X MIND prime

X-MIND prime 3D
Service Manual

SERVICE MANUAL • X-MIND prime 3D • (19) • 10/2019 • NXMPEN060C

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.

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, DSPU, HF(XCU), OSP/VSP, AIS (see chapter 0)
- 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.

Equipment has been designed 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 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.

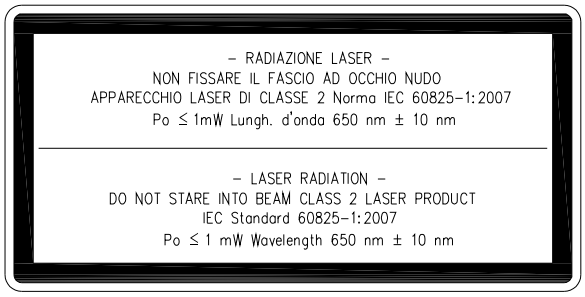
Note
When the unit is switched on, do not move the rotating arm or the tube-head).

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.

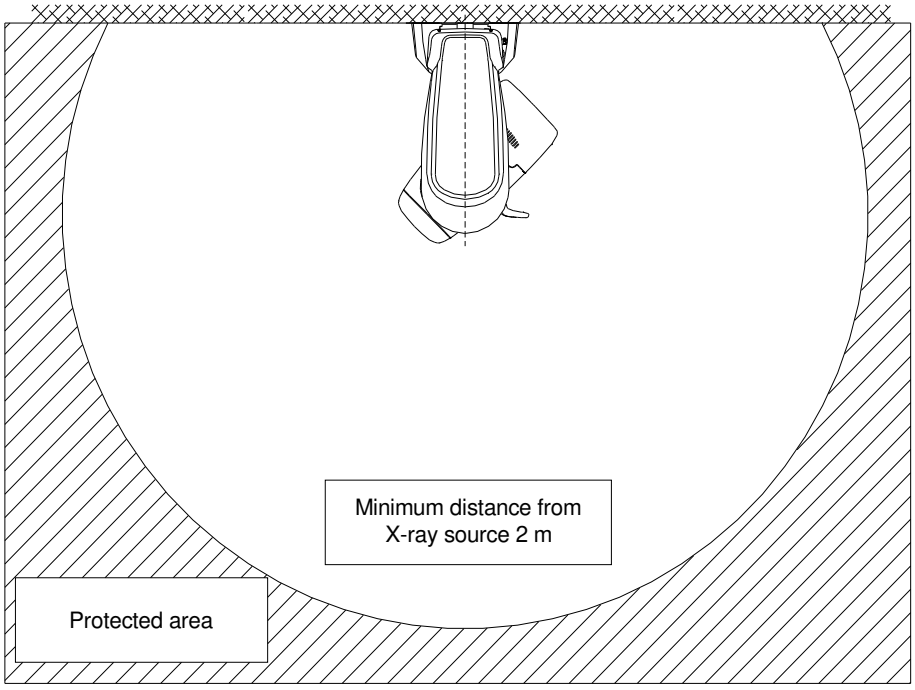


Figure 1

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.5E L=5 m - code 5007090100
- Ethernet cable CAT.5E 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 the EUT requires continued operation during power mains interruptions, it is recommended that the EUT 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.

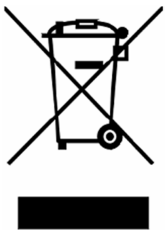
- The initial software installation and system set-up shall be done by authorized and trained personnel only and using the software provided with the machine.
- Any software or firmware upgrade of the equipment shall be done by authorized and trained personnel only.
- After any software or firmware upgrade, 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)
	X-Ray emission (the corresponding yellow LED is on)
	Electronic instructions for use symbol for medical devices, according to EN ISO 15223-1: 2016

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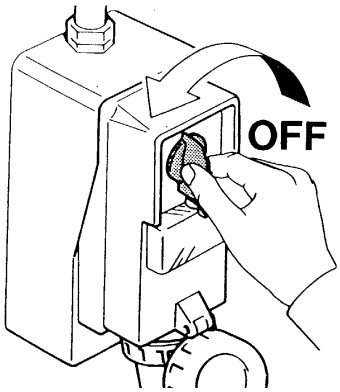
3. CLEANING AND DISINFECTION

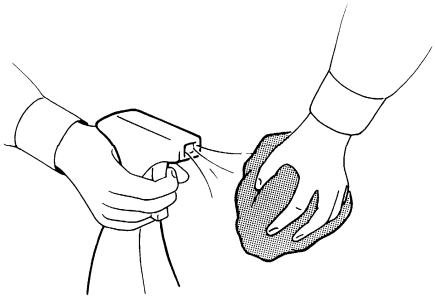
In order to guarantee a good level of hygiene and cleaning, it is necessary to carry out the following procedures.



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 must be replaced after each exam.
Thoroughly clean the chin support, resting handles and temple clamps group whenever they are used.
The chin support, resting handles and temple clamps group 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.

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4. DESCRIPTION

4.1 Identification labels and laser labels

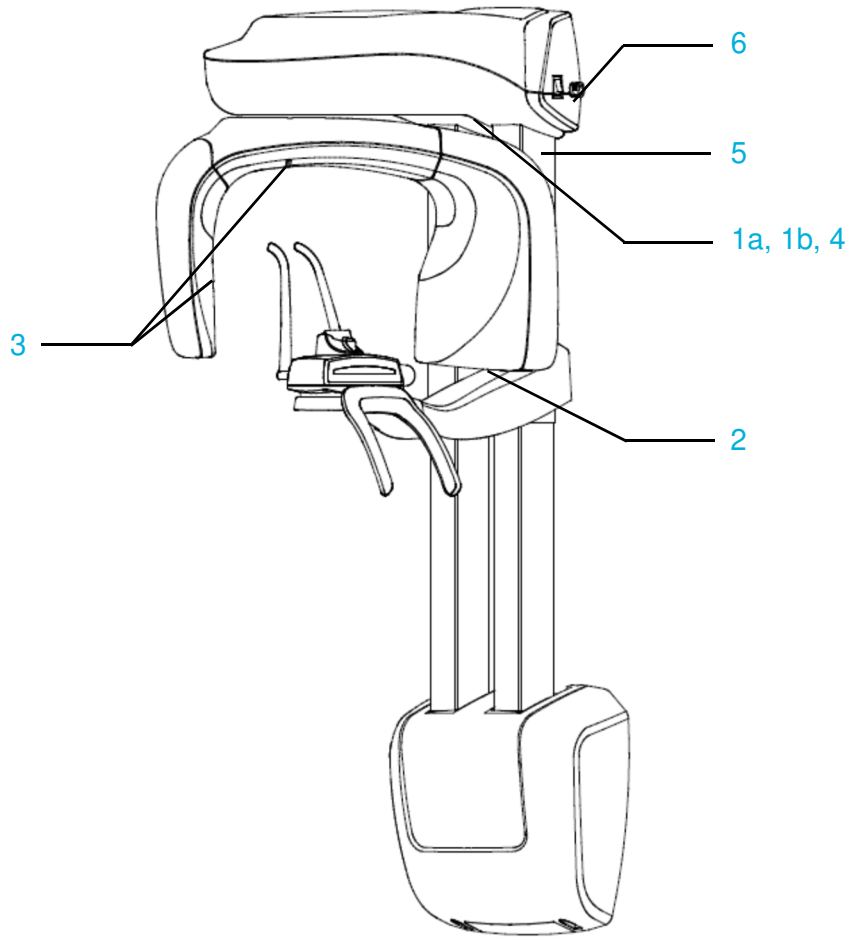
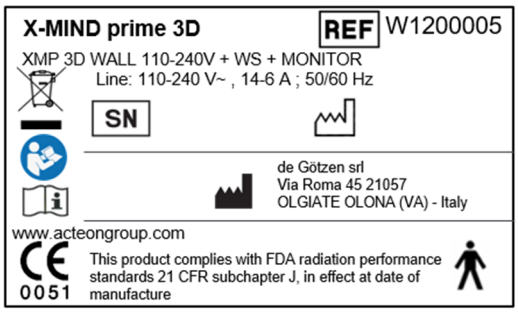


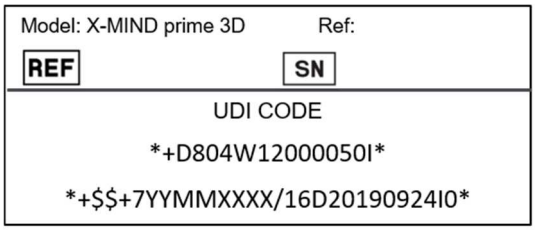
Figure 2: Identification labels

4.1.1 Identification labels and laser labels

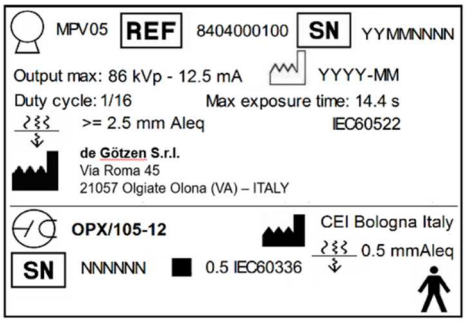
1a
X-MIND prime 3D identification label



1b
UDI label

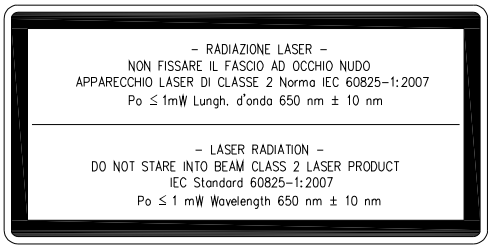


2
Tube-head identification label

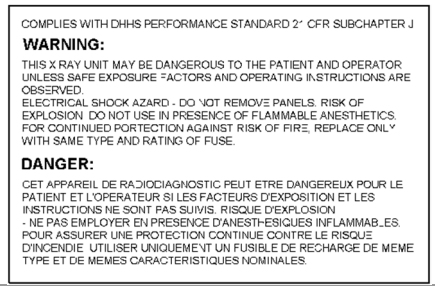


3
(No. 2) Laser symbol label

4
Laser WARNING label



5
WARNING label



6
Emergency button label

4.2 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.

4.3 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 and collimator motor
- Zero position sensors
- X-ray button
- External signal board (A6)
- Lift motors control rack (G2)
- Generator board (A2) ---> (Tubehead)
- Overlay
- 3D sensor Power board
- Sensor 3D ---> (PC) Ethernet 1
- DSPU board (A14) ----> (PC) Ethernet 2

MCU board, DSPU board and HF board are equipped with a local microcontroller that shares information using a CANbus transmission line and protocol.

4.3.1 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) and a 24Vdc 8,4A switching mode power supply (located under the MCU board) G1 which supply 24 Vdc to the MCU board, that generates the different voltages to the unit and the 24 Vdc to the 3D power board.

- Main power supply drives also the up/down motors (M1 and M2) through the motor column driver board (G2) located in the lower part of the unit. Safety switch S2 located in the top side of the unit (red button). In case switch is pressed, the up/down movement is inhibited.
- Main power supply is also provided to the Generator Board A2 used to generate High voltage to the tube head.
- Main power supply is also provided to the 3D power board used to generate High voltage to the Sensor 3D.

The unit does not include a voltage selector circuit for the mains voltage. Therefore, the unit is manufactured in different versions, depending on the line voltage of the installation place.

4.3.2 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.
- Driving of the 4 stepper motors which compose the system.
- Managing the signal of position for the lift motors through the Linak motor driver board.
- 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 luminous 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 and the HW key including the data of XP exams. Adapter board includes the programming data.

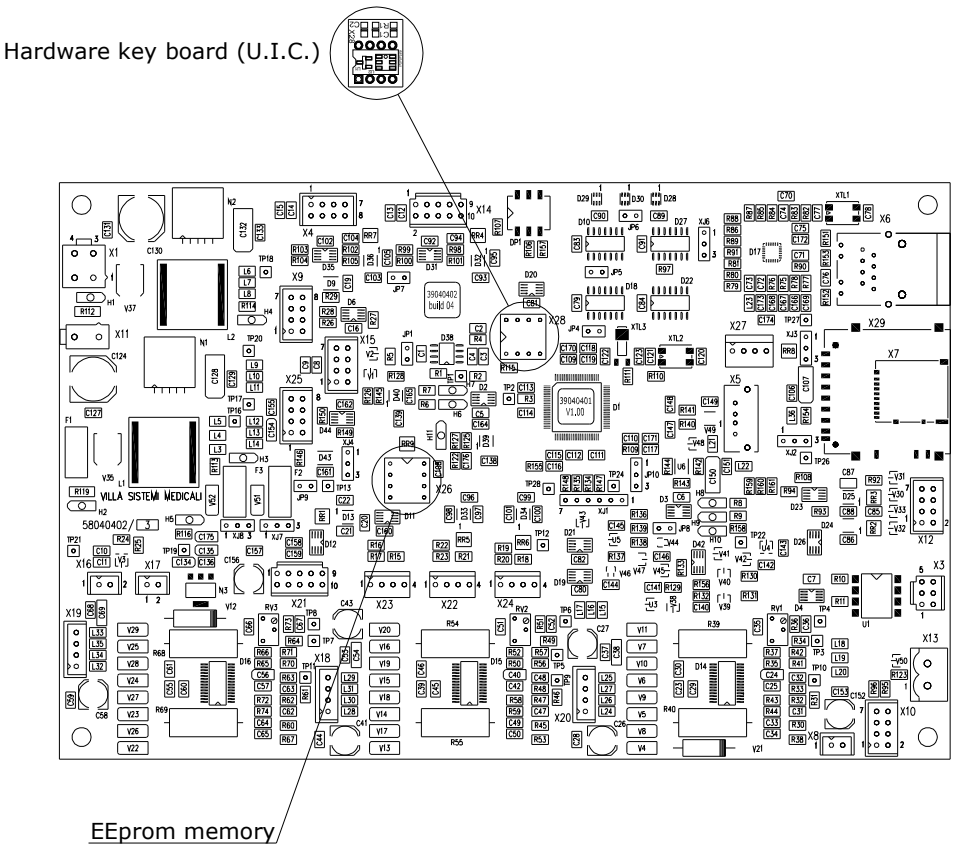


Figure 3

4.3.2.1 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 7.15.2)
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<. - Collimator type setting (see paragraph 11.2.6).

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

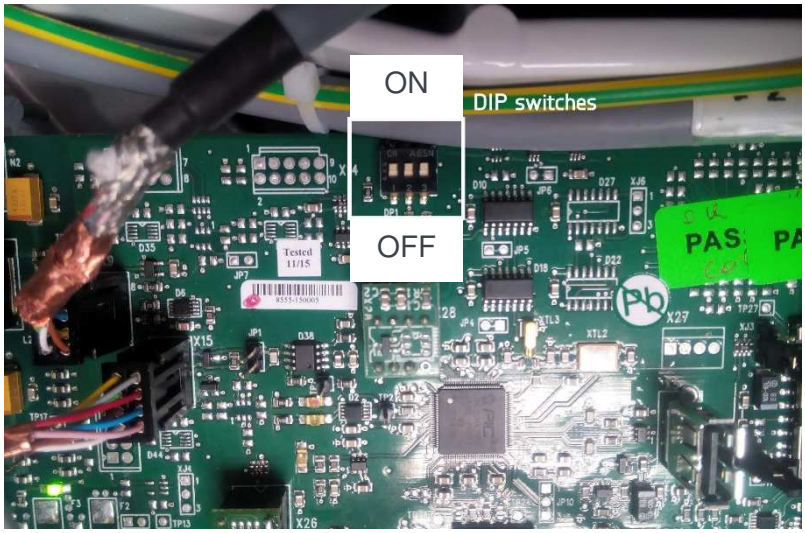


Figure 4

4.3.3 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.

4.3.4 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.
- Give to the MCU the disk collimator light barrier signal.
- Allows the transmission of the 3D exams clock signal from the Generator board (A2) through the MCU to the 3D Sensor.

4.4 Keyboard - Description and functions

Figure 5 shows a general view of X-MIND prime 3D control Interface.

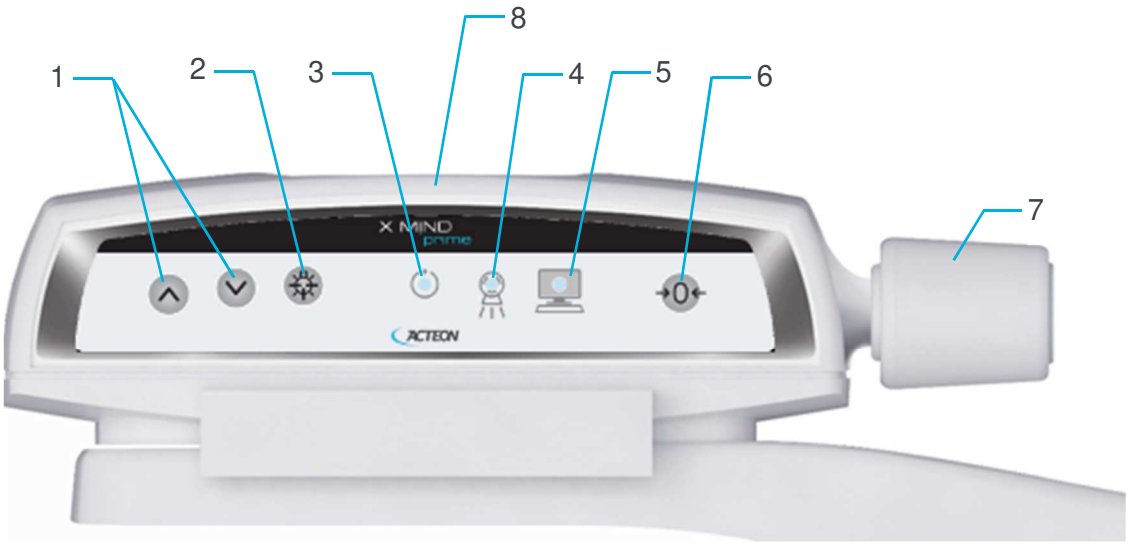
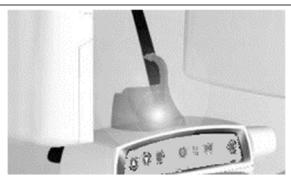


Figure 5 - Keyboard

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	14A @ 110V 50/60Hz 6A @ 240V 50/60Hz
Technical factors for maximum line current	86kV, 12.5mA
Power consumption	1.8kVA @ 110V 50/60Hz 1.4kVA @ 240V 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)	3 A T 250V 6.3x32 mm 10kA@125V 1.6 A T 250V 6.3x32 mm 100A@250V
Line apparent resistance	0.4 Ω max (99-132 V) 0.5 Ω max (198-264 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
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 L/R • 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)

(*) In case collimator kit code 6604061200 is present, 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 (*)

(*) 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	2812.5mAs/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 6
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

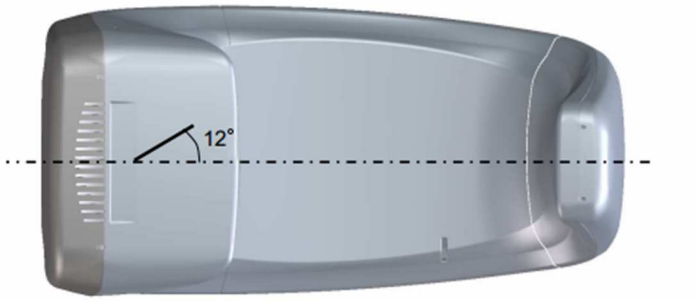


Figure 6: Tube-head target angle (view from the bottom)

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

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
Resolution (spatial frequency at CTF=5%)	4.16 lp/mm
Sensor cover attenuation equivalent	< 0.4 mm Al eq.

Mechanical characteristics	
Focal spot to image receptor distance	52 cm (20")
Telescopic motorised column run	66 cm (26")
Maximum total height Note: For the wall mount model this value refers to the recommended installation height	219 cm (86")
Weight	67 kg base version
Column base (optional)	6 kg
Working conditions	
Minimum room size (please refer to the Service Manual)	120 x 115 cm
Recommended room size (please refer to the Service Manual)	160 x 150 cm
Working temperature range	+ 10°C ÷ + 35°C
Relative working 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, prevents the development of micro-organisms.

5.1 Dimensions

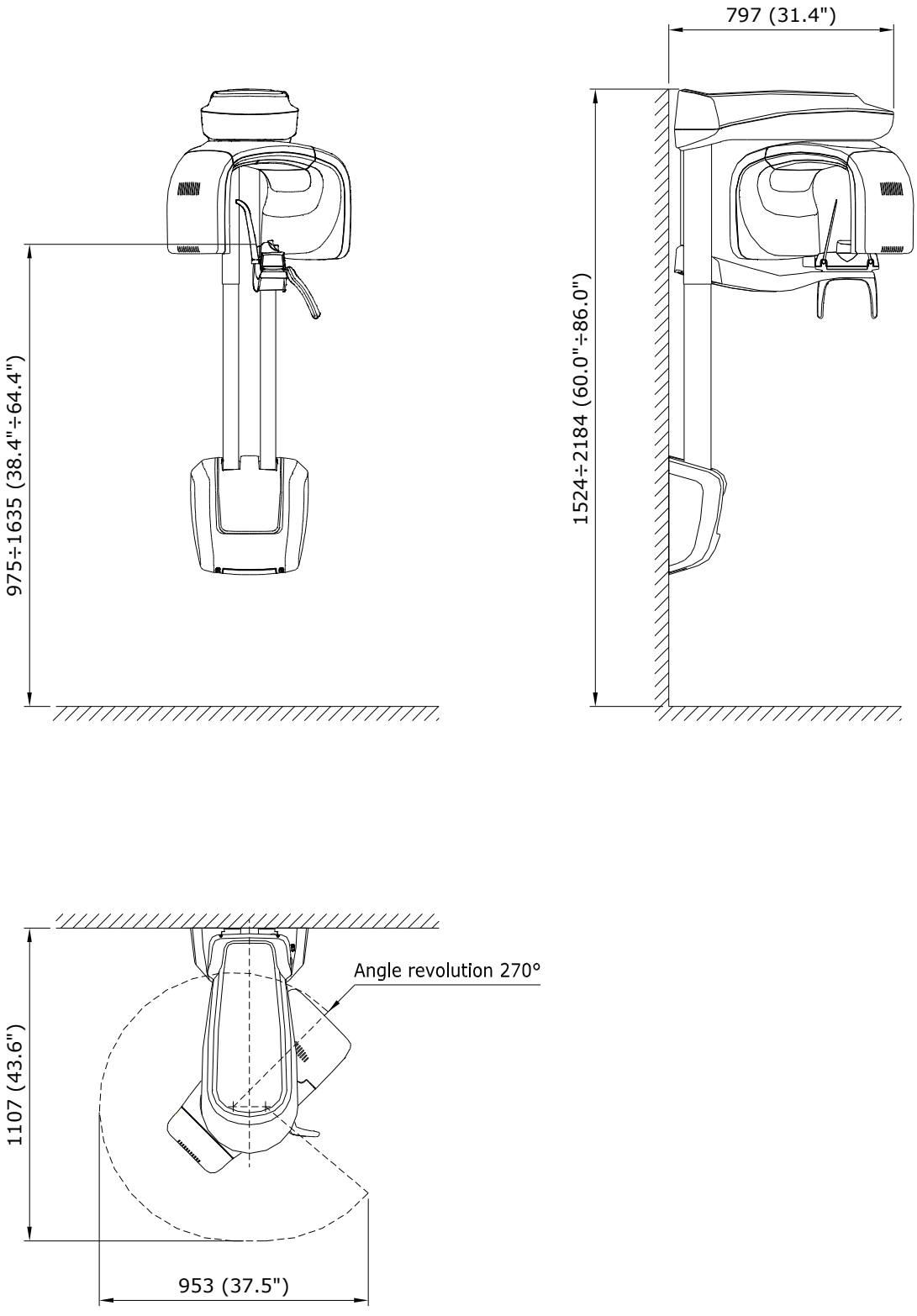


Figure 7: X-MIND prime 3D dimensions – Wall mounted version

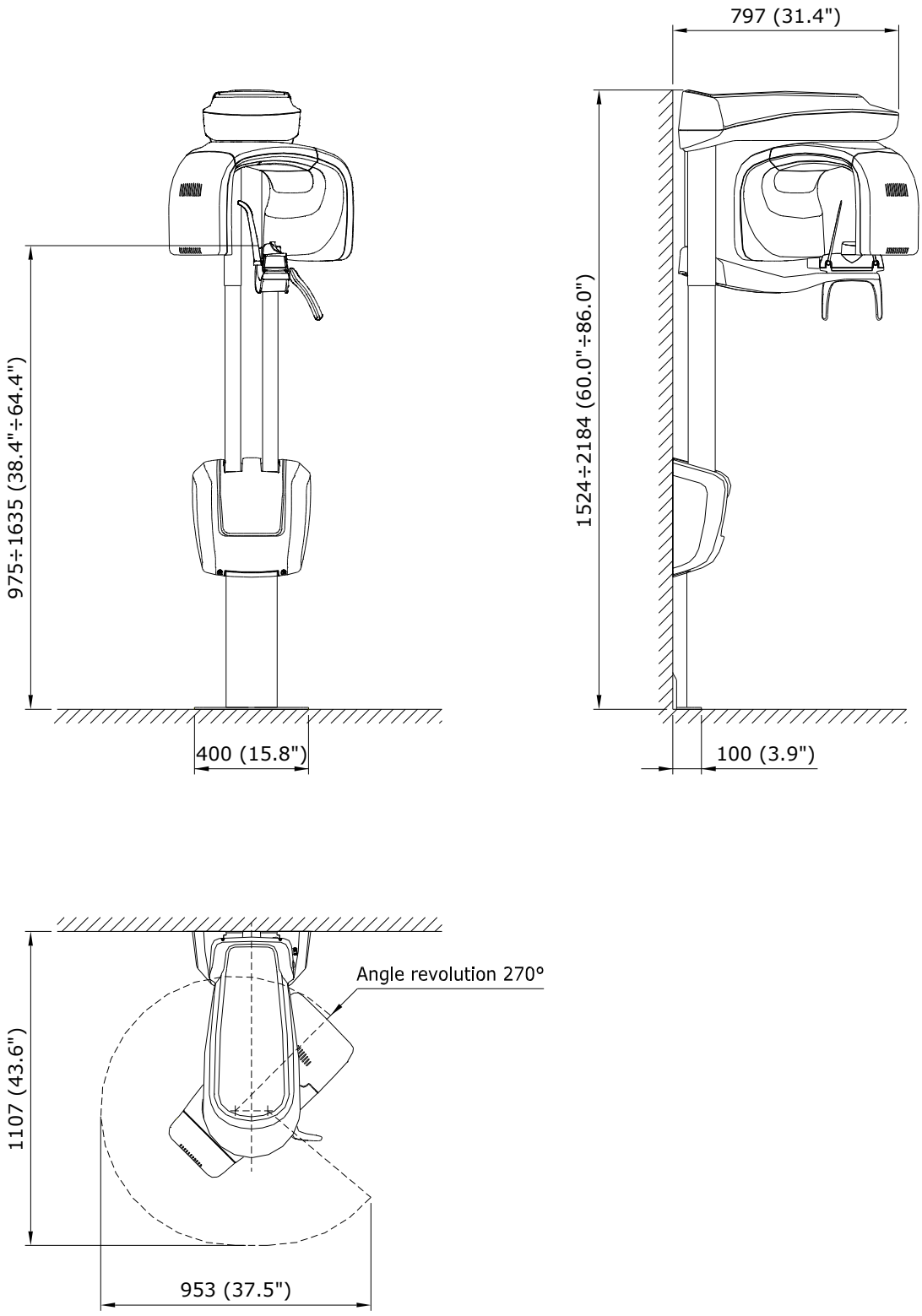


Figure 8: X-MIND prime 3D dimensions – Wall mounted with floor support version

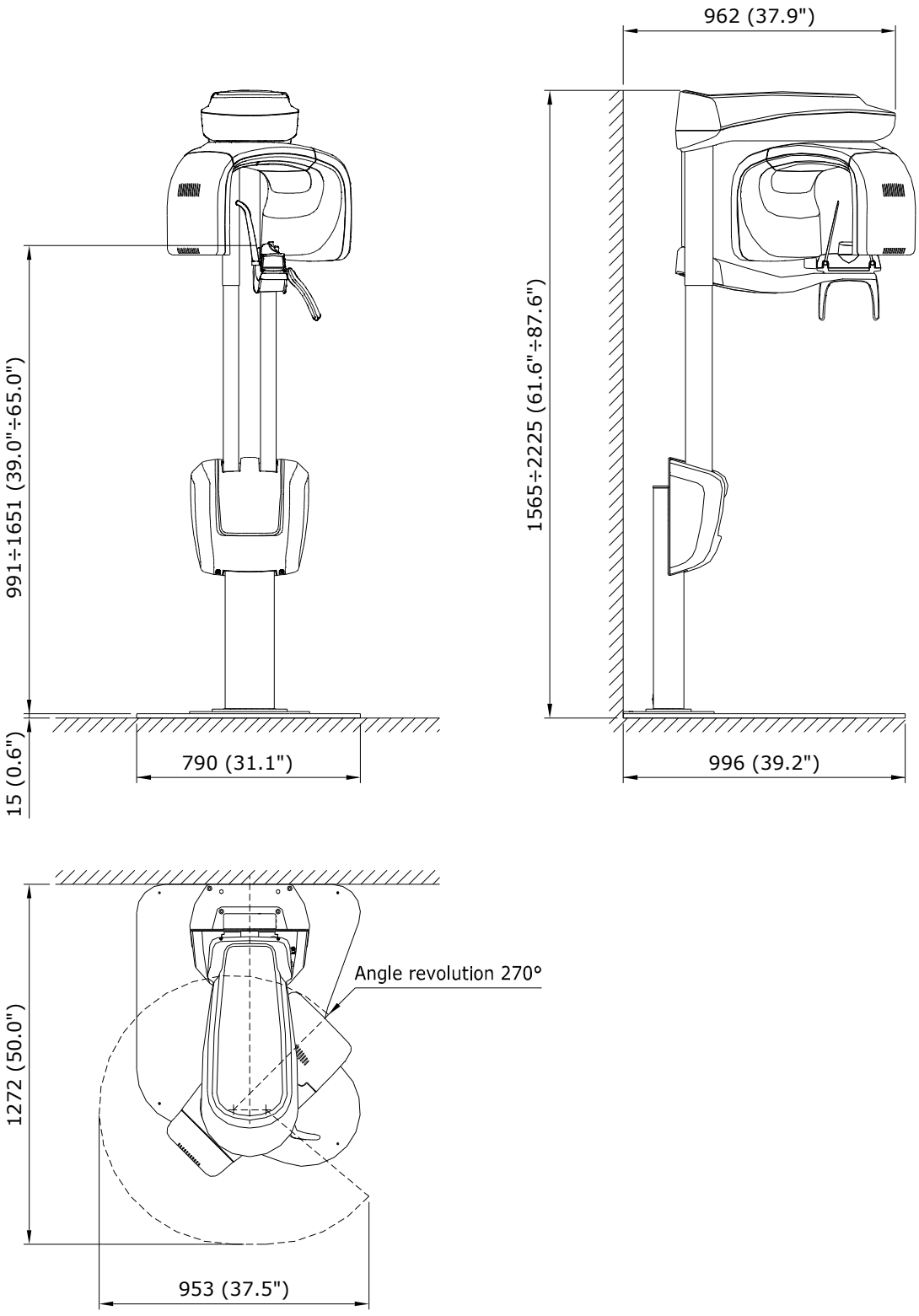
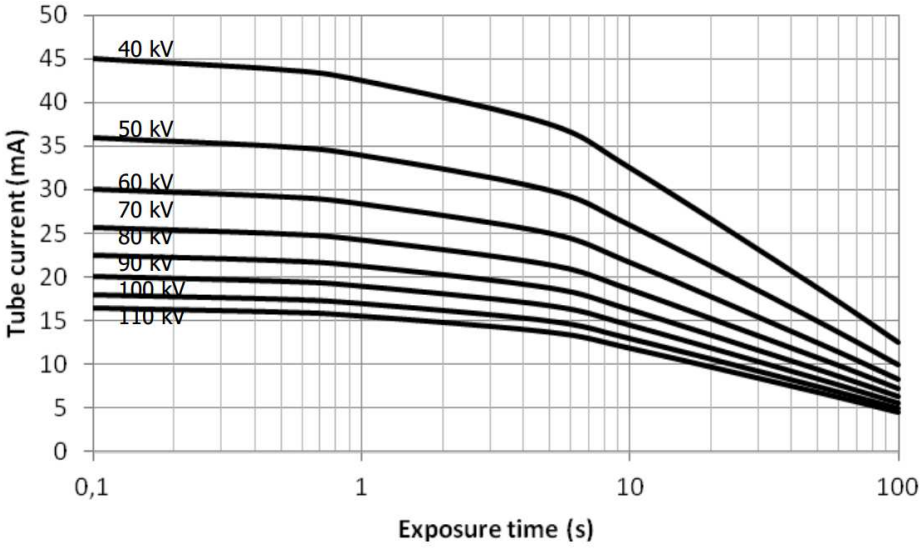


Figure 9: X-MIND prime 3D dimensions – Floor mounted version

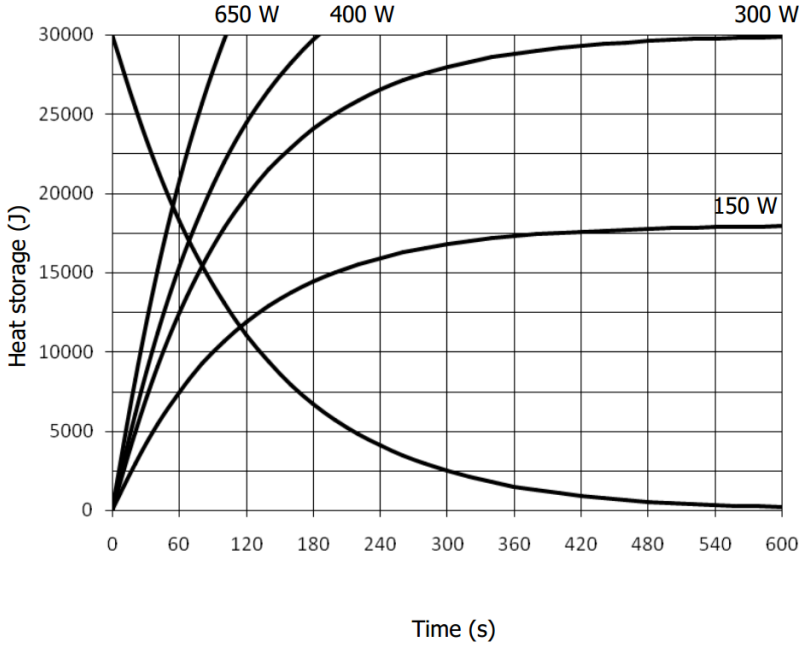
5.2 Tube loading curves, anode heating and cooling curves

Tube “CEI OPX 105-12” (0.5 IEC 336)

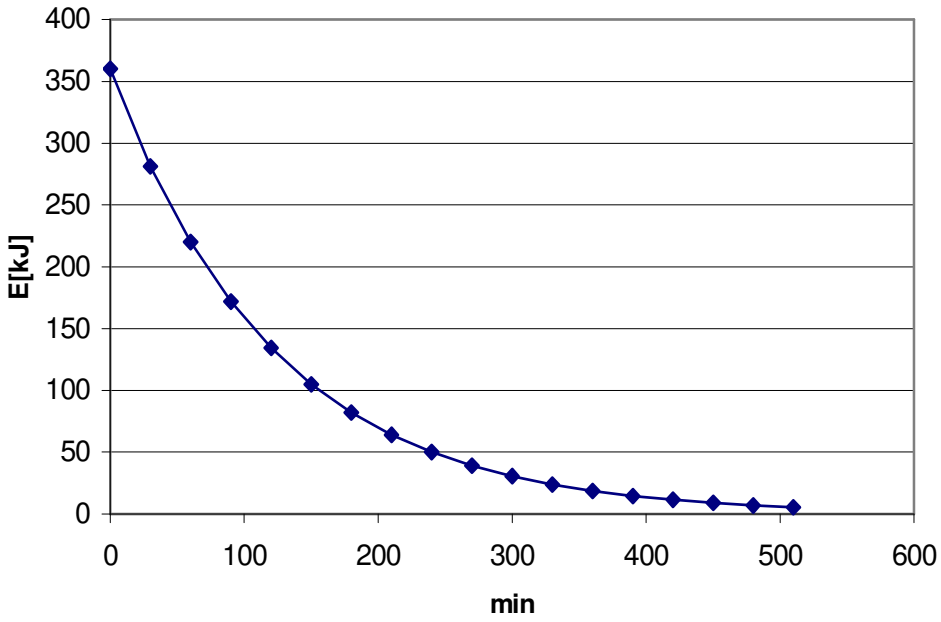
Tube loading curves



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.

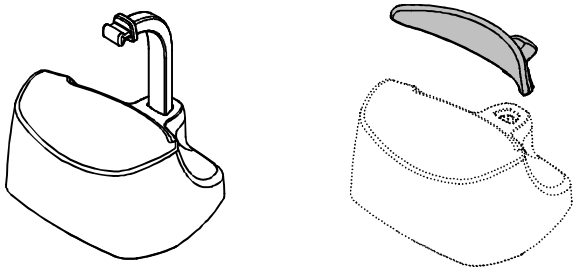
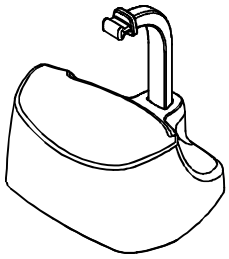
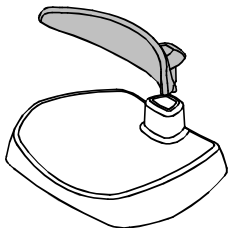
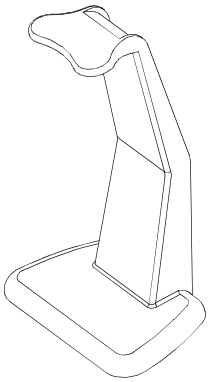
5.5 X-MIND prime 3D – PC communication

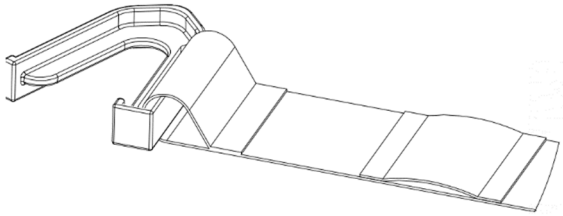
The communication between X-MIND prime 3D and computer is carried out with a LAN connection based on a TCP/IP protocol and a point to point connection between the detector and computer using an UDP protocol on a gigabit Ethernet.
In order to properly operate the unit, follow carefully the instructions reported in the Service Manual at paragraph 7.6.
The system is provided with 2 Ethernet cat 5e 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)	

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.

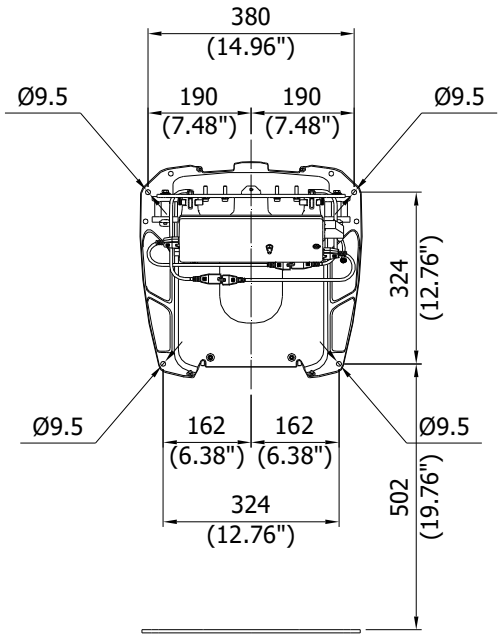
6. PRE-INSTALLATION

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.

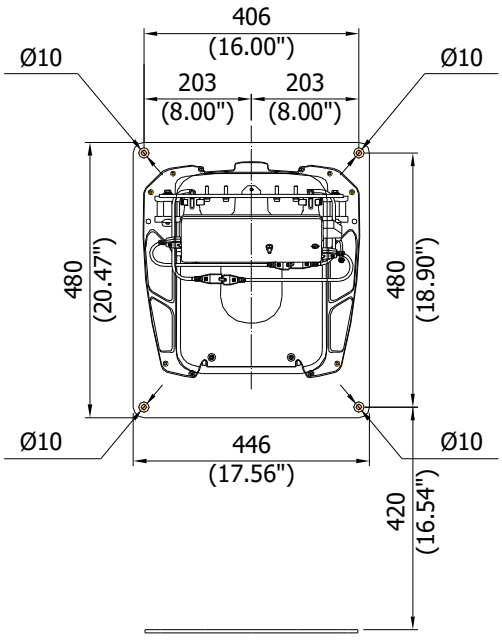
The requirements for a correct installation of X-MIND prime 3D are:

- 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
- a certain distance from heating devices
- the entries in the room, for the transport of the unit, must have a minimum width of 80 cm (31.50").

Note
Also if package can be used as 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.
Fixing to the wall must be done using the 4 holes indicated in the figure.



Standard version



Double stud version (16")

Warning

In its standard versions, X-MIND prime 3D can be fixed directly to the wall. 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 installation (wall mounted)** with the unit installed directly on the wall. Extraction force on each anchor is about 85 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 mounted with floor support installation (optional)** with unit installed to wall and floor. Extraction force on each anchor is about 72.5 Kg each.
  - 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.

- **Floor installation (optional**). Extraction force on each anchor is about 63 Kg each.
  - 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 hollow brick: drill Ø16 + chemical Anchors FIS V-BOND 300T ART. 516352 Plastic anchor FIS H 16X85 K + Steel Insert FIS E 11X85 M6. This solution permit to avoid the use of threated bars.
  - In case of full bricks: drill Ø14 + chemical Anchors FIS V-BOND 300T + Steel Insert FIS E 11X85 M6. This solution permit to avoid the use of threated bars.

6.1 Electrical setting up

• Single-phase grounding supply	110-240 V ~
• Frequency	50/60 Hz
• Power consumption	1.8 kVA (at 110 V) 1.4 kVA (at 240 V)
• Current consumption	14 A (at 110 V) 6 A (at 240 V)
• Apparent line resistance	0.4 Ω max (99-132 V) 0.5 Ω max (198-264 V)

Note
The unit is supplied as a unit to be installed permanently.
Please DO NOT connect the unit to the power using a normal socket, to avoid compromising the electrical safety.

The unit must be connected to a differential magneto-thermal switch, to separate the unit from the supply. This switch must comply with the electrical regulations in force in the country of installation.
The supply conductors must have a 1.5 mm^2 (16 AWG) section.
The general grounding must comply with the rules in force; a wrong quality of the grounding could be dangerous for the operator's safety and cause a bad function of the electrical devices.

Note
Power supply cable is already connected inside the X-MIND prime 3D.

Note

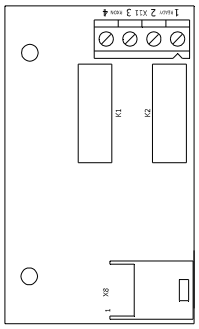
X-MIND prime 3D, IS SET TO connect, at the entrance of the X-ray room, the following control and warning devices:

- READY light: Green light (24V 40W max.), it signals that the machine is ready to perform the exam (contact N.O.)
- X-RAYS light: Yellow light (24V 40 W max.) it signals the entry in the X-ray room is forbidden, since an exposure is on the run (contact N.O.)

The unit only provides the closing contacts relative to the above mentioned functions. Power voltages for the relevant devices have to be provide from outside, making sure not to exceed the indicated ratings.

- Remote X-RAYS button: “Dead man switch” remote control, enables to perform the exam at a distance, the operator can stand outside the X-ray emission area. This button must be suitable to prevent unwanted emission. The standard X-ray button supplied with the unit has the above characteristic.

Remote X-rays button connection



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

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 MCU.

6.2 Packaging

X-MIND prime 3D is delivered in a single carton-board box.
Package itself became a tool used to install the unit.

Contents	Packing dimension	Weight	
		Net	Gross
Complete unit	120x80x67 cm (47.3”x31.5”x26.4”)	62 kg (137 lbs)	80 kg (176 lbs)

Note
The box mount shock detectors.

At the receiving and before install the unit, verify that those sensors have not been activated.

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

6.3 Space requirements

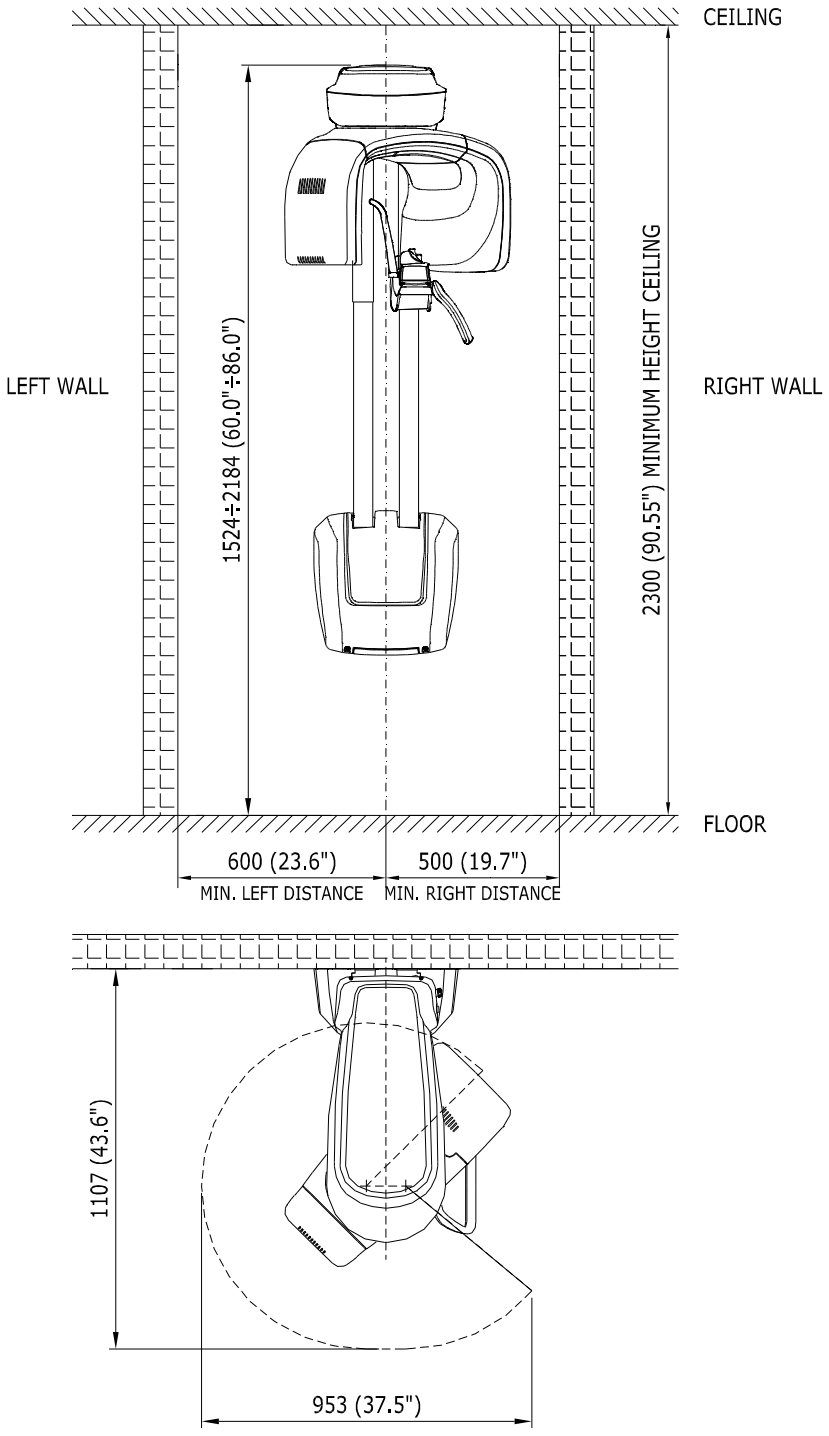
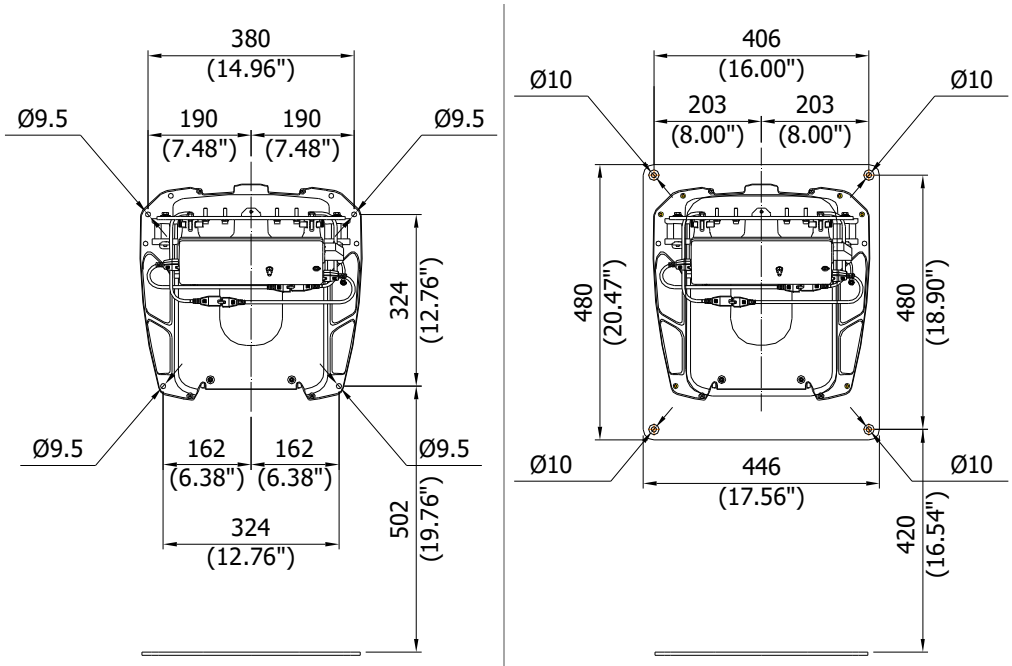


Figure 10

7. INSTALLATION

Note
X-MIND prime 3D is delivered completely pre-mounted; it is contained in a single box.
The mechanical mounting consists exclusively in fixing the unit to the wall and complete with few operations the installation. Most of the adjustments are carried out in factory.
A single technician will be able to install the unit as package is used to support the unit during installation.

Note
Also if package can be used as 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.
Fixing to the wall must be done using the 4 holes indicated in the Figure 11.



Standard version *Double stud version (16")*

Figure 11

Warning

In its standard versions, X-MIND prime 3D can be fixed directly to the wall. 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 installation (wall mounted)** with the unit installed directly on the wall. Extraction force on each anchor is about 85 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 mounted with floor support installation (optional)** with unit installed to wall and floor. Extraction force on each anchor is about 72.5 Kg each.
  - 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.

- **Floor installation (optional**). Extraction force on each anchor is about 63 Kg each.
  - 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 hollow brick: drill Ø16 + chemical Anchors FIS V-BOND 300T ART. 516352 Plastic anchor FIS H 16X85 K + Steel Insert FIS E 11X85 M6. This solution permit to avoid the use of threated bars.
  - In case of full bricks: drill Ø14 + chemical Anchors FIS V-BOND 300T + Steel Insert FIS E 11X85 M6. This solution permit to avoid the use of threated bars.

7.1 Mechanical installation

1. Remove the carton box and the higher polystyrene section.

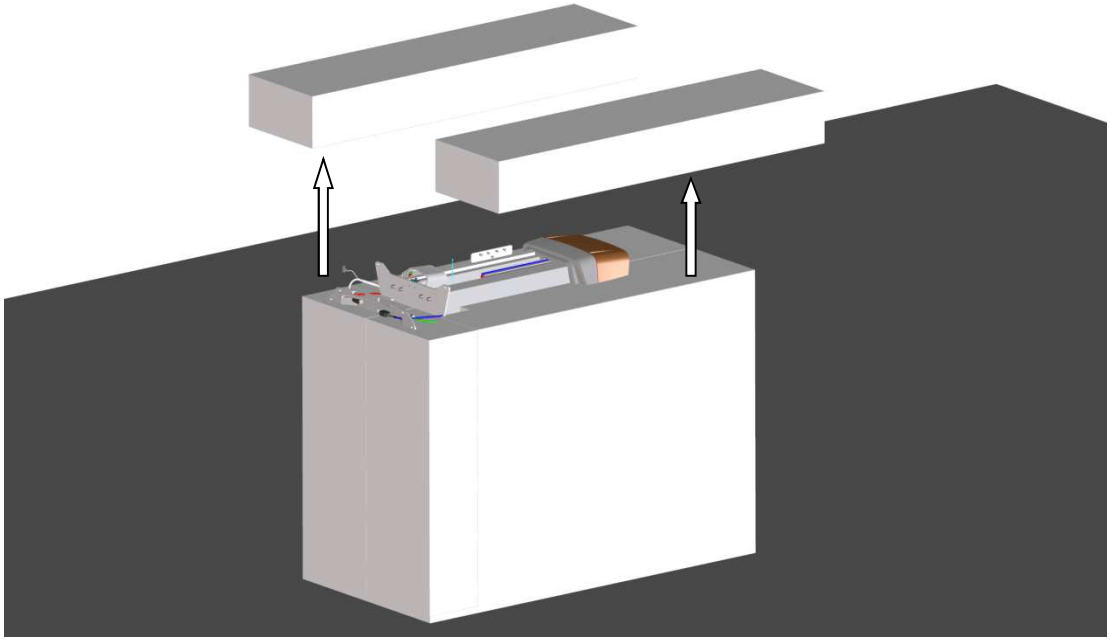


Figure 12

2. Remove the front polystyrene section.

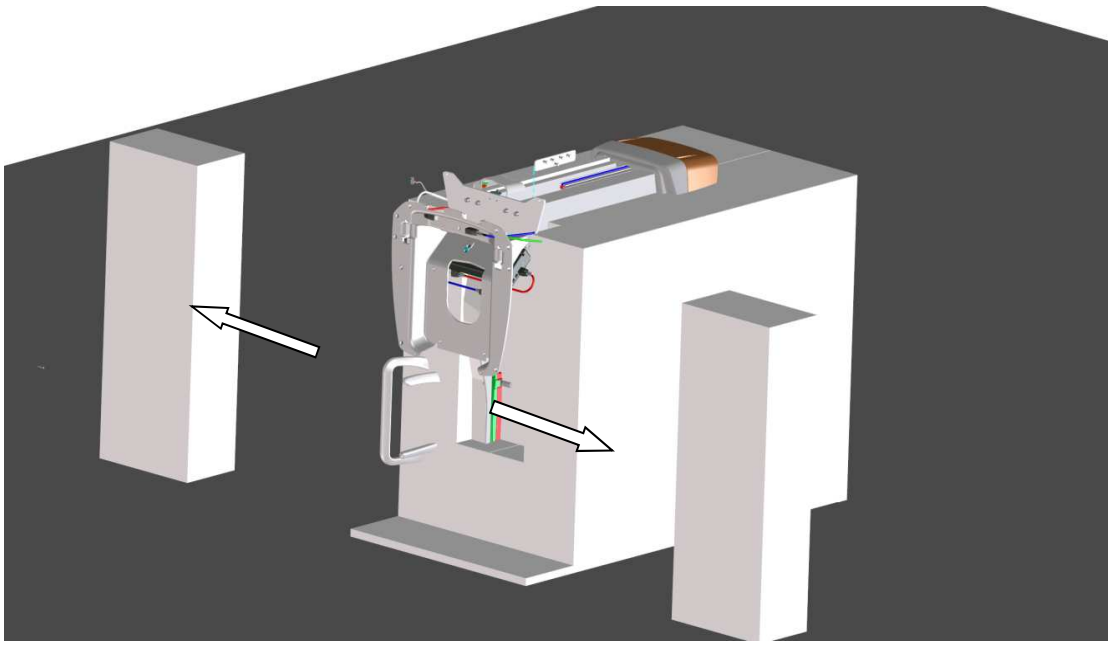


Figure 13

3. Slide the packaging from the polystyrene base close to the wall in the position where the X-MIND prime 3D will be installed.
4. Push the packaging until the wall plate is against the wall.

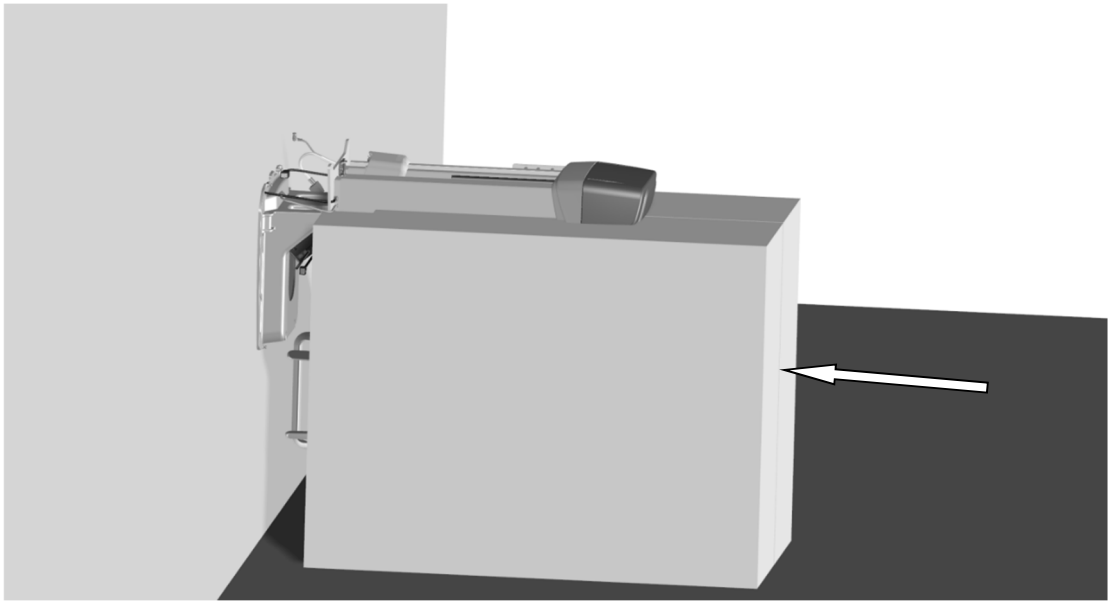


Figure 14

5. Verify with an air bubble lever that the plate is horizontal.

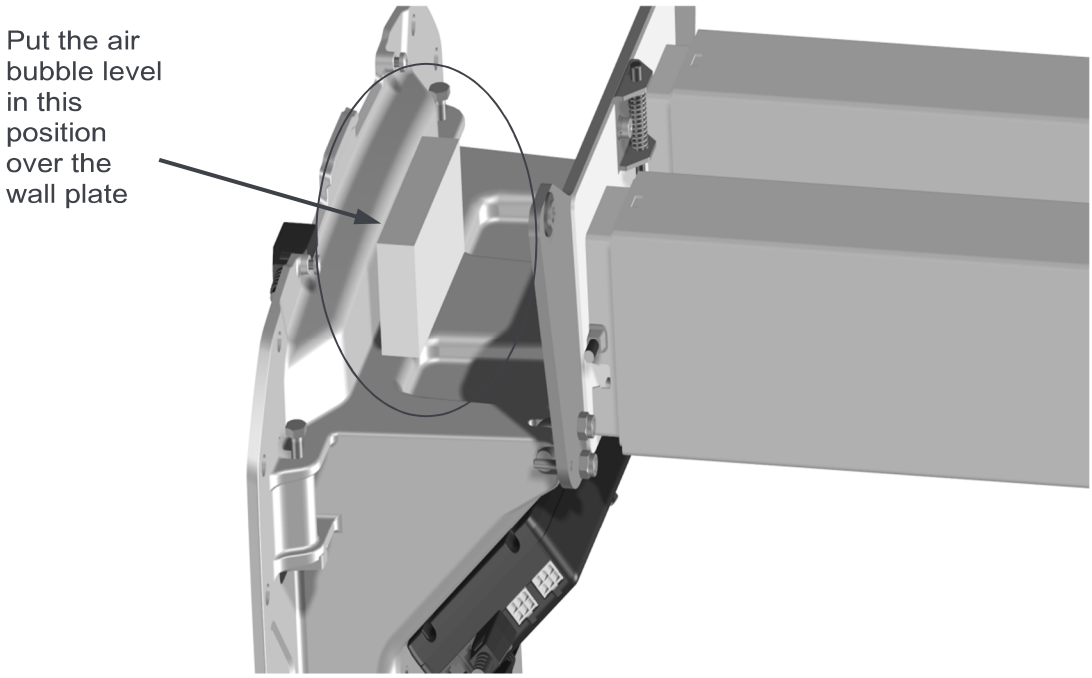


Figure 15

6. Mark on the wall the position of the dowels holes.
7. Move back the packaging, drill the wall, put the dowels, reposition the packaging against the wall and secure the wall plate to the wall with the screw.

Warning

Extracting force on each dowel are:

- 85 Kg for standard installation (wall mounted)
- 72.5 Kg for wall mounted with floor support installation (optional)
- 63 Kg for floor installation (optional).

It is responsibility of the installer to verify type and solidity of the wall and identify the correct type of fixing method (metallic dowels, plastic dowels or chemical fixing anchors etc…).

8. Remove the plastic protection between plate and rotating part.

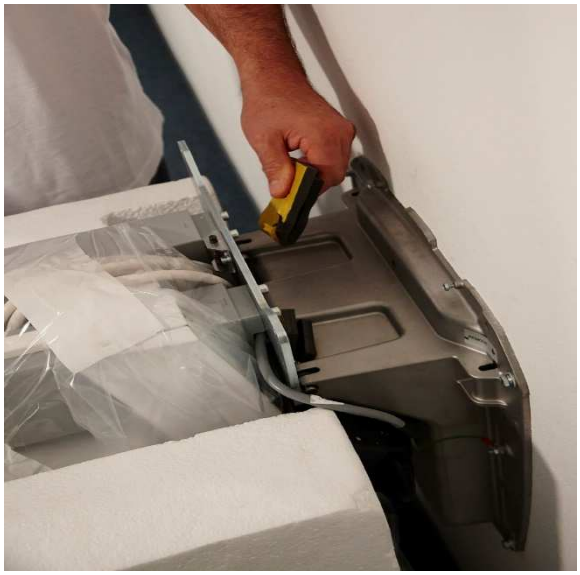


Figure 16

9. Once fixed the plate to the wall, remove the tilting plate locking screws, and their nuts, locking the wall plate.

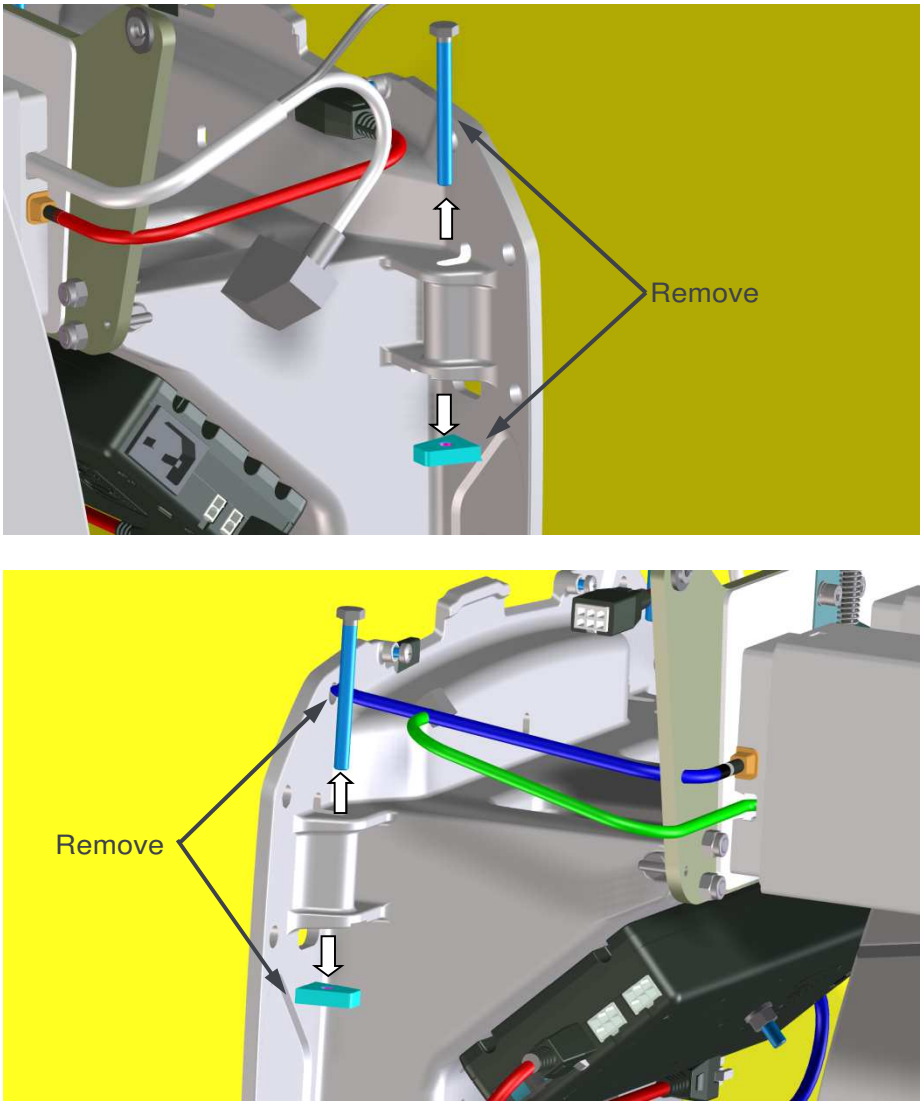


Figure 17

10. Grab the packaging and lift until the insertion of the pin-lock is in its seat.

Note
The force necessary to lift the X-MIND prime 3D is about 20kg, so that a single technician can be enough to install the unit.

Figure 18

11. Once the unit reaches the final position, be sure that the safety pin is properly locked before to leave the package.

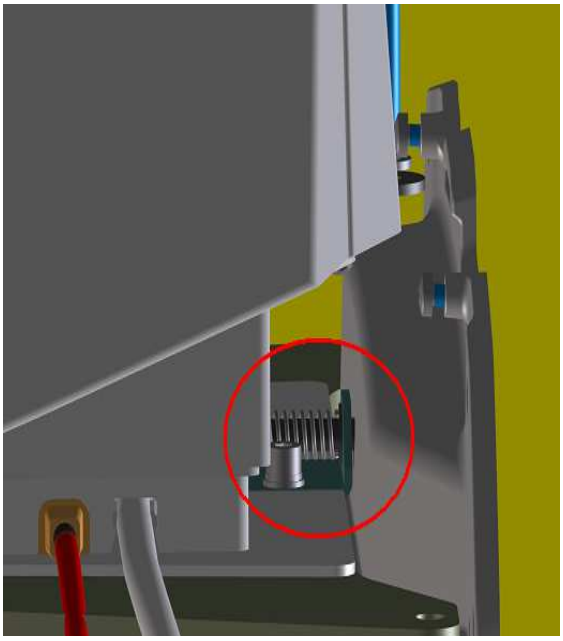


Figure 19

12. Reinsert immediately the tilting plate locking screws, and their nuts and lock the tilting plate at the wall plate.

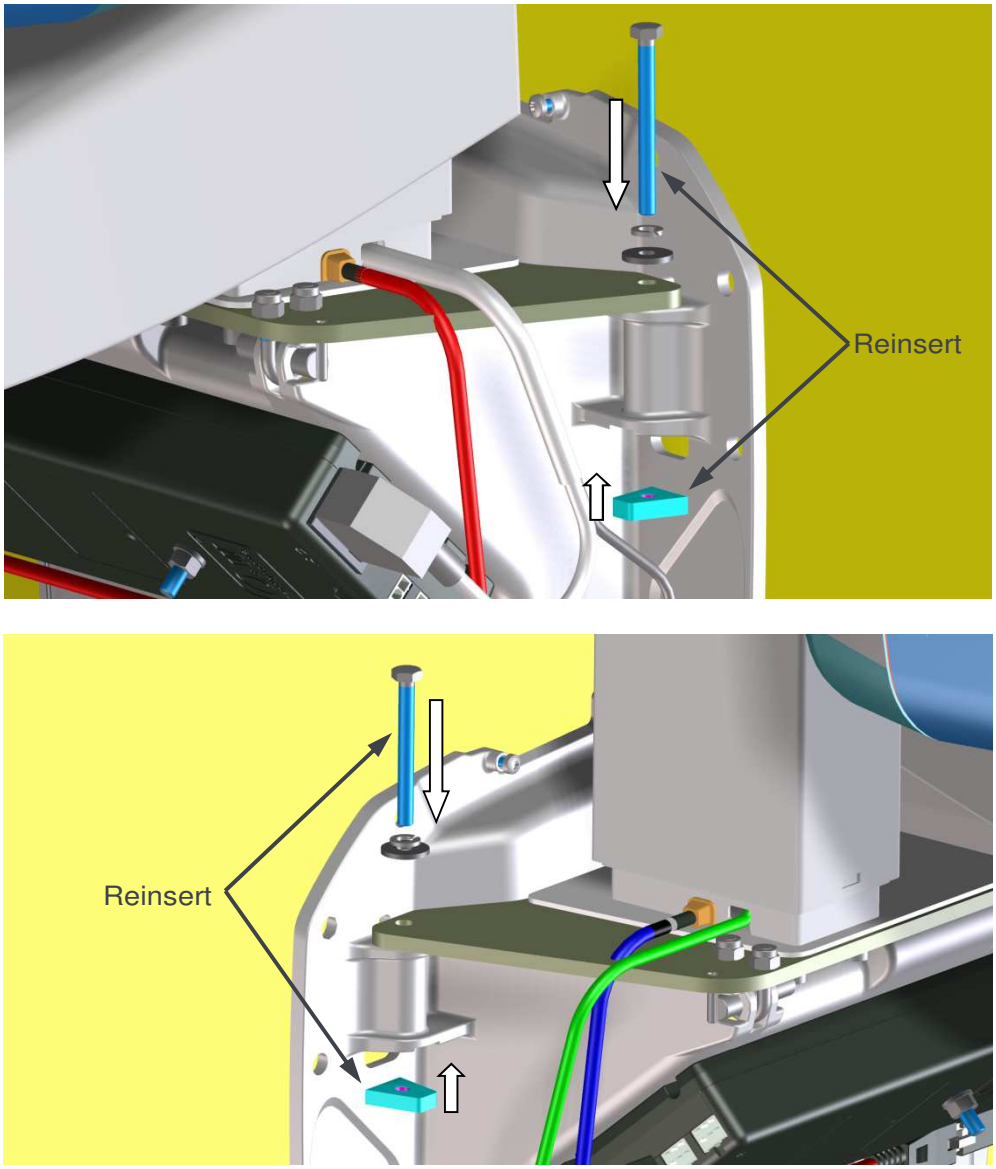


Figure 20

13. Tighten the nuts of the eyebolts of the rotation pins.

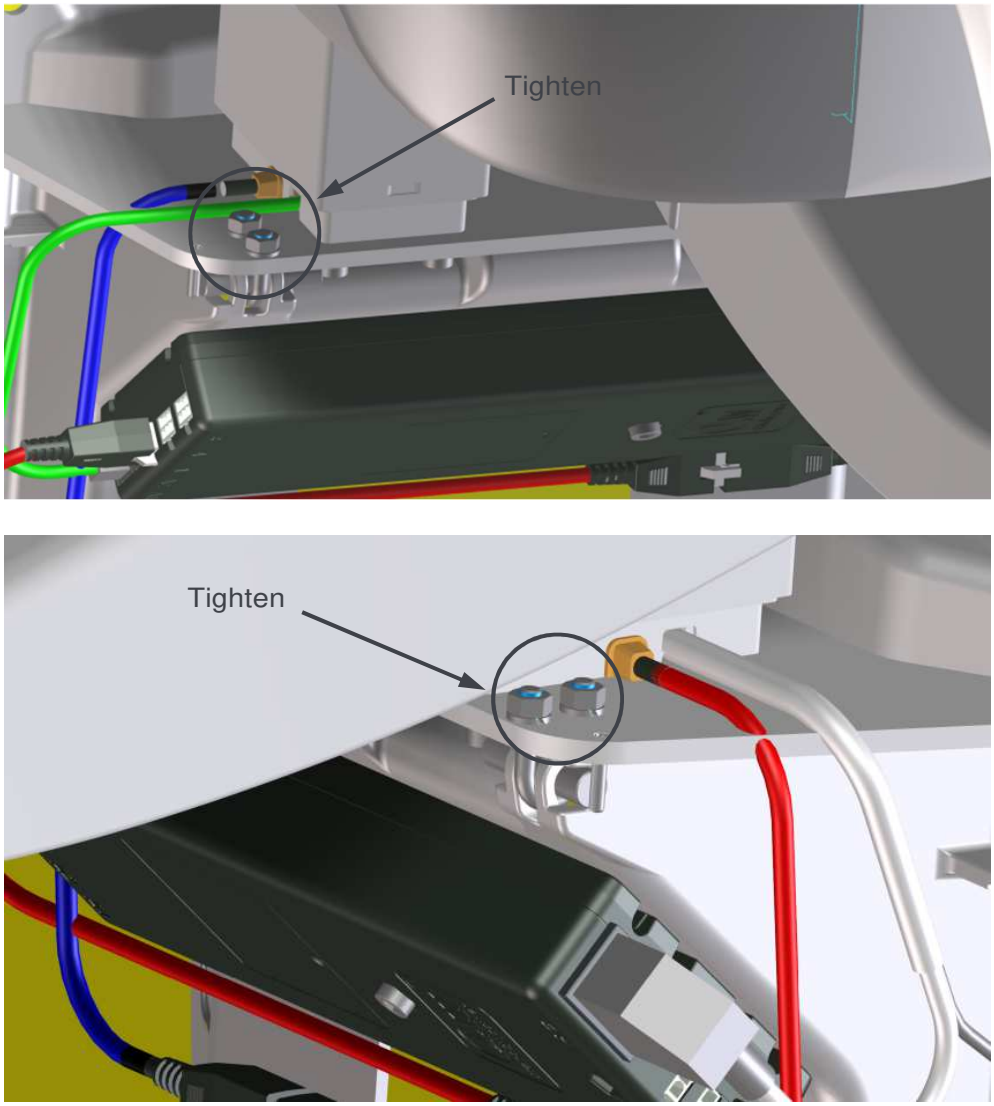


Figure 21

Warning
In case of dismountling the unit (i.e. after exhibition), it is necessary to loosen these nuts in order to avoid damages to the hinge during rotation.

14. Cut the straps that join the two polystyrene elements and remove them.

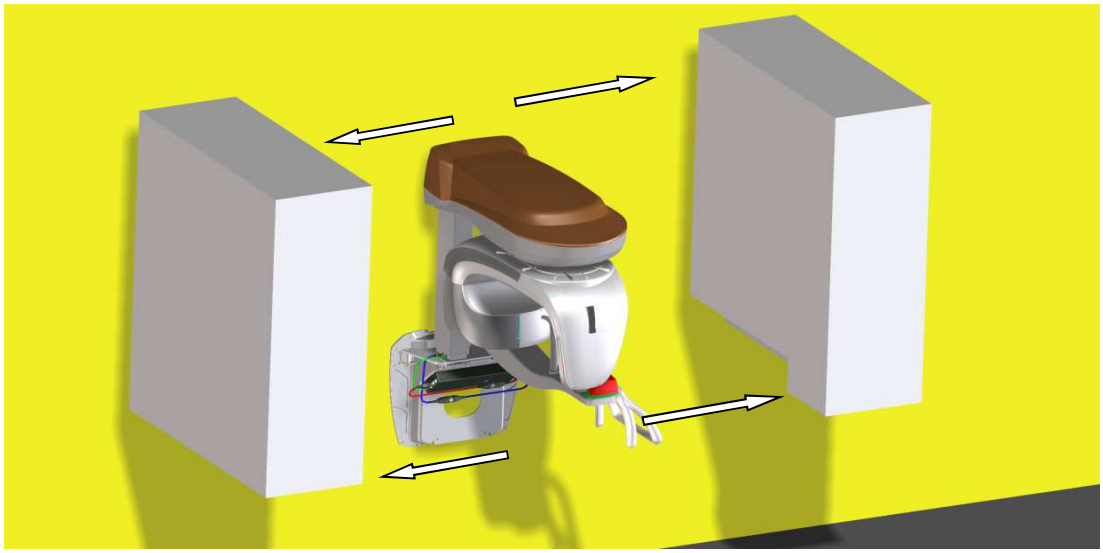


Figure 22

Note
Inside the polystyrene elements, you can find the unit accessories and the wall plate cover.

15. Remove the upper cover releasing the two screws present in the back side (wall direction); front side of the cover is fixed without screw (locking pins).
Remove the safety plate used do keep the rotating arm fixed during transportation.

Figure 23

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 24 (to have access to this part, it is required to remove the top cover as described in the part 15 of the paragraph 7.1):

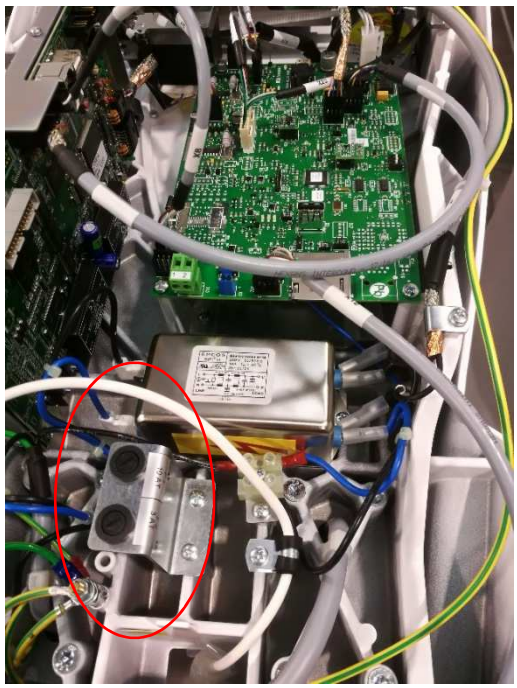


Figure 24

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
100 – 200 Vac	F1: 20 A T F2: 3 A T
200 – 240 Vac	F1: 8 A T F2: 1,6 A T

7.3 Electrical connections

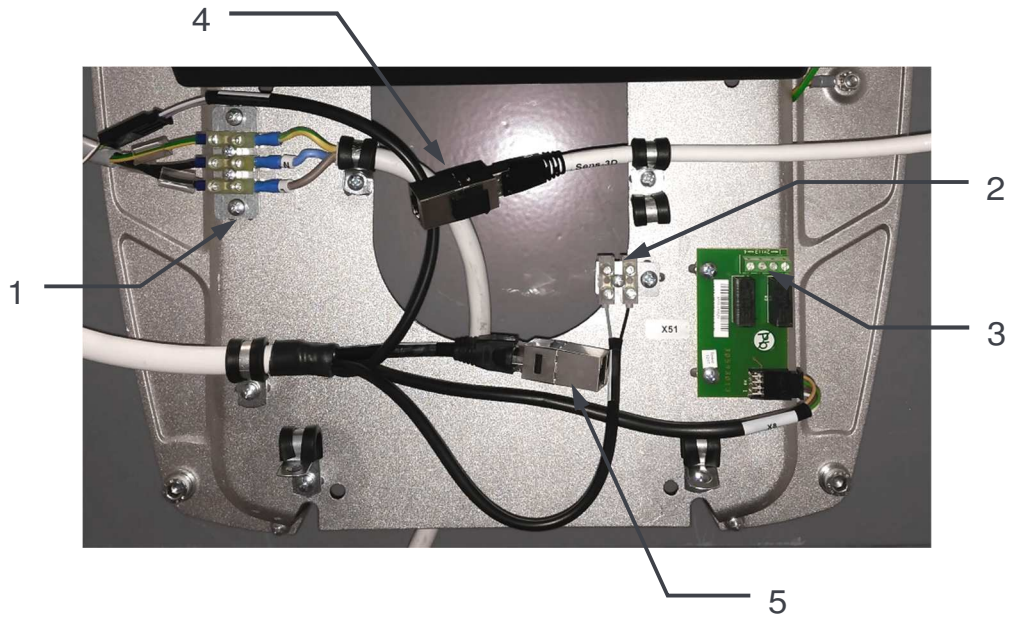


Figure 25

1. **Main Power Supply**: 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.

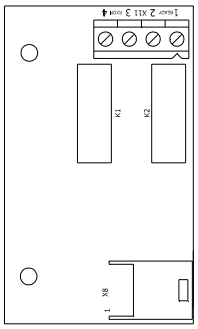
Note
Before to connect main power supply, be sure that the main provided by the Customer is according to specification in terms of voltage, line resistance and safety protections (see paragraph 6.1).

2. **X-Ray button**: a button is provided with the characteristic “dead man’s” switch. Connect it to the indicated terminals.

   In case it is require to add a remote X-Ray button, used to perform exam with the operator outside the room, it must be a “dead man’s” switch and provide a clean contact. This button must be suitable to prevent unwanted emission.

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 MCU.

3. **Light signalling**: X-MIND prime 3D, is set to connect, at the entrance of the X-ray room, the following control and warning devices:
   - READY light (green light 24V – 40W max.): it indicates that the unit is ready to perform the exam (contact N.O.).
   - X-RAYS light (yellow light 24V – 40 W max.): it indicates that the entry in the X-ray room is forbidden, since an exposure is running (contact N.O.).



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

Note
The unit only provides the closing contacts relative to the above mentioned functions. Power voltages for the relevant devices have to be provide from outside, making sure not to exceed the indicated ratings.

4. **3D Sensor Ethernet**: the upper network connector must be connected to the dedicated Network Interface Card on the PC, via Ethernet cable (≥ CAT 5e). This line brings the data from the 3D Sensor.

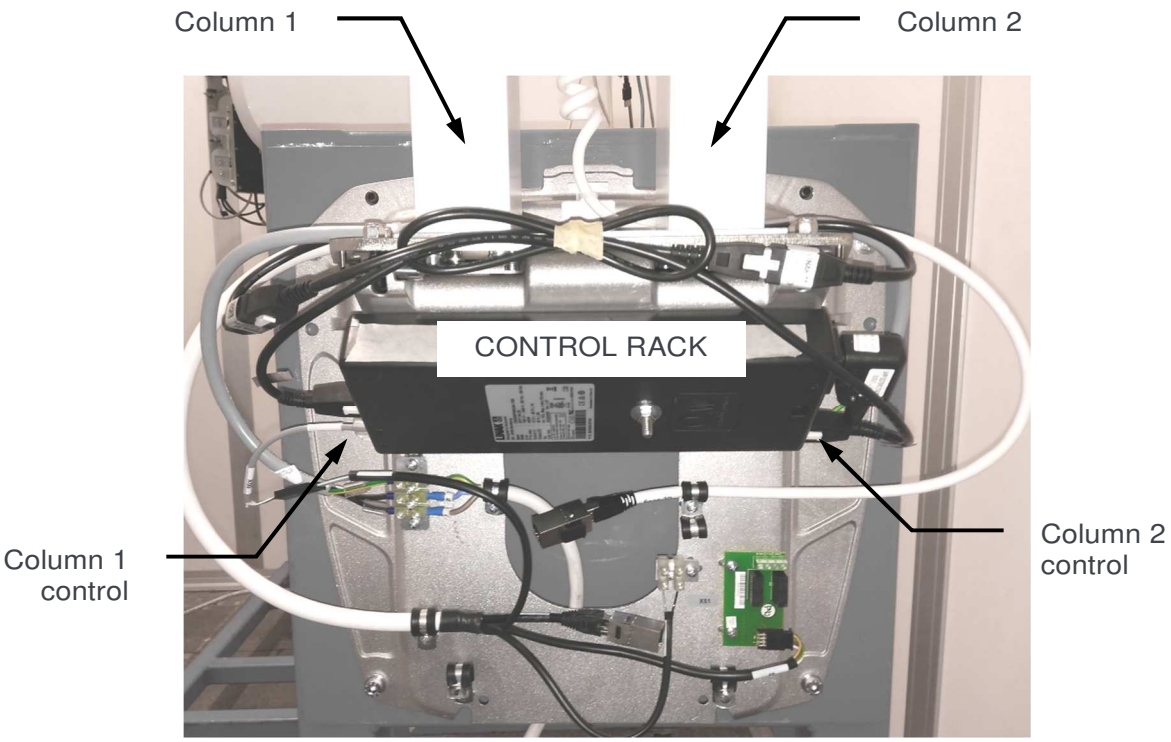
5. **DSPU board Ethernet**: the lower network connector must be connected to the dedicated Network Interface Card on the PC, via Ethernet cable (≥ CAT 5e). This line brings the communication between the unit and the PC.

Warning
Never connect the Ethernet cable coming from the computer to other connectors in the unit (i.e. column movement control rack).

Warning

Here following some actions that during installation, maintenance or troubleshooting MUST be avoided as they damage column or control rack:

- Never disconnect cables from the control rack if power supply is ON
- Never switch ON the unit if one of the two columns is disconnected
- Always verify that the columns are connected to the corresponding port in the control rack.



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 26

7.4.2 Upper cover

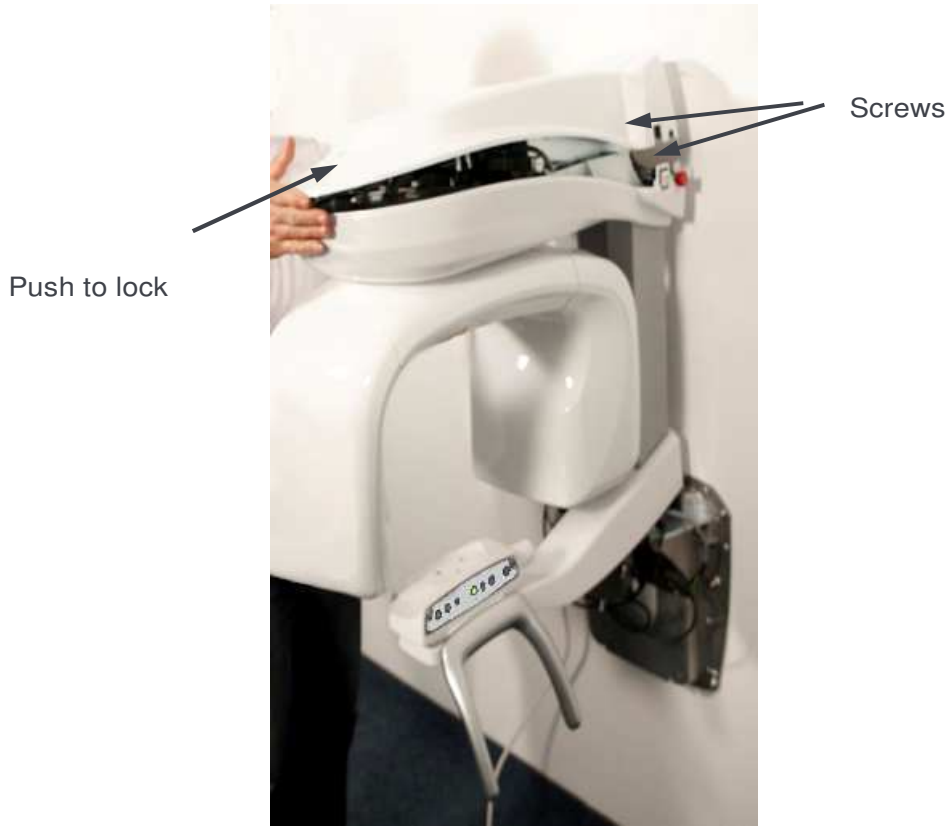


Figure 27

7.4.3 Temple supports

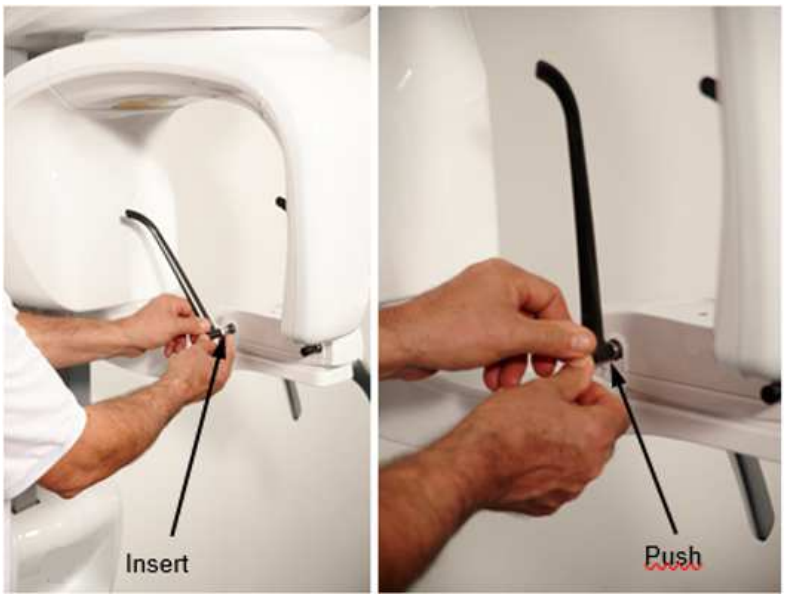


Figure 28

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

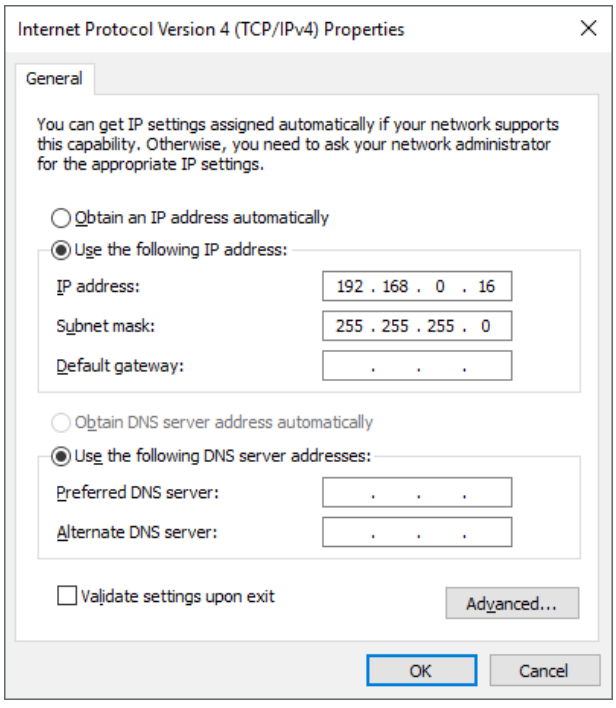
The equipment is supplied with a dedicated dual port Network Interface Card (NIC). In order to connect the X-MIND prime 3D to the PC it is necessary to configure the properties of the dedicated NIC following the procedure described below.

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 DSPU board Ethernet cable to the left port of the NIC.
3. Switch on the unit. The network adapter connected to the DSPU 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

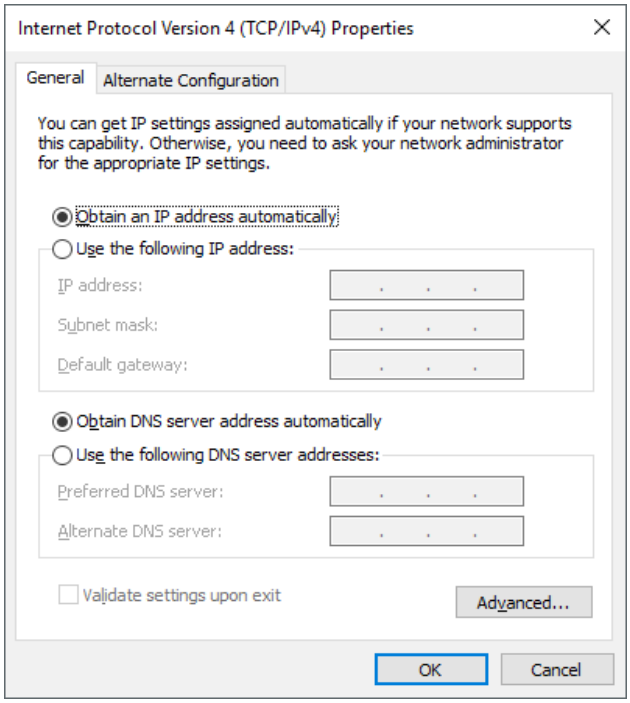
   and then click “OK”.



6. Plug the 3D Sensor Ethernet cable to the right port of the NIC. The second network adapter corresponding to the dual port NIC will become active.

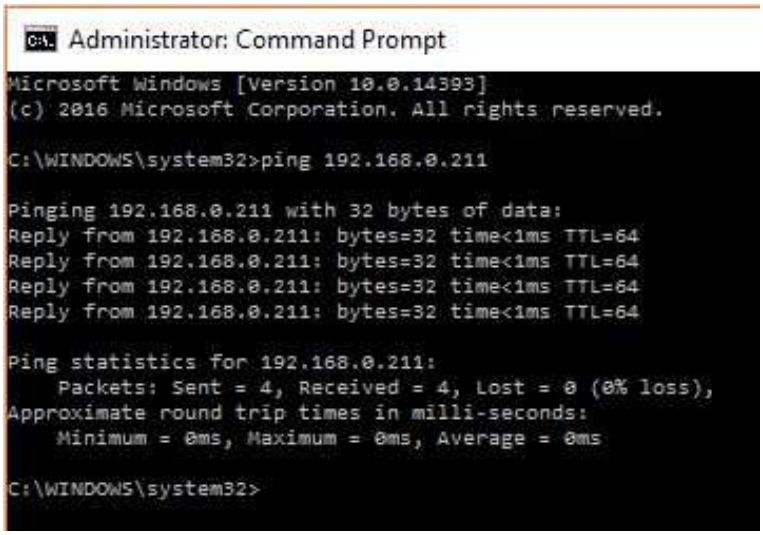
7. Right click on it and select “Properties”.

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

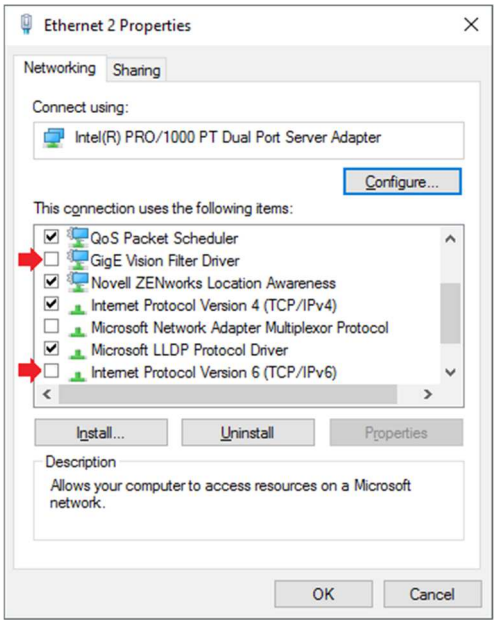


Confirm with OK.

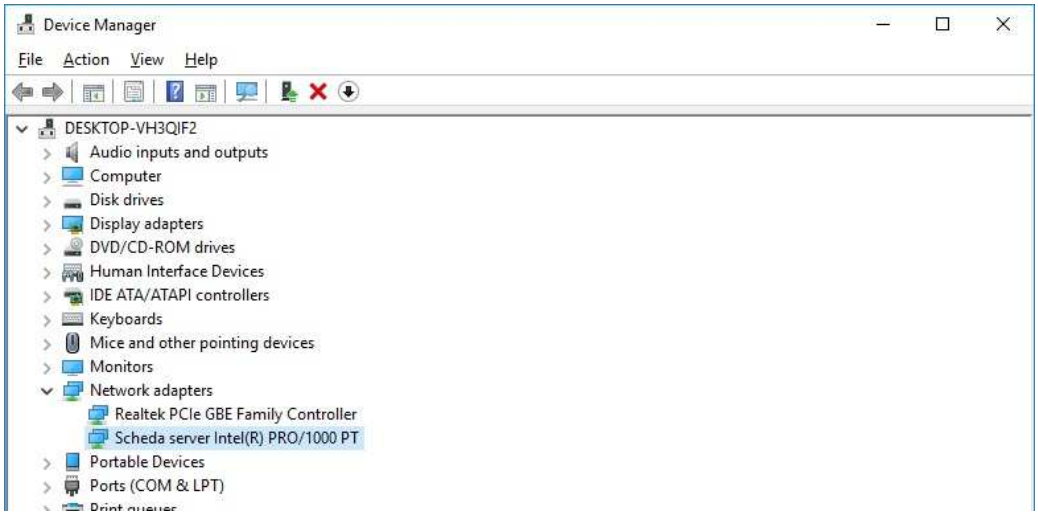
9. To check that the connections are properly configured, with the unit ON, run a command prompt and type “ping 192.168.0.211”. Press Enter and verify that the unit reply to the ping as shown in the figure below.



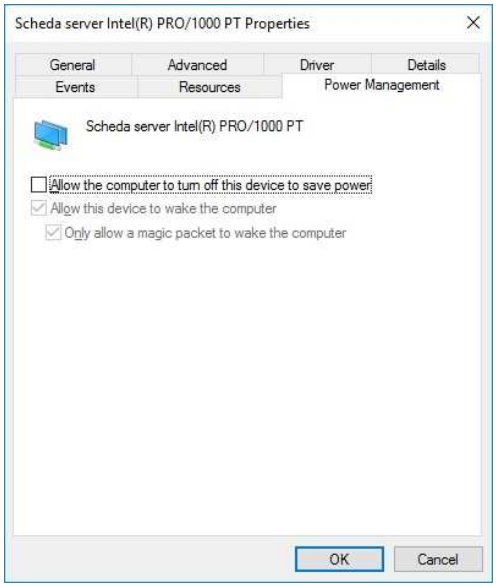
If the ping does not reply, swap the two network cables on the NIC ports and repeat the ping test.
If the problem is still present, unflag the items “GigE Vision Filter Driver” and “Internet Protocol Version 6” from the properties of all the network adapters.



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



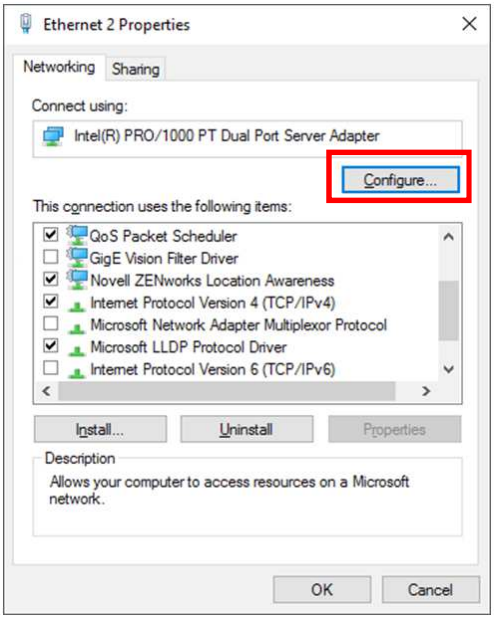
11. Double click on the dedicated dual port NIC (Intel I350-T2 or Intel PRO/1000). Select the “Power Management” tab and unflag the box “Allow the computer to turn off the device to save power”.



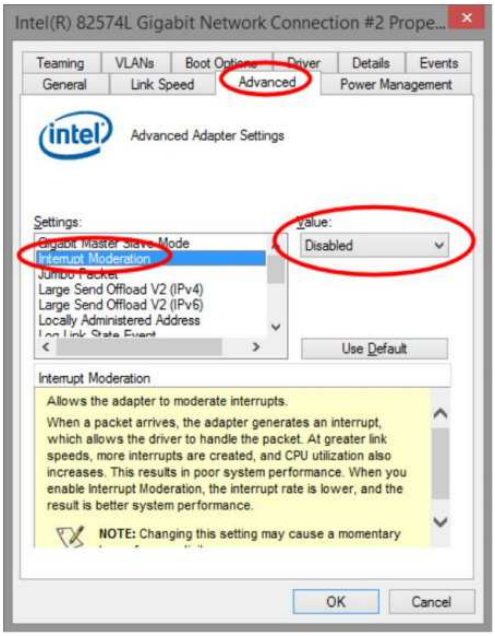
7.7.2 3D sensor Network Interface board configuration

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

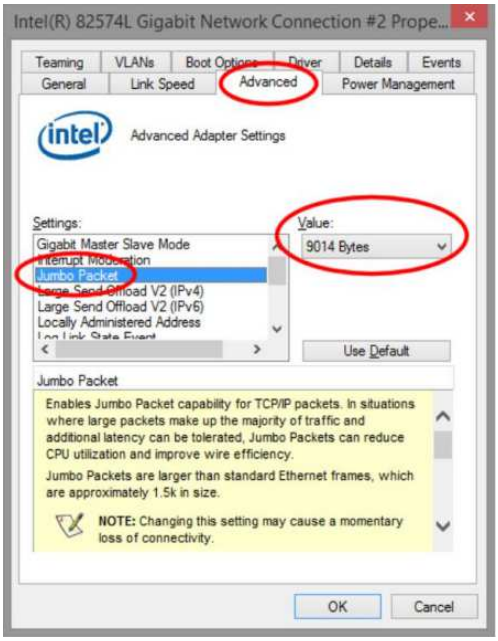
1. Open the “Network Settings” menu of the Ethernet board connected to the 3D sensor by right clicking on its icon and select “Property”.
2. On the Ethernet board property window click on “Configure…”:



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

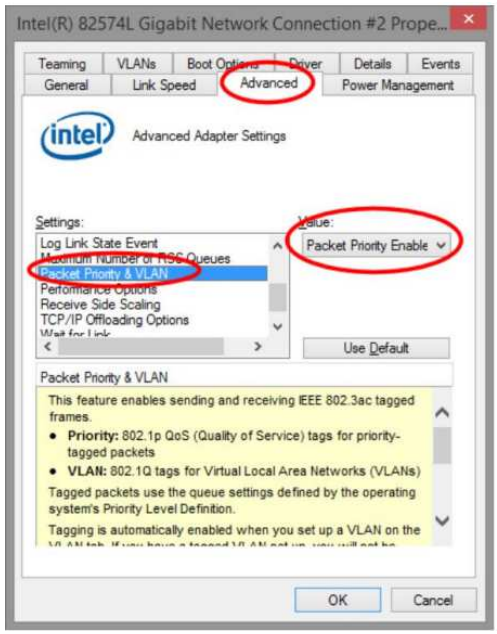


- Jumbo Packet = 9014 Bytes

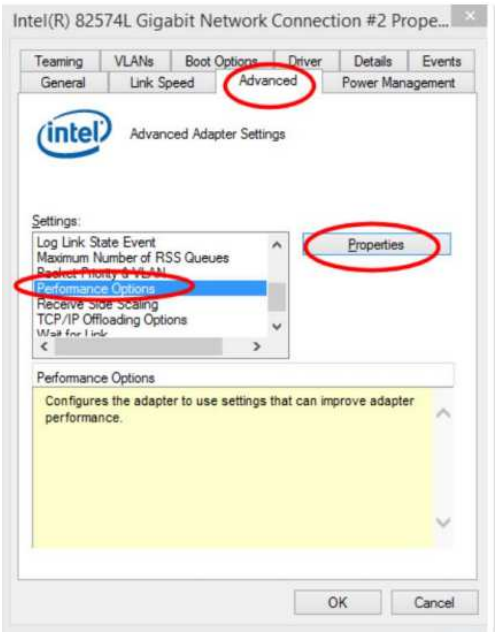


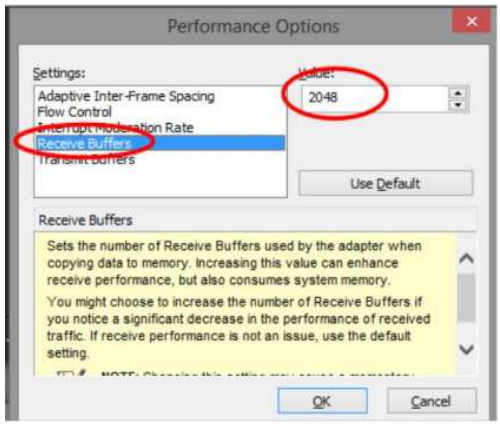
- Maximum Number of RSS Queues = 2 Queues

- Packet Priority &VLAN = Packet Priority Enabled

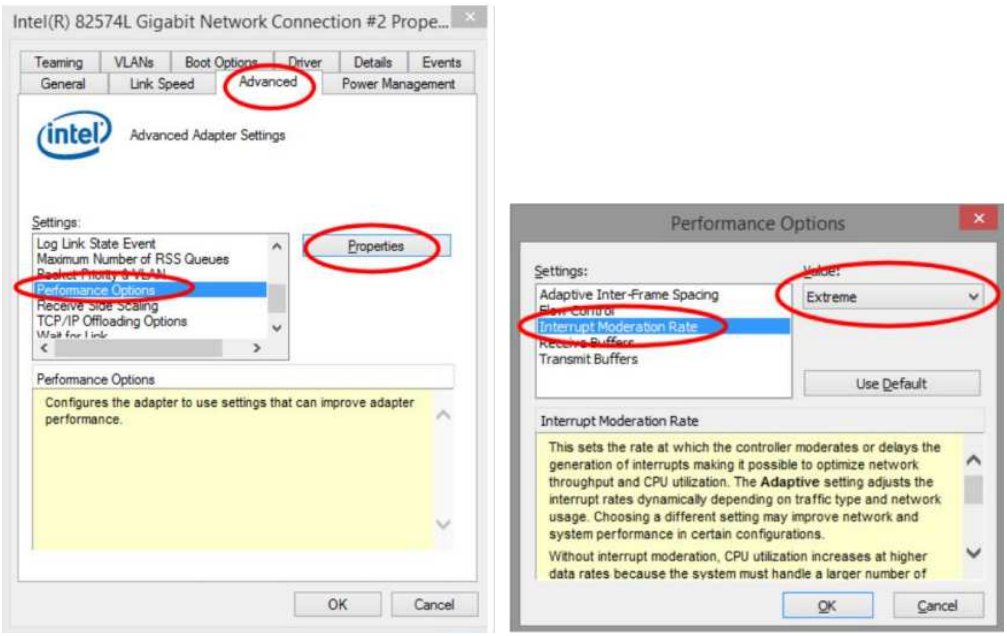


- Performance Options→Properties→Received Buffers = 2048





- Performance Options→Properties→Interrupt Moderation Rate = Extreme

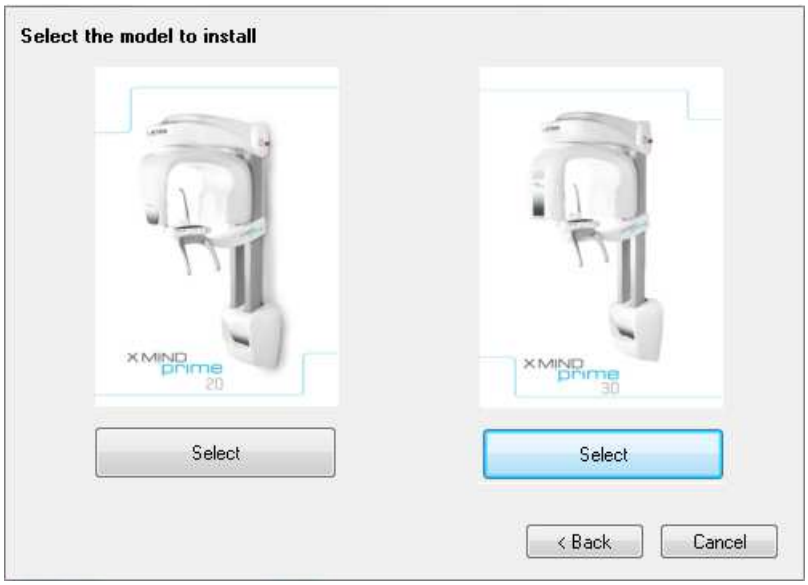


5. Restart the computer.

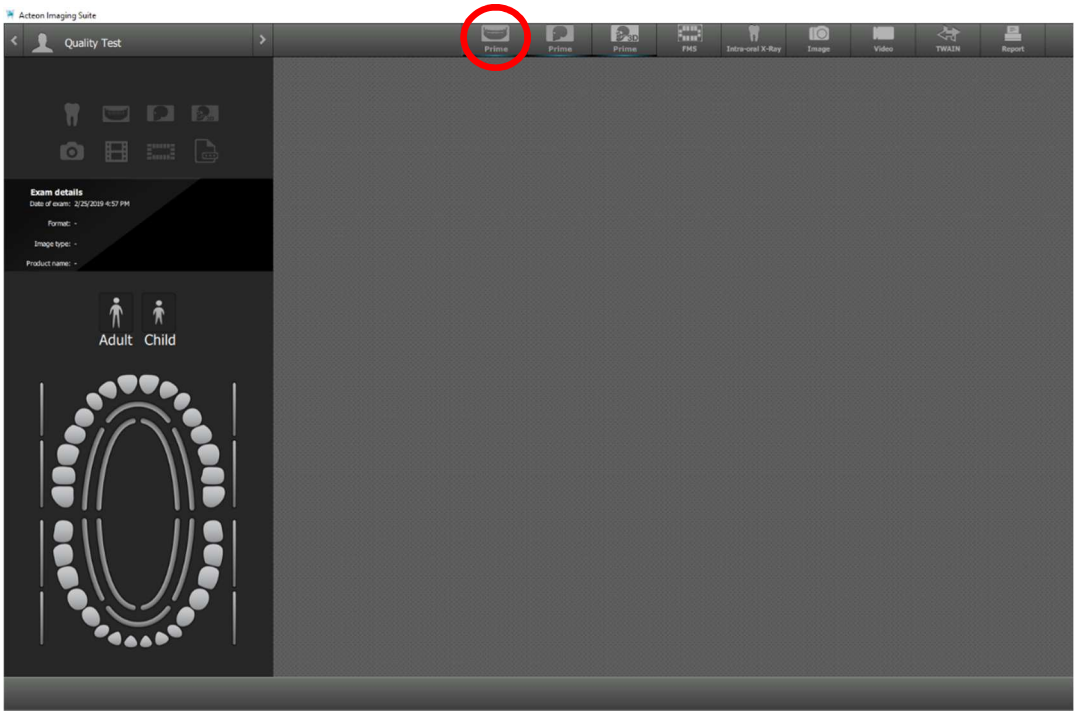
7.8 Software installation

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, the window below opens:

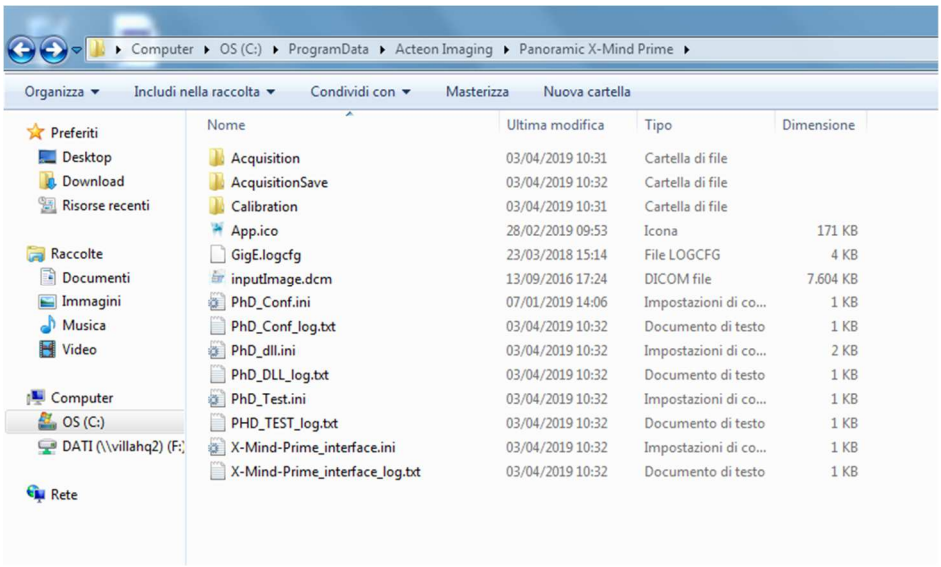


3. To check that the installation is correctly completed, open AIS, click on “Mouth” symbol (see arrow) and then on keyboard symbol (see circle) to open Virtual Keyboard of the unit.



7.9 Detector Calibration files installation

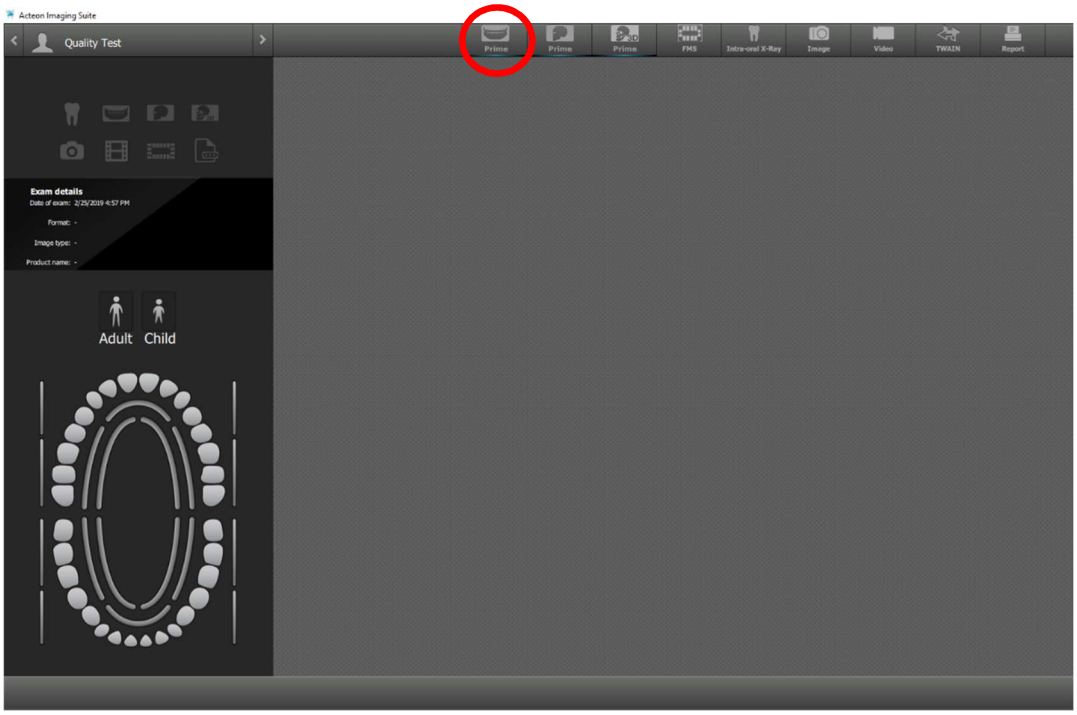
Before starting unit operation, it is necessary to copy all the detector calibration files in the PC.
Insert the USB pen drive or CD/DVD media containing the detector calibration files and open it.
In case of USB pen drive, open the partition “CALIBRATION” and double click on “Install.bat”. In case the automatic copy fails, copy all the files inside the folder “Calibration” in the directory C:\ProgramData\Acteon Imaging\Panoramic X-MIND Prime\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\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. Select the “Mouth” icon.



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

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

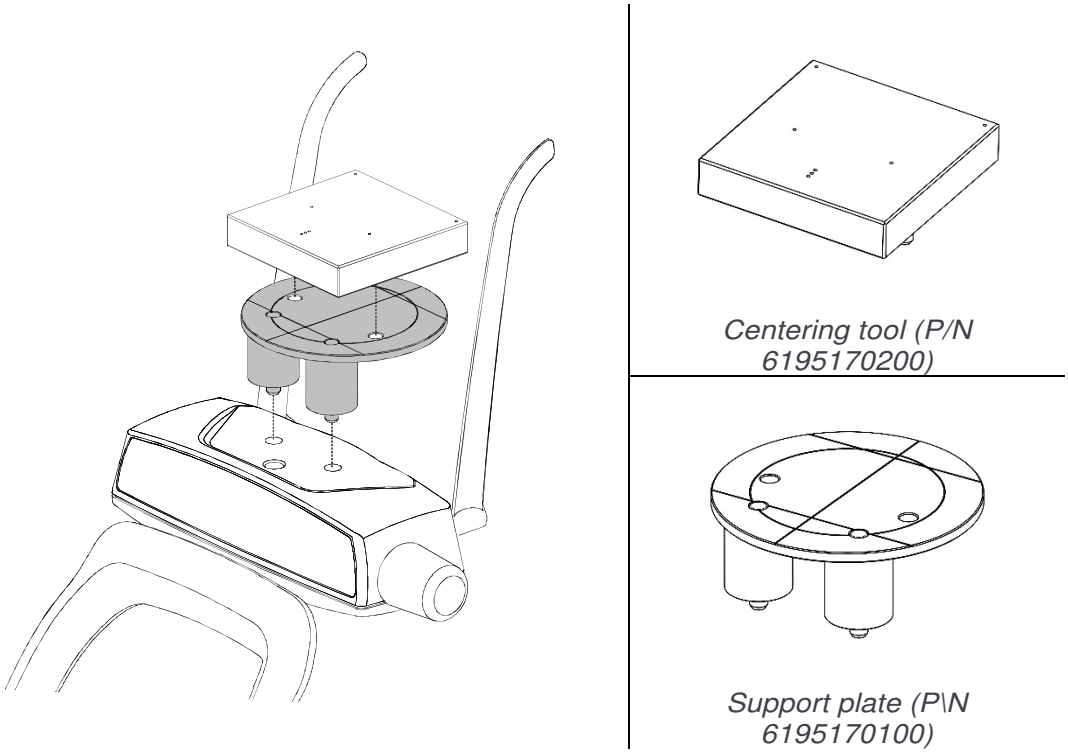
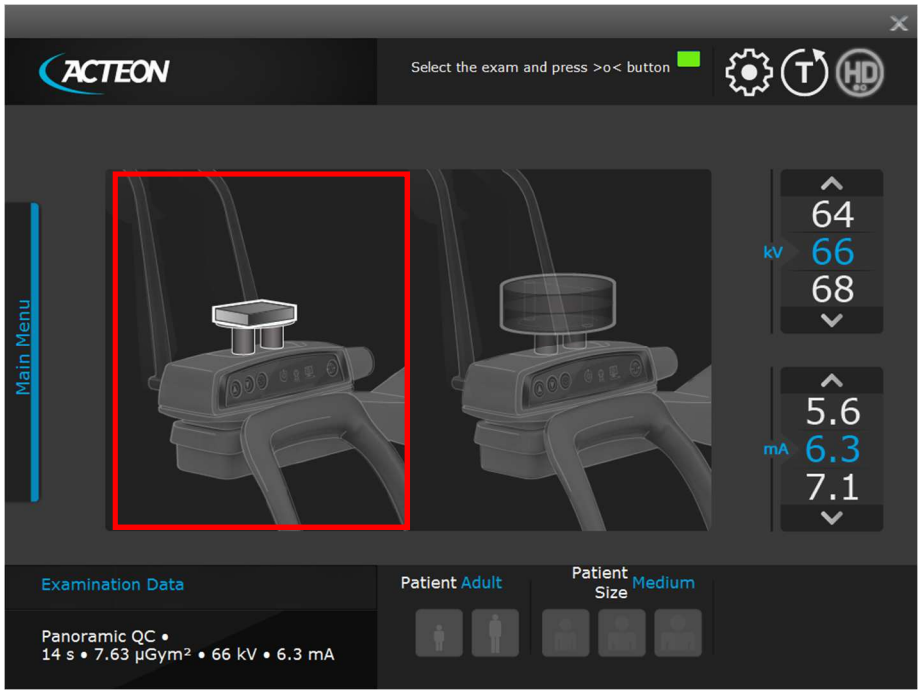
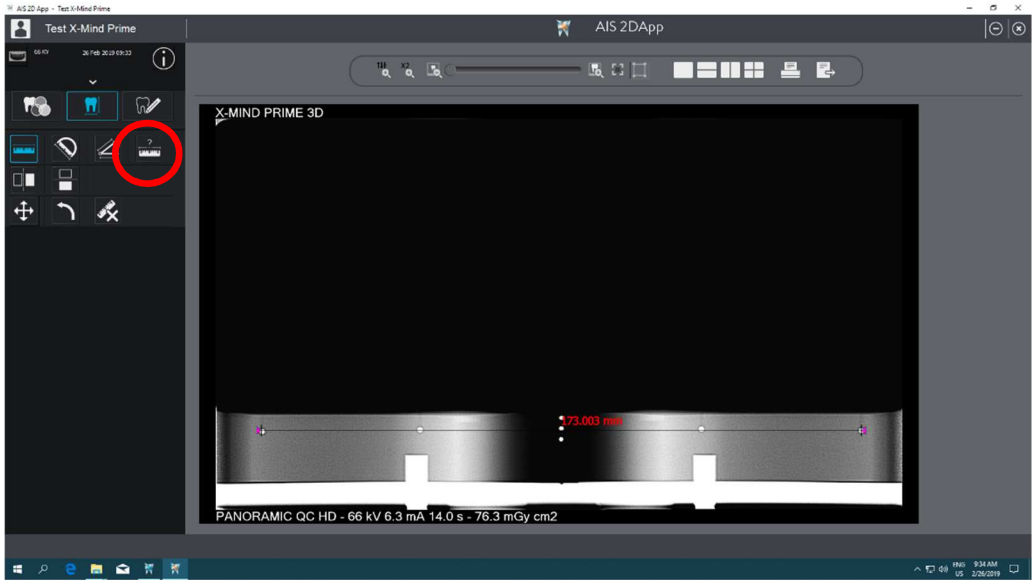


Figure 29: Support plate and centering tool positioning

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



7. Select “Panoramic QC” exam clicking on the left area of the virtual interface.
8. Make an exposure at 66kV, 6.3mA (see User’s Manual – chapter 9).
9. Select the “Ruler” icon and measure the distance between the two external spheres; this value must be 173mm ± 2mm.



10. If distance is outside the tolerance range, enter the service menu (see chapter 0) and adjust the Y axis offset (see paragraph 8.3) accordingly. Repeat the exposure.
11. Measure also the two halves of the image in order to check symmetry. The difference has to be max. 2mm.
12. 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, enter the technical setup and adjust the chin rest offset (see paragraph 8.5).

    Repeat the exposure.

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.

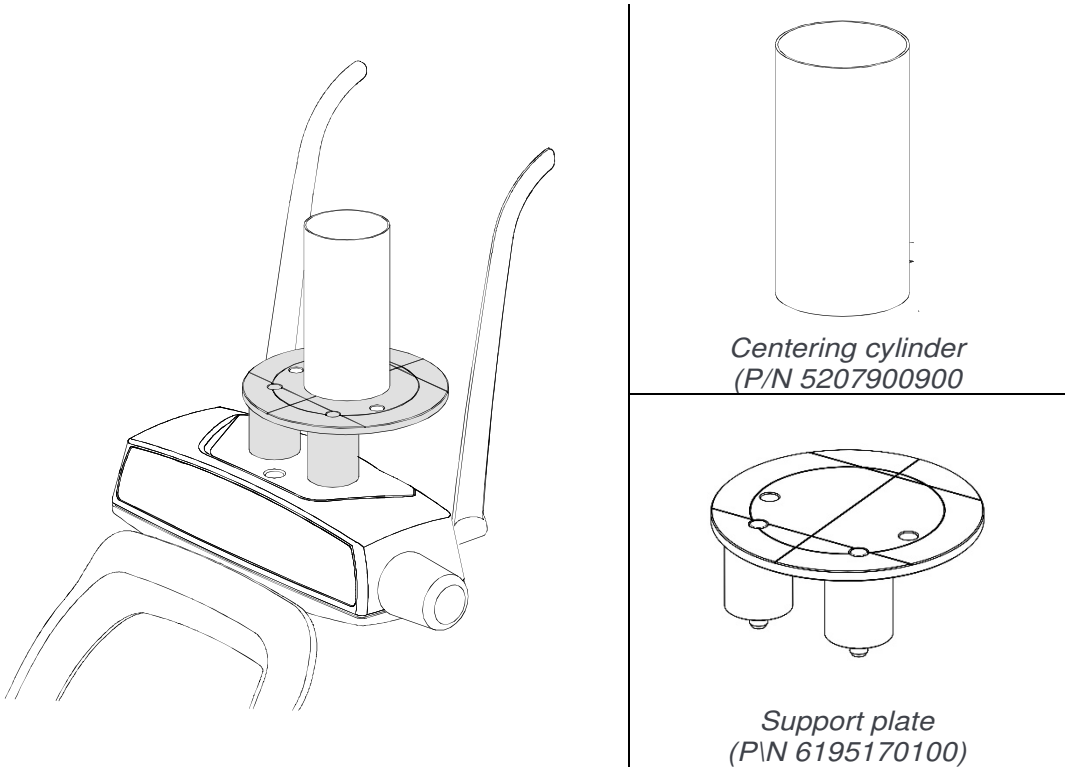
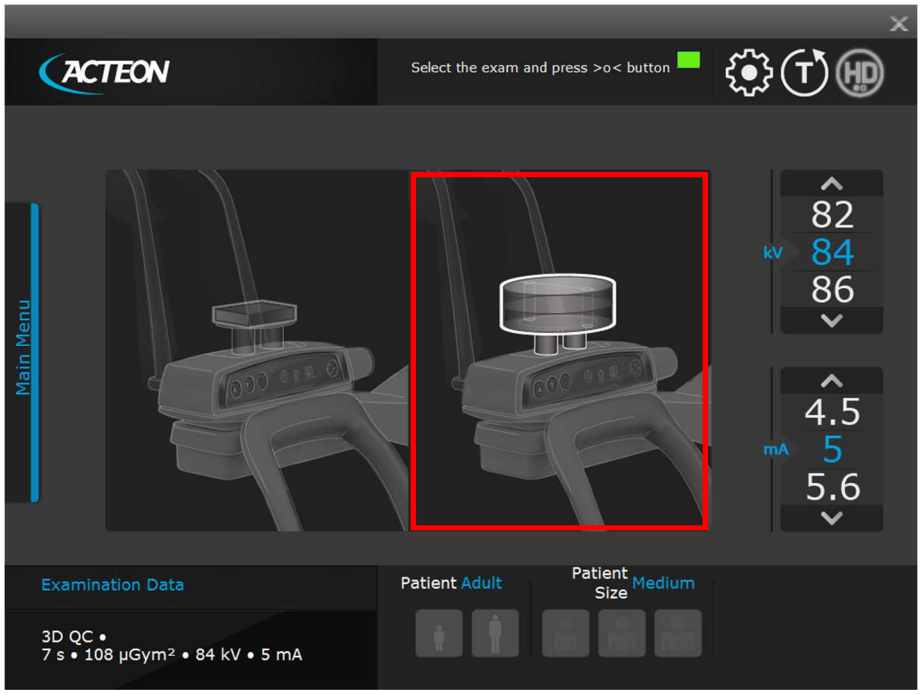
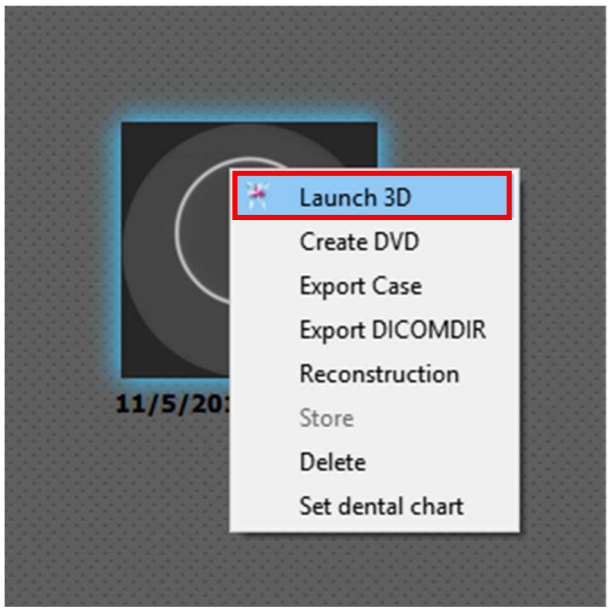


Figure 30: Support plate and centering cylinder positioning

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 right 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 “Export to 3D Planner”.



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

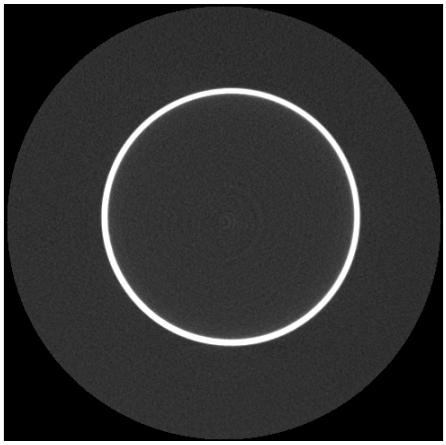


Figure 31

8. In case the reconstruction is not correct (as shown in the following Figure) it will be necessary to follow the procedure described in paragraph 8.8.

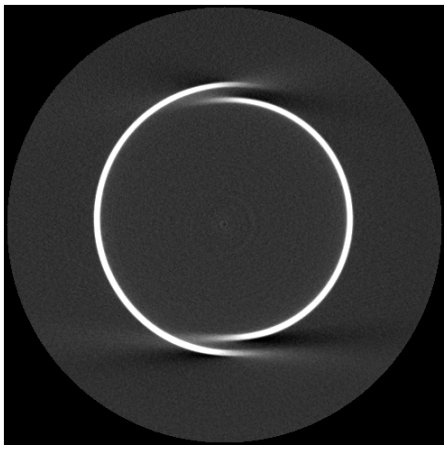


Figure 32

7.12 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 91ignalled 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.

7.12.1 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.

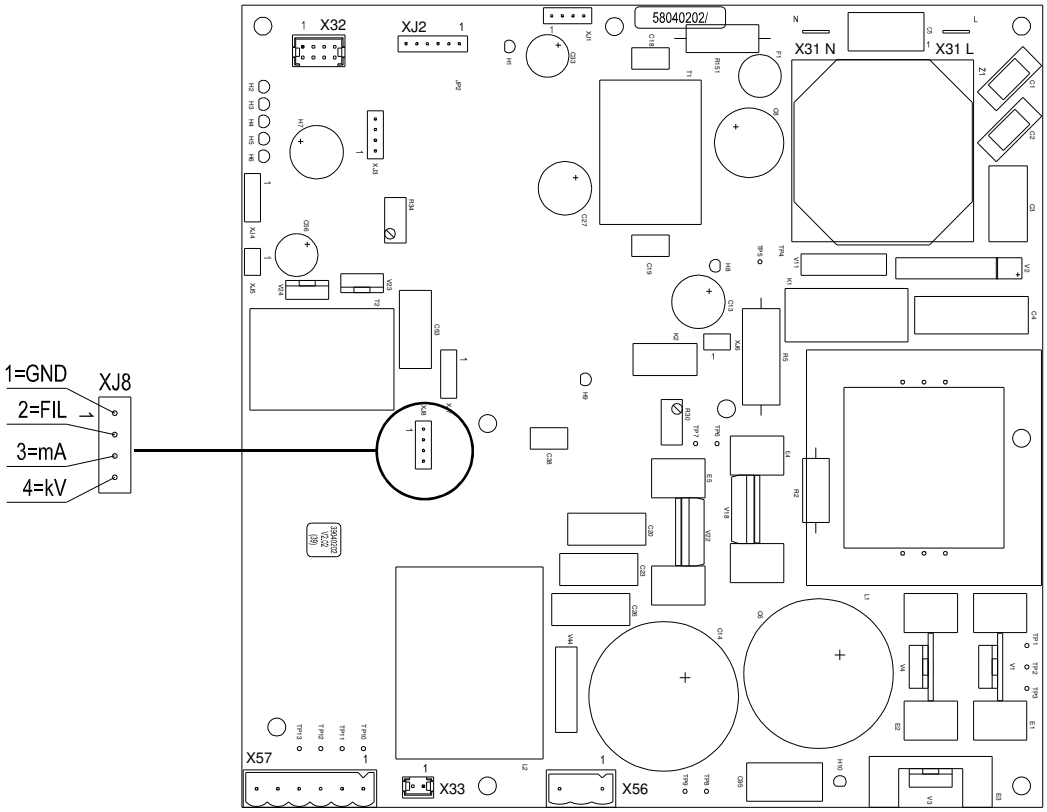
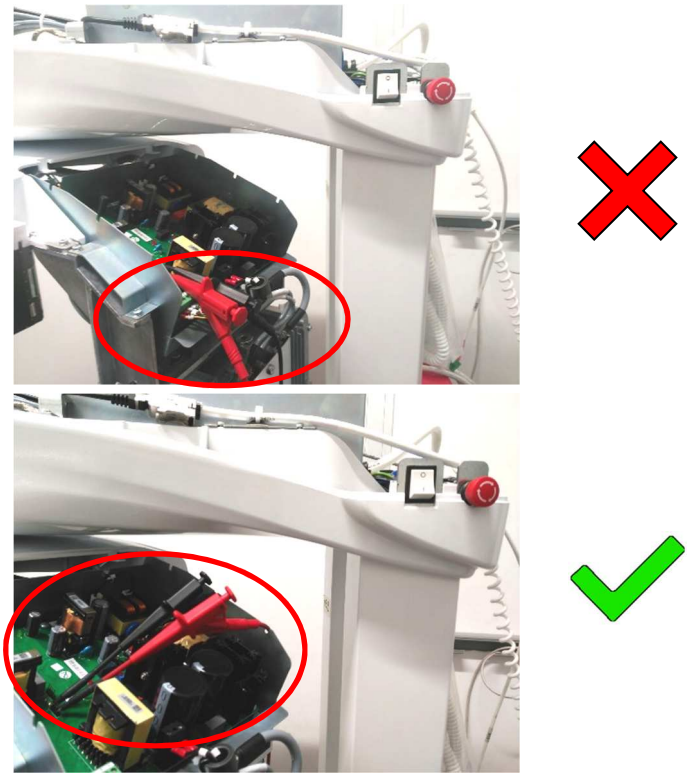


Figure 33

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.

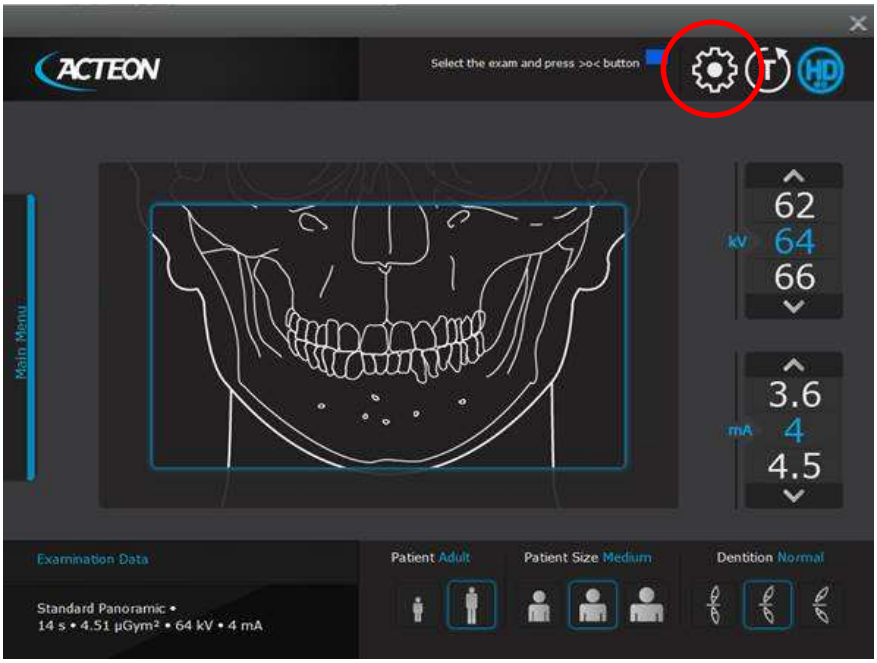
Parameter	Instrument	XJ8 pins
kV	Multimeter or oscilloscope	PIN 1 → GND PIN 4 → kV feedback
mA	Multimeter or oscilloscope	PIN 1 → GND PIN 3 → mA feedback
time	Oscilloscope	PIN 1 → GND PIN 3 → mA feedback

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

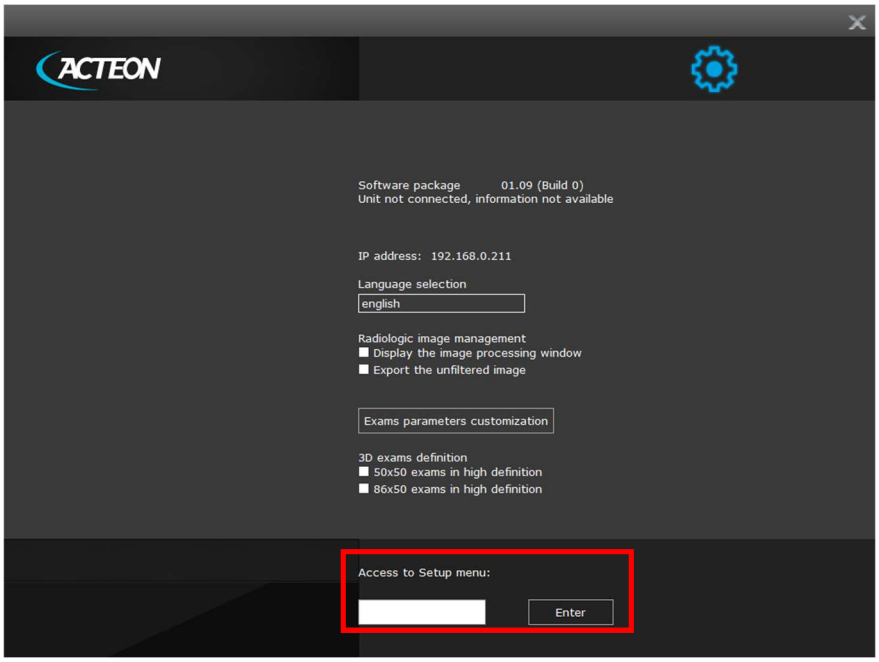


5. Switch ON the system and as soon as the green led starts blinking, press >0< for initialization.

6. From the virtual interface main menu, select the symbol GEAR (configuration).



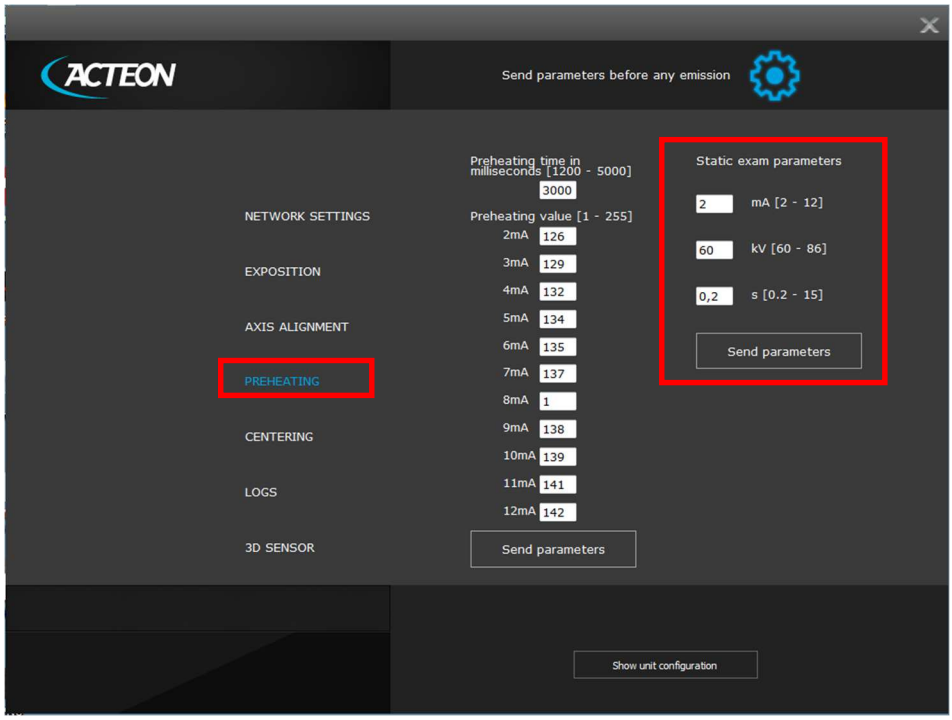
The following window will be displayed:



7. Insert the password “TechAccess” and press Enter.

Warning
As soon as Enter is pressed, the unit will perform an axis reset.

8. On the displayed window, select “PREHEATING” from the left menu.



9. In the “Static exam parameters” area set the following exposure parameters: 60 kV, 2 mA, 3 s. Press “Send parameters”.
The message “Press X-Ray button to start emission” will be displayed on the top of the virtual interface, indicating that the unit is ready to emit X-rays.

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.

10. 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 11.

11. Take a second exposure setting the following parameters: 86 kV, 12.5 mA, 3 s and verify that the measured values are in the acceptance limits listed in the following table.

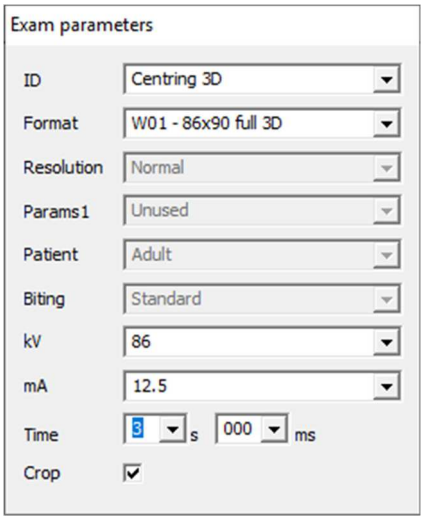
Parameter			Acceptance range		
kV	mA	t (s)	kV feedback (± 8%)	mA feedback (± 10 %)	Time (± 5 %)
60	2	3	2.76 to 3.24 V	0.9 to 1.1 V	2.85 to 3.15 s
86	12.5	3	3.96 to 4.64 V	3.7 to 4.5 V	2.85 to 3.15 s

12. 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.

7.12.2 Verification of Exposure parameters with NON invasive method

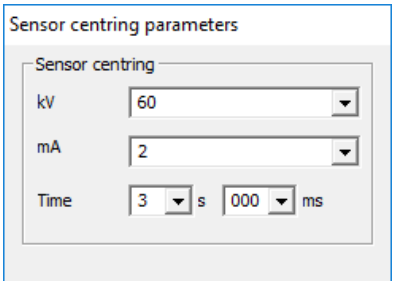
The exposure parameters (kV, time and dose) can also be verified using the so called "non-invasive method".
The exposure parameters can be checked with a non-invasive instrument by performing the following procedure:

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_Test software (located at C:\Program Files (x86)\Acteon Imaging\Panoramic X-MIND Prime 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 – 86x90 full 3D".



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.

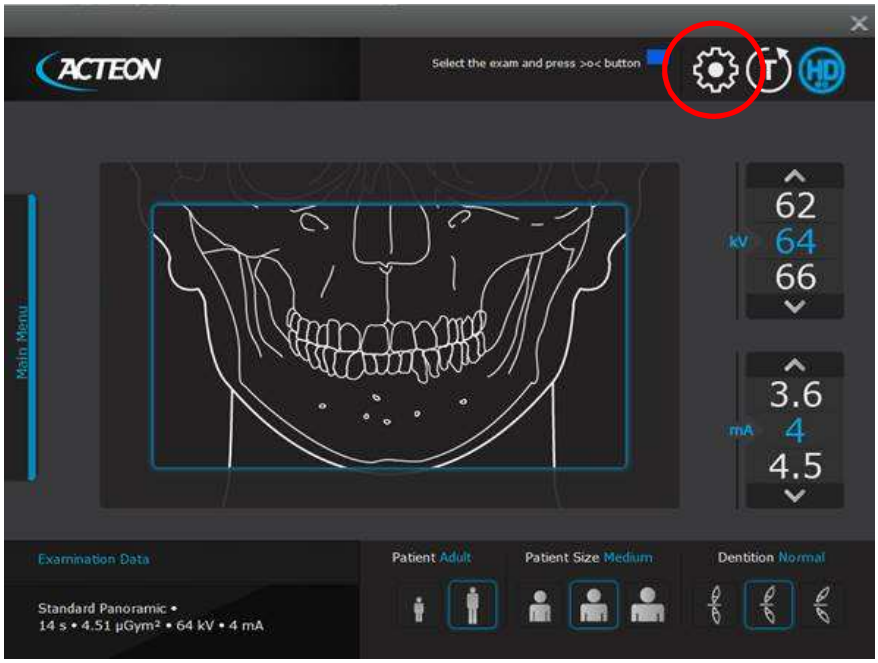
6. Take a second exposure setting the following parameters: 86 kV, 12.5 mA, 3 s and verify that the measured values are in the acceptance limits listed in the following table.

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	12.5	3	79.1 to 92.8 kV	2.85 to 3.15 s

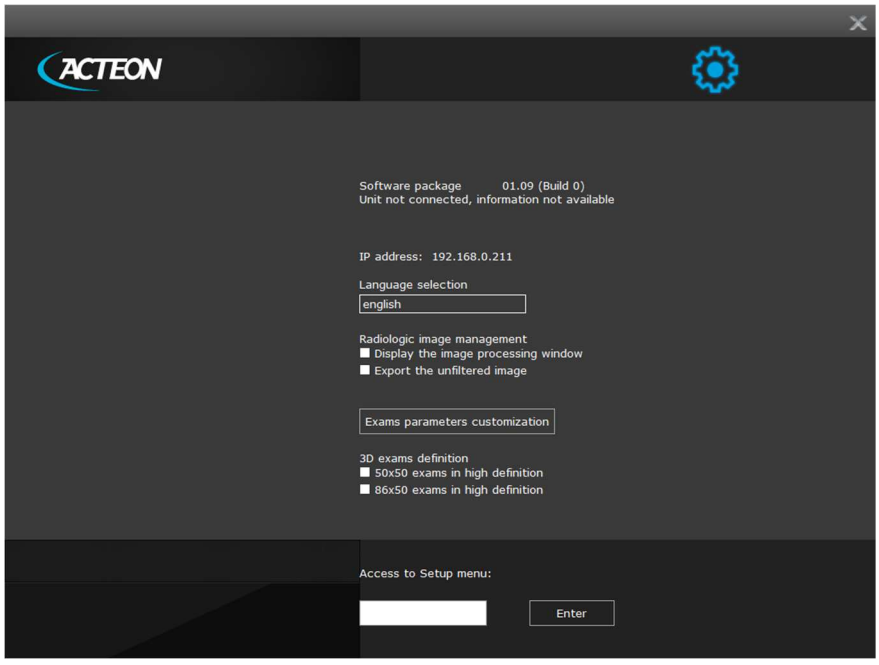
7. In case the test fails (result do not match the indicated values), proceed with the following actions:
   - Check the probe position and repeat the test
   - If the values are still out of range, perform the test using the invasive method as described in paragraph 7.12.1.

7.13 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).

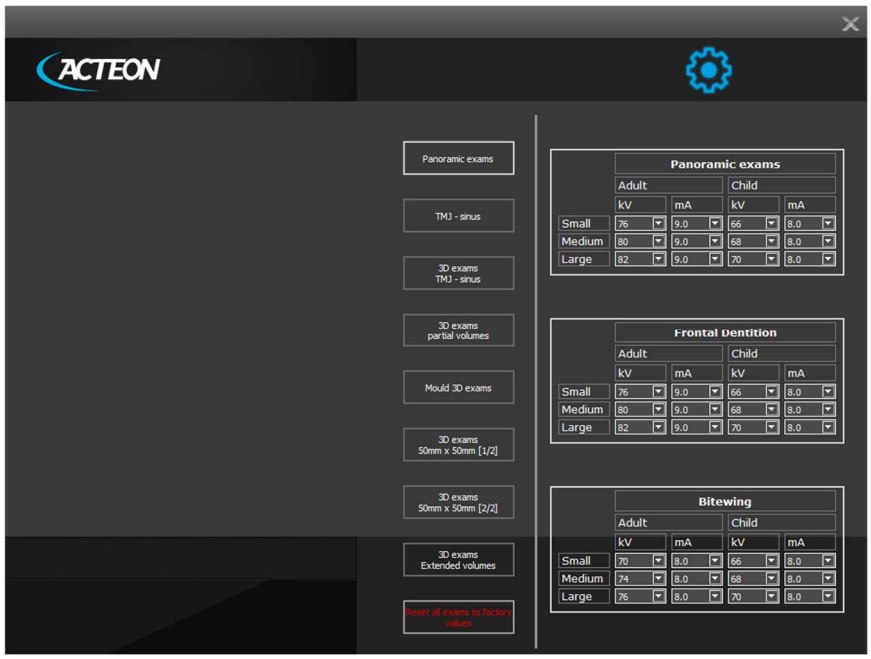


The following window will be displayed:



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”.

7.13.1 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

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 rotation movement to the patient's anatomy.

7.14 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
- Detector calibration files / Software installation CDs or USB pen drive media.

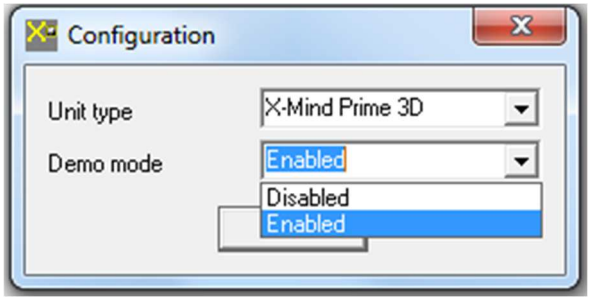
7.15 Exhibition mode setup

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.

7.15.1 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_Conf.exe” program in C:\Program Files (x86)\Acteon Imaging\Panoramic X-MIND Prime
2. On the “Configuration” window select “Demo mode” as “Enabled”:



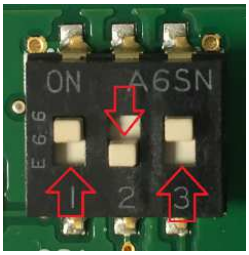
   Confirm with “OK”.
3. Start AIS program and open the G.U.I. The user interface (G.U.I.) will work normally without the unit connected.

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

7.15.2 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 4.3.2.1)



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

7.15.2.1 Single Panoramic 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. Press the >0< button and wait the end of the movements.
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.

7.15.2.2 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. Keeping pressed the X-ray button, press the >0< button.
4. After 5 second release both >0< and X-ray buttons.
5. The unit starts to perform a demo panoramic roto-translation and then the columns will move Up/Down.
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.

7.15.2.3 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 0).
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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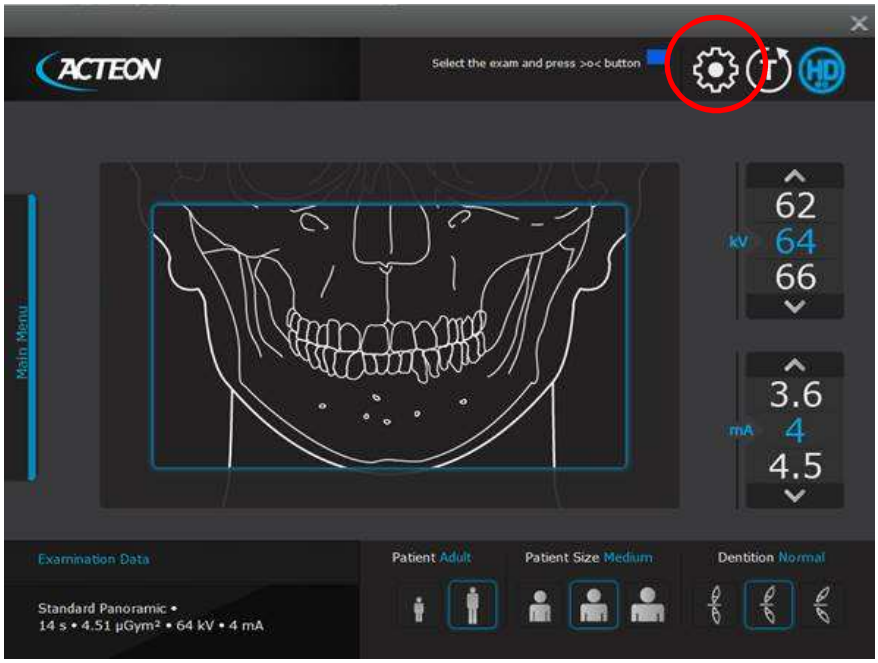
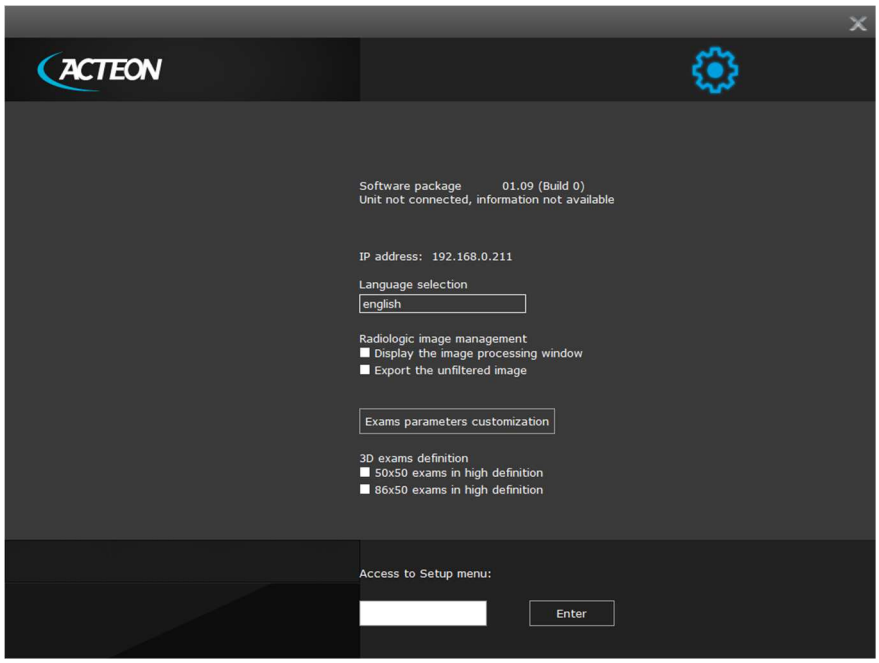
8. SERVICE PROGRAMS DESCRIPTIONS

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.

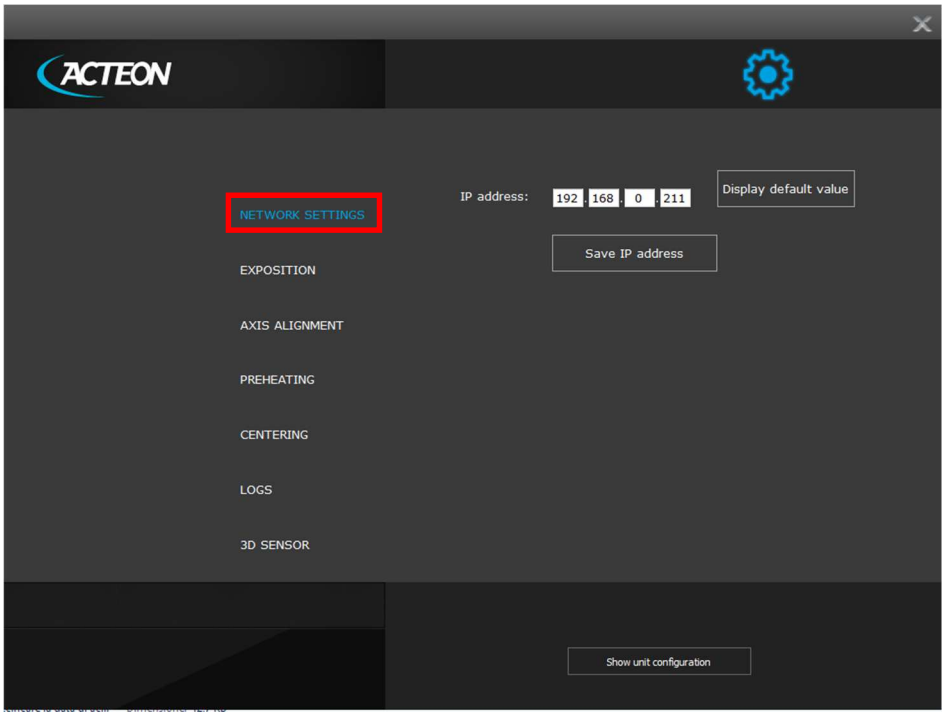
This page is reserved only to authorized technicians: it allows access to the different functional parameters, as following:

- ***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)
- ***Axis Alignment:*** allows to adjust motor offsets (see paragraph 8.3)
- ***Preheating:*** allows to adjust the filament parameters. It is used only in case of tubehead replacement (see paragraph 8.4)
- ***Centering:*** displays the collimator offsets and allows to adjust the chin rest offset (see paragraph 8.5)
- ***Logs:*** this page displays the exam counters (see paragraph 8.6)
- ***3D sensor:*** displays 3D reconstruction offsets.

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

8.1 Network setting

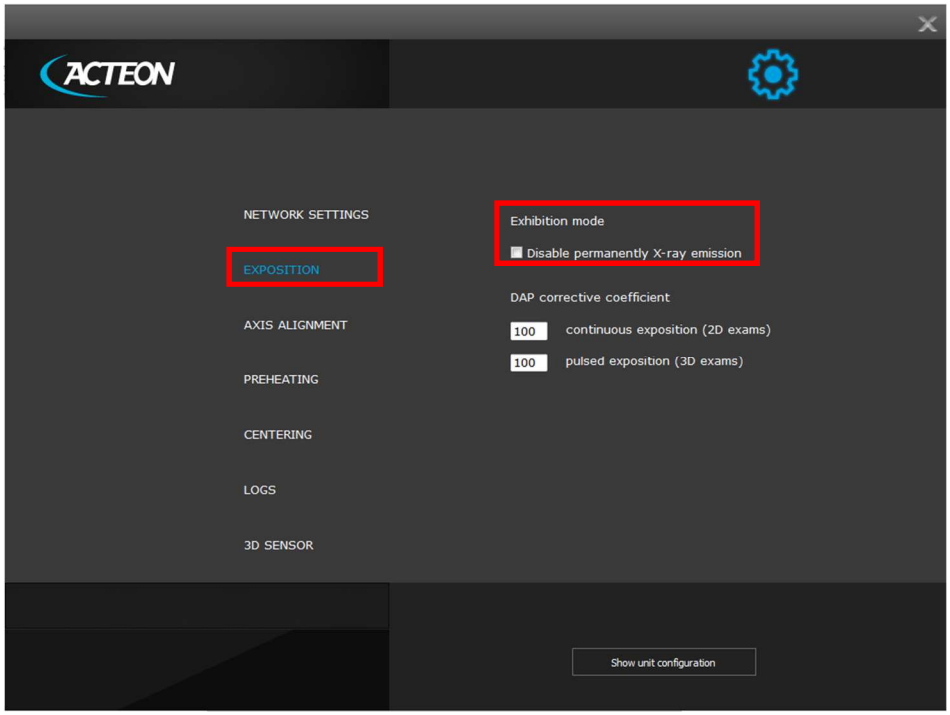
Selecting “Network Setting” it is possible to modify the IP address used to communicate with the X-MIND prime 3D (see paragraph 11.2.8).



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

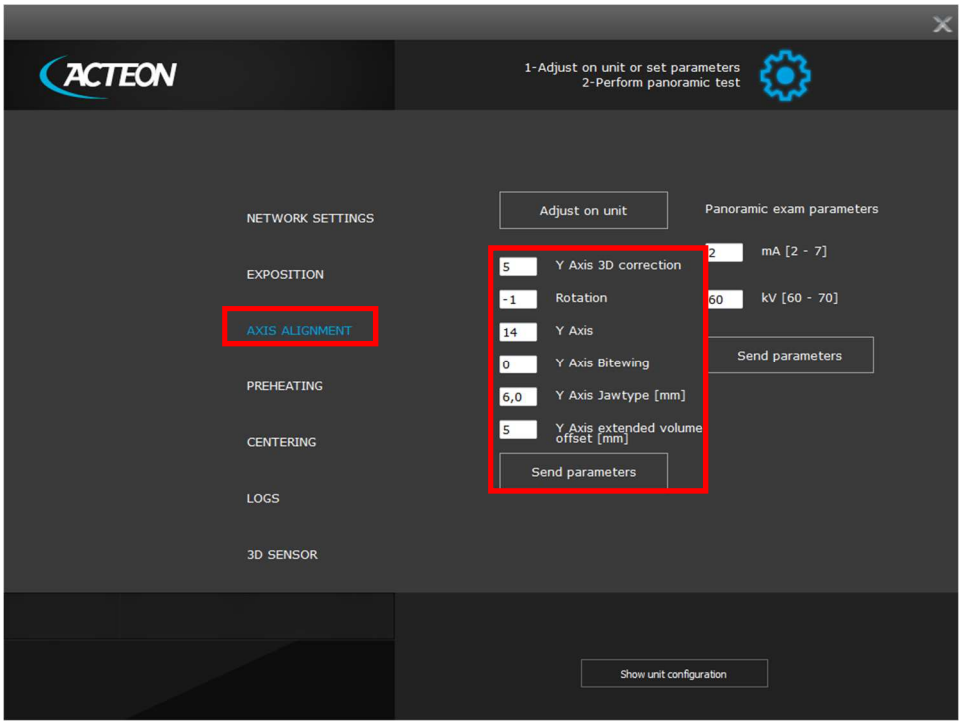
This function allows to disable X-ray emission permanently: check the box to disable X-rays.



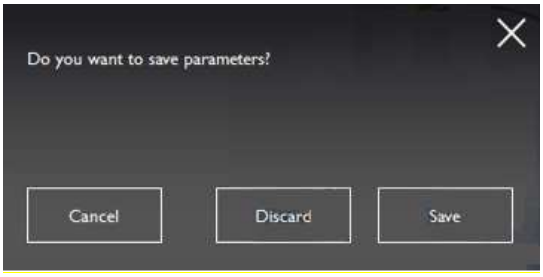
8.3 Axis Alignment

This setup page allows to adjust the following motor offset:

- **Y Axis 3D correction** is used to adjust the position of the field of view along the Y axis in 3D exams.
- **Rotation** is used to adjust the arm rotation offset (positive values correspond to counter-clockwise rotation). It can be verified using the reference line on the support plate.
- **Y Axis** is used to adjust the position of the focal layer of Panoramic image. Modification of this parameter affects the size of the image (distance between the external spheres of the centering image – see paragraph 7.10)
- **Y Axis Bitewing** is used to adjust the Bitewing Y axis offset.
- **Y Axis Jawtype** is used to adjust the Y offset difference among different type of dentition (protruded, retruded).
- **Y Axis extended volume offset** is used to adjust the FOV Y position of the Airways exam with respect to the standard 3D Full Dentition exam. Default is 10 mm that means that the Airways exam FOV is BACKSHIFTED by 10 mm with respect to the 3D Full Dentition exam.



In order to store the offset values permanently click on “Send parameters”, select another menu (e.g. Centring) and then click “Save” on the displayed dialog window.



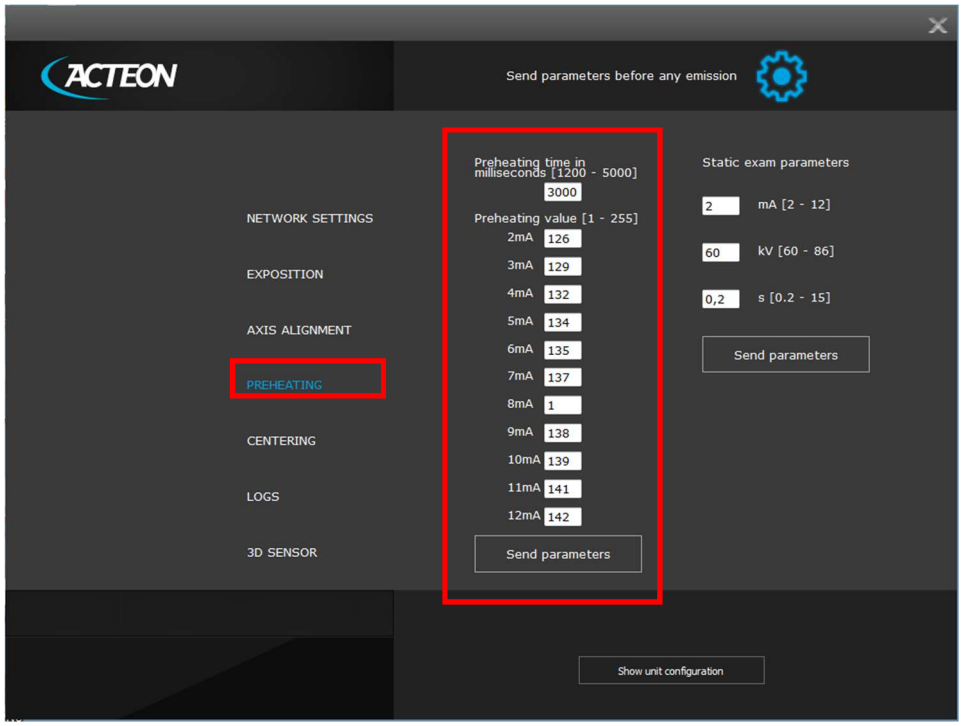
Warning
Modifying the motor offset values can severely impair functionality.

To check the effectiveness of the adjustments it is recommended to perform a panoramic acquisition using the centring tools as described in paragraph 7.10.

8.4 Preheating

This function allows to adjust the filament current used to emit properly the requested anodic current.

Note
This operation has to be done only in case of Tubehead replacement.

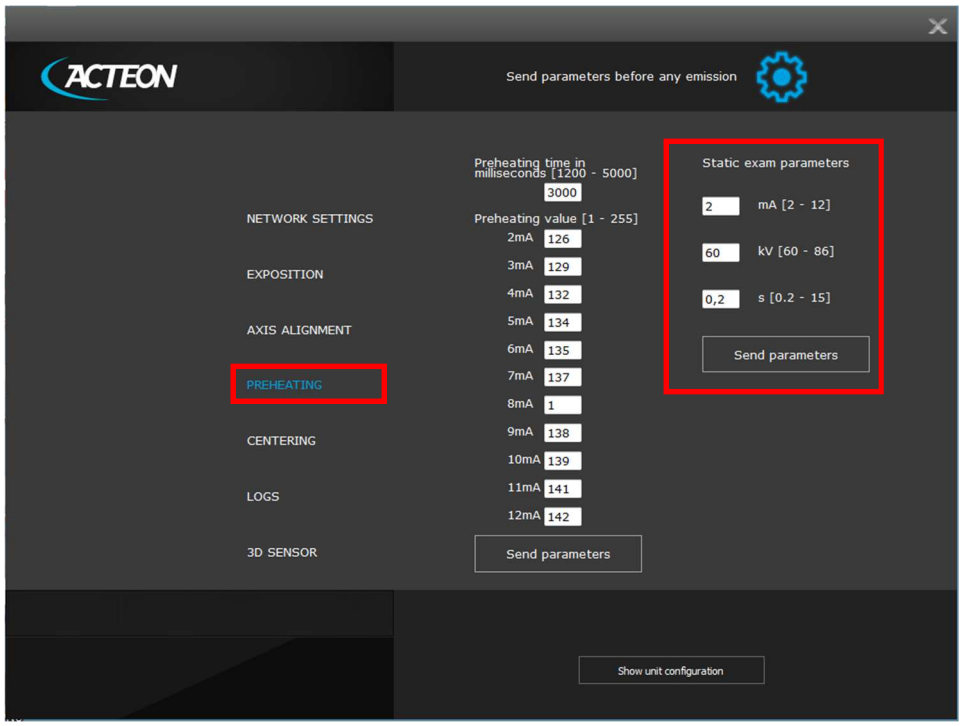


Warning
Wrong settings of preheating parameters may damage X-ray tube.

In order to store the offset values permanently click on “Send Parameters”, select another menu (e.g. Centring) and then click “Save” on the displayed dialog window.

From this menu is it also possible to perform a static acquisition (no movements) with the collimator positioned on the panoramic window.

- Type the desired exposure parameters in the fields mA, kV, s.
- Click on the button “Send parameters” and wait for the message “Press X-Ray button to start emission”.
- Press the X-ray button.

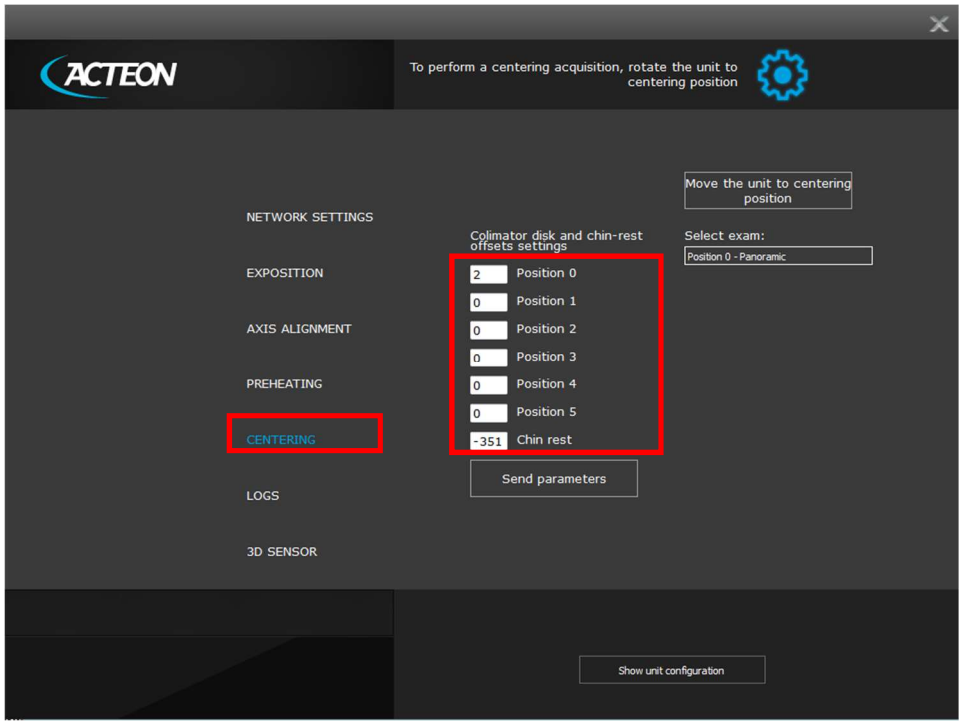


8.5 Centering

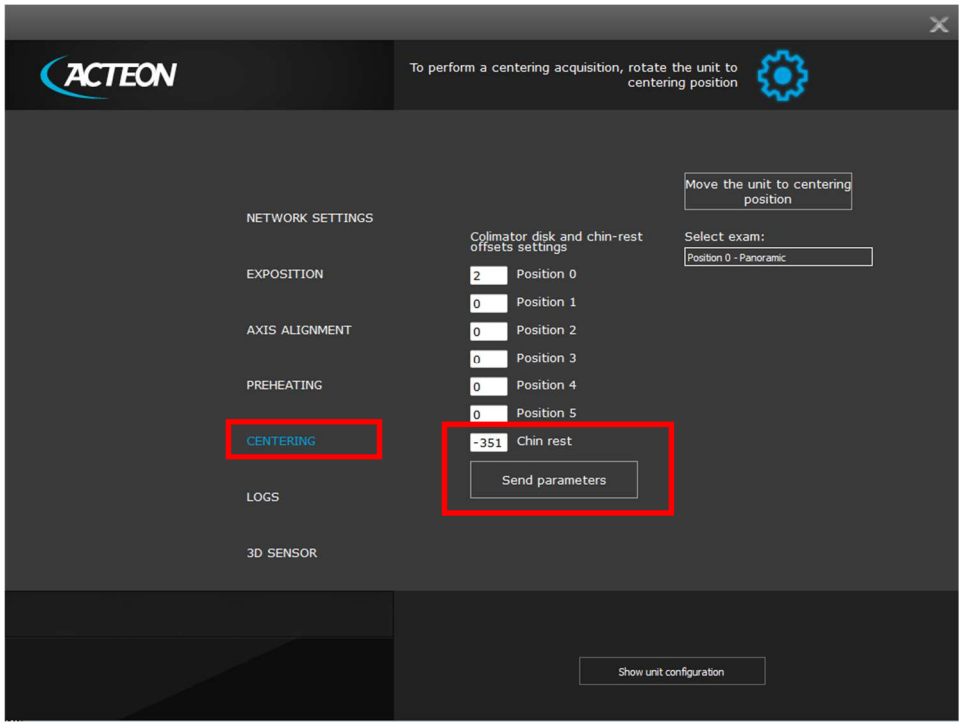
This function displays the collimator disk offset settings:

- Position 0: Panoramic collimator offset (W0)
- Position 1: Full 3D Dentition collimator offset (W1)
- Position 2: Mandibular jaw 85x50mm (W2)
- Position 3: Maxillary jaw 85x50mm (W3)
- Position 4: Maxillary small volume 50x50mm (W4)
- Position 5: Mandibular small volume 50x50mm (W5).

In this menu it is possible to modify the numeric values of the collimator offsets, in case they don't match the parameters reported on the set parameters tables provided with the unit documentation.
In case the values match the ones reported by the set parameters tables, please verify and modify the collimator alignment, following the instructions at paragraph 8.7.



This function also allows to adjust the chin rest motor offset.

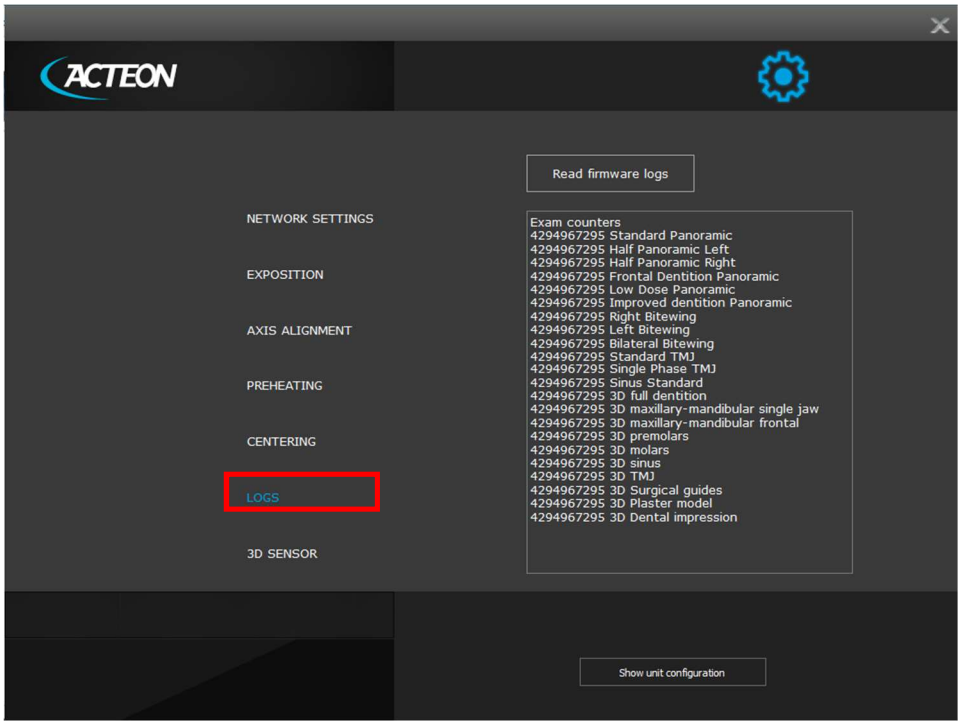


With respect to the centering image (see paragraph 7.10), increasing the chin rest offset will decrease the distance between the left and the central spheres and increase the distance between the central and the right spheres (left and right side are related to the screen visualization).
Type the new offset value in the “Chin rest” box.

In order to store the offset values permanently click on “Send Parameters”, select another menu (e.g. Preheating) and then click “Save” on the displayed dialog window.

8.6 Logs

In this page it is possible to see the exam counters.

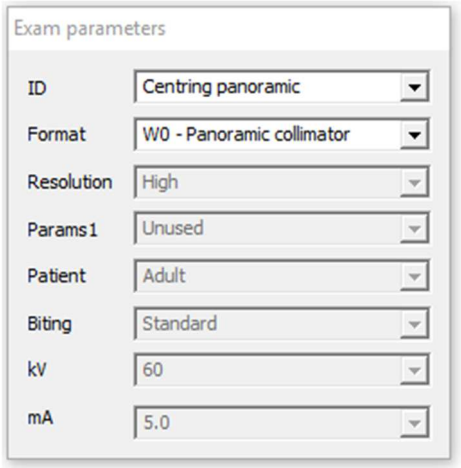


In order to keep the unit logs, refer to paragraph 11.2.1.

8.7 X-Ray beam alignment check

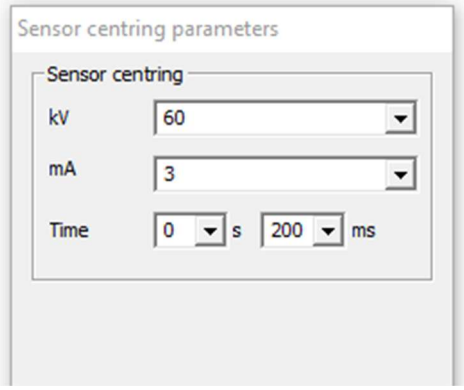
In order to make an exposition without rotating the arm it is necessary to use the software “Phd_test” you can find in the directory C:\Program Files (x86)\Acteon Imaging\Panoramic X-MIND Prime . This function is useful to verify and adjust the x-ray beam alignment on the digital sensor and also to measure exposure parameters (see par. 9.7). This function is required in case of tubehead or digital sensor replacement.

1. From the “Exam parameters” window select the exam ID “Centring panoramic” and the Format “W0 – Panoramic collimator”.



Note
In order to make a static exposition with the 3D collimation select the exam ID “Centring 3D” and the Format “W1 – Full 3D 86x90”.
This is recommended for the measurement of exposure parameters with non-invasive method.

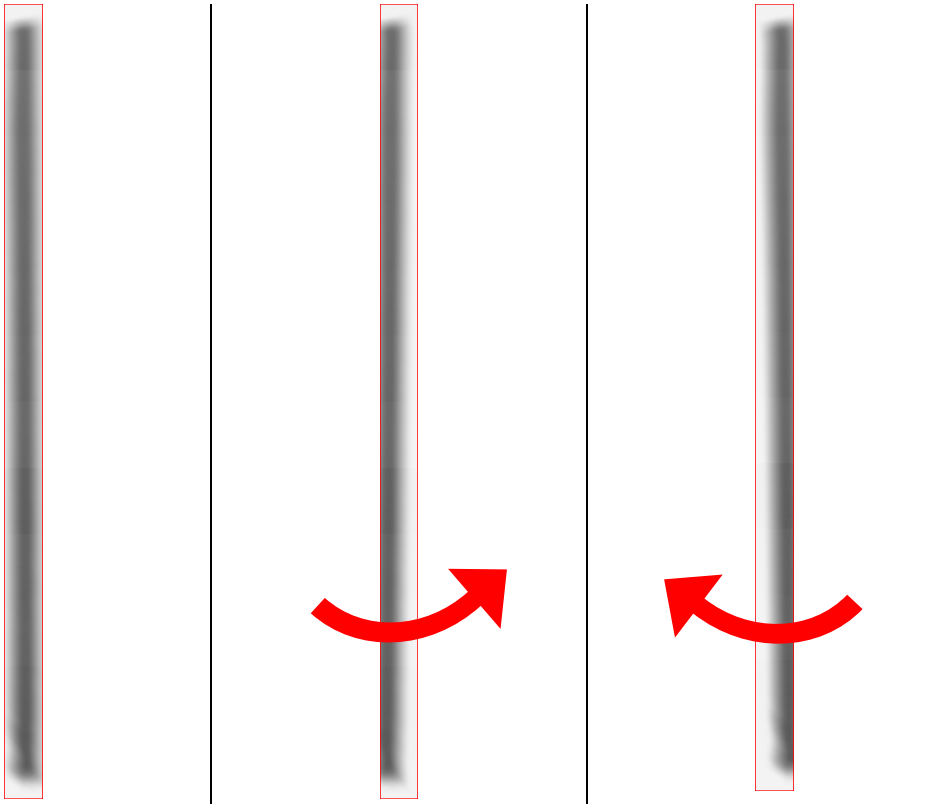
2. Set the exposure parameters from the “Sensor centring parameters” window.



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. If the image is saturated, lower the exposure parameter and perform again the acquisition.

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 only in case of collimator replacement or collimator light barrier replacement.

4. Use the UP/DOWN keys to adjust the collimation according to the figure below. Once the UP/DOWN key is pressed the laser turns on, so press >0< and wait for the blue led before performing another exposure.



The x-ray beam is correctly aligned if a white border is visible on each side of the image

In order to move the x-ray beam to the right of the image press UP + >0<

In order to move the x-ray beam to the left of the image press DOWN + >0<

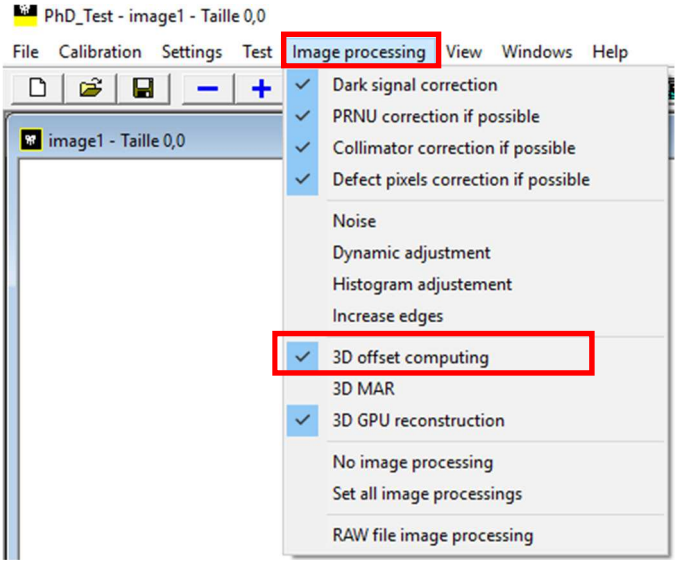
Figure 34

5. 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.

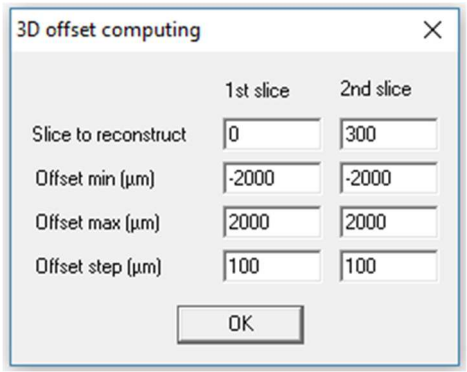
8.8 3D Reconstruction adjustment

In order to adjust the 3D reconstruction and remove possible artefacts, it is necessary to use the software “Phd_Test” you can find in the directory C:\Program Files (x86)\Acteon Imaging\Panoramic X-MIND Prime .

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.

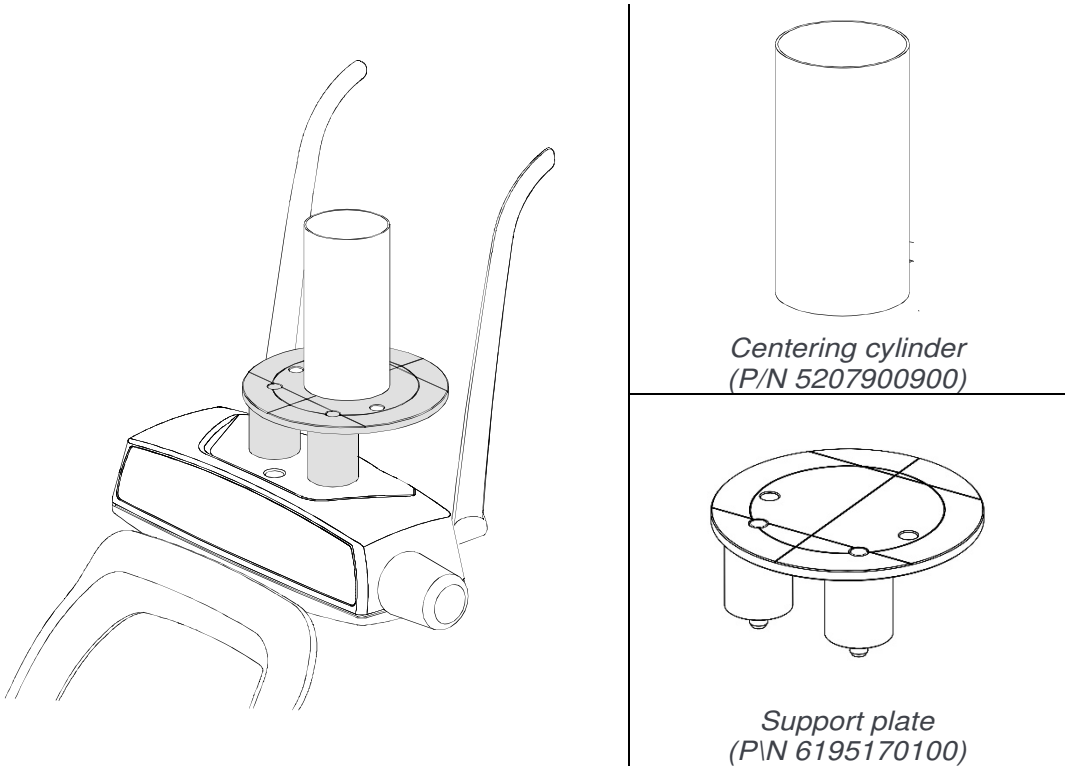
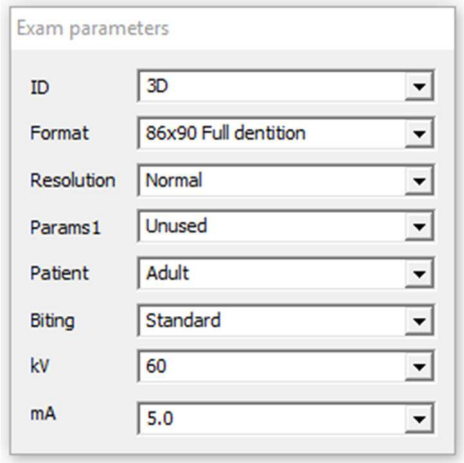


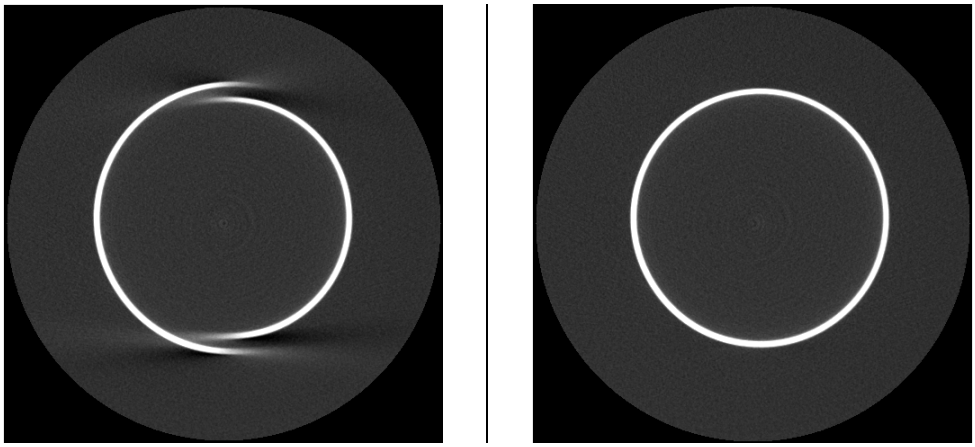
Figure 35: Support plate and centering cylinder positioning

4. In “Phd_Test” program, from the “Exam parameters” window select the exam ID “3D” and the Format “86x90 Full dentition”. Set the parameters to 60kV-5mA.

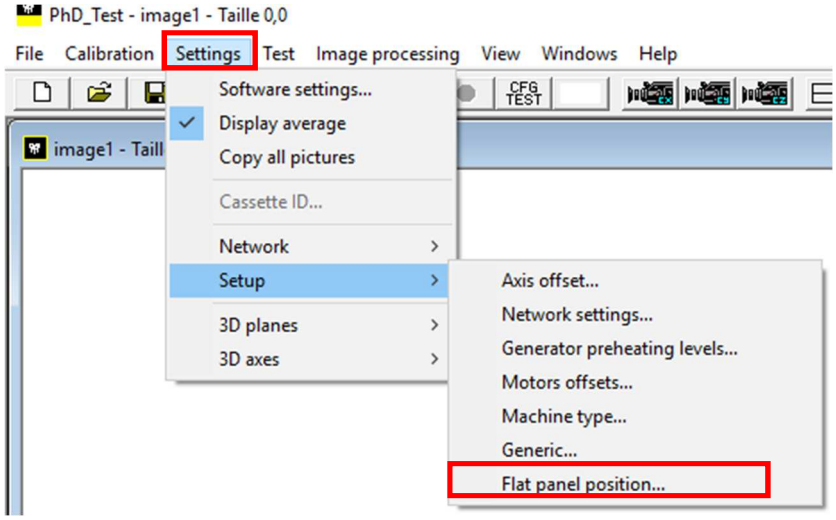


5. Press >0< button on the unit keyboard and wait until the chin rest support is positioned. Press >0< button again to complete the unit positioning.
6. Press the X-ray button to perform the acquisition.

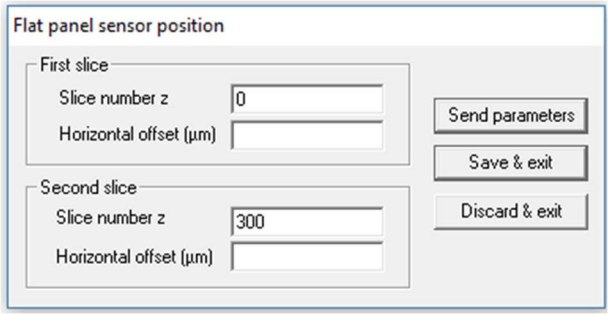
7. Open the files located in C:\ProgramData\Acteon Imaging\Panoramic X-MIND Prime\Centring with an image viewer: the name of these files contains two values: OFFSET_HORIZONTAL_Z and OFFSET_HORIZONTAL_UM.
8. Among the files named OFFSET_HORIZONTAL_Z=000 look for the file in which the reconstructed circle 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*



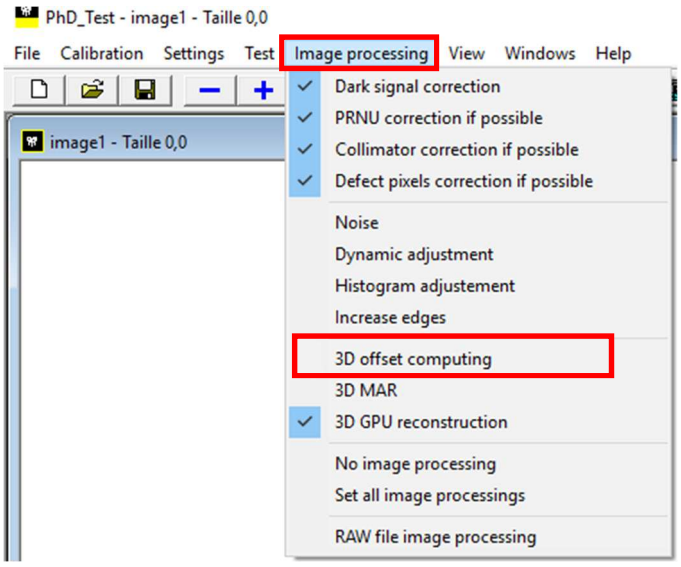
9. Repeat the operation for the files named OFFSET_HORIZONTAL_Z=300 and take note of the OFFSET_HORIZONTAL_UM value.
   *e.g.: OFFSET_HORIZONTAL_Z=000 – OFFSET_HORIZONTAL_UM=**800**.bmp*
10. In “PhD_Test” program go to menu “Settings” and select “Flat panel position”.



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. Wait that the machine complete initialization (you will see the blue led on keyboard is blinking).
14. Click on “Save & exit”.
15. Disable in the menu “Image processing” the “3D offset computing” and reboot the X-MIND prime 3D.

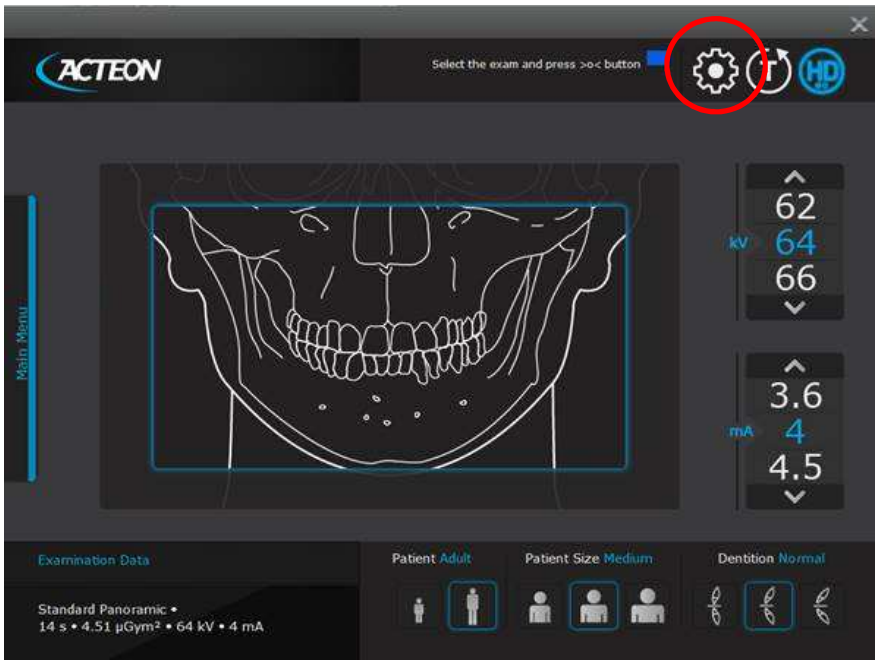


16. Verify that the offset is properly applied following the instructions at paragraph 9.6.3.

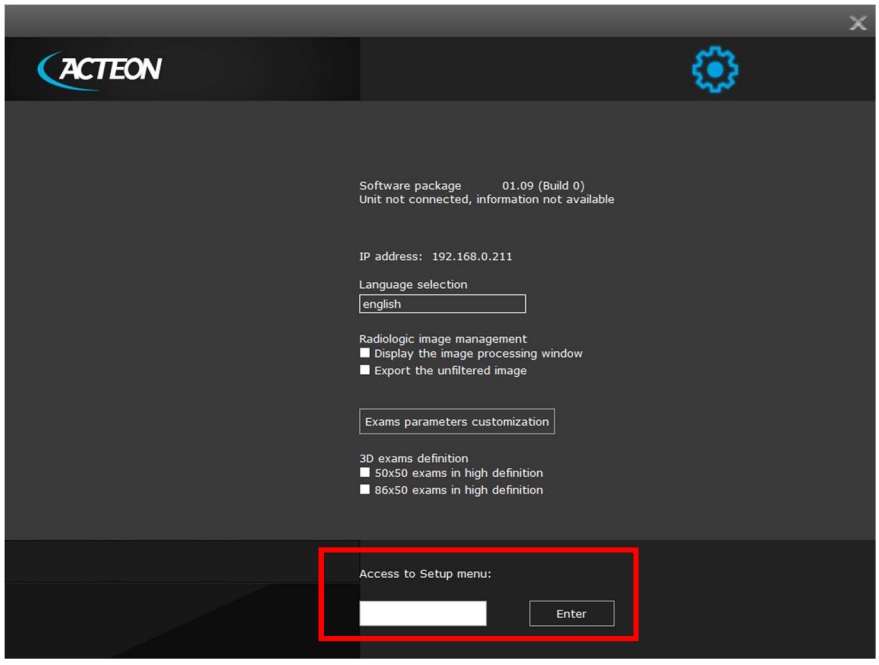
8.9 Activation of the optional functionality Extended Volumes

From X-MIND prime 3D with software version 1.09.00 forward, the Extended Volumes functionality can be unlocked through the following procedure:

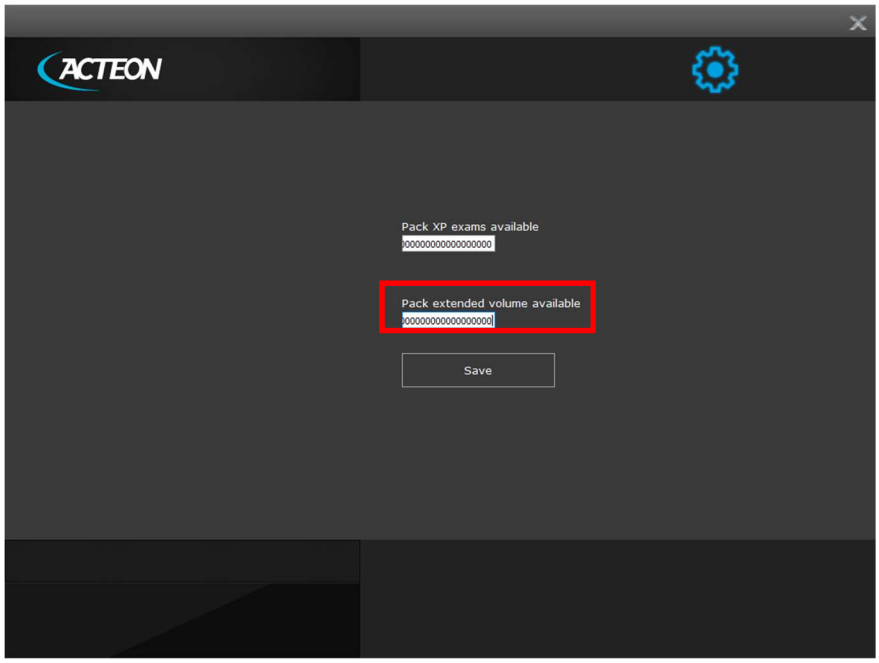
1. Launch AIS software, then from the Acquisition window click on Settings.



2. Type the password “PackAccess” in the “Access to Setup menu” filed and press Enter.

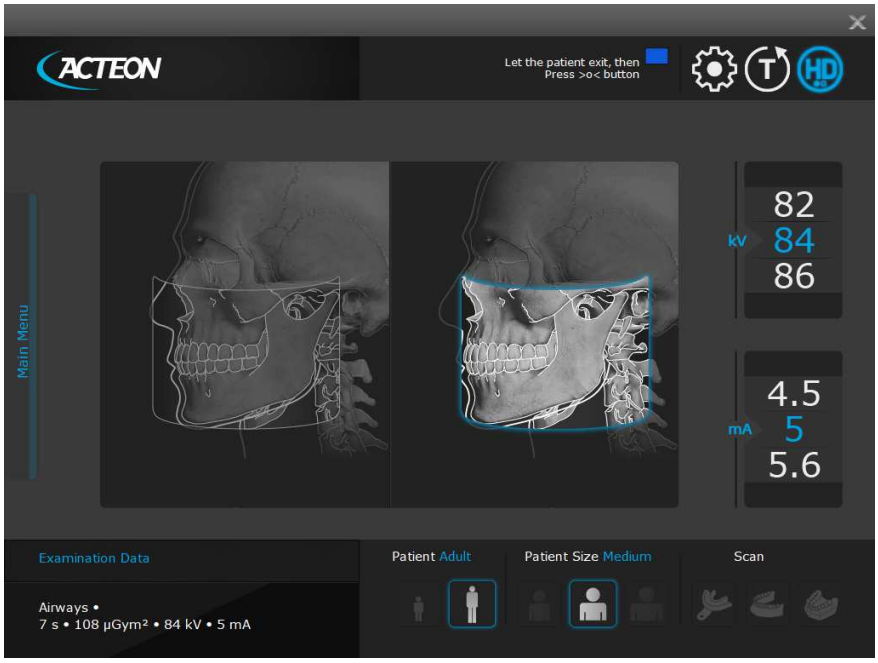


3. Copy the “Activation Code for Extended Volume Package” from the generated associated pdf to the “Pack Extended Volume” field and Save.



4. Close the Settings menu. You will have access to the Extended Volumes acquisitions.
5. Open the X-MIND prime 3D acquisition interface and the voice “Extended Volumes” is present in the list.

6. The normal Extended volume can be selected on the left, while the Airways volume can be selected on the right.



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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	Stand-by status	Failure status	Main function	Corrective action
H1	Green	ON	OFF	+24V	See paragraph 11.2.3
H2	Green	ON	OFF	+24V Motors and DSPU board 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= error on CANbus Steady OFF	Can Bus communication	See Error E1005 (paragraph 9.2.9.3)
H7	Red	Flashing / lit weakly	Steady ON= error on CANbus Steady OFF	Can Bus communication	See Error E1005 (paragraph 9.2.9.3)
H8 H9 H10	Green	OFF		The three LEDs indicates 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	Stand-by 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= error on CAN-bus Steady OFF	CANbus communication	See Error E1005 (paragraph 9.2.9.3)
H4	Green	Flashing / lit weakly	Steady ON= error on CAN-bus Steady OFF	CANbus communication	See Error E1005 (paragraph 9.2.9.3)
H5	Red	OFF	ON	ON if during exposure there is a: - Filament failure - Backup timer intervention - Bad mA / kV feedback - X-ray button release	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)
H6	Yellow	OFF	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	Stand-by status	Failure status	Main function	Corrective action
H2	Green	ON	OFF	8/9V 3D sensor power supply	See Error E1402 (paragraph 9.2.11.2)

9.1.4 DSPU board A4 LEDs

The following table shows the LEDs that are present on DSPU board A4, their functions and the recommended corrective actions in case of defects. To locate the LEDs, refer to the layout of the DSPU board A4 (see chapter 12 – drawing 5).

Led	Colour	Stand-by status	Failure status	Main function	Corrective action
D7	Yellow	Blinking	OFF	Ethernet communication	Verify the unit Ethernet connections
D8	Green	Blinking	OFF	Ethernet communication	Verify the unit Ethernet connections
D9 – PWR	Green	ON	OFF	DSPU power supplies status indication	See paragraph 11.2.3 and Error E1003 (paragraph 9.2.9.1)
D10 – RDY	Green	ON		DSPU, PC and SENSOR are ready to acquire (ON)	
D11 – BUSY	Yellow	OFF		DSPU is acquiring (ON)	
D12 – RES	Yellow	OFF			
D13 – ERR	Red	OFF	Steady ON	Failure during DSPU program execution	Switch OFF/ON the unit, if still ON, checks DSPU logs (see paragraph 11.2.1.3)
D14 – PAN	Green	OFF			

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**
000 / 001	Internal MCU error	9.2.1
400 ÷ 411	MCU – DSPU communication fault (CAN Bus)	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**

Disk collimator		
Code	**Error description**	**Reference paragraph**
260	Disk collimator timeout	**9.2.3.4**

Chin rest		
Code	**Error description**	**Reference paragraph**
265	Zero position micro chin rest always active	**9.2.3.5**
266	Zero position micro chin rest never active	**9.2.3.5**
268	Chin rest timeout	**9.2.3.5**

Hardware key board (U.I.C.)		
Code	**Error description**	**Reference paragraph**
270 / 271	Hardware key fault	**9.2.3.6**

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**

Temperature sensor		
Code	**Error description**	**Reference paragraph**
500 ÷ 503	Temperature sensor reading error	**9.2.6**

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

DSPU		
Code	**Error description**	**Reference paragraph**
1003	DSPU hardware error detected (PhD_Test error 4)	**9.2.9.1**
1004	MCU – DSPU communication error (PhD_Test error 8)	**9.2.9.2**
1005	CAN Bus hardware error (PhD_Test error 16)	**9.2.9.3**
1007	Flat panel temperature too high (PhD_Test error 64) *(Operational message)*	**9.2.9.4**

PC software user interface (GUI)		
Code	**Error description**	**Reference paragraph**
1201	Setup menu: write data EEPROM failure	**9.2.10.1**
1202	Unespected value detected by the software	**9.2.10.2**
1203	Software allocation failure	**9.2.10.1**
1204	Exposure parameters failure	**9.2.10.2**
1205	Image buffer allocation failure	**9.2.10.2**

PC driver interface (OSP / VSP)		
Code	**Error description**	**Reference paragraph**
1401	3D sensor frame lost during exam	**9.2.11.1**
1402	3D sensor configuration failure	**9.2.11.2**
1403	Software watchdog error	**9.2.11.3**
1404	3D sensor do not detect X-rays during exam	**9.2.11.4**

9.2.1 Errors with code from E000 to E001

All these are errors related to the MCU board and its internal peripheral.
Power OFF the unit and, after 1 minute delay, power it ON again; if the error is displayed again, replace the MCU board.

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 3).
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 4.3.2.1).
   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. If collimator is BELT type, perform the setting procedure (see paragraph 11.2.6).
   h. Switch OFF the unit and restore the MCU metallic cover.
   i. Switch ON the unit and restore the factory setting offsets reported in the equipment parameters table (see paragraph 14.1) following the procedures present on chapter 0.

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.

***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 5804040600/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 the DSPU board 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 the DSPU board 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).

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

9.2.3.4 E260: Disk collimator timeout

This error is displayed if a problem on the disk collimator movement is present. The position of the disk collimator is controlled by the optical sensor B3, that is activated during the disk collimator positioning.
If this error is shown means that the optical sensor B3 is never activated during the collimator positioning.
The error may be caused by the sensor B3 and / or its connections fault or by a malfunctioning of the motor M5 axis system (MCU driver or motor group fault).

1. Verify collimator type setting (see paragraph 11.2.6).
2. If the disk does not move or moves with difficulty or jumps:
   a. if disk collimator is belt type, check the belt and verify that it is not broken; if the belt is loose, adjust its tension
   b. if the belt is not broken or the collimator is without belt type: switch off the unit, move by hand the collimator disk and verify if the motor shaft move accordingly with the disk. If not, tighten the screws indicate by the red arrows in the figures below and repeat the test. If the test is still not ok, replace the collimator

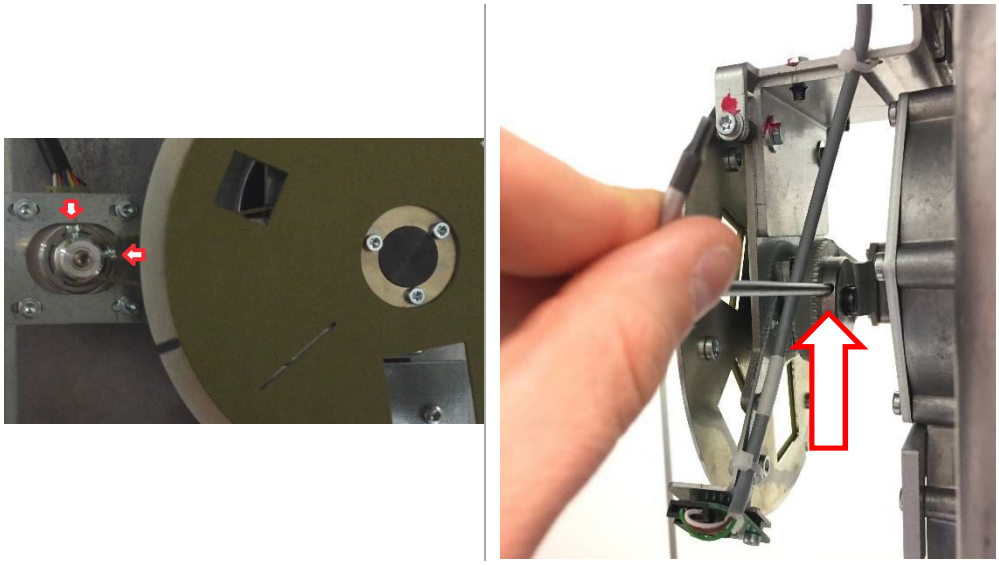


Figure 36: Belt type disk collimator

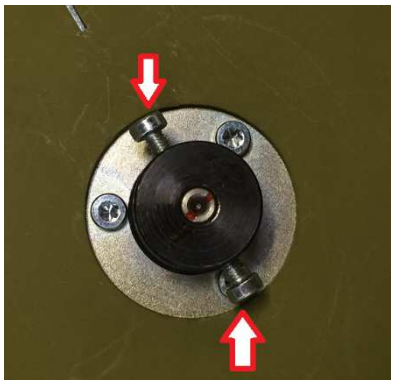


Figure 37: Without belt disk collimator type

c. If the problem is still present, check cable X34-X64 and motor M5 integrity (short circuit, broken wires or loosen contact on the pins); fix the cable or replace the motor group M5.

Note
In case of short circuit on the X34-X64 cable, the MCU board fuse F1 may be blown (the 24V power supply LED H2 OFF and the DSPU board 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.

3. If the collimator moves, verify the functionality of the optical sensor B3 signal as explained in the Note below. If the signal is NOT OK, check the optical sensor cable X1-B3-X41 (between the sensor B3 and the 3D Sensor Power board A10) and if it is not ok, fix or replace it. If the signal is still NOT OK, check the cable X25-X38 and if it is not ok, fix or replace it.

Note
The optical sensor B3 functionality can be checked moving by hand the disk collimator in order to cover / not cover the B3 sensor optical path and using a multimeter, 143ignalled that the voltage between the MCU board X25 pin-2 and pin-6 is:
- about 5V when the optical path is covered
- about 0V when the optical path is not covered.

4. If the error was not solved by the above tests, replace first the MCU board (see paragraph 11.3.2) and then the 3D Sensor Power board (A10).

***Technical Service additional information required**: try to reproduce the error recording an audio-video with a view of the collimator disk motor group movements.*

9.2.3.5 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):

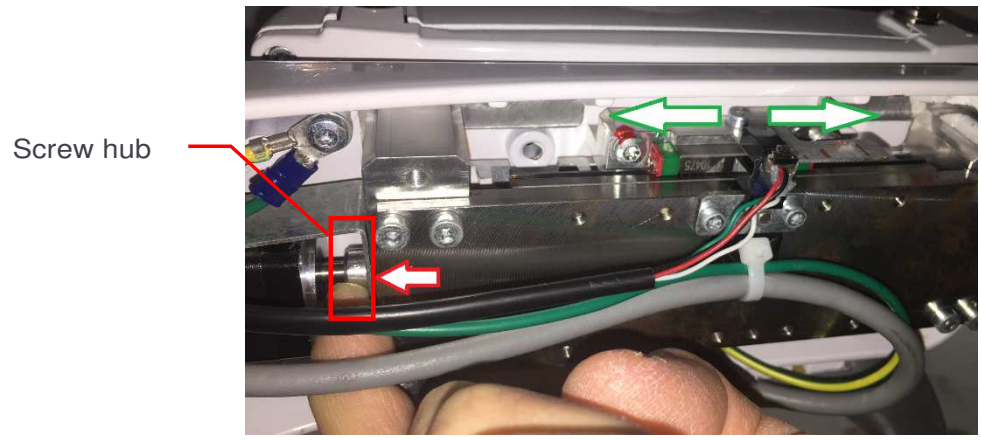


Figure 38

   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 the DSPU board 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).*

9.2.3.6 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 3) 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:

1. Check cable J7-X9 between MCU and DSPU boards; replace or fix it if defective and then verify if the error is still present.
2. Perform the troubleshooting tests listed on Errors E1401 and E1402 (see paragraphs 9.2.11.1 and 0).

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

- *Software logs*
- *MCU SD card log*
- *DSPU log (only if the unit was not powered OFF since the error occurs) (see paragraph 11.2.1).*

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).

9.2.5 Error with code from E400 to E411

This range of errors are dedicated to MCU-DSPU communication problems due to incompatibility between the DSPU and MCU firmware version and/or CAN bus line hardware issue.

e.g.: A DSPU with a more recent firmware version may has been mounted on a unit with an older MCU firmware version.

1. With the unit powered OFF, check the MCU-DSPU CAN bus connections (cable J7-X9): replace or fix it if defective and then verify if the error is still present.
2. Power ON the unit and wait the connection to the PC-GUI. Verify the compatibility between the DSPU firmware, the MCU firmware and the VSP/OSP 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**: try to reproduce the error keeping the following logs:*
- *Software logs*
- *MCU SD card log*
- *DSPU log (only if the unit was not powered OFF since the error occurs) (see paragraph 11.2.1).*

9.2.6 Error with code from E500 to E503

These errors are displayed when the MCU board is not able to read correctly the temperature sensor placed on the 3D sensor power board (A10). Usually these errors are not showed in the GUI but are written in the unit logs (e.g. MCU SD logs or software logs) (see paragraph 11.2.1).

Note
If looking at the MCU SD card logs, it will be notice that the rate of the error is low (e.g. one or two logs readings with the error E50x between two or more correct temperature readings) and there are no consequence on the system functioning, the error may be considered negligible.

1. Check the integrity of the cable X25-X38 (the temperature sensor signal is on X38 pin 4): replace or fix it if defective and then verify if the issue is solved.

2. If the problem is still present replace the 3D Sensor Power board A10 and then the MCU board.

Technical Service additional information required:
- *Software logs*
- *MCU SD card log*

(see paragraph 11.2.1).

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 E1005, generated by the DSPU when 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 11.3.3).
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 11.3.3) 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 11.3.4).
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 11.3.3).
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 11.3.3).
   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: 5804040600/YY

Replace the wrong board.

9.2.8 Errors with code E850 and E852

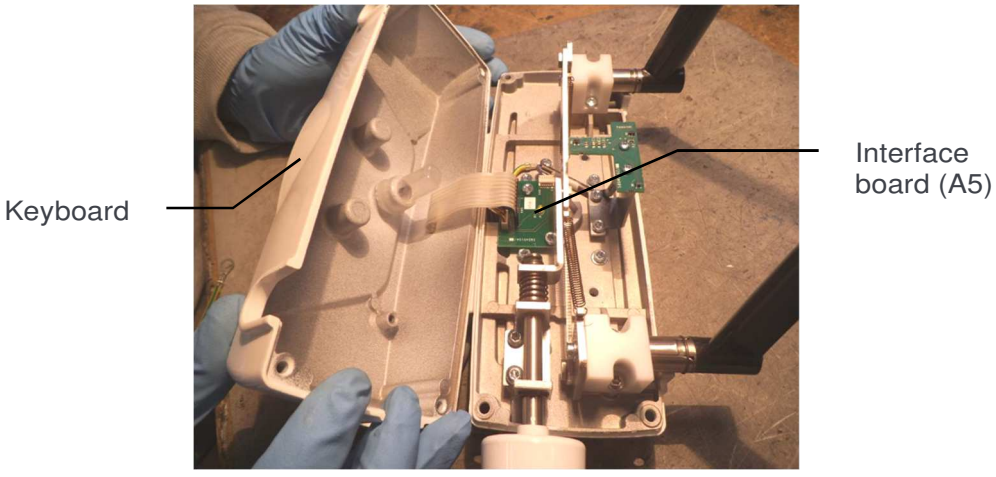
These errors indicate a keyboard fault.

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 160ignalled 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 E1003 to E1007

These errors are detected by DSPU board.

9.2.9.1 E1003: DSPU hardware error (PhD_Test error 4)

A DSPU hardware error has been detected.

With the unit switched OFF, disconnect cable J8 on DSPU; power ON the unit again and verify with a multimeter that between pin-1 and pin-2 of J8 connector there is about 24V.

IF the test is OK, check the DSPU fuses (see paragraph 11.3.1.5) and verify if the problem is still present, otherwise replace the DSPU.

IF the test is NOT OK, verify the 24V power supply (see paragraph 11.2.3).

9.2.9.2 E1004: MCU board is not responding to the DSPU (PhD_Test error 8)

Note
This message is not to be considered an error if it was displayed while the GUI was quitting the setup / service menu. In this case the user has only to press the >0< button to allow the unit to perform the axis reset and restore the normal system condition.

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, DSPU and Generator).

The MCU board does not reply to the DSPU board. This error is displayed when the MCU cannot send messages on CAN bus line or the CAN bus status is not operational.

Refer to Error E1005 (see paragraph 9.2.9.3)

9.2.9.3 E1005: CAN bus hardware error (PhD_Test error 16)

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, DSPU 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 (DSPU, MCU, Generator) is interrupted.

1. Check the CAN bus cable J7-X9 between DSPU 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 paragraph 9.2.7.1) 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 DSPU board.

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

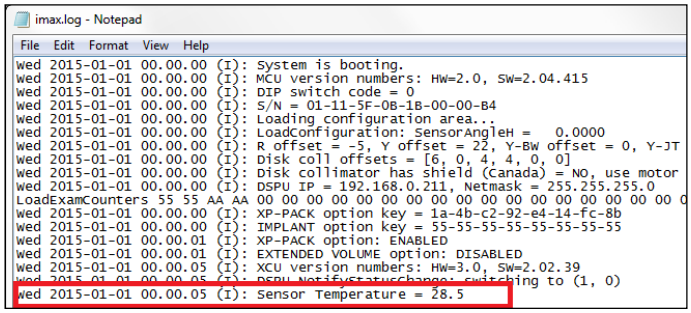
(see paragraph 11.2.1).
If it is not possible to reproduce the error, keep at least the software logs.

9.2.9.4 E1007: Flat panel too hot to perform acquisition (PhD_Test error 64)

This operating message is displayed by the GUI if the temperature of the 3D sensor exceeds the set threshold stored in EEPROM memory.
The MCU board communicates the 3D sensor temperature via CAN bus to the DSPU. If the temperature exceeds the set threshold, the DSPU board switches OFF the 3D sensor (LED H2 on the 3D Power sensor board A10 OFF) until the temperature read drops below the threshold.

1. Check that the room temperature does not exceed the system max working temperature (+ 35° C): wait until the ambient temperature drops below the maximum allowed working temperature.

2. Keep the MCU SD card logs, opening the log file named “imax.log” (folder path: imax→logs) with a txt reader (e.g. Notepad)



   a. If the reported temperature exceeds the ambient temperature by more than 10°, the problem may be related to a bad communication between temperature sensor (on 3D Power sensor board A10) and MCU board: refers to errors E500 ÷ E503 (see paragraph 9.2.6).
   b. If the reported temperature is <39°, verify if the thresholds stored in EEPROM memory are the default ones (see paragraph 11.2.5):
      - 0x020C – Sensor temperature power high threshold = 39°
      - 0x0208 – Sensor temperature power low threshold = 38°

      Correct the values and verify if the problem is solved.

Technical Service additional information required:
- *Software logs*
- *MCU SD card log*

(see paragraph 11.2.1).

9.2.10 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.

9.2.10.1 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).*

9.2.10.2 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*
- *DSPU log (only if the unit was not powered OFF since the error occurs) (see paragraph 11.2.1).*

9.2.11 Error with code from 1401 to 1404

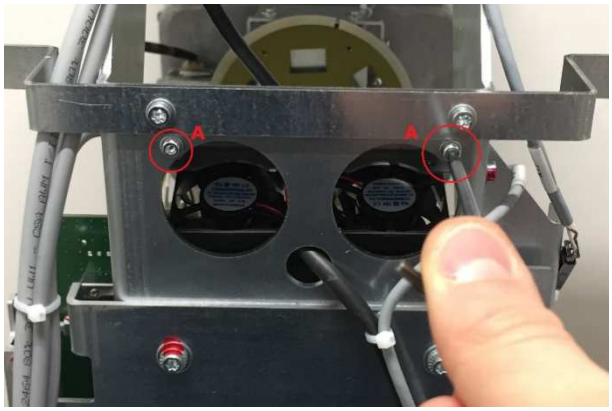
9.2.11.1 E1401: 3D Sensor frame lost during the exam

This message is displayed if the unit drivers on PC detects less frame than expected during the exam acquisitions.
The problem may be related to a communication malfunctioning of the 3D sensor Ethernet connections (cables and PC network interface) or of the 3D sensor.

1. Check the 3D sensor 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 or Intel PRO/1000 dual port
   - The Ethernet cables must be the ones supplied with the unit or CAT 5E 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.

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 DSPU 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.

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

4. Update the network interfaces board drivers (see paragraph 11.2.4): verify if the error is still present.

5. Configure the Network interface board as required by paragraph 7.7.2 and activate the sensor logs (see paragraph 11.2.1.4).

   Verify if the problem is still present.

6. Set the 3D sensor network with a static IP address (see paragraph 11.2.7) Verify if the problem is still present.

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

8. 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.

9. 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 (point (see paragraphs 9.2.7.1 and 9.2.7.9).

10. If the OSP/VSP installed version is < 1.05.02: update to a version ≥ 1.08.03 and activate the sensor logs (see paragraph 11.2.1.4).
    Perform an acquisition in order to reproduce the error.

Contact Technical Service providing the following additional information:
- *Software logs*
- *DSPU log*
- *3D Sensor logs folder*

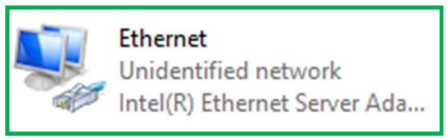
(see paragraph 11.2.1)
- *Last RAW files folder stored (see paragraph 11.2.2)*

9.2.11.2 E1402: 3D sensor configuration failure

This error is displayed in case of a communication error between the flat panel and the PC software or a 3D Power Sensor board A10 problem.

Perform a test exam (without X-ray) and verify, during the arm rotation, the 3D sensor Ethernet connection status (Control Panel→Network and Internet→Network Connections).

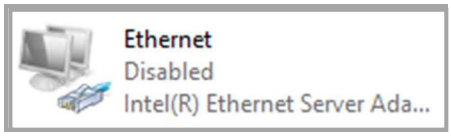
1. IF the Ethernet connection is steady ACTIVE:



   a. Perform points 1, 2, 3, 4 and 7a of Error E1401 (see paragraph 9.2.11.1).

   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 9.2.11.1).

   b. 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 DSPU: 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-X25 (between 3D Power Sensor board A10 and MCU board A1) and the cable X9-J7 (between MCU board A1 and DSPU)
      - ➢ IF the X38-X25 or X9-J7 are NOT OK, fix or replace them
      - ➢ IF the X38-X25 or X9-J7 are OK, replace first the MCU board A1 and then the DSPU.
  - 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*
- *DSPU log*
- *3D Sensor logs folder*

(see paragraph 11.2.1)

- *Last RAW files folder stored (see paragraph 11.2.2)*

9.2.11.3 E1403: Software watchdog

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

Refer to Error E1402 (see paragraph 9.2.11.2).

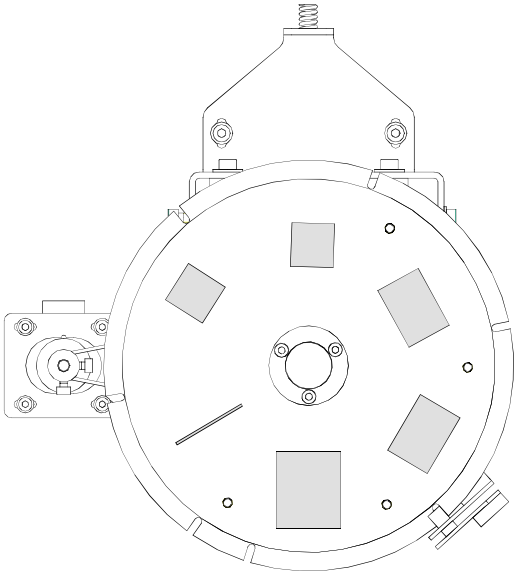
***Technical Service additional information required**:*
- *Software logs*
- *DSPU log*
- *3D Sensor logs folder*

(see paragraph 11.2.1).

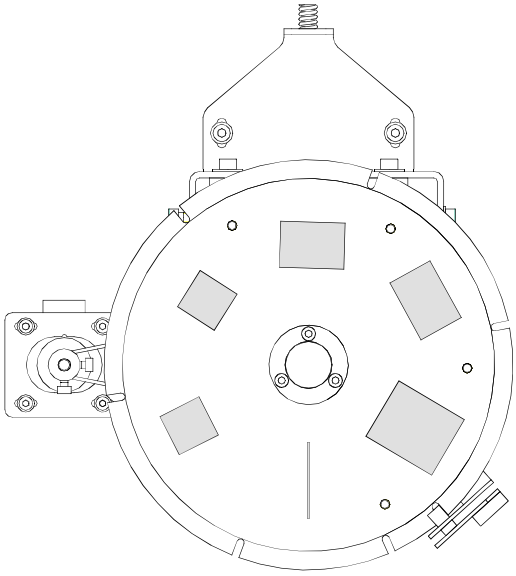
9.2.11.4 E1404: 3D sensor does not detect X-rays during exam

This message indicates that the 3D 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.

1. Remove the tubehead internal cover, select a 3D full dentition exam and verify if the collimator moves accordingly (the biggest collimator window is in front of the X-ray exit, bottom side of the disk collimator). Select a panoramic exam and verify if the collimator is correctly positioned on panoramic window (the narrower window positioned on the bottom side).



3D Full Dentition exam collimator position



Panoramic exam collimator position

IF the collimator movements are NOT OK, refer to error E260 (see paragraph 9.2.3.4).

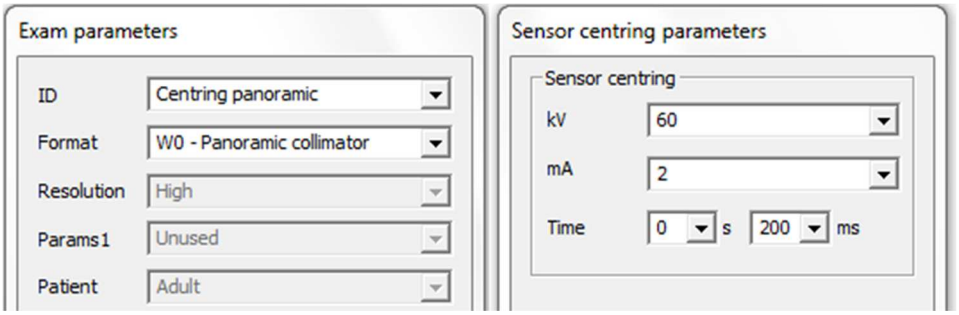
- If the error is still present, verify the X-ray beam alignment (see paragraph 8.7).

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

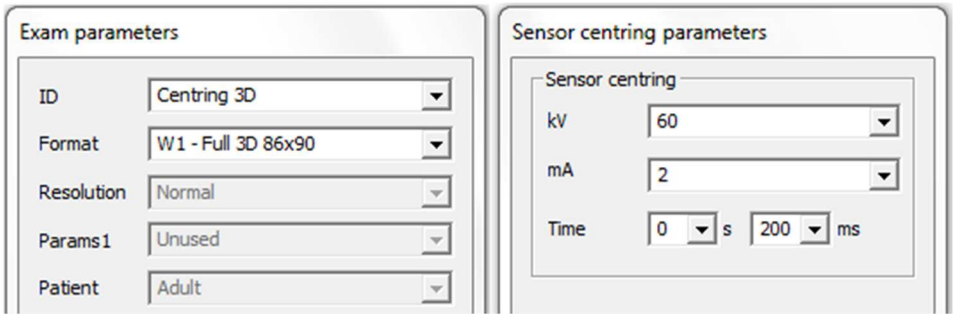
3. Verify the collimator offsets stored in the EEPROM (compare them with the ones reported on the set parameters tables provided with the unit documentation).

IF the offsets does not matches, fix them (see paragraph 8.5).

4. Open “PhD_Test” program and wait the unit connection; perform two static acquisitions with the following settings:
   - Panoramic area acquisition: select Exam ID “Centering panoramic” and collimator format “W0 – Panoramic collimator”. Select 60kV, 2mA and 200ms



   - 3D full area acquisition: select Exam ID “Centering 3D” and collimator format “85x90 Full – W1”. Select 60kV, 2mA and 200ms



IF the 3D and the panoramic images show that collimator is not well aligned to the sensor, verify the X-ray beam alignment (see paragraph 8.7).
IF both the acquired images are completely white (without X-rays), perform the exposure parameters verifications with non-invasive and then with invasive method (see paragraph 7.12). 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 11.2.2)*
- *Panoramic 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 (only in OSP/VSP ≤ 1.04.05 and AIS installer ≤ 5.03C).

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 9.2.11.4).

9.3.2 "Sensor not ready"

Refer to Error E370 (paragraph 9.2.4.3), Error E1402 (paragraph 9.2.11.2) and Error E1401 (paragraph 9.2.11.1).

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\acquisition, remove it and verify if the problem is solved.

9.3.4 "Flat panel too hot"

Refer to Error E1007 (paragraph 9.2.9.4).

9.4 System Anomalies

9.4.1 White panoramic image or/and empty volumes

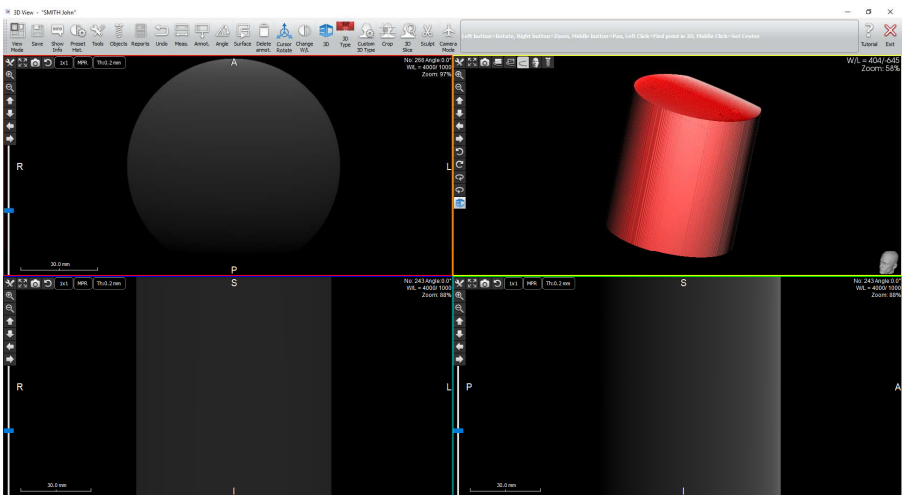
	Panoramic white image
	Empty volume

Figure 39

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\Calibration and that all the calibration options in the image processing menu of the in PhD_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

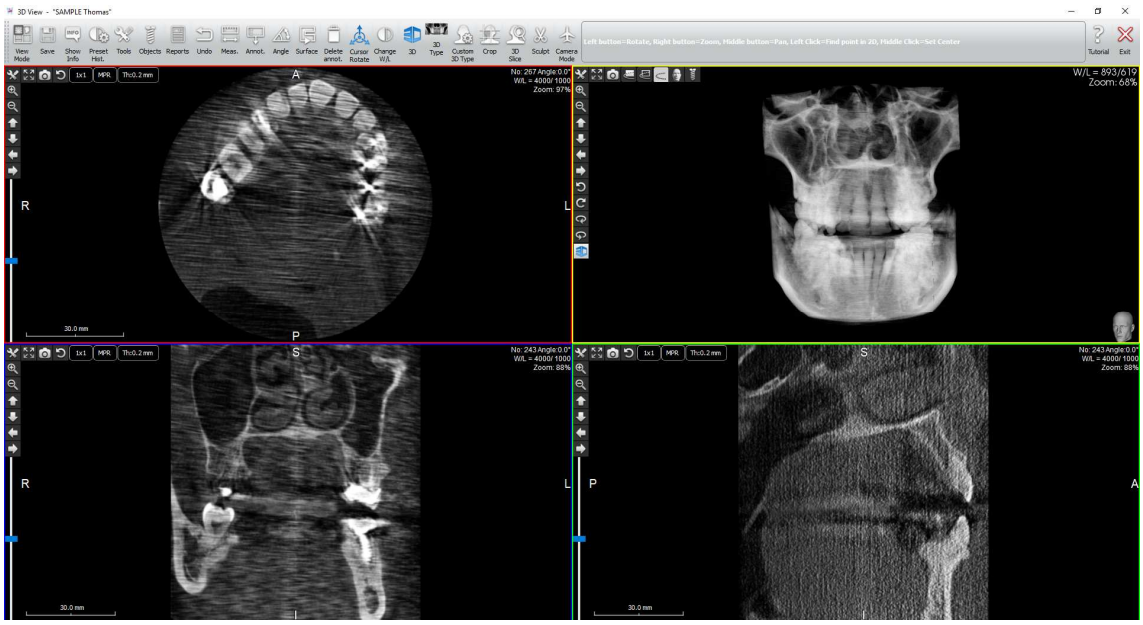


Figure 40

Send the RAW files (see paragraph 11.2.2) of these acquisitions to Acteon Technical Service.

9.4.3 Panoramic acquisition with less frames

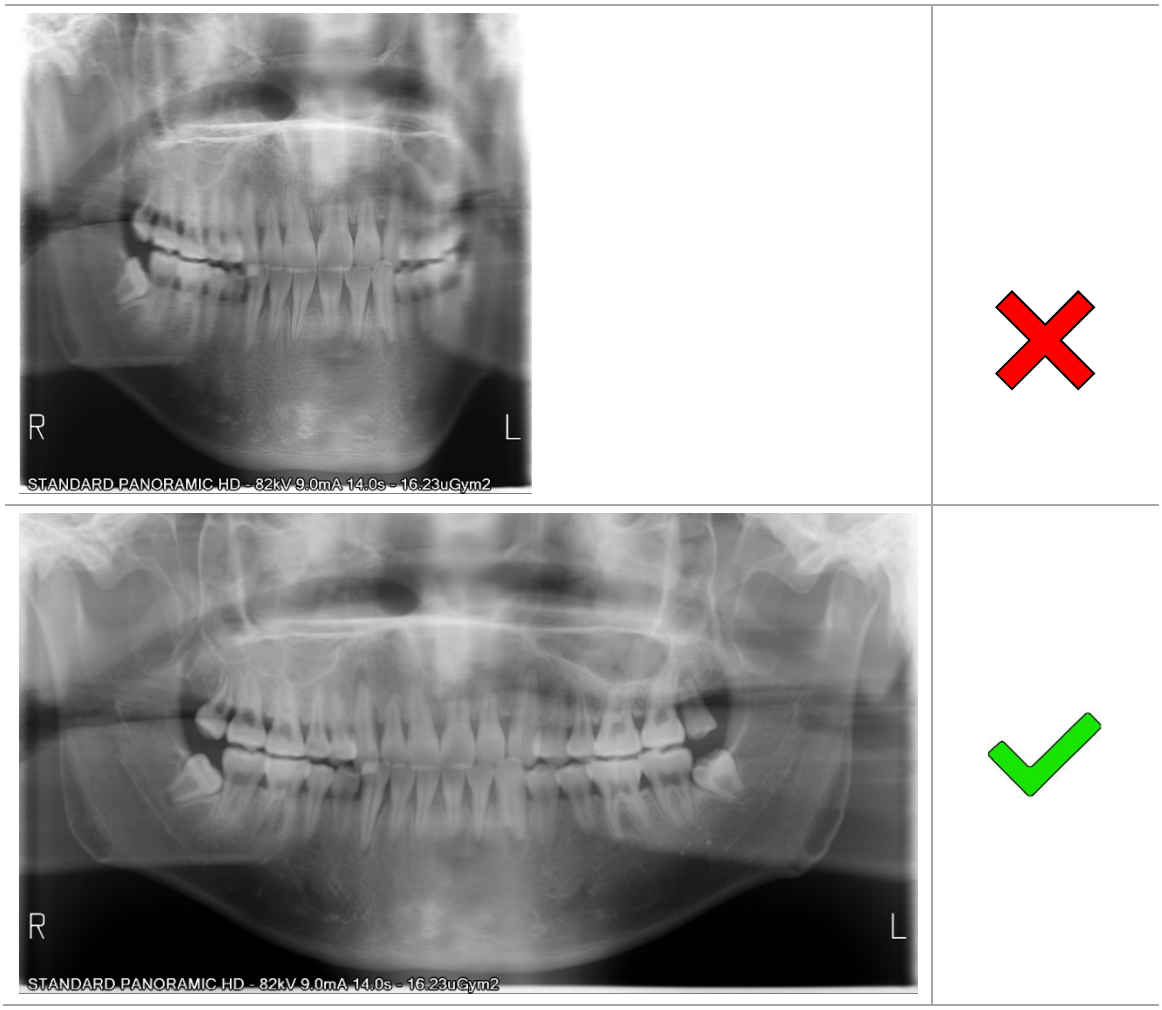


Figure 41

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 9.2.11.1).

2. If the error is still present, send the acquired RAW file (see paragraph 11.2.2) to Technical Service.

9.4.4 Asymmetries on the panoramic images

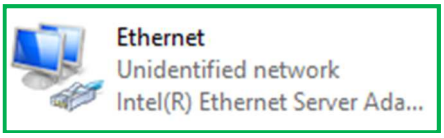
1. Check the orthogonality of the unit lasers (se User Manual – paragraph 7.3).

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

9.4.5 Unit/DSPU connection problems

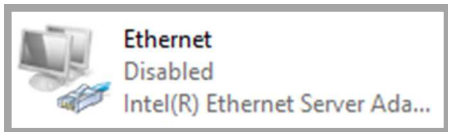
1. Verify if MCU DIP switches are set in normal mode (see paragraph 4.3.2.1).
2. Check the unit power supply (see paragraphs 6.1 and 11.2.3).
3. Verify the unit Ethernet connection status (Control Panel→Network and Internet→Network Connections):

   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 3D sensor Ethernet connections (cables, junctions, PC network board).

4. Plug a functioning Ethernet CAT 5E (or higher) cable to the DSPU 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 DSPU

   b. If the problem is still present, try to connect the DSPU Ethernet cable to another network interface port (e.g. Invert the DSPU and 3D sensor connections setting the right IP address on the network interfaces see paragraph – 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. Verify the main power supply and columns driver board connection (see paragraph 6.1 and 7.2).
3. 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 7.12.1 and 7.12.2
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.

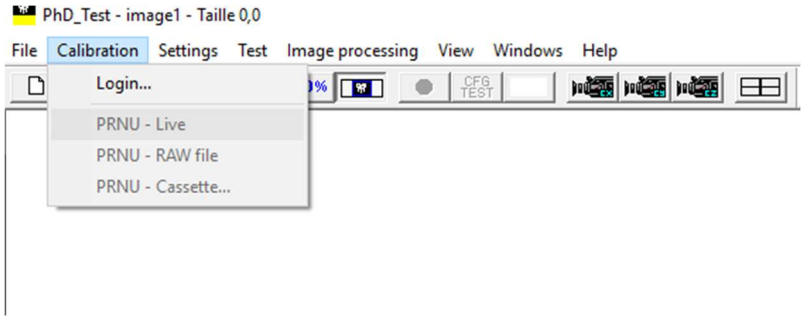
10.1 Service tools

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

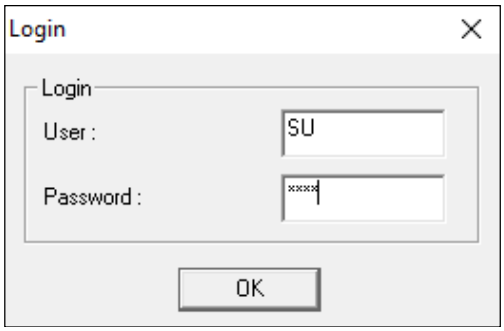
Code	Description	Function
6107900100	Laser centering tool	Laser alignment check
6195170100	Support plate	Support for panoramic and 3D centering tools
6195170200	Centering tool	Panoramic function adjustment
5207900900	Centering cylinder	3D function adjustment
5607900800	1.5mm copper filter	Sensor calibration

10.2 Sensor Calibration

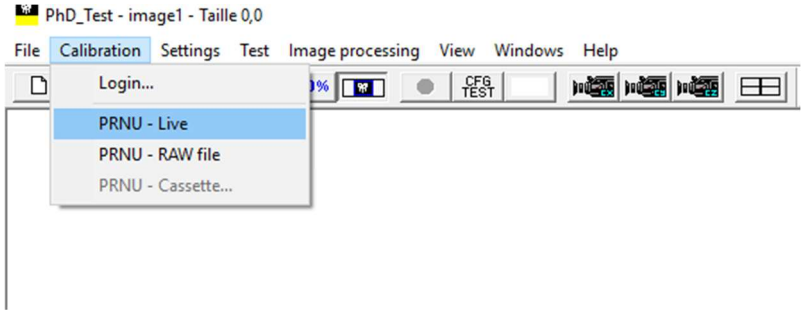
1. In order to perform calibration, place a copper filter of 1.5mm in front of the tubehead in such a way as to cover the entire X-ray beam.
2. Open the “PhD_Test.exe” service program (C:\Program Files (x86)\Acteon Imaging\Panoramic X-MIND Prime .
3. Open the “Calibration” panel from the menu and select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

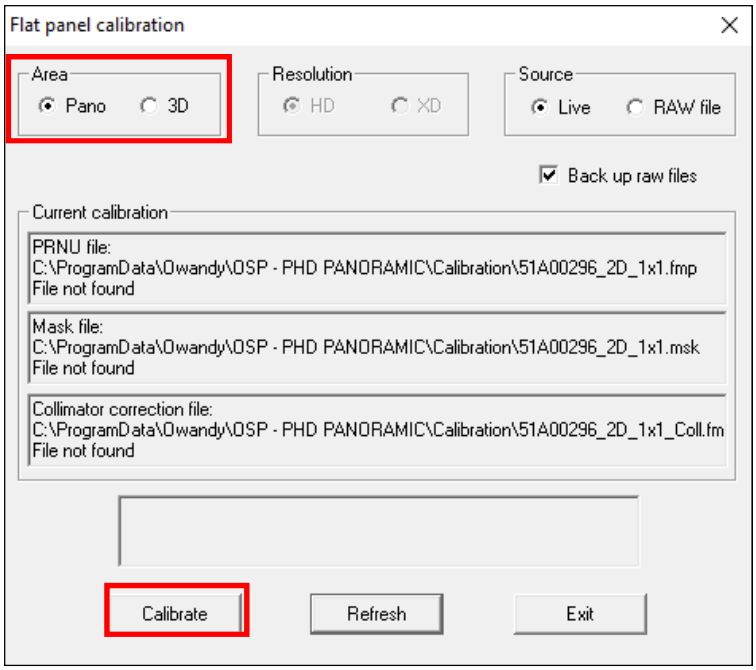


5. Open the “Calibration” panel and select “PRNU- Live”.



6. Make sure that no objects are present in the X-ray field.

7. Select “Pano” in the “Area” panel.



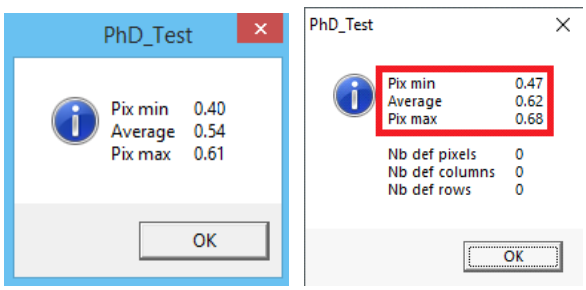
8. Press the button “Calibrate”.
9. Each time the calibration window displays the message “Waiting for an acquisition” press the X-ray button until the end of the exposure.

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 calibration performed (Pano, 3 HD or 3D XD).

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

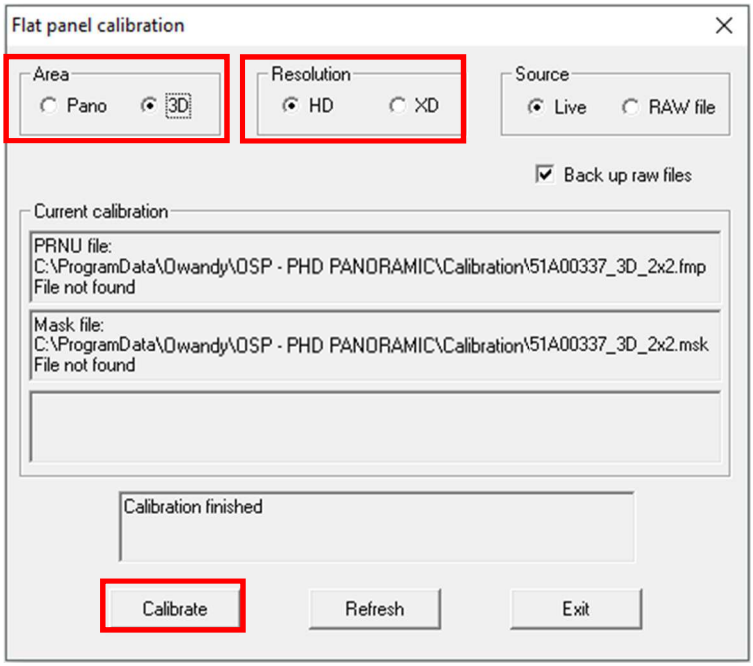
- Pix min: > 0.20
- Pix max: < 0.90

and then press OK.



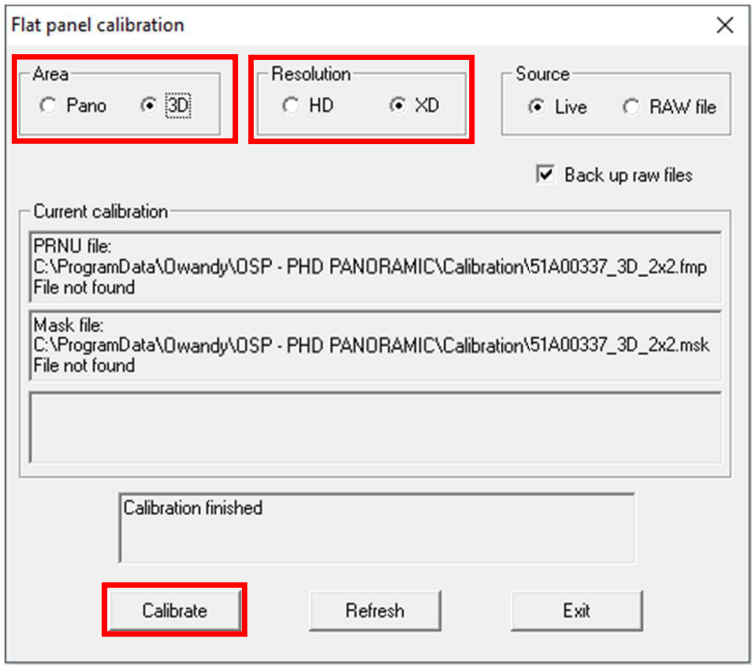
If they are not in the above limits, verify the copper filter positioning and that no objects are present in the X-ray field; repeat the calibration.

10. When the **Panoramic area** calibration is completed, the message “Calibration finished” is displayed. This calibration will generate the following files in the folder C:\ProgramData\Acteon Imaging\Panoramic X-MIND Prime\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. Select “3D” in the “Area” panel, “HD” in the “Resolution” panel.



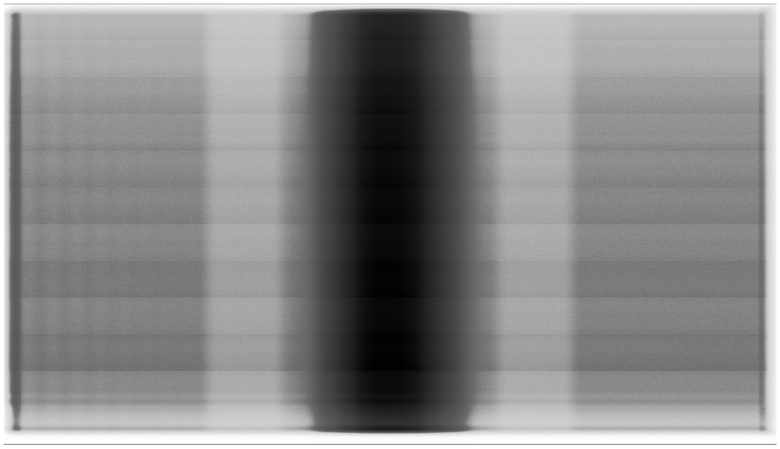
12. Press the button “Calibrate”.
13. Each time the calibration window displays the message “Waiting for an acquisition” press the X-ray button until the end of the exposure.
14. When the 3D HD resolution area calibration is completed, the message “Calibration finished” is displayed. This calibration will generate the following files in the folder C:\ProgramData\Acteon Imaging\Panoramic X-MIND Prime\Calibration:
    - [Sensor S/No]_3D_2x2.fmp
    - [Sensor S/No]_3D_2x2.msk

15. Select “XD” in the “Resolution” panel.



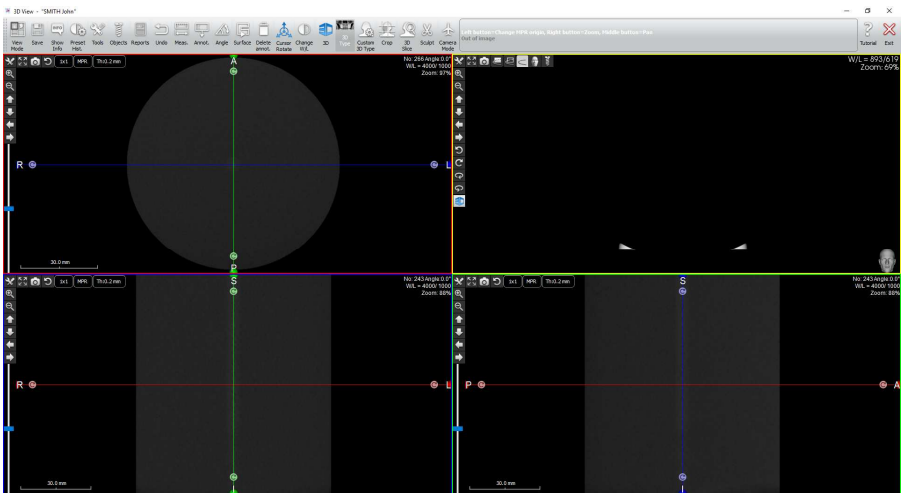
16. Press the button “Calibrate”.
17. Each time the calibration window displays the message “Waiting for an acquisition” press the X-ray button until the end of the exposure.
18. When the 3D XD resolution area calibration is completed, the message “Calibration finished” is displayed. This calibration will generate the following files in the folder C:\ProgramData\Acteon Imaging\Panoramic X-MIND Prime\Calibration:
    - [Sensor S/No]_3D_1x1.fmp
    - [Sensor S/No]_3D_1x1.msk
19. When the Panoramic, 3D HD and 3D XD calibrations are completed, click “Exit”.
20. 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

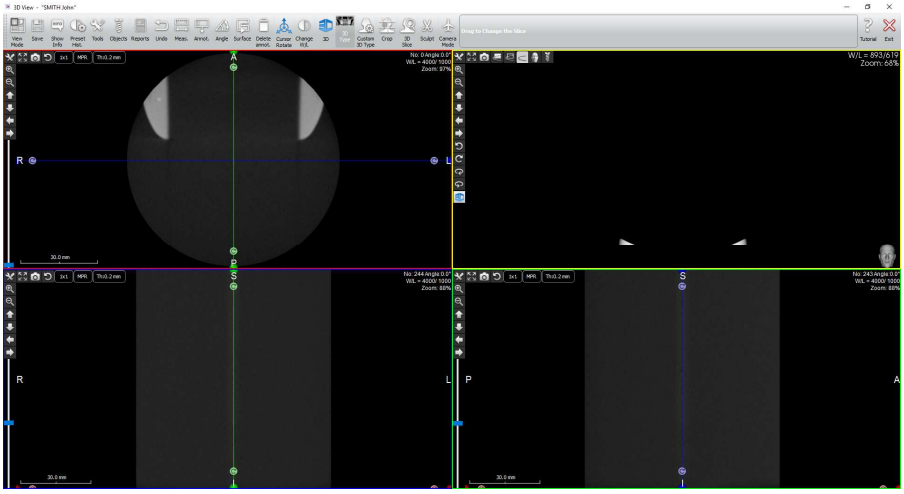
21. Remove the copper filter from the tubehead, switch OFF the unit and close the “PhD_Test.exe” service program.
22. Switch ON the unit.
23. Open the “PhD_Test.exe” service program and make an exposure at 60kV 2.2mA without objects in the X-ray field.
24. Verify that there are no defect lines or inhomogeneous bands on the panoramic image:

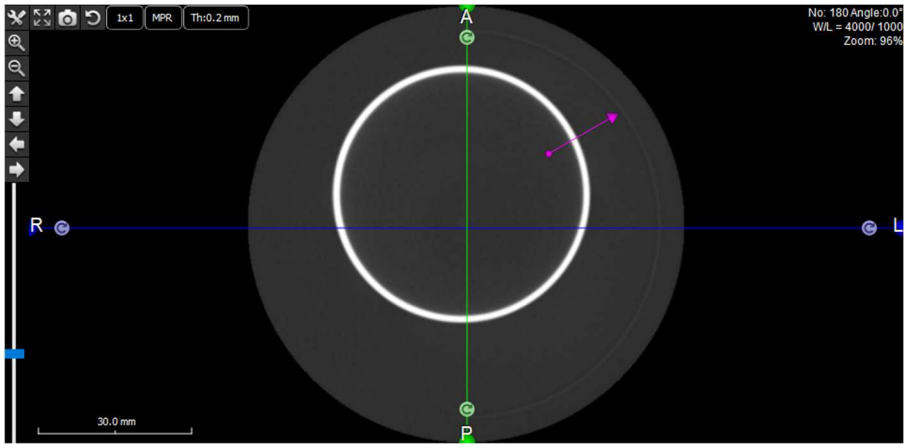


25. Open AIS software and open a test patient.
26. Perform the following 3D acquisitions at 60kV 2.2mA using the relevant chin support:
    - 3D Full Dentition
    - Maxillary single jaw 85x50 volume
    - Mandibular single jaw 85x50 volume

27. 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 red arrow) on an acquisition with the Centering cylinder P/N 5207900900 in the X-ray field

28. If the acquisitions are not OK (**X**):
    - 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\Calibration
    - Verify that all the calibration options are checked in image processing menu (see point 20 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 the DSPU and MCU boards use only USB pen-drive with the following characteristics:
- USB 2.0 type (or lower)
- Capacity ≤ 32Gb
- Formatted as FAT32.

11.1.1 MCU Firmware upgrade

1. Power OFF the unit and remove the metallic plate that cover the MCU USB port.

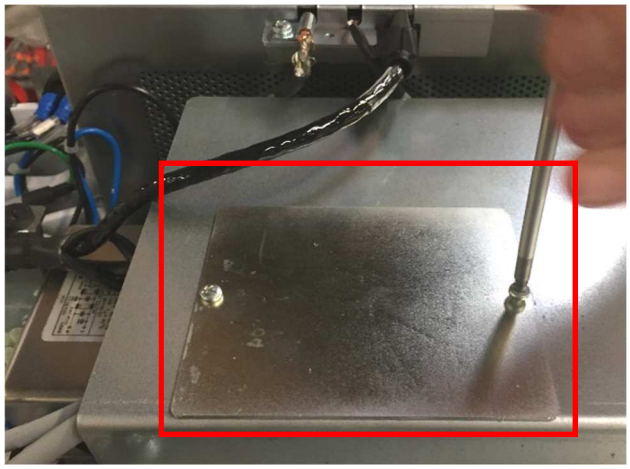


Figure 42

2. Copy the firmware file on the main root of the USB pen-drive (fw named “CPU3D_AAAA-MM-GG-vx.y.z.hex”).

3. Plug the USB pen drive in the USB port on the MCU.

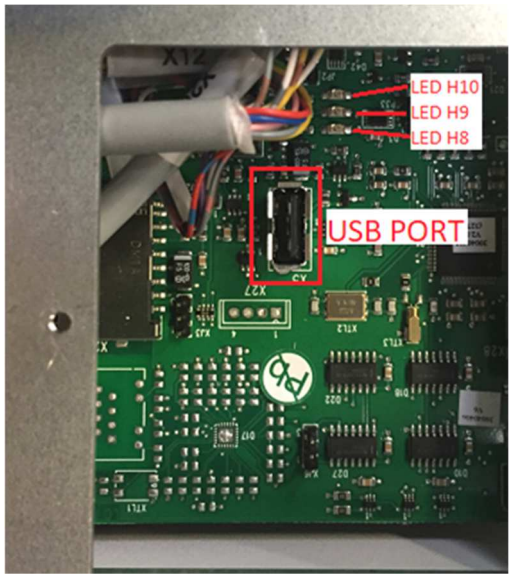


Figure 43

4. Switch ON the unit: the LED H8 starts blinking FAST for some seconds and then blinks slowly (1 pulse per second).
5. When all the 3 LEDs (H8, H9, H10) are turned OFF and the keyboard green LED blinks slowly, the upgrade process is completed.
6. Switch OFF the unit.
7. Remove the USB pen drive and remount the MCU USB port metallic cover.
8. Switch ON the unit and check on the first page of the GUI service program (chapter 0) the current MCU firmware version.

Note

If the LED sequence is different from the one reported in the procedure above or the programming process seems to do not start or it is longer that 1 minute, verify the USB pen drive characteristics and the presence of the firmware “CPU3D_AAAA-MM-GG-vx.y.z.hex” file in the main root. Repeat the procedure.

11.1.2 DSPU Firmware upgrade

1. Power OFF the unit and remove the metallic plate that cover the DSPU USB port.

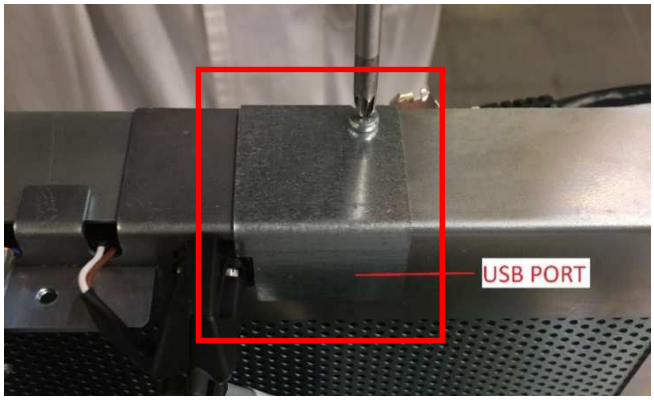


Figure 44

2. Unzip the “PhD_DSPU_Vzzz.yyy_Buildxxx.zip/.rar” file and open the unzipped folder.
3. Copy the files named “phd.gz” and “phd_serv.lnx” in the main root of the USB pen drive.
4. Plug the USB pen drive in the USB port on the MCU.
5. Switch ON the unit:
   - The yellow LED “BUSY” lights on for few seconds, then light OFF for about 30 seconds and then blinks few seconds
   - The yellow LED “RES” light ON and then start blinks for about 50 seconds
   - The green LED “READY” light ON

Figure 45

6. When ONLY the “POWER” and the “READY” LEDs are steady ON switch OFF the unit.

7. Remove the USB pen drive and remount the DSPU USB port metallic cover.
8. Switch ON the unit and check on the first page of the GUI service program (chapter 9) the current DSPU firmware version.

Note

If the LED sequence is different from the one reported in the procedure above or the programming process seems to do not start or it is longer that 1 minute, verify the USB pen drive characteristics and the presence of the firmware “phd.gz” and “phd_serv.lnx” files in the main root. Repeat the procedure.

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	**OSP/VSP ≥ 1.06.05**		YES
	LogsServer_yyyy.mm.dd.log	C:\ProgramData\Acteon Imaging\LogServer\Logs	
MCU	*eeprom.dump* *imax.log*	[SDCARD]:\imax\Logs	NO
DSPU	*FirmwareTraces.txt*	C:\ProgramData\ Acteon Imaging\Panoramic X-MIND prime\Logs	NO
3D sensor	**OSP/VSP ≥ 1.06.05**		NO
	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“*	

11.2.1.1 Software package (OSP/VSP) logs

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

(*) See installed version in the first configuration window page (chapter 0) or in the Control Panel\Programs\Programs and Features windows.

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 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*
   - *imax.log*

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

Log	Description
MCU version numbers	MCU Firmware (SW) version
DIP switch code	MCU DIP-Switches position (see paragraph 4.3.2.1) 0 = Normal mode
S/N	MCU hardware key number (U.I.C.)
Disk collimator has shield (Canada)	NO = Ontario (Canada) collimator option not active YES = Ontario (Canada) collimator option active
Use motor reduction	NO = Collimator without belt option YES = Collimator with belt and reduction gear active
DSPU IP = 192.168.0.211 Netmask = 255.255.255.0	DSPU Ethernet IP and Netmask addresses
XP-PACK option	XP exam option ENABLED or DISABLED
XCU version numbers	Generator board Firmware (SW) version

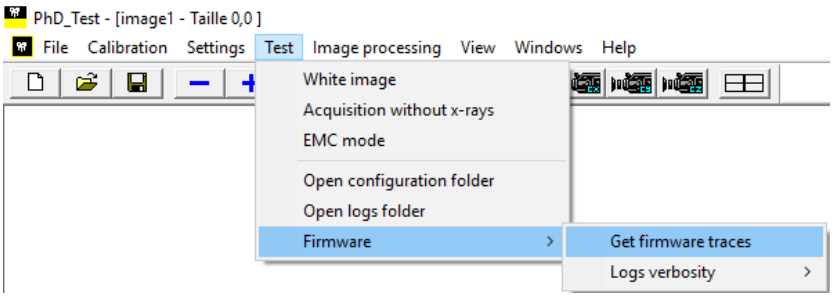
11.2.1.3 DSPU logs

This log record the events that occurs during the last DSPU firmware execution only. If it is required to trace the DSPU log, do not switch OFF the unit after the occurrence of the anomaly and generate the log file following the below reported procedure:

1. Close the GUI.
2. Open the “PhD_Test.exe” service program (C:\Program Files (x86)\Acteon Imaging\Panoramic X-MIND Prime.
3. Wait the unit connection:

DSPU is connected. MCU is connected (FSM_READY_INITIAL). Flat panel is ready.

4. Click on Test→Firmware→Get firmware traces:



5. Wait the log file generation. A log file named “FirmwareTraces.txt” will be stored in the folder path C:\ProgramData\Acteon Imaging\Panoramic X-MIND prime\Logs.

11.2.1.4 Sensor logs

These logs record the events that occur in the communication between the PC network interface, the 3D sensor drivers, the OSP/VSP 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 open the “PhD_dll.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_DRIVER_MANUFACTURER_TRACES=1
   - SENSOR_DRIVER_GIGE_MANUFACTURER_TRACES=1

```
SENSOR_DRIVER_MANUFACTURER_TRACES=1
; 0 if you want to hide flat panel manufacturer information
; 1 if you want to show flat panel manufacturer information
SENSOR_DRIVER_GIGE_MANUFACTURER_TRACES=1
; 0 if you want to hide flat panel GigE manufacturer information
; 1 if you want to show flat panel GigE manufacturer information
```

3. Save and close the “PhD_dll.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).

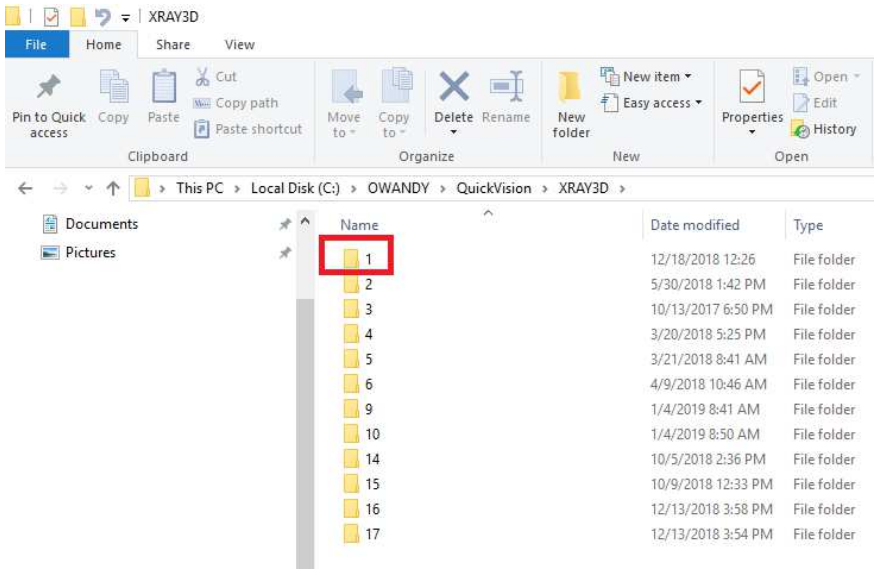
(*) See installed version in the first configuration window page (chapter 0) or in the Control Panel\Programs\Programs and Features windows.

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. The data base folder path is visible by clicking on the AIS "About" button (refer to AIS User Manual).
Typical/default path is C:\Acteon Imaging\AIS\XRAY3D organized in sub-folders named as the patient "File number".



In each patient subfolder are present all the acquisitions of that specific patient.
Each acquisition generate two folders (with the same prefix), one contains the reconstructed DICOM slices and the other, with the suffix "-Raw" contains the RAW data.

Acquisition Nr.1

Acquisition Nr.2

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 4.3.1 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 9.2.11.2).

   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 DSPU connector (X8) 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 and DSPU connectors and verify which ones are the origin of the problem. (* see Note below).

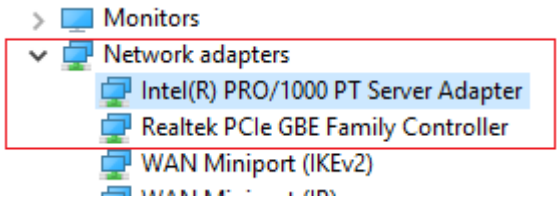
b. IF MCU LED H2 is ON, verify if DSPU board power LED is ON:
   - IF DSPU power LED (D9) is ON, **the 24V power supply is OK**
   - IF DSPU power LED (D9) is OFF, verify if the DSPU fuse F1, F2 and F3 are not blown:
     - IF the DSPU F1, F2 or F3 are NOT OK, replace them and verify if the error is still present (* see Note below)
     - IF the DSPU F1, F2 and F3 are OK, verify the integrity and the proper connection of the cable X8-J8:
       - IF the cable X8-J8 is NOT OK, replace or fix the cable X8-J8
       - IF the cable X8-J8 is OK, remove the J8 connector from DSPU and connect the X8 on the MCU board and verify the 24V between J8-pin1 and J8-pin2:
         - IF J8 24V is OK, the problem may be related to the DSPU board (see Error E1003 – see paragraph 9.2.9.1)
         - IF J8 24V is NOT OK, remove the cable X8 and verify if between MCU connector X8-pin1 and X8-pin2 there are 24V:
           - IF X8 24V is OK, replace the cable X8-J8
           - IF X8 24V is NOT OK, replace the MCU board (see paragraph 11.3.2).

(*) 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), E260 (paragraph 9.2.3.4) and E265 ÷ E268 (paragraph 9.2.3.5). Verify also that there are no short-circuits on cables X8-J8 and X11-X37.

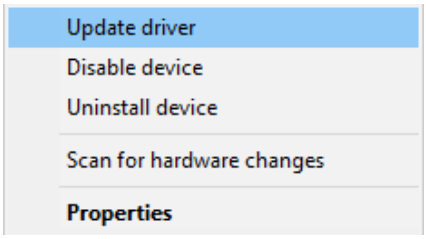
11.2.4 Network interface board drivers upgrade

In case of problems with 3D 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:

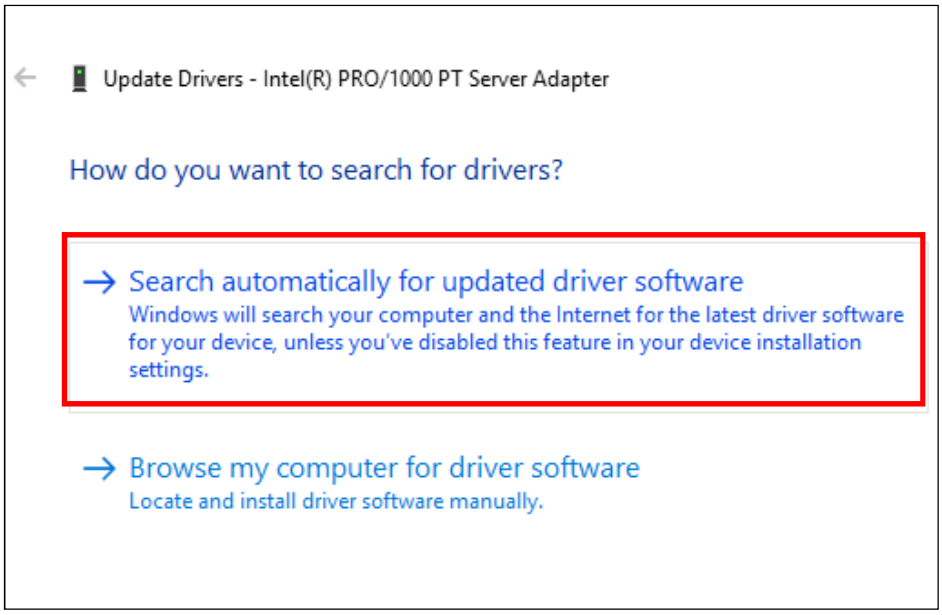
1. Connect the PC to Internet.
2. Open the system "Device Manager" (Control Panel→System and Security→System).
3. Click on Network adapters and right click on all the boards names connected to the unit:

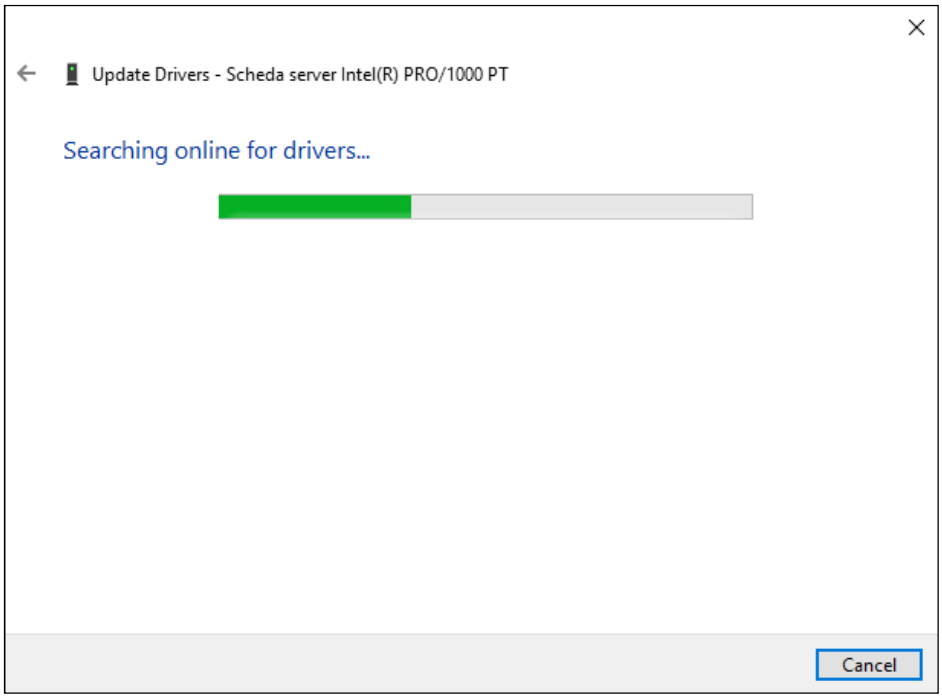


4. Click on Update driver:

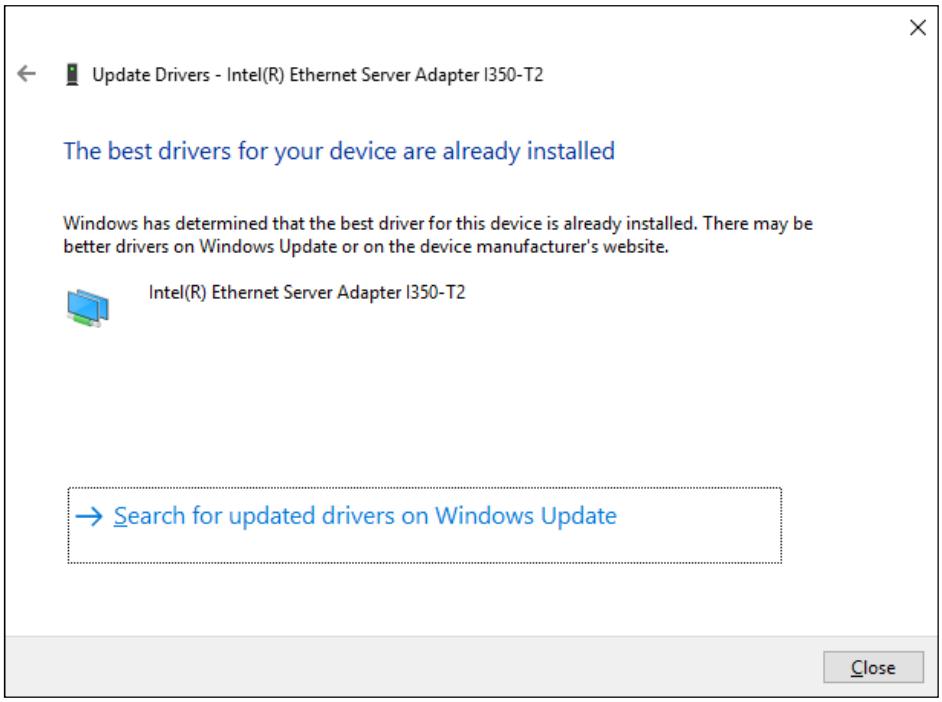


5. Click on "Search automatically for updated driver software":

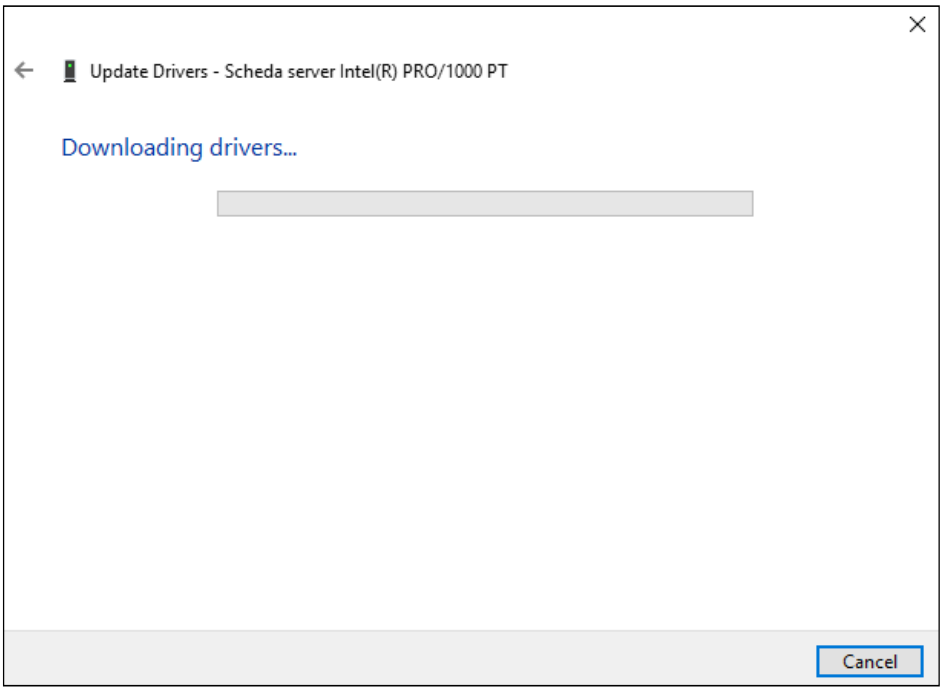


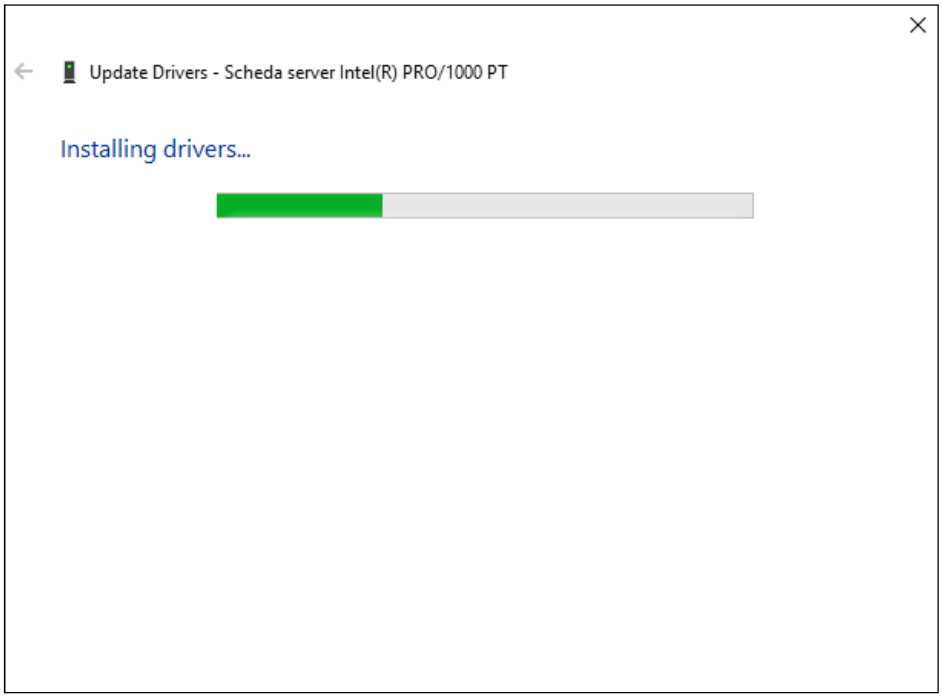


6. If the installed drivers are already updated the following window will be displayed:

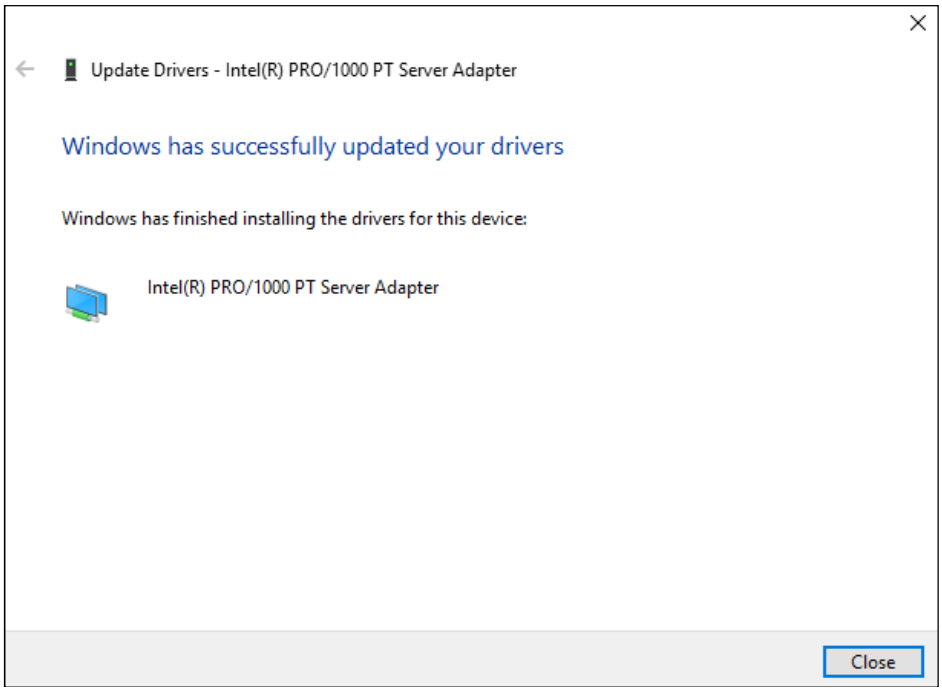


Otherwise, if the search found a driver to be updated, the following windows will be displayed:





7. The update process is finished when the following message is displayed:

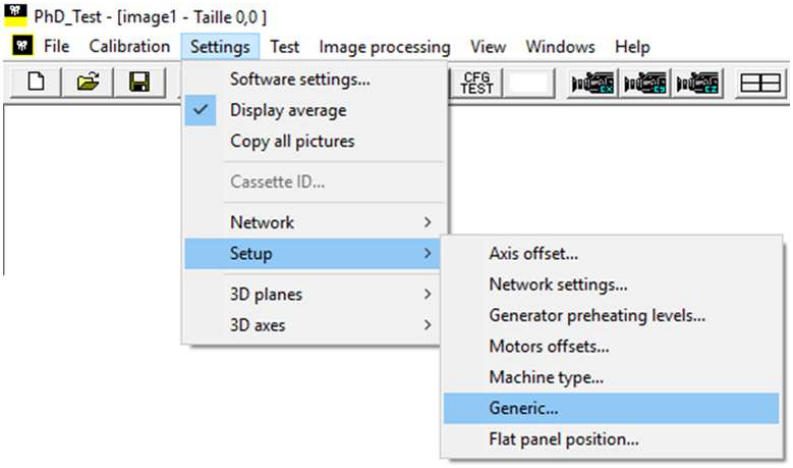


8. Repeat the above procedure on all the PC network interface boards.

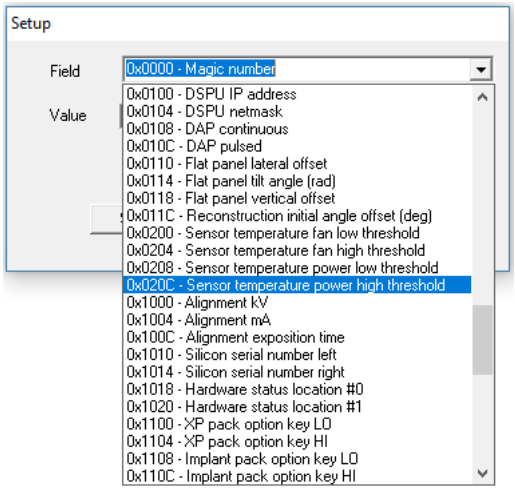
11.2.5 EEPROM Memory values verification and modification

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.

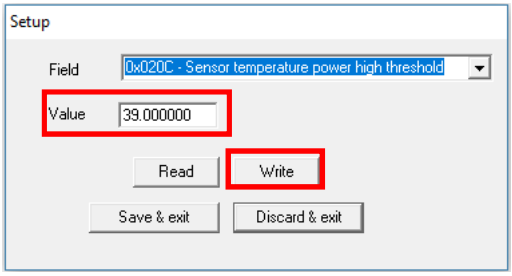
1. Switch ON the unit and when the green keyboard LED blinks slow press the >0< button.
2. Open the "PhD_test.exe" (folder path: C:\Program Files (x86)\Acteon Imaging\Panoramic X-MIND Prime and wait the unit connection.
3. Click on the menu Settings→Setup→Generic:



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

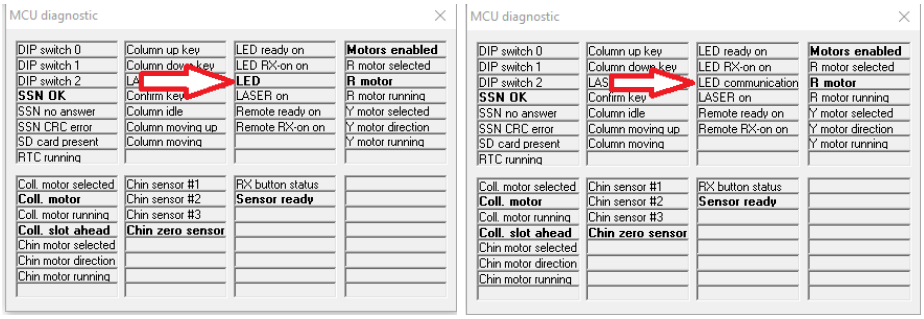
If in the “Value” field the number is preceded by the prefix “0x”, means that that it is expressed in hexadecimal base. In this case refer to the DECIMAL values reported on the right of the field:

If the value must be changed, write in the white filed the correct DECIMAL number and then press the button “Write”.

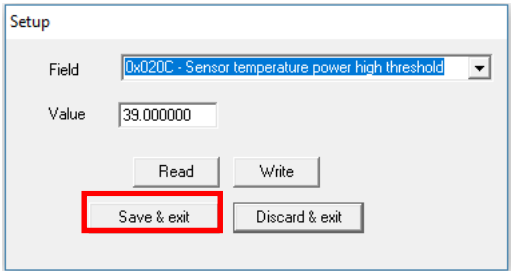
5. Wait the blue keyboard LED blink.

Note

In case of remote technical session: the BLU LED blinking state it 208ignalled also in the “MCU diagnostic” window through the loop-variation between the bold “LED” text and the “LED communication” text in the field indicated by the red arrow in the Figure below:



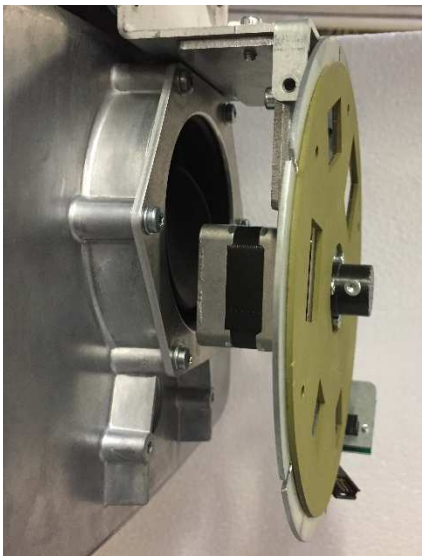
6. Press “Save& exit” button and wait the unit reboot (green LED blink slow).



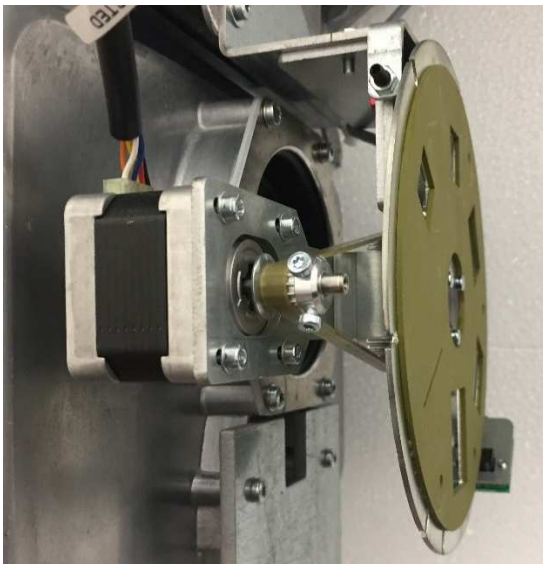
7. Switch OFF the unit.

11.2.6 Disk collimator type settings

Perform the following procedure if the collimator type has to be change from “NORMAL to BELT” or from “BELT to NORMAL”.



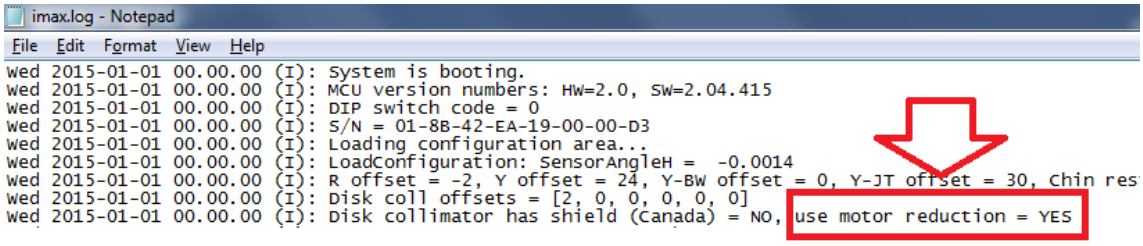
NORMAL TYPE
“Motor reduction = NO”



BELT TYPE
“Motor reduction = YES”

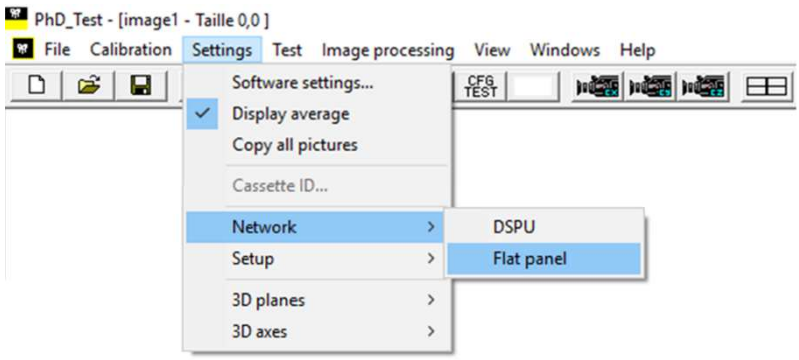
Figure 46

1. Set the MCU DIP-switched as ON-ON-OFF (see paragraph 4.3.2.1).
2. Switch ON the unit: the three keyboard LEDs will light ON in sequence. Wait until the green LED blinks slowly.
3. Press the X-ray button and then the LASER button. The collimator type will change from belt to normal (or normal to belt) and the 2 lasers will blinks.
4. Switch OFF the unit and set the DIP-switches in NORMAL mode (ON-ON-ON).
5. Switch ON the unit and perform an axis reset by pressing the >0< button.
6. If Error E260 is displayed, switch OFF the unit, insert an SD card in the MCU board, switch ON the unit and wait until the green keyboard LED blinks slowly.
7. Switch OFF the unit and open (with a txt reader) the SD card log (imax→log→imax.log):
   - If the parameter “use motor reduction” is equal to NO, repeat the above procedure
   - If the parameter “use motor reduction” is equal to YES and the E260 is still present, refers to Error E260 (see paragraph 9.2.3.4).



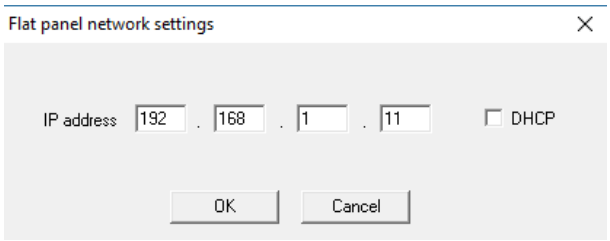
11.2.7 3D Sensor static IP address setting

1. Switch ON the unit and when the green keyboard LED blinks slow press the >0< button.
2. Open the “PhD_test.exe” (folder path: C:\Program Files (x86)\Acteon Imaging\Panoramic X-MIND Prime and wait the unit connection.
3. Click on the menu Settings→Network→Flat panel:



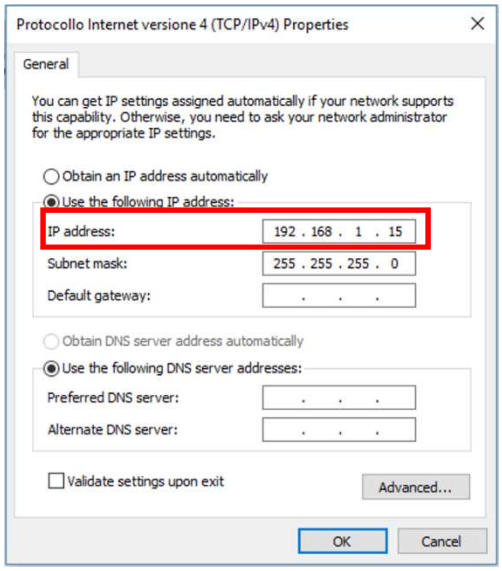
4. Unflag “DHCP” mode box:

5. Write a compatible static IP address in the IP address fields (different from the DSPU one – see paragraph 11.2.8.1).



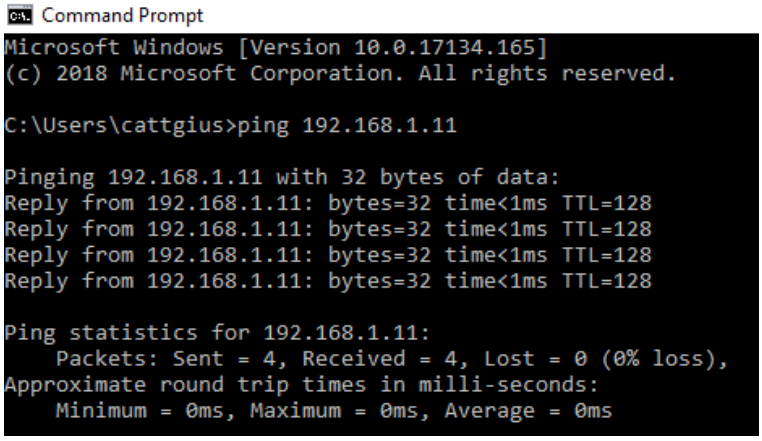
6. Click on OK button and close “PhD_test” program.

7. 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

8. Switch the unit OFF and then power it ON again.
9. 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:

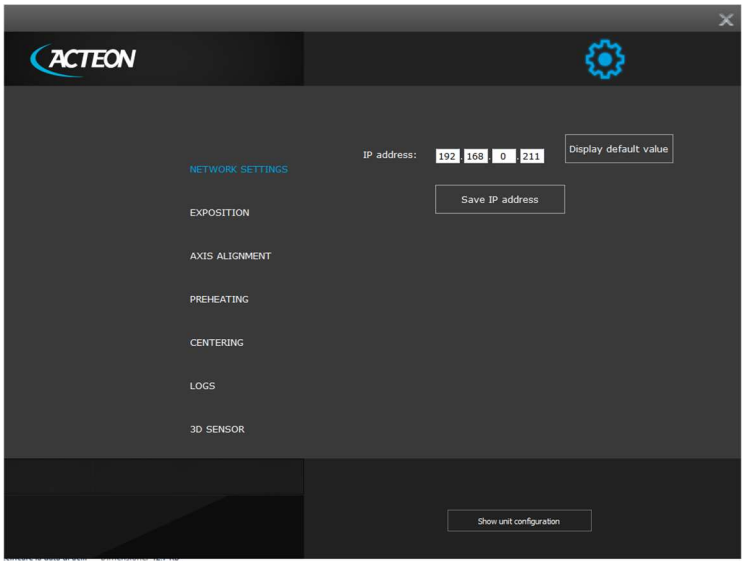


10. IF the sensor does not reply, refer to Error E1402.

11.2.8 DSPU IP address modification and factory reset

11.2.8.1 DSPU IP address modification

1. Enter service menu (see chapter 0).
2. Select the “Network Settings” page (see paragraph 8.1).



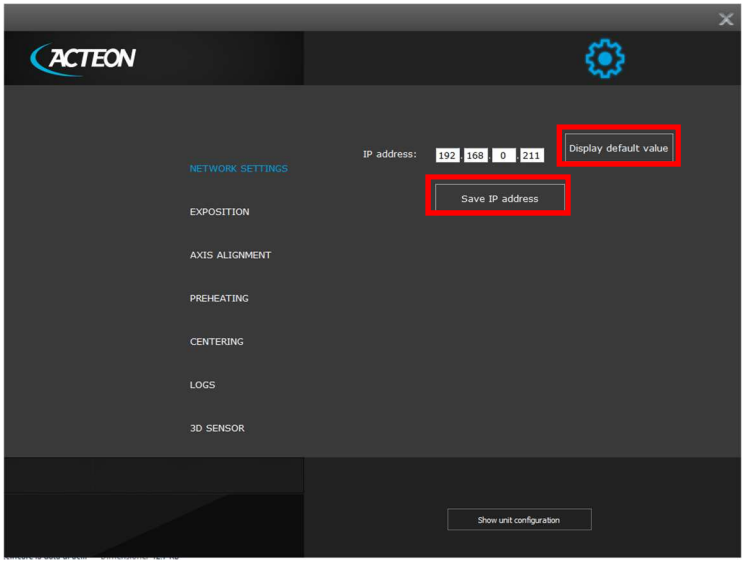
3. Change the IP address; the following message will be displayed:
4. Change the Network interface board IP with a valid one (see paragraph 7.7.1).
5. Wait until the unit connection.
6. When the unit is connected, close the service menu by clicking on the gear and wait the unit reboot.

Note
You can verify the current DSPU IP address by keeping the MCU SD card log (see paragraph 11.2.1.2).

11.2.8.2 DSPU IP address factory reset

Follow the procedure below to restore the factory DSPU IP address 192.168.0.211.

1. Switch ON the unit.
2. Press the column UP and column DOWN keyboard buttons until the keyboard green LED blink.
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 0).
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 DSPU IP address by keeping the MCU SD card log (see paragraph 11.2.1.2).

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) and to the DSPU board.

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.

11.3.1.5 DSPU board (A4) fuses

The DSPU board fuse F1 cuts the 24V supplied by the MCU through the connector J8.
The fuse F2 cuts the DSPU 5V line.
The fuse F3 cuts the DSPU 3.3V line in case of overcurrent.

Fuse type:

- F1: 1 A FF (125V)
- F2: 2 A FF (125V)
- F3: 1 A FF (125V).

Refer to chapter 12 – drawing 5 – for fuse position.

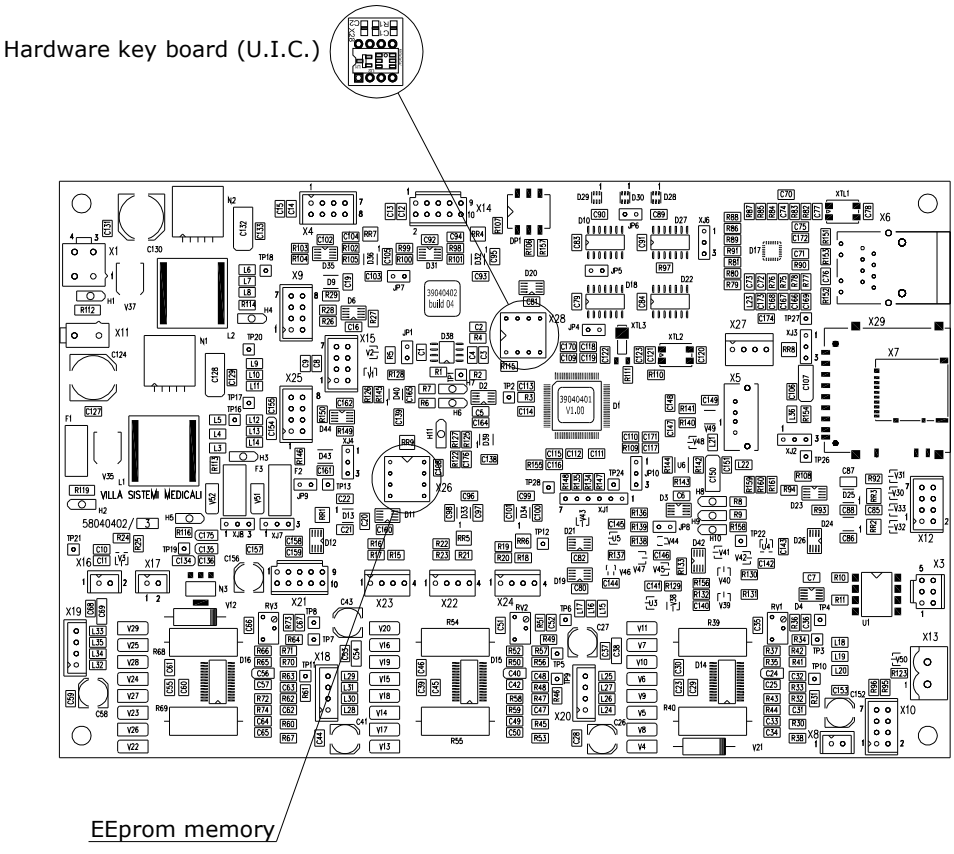
11.3.2 MCU board replacement

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 0 – “Service programs description”.

Note
At the end of the replacement, restore the metallic cover and the ground connection. Both parts have to be recovered from failed board.



11.3.3 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 11.2.2)

**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:

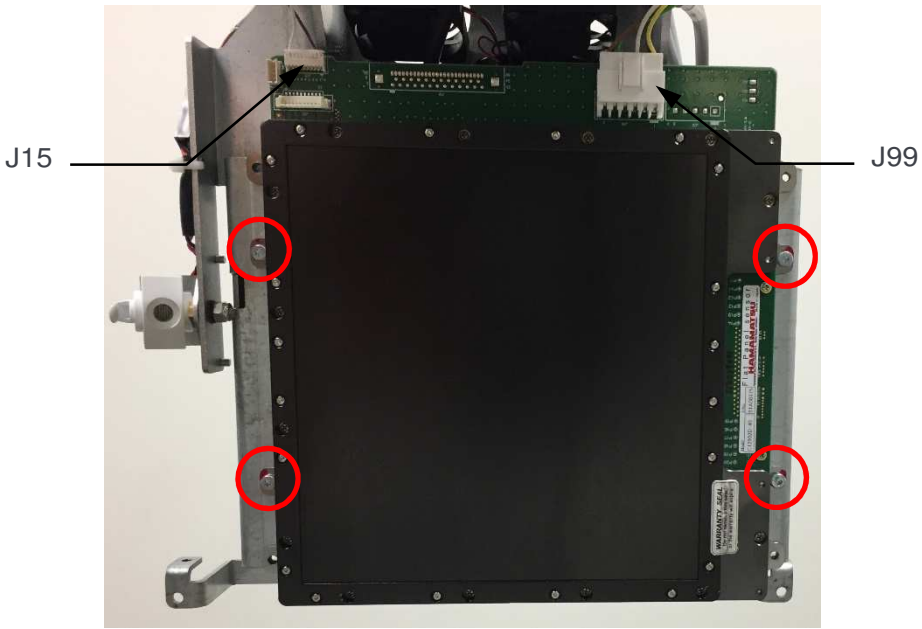


Figure 47

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 8.7).
8. Perform sensor calibration (see paragraph 10.2).
9. Verify the 3D lateral offset (see paragraph 8.8).

11.3.4 Tube head replacement

1. Switch OFF the unit.
2. Remove the tubehead external and internal cover.
3. Remove the Generator board metallic cover:

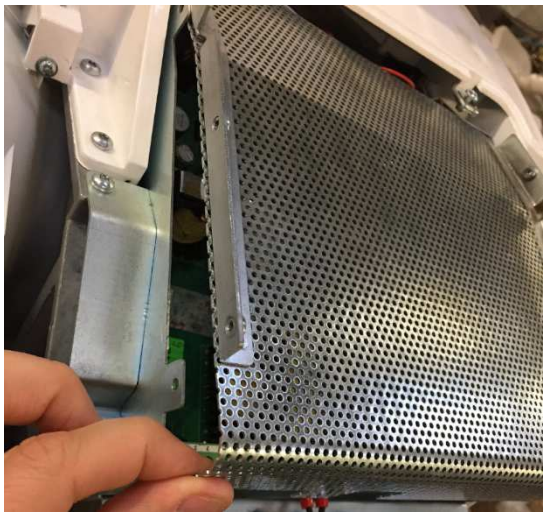


Figure 48

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”:

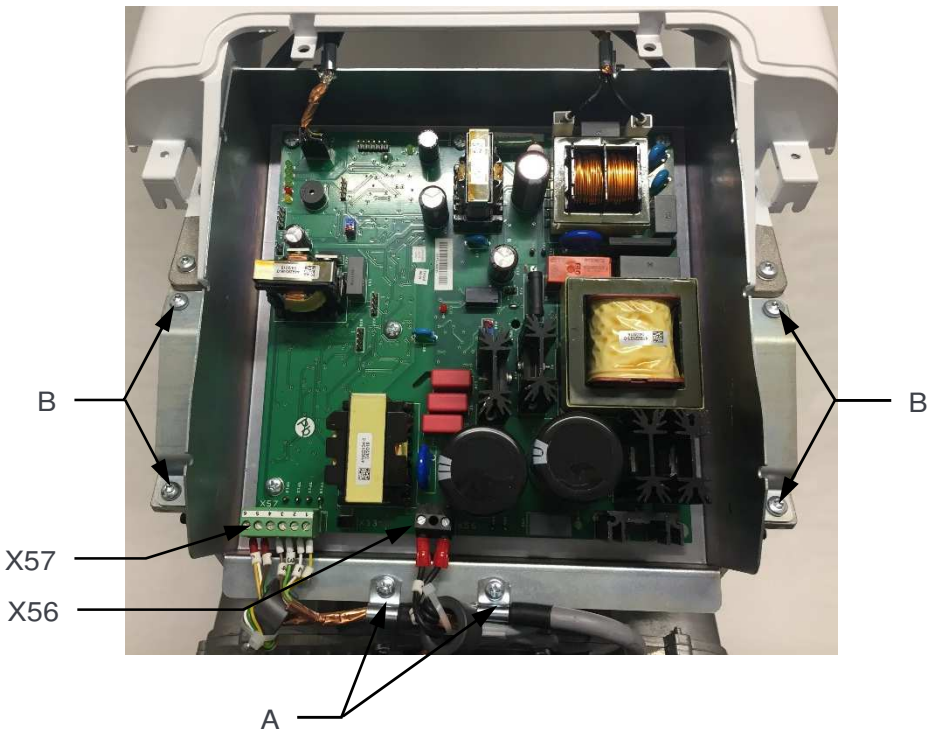


Figure 49

5. Pull up the generator board.

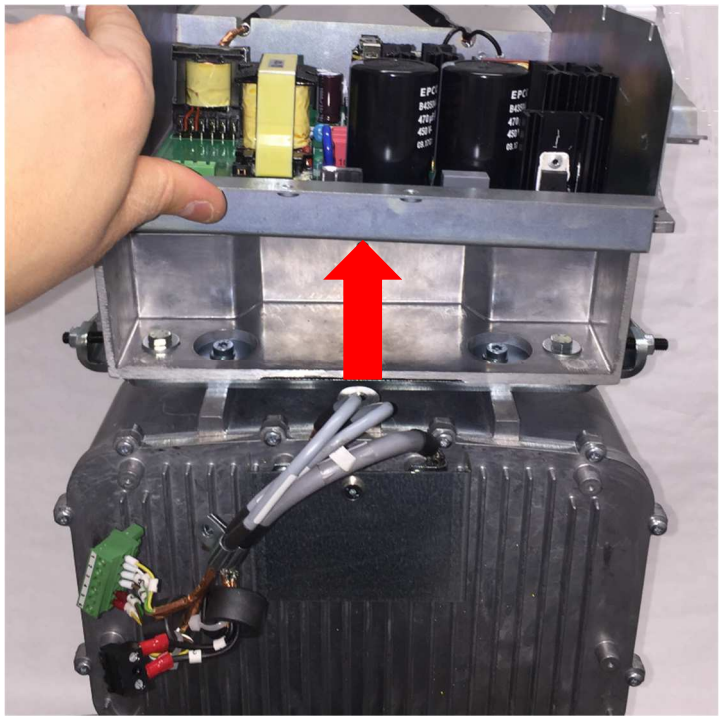


Figure 50

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”.

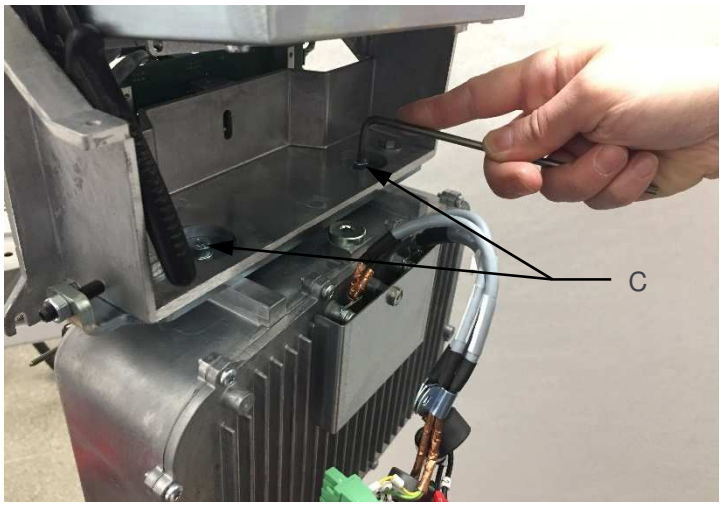


Figure 51

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 51).

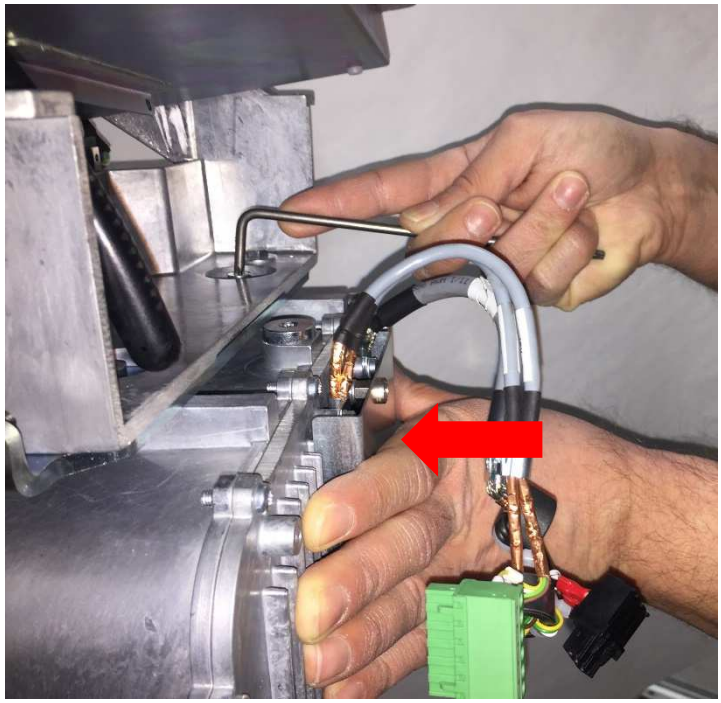


Figure 52

8. Connect X56 and X57 connectors and fix the cables fixing clamps “A” (Figure 49).
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 8.7).

13. In case the beam is not centered to the sensor, loosen the screws “C” (Figure 51) and act on screws “D” and “E” (Figure 54) following the convention reported below:
    - Screw “E” to move the X-ray beam on the right (on the image)
    - Screw “D” to move the X-ray beam on the left (on the image)

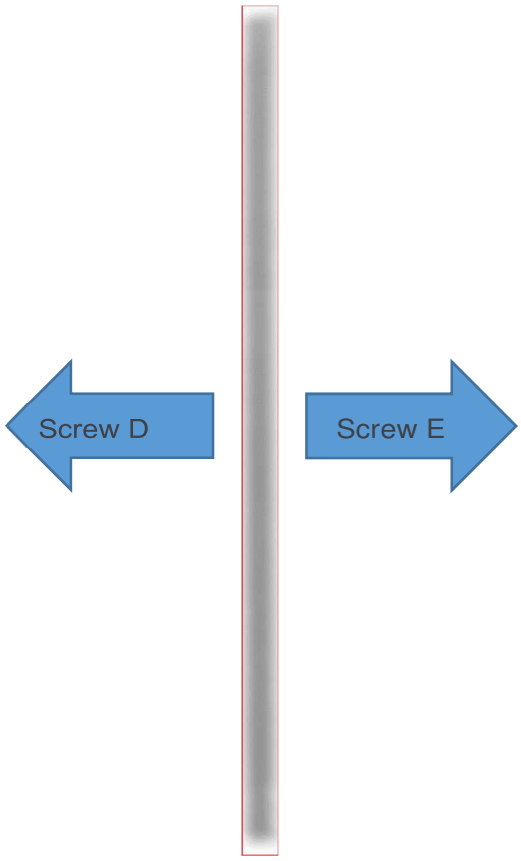


Figure 53

Note
In order to act on a screw (D or E) on one side, loosen the other screw on the opposite side.

Figure 54

14. Tighten screws “C” 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.

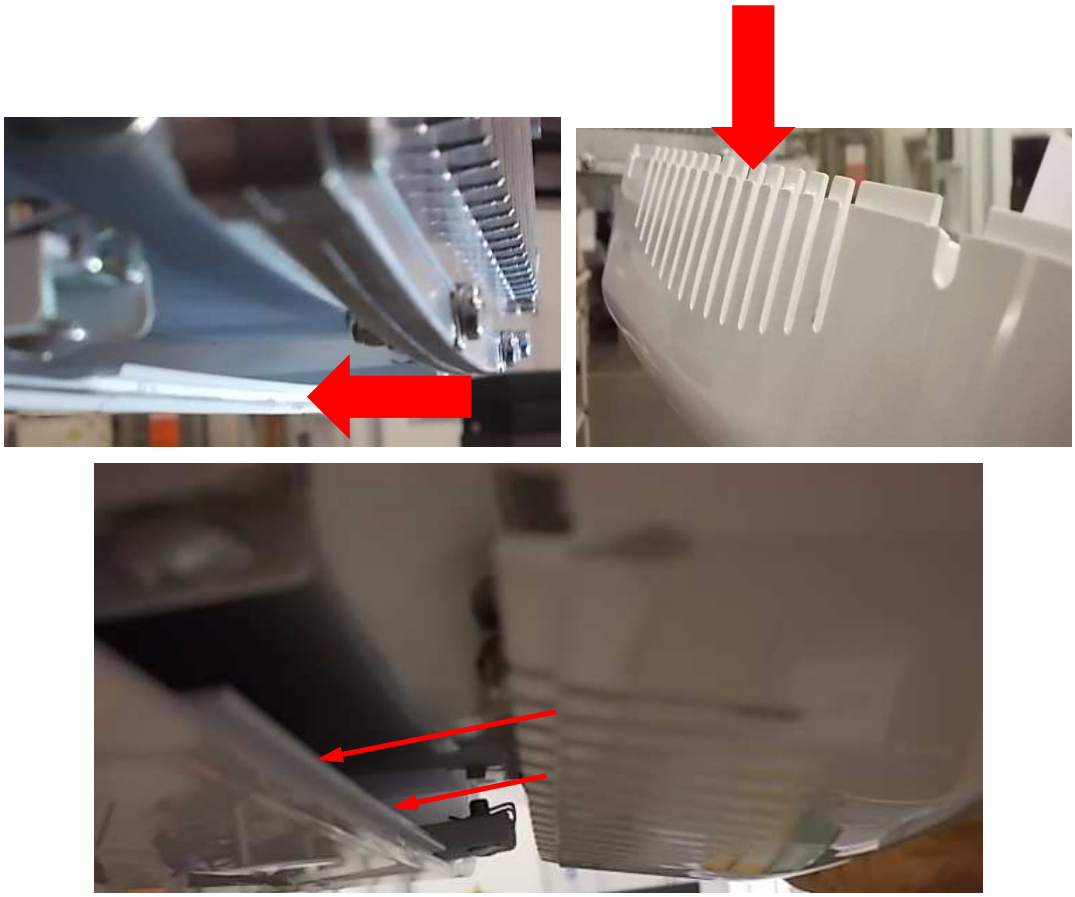


Figure 55

18. Perform the sensor calibration and verification (see paragraph 10.2).
19. Perform a panoramic symmetry verification (see paragraph 7.10).

11.3.5 Columns replacement

1. Remove the upper cover and the fixing plate 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 4.3.2.1).
3. Turn ON the unit.

Note
In service mode NEVER press up/down column keys as they change rotating position.

4. Position the panoramic tool on chin support.
5. 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 56

6. Put adhesive tape between the extremities of the tool.
7. 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 57

Rotation references are present on the tool and it has to be used as reference to position the unit in the same position.

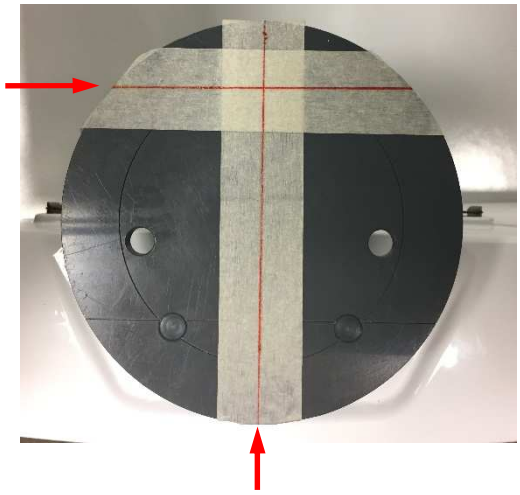
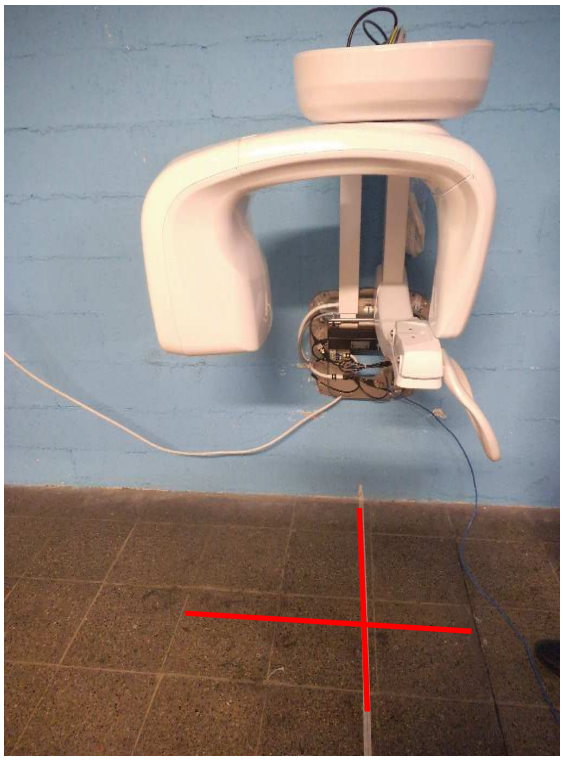


Figure 58

Note
In case it is not available the tool, it is possible to make references on the floor.
Turn ON laser, press >0< button on the keyboard.
Put adhesive tape on the floor corresponding to the laser position and mark laser position using a pen.
Press >0< button on the keyboard until the laser is in 90° position and mark the other axes.



8. Turn OFF the unit and disconnect main power supply.
9. Rotate manually the rotating arm and fix it to the frame as shown in the image using the provided fixing plate.

Figure 59

10. Cut strips and disconnect the cables X3, X10 and X13 from MCU and disconnect cable P1 from DSPU.

Figure 60

11. Remove connector from cable X13 (it may include exposure button).

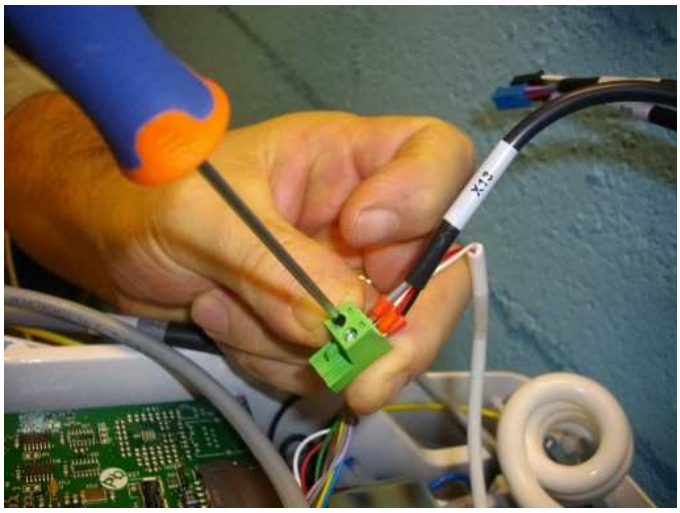


Figure 61

12. Pass the cable out from the top side of the unit.

Figure 62

13. Cut lower strip.

Figure 63

14. Disconnect power cables and chin arm cables from top side of the unit.

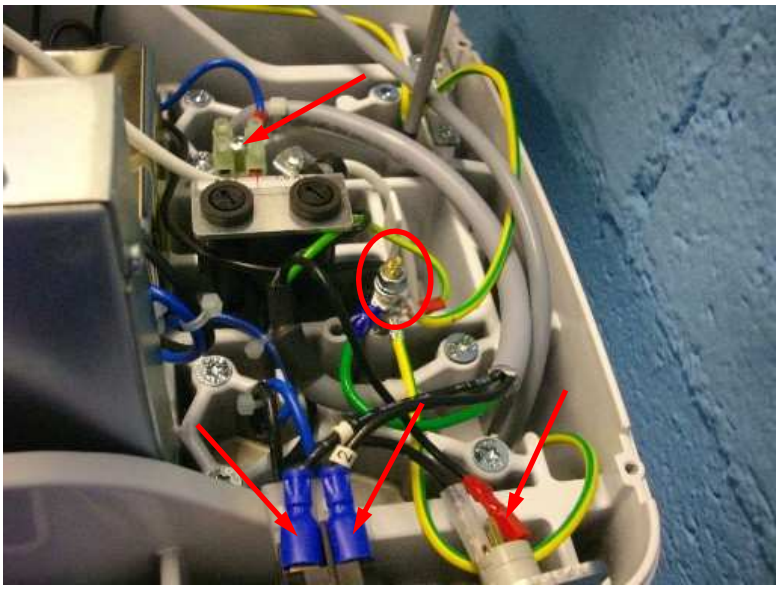
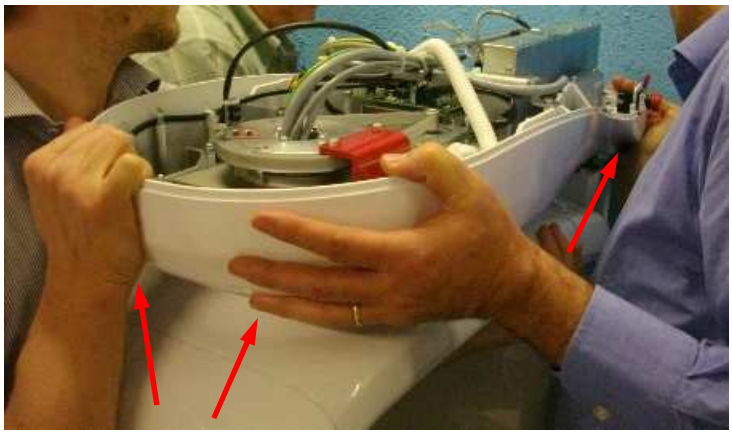


Figure 64

15. Disconnect the exposure button in case it has been connected in the upper side.

Figure 65

Note
Two persons are necessary to lift the head. Put the hands on front and back side. One person has to release screws and pass cables.



16. Remove the 8 fixing screws.

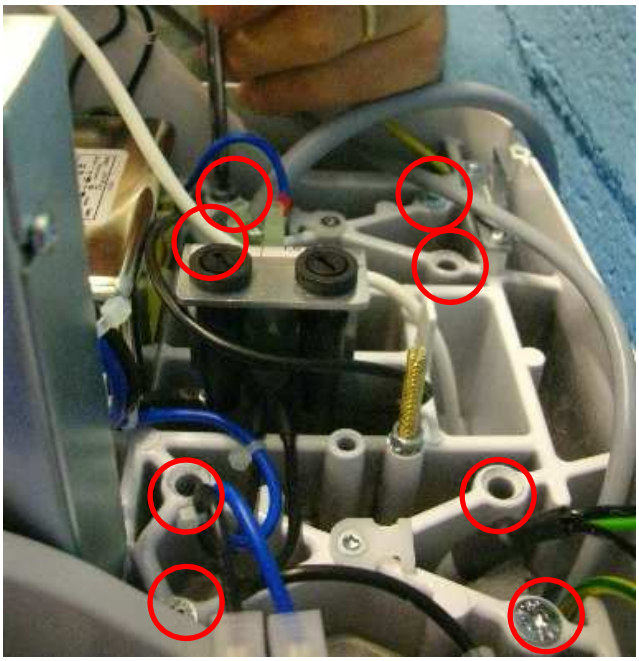


Figure 66

17. Pass the cables out of rotating head.

Figure 67

18. Position head on a protected surface in order to avoid damages.

Figure 68

19. Take the reference of chin support arm before to remove it, measuring the distance between top of the column and chin support arm. Typical value is 40.9 cm.

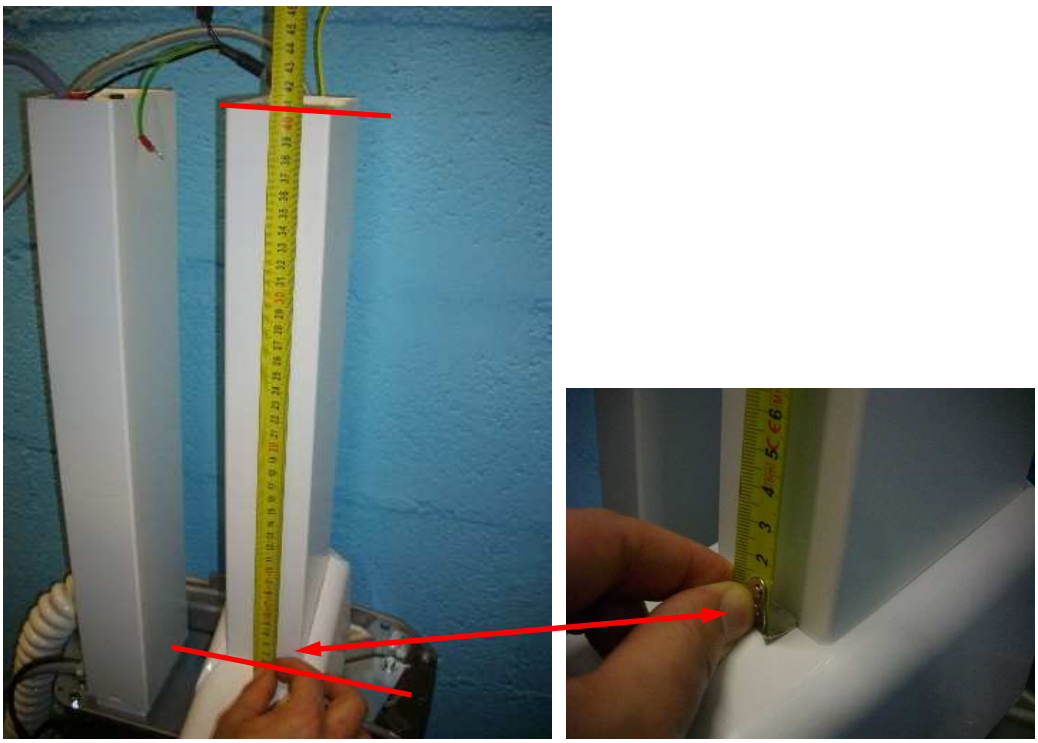


Figure 69

20. Disconnect lift motors control cables and power supply from fixing plate.

Figure 70

21. In order to remove the columns plate, loosen the nuts of the hinges fixing the plate in both sides.

Figure 71

22. Move up the pin used to block the hinge pin in both sides. Slide out the hinge pin in both sides.

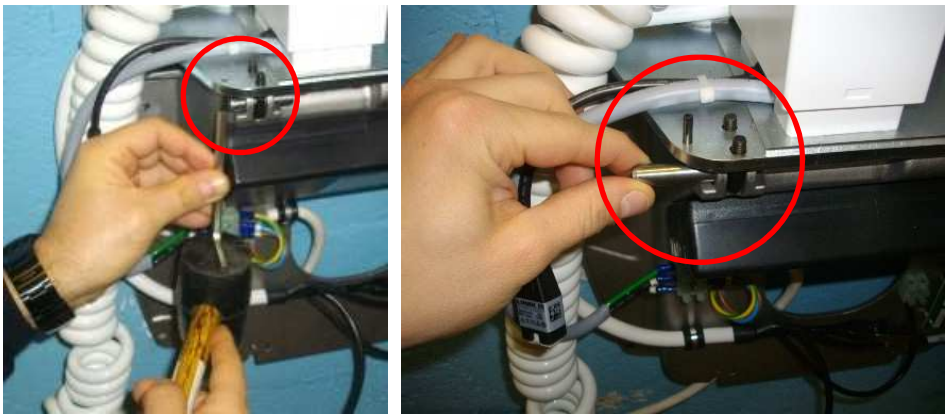


Figure 72

23. Remove the safety pins. In this phase, support the assy.

Figure 73

24. Release the fixing pin to remove the columns assembly.

Figure 74

25. With the group on a desk, remove the adhesive plate and pass the cables out of the column.

Figure 75

26. Remove the lower cover from chin support.

Figure 76

27. Loosen the two nuts inside the chin support arm.

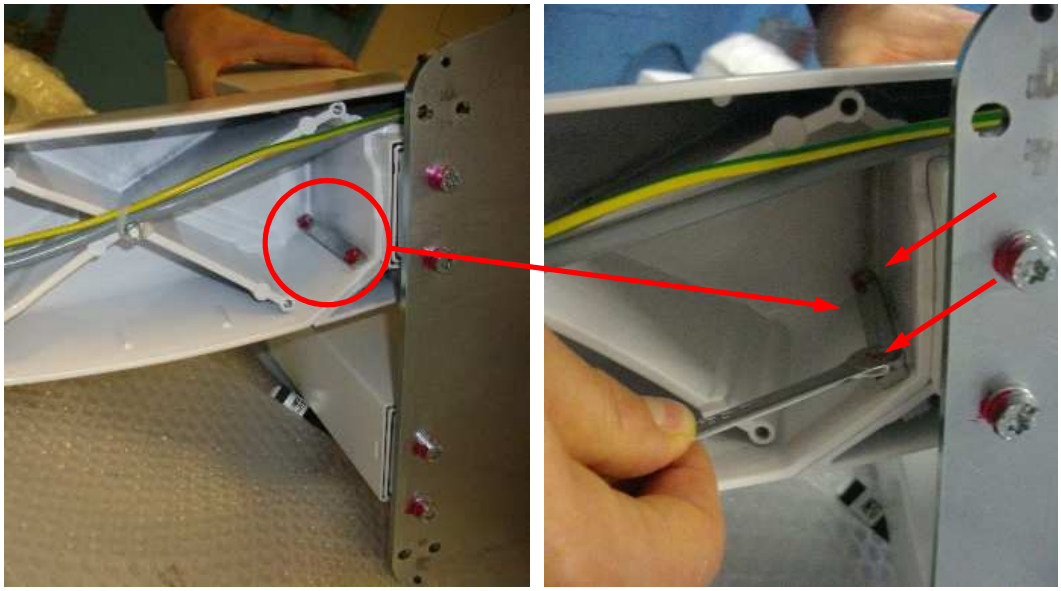


Figure 77

28. Loosen the two screws in the back side of the arm.

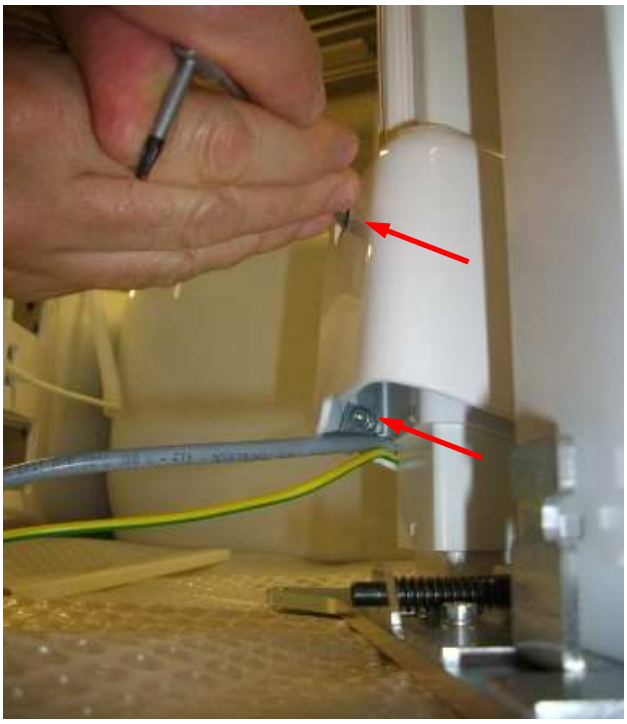


Figure 78

29. Slide the arm out of the column.

Figure 79

30. Remove the control box from the wall plate.

Figure 80

31. Position the arm on right side of the spare column, measuring the distance between top side and arm. Fix it to the column.

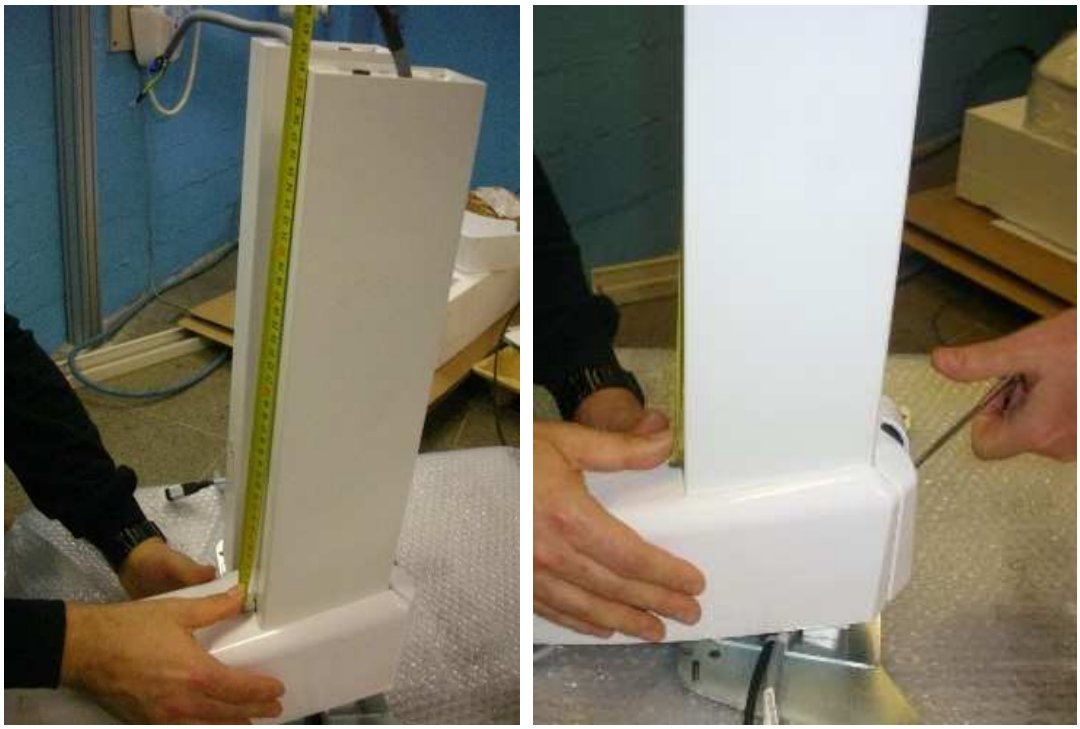


Figure 81

32. Close the arm lower cover.

Figure 82

33. Mount the new control box.

Figure 83

34. Position the new group and pass the cables in the back side of the arm, without mounting the adhesive channel.

Figure 84

35. Mount the hinge and push down the safety pin using a hammer.

Figure 85

36. In order to easily mount the cable, tilt the column group and fix the cable with the terminal strip.

Figure 86

37. Once fixed the cable, insert and fix the safety pin; tighten the hinges.

Figure 87

38. Insert the cables from new column in the head.

Figure 88

39. Position the head on the columns.

Figure 89

40. Put the screws on the column top side and fix them without tightening completely

Figure 90

41. Insert the spiral cable on top side of the head and connect all the cables (see points 10, 14 and 16 above).

Figure 91

42. Connect motor cables to the control box: left side motor must be connected to port 1 (left side of control box), and right side motor to port 2 (right side of control box).

Figure 92

43. Remove the rotating arm fixing plate.

Figure 93

44. Turn ON the unit in Service mode.

45. Turn ON the laser and press >0< button on the keyboard to rotate the unit.

46. Use the references taken before replacement (centering tool or references on the floor) to verify head position.

    Loosening the 8 column fixing screws (Figure 66) it is possible to rotate head until the laser correspond to the references in both positions. Once position is reached, tighten the screws.

47. Turn OFF the unit.

48. Set DIP-switch 3 to OFF to set the unit in normal mode (see paragraph 4.3.2.1).

49. Turn ON the unit and check up/down movement.

50. Make exposure and verify the image quality as described in paragraph 7.10.

11.3.6 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 4.3.2.1).
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 94

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 95

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 96

Rotation references are present on the tool and it has to be used as reference to position the unit in the same position.

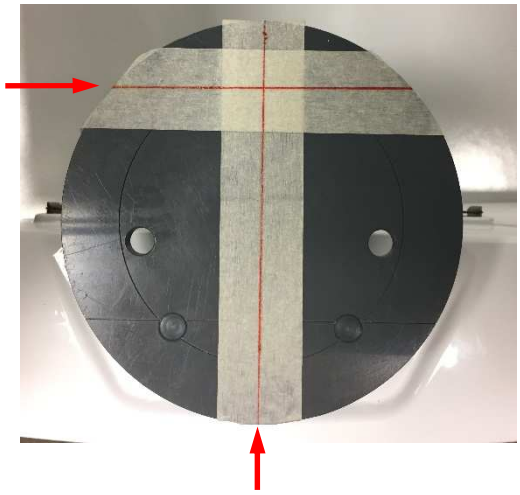
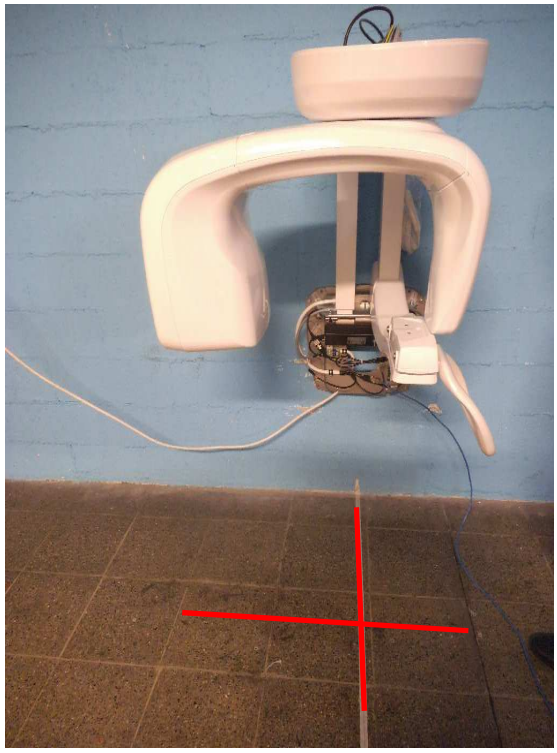


Figure 97

Note
In case it is not available the tool, it is possible to make references on the floor.
Turn ON laser, press >0< button on the keyboard.
Put adhesive tape on the floor corresponding to the laser position and mark laser position using a pen.
Press >0< button on the keyboard until the laser is in 90° position and mark the other axes.



10. Unplug the X12 cable and the ground.

Figure 98

11. Open the wire-way positioned in the back side of the column as shown in the following images.

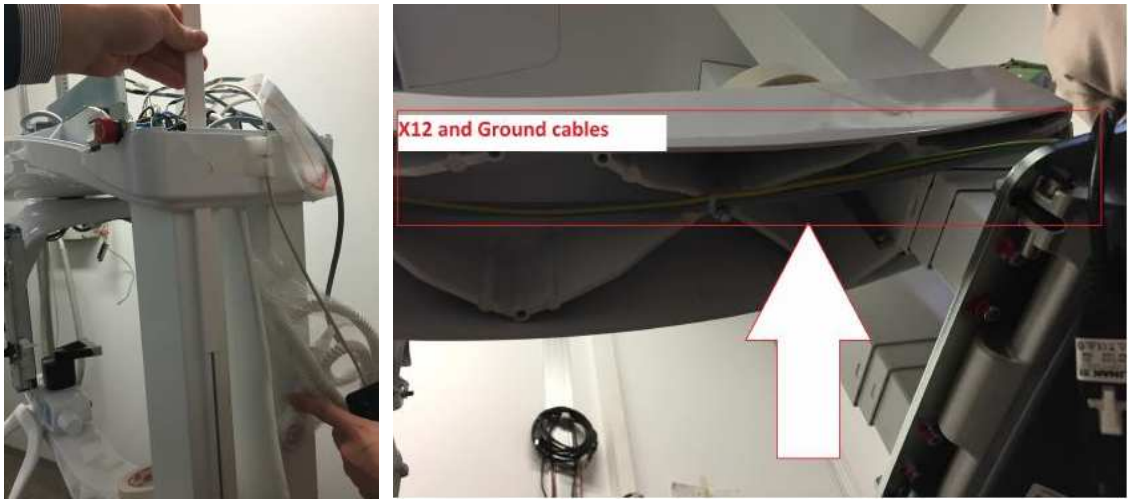


Figure 99

12. Unscrew the two screws under the arm.

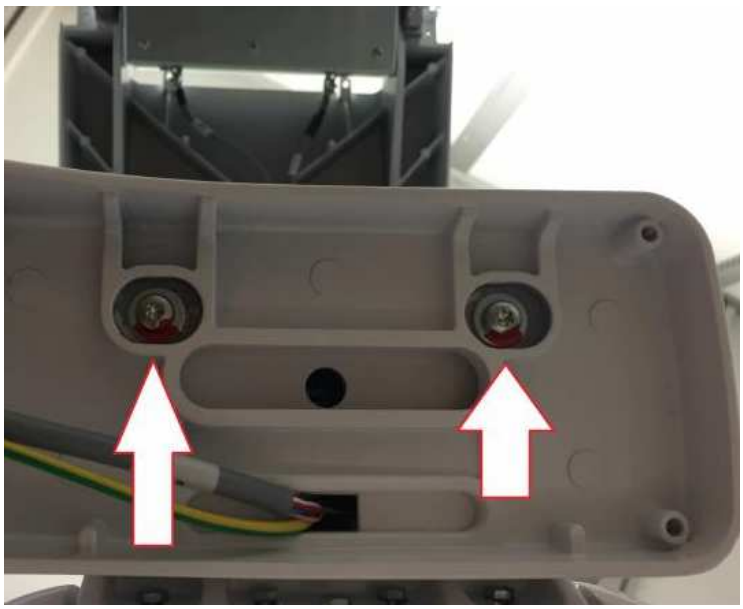


Figure 100

13. Remove the group “key board-handle”.
14. Position the new group.
15. Turn ON the unit in Service mode.
16. Turn ON the laser and press >0< button on the keyboard to rotate the unit.
17. 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.
18. If both the sagittal and horizontal line are aligned, hard tighten the screws.
19. Turn OFF the unit.
20. Set DIP-switch 3 to OFF to set the unit in normal mode (see paragraph 4.3.2.1).
21. Turn ON the unit.
22. Make exposure and verify the image quality as described in paragraph 7.10.

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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. **DSPU board A4 layout**

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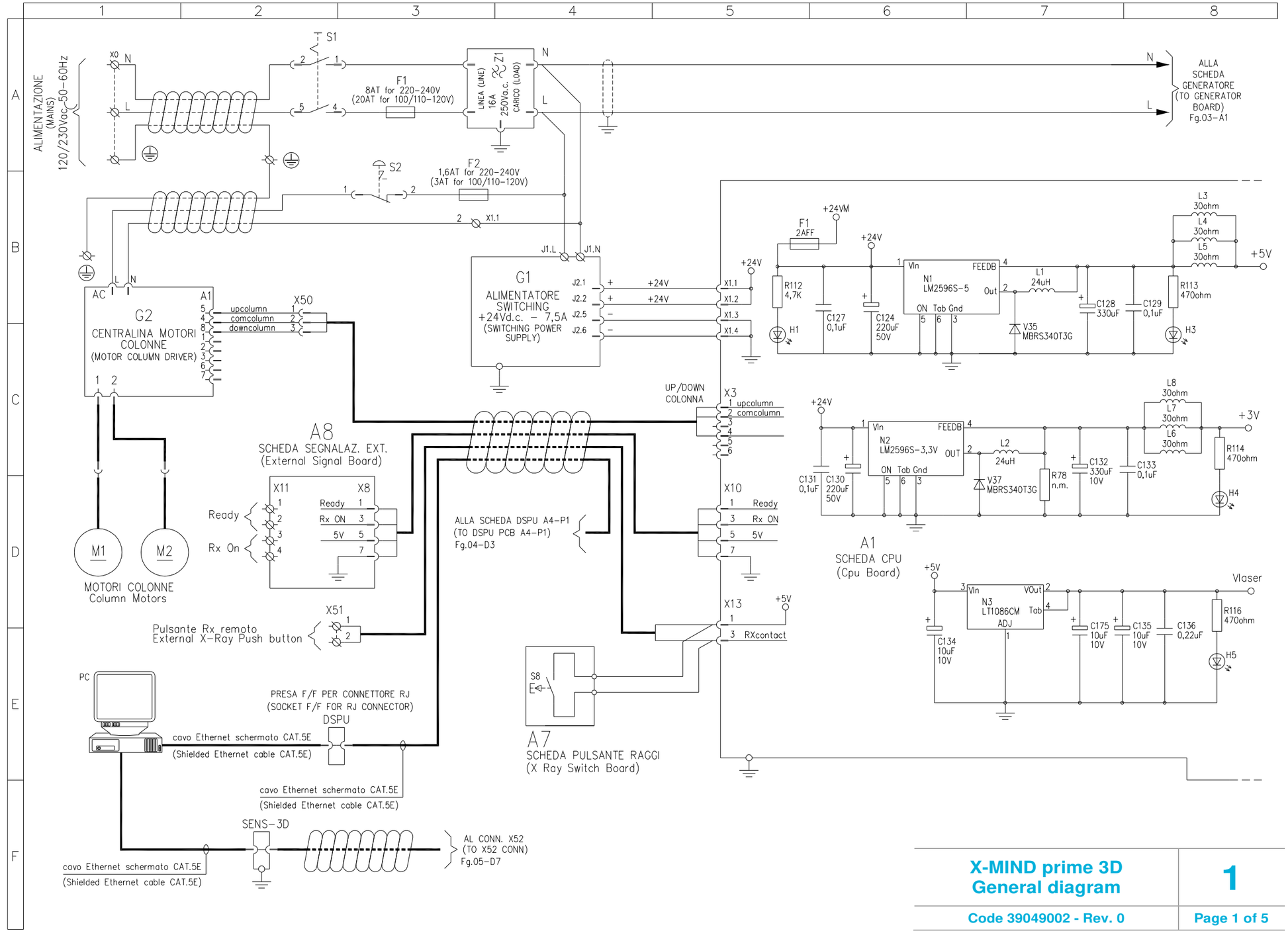
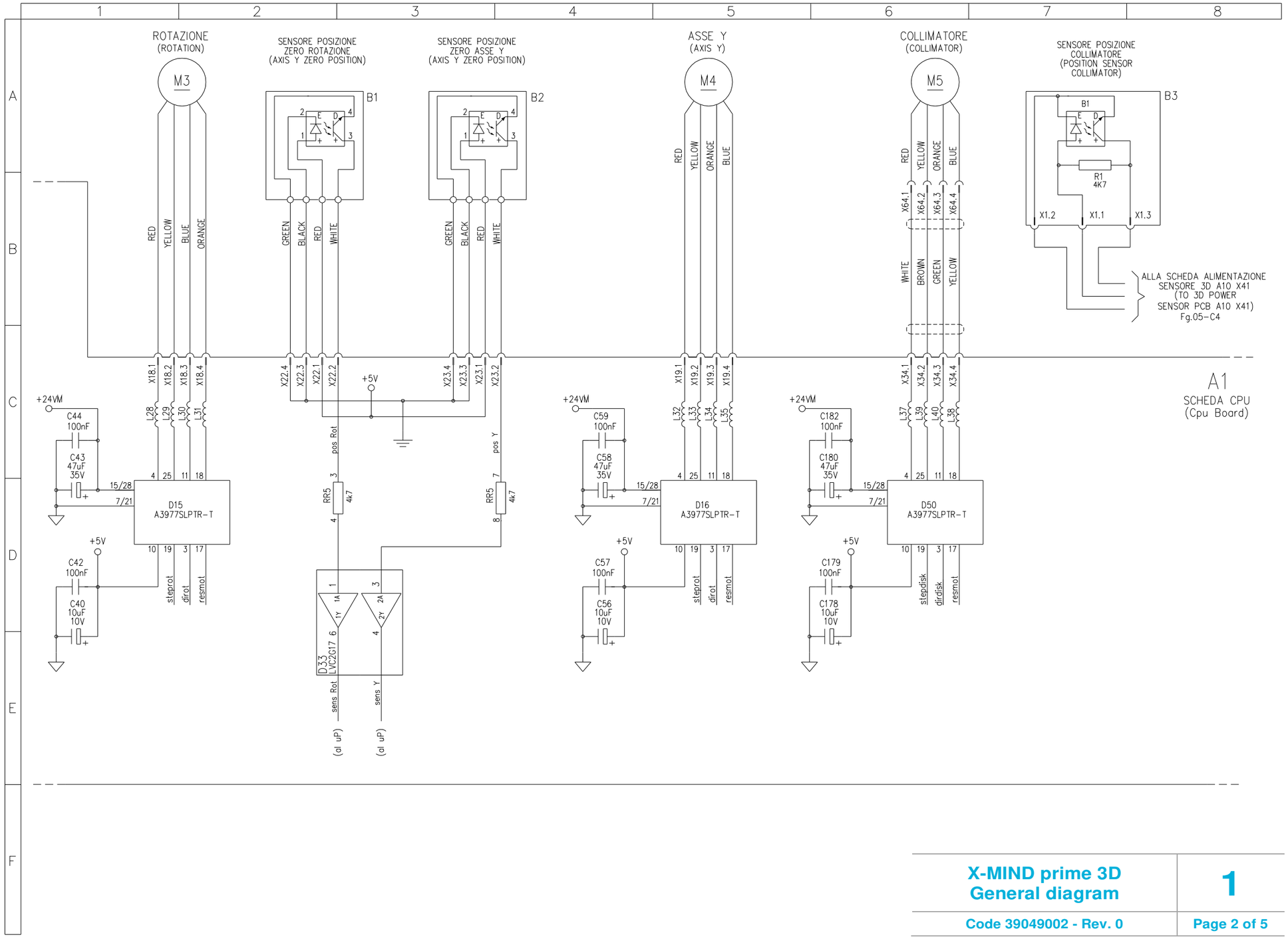
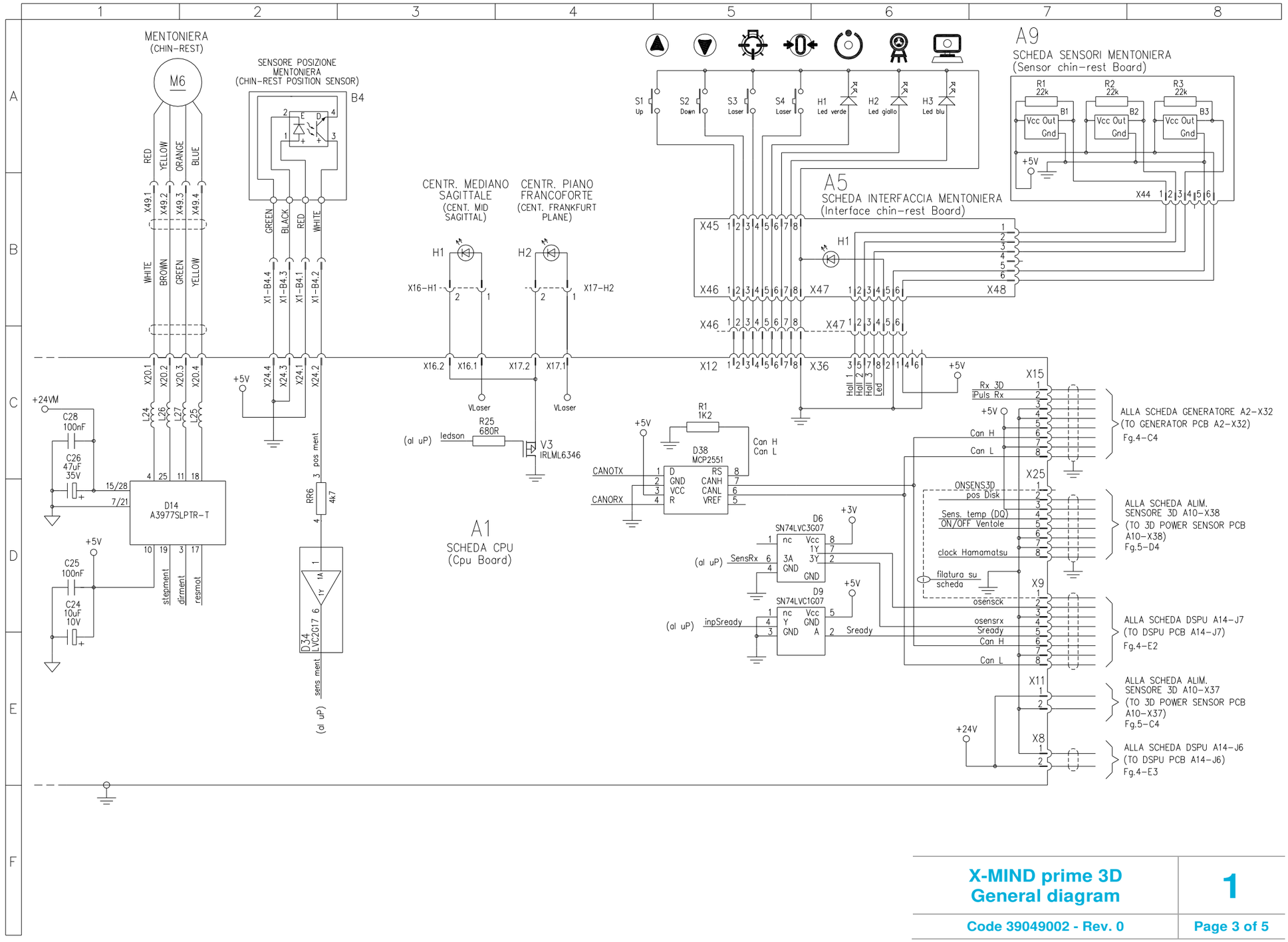


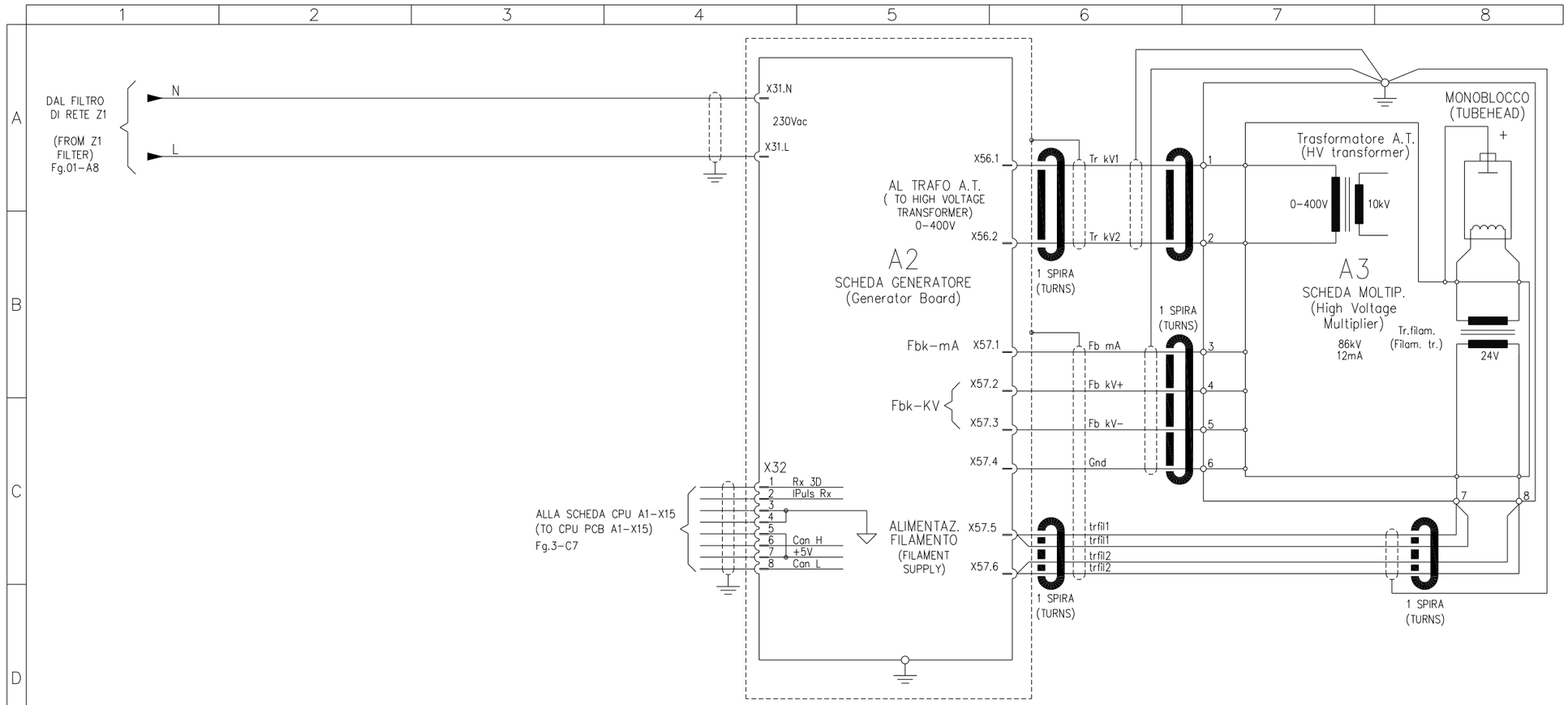
X-MIND prime 3D General diagram	**1**
Code 39049002 - Rev. 0	**Page 1 of 5**



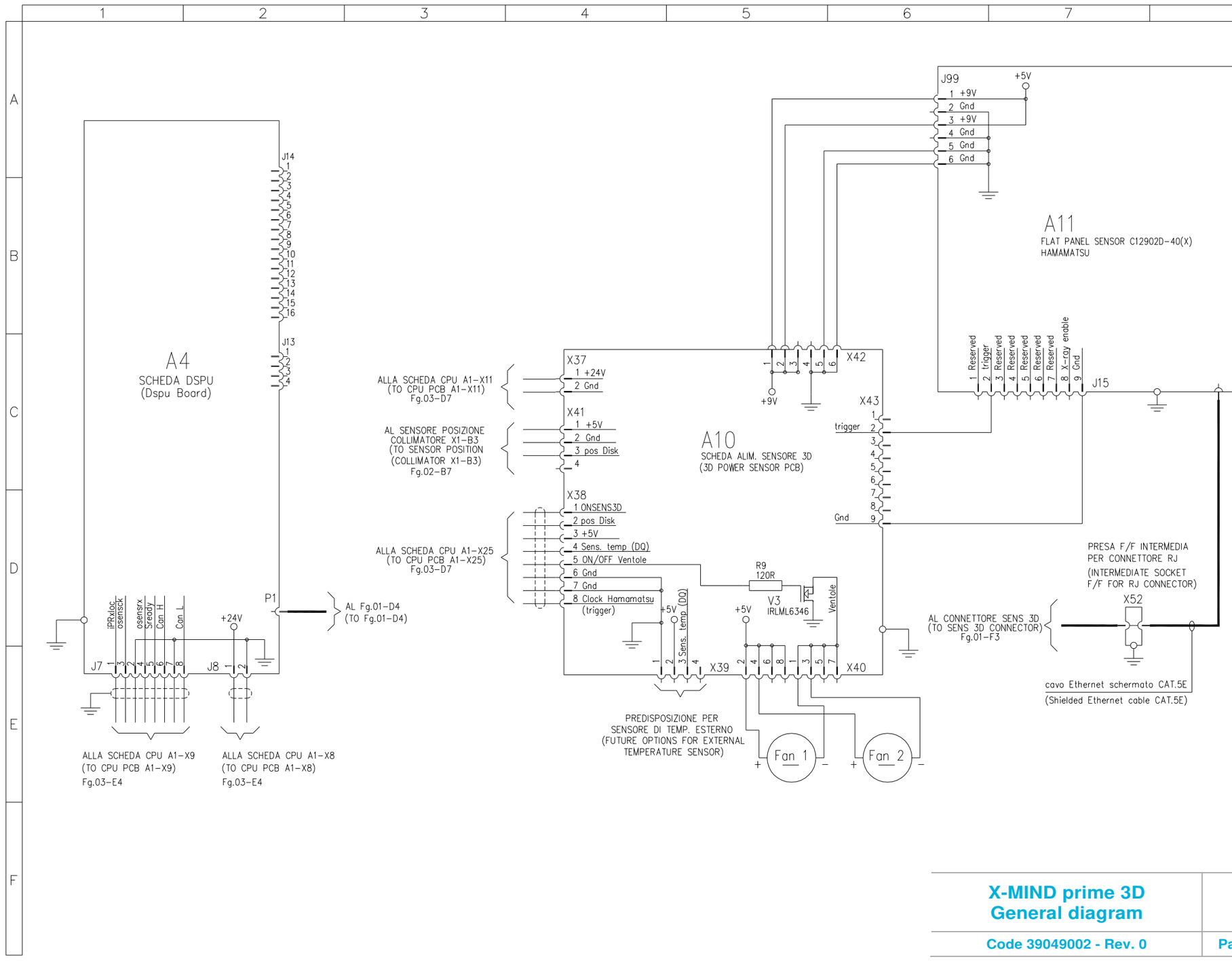
X-MIND prime 3D General diagram	1
Code 39049002 - Rev. 0	Page 2 of 5



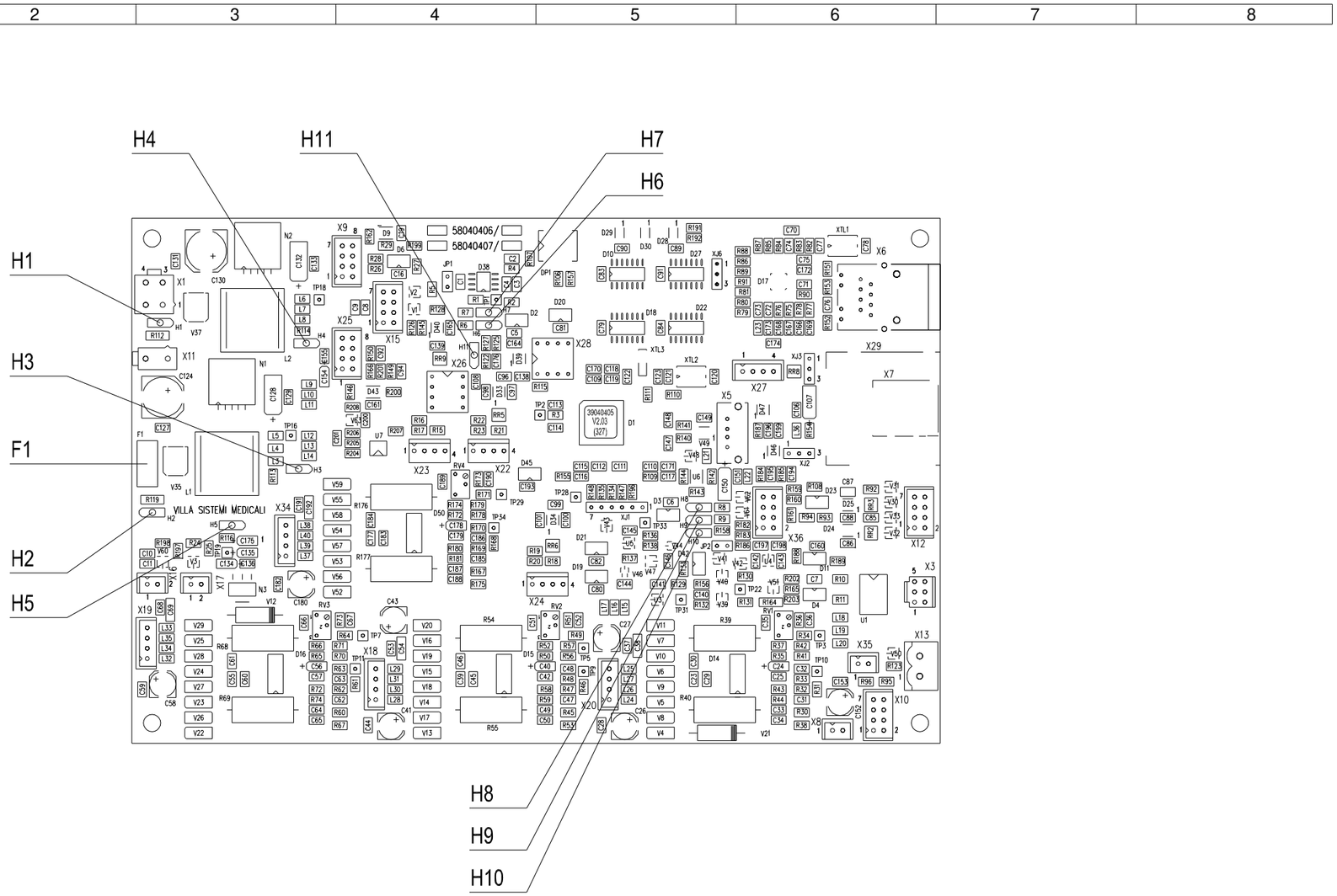
X-MIND prime 3D General diagram	1
Code 39049002 - Rev. 0	Page 3 of 5



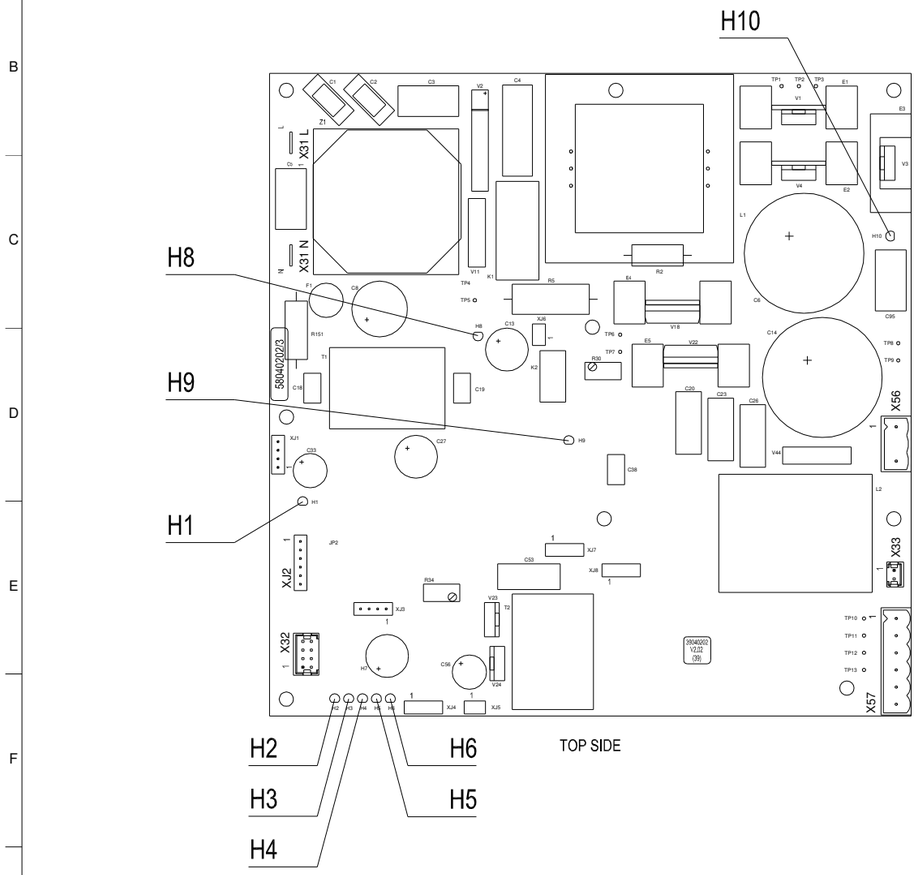
X-MIND prime 3D General diagram	1
Code 39049002 - Rev. 0	Page 4 of 5



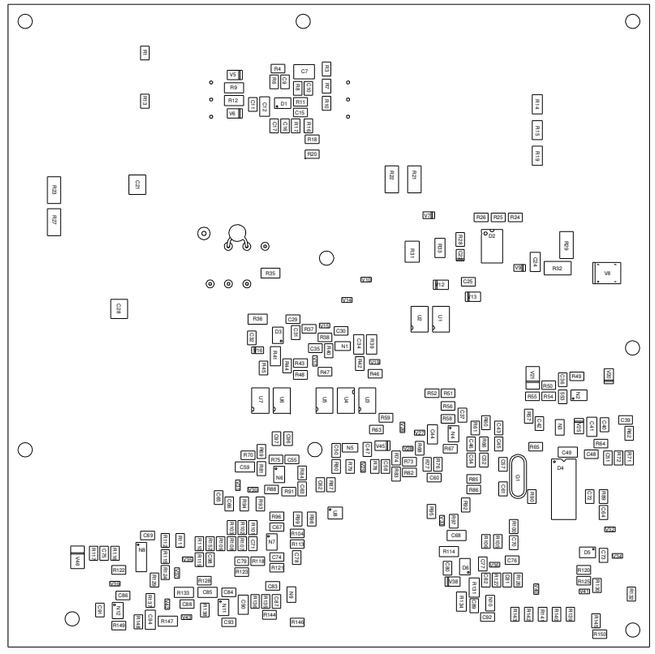
X-MIND prime 3D General diagram	1
Code 39049002 - Rev. 0	Page 5 of 5



X-MIND prime 3D MCU board A1 layout	2
Code 58040406 - Rev. 3	Page 1 of 1



TOP SIDE



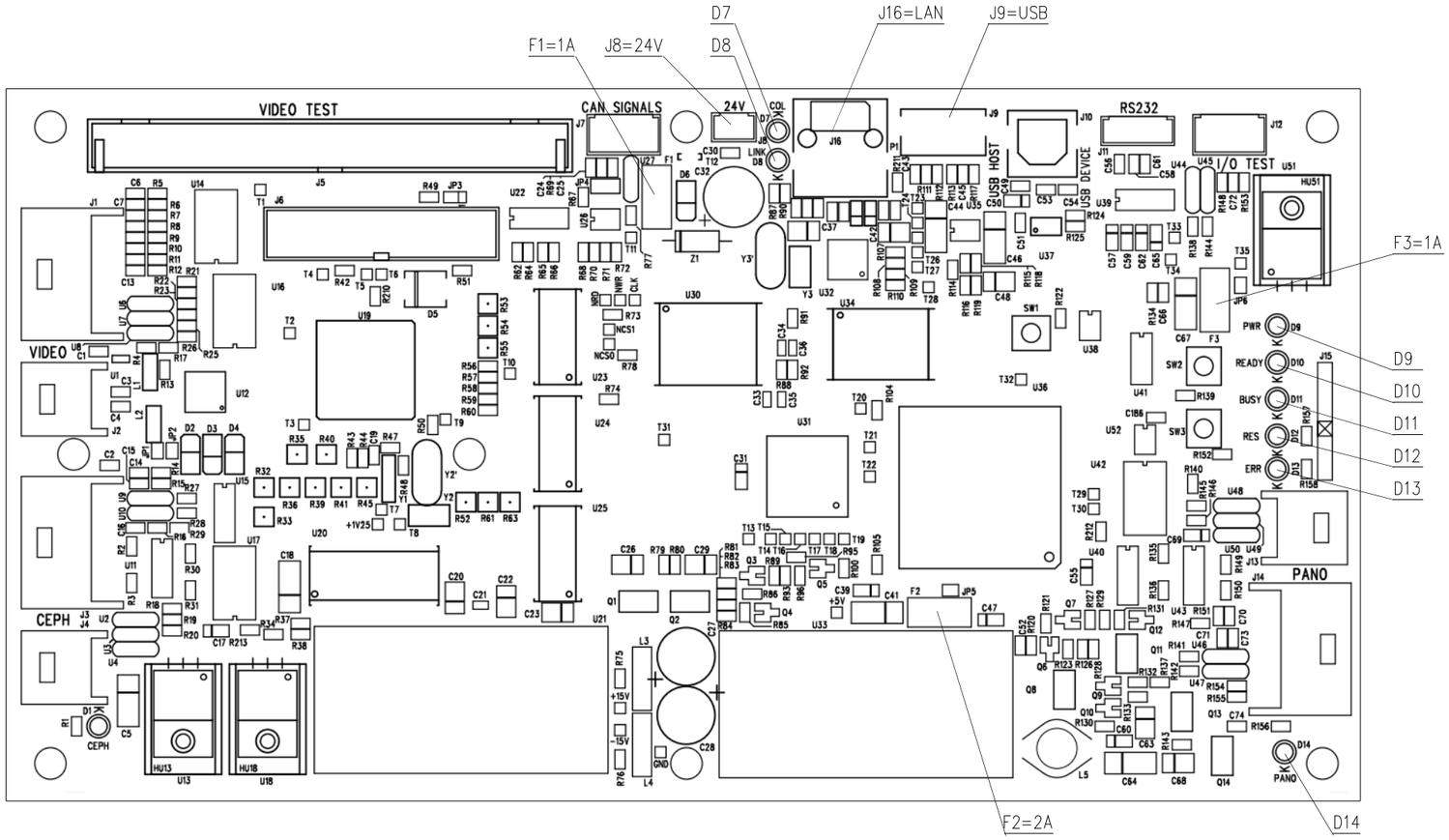
BOTTOM SIDE

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	Page 1 of 1

LEGENDA (LEGEND):

D7=Ethernet (Yellow)
D8=Ethernet (Green)
D9=POWER (Green)
D10=READY (Green)
D11=BUSY (Yellow)
D12=RES (Yellow)
D13=ERR (Red)
D14=PANO (Green)



X-MIND prime 3D DSPU board A4 layout	5
Code 46954831 - Rev. 1	Page 1 of 1

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13. SPARE PARTS

1 – Top side of the unit

2 – Rotating arm

3 – UP/DOWN Column

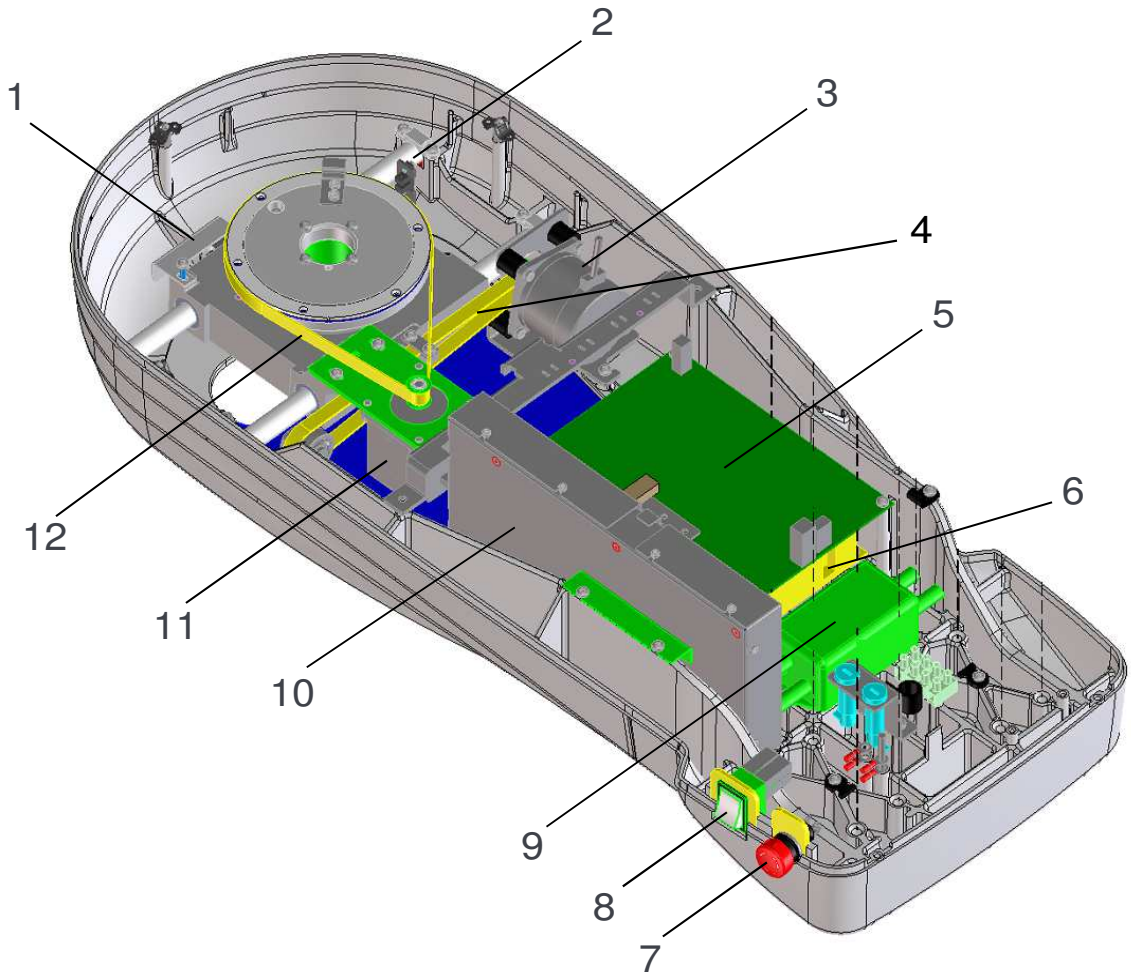
4 – Cables

5 – Covers

6 – Accessories and Service tools

1 – Top side of the unit

Ref.	Order code	Description	Note
1	6204041000	Light sensor assy Y axes	
2	6204040900	Light sensor assy rotation	
3	6604041200	Y axes motor assy	
4	4990807000	Y movement belt	
5	5804040600	3D MCU board	
6	4492823000	Power supply board	
7	4291421400	Emergency pushbutton	
8	4291420900	ON/OFF Switch	
9	4192212200	Main filter	
10	4695483100	DSPU board	
11	6604041100	Rotation motor assy	
12	4990806900	Rotation belt	
--	6104041500	Fuse kit	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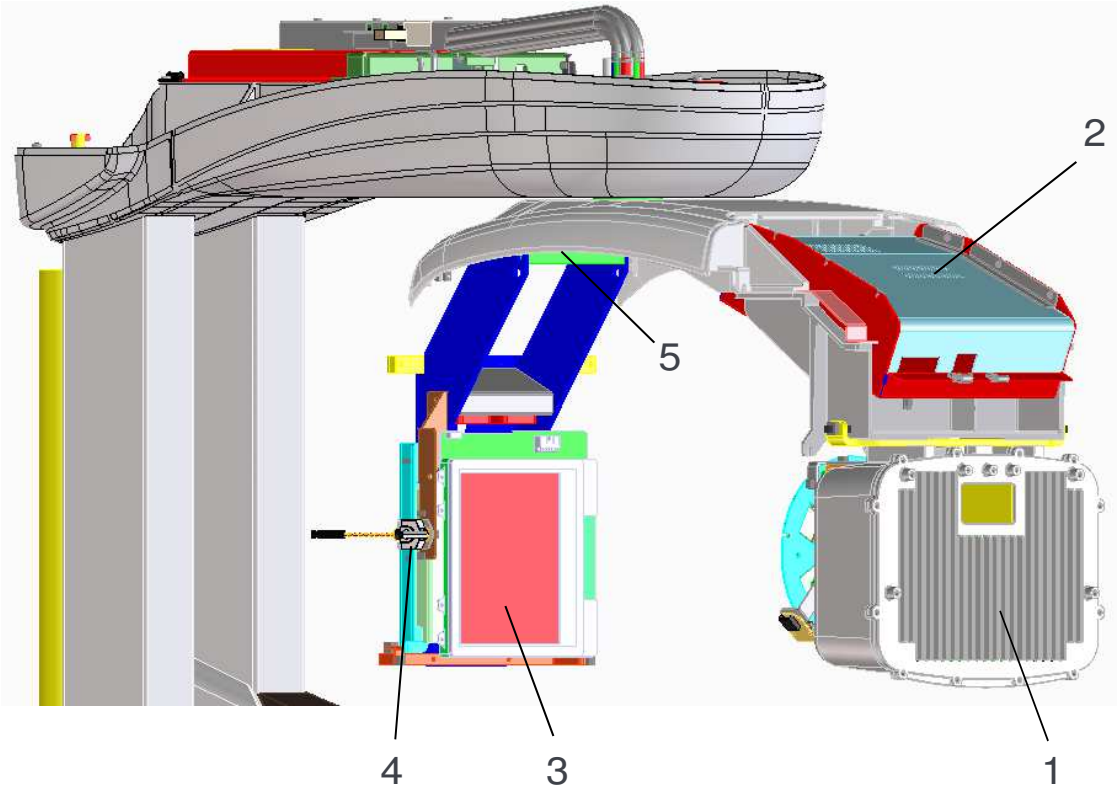
12

2 – Rotating Arm

Ref.	Order code	Description	Note
1	6604000100	Tubehead assy	
2	5804020200	3D HF board	
3	4695481000	3D Digital sensor	
	6604070300	3D sensor fan assy	
4	6604020400	Frankfurt laser assy	
5	6604020000	Sagittal laser assy	
6	6604010500	Chin support assy	
	6604011900	Keyboard assy	
7	6104010112	Temple clasp right	
8	6104010212	Temple clasp left	
9	5804070200	3D digital sensor power board	
10	5804010400	Interface chin rest board A5	
11	5804010200	Sensor chin rest board A9	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4
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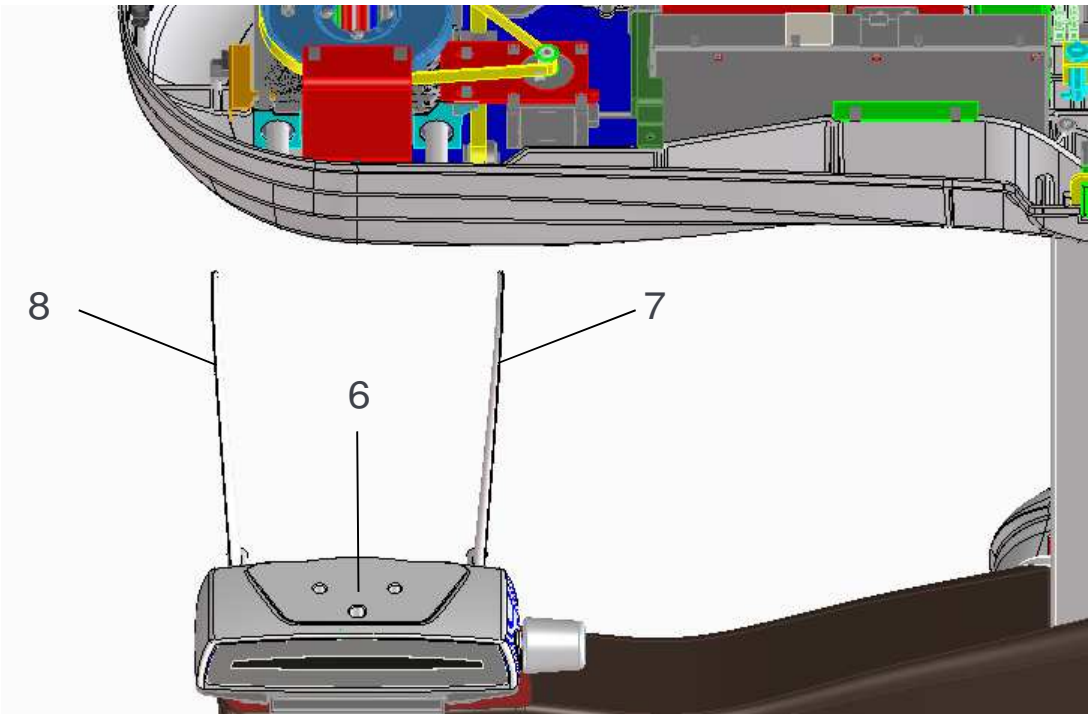
1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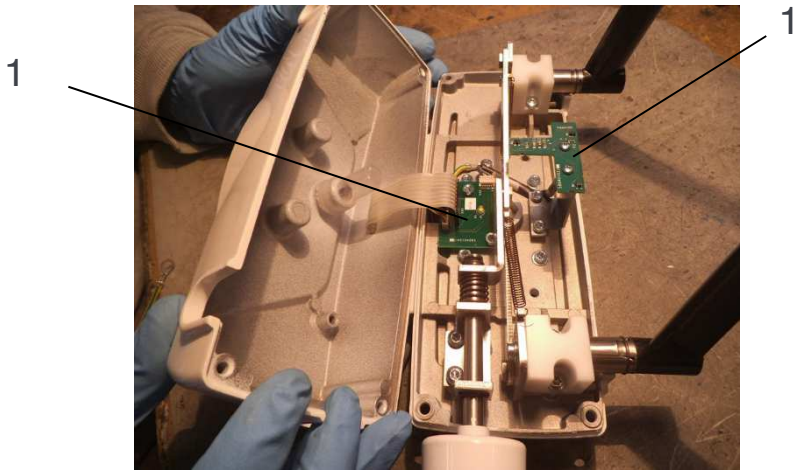
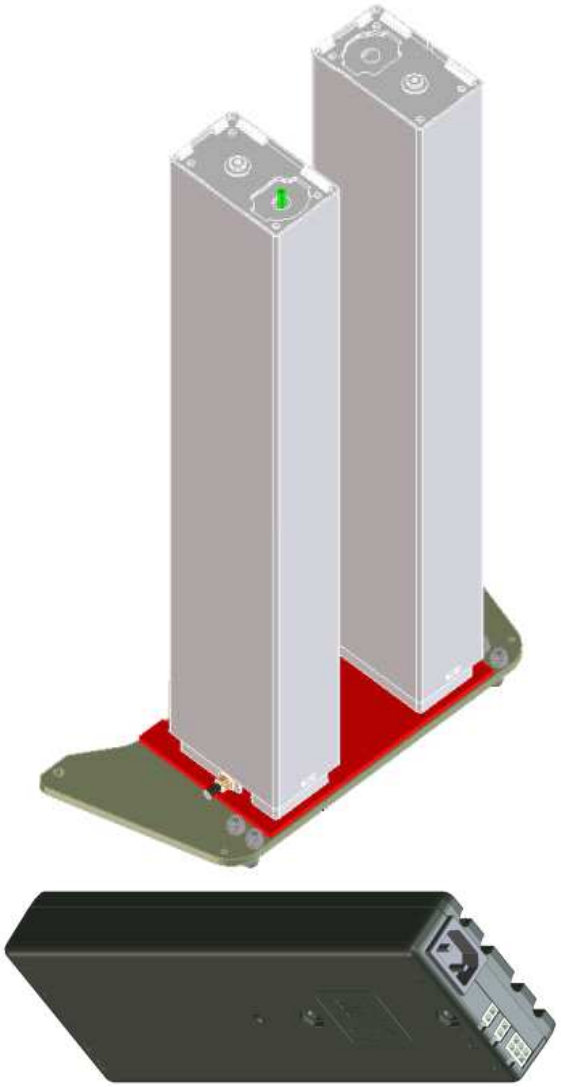

1
1

3 – UP/DOWN Column

Ref.	Order code	Description	Note
1	6604102700	3D column group (Left+Right) *	
--	4492707700	Linak control board	

(*) Note
Kit includes both columns adjusted and assembled to the support plate and the relevant control box.

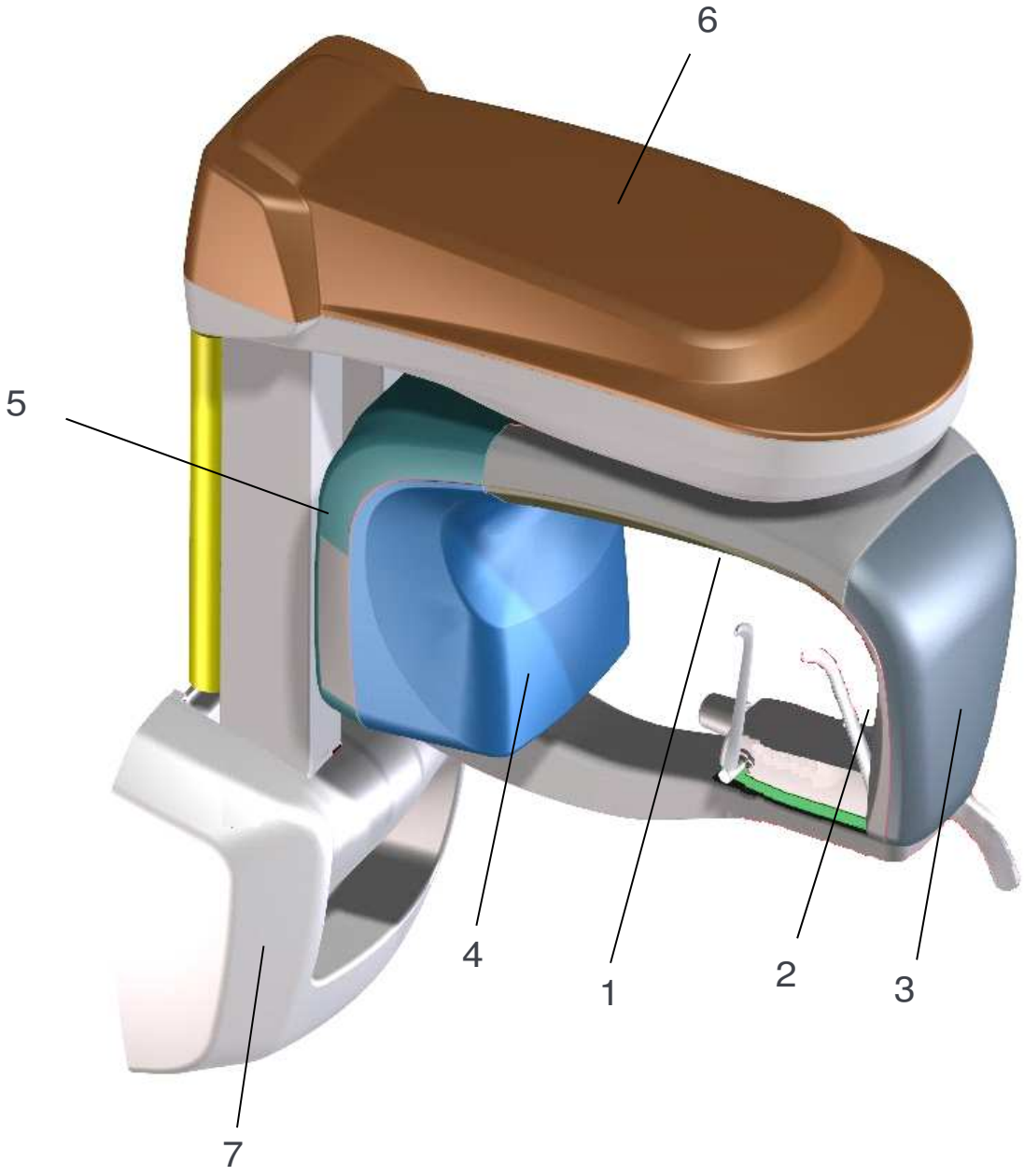


4 – Cables

Ref.	Order code	Description	Note
--	6104090800	X-ray push button with cable	
--	6204100500	Main coiled cable	
--	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	
--	6204041100	MCU board power supply cable X1 / CN2	
--	6204040300	DSPU board power cable X8 / J8	
--	6204040400	DSPU board power cable X9 / J7	
--	6204070200	Sensor signal cable X43 / J15	
--	6204070100	Sensor power cable X42 / J99	
--	6204010300	Keyboard cable X12-X35-X24 / X46-X47-B4	
--	6204010400	Keyboard cable X46-X47	
--	5007090100	Ethernet cable CAT 5E	

5 – Covers

Ref.	Order code	Description	Note
1	6604020305	Rotating arm lower cover	
2	6604020805	Sensor internal cover	
3	6604020921	Sensor external cover	
4	6604020205	Tube head internal cover	
5	6604020621	Tube head external cover	
6	6604041105	Upper cover	
7	6604100121	Wall support cover	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6 – 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	
--	4695488300	Ethernet board Intel I350-T2	

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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 0).

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.:_____

Parameter		Factory setting	New setting	New setting	New setting	New setting
Date						
Rotation axis motor offset						
Y axis motor offset						
X Chin rest						
Bitewing Y offset						
Y Jaw type [mm]						
3D Reconstruction paramenter	Lateral Off. 0					
	Lateral Off. 300					
	Y 3D					
	Y EXT Vol [mm]					
Collimator offsets	W0					
	W1					
	W2					
	W3					
	W4					
	W5					
Tubehead pre-heating values	2mA					
	3mA					
	4mA					
	5mA					
	6mA					
	7mA					
	8mA					
	9mA					
	10mA					
	11mA					
	12mA					

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