramic Test exam and verify if there are interferences in the motor work spaces: remove the objects and repeat the test.

3. If the issue was not solved, refer to the Error E200 ÷ E205 troubleshooting.

9.2.3.3 E240: Zero position sensor for Y axes always active / E241: Zero position sensor for Y axes never active / E243: Timeout of Y axes

These errors are signalling a problem on the Y axis movement. The position of Y axis is controlled by the optical sensor B2, that is activated during the translation axis reset movement.
E240 is displayed when the sensor B2 is found active at the start-up phase and it is never sensed de-activated.
E241 is displayed when the sensor B2 is never sensed activated.
E243 means that the optical sensor B2 is never activated during the translation axis reset.
The above errors may mean that the sensor B2 is broken or that the motor system is not running (MCU driver or motor group fault).

1. If there is no variation and the arm does not move or moves with difficulty or jumps:
   a. check the belt and verify that it is not broken; if the belt is loose, adjust its tension
   b. check cable X19 of motor M4; there can be a short circuit or a broken wire; check also for a loosen contact. In case of short circuit, replace the cable, verifying also that no damage has been caused to the motor driver on the MCU.

Note
In the event of a short circuit on the X19 cable, the MCU board fuse F1 may be blown (the 24V power supply LED H2 OFF) and / or the motor driver (on the MCU board) may be damaged: if it is the case, replace the fuse F1 and then the MCU board.

---

2. If the arm moves but no variation of the signals is detected, replace the optical sensor B2 and if the problem is still present, the MCU board (see paragraph 11.3.2).

<u>Technical Service additional information required:</u>

- *<u>Audio / Video with the global view of the unit movement</u>*
- *<u>Audio / Video of the view of the translation motor group movement (with unit top cover removed)</u>*

9.2.3.4 E265: Chin rest zero sensor is always active / E266: Chin rest zero sensor not active when expected / E268: Chin rest timeout

These errors are displayed if a problem on the chin rest axis movement (motor M6) is present. The position of chin rest axis is controlled by the optical sensor B4, that is activated at the chin rest reset axis movement.
E265 is displayed when the sensor B4 is found active at the unit start-up phase, and it is never sensed de-activated.
E266 is displayed when the sensor B4 is never sensed activated.
E268 means that the optical sensor B4 is never activated during the chin rest reset axis movement.
The above errors may be caused by the B4 sensor B4 and/or its connections fault or by a malfunctioning of the chin rest motor M6 system (MCU driver or motor group fault).

1. If the chin rest does not move or moves with difficulty or jumps:
   a. check the motor system integrity and functioning, verifying that there are no mechanical interferences in the chin rest run moving by hand the system, switching off the unit and manually rotate the screw hub (indicated by the red arrows in the following figures):

Screw hub

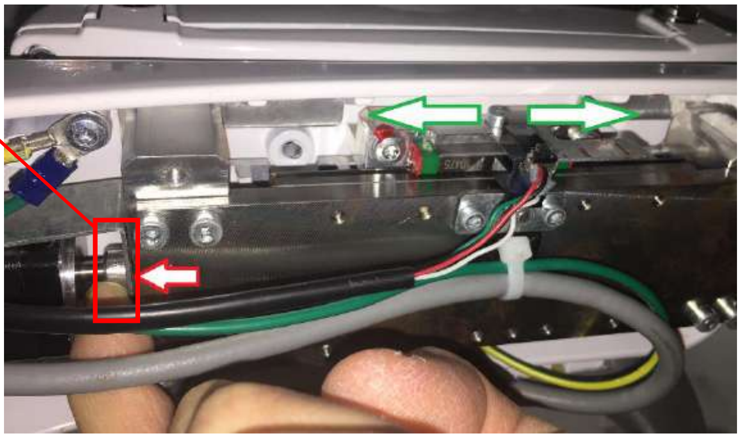


Figure 46

   If there are mechanical problem on the motor linear guide system, fix it or replace the whole chin rest motor linear guide system.

   b. If the mechanical system functioning is ok, check cable X49-X20 and motor M6 integrity (short circuit, broken wires or loosen contact on the pins). Replace the cable or the motor M6.

Note

In case of short circuit on the X49-X20 cable, the MCU board fuse F1 may be blown (the 24V power supply LED H2 OFF) and / or the motor driver (on the MCU board) may be damaged; if it is the case, replace the fuse F1 or the whole MCU board.

2. If the chin rest moves or continues to move against the chin rest end run, verify the functionality of the optical sensor B4 signal as explained in the Note below. If the signal is NOT OK, check the optical sensor cable X1-B4-X24 and if it is not ok, fix or replace it. If cable is OK and sensor signal is still not OK, replace the optical sensor B4.

Note

The optical sensor B4 functionality can be checked placing an opaque thin material in its optical path and using a multimeter, verify that the voltage between the MCU board X24 pin-2 and pin-4 is:

- about 5V when the optical path is covered
- about 0V when the optical path is not covered.

3. If the error was not solved by the above tests, replace the MCU board (see paragraph 11.3.2).

***Technical Service additional information required**: try to reproduce the error recording:*

- *An audio-video with a global view of the chin rest movements*
- *An audio-video with a bottom view of the chin rest motor linear system group movement (removing the chin rest bottom cover).*

9.2.3.5 E270 and E271: Hardware key board fault (U.I.C.)

These errors are shown when the firmware of the X-MIND prime 3D does not sense the presence of the U.I.C. (Unique Identification Code).
The hardware key board (Figure 2) is read during unit start-up; if the check is incorrect, the system displays one of the above error number: verify the presence of the key and that is well inserted.
The issue can be generated by a MCU board or hardware key fault.

1. Verify if the hardware key is well inserted on the MCU board: insert the key and verify if the issue is solved.

2. If the issue was not solved, replace the MCU board and then the hardware key.

Note
In case of MCU hardware fault, replace it following the instruction present at paragraph 11.3.2.

Note
In case there is a fault on the hardware key itself, it must be replaced. All the optional features must be re-enabled with proper codes. To request a new hardware key, report to Acteon the S/N of the equipment and / or the U.I.C code listed on the equipment parameters table (supplied as paper copy with the unit documentation – see paragraph 14.1).

9.2.4 Errors with code from E300 to E399

9.2.4.1 E360: RX button pressed on start-up or before exam

This message is displayed if, during the power ON phase or before starting of the exam, one of the connected X-ray button, has been sensed as pressed.

1. Verify if one of the X-ray buttons was intentionally / unintentionally pressed: switch OFF the unit and release the button. Switch ON the unit and verify if the issue is solved.

2. Switch OFF and ON the unit, press the X-ray button and verify that the LED H11 on MCU board (A1) light-up according to the X-ray button activation: if is not ok, verify the connected X-ray buttons and their connections.

   If they are not ok, replace or fix the buttons and verify if the issue is solved. If the error is still present, replace the MCU board (see paragraph 11.3.2).

9.2.4.2 E362: X-ray button released during emission

The above error message is displayed if the X-ray button is unintentionally / intentionally released during an exam; the emission is stopped and all motors released in order to allow the patient's exit.

Verify if the X-ray button has been intentionally / unintentionally released during the exam:

a. If it was intentionally released, press button >0< to reset the error on the unit and close the error window displayed on the GUI.
b. If it was unintentionally released, refer to Error E360.

9.2.4.3 E370: Sensor ready lost during exposure

This error is displayed if the “sensor ready” signal was lost during the exposure.

With the unit powered OFF, proceed as follow:

- Perform the troubleshooting tests listed on Errors E1401 and E1402 (see paragraphs 9.2.10.1 and 9.2.10.2).

Technical Service additional information required*: try to reproduce the error keeping the following logs:*

- *Software logs*
- *MCU SD card log*

9.2.4.4 E371: Sensor not ready

This error is displayed when the user tries to perform an exam while the sensor connection has not yet been established.

Clear the error and wait for at least 5 minutes: if the sensor connection is not achieved, refer to troubleshooting of Error E370 (see paragraph 9.2.4.3).

9.2.4.5 E374: The computer connection drops or times out during exam

During the examination, it’s checked periodically that the TCP / IP connection with ASP is constantly active, if it closes (e.g. ASP closes the program), the firmware stops everything with this error. It can be an ethernet connection problem between the PC and the sensor.

9.2.4.6 E375: Sensor took long in configuration mode (while in preheat)

During the preheating time, the sensor reports that it’s being configured; if at the end of the preheating the sensor is not yet ready, an extra 50% of preheating time is allowed; if in the end, however, the sensor always tells that it’s in the configuration phase, this error comes out. It can be a sensor problem and its connections to the PC (sensor power supply is definitely OK).

9.2.4.7 E380: CANBus invalid reply

CAN Bus (CCU-MCU-HF) HW problem or some FW bug.

9.2.5 Error with code from E500 to E505

This range of errors are dedicated to MCU – PC ethernet communication problems due to incompatibility between ASP software and MCU firmware version and/or ethernet hardware issues).

1. check the ethernet connection and the network card settings (see paragraph 7.7.1).

2. Power ON the unit and wait the connection to the PC-GUI. Verify the compatibility between MCU firmware and ASP versions: update/downgrade the FW-SW to a released/compatible configuration.

Note
Contact Technical Service to verify that the firmware and software versions are compatible with the unit configuration.

Technical Service additional information required:

- *Software logs*
- *MCU SD card log (see paragraph 11.2.1).*

9.2.6 Error with code from E600 to E680

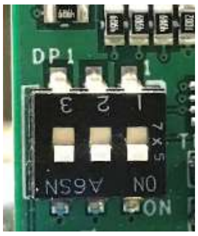
9.2.6.1 E600, 601, 611

These errors are related either to a CCU board malfunction or to a CAN bus problem between MCU board and CCU board.

Note

It may happen that at the end of CCU board firmware upgrade the error E600 is displayed in the PhD_C_Test program. In this case power off the machine and restart the software. If the error is persistent continue the troubleshooting.

1. Check that CCU dip switches are all in the ON position (down), if not place them as in the picture and power off the machine and power it on again.



2. Check the CAN bus cable X9-X9 between CCU board and MCU board: replace or fix it if defective and then verify if the problem is still present. (See Paragraph 9.2.6.11)
3. Check the CCU voltage power supply and the CCU leds.

***Technical Service additional information required**: try to reproduce the error keeping the following logs:*

- *Software logs*
- *MCU SD card log*
- *CCU SD card log*

9.2.6.2 E602 The flat panel isn't open, but should be

This error is shown when the Flat Panel sensor is not in ceph exam position while the unit is in a status which requires the sensor to be open in ceph position. Eg. ceph exam preparation or execution.

Checks:

1. Check that the sensor has not been accidentally hit by the operator or that is has not intentionally been closed by the operator during a ceph status.

In this case reset the unit and repeat the ceph positioning
2. Check that the ceph sensor position is mechanically stable, if it is not call the AS
3. When the sensor is in ceph position, check that the Hall sensor B13 can reach the magnet positioned on the 3D sensor rotating shaft. Check also that the magnet is present and stable.
   Test with the multimeter on connector X79-pin4 and GND X79-6 (A12), MUST BE 0V when sensor is in ceph position and> 3V when in other positions
4. Check that the B13 hall sensor signal is correctly connected to the CCU board through the following connection chain: X79 connector-> A12 collimator board-> cable X77-X59 pins 4->CCU board.

9.2.6.3 E603 The chin rest must be removed in order to start exam

Remove the chin rest from the unit in order to prepare the unit to perform the exam.

9.2.6.4 E604 Flat Panel is open, but should be closed

This error is shown when the Flat Panel sensor is not closed in 3D/pan position while the unit is in a panoramic, 3D or static image status.
Checks:

1. Check that the sensor has not intentionally been opened by the operator. In this case reset the unit and repeat the exam.
2. Check that the ceph sensor position is mechanically stable, if it isn't call the AS
3. When the sensor is in 3D/pan position, check that the Hall sensor B12 can reach the magnet positioned on the 3D sensor rotating shaft. Check also that the magnet is present and test with the multimeter on connector X79-pin3 and GND X79-5 (A12), MUST BE 0V when sensor is in pan3D position and> 3V when in other positions
4. Check that the B12 hall sensor signal is correctly connected to the CCU board through the following connection chain: X79 connector->A12 collimator board->cable X77-X59 pins 2->CCU board.

9.2.6.5 E605 A time out error occurred durin CCU motors movement

This error is shown in case the CCU doesn't communicate the end of an axis movement to the MCU within the time out limit
Checks:

Switch off-on the unit, when the green led blinks press the >O< button and verify that during the axis reset the following axis, driven by CCU board, moves correctly:

- Primary collimator
- Secondary collimator

- Ceph sensor

In case one specific axis does not move, refer to the specific error related to that axis:

- Primary collimator->E650-E661
- Secondary collimator->E640-E645
- Ceph sensor->E630-635

9.2.6.6 E606 Flat Panel is open, but should be closed

This error is shown when the Flat Panel sensor is not closed in 3D/pan position while

9.2.6.7 E623: timeout error during the CCU EEPROM erase operation / E624: timeout error during the CCU EEPROM write operation

These errors are shown for a timeout during the CCU EEPROM erase or write operation.
Power OFF the unit and, after 1 minute delay, power it ON again and verify the correct functioning of the unit, checking the machine configuration and the set-up data.
In case the error is persistent report it to the technical service.
If a new error is displayed, refer to the specific error paragraph description to fix the issue).
.

9.2.6.8 E630: Sensor holder zero position optical sensor always active / E631 and E632: Sensor holder zero position optical sensor still active after exiting from zero sensor / E633: Sensor holder zero position optical sensor never active / E634: Timeout on sensor holder movement / E635: Sensor holder motor overrun

These errors are signals of a problem on the ceph sensor movement.

The position of the sensor movement is controlled by the optical sensor B6, that is activated during the sensor holder axis reset; if this sensor is found active at the start up phase, and it is never sensed de-activated, the errors E630 - E632 are displayed, meaning that the sensor itself is broken or that the motor is not running.
In case that it is never sensed activated, the errors E633 and E634 are displayed.

In all cases, the optical sensor functionality can be checked placing an opaque thin material in the optical path and using a multimeter, verify that the voltage between pin X95-3 and pin X95-5 on the Ceph driver board A13 is about 5V when the optical path is covered by the thin material and about 0V when the optical path is not covered.
Check the continuity of the cables up to the CCU with a multimeter. The path is as follows:

B6->X95->A13->X89-pin5 / X58-pin5 ->CCU

Any interruption of this chain can therefore also lead to the A13 board

If there is no variation and the sensor holder does not move or moves with difficulty or jumps:

a. check the belt and verify that it is not broken; if the belt is loose, adjust its tension

b. check the 24V on the A13 board (led H2) if not present check the cables X53-X87, X54-X88 and the fuse F1.

c. check cable X92 of motor M9; there can be a short circuit or a broken wire; check also for a loosen contact. In case of short circuit, replace the cable, verifying also that no damage has been caused to the motor driver on the A13 board.

Note

In the event of a short circuit on the X92 cable, the A13 board fuse F1 may be blown (the 24V power supply LED H2 OFF) and/or the motor driver (on the A13 board) may be damaged: if it is the case, replace the fuse F1 and then the board.

If the sensor holder moves but no variation of the signals is detected, replace the optical sensor B6, its cable and if the problem is still present, the A13 board.

In addition if the movement is just in one verse check also the cable X54-X88 between CCU A11 board and A13 board and and finally replace the CCU A11 board

Technical Service additional information required: *try to reproduce the error recording:*

- *An audio-video with a global view of the chin rest movements*
- *An audio-video with a bottom view of the chin rest motor linear system group movement (removing the chin rest bottom cover).*

9.2.6.9 E640: Secondary collimator zero position optical sensor always active / E641 and E642: Secondary collimator zero position optical sensor still active after exiting from zero sensor / E643: Secondary collimator zero position optical sensor never active / E644: Timeout on Secondary collimator movement E645: Secondary collimator motor overrun

These errors are signals of a problem on the secondary collimator movement.

The position of the secondary collimator movement is controlled by the optical sensor B5, that is activated during the sensor holder axis reset; if this sensor is found active at the start up phase, and it is never sensed de-activated, the errors E640 - E642 are displayed, meaning that the sensor itself is broken or that the motor is not running.
In case that it is never sensed activated, the errors E643 and E644 are displayed.

In all cases, the optical sensor functionality can be checked placing an opaque thin material in the optical path and using a multimeter, verify that the voltage between pin X95-4 and pin X95-6 on the Ceph driver board A13 is about 5V when the optical path is covered by the thin material and about 0V when the optical path is not covered.
Check the continuity of the cables up to the CCU with a multimeter. The path is as follows:

B5->X95->A13->X89-pin3 / X58-pin3->CCU

Any interruption of this chain can therefore also lead to the A13 board

If there is no variation and the secondary collimator does not move or moves with difficulty or jumps:

- **a.** check the belt and verify that it is not broken; if the belt is loose, adjust its tension
- **b.** check the 24V on the A13 board (led H2) if not present check the cables X53-X87, X54-X88 and the fuse F1.
- **c.** check cable X93 of motor M10; there can be a short circuit or a broken wire; check also for a loosen contact. In case of short circuit, replace the cable, verifying also that no damage has been caused to the motor driver on the A13 board.

Note
In the event of a short circuit on the X93 cable, the A13 board fuse F1 may be blown (the 24V power supply LED H2 OFF) and/or the motor driver (on the A13 board) may be damaged: if it is the case, replace the fuse F1 and then the board.

If the secondary collimator moves but no variation of the signals is detected, replace the optical sensor B5 its cable and if the problem is still present, the A13 board.

In addition if the movement is just in one verse check also the cable X54-X88 between CCU A11 board and A13 board and and finally replace the CCU A11 board.

***Technical Service additional information required**: try to reproduce the error recording:*

- *An audio-video with a global view of the chin rest movements*
- *An audio-video with a bottom view of the chin rest motor linear system group movement (removing the chin rest bottom cover).*

9.2.6.10 E650 - E653: Primary collimator movement timeout / E654 - E657: Primary collimator zero position optical always active / E658 - E661: Primary collimator motor overrun

These errors are signals of a problem on the primary collimator axes.
Each axis is identified by a label on the collimator and in the following table the corrispondence between error and axis is reported:

Error	P1 axis	P2 axis	P3 axis	P4 axis
movement timeout	E650	E651	E652	E653
zero always active	E654	E655	E656	E657
overrun	E658	E659	E660	E661

The position of the primary collimator axes is controlled by the optical sensors B7-B10, that are activated during the axes reset; if these sensors are found active at the start up phase, and are never sensed de-activated, the errors E654 - E657 are displayed, meaning that the corresponding sensor is broken or that the motor is not running.
In case that a sensor is never sensed activated, the errors E650 - E653 are displayed

In all cases, the optical sensor functionality can be checked placing an opaque thin material in the optical path and using a multimeter, verify that the voltage between the following pins: for B7 pin X84-5 and pin X84-3, for B8 pin X84-5 and pin X84-4, for B9 pin X85-5 and pin X85-3 and for B10 pin X85-5 and pin X85-4 on the Collimator driver board A12 is about 5V when the optical path is covered by the thin material and about 0V when the optical path is not covered.
Check the X77-X59 cable.

If there is no variation and an axis does not move or moves with difficulty:

a. check that the correspondent actuator is not broken;
b. check the 24V on the A12 board (check led H6 of CCU A11 board) if not present check the cable X67-X75 and the fuse F1 on CCU A11 board.
c. check the specific cable among X80-X83 of motor M5-M8; there can be a short circuit or a broken wire; check also for a loosen contact. In case of short circuit, replace the cable, verifying also that no damage has been caused to the motor driver on the A12 board and on the cable X66-X67.

Note
In the event of a short circuit on one of the cable among X80-X83, the CCU A11 board fuse F1 may be blown (the 24V power supply LED H6 OFF) and/or the motor driver (on the A12 board) may be damaged: if it is the case, replace the fuse F1 and then the boards.

If the arm moves but no variation of the signals is detected, replace the optical sensor B7-B8 or B9-B10 their cables and if the problem is still present, the A12 board.

In addition if the movement is just in one verse check also the cable X66-X76 between CCU A11 board and A12 board and and finally replace the CCU A11 board.

***Technical Service additional information required**: try to reproduce the error recording:*

- *An audio-video with a global view of the chin rest movements*
- *An audio-video with a bottom view of the chin rest motor linear system group movement (removing the chin rest bottom cover).*

9.2.6.11 E670 / E671 Can Bus

Note
This error can be related to the Generator board errors E750 and E761 or a Generator board power supply fault. Therefore, in these cases the CAN-Bus is not able to assure the communication between the unit boards (MCU, CCU and Generator).

This message is displayed when the CAN bus line has been interrupted, due to a hardware or a power voltage problem. Therefore, the communication between the boards (CCU, MCU, Generator) is interrupted.

1. Check the CAN bus cable X9-X9 between CCU board and MCU board: replace or fix it if defective and then verify if the problem is still present.
2. Check the CAN bus cable X15-X32 between MCU board and Generator board: replace or fix it if defective and then verify if the problem is still present.
3. Verify the Generator board status performing the test listed for error E750 (see paragraph9.2.7.1) and E761 (see paragraph 9.2.7.9).
4. Perform the tests reported by Error E760 (see paragraph 9.2.7.11).
5. Perform the test of the Error E761 (see paragraph 9.2.7.9).
6. If the error is still present, replace first the MCU board (see paragraph 11.3.2) and then the CCU board (see paragraph 11.3.3).

***Technical Service additional information required**: try to reproduce the error keeping the following logs:*
- *Software logs*
- *MCU SD card log*
- *CCU SD card log*

9.2.6.12 E680 Ceph exam was aborted

It is an error of CCU origin, it comes out in the event that during a static CEPH the examination is aborted releasing the x-ray button

9.2.7 Error with code from 750 to 770

Warning

Those errors are related to the X-ray generator, so they can be safety related.

In case of Error messages E759 and E755, the system must be immediately powered off, because an unexpected emission (E759) can be present or the emission has not been terminated into the expected time.

Warning

On the Generator board (A2) there are dangerous high voltage, 230 VAC / 120 VAC and 400 VDC.

Before accessing the Generator board, it is mandatory to switch OFF the unit, disconnect it from the mains and wait up to 4 minutes in order to allow the discharge of the capacitor (LED H10 on the Generator board steady OFF).

9.2.7.1 E750: Generator board initialization error

This message is signalling that the MCU board is not able to initialize the Generator board (A2). This error can be generated by and hardware failure on the CAN-Bus or on the Generator board main power supply connection.

With the unit switched OFF (at least for 4 minutes), perform the following tests:

1. Check fuse F1 (T1A 250V) on the Generator board: if the fuse is blown, replace it and redo the test.
2. Check integrity of the CAN-Bus cable X32-X15 between MCU board and Generator board: if NOT OK, replace it and redo the test.

If the error is still present after tests 1 and 2, switch ON the unit and proceed as follow:

Warning
During the following tests, pay attention to the dangerous High Voltage on the Generator board.

3. Verify the main power LED H8 on the Generator board:
   a. if the LED H8 is OFF, check with a multimeter that between pins X31-L and X31-N the unit power provide AC voltage is present (eg. 230V or 120V):
      - if the power supply X31-L and X31-N is OK, replace the Generator board
      - if the power supply X31-L and X31-N is NOT OK, check the integrity and proper connection between Line filter Z1 and Generator board; fix or replace the faulty component
   b. if the LED H8 is BLINKING, replace the Generator board
   c. if the LED H8 is ON, replace the Generator board and then the MCU board (see paragraph 11.3.2).

Note
The error E750 (Generator board power supply fault) can be related to the Error E670 / E671, related to a fault on the CAN-Bus line is detected.

9.2.7.2 E751: kV over voltage

This message is displayed when a value higher than expected has been detected on the Generator board (A2).

With the unit switched OFF (at least for 4 minutes), perform the following tests:

1. Check that connector X57 is well connected: connect it and verify if the error is still present.
2. With the connector X57 CONNECTED, using a multimeter, perform the measures listed in the following table:

Parameter	Connection	Value
Feedback kV +	X57-4(GND) and X57-2	13.3kΩ ± 2%
Feedback kV -	X57-4(GND) and X57-3	14.3kΩ ± 2%

3. With the connector X57 DISCONNECTED perform the measures (connector side) listed in the following table:

Parameter	Connection	Value
Insulation between the PINs of the power tube filament	X57-5/6 and X57-4	Infinite
Insulation between primary H.V. winding and GND	X56-1/2 and GND (Tubehead shell)	Infinite
Feedback kV +	X57-4 and X57-2	19.8 ÷ 20.2 kΩ
Feedback kV -	X57-4 and X57-3	19.8 ÷ 20.2 kΩ

IF values measured at point 3 are incorrect, replace the tubehead (see paragraph 11.3.9).
IF values measured at point 2 are incorrect, while values measured at point 3 are correct, replace the Generator board.
IF values measured at point 2 and 3 are correct, the X57 connector is well inserted and its connections to the tubehead are OK, replace the Generator board and then the tubehead.

9.2.7.3 E752: Filament overload

This message is displayed when a filament overload is detected by the Generator board during preheating time or X-ray exposure.

If the error is displayed, contact Technical Service.

9.2.7.4 E753: Overload on Anodic current

This message is displayed when an abnormal value of the anodic current has been detected.

With the unit switched OFF (at least for 4 minutes), perform the following tests:

1. Check that connectors X56 and X57 are well connected: connect it and verify if the error is still present.
2. With connector X57 CONNECTED, using a multimeter, perform the measures listed in the following table:

Parameter	Connection	Value
Feedback mA	X57-4(GND) and X57-1	326 Ω ÷ 334 Ω

3. With the connector X57 DISCONNECTED perform the measures (connector side) listed in the following table:

Parameter	Connection	Value
Feedback mA	X57-4(GND) and X57-1	326 Ω ÷ 334 Ω

IF values measured at point 2. And 3. Are incorrect, replace the tubehead (see paragraph 11.3.9) and the Generator board.
IF value measured at point 2. Is incorrect and value measured at point 3. Is correct, replace the Generator board.
IF value measured at point 3. Is incorrect and value measured at point 2. Is correct, replace the tubehead.
IF the tests listed at point 1., 2. And 3. Do not solve the error, replace the Generator board and then the tubehead.

9.2.7.5 E754: Broken filament

This message is displayed when there is a fault on the power circuit of the filament, not only the filament itself.

With the unit switched OFF (at least for 4 minutes), perform the following tests:

1. Verify the continuity (max Ohmic value ≤ 0.5Ω) between pins the X57-5 and X57-6: if there is no continuity, replace the tubehead (see paragraph 11.3.10).
2. Verify that the pre-heating parameters stored in the MCU EEPROM memory matches the ones listed in the equipment parameters table (supplied as paper copy with the unit documentation – see paragraph 14.1) (see paragraph 8.4); correct them and verify if the error is still present.

Note
If the tubehead is a spare part, the new pre-heating values are printed on the tubehead label.

3. If the error was not solved by point 1. And 2., replace the tubehead and then the Generator board.

9.2.7.6 E755: Alarm "Backup timer intervention"

The emission is controlled through a safety backup timer that interrupts the power to the tubehead in case of a fault (hardware or software). The intervention of the backup timer is signalled also by a lighting on of the red LEDs H5 and H9.

Warning
This error can be safety related. In case of Error messages E755, the system must be immediately powered off and not been used, because an emission has not been terminated into the expected time.

In any case it is mandatory to contact Technical Service **and not use or switch ON the system anymore.**

9.2.7.7 E756: PFC (Power Factor Control) failure

This message is signalling that the PFC (Power Factor Control) circuit functioning is not correct.

If the error is displayed, contact Technical Service.

9.2.7.8 E757: Brown out alarm / E766: Generator board reset due to a brown-out / E767: Generator board reset due to a low voltage detection / E768: Generator board reset due to a watchdog timeout / E769: Generator board reset due to a stack overflow

These messages are displayed when the Generator board microcontroller is reset due to the displayed issue.

If the error is displayed, contact Technical Service.

9.2.7.9 E758: Alarm “No X-ray” / E761: Alarm “No X-ray emission”

These errors are displayed when the anodic current has been interrupted during or at the beginning of the emission and may indicate that the Generator board is in a safety status (eg. Due to a discharge inside the tubehead, a broken tube or any other tubehead damage).
Error E761 may be displayed / associated with other errors (i.e. E362 and E760) that can explain the main cause of the X-ray interruption occurred during the previous exposure (refers also to the associated error paragraph).
In order to reset these errors:

1. Switch OFF the unit and wait at least 4 minutes.
   a. Switch ON the unit, perform an exposure and verify if the error is still present.
   b. Switch OFF the unit, wait at least 4 minutes and switch it ON again: verify that the pre-heating parameters stored in the MCU EEPROM memory matches the ones listed in the equipment parameters table (supplied as paper copy with the unit documentation – see paragraph 14.1) (see paragraph 8.4); correct them and verify if the error is still present.
2. With the unit switched OFF (at least for 4 minutes), verify the proper connection of the connectors X56 and X57; fix them, switch ON the unit and verify if the error is still present.
3. With the unit switched OFF (at least for 4 minutes), perform the following tests:
   a. Verify the primary winding continuity (max Ohmic value ≤ 0.5Ω) on the pins X56-1 and X56-2
   b. Verify the filament continuity (max Ohmic value ≤ 0.5Ω) on the pins X57-5 and X57-6
   c. Verify the mA feedback Ohmic resistance on the pins X57-1 and X57-4, it should be between 326Ω ÷ 334Ω.

If one of the above tests (a., b. or c.) fails, replace the tubehead (see paragraph 11.3.9).

4. If the error is still present, replace both the tubehead and Generator board.

***Technical Service additional information required**: try to reproduce the error keeping the following logs:*

- *Software logs*
- *MCU SD card log (see paragraph 11.2.1).*

9.2.7.10 E759: Alarm “Unexpected emission”

Warning
In case of Error message E759, the system must be immediately powered OFF because an unexpected emission can be present.

An unexpected emission has been detected by the Generator board.

1. With the unit switched OFF (at least for 4 minutes), verify the proper connection of the pins X57-1 and X57-4; connect them and verify if the error is still present.
2. With the unit switched OFF (at least for 4 minutes), verify the Ohmic resistance between the TP10 (mA feedback) and GND (TP13), it should be between 326Ω ÷ 334Ω. If it is NOT OK, remove the connector X-57 and repeat the Ohmic test on the connector (tubehead side).
   IF the test is NOT OK, replace the tubehead (see paragraph 11.3.9).
   IF the test is OK, replace the Generator Board.
3. If the error is still present, **it is mandatory NOT use or switch ON the system anymore** and contact Technical Service.

9.2.7.11 E760: Alarm “NO RX button command”

This message is displayed when the Generator board (A2) is not detecting the X-ray button during the emission.

If the X-ray button was NOT intentionally released, switch OFF and ON the unit. Wait the keyboard blinks (DO NOT press the >0< button) and perform the following checks:

1. Press the X-ray button and verify that the LED H11 on MCU board (A1) light-up according to the X-ray button activation.
   IF the test is NOT OK, verify the connected X-ray buttons and their connections: replace or fix them and verify if the error is still present. If still present, replace the MCU board (see paragraph 11.3.2).

2. Press the X-ray button and verify that the LED H2 on the Generator board (A2) light-up according to the LED H11 on the MCU board and to the X-ray button activation.
   IF the test is NOT OK, verify the integrity of the cable X15-X32 (Pin 2 = X-ray button signal) between MCU and Generator board: replace the cable if not OK and if the error is still present, replace the MCU board.
3. If the above tests are OK and/or the error is still present, replace the Generator board.

9.2.7.12 E762: “Bad Generator board unit status, emission flag detected unexpectedly

This message is displayed when the MCU detect a wrong status of the Generator board.

If the error is displayed, contact Technical Service.

9.2.7.13 E763: kV channel analog feedback out of range / E764: mA channel analog feedback out of range / E765: Filament channel analog feedback out of range

These messages are displayed when Generator board detect a wrong kV, mA or Filament analog level.

If the error is displayed, contact Technical Service.

9.2.7.14 E770: Mismatch between the Generator board (A2) and MCU board (A1) types (2D / 3D)

This error is displayed when the Generator board or MCU board is not configured as 3D type.

With the unit powered OFF, wait at least 4 minutes and verify that the codes printed on the two boards matches the following ones:

- Generator board: 5804020200/XX
- MCU board: 5804040700/YY

Replace the wrong board.

9.2.8 Errors with code E850 and E852

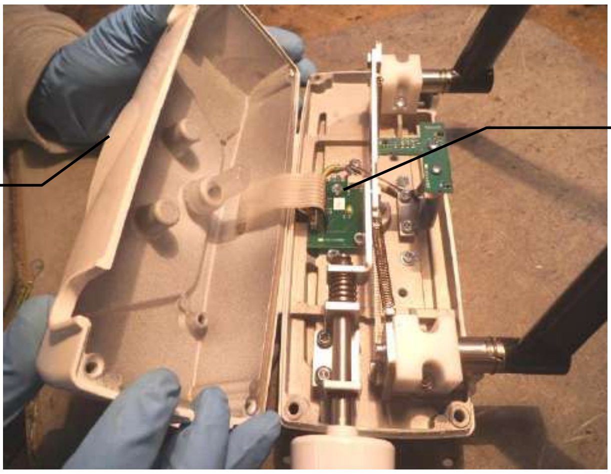
These errors indicate a keyboard fault.

9.2.8.1 E850: One or more buttons pressed during power ON

During the power ON phase, one or more keyboard buttons have been sensed as pressed by the MCU board (A1).

1. With the unit switched OFF, check that no keyboard buttons are pressed: power the unit ON and verify if the error is still present.
2. With the unit switched OFF, disconnect cable X12 on MCU board, power ON the unit, wait the connection with the GUI (about 3 minutes) and verify that error E850 is no more displayed.
    a. If the error is still present, replace the MCU board (see paragraph 11.3.2)
    b. If the error is no more displayed, verify:
        - integrity of the cable X12-X46 between MCU and X46/X47: replace the cable and verify if the error is still present
        - integrity of the cable X46/X47 between X12-X46 and Interface board A5: replace the cable and verify if the error is still present (* see Note)
    c. If the above tests are OK, replace the keyboard membrane and then the Interface board (A5) (* see Note).

(*) Note
In order to check / replace these components, it will be necessary to open the keyboard following the chin rest replacement procedure.



9.2.8.2 E852: One key pressed during the movement

During the system movements, the keyboard is inactive, but at the pressure of >0< button all movements are stopped and this message is displayed.
This function allows the user to stop the system movements in case an unexpected system behavior or a collision during the system positioning.

1. Make sure that >0< button was not intentionally/unintentionally pressed during a unit movement: reset the unit and verify if the error is still present.
2. Check that the >0< button is not stuck: replace the keyboard membrane if the >0< button is faulty.
3. If the tests are OK, refer to error E850 (see paragraph 9.2.8.1).

9.2.9 Error with code from E1201 to E1205

These errors are related to the system PC software application issues or the communication with unit’s boards.

9.2.9.1 E1201: Failed to write data in EEPROM from Setup menu / E1203: Error detected in software allocation

These messages are displayed when a software error has been detected.

If the error is displayed, contact Technical Service.

Technical Service additional information required:

- *Condition/unit state/sequence in which the error occurs/can be reproduced*
- *Software logs (see paragraph 11.2.1).*

9.2.9.2 E1202: Unexpected value encountered by the software / E1204: Error detected in exposition parameters / E1205: Error detected in image buffer allocation

These messages are displayed when a Software or Firmware error has been detected.

If the error is displayed, contact Technical Service.

Technical Service additional information required:

- *Software logs (see paragraph 11.2.1).*

9.2.10 Error with code from 1401 to 1405

9.2.10.1 E1401: Sensor connection lost during the exam / E1405: Sensor frame lost during exam

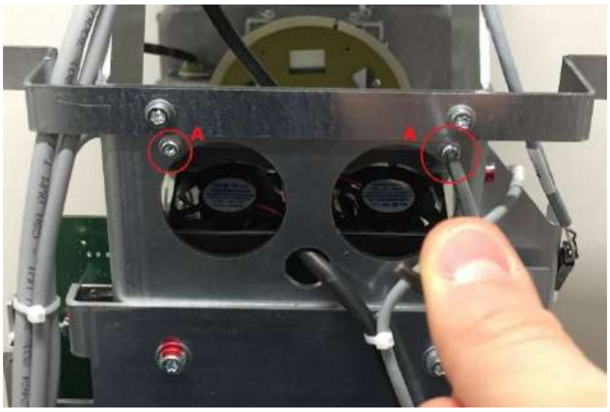
This message is displayed if the unit drivers on PC detects less frame than expected during the exam acquisitions.
If the problem happens during a panoramic or a 3D exam it may be related to a communication

malfunctioning of the 3D sensor Ethernet connections (cables and PC network interface) or of the 3D sensor.
If the problem happens during a cephalometric exam it may be related to a communication malfunctioning of the ceph sensor Ethernet connections (cables and PC network interface) or of the ceph sensor.

1. Check the Ethernet connections (cables, junctions, PC network board) and PC network board settings (see paragraph 7.7.1).
   Check also if the cables and the network board interface are compliance with the mandatory characteristics reported below:
   - The network interface must be Intel I350-T2 dual port
   - The Ethernet cables must be the ones supplied with the unit or CAT 6 cables (or higher category)
   - The 3D sensor must be directly connected to the PC, no Ethernet hub/switch are allowed between the 3D sensor and the PC.
   - The unit must be directly connected to the PC, no Ethernet hub/switch are allowed between the unit and the PC

Note
In order to check the Ethernet cable/junctions integrity and functioning, it is suggested to:

1. Remove the two fans “A” screws to access to the 3D sensor Ethernet connector.



2. Unplug the Ethernet cable connected to the 3D sensor.
3. Plug a functioning Ethernet CAT 5E (or higher) cable to the 3D sensor and connect it directly to the PC network interface:

- If the problem, in this configuration, disappears: there may be a faulty Ethernet cable or junction connected between the PC and the 3D sensor
- If the problem is still present, try to connect the sensor to another network interface Ethernet port (e.g. Invert the “Ethernet” (MCU) and 3D sensor connections setting the right IP address on the network interfaces – see paragraph 7.7.1.
  If the problem is solved, it can be related to the network interface board.

2. Fix the PC network settings or replace the faulty/not compliant components.

   Update the network interfaces board drivers (see paragraph 11.2.4).

   Verify if the error is still present

3. Configure the Network interface board as required by paragraph 7.7.1 and activate the sensor logs (see paragraph 11.2.1.4).
   Verify if the problem is still present.

4. Set the 3D sensor network with a static IP address (see paragraph 11.2.6)
   Verify if the problem is still present..

5. Perform the tests reported by Error E760 (see paragraph 9.2.7.11).

6. Verify if the following values matches the ones stored in the EEPROM memory (see paragraph 11.2.5):

   - 0x0084 – 3D Std RX on time = 17
   - 0x0085 – 3D Std RX off time = 33
   - 0x0086 – 3D HD RX on time = 17
   - 0x0087 – 3D HD RX off time = 33
   - 0x0088 – 3D SHD RX on time = 17
   - 0x0089 – 3D SHD RX off time = 33

   Correct the values if they do not match and verify if the problem is solved.

7. In case the problem is not on ceph exam, perform both a 3D and a panoramic acquisition:

   a. If the problem is systematically present only on 3D acquisitions, verify the integrity of the sensor trigger signal cables:

   - X43-J14 (from 3D Power Sensor board A10 and the 3D sensor)
   - X38-X25 (from 3D Power Sensor board A10 and MCU board A1)
   - X32-X15 (from Generator board A2 and MCU board A1)

   If the cables are OK, replace first the 3D Power Sensor board, then the MCU board and then the Generator board.

   b. If the problem is present both on 3D and panoramic acquisitions, verify if the tubehead connector X56 is well inserted and then perform the tests of the Error E761 (see paragraphs 9.2.7.1 and 9.2.7.9).

8. If the problem is on the ceph sensor check the ethernet cable from the ceph arm to the ethernet switch and the ethernet cable to the PC. Check also if the detector is well inserted in its holder. Try to move the sensor and check that the blue led (sensor power supply) is always ON

Contact Technical Service providing the following additional information:

- *Software logs*
- *Ceph Sensor logs*
- *3D Sensor logs folder(see paragraph 11.2.1)*
- *Last RAW files folder stored (see paragraph 11.2.1.5)*

9.2.10.2 E1402: sensor configuration failure

If this error is displayed during a panoramic or 3D exam it is related to a communication error between the flat panel and the PC software or a 3D Power Sensor board A10 problem.
If it is displayed during a ceph exam it is related to a communication problem between the ceph sensor and the PC or to a problem of the boards A11, A13 and A14

Perform the exam in which the error was displayed in a test mode (without X-ray) and verify, during the movements the status of the Ethernet connection (Control Panel→Network and Internet→Network Connections).

1. IF the Ethernet connection is steady ACTIVE:

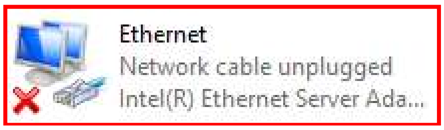
   a. Perform points 1, 2, 3, 4 and 7a of Error E1401 (see paragraph 9.2.10.1).

   b. Activate the sensor logs (see paragraph 11.2.1.4) and perform an acquisition in order to reproduce the error.

2. IF the Ethernet connection is DISABLED:

   Right click on Network board icon and click on “Enable”.

3. IF the Ethernet connection is NOT steady ACTIVE:



   a. Check the 3D sensor Ethernet connections (cables, junctions, PC network board): replace the faulty components (see point 1 of Error E1401 – paragraph 9.2.10.1).

   b. If the problem occurs during a panoramic or a 3D exam check that the 3D Power Sensor board A10 is ok by checking that the LED H2 on A10 board is ON.

      - IF LED H2 is ON: verify the 9V between J99-pin1 and J99-pin6 (3D sensor side). If NOT OK, replace cable X42-J99.
      - IF LED H2 is OFF: verify if the 3D Power Sensor board A10 fuse is blown.
         - IF the fuse is blown, verify the integrity of the cable X42-J99, replace the cable (if faulty) and then the fuse.

- IF the fuse is NOT blown, verify with a multimeter the 24V between X37-pin1 and X37-pin2 (A10 board side).
  - IF X37 24V is OK, verify the 3D sensor ON signal, driven by CCU: 5V between the X38-pin 1 and X38-pin 7(GND).
    - IF 5V is OK, verify cable X42-J99 (between the A10 board and the 3D sensor): if faulty fix or replace it. If the LED H2 is still OFF, replace the 3D Power Sensor board A10
    - IF 5V is NOT OK, verify the integrity of the cable X38-X61 (between 3D Power Sensor board A10 and CCU board A11) and the cable X9-X9 (between MCU board A1 and CCU board A11)
      - ➢ IF the X38-X61 or X9-X9 are NOT OK, fix or replace them
      - ➢ IF the X38-X61 or X9-X9 are OK, replace the MCU board A1.
  - IF the X37 24V is NOT OK, disconnect the X37 connector (A10 board side) and verify if between X37-pin1 and X37-pin2 (cable side), there are 24V.
    - IF X37 24V is now OK, replace the 3D Power Sensor board A10
    - IF X37 24V is still NOT OK, verify the cable X11-X37 and perform the 24V power supply verification (see paragraph 11.2.3)

c. Activate the sensor logs (see paragraph 11.2.1.4) and perform an acquisition in order to reproduce the error.

Contact Technical Service providing the following additional information:

- *Software logs*
- *3D Sensor logs folder (see paragraph 11.2.1)*
- *Ceph sensor logs*
- *Last RAW files folder stored (see paragraph 11.2.1.5)*

9.2.10.3 E1403: Software watchdog

This message is displayed if the software did not periodically reset the Ethernet watchdog timer.

It may be related to a wrong machine configuration (e.g. the ceph option has been disabled).
Refer to paragraph 8.4 to check machine configuration.

Refer to Error E1402 (see paragraph 9.2.10.2).

Technical Service additional information required:

- *Software logs*
- *3D Sensor logs folder (see paragraph 11.2.1).*

9.2.10.4 E1404: sensor does not detect X-rays during exam

This message indicates that the sensor has not received X-rays during the last exposure.
The problem may be related to the generation of X-rays (generator board or tubehead problem), to a bad positioning of the collimator or a radiopaque object may be in the X-ray field.

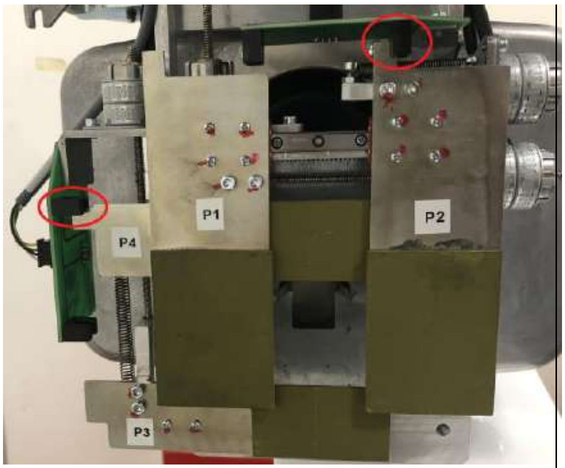
If this error is displayed during a panoramic or 3D exam go to point 2.

1. If the error is displayed during a ceph exam, perform a ceph exam test and verify:

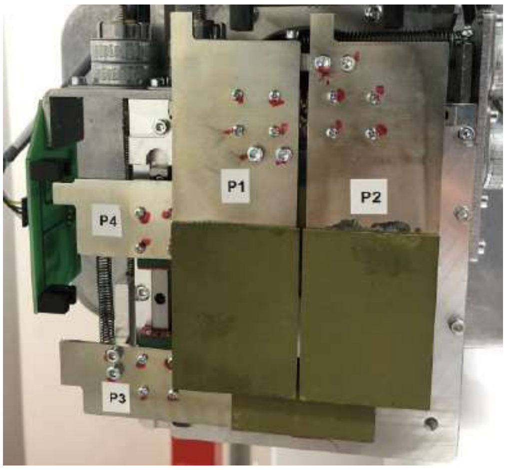
   IF the secondary collimator and the ceph sensor move accordingly to the exam selected. If they do not move refers to E630-E635 (ceph sensor problems) or E640-E645 (secondary collimator problems).

   - If the error is still present, verify the ceph and the WINDOW 6 offsets stored in the EEPROM (compare them with the ones reported on the set parameters tables provided with the unit documentation). If they are not the same, correct them and then repeat the ceph exam test.(see paragraph 7.9).
   - If the error is still present, verify if the issue is present also in a panoramic exams
     - If the issue is not present in a panoramic exam, verify the ceph axis alignment (paragraph 11.2.11).
     - If the issue is present also in a panoramic exam, go to next point.

2. Remove the tubehead internal cover, open Phd_C_Test application and select the “Centering emission” ID and verify if the collimator move accordingly (the biggest collimator window is in front of the X-ray exit). “Centring panoramic” ID with “panoramic collimator” format and verify if the collimator is correctly positioned on panoramic window (the narrower collimator window is in front of the X-ray exit).



Centering emission collimator position
Note that the P2 and P4 blades are positioned close their light barriers



Panoramic exam collimator position

IF the collimator movements are NOT OK, refer to errors E650-E661 (see paragraph 9.2.6.10)

- If the error is still present, verify the X-ray beam alignment (see paragraph 11.2.9).

3. Verify if a radiopaque object is present in the X-ray field, remove it and verify if the problem is still present

4. Verify the collimator offsets stored in the EEPROM (compare them with the ones reported on the set parameters tables provided with the unit documentation).
   IF the offsets does not matches, fix them (see paragraph 8.4)

5. Perform the X-ray beam alignment check tests described in paragraph11.2.9.1.

6. IF the acquired images are completely white (without X-rays), perform the exposure parameters verifications with non-invasive and then with invasive method (paragraph 7.13.2). If the non-invasive method is NOT OK but the invasive method is OK, replace the tubehead.

Contact Technical Service providing the following additional information:

- *Software logs (see paragraph 11.2.1.1)*
- *Last RAW files folder stored (see paragraph 11.2.1.5)*
- *Panoramic, ceph and 3D static acquisitions*

9.3 User Interface (G.U.I.) messages

9.3.1 “Unit and computer not synchronized”

1. Can happen if the KV or mA parameters are modified from the G.U.I. too fast.
2. The message may be displayed while the G.U.I. is closing the Service Menu. If the problem persist, contact Technical Service.
3. If the problem is not the one described in the above points, refer to Error E1404 (paragraph 9.2.10.4).

9.3.2 “Sensor not ready”

Refer to Error E370 (paragraph 9.2.4.3), Error E1402 (paragraph 9.2.10.2) and Error E1401 (paragraph 9.2.10.1).

9.3.3 “Software error”

Verify if a raw file of a previous acquisition is still in C:\ProgramData\Acteon Imaging\Panoramic X-Mind Prime Ceph\Acquisition, remove it and verify if the problem is solved.

9.4 System Anomalies

9.4.1 White panoramic image or/and empty volumes

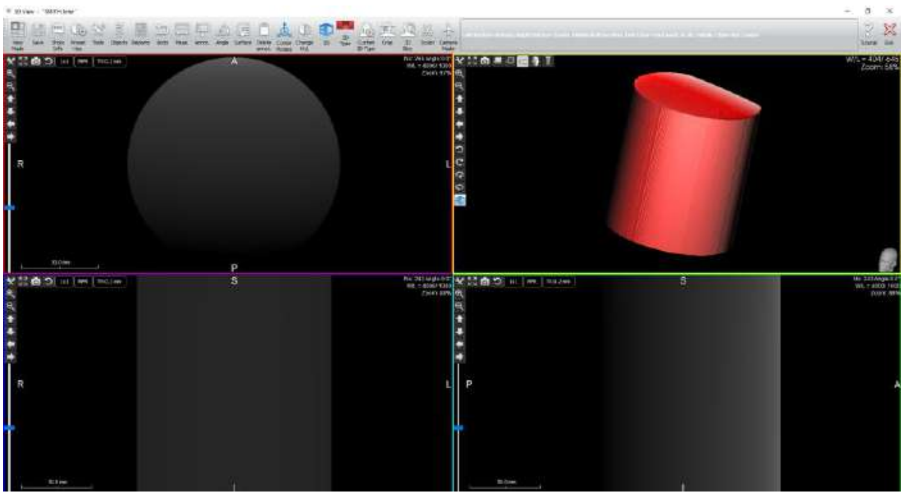
	Panoramic white image
	Empty volume

Figure 47

1. Verify the presence of the correct calibration files (8 files named as the SN of the sensor mounted on the unit) in the calibration folder C:\ProgramData\Acteon Imaging\Panoramic X-Mind Prime Ceph\Calibration and that all the calibration options in the image processing menu of the in PhD_C_Test.exe are checked (see paragraph 10.2).

2. Perform tests of Error E760 (paragraph 9.2.7.11).

3. Verify the integrity of tubehead X57 connector, pin 5 and 6.

9.4.2 3D Bad reconstruction

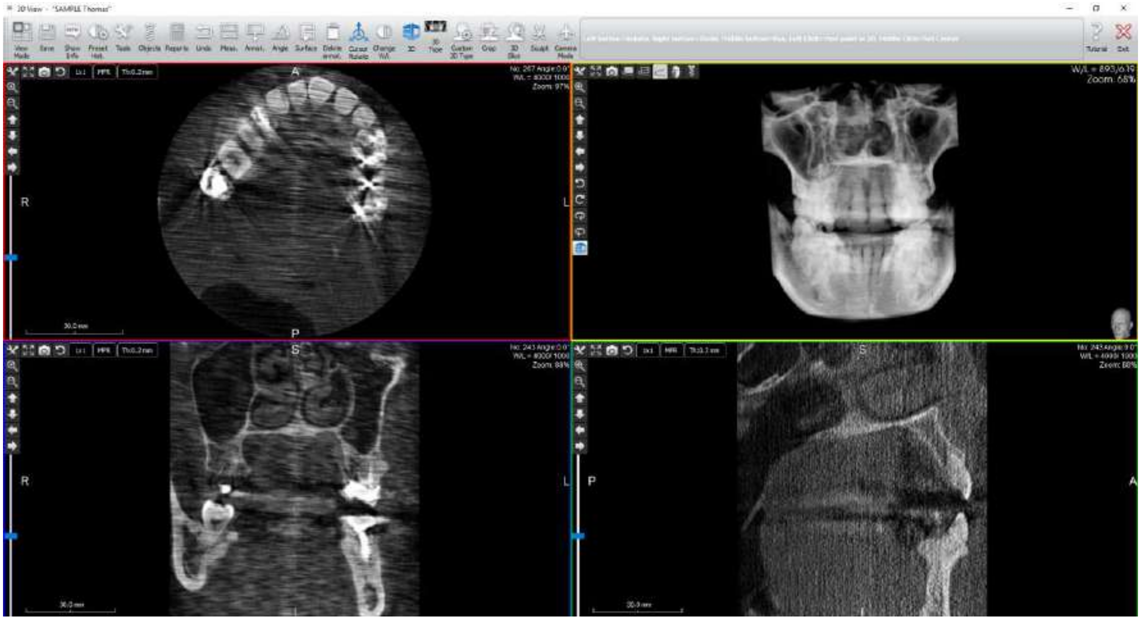


Figure 48

Send the RAW files (see paragraph 11.2.1.5) of these acquisitions to Acteon Technical Service.

9.4.3 Panoramic acquisition with less frames

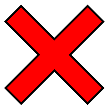
	
	

Figure 49

1. The panoramic acquisition above (**X**) may be indicate an acquisition with less frame than expected. In this case verify the 3D Sensor Ethernet connections (cables, junctions, PC network board). Refer to Error E1401 point 1 (see paragraph 9.2.10.1).

2. If the error is still present, send the acquired RAW file (see paragraph 11.2.1.5) to Technical Service.

9.4.4 Asymmetries on the panoramic images

1. Check the orthogonality of the unit lasers (see User Manual – paragraph 7.3).

2. Perform the verification of the panoramic function (see paragraph 7.10).

9.4.5 Unit/MCU connection problems

1. Verify if MCU DIP switches are set in normal mode (see paragraph 4.2.2.1).

2. Check the unit power supply (see paragraphs 6.1 and 11.2.3).

3. Verify the unit Ethernet connection status (Control Panel→Network and Internet→Network Connections):

    a. IF the Ethernet connection is steady ACTIVE:

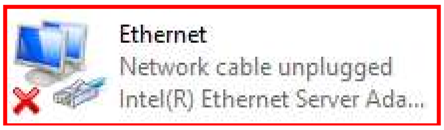
    Verify the correct network interface board configuration (see paragraph 7.7.1).

    b. IF the Ethernet connection is DISABLED:

    Right click on Network board icon and click on “Enable”.

    c. IF the Ethernet connection is NOT steady ACTIVE:

    Check the Ethernet connections (cables, junctions, PC network board and the switch inside the unit).

4. Plug a functioning Ethernet CAT 6 (or higher) cable to the MCU and connect it directly to the PC network interface:

    a. If the problem, in this configuration, disappears: there may be a faulty Ethernet cable or junction connected between the PC and the MCU.

    b. If the problem is still present, try to connect the MCU Ethernet cable to another network interface port (e.g. Invert the MCU and 3D sensor connections setting the right IP address on the network interfaces – see paragraph 7.7.1).
    If the problem is solved, it can be related to the network interface board.

9.4.6 The column does not moves

1. Verify that the safety red switch is released in the top side of the unit.

2. If the problem persists, power off the machine and wait for about 20-30 seconds, then power on again the machine.

3. Verify the main power supply and columns driver board connection (see paragraph 6.1 and 7.2).

4. Verify the column fuse (see paragraph 11.3.1).

If the problem is still present, contact Technical Service.

10. PERIODIC MAINTENANCE

Note
Maintenance and inspection procedure must be performed without patient positioned in the equipment.

As with all electrical appliances, this unit must be used correctly and maintenance and inspections must be made at regular intervals. Such precautions shall guarantee the safe and efficient function of the appliance.

Warning
Preventive and/or corrective operations must only be carried out by personnel authorised and properly trained on part replacement and maintenance.

The inspections made directly by the operator are the following:

Frequency	Type of check	Method
Daily	Functioning of the indicator lights	Visual inspection
Daily	Check that the cables do not show signs of breaking or wear	Visual inspection
Daily	Check that the unit is not damaged externally in such a way that the safety of protection from radiation is compromised	Visual inspection
Daily	Check that there are no traces of oil on the tube-head	Visual inspection
Daily	Check that arm movement is smooth	Practical inspection
Monthly	Integrity of equipment and labels	Visual inspection
Every 6 Months	QC test	Refer to paragraph 7.5 of User's Manual

Warning
If the operator detects irregularities or failures, he must immediately call Technical Service.

The appliance's performance is checked and, where necessary corrected, during the maintenance activities performed by the Technical Service Department, in accordance with the indications provided in the following chapters.

The periodic maintenance performed by the Technical Service Department comprises the performance of the following additional inspection activities:

Frequency	Type of check	Method
Annually	General visual inspection	Visual inspection
Annually	Grounding of all the conductive parts and cables	Practical inspection
Annually	Condition of the internal and external cables: wear and tear and fastenings	Visual and practical inspection
Annually	Tightening of the primary bolts and screws such as the wall fastening systems, the moving mechanisms and the chin rest arm	Practical inspection
Annually	Correct equipment centring	See paragraphs 7.10 and 7.11
Annually	Check technical factors	See paragraphs 7.13.1 and 7.13.2
Annually	Perform sensor calibration	See paragraph 10.2

Warning
Only use original spare parts if components need to be replaced.
The relevant replacement instruction is supplied with the spare part.

Note
The Service Engineer has to take special care for all what concerns electrical safety of the device and must make sure of restoring all provisions for electrical safety which may be affected during a service intervention and to solicit the customer to have the electrical safety tests repeated every time the intervention has caused the replacement of important parts or the intervention has significantly affected safety provisions of the device.

Note
Interventions carried out by the Service Engineer must be noted in the Maintenance Record page at the end of the User Manual, with a short description of the actions done.

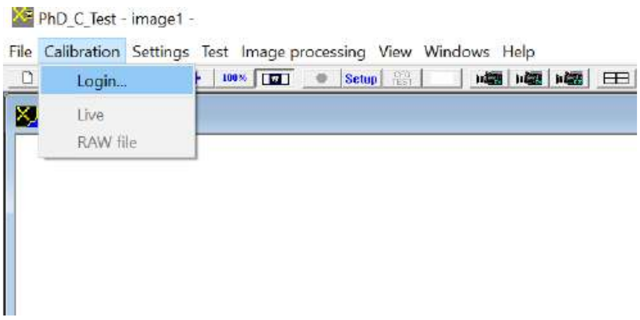
10.1 Service tools

In order to perform a correct system calibration, is necessary the use of the following tools:

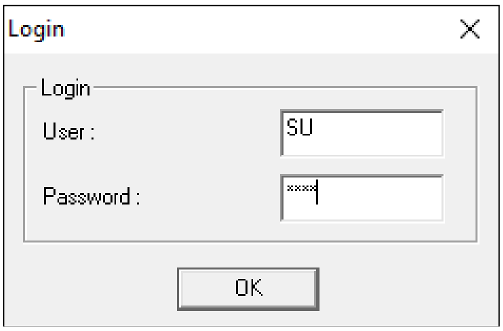
Code	Description	Function
6107900100	Laser centering tool	Laser alignment check
6195170100	Support plate	Support for panoramic and 3D centering tools
6195170200	Centering tool	Panoramic function adjustment
5207900900	Centering cylinder	3D function adjustment
5607900800	1.5mm copper filter	Sensor calibration

10.2 Sensor Calibration

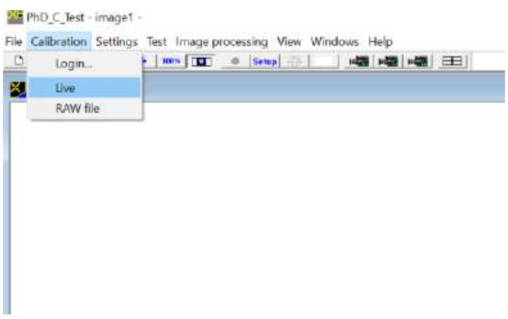
1. In order to perform calibration, place a copper filter of 1.5mm in front of the tubehead in such a way as to cover the entire X-ray beam.
2. Open the “PhD_C_Test.exe” service program (C:\Program Files (x86)\Acteon Imaging\Panoramic X-Mind Prime Ceph).
3. Open the “Calibration” panel from the menu and select “Login”.



4. In the “User” field type in capital letter “SU”. In the “Password” field type the password (see password generation on paragraph 10.2.1).

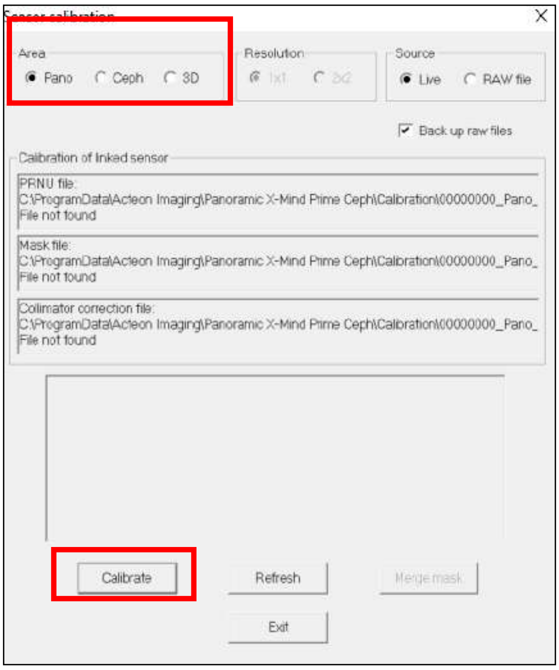


5. Open the “Calibration” panel and select “Live”.



6. Make sure that no objects are present in the X-ray field (including temple rods and chin support).

7. Select “Pano” in the “Area” panel.



8. Press the button “Calibrate”.
9. Each time the calibration window displays the message “Waiting for an acquisition” press the X-ray button until the end of the exposure.

Note

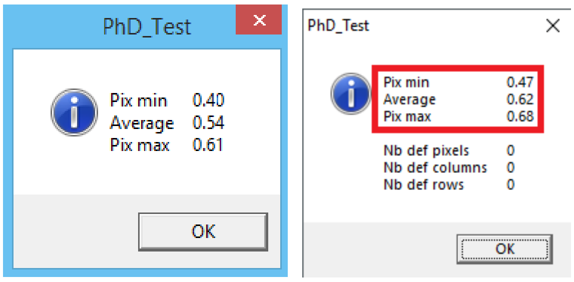
If during calibration, the message “Sensor not ready” or “Time out” is displayed by the “Flat Panel calibration” window, click on “Calibrate” button and repeat the last performed calibration (Pano, ceph 1x1 or 2x2,3D 1x1 or 2x2).

Note

During the calibration, when one of the following windows is displayed, verify that the values reported are within the tolerances:

- Pix min: > 0.20
- Pix max: < 0.90

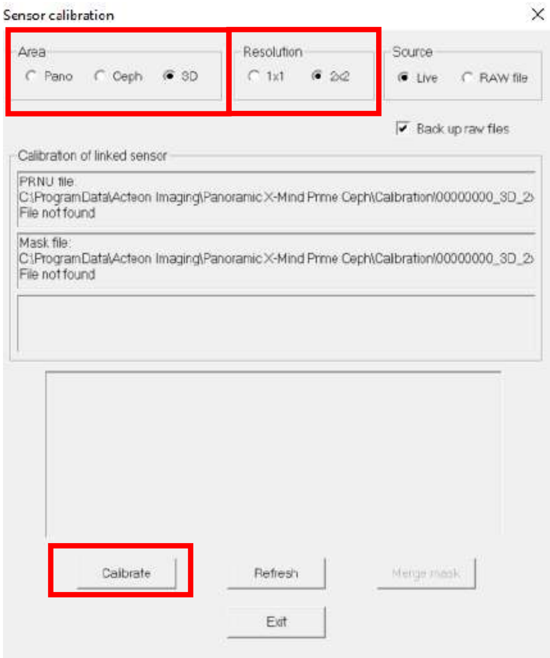
and then press OK.



If they are not in the above limits, verify the copper filter positioning and that no objects are present in the X-ray field; repeat the calibration.

10. When the **Panoramic area calibration** is completed**,** the message "Calibration finished. Remove the 1.5 mm Cu filter " is displayed. This calibration will generate the following files in the folder C:\ProgramData\Acteon Imaging\Panoramic X-MIND Prime Ceph\Calibration:
    - [Sensor S/No]_2D_1x1.fmp
    - [Sensor S/No]_2D_1x1.msk
    - [Sensor S/No]_2D_1x1.Coll
    - [Sensor S/No].ini (if not present)

11. Don't remove the copper filter and Select "3D" in the "Area" panel, "2x2" in the "Resolution" panel.



12. Press the button “Calibrate”.

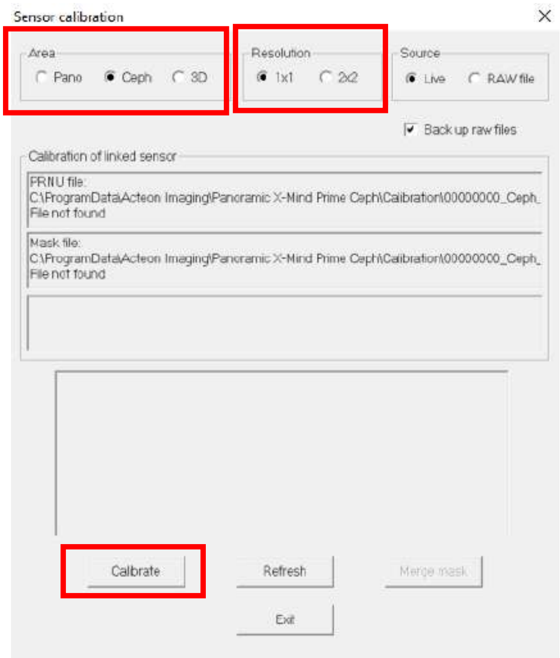
13. Each time the calibration window displays the message “Waiting for an acquisition” press the X-ray button until the end of the exposure.

14. When the 2x2 resolution area calibration is completed, the message "Calibration finished. Remove the 1.5 mm Cu filter" is displayed. This calibration will generate the following files in the folder C:\ProgramData\Acteon Imaging\Panoramic X-MIND Prime Ceph\Calibration:
    - [Sensor S/No]_3D_2x2.fmp
    - [Sensor S/No]_3D_2x2.msk

15. Don't remove the copper filter and Select "1x1" in the "Resolution" panel.

16. Press the button “Calibrate”.
17. Each time the calibration window displays the message “Waiting for an acquisition” press the X-ray button until the end of the exposure.
18. When the 3D 1x1 resolution area calibration is completed, the message “Calibration finished” is displayed. This calibration will generate the following files in the folder C:\ProgramData\Acteon Imaging\Panoramic X-MIND Prime Ceph\Calibration:
    - [Sensor S/No]_3D_1x1.fmp
    - [Sensor S/No]_3D_1x1.msk
19. Don't remove the copper filter, rotate the ceph head holder to antero posterior position, fold up the nasion

20. Select "Ceph" in the "Area" panel, "1x1" in the "Resolution" panel.



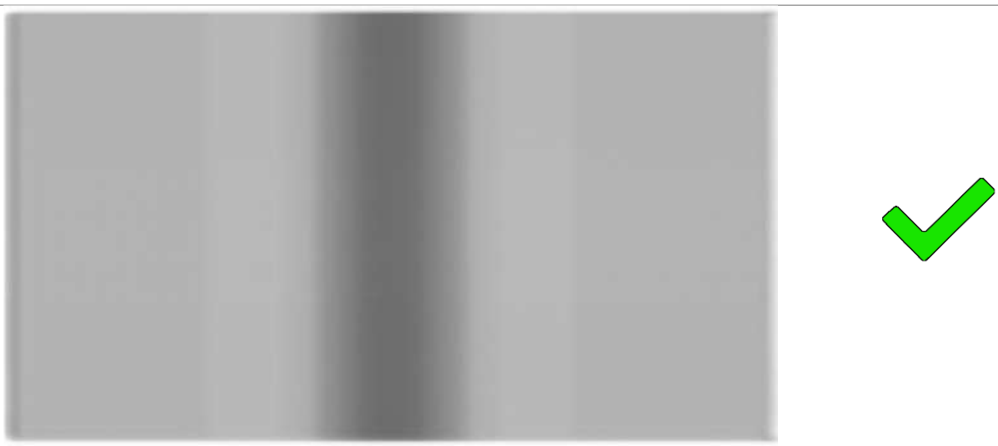
21. Press the button "Calibrate”
22. Press >O< on the machine on the keyboard, when the machine stop moving and the blu and green leds blink open the 3D detector in ceph position; the machine goes in calibration position;Wait unti the machine stops moving;
23. Each time the calibration window displays the message "Waiting for an acquisition" press the X-ray button until the end of the exposure.
24. When the ceph 1x1 resolution area calibration is completed, the message "Calibration finished. Remove the 1.5 mm Cu filter " is displayed. This calibration will generate the following files in the folder C:\ProgramData\Acteon Imaging\Panoramic X-MIND Prime Ceph\Calibration:
    - [Sensor S/No]_Ceph_1x1.fmp
    - [Sensor S/No]_Ceph_1x1.msk
    - [Sensor S/No].ini

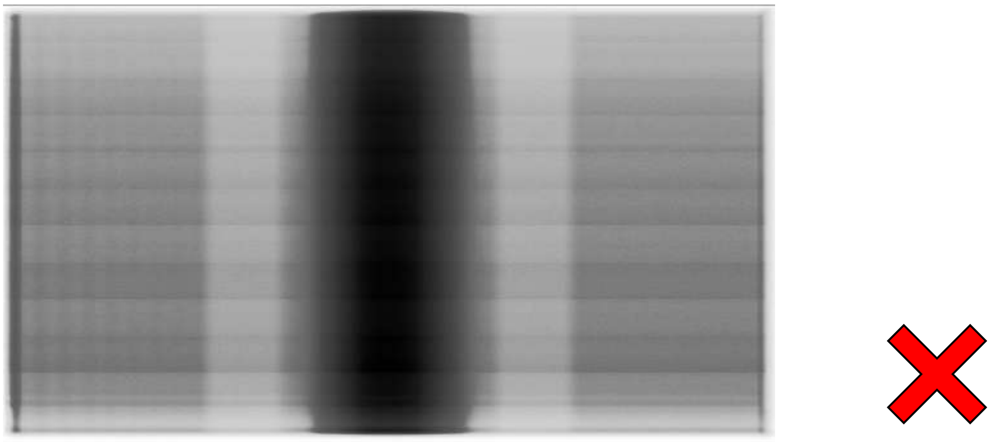
Note
If during calibration, a message "Error while computing the defect mask" is displayed, check that the ceph head holder is in antero posterior position. Then quit the current calibration procedure and repeat a new calibration by clicking on "Calibrate" button.

25. Don't remove the copper filter and Select "2x2" in the "Resolution" panel.

26. Press the button "Calibrate”.
27. Each time the calibration window displays the message "Waiting for an acquisition" press the X-ray button until the end of the exposure.
28. When the ceph 2x2 resolution area calibration is completed, the message "Calibration finished. Remove the 1.5 mm Cu filter " is displayed. This calibration will generate the following files in the folder C:\ProgramData\Acteon Imaging\Panoramic X-MIND Prime Ceph\Calibration:
    - [Sensor S/No]_Ceph_2x2.fmp
    - [Sensor S/No]_Ceph_2x2.msk
29. When the Panoramic, 3D 1x1 and 2x2, Ceph 1x1 and 2x2 calibrations are completed, click "Exit”
30. Select the following filters from the "Image processing" menu:
    - Dark signal correction
    - PRNU correction if possible
    - Collimator correction if possible
    - Defect pixels correction if possible
31. Close the detector.
32. Remove the copper filter from the tubehead, switch OFF the unit and close the "PhD_C_Test.exe" service program.
33. Switch ON the unit.

34. Open the "PhD_C_Test.exe" service program and make an exposure at 60kV 2.2mA without objects in the X-ray field.
35. Verify that there are no defect lines or inhomogeneous bands on the panoramic image:

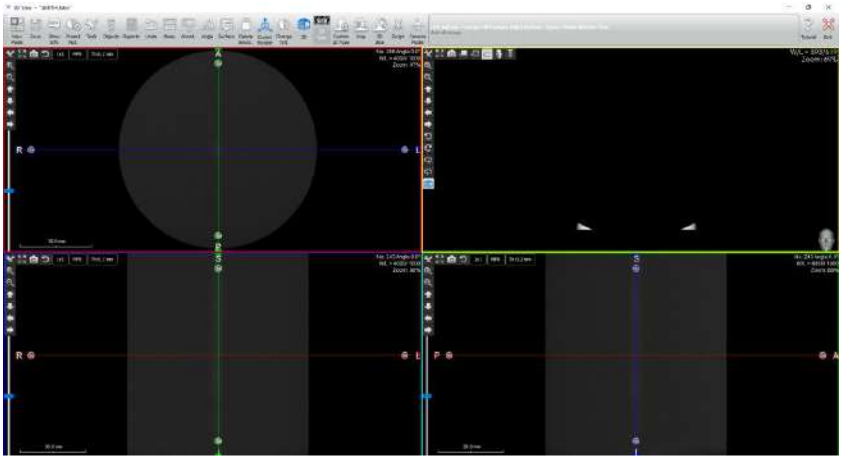


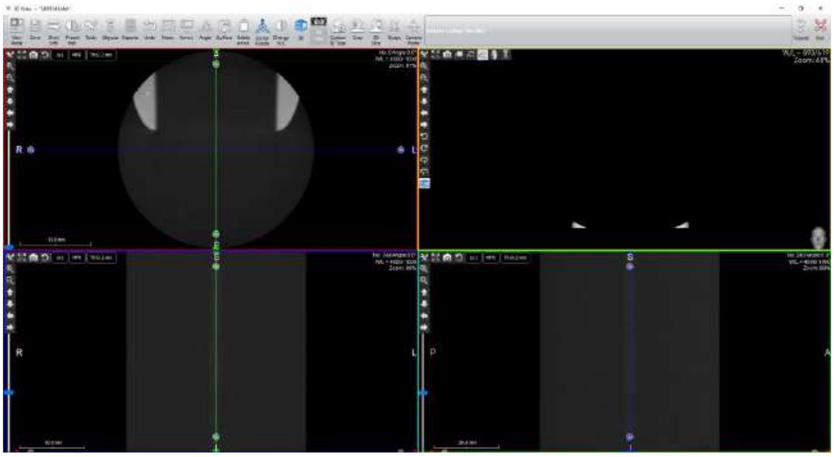


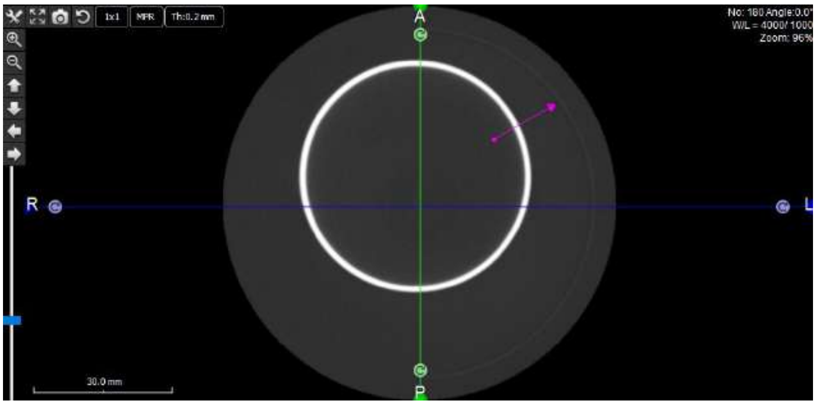
36. Select a ceph30x24LL, High resolution, position the ceph head holder in latero lateral position, place the nasion in field and take an exposure at 60kV3.2mA without objects in the X-ray field.
37. Verify that there are no defect lines or inhomogeneous horizontal bands on the image.
38. Select a ceph30x24LL, Normal resolution, position the ceph head holder in latero lateral position, place the nasion in field and take an exposure at 60kV3.2mA without objects in the X-ray field.
39. Verify that there are no defect lines or inhomogeneous horizontal bands on image.
40. Open AIS software and open a test patient
41. Perform the following 3D acquisitions at 60kV 2.2mA using the relevant chin support:

- 3D Full Dentition
- Maxillary single jaw 85x50 volume
- Mandibular single jaw 85x50 volume

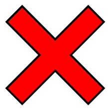
42. Open the volumes in AIS 3D and scroll all the reconstructed slices along the volume height verifying that there are no artefacts (e.g. rings artefacts):







Example of an artifact (indicated by the pink arrow) on an acquisition with the Centering cylinder P/N 5207900900 in the X-ray field



43. If the acquisitions are not OK (**X**):
    - Verify the presence of the correct calibration files (13 files named as the SN of the sensor mounted on the unit) in the calibration folder C:\ProgramData\Acteon Imaging\Panoramic X-MIND Prime Ceph\Calibration
    - Verify that all the calibration options are checked in image processing menu (see point 30 above)
    - If the acquisitions are still not OK, redo the calibration.

10.2.1 Password generation

Date	Value	Month	Value	Year	Value
1	53	January	a	2003	c
2	56	February	b	2004	d
3	59	March	c	2005	e
4	62	April	d	2006	f
5	65	May	e	2007	g
6	68	June	f	2008	h
7	71	July	g	2009	i
8	74	August	h	2010	J
9	77	September	i	2011	k
10	80	October	j	2012	l
11	83	November	k	2013	m
12	86	December	l	2014	n
13	89			2015	o
14	92			2016	p
15	95			2017	q
16	98			2018	r
17	01			2019	s
18	04			2020	t
19	07			2021	u
20	10			2022	v
21	13			2023	w
22	16			2024	x
23	19			2025	y
24	22			2026	z
25	25				
26	28				
27	31				
28	34				
29	37				
30	40				
31	43				

Example:

- *if the actual day is 22 you have to digit "16"*

- *if month is April you have to digit "d"*
- *if year is 2016 you have to digit "p"*

*Password for this date will be "16dp" but will be displayed "****".*

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11. CORRECTIVE MAINTENANCE

11.1 Firmware upgrade

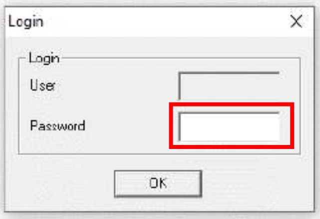
Note
To update MCU and CCU boards be sure the ehternet board connected to the machine is properly set as described in paragraph 7.7.1.

11.1.1 MCU Firmware upgrade

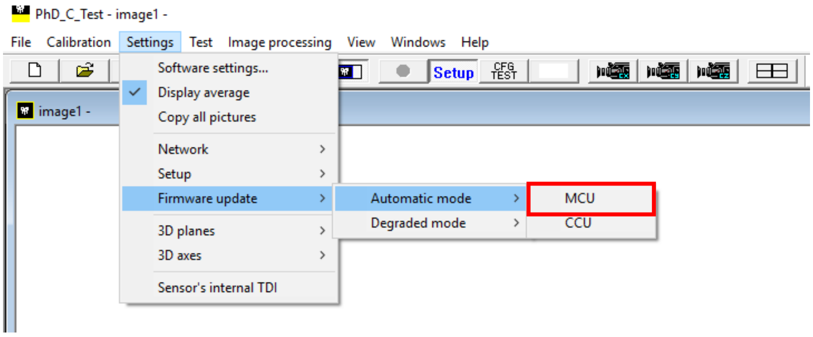
1. Copy in a working directory of the PC the MCU firmware to upload (the file name is in the form MCUet-YYYY-MM-DD-vM.mm.bbb.hex).

2. Power ON the machine. Open "PhD_C_Test.exe" service program (C:\Program Files (x86)\Acteon Imaging\Panoramic X-Mind Prime Ceph).

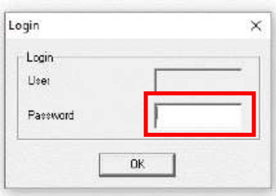
3. Click on SETUP button and in the Login windows that will open insert the password **PhdAccess** and click OK



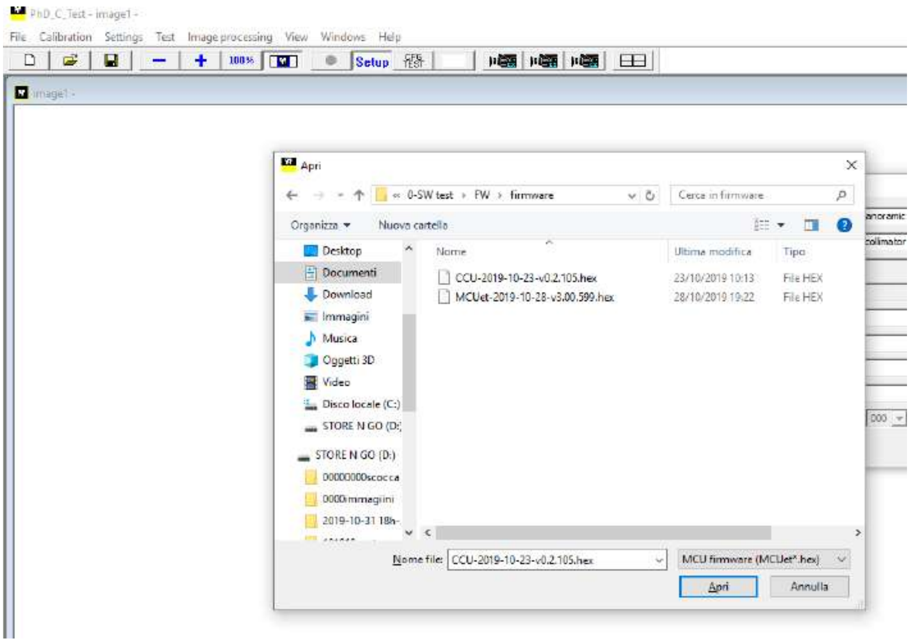
4. From the menu *Settings* select *Firmware update>Automatic mode>MCU*.



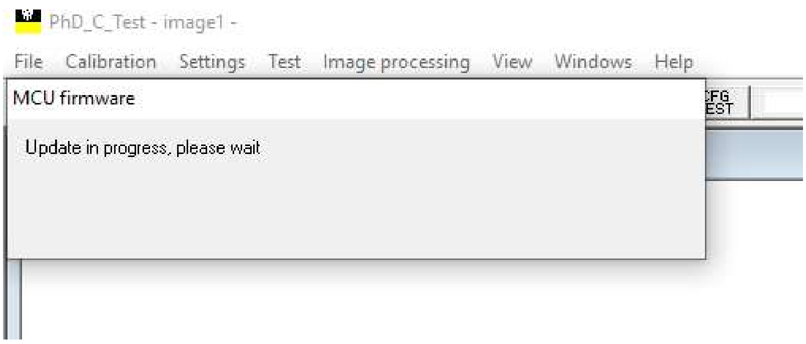
5. In the Login window that will open insert the password **EthUpload** and click OK.



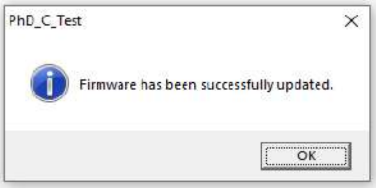
6. Browse the working folder where the firmware to upload has been copied, select it and click Open.



7. The firmware upload will start and the progress will be indicated by the message window. The upgrade progress might take up to two minutes.



8. When the upload process has been completed, the following window is displayed. Click on OK button.



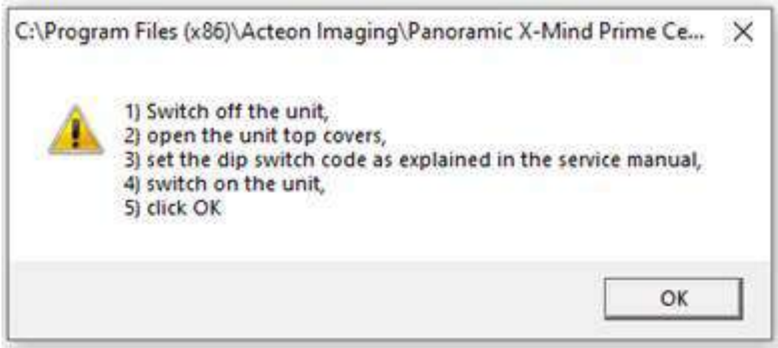
9. Switch OFF the unit.
10. Click on OK button of the information window.

11. Switch ON the unit and check on the first page of the GUI service program (chapter 8) the current MCU firmware version.

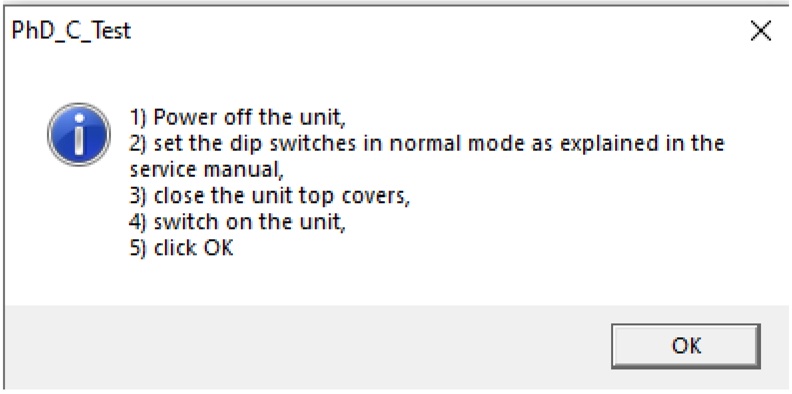
<u>Only in case the firmware upload process fails</u> (at point. 8 of the MCU firmware upgrade procedure), we suggest to perform the following steps

Note
The following procedure has to be performed only in case the automatic mode firmware uploading process failed at least one time before

- Switch off the unit
- Close PhD_C_test
- Open Phd_C_Test and Switch on the unit
  Wait at least 1 minute (the unit it will be probably in an error state: 3 keyboard leds blinks fast)
- In the PhD_C_Test selection bar select: Settings->Firmware update -><u>**Degraded mode**</u>->MCU
- Insert the password (same of point 5. of the service procedure)
- Select the new firmware MCUet-xxxx.hex file
- Skip the following steps by pressing OK (no need to open the unit covers and set dip switches)



- Wait the end of the uploading process
- Switch off the unit, switch On the unit and click OK to the following window (skip step 2 and 3)

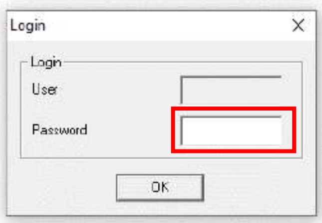


11.1.2 CCU Firmware upgrade

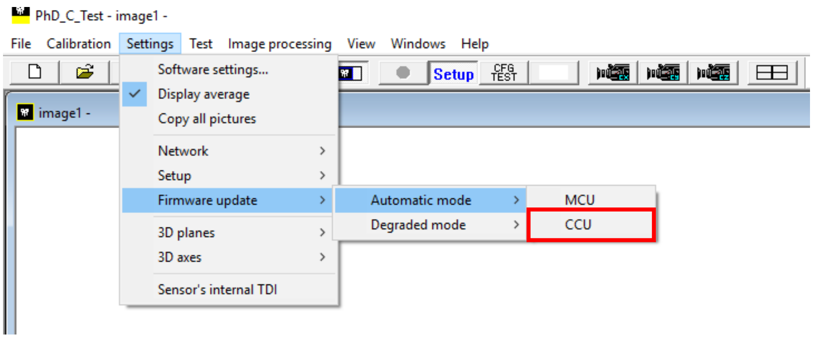
1. Copy in a working directory of the PC the CCU firmware to upload (the file name is in the form CCU-YYYY-MM-DD-vM.mm.bbb.hex).

2. Power ON the machine. Open "PhD_C_Test.exe" service program (C:\Program Files (x86)\Acteon Imaging\Panoramic X-Mind Prime Ceph).

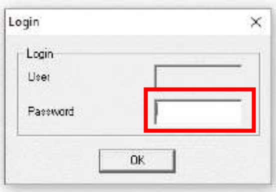
3. Click on SETUP button and in the Login windows that will open insert the password **PhdAccess** and click OK



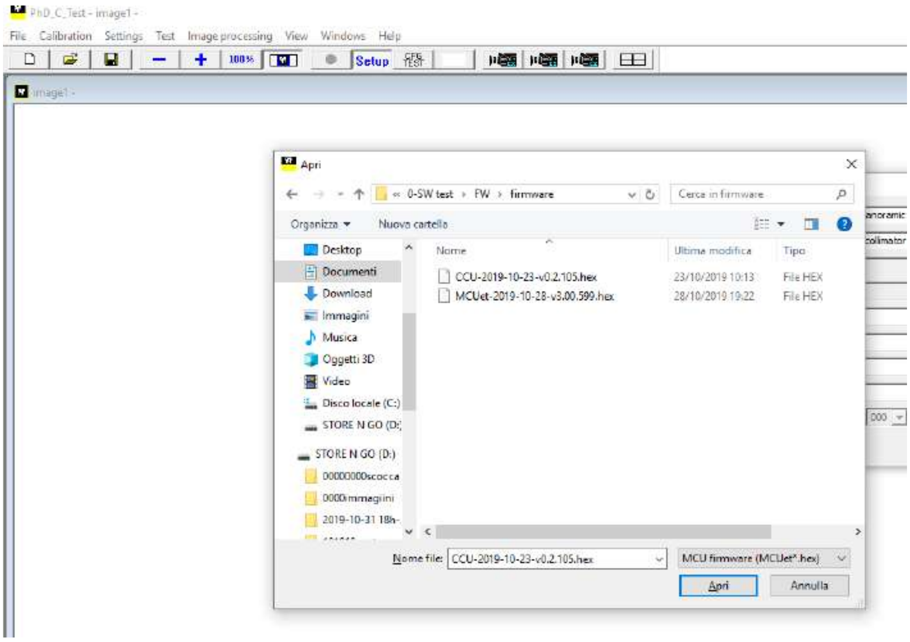
4. From the menu *Settings* select *Firmware update>Automatic mode>CCU*.



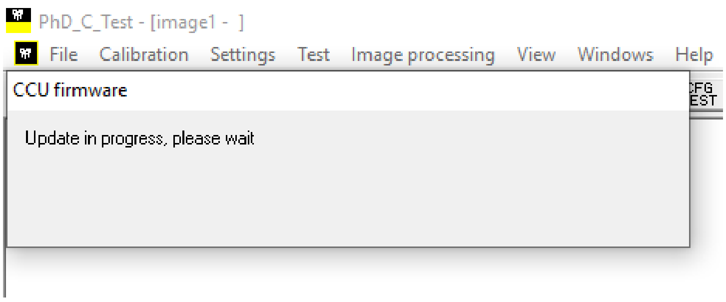
5. In the Login window that will open insert the password **EthUpload** and click OK.



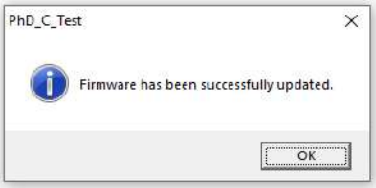
6. Browse the working folder where the firmware to upload has been copied, select it and click Open.



7. The firmware upload will start and the progress will be indicated by the message window. The upgrade progress might take up to two minutes.



8. When the upload process has been completed, the following window is displayed. Click on OK button.



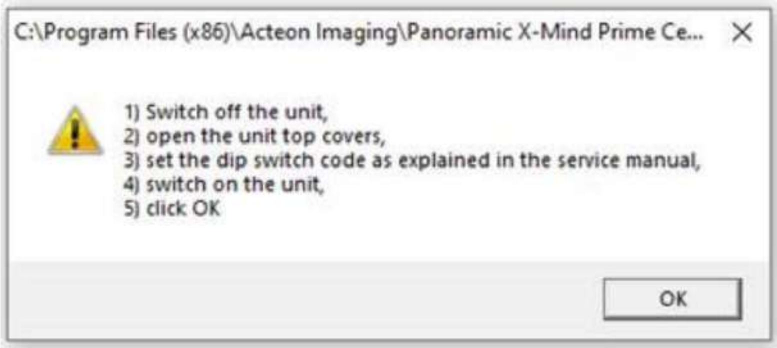
9. Switch OFF the unit.
10. Click on OK button of the information window.

11. Switch ON the unit and check on the first page of the GUI service program (chapter 8) the current CCU firmware version.

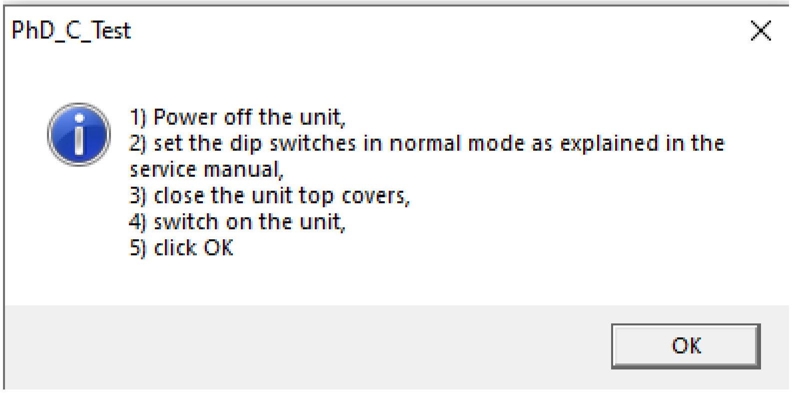
<u>Only in case the firmware upload process fails</u> (at point. 8 of the CCU firmware upgrade procedure), we suggest to perform the following steps

Note
The following procedure has to be performed only in case the automatic mode firmware uploading process failed at least one time before

- Switch off the unit
- Close PhD_C_test
- Open Phd_C_Test and Switch on the unit
  Wait at least 1 minute (the unit it will be probably in an error state: 3 keyboard leds blinks fast)
- In the PhD_C_Test selection bar select: Settings->Firmware update -><u>**Degraded mode**</u>->CCU
- Insert the password (same of point 5. of the service procedure)
- Select the new firmware CCU-xxxx.hex file
- Skip the following steps by pressing OK (no need to open the unit covers and set dip switches)



- Wait the end of the uploading process
- Switch off the unit, switch On the unit and click OK to the following window (skip step 2 and 3)



11.2 Checks, settings and adjustment

11.2.1 Logs files recover

The X-MIND prime 3D firmware and software record some of the events that occurs during the unit functioning, stored in files called “Logs”. These files have to be provided to the Technical Service as required by the different error descriptions. The following table lists all the logs file names and their path location, while the paragraph below explains the procedures for activating and collecting them.

	File name	Path location	Active by default
Software package	*LogsServer_yyyy.mm.dd.log*	C:\ProgramData\Acteon Imaging\LogServer\Logs	**Yes**
MCU	*eeprom.dump* *mcu.log*	[SDCARD]:\mcu\Logs	**NO**
CCU	*CCU.log*	[SDCARD]:\ccu\Logs	**NO**
3D Sensor	*dcam_yyyy.mm.dd-hh.mm.ss.log* *GigE_yyyy.mm.dd-hh.mm.ss.log*	C:\ProgramData\Acteon Imaging\LogServer\Logs in the sub-folders *“Logs_dcam“ and “Logs_GigE“*	NO
Ceph Sensor		*C:\Program Files (x86)\Teledyne DALSA\Sapera\Bin\logview.exe*	Yes

11.2.1.1 Software package (ASP) logs

These logs record the events that occurs during the ASP (installed on the PC) execution.
These logs are always active by default after any X-MIND prime 3D ASP installation.

The logs file are stored in the folder path: C:\ProgramData\Acteon Imaging\LogServer\Logs.
In this folder, every day a .log file named LogsServer_yyyy.mm.dd.log is store (where yyyy=year, mm=month and dd=day).

11.2.1.2 MCU logs

Note

The SD card MUST has the following characteristics:

- Capacity ≤ 32Gb
- Formatted as FAT32.

This log record the events that occurs during the MCU firmware execution, even if the unit is not connected to the computer.

1. Insert an SD card in the MCU SD card reader.
2. Switch ON the unit.
3. Wait at least 30s (10 minutes if sensor power on issues occur, related to sensors overheating) or use the unit normally, or reproduce the error/problem to be logged.
4. Switch OFF the unit.
5. Read the SD card. The “Logs” folder contents the following files:
   - *eeprom.dump*
   - *mcu.log*

The main information listed in the “mcu.log” file are:

Log	Description
MCU version numbers	MCU Firmware (SW) version
DIP switch code	MCU DIP-Switches position (see paragraph 4.2.2.1) 0 = Normal mode
S/N	MCU hardware key number (U.I.C.)
Acquisition mode	Area mode / DTDI
Tubehead type	2D / 3D
Machine offsets	
MCU IP = 192.168.0.211 Netmask = 255.255.255.0	MCU Ethernet IP and Netmask addresses
XP-PACK option	XP exam option ENABLED or DISABLED
XCU version numbers	Generator board Firmware (SW) version
CCU version numbers	CCU board Firmware(SW) version
Sensor temperature	

11.2.1.3 CCU logs

Note

The SD card MUST has the following characteristics:

- Capacity ≤ 32Gb
- Formatted as FAT32.

This log record the events that occurs during the CCU firmware execution, even if the unit is not connected to the computer.

1. Insert an SD card in the MCU SD card reader.
2. Switch ON the unit.
3. Wait at least 30s (10 minutes if sensor power on issues occur, related to sensors overheating) or use the unit normally, or reproduce the error/problem to be logged.
4. Switch OFF the unit.
5. Read the SD card. The "Logs" folder contents the following files:
   - *eeprom.dump*
   - *ccu.log*

The main information listed in the "mcu.log" file are:

Log	Description
CCU version numbers	CCU Firmware (SW) version
Nasion potentiometer readout	
DIP switch code	CCU DIP-Switches position (see paragraph 4.2.2.1) 0 = Normal mode
Position of the imaging detector	

11.2.1.4 3D Sensor logs

These logs record the events that occur in the communication between the PC network interface, the 3D sensor drivers, the ASP and the 3D sensor.

Note
Before activating the 3D sensor logs, check that the network interface board dedicated to the 3D sensor is configured properly (see paragraph 7.7.2).

---

1. In the folder path C:\ProgramData\Acteon Imaging\Panoramic X-MIND Prime Ceph open the “PhD_C.ini” file with a text editor (e.g. Notepad).
2. Activate the 3D sensor logs by setting the following variables to “1” (instead of “0”):
   - SENSOR_PAN3D_MANUFACTURER_TRACES=1
   - SENSOR_PAN3D_GIGE_MANUFACTURER_TRACES=1

```
SENSOR_PAN3D_MANUFACTURER_TRACES=0
; 0 if you want to hide the pano/3D sensor manufacturer information
; 1 if you want to show the pano/3D sensor manufacturer information
SENSOR_PAN3D_GIGE_MANUFACTURER_TRACES=0
; 0 if you want to hide the pano/3D sensor GigE manufacturer information
; 1 if you want to show the pano/3D sensor GigE manufacturer information
```

3. Save and close the “PhD_C.ini” file.
4. If possible, reproduce the error/problem to be logged, otherwise use the unit normally.

Note
If the problem is not reproducible, it’s allowed to keep the log tracing active during the normal functioning of the unit.

The log files are saved in the folder path C:\ProgramData\ Acteon Imaging\LogServer\Logs in two different subfolders:
- “Logs_dcam” → dcam_yyyy.mm.dd-hh.mm.ss.log
- “Logs_GigE” → GigE_yyyy.mm.dd-hh.mm.ss.log

(where yyyy=year, mm=month and dd=day, hh=hours, minutes, seconds).

11.2.1.5 Ceph Sensor logs

These logs record the events that occur in the communication between the ceph sensor and ASP software.

Note
Before recording the log, check that the network interface board connected to the ceph sensor the one labelled as "Network" is configured properly
(see paragraph 7.7.1).

To save the log:

1. In the folder C:\Program Files (x86)\Teledyne DALSA\Sapera\Bin\ run the program logview.exe
2. Then try to replicate the issue and save the log file selecting in the File menu the option save all messages.

Note
If the issue is rare open logview.exe, select the menu Options -> View GUI settings and set 50000 in *Maximum messages shown* box.

3. In addition in the folder C:\Windows\SysWOW64 retrieve the file logs.dat.

11.2.2 RAW files recovery

In case of image quality or sensor problems, it is required to send these raw folders to Technical Service.

The raw folders of the last ten acquired exams (2D, 3D and static) are stored in C:\ProgramData\Acteon Imaging\Panoramic X-MIND Prime\AcquisitionSave folder. The sub-folders are organized in folders named with time and date of the ten acquisitions.

All the raw folders of the **3D exams** acquired through AIS software are stored in the 3D X-rays AIS data base. (refer to AIS manual)

The raw folders of **2D exams** are not by default stored on the PC. They are temporarily saved in the "AcquisitionSave" folder (see above).

11.2.3 24V Power supply check

Warning
The switching power supply can have dangerous voltage.
Wait for at least 5 minutes before carrying out any action.

Before performing the following procedure, verify the main fuse integrity (see paragraph 11.3.1.1) and the main power supply line (see paragraph 4.2.1 and chapter 12 – General Diagram).

Verify if the MCU LED H1 is ON

1. If MCU H1 is OFF, remove the cable X1 and verify the 24V between X1-pin1 and X1-pin2.
    - IF X1 24V is NOT OK, fix or replace the cable X1 and then the switching power supply G1.
    - IF X1 24V is OK, unplug the connector X11 and verify if the MCU LED H1 light up:
        - IF MCU H1 is still OFF, replace the MCU board A1
        - IF MCU H1 is now ON, verify the integrity and the insulation between pin1 and pin2 of cable X11-X37. If the problem is still present, replace the 3D sensor power board.

2. If MCU H1 is ON, verify if the MCU LED H2 is ON.

Note
If the LED H1 is ON the 24V to the 3D sensor power board is correctly supplied by the MCU connector X11. In this case, if there are still problems related to the 3D sensor connection, check the cable X11-X37 and then refer to Error E1402 (see paragraph 9.2.10.2).

   a. IF MCU LED H2 is OFF, verify that fuse F1 is not blown:
    - IF fuse F1 is blown, replace it and verify if the error is still present (* see Note below).
    - IF fuse F1 is NOT blown, disconnect the motors connectors (X18, X19, X20 and X34) and verify if the LED H2 lights up:
        - IF MCU H2 is still OFF, replace the MCU board A1
        - IF MCU H2 is now ON, connect one at a time the motors connectors and verify which ones are the origin of the problem. (* see Note below).

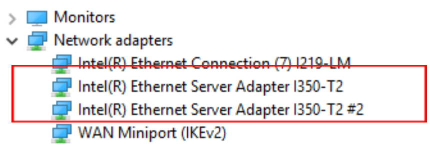
(*) Note

Before replacing, a burned fuse or any other parts verify that there are no short-circuit on motors (M3, M4, M5, M6) and theirs cables as described in the troubleshooting of the Errors E200 ÷ E205 (paragraph 9.2.3.1), E240 ÷ E243 (paragraph 9.2.3.3) and E265 ÷ E268 (paragraph 9.2.3.4). Verify also that there are no short-circuit on cable X11-X37.

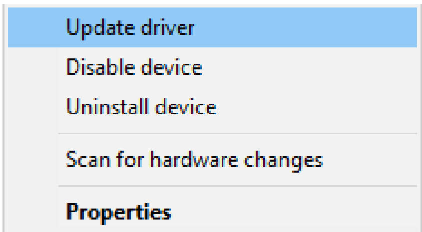
11.2.4 Network interface board drivers upgrade

In case of problems with 3D/ceph sensor Ethernet connections (Errors E1400÷1404, E371 and E370) or with the X-MIND prime 3D connection, a verification of the network board driver update is suggested:

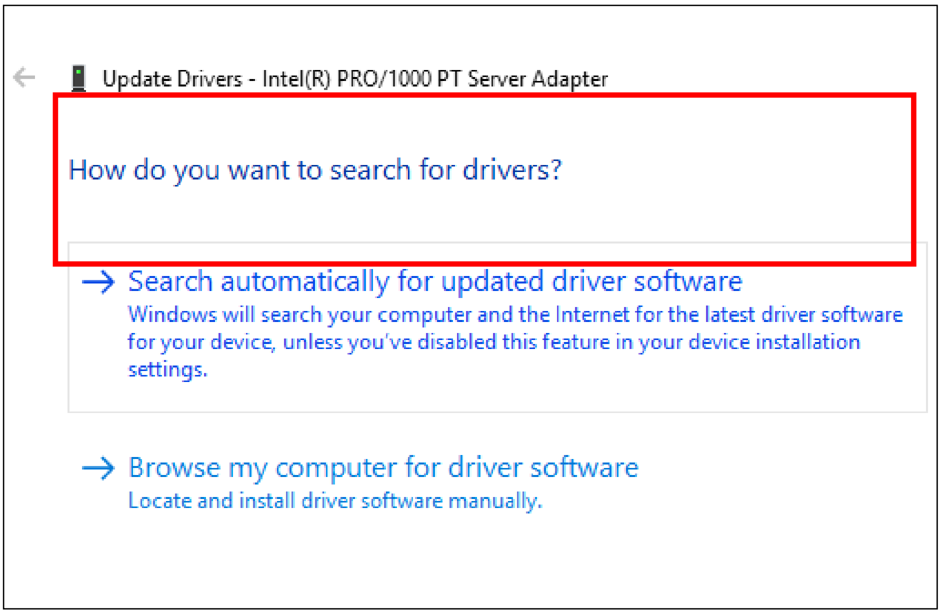
1. Connect the PC to Internet.
2. Open the system "Device Manager" (Control Panel→System and Security→System).
3. Click on Network adapters and right click on all the boards names connected to the unit:

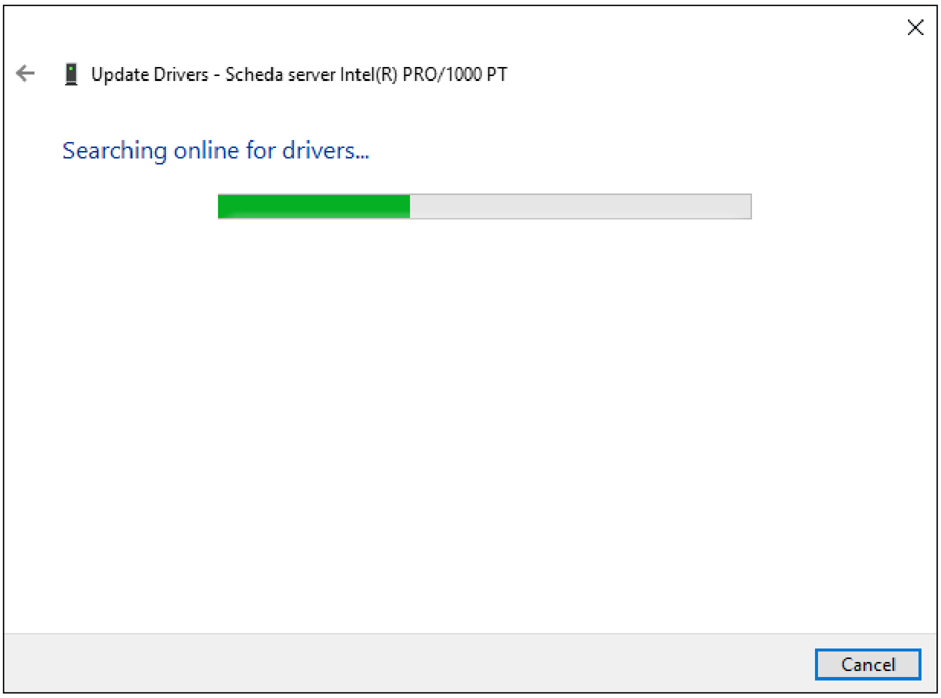


4. Click on Update driver:

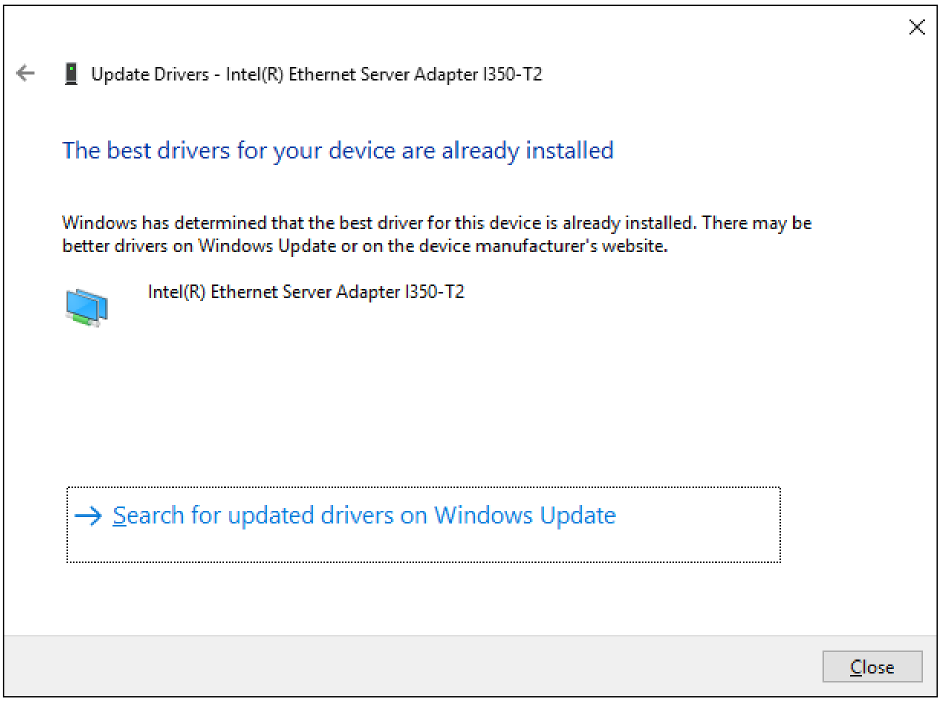


5. Click on "Search automatically for updated driver software":

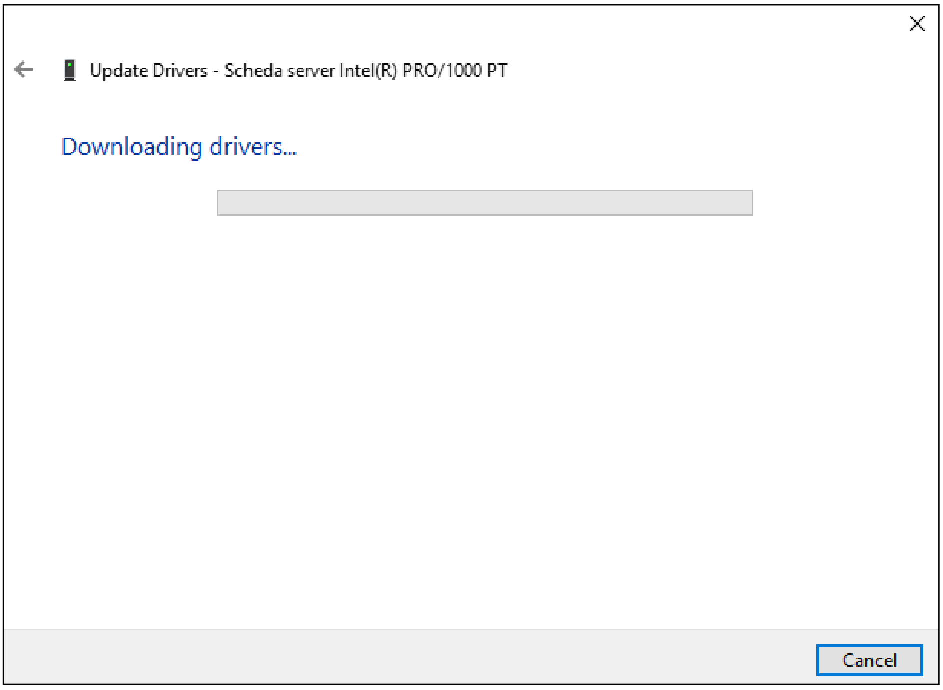


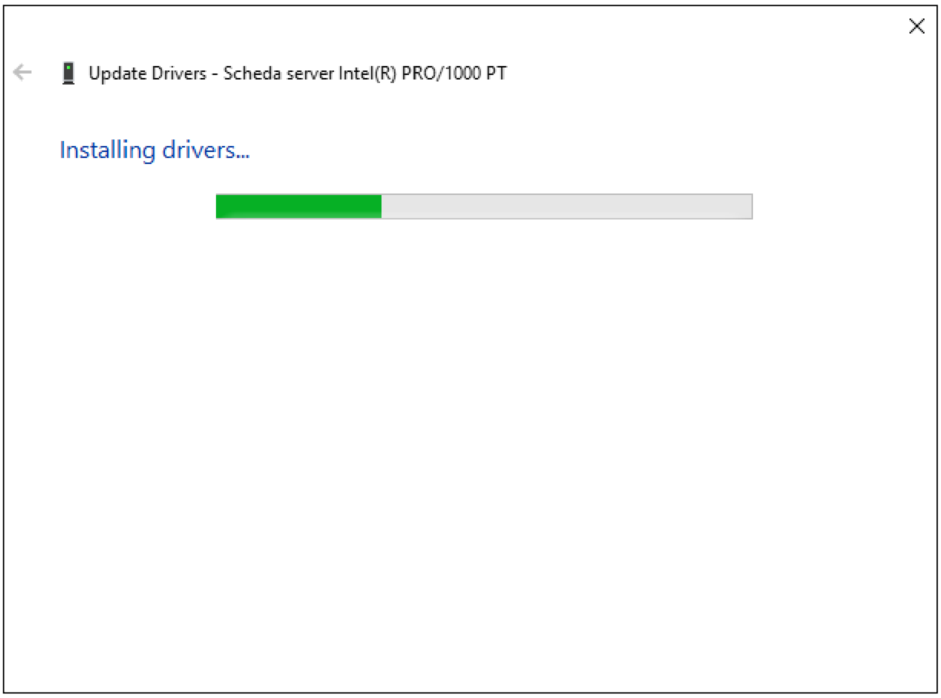


6. If the installed drivers are already updated the following window will be displayed:

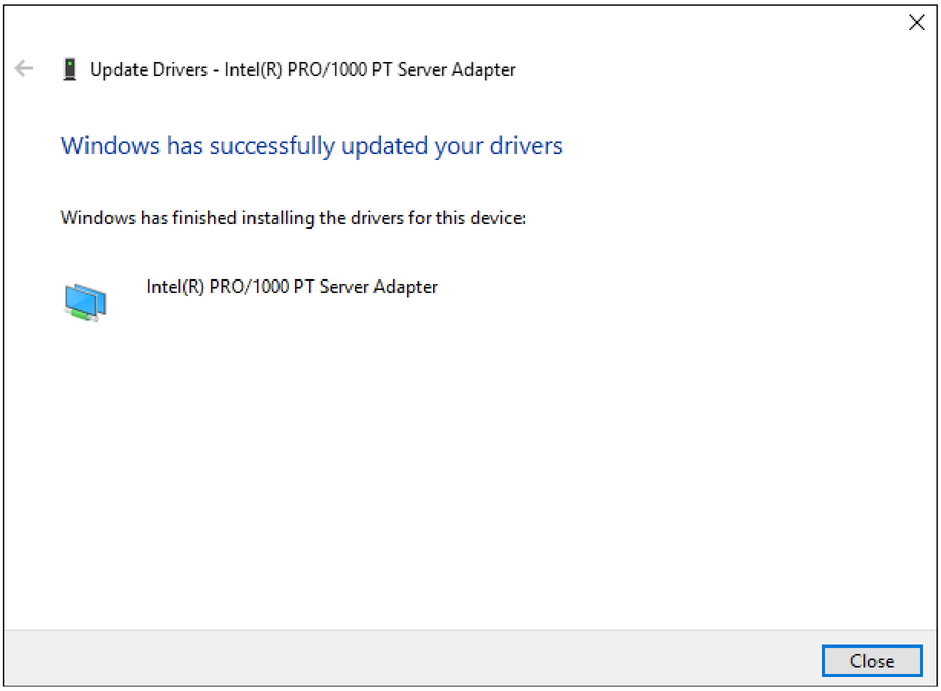


Otherwise, if the search found a driver to be updated, the following windows will be displayed:





7. The update process is finished when the following message is displayed:



8. Repeat the above procedure on all the PC network interface boards.

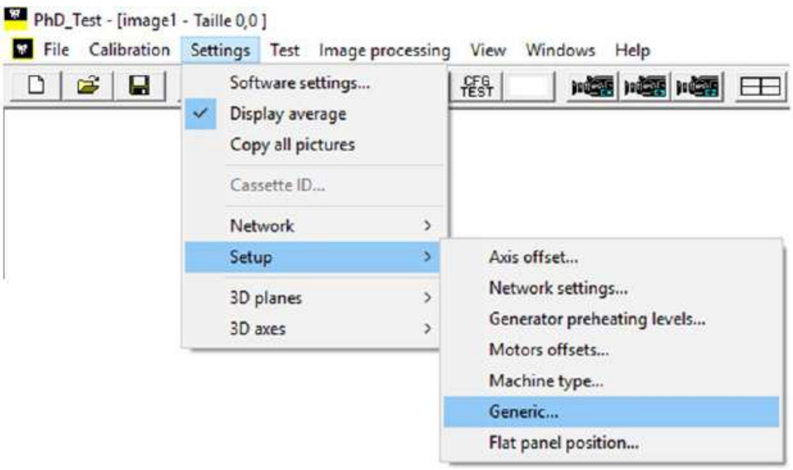
11.2.5 EEPROM Memory values verification and modification

Note

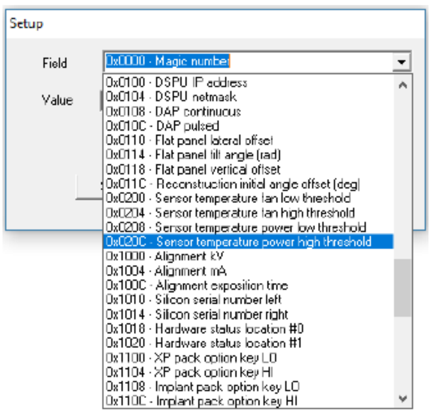
DO NOT CHANGE ANY EEPROM VALUES DIFFERENT FROM THE ONES REQUIRED BY THIS MANUAL (eg. Required by a troubleshooting or Errors procedures).

An incorrect and improper modification of an EEPROM value may affect the correct functioning of the unit. The service technician is responsible for the following operations.

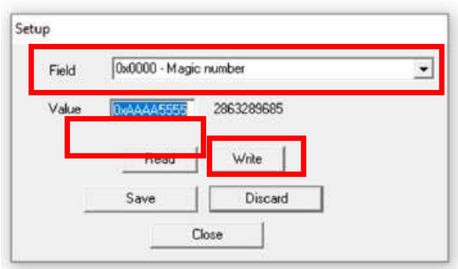
1. Switch ON the unit and when the green keyboard LED blinks slow press the >0< button.
2. Open the "PhD_C_test.exe" (folder path: C:\Program Files (x86)\Acteon Imaging\Panoramic X-MIND Prime Ceph), wait the unit connection and enter in SETUP mode.
3. Click on the menu Settings→Setup→Generic:



4. In the "Setup" window select the field needed value: 0x#### - [name of the EEPROM variabiles]:



The EEPROM stored values will be displayed in the “Value” field. If the value number is not correct, manually write the correct DECIMAL number in the white “Value” field and then press the button “Write”:

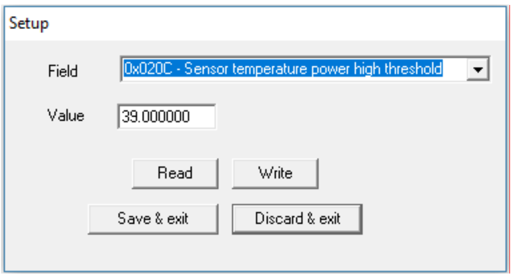


Note

If in the “Value” field the number is preceded by the prefix “0x”, means that that it is expressed in hexadecimal base. In this case refer to the DECIMAL values reported on the right of the field:

If the value must be changed, write in the white filed the correct DECIMAL number and then press the button “Write”.

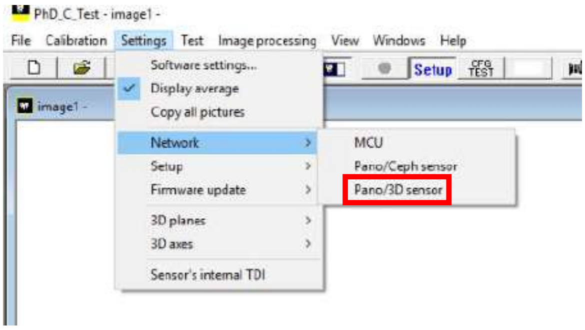
5. Press “Write”, then “Save& exit” button and wait the unit reboot (green LED blink slow).



6. Switch OFF the unit.

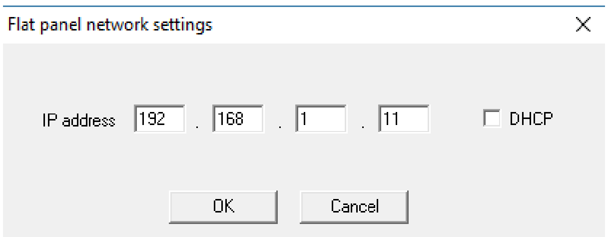
11.2.6 3D Sensor static IP address setting

1. Switch ON the unit and when the green keyboard LED blinks slow press the >0< button.
2. Open the “PhD_C_test.exe” (folder path: C:\Program Files (x86)\Acteon Imaging\Panoramic X-MIND Prime Ceph) and wait the unit connection.
3. Click on the SET-UP button and in the windows that will open type the password **PhdAccess.**
4. Click on the menu Settings→Network→Pano/3D sensor:



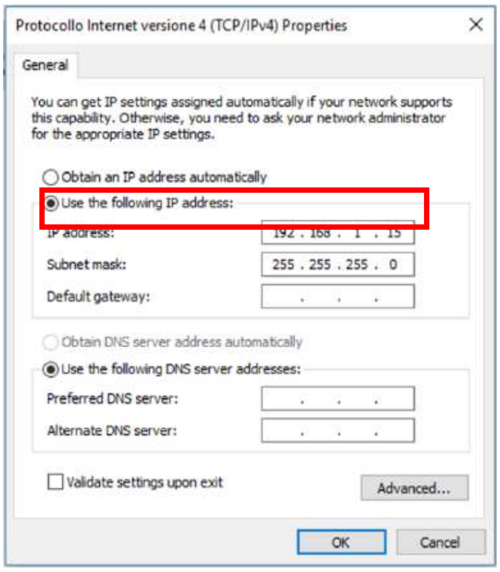
5. Unflag “DHCP” mode box:

6. Write a compatible static IP address in the IP address fields (different from the MCU one (see paragraph 8.1).



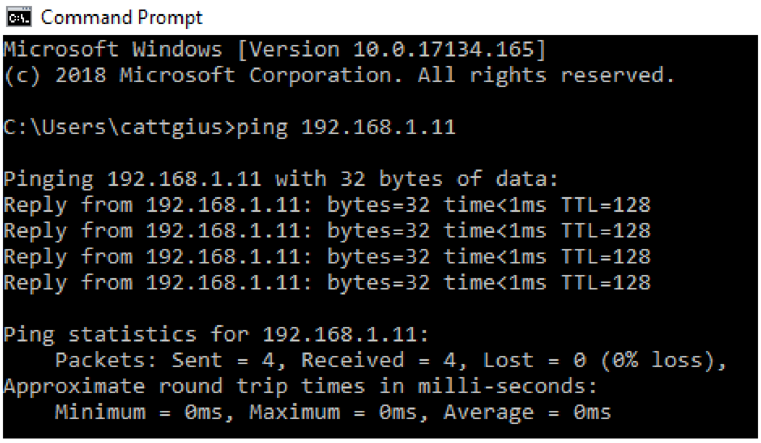
7. Click on OK button and close “PhD_C_test” program.

8. Set the network board connected to the 3D sensor with a valid static IP address:



E.g.: in the case reported in the image above, the last number must be different from 11

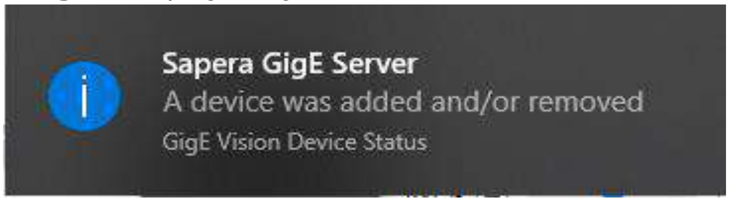
9. Switch the unit OFF and then power it ON again.
10. To check that the connection is properly configured, run a command prompt and type “ping [3D sensor IP address]” (e.g. ping 192.168.1.11). Press Enter and verify that the unit reply to the ping as shown in the figure below:



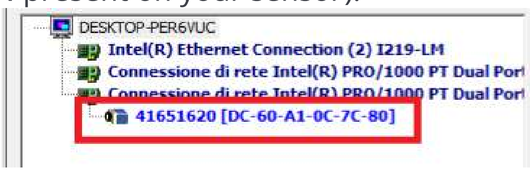
11. IF the sensor does not reply, refer to Error E1402.

11.2.7 Ceph sensor IP address modification

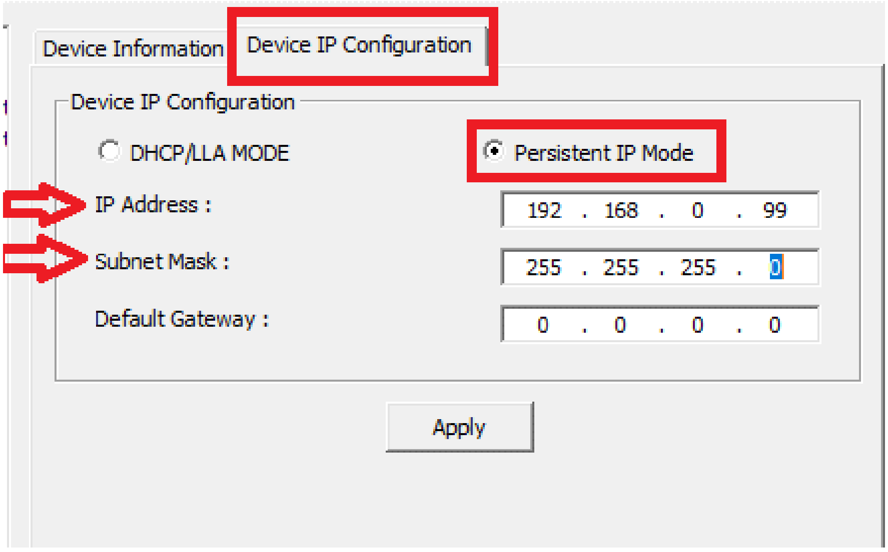
1. Check that the network card connected to the Ceph sensor - i.e. the one connected to the machine port labelled with “Ethernet” - is configured with a static IP in the family of the current sensor IP. The factory default is: IP address:192.168.0.16, Subnet Mask: 255.255.255.0 (refer to paragraph 7.7.1).
2. Switch ON the unit.
3. Wait until connection with the sensor presence is recognized by the PC, i.e. when this message is displayed by windows:



4. Start the program “CorNetConfigApp.exe” present on desktop (C:\Program Files (x86)\Teledyne DALSA\Network Interface\Bin).
5. In the left side select the item with the S/N of the sensor (check that it is matching with the S/N present on your sensor).



6. In the right side of the menu select the window “Device IP Configuration”. Select “Persistent IP Mode”.
7. In the field “IP Address” set the static IP to apply to the sensor (the default is 192.168.0.99).
8. In the field “Subnet Mask” set the value. (the default is 255.255.255.0).
9. Click on Apply



10. Wait the end of the process.

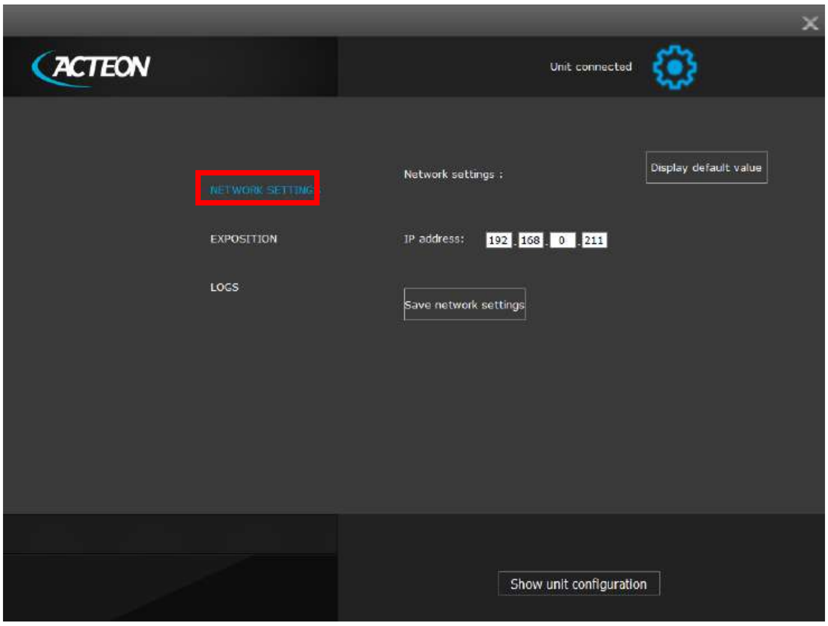
Note

If the sensor IP family has been changed to connect again to the machine also MCU IP address (refer to paragraph 8.1) and PC network ethernet card are to be changed.

11.2.8 MCU IP address modification and factory reset

11.2.8.1 MCU IP address modification

1. Enter service menu (see chapter 8).
2. Select the "Network Settings" page (see paragraph 8.1).



3. Change the IP address; click on Save IP address.
4. Change the Network interface board IP with a valid one (see paragraph 7.7.1).
5. Power OFF the unit and power it ON again and check the connection.

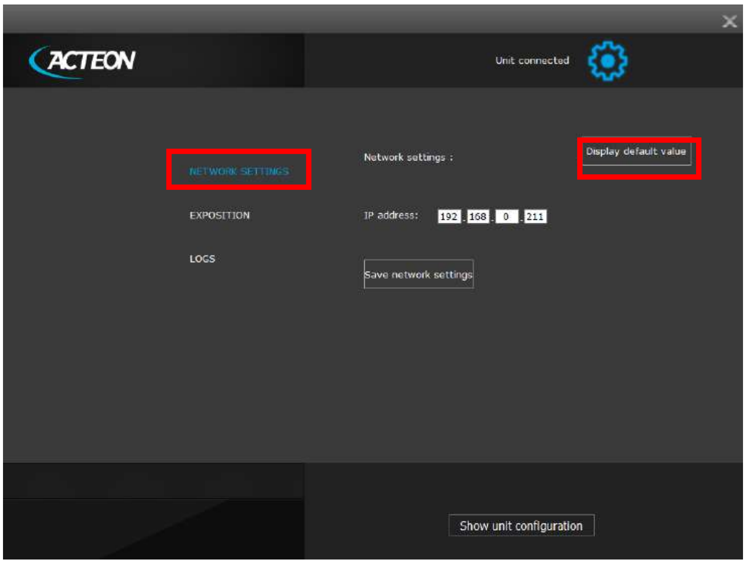
Note

You can verify the current MCU IP address by the MCU SD card log (see paragraph 11.2.1.2).

11.2.8.2 MCU IP address factory reset

Follow the procedure below to restore the factory MCU IP address 192.168.0.211.

1. Switch ON the unit.
2. Press column UP and column DOWN keyboard buttons switch ON the unit and keep pressed column UP and column DOWN keys until the keyboard green LED blinks.
3. Switch the unit OFF and then power it ON again.
4. Set a compatible IP address on the Network interface board IP (eg. 192.168.0.16, see paragraph 7.7.1).
5. Enter service menu (see chapter 8).
6. Select the “Network Settings” page (see paragraph 8.1).



7. Click on “Display default value” button and then on “Save IP address” button.
8. Wait the unit connection.
9. Exit the service menu by clicking on the gear.

Note
You can verify the current MCU IP address by keeping the MCU SD card log (see paragraph 11.2.1.2).

11.2.9 Primary collimator alignment

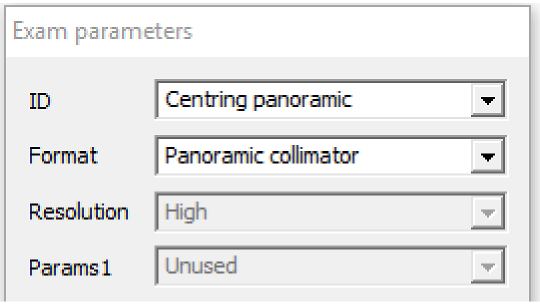
11.2.9.1 Primary collimator beam alignment check

In order to make an exposition without rotating the arm it is necessary to use the software "PhD_C_Test" you can find in the directory C:\Program Files (x86)\Acteon Imaging\Panoramic X-Mind Prime Ceph. This function is useful to verify and adjust the x-ray beam alignment on the digital sensor and also to measure exposure parameters (see paragraph.7.13). This function is required in case of tubehead or digital sensor replacement.

Note
Before acquiring and image <u>remove</u> any object from the x-ray beam field including the chin support and the panoramic temple clamps.

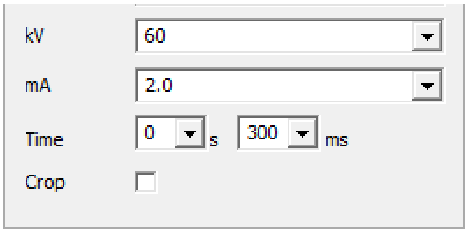
- <u>**Panoramic collimator checks**</u>

1. From the "Exam parameters" window select the exam ID "Centring panoramic" and the Format "Panoramic collimator".



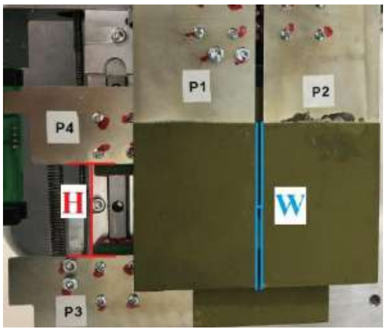
Note
In order to make a static exposition with the 3D collimation select the exam ID "Centring 3D" and the Format "W01 - 86x90 full 3D.
While the recommended IDs for the measurement of exposure parameters with non-invasive method are “Centering emission” or "Centring 3D" with “No Collimator” Format

2. Set the exposure parameters from the "Exam parameter" window.



3. Once the green led on the keyboard gets solid, press the X-ray button to make an exposition. The acquired image will be displayed.
4. If needed, the images can be saved by clicking the button "Save" . To save the image in bitmap format, put ".bmp" at the end of the file name while saving.
5. With the panoramic collimator format selected, **verify that**:
   - In the panoramic acquisition **a white border is visible on each side of the image**
   - In the panoramic acquisition the irradiated area is **not tilted** and **centered** in the acquisition area
   - The width of the panoramic collimator window (distance between leads edge of P1 and P2) is **W=1mm +/-0.2mm**
   - The maximum distance between the iron part of the P3-P4 blades is **H≤ 32mm**

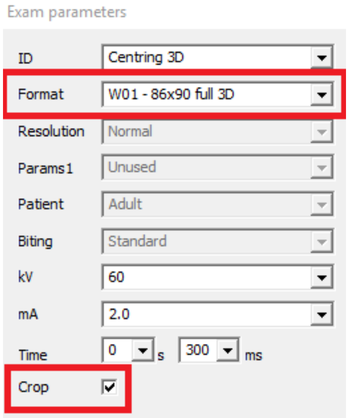
The x-ray beam **correctly aligned:** a white border is visible on each side of the image



Collimator Width and Height physical measurement

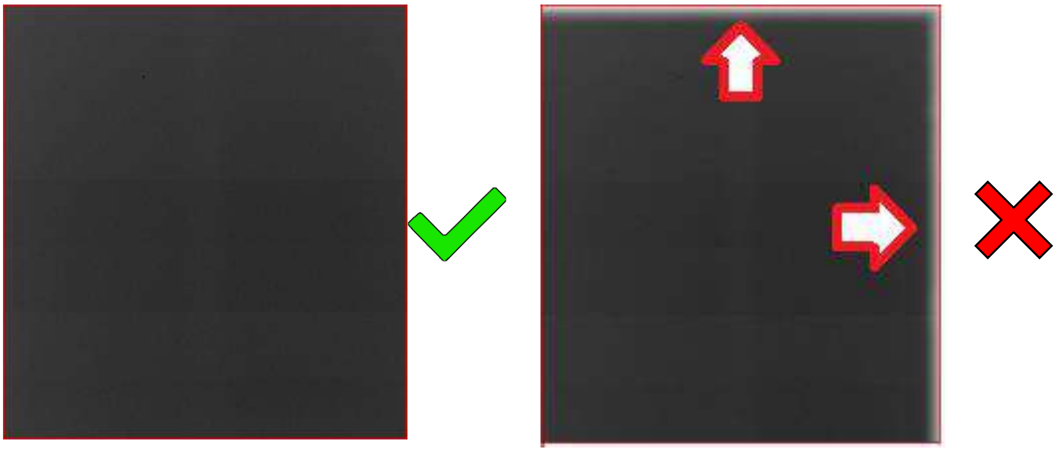
- **3D collimator checks**

6. In the “Exam parameters” window set the “Centring 3D” ID
7. Set the crop option and 60kV 2mA 300ms:



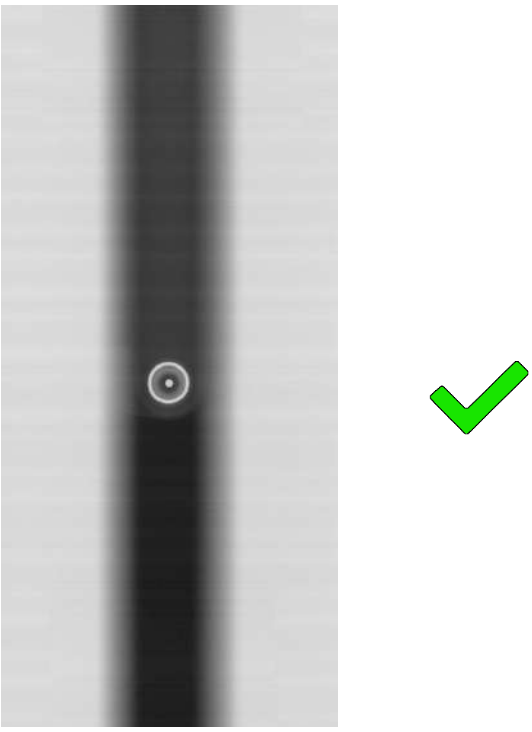
8. Acquire one image for each of the following 3D window formats:
   - W01 – 86x80 full 3D
   - W02 – 86x50 Mand
   - W03 – 86x50 Maxil
   - W04 – 50x50 Maxil
   - W05 – 50x50 Mand

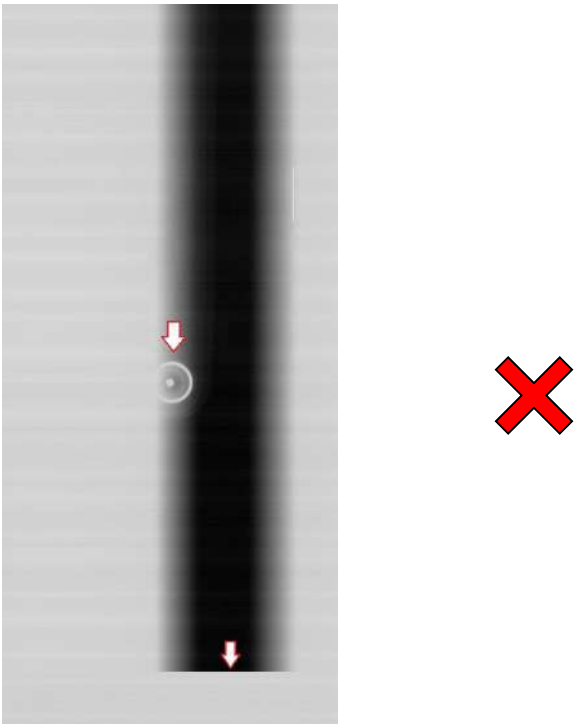
9. In each of the above acquisitions verify that the red edge borders are fully well irradiated



- **<u>Ceph collimator checks</u>**

10. In the “Exam parameters” window set the “Centring ceph” ID and the following options:
    - Format: Height 24
    - Resolution: High
    - Param1=”View of primary collimator field”
    - 70kV 8mA
11. In the image processing menu set the option “Dynamic adjustment”
12. Rotate the ceph head support in the lateral position
13. Prepare the unit to acquire a ceph exam
14. Acquire the centring ceph exam by pressing the X-ray button
15. In the acquisition verify that:
    - The dot and the outer circle are inside of the main exposed area
    - The top and bottom border of the acquired area are fully exposed
    - The width of the ceph collimator window (distance between leads edge of P1 and P2) is **W=2mm +/-0.2mm**





11.2.9.2 Primary collimator beam alignment adjustment

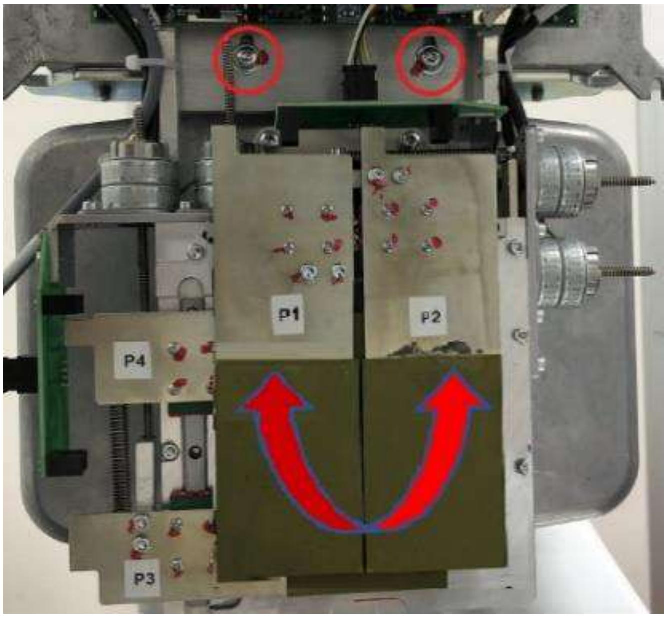
Warning
In case of tubehead replacement or digital sensor replacement the x-ray beam should be aligned using mechanical regulations: do not perform the following instructions.
Perform the following operations <u>only in case of collimator replacement, collimator light barrier or motors replacement or if the above verification checks failed</u>

1. If the collimator position has to be adjusted, enter the SET-UP mode, open “Unit setting configuration” window and select “Collimator offsets” tab (refer to paragraph 8.4)

2. Select “W0-Pan windows” if you want to adjust the panoramic collimation windows

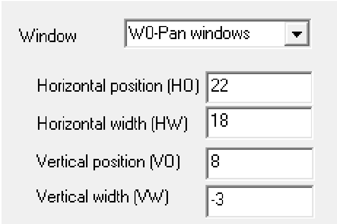
Note
Perform first the Panoramic collimator adjustment (as explained below) and then proceed with the exact sequence of the operations reported in the following paragraphs

3. If the irradiated area in the panoramic acquisition is tilted with respect to the sensor area, adjust the collimator rotation through its fixing screws indicated by the red circles in the image below.



Collimator fixing-regulations for tilting adjustment

4. If the tilt of the irradiated area is ok, but the position is not: modify the offsets following the conventions reported below and then press on send parameter, save



5. Once an offset value has been changed, before acquiring a new static image, press the >o< button on the keyboard in order to perform a collimator reset and apply the new parameters to the to the collimator position.

COLLIMATOR OFFSETS (HO, HW,VO,VW) CONVENTIONS

- The **horizontal position (HO)** offset allows to move the window on the right or left of the acquisition area without modifying the window width (P1 and P2 blades distance remains unchanged)

OFFSET	EFFECT ON ACQUIRED IMAGE
HO [+]	Move the collimator window on the LEFT of the sensor acquired area
HO [-]	Move the collimator window on the RIGHT of the sensor acquired area

- The **horizontal width (HW)** offset allows to increase/ decrease the collimator width by moving only the P1 collimation blade

OFFSET	EFFECT ON ACQUIRED IMAGE
HW [+]	INCREASE the window width by moving the P1 blade on the Left of the sensor acquired area without moving the P2 blade
HW [-]	DECREASE the window width by moving the P1 blade on the Left of the sensor acquired area without moving the P2 blade

- The **vertical position (VO)** offset allows to move the window towards the Top/Bottom border of the acquisition area without modifying the window height (P3 and P4 blades distance remains unchanged)

OFFSET	EFFECT ON ACQUIRED IMAGE
VO [+]	Move the collimator window DOWN
VO [-]	Move the collimator window UP

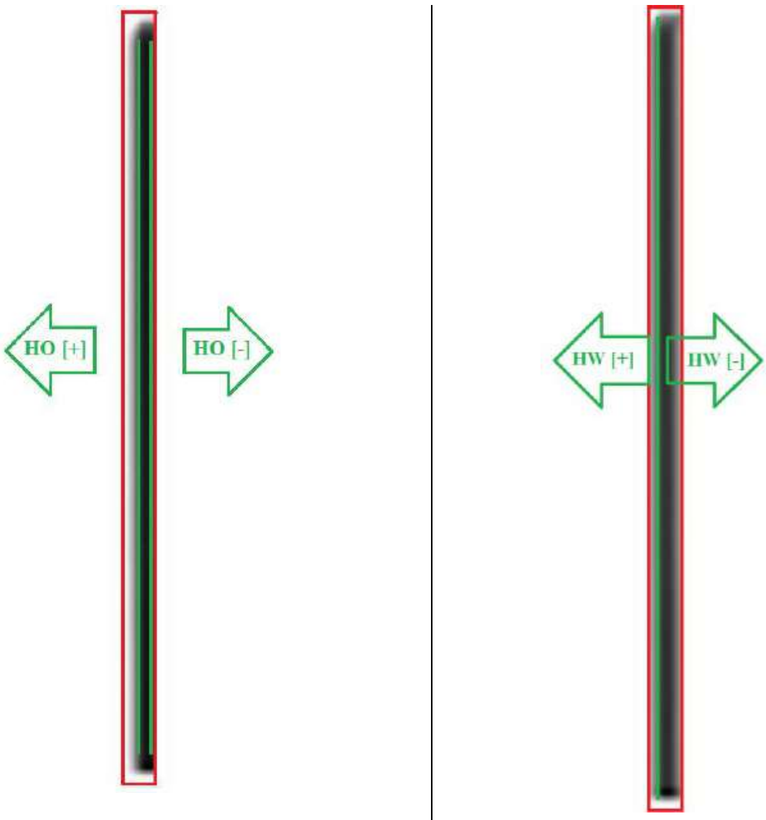
- <u>The **vertical width (VW)** offset allows</u> to increase/ decrease the collimator height by moving only the P3 collimation blade

OFFSET	EFFECT ON ACQUIRED IMAGE
VW [+]	INCREASE the window height by moving the P3 blade on towards the bottom edge of the sensor acquired area without moving the P2 blade
VW [-]	DECREASE the window width by moving the P3 blade towards the top edge of the sensor acquired area without moving the P4 blade

- <u>**Pixel-Offset Conversion**</u>

1 offset ≃ 2 pixel (0.240mm) if ID= “Centering panoramic” (Resolution= High)
1 offset ≃ 1 pixel (0.240mm) if ID= “Centering 3D” (Resolution= Normal)

*Note: The symbols [+] and [-] mean, respectively, an increase and a decrease of the offset value.



Horizontal Offset (HO) convention

Horizontal Width (HW) convention

Vertical Offset (VO) convention

Vertical Width (VW) convention

6. Repeat the tests prescribed by paragraph 11.2.9.1 “Panoramic collimator checks“

7. Once the panoramic collimator has been correctly adjusted, in the tab “Collimator offsets” of the “Unit setting configuration” window assign to the “W4 - 3D windows” the same HO, HW, VO and VW offsets values assigned to the “W0 – Pan windows”

8. Repeat the tests prescribed by paragraph 11.2.9.1

Note
If the collimator has been replaced or adjusted the sensor calibration of Pano and 3D area (resolution 1x1 and 2x2) must to be performed (refer to paragraph 10.2).

Note
Perform the following part of the paragraph only in case the “Ceph collimator checks“ , prescribed by paragraph 11.2.9.1, failed .

9. In the tab “Collimator offsets” of the “Unit setting configuration” window assign to the “W6 - Ceph windows” the same HO, HW, VO and VW offsets values assigned to the “W0 – Pan windows”

10. Repeat the tests prescribed by paragraph 11.2.9.1 in „ceph collimator checks“ part

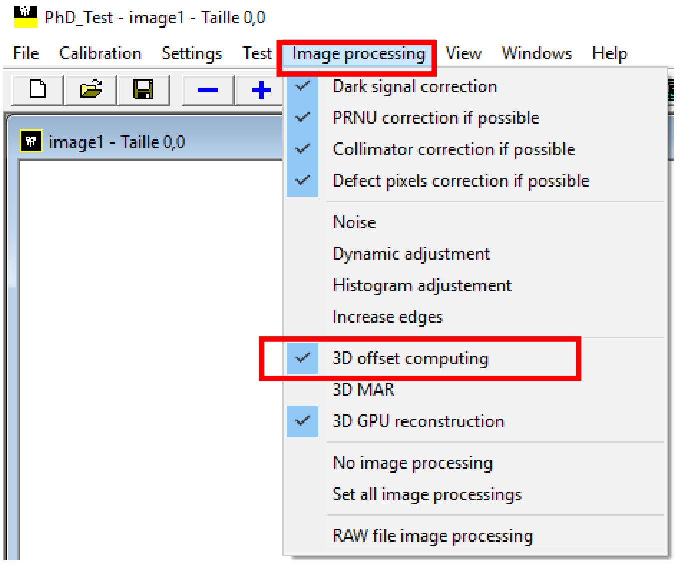
11. If the tests failed again refer to the ceph alignment paragraph 11.2.11

Note
After any changes to the offset values, update the paper copy of the equipment parameters table in Appendix A with the new values.

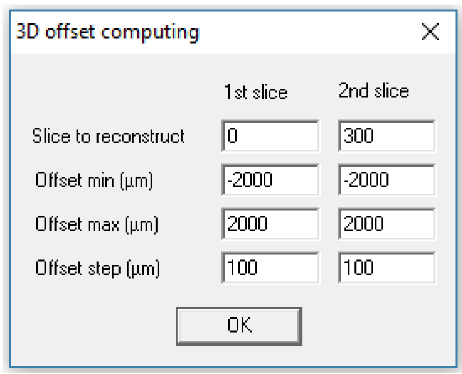
11.2.10 3D Reconstruction adjustment

In order to adjust the 3D reconstruction and remove possible artefacts, it is necessary to use the software "Phd_C_Test" you can find in the directory C:\Program Files (x86)\Acteon Imaging\Panoramic X-Mind Prime Ceph.

1. Once you start the software, select on the menu "Image processing" the modality "3D offset computing".



2. On the window that opens set the following parameters:



3. Insert support plate (P/N 6195170100) on the chin rest, and place the centering cylinder (P/N 5207900900) in the middle of the plate.

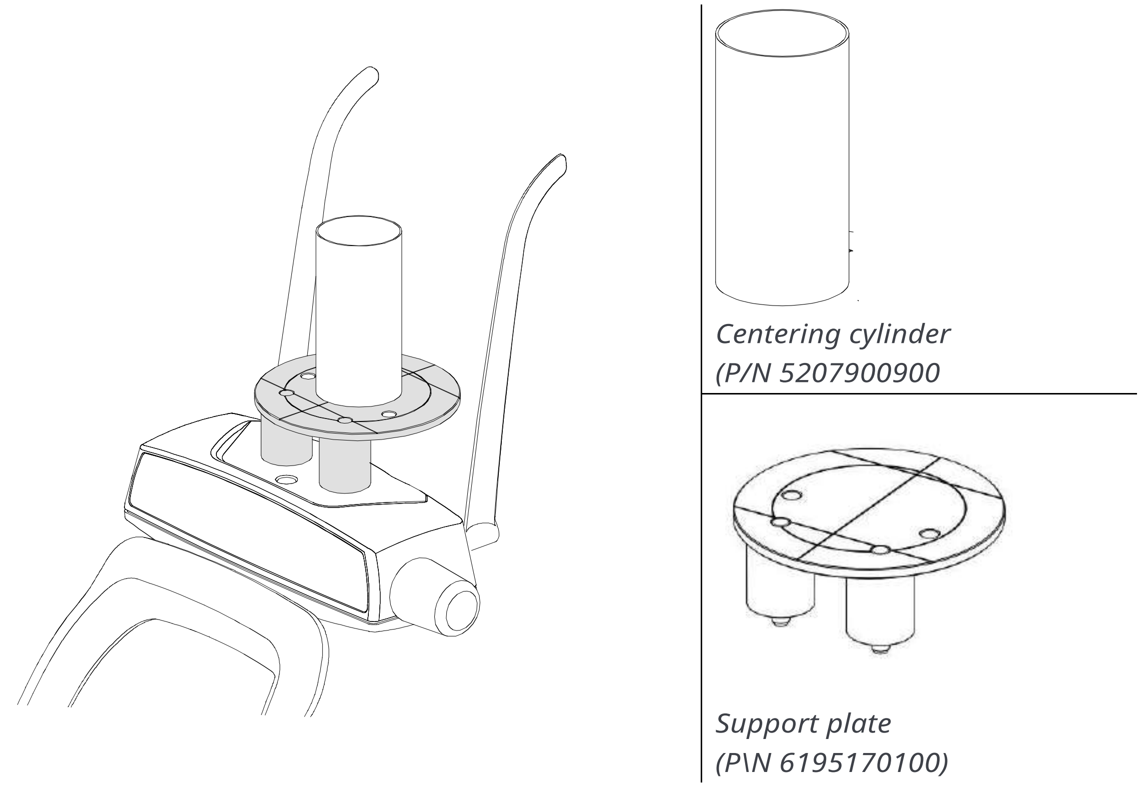
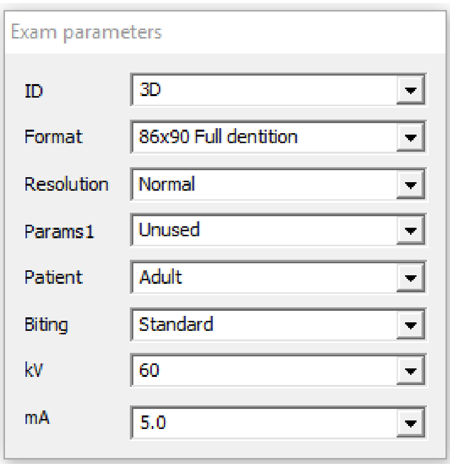


Figure 50: Support plate and centering cylinder positioning

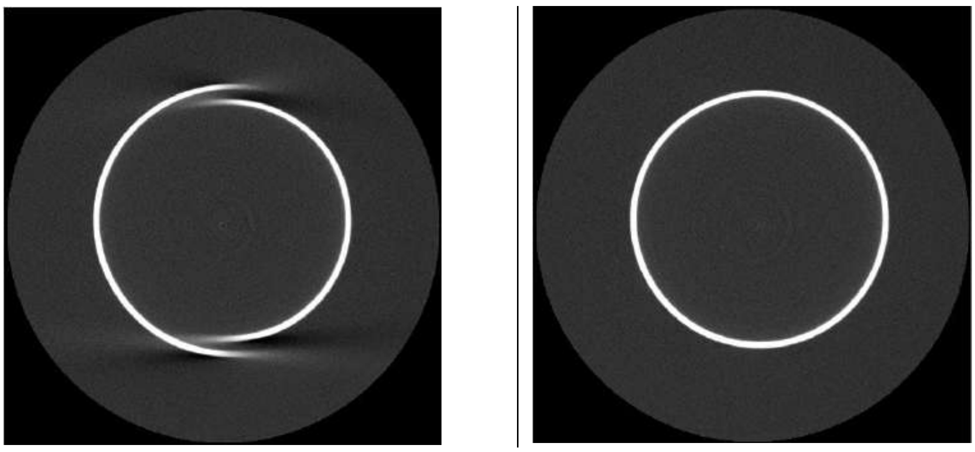
4. In "PhD_C_Test" program, from the "Exam parameters" window select the exam ID "3D" and the Format "86x90 Full dentition". Set the parameters to 60kV-5mA.



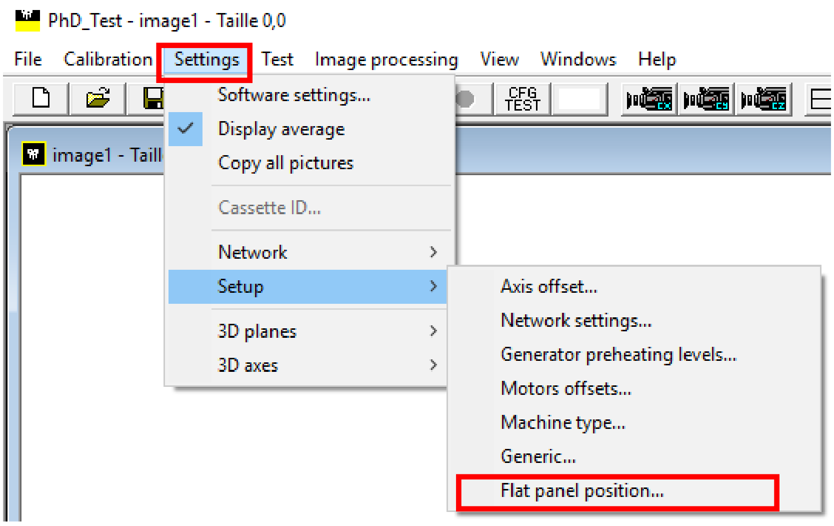
5. Press >0< button on the unit keyboard and wait until the chin rest support is positioned. Press >0< button again to complete the unit positioning.

6. Press the X-ray button to perform the acquisition.

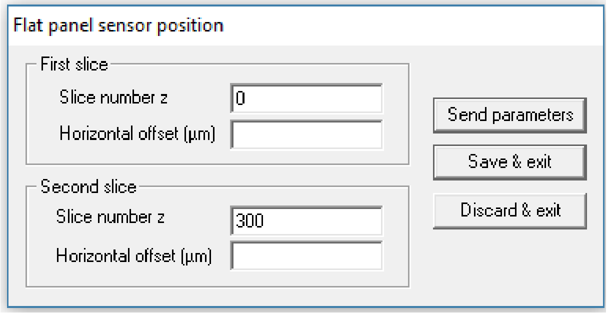
7. Open the files located in C:\ProgramData\Acteon Imaging\Panoramic X-Mind Prime Ceph\Centring with an image viewer: the name of these files contains two values: OFFSET_HORIZONTAL_Z and OFFSET_HORIZONTAL_UM.
8. Among the files named OFFSET_HORIZONTAL_Z=000 look for the file in which the reconstructed circle is the most continuous (see right image) and write down the corresponding value OFFSET_HORIZONTAL_UM contained in the name of the file.
   *e.g.: OFFSET_HORIZONTAL_Z=000 - OFFSET_HORIZONTAL_UM=**600**.bmp*



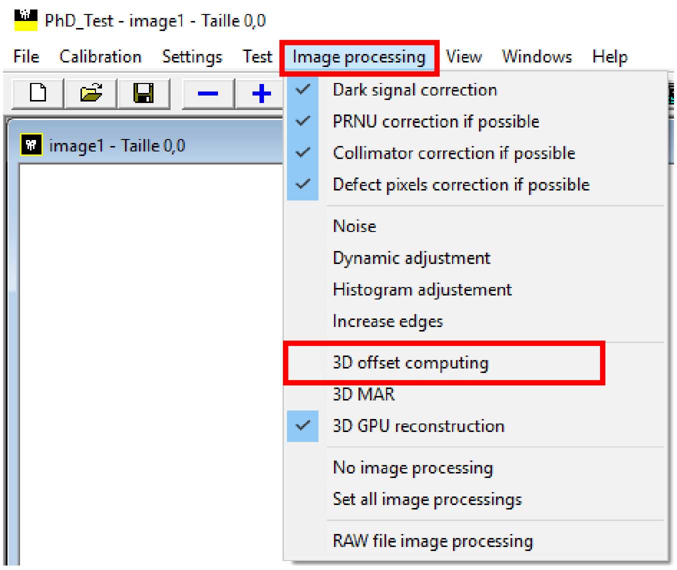
9. Repeat the operation for the files named OFFSET_HORIZONTAL_Z=300 and take note of the OFFSET_HORIZONTAL_UM value.
   *e.g.: OFFSET_HORIZONTAL_Z=000 - OFFSET_HORIZONTAL_UM=**800**.bmp*
10. In "PhD_C_Test" program go to menu "Settings" and select "Flat panel position".



11. In the panel "First slice" insert the values Slice number z = 0 and Horizontal offset (µm) = HORIZONTAL_OFFSET_UM previously chosen for slice number 0. In the panel "Second slice" insert the values Slice number z = 300 and Horizontal offset (µm) = HORIZONTAL_OFFSET_UM previously chosen for slice number 300.



12. Click on "Send parameters".
13. Click on "Save & exit".
14. Disable in the menu "Image processing" the "3D offset computing" and reboot the X-Mind Prime 3D.



15. Verify that the offset is properly applied following the instructions at paragraph 7.11.

11.2.11 Ceph Axis alignment

Warning
All the following sub-paragraphs of this chapter are organized in checks and adjustments procedures.
Before making any adjustment (mechanical regulation or offsets modification), it's mandatory to ensure that the checks required by the previous sub-paragraphs are within the prescribed tolerances. If they are not in the tolerances, first perform the adjustments prescribed by the previous sub-paragraphs.

Warning
If during the following paragraph an offsets adjustment is required:
- refer to chapter "Machine configuration and setup" paragraph 8.4
- After the changes update the paper copy of the equipment parameters table (supplied as paper copy with the unit documentation) with the new offset values (see Appendix A at paragraph 14.1).

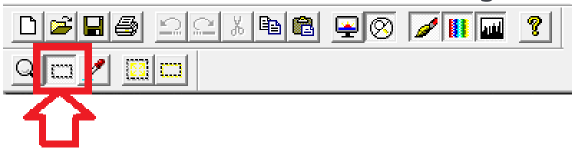
11.2.11.1 Ceph ear rods adjustment

Checks

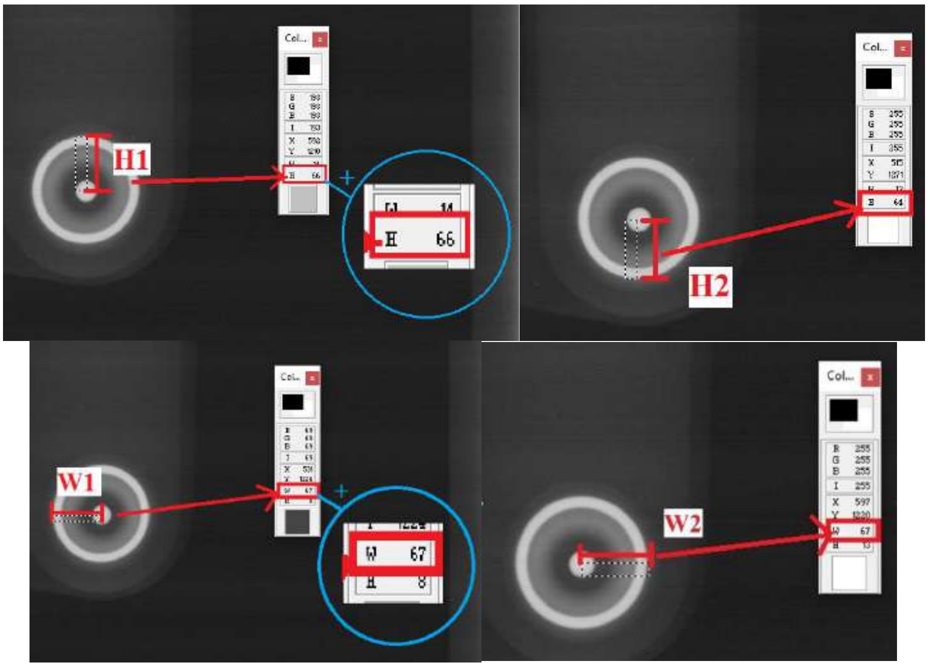
1. Rotate the ceph head support in the lateral position
2. Open "PhD_C_Test.exe" service program
3. And select the following parameters:
   - Format: No collimator
   - Resolution: High
   - Param1: View of Primary collimator field
   - 70kV 8mA
4. In the image processing menu select: "Dynamic adjustment"
5. Prepare the unit to take the ceph exam and then press the X-Ray button until the end of the exposure
6. Save the image as "Rods.bmp"

7. Open the image in  SyMage software application (C:\Program Files (x86)\Acteon Imaging\Panoramic X-Mind Prime Ceph\SyMage)

8. In the menu bar select the “Rectangle Selection” tool



9. Verify that the that the misalignment between the centres of the inner dot and the outer circle is not more than 15 pixel (0.099mm/pixel) both in vertical and horizontal directions:
   |H1-H2|≤15pixels
   |W1-W2|≤15pixels



Adjustments

- **Vertical ear rods corrections:**

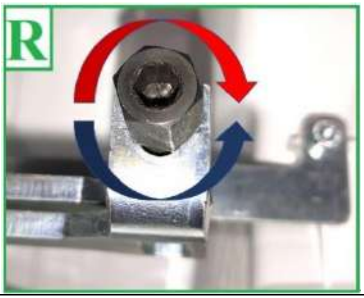
Warning
The vertical regulation of the ear rods will affect also the projection of the secondary collimator on image plane, which will vary the upper and lower not exposed borders position. Therefore after this adjustment repeat the tests images requested by paragraph 7.12.

1. Remove the ceph upper cover (refer to paragraph 7.4.3)

2. Lose the fixing screws F and act on regulation screw R according the table below

3. Tighten the fixing screws F and acquire again a check image

4. Iterate the procedure until the required tollerance on |H1-H2| measure is reached



ACT of regulation screws	Effect on measure of H1-H2
R [clockwise]	INCREASE segment H1 on the acquired image, move RING UP
R [anti-clockwise]	DECREASE segment H1on the acquired image, move RING DOWN

<u>R screw turn-pixels "conversion"</u>
1 complete screw R turn→ add/remove about 7 pixels to the measure of |H1-H2| on acquired image
<u>Furthers checks after the adjustment</u>
If the vertical regulation has been modified perform all the checks required by paragraph 7.12.

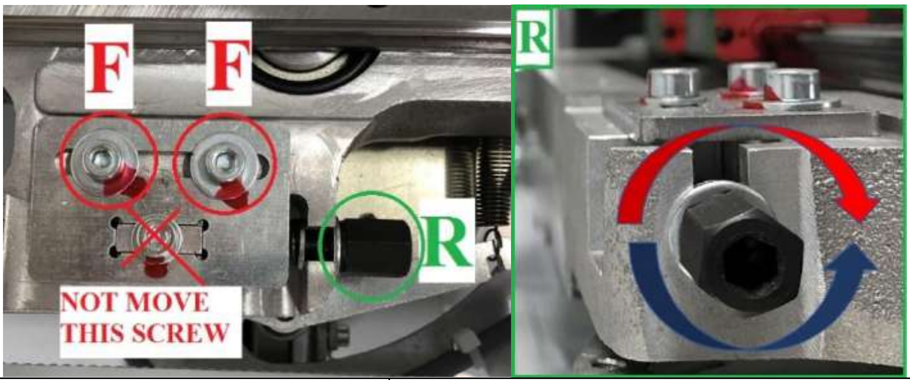
- **<u>Horizontal ear rods corrections:</u>**

1. Remove the ceph upper cover (refer to paragraph 7.4.3)

2. Lose the fixing screws F and act on regulation screw R according the table below

3. Tighten the fixing screws F and acquire again a check image

4. Iterate the procedure until the required tolerances of |W1-W2| are reached.



ACT of regulation screws	Effect on measure of W1-W2
R [clockwise]	INCREASE segment W1 on the acquired image, move RING on the LEFT of the acquired image
R [anti-clockwise]	DECREASE segment W1 on the acquired image, move RING on the RIGHT of the acquired image

R screw turn-pixels "conversion"
1 complete screw R turn→ add/remove about 14 pixels to the measure of |W1-W2| on acquired image

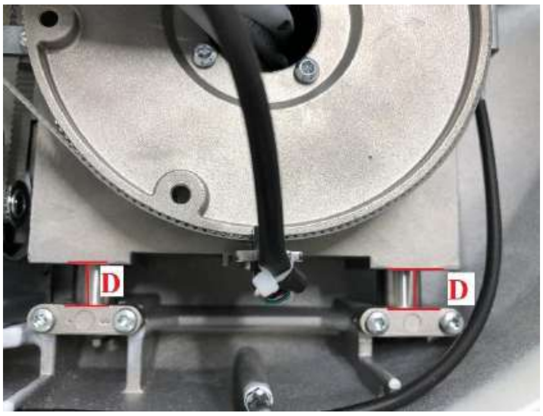
11.2.11.2 Y ceph offset

Checks

1. Verify if the numerical value of the "Y ceph offset" stored in the unit EEPROM memory (see paragraph 8.4) is the same one reported by the equipment parameters table (supplied as paper copy with the unit documentation – see paragraph 14.1). If it's not the same correct it.

2. Remove the unit upper covers (see paragraph 7.4.3), select a "Ceph" exam, prepare the unit to take a ceph exam, once the unit is positioned and ready to make an exposure (green keyboard LED steady ON) and verify that the distance between the slide of the Y axis and the back run limits (D in the following figure) is:

D=13mm± 2mm



Adjustments

Warning
The Y ceph offsets regulations will affect the position of the projection of the primary collimator on the ceph image plane. Therefore after the Y axis adjustment it's recommended to perform all the ceph checks requested by the following paragraphs (in the exact numeric sequence).

If an adjustment is required modify the Y Ceph offset according to the following convention:

OFFSET	Effect on measure of segment D
Y ceph [+]*	INCREASE the segment D length
Y ceph [-]*	DECREASE the segment D length

*Note: The symbols [+] and [-] mean, respectively, an increase and a decrease of the offset value.

Offset Conversion
1 offset ≃ 0.2mm measured on the Y axis

Furthers checks after the adjustment
If the offset has been modified perform all the checks of the following paragraphs following the numeric sequence

11.2.11.3 Primary collimator W6-Ceph window

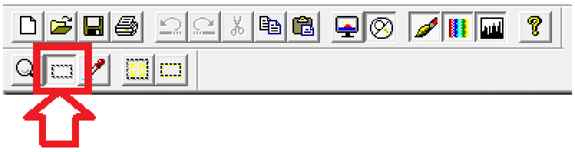
Warning
Before proceeding with following points perform the primary collimator alignment checks/adjustments requested by paragraphs 11.2.9.1 and 11.2.9.2

Checks

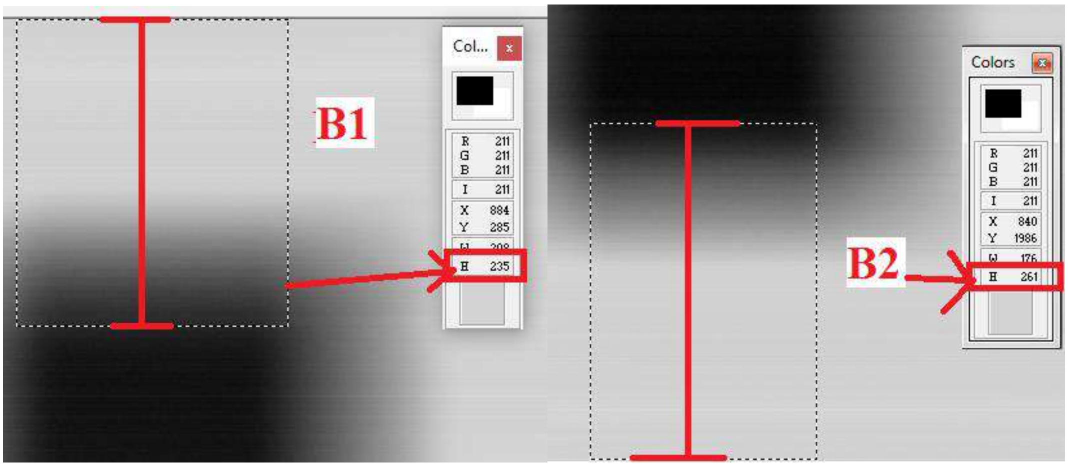
1. Rotate the ceph head support in antero-posterior (AP) position
2. Open "PhD_C_Test.exe" service program
3. Select the following parameters:

   - Format: Height Custom
   - Resolution: High
   - Param1: View of Primary collimator field
   - 70kV 8mA

4. In the image processing menu select: “Dynamic adjustment”
5. Prepare the unit to take the ceph exam and then press the X-Ray button until the end of the exposure
6. Save the image as “Primary custom.bmp”
7. Open the image in  SyMage software application (C:\Program Files (x86)\Acteon Imaging\Panoramic X-Mind Prime Ceph\SyMage)
8. In the menu bar select the “Rectangle Selection” tool



9. Verify that the that the upper (B1) and lower (B2) **not exposed borders** are (measured in High resolution 0.099mm/pixel):
   B1>210pixels
   B1>210pixels



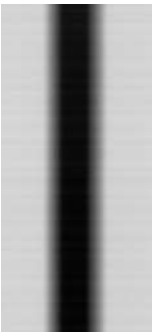
10. Select the following parameters:

   - Format: Height 24
   - Resolution: High
   - Param1: View of Primary collimator field
   - 70kV 8mA

11. Prepare the unit to take the ceph exam and then press the X-Ray button until the end of the exposure

12. Save the image as “Primary-full.bmp”

13. Verify that **the upper and lower borders are fully irradiated.**



Adjustments

If the B1 and B2 measures are not in the prescribed tolerances and/or the upper and lower borders are of the Primary-fully.bmp image are not fully irradiated:

1. Enter the SET-UP mode, open “Unit setting configuration” window and select Collimator offsets” tab (refer to paragraph 8.4)
2. Adjust the W6-ceph window “Vertical position – VO” and “Vertical width - VW ” according to the following conventions:

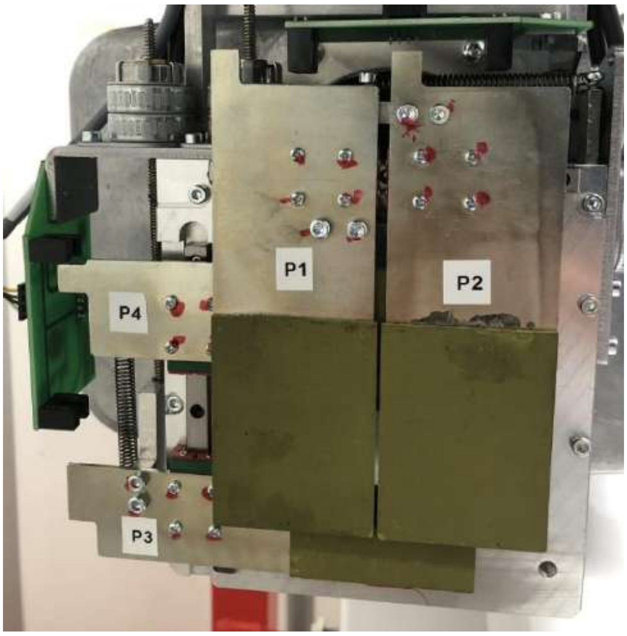
The **vertical position (VO)** offset allows to move the window towards the Top/Bottom border of the acquisition area without modifying the window height (P3 and P4 blades distance remains unchanged)

OFFSET	EFFECT ON ACQUIRED IMAGE (measuer of B1 and B2)
VO [+]*	Move the collimator window DOWN Increase B1 and decrease B2 of the same distance
VO [-]*	Move the collimator window UP Decrease B1 and increse B2 of the same distance

The **vertical width (VW)** offset allows to increase/ decrease the collimator height by moving only the P3 collimation blade

OFFSET	EFFECT ON ACQUIRED IMAGE (measure of B1 and B2)
VW [+]*	REDUCE B2 by moving the P3 blade towards the bottom edge of the sensor acquired area without moving the P2 blade
VW [-]*	INCRESE B2 by moving the P3 blade towards the top edge of the sensor acquired area without moving the P4 blade

*Note: The symbols [+] and [-] mean, respectively, an increase and a decrease of the offset value.



Primary collimator blades numbering

- **Pixel-Offset Conversion**
  1 offset ≃ 6 pixel (0.099mm) if ID= “Centering ceph” (Resolution= High).

Note
After any changes to the offsets values, update the paper copy of the equipment parameters table (supplied as paper copy with the unit documentation) with the new offset values (see Appendix A paragraph 14.1).

Furthers checks after the adjustment
If the offset has been modified perform all the checks of the following paragraphs following the numeric sequence

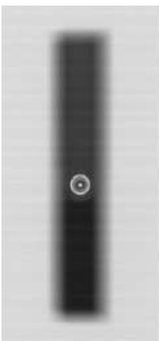
11.2.11.4 Rotation ceph offset

Checks

1. Rotate the ceph head support in the lateral position
2. Open "PhD_C_Test.exe" service program
3. Select the following parameters:

   - Format: Height Custom
   - Resolution: High
   - Param1: View of Primary collimator field
   - 70kV 8mA

4. In the image processing menu select: “Dynamic adjustment”
5. Prepare the unit to take the ceph exam and then press the X-Ray button until the end of the exposure
6. Save the image as “Rotation.bmp”



7. Verify that the that the **dot and ring projections are centred to the primary collimator beam**

Adjustments

If the ring-dot are not centred to the primary X-ray beam perform the following procedures:

1. Verify if the numerical values of the “W6-Ceph window” collimator offsets “HO, HV,VO,VW” stored in the unit EEPROM memory (see paragraph 8.4) are the same ones reported by the equipment parameters table (supplied as paper copy with the unit documentation – see paragraph 14.1). If they are not the same correct them.
2. Verify if the numerical value of the “Rotation ceph offset” stored in the unit EEPROM memory (see paragraph 8.4) is the same one reported by the equipment parameters table (supplied as paper copy with the unit documentation – see paragraph 14.1). If it’s not the same correct it.

Warning
Before proceeding with following points perform the panoramic primary collimator alignment checks requested by paragraph 14.1).

3. If an adjustment of the Rotation ceph offset is required modify its values according to the following convention:

OFFSET	Effect on position of x-ray beam
Rotation ceph [+]*	Move the X-ray beam on the RIGHT of the ear rods/ image
Rotation ceph [-]*	Move the X-ray beam on the LEFT of the ear rods/ image

*Note: The symbols [+] and [-] mean, respectively, an increase and a decrease of the offset value.

Offset Conversion
1 offset ≃ 37pixel (3.7mm) measured on the image (Resolution:High)

Furthers checks after the adjustment
If the offset has been modified perform all the checks of the following paragraphs following the numeric sequence.

11.2.11.5 Secondary collimator offset

Checks

1. Rotate the ceph head support in lateral position

2. Open "PhD_C_Test.exe" service program

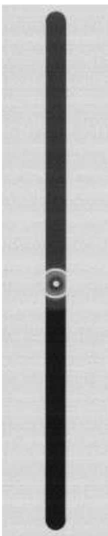
3. Select the following parameters:

    - Format: Height 24
    - Resolution: High
    - Param1: View of sec. collimator field
    - 70kV 8mA

4. In the image processing menu select: “Dynamic adjustment”

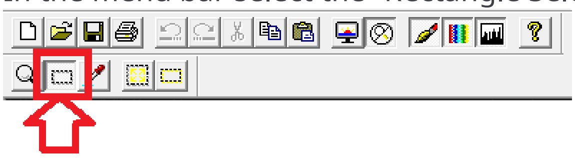
5. Prepare the unit to take the ceph exam and then press the X-Ray button until the end of the exposure

6. Save the image as “Secondary.bmp”

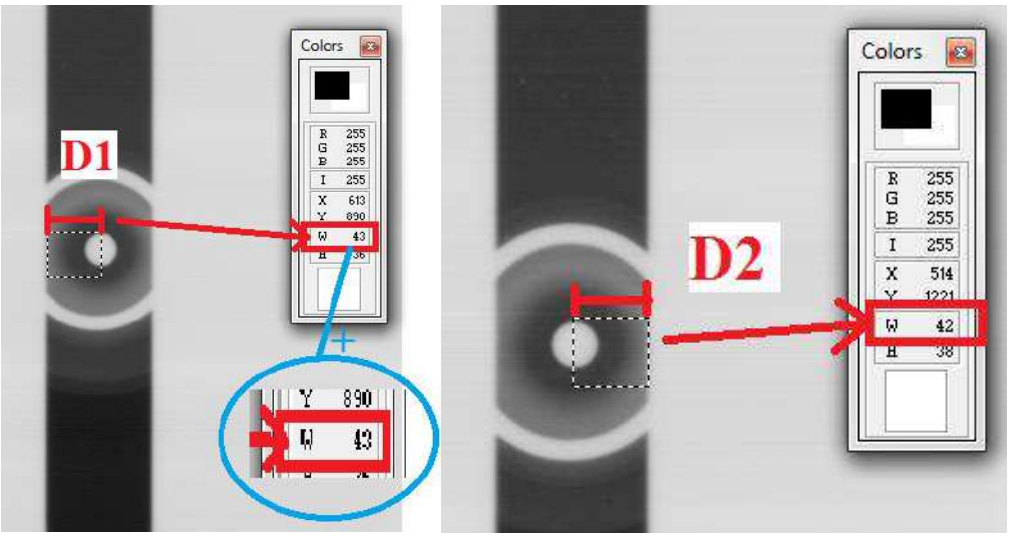


7. Open the image in  SyMage software application (C:\Program Files (x86)\Acteon Imaging\Panoramic X-Mind Prime Ceph\SyMage)

8. In the menu bar select the “Rectangle Selection” tool



9. Verify that the that the dot of the ceph support is positioned in the center of the exposed area and the difference between D1 and D2 is in the following tolerance
   |D1-D2| ≤ 4 pixels



Adjustments

If an adjustment is required modify the "Coll II" offset according to the following convention:

OFFSET	Effect on measure of segments D1 and D2
Coll II [+]*	INCREASE the segment D1 length on the image
Coll II [-]*	DECREASE the segment D1 length on the image

*Note: The symbols [+] and [-] mean, respectively, an increase and a decrease of the offset value.

Offset Conversion
1 offset ≃ 3 pixel of shift of the secondary collimator position measured on the acquired image

Furthers checks after the adjustment
If the offset has been modified perform the checks/adjustments required by "Sensor ceph offset" paragraph 11.2.11.6.

11.2.11.6 Sensor ceph offset

Checks

1. Rotate the ceph head support in lateral position

2. Open "PhD_C_Test.exe" service program

3. Select the following parameters:

   - Format: Height 24
   - Resolution: High
   - Param1: Static acquisition centred
   - 70kV 8mA
   - 300ms

4. Prepare the unit to take the ceph exam and then press the X-Ray button until the end of the exposure

5. Save the image as “Static-ceph.bmp”

6. Take an X-ray emission and verify that:
   - **There aren't not exposed borders on the sides of the acquired area (on the right and left)**
   - **The dot of the ceph patient support is centred to the sensor area**

Adjustments

If an adjustment is required modify the "Sens Ceph" offset according to the following convention:

OFFSET	**Effect on the image acquisition (position of projections of dot and secondary collimator)**
Sens Ceph [+]*	Move the dot/Ring the LEFT of the image; Remove a not exposed edge on the LEFT of the image
Sens Ceph [-]*	Move the dot/Ring the RIGHT of the image; Remove a not exposed edge on the RIGTH of the image

*Note: The symbols [+] and [-] mean, respectively, an increase and a decrease of the offset value.

Offset Conversion
1 offset ≃ 2 pixel of shift of the secondary collimator position measured on the acquired image

Furthers checks after the adjustment
If the offset has been modified perform the checks required by "Verification of ceph function" paragraph 7.12

11.2.11.7 Secondary collimator – Ceph Sensor tilting check and adjustment

A not perfect parallelism between the secondary collimator and the sensor acquisition area may cause slight lines along the whole or partial height of the image similar to those reported in the paragraph 11.2.12

checks

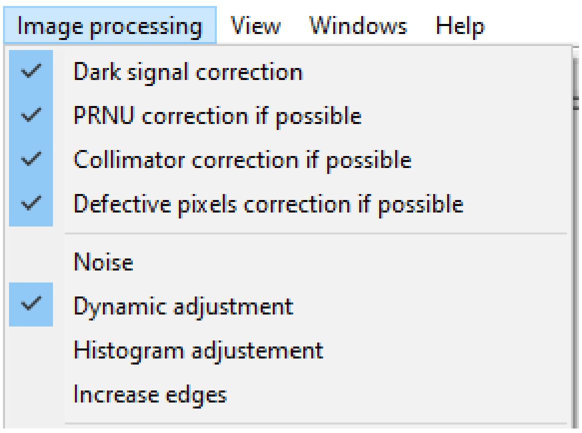
1. Open PhD_C_Test (technical Tool) service program

2. Wait the unit connection

3. Select the following exam:

    - Exam ID: Ceph
    - Format: No collimator
    - Resolution: High
    - Param 1: View of sec. collimator field
    - kV: 70
    - mA:8

4. Verify that the Image processing options selected are like the following:

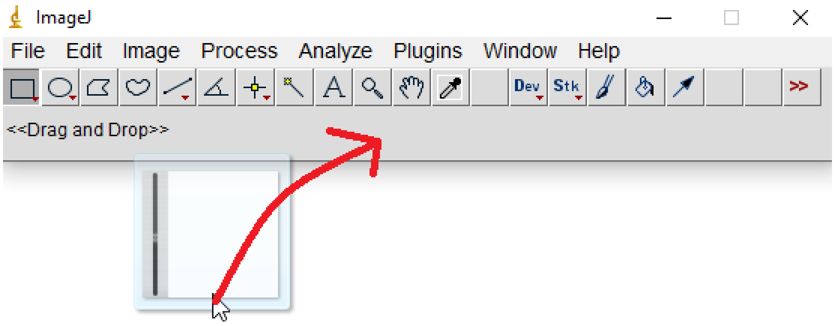


5. Prepare the unit to acquire the above selected image

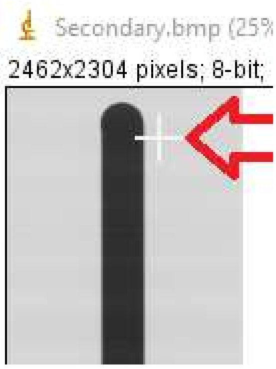
6. Acquire the image and save it as “Secondary.bmp”

7. Run ImageJ software (download it from Internet: eg. http://wsr.imagej.net/distros/win/ij153-win-java8.zip)

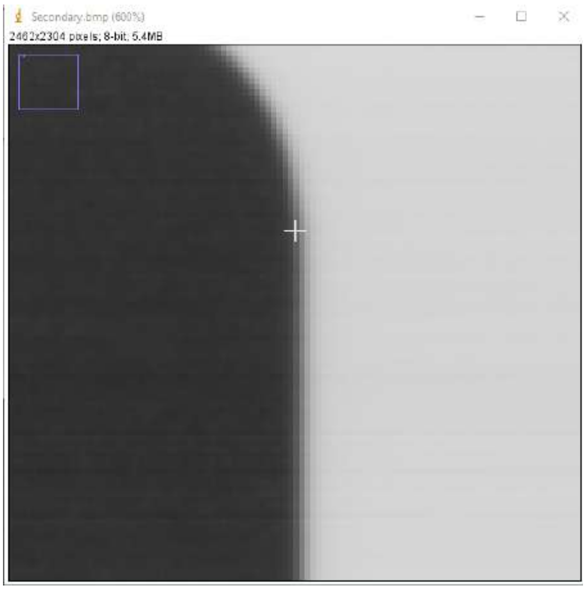
8. Import (drag and drop) the CephHigh.bmp image in the ImageJ bar.



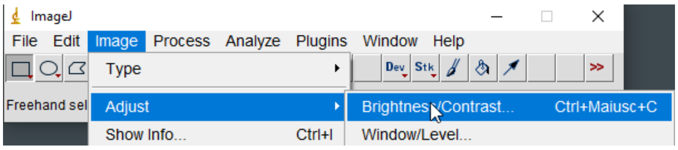
9. With the mouse cursor point the top irradiated area of the secondary collimator projection



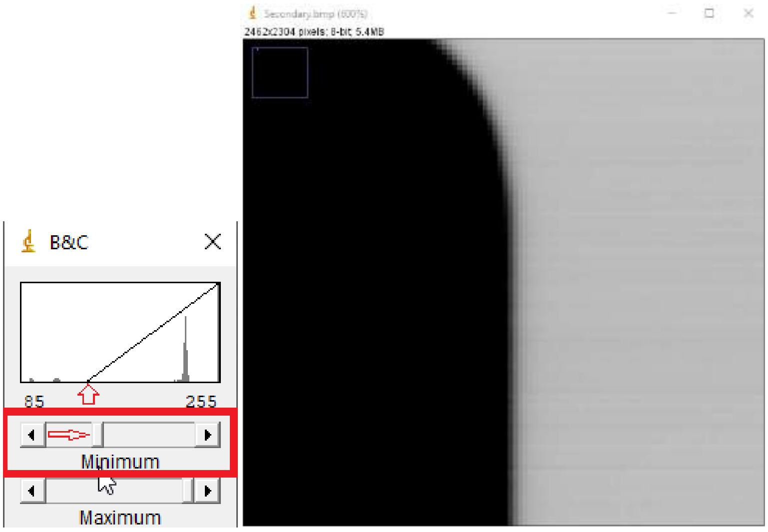
10. Zoom-in on the left edge by pressing "+" on the keyboard



11. Click on Image→Adjust and open the Brightness/Contrast… tool

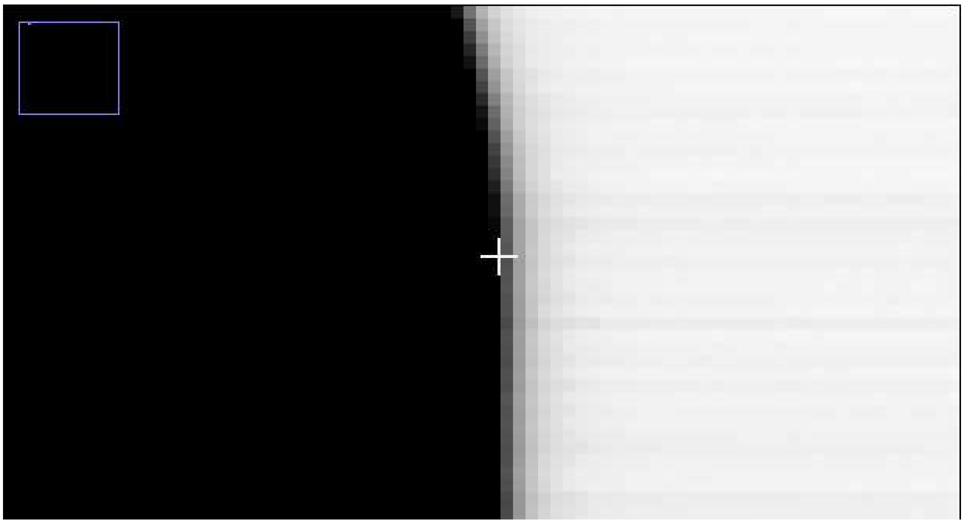


12. Adjust the “Minimum” level with the cursors, in order to enhance the contrast of the edge and obtain and image where the edge between the irradiated and the collimated areas are clearly defined

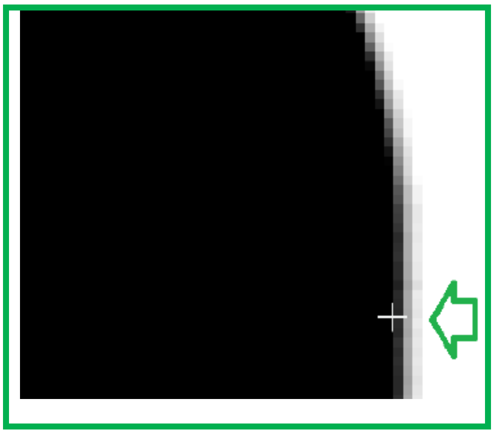


13. Select the straight-line tool in the ImageJ tool set

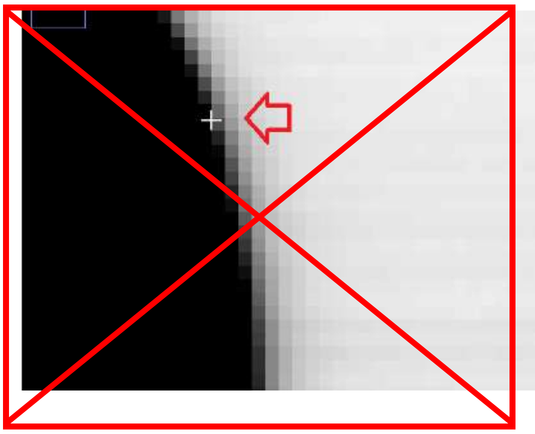
14. With the cursor point the edge of the secondary collimator



Note. Release the cursor on the straight part of the secondary collimator shadow and not close the circular edge.

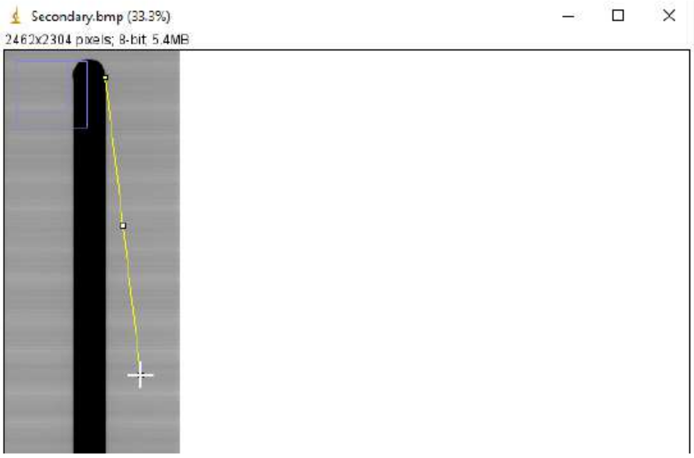


V

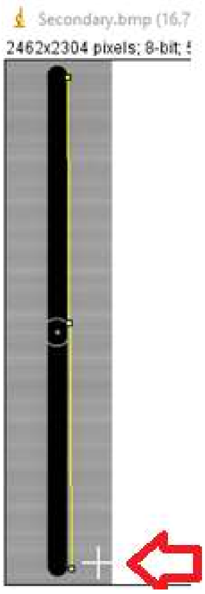


X

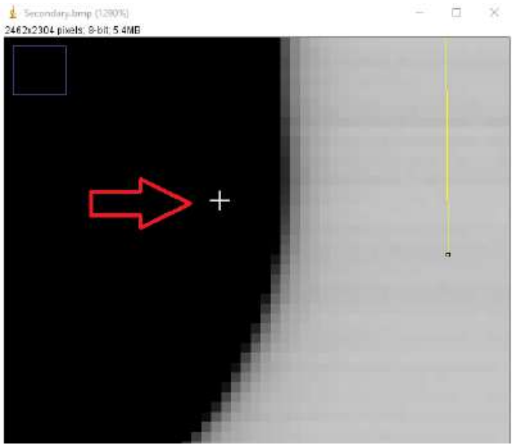
15. While the cursor is in this exact position, click with the mouse and keeping the left mouse button pressed press the keyboard button "-" in order to zoom-out the image



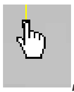
16. Keeping the left mouse button pressed, place the cursor close to the bottom right edge of the secondary collimator shadow and release the mouse button Note. The cursor has to be close to the bottom edge not in the exact position



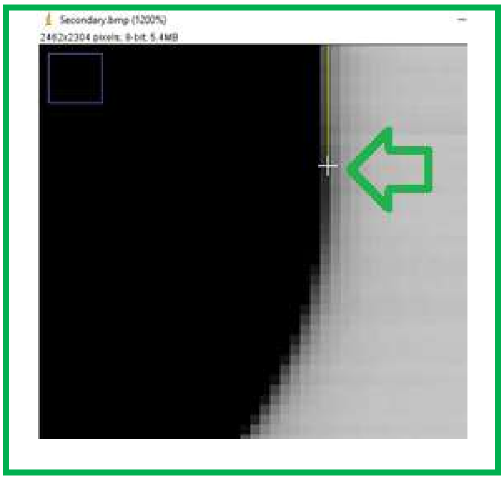
17. Place the cursor (do not click with the mouse) close to the bottom edge of the secondary collimator and then press the keyboard button "+" in order to zoom-in this image area



18. Place the cursor on the white box under the yellows straight line

19. When the hand symbol appears , press the left mouse button and keeping it pressed place the cursor on the exact position of the bottom edge of the secondary collimator shadow.

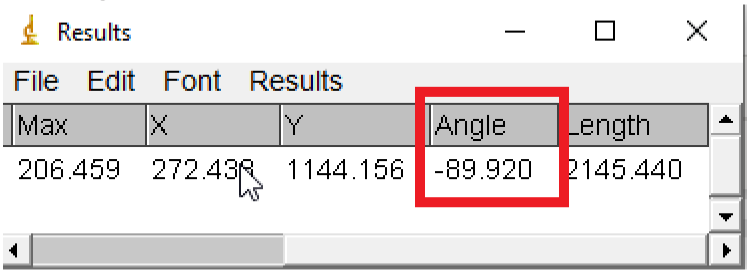
    Note. Release the cursor on the straight part of the secondary collimator shadow and not close the circular edge.



V

X

20. Verify the tilting angle of the secondary collimator by pressing Ctrl+M on the keyboard. The angle will be displayed in the ImageJ “Result” window under the column named “Angle”



21. Verify that the secondary collimator- ceph sensor relative Angle (measured above) is within the following tolerance

Tolerance	|Angle|=90° ±0.1°

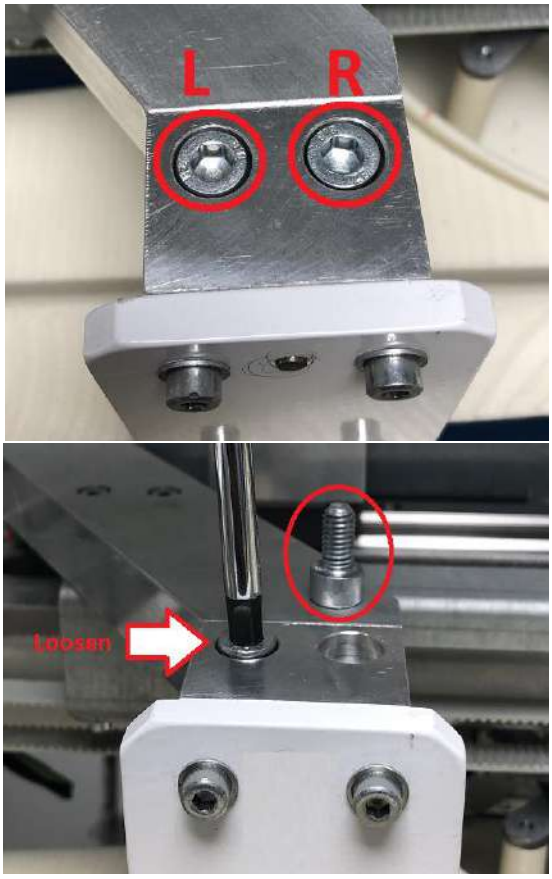
Adjustments

If the measured angle is out of the prescribed tolerances, the mechanical tilting of the secondary collimator has to be corrected as described below:

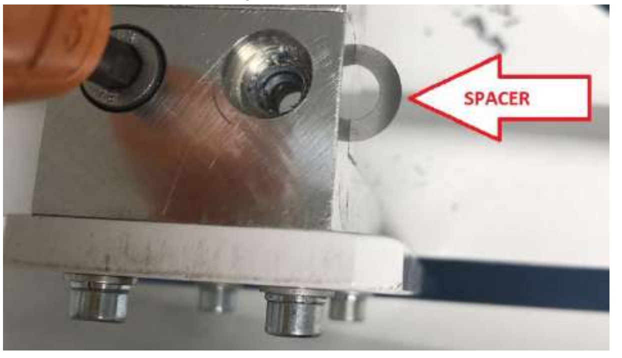
1. Open the ceph group top cover

2. Completely unscrew the screw on the side where the spacers-washers must be added according to the conventions reported by Table 1 below (right screw-R or left screw-L) and loosen the screw on the other side

Note. The following images will report only the case in which the washers has to be added to the right(R) side of the secondary collimator(case |Angle|<90°), operate on the opposite side if the measure angle does not fit this specific case as prescribed by Table 1

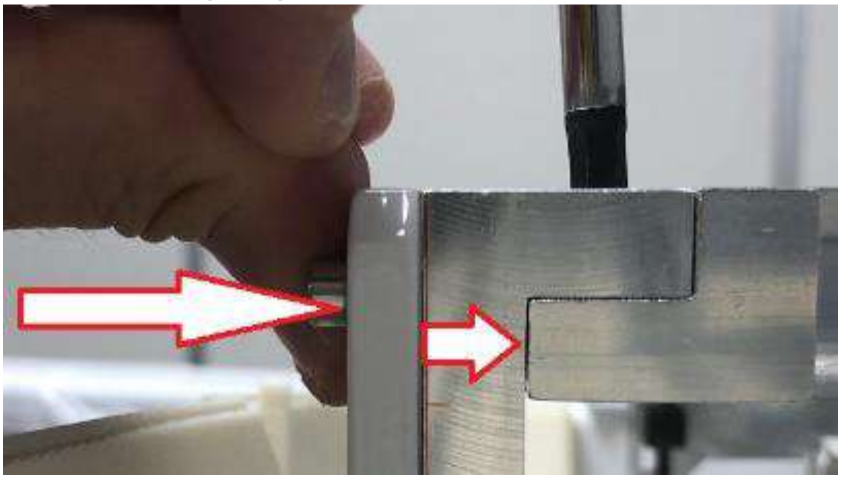


3. Insert the spacers washers in the required side



4. Using a thin tool, align the washers holes to the screw hole

5. Insert the removed screw
6. Tighten both the screws taking care to recover the mechanical play in the direction indicated in the following image



7. Iterate the process in order to verify the effectiveness of the correction.
8. Once the measured angle is within the prescribed tolerance verify the absence of vertical lines on ceph images following the vertical line correction procedures (paragraph 11.2.12)

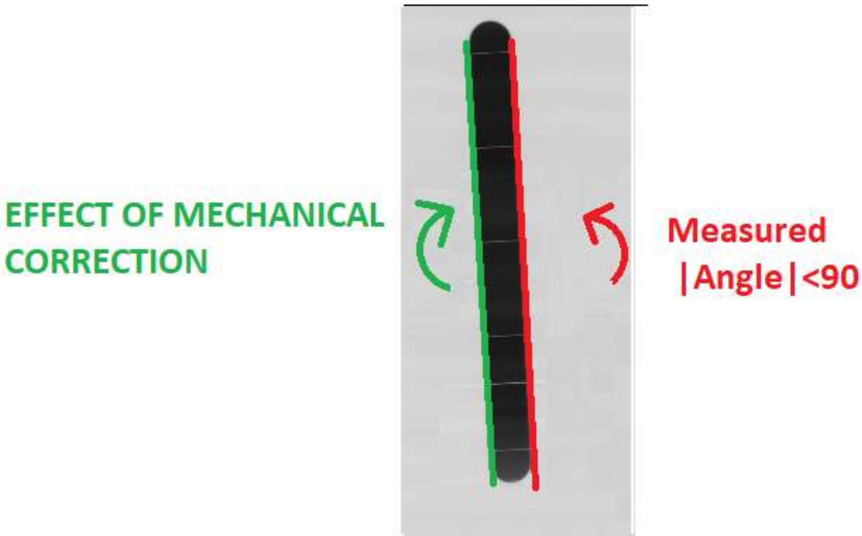
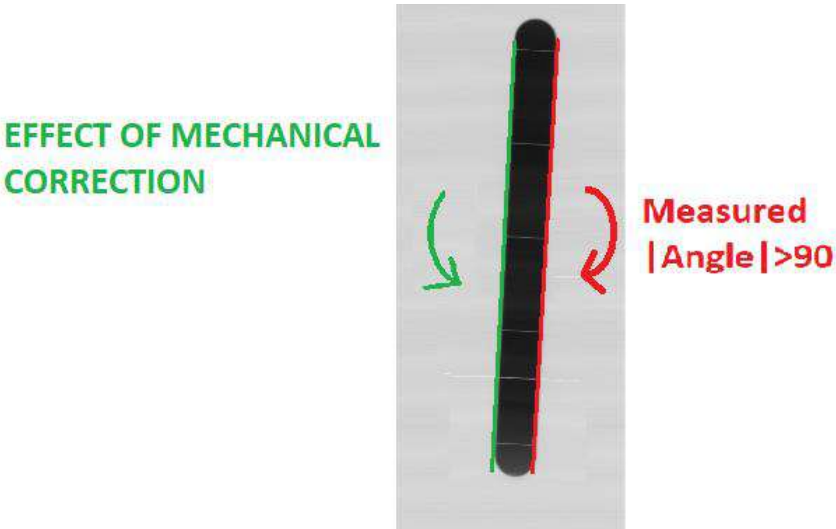
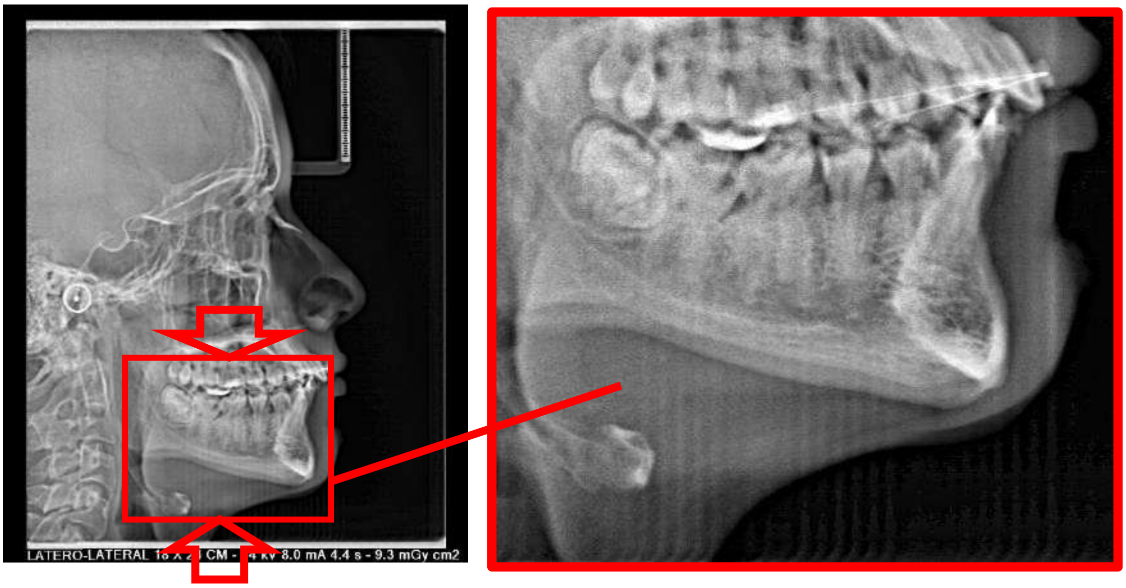
Secondary Collimator tilting correction	
ADDED SPACERS POSITION	**EFFECT OF THE SECONDARY COLLIMATOR TILTING MECHANICAL CORRECTION <u>ON ACQUIRED IMAGE</u>**
Insert the washers spacers on the **RIGHT** of the Secodary collimator 	**INCREASE** the absolute value of the measured |Angle| 
Insert the washers spacers on the **LEFT** of the Secodary collimator 	**REDUCE** the absolute value of the measured |Angle| 
Spacers width-Angle conversion	0.1mm washer spacer ≈ 0.16° 0.05mm washer spacer≈0.08°

Table 1

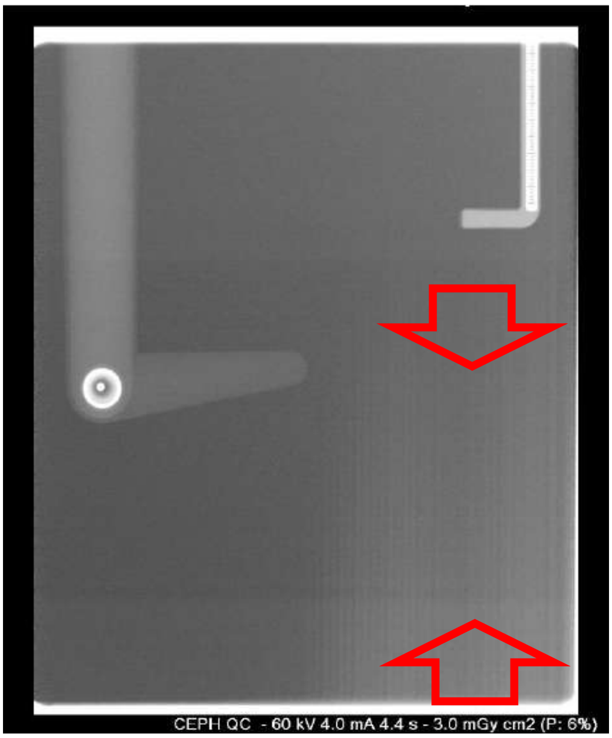
11.2.12 How to remove slight vertical lines on HD and HS ceph images

After the final installation, some units presents slight vertical lines on ceph images like the ones reported in the following example:

Patient Acquisition



QC Ceph Acquisition



CORRECTION:

Note1. Since the HS (High Speed, Normal Resolution) offsets are based on HD (High Definition, High Resolution) set of offsets, it is recommended to adjust/verify first the HD images before performing the HS- Vertical Lines check and adjustment

HD High Definition-Vertical Lines

Before performing this procedure make sure that:

- Primary collimator is well aligned to the hear rods (see "Rotation ceph offset" checks paragraph 11.2.11.4)

checks

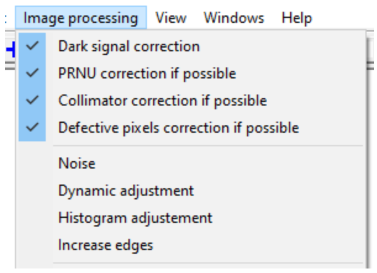
22. Open PhD_C_Test (technical Tool) service program

23. Wait the unit connection

24. Select the following exam:

    - Exam ID: Ceph
    - Format: 30x24 LL
    - Resolution: High
    - kV: 60
    - mA:2.2

25. Verify that the Image processing options selected are like the following:

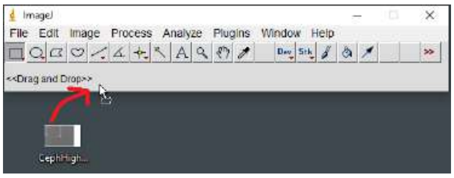


26. Place the unit ear rods in LL position and prepare the unit to acquire the above image

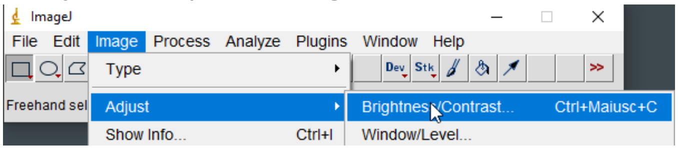
27. Acquire the image and save it as "CephHigh.bmp"

28. Run ImageJ software (download it from Internet: eg. http://wsr.imagej.net/distros/win/ij153-win-java8.zip)

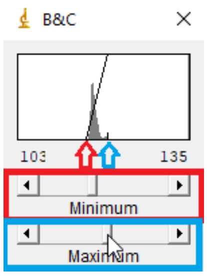
29. Import (drag and drop) the CephHigh.bmp image in the ImageJ bar.



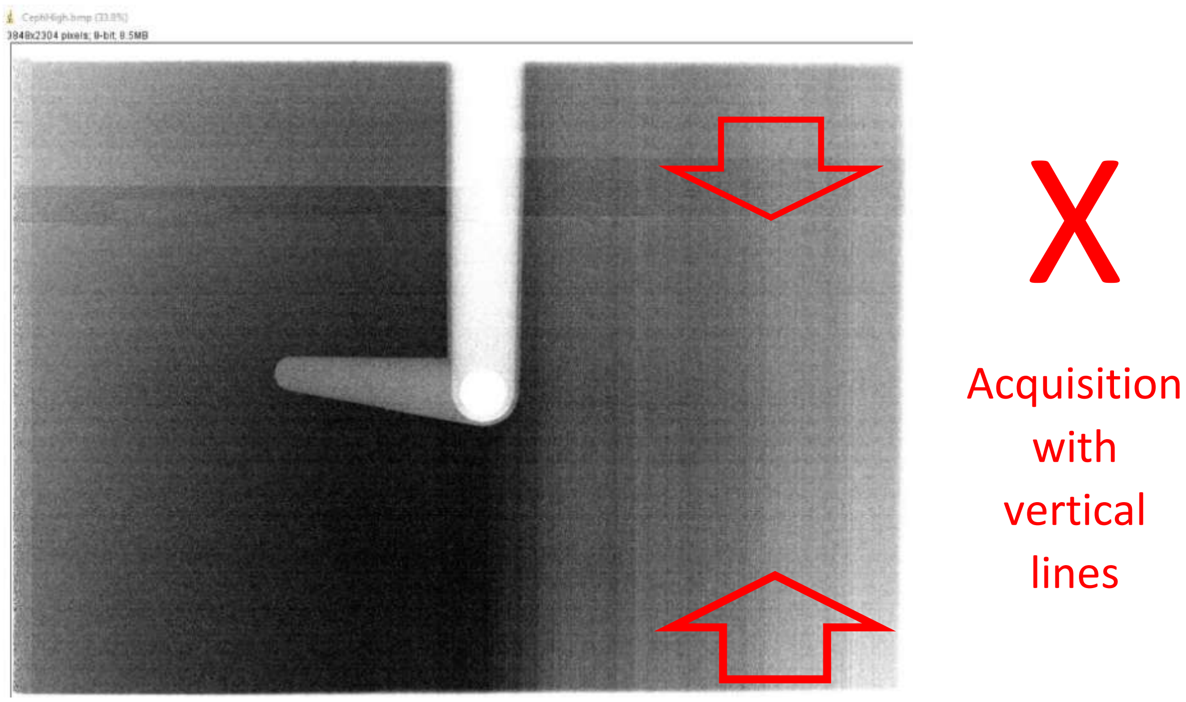
30. Click on Image→Adjust and open the Brightness/Contrast... tool

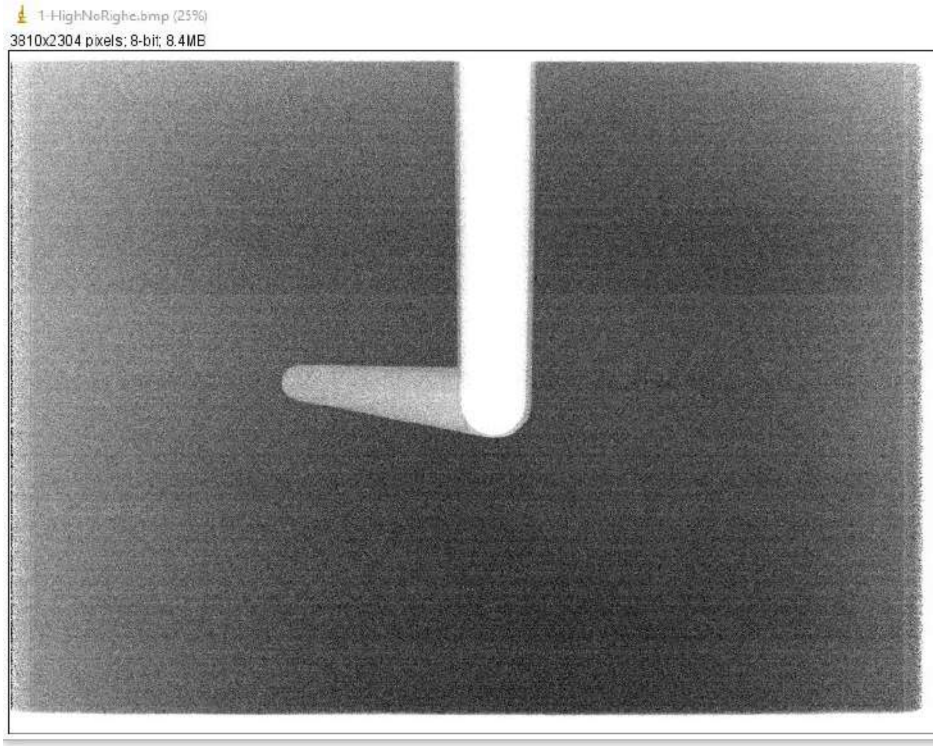


31. Adjust the "Minimum" and "Maximum" levels with the cursors, in order to fit the minimum and maximum components of the peak displayed in the histogram reported in the B&C window, as reported in the following image.



32. Verify if in the acquired image are present vertical lines and where they are located

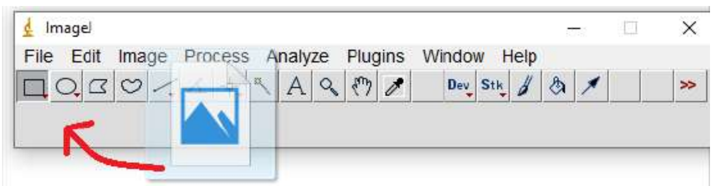




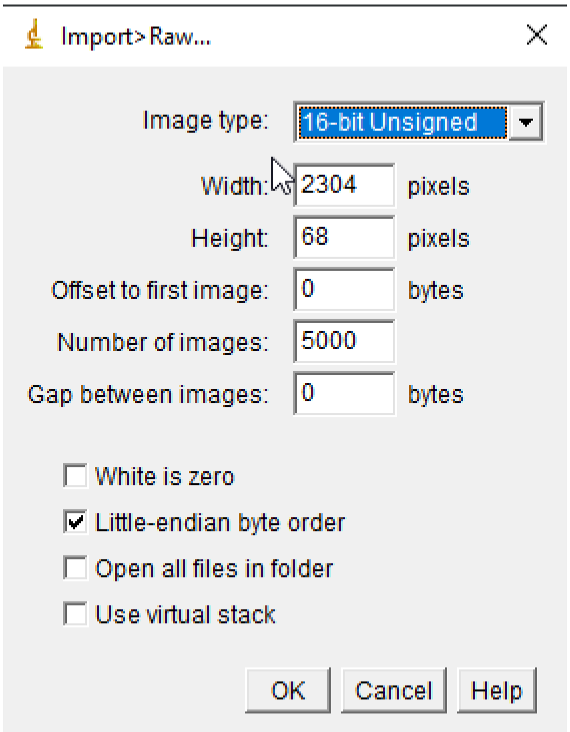
V

Acquisition without vertical lines

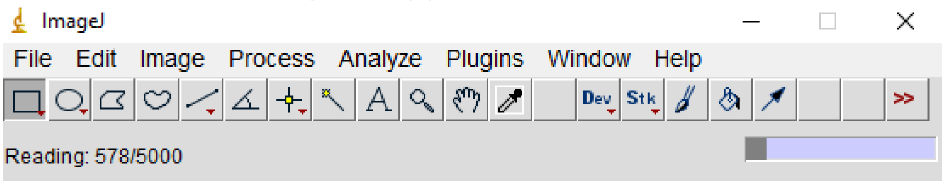
33. If in the acquisition are present vertical lines like the ones displayed in the above images open the raw files in ImageJ as explained in the following points:
    - Go to "*C:\ProgramData\Acteon Imaging\Panoramic X-Mind Prime Ceph\AcquisitionSave*".
    - Select and open the folder of the last acquisition
      eg. The folder named 2019-09-13 16h-56m-15s, is the folder of the acquisition of the 13th September 2019 at 4:56pm and 15secods.
    - Import (drag and drop) the "30.raw" file in the ImageJ bar.

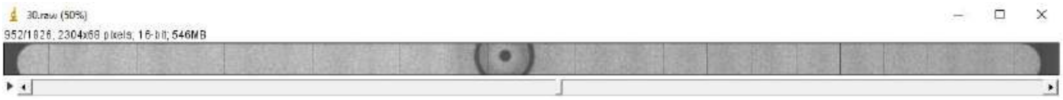


- In the Imagej “Import>Raw...” window set the following settings and then press OK



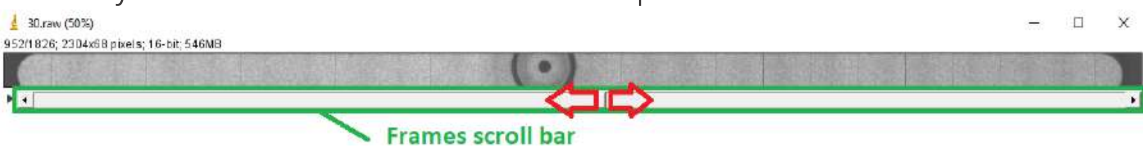
- Wait for the end of the uploading process



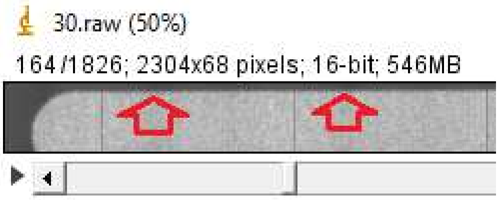
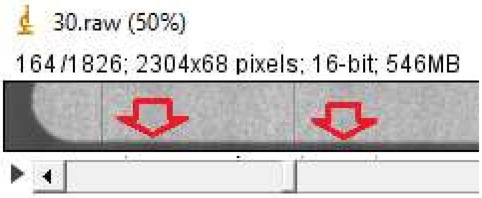


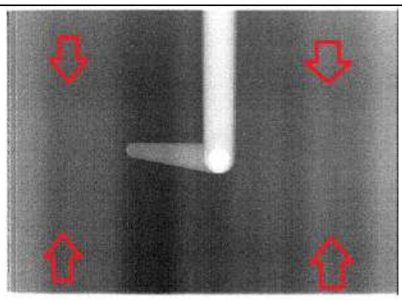
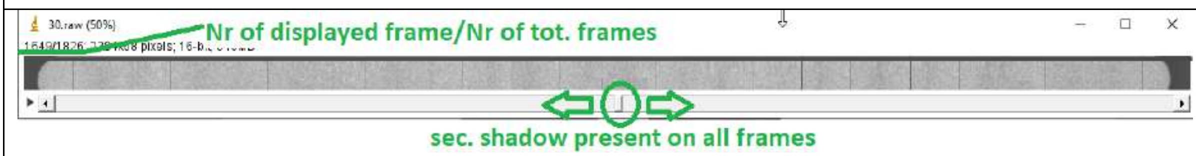
Note. In case the displayed frames are not well visible like the image above (too dark or too light) adjust the bright and contrast levels as explained at points 30 and 31 of this paragraph.

34. Scroll the frames bar from the left to the right to identify the frames where the secondary collimator shadow enters the sensor acquisition area.

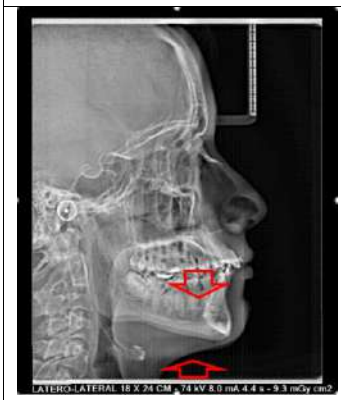


The secondary collimator shadow can enter in the sensor acquisition area from the top or bottom border of the frame.

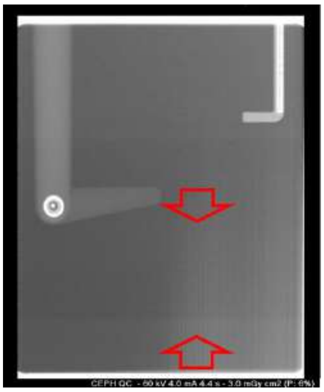
Shadow on top frame border	Shadow on bottom frame border
	

NOTE	In some cases the vertical lines may be present only on one side of the image. In these cases if the vertical lines on the final image are noticed only on the first part of the image acquisition (patient nose side) the secondary collimator shadows has to be searched in the first frames otherwise if the vertical lines are located in the end of image acquisition (back of patient head side) the secondary collimator shadow has to be searched in the lasts frames.
Examples of vertical lines on whole image acquisition	
 **PhD_C_Test (technical Tool) 30x24LL Acquisition**	
	

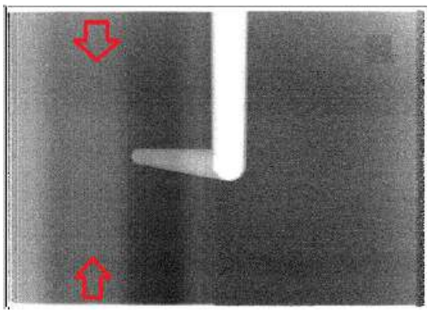
Examples of vertical lines on first part of the acquired image (patient nose side)



Patient AIS/QuickVision acquisition

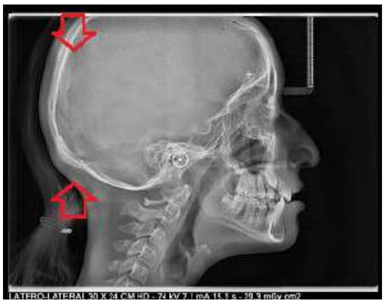


QC Ceph AIS/QuickVison acquisition

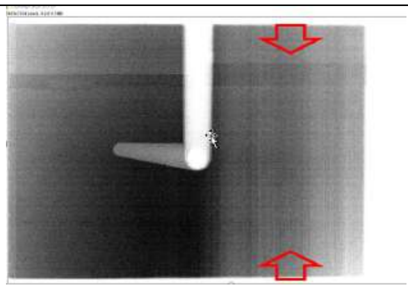


PhD_C_Test (technical Tool) 30x24LL Acquisition

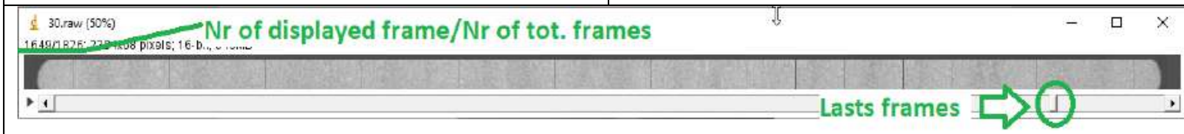
Examples of vertical lines on the end part of the acquired image (back side of patient head)



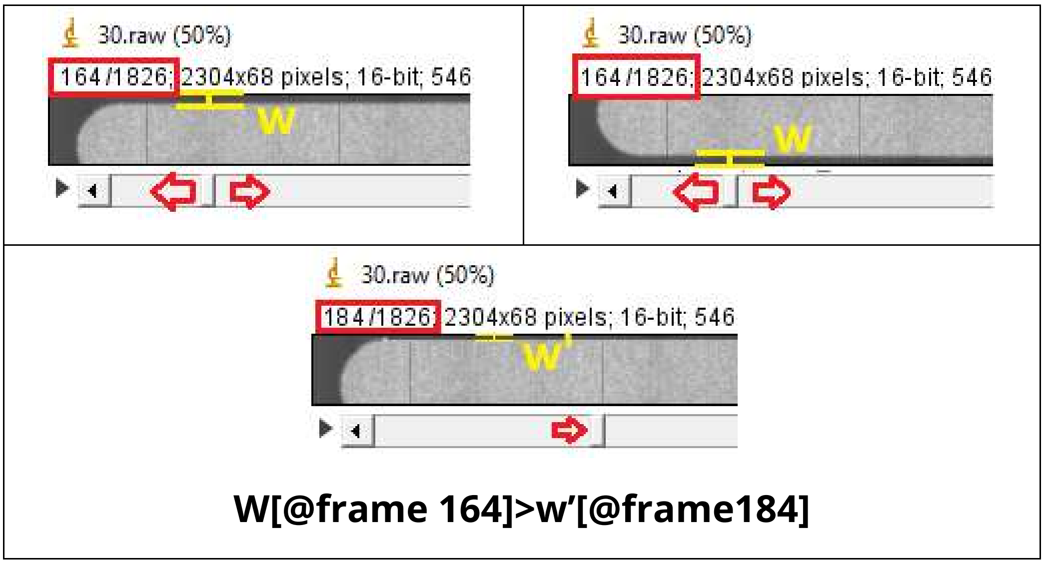
Patient AIS/QuickVision acquisition



PhD_C_Test (technical Tool) 30x24LL Acquisition



35. Zoom-in (press "+" on keyboard) in order to maximise the shadow view, and scroll the frames with the scrolling bar in order to identify the frame where the shadow width (segment "W") is larger.

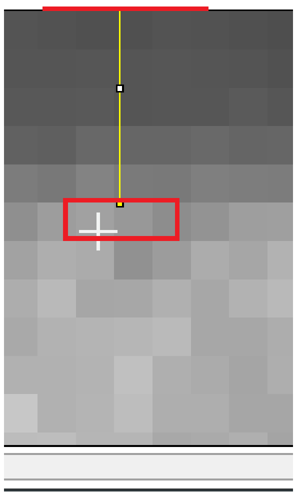


Eg. In the above example the frame where the shadow width is larger is the frame number 164 .

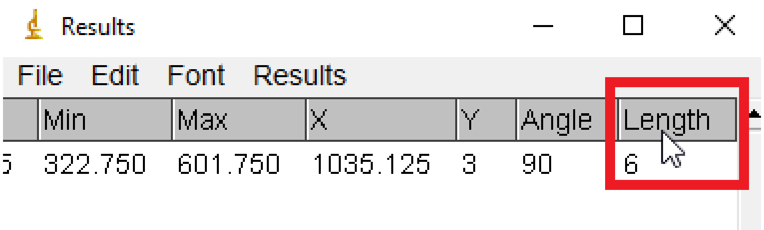
36. Select the frame in which the shadow width is larger

37. Select the straight-line tool in the ImageJ tool set

38. Draw a straight line (LEFT click and press SHIFT ⇧) between the first pixel well irradiated area and the closer border (top or bottom border, depending on shadow position) of the frame area

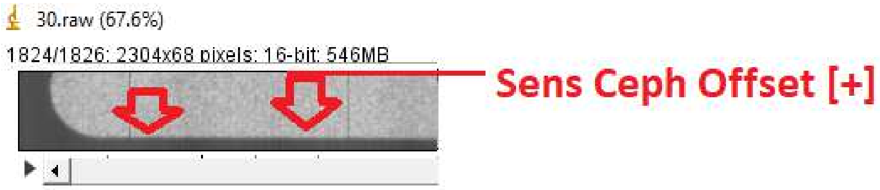
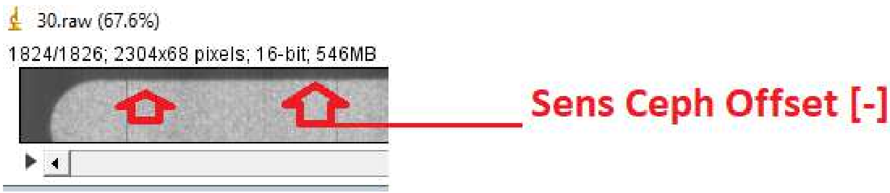


39. Verify the line length by pressing Ctrl+M on the keyboard. The length (expressed in pixel) will be displayed in the ImageJ “Result” window under the column named “Length”

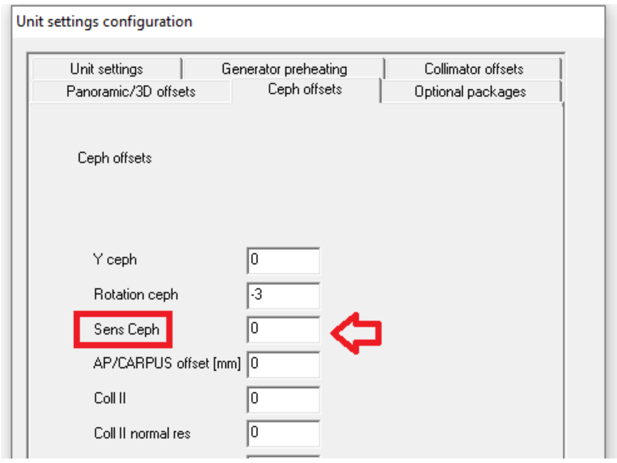


Adjustments

Minimize the secondary collimator shadow on the frame, changing the Sens Ceph offset value following the criteria reported in the following table:

HD-Vertical Lines correction	
OFFSET	**EFFECT ON ACQUIRED FRAME**
Sens Ceph [+]*	Reduce the secondary collimator shadow if it is located on BOTTOM side of the frame 
Sens Ceph [-]*	Reduce the secondary collimator shadow if it is located on TOP side of the frame 
Pixel Offset Conversion	1 Offset Step = 2 pixel

**Note: The symbols [+] and [-] indicate respectively to increase and decrease the offset value already stored in the Unit Setting configuration window:*



Iterate the process in order to verify the effectiveness of the correction.

If It is not possible to correct the lines with the adjustment of the Sens Ceph offset, **verify the secondary collimator-sensor parallelism** (see paragraph 11.2.11.7) and then repeat this procedure.

HS High Speed-Vertical Lines

checks

Note. Since the HS (High Speed, Normal Resolution) offsets are based on HD (High Definition, High Resolution) set of offsets, it is recommended to adjust/verify first the HD images before performing the HS- Vertical Lines check and adjustment

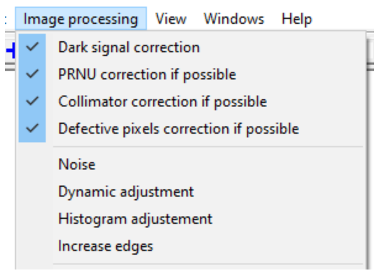
1. Open PhD_C_Test (technical Tool) service program

2. Wait the unit connection

3. Select the following exam:

    - Exam ID: Ceph
    - Format: 30x24 LL
    - Resolution: **Normal**
    - kV: 60
    - mA:2.2

4. Verify that the Image processing options selected are like the following:

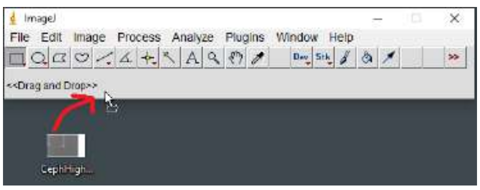


5. Place the unit ear rods in LL position and prepare the unit to acquire the above image

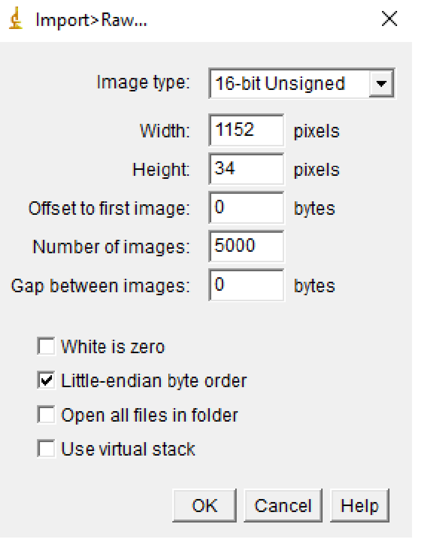
6. Acquire the image and save it as “CephNormal.bmp”

7. Run ImageJ software (download it from Internet: eg. http://wsr.imagej.net/distros/win/ij153-win-java8.zip)

8. Import (drag and drop) the CephNormal.bmp image in the ImageJ bar.

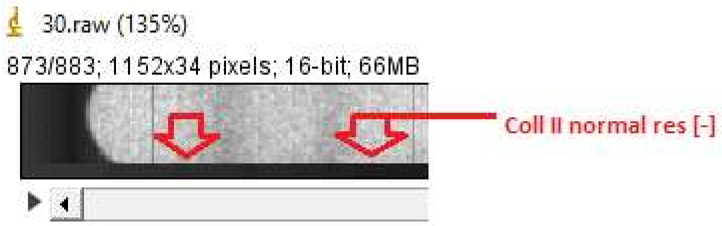
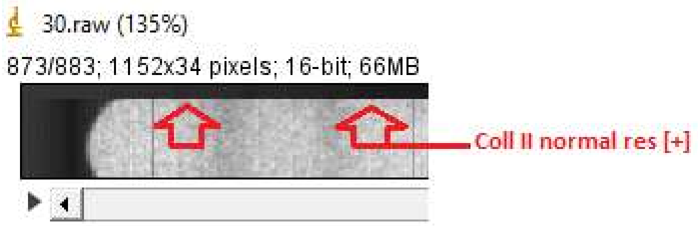


9. Perform the steps of the “*HD High Definition-Vertical Lines -checks-”* from step 31 to 39 using the following setting in the “Import>Raw…” window instead of the values reported by step 33 of the HD procedure.

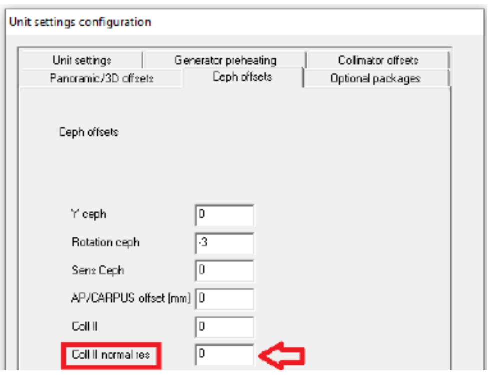


Adjustments

Minimize the secondary collimator shadow on the frame following the criteria reported in the following table:

HS-Vertical Lines correction	
OFFSET	**EFFECT ON ACQUIRED FRAME**
Coll II normal res [-]*	Reduce the secondary collimator shadow if it is located on BOTTOM side of the frame 
Coll II normal res [+]*	Reduce the secondary collimator shadow if it is located on TOP side of the frame 
Pixel Offset Conversion	1 Offset Step = 1 pixel

**Note:* *The symbols [+] and [-] indicate respectively to increase and decrease the offset value already stored in the Unit Setting configuration window:*



11.3 Parts replacement

11.3.1 Fuses replacement

Before replacing fuses, turn the unit OFF and disconnect it from the mains (by turning OFF the mains power supply breaker dedicated to the unit).
Replace the broken fuse with one of the same specification.

11.3.1.1 Main fuses

The main fuses F1 and F2 are located on the top side of the unit.
The fuse F1 cuts the mains supplied to the switching power supply (G1) in case of overcurrent.
The fuse F2 cuts the mains supplied to the motor column driver (G2) in case of overcurrent.

Fuses type:

- F1: 6.3x32 F fuse. Refer to chapter 5 – Technical Characteristics – for the value
- F2: 6.3x32 F fuse. Refer to chapter 5 – Technical Characteristics – for the value.

11.3.1.2 MCU board (A1) fuse

The MCU board fuse F1, in case of overcurrent, cuts the 24V supplied to the motors (M3, M4, M5, M6) .

Note
It does not cut the 24V supplied to the 3D sensor power board (A10).

Fuse type: 2 A FF (125V)

Refer to chapter 12 – drawing 2 – for fuse position.

11.3.1.3 Generator board (A2) fuse

The Generator board fuse F1, in case of overcurrent, cuts the Generator board main power supply.

Fuse type: 1 A T (250V) TR5

Refer to chapter 12 – drawing 3 – for fuse position.

11.3.1.4 3D Power sensor board (A10) fuse

The 3D Power sensor board fuse cuts the 8-9V supplied by the board A10 to the 3D sensor in case of overcurrent.

Fuse Type: 2 A FF (125V)

Refer to chapter 12 – drawing 4 – for fuse position.

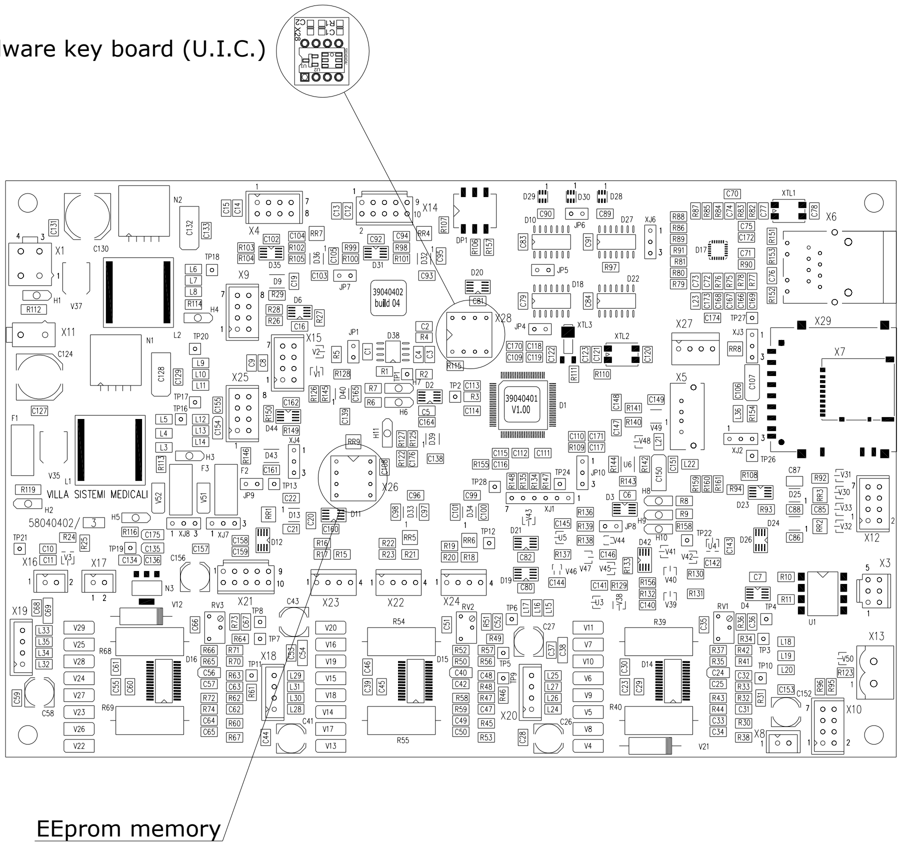
11.3.2 MCU board replacement

Warning
The board shipped as replacement carry the Hardware key and the EEPROM not configured.

To make the system working, the Hardware key must be retrieved from the failed board and positioned on the new board. This component includes the U.I.C. (Unique Identification Code) which determines the enabling codes for the radiological exams.

Moreover, on the EEPROM has stored the system configuration data; remove the EEPROM from the new board and replace it with the one present on the failed board. In case the old EEPROM was not functioning, it will be necessary to mount the not configured EEPROM and restore manually the configuration data present on the equipment parameters table supplied with the Service Manual (see paragraph 14.1), following the procedure present on chapter 8 – "Service programs description".

Note
At the end of the replacement, restore the metallic cover verify that thee firmware is compatible with the firmware of the other boards and with the ASP driver.
If you have any doubt contact the technical service.


Hardware key board (U.I.C.)
EEprom memory
VILLA SISTEMI MEDICALI
58040402/
39040401
V1.00
39040402
build 04

11.3.3 A11 CCU board replacement

Replacement of this board doesn't require any adjustment. Take care of cable connections.

11.3.4 A2 Generator board replacement

Replacement of this board doesn't require any adjustment. Take care of cable connections Refer to paragraph 11.3.9 steps 1-4 for more information.

11.3.5 A12 Collimator driver board replacement

Replacement of this board doesn't require any adjustment. Take care of cable connections.

11.3.6 A13 CEPH driver board replacement

Replacement of this board doesn't require any adjustment. Take care of cable connections.

11.3.7 A14 Ceph sensor board replacement

Replacement of this board doesn't require any adjustment. Take care of cable connections.

11.3.8 Ceph sensor replacement

Once replaced the CEPH sensor, make a complete centering check as described in paragraph 7.12.

11.3.9 3D sensor replacement

Note

Before a 3D sensor replacement, it is MANDATORY to:

- Properly set the network interface board (see paragraph 7.7.2).
- Activate the sensor logs (see paragraph 11.2.1.4) and try to reproduce the error
- Provide the sensor logs* (see paragraph 11.2.1.4) to Technical Service

- If the sensor has to be replaced due to an image quality problem, provide to Technical Service the .raw files of the complained acquisitions (see paragraph 11.2.1.5)

**The logs MUST be record with the Network board set as described by paragraph 7.7.2*

Note
The following operations must be performed by two persons.

1. Switch OFF the unit.
2. Disconnect cables J99 and J15.

Note
Connector J15 is VERY FRAGILE, remove it using GREAT CARE.

3. First operator holds the sensor with both hands while the second operator unscrews the 4 screws indicated by the red circles in the image:

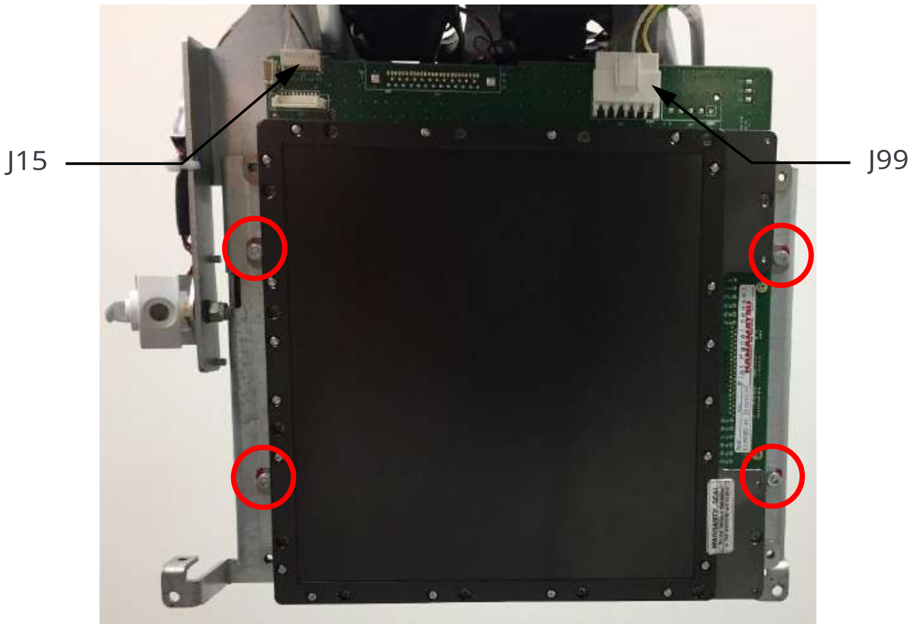


Figure 51

4. Second operator removes the Ethernet cable.
5. Place the defective sensor in the box of the spare sensor, following the packaging instructions supplied with the new 3D sensor.
6. Connect the Ethernet cable to the new sensor. Place the sensor on the unit and tighten the four screws removed before. Connect the J15 and J99 cables.
7. Verify the X-ray beam alignment (see paragraph 11.2.9.1).
8. Perform sensor calibration (see paragraph 10.2).
9. Verify the 3D lateral offset (see paragraph 11.2.10).

11.3.10 Tube head replacement

1. Switch OFF the unit.
2. Remove the tubehead external and internal cover.
3. Remove the Generator board metallic cover:

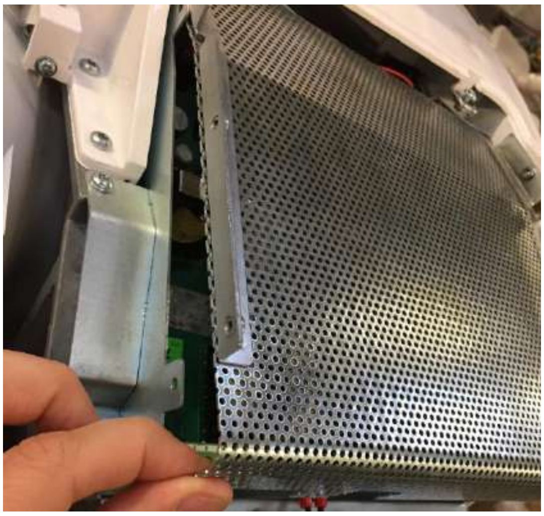


Figure 52

4. Unscrew the cables fixing clamps "A" and then disconnect X57 and X56 connectors from Generator board. Unscrew the 4 generator board support screws "B":

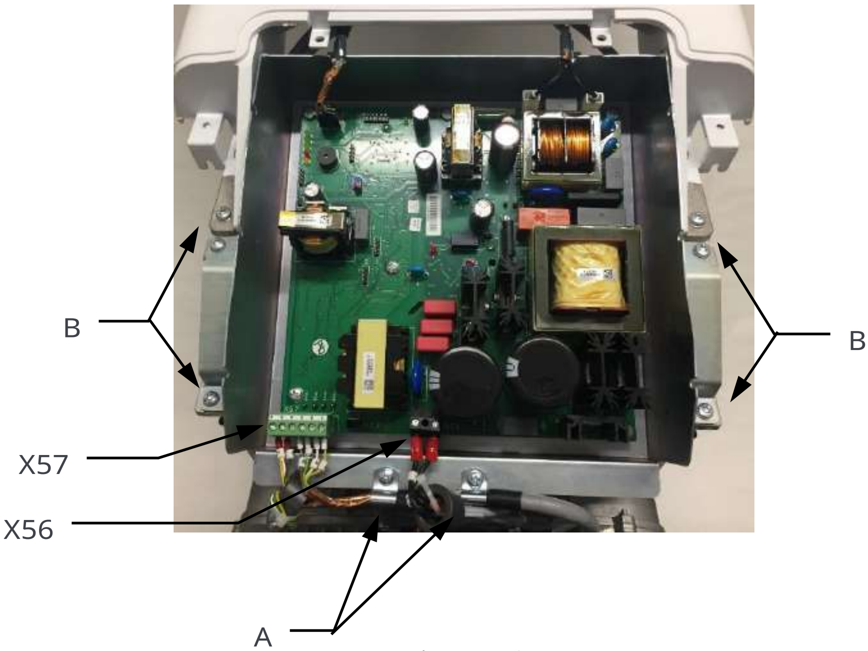


Figure 53

5. Pull up the generator board.

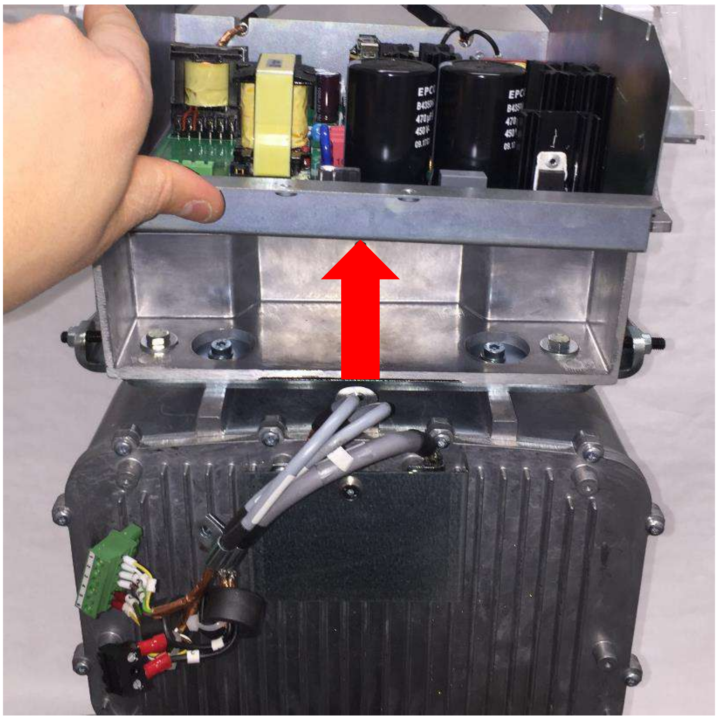


Figure 54

Note
The presence of a second operator is required during the following steps.

6. While the first operator holds the tubehead with two hands, the second unscrew the generator board screws “C”.

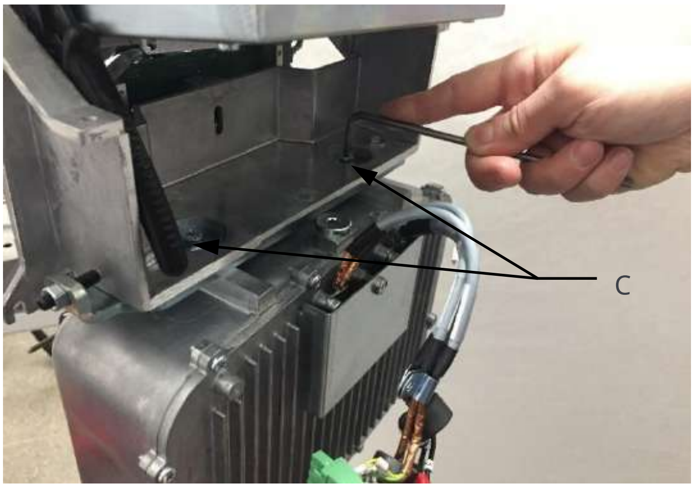


Figure 55

7. Mount the new tubehead, taking care to push it with one hand in the direction of the sensor while tightening the screws "C" (Figure 55).

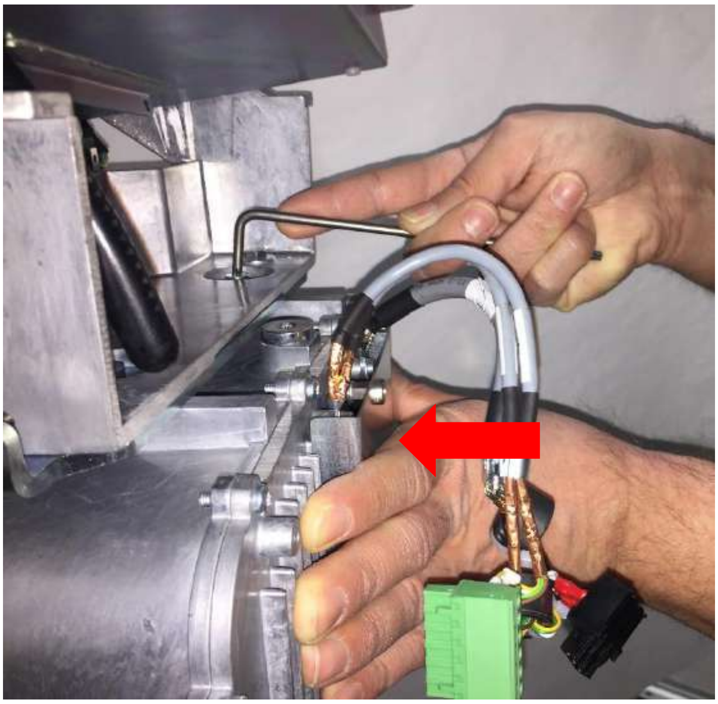


Figure 56

8. Connect X56 and X57 connectors and fix the cables fixing clamps "A" (Figure 53).
9. Mount the generator board metallic cover and tighten its fixing screws.
10. Switch ON the unit and wait the G.U.I. connection.
11. Insert the preheating values reported on the label of spare tubehead in the EEPROM memory (see paragraph 8.4).

Warning
Wrong settings of preheating parameters may damage X-ray tube.

12. Perform the X-ray beam centering verification (see paragraph 11.2.9).

13. In case the beam is not centered to the sensor, loosen the screws “D” (*Figure 58*) and act on screws “E” and “F” (Figure 58) following the convention reported below:
    - Screw “F” to move the X-ray beam on the right (on the image)
    - Screw “E” to move the X-ray beam on the left (on the image)

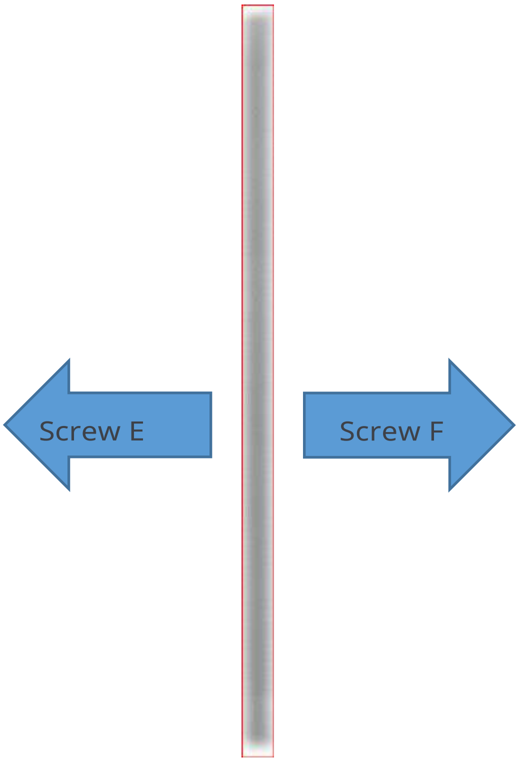


Figure 57

Note
In order to act on a screw (E or F) on one side, loosen the other screw on the opposite side.

Figure 58

14. Tighten screws “D” and repeat the static acquisition.
15. Once X-ray beam has been well centred, tighten all the screws.
16. Mount the tubehead internal cover.
17. Mount the tubehead external cover paying attention to insert first the lower pins of the cover in the guide present in the tube head internal cover and then fix the upper part of the covers.

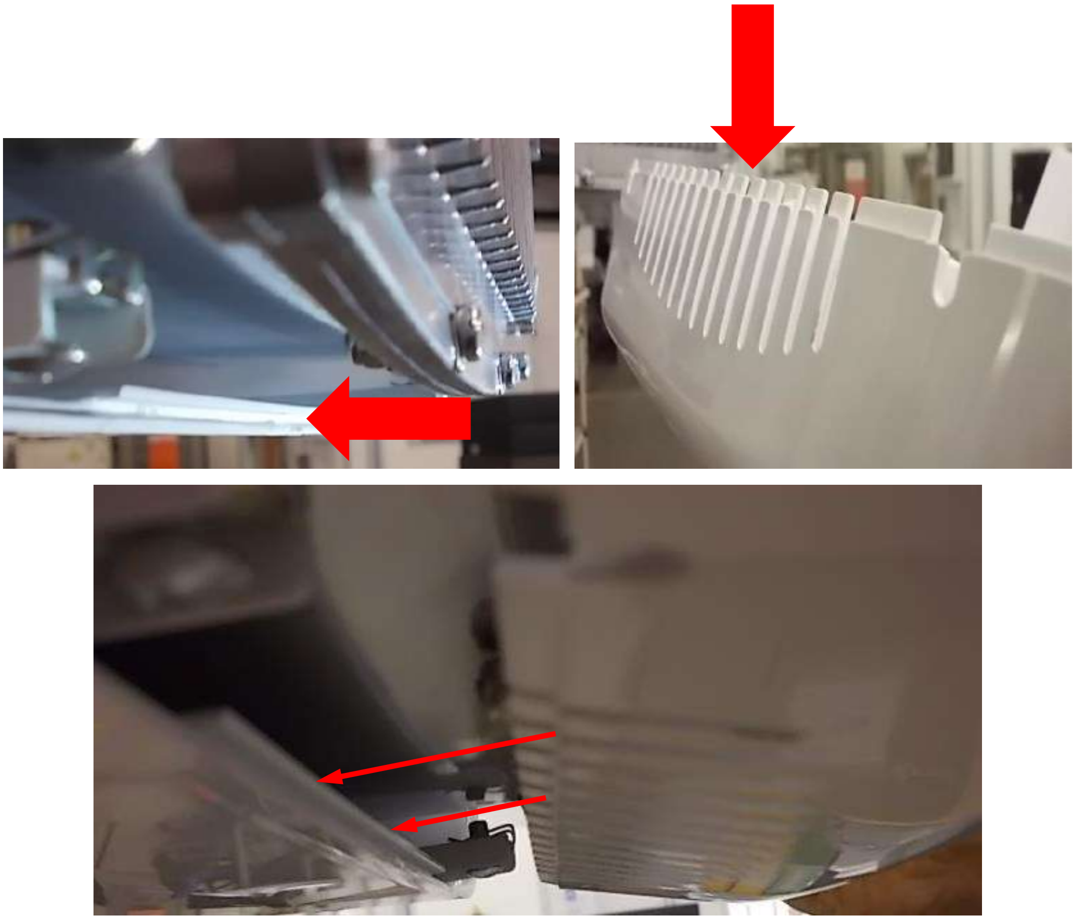


Figure 59

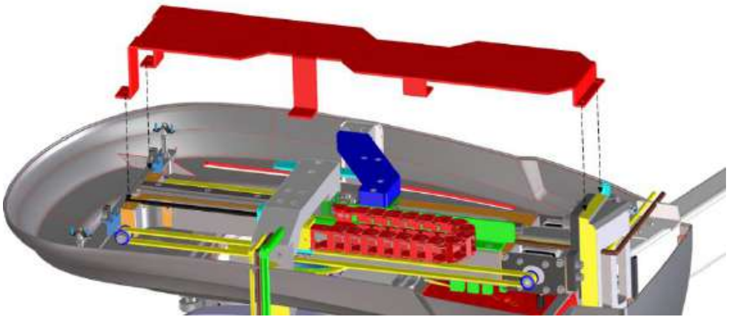
18. Perform the sensor calibration and verification (see paragraph 10.2).
19. Perform a panoramic symmetry verification (see paragraph 7.10).

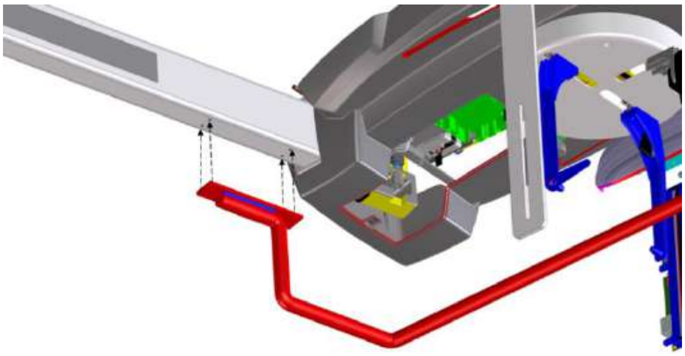
11.3.11 Column replacement

Column replacement requires the complete dismounting of the unit. It is suggested to take a complete package to perform in the proper way this activity.

1. Remove the CEPH arm upper cover

2. Install the CEPH arm protection plate and CEPH arm handle (these tool have been removed during installation of the unit)



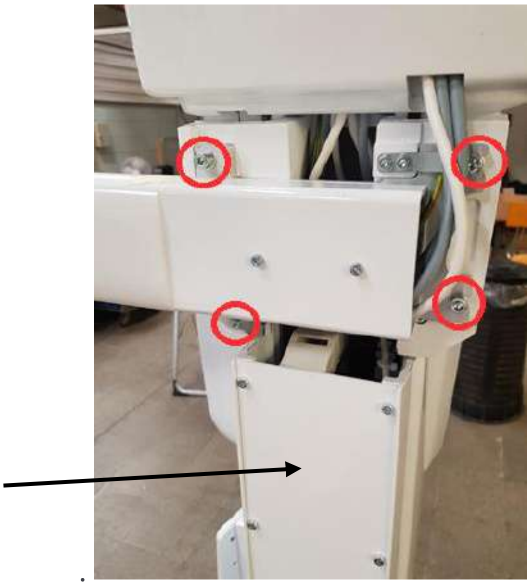


3. Fix secondary collimator and sensor arms to the protection plat and remove the panceph sensor from the unit.

4. Remove the upper cover of the unit and the MCU cover to access the connectors

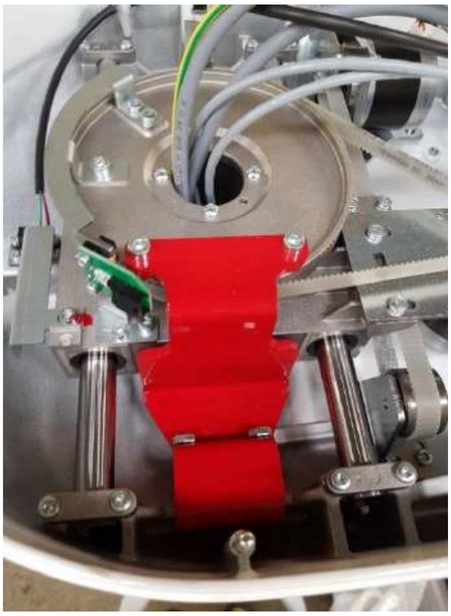
5. Disconnect cables coming from CEPH arm

6. Remove the screws of the following image and open the back cover



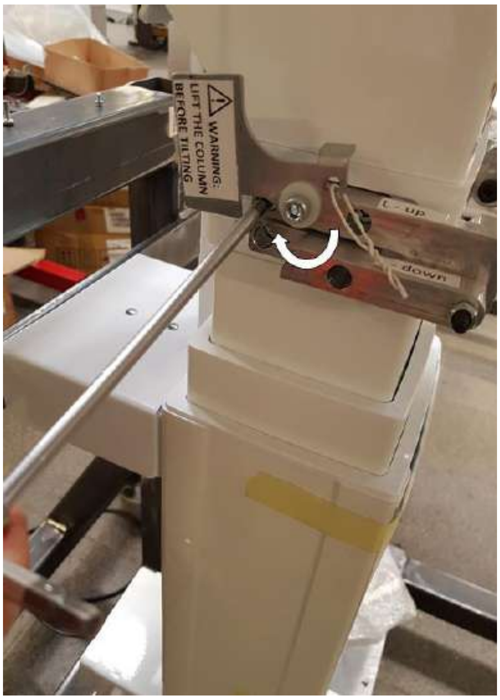
7. Remove the CEPH arm and position it up-side down, if possible inside the original package

8. Fix the rotating arm installing the support provided with the unit (that was removed during installation)

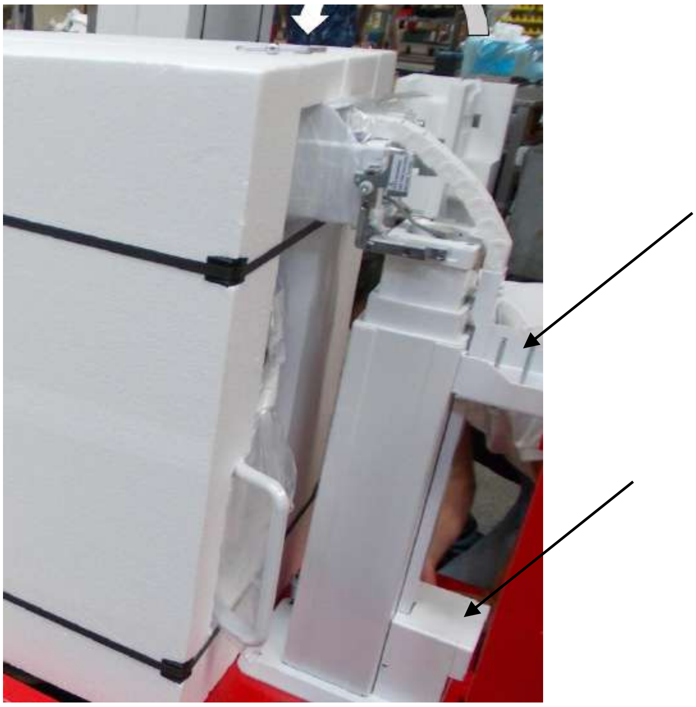


9. Protect the unit with plastic film and install the package. Fix it using adhesive tape

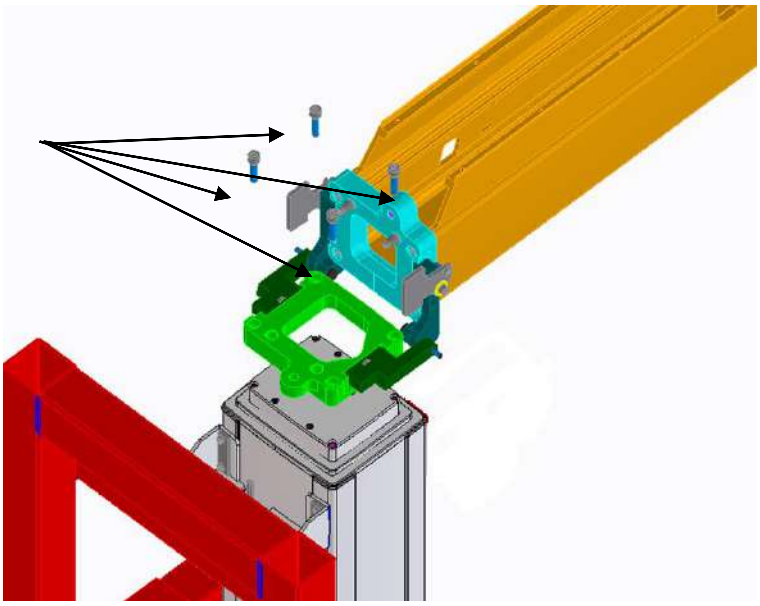
10. Remove fixing screws.



11. Tilt down the upper part of the unit. Disconnect cables and remove the back plates from the column



12. Remove the top side screws and the cable channel



13. Replace the column and the T Motion control box (in the tilted part of the column).

14. Once replaced, it is necessary to repeat the complete installation as for paragraph 7.1.

15. Repeat all the verification before to use the unit with patients as for chapter 7.

11.3.12 Chin support replacement

1. Remove the upper cover. Remove cover from MCU board.
2. Set DIP-switch 3 to OFF (1 and 2 ON) in order to enter in Service Mode (see paragraph 4.2.2.1).
3. Switch ON the unit and wait until the green LED blinks.

Note
In service mode NEVER press up/down column keys as they change rotating position.

4. Unplug the "broken" cable X12 and connect the X12 of the new chin support. Use its keyboard for the next step.

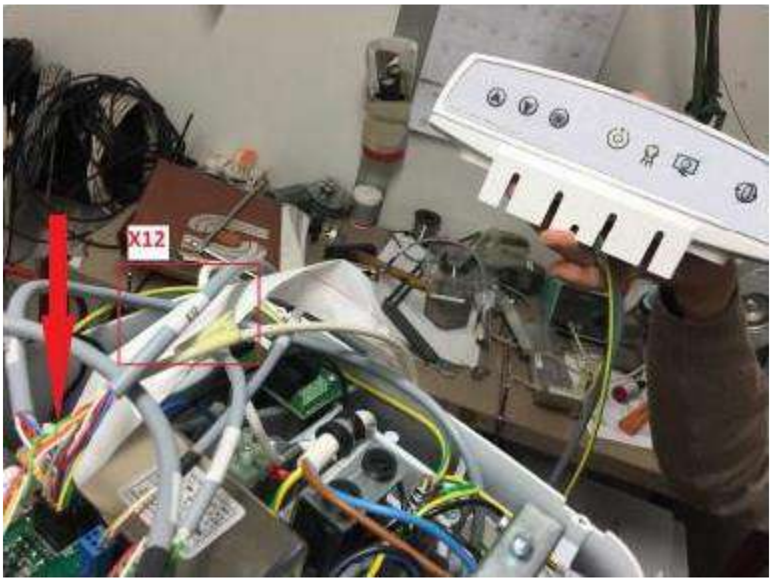


Figure 60

5. Press the >0< button
6. Position the panoramic tool on chin support.

7. Turn ON laser and press >0< button on the keyboard until sagittal laser is on the middle of tool. Use adhesive tape and mark the laser position (using a pen).

Figure 61

8. Put adhesive tape between the extremities of the tool.
9. Press >0< button on the keyboard until sagittal laser is parallel to chin support arm. On adhesive tape mark the laser position (using a pen).

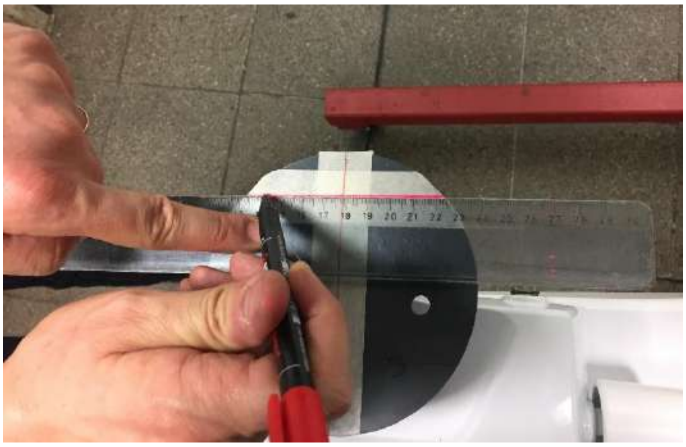


Figure 62

Rotation references are present on the tool and it has to be used as reference to position the unit in the same position.

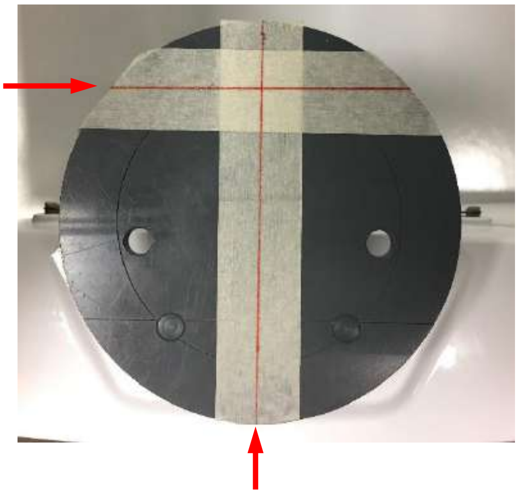


Figure 63

10. Unplug the X12 cable and the ground.

Figure 64

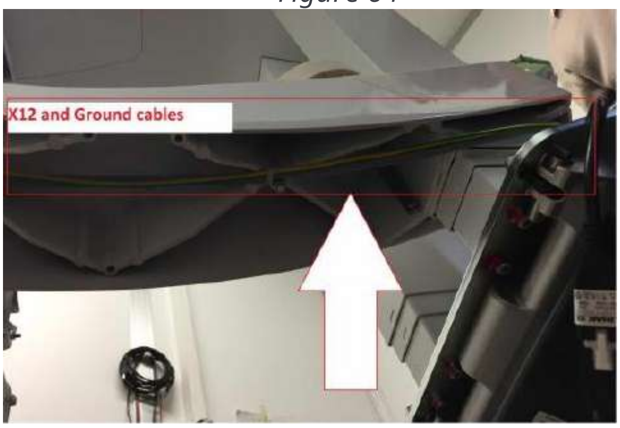


Figure 65

11. Unscrew the four screws under the arm.

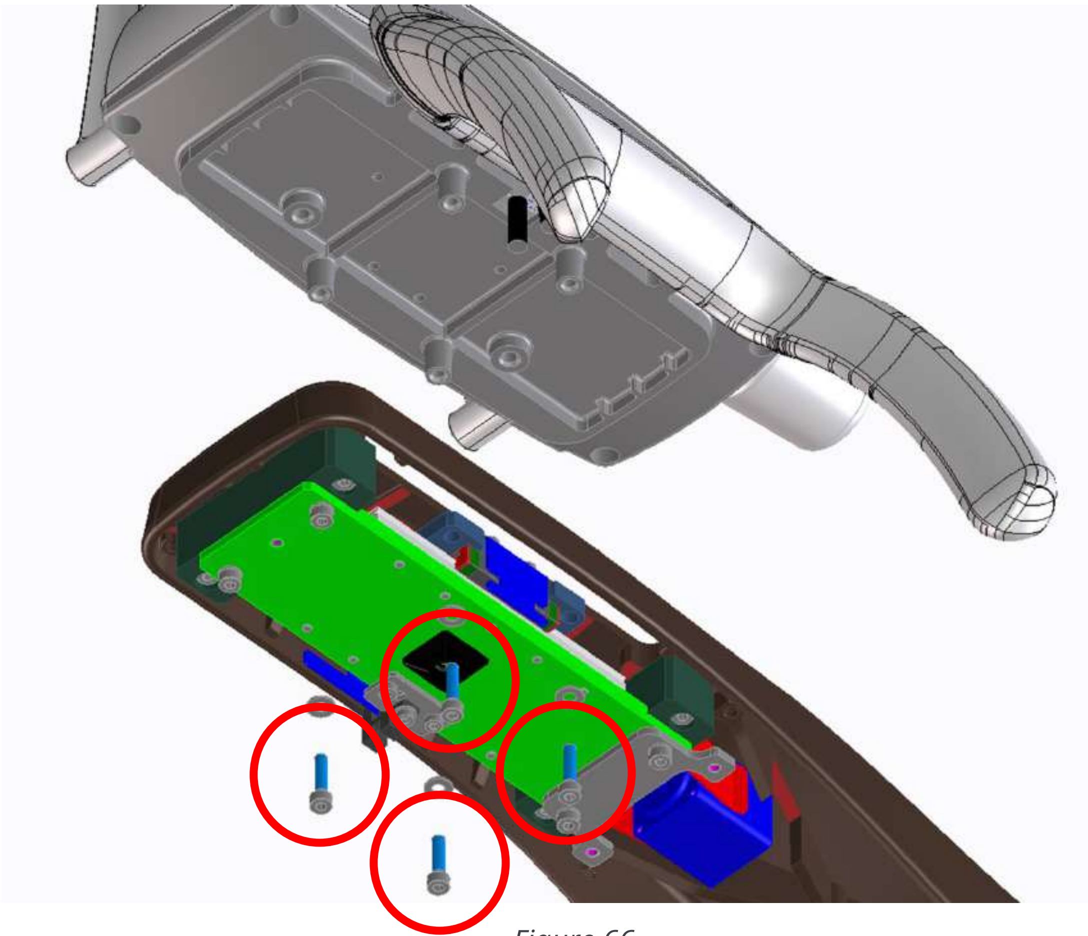


Figure 66

12. Remove the group “key board-handle”.
13. Position the new group.
14. Turn ON the unit in Service mode.
15. Turn ON the laser and press >0< button on the keyboard to rotate the unit.
16. Verify that the sagittal laser is projecting on the reference on the tape and than lightly tighten the screws under the arm. Verify that the horizontal line is on the horizontal line on the tape.
17. If both the sagittal and horizontal line are aligned, hard tighten the screws.
18. Turn OFF the unit.
19. Set DIP-switch 3 to OFF to set the unit in normal mode (see paragraph 4.2.2.1).
20. Turn ON the unit.
21. Make exposure and verify the image quality as described in paragraphs 7.10 and 7.11.

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12. SCHEMATICS AND DRAWINGS

1. **X-MIND prime 3D General diagram**
2. **MCU board A1 layout**
3. **Generator board A2 layout**
4. **3D Power sensor board A10 layout**
5. **CCU board A11 layout**
6. **Collimator driver board A12**
7. **Ceph driver board A13**
8. **Ceph sensor power supply board A14**

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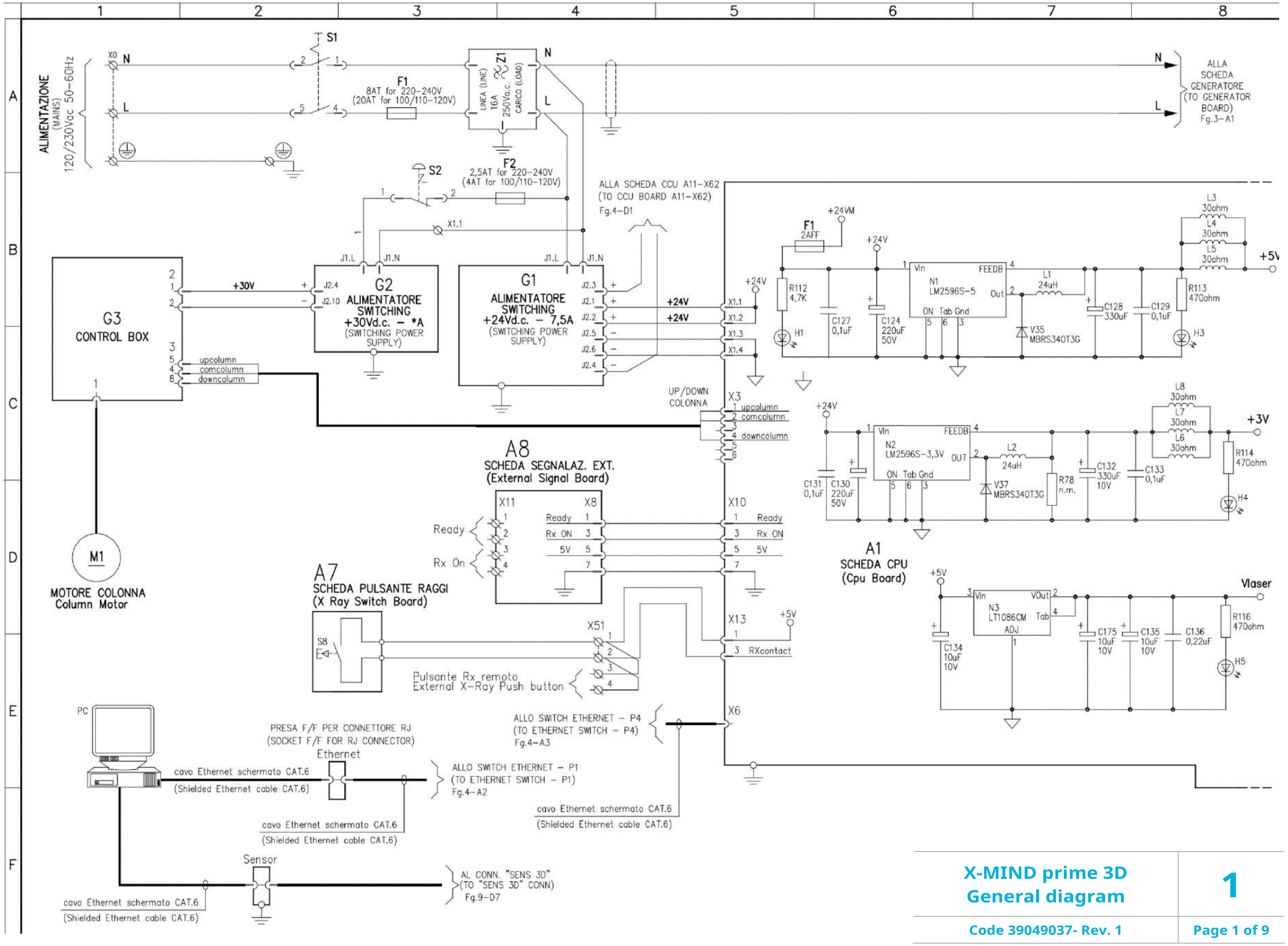
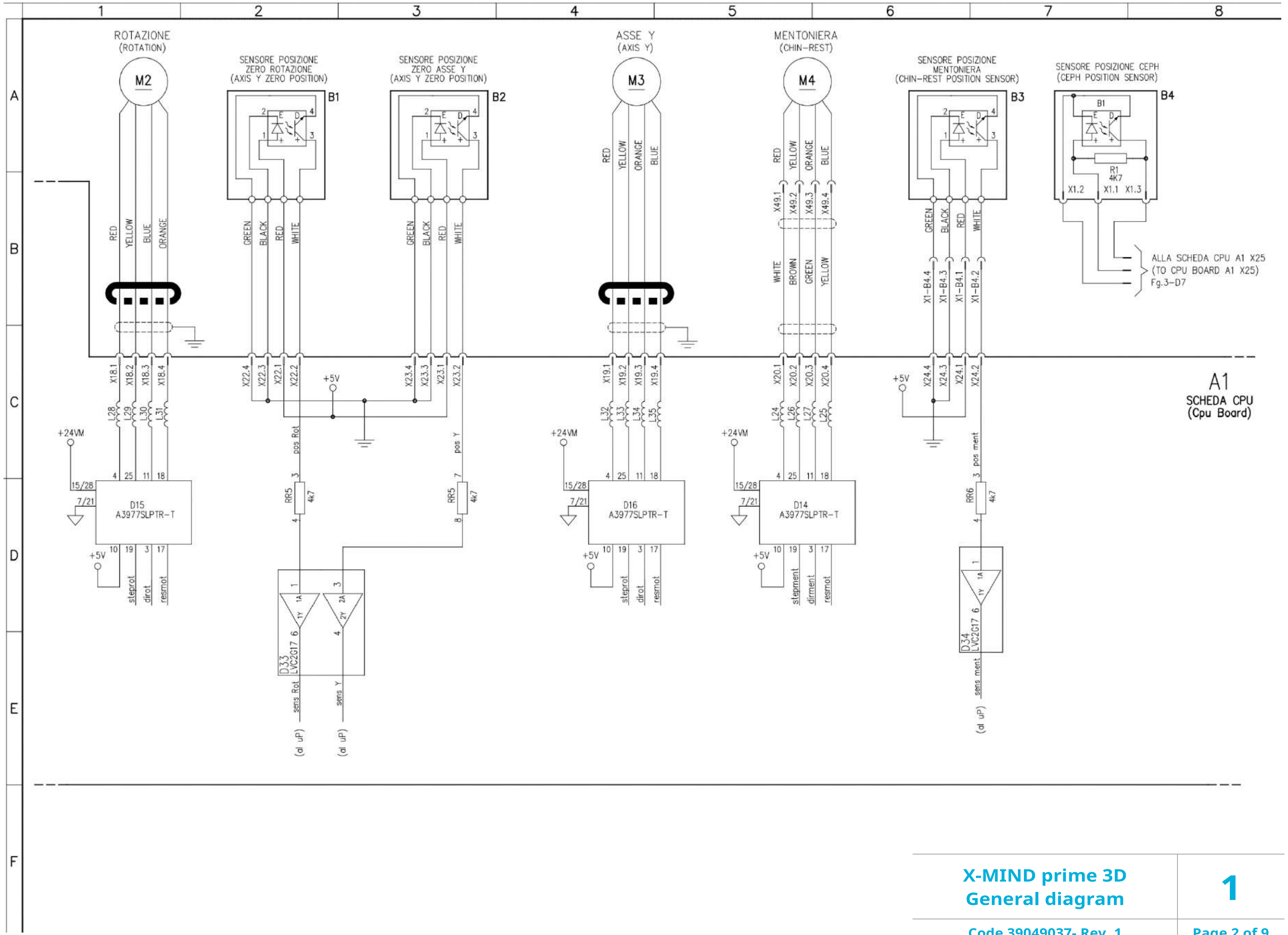
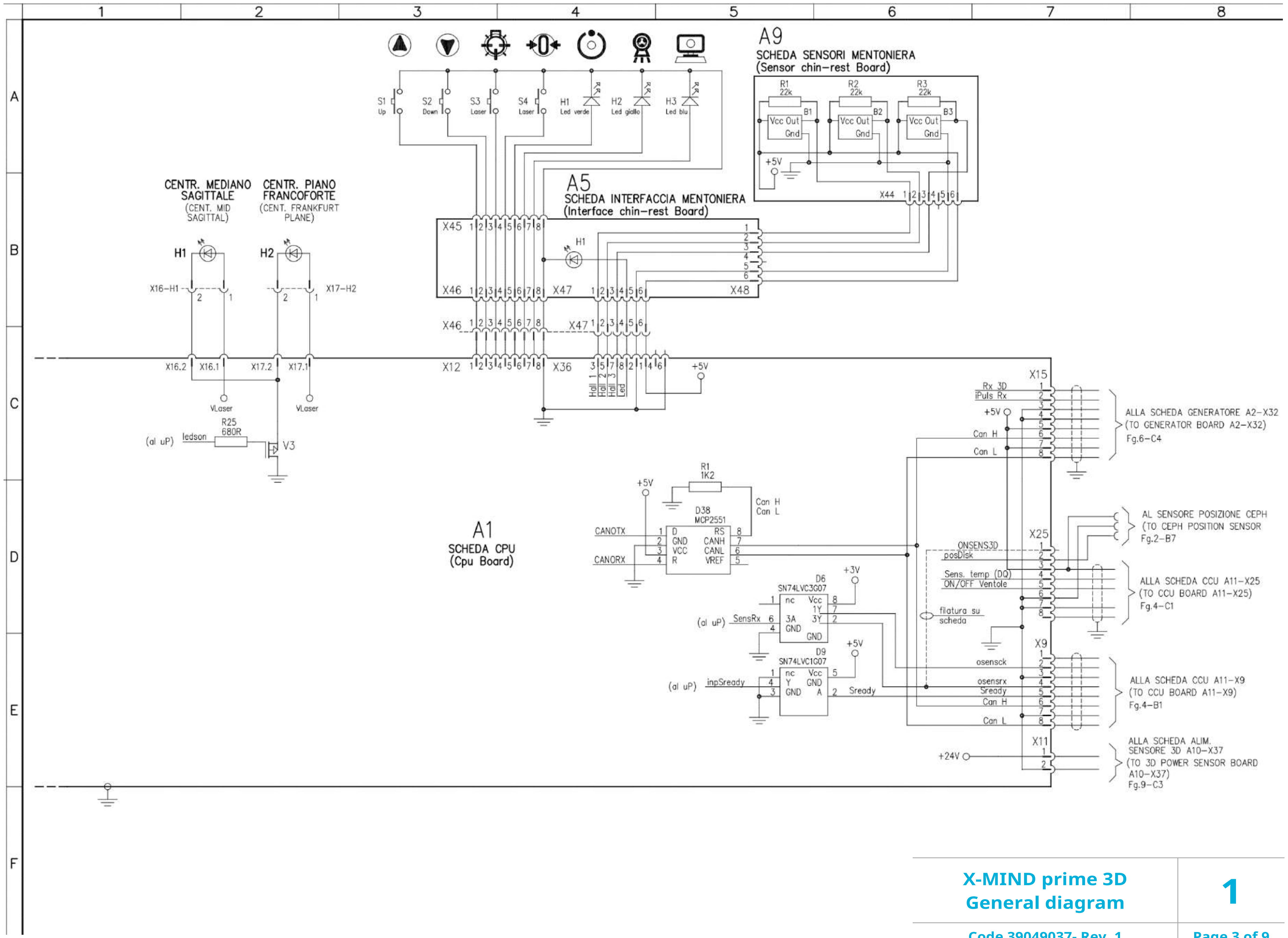


X-MIND prime 3D General diagram	1
Code 39049037- Rev. 1	Page 1 of 9



X-MIND prime 3D General diagram	1
Code 39049037- Rev. 1	Page 2 of 9

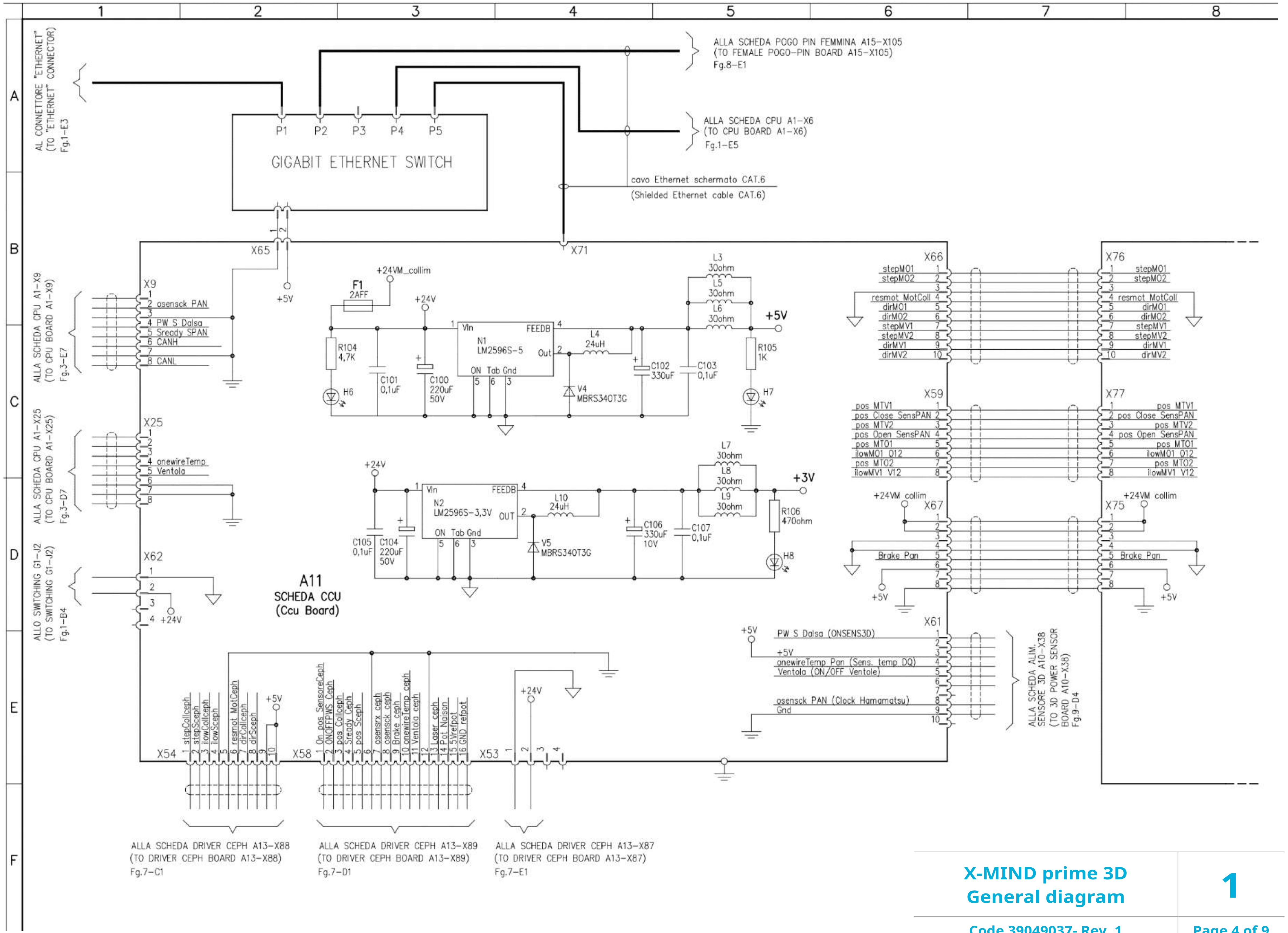


X-MIND prime 3D
General diagram

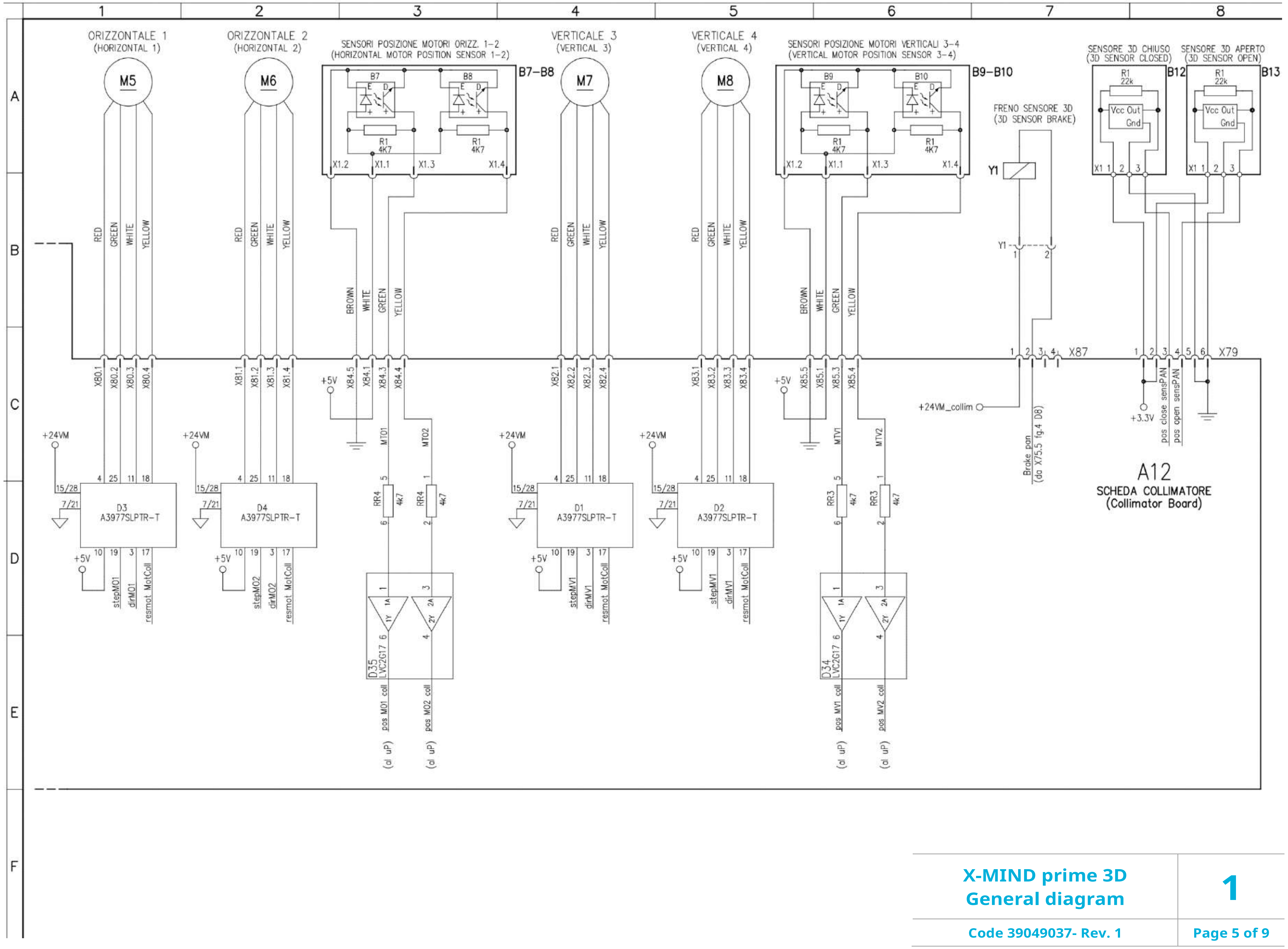
1

Code 39049037- Rev. 1

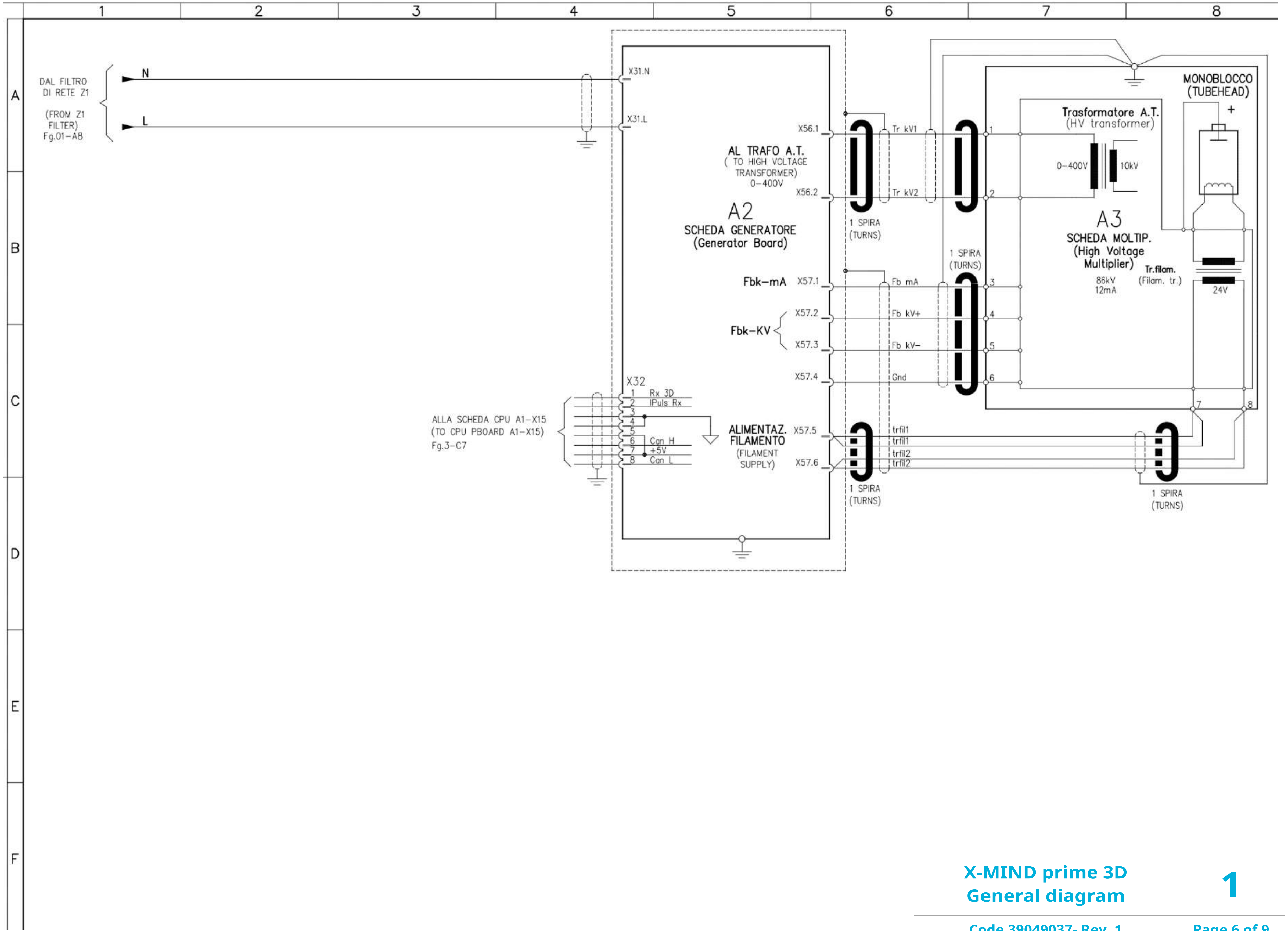
Page 3 of 9



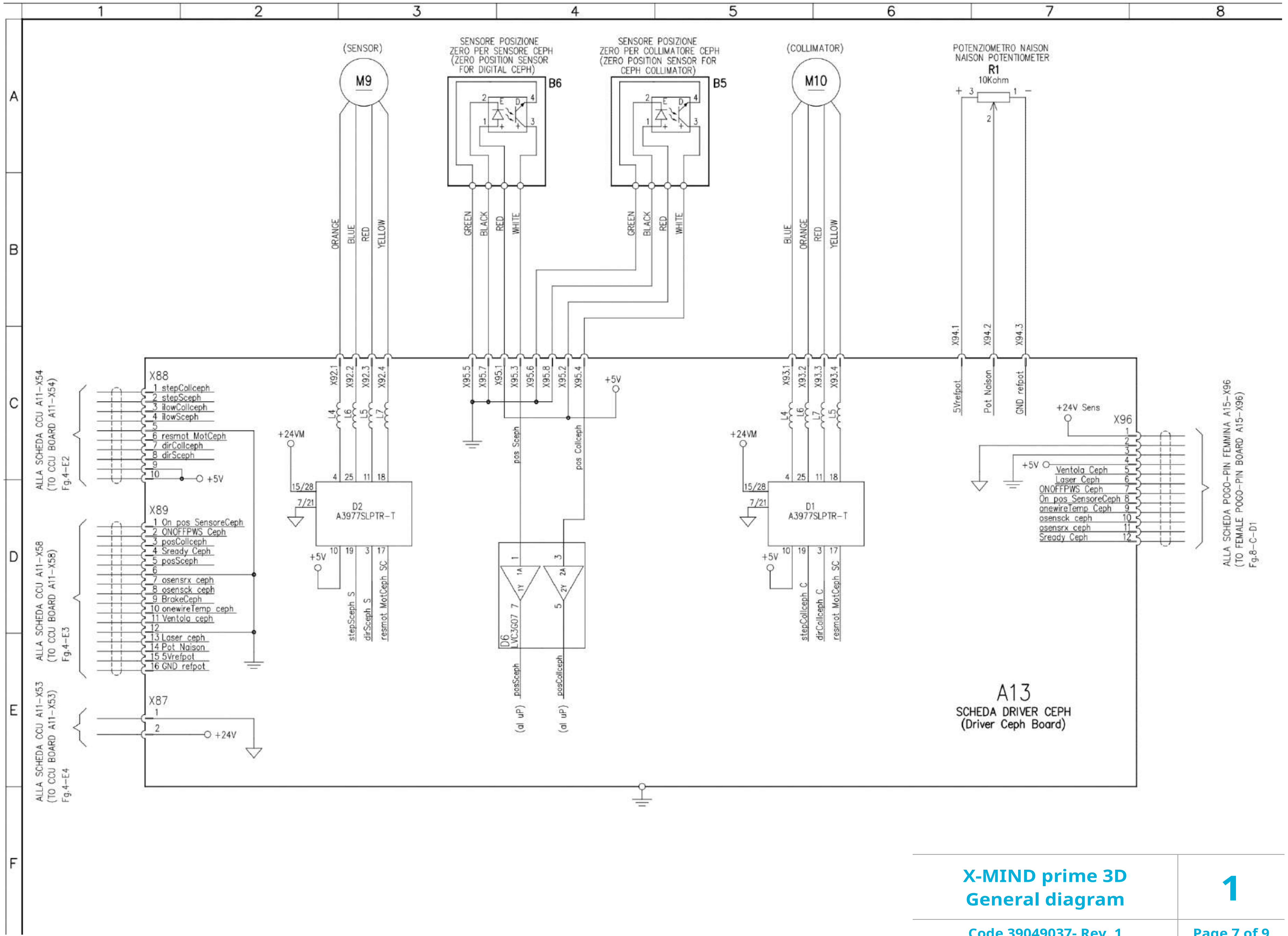
X-MIND prime 3D General diagram	1
Code 39049037- Rev. 1	Page 4 of 9



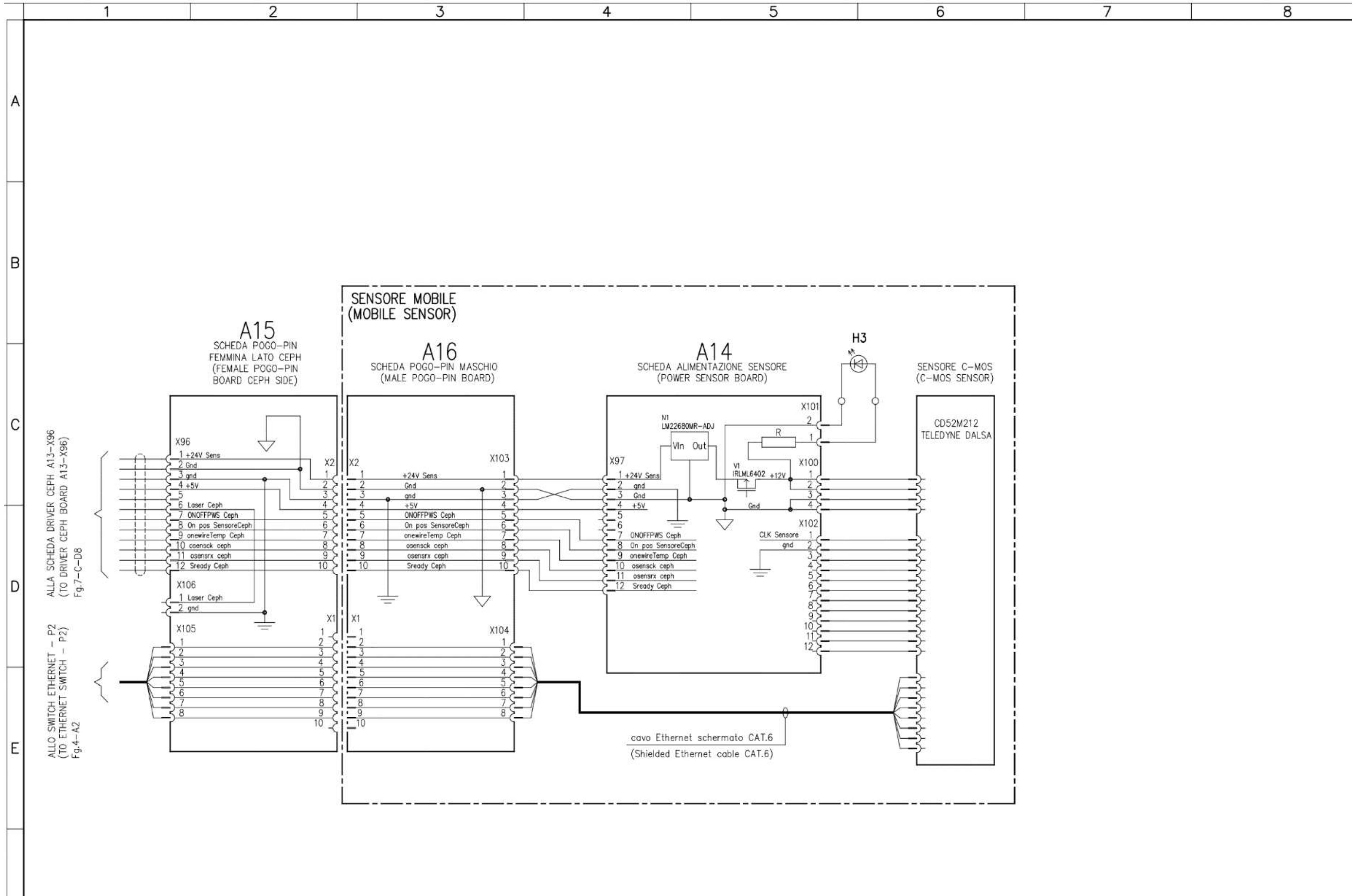
X-MIND prime 3D General diagram	1
Code 39049037- Rev. 1	Page 5 of 9



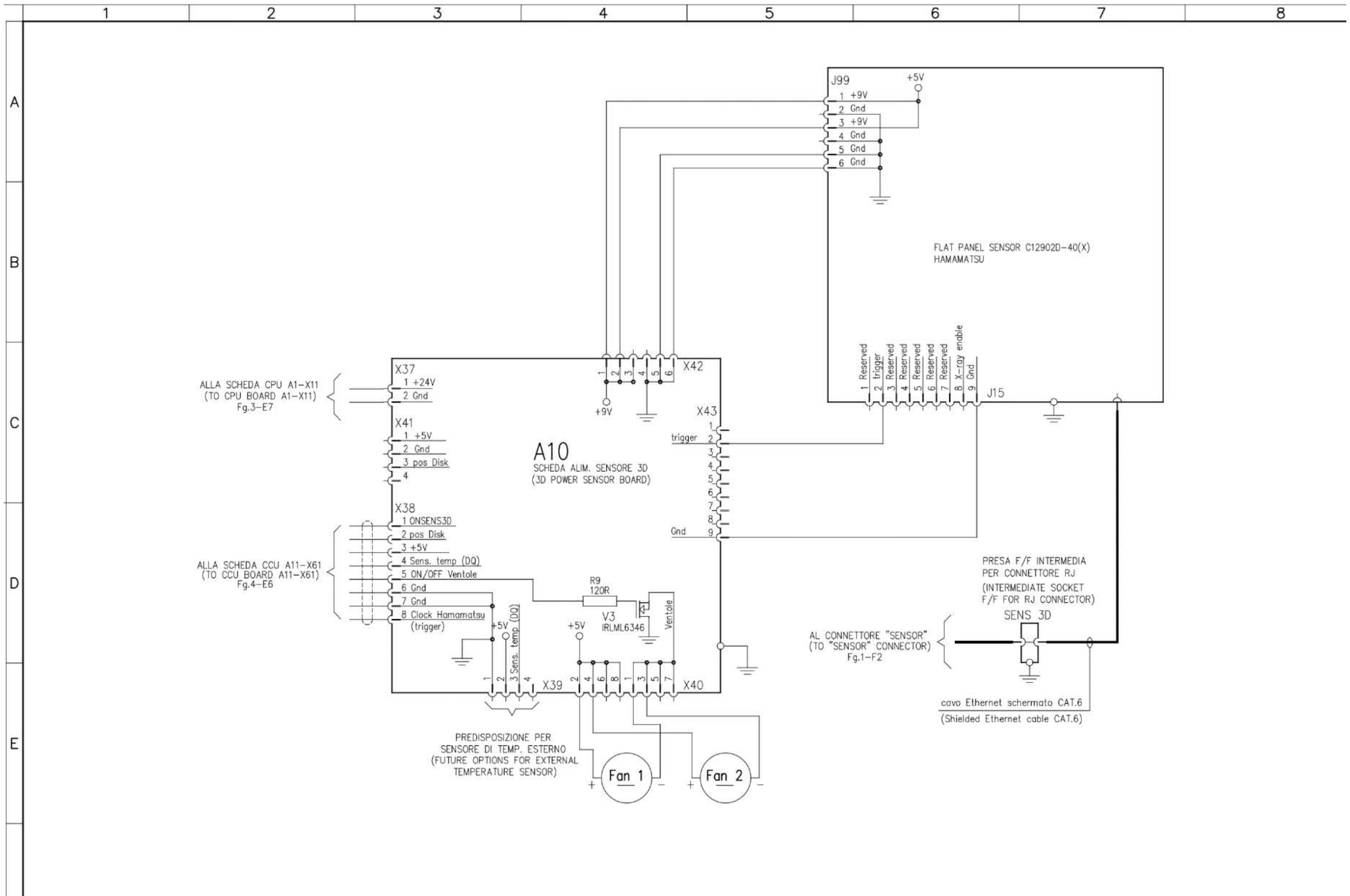
X-MIND prime 3D General diagram	1
Code 39049037- Rev. 1	Page 6 of 9



X-MIND prime 3D General diagram	1
Code 39049037- Rev. 1	Page 7 of 9



X-MIND prime 3D General diagram	1
Code 39049037- Rev. 1	Page 8 of 9



X-MIND prime 3D General diagram	1
Code 39049037- Rev. 1	Page 9 of 9

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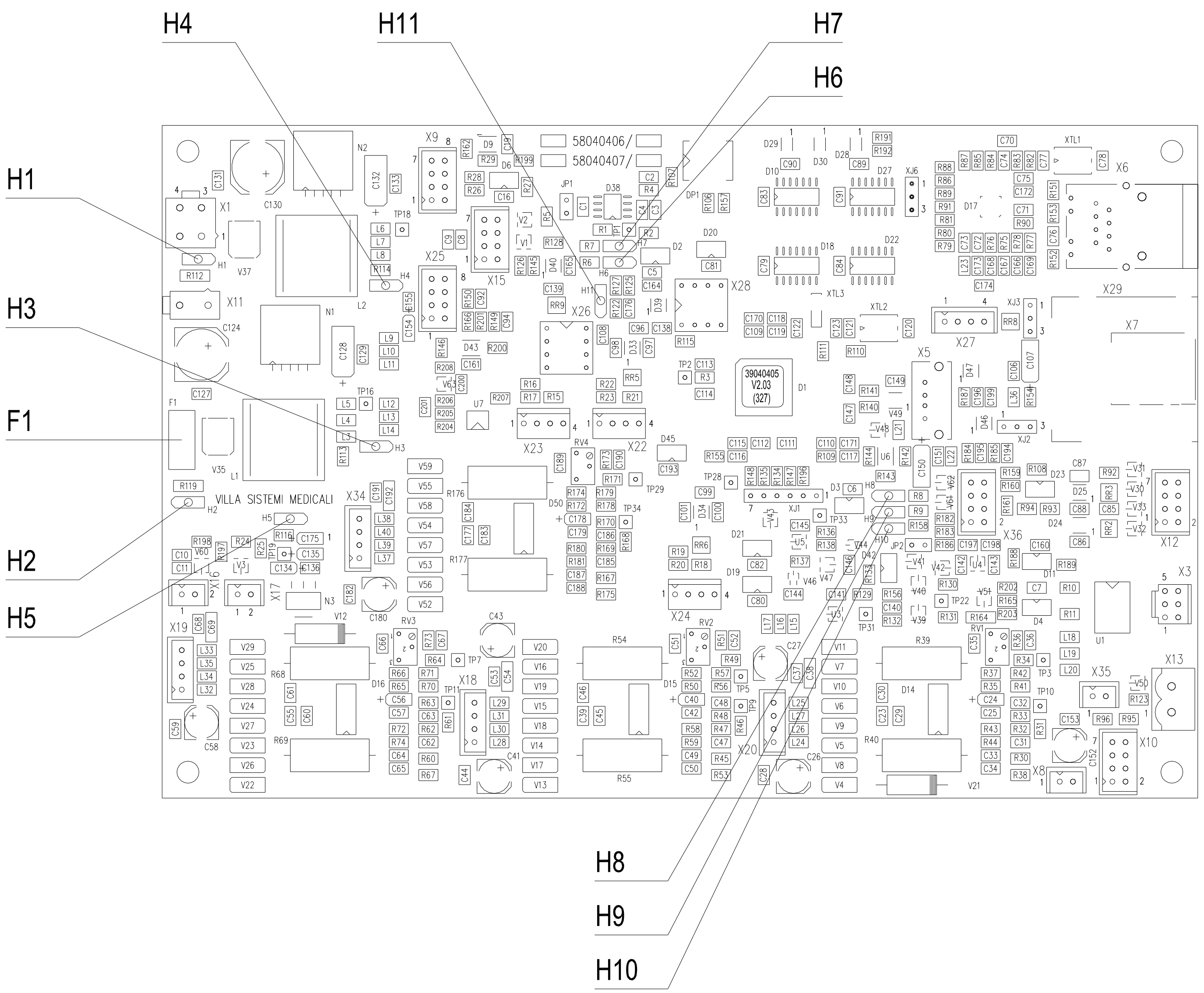
B								
C								
D								
E								
F								



X-MIND prime 3D MCU board A1 layout	2
Code 58040407 - Rev. 3	Page 1 of 1

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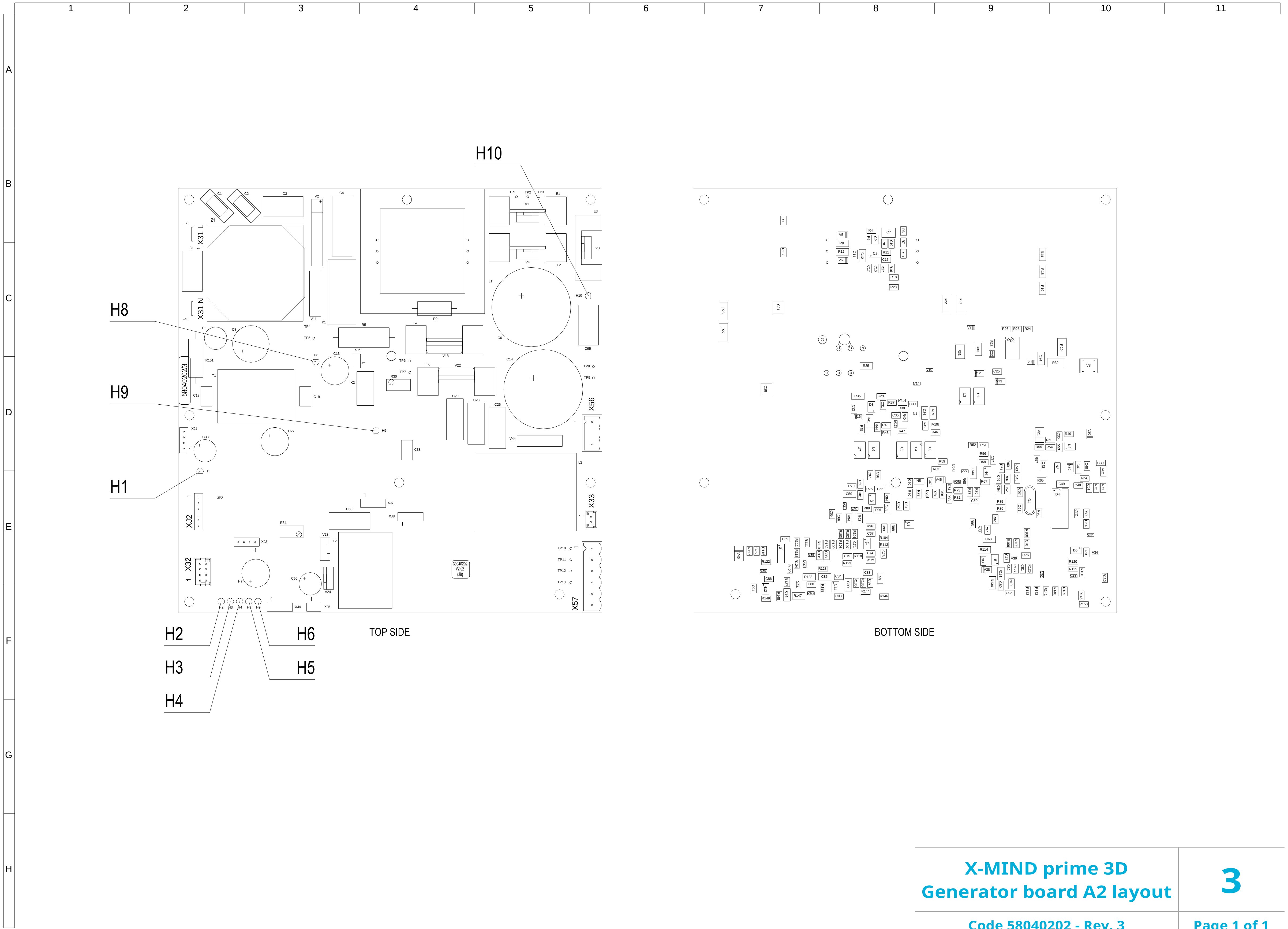
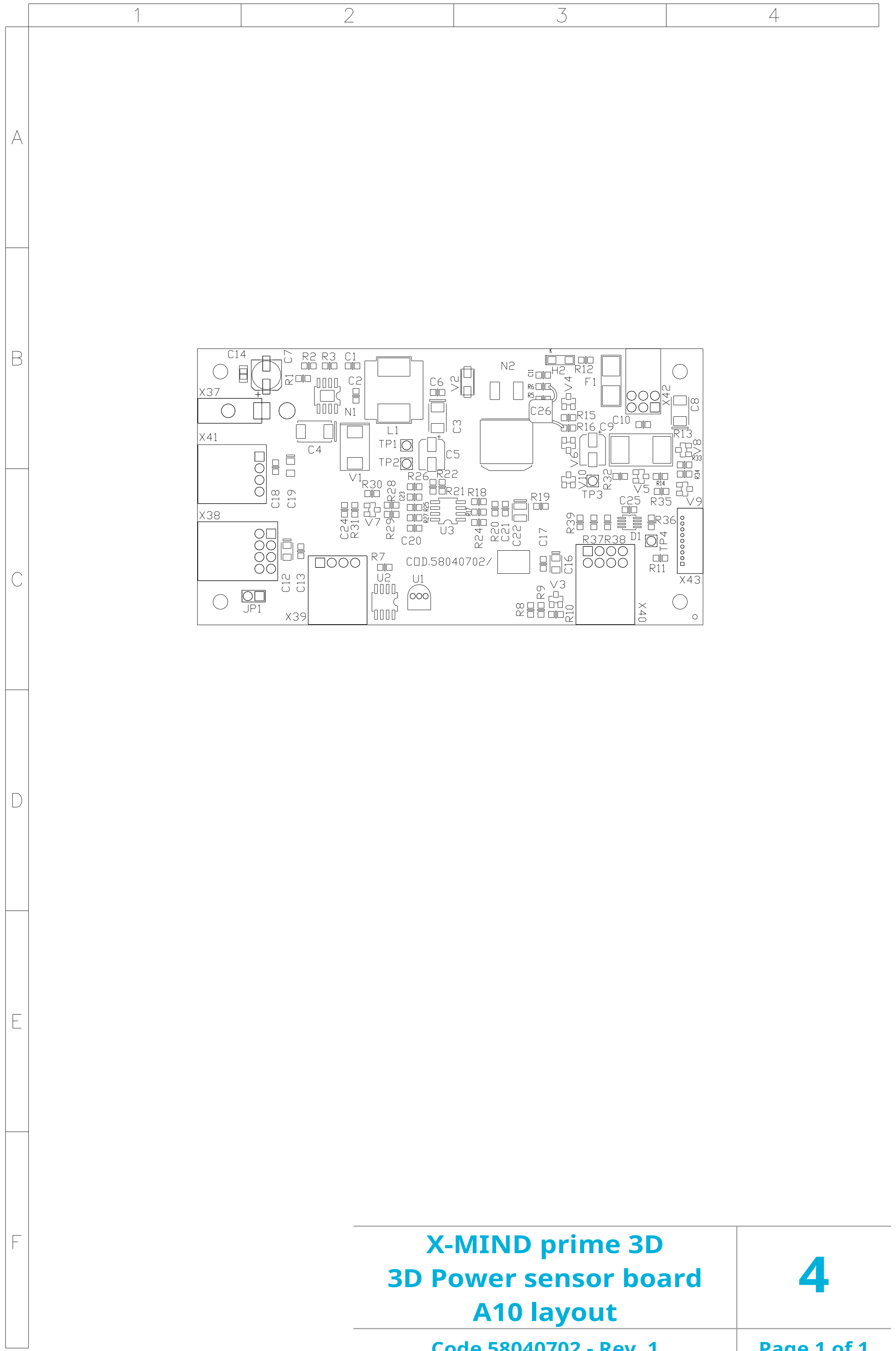


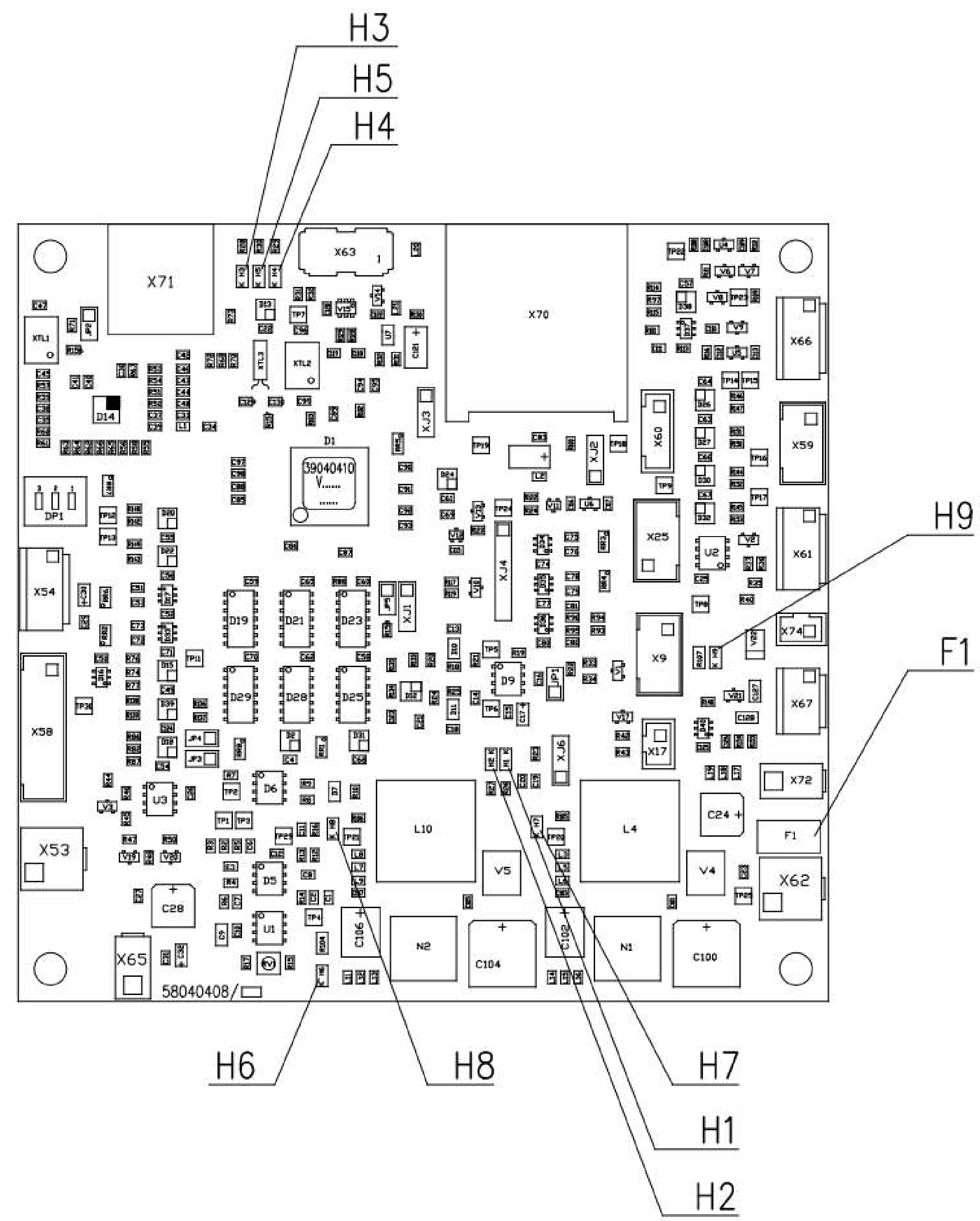
X-MIND prime 3D Generator board A2 layout	3
Code 58040202 - Rev. 3	Page 1 of 1



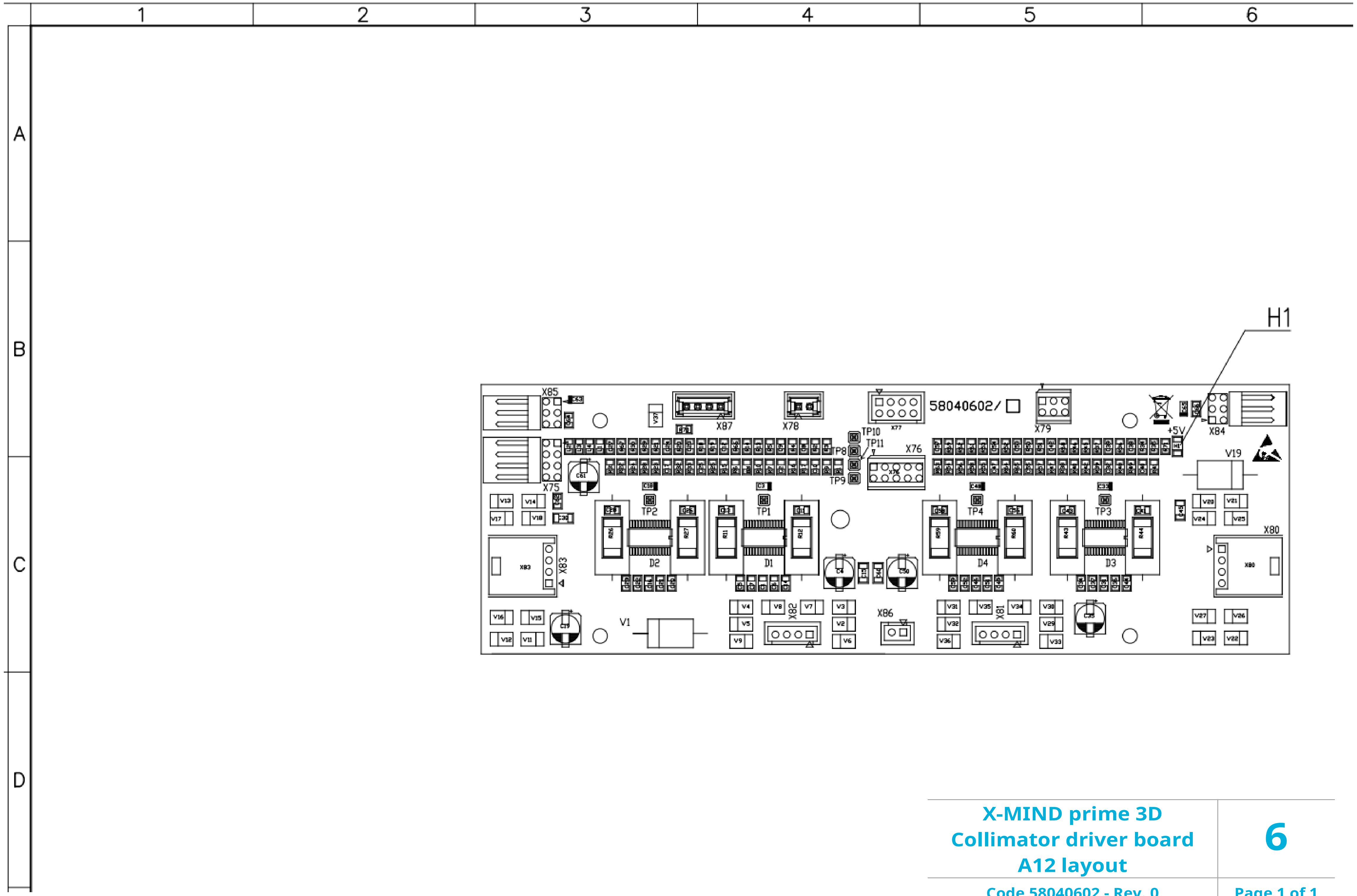
X-MIND prime 3D
3D Power sensor board
A10 layout

4

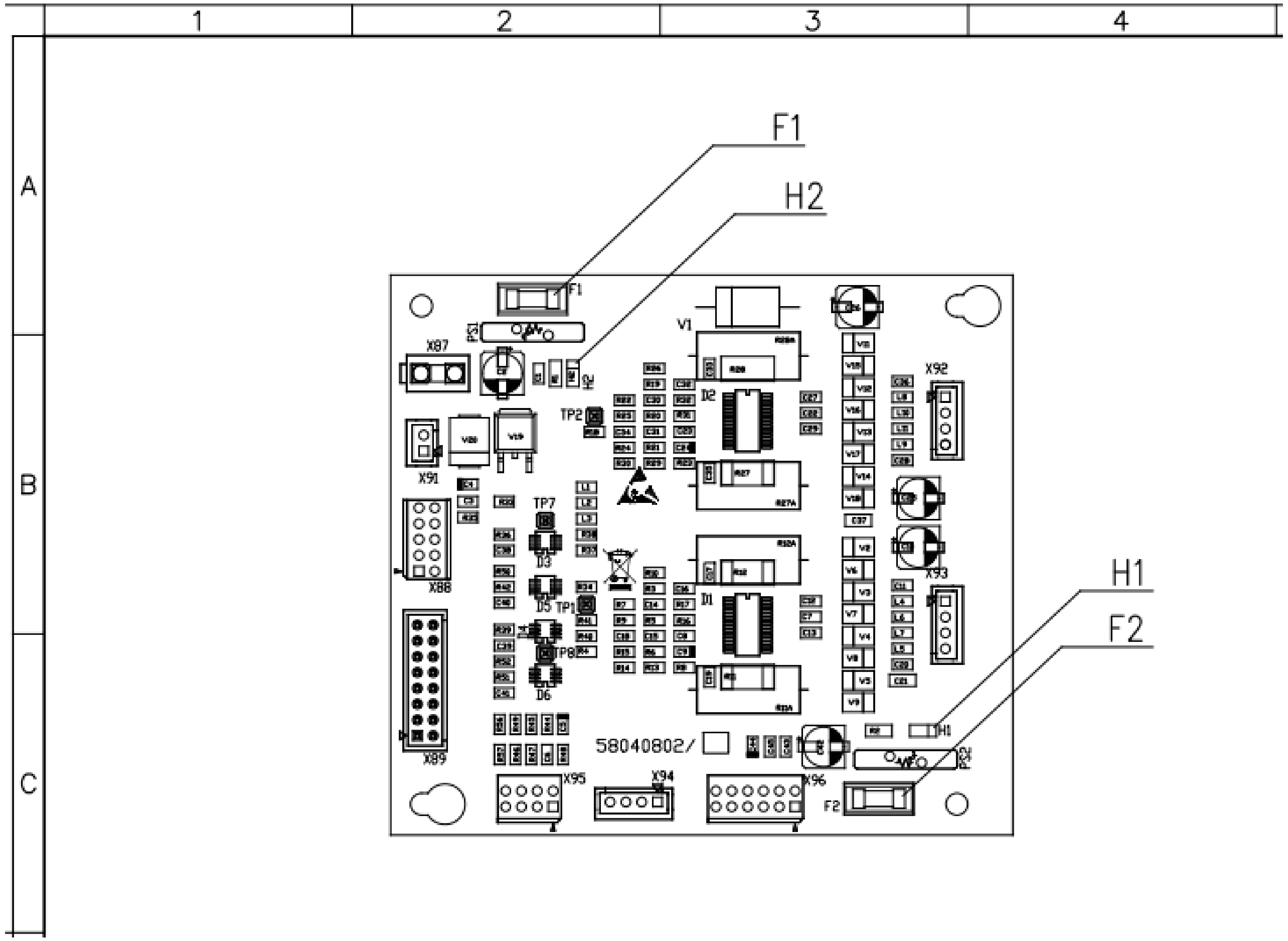
Code 58040702 - Rev. 1



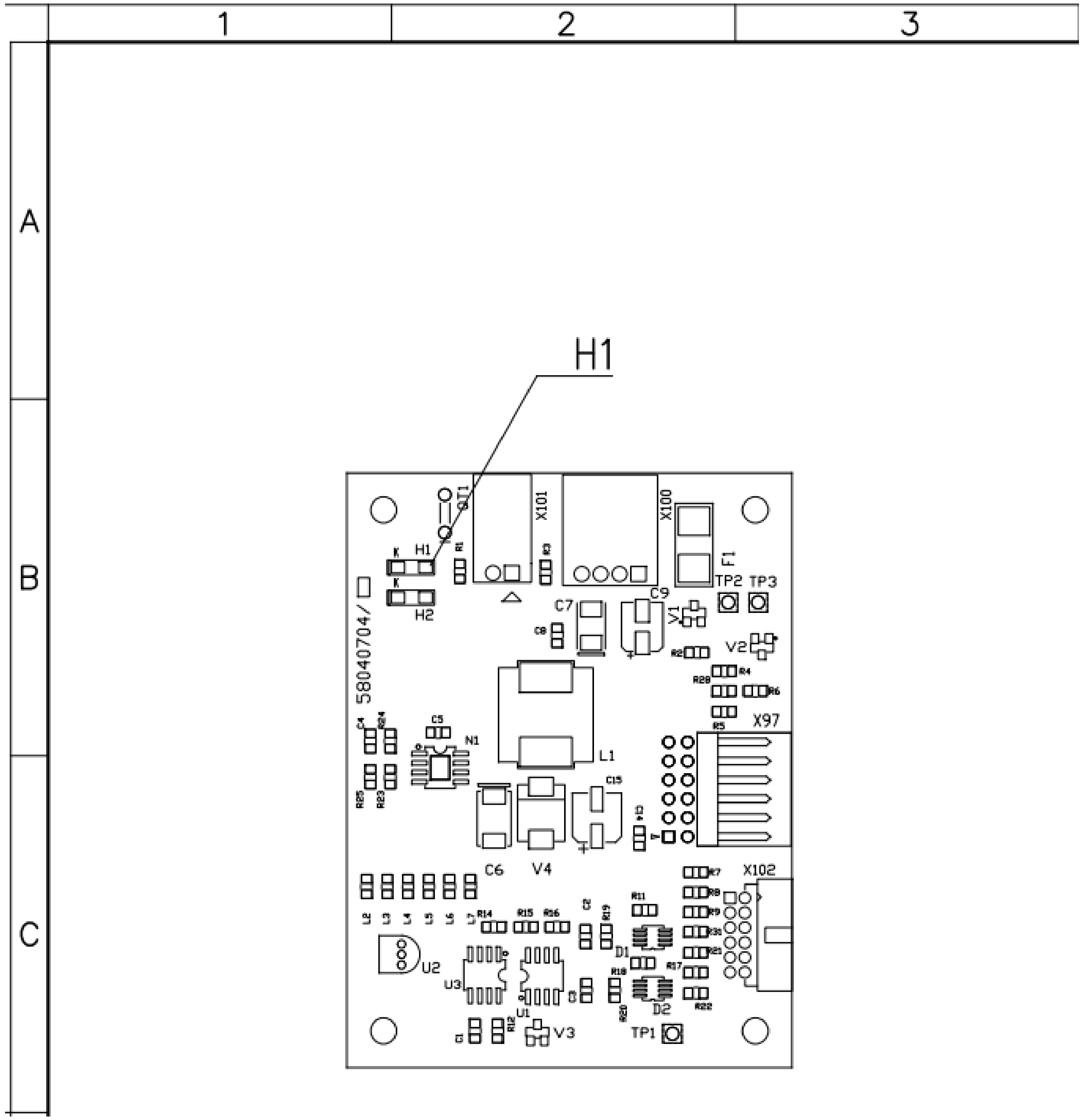
X-MIND prime 3D **CCU board A11 layout**	**5**
Code 58040408 - Rev. 0	**Page 1 of 1**



X-MIND prime 3D Collimator driver board A12 layout	6
Code 58040602 - Rev. 0	Page 1 of 1



X-MIND prime 3D Ceph driver board A13 layout	7
Code 58040802 - Rev. 0	Page 1 of 1



X-MIND prime 3D Ceph sensor power board A14 layout	8
Code 58040704 - Rev. 0	Page 1 of 1

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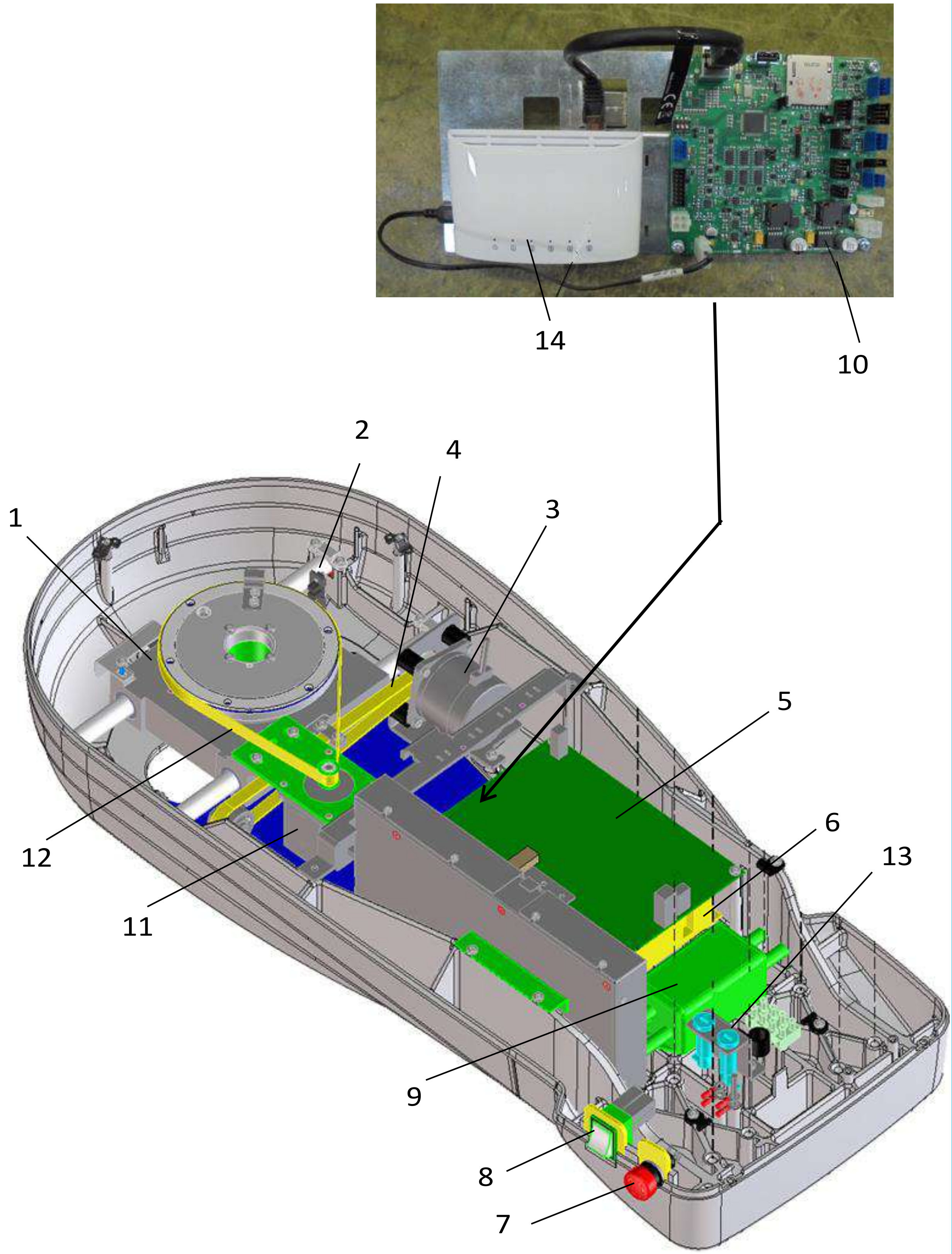
13. SPARE PARTS

13.1 Top side of the unit

13.1.1 Electrical and mechanical part

Ref.	Order code	Description	Note
1	6204041000	Light sensor assy Y axis	
2	6204040900	Light sensor assy rotation	
3	6604041200	Y axis motor assy	
4	4990807000	Y movement belt	
5	5804040700	A1 - CPU (MCU) board	
6	4492824900	G1 - Power supply board	
7	4291421400	Emergency pushbutton	
8	4291422000	ON/OFF Switch	
9	4192212200	Mains filter	
10	5804040800	A11 CCU board	
11	6604041100	Rotation motor assy	
12	4990806900	Rotation belt	
13	6104042100	Fuse kit wide range	
14	4695456700	5 port Gigabit Switch	
15	5804041000	Optical sensor board Ceph position	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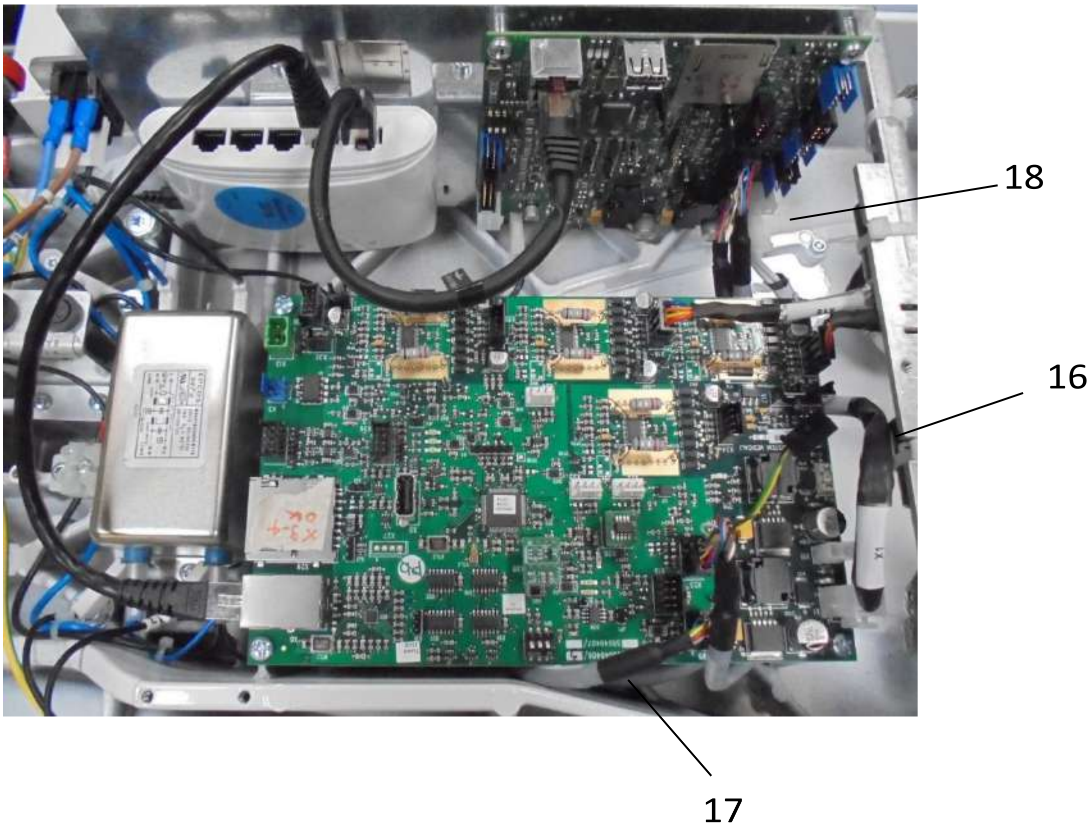
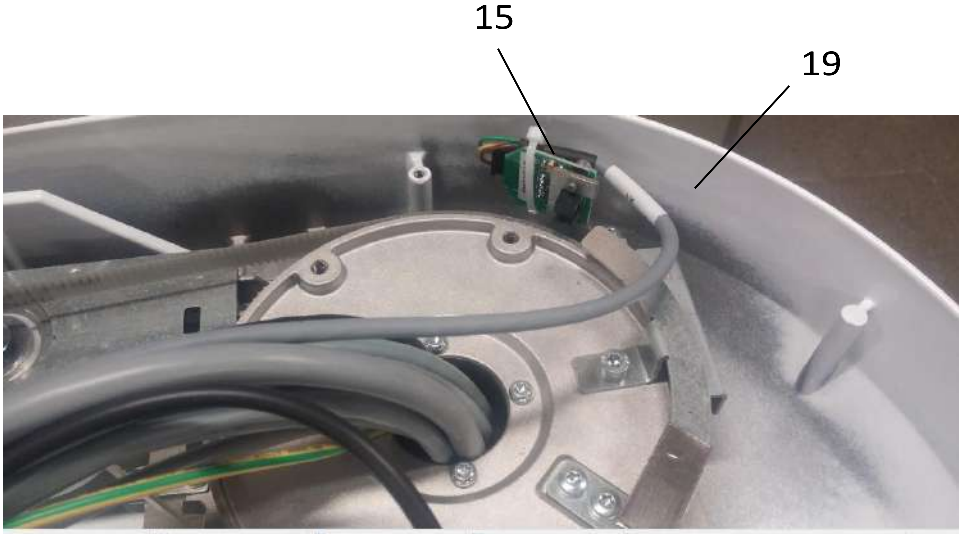
13.1.2 Cable

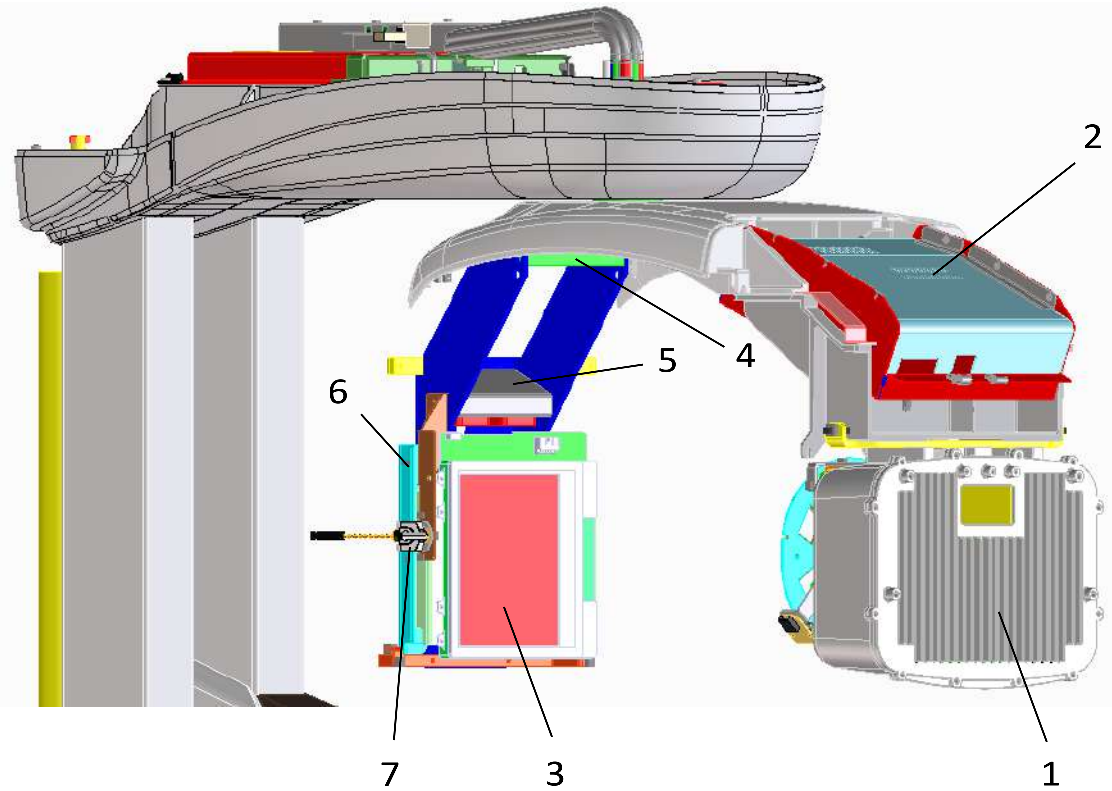
16	6204042300	MCU board power supply cable X1-X62 /J1
17	6204042400	Canbus CPU Ceph board cable X9/X9
18	6204042500	One wire CPU Ceph board cable X25/X25
19	6204043100	Optical sensor cable X25 / X1





13.2 Rotating arm

Ref.	Order code	Description	Note
1	6604001500	Tubehead assy	
2	5804020200	A2 - 3D HF generator and XCU board	
3	6604070100	3D Digital sensor assy	
	including	6204070200 sensor signal cable J15/X43	
4	6604020000	Sagittal laser assy	
5	6604070300	3D sensor fan assy	
6	6204070100	3D sensor power cable J99 / X42	
7	6604020400	Frankfurt laser assy	
8	5804070200	A10 - 3D digital sensor power board	
12	6204070900	Sensor brake assy	
13	6204020300	Hall sensors with cable	

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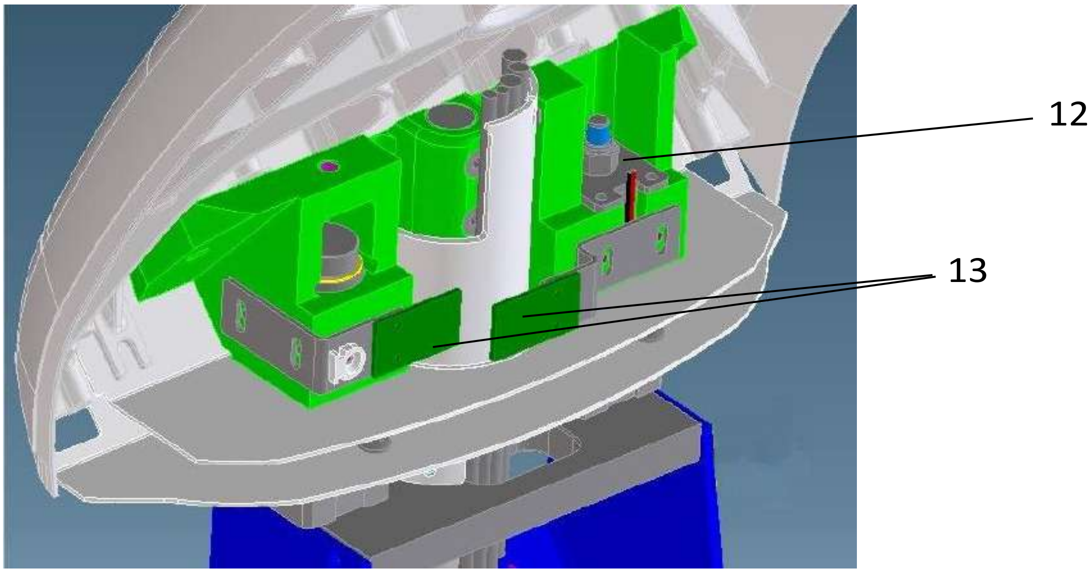
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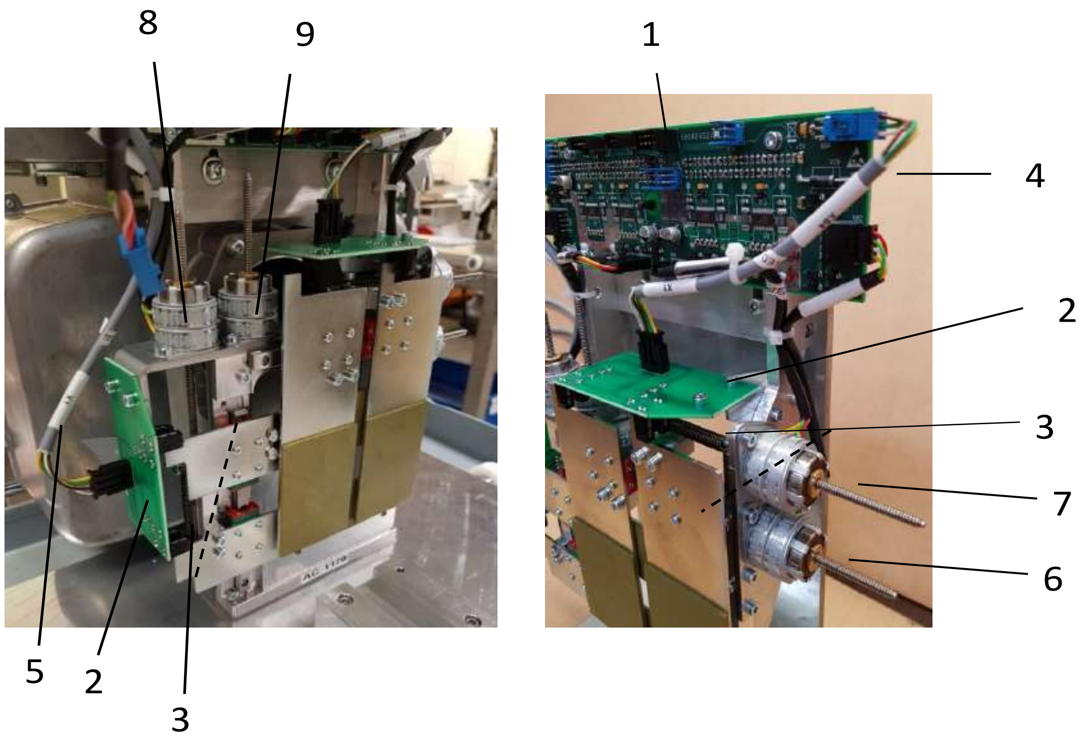
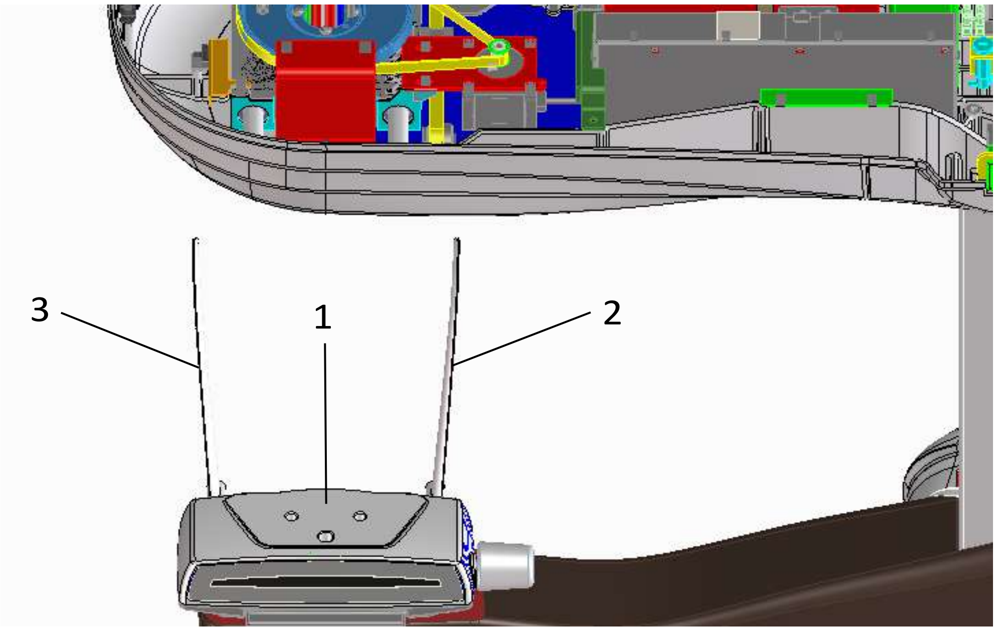
13.3 Collimator

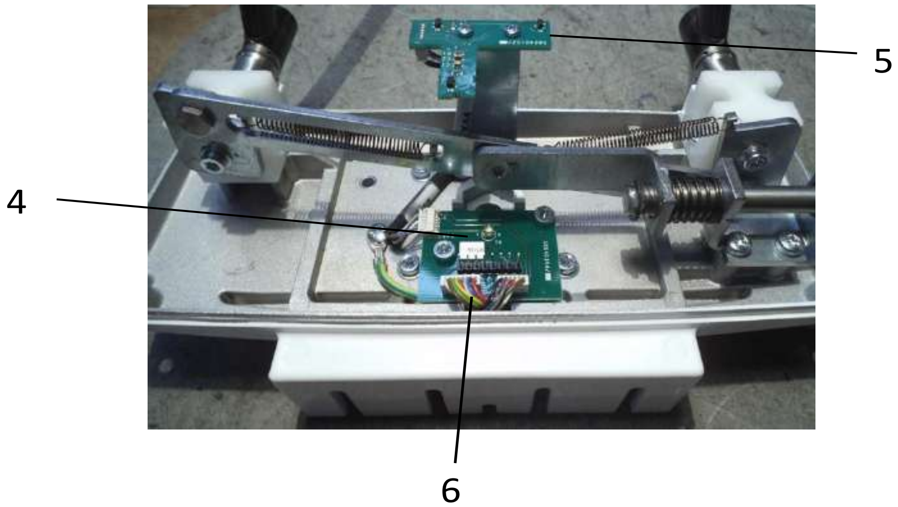
1	5804060200	A12 - Collimator driver board
2	5804060400	Optical sensor board
3	5704060100	Traction spring T31030 DIM
4	6204060100	Horizontal sensor motor cable
5	6204060200	Vertical sensor motor cable
6	6204060300	Horizontal motor 1
7	6204060400	Horizontal motor 2
8	6204060500	Vertical motor 3
9	6204060600	Vertical motor 4



13.4 Chin support

Ref.	Order code	Description	Note
1	6604010500	Chin support assy	
	6604011900	Keyboard assy	
2	6104010112	Temple clasp right	
3	6104010212	Temple clasp left	
4	5804010400	Interface chin rest board A5	
5	5804010200	Sensor chin rest board A9	
6	6204010400	Keyboard cable X46-X47	

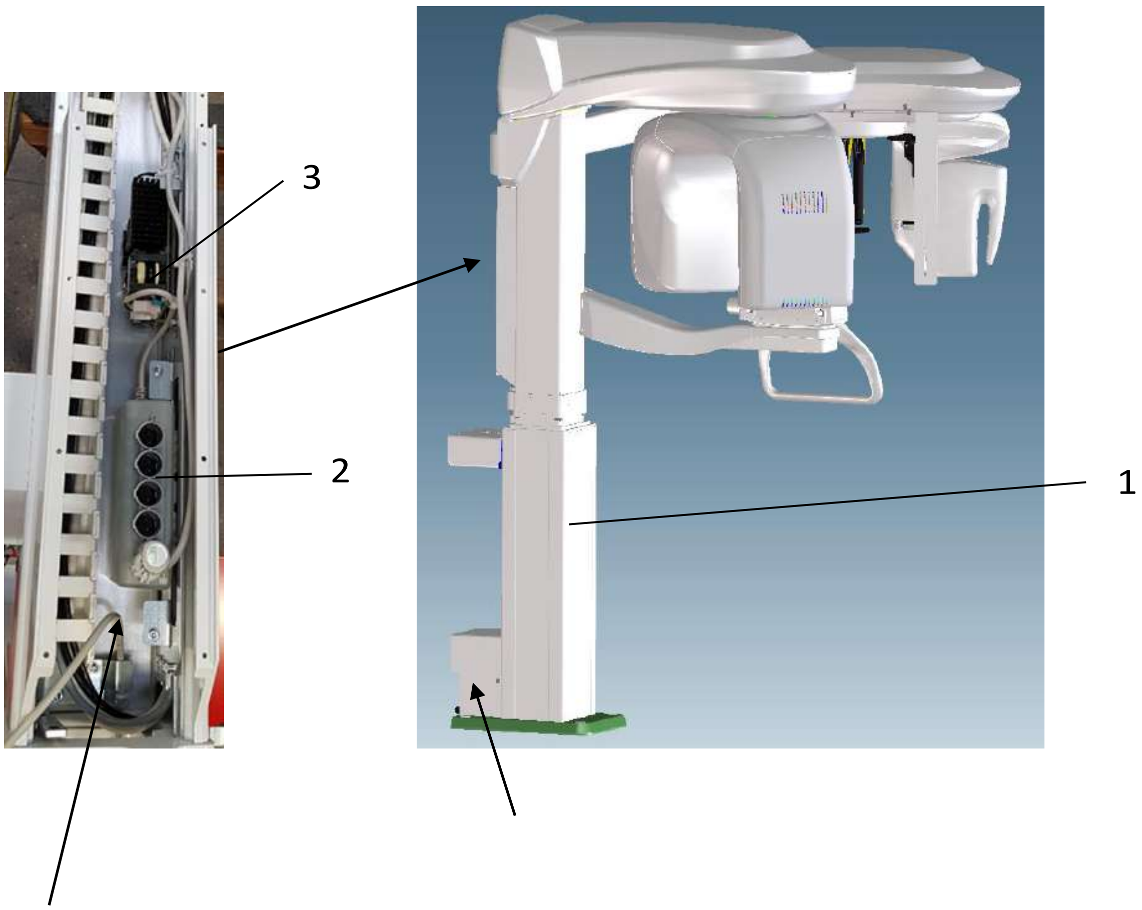


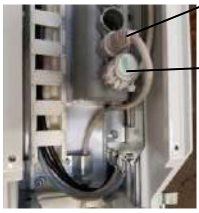


13.5 UP/DOWN Column

13.5.1 Electrical and mechanical part

Ref.	Order code	Description	Note
1	4391100205	Lifting column T-Motion	
2	4492825200	T-Motion control box G3	
3	4492825100	G2 Power supply	
4	5004101800	Control box/Lifting column cable	
5	5004101900	Control box signal cable	
6	5859301200	A8 - External signal board	
7	4591851000	RJ45 Cat6 adapter	

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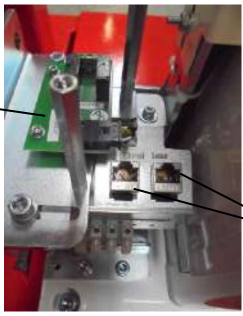
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13.5.2 Cable

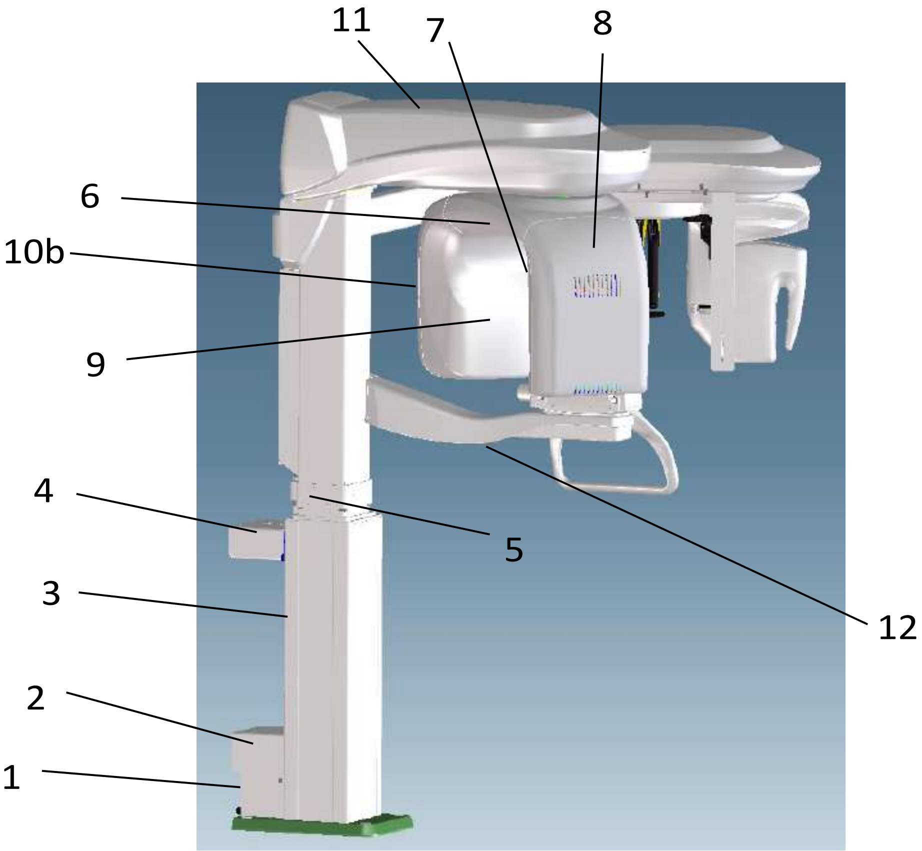
Ref.	Order code	Description	Note
--	6204043200	X-ray push button with cable	
--	6204011400	Chin rest signal cable X12-X24-X36 / X46-X47 X1B4	
--	6204011500	Chin rest motor cable X20 / X49	
--	6204101200	Power switching cable J1	
--	6204101000	Power cable	
--	6204101100	Signal & Rx cable X8-X51 / X10-X13	
--	5007080200	Ethernet cable CAT 6	

13.6 TOP side / Rotation arm cables

Ref.	Order code	Description	Note
--	6204040500	Laser 1 cable X16	
--	6204040600	Laser 2 cable X17	
--	6204040100	HF board power supply cable Z1 / X31	
--	6204040200	HF board signals cable X15 / X32	
--	6204041800	Power Sensor 3D board cable X11 / X37	
--	6204042600	Collimator signal cable X59/X77	
--	6204042700	Collimator power cable X67/X75	
--	6204042800	Collimator motor signal cable X66/X76	
--	6204043000	Signal pan sensor cable X61/X38	
--	5004040300	Ethernet cable CAT 6	

13.7 Covers

Ref.	Order code	Description	Note
1	5604101405	Rear base cover	
2	5604101505	Base cover	
3	5604101605	Duct	
4	5604101705	Upper cover	
5	5604103305	Lateral cover	
6	6604020305	Rotating arm lower cover	
7	6604020805	Sensor internal cover	
8	6604020921	Sensor external cover	
9	6604020205	Tube head internal cover	
10b	6604020621	Tube head external cover with logo	
11	6604041105	Upper cover	
12	5404090205	Lower guard 3D chin rest arm	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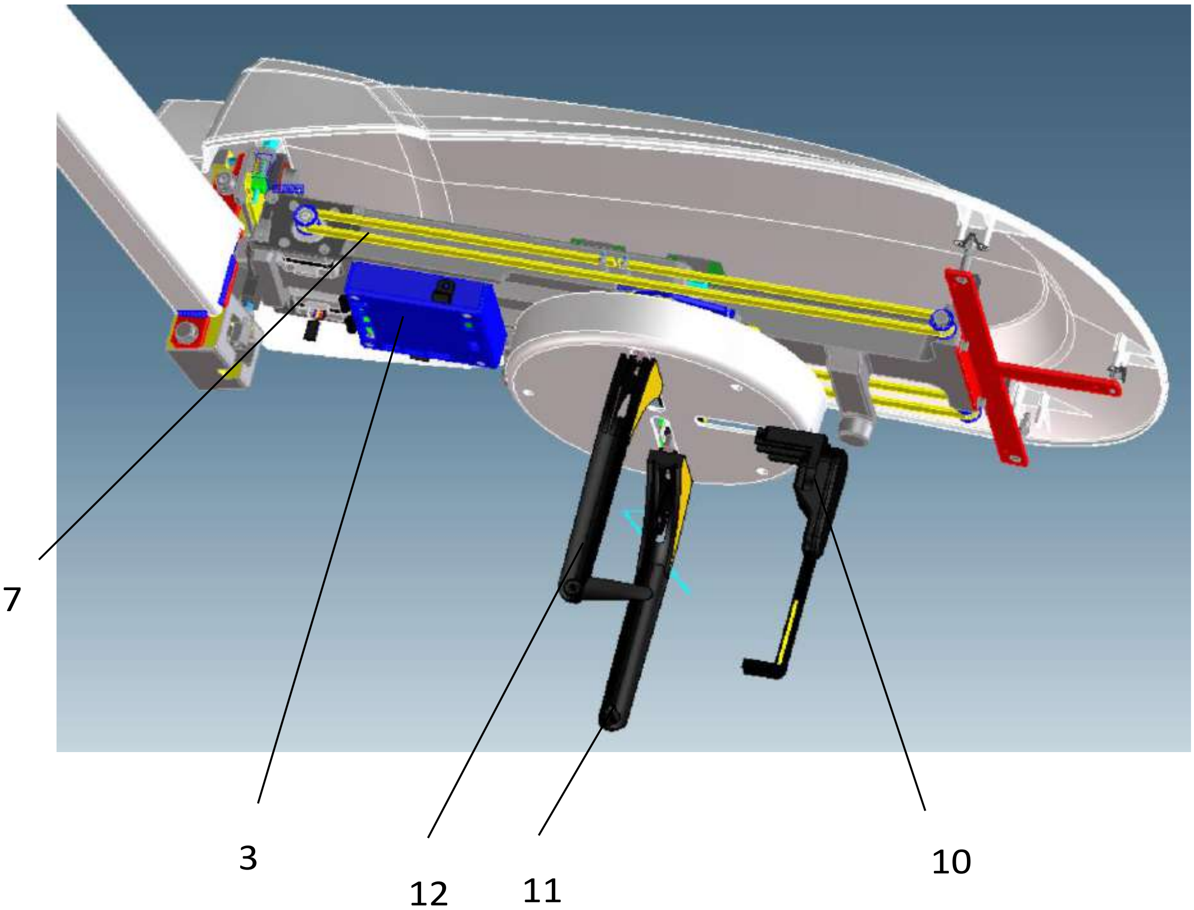
13.8 CEPH Arm and Mobile Sensor

13.8.1 Electrical - mechanical part & cables

Ref.	Order code	Description	Note
1	6204080300	Ceph collimator motor with cable X93	
2	6204080400	Ceph sensor motor with cable X92	
3	5804080200	A13 - Driver Ceph board	
4	6204080500	Nasion potentiometer with cable X94	
5	6204080600	Ceph motor sensor cable	
6	5404081312	Brake lever	
7	4990804800	Open belt 10 T2.5 roll 1.025m	
8	5711418800	Traction spring 6,6x33,5x0,7	
9	4910322900	Radial bearing 4x13x5	
10	6107080700	Nose rest group	
11	6104080900	Right head support Assy	
12	6104081000	Left head support Assy	
13	4990806900	Belt	
14	5404070400	Fixed part sensor connection	
15	5804070600	A15 - Fixed Pogo-pin board	
--	6204080800	Signal ceph cable X58 / X89	
--	6204080900	Signal motor ceph cable X54 / X88	
--	6204081000	Power ceph cable X53 / X87	
--	6204080700	Signal sensor ceph cable X96 / X96	
--	5007080200	Ethernet cable CAT 6	
--	6104081300	Hand support plate for carpus exam	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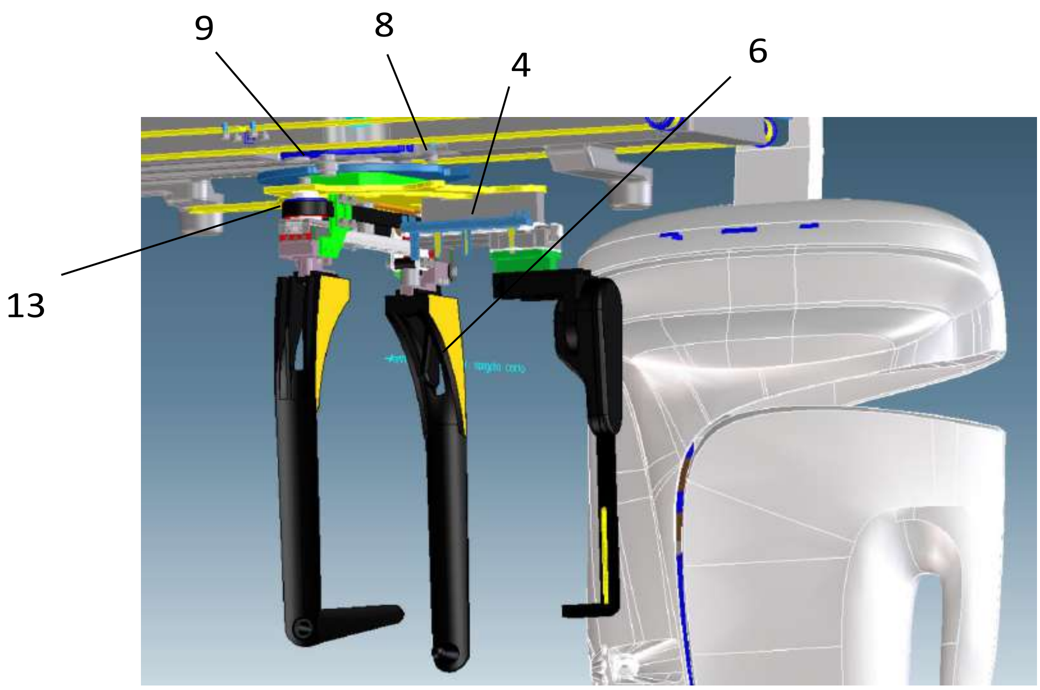
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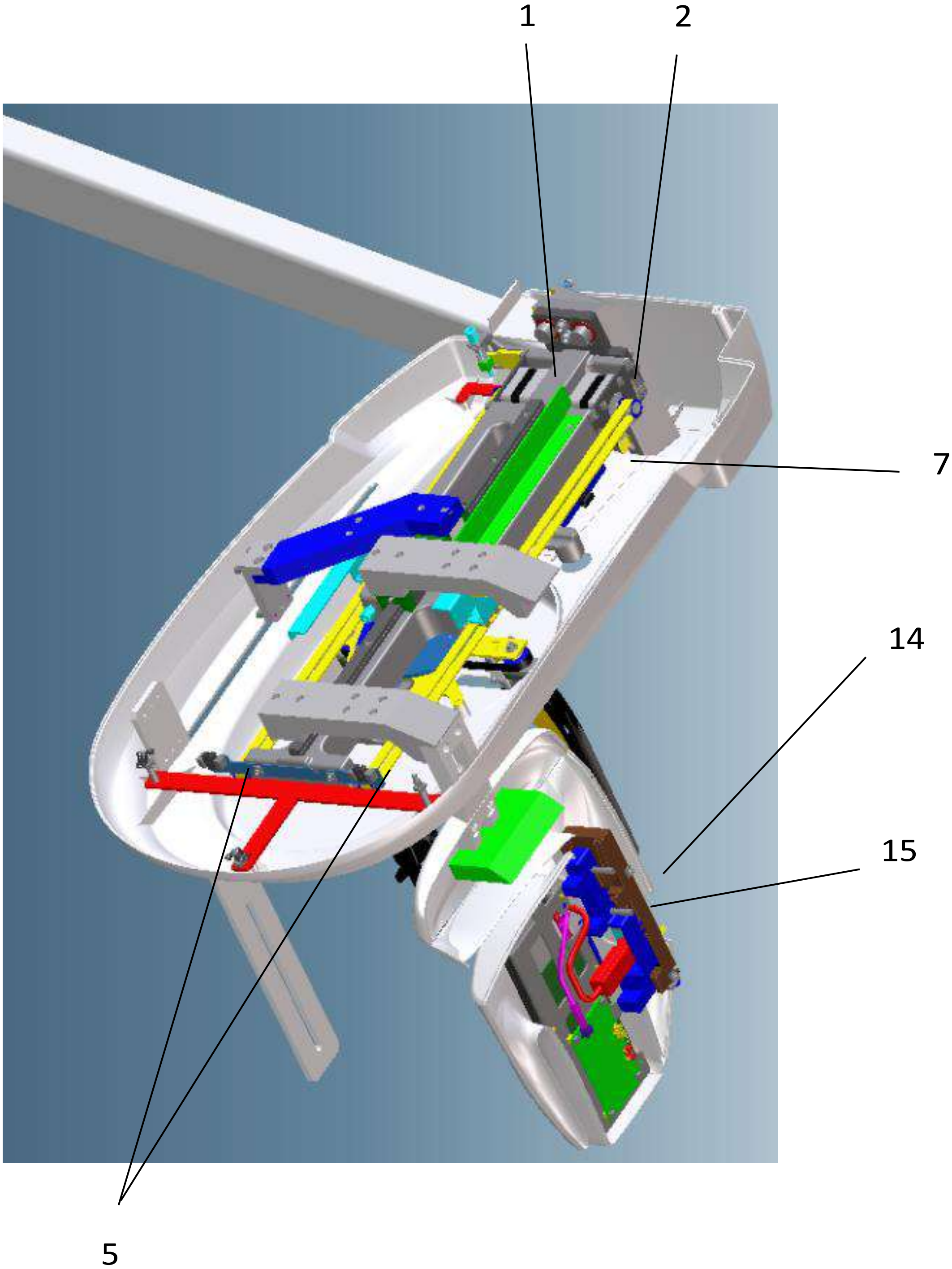
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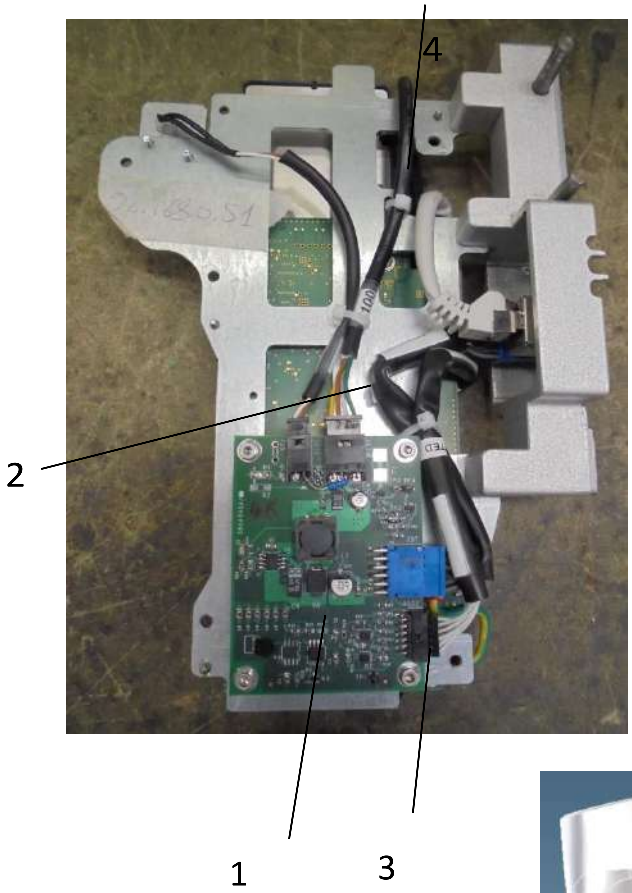
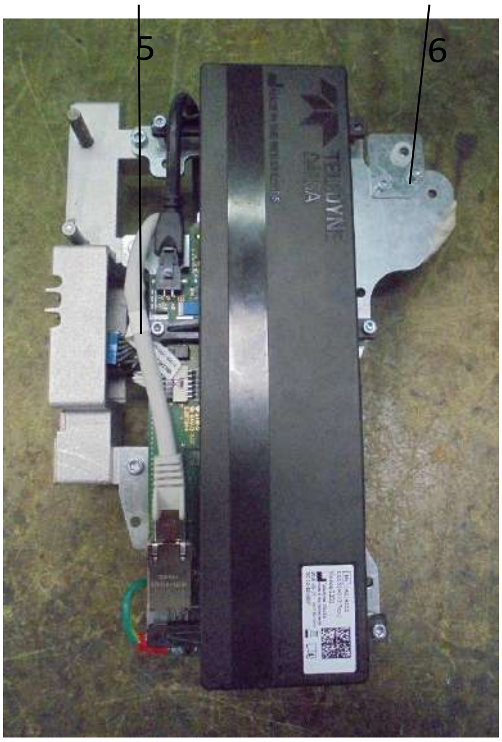
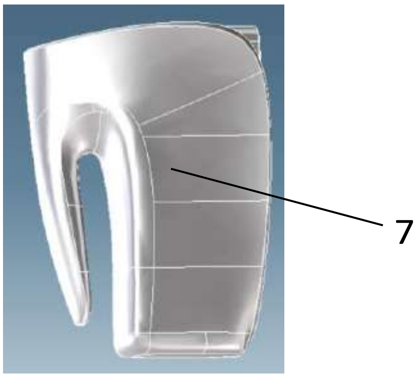
13.8.2 Mobile Sensor

1	5804070400	A14 Power sensor board
2	6204070400	Power & signal pogo pin-sensor cable X103 / X97
3	6204070500	Signal sensor cable X102 / Sync
4	6204070600	Power sensor cable X100 / Pwr
5	5004070100	Ethernet cable CAT 6
6	6104070800	Sensor led assy
7	7104070600	2D Ceph Mobile sensor Assy

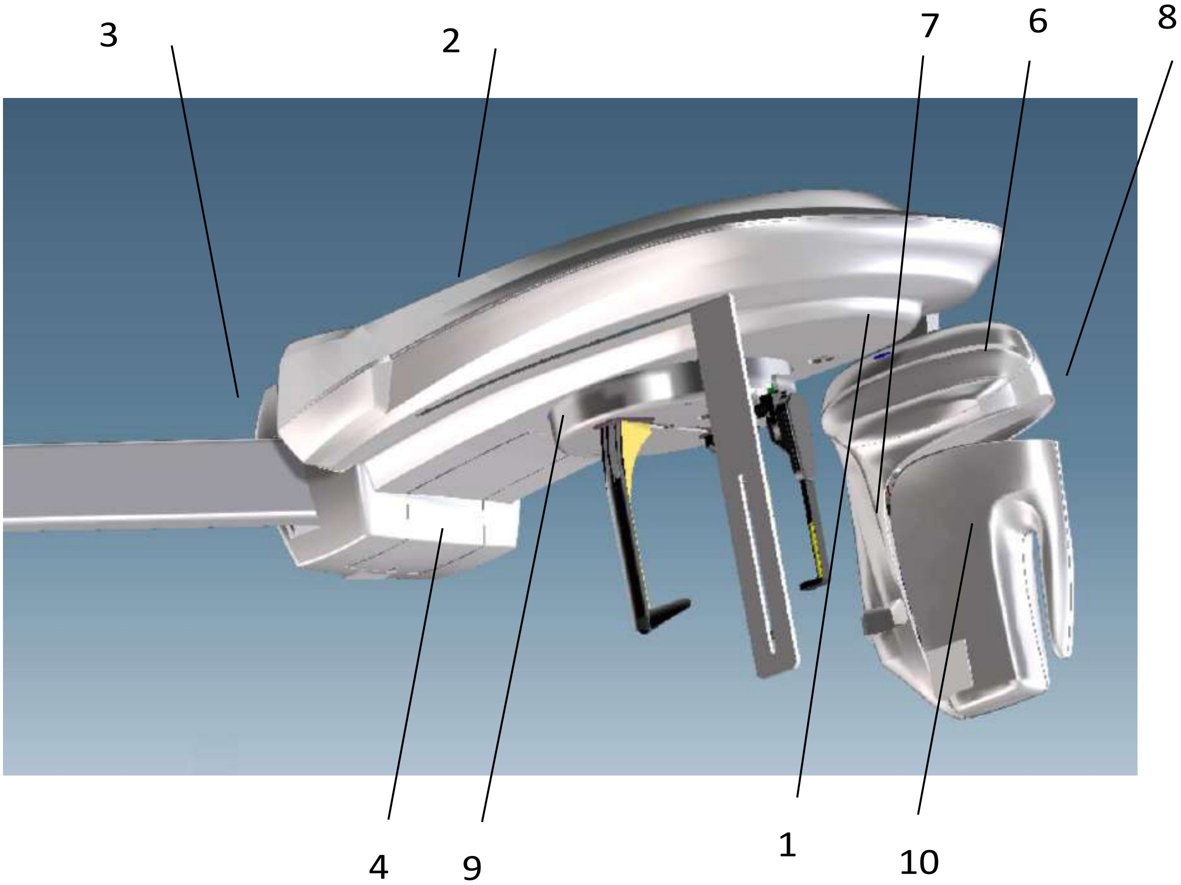






13.8.3 Covers

1	5404080205	Ceph lower cover
2	6104081100	Ceph upper cover
3	6104081200	Ceph rear arm cover
4	5404080305	Ceph CS cover
5	5404080505	Ceph cover arm
6	5404080405	Ceph sensor cover
7	5404070700	Ceph fix cover – 1 -
8	5404070800	Ceph fix cover – 2 -
9	5404080605	Head rest rotation cover
10	5404070200	Sensor cover 1
10b	5404071000	Sensor cover 2 with logo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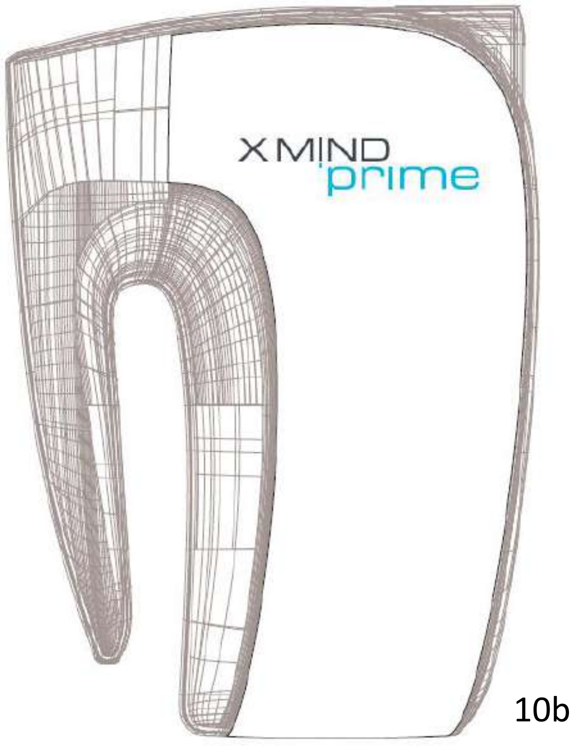
X MIND prime
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13.9 Accessories and Service tools

Ref.	Order code	Description	Note
--	6607090100	PAN centering bites (50 pcs)	
--	6107110700	Disposable bite protective sleeves (100 pcs)	
--	6604011505	Panoramic standard chin support	
--	6604011705	Panoramic chin support (reduced height)	
--	5407098100	Edentulous patients appendix	
--	6604011605	Maxillary-Sinus chin support	
--	6604011800	TMJ positioner	
--	6107110800	TMJ positioner protective sleeves (60 pcs)	
--	6695190000	Service tools kit	
--	6104081500	Ear protection pack (300 pcs)	

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14. APPENDIX

14.1 Appendix A: Setup parameters table

The following table lists those adjustment parameters stored in the unit during factory testing and that must be re-entered into the non-volatile memory in case of replacement of the MCU board (A1). This is due to the fact that the new MCU board, provided as a spare part, has been factory tested from the functional point of view, but contains only default parameters which are not related to the unit where it will be installed.
Entering of the listed parameters can be performed through the service programs (see chapter 8).

Note
The information listed in the table are the technical parameters set during factory testing. Preferences set by the user (e.g. exposure parameters different than the default ones) are not listed.

The table also has columns with blank cells. These cells must be filled in when, during installation or during the life on the unit, any of the listed parameters will be modified (e.g. after replacing a motor or a positioning sensor).

X-MIND prime 3D

Unit code:____________________________________

Unit S/N:____________________________________

U.I.C.:____________________________________

<table>
<tr><th colspan="2">Parameter</th><th>Factory setting</th><th>New setting</th><th>New setting</th><th>New setting</th><th>New setting</th></tr>
<tr><td colspan="2">Date</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><th colspan="7">Panoramic Exams</th></tr>
<tr><td colspan="2">Rotation axis motor offset</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Y axis motor offset</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">X Chin rest</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Bitewing Y offset</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Y Jaw type [mm]</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><th colspan="7">3D Exams</th></tr>
<tr><td colspan="2">Lateral Offset z=0</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Lateral Offset z=300</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Y axis 3D</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Y axis Extended volume [mm]</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><th colspan="7">Ceph Exams</th></tr>
<tr><td colspan="2">Rotation axis motor offset</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Y axis motor offset</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">X Ceph sensor motor offset</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">AP-Carpus Offset [mm]</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Secondary collimator motor</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Secondary collimator normal resolution</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">Nasion potentiometer calibration</td><td>Min</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Max</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Parameter		Factory setting	New setting	New setting	New setting	New setting
Primary collimator offsets						
W0 Panoramic windows	H0					
	HW					
	VO					
	VW					
W4 3D windows	H0					
	HW					
	VO					
	VW					
W6 Ceph windows	H0					
	HW					
	VO					
	VW					
HO=Horitzontal offset, HW=Horizontal width, VO=Vertical offset, VW=Vertical width						
Tubehead preheating values (Filament levels)						
Tubehead pre-heating values	2mA					
	3mA					
	4mA					
	5mA					
	6mA					
	7mA					
	8mA					
	9mA					
	10mA					
	11mA					
	12mA					

CE 0051

de Götzen S.r.l.
Via Roma 45 • 21057 OLGIATE OLONA (VARESE) • ITALY
Tel +39 0331 376 762 • Fax +39 0331 376 763
E-mail: imaging.italysupport@acteongroup.com •
www.acteongroup.com