XMIND prime

X-MIND prime
Service Manual

SERVICE MANUAL • X-MIND prime • (19) • 10/2019 • NXMPEN050B

ACTEON

Contents

Note

This manual in English is the original 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 unit.

Warning

- The X-MIND prime 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 the safety aspects of the patient and/or the 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 8)
- Other software version used with X-MIND prime
- 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 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.
The responsibility for the quality assurance program is defined in the relevant chapter of the User's Manual.

Acteon provides specific training for service engineers.
Acteon technical support sends to all authorized dealer training course calendar.
One copy of User and Service Manual are always provided with the unit.

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 other than those indicated herein.
Before performing any maintenance operation, disconnect the unit from the power supply.
X-MIND prime is an electric medical device and so can only be used under the supervision of suitably qualified medical personnel, with necessary knowledge of X-ray protection.
The user is responsible for compliance with legal requirements as regards ownership, installation and use of the equipment.
This device has not been designed for use in environments where vapours, anaesthetic mixtures flammable with air, or oxygen and nitrous oxide, may be present.
Do not let water, or other liquids, penetrate the device, as this could cause short circuits and corrosion.
Before cleaning the device, make sure the main power supply has been disconnected from the equipment. When pushing the ON/OFF button of the equipment, it must not come on.
Wherever necessary, use appropriate accessories, such as leaded aprons, to protect the patient from radiation.
While performing the X-ray, no-one, apart from the operator and the patient, must remain in the room.
X-MIND prime has been built for continuous operation with an intermittent load; so the described use cycles must be observed, to enable the device to cool down.
X-MIND prime must be switched off while using electrosurgical devices or similar apparatus.

Warning
For safety reasons, the patient support arm must not be abnormally overloaded, for example by leaning on it. The traction on the handle must be less than 16 kg.

Warning
To avoid the risk of electric shock, the equipment must only be connected to a mains supply with earthing.

Clean and disinfect, when necessary, all parts that may come into contact with the patient.
The centring bite or the bite protective sleeve must be replaced after each exam.
To avoid permanent damage to the unit, never try to rotate the moving arm manually when the unit is switched on.
In the case of Error 362 or Error 760, movement is possible to let the patient exit.

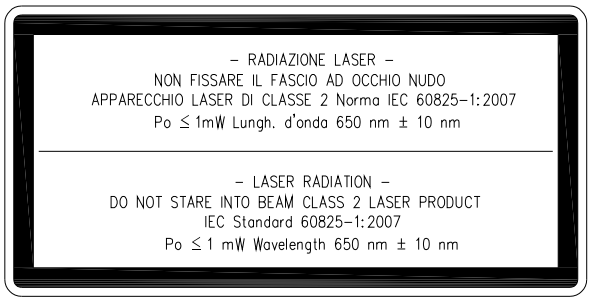
Note
When the unit is switched on, do not move the rotating arm.

2.1.1. Precautions while using laser centring devices

For patient positioning, X-MIND prime 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 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 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.

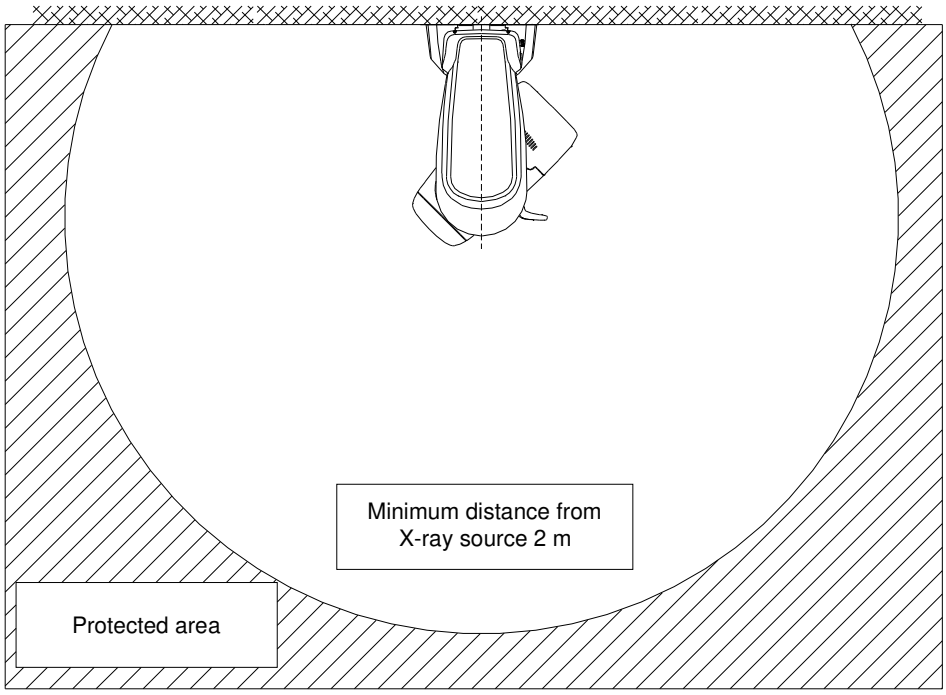


Figure 1

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 should not be used adjacent to or stacked with other equipment; if adjacent use is necessary, X-MIND prime 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, including cables. Minimum distance 30 cm.

2.3.1. Electromagnetic emissions

In accordance with the IEC 60601-1-2 Ed4 standard, X-MIND prime 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 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 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 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 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, 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 might be exposed to Cybersecurity threats.
X-MIND prime 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 the user responsibility to make sure that the following protection measures are followed.

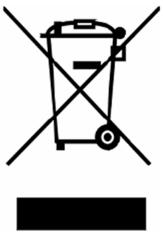
- The initial software installation and system set-up shall be done by authorized and trained personnel only and using the software provided with the unit
- Any software or firmware upgrade of the equipment shall be done by authorized and trained personnel only
- After any software or firmware upgrade, or any other maintenance operation, image quality checks shall be performed to ensure the system is working as expected.
- 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 sticks or CD/DVD media before using them to check that they are free of viruses, malware or any dangerous software
- Avoid installation of an unknown or untrusted software since it may undermine the 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 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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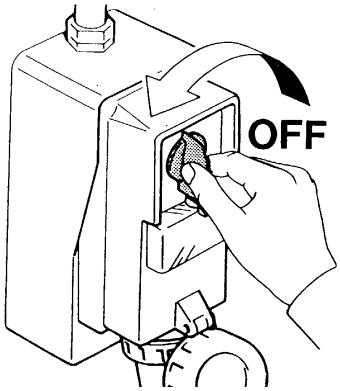
3. CLEANING AND DISINFECTION

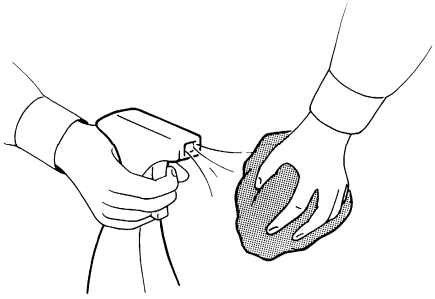
In order to guarantee a good level of hygiene and cleaning, it is necessary to carry out the following procedures.

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

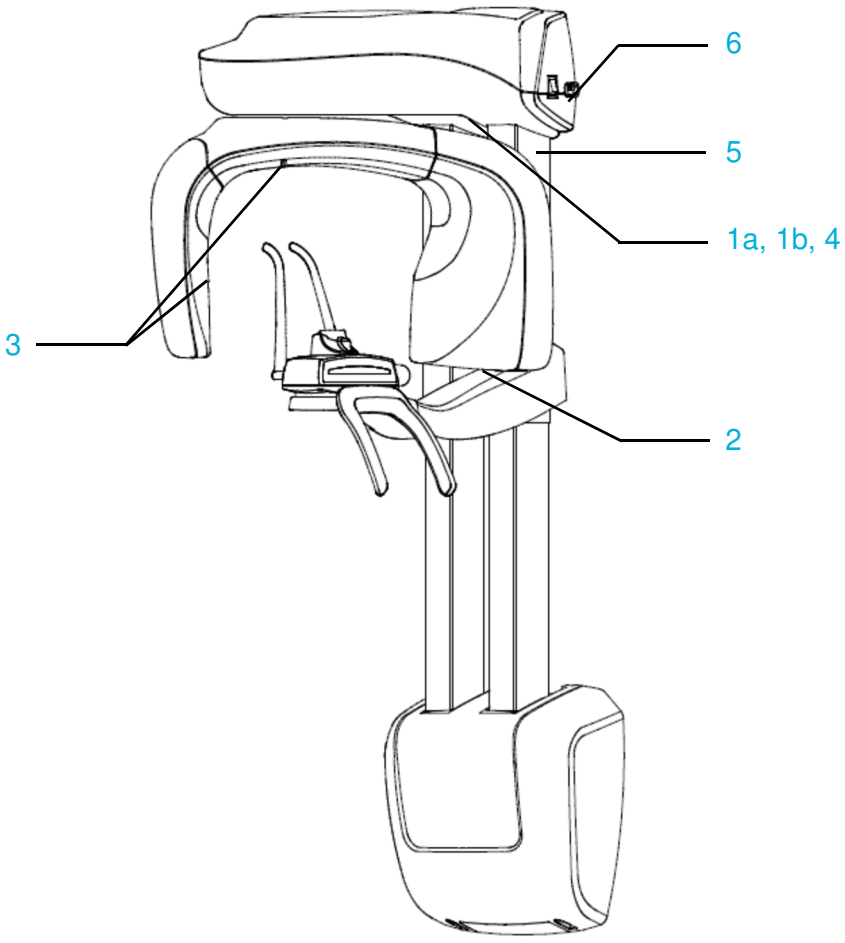
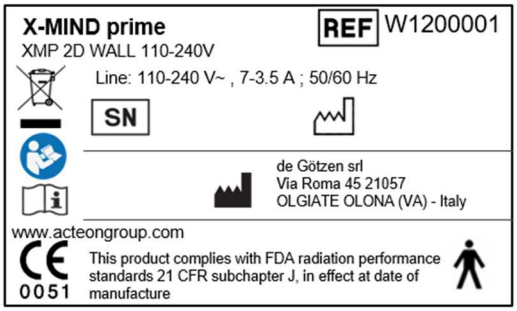


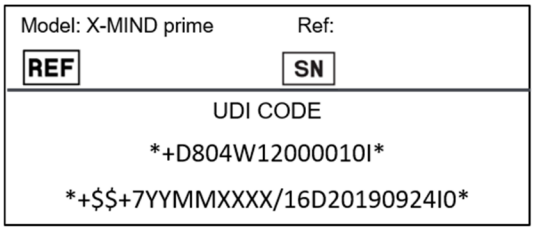
Figure 2

4.1.1. Identification labels and laser labels

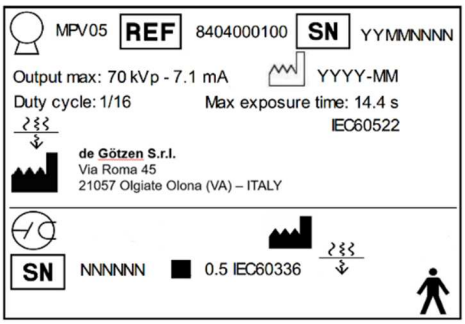
1a
X-MIND prime identification label



1b
UDI label

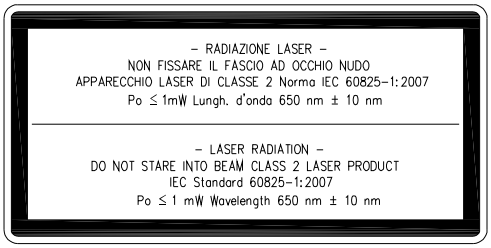


2
Tube-head identification label

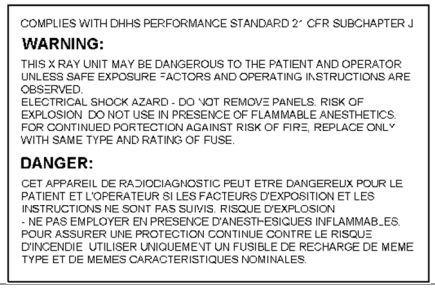


3
(No. 2) Laser symbol label

4
Laser WARNING label



5
WARNING label



6
Emergency button label

4.2. Functions, models and versions

X-MIND prime, 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 70kV, in 2kV steps and anodic current from 2 mA to 7.1 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, 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.

Note
The code entered in X-MIND prime to enable additional exams is protected by a unique Identification Code (UIC); in the event the UIC is not present or is faulty, error E270 or E271 will be shown.
The UIC is simply an identifier of the single X-MIND prime unit and is generated by Acteon for the single device serial number.

4.3. Block diagram

This paragraph provides a brief description, at block diagram level, of the X-MIND prime. 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 directly connected to the following components:

- Power supply assembly (G1)
- Motors (rotation and Y axes)
- Zero position sensors
- X-ray button
- External signal board (A6)
- Lift motors control rack (G2)
- Generator board (A2) -> (Tubehead)
- Overlay
- Digital sensor
- DSPU board (A14) ---> (PC) Ethernet

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.

- 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.

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 2 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 signalled using specific CANBus messages.

MCU includes also the configuration and calibration data and the HW key including the data of XP exams.
EEprom memory includes the programming data. Hardware key board includes the XP data.

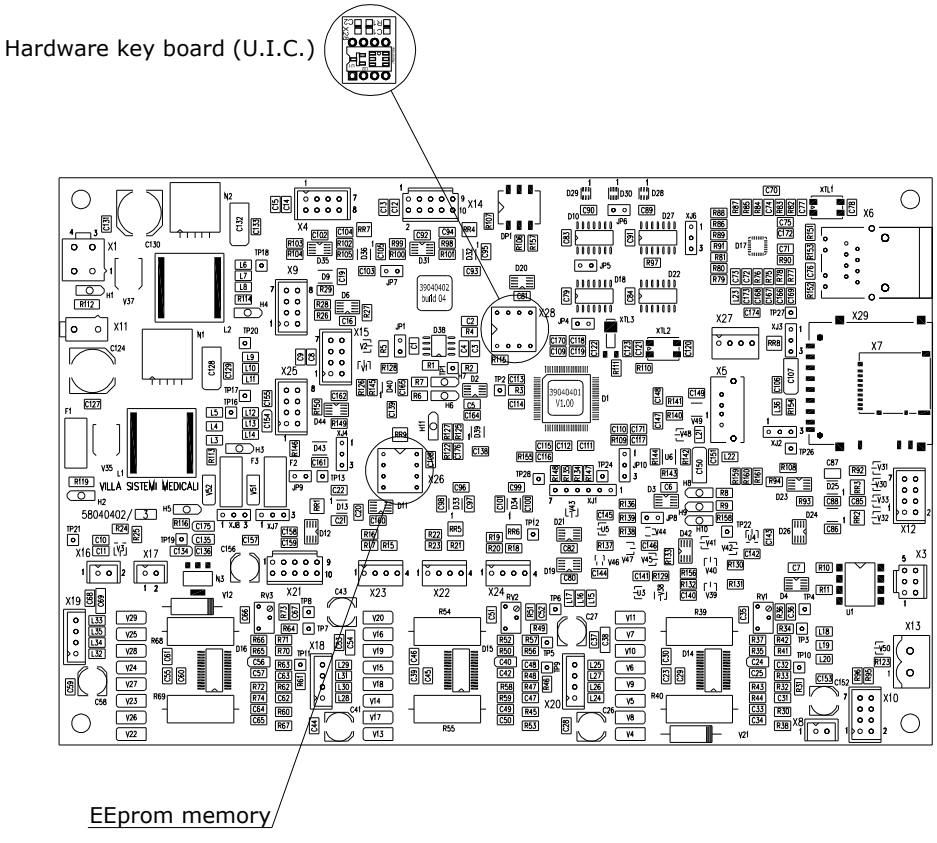


Figure 3

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 7.13.2)
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<.

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

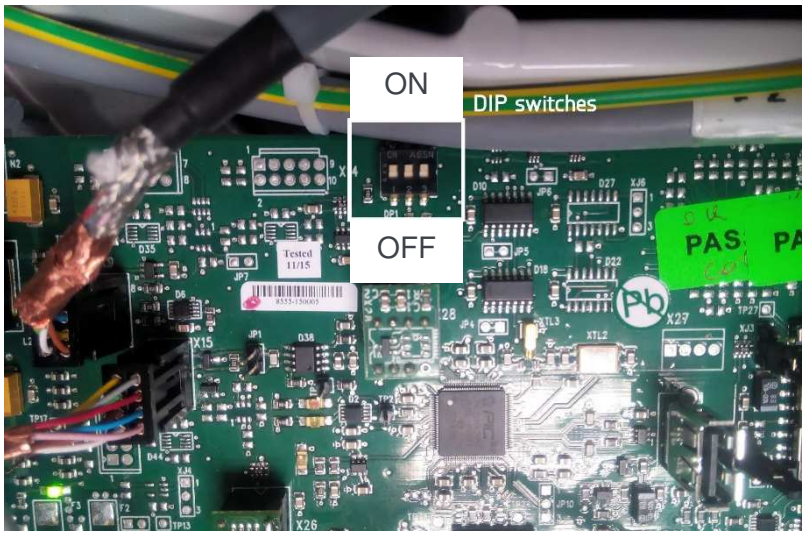


Figure 4

4.3.3. Generator Board (A2) and Tubehead

The Generator board and the tubehead are located on the rotating arm, very close to each other. The power supply voltage is directly provided by the mains line.

Generator board includes a µprocessor that communicate with the main MCU board (A1) through the CAN BUS 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 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 (Canon D-058) 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.

4.4. Keyboard - Description and functions

Figure 5 shows a general view of X-MIND prime 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 "Unit 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.	

5. TECHNICAL CHARACTERISTICS

General features	
Type	X-MIND prime
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	7A @ 110V 50/60Hz 3.5 A @ 240V 50/60Hz
Technical factors for maximum line current	70kV, 7.1mA
Power consumption	1.1kVA @ 110V 50/60Hz 1.0kVA @ 240V 50/60Hz
Protection fuse (F1)	10 A T 250V 6.3x32 mm 10kA@125V 4 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 - 70kVp, with 2 kVp steps
Anodic current	2 - 7.1mA, 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)
Additional filtration	≥ 2 mm Al eq.

Exposure times	
Panoramic exam (PAN)	14.4s Adult / 13.3s Child
Half-panoramic exam	7.8s Adult / 7.3 s Child
Ortho Rad panoramic exam	11.9 s Adult / Child
Low dose panoramic exam	11.9s Adult / 10.8s Child
Frontal dentition	4.4 s Adult / Child
TMJ mouth closed/open	4.8 s per image for left and right joint in open and closed condition
Sinus P/A projection	9.4 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 L/R • Bitewing L and R
TMJ (Temporal Mandibular Joint) exam	TMJ open and closed mouth
Sinus exam	Sinus P/A projection

Image magnification	Geometric magnification	Magnification after software correction
Adult / Child standard Panoramic	1 : 1.23 (constant over dentition part)	1 : 1 (*)
TMJ open/closed mouth	1 : 1.20 (nominal)	1 : 1 (*)
Sinus	1 : 1.22 (nominal)	1 : 1 (*)

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

Note
X-MIND prime 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 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	70 kVp
kVp accuracy	± 8 %
Maximum anodic current	7.1 mA
Anodic current accuracy	± 10 %
Duty cycle	1 : 16
Reference loading conditions related to maximum energy input to the anode	1125mAs/h @70 kVp
Nominal power	0.50 kW (70 kVp - 7.1 mA)
Transformer insulation	Oil bath
Target angle and reference axis	See Figure 6
Cooling	By convection
Leakage radiation at 1 m	< 0.5 mGy/h @ 70 kVp - 7.1 mA - 3s duty cycle 1/16
Tube-head maximum thermal capacity	310kJ

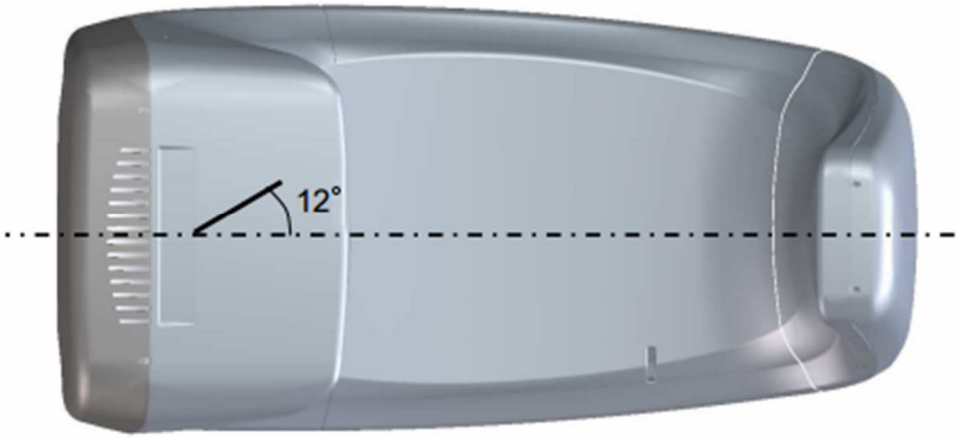


Figure 6: Tube-head target angle (view from the bottom)

X-ray tube characteristics		
Manufacturer	Canon	CEI
Type	D-058	OPX 105-12
Nominal focal spot	0.5 EN 60336	0.5 EN 60336
Inherent filtration	At least 1.0 mm Al eq.	0.5 mm Al eq.
Anode tilt	12.5°	12°
Anode material	Tungsten	Tungsten
Nominal maximum voltage	70 kVp	110 kVp
Filament max current	3 A	4 A
Filament max voltage	3.6 V	6.7 V
Anode thermal capacity	13 kJ	30 kJ
Anode thermal capacity during continuous operation	300 W	300 W

Laser centring 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	FFT-CCD area image sensor
Sensible Area (H x L) PAN Sensor	146 x 6 mm
Pixel dimension	48 µm, 96 µm in 2x2 binning
Number of pixels	3072x128
Spatial resolution	4 lp/mm
Sensor cover attenuation equivalent	< 0.4 mm Al eq.

Mechanical characteristics	
Focal spot to image receptor distance	50 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	62 kg base version
Column base (optional)	6 kg
Working conditions	
Minimum room size (please refer to the Service Manual)	120 x 115 cm ("x")
Recommended room size (please refer to the Service Manual)	160 x 150 cm ("x")
Working temperature range	+ 10°C ÷ + 40°C
Relative working humidity (RH) range	30% ÷ 75%
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
Monitor characteristics: the PC and the monitor are not supplied with the equipment.
In order to properly view images taken with X-MIND prime, the PC monitor must have the following minimum characteristics:

- Resolution: 1366 x 768 pixels
- Colour depth: 16M of colour
- Contrast: 500:1
- Luminosity 200cd/m^2

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

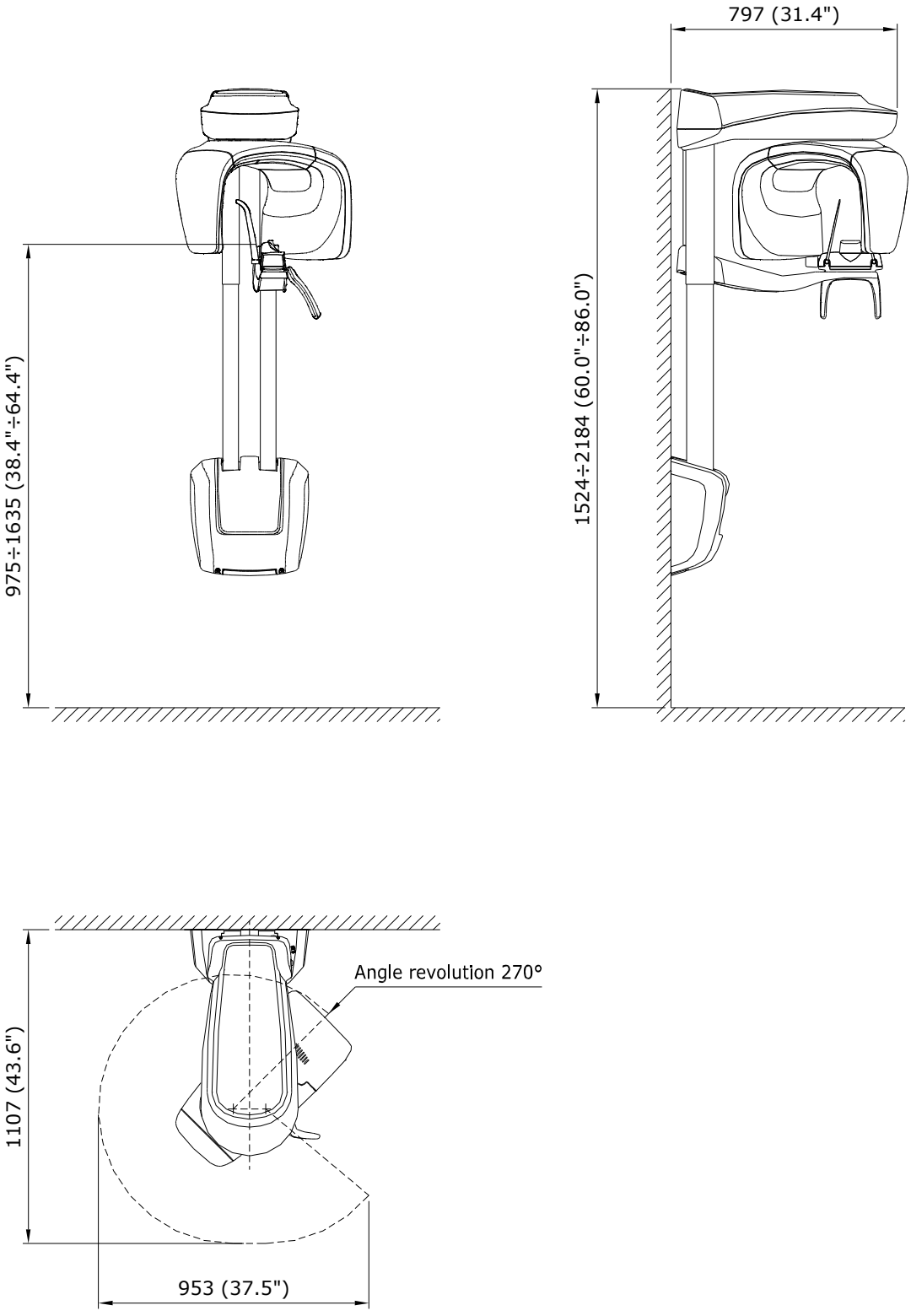


Figure 7: X-MIND prime dimensions - Wall mounted version

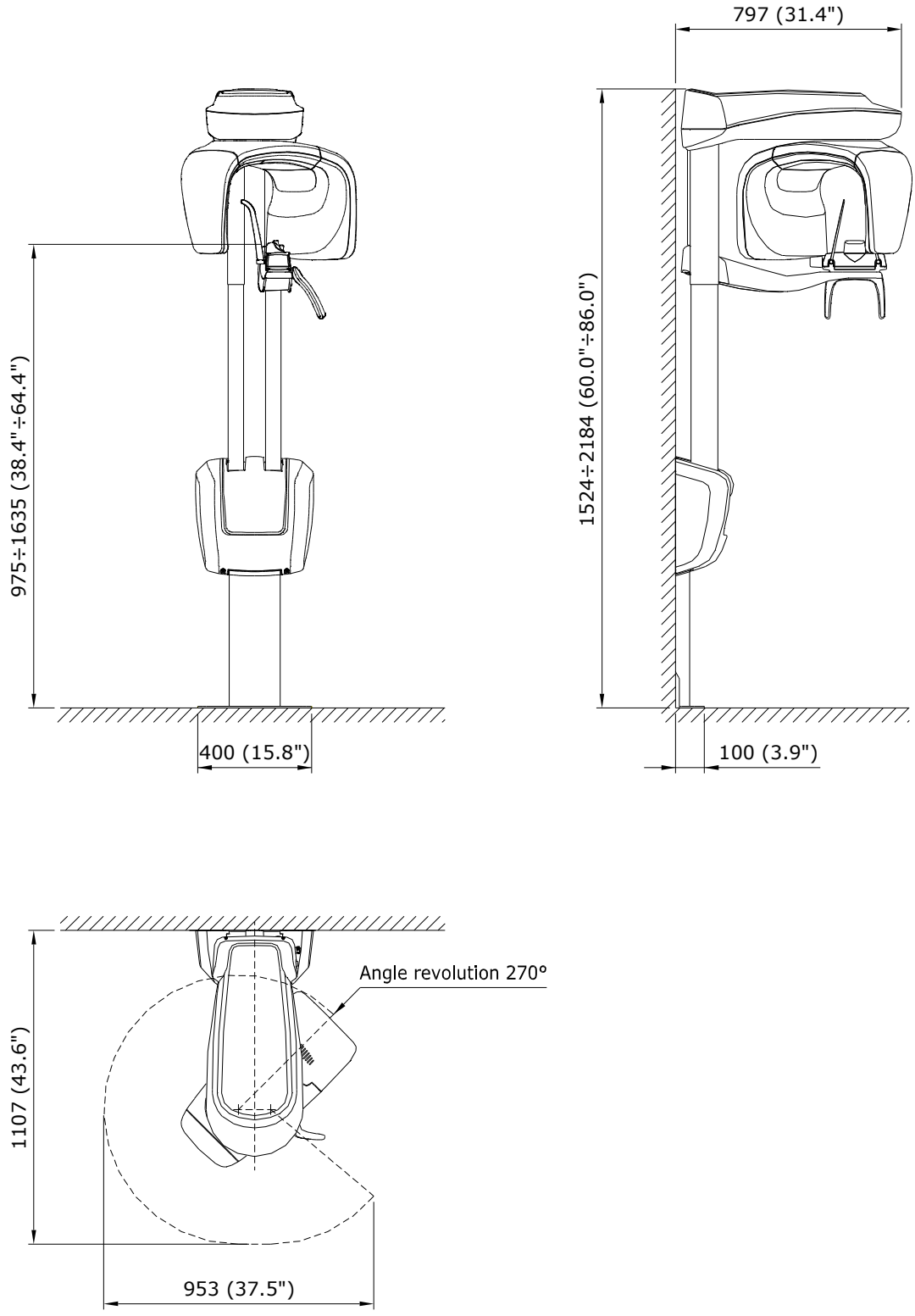


Figure 8: X-MIND prime dimensions - Wall mounted with floor support version

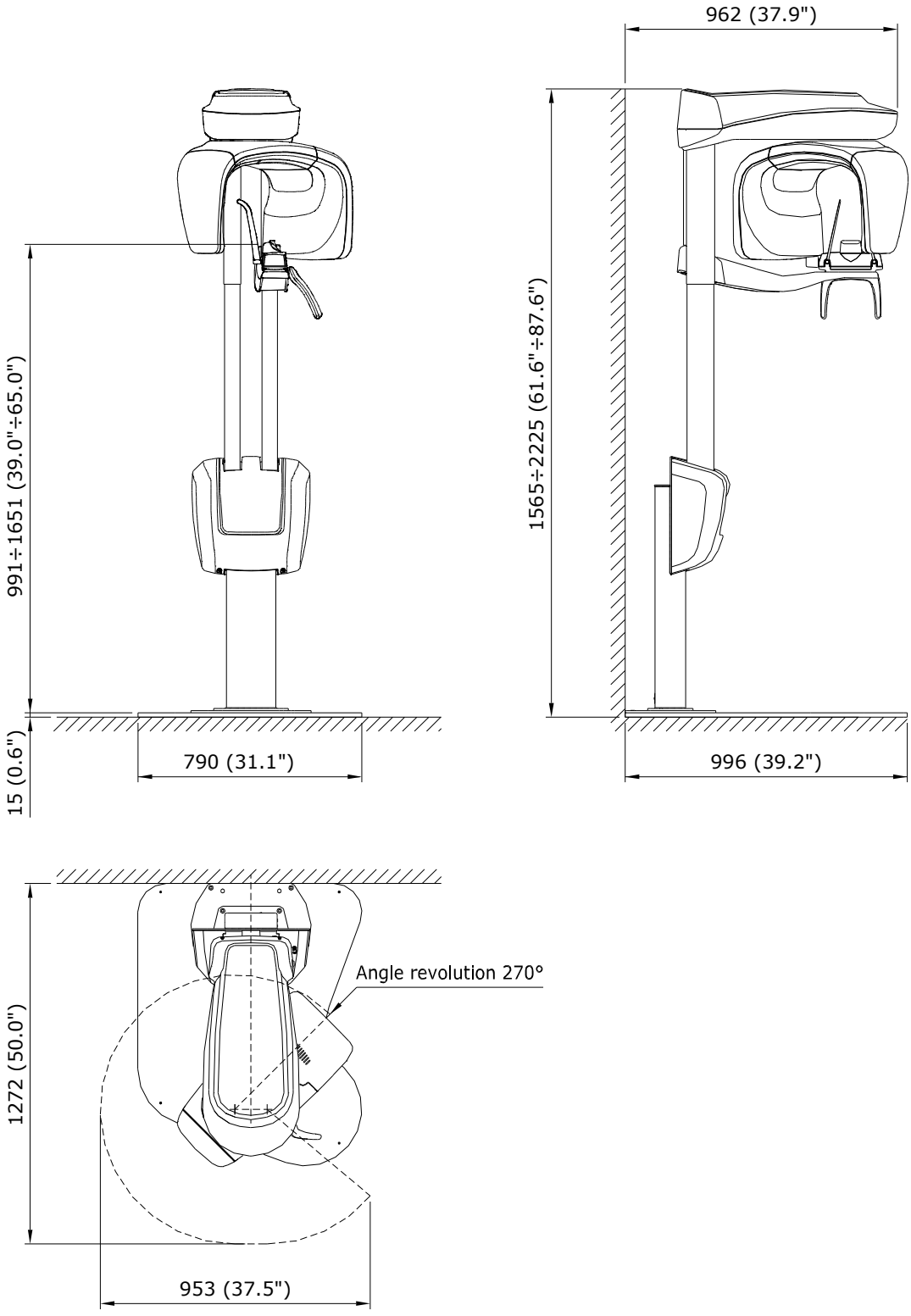
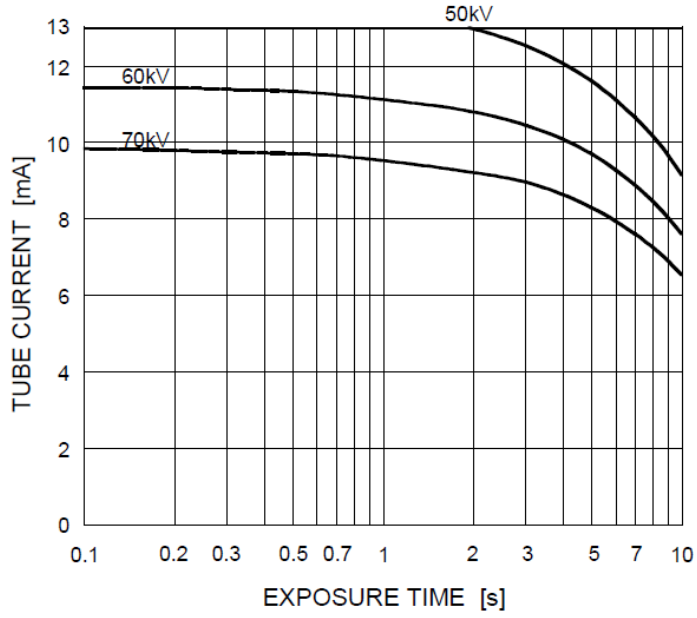


Figure 9: X-MIND prime dimensions - Floor mounted version

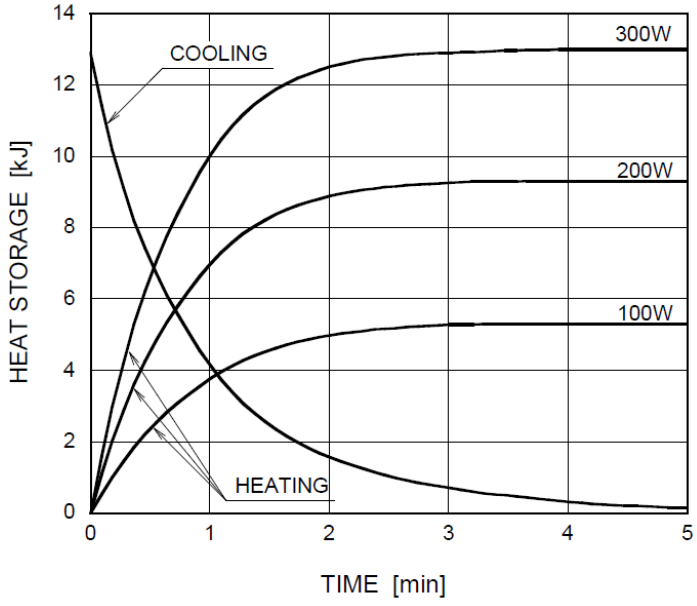
5.2. Tube loading curves, anode heating and cooling curves

Tube "Canon D-058" (0.5 IEC 336)

Tube loading curves

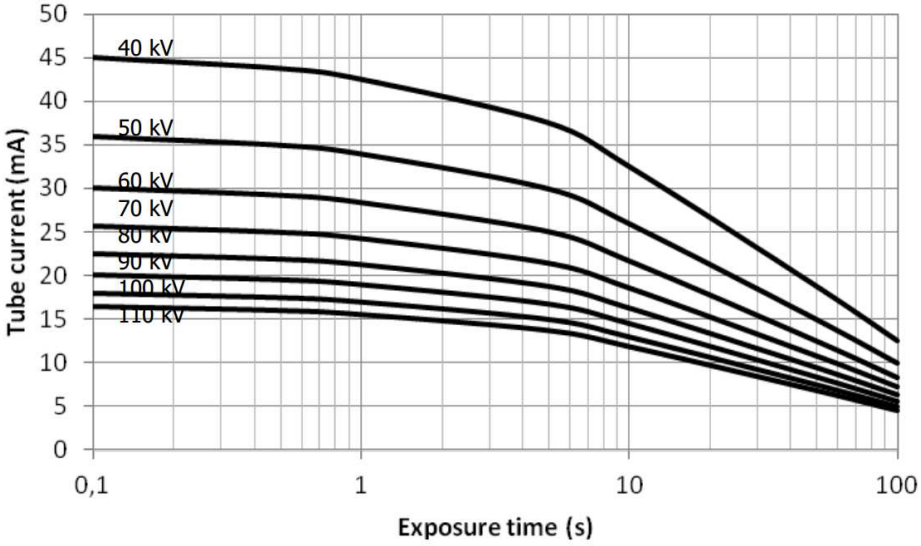


Anode heating and cooling curves

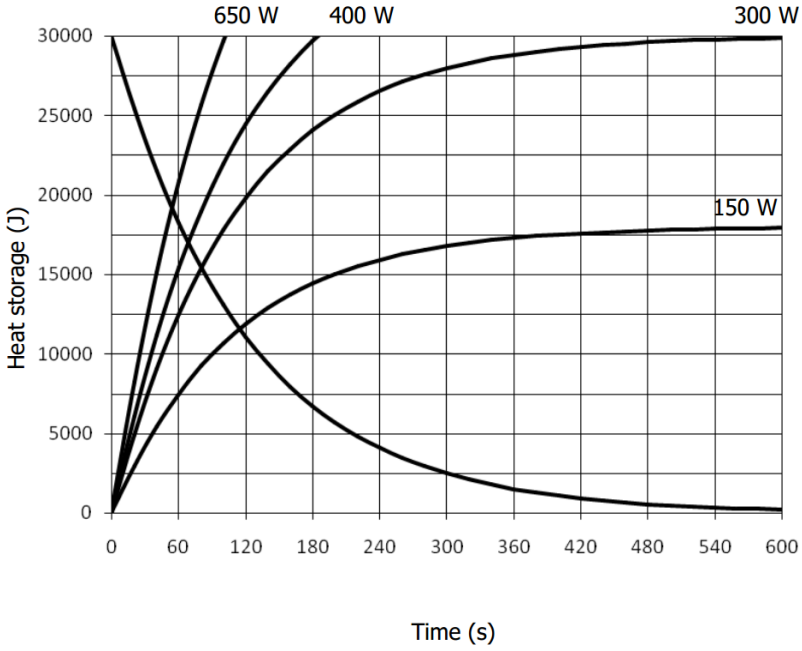


Tube "CEI OPX 105-12" (0.5 IEC 336)

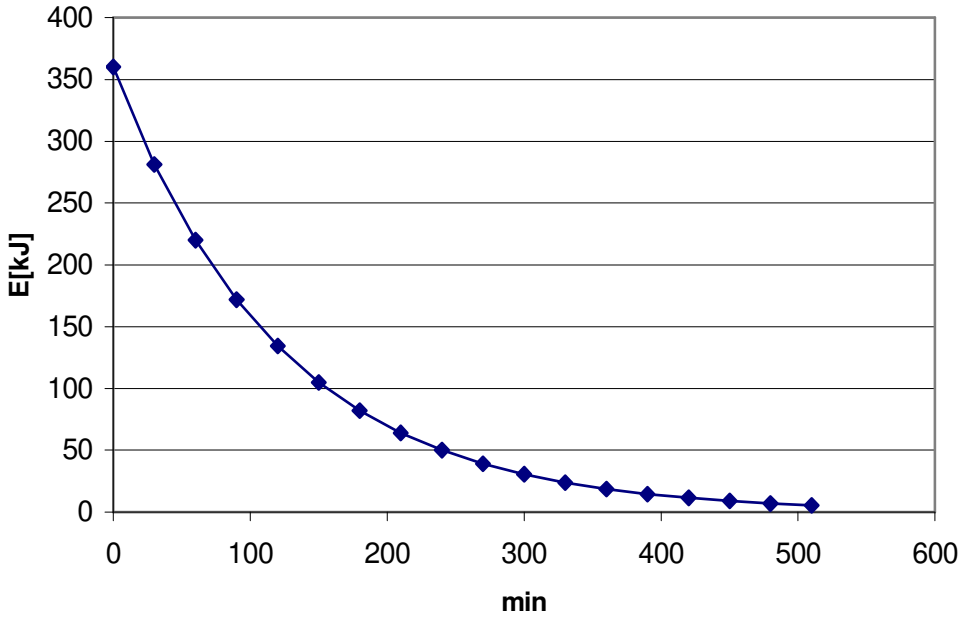
Tube loading curves



Anode heating and cooling curves



Tube head cooling curve



5.3. PC requirements

Warning
PC to be used with the unit must comply with the standard IEC 60950-1:2005.

In the following paragraphs are listed the minimum PC characteristics.

5.3.1. PC minimum characteristics

- Mother board with at least one free PCI express X16 slot (mandatory for the Dual Port Network Card provided with the equipment).
- Processor Intel Core I3 (Dual core).
- 2 GB RAM.
- Hard drive 320GB.
- Operating System Windows 7.
- USB port 2.0.
- 10/100 Ethernet port.

5.4. Software

The equipment Graphical User Interface can be run with the software provided with the unit 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.

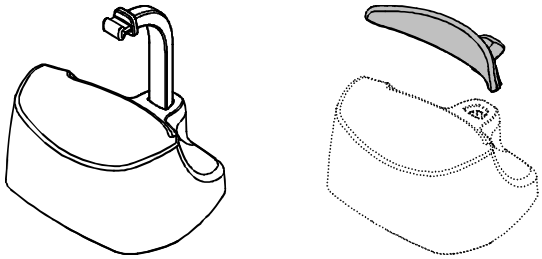
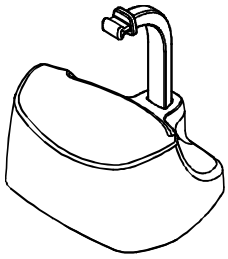
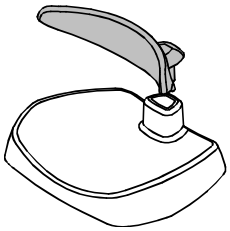
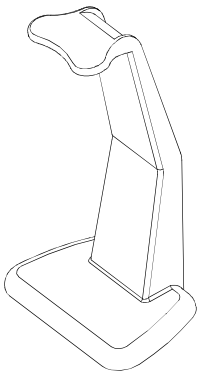
5.5. X-MIND prime – PC communication

The communication between X-MIND prime and computer is carried out with a LAN connection based on a TCP/IP protocol.
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 an Ethernet cat 5e cable in order to permit the PC connection. In case of replacement, a cable of the same or superior category has to be used.
If the communication between X-MIND prime and PC is not properly set problems in unit connection causing impossibility of acquisition or loss of data causing distortion and artefacts on the images can occur.

Note
X-MIND prime is not intended to transmit or receive information to/or from other equipment through network/data couplings, but with the computer where the unit GUI is activated.

5.6. Separate parts supplied with X-MIND prime

X-MIND prime 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)	
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.

5.7. Reference standards

Medical electrical equipment for extra-oral dental radiography X-MIND prime 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/(R)2012 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 with Directives 93/42/EEC (as amended), 2011/65/EU, 2006/42/EC.

Classifications

X-MIND prime 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.

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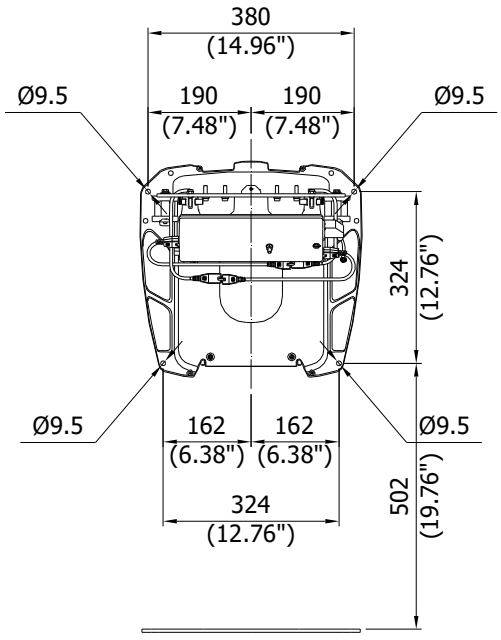
6. PRE-INSTALLATION

The instructions indicated in this chapter and in the following ones enable to perform a correct installation in order to allow a regular operation of X-MIND prime.
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.

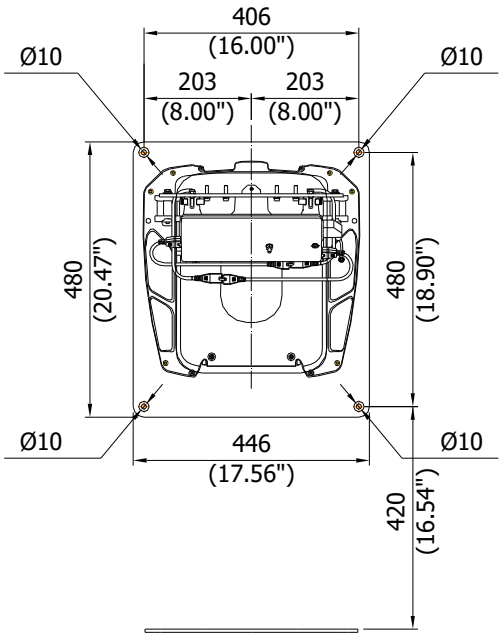
The requirements for a correct installation of X-MIND prime are:

- minimum height of the room: 2.5 m (8.20') and a surface variable according to the configuration of X-MIND prime 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, 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 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 1.1 kVA (at 110 V)
- 1.0 kVA (at 240 V)
- Current consumption 7 A (at 110 V)
- 3.5 A (at 240 V)
- Apparent line resistance 0.4 Ω max (99-132 V)
  0.5 Ω max (198-264 V)

Note
The device 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.

Note

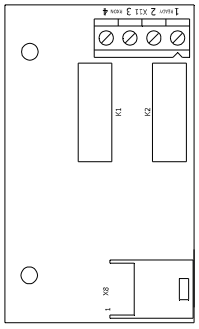
X-MIND prime, IS SET TO connect, at the entrance of the X-ray room, the following control and warning devices:

- **READY light**: Green light (24V 40W max.), it signals that the unit 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 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

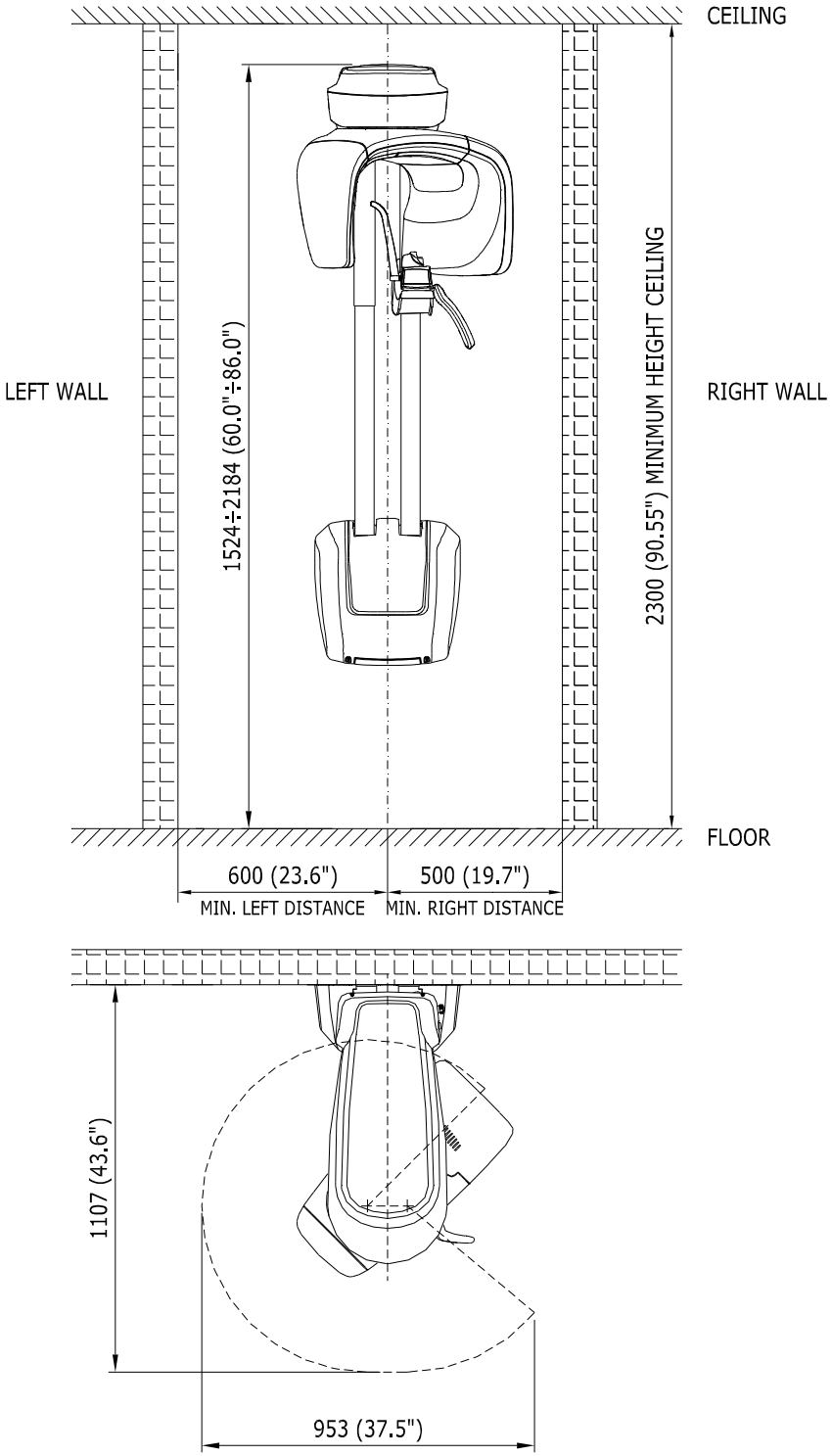
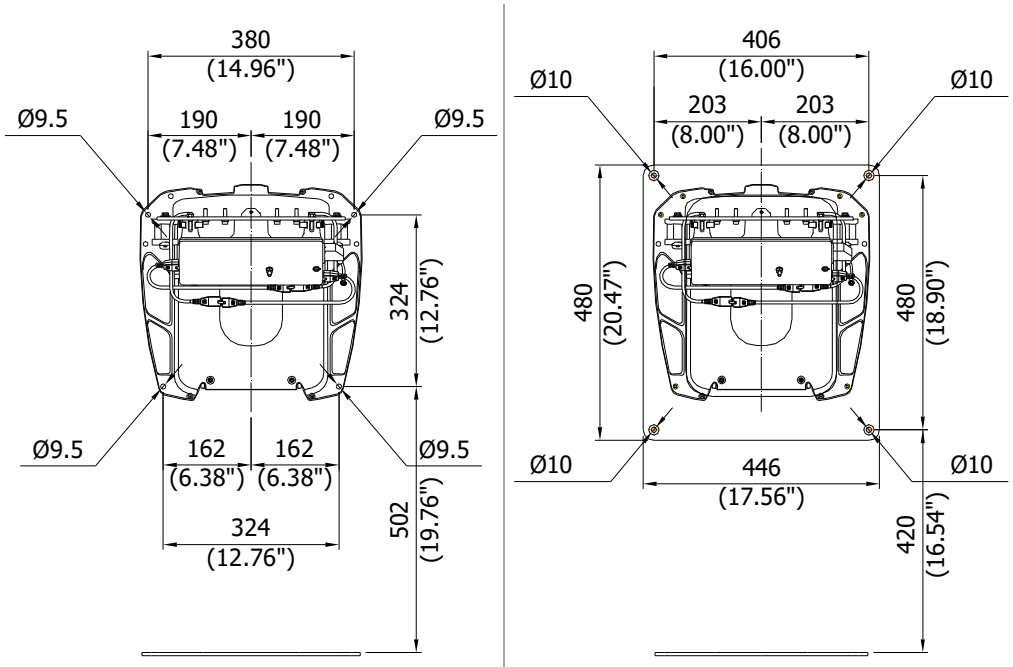


Figure 10

7. INSTALLATION

Note
X-MIND prime 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, 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 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.

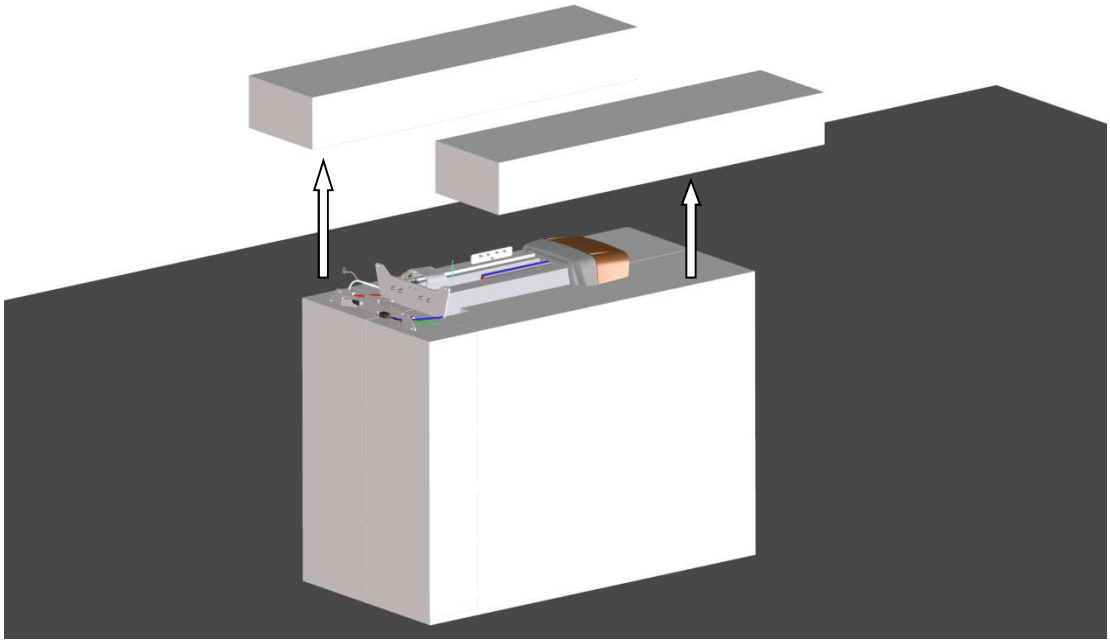


Figure 12

2. Remove the front polystyrene section.

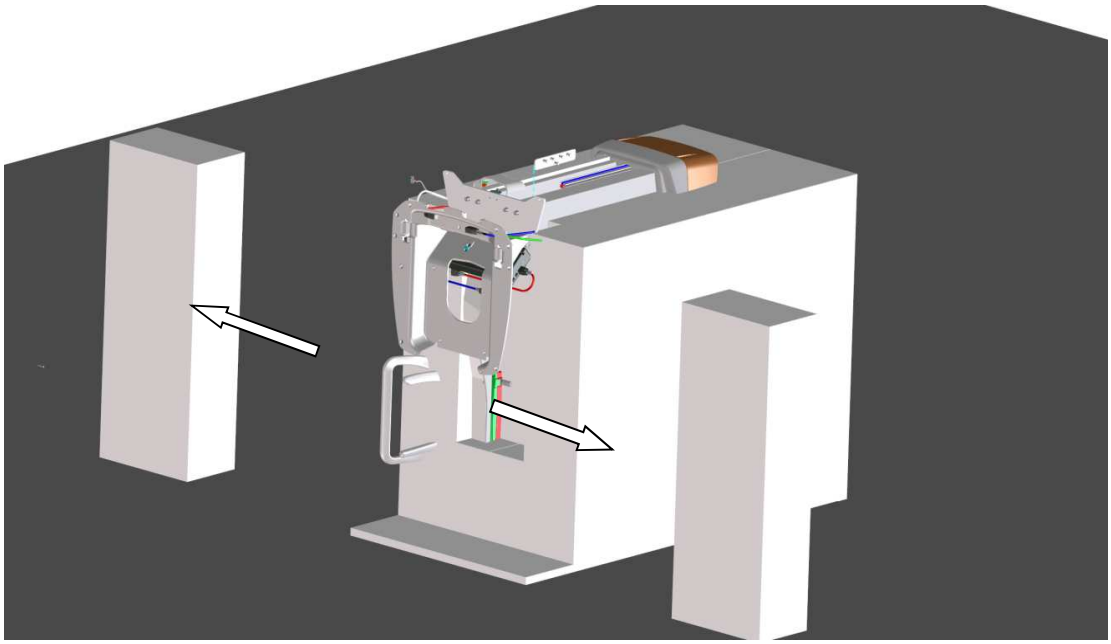


Figure 13

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

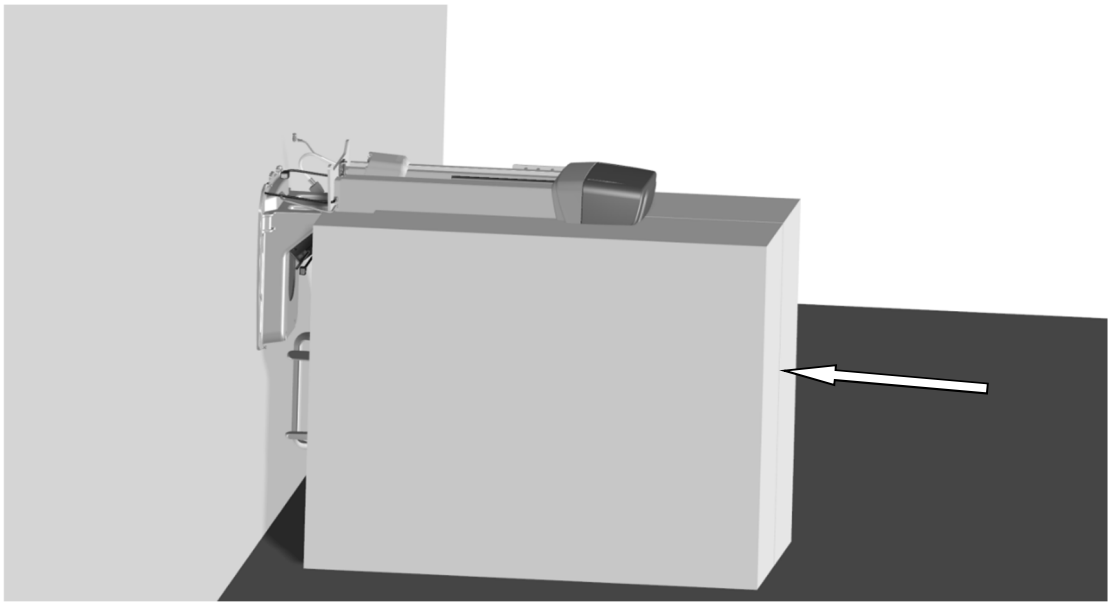


Figure 14

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

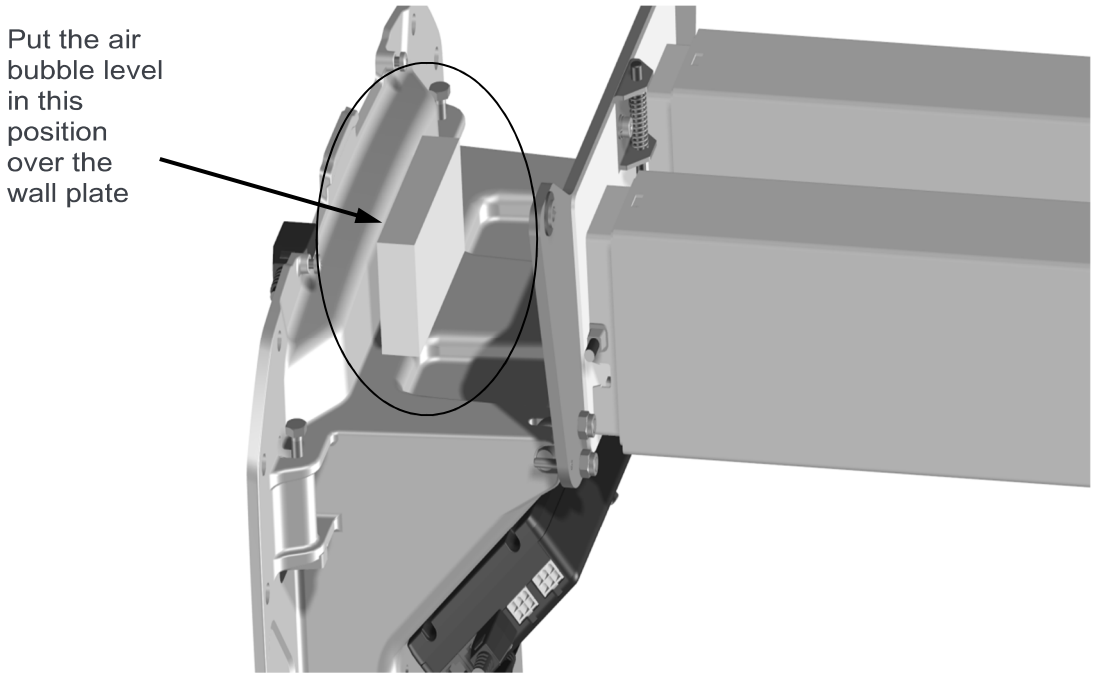


Figure 15

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.

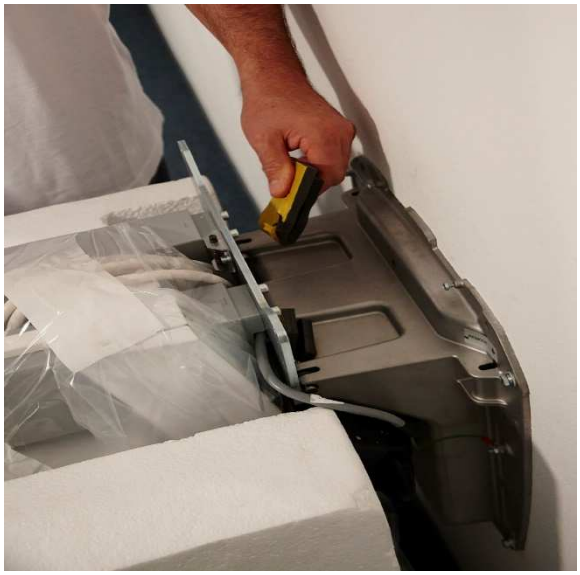


Figure 16

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

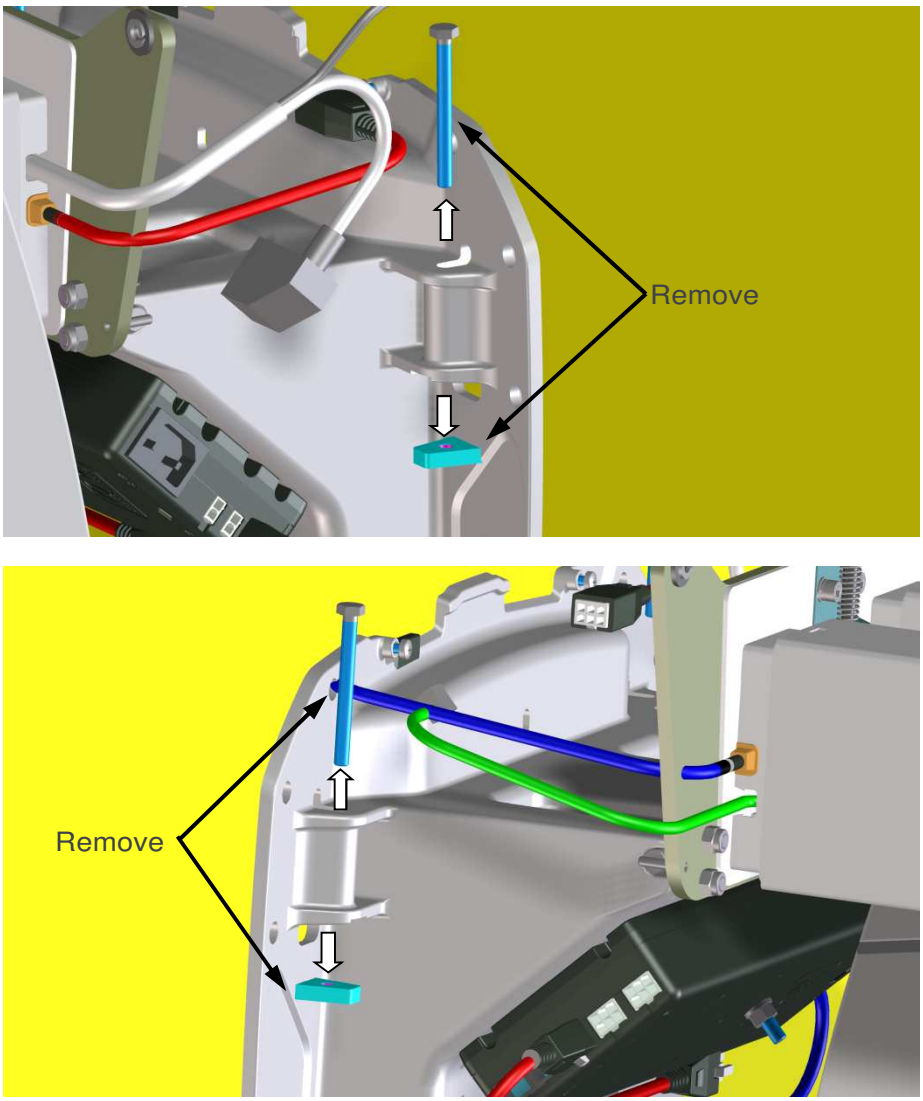


Figure 17

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 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.

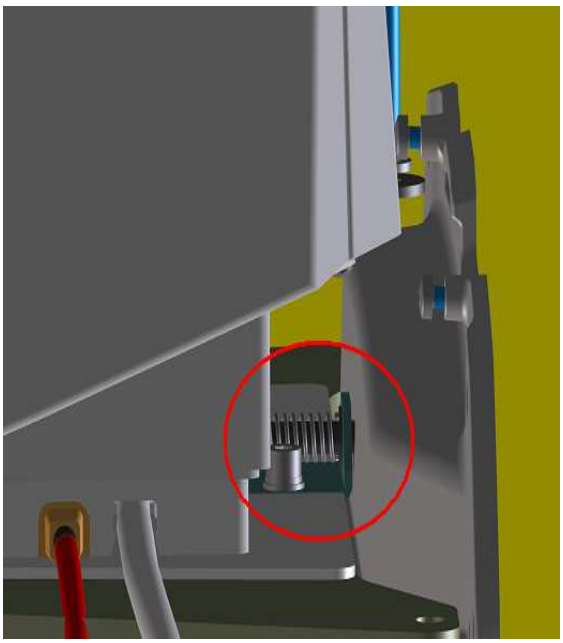


Figure 19

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

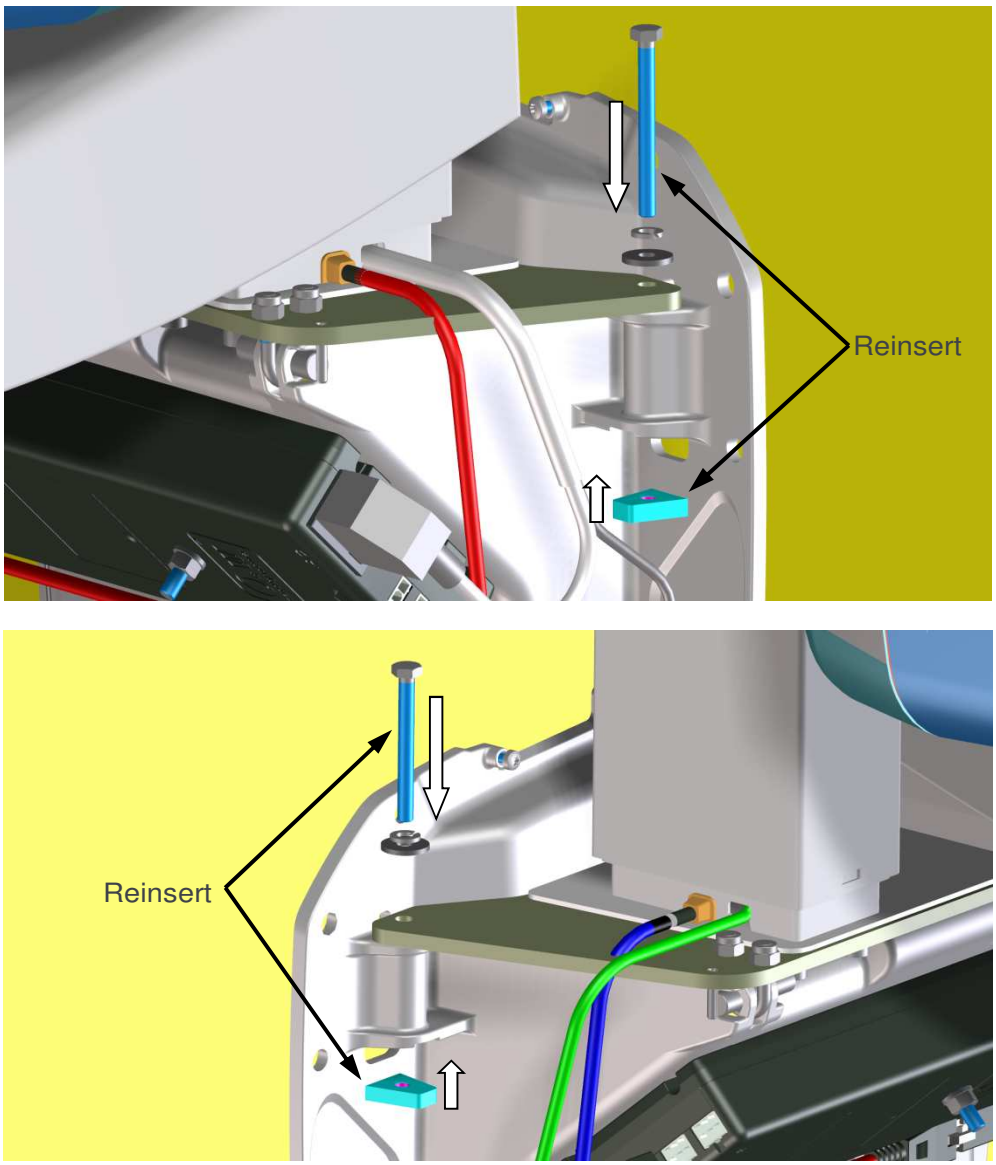


Figure 20

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

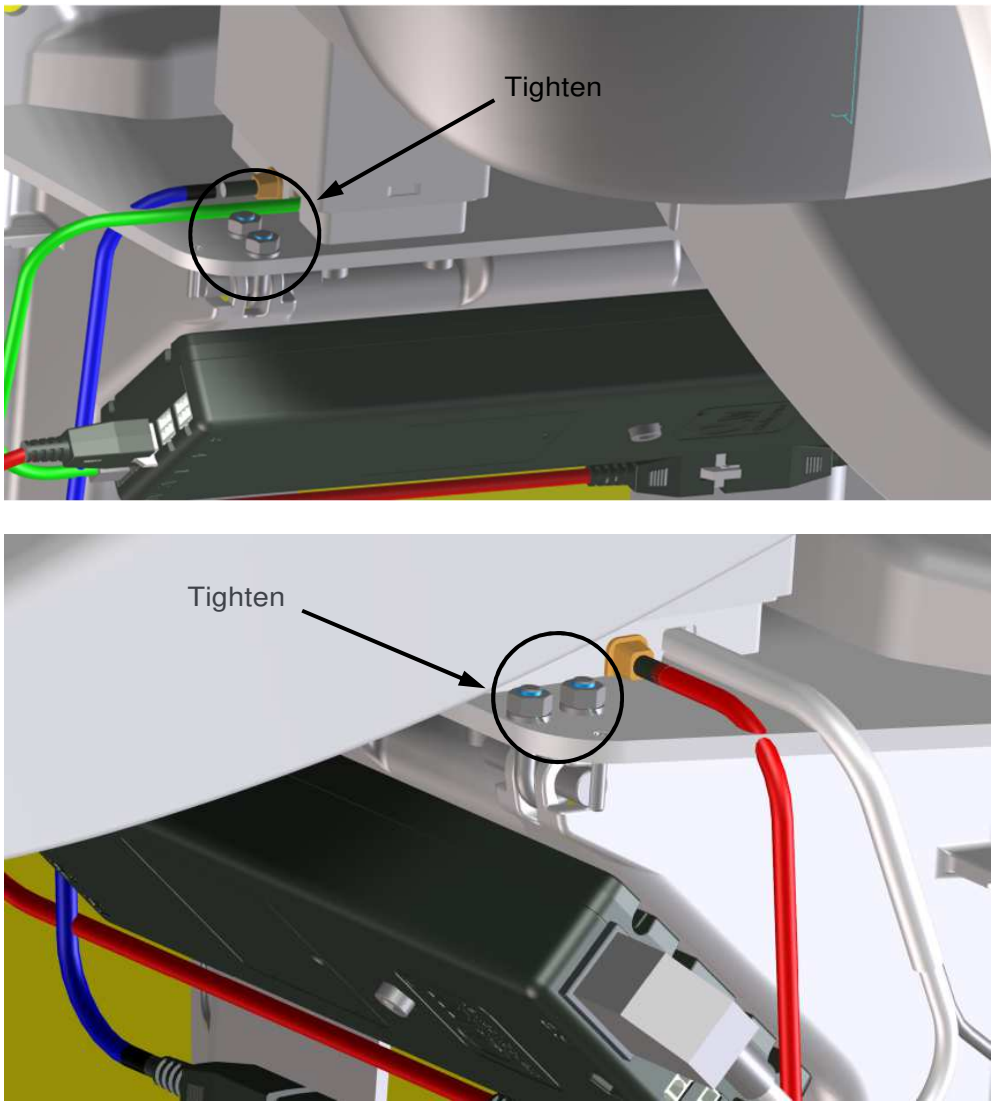


Figure 21

Warning
In case of dismantling 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.

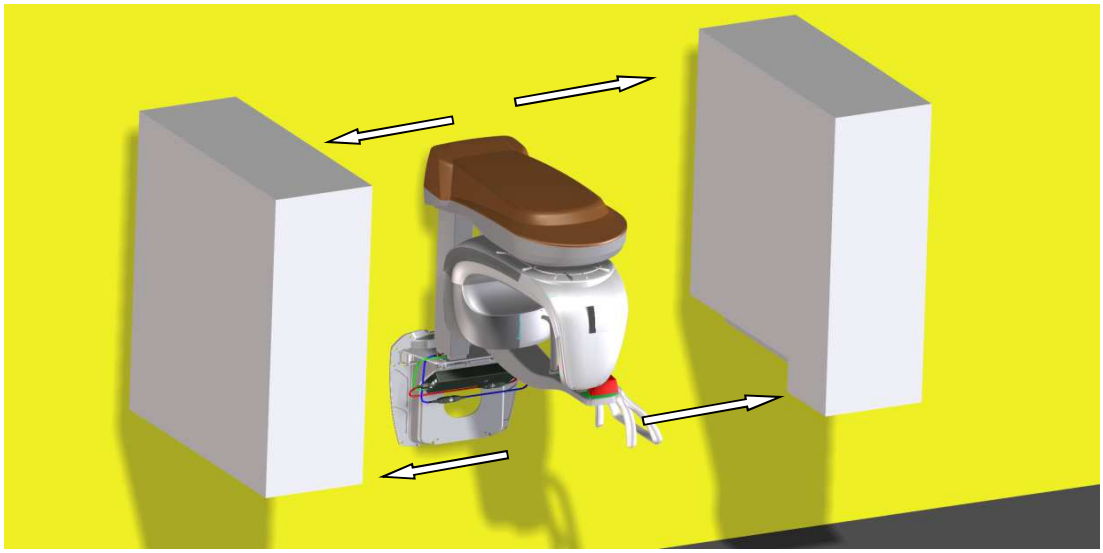


Figure 22

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.

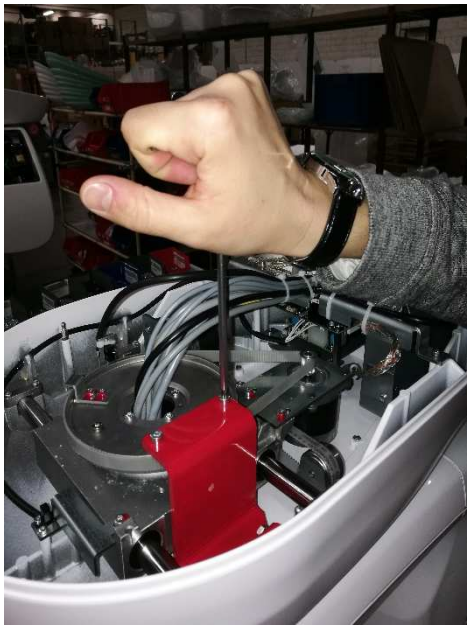


Figure 23

7.2. Fuses installation

X-MIND prime 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 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):

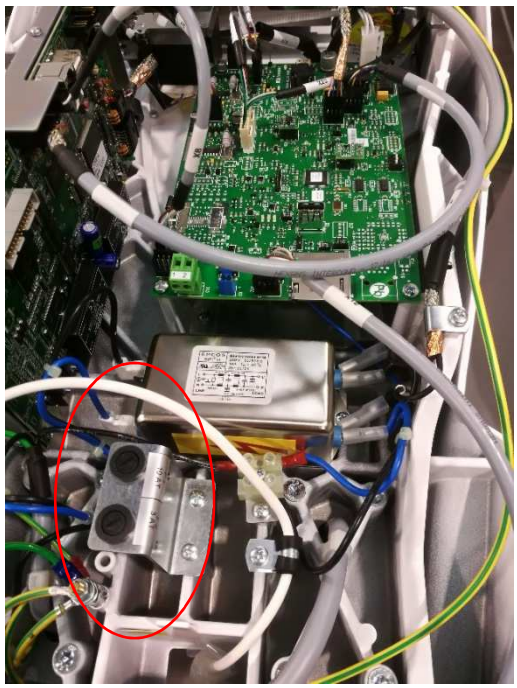


Figure 24

For X-MIND prime 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: 10 A T F2: 3 A T
200 – 240 Vac	F1: 4 A T F2: 1,6 A T

7.3. Electrical connections

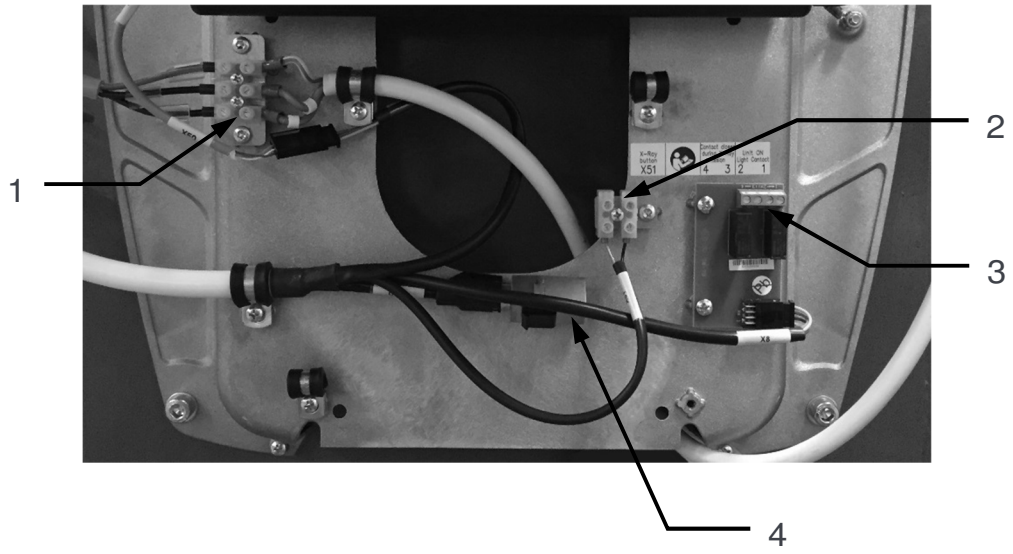


Figure 25

1. **Main Power Supply**: the power supply cable is already connected inside the X-MIND prime. It is only necessary to connect it to the dedicated power supply line.

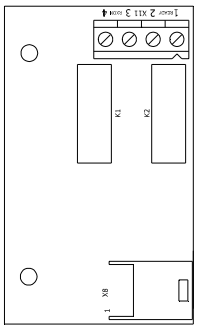
Note
Before to connect main power supply, be sure that the main provided by the Customer is according to specification in terms of voltage, line resistance and safety protections (see paragraph 6.1).

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, 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 indicate that the unit is ready to perform the exam (contact N.O.).
   - X-RAYS light (yellow light 24V - 40 W max.): it indicate 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.

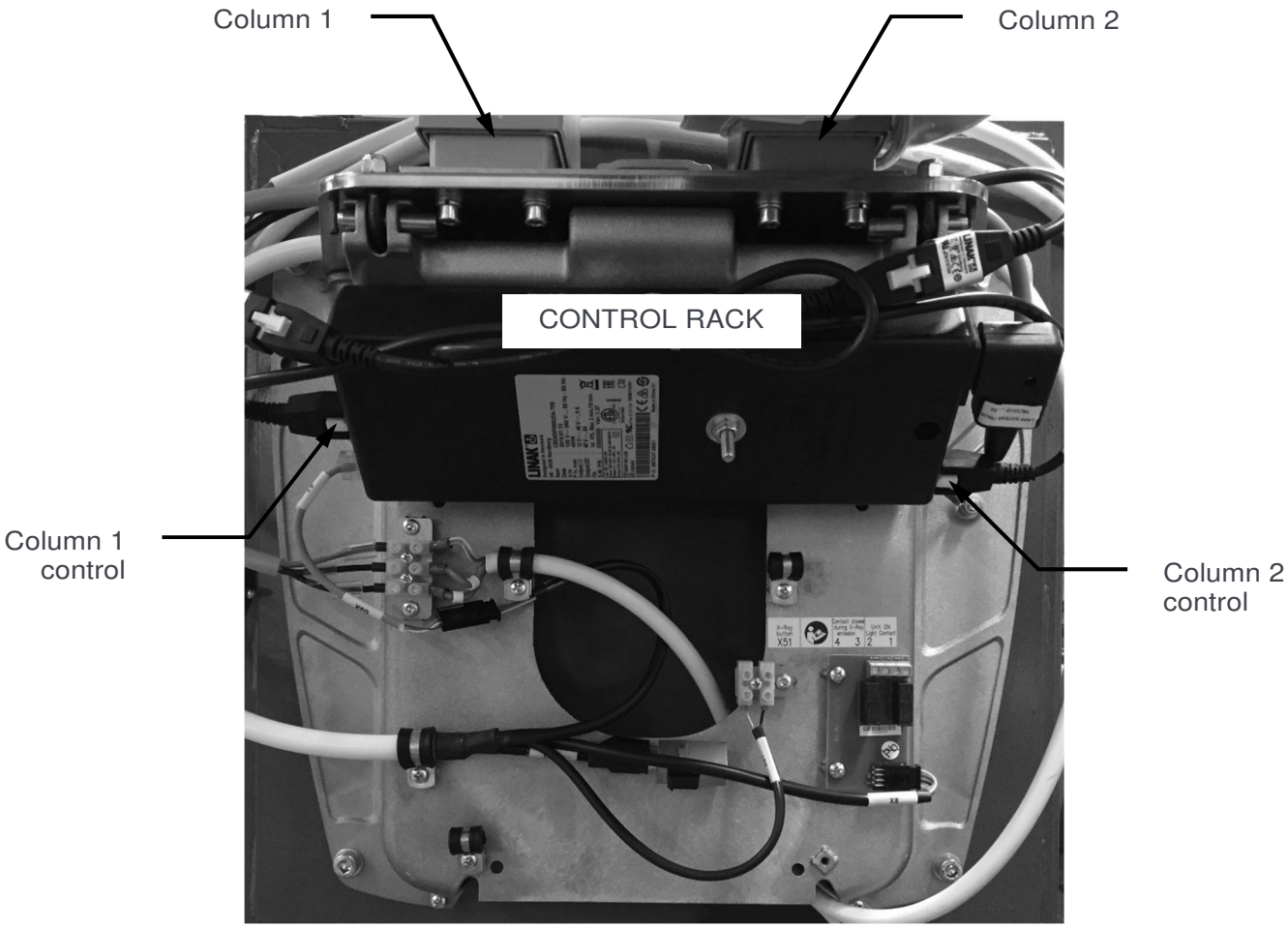
4. **DSPU board Ethernet**: the lower network connector must be connected to the dedicated Network Interface Card on the PC, via Ethernet cable (≥ CAT 5e). This line brings the communication between the unit and the PC.

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

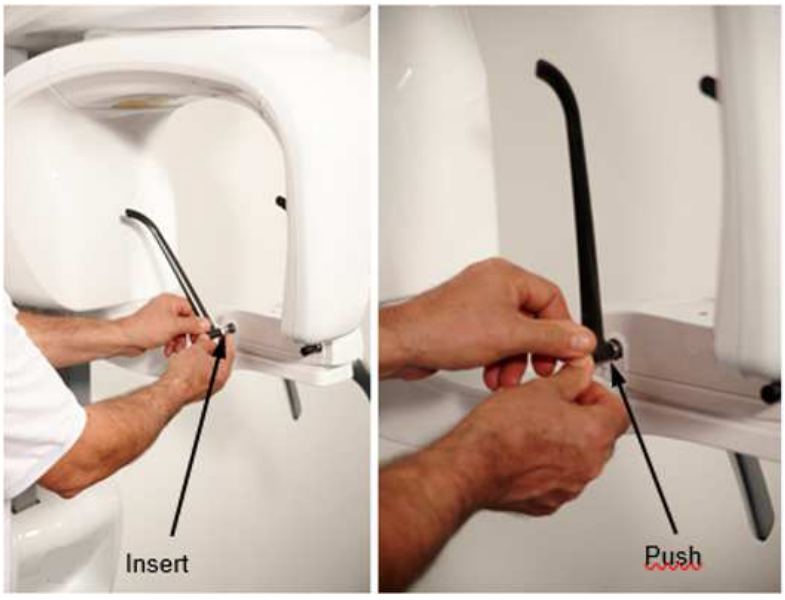


Figure 28

7.5. Unit fully installed

7.6. How to position the cables

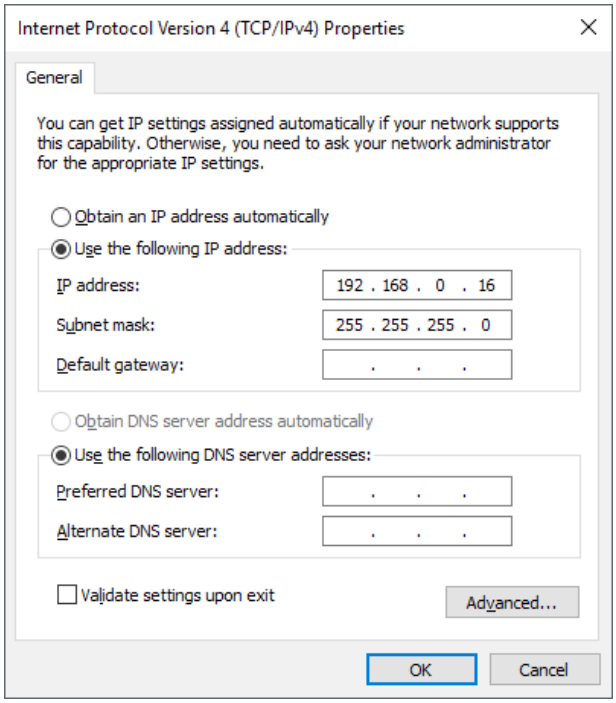
The cables output are from lower side of the X-MIND prime so that it's possible to position them in a single cable channel on the wall.

7.7. Network Interface board configuration

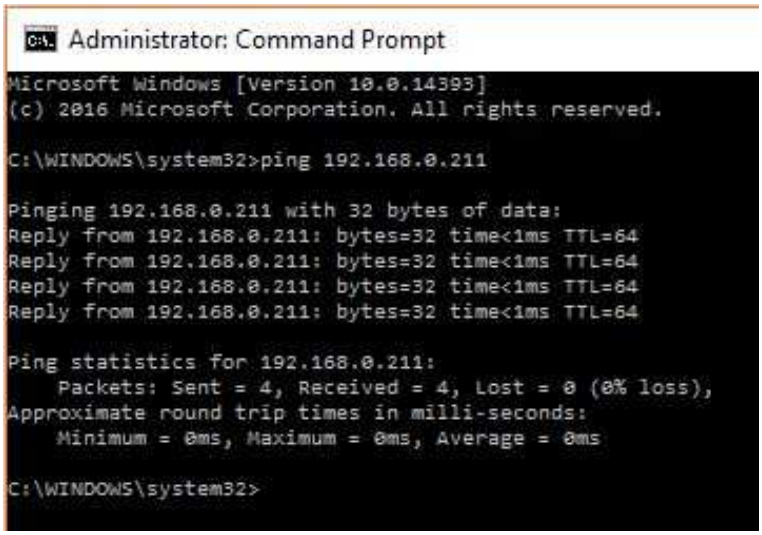
In order to connect the X-MIND prime to the PC it is necessary to configure the properties of the dedicated NIC (Network Interface Card) following the procedure described below.

1. Go to *Control Panel > Network and Internet > Network and Sharing Center > Change adapter settings.*
2. Plug the DSPU board Ethernet cable to the NIC port.
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. To check that the connection 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.



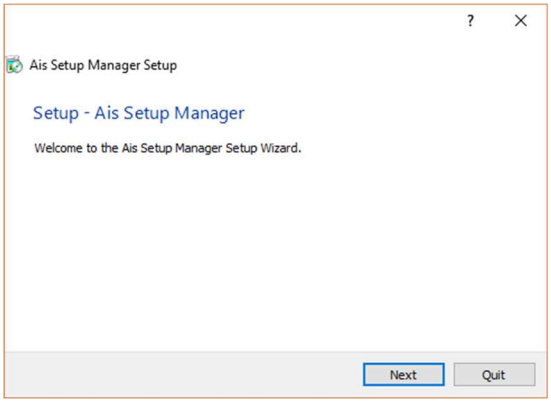
If the ping does not reply, verify if the DSPU IP address was changed (see paragraph 11.2.5).

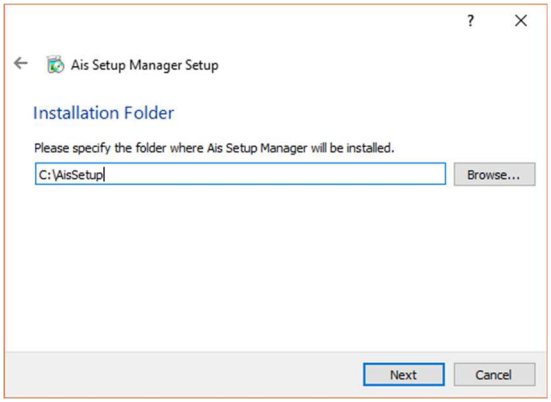
7.8. Software installation

Note
The windows user must have an administrator profile.
AIS requires that Windows 7 or 10 is already installed on your computer and correctly configured.

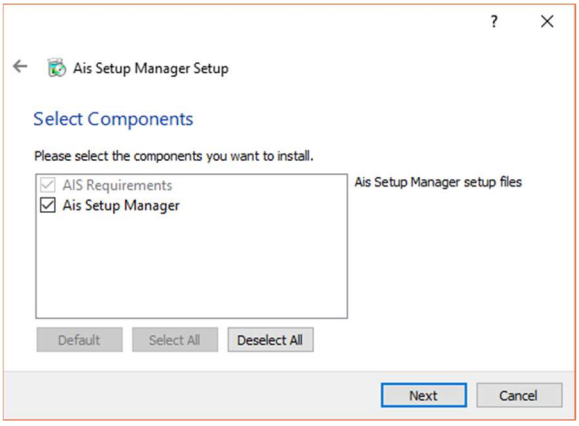
1. Close all the running applications and launch the AisSetupManager installer.

2. Setup window will appear, click on “Next” to proceed. Don’t change the destination folder and click on “Next”.

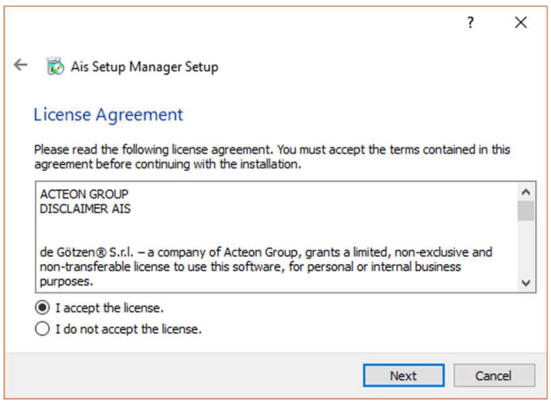


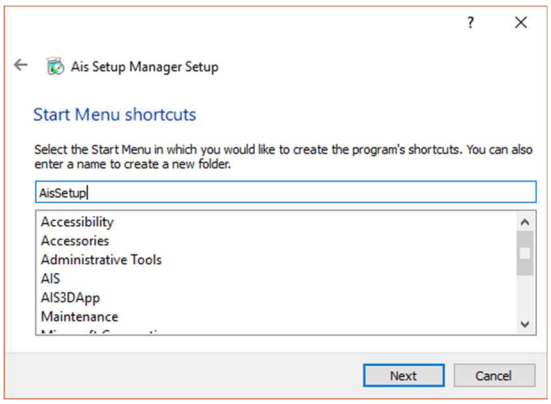


3. Select "Ais Setup Manager" and click on “Next”.

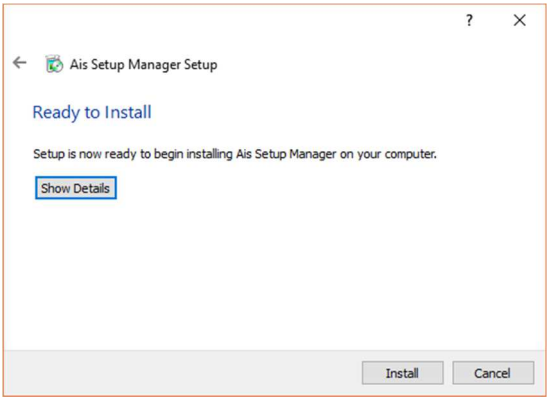


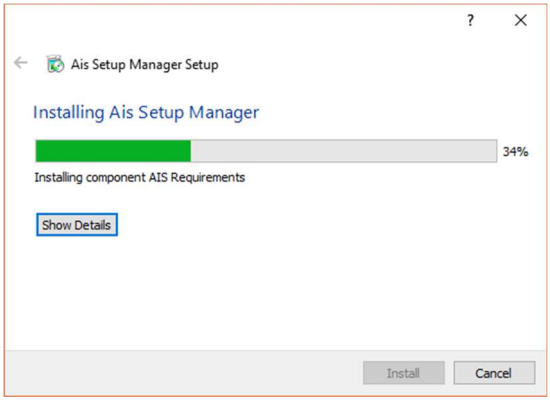
4. Accept the license agreement then click on “Next”. In the following window, click on “Next” to create the Start Menu shortcuts.



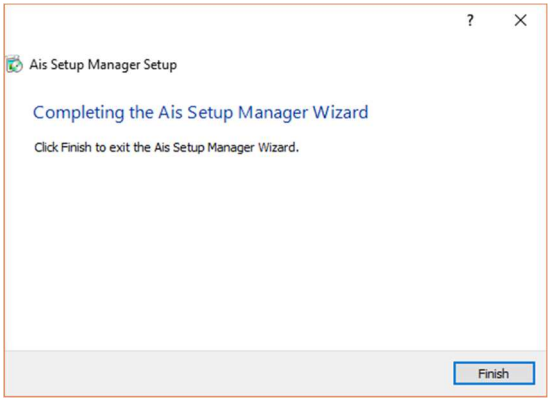


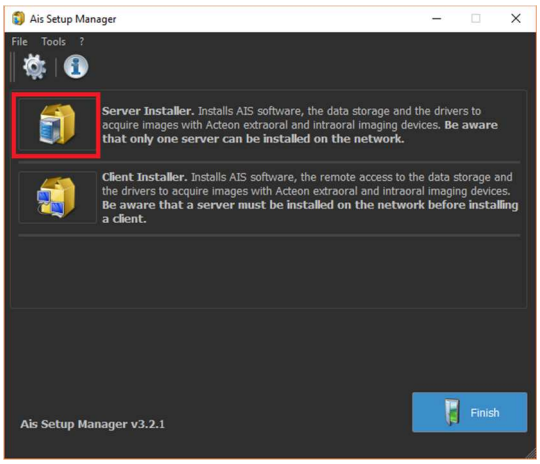
5. Click on “Install” to continue and wait the completion of the installation.



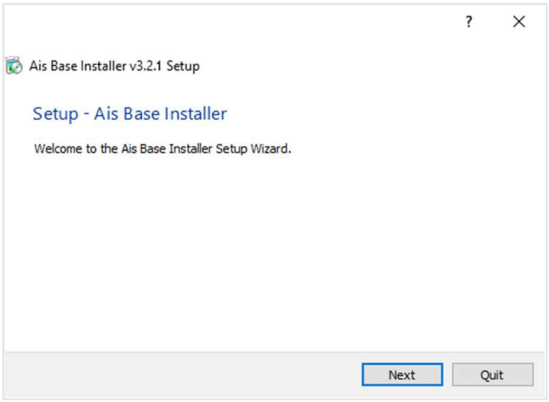


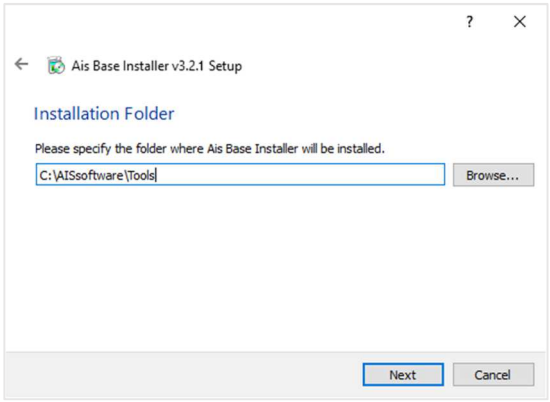
6. Click on “Finish”. The Ais Setup Manager window will appear, click on “Server Installer” to continue.



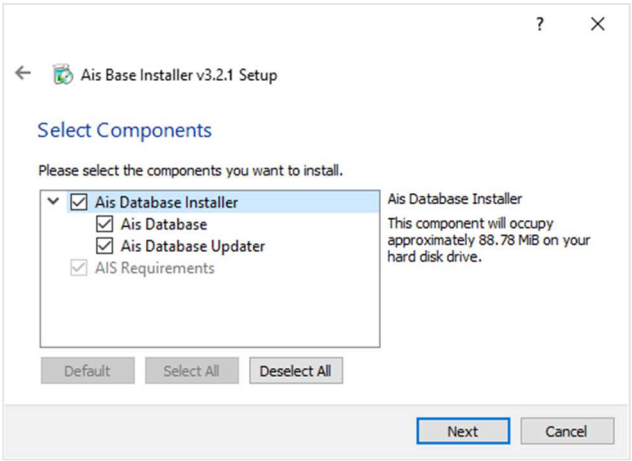


7. The setup window for the Database installation will appear, click on “Next” to proceed. Don’t change the destination folder and click on “Next”.

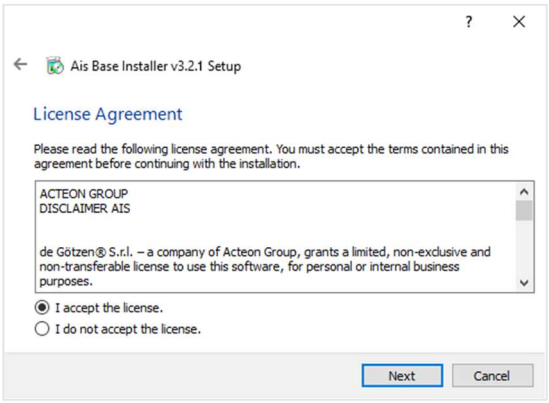


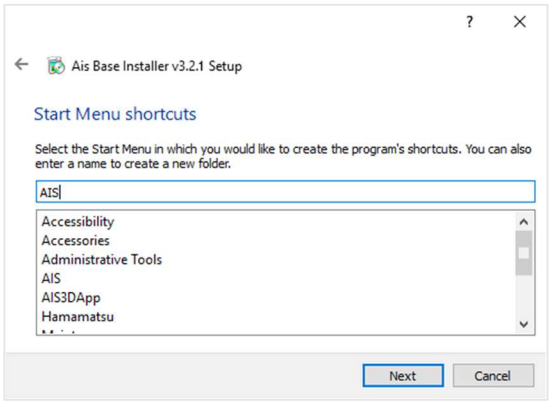


8. Select from the list the mandatory components needed for the Database installation: Ais Database and Ais Database Updater must be selected. Click on “Next”.

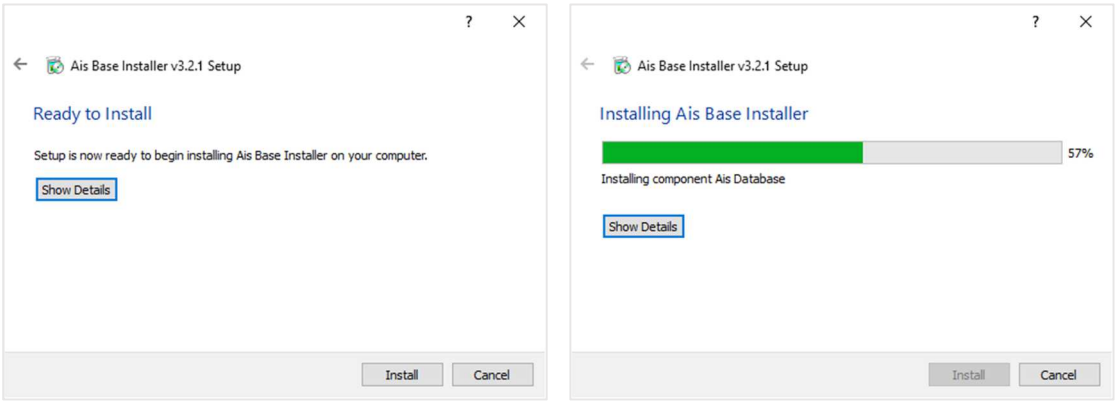


9. Accept the license agreement then click on “Next”. Click on “Next” to create the Start Menu shortcuts.

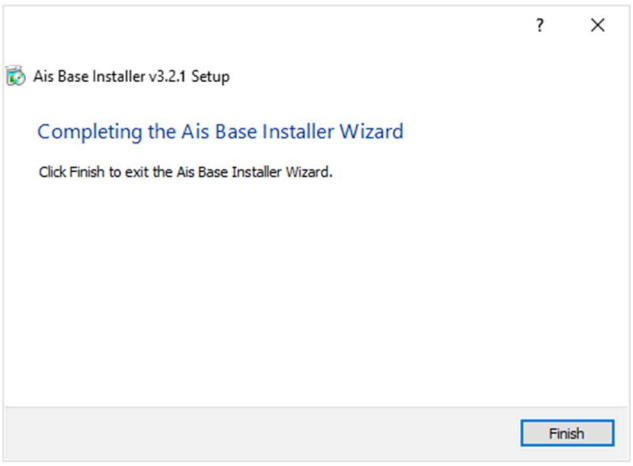




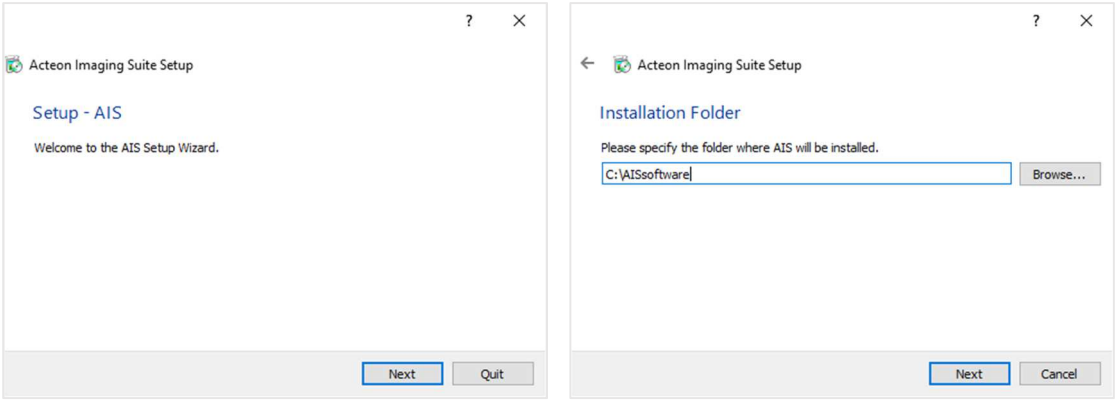
10. Click on “Install” to continue and wait the completion of the installation.



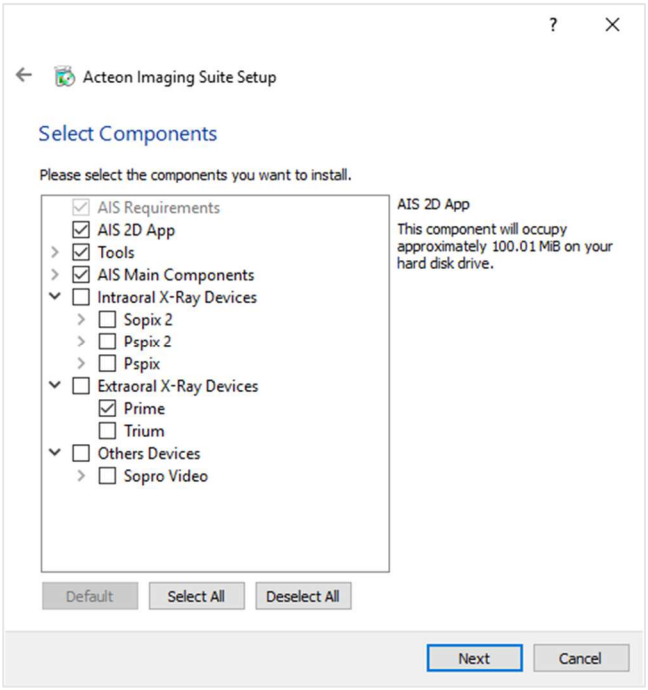
11. Click on “Finish” to complete the Database installation.



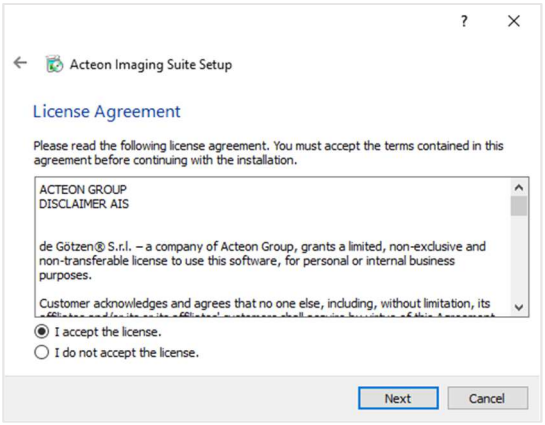
12. Following the Database installation, the setup window for AIS software will appear, click on “Next” to proceed. Don’t change the destination folder and click on “Next”.

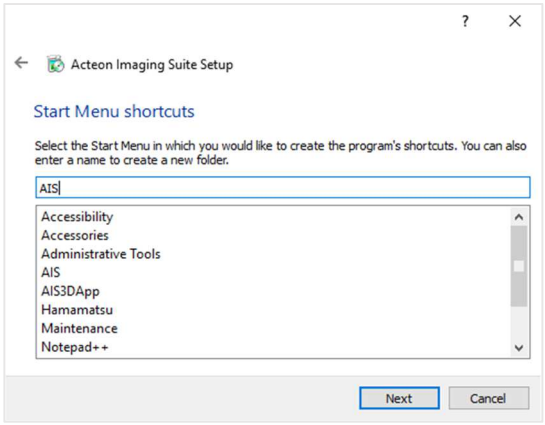


13. Select from the list the drivers needed for installation: Tools, AIS Main Components and Prime drivers are mandatory. Click on “Next”.

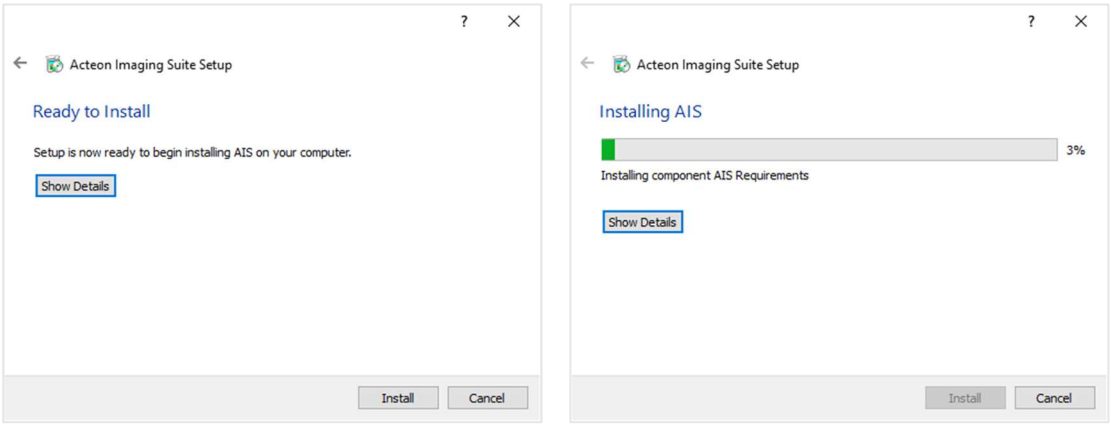


14. Accept the license agreement then click on “Next”. Click on “Next” to create the Start Menu shortcuts.

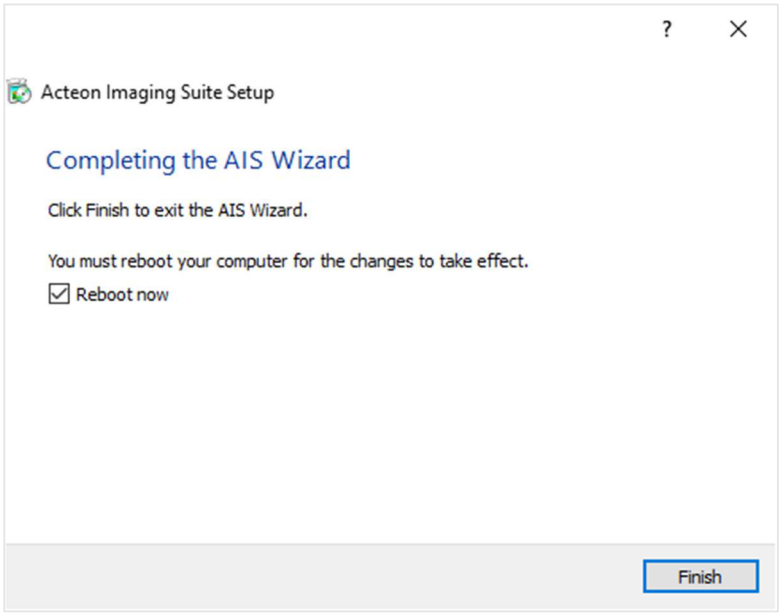




15. Click on “Install” to continue and wait the completion of the installation.

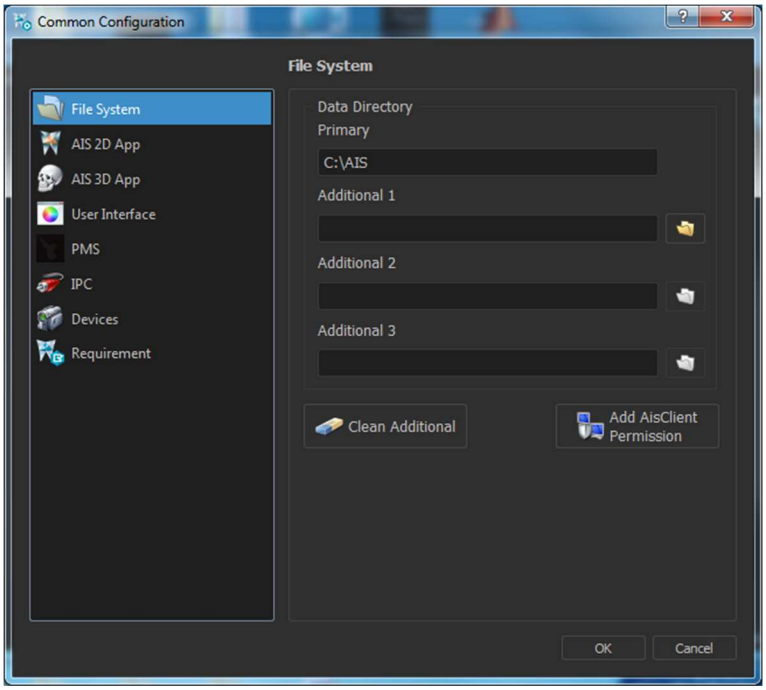


16. Click "Finish" to complete the process.

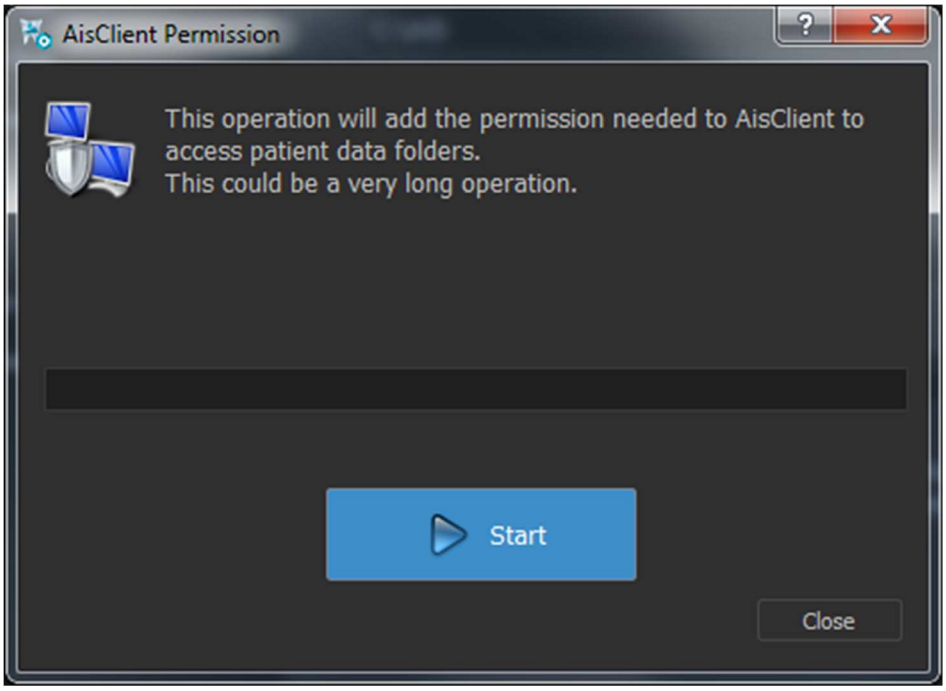


17. Launch AIS and follow the instructions provided in the AIS User Manual for the software activation. The “License number”, mandatory for AIS activation, can be found in the “CALIB_&_LIC” partition of the USB pen drive provided by Acteon.

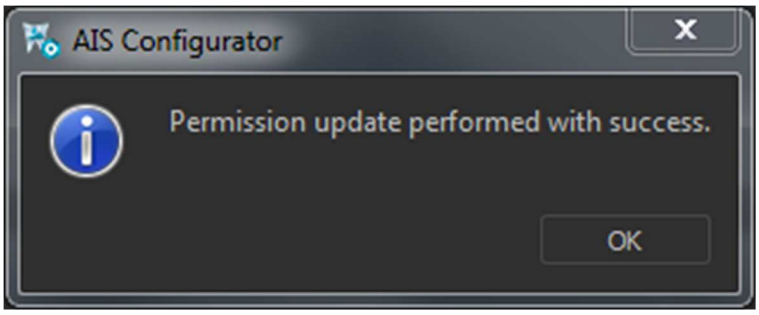
18. To ensure read-write rights for the network users, open the AIS Configurator application, then go on Configurator -> Common Configurator -> File System and click on “Add AisClient Permission” button.



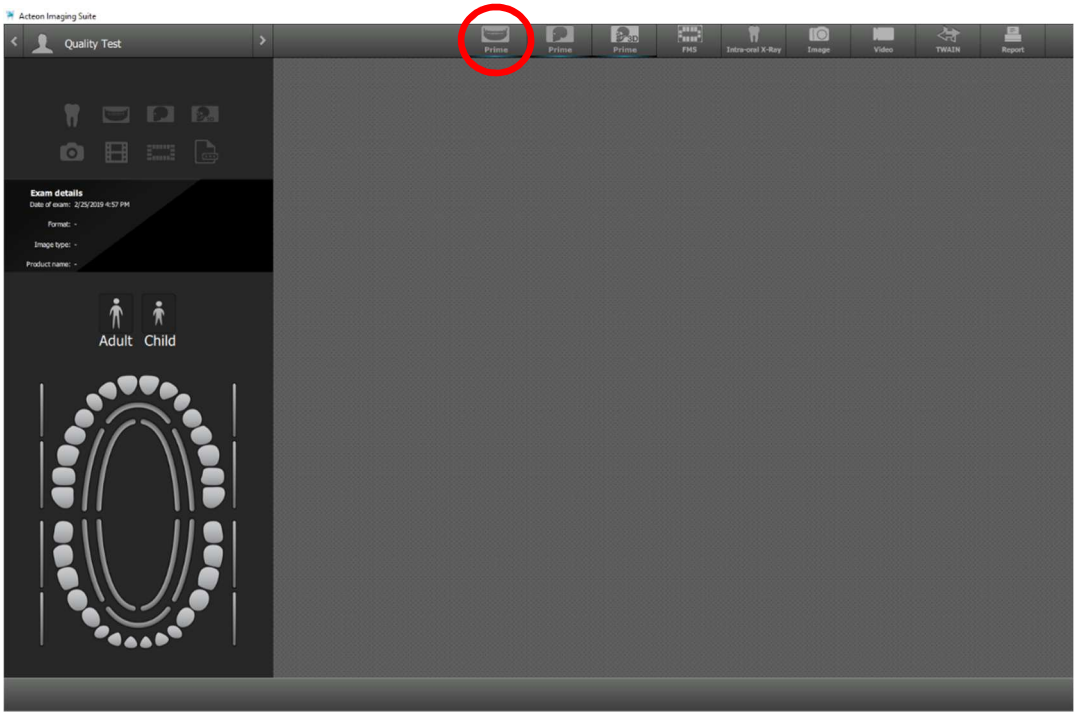
19. This can take a while depending on the size of the Database.



20. Click on “OK” once finished.

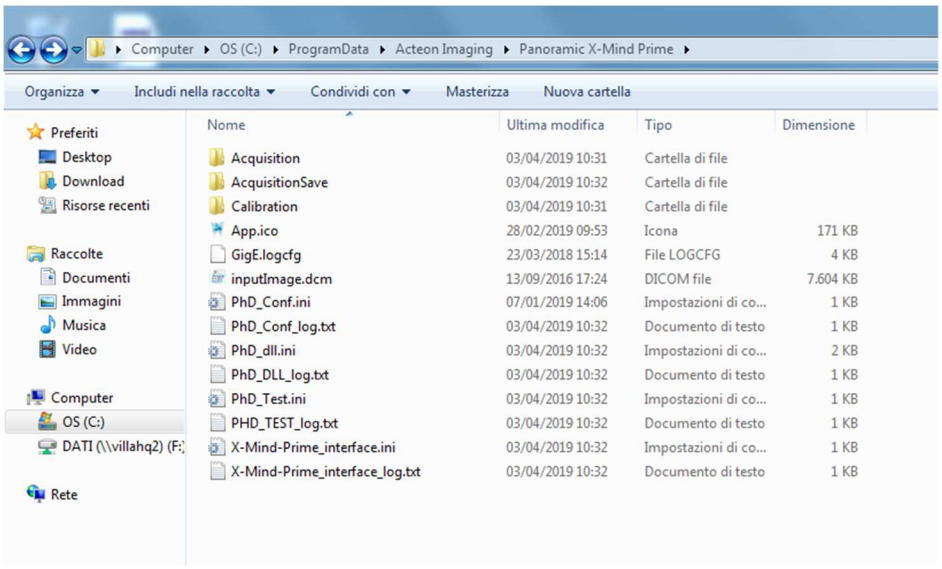


21. To check that the installation is correctly completed, open AIS, click on "Panoramic" symbol (see red circle) to open "Virtual Keyboard" of the unit.



7.8.1. Detector calibration files installation

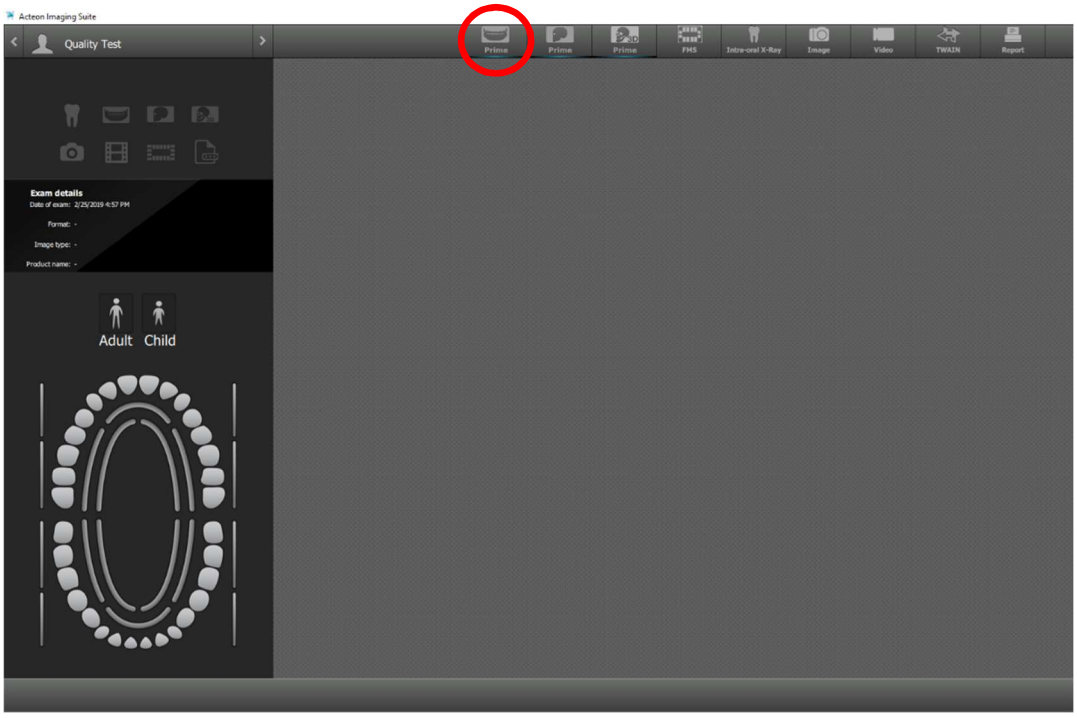
Before starting unit operation, it is necessary to copy all the detector calibration files in the PC.
Insert the USB pen drive or CD/DVD media containing the detector calibration files and open it.
In case of USB pen drive, open the partition "CALIB_&_LIC" and double click on "Install.bat". In case the 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).



7.9. 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 go to Exam Selection.
2. Open A.I.S. software and open the patient "Quality Test". If not present, create a new patient (Name: "Quality"; Family name: "Test").
3. From the top toolbar, select the Panoramic icon to open the X-MIND prime interface.



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

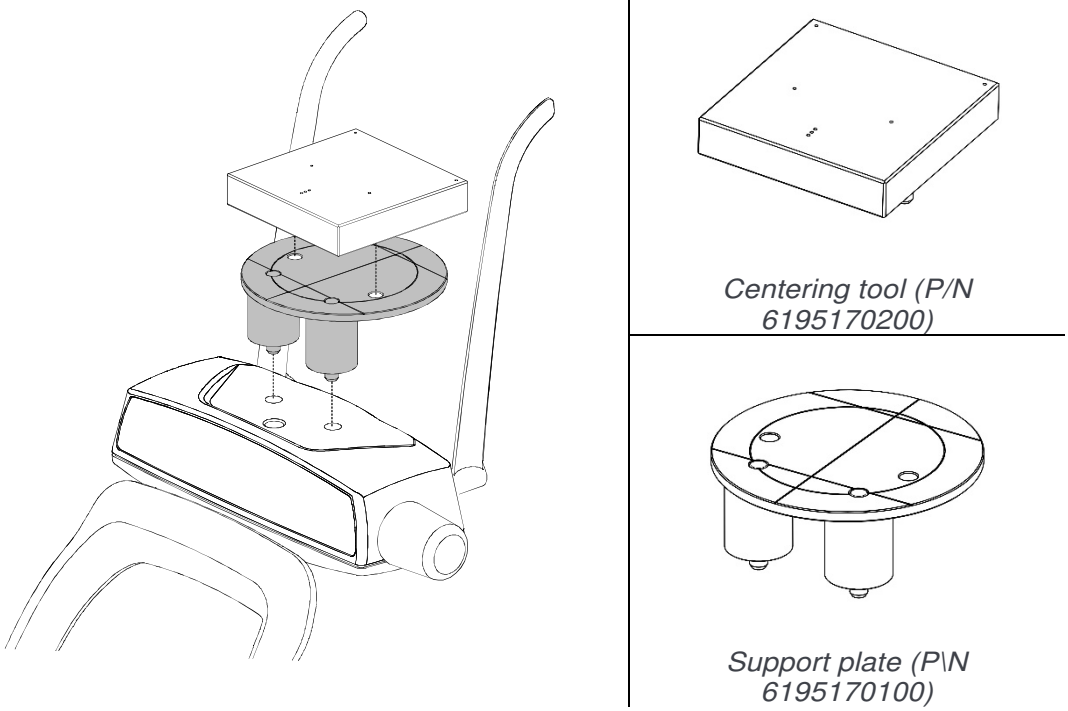
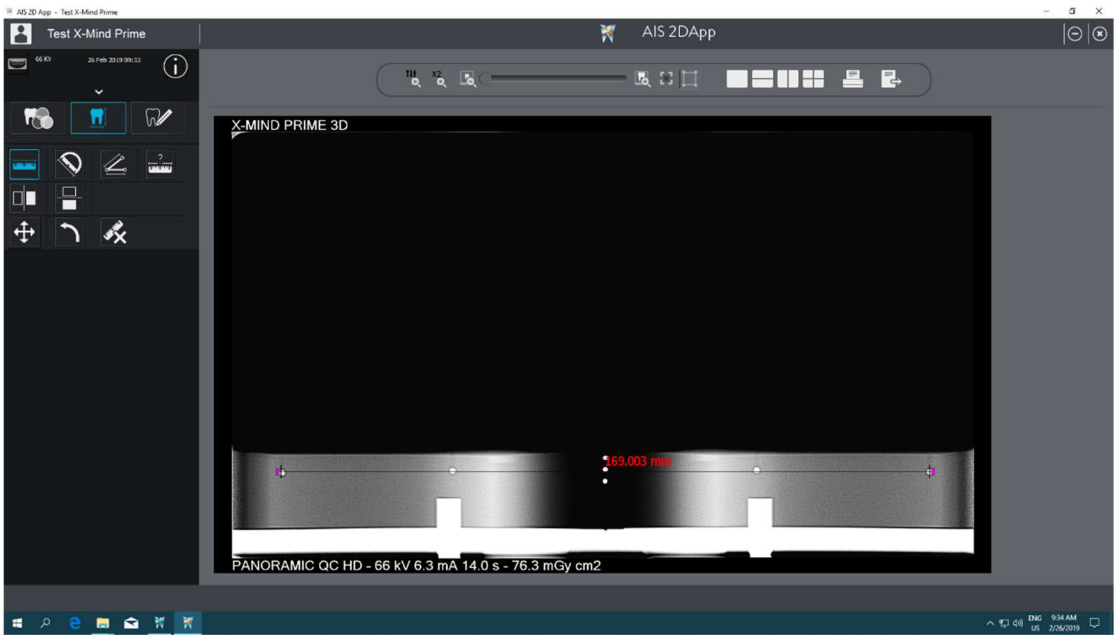


Figure 29: Support plate and centering tool positioning

5. On the virtual keyboard, select Standard Panoramic – Adult – and make an exposure at 66kV, 5mA.
6. Select from the menu "Ruler" and measure the dimension of the image using as reference the two external balls. The image has to be 169mm ± 2mm.



7. If distance is outside the tolerance range, enter the service menu (see chapter 8) and adjust the Y axis offset (see paragraph 8.3) accordingly. Repeat the exposure.
8. Measure also the two half of the image in order to check symmetry. The difference has to be max. 1mm.
9. If distance is outside the tolerance range, 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" Repeat the exposure.

7.10. 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 tipically 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 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.

7.10.1. 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.

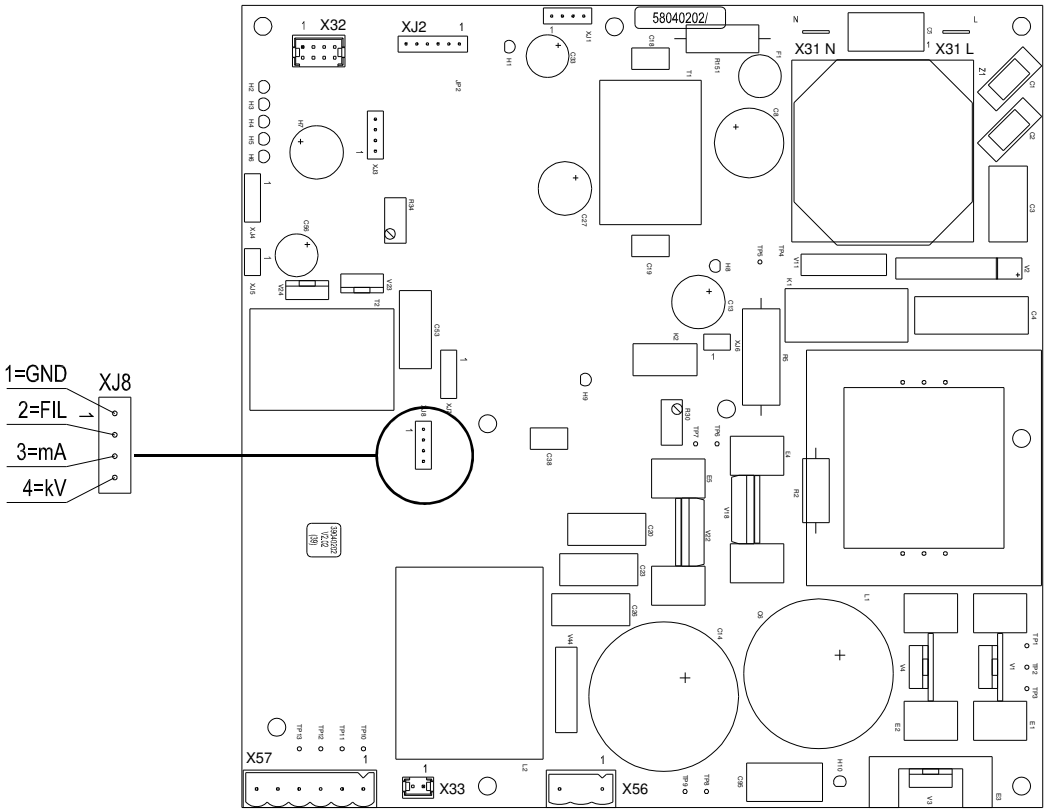
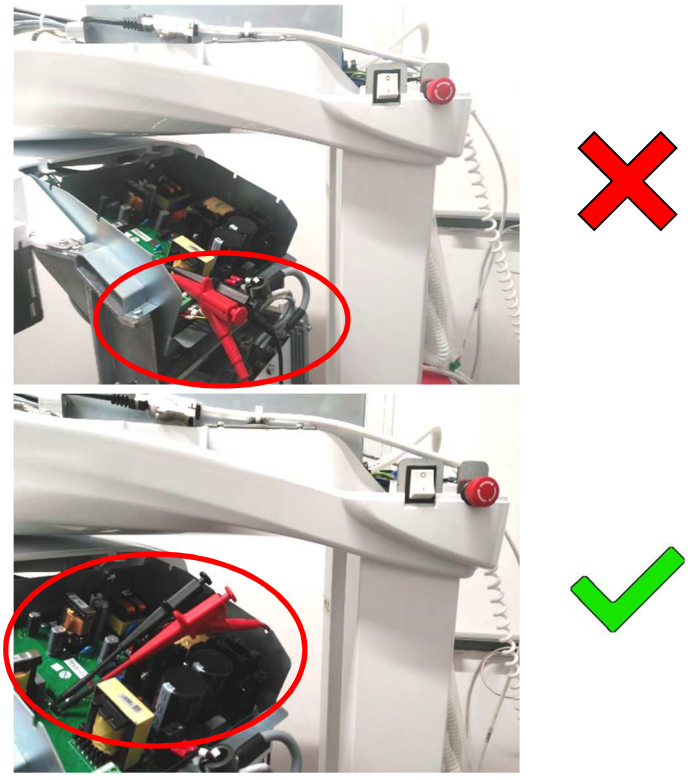


Figure 30

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.

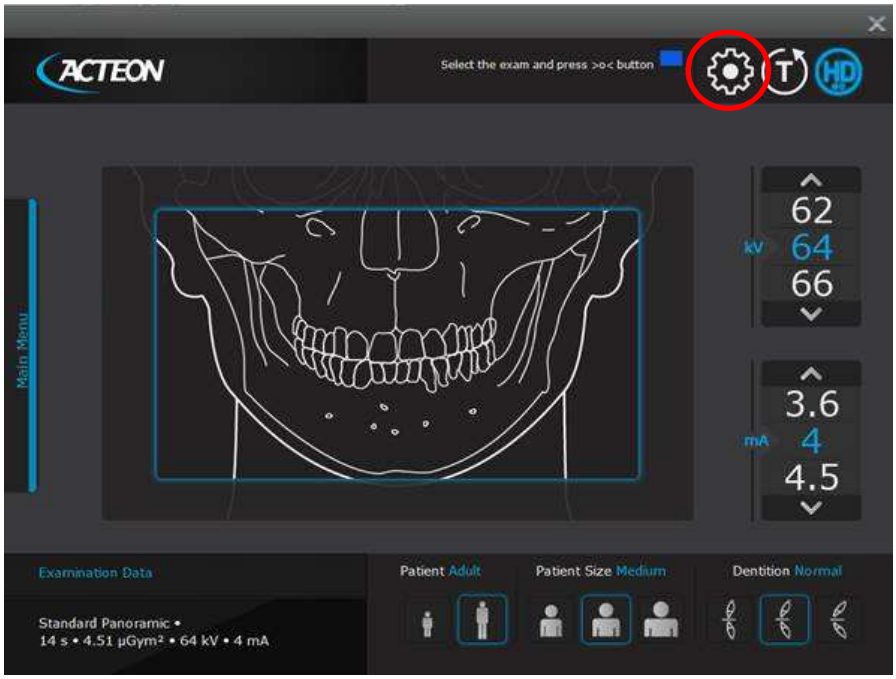
Parameter	Instrument	XJ8 pins
kV	Multimeter or oscilloscope	PIN 1 → GND PIN 4 → kV feedback
mA	Multimeter or oscilloscope	PIN 1 → GND PIN 3 → mA feedback
time	Oscilloscope	PIN 1 → GND PIN 3 → mA feedback

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

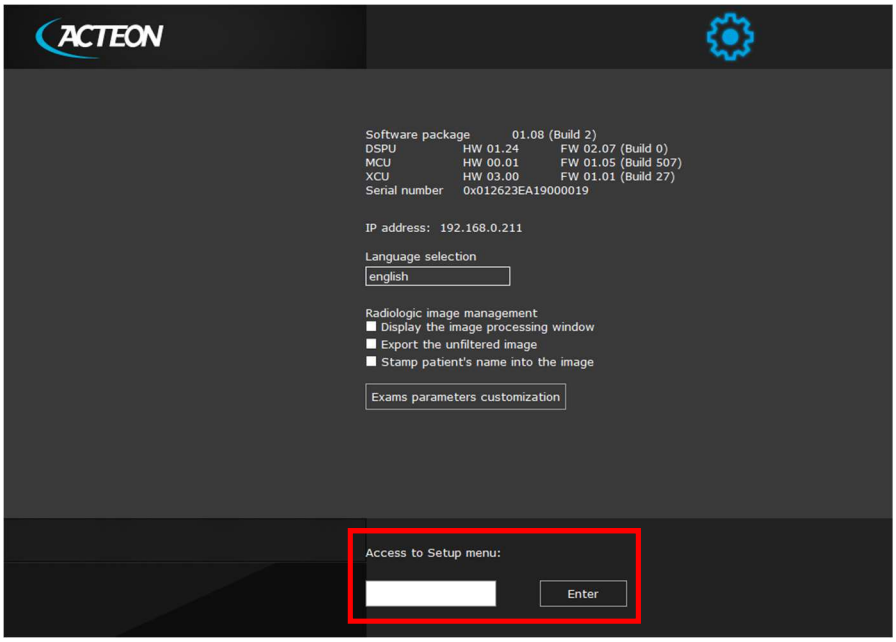


5. Switch ON the system and as soon as the green led starts blinking, press >0< for initialization.

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



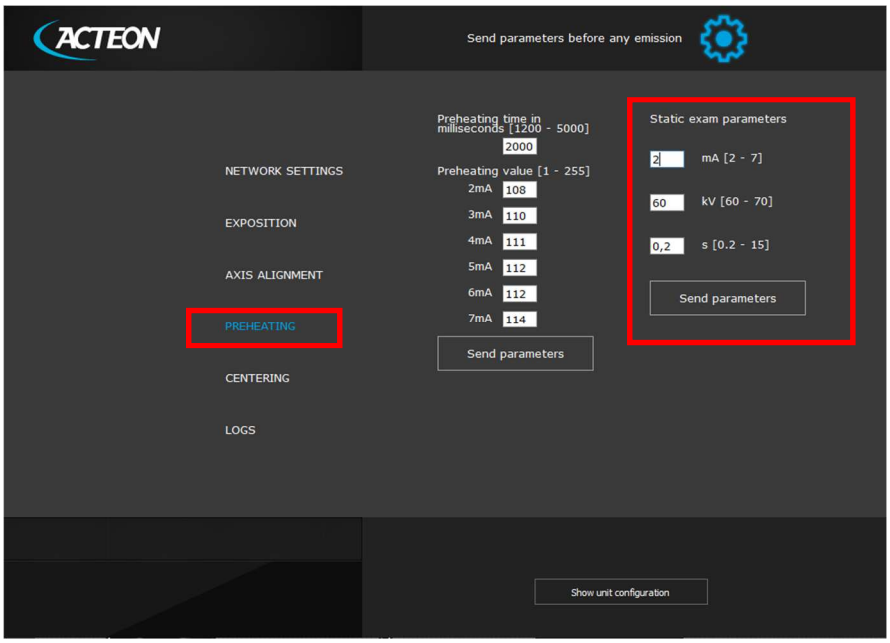
The following window will be displayed:



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, 3 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: 70 kV, 6 mA, 3 s and verify that the measured values are in the acceptance limits listed in the following table.

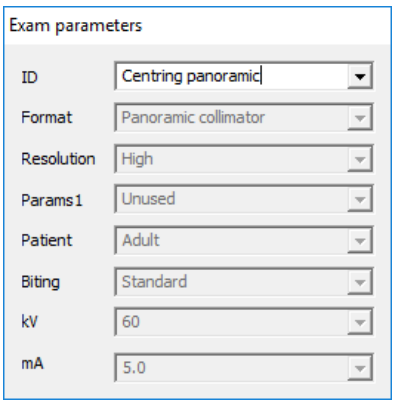
Parameter			Acceptance range		
kV	mA	t (s)	kV feedback (± 8%)	mA feedback (± 10 %)	Time (± 5 %)
60	3	3	2.76 to 3.24 V	0.9 to 1.1 V	2.85 to 3.15 s
70	6	3	3.22 to 3.78 V	1.8 to 2.2 V	2.85 to 3.15 s

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 9.2.6.2
    - mA out of range: follow the instructions described at paragraph 9.2.6.3
    - time out of range: replace the generator board.

7.10.2. Verification of Exposure parameters with NON invasive method

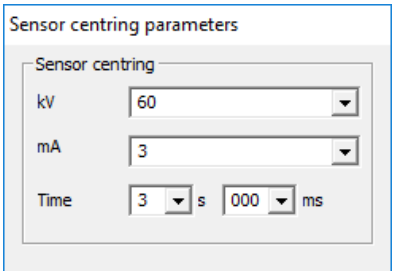
The exposure parameters (kV, time and dose) can also be verified using the so-called "non-invasive method".
The exposure parameters can be checked with a non-invasive instrument by performing the following procedure:

1. Place the probe of the dosimeter on the 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 panoramic".



Note
The "Centring panoramic" 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, 3 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.

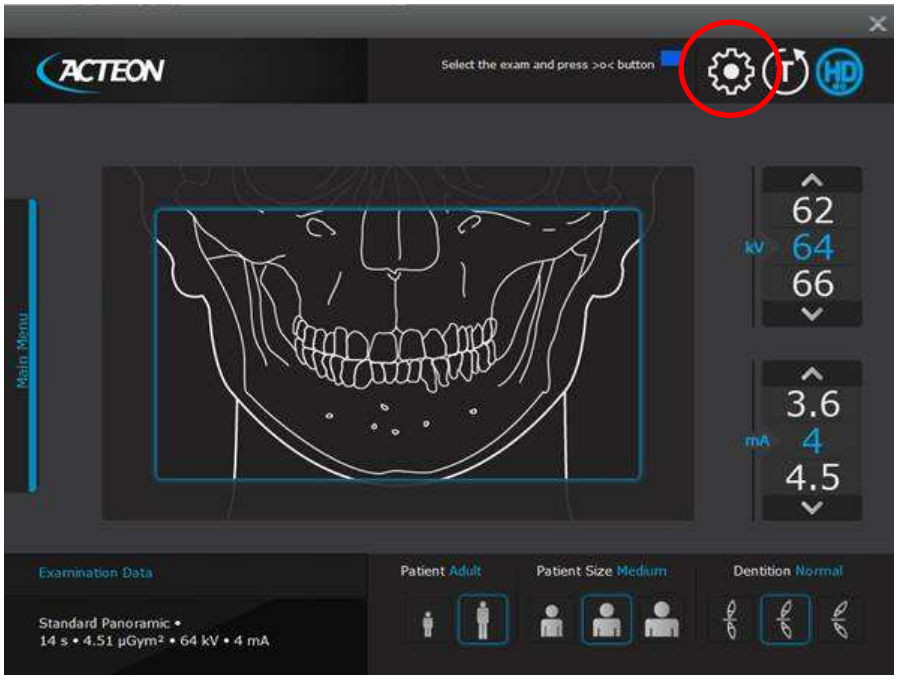
6. Take a second exposure setting the following parameters: 70 kV, 6 mA, 3 s and verify that the measured values are in the acceptance limits listed in the following table.

kV	mA	t (s)	kV acceptance limits	Time acceptance limits
60	3	3	55.2 to 64.8 kV	2.85 to 3.15 s
70	6	3	64.4 to 75.6 kV	2.85 to 3.15 s

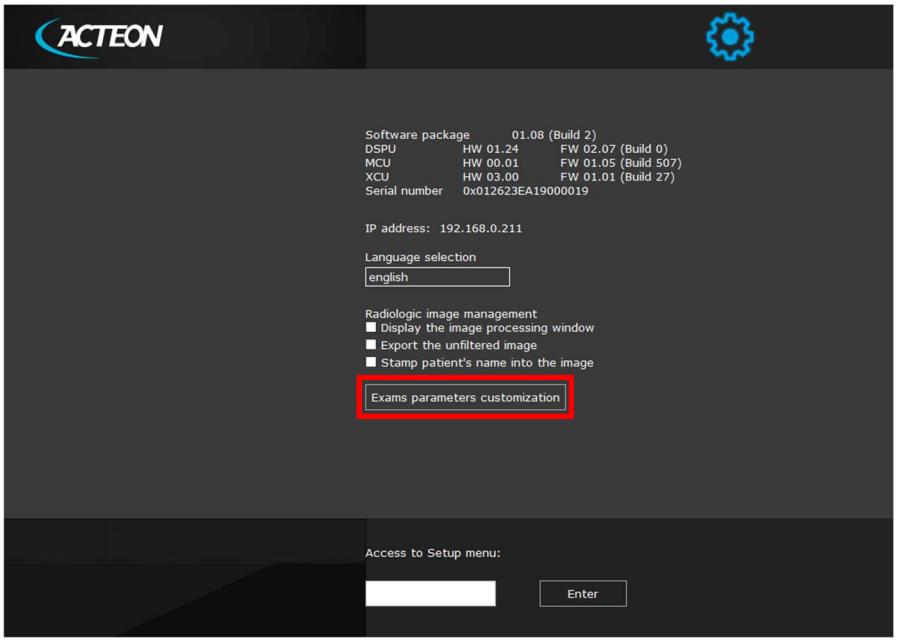
7. In case the test fails (result do not match the indicated values), proceed with the following actions:
   - Check the probe position and repeat the test
   - If the values are still out of range, perform the test using the invasive method as described in paragraph 7.10.1.

7.11. 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).

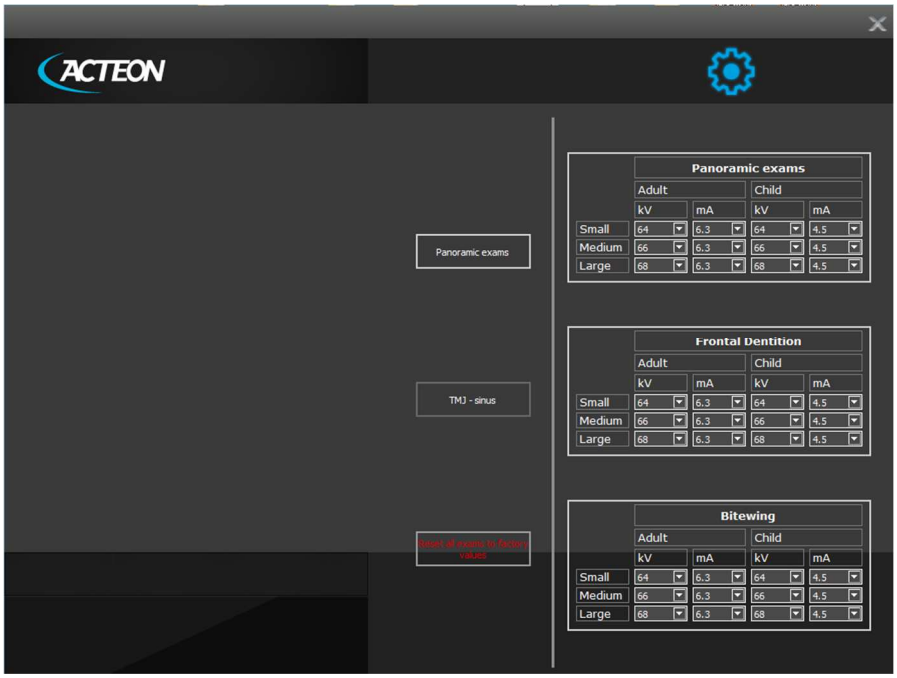


The following window will be displayed:



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".

7.11.1. Table of pre-set anatomic parameters

Exposure values in PAN mode				
	Adult Patient (14.4 seconds)		Child Patient (14.4 seconds)	
	kV	mA	kV	mA
Small	64	5.6	64	4.5
Medium	66	5.6	66	4.5
Large	68	5.6	68	4.5

Exposure values in Bitewing mode				
	Adult Patient (14.4 seconds)		Child Patient (14.4 seconds)	
	kV	mA	kV	mA
Small	64	5.6	64	4.5
Medium	66	5.6	64	4.5
Large	68	5.6	68	4.5

Exposure values in SINUS mode				
	Adult Patient (9.4 seconds)		Child Patient (9.4 seconds)	
	kV	mA	kV	mA
Small	64	5.6	64	4.5
Medium	66	5.6	66	4.5
Large	68	5.6	68	4.5

Exposure values in TMJ mode				
	Adult Patient (9,7 seconds)		Child Patient (9,7 seconds)	
	kV	mA	kV	mA
Small	64	5.6	64	4.5
Medium	66	5.6	66	4.5
Large	68	5.6	68	4.5

7.12. 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 unit
- Setup Parameter Table containing the factory configuration
- Detector calibration files / Software installation CDs or USB pen drive media.

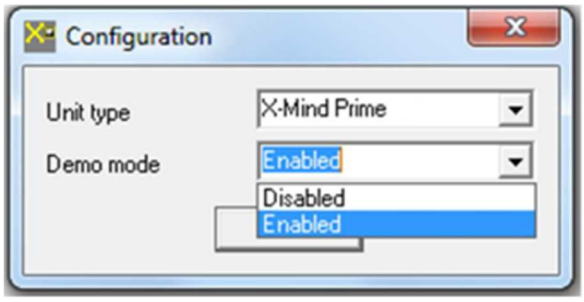
7.13. Exhibition mode setup

The X-MIND prime 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.

7.13.1. 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":



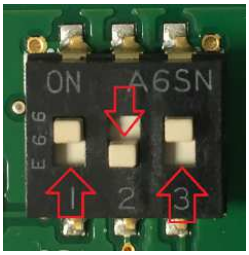
   Confirm with "OK".
3. Start AIS program and open the G.U.I. The user interface (G.U.I.) will work normally without the unit connected.

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.

7.13.2. 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.

7.13.2.1. 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.

7.13.2.2. 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.

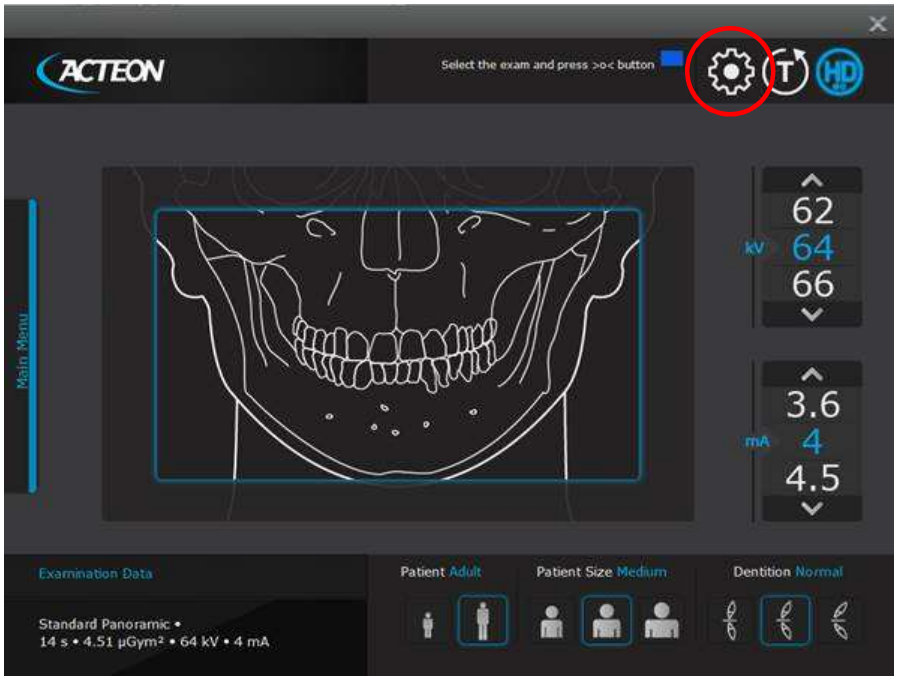
7.13.2.3. Unit and G.U.I. full demonstration (X-ray emission permanently disabled)

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

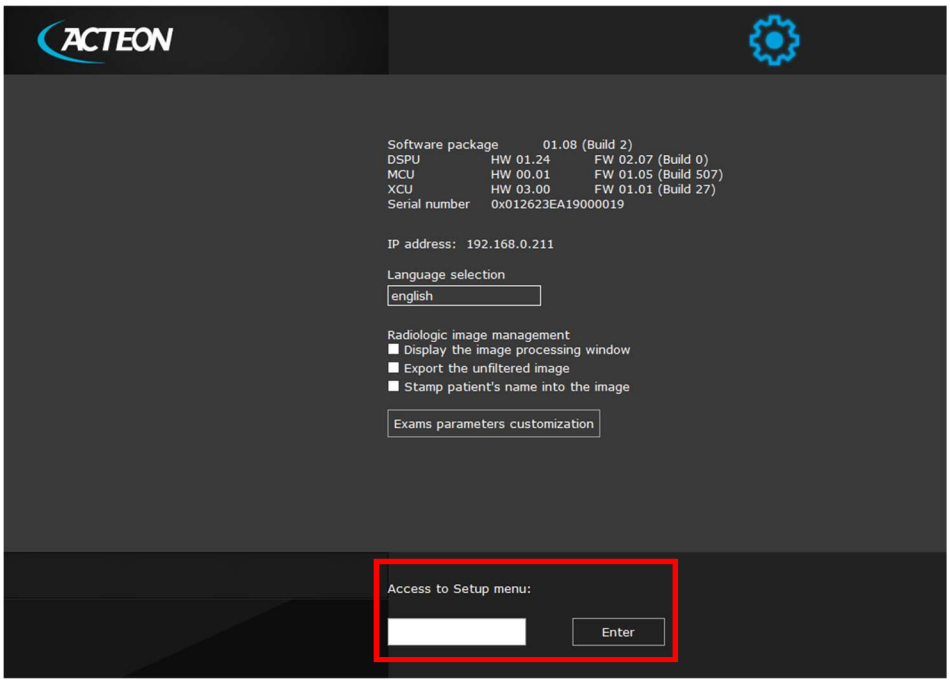
1. Enter service menu (see chapter 8).
2. Select the "Exposition" page (see paragraph 8.2).
3. Check "Disable permanently X-ray emission" box.
4. Click on the gear and save the new configuration in the EEPROM memory.
5. Wait the unit reboot and use the G.U.I. and unit normally; the system will perform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

8. SERVICE PROGRAM DESCRIPTIONS

In order to access Service programs, from Main Menu select the symbol "GEAR" (configuration).



The first page show the SW versions present in the unit. This is useful in case it is required to know the actual 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.

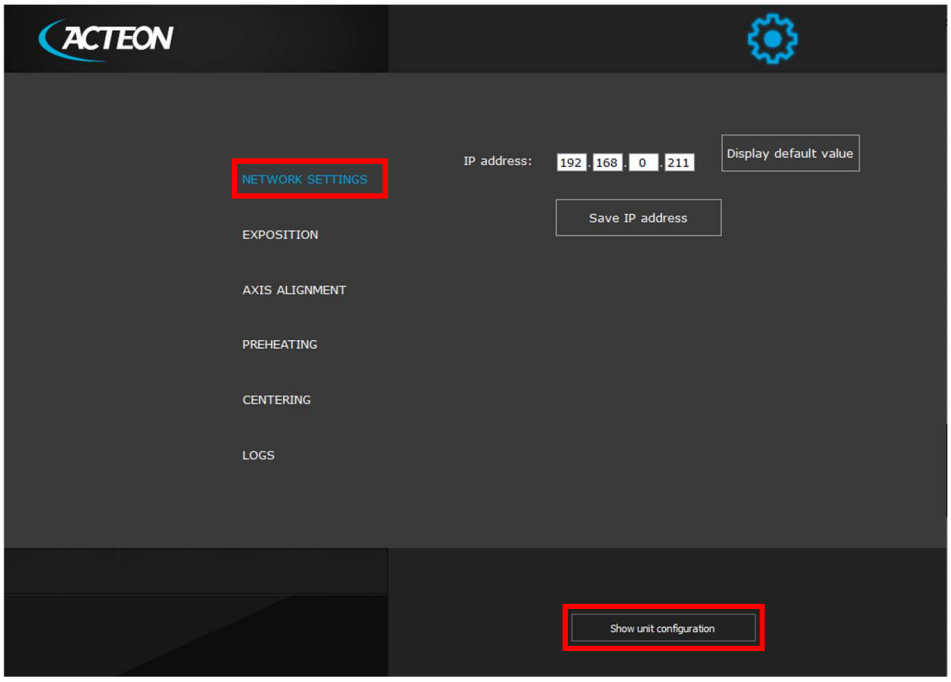
This page is reserved only to authorised technicians: it allows the access to the different functional parameters, as following:.

- ***Network Setting***: allows to set the IP address of the sensor (see paragraph 8.1)
- ***Exposition***: allows to disable X-ray emission permanently (see paragraph 8.2)
- ***Axis Alignment***: allows to adjust motor offset (see paragraph 8.3)
- ***Preheating***: allows to adjust the filament parameters. It is used only in case of tubehead replacement (see paragraph 8.4)
- ***Logs***: this page displays the exam counters (see paragraph 8.5).

Each time a parameter is modified, or a different sub menu is selected, 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 (see paragraph 7.6).

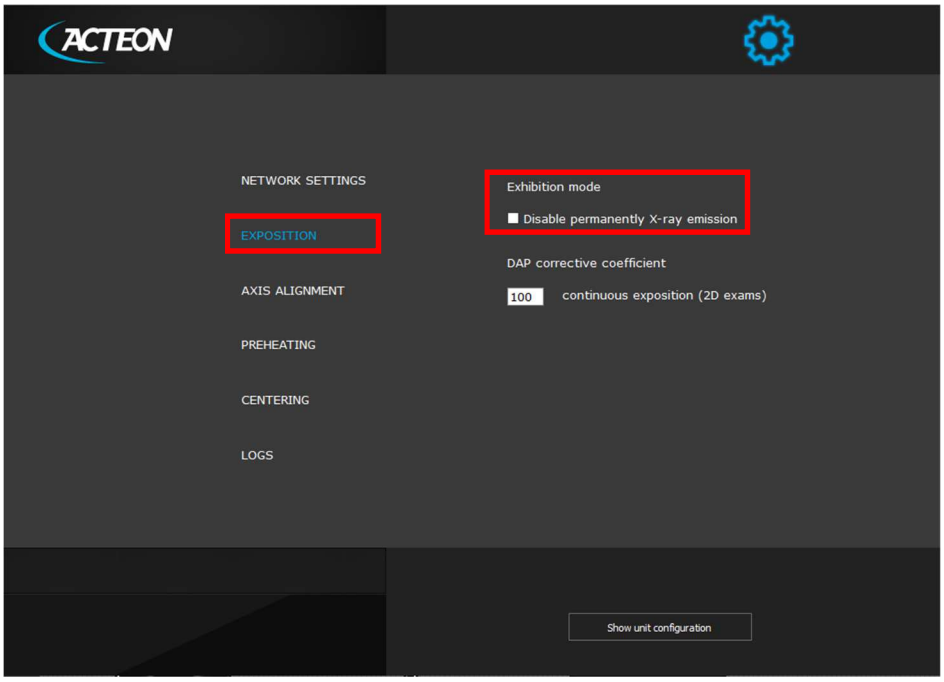


If necessary, change the IP Address according with the one present on the PC (same IP, but last 3 digits different; same Subnet mask).

Clicking on "Show unit configuration" button it is possible to check SW versions.

8.2. Exposition

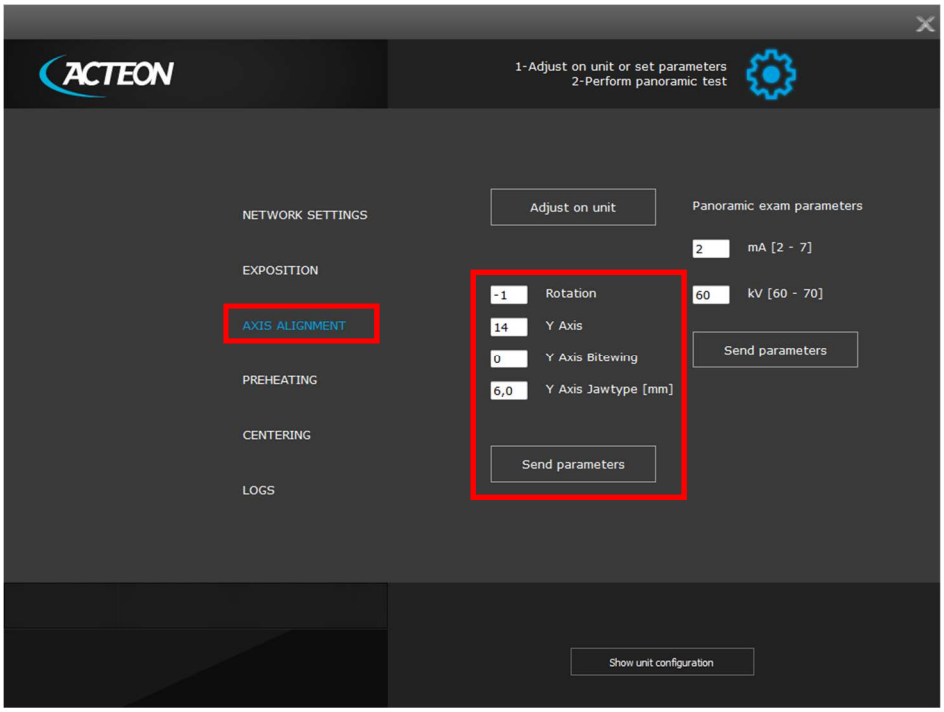
This function allows to disable X-ray emission permanently: check the box to disable X-rays.



8.3. Axis Alignment

This setup page allows to adjust the following motor offset:

- **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 7.9)
- **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).



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.

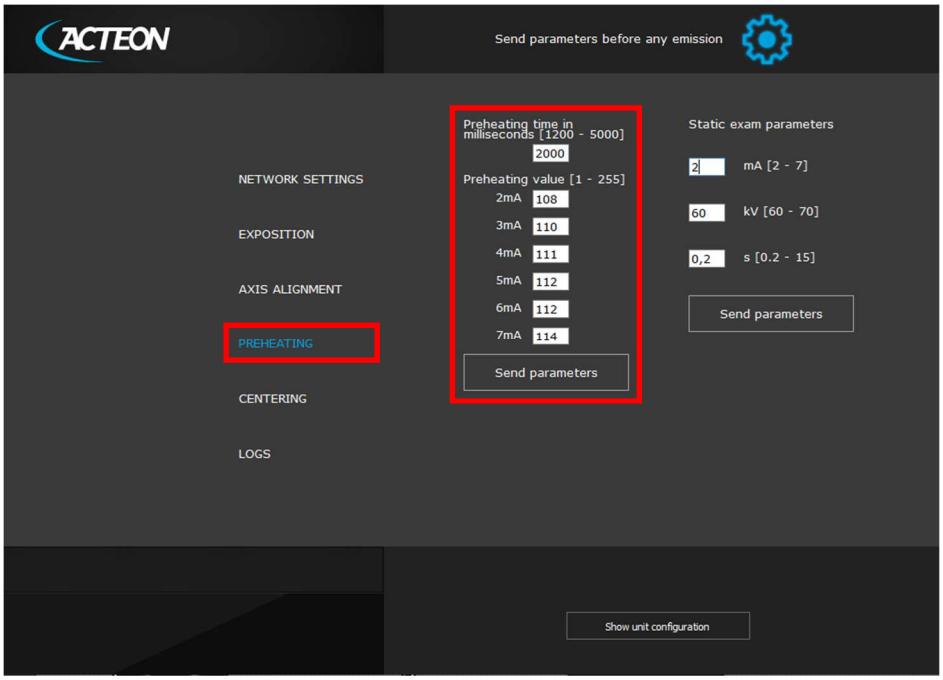
Warning
Modifying the motor offset values can severely impair functionality.

To check the effectiveness of the adjustments it is recommended to perform a panoramic acquisition using the centring tools as described in paragraph 7.9.

8.4. Preheating

This parameter 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.

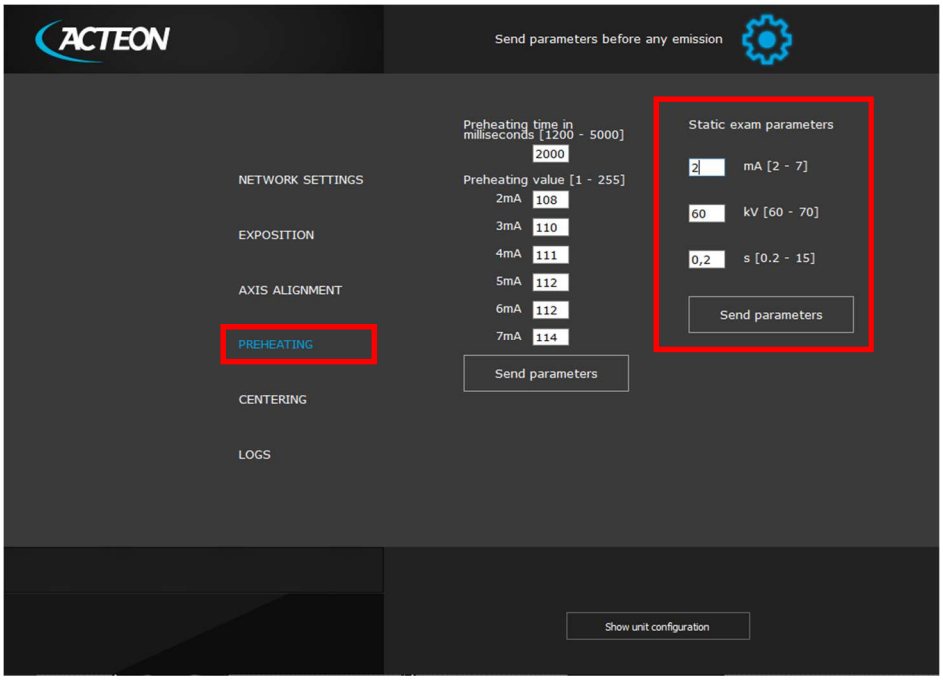


Warning
Wrong settings of preheating parameters may damage X-ray tube.

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.

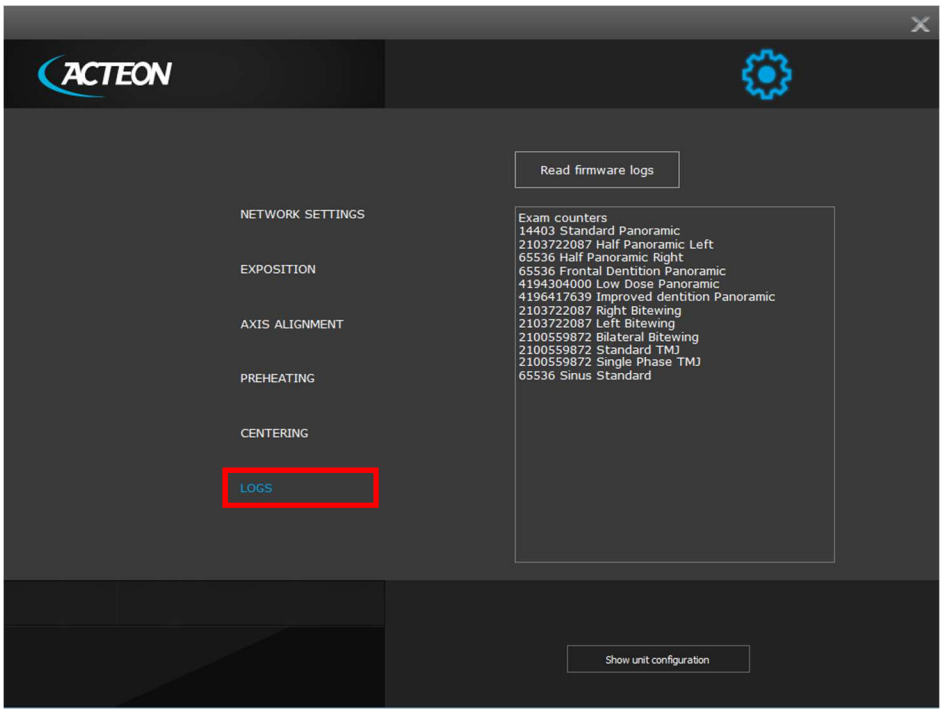
From this menu is it also possible to perform a static acquisition (no movements) with the collimator positioned on the panoramic window.

- 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. Logs

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

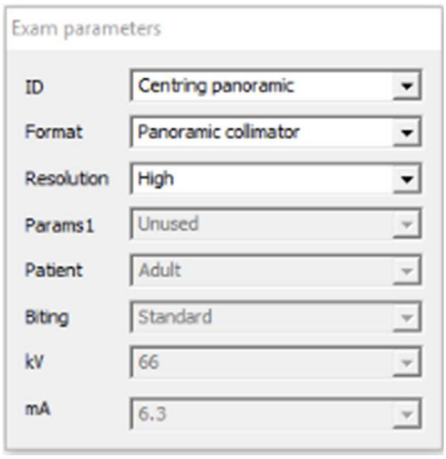


In order to keep the unit logs, refer to paragraph 11.2.1.

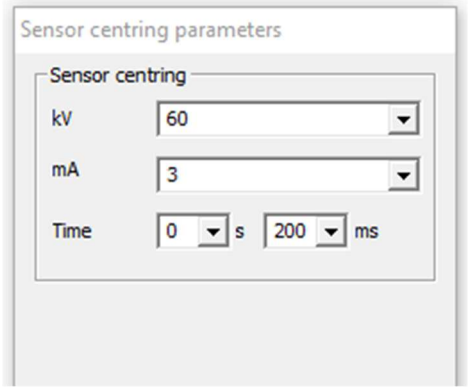
8.6. X-ray beam alignment check

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. 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 "Panoramic collimator".



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:.
In case of collimator replacement don't change the position of tubehead and sensor.

4. If needed, the images can be saved by clicking the button "Save"  . To save the image in bitmap format, put ".bmp" at the end of the file name while saving.

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, X36, X15, X10, 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 9.2.8.4)
H7	Red	Flashing / lit weakly	Steady ON= error on CANbus Steady OFF	Can Bus communication	See Error E1005 (paragraph 9.2.8.4)
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 9.2.6.9)

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 9.2.6.1)
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 9.2.6.9)
H3	Green	Flashing / lit weakly	Steady ON= error on CAN-bus Steady OFF	CANbus communication	See Error E1005 (paragraph 9.2.8.4)
H4	Green	Flashing / lit weakly	Steady ON= error on CAN-bus Steady OFF	CANbus communication	See Error E1005 (paragraph 9.2.8.4)
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 9.2.6.2, 9.2.6.3, 9.2.6.4, 9.2.6.7, 9.2.6.9)
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 9.2.6.1)
H9	Red	OFF	ON	X-ray exposure too long (backup timer intervention)	See Error E755 (paragraph 9.2.6.5)
H10	Green	ON	OFF	Main power supply	See Error E750 (paragraph 9.2.6.1)

9.1.3. 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 4).

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 9.2.8.2)
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 11.2.3)
D14 - PAN	Green	OFF			

9.2. Displayed messages

The X-MIND prime 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**

Hardware key board (U.I.C.)		
Code	**Error description**	**Reference paragraph**
270 / 271	Hardware key fault	**9.2.3.4**

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**

Generator Board		
Code	**Error description**	**Reference paragraph**
750	Generator board initialization error	**9.2.6.1**
751	Alarm "overvoltage kV"	**9.2.6.2**
753	Alarm "overload anodic current"	**9.2.6.3**
754	Alarm "filament not OK"	**9.2.6.4**
755	Alarm "backup timer"	**9.2.6.5**
757	Alarm "Brown OUT"	**9.2.6.6**
758	Alarm "NO X-ray"	**9.2.6.7**
759	Alarm "unexpected emission"	**9.2.6.8**
760	Alarm "NO RX button command"	**9.2.6.9**
761	Alarm "NO X-ray emission"	**9.2.6.7**
762	Bad unit status: emission flag detected unexpectedly	**9.2.6.10**
763	kV analog feedback out of range	**9.2.6.11**

Generator Board		
Code	**Error description**	**Reference paragraph**
764	mA analog feedback out of range	**9.2.6.11**
765	Filament analog feedback out of range	**9.2.6.11**
766	Generator board reset due to a brown out	**9.2.6.6**
767	Generator board reset due to low voltage detection	**9.2.6.6**
768	Generator board reset due to a watchdog timeout	**9.2.6.6**
769	Generator board reset due to a stack overflow	**9.2.6.6**
770	Mismatch between generator board (A2) and MCU board (A1) types (2D / 3D)	**9.2.6.12**

Keyboard		
Code	**Error description**	**Reference paragraph**
850	One or more keycodes are pressed	**9.2.7.1**
852	Button >0< pressed during movements	**9.2.7.2**

DSPU		
Code	**Error description**	**Reference paragraph**
1001	Error in the communication with the Digital sensor (PhD_Test error 1)	**9.2.8.1**
1003	DSPU hardware error detected (PhD_Test error 4)	**9.2.8.2**
1004	MCU – DSPU communication error (PhD_Test error 8)	**9.2.8.3**
1005	CAN Bus hardware error (PhD_Test error 16)	**9.2.8.4**
1006	Line clocks missing error (PhD_Test error 32)	**9.2.8.5**

PC software user interface (GUI)		
Code	**Error description**	**Reference paragraph**
1201	Setup menu: write data EEPROM failure	**9.2.9.1**
1202	Unespected value detected by the software	**9.2.9.2**
1203	Software allocation failure	**9.2.9.1**
1204	Exposure parameters failure	**9.2.9.2**
1205	Image buffer allocation failure	**9.2.9.2**

PC driver interface (OSP / VSP)		
Code	**Error description**	**Reference paragraph**
1403	Software watchdog error	**9.2.10**

9.2.1. Errors with code E000 and 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.

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. Restore the MCU metallic cover and the unit top cover.
   h. 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 8.

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 5804040200/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 (motors and zero position sensors).

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

These errors are shown when the firmware of the X-MIND prime 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 the examination procedure

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 signal lost during exam

This error is displayed if the "sensor ready" signal was lost during the last 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. Check the connection between DSPU board and Interface board A5 and between Interface board and Digital sensor; replace or fix it if defective and then verify if the error is still present.
3. Check the Ethernet connection (cables, junctions, PC network board); replace the faulty components and then verify if the error is still present.
4. Perform the test of the Error E1006 (see paragraph 9.2.8.5).
5. If the problem is still present replace the DSPU board and then the Digital sensor (see paragraph 11.3.3).

***Technical Service additional information required**: try to reproduce the error keeping the following logs:*
- *Software logs*
- *MCU SD card log*
- *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 an 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. Errors with code from E750 to E750

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).

9.2.6.1. E750: Generator board initialization failure

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 since 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.

9.2.6.2. 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 since 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 11.3.4).
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.

9.2.6.3. 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 since 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	326Ω ÷ 334Ω

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	326Ω ÷ 334Ω

IF values measured at point 2. and 3. are incorrect, replace the tubehead (see paragraph 11.3.4) 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.

9.2.6.4. 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 since 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); 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.

9.2.6.5. 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.**

9.2.6.6. 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.

9.2.6.7. 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 others 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); correct them and verify if the error is still present.
2. With the unit switched OFF (at least since 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 since 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 11.3.4).
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).

9.2.6.8. 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 since 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 since 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 11.3.4).
   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.

9.2.6.9. 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.

9.2.6.10. 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.

9.2.6.11. 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.

9.2.6.12. 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: 5807406100/XX
- MCU board: 5804040200/YY

Replace the wrong board.

9.2.7. Errors with code E850 and E852

These errors indicate a keyboard fault.

9.2.7.1. E850: More than one button 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: replace the cable and verify if the error is still present
   c. If the above tests are OK, replace the keyboard membrane.

9.2.7.2. 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 behaviour 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 9.2.7.1).

9.2.8. Error with code from E1001 to E1006

These errors are detected by DSPU board.

9.2.8.1. E1001: Error in the communication with the Digital sensor (PhD_Test error 1)

A communication error between DSPU board and Digital sensor has been detected by the DSPU board.

With the unit switched OFF, check the connection between DSPU board and Interface board A5 and between Interface board and Digital sensor; replace or fix it if defective and then verify if the error is still present.

IF the test is NOT OK, replace first the DSPU board and then the Digital sensor (see paragraph 11.3.3).

9.2.8.2. 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 11.3.1.4) 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).

9.2.8.3. 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 9.2.8.4)

9.2.8.4. 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 9.2.6.1) and E761 (see paragraph 9.2.6.7).
4. Perform the tests reported by Error E760 (see paragraph 9.2.6.9).
5. 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.

9.2.8.5. E1006: Line clocks missing error (PhD_Test error 32)

This message is displayed when a clock line is missing from MCU board to DSPU board.

With the unit powered OFF, check the clock lines in the cable J7-X9 between DSPU board and MCU board.

IF the test is NOT OK, replace or fix it if defective and the verify if the error is still present.

IF the test is OK, 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. Error with code from E1201 to E1205

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

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

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

If the error is displayed, contact Technical Service.

Technical Service additional information required:
- *Condition/unit state/sequence in which the error occurs/can be reproduced*
- *Software logs (see paragraph 11.2.1).*

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

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

If the error is displayed, contact Technical Service.

Technical Service additional information required:
- *Software logs*
- *DSPU log (only if the unit was not powered OFF since the error occurs) (see paragraph 11.2.1).*

9.2.10. E1403: Software watchdog

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

Check the Ethernet connection (cables, junction, PC network board) and PC network board settings (see paragraph 7.7); replace or fix the defective parts.

If the error is still present, 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).*

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

9.3.1. "Unit and computer not synchronized"

1. Can happen if the KV or mA parameters are modified from the G.U.I. too fast.
2. The message may be displayed while the G.U.I. is closing the Service Menu. If the problem persist contact Technical Service.

9.3.2. "Sensor not ready"

Refer to Error E370 (paragraph 9.2.4.3).

9.4. System Anomalies

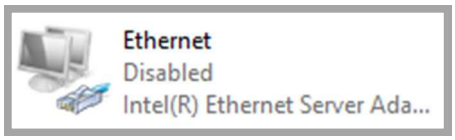
9.4.1. Asymmetries on the panoramic images

1. Check the orthogonality of the unit lasers (se User Manual - paragraph 7.3).
2. Perform the verification of the panoramic function (see paragraph 7.9).

9.4.2. 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).
   b. IF the Ethernet connection is DISABLED:



   Right click on Network board icon and click on "Enable".
   c. IF the Ethernet connection is NOT steady ACTIVE:

   Check the Ethernet connections (cables, junctions, PC network board).
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.
   If the problem is solved, it can be related to the network interface board.

9.4.3. The columns 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 paragraphs 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

Warning
If the operator detects irregularities or failure, 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 accessible conductive parts	Practical inspection
Annually	Condition of the internal and external cables: wear and tear and fastenings	Visual and practical inspection
Annually	The tightening of the primary bolts and screws such as the wall fastening systems and the moving mechanisms	Visual and practical inspection
Annually	Correct equipment centering	See paragraph 7.9
Annually	Check technical factors	See paragraphs 7.10.1 and 7.10.2

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 centering tool
6195170200	Centering tool	Panoramic function adjustment
5607900800	1.5mm copper filter	Sensor calibration

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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.

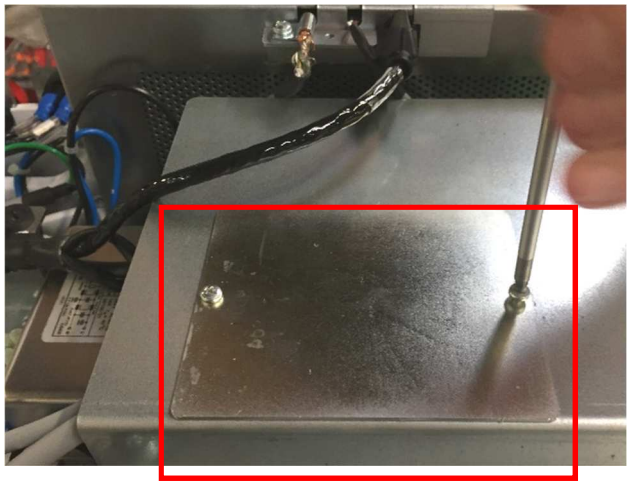


Figure 31

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

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

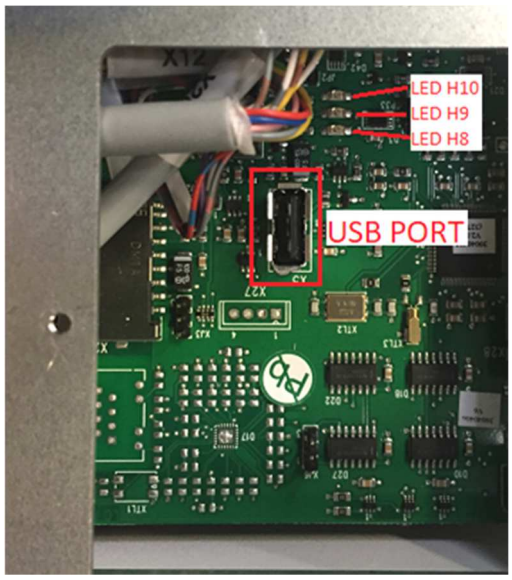


Figure 32

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 8) 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 "PHD_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.

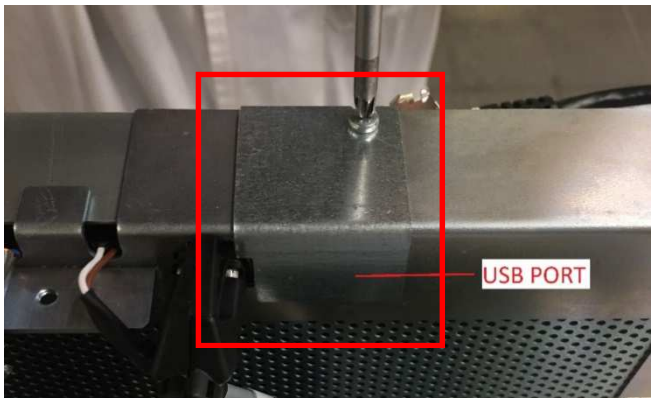


Figure 33

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 34

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

	File name	Path location	Active by default
Software package	*LogsServer_yyyy.mm.dd.log*	C:\ProgramData\Acteon Imaging\LogServer\Logs	YES
MCU	*eeprom.dump* *mcu.log*	[SDCARD]:\mcu\Logs	NO
DSPU	*FirmwareTraces.txt*	C:\ProgramData\Acteon Imaging\LogServer	NO

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 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 8) 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*
   - *mcu.log*

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

Log	Description
MCU version numbers	MCU Firmware (SW) version
DIP switch code	MCU DIP-Switches position 0 = Normal mode
S/N	MCU hardware key number (U.I.C.)
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

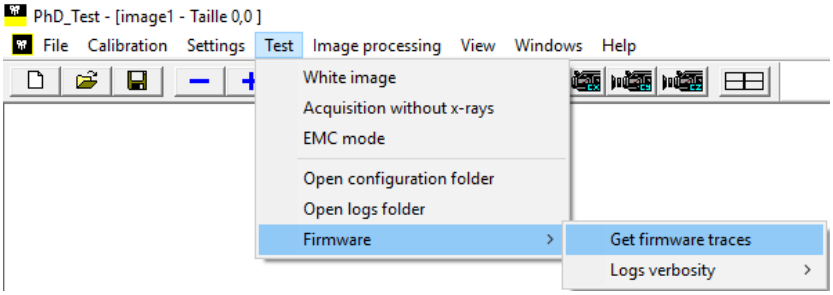
11.2.1.3. DSPU logs

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:

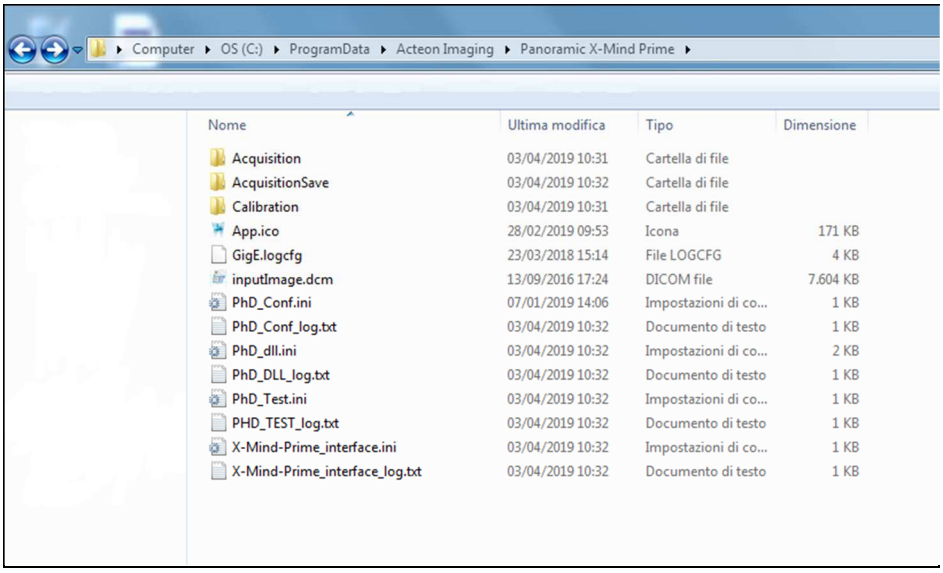


5. Wait the log file generation. A log file named "FirmwareTraces.txt" will be stored in the folder path C:\ProgramData\Acteon Imaging\LogServer.

11.2.2. POW files recovery

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

The POW files are not by default stored on the PC. To enable the files storing, open the file C:\ProgramData\Acteon Imaging\Panoramic X-Mind Prime\PhD_dll.ini:



Modify the "GENERATE_POW_FILE" value from 0 to 1:

```
[BOARD]
TYPE=410

[LAN]
ADRESSE_IP_DSPU=192.168.0.211


;*****************************************************************
[OPTION]
ESPION=0
; 0 if you don't want to display states of the digital X rays system.
; 1 if you want to display step states of the digital X rays system.
FILES=0
; 0 if you don't want to save pictures on hard disk.
; 1 if you want to save pictures during image processing on your hard disk.
LOG_FILE_DAYS=30
; Log file (states of the digital X rays system) is saved on hard-disk LOG_FILE_DAYS days.
GENERATE_POW_FILE=1
; 0 if you don't want to generate a POW file at the end of image tranfert.
; 1 if you want to generate a POW file at the end of image tranfert.
SENSOR_DRIVER_MANUFACTURER_TRACES=0
; 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=0
; 0 if you want to hide flat panel GigE manufacturer information
; 1 if you want to show flat panel GigE manufacturer information
NUM_POW_FILE=100
```

POW file will be stored in the folder C:\ProgramData\Acteon Imaging\Panoramic X-Mind Prime.

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 NOT OK, fix or replace the cable X1 and then the switching power supply G1..

2. If MCU H1 is ON, verify if the MCU LED H2 is ON.
   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 and X19) 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)

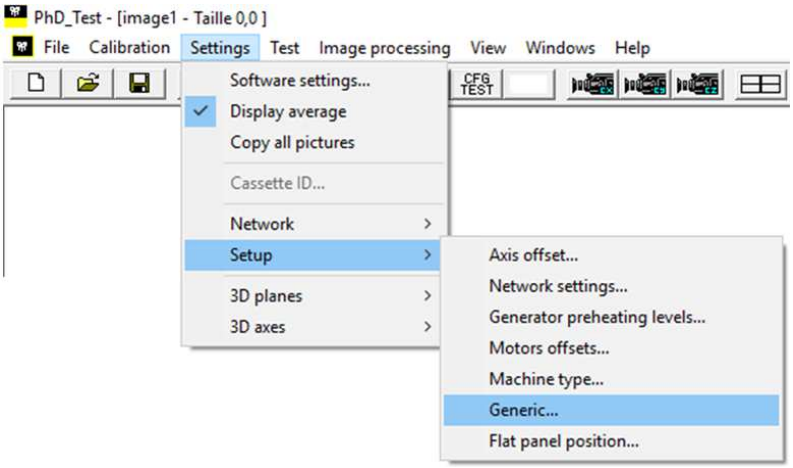
- IF the DSPU F1, F2 and F3 are OK, verify the integrity and the proper connection of the cable X8-J8:
  - IF the cable X8-J8 is NOT OK, replace or fix the cable X8-J8
  - IF the cable X8-J8 is OK, remove the J8 connector from DSPU and connect the X8 on the MCU board and verify the 24V between J8-pin1 and J8-pin2:
    - IF J8 24V is OK, the problem may be related to the DSPU board (see Error E1003 – see paragraph 9.2.8.2)
    - 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) and theirs cables as described in the troubleshooting of the Errors E200 ÷ E205 (paragraph 9.2.3.1) and E240 ÷ E243 (paragraph 9.2.3.3). Verify also that there are no short-circuits on cables X8-J8.

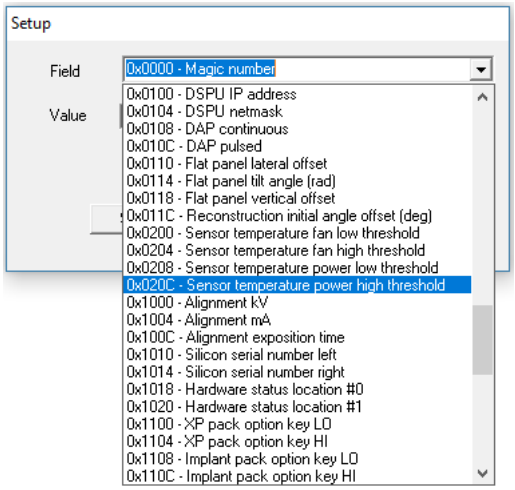
11.2.4. EEPROM Memory values verification and modification

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.

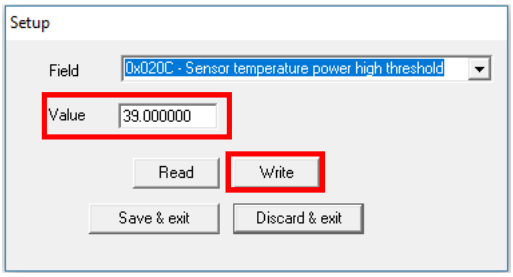
1. Switch ON the unit and when the green keyboard LED blinks slow press the >0< button.
2. Open the "PhD_test.exe" (folder path: C:\Program Files (x86)\Acteon Imaging\Panoramic X-Mind Prime and wait the unit connection.
3. Click on the menu Settings→Setup→Generic:



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

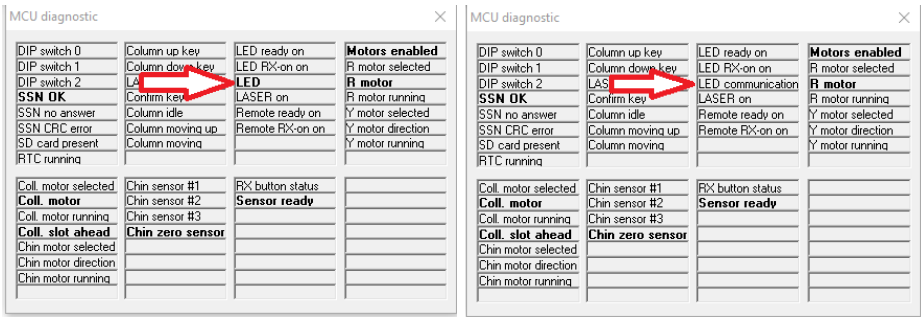
If in the "Value" field the number is preceded by the prefix "0x", means that it is expressed in hexadecimal base. In this case refer to the DECIMAL values reported on the right of the field:

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

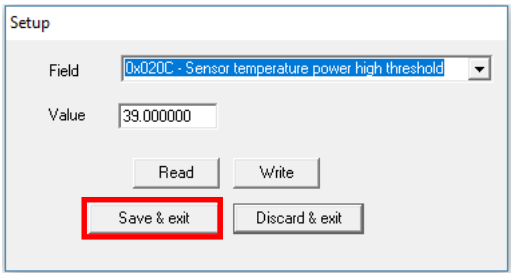
5. Wait the blue keyboard LED blink.

Note

In case of remote technical session: the BLU LED blinking state it signaled 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).

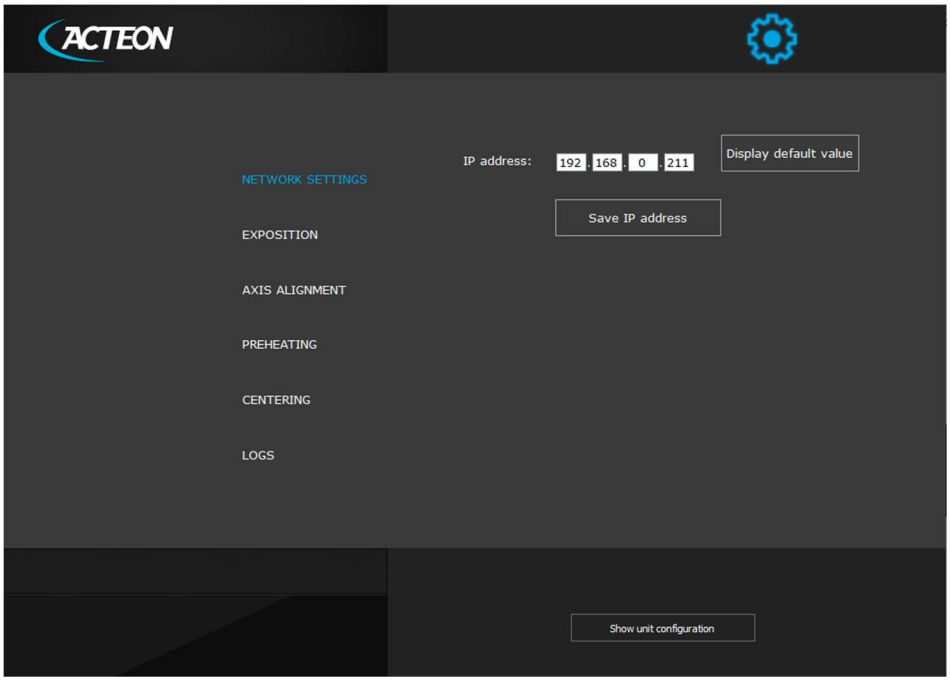


7. Switch OFF the unit.

11.2.5. DSPU IP address modification and factory reset

11.2.5.1. DSPU IP address modification

1. Enter service menu (see chapter 8).
2. Select the "Network Settings" page (see paragraph 8.1).



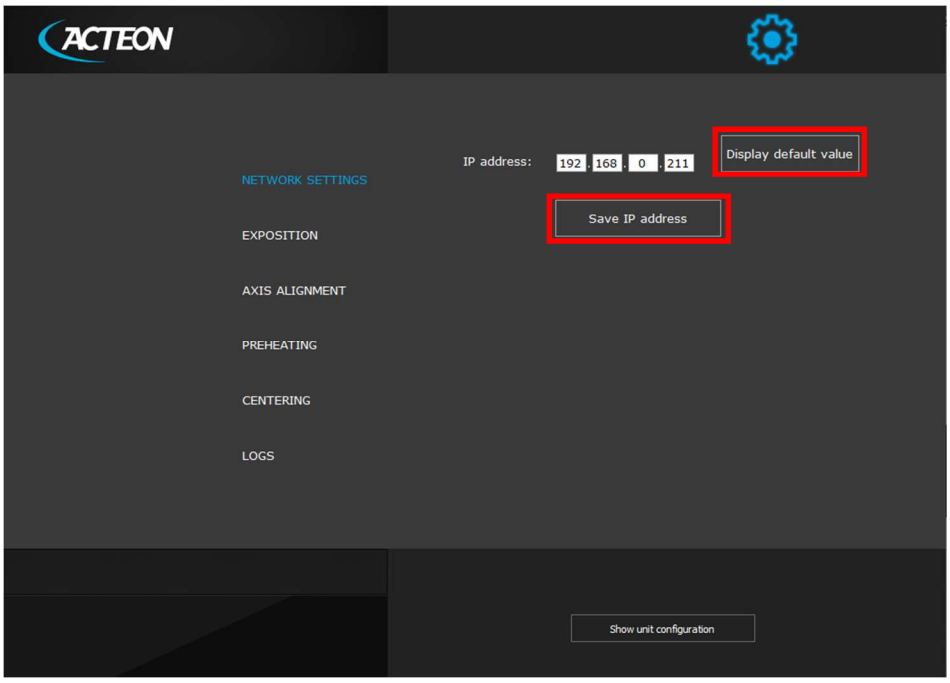
3. Change the IP address; the message "IP was changed, trying to reconnect" will be displayed.
4. Change the Network interface board IP with a valid one (see paragraph 7.7).
5. Wait until the unit connection.
6. When the unit is connected, close the service menu by clicking on the gear and wait the unit reboot.

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

11.2.5.2. 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).
5. Enter service menu (see chapter 8).
6. Select the "Network Settings" page (see paragraph 8.1).



7. Click on "Display default value" button and then on "Save IP address" button.
8. Wait the unit connection.
9. Exit the service menu by clicking on the gear.

Note
You can verify the current 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) and to the DSPU board.

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. 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.

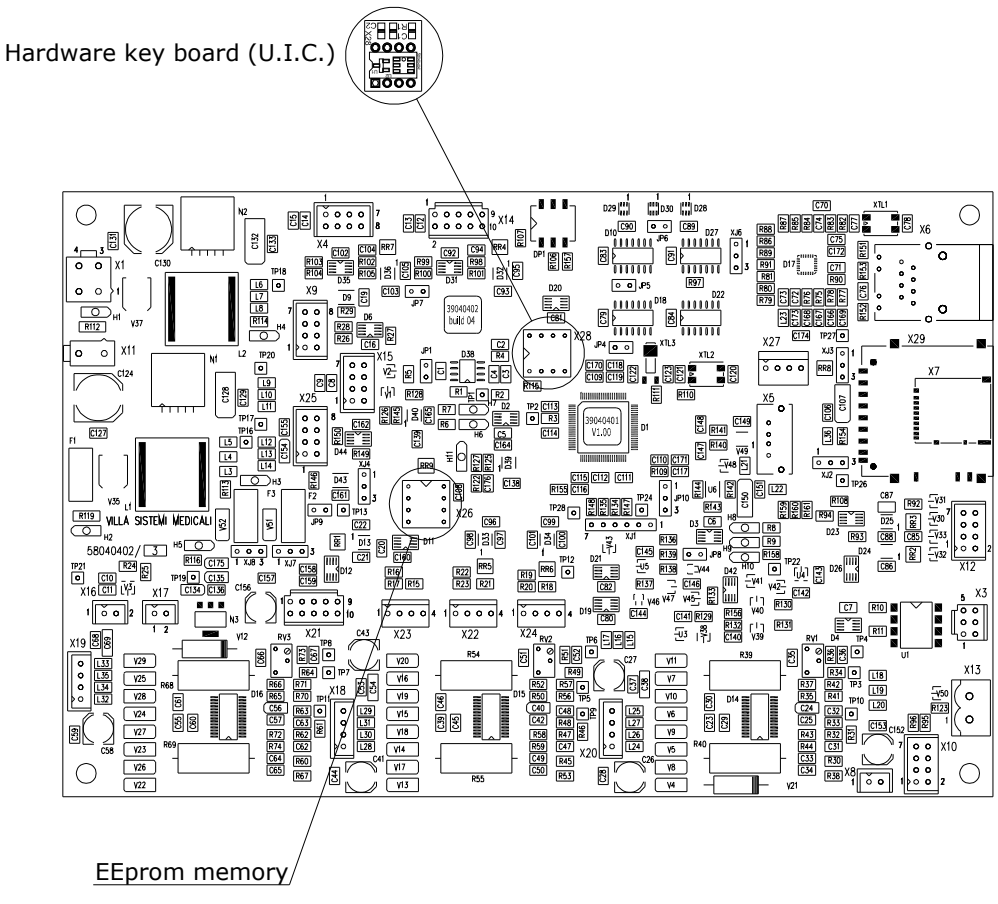
11.3.2. MCU board replacement

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 (see paragraph 14.1), following the procedure present on chapter 8.

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



11.3.3. Digital sensor replacement

Digital sensor is fixed with two pins, that define the position. No adjustment are allowed in the sensor area.
It is always required to perform X-ray beam centering verification (see paragraph 7.9) and make the standard verification on image quality before to make examinations with patients.

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:

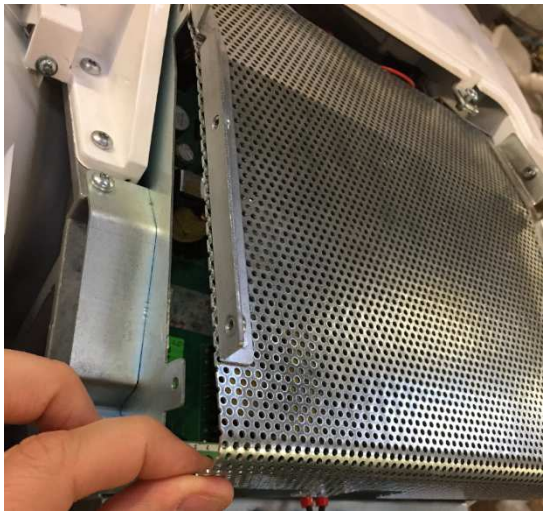


Figure 35

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":

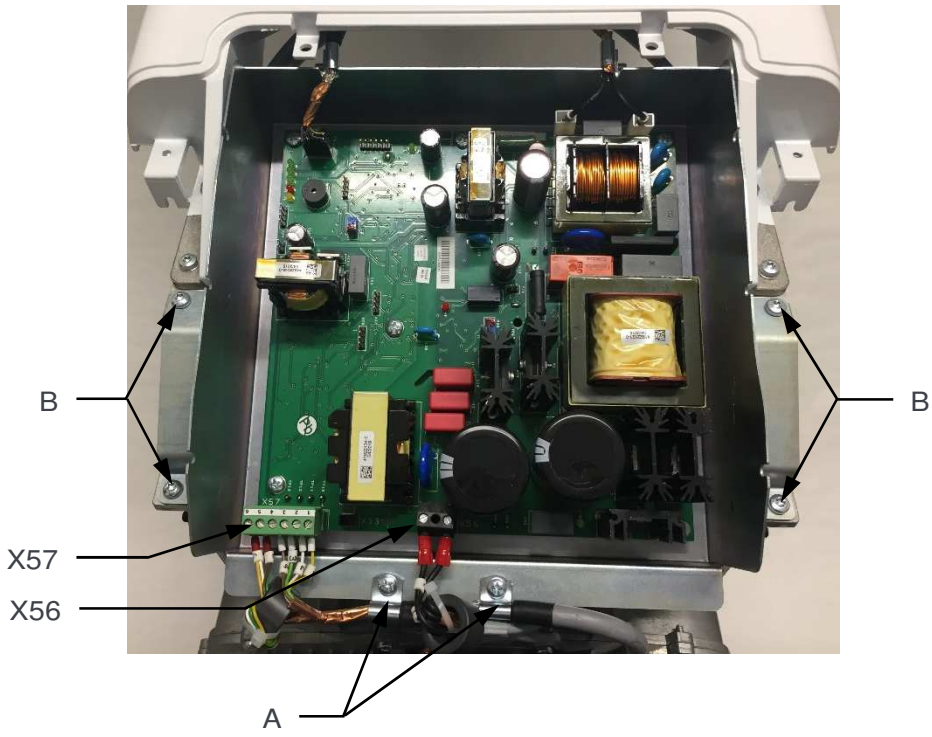


Figure 36

5. Pull up the generator board.

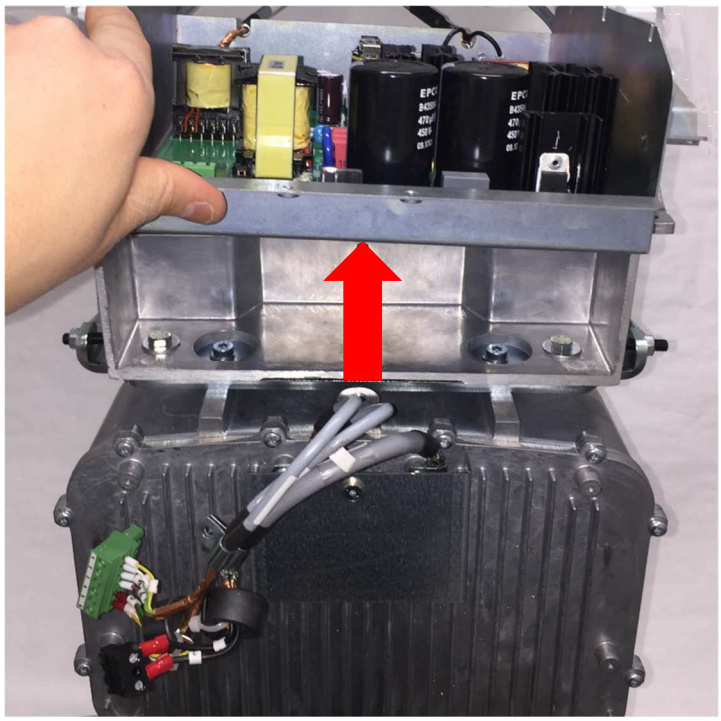


Figure 37

Note
The presence of a second operator is required during the following steps.

6. While the first operator hold the tubehead with two hands, the second unscrew the generator board screws "C".

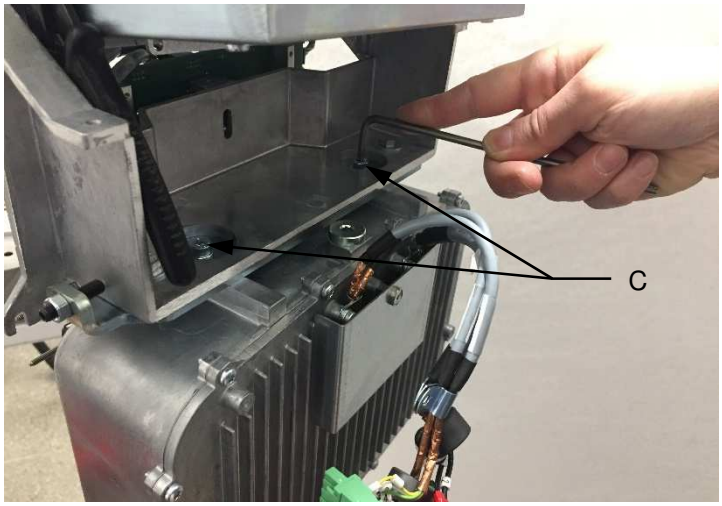


Figure 38

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 38).

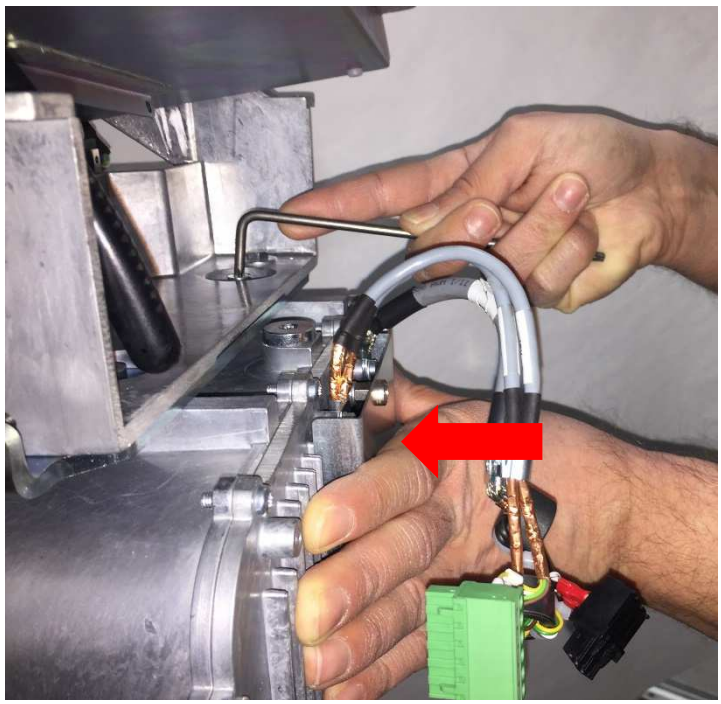


Figure 39

8. Connect X56 and X57 connectors and fix the cables fixing clamps "A" (Figure 36).
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 8.6).

13. In case the beam is not centered to the sensor, loosen the screws "C" (Figure 38) and act on screws "D" and "E" (Figure 41) 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)

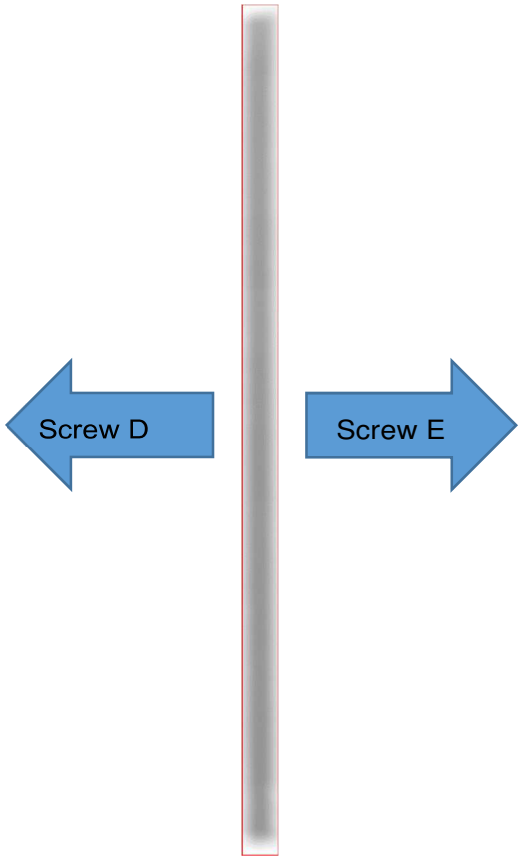


Figure 40

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

Figure 41

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.

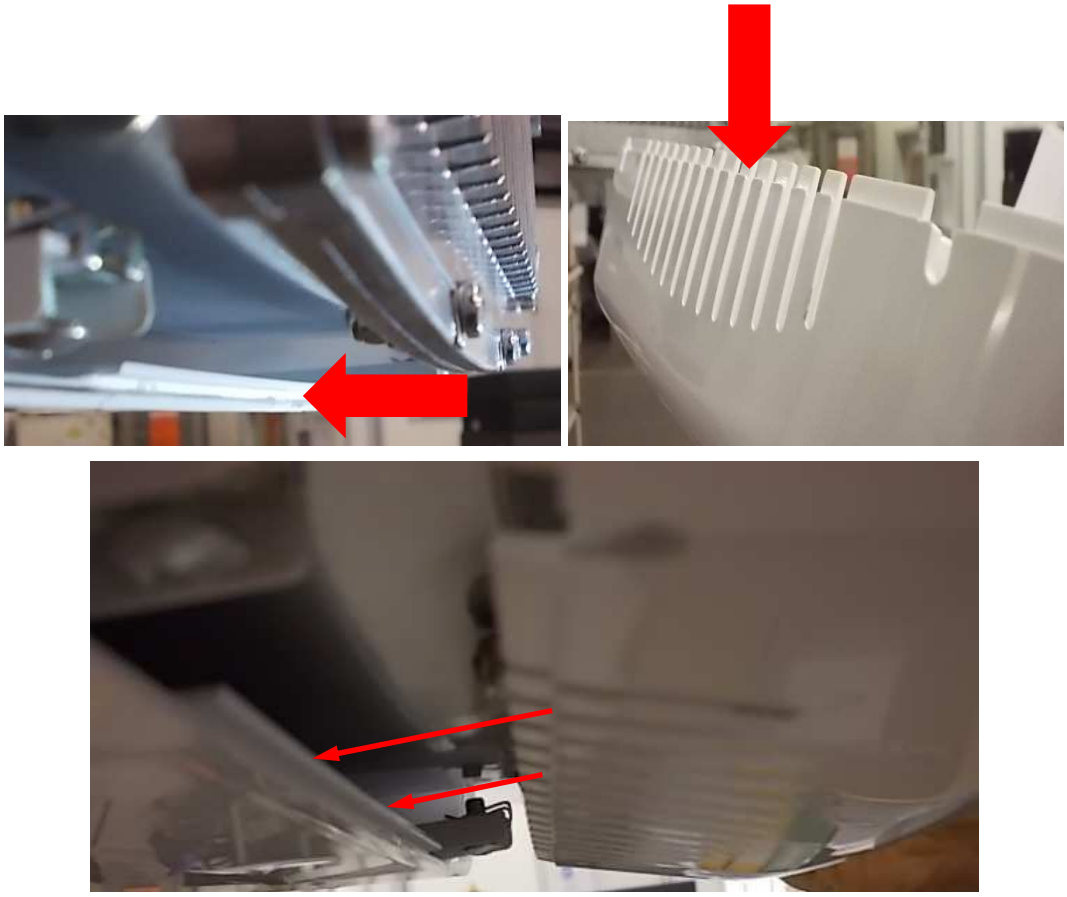


Figure 42

18. Perform a panoramic symmetry verification (see paragraph 7.9).

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 43

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 44

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

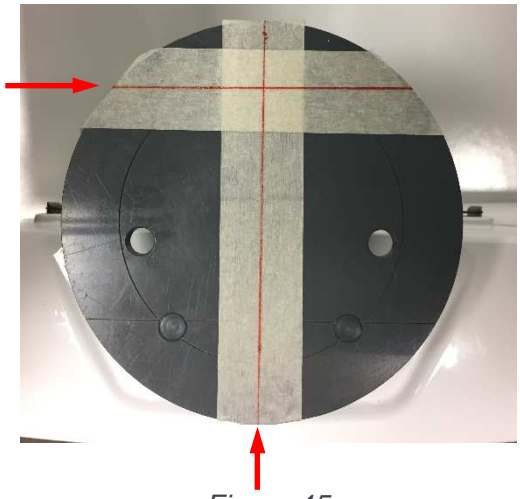
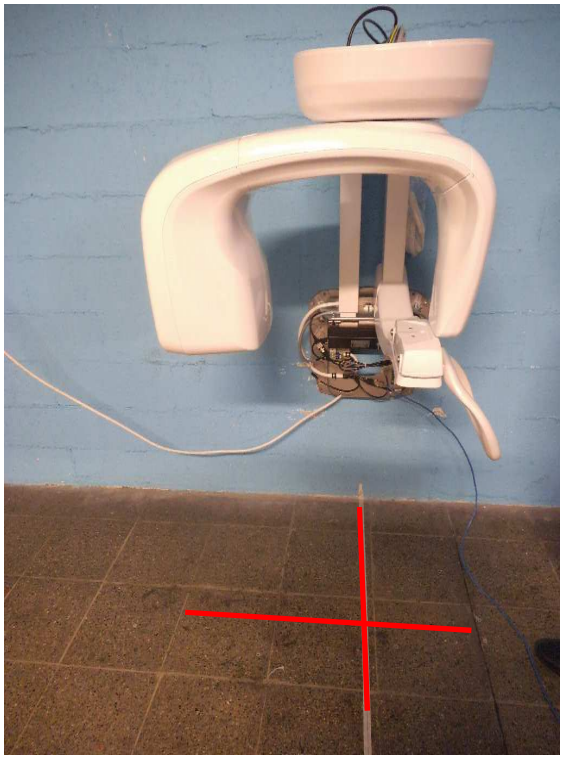


Figure 45

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 46

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

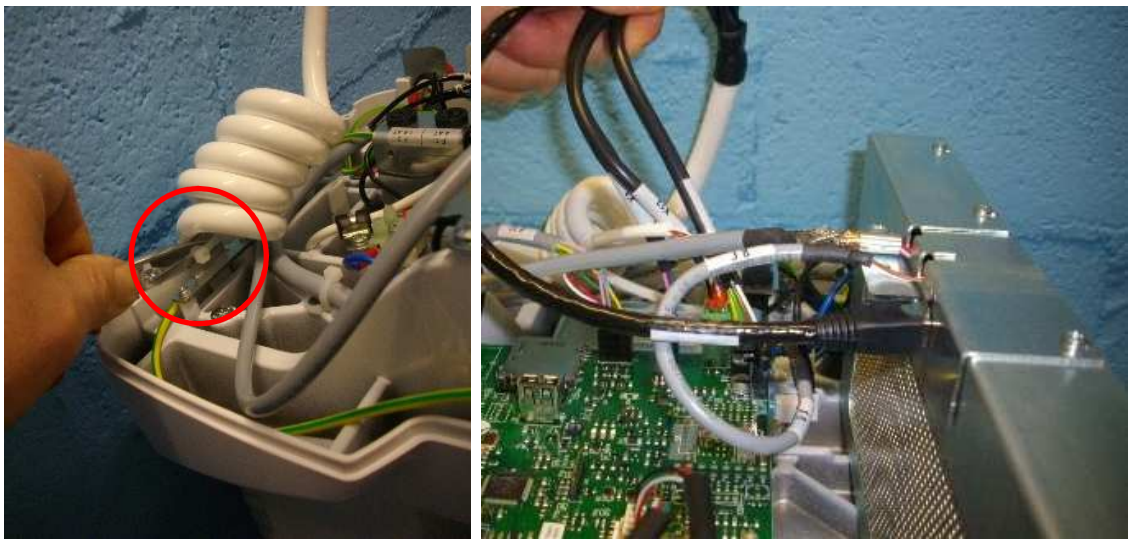


Figure 47

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

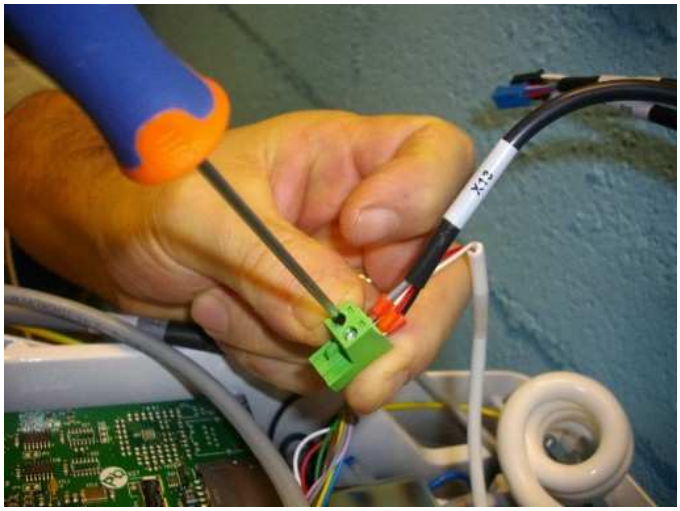


Figure 48

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

Figure 49

13. Cut lower strip.

Figure 50

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

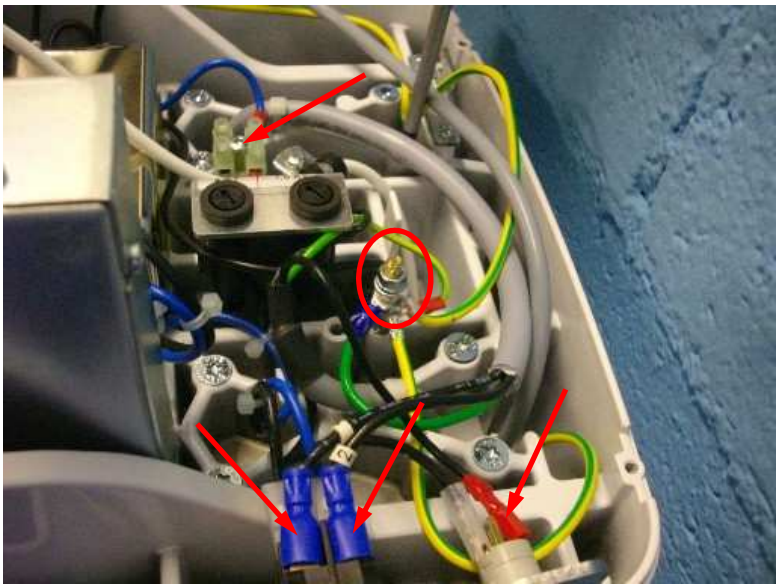
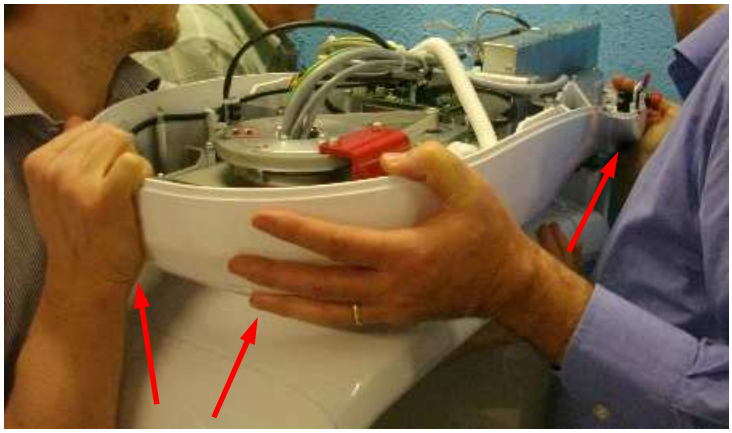


Figure 51

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

Figure 52

Note
Two person 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.

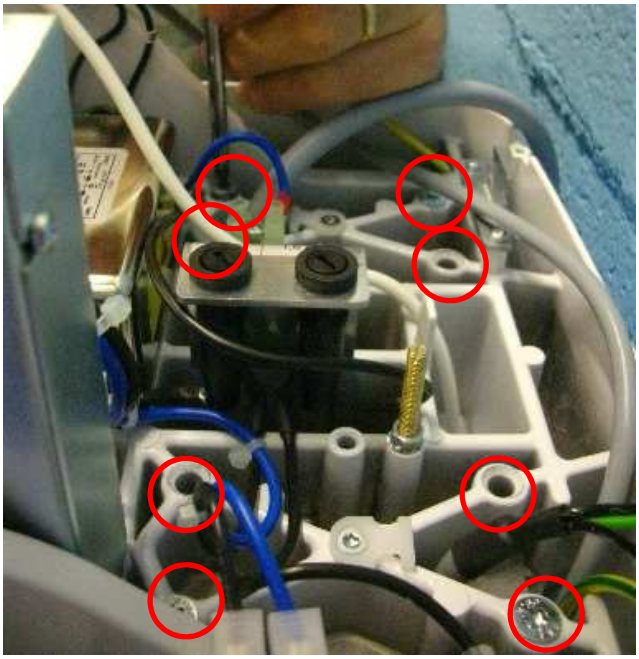


Figure 53

17. Pass the cables out of rotating head.

Figure 54

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

Figure 55

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.

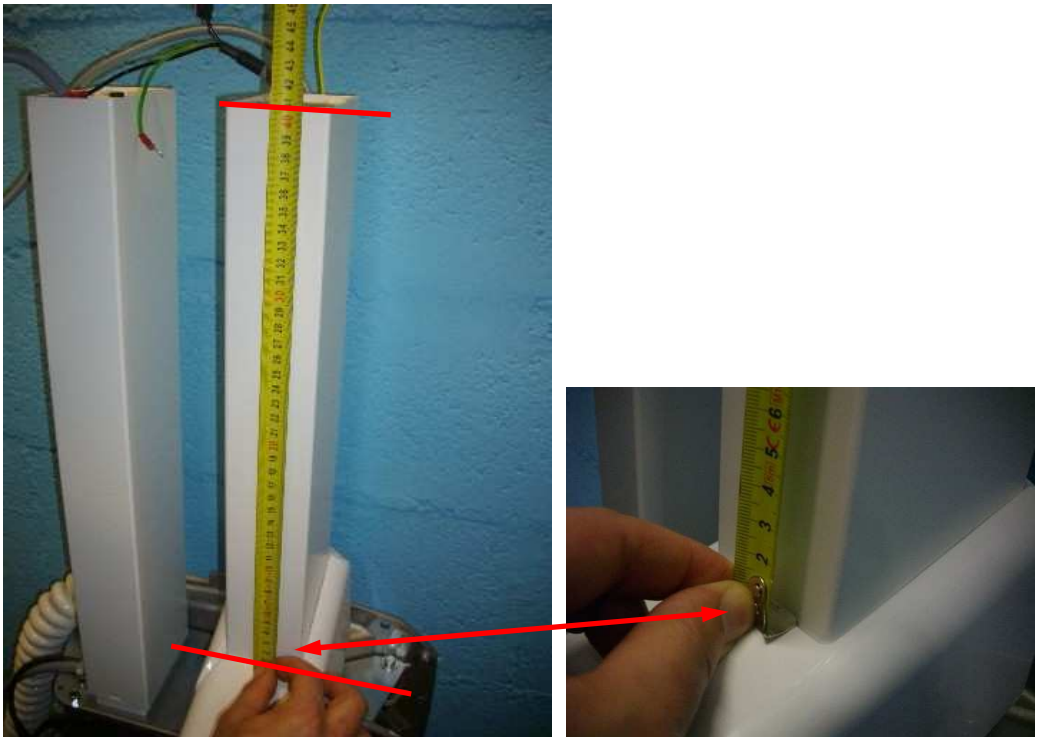


Figure 56

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

Figure 57

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

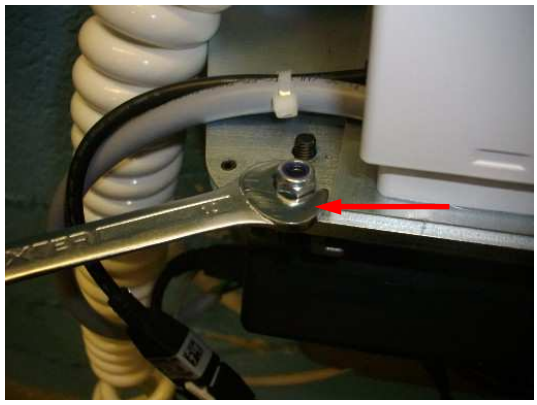


Figure 58

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

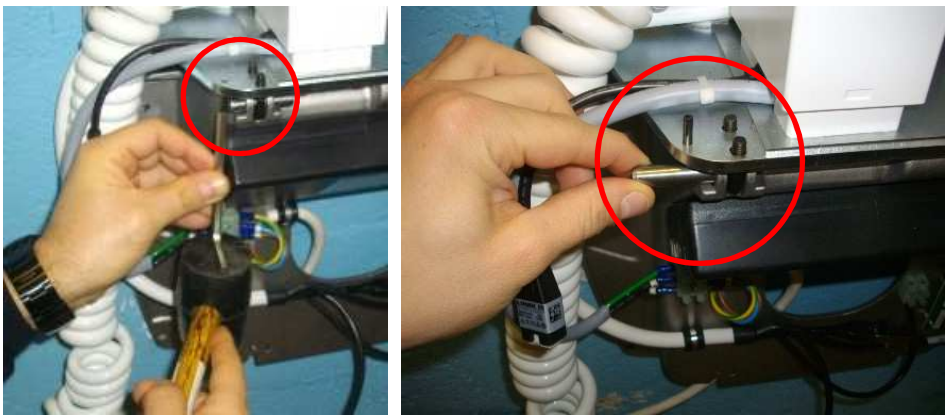


Figure 59

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

Figure 60

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

Figure 61

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

Figure 62

26. Remove the lower cover from chin support.

Figure 63

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

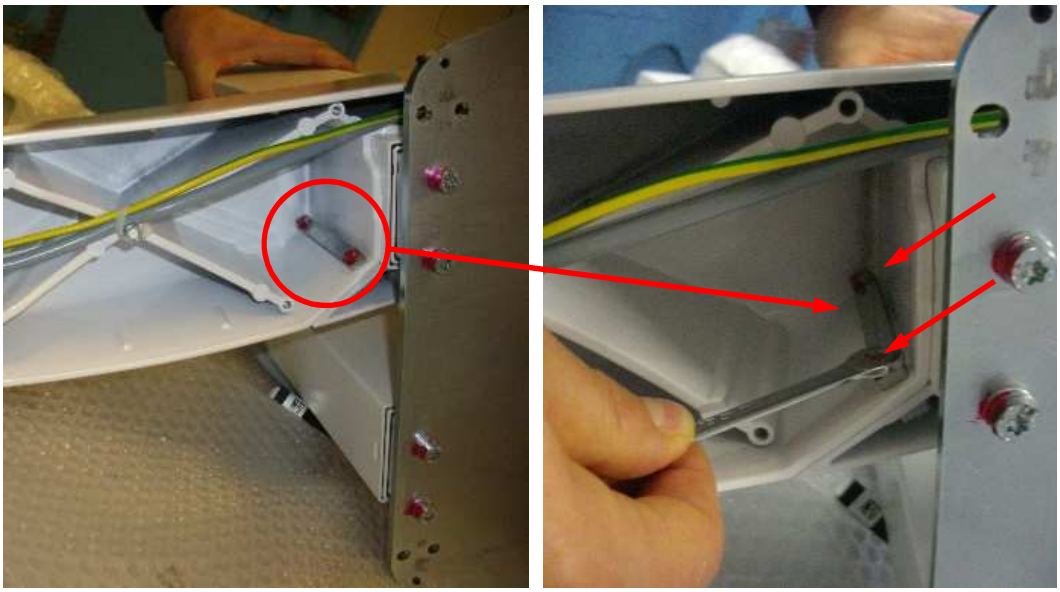


Figure 64

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

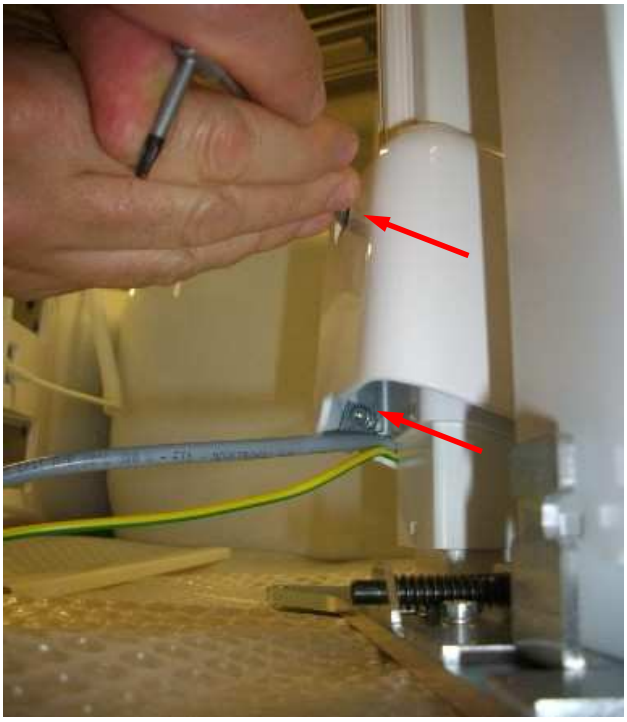


Figure 65

29. Slide the arm out of the column.

Figure 66

30. Remove the control box from the wall plate.

Figure 67

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

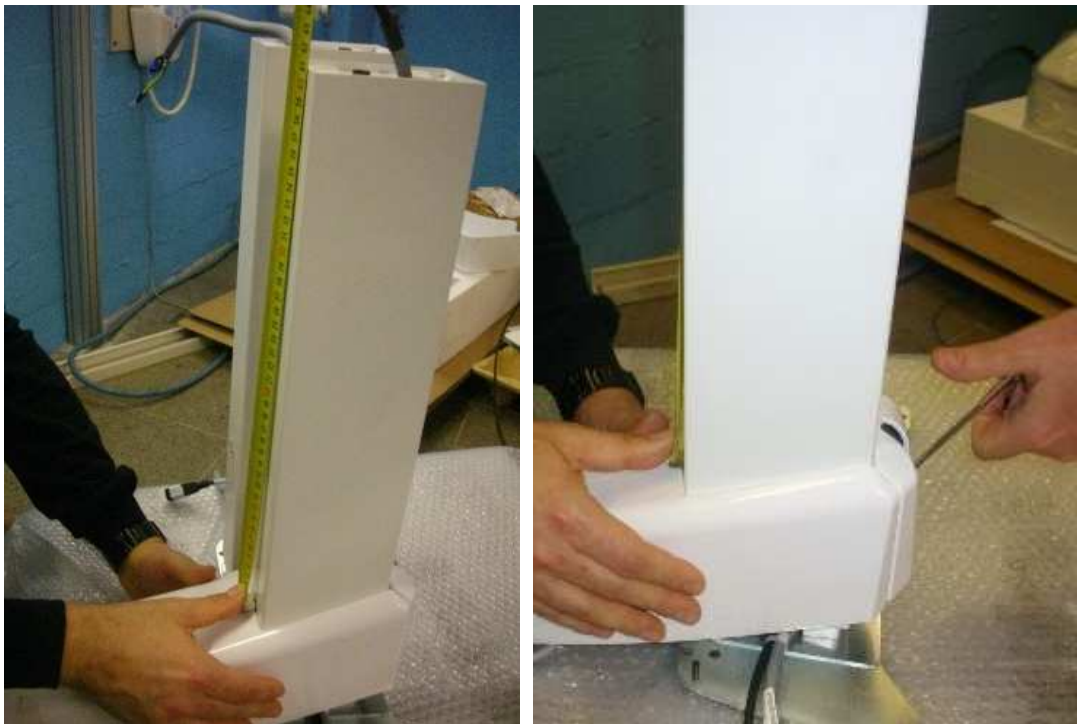


Figure 68

32. Close the arm lower cover.

Figure 69

33. Mount the new control box.

Figure 70

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

Figure 71

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

Figure 72

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

Figure 73

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

Figure 74

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

Figure 75

39. Position the head on the columns.

Figure 76

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

Figure 77

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

Figure 78

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 79

43. Remove the rotating arm fixing plate.

Figure 80

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 53) 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 7.9.

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.

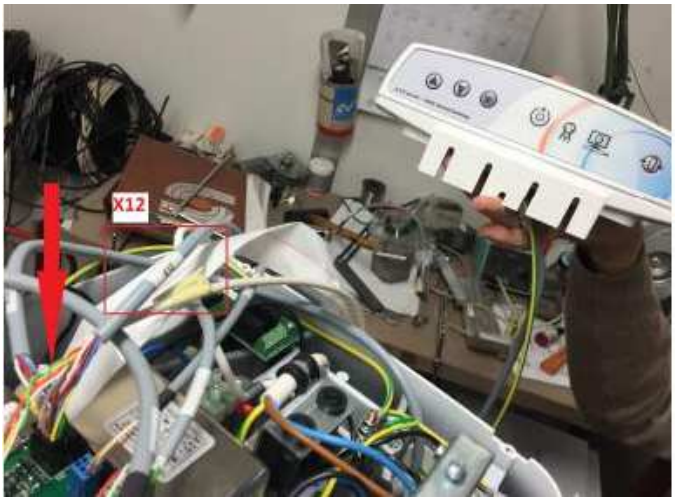


Figure 81

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 82

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 83

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

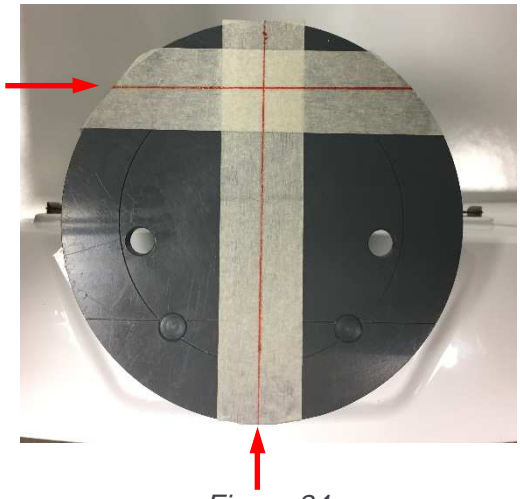
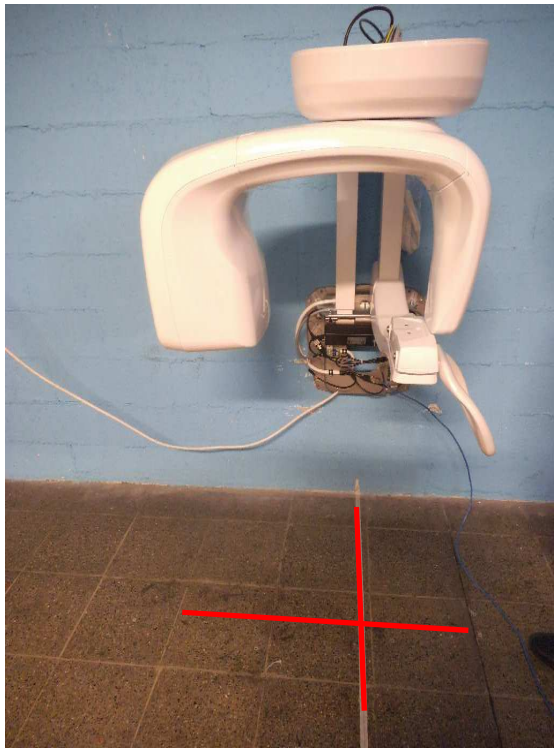


Figure 84

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.

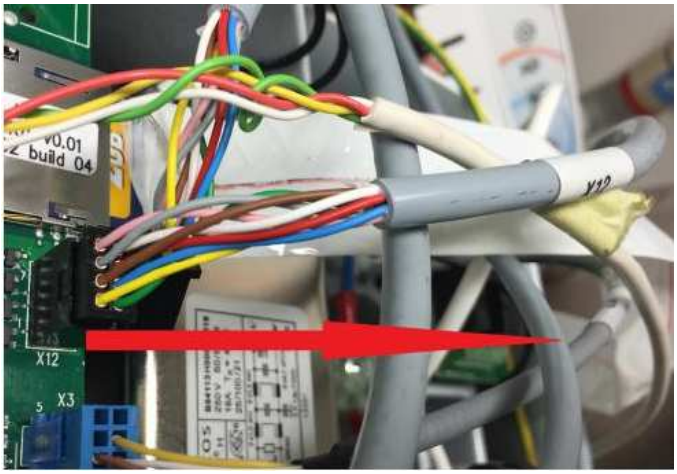


Figure 85

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

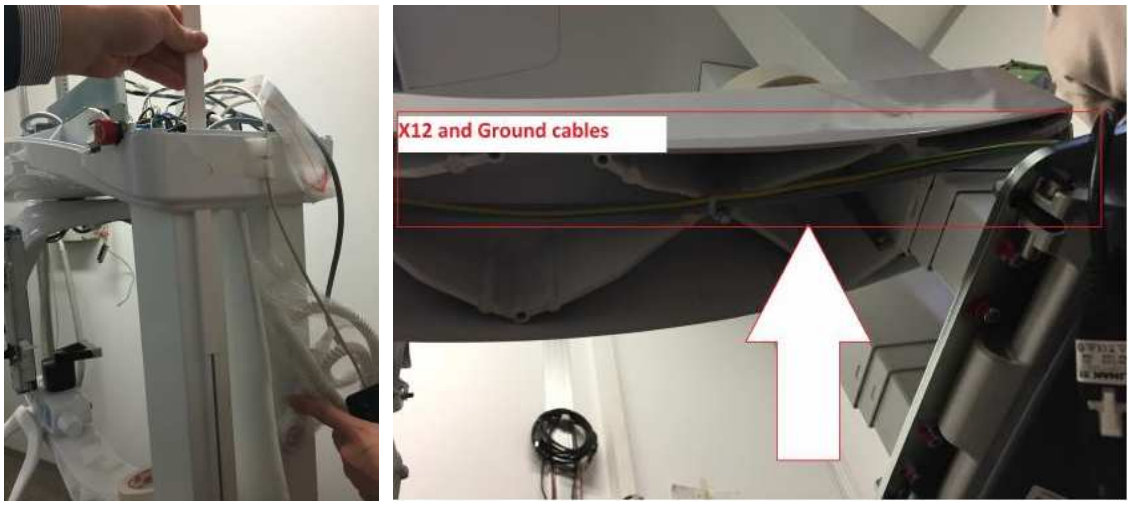


Figure 86

12. Unscrew the two screws under the arm.

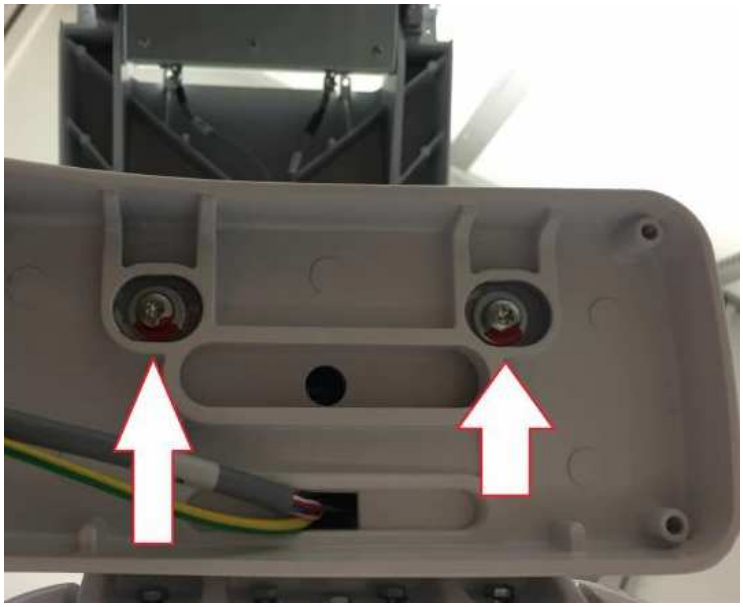


Figure 87

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 7.9.

12. SCHEMATICS AND DRAWINGS

1 – General diagram

2 – Layout MCU PCB A1

3 – Layout Generator PCB A2

4 – Layout External signal PCB A8

5 – Layout DSPU PCB A4

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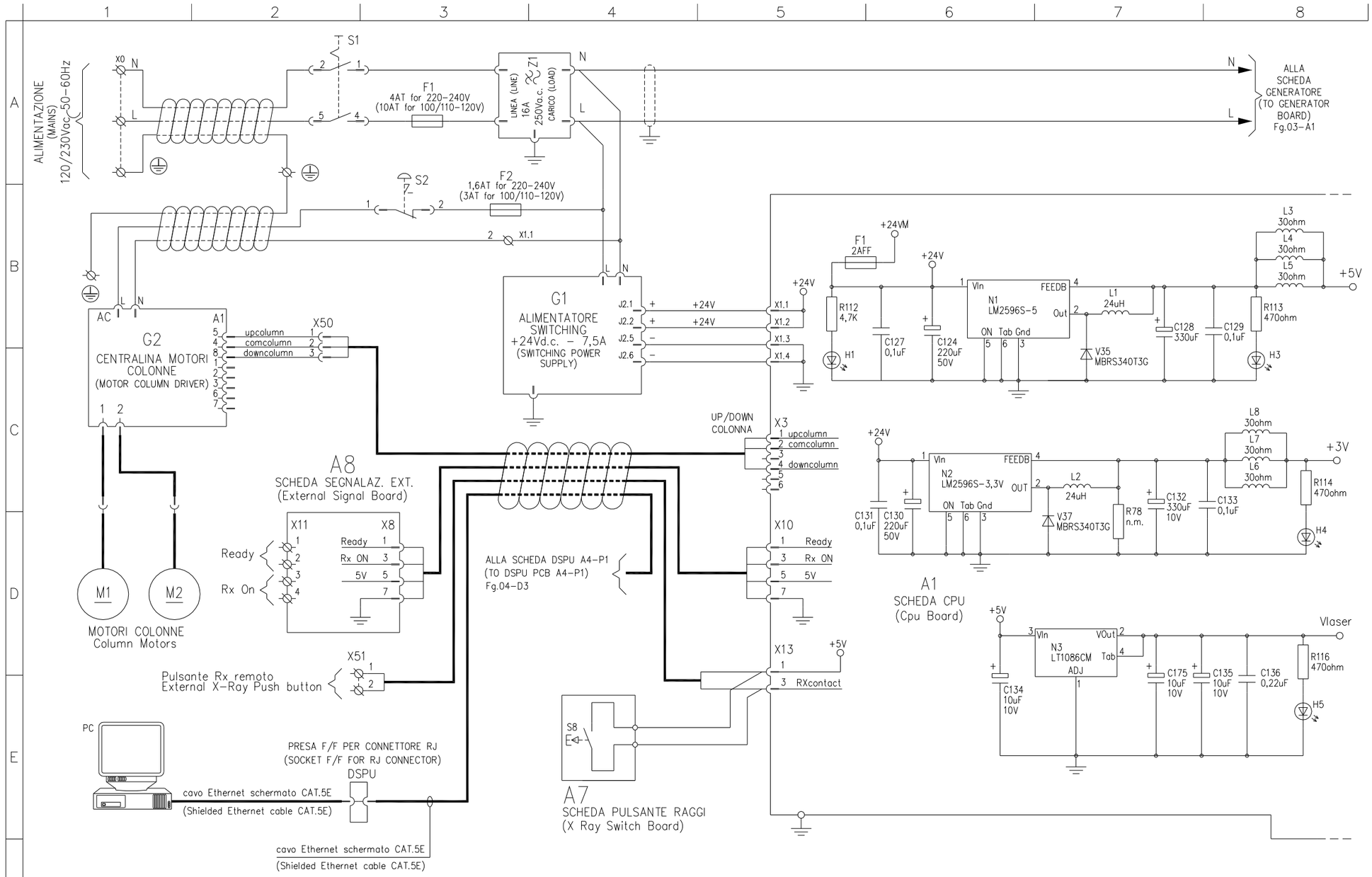
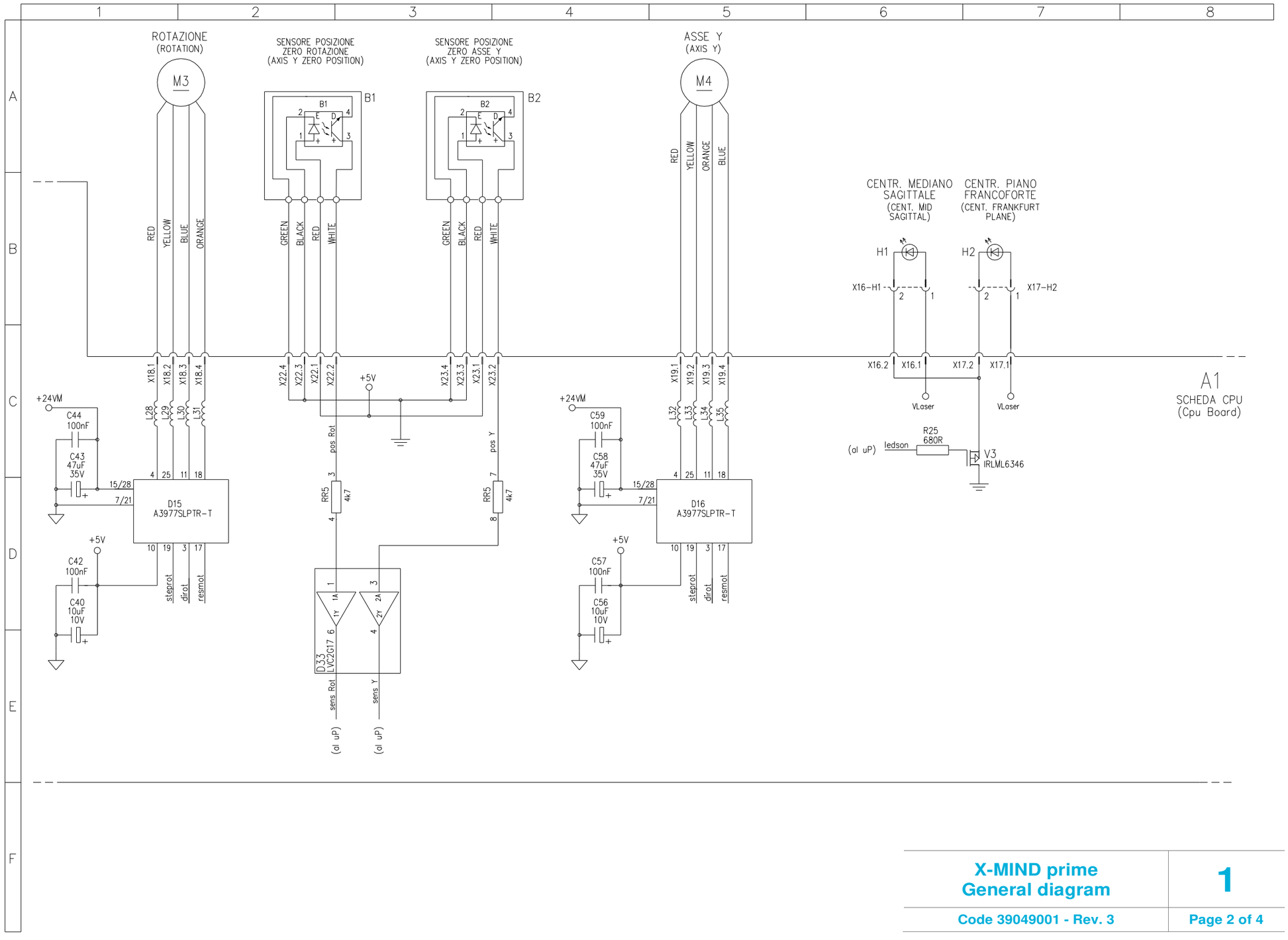
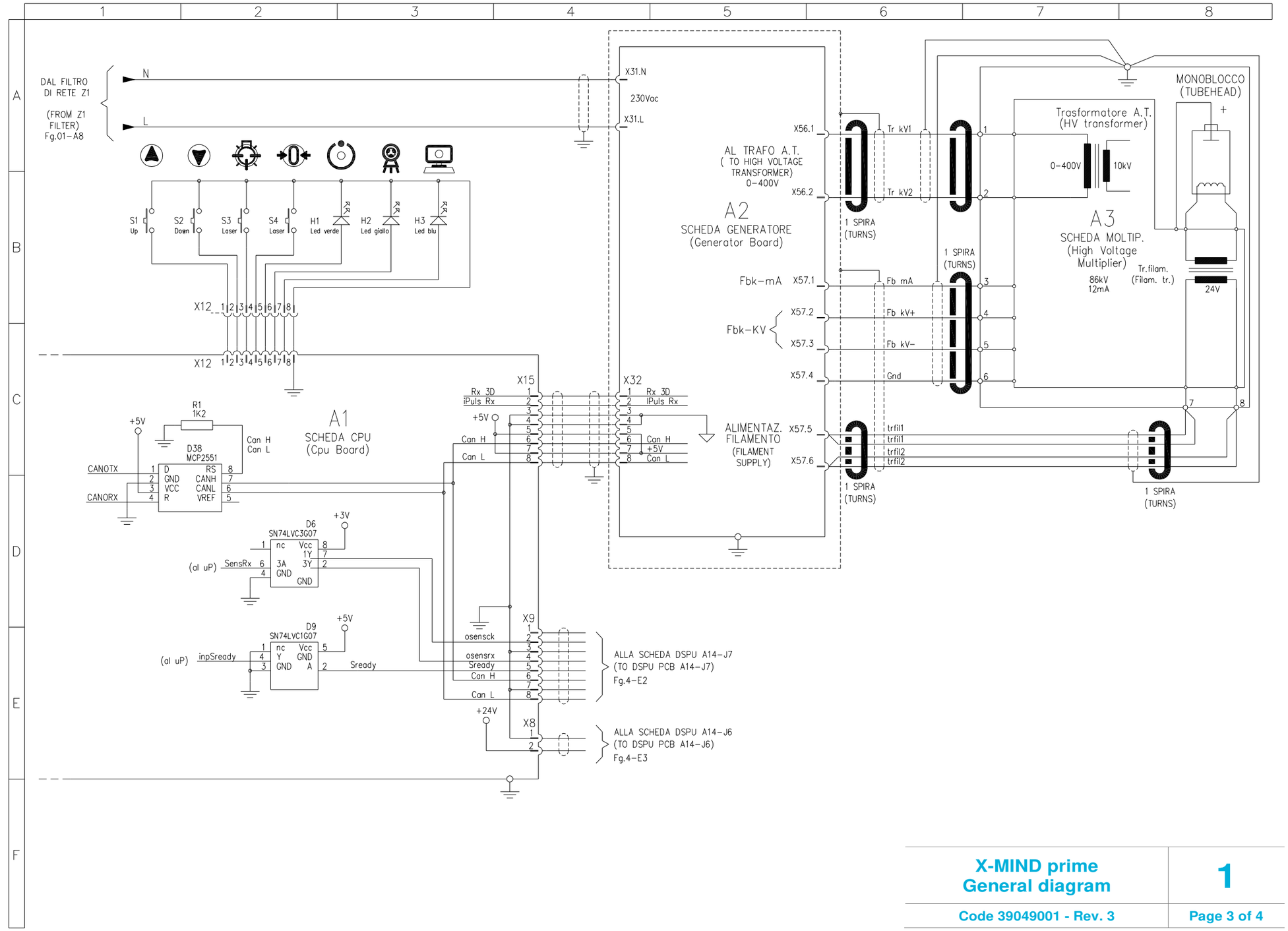


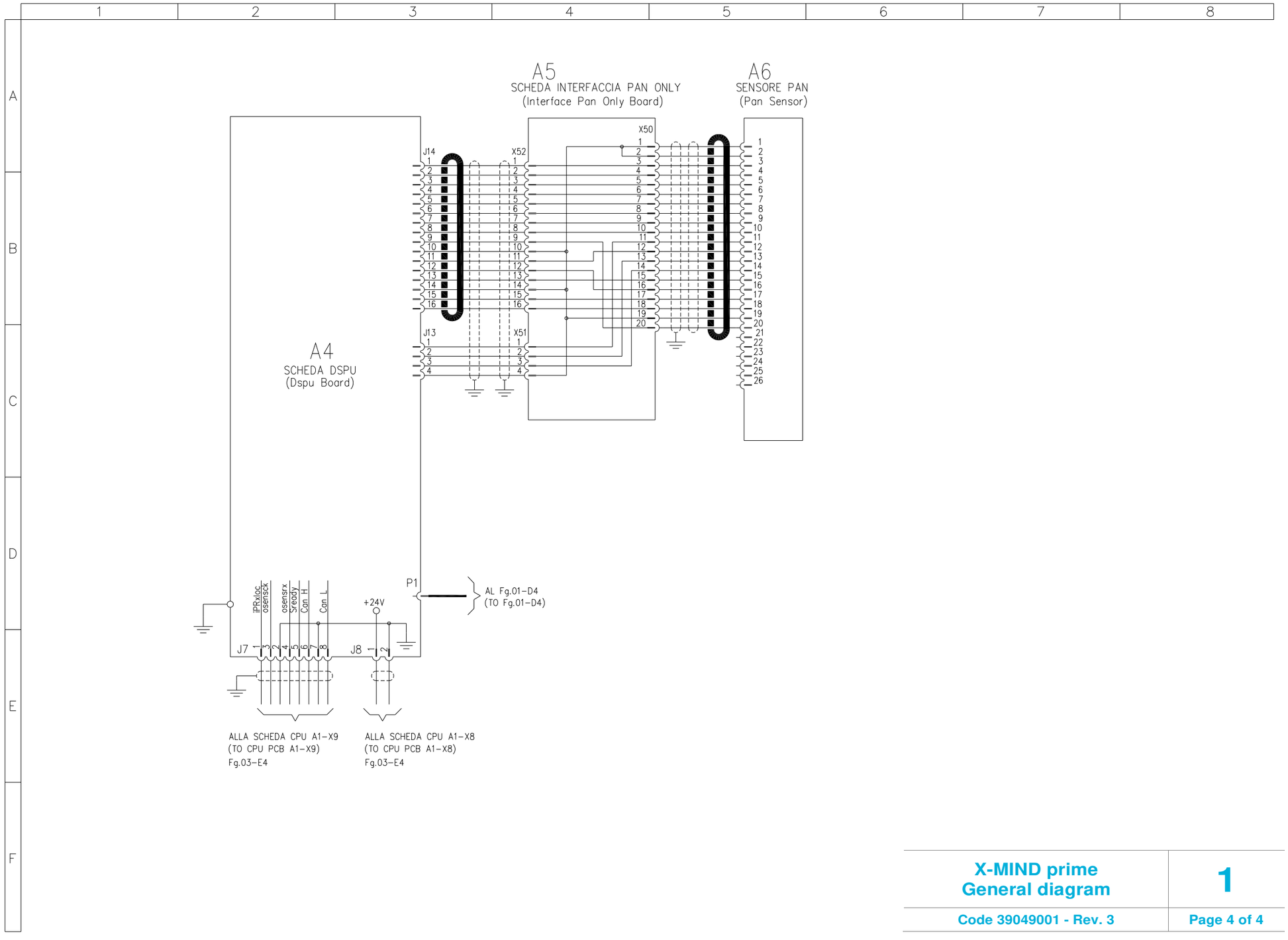
X-MIND prime General diagram	1
Code 39049001 - Rev. 3	Page 1 of 4



X-MIND prime General diagram	1
Code 39049001 - Rev. 3	Page 2 of 4

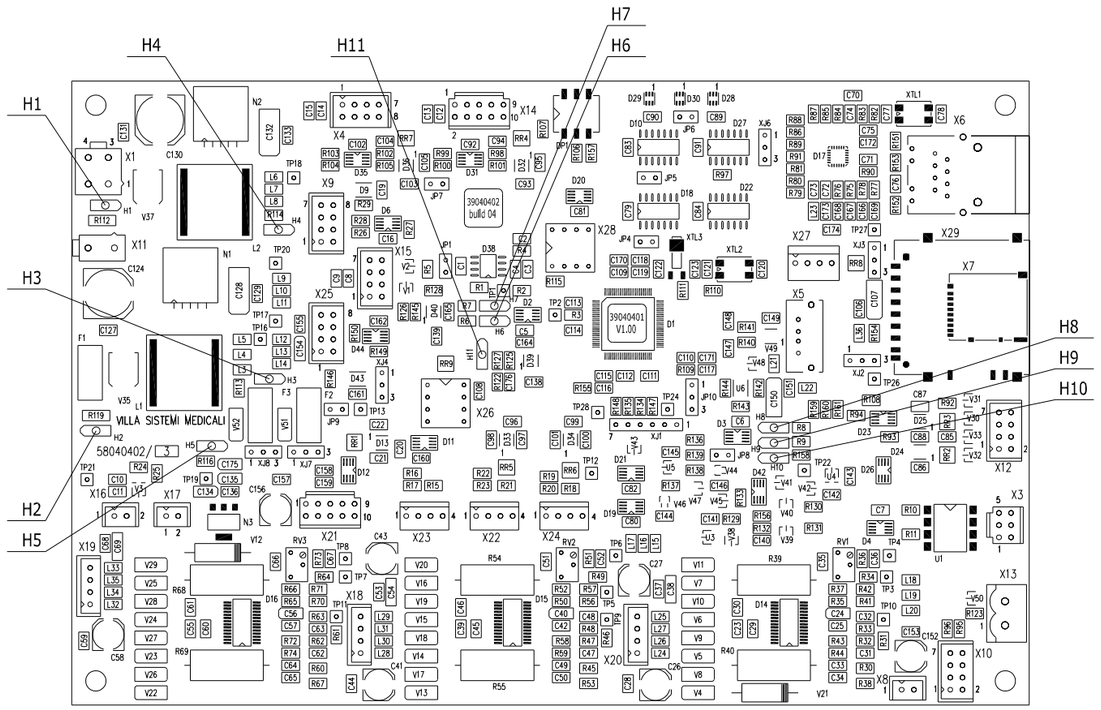


X-MIND prime General diagram	1
Code 39049001 - Rev. 3	Page 3 of 4

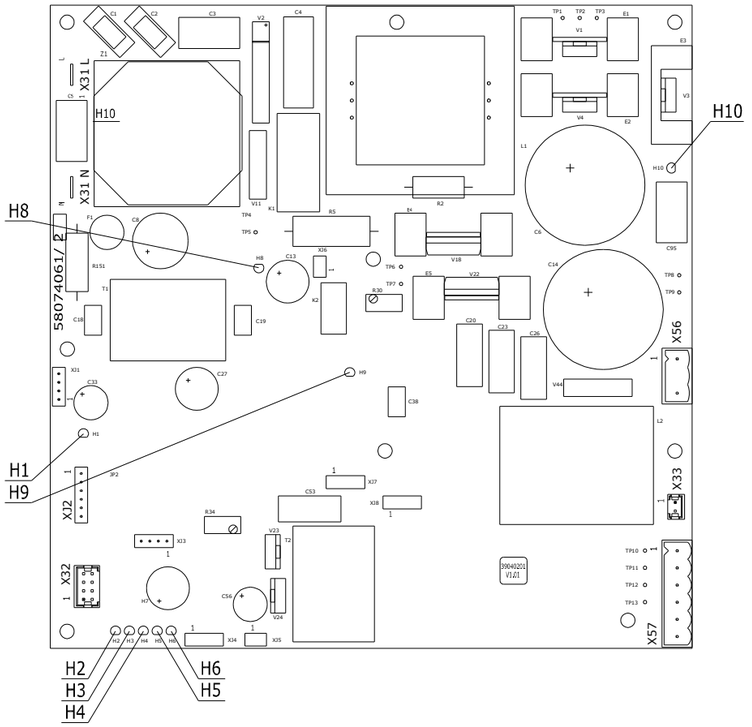


X-MIND prime General diagram	1
Code 39049001 - Rev. 3	Page 4 of 4

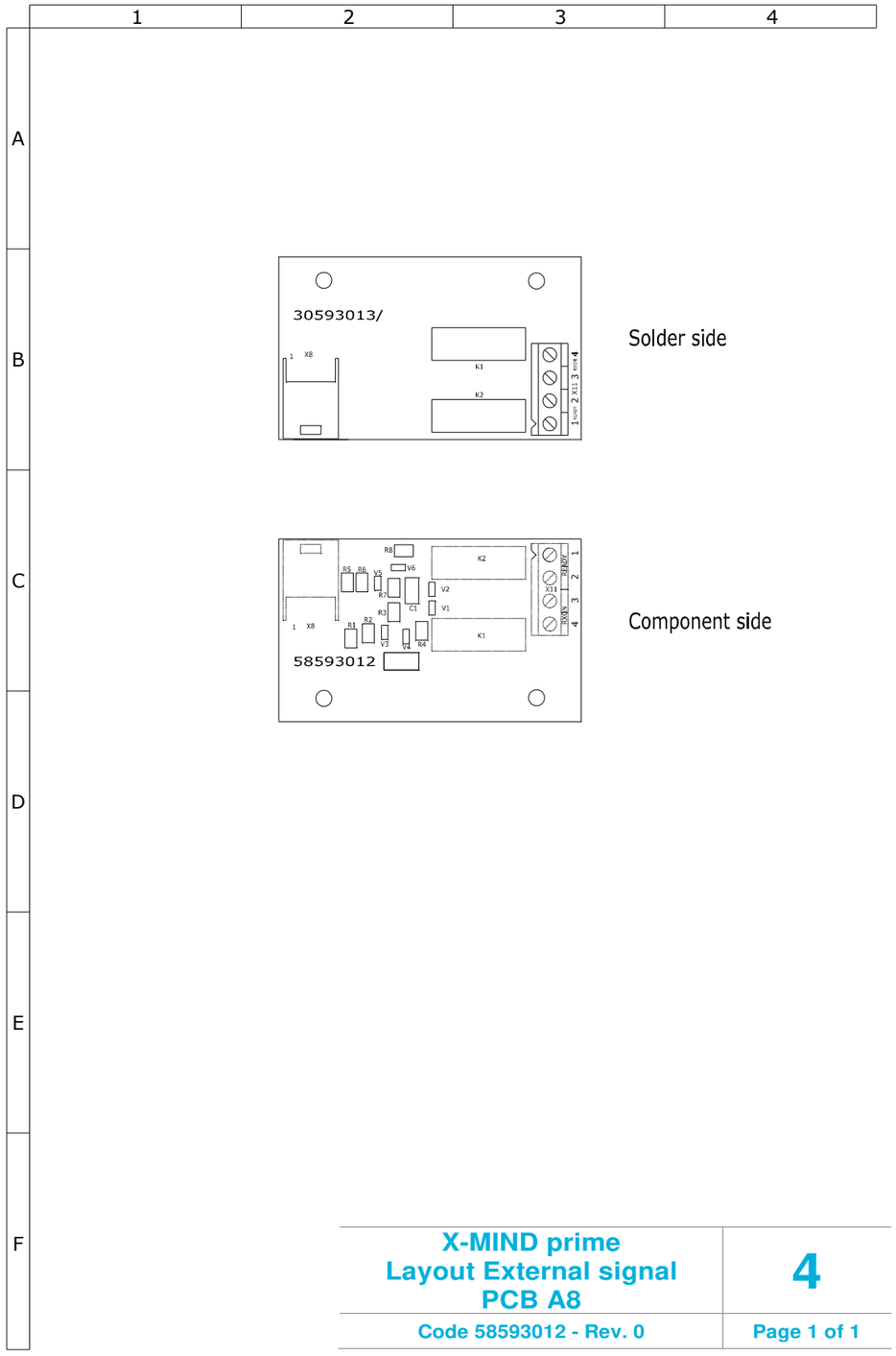
	1	2	3	4	5	6	7	8
A								
B								
C								
D								
E								
F								



X-MIND prime **Layout MCU PCB A1**	**2**
Code 58040402 - Rev. 3	**Page 1 of 1**



X-MIND prime Layout Generator PCB A2	**3**
Code 58074061 - Rev. 2	**Page 1 of 1**



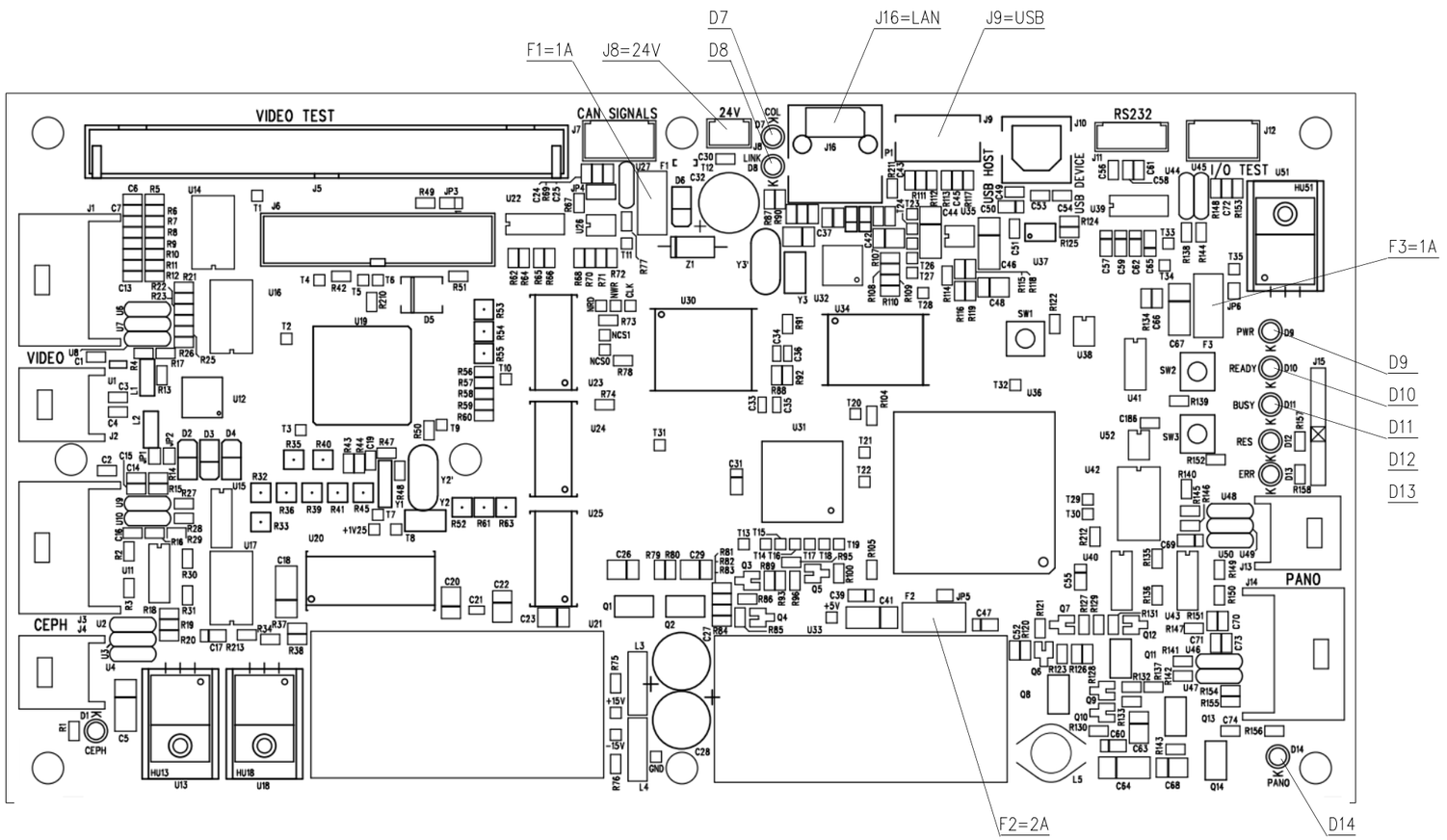
Solder side

Component side

X-MIND prime Layout External signal PCB A8	4
Code 58593012 - Rev. 0	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 Layout DSPU PCB A4	5
Code 46954788 - Rev. 4	Page 1 of 1

13. SPARE PARTS

1 – Top side of the unit

2 – Rotating arm

3 – Up/Down Column

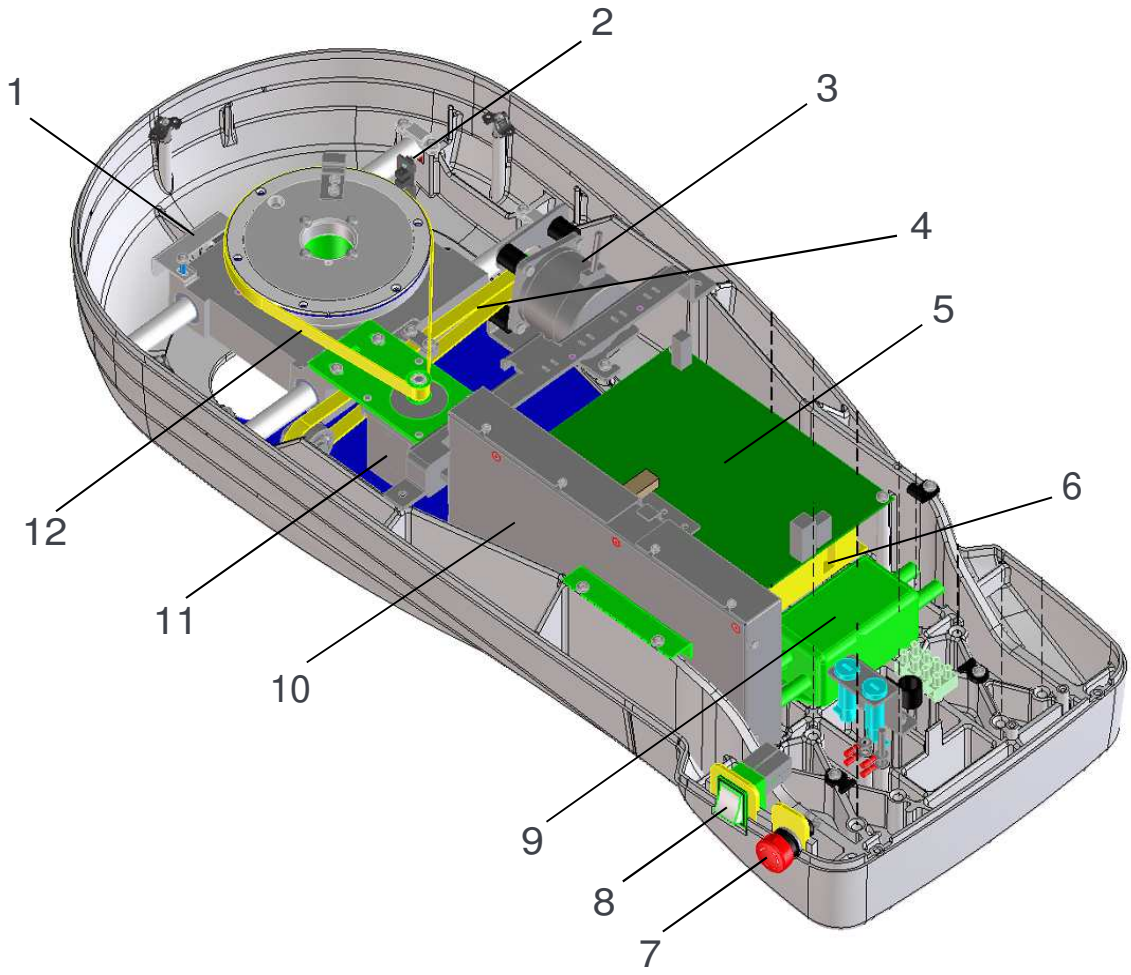
4 - Cables

5 - Covers

4 - 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	6604040200	Y axes motor assy	
4	4990807000	Y movement belt	
5	5804040200	MCU board	
6	4492823000	Power supply board	
7	4291421400	Emergency pushbutton	
8	4291420900	ON/OFF Switch	
9	4192212200	Main filter	
10	4695478800	DSPU board	
11	6604040100	Rotation motor assy	
12	4990806900	Rotation belt	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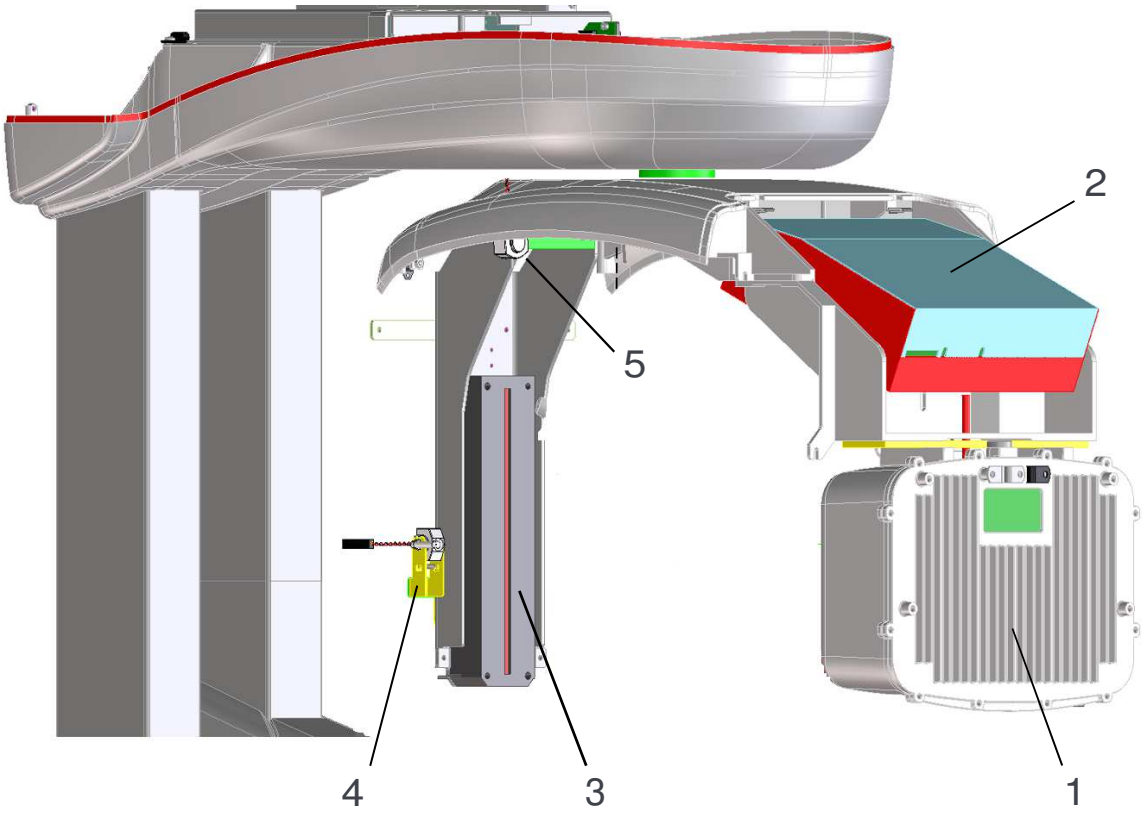
2 - Rotating Arm

Ref.	Order code	Description	Note
1	6604000000	Tube head assy	
2	5807406100	HF board	
3	4695443500	Digital sensor	
4	6604020100	Frankfurt laser assy	
5	6604020000	Sagittal laser assy	
6	6604010400	Chin support assy	
	6104010800	Kayboard assy	
7	6604010112	Temple clasp right	
8	6604010212	Temple clasp left	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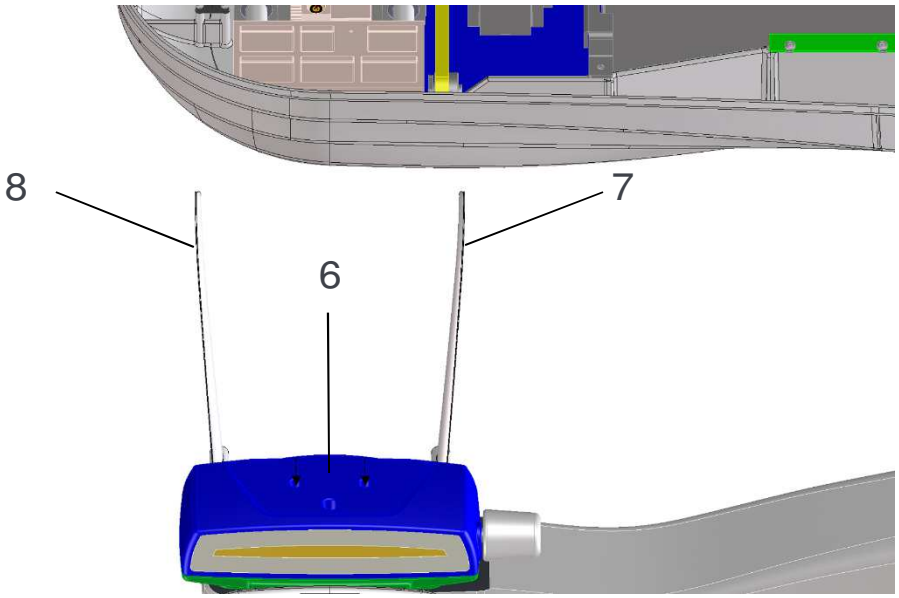
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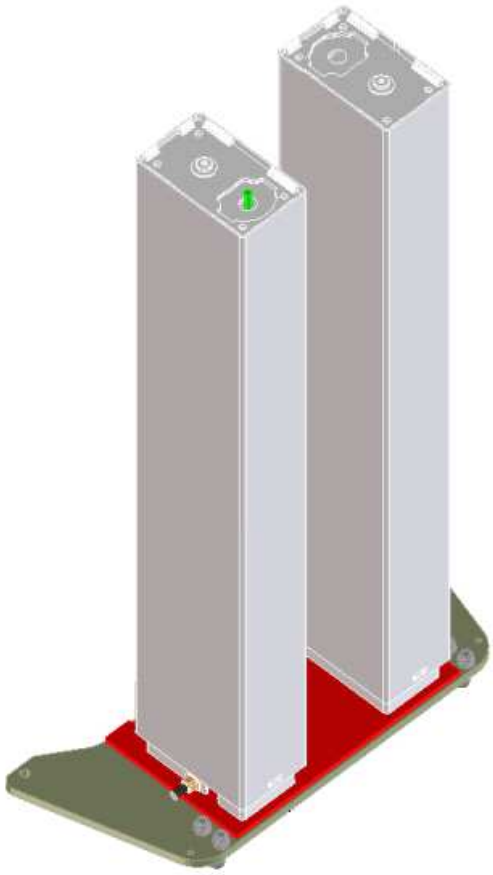
3 – UP/DOWN Column

Ref.	Order code	Description	Note
1	6604101300	UP/DONN Column assy	
--	4492707700	Linak control board	

Note
Kit includes both column adjusted and assembled to the support plate and the relevant control box.

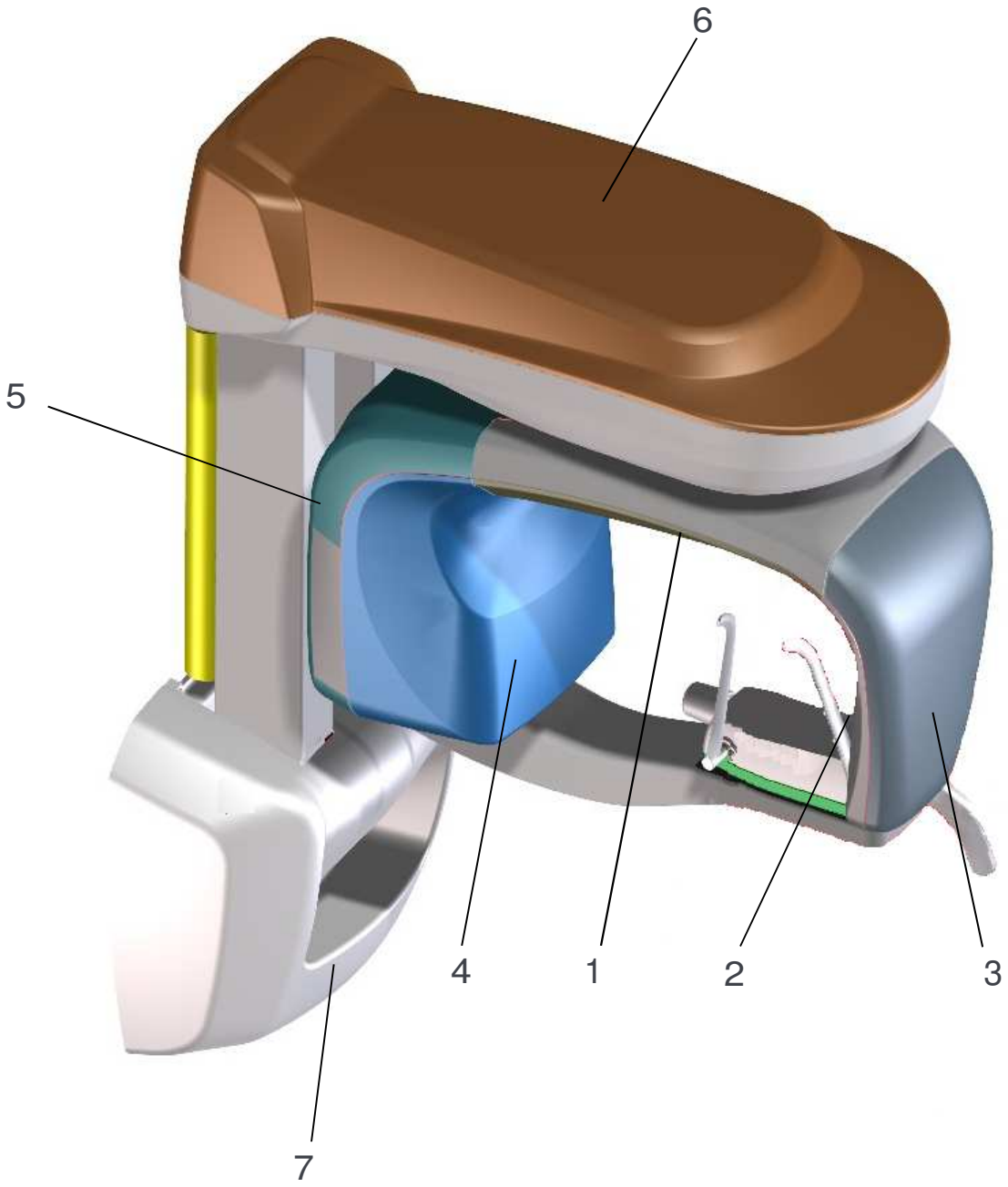


4 - Cables

Ref.	Order code	Description	Note
--	6104090800	X-ray push button with cable	
--	6204100500	Main coiled cable	
--	6204040500	Laser cable 1	
--	6204040600	Laser cable 2	
--	6204040100	HF board power supply cable Z1 / X31	
--	6204040200	HF board signal 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	
--	5007090100	Ethernet cable CAT 5E	

5 - Covers

Ref.	Order code	Description	Note
1	6604020305	Rotating arm lower cover	
2	6604020505	Sensor internal cover	
3	6604021005	Sensor external cover	
4	6604020205	Tube head internal cover	
5	5404020621	Tube head external cover	
6	6604041105	Upper cover	
7	6604100121	Wall plate cover	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6 - Accessories and Service Tool

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	
--	6607099800	TMJ positioner	
--	6107110800	TMJ positioner protective sleevers (60 pcs)	
--	6695190000	Service tools kit	

14. APPENDIX

14.1. Appendix A: Setup parameters table

The following table lists those adjustment parameters stored in the unit during factory testing and that must be re-entered into the non-volatile memory in case of replacement of the MCU board (A1). This is due to the fact that the new MCU board, provided as a spare part, has been factory tested from the functional point of view, but contains only default parameters which are not related to the unit where it will be installed.
Entering of the listed parameters can be performed through the service programs (see chapter 8).

Note
The information listed in the table are the technical parameters set during factory testing. Preferences set by the user (e.g. exposure parameters different than the default ones) are not listed.

The table also has columns with blank cells. These cells must be filled in when, during installation or during the life on the unit, any of the listed parameters will be modified (e.g. after replacing a motor or a positioning sensor).

X-MIND prime

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						
Bitewing Y offset						
Y Jaw type (mm)						
Tubehead pre-heating values	2mA					
	3mA					
	4mA					
	5mA					
	6mA					
	7mA					

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