



DENTALAIRE DC

Installation and Maintenance Manual

EN



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DENTALAIRE DC
Installation and Maintenance Manual
Edition ENGLISH

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1. INTRODUCTION

The accompanying documentation provided with the device includes:

DOCUMENT NAME	CODE
DENTALAIRE DC user manual	691000210
DENTALAIRE DC installation and maintenance manual	691000220
Paper template for wall support fixing (only for wall mounted version)	661000100

1.1 Skills of the installer / maintainer technician

Skills:

- Connecting equipment to the power network.
- Installation of x-ray equipment.
- Knowledge of radiation protection regulations.
- Knowledge of English (basic comprehension of technical texts in English).

1.2 Symbology

List of symbols used in this manual and device labels:

	Low voltage directive compliance mark.		Manufacturer.
	Attention, possible dangerous situation can harm the patient or operator.		Manufacturer date.
	Prescription, potentially harmful situation that could harm the product. Also used for other important information.		The symbol is located on the device label and indicates to follow the instructions for use.
	Avoid cutter.		Device weight.
	Instruction for use.		Use, transport and storage temperature limits.
	Serial number.		Reference number.
	Separate collection, not disperse into the environment. Dispose of the product in accordance with the regulations in force.		Use, transport and storage humidity limits.
	Warning electrical shock.		Warning x-rays.
	Do not step onto the base plate or legs.		Carry the mobile unit by the appropriate handle.
	Switch OFF.		Use, transport and storage pressure limits.
	Switch ON.		Type B applied part.
	Small focal spot.		Inherent filtration.
L	Mains phase 1 live.	N	Mains neutral.



N*	Mains phase 2.
	Non-ionizing electromagnetic radiation.
	Irradiation light on control panel.
	Earth.

	Protective earth (PE).
	Irradiation light on remote switch.
	Irradiation command on remote switch.

1.3 Acronyms

AC	Alternating current	L	Line Conductor
AWG	American wire gauge	N	Neutral Conductor
BLD	Beam Limiting Device	MSG	Messages
CB	Connection board (PCB bridge)	PC	Personal Computer
DAP	Dose Area Product	PCB	Printed Circuit Board
DC	Direct Current	PE	Protective earth
EC	European Community	PHT	Pre-Heating Time
EG	Ground Conductor	QR	Quick Response
ELM	External Light Module (PCB signalling light)	QSPI	Quad serial peripheral interface
EMC	Electromagnetic Compatibility	REF	Reference
ESD	Electrostatic Discharge	RF	Radio frequency
FDA	Food and Drug Administration	RJ	Registered Jack
FIL	Filament	SAE	Society of Automotive Engineers
FM	Floor Mobile	SN	Serial number
FW	Firmware	SSD	Source Skin Distance
HLV	Half Value Layer	THA	Tube House Assembly
HMICPU	Human-Machine Interface + Central Processing Unit	TP	Test point
HV	High Voltage	US	United States
ID	Identification	USB	Universal Serial Bus
IEC	International Electrotechnical Commission	WEEE	Waste from Electrical and Electronic Equipment
IP00	Ingress Protection	WM	Wall Mounted
ISO	International Organization for Standardization		

1.4 Technical Specifications

POWER SUPPLY	
Nominal Line Voltage	120 - 230 V ± 10%
Line Frequency	50 - 60 Hz
Rated current	7 A at 120 V, 3.5 A at 230 V
Permissible apparent impedance of supply mains	< 1.0 Ohm
Maximum rated power	840 W at maximum loading factors 70 kV - 7 mA
Line fuses	T6.3 AL 250 V
Additional high breaking capacity fuses for FM model	T6.3 AH 250 V with an interrupting rating of 1500 A at 250 Vac

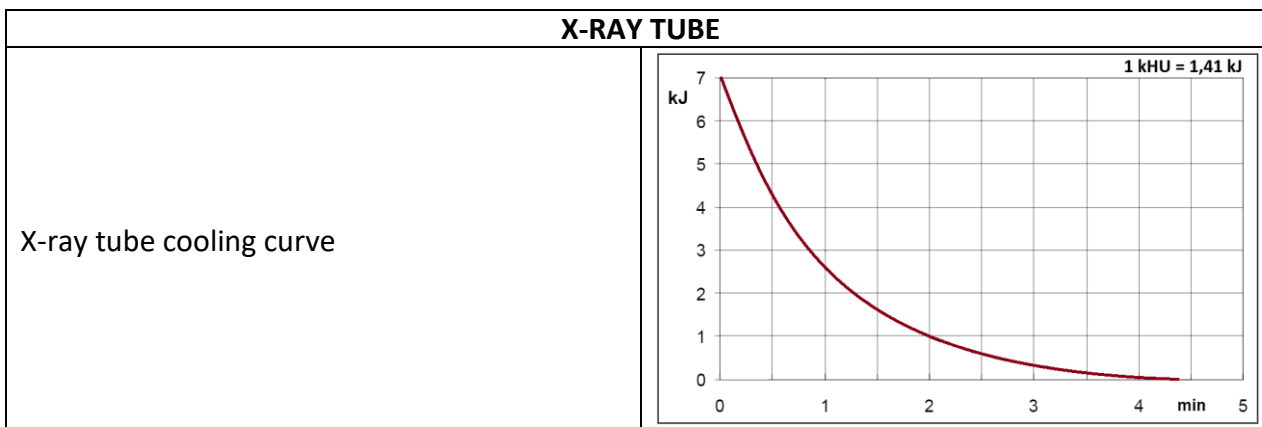


PERFORMANCE	
Mode of operation	Continuous (long time operation)
Nominal Duty Cycle	1:20
Irradiation time	0.01–3.2 s \pm 5% + 1 ms, R20 scale
Tube Voltage	60, 65 or 70 kV \pm 5% selectable
High-voltage waveform	High Frequency DC, residual ripple \leq 4 kV
Tube Current	7 mA \pm 10%
Frequency HV generator	70 kHz
Source Skin Distance (SSD)	20 cm (7 ⁷ / ₈ in), optional 30 cm (11 ¹³ / ₁₆ in)
Radiation output field	Section $<$ 6.0 cm (2 ²³ / ₆₄ in)
Circular BLD	Circular field: diameter 5.8 cm (9 ⁹ / ₃₂ in), 26 cm ² (4.03 in ²) area at 20 cm (7 ⁷ / ₈ in) SSD, eccentricity $<$ 10%
BLD 3x4	Field 2.2 x 3.2 cm (0 ⁵⁵ / ₆₄ x 1 ¹⁷ / ₆₄ in), 7 cm ² (1.09 in ²) area at 20 cm (7 ⁷ / ₈ in) SSD
BLD 2x3	Field 3.2 x 4.4 cm (1 ¹⁷ / ₆₄ x 1 ⁴⁷ / ₆₄ in), 14 cm ² (2.17 in ²) area at 20 cm (7 ⁷ / ₈ in) SSD

CONTROL PANEL	
Exposure factor	Set in s [0.01-3.2] or mAs [0.071-22.4]
Precision	\pm 0.02 s or 5% (whichever is greater) with power supply at the mains nominal value
Exposure factor settings	Automatic with a selection of tooth type and patient size or manual selection, for use with film, phosphor plate, or digital sensor
X-ray indication	Yellow light on the remote switch, illustration on the control panel display and buzzer
X-ray ON	<ul style="list-style-type: none"> Remote switch with cable extendable to 3 m (118 ⁷/₆₄ in) Button on the control panel display

RADIATION QUALITY	
First half value layer HVL	\geq 2 mm (0 ⁵ / ₆₄ in) Al at 70 kV
Total filtration	2 mm (0 ⁵ / ₆₄ in)
Dose yield at 60 kV	6.5 mGy/s \pm 20% at 20 cm (7 ⁷ / ₈ in) from the source
Dose yield at 65 kV	7.8 mGy/s \pm 20% at 20 cm (7 ⁷ / ₈ in) from the source
Dose yield at 70 kV	9.2 mGy/s \pm 20% at 20 cm (7 ⁷ / ₈ in) from the source
Radiation leakage	$<$ 0.25 mGy/h ($<$ 28.75 mR/h) at 1 m (39 ³ / ₈ in)
Focal spot mark	Dot embossed on plastic covers of the THA

X-RAY TUBE	
Anode material	Tungsten
Anode angle	16°
Focal Spot	0.4 (IEC 60336:2006)
Nominal continuous power	110 W



DIMENSIONS and WEIGHTS WM model			
Support arm length	S	30 cm (11 ¹³ / ₁₆ in)	
	M	60 cm (23 ⁵ / ₈ in)	
	L	80 cm (31 ¹ / ₂ in)	
	XL	100 cm (39 ³ / ₈ in)	
Useful Reach SSD 20 cm (7 ⁷ / ₈ in)	143 cm (56 ³ / ₈ in) with support arm S		
	173 cm (68 ³ / ₁₆ in) with support arm M		
	193 cm (76 ¹ / ₁₆ in) with support arm L		
	213 cm (83 ¹⁵ / ₁₆ in) with support arm XL		
Weights	Wall support	3.5 kg	
	Support arm	S	3.0 kg
		M	4.3 kg
		L	5.1 kg
		XL	6 kg
	Scissor arm	12 kg	
THA	6.5 kg		

DIMENSIONS and WEIGHTS FM model		
Mobile stand base width	71 cm (27 ²⁷ / ₃₂ in)	
Mobile stand base length	92.5 cm (36 ²⁷ / ₆₄ in)	
Overall height	193 cm (75 ²³ / ₃₂ in)	
Weights	Mobile stand base	31 kg
	Scissor arm	12 kg
	THA	6.5 kg

ENVIRONMENTAL CONDITIONS		
Transport and storage	Temperature	From -20 to +50°C
	Relative humidity	From 10 to 90%
	Pressure	From 500 to 1060 hPa
Operation	Temperature	From 15 to 40 °C
	Relative humidity	From 30 to 75%
	Pressure	From 700 to 1060 hPa

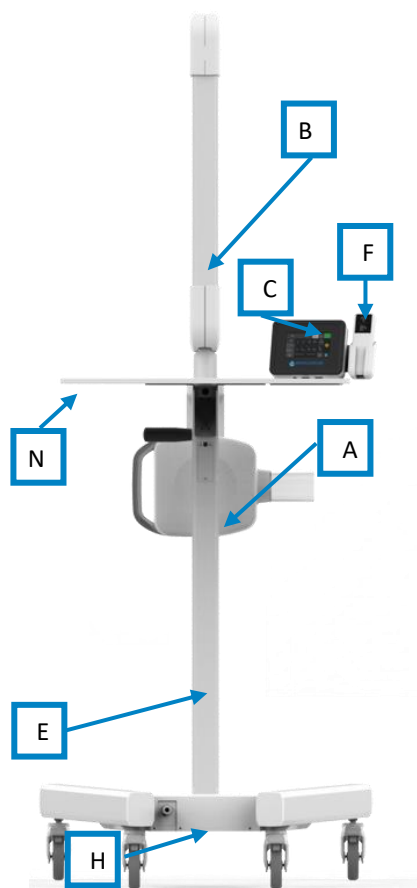
2. DEVICE CONFIGURATIONS

2.1 Models and main components

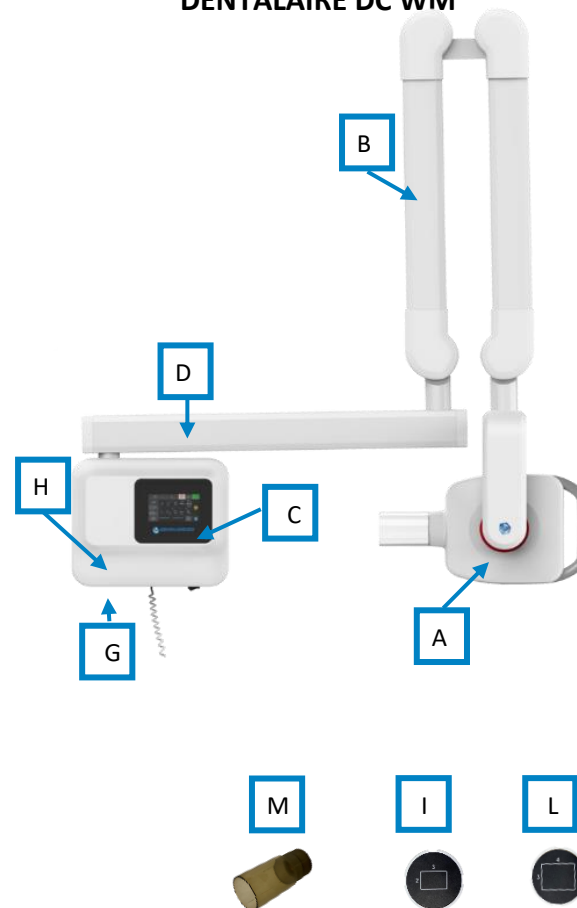
DENTALAIRE DC devices are available for wall mounting or on mobile stand base:

MODEL	CODE	NOTE
DENTALAIRE DC FM	971200100	Intraoral generator with mobile stand base
DENTALAIRE DC WM	971000100	Intraoral generator wall mounted with support arm (D) 30 cm (11 ¹³ / ₁₆ in)
	971000200	Intraoral generator wall mounted with support arm (D) 60 cm (23 ⁵ / ₈ in)
	971000300	Intraoral generator wall mounted with support arm (D) 80 cm (31 ¹ / ₂ in)
	971000400	Intraoral generator wall mounted with support arm (D) 100 cm (39 ³ / ₈ in)

DENTALAIRE DC FM



DENTALAIRE DC WM



ID	DESCRIPTION	CODE
A	THA	931000100
B	Scissor arm	931000200
C	Control panel (HMICPU)	931000300
D	Support arm 30 cm (11 ¹³ / ₁₆ in) S	931000400
	Support arm 60 cm (23 ⁵ / ₈ in) M	931000500
	Support arm 80 cm (31 ¹ / ₂ in) L	931000600
	Support arm 100 cm (39 ³ / ₈ in) XL	931000700
E	Mobile stand base	931200100

ID	DESCRIPTION	CODE
F	Remote switch	931000800
G	Wall support	931000900
H	Power driver (PWD)	931001000
ACCESSORIES		
I	BLD 2x3	911000100
L	BLD 3x4	911000200
M	Cone extension	911000300
N	PC support tray	911200100



2.2 Essential performance

The essential performance of the device, necessary to reach the intended use, are:

- accuracy of loading factors,
- reproducibility of the radiation output.

The essential performance are guaranteed by the manufacturer through specific tests carried out during the production phase and through the firmware of the device, which allows the loading factors to always be within the established ranges.

Essential performance can be assessed through:

- absence of noise, artifacts or distortion in an image,
- absence of errors in the visualized numeric values, which cannot be attributed to physiological effects and that can alter the diagnosis,
- absence of alarms,
- proper operation of the device.

The basic safety of the device has been tested according to the requirements of the following regulations:

- IEC 60601-1,
- IEC 60601-1-3,
- IEC 60601-2-65,
- IEC 60601-1-2.



No modification of this medical device is allowed. For safety reasons, this device should only be used with the original accessories, the user is responsible for any damage caused by unapproved accessories. In particular, the use of cables with RJ11 connectors, instead of the supplied cables with RJ45 connectors, causes failures to the connector itself, resulting in equipment malfunction.



3. ELECTRONIC BOARDS, WIRINGS AND SCREWS

Below is a description of the set of electronic boards and wiring that make up the DENTALAIRE DC devices:

NAME	DESCRIPTION	CODE
ELECTRONIC BOARDS		
PWD	Power driver: <ul style="list-style-type: none"> • It is powered by the network and generates the internal voltages useful for the operation of the other electronics that make up the device. • Powers and communicates with the HMICPU interface. • Check the THA. • Check X-RAY CABLED COMMAND BOARD. • Check ELM. 	931001000
HMICPU	Control panel with TFT IPS 4.3" display: <ul style="list-style-type: none"> • Deals with the human-machine interface. • Communicate with PWD. • Check X-RAY CABLED COMMAND BOARD (multiplexing). 	931000300
MULTIPLIER X30HF BOARD	Multiplier board contained in the THA.	581000600
ELM	PWD add-on module to manage external lights signalling device in operation and beams in progress (optional).	931001100
CB	HV and FIL signal cable interconnection board between scissor arm and THA. It is equipped with specific test points for the measurement of the anodic current coming out of the THA.	931001200
FEEDTHROUGH BOARD	"Feedthrough" board for connecting HV and FIL signals from external to internal of the THA.	581000700
X-RAY CABLED COMMAND BOARD	Remote switch board.	931000800
WIRING		
CBL_FIL1W30	Wiring inside the support arm 30 cm (11 ¹³ / ₁₆ in) for device WM for filament signal connection from wall support plate to extreme connection of support arm 30 cm (11 ¹³ / ₁₆ in) with scissor arm.	621001400
CBL_FIL1W60	Wiring inside the support arm 60 cm (23 ⁵ / ₈ in) for device WM for filament signal connection from wall support plate to extreme connection of support arm 60 cm (23 ⁵ / ₈ in) with scissor arm.	621001100
CBL_FIL1W80	Wiring inside the support arm 80 cm (31 ¹ / ₂ in) for device WM for filament signal connection from wall support plate to extreme connection of support arm 80 cm (31 ¹ / ₂ in) with scissor arm.	621000800
CBL_FIL1W100	Wiring inside the support arm 100 cm (39 ³ / ₈ in) for device WM for filament signal connection from wall support plate to extreme connection of support arm 100 cm (39 ³ / ₈ in) with scissor arm.	621000500
CBL_FIL1F	Wiring inside mobile stand pole for device FM for filament signal connection from the basement of the mobile stand	621001800



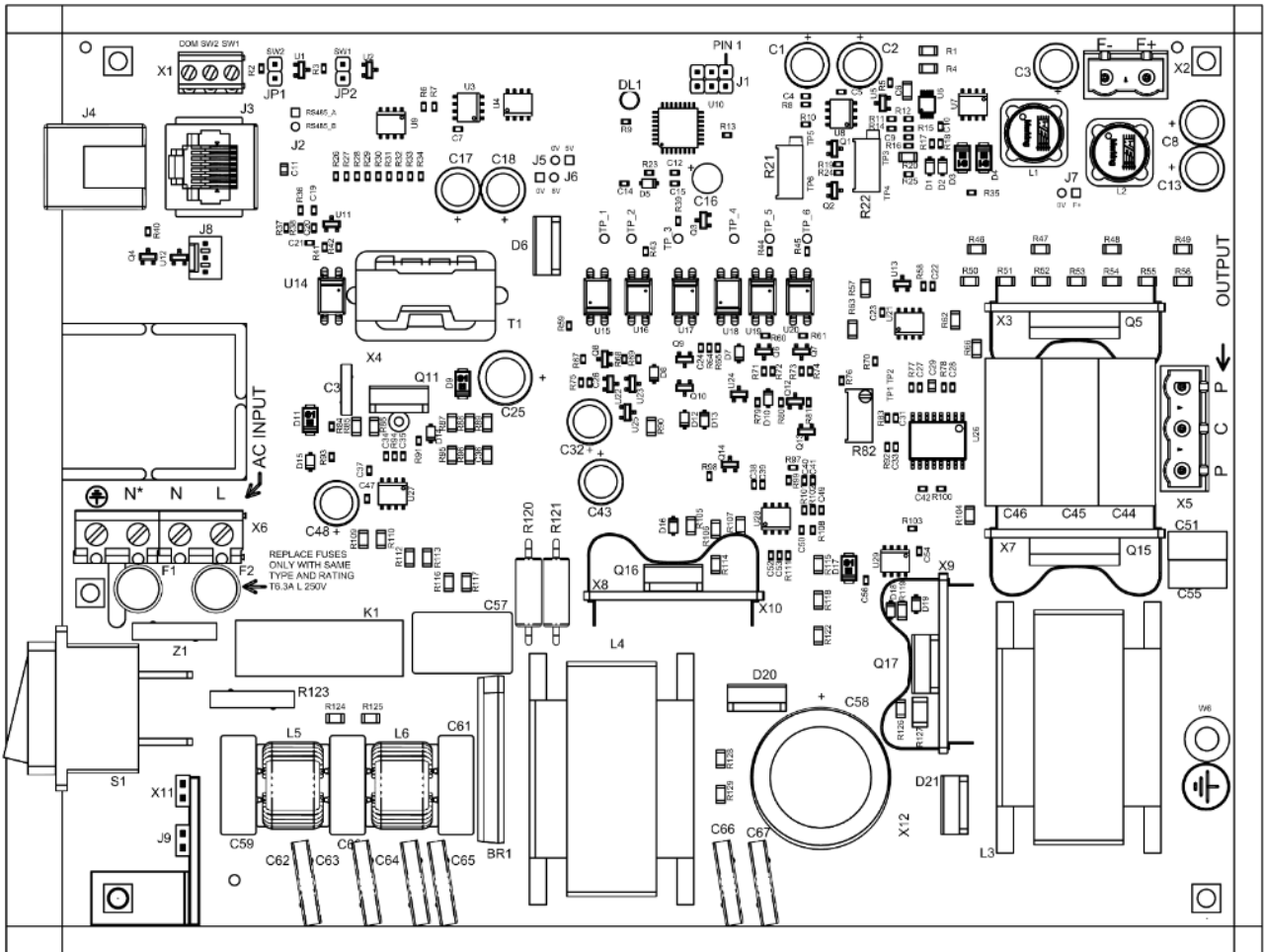
NAME	DESCRIPTION	CODE
	base to extreme connection of mobile stand pole with scissor arm.	
CBL_FIL2U	Universal wiring inside scissor arm for both devices FM and WM for filament signal connection to the extremes of the scissor arm (extreme 1: support arm / mobile stand pole and extreme 2: joint).	621000200
CBL_FIL3U	Universal wiring inside the THA joint for both devices FM and WM for filament signal connection between joint and THA.	Part of 621001600
CBL_HV1W30	Wiring inside the support arm 30 cm (11 ¹³ / ₁₆ in) for device WM for HV signal connection from wall support plate to extreme connection of support arm 30 cm (11 ¹³ / ₁₆ in) with scissor arm.	621001300
CBL_HV1W60	Wiring inside the support arm 60 cm (23 ⁵ / ₈ in) for device WM for HV signal connection from wall support plate to extreme connection of support arm 60 cm (23 ⁵ / ₈ in) with scissor arm.	621001000
CBL_HV1W80	Wiring inside the support arm 80 cm (31 ¹ / ₂ in) for device WM for HV signal connection from wall support plate to extreme connection of support arm 80 cm (31 ¹ / ₂ in) with scissor arm.	621000700
CBL_HV1W100	Wiring inside the support arm 100 cm (39 ³ / ₈ in) for device WM for HV signal connection from wall support plate to extreme connection of support arm 100 cm (39 ³ / ₈ in) with scissor arm.	621000400
CBL_HV1F	Wiring inside mobile stand pole for device FM for HV signal connection from the basement of the mobile stand base to extreme connection of mobile stand pole with scissor arm.	621001700
CBL_HV2U	Universal wiring inside scissor arm for both devices FM and WM for HV signal connection to the extremes of the scissor arm (extreme 1: support arm / mobile stand pole and extreme 2: joint).	621000100
CBL_HV3U	Universal wiring inside the THA joint for both devices FM and WM for HV signal connection between joint and THA.	Part of 621001600
CBL_EG1W30	Wiring inside the support arm 30 cm (11 ¹³ / ₁₆ in) for device WM for ground signal connection from wall support plate to extreme connection of support arm 30 cm (11 ¹³ / ₁₆ in) with scissor arm.	621001500
CBL_EG1W60	Wiring inside the support arm 60 cm (23 ⁵ / ₈ in) for device WM for ground signal connection from wall support plate to extreme connection of support arm 60 cm (23 ⁵ / ₈ in) with scissor arm.	621001200
CBL_EG1W80	Wiring inside the support arm 80 cm (31 ¹ / ₂ in) for device WM for ground signal connection from wall support plate to extreme connection of support arm 80 cm (31 ¹ / ₂ in) with scissor arm.	621000900
CBL_EG1W100	Wiring inside the support arm 100 cm (39 ³ / ₈ in) for device WM for ground signal connection from wall support plate to extreme connection of support arm 100 cm (39 ³ / ₈ in) with scissor arm.	621000600
CBL_EG1F	Wiring inside mobile stand pole for device FM for ground signal connection from the basement of the mobile stand base to extreme connection of mobile stand pole with scissor arm.	621001900



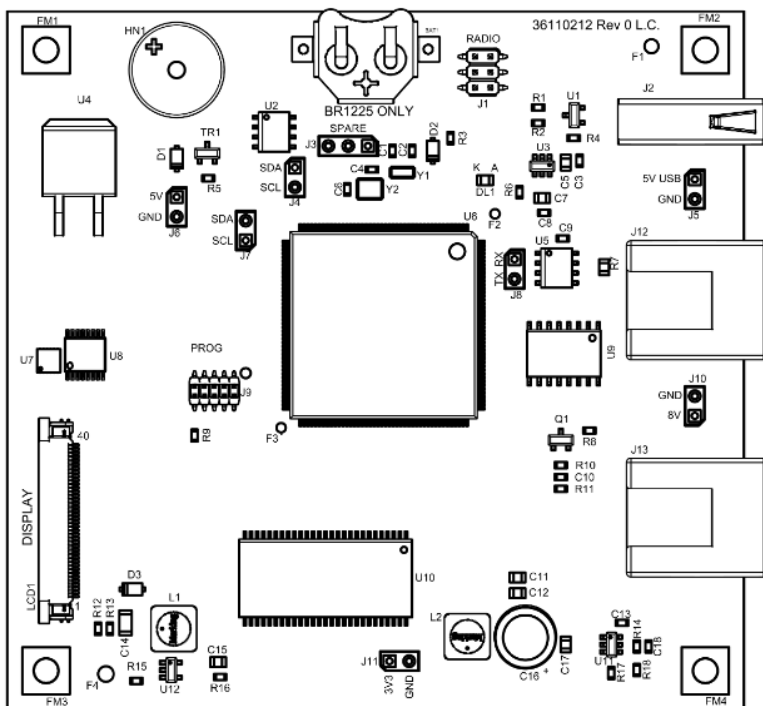
NAME	DESCRIPTION	CODE
CBL_EG2U	Universal wiring inside scissor arm for both devices FM and WM for ground signal connection to the extremes of the scissor arm (extreme 1: support arm / mobile stand pole and extreme 2: joint).	621000300
CBL_EG3U	Universal wiring inside the THA joint for both devices FM and WM for ground signal connection between joint and THA.	Part of 621001600
CBL_SPIRAL	Universal connection spiral cable for connection: <ul style="list-style-type: none">• Option 1: HMICPU-PWD.• Option 2: HMICPU-REMOTE BUTTON.• Option 3: PWD-REMOTE BUTTON.	621003000
CBL_ETHERNET 50	50 cm (19 ¹¹ / ₁₆ in) HMICPU-PWD ethernet cable for device WM in case of type I1 installation (§4.1).	440000002
CBL_ETHERNET 1000	1000 cm (393 ⁴⁵ / ₆₄ in) ethernet cable for universal connection HMICPU-PWD-REMOTE BUTTON (switching between walls).	440000001
CBL_ETHERNET 135	135 cm (53 ⁵ / ₃₂ in) ethernet cable inside mobile stand pole for device FM for HMICPU-PWD connection.	621003300
CBL_SUPPLY_EXT	Part 1 of 3 of the supply cable of the device FM (from external to fuses on mobile stand base).	621002000
CBL_SUPPLY_FUS	Part 2 of 3 of the supply cable of the device FM (from fuses to contacts on switch present on mobile stand base).	621002300
CBL_SUPPLY_INT	Part 3 of 3 of the supply cable of the device FM (from contacts on switch present on mobile stand base to PWD power input (X6)).	621002100
CBL_ELU	Universal connection cable for PWD and ELM boards for external light control.	621002200 part of ELM
FERRITES		
FRT_CBL_HV_PWD	FERRITES LAIRD 28A2024-0A0 double turn on CBL_HV1F (for device FM) or on CBL_EG1Wxxx (for device WM) outgoing from PWD board.	420000002
FRT_CBL_ETH_HMICPU	FERRITES LAIRD 28A2025-0A0 on CBL_ETHERNET 135 towards HMICPU.	420000003



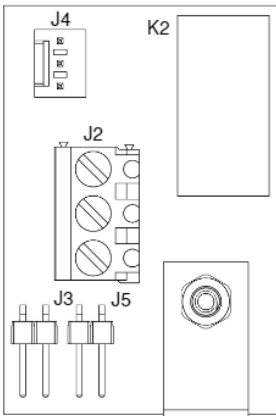
3.1 PWD



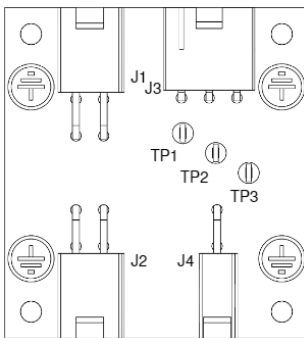
3.2 HMICPU



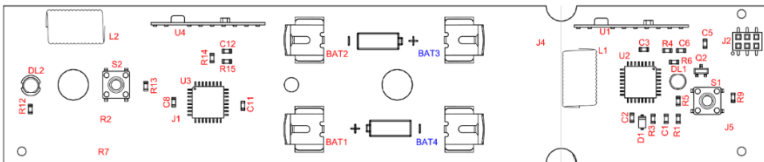
3.3 ELM



3.4 CB



3.5 Remote switch board





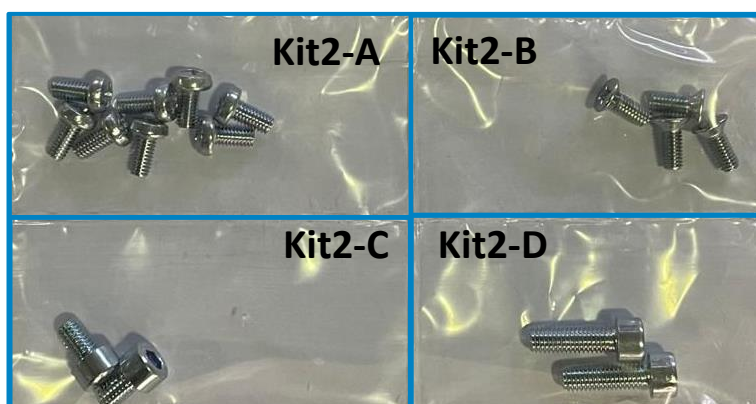
3.6 Screw kit for the FM model - Kit1

The image below illustrates the items belonging to Kit1 (code: 931200200), useful for the assembly of the FM model. The kit1 also includes the wheels, not visible in the image.



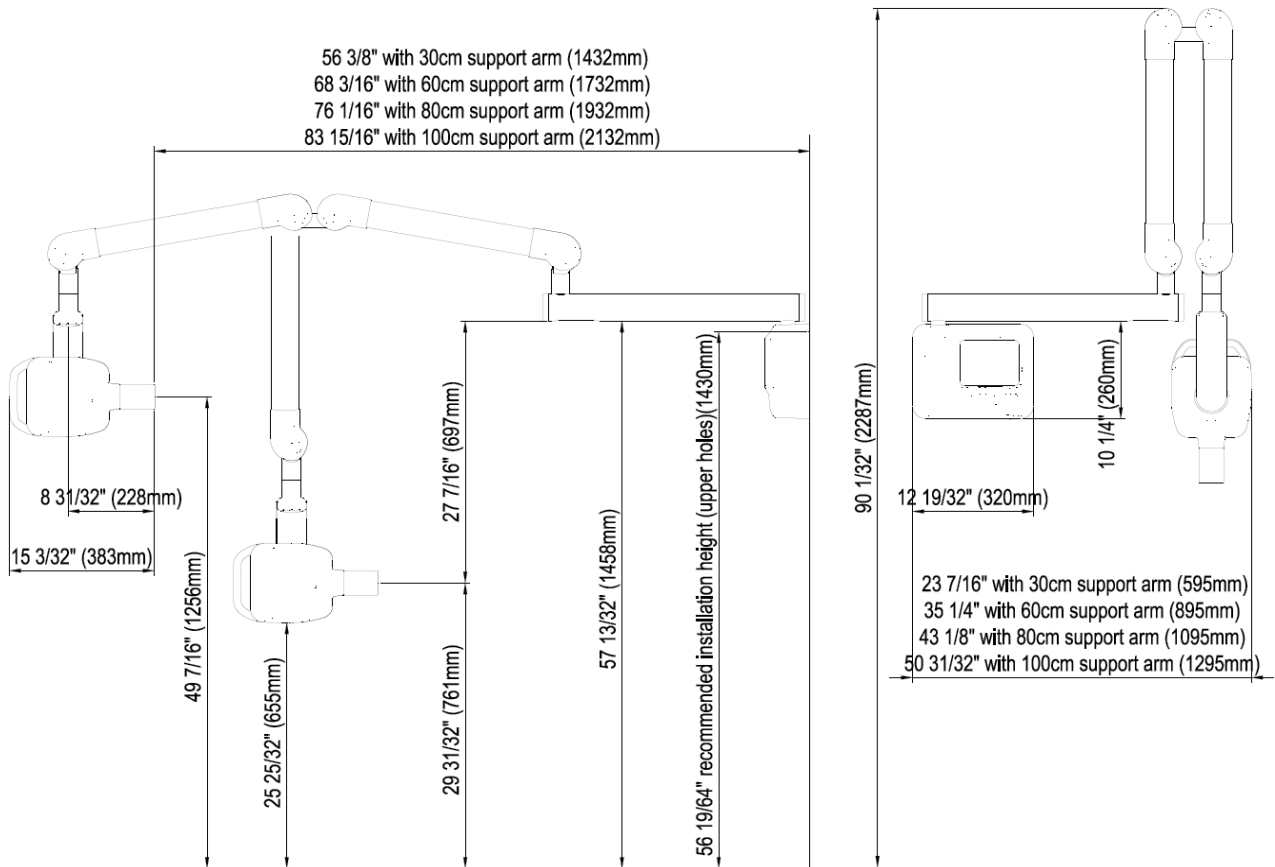
3.7 Screw kit for the PC support tray (optional) – Kit2

The image below illustrates the items belonging to Kit2 (code: 931200300), useful for the assembly of the PC support tray.



4. WM MODEL INSTALLATION

This chapter illustrates the installation and wall fixing indications of the WM device.



- The recommended height for fixing the upper bolts of the wall support is at least 143 cm (56 19/64 in) from the floor.
- The maximum useful distances from the wall refer to the possible configurations with SSD of 20 cm (7 7/8 in) made with the various types of support arm available (30 -:- 100 cm (11 13/16 -:- 39 3/8 in)).



4.1 Types of installation

	Risk of electromagnetic interference.
	The device should not be installed or operated near other devices that may disturb it or that may in turn be disturbed.

TYPOLOGY	DESCRIPTION	ILLUSTRATION
I1	Control panel and remote switch inside the room.	
I2	Control panel inside the room and remote switch outside the room.	
I3	Control panel outside the room (with optional remote switch connection).	
	<p>Follow the instructions in the following paragraphs to correctly mount the WM device and for balancing the frictions of support arm, scissor arm and THA.</p> <p>The 3 types of installation I1, I2 and I3 differ in the mounting position of the control panel and the remote switch.</p> <p>Refer to §4.3.7 to create the desired type of installation.</p>	

4.2 Pre-installation requirements

4.2.1 Structural requirements

The maximum useful extension depends on the length of the support arm and the cone used.

DENTALAIRE DC useful reach		
Support arm	SSD 20 cm (7 ⁷ / ₈ in)	SSD 30 cm (11 ¹³ / ₁₆ in)
Support arm 30 cm (11 ¹³ / ₁₆ in)	143 cm (56 ³ / ₈ in)	133 cm (52 ⁷ / ₁₆ in)
Support arm 60 cm (23 ⁵ / ₈ in)	173 cm (68 ³ / ₁₆ in)	163 cm (64 ¹ / ₄ in)
Support arm 80 cm (31 ¹ / ₂ in)	193 cm (76 ¹ / ₁₆ in)	183 cm (72 ¹ / ₈ in)
Support arm 100 cm (39 ³ / ₈ in)	213 cm (83 ¹⁵ / ₁₆ in)	203 cm (80 in)

Type of fastening		
Class	Diameter	Core mm ²
ISO 8.8	M 8X1.25	36.6 (0.057 in ²)
ISO 8.8	M 8X1	39.2 (0.061 in ²)
SAE- Grade 5	5/16" – 18 UNC	33.8 (0.052 in ²)
SAE- Grade 5	5/16 – 24 UNF	37.41 (0.058 in ²)



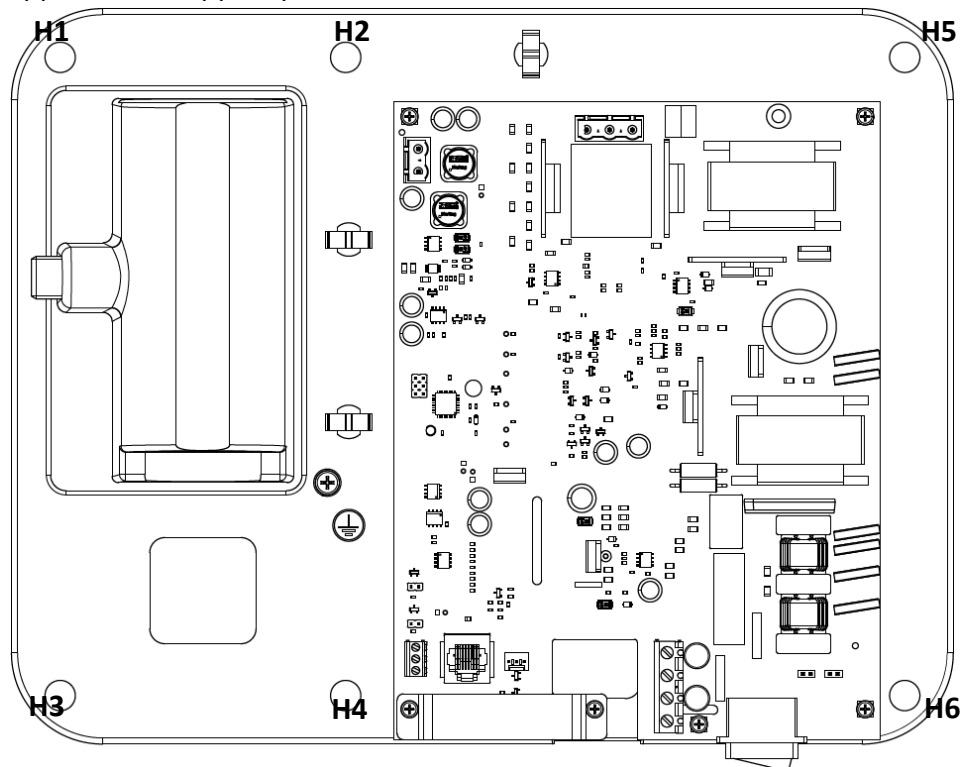
Risk of falling.



INADEQUATE SCREWS OR SUPPORTS OR NOT SOLID ENOUGH WALLS MAY CAUSE THE DETACHMENT OF THE SUPPORT FROM THE WALL WITH THE FALL OF THE DEVICE ON THE PATIENT OR OPERATOR.

4.2.1.1 Wall support plate mounting options

- Use 4 M8 bolts (or higher) in the 4 holes H1-H2-H3-H4 in case of a full column (e.g. reinforced concrete wall or with a steel plate inside the wall).
- Use 6 M8 bolts (or higher) in holes H1-H2-H3-H4-H5-H6 with chemist for better and safer sealing and installation on perforated or not properly adequate walls.
- Use a counter plate with a minimum thickness of 2 mm (0 ⁵/₆₄ in) and a surface greater than the supplied wall support plate in case the wall is unable to withstand the indicated load.






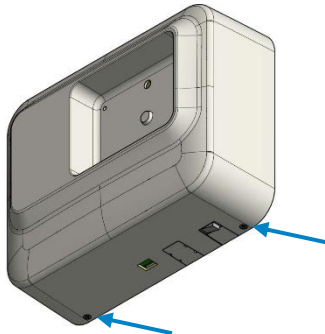
4.2.2 Electrical system requirements

i	Do not use the device if it has electrical, mechanical or radiation related defects.
	Place the device in an environment that complies with the regulations in force in the country of use.
	The electrical connections must be made by a technician authorized by the manufacturer and under the supervision of a Qualified Expert.
	The device must be placed in a room for medical use only, designed by an expert in protection against the risks associated with radiation in accordance with the regulations in force in the country of use.
	For Europe, the electrical system in which the device is installed must comply with the IEC 60364-7-710 standards (requirements for electrical systems in areas for medical use).
	Connect DENTALAIRE DC using a power line dedicated solely to the device itself.
	Upstream of the power supply network of the device, it is recommended to place a protection device (circuit breaker) with the following characteristics: <ul style="list-style-type: none"> • Thermal-magnetic with earth leakage protection -2P- type C magnetic curve - type A - I_{dn} = 30 mA - I_{cn} = 6 kA (minimum) - V_n = 230 Vac. <ul style="list-style-type: none"> - With rated current of 16 Amp for 230 V nominal mains voltage. - With rated current of 25 Amp for 120 V nominal mains voltage.

4.3 Assembly

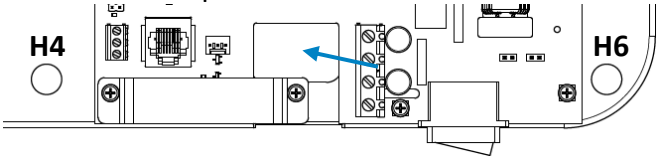
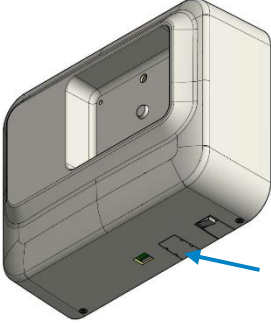
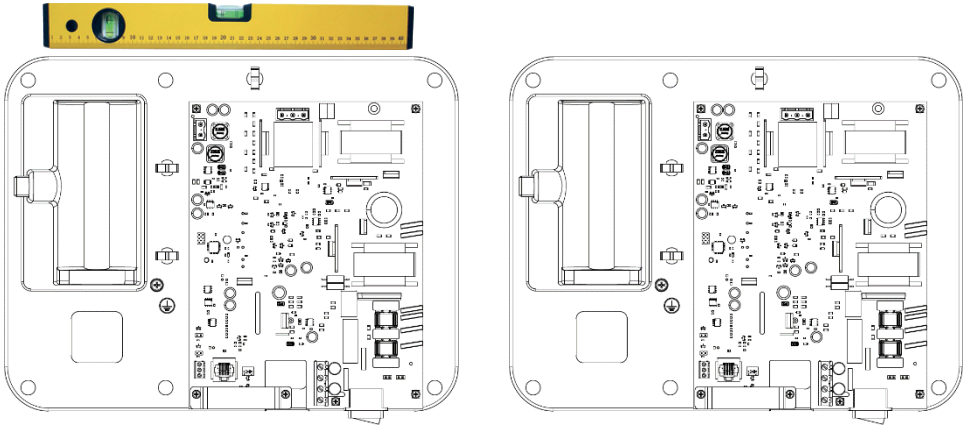


i	During the assembly, carefully check that all connections are intact, that the pins in the connector bodies are firmly in place and that the screws and bolts of the PE wires are tightened completely.
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4.3.1 Mounting the wall support plate on the wall

STEP	DESCRIPTION
A	Open the packaging taking care not to scratch or damage the contents.
	Risk of scratching plastic parts.
i	Do not remove the label "avoid cutter". Open the package on the opposite side.
B	Remove the plastic wall support cover by unscrewing the lower screws. <div style="text-align: center;">  </div>
C	Use the paper template for fixing the wall support plate to the wall and mark the references on the wall.
D	Drill the holes on the wall according to the type of fixing (§4.2.1.1). Note: the higher load is supported by the upper holes (H1, H2 e H5).



AVOID CUTTER

STEP	DESCRIPTION
E	<p>Secure the wall support plate using appropriate fixing systems (§4.2).</p> <ul style="list-style-type: none"> In the case of wall-mounted power cables, make sure that they come out into the recess on the plate located between H4 and H6.  <ul style="list-style-type: none"> In case of power supply through an external duct, make sure to place them near the central entrance of the cover of the wall support. 
F	<p>Make sure the wall support plate is horizontally parallel to the floor and vertically parallel to the wall using a bubble level.</p> 
	<p>Risk of unwanted arm displacement. Risk of re-examination.</p>
	<p>Incorrect levelling of the plate may cause an unwanted shift of the arm.</p>

4.3.1.1 Security contacts optional connection

On the PWD board it is possible to **optionally** connect 2 safety contacts (end of travel, limit switch, passive switches) for status reporting:

- Leaded door(s) that allow access to the room where the device is installed.
- The key(s) for enabling the device.

STEP	DESCRIPTION
A	<p>Connect:</p> <ul style="list-style-type: none"> • Safety contact 1 to X1.SW1 (if not used close jumper JP1). • Safety contact 2 to X1.SW2 (if not used close jumper JP2).

4.3.1.2 External light connection

On the PWD board it is possible to connect an optional board useful to the control of the room external lights for signalling active device and/or active x-rays.





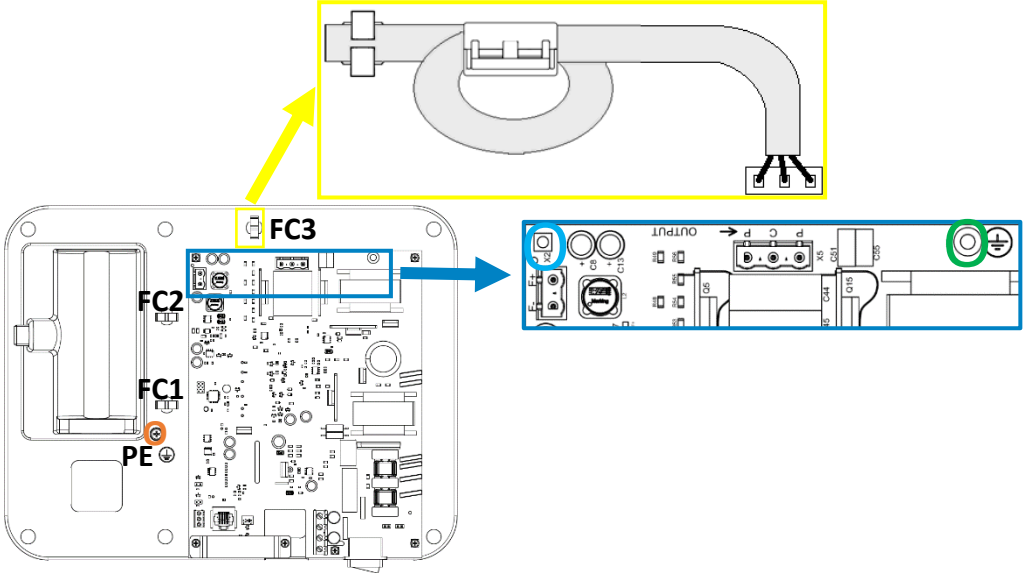
STEP	DESCRIPTION
A	<p>Connect the ELM board J4 connector to PWD board J8 connector using CBL_ELU (pin-to-pin connection).</p>

STEP	DESCRIPTION
B	<p>Access device signalling lamp connection (typically red):</p> <ul style="list-style-type: none"> • Power max 50 W. • Connect the lamp terminals to the pins J2.N and J2.R of ELM. • Device ON → lamp ON. • Device OFF → lamp OFF. <p>Active X-ray signalling lamp connection (typically yellow):</p> <ul style="list-style-type: none"> • Power max 50 W. • Connect the lamp terminals to the pins J2.N and J2.Y of ELM. • X-rays active → lamp ON. • X-rays not active → lamp OFF. <p>The diagram shows a transformer K2 with primary pins 1 and 2 connected to J4 pins 1 and 2 (+8V YELLOW). Pin 3 of J4 (CHGND) is connected to pin 4 of K2. Secondary pins 1 and 2 of K2 are connected to J2 pins 1 (N) and 2 (Y). Secondary pin 3 of K2 is connected to J2 pin 3 (R). J3.1 and J3.2 are connected to J5.1 and J5.2 respectively.</p>



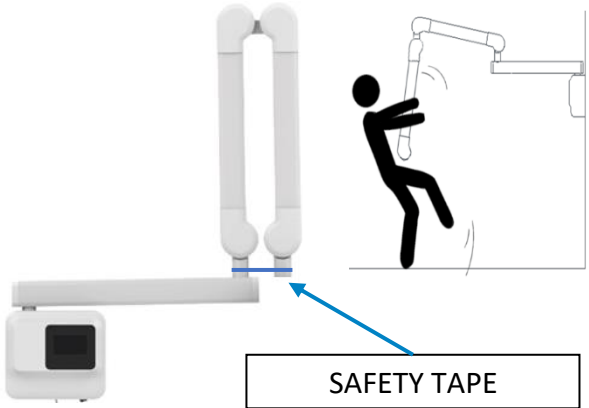
4.3.2 Mounting the support arm




STEP	DESCRIPTION
A	Remove the support arm from the packaging and check the integrity of the components.
B	<p>Remove the rotational end-of-stroke spacer by taking care not to pull the cables inside the support arm. Risk of cable connectors breaking.</p>
C	<p>Push the wall plate friction cylinder back to prevent it from getting in the way.</p> <p>Insert the support arm rod into the wall support plate taking care not to damage the cables during their passage inside the wall support plate bushing.</p>



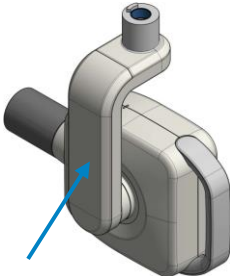
STEP	DESCRIPTION
D	Mount the rotation end-of-stroke spacer (§4.3.2 STEP B), then <u>tighten</u> the plate friction slightly (§4.3.2 STEP C).
	Do not tighten the friction excessively at this stage. Run only to fully mounted device.
E	Verify that the support arm can perform a 180° rotation stroke.
F	<ul style="list-style-type: none"> Secure the CBL_EG1Wxxx to the PE ground point (indicated by  in the image below). Verify that the tightening is accurate and that the cable lug holds its position. Pass through the FC1 and FC2 cable stopper points and connect the CBL_FIL1Wxxx to PWD's X2 connector. Connect the ground wire contained in CBL_FIL1Wxxx to the ground point above the X2 connector (indicated by  in the image below). Pass through the FC1, FC2 and FC3 cable stopper points the CBL_HV1Wxxx. Pass the CBL_HV1Wxxx twice inside the FRT_CBL_HV_PWD ferrite (indicated in yellow in the image below) and connect it to PWD's X5 connector. Connect the ground wire contained in CBL_HV1Wxxx to ground point (indicated by  in the image below). 

4.3.3 Mounting the scissor arm

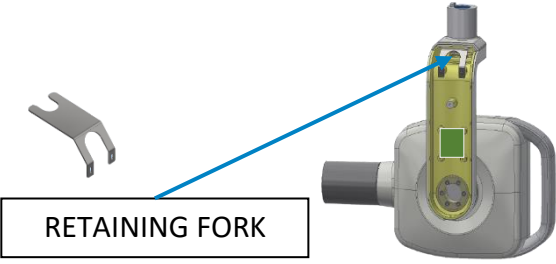
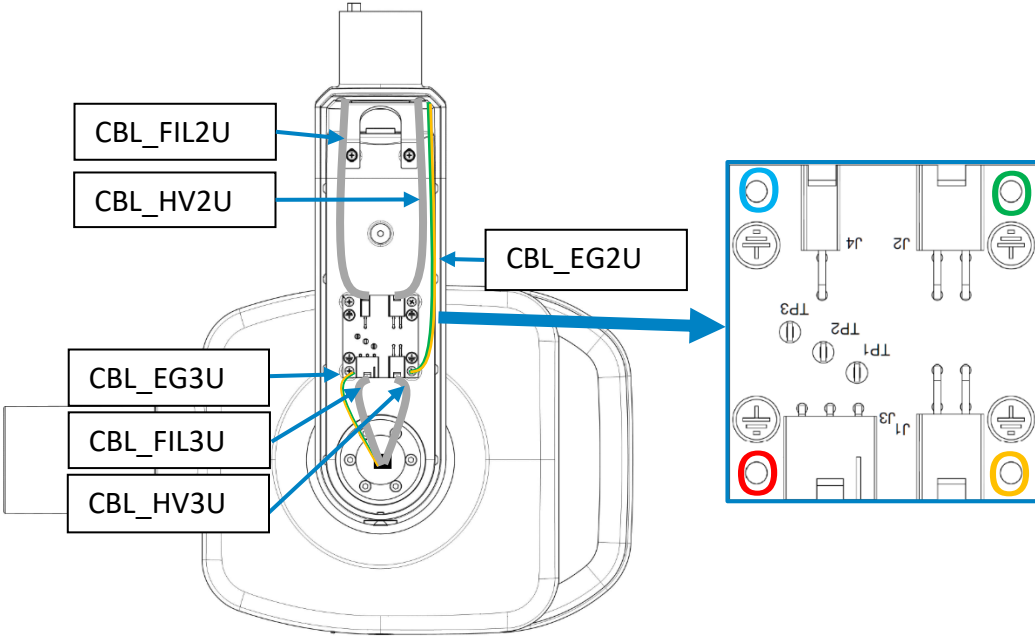
STEP	DESCRIPTION
	Danger of injury.
	<p>The springs inserted into the scissor arm can cause injury to the installer and damage the arm itself if manipulated incorrectly. Keep the safety tape at the bottom of the scissor arm until the THA is mounted to prevent sudden opening during assembly operations.</p> 

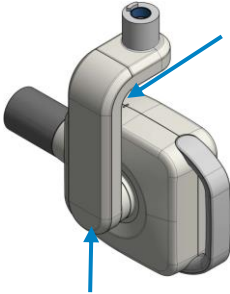
STEP	DESCRIPTION
A	Remove the cover shown in the figure below. 
B	Push the friction cylinder of the support arm back into the insertion side of the scissor arm to prevent it from getting in the way. 
C	Thread the scissor arm inside the support arm bushing (scissor arm side) taking care not to compromise the cables and connectors coming out of the scissor arm.
D	Connect: <ul style="list-style-type: none"> • CBL_FIL2U of scissor arm with CBL_FIL1Wxxx of support arm (male-female connector coupling). • CBL_HV2U of scissor arm with CBL_HV1Wxxx of support arm (male-female connector coupling). • CBL_EG2U of scissor arm on a plate for faston coupling fixed inside the support arm (faston). • Close the previously opened cable cover (§4.3.3 STEP A).
E	Tighten the support arm friction <u>slightly</u> (§4.3.3 STEP B).
	Do not tighten the friction excessively at this stage. Run only to fully mounted device.
F	Verify that the scissor arm can perform a 330° rotation stroke.

4.3.4 Mounting the THA

STEP	DESCRIPTION
A	Remove the plastic cover of the joint. 






STEP	DESCRIPTION
B	<p>Remove the joint retaining fork.</p> 
C	<p>Thread the scissor arm inside the THA joint, taking care not to compromise the cables and connectors coming out of the scissor arm.</p>
D	<p>Pass:</p> <ul style="list-style-type: none"> • CBL_FIL2U to the left of the retaining fork and connect to CB's J4 connector. Connect the ground wire contained in CBL_FIL2U to the ground point to the left of the J4 connector (indicated by ○ in the image below). • CBL_HV2U to the right of the retaining fork and connect to CB's J2 connector. Connect the ground wire contained in CBL_HV2U to the ground point to the right of the J2 connector (indicated by ○ in the image below). • CBL_EG2U to the right of the retaining fork and connect to the ground point to the right of CB's J1 connector (indicated by ○ in the image below). Verify that the tightening is accurate and that the cable lug holds its position. 
E	<p>Check that:</p> <ul style="list-style-type: none"> • CBL_FIL3U of THA is connected to CB's J3 connector. • CBL_HV3U of THA is connected to CB's J1 connector. • CBL_EG3U of THA is connected to the ground point to the left of CB's J3 connector (indicated by ○ in the image above). Verify that the tightening is accurate and that the cable lug holds its position.
F	<p>Verify that the THA can perform a rotation stroke of:</p> <ul style="list-style-type: none"> • 380° around the vertical axis. • 305° around the horizontal axis.

STEP	DESCRIPTION
G	Reassemble the THA joint plastic cover previously removed (§4.3.4 STEP A) by screwing the screws below indicated. 






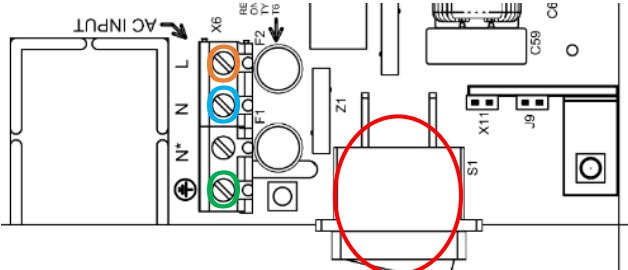
4.3.5 Mounting the beam limiter

The device comes with a circular beam limiter with a diameter of 5.8 cm (2 9/32 in) operating at SSD of 20 cm (7 7/8 in).

On request, the following accessories are available:

ACCESSORIES	DESCRIPTION
Cone extension	 10 cm (3 15/16 in) cone extension for operation at the source-skin distance (SSD) of 30 cm (11 13/16 in).
BLD 2x3	 2 x 3 cm (0 25/32 x 1 3/16 in) rectangular radiation beam limiter diaphragm.
BLD 3x4	 3 x 4 cm (1 3/16 x 1 37/64 in) rectangular radiation beam limiter diaphragm.


4.3.6 Connection to the electrical network

STEP	DESCRIPTION
	Risk of electric shock.
	Disconnect the power supply in the room before operating.
A	Unsheathe the supply cable by ~ 7 cm (2 3/4 in) and check that the 3 input conductors (L-N-PE) are not damaged.
B	Connect: <ul style="list-style-type: none"> • The grounding conductor at PWD's clamp X6.PE (indicated by  in image below). • The phase conductor at PWD's clamp X6.L (indicated by  in the image below). • The neutral conductor at PWD's clamp X6.N (indicated by  in the image below). • The N* point is not used, no conductor is connected. 


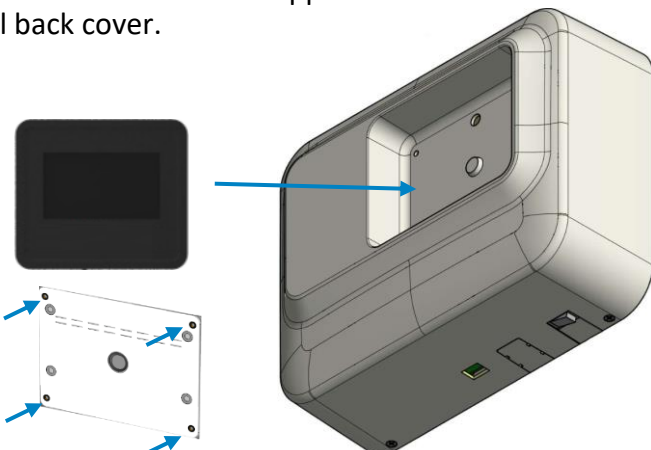


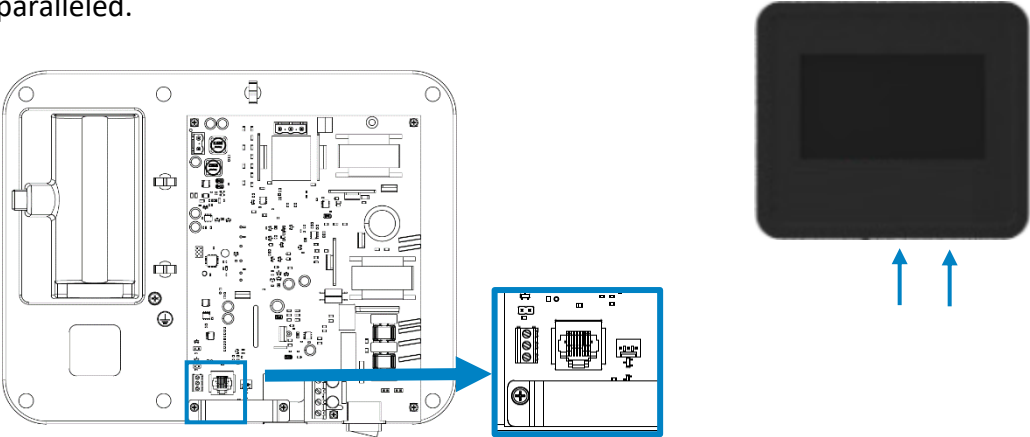
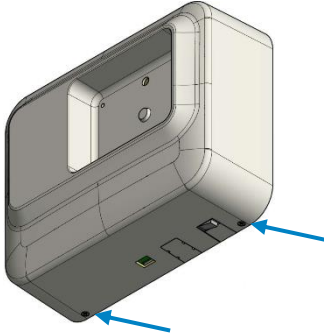
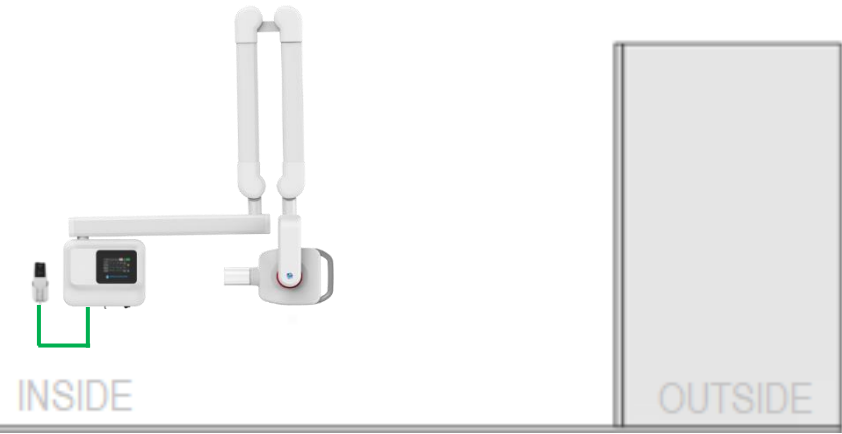


STEP	DESCRIPTION
	Verify that the PHASE conductor (X6.L of PWD) is under voltage: <ul style="list-style-type: none"> • Check that the device switch S1 of the PWD (indicated by ○ in the image above) is on position "O" (OFF). If not, take it to an "O" position. • Activate the power supply in the room. • Detect network voltage with an AC voltmeter between X6.L and X6.PE. <ol style="list-style-type: none"> a. The voltage detected must match the network voltage. If not, remove voltage from the room and reverse the conductor placed on X6.L with the X6.N one and repeat the measurement. b. If the connection is correct between the X6.L and X6.PE points it must be possible to read the actual line voltage. c. Check for no voltage between X6.N and X6.PE points, otherwise, have the distribution network checked by an electrician.

4.3.7 Final tuning

STEP	DESCRIPTION
A	Adjust: <ul style="list-style-type: none"> • Plate friction. • Support arm friction. • Scissor arm friction.
B	Reassemble the plastic covers of: <ul style="list-style-type: none"> • THA. • Scissor arm joints.
	Avoid reopening the scissor arm joints covers, unless strictly necessary for maintenance operations, as they could be damaged. If it is necessary to remove the scissor arm joints covers, be sure to use a coaxial movement to remove them.
C	Install the control panel in one of the 3 types of installation available (§4.3.7.1-4.3.7.3).



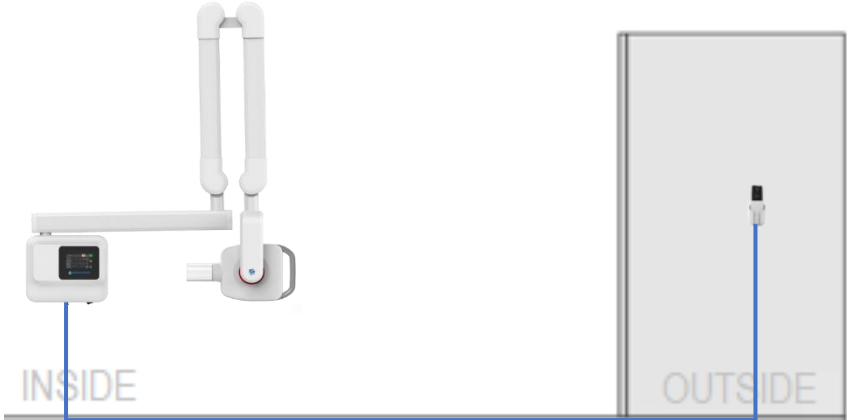
4.3.7.1 Type of Installation I1

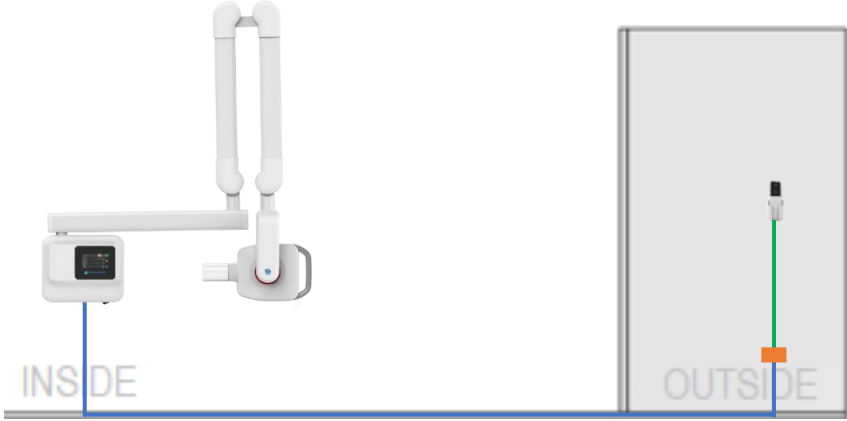

STEP	DESCRIPTION
A	Attach the black faceplate to the back cover of the control panel. 
B	Mount the control panel inside the wall support cover via the 4 screws at the ends of the control panel back cover. 

STEP	DESCRIPTION
C	<p>Connect the CBL_ETHERNET 50 from the J3 PWD connector to one of the two ethernet inputs of the control panel while already mounted on the wall support cover. The two ethernet ports of the terminal are equivalent because they are paralleled.</p> 
D	<p>Reassemble the wall support plastic cover via the lower screws.</p> 
E	<p>Connect the remote switch via supplied CBL_SPIRAL (shown in green in the image below) to PWD's J4 connector, which is also visible when the wall support cover is mounted.</p> 
F	<p>Secure the remote switch stand to the wall in a comfortable position with respect to wall support plate.</p> 
	<p>The CBL_SPIRAL has a maximum extension of 3 m (118 ⁷/₆₄ in).</p>

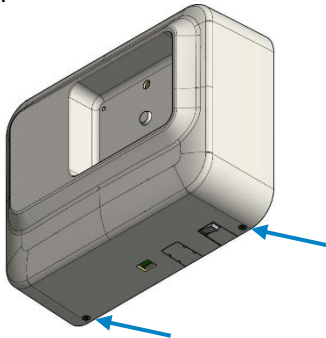
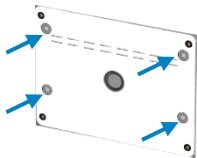


4.3.7.2 Type of installation I2


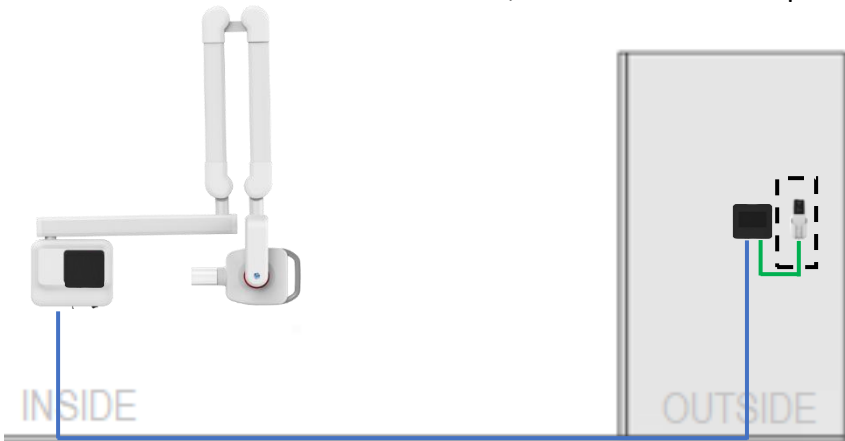

STEP	DESCRIPTION
A	Refer to §4.3.7.1 STEP A.
B	Refer to §4.3.7.1 STEP B.
C	Refer to §4.3.7.1 STEP C.
D	Take the supplied CBL_ETHERNET 1000 or, alternatively, a cat5e ethernet cable (max 10 m (393 ⁴⁵ / ₆₄ in)) out of the room by passing through the wall. Connect one end of the cable to PWD's J4, which is also visible when the wall support cover is mounted. Follow the next instructions for connecting the other end.
	<p>Check by appropriate instrument (e.g. ethernet cable tester) the continuity of the 1-8 signals at the 2 ends of the ethernet cable as a result of its passage from the wall.</p> 
E	Refer to §4.3.7.1 STEP D.
F	<p>Outside the room where the device is installed, connect the remote switch according to 1 of the 2 modes below:</p> <ul style="list-style-type: none"> • Fixed wall switch:  <p>CBL_ETHERNET 1000 indicated in blue in the image above.</p> <ul style="list-style-type: none"> - Secure the remote switch stand to the wall in a convenient position with respect to the remainder of the outgoing CBL_ETHERNET 1000 from the wall. - Connect the CBL_ETHERNET 1000 wall-exiting end to the remote switch. - Cover the CBL_ETHERNET 1000 with appropriate external channel.

STEP	DESCRIPTION
	<ul style="list-style-type: none"> Mobile switch:  <p>CBL_ETHERNET 1000 indicated in blue in the image above. CBL_SPIRAL indicated in green in the image above.</p> <ul style="list-style-type: none"> - Secure the remote switch stand to the wall in a convenient position. - Make an RJ45 wall socket (indicated in orange in the image above). - Connect the CBL_ETHERNET 1000 wall-exiting end to RJ45 wall socket. - Connect the remote switch using the CBL_SPIRAL supplied to the RJ45 wall socket.
	<p>The CBL_SPIRAL has a maximum extension of 3 m (118 ⁷/₆₄ in).</p>

4.3.7.3 Type of installation I3

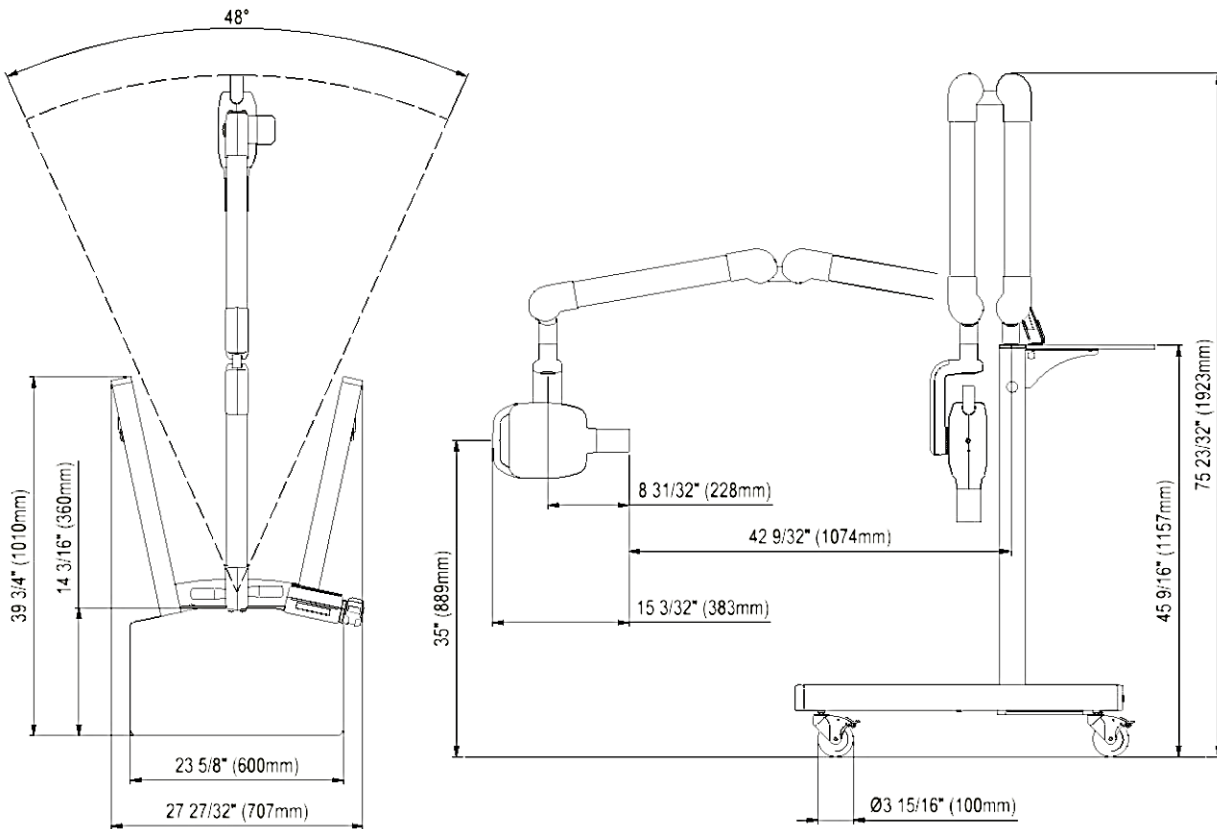
STEP	DESCRIPTION
<p>A</p>	<p>Reassemble the wall support plastic cover via the lower screws.</p> 
<p>B</p>	<p>Place the control panel on the wall and mark the hole references. Drill 4 holes on the wall.</p>
<p>C</p>	<p>Fix the control panel (without the black faceplate) to the wall.</p> 
<p>D</p>	<p>Refer to §4.3.7.1 STEP A.</p>
<p>E</p>	<p>Refer to §4.3.7.2 STEP D.</p>



STEP	DESCRIPTION
<p>i Check by appropriate instrument (e.g. ethernet cable tester) the continuity of the 1-8 signals at the 2 ends of the ethernet cable as a result of its passage from the wall.</p>	
<p>F</p>	<p>Outside the room where the device is installed, connect the control panel:</p>  <p>CBL_ETHERNET 1000 indicated in blue in the image above.</p> <ul style="list-style-type: none"> - Connect the CBL_ETHERNET 1000 wall-exiting end to the control panel. - Cover the CBL_ETHERNET 1000 with appropriate external channel. <p>The type of installation I3 allows the activation of the x-ray emission through the appropriate button on the control panel without using the remote switch.</p>  <p>The command can only be enabled by accessing a special service page protected by a password. The installer must enable this option only if:</p> <ul style="list-style-type: none"> • Fully complies with the requests reported to §1.1 skills of the installer / maintainer technician. • The control panel is located at least 2 m (78 ⁴⁷/₆₄ in) from the patient, outside the trajectory of the x-ray beam (protection from diffuse and dispersed radiation). <p>However, it is possible to connect to the control panel (located outside the room where the device is installed) a remote switch using the supplied CBL_SPIRAL (shown in green in the image above) according to the following instructions:</p> <ul style="list-style-type: none"> • Secure the remote switch stand to the wall in a convenient position. • Connect the remote switch via the CBL_SPIRAL supplied with ethernet input of the control panel.
<p>i</p>	<p>The CBL_SPIRAL has a maximum extension of 3 m (118 ⁷/₆₄ in).</p>

5. FM MODEL INSTALLATION

This chapter illustrates the installation indications of the FM device.



5.1 Pre-installation requirements

5.1.1 Electrical system requirements

	Do not use the device if it has electrical, mechanical or radiation related defects.
	Place the device in an environment that complies with the regulations in force in the country of use.
	The electrical connections must be made by a technician authorized by the manufacturer and under the supervision of a Qualified Expert.
	The device must be placed in a room for medical use only, designed by an expert in protection against the risks associated with radiation in accordance with the regulations in force in the country of use.
	For Europe, the electrical system in which the device is installed must comply with the IEC 60364-7-710 standards (requirements for electrical systems in areas for medical use).
	Connect DENTALAIRE DC using a power line dedicated solely to the device itself.
	Upstream of the power supply network of the device, it is recommended to place a protection device (circuit breaker) with the following characteristics: <ul style="list-style-type: none"> • Thermal-magnetic with earth leakage protection -2P- type C magnetic curve - type A - I_{dn} = 30 mA - I_{cn} = 6 kA (minimum) - V_n = 230 Vac. <ul style="list-style-type: none"> - With rated current of 16 Amp for 230 V nominal mains voltage. - With rated current of 25 Amp for 120 V nominal mains voltage.


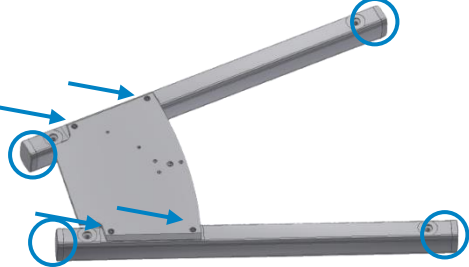
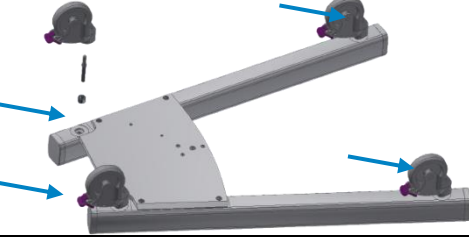

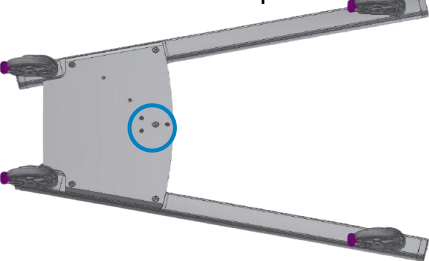





5.2 Assembly

i During the assembly, carefully check that all connections are intact, that the pins in the connector bodies are firmly in place and that the screws and bolts of the PE wires are tightened completely.


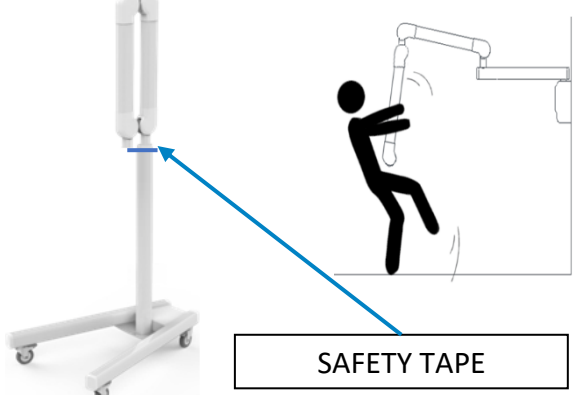


Before starting the assembly phase, take the screw Kit1 illustrated at §3.6 of this manual.

5.2.1 Mounting the mobile stand base


STEP	DESCRIPTION
A	<p>Add the covers to the ends of the legs (indicated by  in the image). Mount the legs of the mobile stand and fix them to the basement using the 4 screws Kit1-E.</p> 
B	<p>Mount the four wheels with brakes using pins (Kit1-A) and spacers (Kit1-B).</p> 
C	<p>Secure the mobile stand pole, using the screw Kit1-G and the 3 screws Kit1-F (indicated by  in the image below), taking care not to damage the cables and connectors coming out of the mobile stand pole.</p> 
D	<p>Secure the 2 handles (Kit1-N) for the displacement indicated by  in the image below.</p> 

STEP	DESCRIPTION
	Do not mount the PWD board on the mobile stand base at this stage. This avoids possible damage to the same due to accidental falls of tools used during the assembly phase of the scissor arm and the THA.


5.2.2 Mounting the scissor arm

STEP	DESCRIPTION
 <p>Danger of injury.</p> <p>The springs inserted into the scissor arm can cause injury to the installer and damage the arm itself if manipulated incorrectly. Keep the safety tape at the bottom of the scissor arm until the THA is mounted to prevent sudden opening during assembly operations.</p>	
<p>A</p>	<p>Loosen the friction screw on the pole of the mobile stand and push the friction cylinder back to prevent it from getting in the way.</p> 
<p>B</p>	<p>Pull the sheath and extract the cables from the stand pole. Remove the clamp and sheath.</p> 
<p>C</p>	<p>Thread the scissor arm inside the mobile stand pole bushing taking care not to compromise the cables and connectors coming out of the scissor arm. Slide the cables inside the mobile stand pole.</p>
<p>D</p>	<p>Connect:</p> <ul style="list-style-type: none"> • CBL_FIL2U of scissor arm with CBL_FIL1F of mobile stand pole (male-female connector coupling).




STEP	DESCRIPTION
	<ul style="list-style-type: none"> • CBL_HV2U of scissor arm with CBL_HV1F of mobile stand pole (male-female connector coupling). • CBL_EG2U of scissor arm with CBL_EG1F of mobile stand pole (male-female faston coupling).
E	Tighten the support arm friction <u>slightly</u> (§5.2.2 STEP A).
	Do not tighten the friction excessively at this stage. Run only to fully mounted device.
F	Verify that the scissor arm can perform a 48° rotation stroke inside mobile stand legs.



5.2.3 Mounting the THA


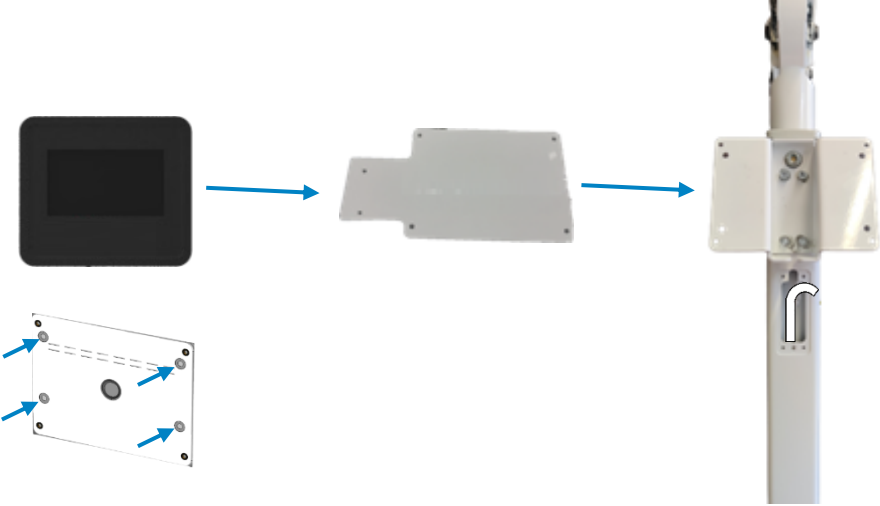

	Refer to the procedure reported in §4.3.4.
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5.2.4 Mounting the beam limiter


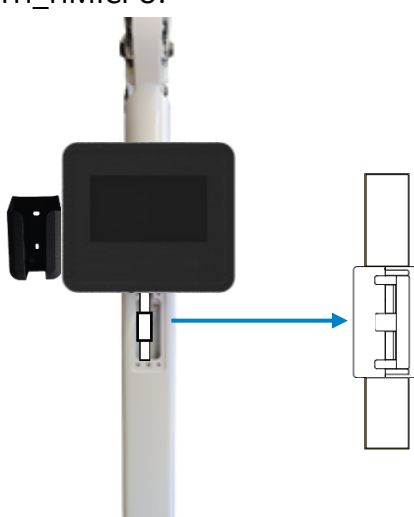
	Refer to the procedure reported in §4.3.5.
---	--

5.2.5 Mounting the control panel

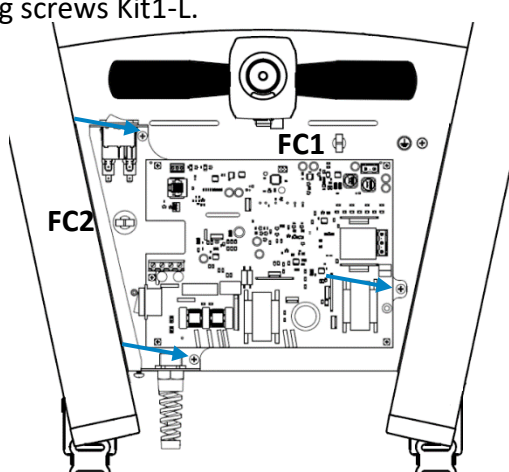
STEP	DESCRIPTION
A	Remove the cover shown in the figure below. 
B	Mount the control panel support, using the supplied screws 2 x Kit1-I and 2 x Kit1-H, on the holes of the mobile stan pole near the scissor arm brake adjustment. 

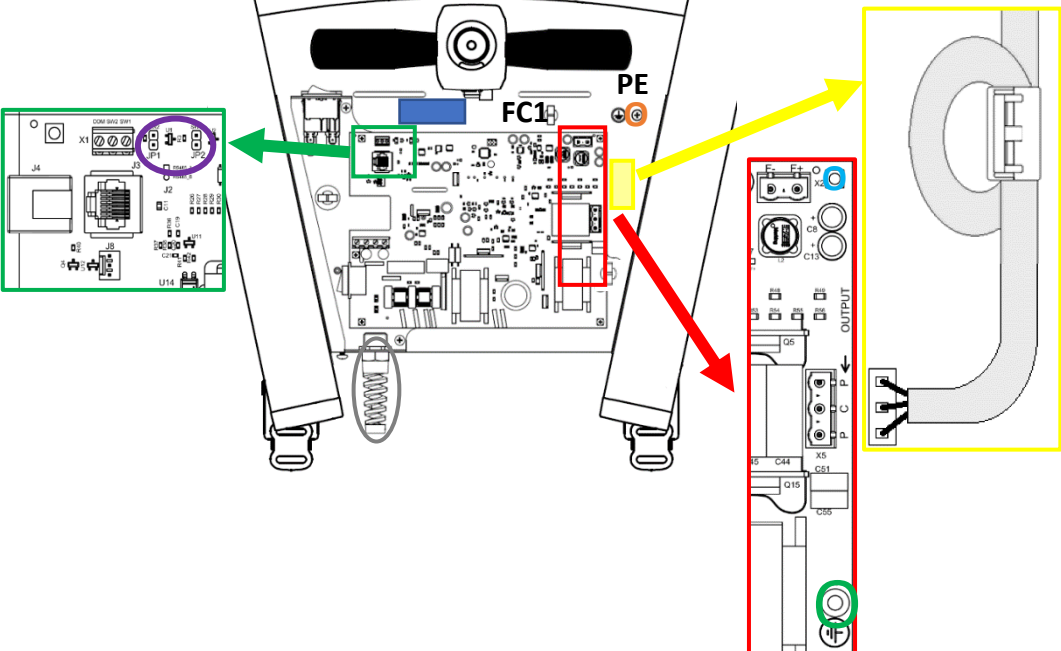
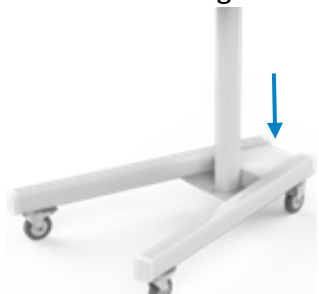
STEP	DESCRIPTION
C	Attach the black faceplate to the back cover of the control panel. 
D	Mount the control panel using the 4 screws Kit1-M. Interpose between the control panel support (mounted §5.2.5 STEP B) and the control panel, the bracket for the support of the remote switch.  <p>The bracket for the support of the remote switch allows the fixing of the remote switch both to the right and to the left of the control panel.</p>
E	Secure the remote switch stand to the bracket using 2 screws Kit1-L. 



STEP	DESCRIPTION
F	<p>Connect the CBL_ETHERNET 135 to the control panel's central RJ45 connector.</p>  <p>Taking care not to damage it, pull the excess of CBL_ETHERNET 135 towards the basement.</p>
G	<p>At the height of the cover (removed §5.2.5 STEP A), pass the CBL_ETHERNET 135 inside the ferrite FRT_CBL_ETH_HMICPU.</p> 

5.2.6 Mounting the power group


STEP	DESCRIPTION
A	<p>Fix the power group (PWD board + board support plate) to the basement by means of the 3 fixing screws Kit1-L.</p>  <p>Add the cable stopper point FC1 (Kit1-D).</p>

STEP	DESCRIPTION
<p>B</p>	<ul style="list-style-type: none"> • Pass through the FC1 cable stopper point the outgoing CBL_EG1F from mobile stand pole and fix it at the PE ground point (indicated by ○ in the image below) using a screw Kit1-L and a washer Kit1-C. Verify that the tightening is accurate and that the cable lug holds its position. • Pass through the FC1 cable stopper point and connect the outgoing CBL_FIL1F from mobile stand pole to PWD's X2 connector. Connect the ground wire contained in CBL_FIL1F to the right of the X2 connector (indicated by ○ or in the image below). • Pass through the FC1 cable stopper point the outgoing CBL_HV1F from mobile stand pole. Pass the CBL_HV1F twice inside the FRT_CBL_HV_PWD ferrite (indicated in yellow in the image below) and connect to PWD's X5 connector. Connect the ground wire contained in CBL_HV1F to ground point (indicated by ○ in the image below). • Connect the outgoing CBL_ETHERNET 135 from mobile stand pole to PWD's J3 connector: <ul style="list-style-type: none"> ○ Collect the excess of CBL_ETHERNET 135 (§5.2.5 STEP F) in the area indicated by blue rectangle in the image below. ○ Be careful not to over bend the collected CBL_ETHERNET 135 creating only soft curves to avoid communication issues between the control panel and the PWD. • Close the JP1 and JP2 jumpers (indicated by ○ in the image below) that are located to the right of PWD's X1 connector to disable port contact control and enablement key (not applicable for mobile version).  <ul style="list-style-type: none"> • Screw the cable gland indicated by ○ in the image.
<p>C</p>	<p>Secure the appropriate basement cover using 3 screw Kit1-L and 3 washer Kit1-C.</p> 





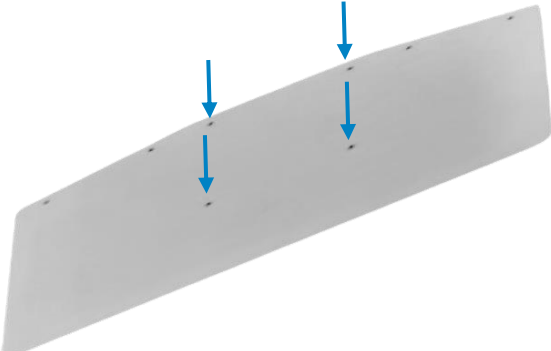
5.2.7 Power cable preparation

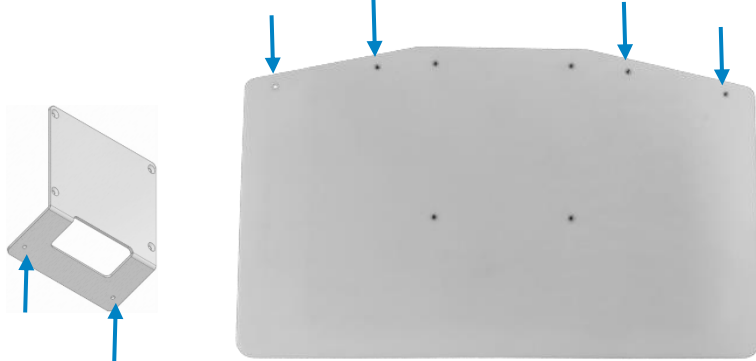

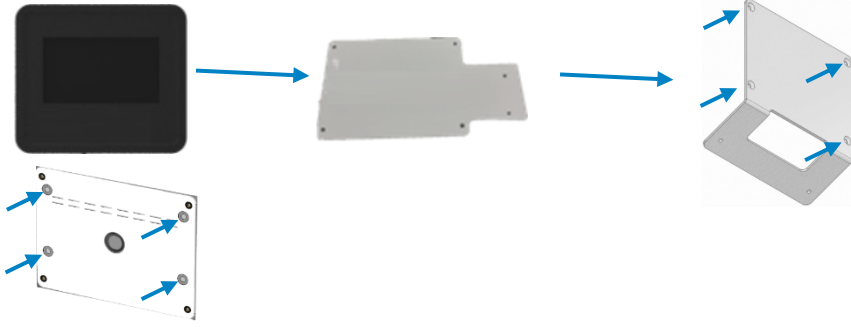

The mobile device has a non-detachable power cable (CBL_SUPPLY_EXT). The CBL_SUPPLY_EXT must be completed by the installer by mounting a plug for connection to the local electricity network.

STEP	DESCRIPTION
A	Complete CBL_SUPPLY_EXT with a plug with grounding connection.
	Use plugs that comply with the regulations in force in the country of use (if not present). Where possible, use plugs where the ground connection occurs before the power connections are connected and is interrupted after they are opened.
B	Check the correct plug fastening of the conductors (L, N, PE) coming out of CBL_SUPPLY_EXT.


5.2.8 Mounting the PC support tray (optional)

Before starting the assembly phase, take the screw Kit2 illustrated at §3.7 of this manual.

STEP	DESCRIPTION
A	Remove the cover shown in the figure below. 
B	Mount the PC support tray, using the supplied screws 2 x Kit2-D and 2 x Kit2-C, on the holes of the mobile stan pole near the scissor arm brake adjustment. 
C	Place the tray on the stand and secure it via 4 screws Kit2-A. 

STEP	DESCRIPTION
D	<p>Place the control panel stand on the left or right side of the PC support tray and secure it via 2 screws Kit2-A on the appropriate holes below.</p> 
E	<p>Attach the black faceplate to the back cover of the control panel.</p> 
F	<p>Mount the control panel using the 4 screws Kit2-B. Interpose between the control panel support (mounted §5.2.8 STEP D) and the control panel, the bracket for the support of the remote switch.</p>  <p>The bracket for the support of the remote switch allows the fixing of the remote switch both to the right and to the left of the control panel.</p>
G	<p>Secure the remote switch stand to the bracket using 2 screws Kit2-A.</p> 



STEP	DESCRIPTION
H	Pass the CBL_ETHERNET 135 into the side hole of the stand. 
I	Connect the CBL_ETHERNET 135 to the control panel's central RJ45 connector. Taking care not to damage it, pull the excess of CBL_ETHERNET 135 towards the basement.

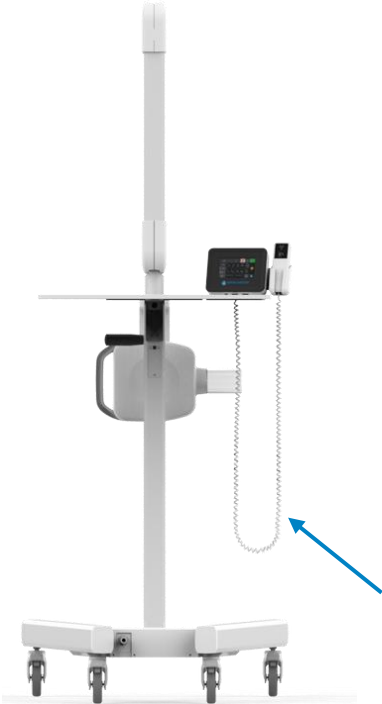
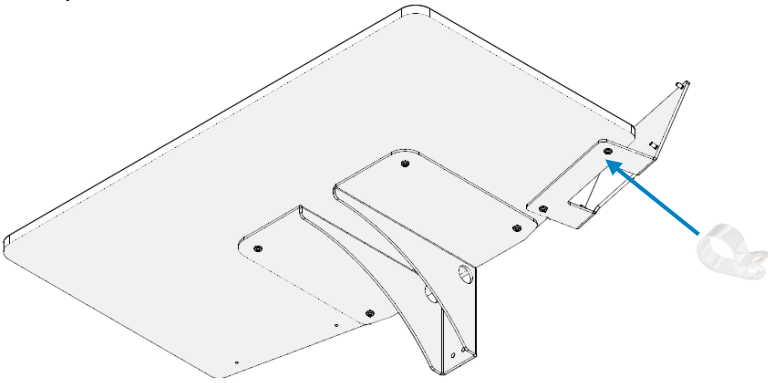
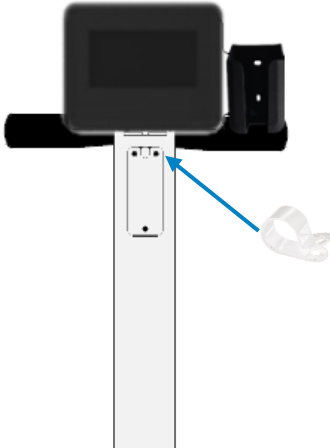
5.2.9 Connection to the electrical network

	Risk of degradation of the electrical safety level.
	Units supplied with power cable and plug must be equipped with fuses on each power conductor. Mobile units are equipped with a power flying cable and as such are NOT permanently connected.

5.2.10 Final turning

STEP	DESCRIPTION
A	Adjust: <ul style="list-style-type: none"> • Mobile stand pole friction. • Scissor arm friction.
B	Reassemble the plastic covers of: <ul style="list-style-type: none"> • THA. • Scissor arm joints. • Cover mobile stand pole removed at §5.2.5 STEP A.
	Avoid reopening the scissor arm joints covers, unless strictly necessary for maintenance operations, as they could be damaged. If it is necessary to remove the scissor arm joints covers, be sure to use a coaxial movement to remove them.

5.2.11 Connection of the remote switch

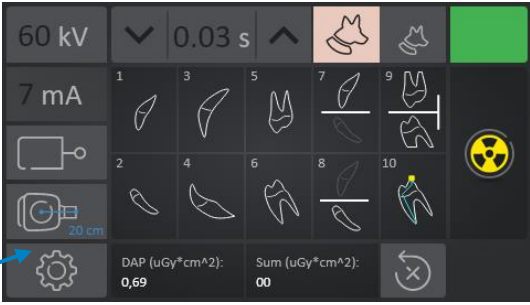
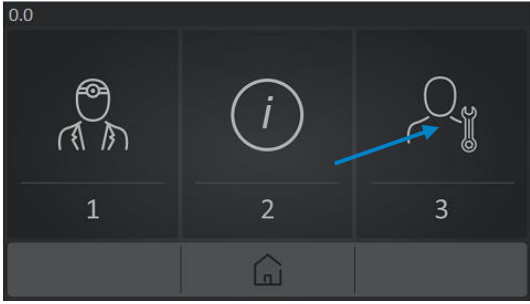


STEP	DESCRIPTION
<p style="text-align: center;">A</p>	<p>Connect the remote switch using the CBL_SPIRAL supplied to the RJ45 connector of the control panel.</p> 
<p style="text-align: center;">B</p>	<p>Block the CBL_SPIRAL using the plastic cable clamp (Kit1-D):</p> <ul style="list-style-type: none"> • In case of device FM with PC support tray fix the plastic cable clamp to the control panel stand screw.  <ul style="list-style-type: none"> • In case of device FM without PC support tray fix the plastic cable clamp to the cover mobile stand pole screw. 


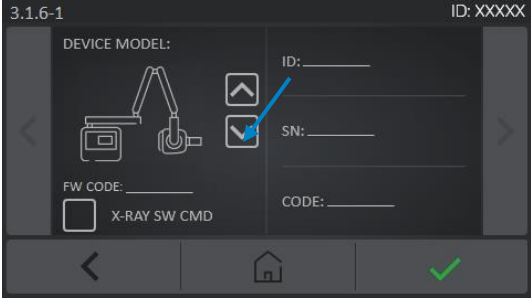
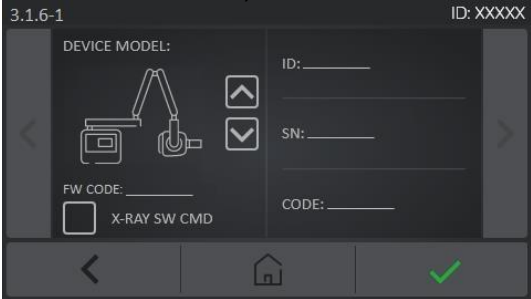

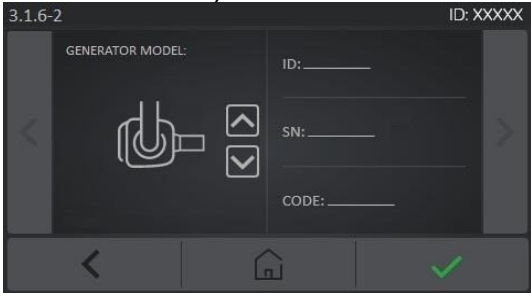


6. TURNING ON THE DEVICE

Below are the settings and checks to be carried out when the device is turned ON for the first time to verify the correct assembly and operation of the device.

6.1 Model setting, SN and associated THA verification

STEP	DESCRIPTION
A	Turn ON the device.
B	Select settings on the home page. 
C	Select service menu. 
D	Select technical service ID. 
E	The device displays an alphanumeric keypad.  <p>Enter the password to access the service menu.</p>

STEP	DESCRIPTION
F	<p>Select icon 6.</p> 
G	<p>Verify that the DEVICE MODEL is correct. Otherwise, adjust it using the appropriate arrow.</p> 
H	<p>Verify the the information:</p> <ul style="list-style-type: none"> • ID: device identifier, • SN: device serial number, • CODE: device commercial code,  <p>correspond to those shown on the labels placed on the device. Otherwise, contact technical assistance.</p>
I	<p>Activate the "X-RAY SW CMD" command to enable the ability to operate the x-ray command on the control panel.</p>
<p> The installer must ensure that it falls back into the type I3 of installation §4.3.7.3.</p>	
J	<p>Scroll with the arrow to the right.</p> <p>Verify that the information:</p> <ul style="list-style-type: none"> • ID: THA identifier, • SN: THA serial number, • CODE: THA commercial code, 




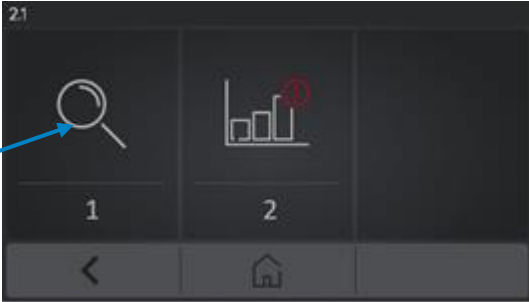
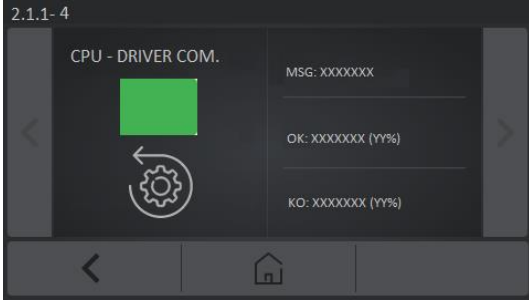

STEP	DESCRIPTION						
	correspond to those shown on the labels placed on the device. Otherwise, contact technical assistance.						
K	<p>Scroll with the arrow to the right. Verify that the information:</p> <ul style="list-style-type: none"> • SN e FW CPU, • SN e FW PWD, • MSG traded between PWD and CPU, <div data-bbox="644 499 1174 797" style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p>3.1.6-3 ID: XXXXX</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">CPU SN: _____</td> <td style="width: 50%;">CPU FW: _____</td> </tr> <tr> <td>PWD SN: _____</td> <td>PWD FW: _____</td> </tr> <tr> <td>MSG V: _____</td> <td></td> </tr> </table> </div> <p>are present.</p>	CPU SN: _____	CPU FW: _____	PWD SN: _____	PWD FW: _____	MSG V: _____	
CPU SN: _____	CPU FW: _____						
PWD SN: _____	PWD FW: _____						
MSG V: _____							

6.2 Device operation control







Below are illustrated the checks to be performed to verify the correct operation of the device. Execute steps §6.1 STEP A -:- E before carrying out the steps indicated in §6.2.1.

6.2.1 CPU-PWD communication verification and input status

STEP	DESCRIPTION
A	<p>Select settings on the home page.</p> <div data-bbox="651 1113 1182 1413" style="border: 1px solid black; padding: 5px; margin: 10px 0;"> </div>
B	<p>Select the diagnostic and usage information menu.</p> <div data-bbox="651 1453 1182 1753" style="border: 1px solid black; padding: 5px; margin: 10px 0;"> </div>

STEP	DESCRIPTION
C	The icon indicated allows the access to device information. 
D	The icon indicated allows the access to device diagnostics. 
E	On screen ID 2.1.1-4 it is possible to see: <ul style="list-style-type: none"> • “CPU-DRIVER COM.”: <ul style="list-style-type: none"> - Green: CPU-PWD stable communication, - Red: CPU-PWD unstable communication. • “MSG”: number of total messages exchanged between CPU and DRIVER, • “OK”: number of "MSG" exchanged correctly, • “KO”: number of "MSG" exchanged incorrectly,  <ul style="list-style-type: none"> • The command  allows the reset of the counters. Communication between control panel and power driver is present if the square remains green continuously. If not, check: <ul style="list-style-type: none"> • CBL_ETHERNET 1000 integrity. • Control panel. Especially: <ul style="list-style-type: none"> - that it is turned ON while the device is ON, - that the RJ45 connectors are intact and do not show damage. • Power driver. <ul style="list-style-type: none"> - that it is turned ON while the device is ON, - that the RJ45 connectors are intact and do not show damage.


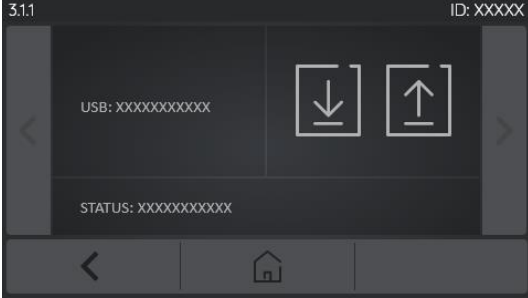






STEP	DESCRIPTION
<p>F</p>	<p>On screen ID 2.1.1-5 it is possible to see:</p> <div style="display: flex; align-items: flex-start;"> <div style="margin-right: 10px;">   </div> <ul style="list-style-type: none"> • The status of optional security contacts: <ul style="list-style-type: none"> • Green: security contacts 1 and 2 ON. • Red: security contacts 1 or 2 OFF. </div> <div style="text-align: center; margin: 10px 0;">  </div> <ul style="list-style-type: none"> - Safety contact 1 is ON if safety contact 1 (X1.SW1) is activated or jumper JP1 is closed. - Safety contact 2 is ON if safety contact 2 (X1.SW2) is activated or jumper JP2 is closed. <div style="display: flex; align-items: flex-start; margin-top: 10px;"> <div style="margin-right: 10px;">   </div> <ul style="list-style-type: none"> • The status of the buzzer ON / OFF. To run a functional test press . • The status of the remote switch PRESSED / RELEASED. </div>

7. Service menu


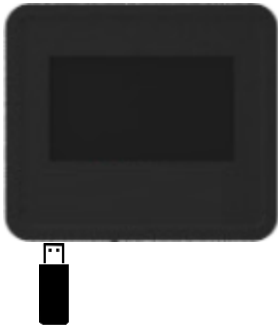
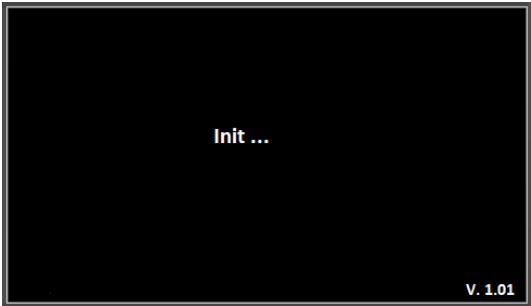
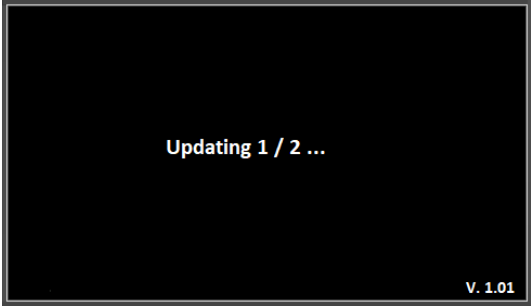
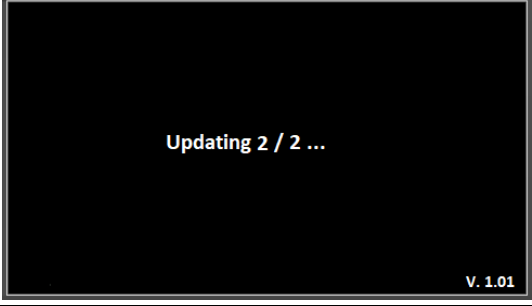
Below are illustrated the functions of the service menu. Execute steps §6.1 STEP A -:- E to access the menu.

7.1 Data upload / download


STEP	DESCRIPTION
<p style="text-align: center;">A</p>	<p>Select icon 1.</p>  <p>The icon indicated allows the data upload and download using a USB key.</p>
<p style="text-align: center;">B</p>	 <p>  Download data from USB key to device.  Upload data from device to USB key. </p> <p>On this screen it is possible to see the STATUS of data transmission:</p> <ul style="list-style-type: none"> • USB E01: error configuration file not found, • USB E02: error configuration file size out of limits (> 6 kb), • USB E03: error configuration file unreadable, • USB E04: error configuration file cannot be opened, • USB E05: error configuration file not accessible, • USB E06: error incorrect cfg trial mode, • USB E07: error cfg file not compliant, • OK: done.
	<p>If technical assistance is required, a file can be generated containing the state of the art of the device parameters.</p> <p>After inserting the USB key into the appropriate USB HOST under the display, use the data upload function () on the ID 3.1.1 screen, a <u>confxxxx</u> file will be automatically loaded on the USB key (where xxxx are the last 4 digits of the serial number of the HMICPU).</p>




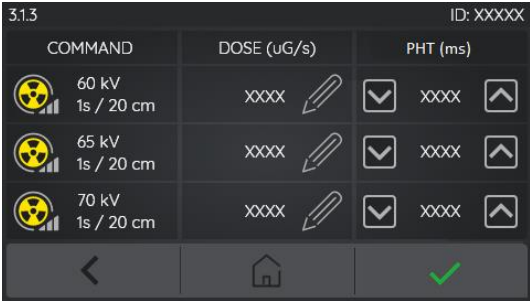
7.2 Update of device firmware

STEP	DESCRIPTION
A	Insert a USB key (2.0 at least) in the PC USB port and copy in the USB key the following files supplied by FONA: <ul style="list-style-type: none"> • hmi_0102.bin • img_0101.bin • upgrade.ini
	Copy in the USB key DIRECTLY the files, and not a folder.
B	When the device is turned OFF, insert the USB key with the appropriate firmware version in the appropriate USB HOST under the display. <div style="text-align: center;">  </div>
C	Turn ON the device and wait for the firmware update home page visualization (auto-detect).
D	Wait for messages: <ul style="list-style-type: none"> • “Init...”, <div style="text-align: center;">  </div> • “Updating 1 / 2...” (FW update), <div style="text-align: center;">  </div> • “Updating 2 / 2...” (images update). <div style="text-align: center;">  </div>




STEP	DESCRIPTION
	Wait for the update procedure to complete and the application to start to make sure that the firmware download process has completed successfully.
	<p>Status / error messages are displayed in the center of the screen:</p> <ul style="list-style-type: none"> • Init: initialization, • Updating 1/2: FW update in progress, • Updating 2/2: QSPI update in progress, • FW E01: error no valid FW detected, • FW E02: error incorrect FW dimensions, • FW E03: error FW downgrade not allowed, • FW E04: error incorrect QSPI size, • FW E05: error QSPI downgrade not allowed. <p>During the FW update, it is possible to see the bootloader version at the bottom right.</p>


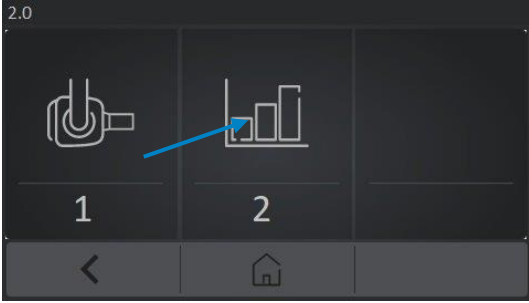

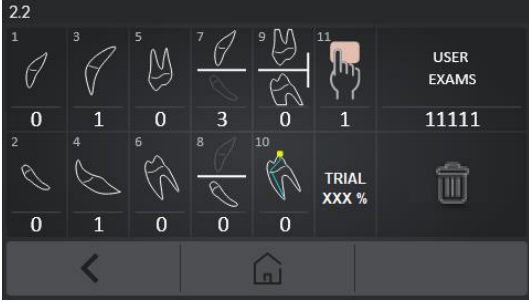

7.3 Checking the radiographic yield of the device

STEP	DESCRIPTION
<p data-bbox="245 920 268 952">A</p>	<p data-bbox="376 777 549 808">Select icon 3.</p> 
<p data-bbox="245 1256 268 1288">B</p>	<p data-bbox="376 1093 1267 1124">Check that the dose and PHT values at 60, 65 and 70 kV are present.</p> 

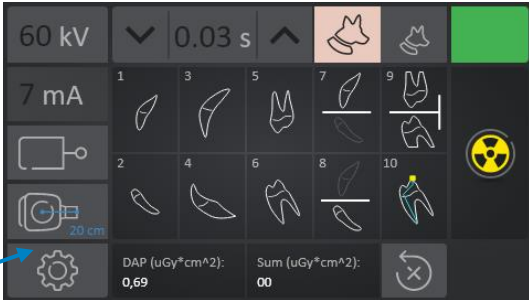
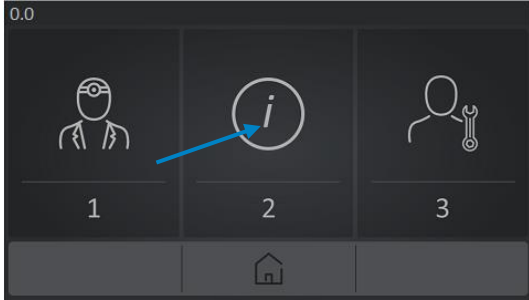



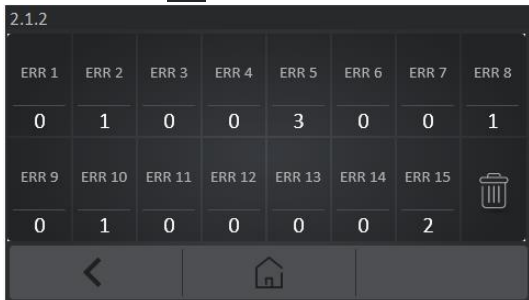



7.4 Exposure counter

STEP	DESCRIPTION
<p data-bbox="245 1711 268 1742">A</p>	<p data-bbox="376 1554 820 1585">Select settings on the home page.</p> 




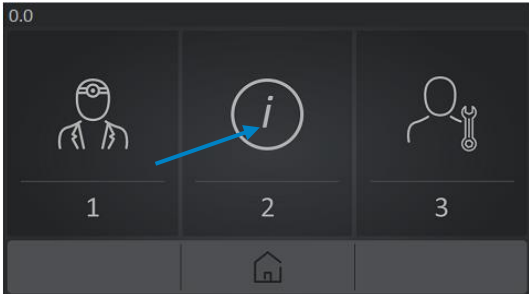

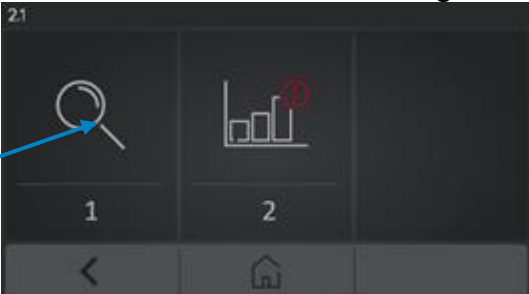

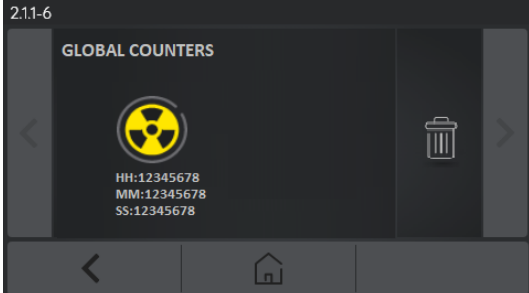

STEP	DESCRIPTION
B	<p>Select diagnostic and usage information menu.</p> 
C	<p>The icon indicated allows the access to the exposure counter (the icon is visible only if the "EXAMS COUNTER" option has been enabled on screen ID 1.3-1).</p> 
D	<p>On this screen it is possible to see the number of exams performed and eventually reset the counter by pressing the .</p>  <p>If the device is used in trial mode, the percentage of exams performed is visualized. When "TRIAL xxx %" is > 90%, the status of the device visualized on the home page turns orange for 10 seconds following an examination to report the situation. Contact technical support.</p> 

7.5 Alarm counter

STEP	DESCRIPTION																																								
A	<p>Select settings on the home page.</p> 																																								
B	<p>Select diagnostic and usage information menu.</p> 																																								
C	<p>The icon indicated allows the access to the device information.</p> 																																								
D	<p>The icon indicated allows the access to the alarm counter.</p> 																																								
E	<p>On this screen it is possible to see the repeatability of errors and eventually reset the counter by pressing the icon  .</p>  <table border="1" data-bbox="639 1749 1161 2033"> <thead> <tr> <th colspan="8">2.1.2</th> </tr> <tr> <th>ERR 1</th> <th>ERR 2</th> <th>ERR 3</th> <th>ERR 4</th> <th>ERR 5</th> <th>ERR 6</th> <th>ERR 7</th> <th>ERR 8</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>1</td> <td>0</td> <td>0</td> <td>3</td> <td>0</td> <td>0</td> <td>1</td> </tr> <tr> <th>ERR 9</th> <th>ERR 10</th> <th>ERR 11</th> <th>ERR 12</th> <th>ERR 13</th> <th>ERR 14</th> <th>ERR 15</th> <th></th> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>2</td> <td></td> </tr> </tbody> </table>	2.1.2								ERR 1	ERR 2	ERR 3	ERR 4	ERR 5	ERR 6	ERR 7	ERR 8	0	1	0	0	3	0	0	1	ERR 9	ERR 10	ERR 11	ERR 12	ERR 13	ERR 14	ERR 15		0	1	0	0	0	0	2	
2.1.2																																									
ERR 1	ERR 2	ERR 3	ERR 4	ERR 5	ERR 6	ERR 7	ERR 8																																		
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ERR 9	ERR 10	ERR 11	ERR 12	ERR 13	ERR 14	ERR 15																																			
0	1	0	0	0	0	2																																			



7.6 Global counter

STEP	DESCRIPTION
A	<p>Select settings on the home page.</p> 
B	<p>Select diagnostic and usage information menu.</p> 
C	<p>The icon indicated allows the access to the device information.</p> 
D	<p>The icon indicated allows the access to the device diagnostic.</p> 
E	<p>On the screen it is possible to see the total working time of the device and eventually reset the counter by pressing the icon .</p> 
	<p>More information about the user menu and the device information can be found in the user manual (code: 691000210).</p>

8. Service and maintenance

8.1 Mains fuses

REF	USE	BOARD	TECHNICAL DATA	DESCRIPTION
F1 – F2	Mains power input.	PWD	6.3 A, 250 V, \varnothing 9 mm (0 23/64 in)	ROUND FUSE TIME LAG.
F _{EXT1} – F _{EXT2}	FM model additional fuses.	//	6.3 AH, 250 V with an interrupting rating of 1500 A at 250 Vac	HIGH BREAKING CAPACITY FUSES.



Risk of electric shock.



Do not replace a burnt fuse. The fuse is a protective device and its intervention indicates that a malfunction has occurred.

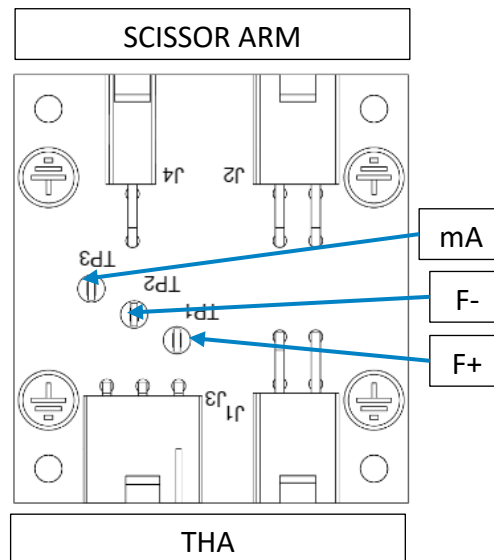
The malfunction must be fixed before restoring the unit.

Activating a unit of this type by replacing a blown fuse is dangerous given the high voltage and high energies involved. Contact technical support.

8.2 THA test

It is possible to measure the anodic current and the voltage of the filament with DC voltmeter directly on the CB board placed in the joint.

- The point F- is at ground level is also used for the measurement of the voltage corresponding to the anodic current.
- The anodic current, in mA, is measured by reading the DC voltage between mA and F-.
- 1V corresponds to 1 mA.
- The voltage of the filament supply is measured between F+ & F-.





8.3 THA replacement

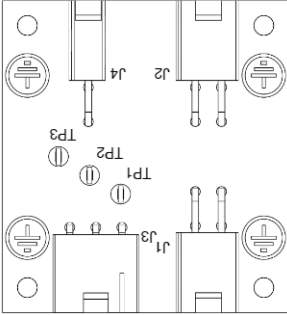
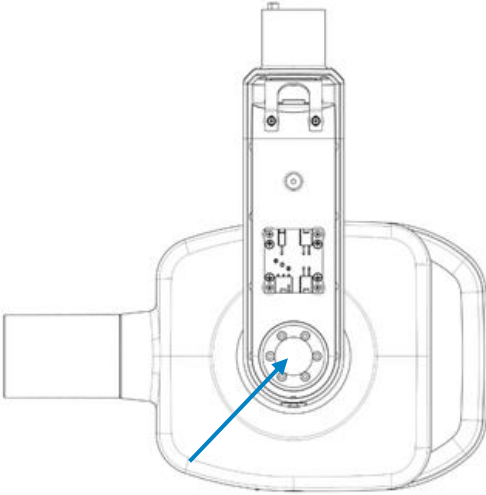
<p>Danger of injury. Compressed springs of the scissor arm can cause injury to the installer and damage the arm itself in case of inadequate handling.</p> <p>Risk of operator exposure to radiation.</p>	
<p>Block the ends of the scissor arm with a tape before working to prevent sudden openings during the disassembly of the mounted THA. Do not stand in front of the scissor arm when it is opened.</p> <p>Take at least 2 m (78 ⁴⁷/₆₄ in) from the source, out of the radiation beam, to avoid being affected.</p>	
<p>The PWD, the THA and the HMICPU are uniquely coupled. When it is necessary to replace the THA and/or one of 2 boards, if possible, generate the <u>confxxx</u> file as indicated in §7.1 and send it to FONA, if the damage does not allow the device to be switched ON, communicate to FONA the following data present on the device:</p> <ul style="list-style-type: none"> • Device SN (e.g. 4710IA0000). • Device REF (e.g. 971000200). • Control panel SN (e.g. 4710I20000). • PWD SN (e.g. 21450010). • THA SN (e.g. 4710I00001). <p>It is also necessary to communicate the SN of the replacement material. Once in possession of all the necessary information, FONA generate a <u>replxxxx</u> (where xxxx are the last 4 digits of the HMICPU serial number) file for matching the parts present on the device and the replacement ones.</p>	

They are required for the adjustment of the unit:

- Regularly calibrated multimeter for continuous voltage measurement.
- Regularly calibrated non-invasive kV meter.

8.3.1 Mounting the new THA



STEP	DESCRIPTION
A	Turn OFF the power supply and wait at least 30 seconds to allow the complete discharge of the power group of the device.
B	Open the scissor arm and remove the joint cover. <div style="text-align: center;"> </div>

STEP	DESCRIPTION
C	<p>Disconnect:</p> <ul style="list-style-type: none"> • CBL_HV3U from connector J1 CB. • CBL_FIL3U from connector J3 CB. • CBL_EG3U from ground to the left of the connector J3 CB. 
D	<p>Support the THA and remove the retaining fork. Pass the cables and connectors into the mounting pin, indicated in the image below.</p> 
E	<p>Insert the retaining fork and tighten the screws.</p>
F	<p>Connect:</p> <ul style="list-style-type: none"> • CBL_HV3U of the replacement THA to connector J1 CB. • CBL_FIL3U of the replacement THA to connector J3 CB. • CBL_EG3U of the replacement THA to ground to the left of the connector J3 CB.




8.3.2 File update procedure

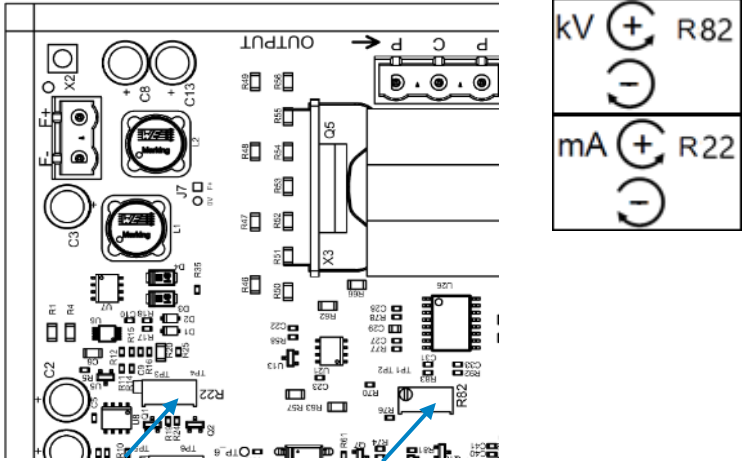

After THA and/or board replacement and/or to restore electronics parameters (e.g.: display offset calibration), follow these steps:

STEP	DESCRIPTION
A	Insert a USB key (2.0 at least) in the PC USB port.
B	Copy in the USB key the <u>replxxx.dat</u> file generated by FONA.
C	Extract the USB key from the PC.
D	Verify that the device is turned OFF.
E	Insert the USB key in the appropriate USB HOST under the display of the control panel. 
F	Turn ON the device.
G	Wait for application start. The file is read and uploaded automatically.
	Do not upload the <u>replxxx.dat</u> file on a USB key that contains the device FW to avoid an unnecessary automatic firmware update of the device.

8.3.3 Filament calibration

Replacing the THA requires filament and high voltage calibration.

STEP	DESCRIPTION
A	Turn OFF the device.
B	Set the multimeter for DC voltage measurement, 10 V _{DC} end of scale, if available activate the "MAX HOLD" function. <ul style="list-style-type: none"> • Connect the negative (-) measuring tip of multimeter to TP2 test point of CB board (F-). • Connect the positive (+) measuring tip of multi-meter to TP3 test point of CB board (mA sense).
	Note that measured voltage is negative.
C	Place the non-invasive kV meter at about 20 cm (7 7/8 in) in front of the output beam ready to measure the kV level. Be sure that measuring area of the non-invasive meter is properly aligned with output beam.
D	Turn ON the power supply.
E	Verify that the dose and the PHT values at 60, 65 and 70 kV present in the documentation accompanying the THA (code: 791000230) are equal to the ones reported enter on screen ID 3.1.3 (Refer to §7.3 to check the parameters).

STEP	DESCRIPTION
F	<p>If procedure is performed as a first-time adjustment, turns R82 (kV adjustment) at least 8 turns clockwise.</p> 
G	Set 60 kV 1 second on the control panel.
H	<p>Perform X-ray exposure and verify that:</p> <ul style="list-style-type: none"> the maximum value of measured voltage at the mA point is $6.3 \div 6.8 V_{DC}$, 1 V corresponding to 1 mA of anode current. <p>If not, slightly tune the trimmer R22 to fall in the indicated range: turn it clockwise to reduce the current or counter clockwise to increment it.</p> <ul style="list-style-type: none"> the measured kV level is below 60 kV otherwise apply some extra clockwise turns to R82.
I	Repeat the exposure at 60 kV until mA reading is within required range of $6.3 \div 6.8 V_{DC}$.
J	Once mA value is properly adjusted, kV value can be regulated using R82. Increase kV setting gradually and perform emissions until measured value is $58 \div 60$ kV.
K	Set 70 kV 1 second on the control panel.
L	<p>Perform X-ray exposure and verify that:</p> <ul style="list-style-type: none"> the maximum value of measured voltage at the mA point is $6.5 \div 7.5 V_{DC}$. <p>If not, tune the trimmer R22 to have a value in the indicated range.</p> <ul style="list-style-type: none"> the measured kV level is from $69 \div 70.5$ kV. If not, tune the HV calibration trimmer R82 to have a value in the indicated range.
M	Set 60 kV 1 second on the control panel.
N	<p>Perform X-ray exposure and verify that:</p> <ul style="list-style-type: none"> the maximum value of measured voltage at the mA point is $6.3 \div 7.5 V_{DC}$. the measured kV level is $58 \div 62$ kV.
O	Set 65 kV 1 second on the control panel.
P	<p>Perform X-ray exposure and verify that:</p> <ul style="list-style-type: none"> the maximum value of measured voltage at the mA point is $6.3 \div 7.5 V_{DC}$. the measured kV level is $63 \div 67$ kV.
	<p>The procedure ends when all values fall within the nominal tolerances. The fine adjustment of kV and mA technical factors requires attention during its development:</p> <ul style="list-style-type: none"> A change of one regulation trimmer affects the other value too. <p>During R82 and R22 adjusting phase, it is necessary to know that:</p> <ul style="list-style-type: none"> Increase the HV value (R82) slightly increases the mA because the electric field inside the tube becomes higher and attracts more electrons.



STEP	DESCRIPTION
	<ul style="list-style-type: none"> • Increase the mA value (R22) decreases the resulting HV value due to extra losses on the voltage multiplier stage. <p>It is suggested to perform calibration procedure respecting the following order:</p> <ol style="list-style-type: none"> 1. Set mA just a little below nominal value. 2. Rise kV to required value. 3. Verify that mA value is slightly higher than initial measurement. <p>Please note that a minimal adjustment on R22 trimmer affects in an insignificant way the kV setting.</p> <p>In case it is not possible to adjust the THA in the indicated ranges:</p> <ul style="list-style-type: none"> • Remove power. • Put the device out of service. • Call the service technician.
Q	Verify that during the execution of the exposures the device does not go into alarm.
R	Check and close the cover of the joint, removed at §8.3.1 STEP B.

8.4 Electronic boards replacement



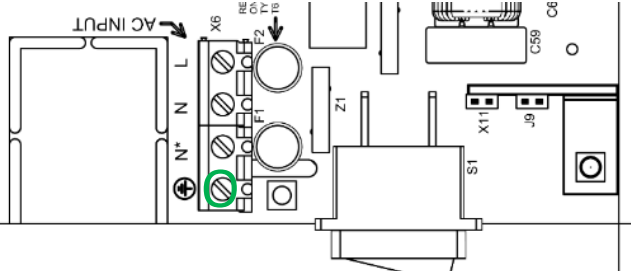
	<p>Risk of operator exposure to radiation.</p>
	<p>Take at least 2 m (78 ⁴⁷/₆₄ in) from the source, out of the radiation beam, to avoid being hit.</p>
	<p>The PWD, the THA and the HMICPU are uniquely coupled.</p> <p>When it is necessary to replace the THA and/or one of 2 boards, if possible, generate the <u>confxxxx</u> file as indicated in §7.1 and send it to FONA, if the damage does not allow the device to be switched ON, communicate to FONA the following data present on the device:</p> <ul style="list-style-type: none"> • Device SN (e.g. 4710IA0000). • Device REF (e.g. 971000200). • Control panel SN (e.g. 4710I20000). • PWD SN (e.g. 21450010). • THA SN (e.g. 4710I00001). <p>It is also necessary to communicate the SN of the replacement material.</p> <p>Once in possession of all the necessary information, FONA generate a <u>replxxxx</u> (where xxxx are the last 4 digits of the HMICPU serial number) file for matching the parts present on the device and the replacement ones.</p>

8.4.1 PWD board replacement

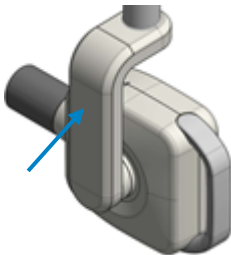
They are required for the adjustment of the unit:

- Regularly calibrated multimeter for measuring electrical resistance.
- Regularly calibrated non-invasive kV meter.

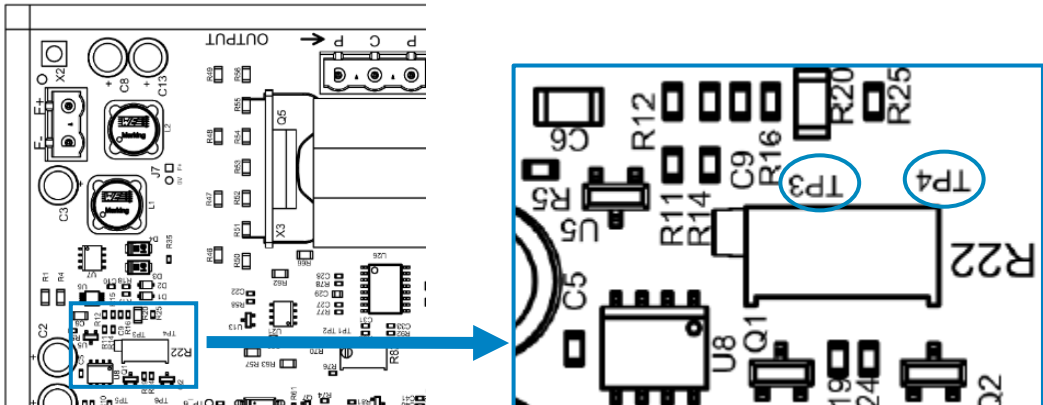
OPTION A:

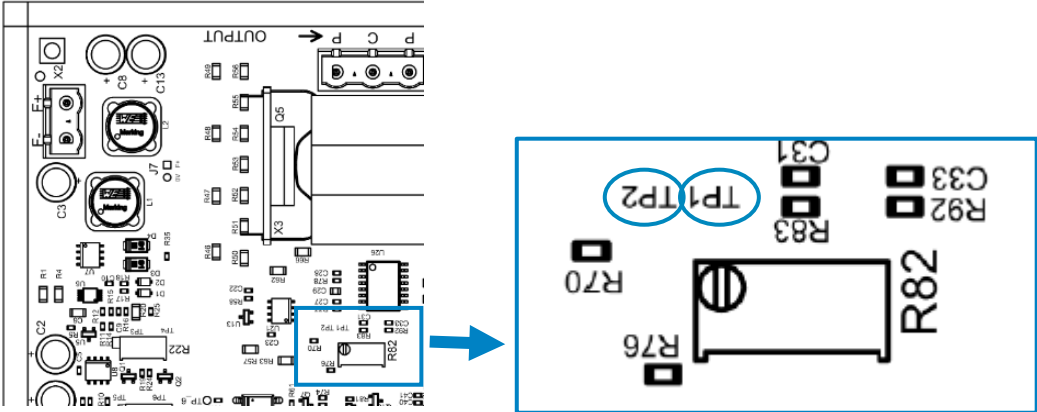
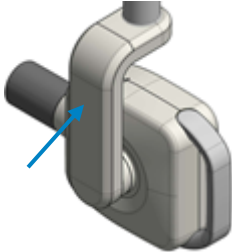

STEP	DESCRIPTION
A	Turn OFF the device.
B	Remove the power supply of the room and wait at least 30 seconds to allow the complete discharge of the power group of the device.
C	Remove the wall support cover (WM model) / mobile stand basement cover (FM model). 
D	Disconnect the main power supply cables from the PWD terminal block X6 by removing the earth conductor last (indicated by  in the image below). 
E	Disconnect: <ul style="list-style-type: none"> • WM model: <ul style="list-style-type: none"> - CBL_EG1Wxxx from ground point PE. - CBL_FIL1Wxxx from connector X2 of PWD. - CBL_HV1Wxxx from connector X5 of PWD. • FM model: <ul style="list-style-type: none"> - CBL_EG1F from ground point PE. - CBL_FIL1F from connector X2 of PWD. - CBL_HV1F from connector X5 of PWD.
F	Disassemble: <ul style="list-style-type: none"> • WM model: <ul style="list-style-type: none"> - PWD board from the wall support plate. • FM model: <ul style="list-style-type: none"> - Power group (PWD board + board support plate) from the basement.
G	Note the serial number of the replacement PWD board.
H	Mount: <ul style="list-style-type: none"> • WM model: <ul style="list-style-type: none"> - Replacement PWD board on the wall support plate. • FM model: <ul style="list-style-type: none"> - Power group (PWD board + board support plate) on the basement.



STEP	DESCRIPTION
I	Connect: <ul style="list-style-type: none"> • WM model: <ul style="list-style-type: none"> - Refer to §4.3.2 STEP F. • FM model: <ul style="list-style-type: none"> - Refer to §5.2.6 STEP B.
J	Reconnect the main power cables to PWD's X6 terminal: <ul style="list-style-type: none"> • WM model: <ul style="list-style-type: none"> - The grounding conductor at PWD's clamp X6.PE. - The phase conductor at PWD's clamp X6.L. - The neutral conductor at PWD's clamp X6.N. • FM model: <ul style="list-style-type: none"> - The grounding conductor at PWD's clamp X6.PE. - The phase conductor at PWD's clamp X6.L. - The neutral conductor at PWD's clamp X6.N*.
K	Verify the correctness of the connections made and reactivate the power supply.
L	Follow the steps of §8.3.2 to couple the THA, the HMICPU and PWD boards.
M	Turn OFF the device.
N	Remove the joint cover. 
O	Perform the calibration procedure reported at §8.3.3.
P	Make an exposure to check the suitability of the connections.
Q	Turn OFF the power supply.
R	Close the covers.

OPTION B: if only a multimeter is available, as an alternative to what is indicated in OPTION A, it is possible to follow the steps below.

STEP	DESCRIPTION
A	Follow the steps A-C of §8.4.1 OPTION A.
B	Set the multimeter for resistance measurement (Ω symbol). Measure the resistance value between TP3 and TP4 on faulty PWD and note the value. 

STEP	DESCRIPTION
C	Set the multimeter for resistance measurement (Ω symbol). Measure the resistance value between TP1 and TP2 and note the value. 
D	Follow the steps D-I of §8.4.1 OPTION A.
E	Set the multimeter for resistance measurement (Ω symbol). Measure the resistance value between TP3 and TP4 on replacement PWD. Adjust the trimmer R22 until the value between TP3 and TP4 is identical to that noted in STEP B.
F	Set the multimeter for resistance measurement (Ω symbol). Measure the resistance value between TP1 and TP2 on replacement PWD. Adjust the trimmer R82 until the value between TP1 and TP2 is identical to that noted in STEP C.
G	Follow the steps J-L of §8.4.1 OPTION A.
H	Turn OFF the device.
I	Remove the joint cover. 
J	Set the multimeter for DC voltage measurement, 10 V _{DC} end of scale, if available activate the “MAX HOLD” function. <ul style="list-style-type: none"> • Connect the negative (-) measuring tip of multimeter to TP2 test point of CB board (F-). • Connect the positive (+) measuring tip of multi-meter to TP3 test point of CB board (mA sense).
	Note that measured voltage is negative.
K	Turn ON the device.
L	Set 60 kV 1 second on the control panel.
M	Perform X-ray exposure and verify that: <ul style="list-style-type: none"> • the value of measured voltage is $6.8 \div 7.2$ V_{DC} (ideal value 7), 1 V corresponding to 1 mA of anode current.
N	Set 70 kV 1 second on the control panel.
O	Perform X-ray exposure and verify that: <ul style="list-style-type: none"> • the value of measured voltage is $6.8 \div 7.2$ V_{DC} (ideal value 7), 1 V corresponding to 1 mA of anode current.
P	Turn OFF the power supply.
Q	Close the covers.



8.4.2 Control panel (HMICPU) replacement

In case of problems related to the HMICPU board, it will be necessary to replace the entire control panel.

STEP	DESCRIPTION
A	Turn OFF the device.
B	Remove the currently present control panel.
C	Note the serial number of the replacement control panel.
D	Mount the control panel: <ul style="list-style-type: none">• WM model:<ul style="list-style-type: none">- Follow the instructions in §4.3.7 according to the type of installation.• FM model:<ul style="list-style-type: none">- Follow the instructions in §5.2.5
E	Follow the steps of §8.3.2 to couple the THA, the HMICPU and PWD boards.

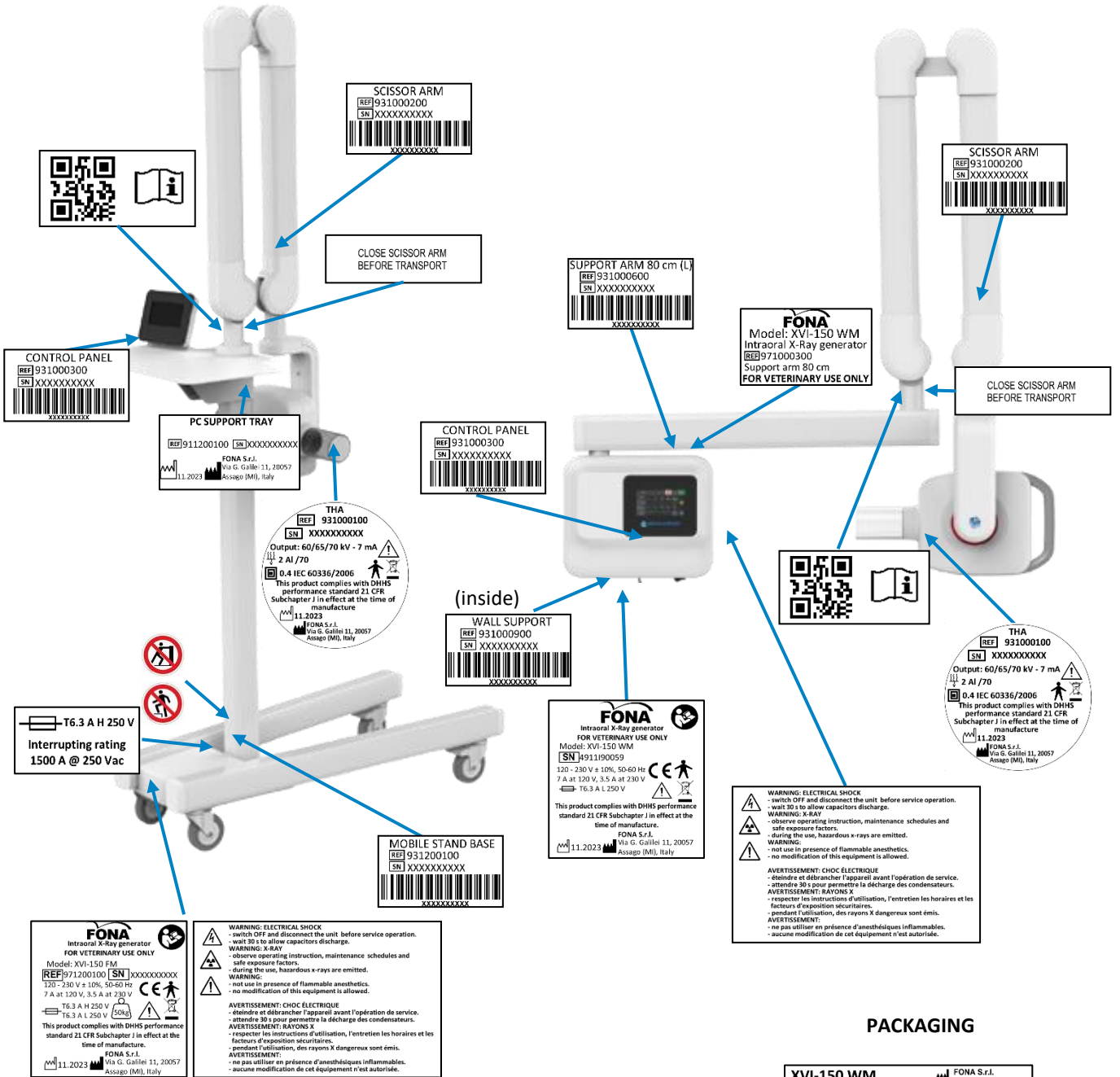


8.5 Marking labels

- Check that all labels are legible and correctly positioned.
- Request replacement of any defective labels.

DENTALAIRE DC FM

DENTALAIRE DC WM



PACKAGING

XVI-150 WM
FOR VETERINARY USE ONLY
REF 971000300
SN XXXXXXXXXXXX
MADE IN ITALY
CE

<input type="checkbox"/> Wall support (931000900)	<input type="checkbox"/> Scissor Arm (931000200)
<input type="checkbox"/> Mobile stand base (931200100)	<input type="checkbox"/> Support arm 30 cm S (931000400)
<input type="checkbox"/> Power driver PkVD (931001000)	<input type="checkbox"/> Support arm 60 cm M (931000500)
<input type="checkbox"/> THA (931000100)	<input type="checkbox"/> Support arm 80 cm L (931000600)
<input type="checkbox"/> Remote switch (931000800)	<input type="checkbox"/> Support arm 100 cm XL (931000700)
<input type="checkbox"/> Control panel HMI/CFU (931000300)	

1500 Ipa, 50/60 Hz, 100%, 20°C, +50°C

ACCESSORIES

Cone Extension
REF 911000300
SN XXXXXXXXXXXX
This product complies with DHHS performance standard 21 CFR Subchapter J in effect at the time of manufacture.
FONA S.r.l.
Via G. Galilei 11, 20057
Assago (MI), Italy

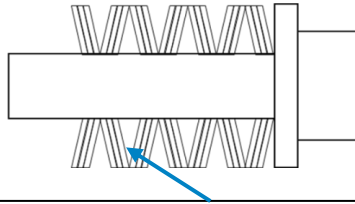
BLD 3 x 4 cm
REF 911000200
SN XXXXXXXXXXXX
This product complies with DHHS performance standard 21 CFR Subchapter J in effect at the time of manufacture.
FONA S.r.l.
Via G. Galilei 11, 20057
Assago (MI), Italy

BLD 2 x 3 cm
REF 911000100
SN XXXXXXXXXXXX
This product complies with DHHS performance standard 21 CFR Subchapter J in effect at the time of manufacture.
FONA S.r.l.
Via G. Galilei 11, 20057
Assago (MI), Italy

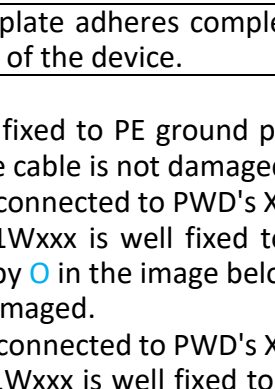
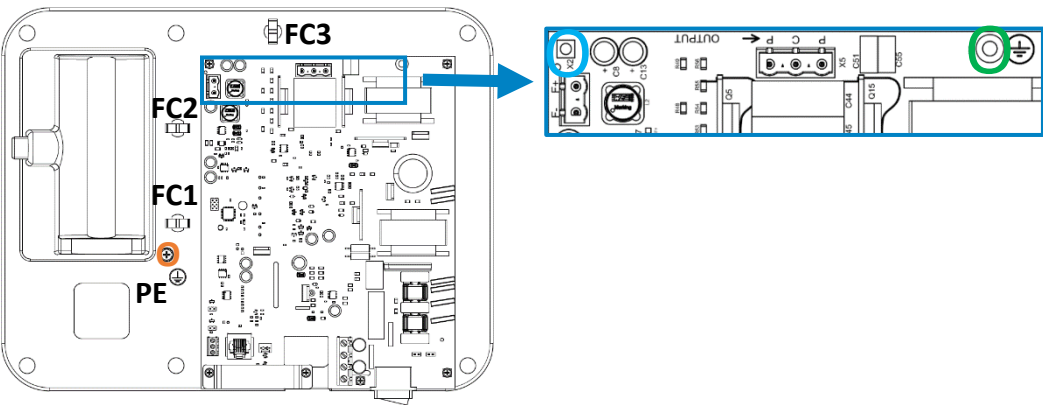


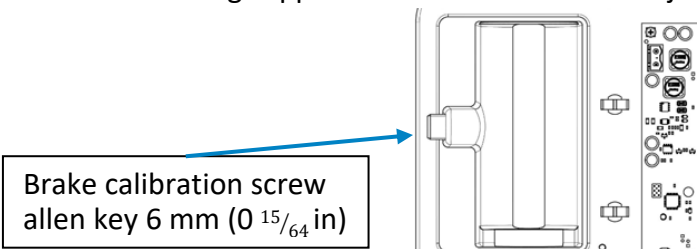
8.6 Maintenance of wall support plate

The friction of the wall support plate, which acts sideways on the support arm, consists of a brass pin machine pushed by a screw through 21 elastic washers assembled in 7 piles facing in an alternating direction. Each stack consists of 3 conical elastic washers facing in the same direction.



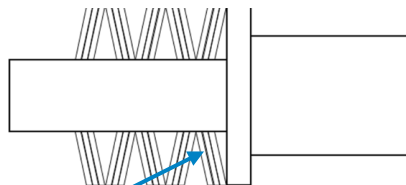
Arrangement of conical elastic washers on the brake pin in the plate.
 Dimensions 12x6.2x0.6 mm (0 15/32x0 1/4x0 1/32 in)

STEP	DESCRIPTION
A	Remove the wall support cover. 
B	Check that the wall support plate adheres completely to the wall and remains stable during the movements of the device.
C	Verify that: <ul style="list-style-type: none"> • CBL_EG1Wxxx is well fixed to PE ground point (indicated by ○ in image below). Make sure the cable is not damaged. • CBL_FIL1Wxxx is well connected to PWD's X2 connector. The ground wire contained in CBL_FIL1Wxxx is well fixed to ground point above the X2 connector (indicated by ○ in the image below). Make sure the cables and connectors are not damaged. • CBL_HV1Wxxx is well connected to PWD's X5 connector. The ground wire contained in CBL_HV1Wxxx is well fixed to ground point (indicated by ○ in the image below). Make sure the cables and connectors are not damaged. 

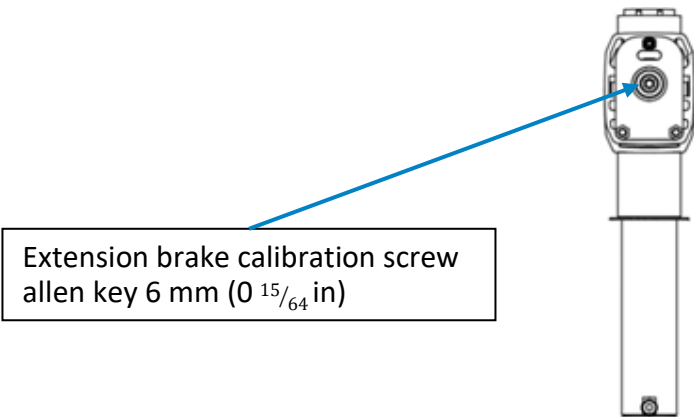
STEP	DESCRIPTION
D	Check the friction level during support arm movements and adjust if necessary. <div style="text-align: center; margin-top: 20px;">  </div>

8.7 Maintenance of support arm

The support arm friction (the same one used in the mobile stand pole) acts sideways on the scissor arm, consists of a pin pushed by a screw through 15 conical elastic washers assembled in 5 stacks facing in an alternating direction, each stack consists of 3 conical elastic washers facing in the same direction.



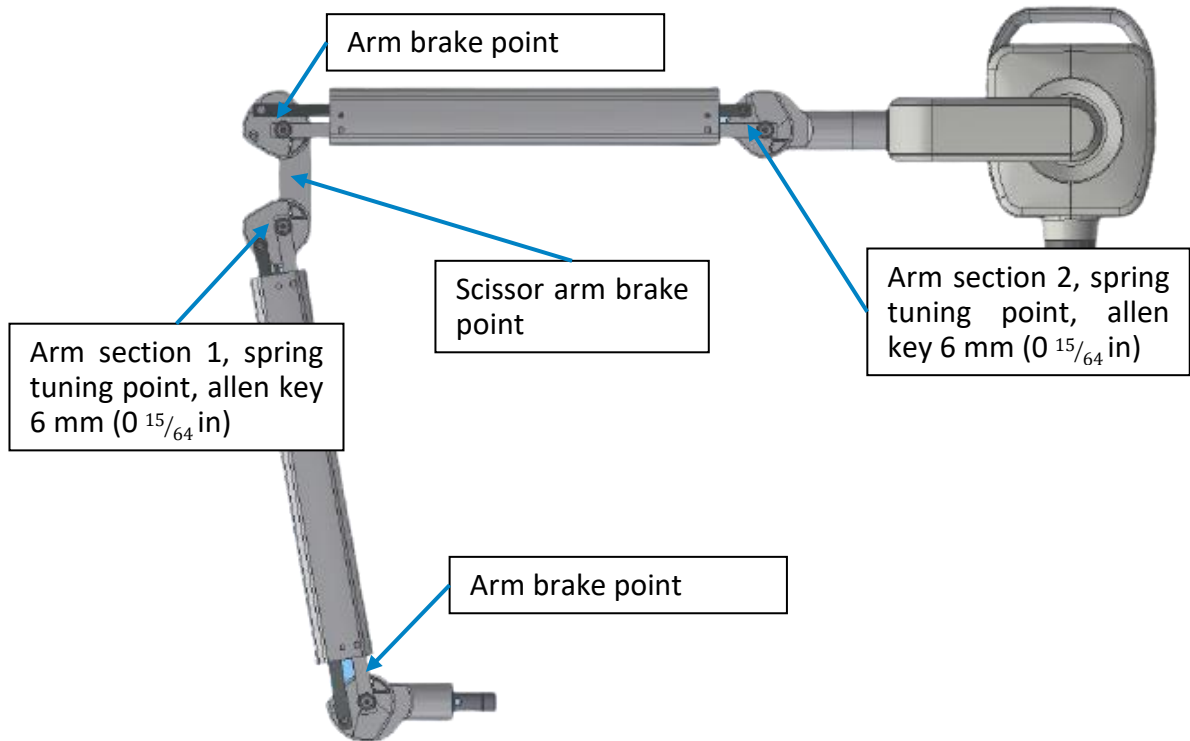
Arrangement of conical elastic washers on the static pole brake part.
 Dimensions 10x5.2x0.5 mm ($0 \frac{25}{64} \times 0 \frac{13}{64} \times 0 \frac{1}{64}$ in)

STEP	DESCRIPTION
A	Check the friction level during scissor arm movement and adjust it if necessary. <div style="text-align: center; margin-top: 20px;">  </div>
B	Verify that: <ul style="list-style-type: none"> • CBL_FIL2U of scissor arm is well connected with CBL_FIL1Wxxx of support arm (male-female connector coupling). Make sure the cables and connectors are not damaged. • CBL_HV2U of scissor arm is well connected with CBL_HV1Wxxx of support arm (male-female connector coupling). Make sure the cables and connectors are not damaged. • CBL_EG2U of scissor arm is well connected on faston hooking plate fixed inside the support arm (faston). Make sure the cables and connectors are not damaged.
C	Verify that the support arm can perform a 180° rotation stroke.



8.8 Maintenance of scissor arm

	Risk of breakage.
	Attempting to loosen the brake pins without loosening the blocking grain can cause the brake's part to break.
	Avoid reopening the scissor arm joints covers, unless strictly necessary for maintenance operations, as they could be damaged. If it is necessary to remove the scissor arm joints covers, be sure to use a coaxial movement to remove them.







Recommended tools:

- Allen key 6 mm (0 15/64 in).
- Allen key 3 mm (0 1/8 in).
- Key 13 mm (0 33/64 in).

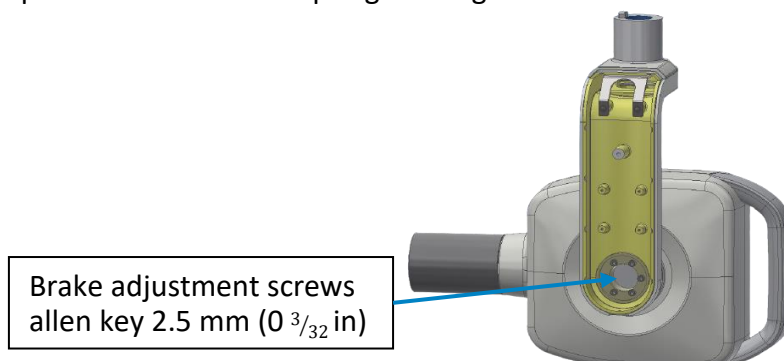


STEP	DESCRIPTION
A	Check for wear and pins of the levers: <ul style="list-style-type: none"> • Remove scissor arm joints covers. • Check wear for the breasts and levers. • Make sure there are no loose parts.
B	Replacement of worn parts or of the scissor arm if damaged. To replace faulty pins or levers it is necessary: <ul style="list-style-type: none"> • Detach the THA and operate with fully open scissor arm. • Loosen the two springs of the scissor arm completely before pulling out the pins. • At the end, reassemble the THA (§4.3.4). • Check the rotation of the arm and the THA. • If the scissor arm does not hold the load, keeping the THA mounted, pull the springs and adjust the brakes.

STEP	DESCRIPTION
C	<p>To load each section of the arm is necessary to:</p> <ul style="list-style-type: none"> • Remove the plastic covers in the scissor arm joints. • Reduce the friction level in the 2 respective brake points, first loosening the block dowel (3 mm (0 1/8 in) allen key) inside the pin, then the other two pins (13 mm (0 33/64 in) key). • Pull the spring (6 mm (0 15/64 in) allen key) until the arm is balanced in an intermediate position. • Tighten the two brake pins by introducing a slight resistance to movement, then lock the friction pins by tightening the inner dowel. • Check for damage to cables and connectors. • Check that the cables are all correctly connected. <div style="display: flex; justify-content: space-around;">   </div> <p style="text-align: center;">Unscrew the THA dowel with a 3 mm (0 1/8 in) allen key.</p> <div style="display: flex; justify-content: space-around;">   </div> <p style="text-align: center;">Spring loading with flexible or long allen key.</p>

8.9 Maintenance of THA

The THA friction, for the control of the rigidity of the rotation of the horizontal axis, consists of a plastic disc, which presses on two wave springs through 6 screws.



STEP	DESCRIPTION
A	Remove the plastic cover of the joint and check the brass pin and retaining fork, replace them if damaged or overconsumed.
B	Inspect the cone, to verify that there is no damage. Replace the THA if necessary (§8.3).
C	Make sure there are no oil leaks. Otherwise, replace the THA (§8.3).
D	Check the movements and if necessary tighten the brakes to the friction.



STEP	DESCRIPTION
E	Verify that: <ul style="list-style-type: none"> • CBL_FIL2U is well connected to CB's J4 connector. • The ground wire contained in CBL_FIL2U is well connected to the ground point to the left of CB's J4 connector. • CBL_HV2U is well connected to CB's J2 connector. • The ground wire contained in CBL_HV2U is well connected to the ground point to the right of CB's J2 connector. • CBL_EG2U is well connected to the ground point to the right of CB's J1 connector. • CBL_FIL3U of THA is well connected to CB's J3 connector. • CBL_HV3U of THA is well connected to CB's J1 connector. • CBL_EG3U of THA is well connected to the ground point to the left of CB's J3 connector. Make sure the cables and connectors are not damaged.
F	Make sure the screws for mechanical safety are well locked.
G	Make sure the 3 brake adjustment screws are properly tightened to have a gentle rotation.
H	Verify that the THA can perform a rotation stroke of: <ul style="list-style-type: none"> • 380° around the vertical axis. • 305° around the horizontal axis.
I	Refit the joint cover removed in §8.9 STEP A.

8.10 Maintenance of mobile stand base

STEP	DESCRIPTION
A	Check that the wheels and brakes work properly.
B	Check and if necessary adjust the friction of the mobile stand pole.
C	Check that the switch is not damaged and the operating light turns on.
D	Check that the spiral cable gland of the power supply cable is well fixed and intact.
E	Make sure that the power supply cable and the connection plug are intact.

8.11 Mechanical checks

The examination of the mechanical parts of the device is divided into controls to be planned during periodic inspection and activities to be carried out during preventive maintenance (to be organized).

	Call technical support in case of anomalies.
--	--

8.11.1 Periodic inspection

STEP	DESCRIPTION
A	Ensure the overall mechanical integrity of the components and plastic covers.
B	Make sure no parts are corroded.
C	Make sure that the movements of the THA take place within the limits and without exceeding the limit switch: <ul style="list-style-type: none"> • Vertical axis 380°. • Horizontal axis 305°.

8.11.2 Preventive maintenance

STEP	DESCRIPTION
A	Control and adjustment of moving parts: <ul style="list-style-type: none"> • Adjust support arm friction. • Adjust scissor arm friction. • Check the wear of the pins and levers of the scissor arm. • Adjust scissor arm springs and friction. • Adjust THA friction. • Make sure that the 6 screws of the THA joint are well tightened. • Make sure that the retaining fork that supports the THA is intact and well tightened.

8.12 Electrical checks

Electrical checks are recommended during preventive maintenance:



Call technical support in case of anomalies.

STEP	DESCRIPTION
A	Cable integrity: <ul style="list-style-type: none"> • Check all cables on the device, making sure they are not damaged in any way and that the connectors are all inside their locations. • Check that the grounded cables are in their locations and tightened.

8.13 Anodic current check



Risk of incorrect measurement.



Measurements must be carried out only by qualified personnel to avoid the risk of electric shock or radiation exposure.

The anodic current is measured with a DC voltmeter set for 10 V DC that reads the voltage on the appropriate test points on the CB board present in the joint.

The voltage read indicates the current flowing.

Call technical support if the measures you take are not in the tolerance range.

STEP	DESCRIPTION
A	Turn OFF the power from the bipolar switch.
B	Remove the joint cover.
C	Locate the test points on the CB board.
D	Connect the multimeter for direct current measurement.
E	Turn ON the device.
F	Set on control panel 60 kV, 7 mA and 0.1 s.
G	Perform an exposure.
H	Verify that the measured value is within the nominal tolerance.
I	Verify that the measured voltage is within the nominal tolerance.
J	Perform 2 exposures a 60 kV, 7 mA, 0.5 s and check the values.
K	Record the collected data.
L	Turn OFF the device.
M	Remove the multimeter.



8.14 Anodic voltage and exposure time check

To check the exposure times and level of the anodic voltage, use a non-invasive kV and exposure times meter.

	Risk of incorrect measurement.
	<p>Measurements must be carried out only by qualified personnel to avoid the risk of electric shock or radiation exposure.</p> <p>It is recommended to place the radiation sensor about 50 cm (19 ¹¹/₁₆ in) from the radiation source (focal spot).</p> <p>Set the instrument appropriately to measure the exposure time.</p> <p>Call technical support if the measures you take are not in the tolerance range.</p>

STEP	DESCRIPTION
A	Turn ON the device.
B	Set exposure parameters to 60 kV, 7 mA and 0.4 s.
C	Back up to the safety position.
D	Shoot and read the values indicated by the kV meter: <ul style="list-style-type: none"> • The time must be 0.4 s ± 0.04 s (range 0.36 - 0.44 s). • The kV level must be 60 kV ± 3 kV (range 57 - 63 kV).
E	If the values indicated are not reached, the unit cannot be used and must be taken out of service.
F	Set exposure parameters to 70 kV, 7 mA and 0.5 s.
G	Back up to the safety position.
H	Shoot and read the values indicated by the kV meter: <ul style="list-style-type: none"> • The time must be 0.5 s ± 0.05 s (range 0.45 - 0.55 s). • The kV level must be 70 kV ± 3.5 kV (range 66.5 - 73.5 kV).
I	If the values indicated are not reached, the unit cannot be used and must be taken out of service.
J	Record the collected data.
K	Turn OFF the device via the bipolar switch.

**8.15 Evaluation of emitted radiation****Risk of incorrect measurement.**

Measurements must be carried out only by qualified personnel to avoid the risk of electric shock or radiation exposure.

It is recommended to place the radiation sensor about 50 cm (19 ¹¹/₁₆ in) from the radiation source (focal spot).



In radiology a 6 mm (0 ¹⁵/₆₄ in) AL filter (purity 99.9%) is an object of representative test of an average patient. It can be preplaced before the radiation beam to assess the level of radiation useful on the image receiver.

Use an X radiation dosimeter to measure the dose emitted.

Call technical support if the measures you take are not in the tolerance range.

STEP	DESCRIPTION				
A	Turn ON the device via the bipolar switch.				
B	Set exposure parameters to 60 kV, 7 mA and 1 s.				
C	Back up to the safety position.				
D	Make 3 exposures and calculate the average value. In the following table, the acceptable values.				
	<table border="1"> <tr> <td>Distance</td> <td>20 cm (7 ⁷/₈ in)</td> </tr> <tr> <td>Dose rate ± 20%</td> <td>6.5 mGy/s</td> </tr> </table>	Distance	20 cm (7 ⁷ / ₈ in)	Dose rate ± 20%	6.5 mGy/s
	Distance	20 cm (7 ⁷ / ₈ in)			
Dose rate ± 20%	6.5 mGy/s				
E	Set exposure parameters to 70 kV, 7 mA and 1 s.				
F	Back up to the safety position.				
G	Make 3 exposures and calculate the average value. In the following table, the acceptable values depending on the distance.				
	<table border="1"> <tr> <td>Distance</td> <td>20 cm (7 ⁷/₈ in)</td> </tr> <tr> <td>Dose rate ± 20%</td> <td>9.2 mGy/s</td> </tr> </table>	Distance	20 cm (7 ⁷ / ₈ in)	Dose rate ± 20%	9.2 mGy/s
	Distance	20 cm (7 ⁷ / ₈ in)			
Dose rate ± 20%	9.2 mGy/s				
H	Record the collected data.				
I	Turn OFF the device.				



9. Reports

Below are the forms with the list of controls to be carried out on the device:

- Installation report, to document the correct assembly and installation.
- Annual inspection, with the list of checks to be carried out periodically on an annual basis.
- Preventive maintenance (recommended), with list of checks to perform.

9.1 Installation report

The installation report lists the controls to be done after installing the device, which is already fully calibrated in the factory.

PARAGRAPH	DESCRIPTION
HEADING	References: <ul style="list-style-type: none"> • The name and address of the customer. • The name and address of the dealer. • The serial number of the device. • The serial number of the THA. • The serial number of installed boards. • FDA form number (US only).
INSTRUMENTATION	List of test tools to use: <ul style="list-style-type: none"> • AC / DC voltmeter (alternating current / direct current). • Anodic current meter. • Dosemeter for X radiation.
CHECKS	Checks to be carried out: <ul style="list-style-type: none"> • Compliance of the installation environment. • Manual availability (via QR code). • Adequacy of measuring instruments. • General condition of the machine. • Labelling. • Check the type of installation and serial number on the device. • Check yellow / green conductors tightened on the PE points. • Function control of icons and menus on the display. • Remote switch light and buzzer control. • Control of voluntary termination of radiation.
CONFORMITY	Certify the conformity of the device installed successfully.
INSTALLATION FAILED	If the indicated values are not obtained, the device must be taken out of service and cannot be used.
DATE AND SIGNATURE	Closing the installation report: <ul style="list-style-type: none"> • Date and customer signature. • Date and installer signature.



9.2 Periodic inspection and preventive maintenance report

DENTALAIRE DC is an equipment that requires little maintenance, for which the following activities are recommended:

- General inspection, by specialized operators, to be carried out annually.
- Preventive maintenance, by specialized operators, to be carried out after 4, 7, 10 years from the date of installation.
- The inspection and maintenance report covers both periodic inspection and preventive maintenance checks.

The form to be completed is structured as follows:

PARAGRAPH	DESCRIPTION
HEADING	References: <ul style="list-style-type: none"> • The name and address of the customer. • The name and address of the dealer. • The serial number of the device. • The serial number of the THA. • The serial number of installed boards. • FDA form number (US only).
INSTRUMENTATION	List of test tools to use: <ul style="list-style-type: none"> • AC / DC voltmeter (alternating current / direct current). • KV anodic voltage and time meter. • Dosemeter for X radiation.
GENERAL INSPECTION CHECKS	General checks to be carried out annually: <ul style="list-style-type: none"> • Manual availability (via QR code). • Adequacy of measuring instruments. • General state of mechanics. • Labelling. • Function control of icons and menus on the display. • Check functionality of external safety inputs (if installed). • Remote switch light and buzzer control. • Control of voluntary termination of radiation.
INSPECTION COMPLIANCE	Certify by report the outcome of the inspection. Positive or negative (if it fails put the unit out of service and contact the support service).
PREVENTIVE MAINTENANCE PLAN	Check the applicable time for preventive maintenance at the time of inspection.
PREVENTIVE MAINTENANCE CHECKS	List of activities to be carried out in preventive maintenance: <ul style="list-style-type: none"> • Adequacy of measuring instruments. • Mechanical checks. • Check yellow / green conductors tightened on the PE points. • Anode voltage control. • Anode current control. • Control of exposure times. • Control of the radiation dose.
COMPLIANCE AFTER MAINTENANCE	Certify by report the outcome of the inspection. Positive or negative (if it fails put the unit out of service and contact the support service).
DATE AND SIGNATURE	Closing the installation report: <ul style="list-style-type: none"> • Date and customer signature. • Date and installer signature.

**INSTALLATION REPORT**

Customer:		Dealer:
	Serial number	Date of installation:
Device		FDA Assembly Report 2579 #
THA		
PWD board		
HMIPCU board		

MEASURING INSTRUMENTS

	Manufacturer	Model	Accuracy	Calibration Date
AC/DC voltmeter				
Anodic current meter				
Dosemeter for X radiation				

CHECKS

Yes No Note

	Yes	No	Note
Compliance of the installation environment	<input type="checkbox"/>	<input type="checkbox"/>	
Manual availability	<input type="checkbox"/>	<input type="checkbox"/>	
Adequacy of measuring instruments	<input type="checkbox"/>	<input type="checkbox"/>	
General condition of the machine	<input type="checkbox"/>	<input type="checkbox"/>	
Labelling	<input type="checkbox"/>	<input type="checkbox"/>	
Type of installation (wall or mobile)	<input type="checkbox"/>	<input type="checkbox"/>	
Check yellow/green conduct tightened on PE points	<input type="checkbox"/>	<input type="checkbox"/>	
Function control of icons and menus on the display	<input type="checkbox"/>	<input type="checkbox"/>	
Remote switch light and buzzer control	<input type="checkbox"/>	<input type="checkbox"/>	
Control of voluntary termination of radiation	<input type="checkbox"/>	<input type="checkbox"/>	
Device compliant with safety tests	<input type="checkbox"/>	<input type="checkbox"/>	

Notes:

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Technician	Customer
Date: Signature:	Date: Signature:



ANNUAL INSPECTION REPORT

Customer:		Dealer:	
	Serial number	Date of installation:	
Device		FDA Assembly Report 2579 #	
THA			
PWD board			
HMIPCU board			

MEASURING INSTRUMENTS

	Manufacturer	Model	Accuracy	Calibration Date
AC/DC Voltmeter				
KV and time meter				
Dosemeter for X radiation				

CHECKS

	Yes	No	Note
Manual availability	<input type="checkbox"/>	<input type="checkbox"/>	
Adequacy of measuring instruments	<input type="checkbox"/>	<input type="checkbox"/>	
General state of mechanics	<input type="checkbox"/>	<input type="checkbox"/>	
Labelling	<input type="checkbox"/>	<input type="checkbox"/>	
Function control of icons and menus on the display	<input type="checkbox"/>	<input type="checkbox"/>	
Check functionality of external safety inputs	<input type="checkbox"/>	<input type="checkbox"/>	
Remote switch light and buzzer control	<input type="checkbox"/>	<input type="checkbox"/>	
Control of voluntary termination of radiation	<input type="checkbox"/>	<input type="checkbox"/>	
Device compliant with safety tests	<input type="checkbox"/>	<input type="checkbox"/>	

PREVENTIVE MAINTENANCE REPORT

4 YEARS 7 YEARS 10 YEARS 12 YEARS 14 YEARS 16 YEARS 18 YEARS 20 YEARS

CHECKS

	Yes	No	Note
Adequacy of measuring instruments	<input type="checkbox"/>	<input type="checkbox"/>	
Mechanical checks	<input type="checkbox"/>	<input type="checkbox"/>	
Check yellow/green conduct. tightened on the PE	<input type="checkbox"/>	<input type="checkbox"/>	
Anodic voltage 60 kV	<input type="checkbox"/>	<input type="checkbox"/>	kV
Anodic current 60 kV	<input type="checkbox"/>	<input type="checkbox"/>	mA
Anodic voltage 70 kV	<input type="checkbox"/>	<input type="checkbox"/>	kV
Anodic current 70 kV	<input type="checkbox"/>	<input type="checkbox"/>	mA
Exposure time 0.4 s	<input type="checkbox"/>	<input type="checkbox"/>	s
Dose rate 60 kV at distance of 20 cm (7 7/8 in)	<input type="checkbox"/>	<input type="checkbox"/>	mGy/s
Dose rate 70 kV at distance of 20 cm (7 7/8 in)	<input type="checkbox"/>	<input type="checkbox"/>	mGy/s
Device compliant with tests	<input type="checkbox"/>	<input type="checkbox"/>	

Technician		Customer	
Date:	Signature:	Date:	Signature:

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Installation and Maintenance Manual

DENTALAIRE

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