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FONA

FONA XDC

Service and Installation Manual

English



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Graphic symbols


Compliance to European Community requirements


Caution


Notice


Follow operating instructions


Operating instruction


Separate Collection, Do Not Dispose


Temperature limitation


Date of manufacture


Type B applied part


Non-ionizing electromagnetic radiation


Small focal spot


Inherent filtration


Irradiation light on hand-switch


Irradiation light on control panel


Exposure release


Manufacturer


Switch OFF

Switch ON


System ready

L Mains live point

N Mains neutral point


Protective earth (PE)


Earth


System locked


Chemical Film


MENU key



kV level selection


Upper Incisor


Occlusal


Lower Incisor


Phosphor plate


Increment


Child build


Upper cuspid/premolar


Premolar crowns


Lower cuspid/premolar


Digital sensor


Decrement


Adult build


Upper molar


Molar crowns


Lower molar

New since: 04.2014
Manufactured by FONA S.r.l. Via Galileo Galilei 11 - 20090 Assago (MI) Italy

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1. Introduction

Documentation

The accompanying documents supplied with the system include the following documents which are integral parts of the product:

- FONA XDC Operating Instructions
- FONA XDC Service and Installation Manual.

Abilities of service technician

Skills to perform:

- Connection of equipment to the mains line.
- Installation of radiographic equipment and radiation protection.
- Comprehension of technical manuals in English.

1.1 Technical data summary

Packaging Wall systems	Wall unit, Support_Arm S 30 cm, Circular BLD, source skin distance (SSD) 20 cm	Size: 97x27x34 cm (38.2x10.6x13.4") Gross weight: 27 kg (60 lbs)
	Wall unit, Support_Arm M 60 cm, Circular BLD, SSD 20 cm	Size: 97x27x34cm (38.2x10.6x13.4") Gross weight: 28 kg (62 lbs)
	Wall unit, Support_Arm L 80 cm, Circular BLD, SSD 20 cm	Size: 97x27x34 cm (38.2x10.6x13.4") Gross weight: 29 kg (64 lbs)
	Wall unit, Support_Arm XL 100 cm, Circular BLD, SSD 20 cm	Size: 115x27x34 cm (45.3x10.6x13.4") Gross weight: 30 kg (66 lbs)
Packaging Mobile systems	Mobile unit, Circular BLD, SSD 20 cm	Size: 97x27x51 cm (38.2x10.6x13.4") Gross weight: 84 kg (185 lbs)

Power supply	Nominal Line Voltage	100-240 V ± 10%
	Line Frequency	47-63 Hz
	Rated current	6 A at 100-120 V, 3 A at 200-240 V
	Maximum Line Current	6 A
	Permissible apparent impedance of supply mains	≤ 0.5 Ohm at 100-120 V, ≤ 1.0 Ohm at 200-240 V
	Line voltage regulation for maximum line current:	2.6% at 120 V, 1.3 % at 240 V (maximum voltage drop 3.0 V)
	Line Fuse	T 6.3 A, 250 V (time lag), second fuse to be enabled for two phase supply or for non permanent connection to mains with plug
	Power input upon radiation	690 W
	Power input standby mode	< 6 W

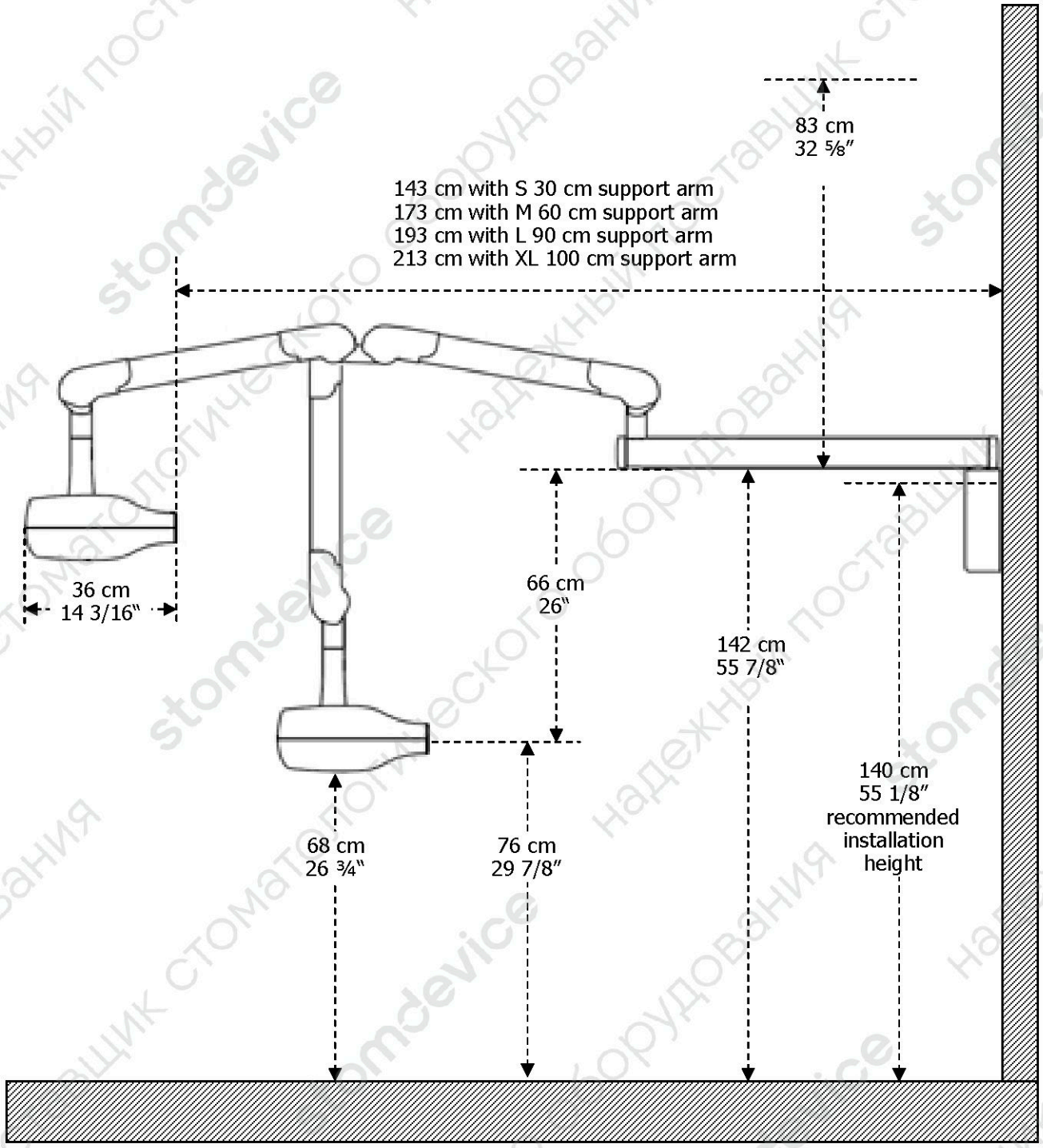
Wall suspension	Arm Length	Short (S): 30 cm /11.8", Medium (M): 60 cm /23.6", Long (L): 80 cm /31.5", Extra Long (XL) 100 cm /39,4"
	Useful Reach with cone for 20 cm (8") SSD	143 cm /56.3" with Short (S) arm 173 cm /68.1" with Medium (M) arm 193 cm /76" with Long (L) arm 213 cm /83.9" with Extra Long (XL) arm

Transport	Temperature, transport	From -20°C to +50°C (from -4°F to 122°F)
	Relative humidity, transport	From 10 to 90%
	Pressure, transport	from 500 to 1060 hPa

Operation	Temperature, operation	From 10 to 40 °C (from 50°F to 104°F)
	Relative humidity, operation	From 30 to 75%
	Pressure, operation	From 700 to 1060 hPa

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1.2 Dimensions of wall systems



- 140 cm (55 1/8″) is the recommended installation height of the top bolts of the wall support from the floor
- The maximum reaches from the wall refer to the four possible configurations SSD 20 cm (8″) equipped with short (S), medium (M), long (L), and extra long (XL) support arms.

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2. System configurations

2.1 Wall mounted systems

	Description	Code
Preferred System	Wall System, Support_Arm S 30 cm, Circular BLD, 20 cm SSD	97 590 62320
	Wall System, Support_Arm M 60 cm, Circular BLD, 20 cm SSD	97 590 62620
	Wall System, Support_Arm L 80 cm, Circular BLD, 20 cm SSD	97 590 62820
	Wall System, Support_Arm XL 100 cm, Circular BLD, 20 cm SSD	97 590 62120



	ID	Description	Code
Loose components	A	X-ray head XDC, Circular BLD, 20 cm (8") SSD	93 190 01700
	B	Power driver and control unit XDC, 100-240 VAC	93 190 60100
	C	Scissor arm	93 190 12010
	D	Wall adaptor XDC	93 190 11000
	E	Support arm S 30 cm	93 190 17100
		Support arm M 60 cm	93 190 17200
		Support arm L 80 cm	93 190 17300
		Support arm XL 100 cm	93 190 17400

	ID	Description	Code
Accessories	G	Cone Extension XDC 10 cm (4") for 30 cm (12") SSD	91 190 00010
	H	BLD adaptor 2x3 cm, film size 0	91 190 00030
	I	BLD adaptor 3x4 cm, film size 2	91 190 00040

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2.2 Mobile system

	Description	Code
Preferred System	Mobile system	97 590 67820



	ID	Description	Code
Loose components	A	X-ray head XDC, Circular BLD, 20 cm (8") SSD	93 190 01700
	B	Power driver and control unit XDC, 100-240 VAC	93 190 60100
	C	Scissor arm XDC	93 190 12010
	F	Mobile stand XDC	93 190 20080

	ID	Description	Code
Accessories	G	Cone Extension XDC 10 cm (4") for 30 cm (12") SSD	91 190 00010
	H	BLD adaptor 2x3 cm, film size 0	91 190 00030
	I	BLD adaptor 3x4 cm, film size 2	91 190 00040

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2.3 Accessories



Code:
91 190 00030

BLD adaptor 2x3 cm, film size 0

Rectangular pedo format of 2.2 x 3.2 cm (7/8″ x 1-1/4″)



Code:
91 190 00040

BLD adaptor 3x4 cm, film size 2

Rectangular adult format of 3.2 x 4.4 cm (1-1/4″ x 1-3/4″)



Code:
91 190 00010

Cone Extension XDC 10 cm (4″) for 30 cm (12″) SSD

BLD with circular output field of 5.8 cm (2-5/16″) diameter.



Code:
93 190 00150

Metal box for remote X-ray hand-switch



Code:
76 190 30000

XDC Test JIG

Tool to support measurement of filament voltage and anode current

Code: 86 190 21500



16″ XDC wall mounting plate
It fits 16″ mounting studs for both wall adaptor (WA) and power driver and control unit (PDCU) on the left or right side

Code: 91 190 00050



Kit of supply cables for tube-head XDC 12 m (40′)
The kit is composed of:

- Cable shielded, 3 wires AWG18
- Cable unshielded, 3 wires AWG18
- Green-yellow wire AWG13
- Connecting block and label

⚠ Risk of EMC interference.

ⓘ The use of different type of cables may result in increased electromagnetic emissions or decreased immunity of the equipment to the same.

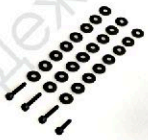
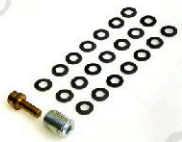
Code: 91 190 00060



Relay board XDC for external warning lights

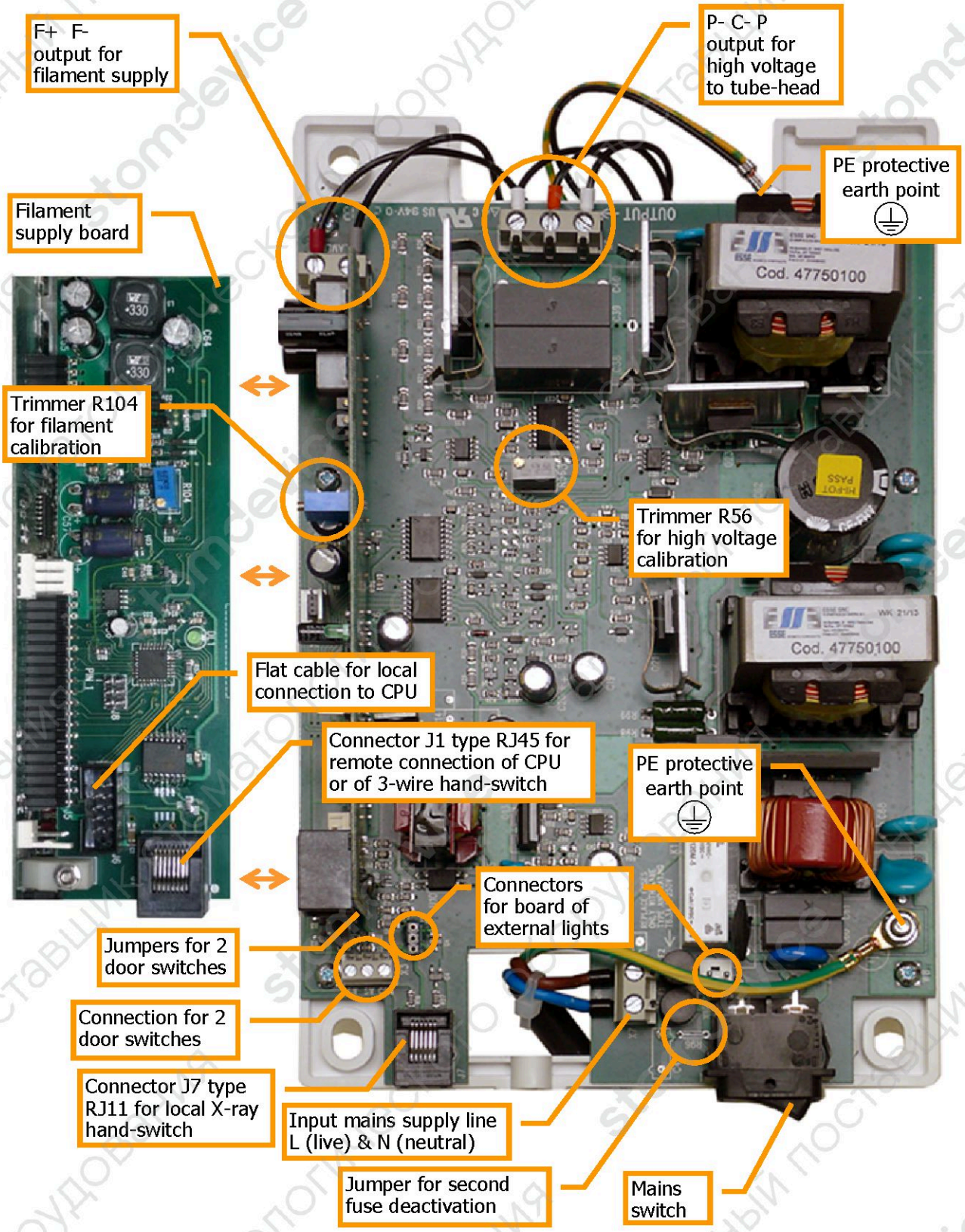
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2.4 Spare parts

 Code: 93 190 00140 X-ray hand-switch XDC with coiled cord	 Code: 76 190 30002 Board CPU XDC
 Code: 76 190 30003 Control panel XDC with keyboard and display	 Code: 76 190 30004 Power driver board XDC
 Code: 76 190 30005 Set of 8 plastic covers for joints of scissor arm XDC	 Code: 76 190 30001 Arm cable XDC
 Code: 76 500 30045 Set of caps for support arm and mobile base XDC	 Code: 76 500 30100 Friction kit for articulation of scissor arm with 4 cup springs 20x10x0.8
 Code: 76 500 30030 Friction kit acting on shaft of scissor arm, with 15 cup springs 10x5x0.4	 Code: 76 500 30060 Friction kit for tube head horizontal axis, with 3x8 cup springs 10x3x0.5
 Code: 76 500 30040 Componenti Friction kit acting on shaft of support arm, with 21 cup springs 12.5x6x0.5	 Code: 76 500 30025 End stop spacer for support arm with screw

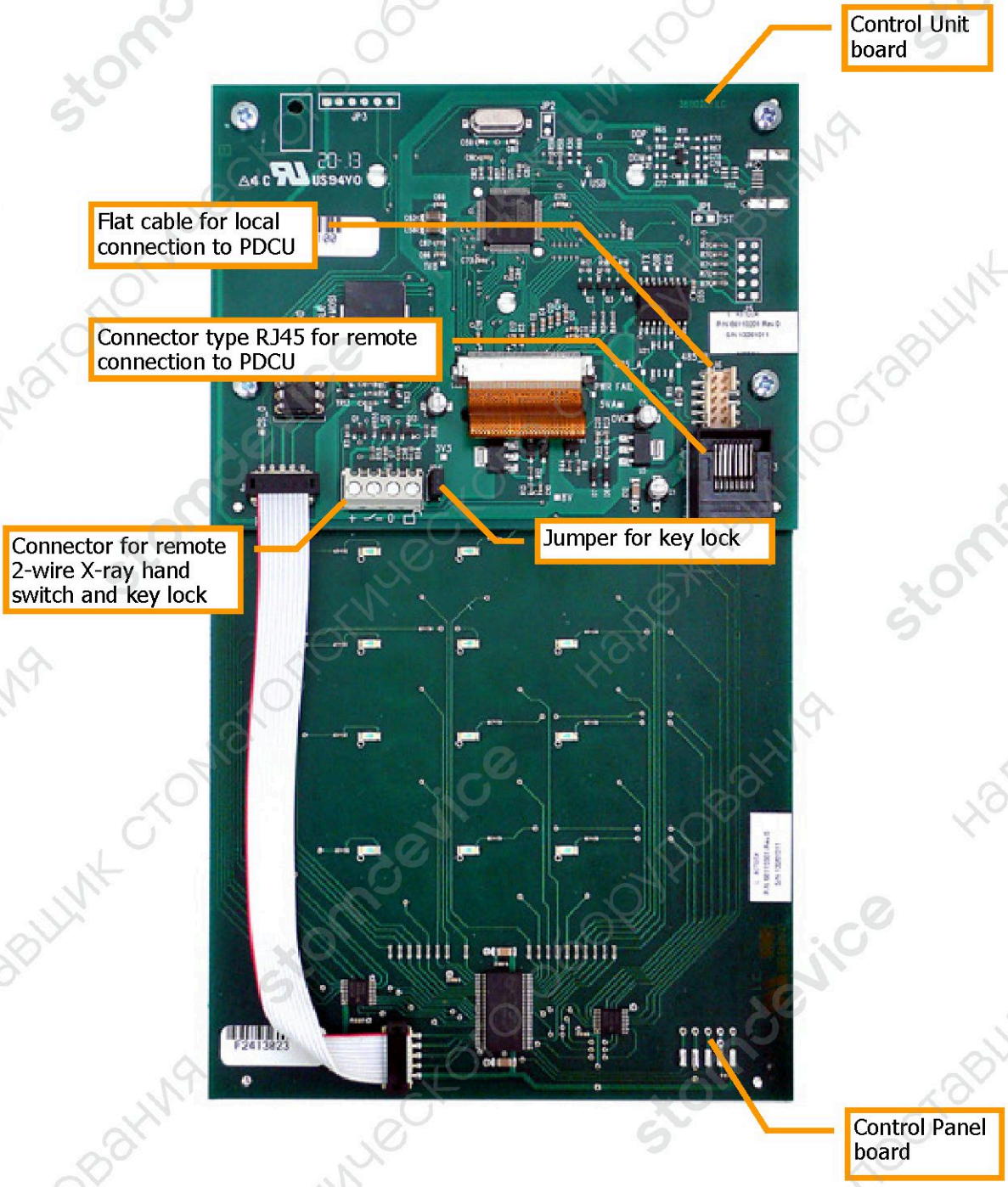
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2.5 Layout of power driver unit



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2.6 Layout of control unit board



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3. Assembly and Installation

Risk of EMC interference.

The unit has not to be placed or activated close to other equipment which could disturb it or which could be disturbed.

3.1 Possibilities of installation

3.1.1 Unit in the treatment room with local hand switch

The X-ray hand-switch is placed locally.

The following connections have to be realized:

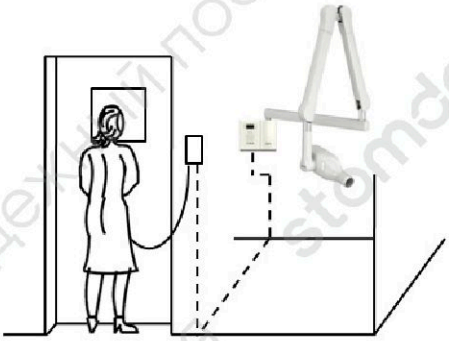


- Mains power supply (live, neutral, protective earth wires) entering the PDCU at bottom
- Output power cable and filament supply plus protective earth connection exiting from PDCU at top to enter the wall adaptor
- Optional:
  - Wire for door contact through the opening at bottom of PDCU
  - Wires for external lights through the opening at bottom of PDCU

3.1.2 Unit in the treatment room with hand switch remote

The X-ray hand-switch is placed remotely.

The following connections have to be realized:



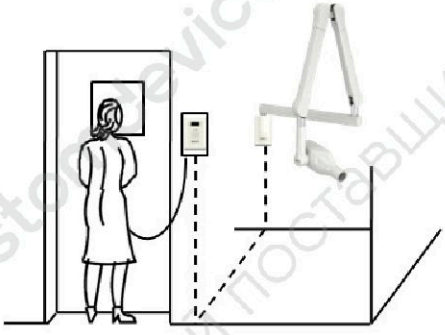
- Mains power supply (live, neutral, protective earth wires) entering the PDCU at bottom
- Output power cable and filament supply plus protective earth connection exiting from PDCU at top to enter the wall adaptor
- The cable for remote hand switch is connected internally to the PDCU.
- Optional:
  - Wire for door contact through the opening at bottom of PDCU
  - Wires for external lights through the opening at bottom of PDCU

A box for remote X-ray hand-switch is optionally available.

3.1.3 X-ray emission in the treatment room with remote control and release switch

The X-ray hand-switch is connected to the PDCU placed remotely.

The following connections have to be realized:



- Mains power supply (live, neutral, protective earth wires) entering the PDCU at bottom
- Long (12 m maximum) output power cable and filament supply plus protective earth exiting from PDCU at top to the connection block into the wall adaptor.
- Additional protective earth connection from the mains line.
- The X-ray hand switch is connected externally to the PDCU, remotely placed.
- Optional:
  - Wire for door contact through the opening at bottom of PDCU
  - Wires for external lights through the opening at bottom of PDCU

A Kit of 12 m (40') supply cables for tube-head XDC is optionally available

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3.2 Structural Requirements

Useful Reach

The wall adaptor has to be mounted in a convenient position on the left or right side of the chair or on the back wall (head of the patient). The useful reach depends on the length of support arm and cone mounted (source skin distance, SSD).

FONA XDC Useful Reach		
Support Arm	SSD 20 cm (8″)	SSD 30 cm (12″)
Short (S): 30 cm /11.8″	143 cm /56.3″	133 cm /52.4″
Medium (M): 60 cm /23.6″	173 cm /68.1″	163 cm /64.1″
Long (L): 80 cm /31.5″	193 cm /76″	183 cm /72″
Extra Long (XL) 100 cm /39,4″	213 cm /83.9″	203 cm /79.9″

Recommended Bolts		
Class	Diameter	Core Section mm^2
ISO 8.8	M 8X1.25	36.6
ISO 8.8	M 8X1	39.2
SAE- Grade 5	5/16″ – 18 UNC	33.8
SAE- Grade 5	5/16 –24 UNF	37.41

WARNING

Risk of falling over

INSUFFICIENT WALL OR HARDWARE STRENGHT MAY CAUSE THE WALL ADAPTOR TO PULL OUT FROM THE WALL AND THE SYSTEM TO FALL OVER THE PATIENT OR THE OPERATOR CAUSING INJURIES.

Wall Support Mounting options

The wall adaptor can be mounted with 1, 2, or 3 bolts at top, depending on wall quality, and with 1, 2, or 3 bolts at bottom.



A. Two bolts only (top and bottom central holes – T2, B2) are used on a solid slim column (e.g. steel mounting studs) with weak sides (e.g. wooden wall). The top bolt has to withstand a load of 6000 N, comprehensive of the safety factor, i.e. about 1350 lbf or 612 kgf. Proper screw to be selected for a solid connection to the wall. Classes ISO 8.8 (M 8, M 8x1, M 8x1.25) or SAE Grade 5 (5/16″ 18UNC, 5/16″ 24 UNF) are recommended.

B. Two bolts at top sides (T1, T3) and one or two at bottom (B1, B2, B3) is the regular mounting for solid wall (concrete). Each bolt at top has to withstand a load of 3000 N, comprehensive of the safety factor, i.e. about 675 lbf or 306 kgf.
On solid concrete use heavy duty metal anchors. On hollow bricks use injection chemical fixing.

C. Three bolts at top (T1, T2, T3) and one or two at bottom (B1, B2, B3) are required when the wall is not solid enough and the load has to be distributed on more points. Each bolt at top has to withstand a load of 2000 N, comprehensive of the safety factor, i.e. about 450 lbf or 204 kgf.

In case the wall is not in condition to withstand the indicated load, corrective actions can be evaluated by adoption of reinforcing plates:

D. Large plate to fit vertical supports at 16″ distance, with 4 mounting holes and one cable opening for the wall mount in the middle.

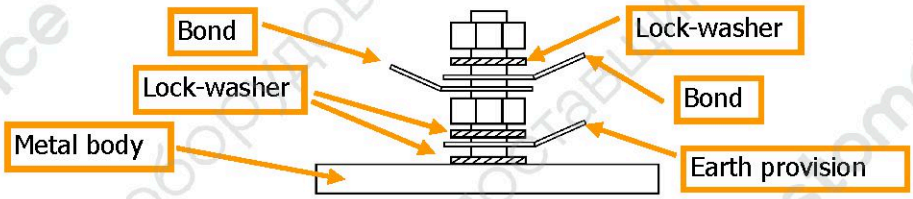
E. In case of a thin (wooden) wall not solid enough, the use of a reinforcing steel counter plate 2 mm thick can be the solution.

F. The use of two reinforcing steel plates of about 4 times the surface of the wall adaptor, one by each side of the wall, can help when a single plate is not adequate; additional bolts have to be used to hold together the two plates.

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3.3 Electrical connections

3.3.1 Common bolt for earth connection and bonding



- The earth provision is blocked in place first and blocked in place with lock-washers and a nut tightly secured.
- The bonding conductors are placed next and blocked in place with lock-washer and nut tightly secured.

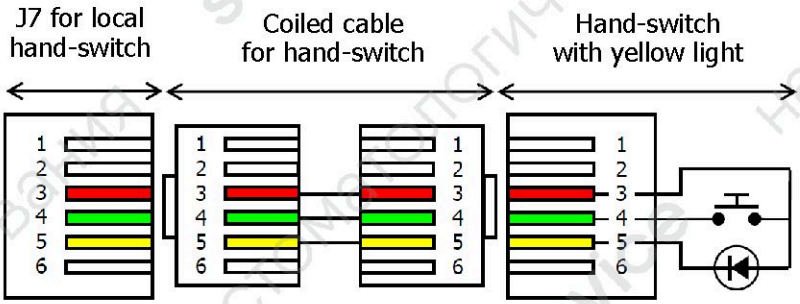
⚠ Risk of loss of electrical protection.

ⓘ The role of the lock-washer and the nut tightly secured is to prevent an accidental loosening of the green-yellow wires in the time, which would compromise the low impedance, essential for electrical safety.

3.3.2 Wiring for local or remote hand-switch connection

Here below the pin-out of connectors J7 and J1 (on the filament supply board) for local and remote connection respectively of the X-ray hand-switch with yellow light:

- Use J7 for a 3-wire local connection.
- Use J1 with RJ45 cable for a 3-wire remote connection.

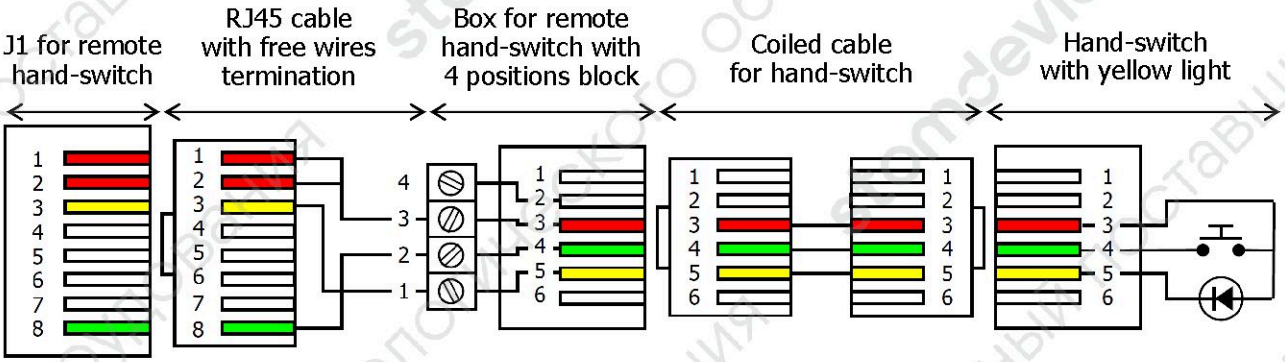


ⓘ RJ11 6C and RJ45 8C: bottom view, the hook is on the other side

ⓘ Plug RJ11 and RJ45: frontal view, the cable is on the rear

ⓘ Note. The actual wire colours may be different

J7 connector pin out: J7-3: +8V; J7-4: X-Ray command; J7-5: Yellow light



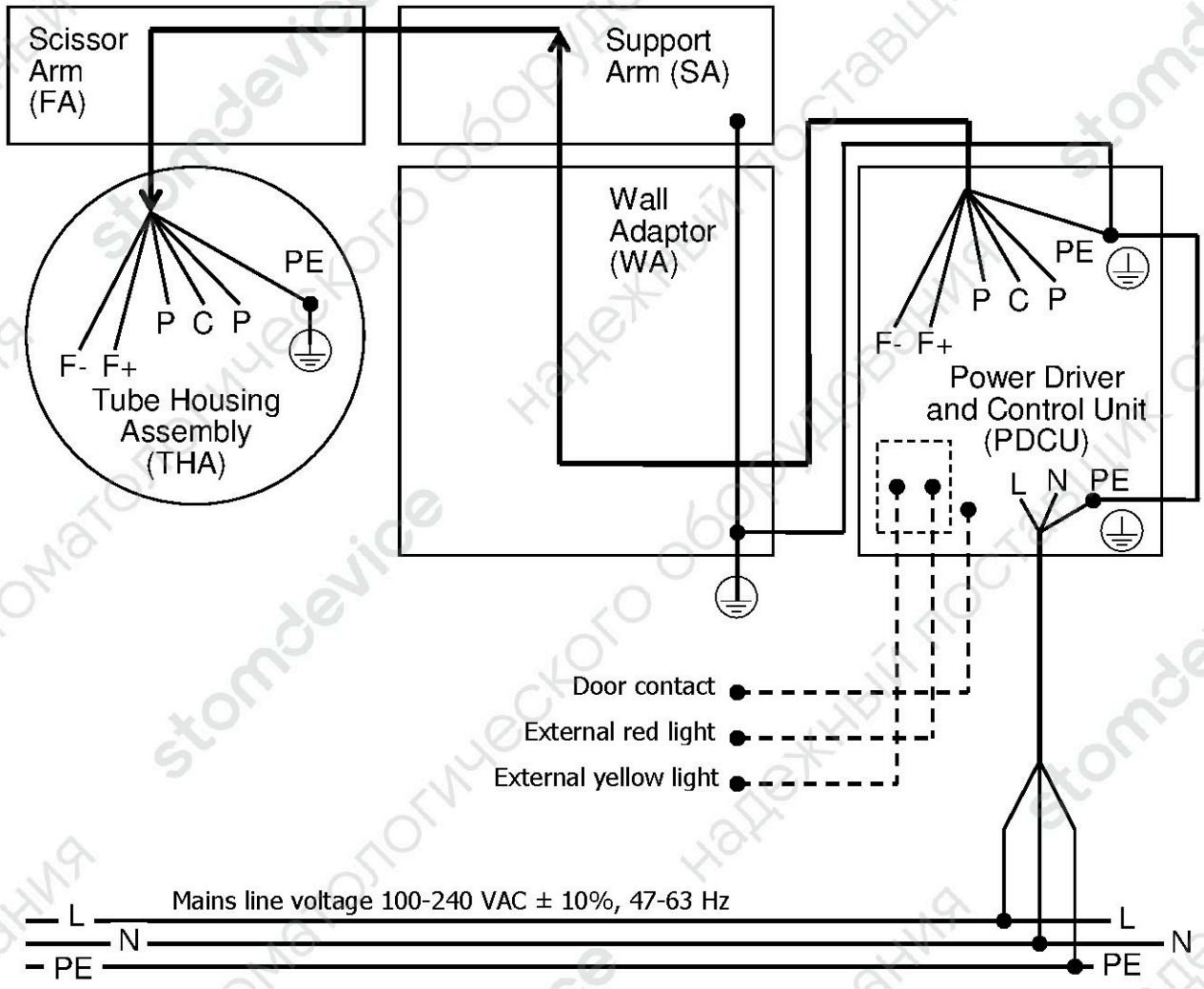
J1 connector pin out: J1-1 and J1-2: +8V; J1-3: Yellow light; J1-8: X-Ray command

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3.3.3 Wiring the unit with local control

It is here considered the case in which the power driver and control unit module (PDCU) is mounted close to the wall adaptor, at one side.



The mains power line cable must be connected to the input terminals in the bottom part of the power driver and control unit (PDCU) module.

The cable to connect to the mains supply line (2 conductors plus earth conductor) is not provided.

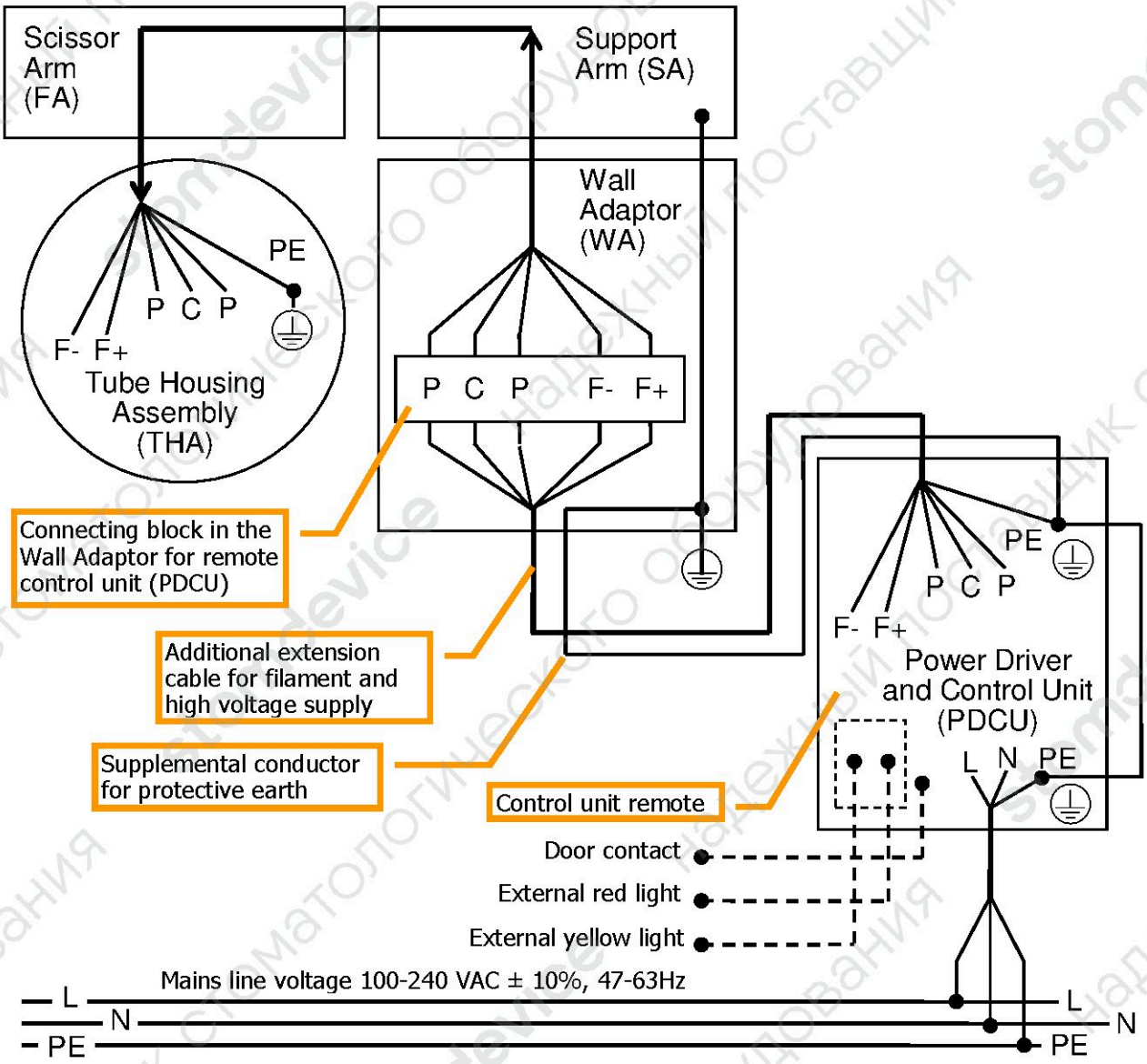
Cables with conductors of larger section have lower electrical resistance and voltage drop.

Wire Type	Cross Section Area	Resistance/m	m/0.05 Ohm
AWG 14	2.08 mm^2	0.00829 Ohm/m	6.0 m
AWG13	2.62 mm^2	0.00657 Ohm/m	7.6 m

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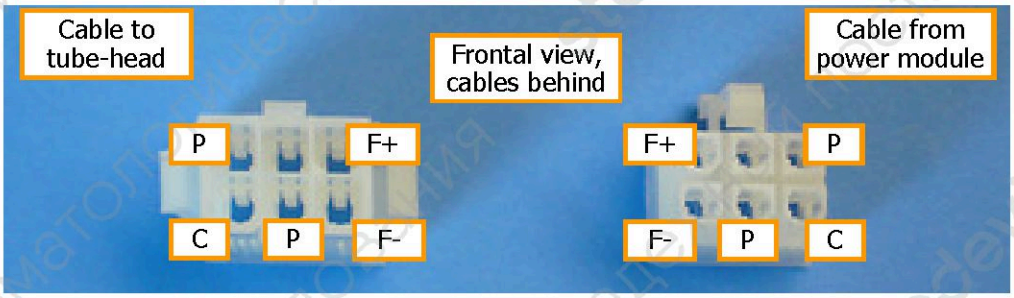
3.3.4 Wiring the unit with remote control

It is here considered the case in which the power driver and control unit module (PDCU) is mounted remotely, far from the wall adaptor.



3.3.5 Reduction in length of cable for filament and high voltage supply

In case the cable for filament and high voltage supply needs to be reduced in length, either the one in the scissor arm or the long extension for remote mounting of the power module (PDCU), it is recommended to produce the same terminations as those provided (ring for earth provision of 4 mm diameter and pins for the other wires) making reference to the following image for wire identification.



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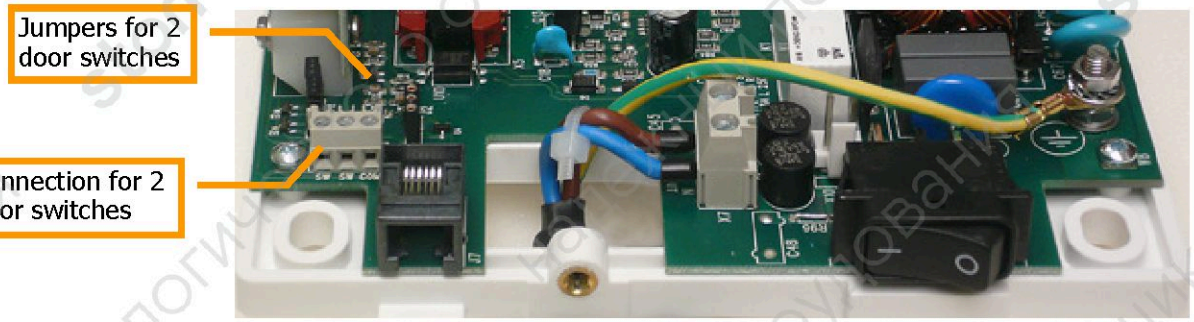
3.4 Optional Items

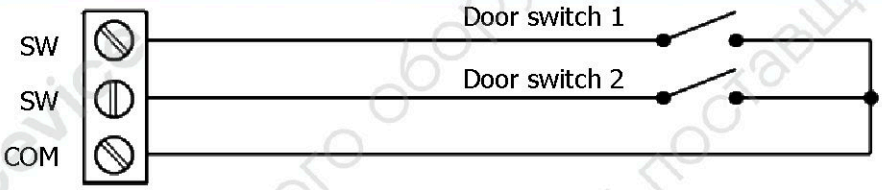
3.4.1 Optional door contact and second enable

A block is available on the PDCU main board for connection of the door contact, to prevent X-ray radiation with door open.

The unit is provided with two jumpers in place which have to be removed to connect two door contacts, and conversely they have to stay in place if the two door contacts are not used. Use one position for a single door contact.

One contact can alternatively be used as second enable for safety reasons.

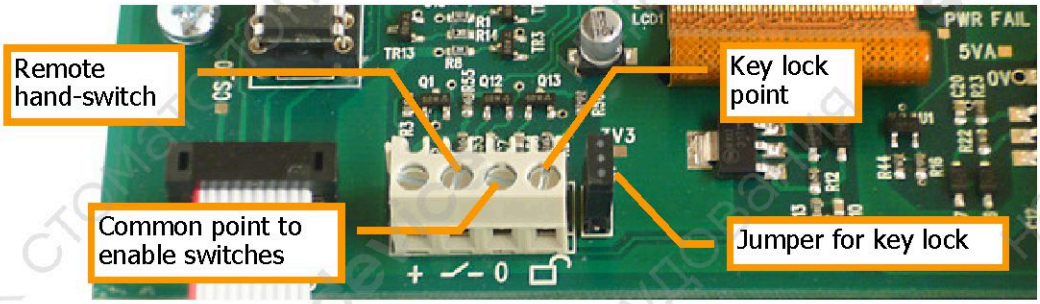




3.4.2 Optional remote hand-switch and key lock

Two-wire remote X-ray hand-switch

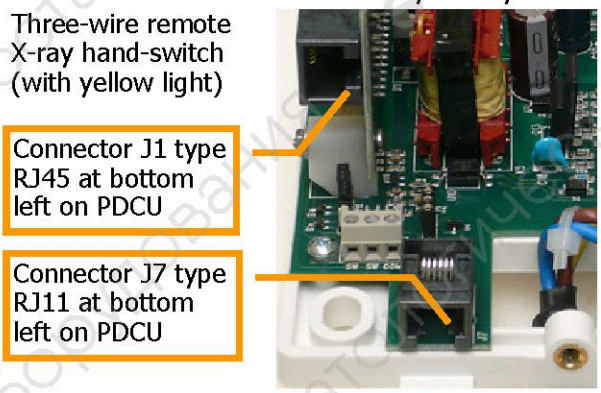
A. A two-wire remote hand-switch and a key lock to enable and disable the use of the system can be connected to the block in the control unit module.



a. The remote hand-switch has to be connected between the common point and the switch symbol.

b. The key lock switch has to be connected between the common point and the key lock symbol. Remove the jumper to activate the key lock functionality

Three-wire remote X-ray hand-switch (with yellow light)



B. In order to activate the remote X-ray hand-switch with yellow light a three-wire connection has to be made to the output connector J1, placed on the ment supply board of the PDCU module, with a registered jack cable RJ45 (8 contacts) at one end and no termination at the other end.

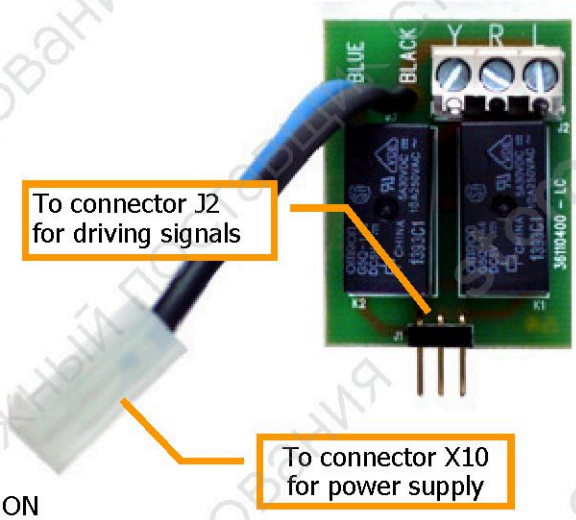
a. The RJ45 cable with connector on one side and free termination the other side is not provided.

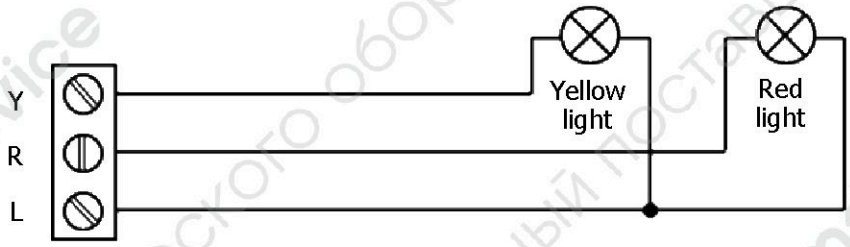
b. Refer to section 3.3.2, Wiring for local or remote hand-switch connection, for cable wiring details.

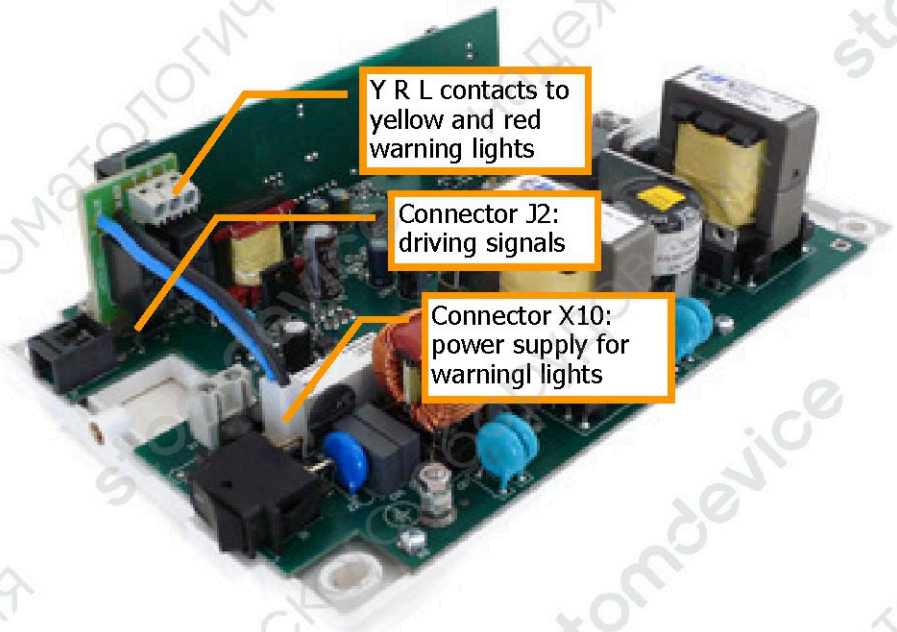
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3.4.3 Optional board for external lights

A. An optional board to be mounted on the power driver module (PDCU) is available to handle two external warning lights:
   a. Connect the board on connectors J2 and X10.
   b. The lights are supplied at the mains line voltage.
   c. Use 50 W bulbs maximum.
   d. X-ray unit ON light. It turns ON when the unit is powered: use L and R contacts.
   e. X-ray radiation ON. It turns ON during irradiation: use L and Y contacts.







PDCU with optional board for external lights mounted (left side).

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3.5 Installation of wall system

3.5.1 Mounting the wall adaptor



A. Open the packaging box paying attention not to damage the internal items.

⚠ Risk of scratching.

ℹ Avoid the use of a cutter not to damage the plastic cover.



B. Take away the plastic cover removing the screw at bottom.

C. Use the Wall Adaptor plate or the drill template to mark the fixing points.
The Power driver and control unit (PDCU) can be mounted close to the Wall Adaptor at the right or left side or in a remote position with connecting cables laid out accordingly.

D. Make the holes in the wall according to the applicable type of mounting with one, two, or three bolts at top, and those at bottom, with or without reinforcing plate.
To be noted that the load is born by the bolts at top.

E. Mount the metal frame on the wall using proper heavy-duty anchors and make sure that the cables enter from behind.

F. Secure it to the wall ensuring it is levelled with zero forward-backward and side deviations.

⚠ Risk of unwanted arm drifting.

ℹ Improper levelling of the mounting plate causes the arm to swing out of position.

ℹ An uneven wall might require interposing thin inserts (like wide washers) at the fixing points at top or at bottom, between the wall and the mounting plate, to assure forward-backward verticality.



Put the level on the front to check for forward-backward deviations from verticality.



Put the level on the side to check for side deviations from verticality.

G. Perform wire connection and final set-up complying with recommended sequence of actions reported in the following.

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3.5.2 Mounting the PDCU

A. Use the mounting plate or the drill template to mark the holes on the wall.

B. Take apart the control panel removing the screw at bottom.

Pay attention when disconnecting the flat cable of the control panel from the power board.

C. Drill the four holes in the wall and secure the power and control unit module making sure it is levelled.
Cabling should have been laid out in accordance to mounting requirements.



3.5.3 Mounting the Support Arm

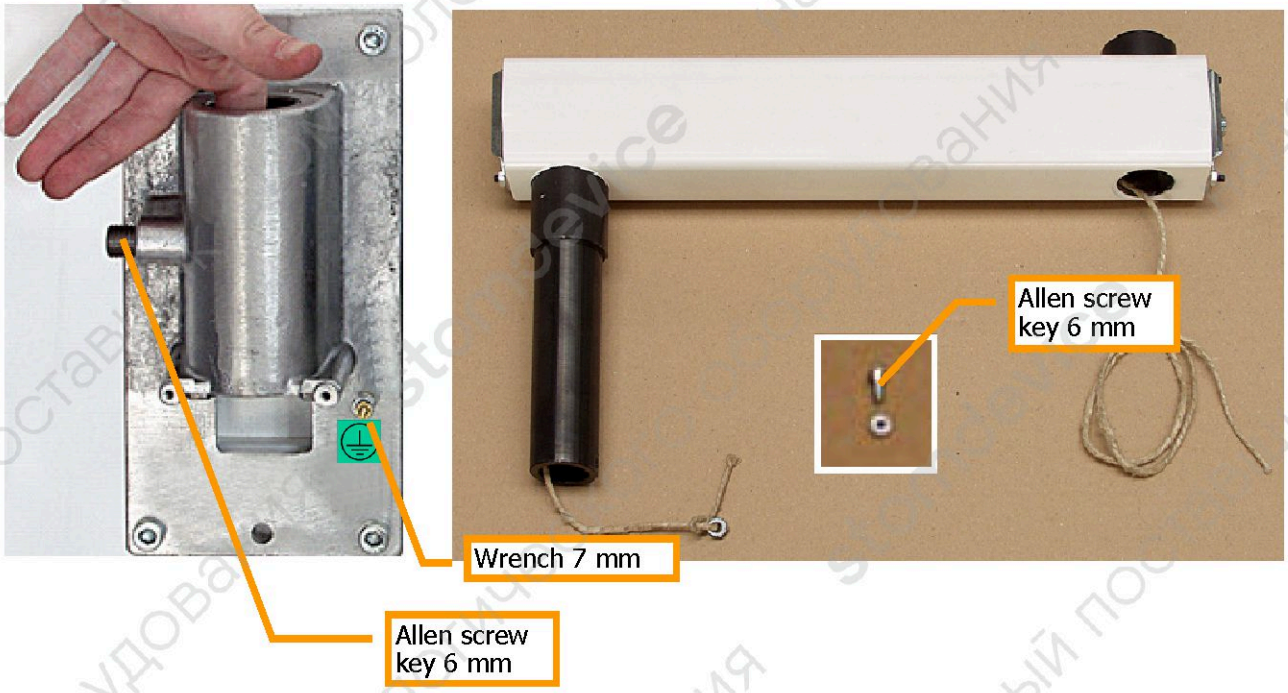
A. Unpack the support arm and check for integrity of parts.

B. Remove the rotation end-stop spacer but do not remove the string to pull the cable of the Scissor Arm to the Wall Adaptor through the Support Arm.

C. Push back the cylinder of the friction not to interfere, lightly grease the shaft of the extension arm, avoiding to do it in the middle where the friction is acting, and insert it into the wall adaptor.

D. Mount the rotation end-stop spacer and close the side friction without tightening. Tuning of side friction to be done when the system is completely mounted.

E. Verify 180° rotation from parking position at one side to the other side.



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3.5.4 Mounting the Scissor Arm

Handling

Risk of injury.

The compressed springs in the scissor arm may cause injury to the installer as well as damage to the arm itself if the arm is not handled properly.

Keep the binding string at the bottom of the arm to prevent sudden opening when operating without tube-head mounted and do not stay in front of the arm when it is opened.



A. Light grease the shaft at the base of the arm avoiding to do it in the middle where the fiction is acting, and make sure the ring spacer is in place

B. Push back the cylinder of the friction into the support arm not to interfere during the insertion of the shaft.





C. Secure the trailing rope /string to the end of the cable of the Scissor Arm.

D. Pull the other end of the trailing rope to drive the cable of the Scissor Arm through the Support Arm out into the Wall Adaptor.

E. Hold the opening section of the Scissor Arm, carefully remove the safety string and allow the arm to open slowly, away from people.

F. Close the friction without tightening. The actual tuning of the friction to be done when the system is fully assembled.

G. Verify 330° rotation for wall systems.

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3.5.5 Mounting and Connecting the X-ray Head



A. Remove the retaining fork from the arm shaft.
B. Remove the plastic cover from the yoke of the tube head and slide it into the arm shaft passing the cable through, then hold it in place with the retaining fork.
C. Screw the two ground provisions to the PE point and attach the connectors together.
D. Verify smooth movement of the tube head within limits without exceeding them:
   a. 500° rotation of the tube-head around its vertical axis.
   b. 340° rotation of the tube-head around its horizontal axis
E. Tune the friction disk in case.
F. Put back the plastic cover of the yoke and screw it at bottom.

3.5.6 Mounting the Beam Limiting Device

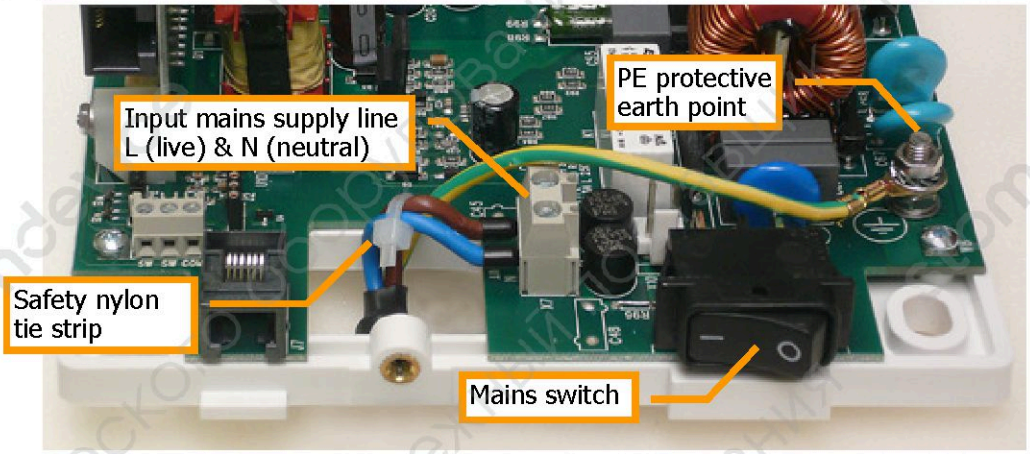
The unit comes with default circular BLD 5.8 cm (2-5/16″) diameter, featuring 20 cm (8″) Source Skin Distance (SSD).

The following options can be mounted:

A. 10 cm cone extension to reach 30 cm (12″) SSD, featuring BLD with circular output field of 5.8 cm (2-5/16″) diameter.
B. Rectangular beam limiting device BLD to film size 2 (adult) of 3.2 x 4.4 cm (1-1/4″ x 1-3/4″) to be inserted into the circular BLD and working both at 20 cm (8″) or at 30 cm (12″) SSD.
C. Rectangular beam limiting device BLD to film size 0 (pedo) of 2.2 x 3.2 cm (7/8″ x 1-1/4″) to be inserted into the circular BLD and working both at 20 cm (8″) or at 30 cm (12″) SSD.

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3.5.7 Connecting the PDCU to the mains line



Input from the mains line

D. The terminal block to consider is the one at bottom close to the mains switch, holding 2 positions for live (L) and neutral (N) conductors.

E. ⚠ Risk of electrical shock

ⓘ Turn "OFF" the mains voltage supply line of the room before operating.

F. Cut the input wires to have the green-yellow one 7 cm longer than the power supply ones for protective earth connection.

G. Terminate the green-yellow one with 4 mm ring for proper connection to the PE point (4 mm bolt) and possibly terminate the power supply ones with pin terminals.

H. Make sure no outgoing wire is connect to the PDCU.

I. Connect the green-yellow wire to the PE point and block it with lock-washer and nut.

The next actions are different in case of 1 phase or 2 phases mains supply line.

1 phase supply

J. Connect the live and neutral wires to the input terminal block at bottom of the PDCU module (L and N positions).

K. Make sure that the "live" conductor is the "hot" one:

c. Connect an AC voltmeter between the block terminal "live in" and "ground".

d. Turn "ON" the mains voltage supply line of the room and then turn the line voltage supply switch to "ON". If full line voltage is measured the wiring is correct. If not turn the line voltage supply switch to "OFF", reverse "live in" and "neutral in" wires and repeat the measurement; eventually the full line voltage should be read between "line" and "ground" (the voltage tester light turns ON).

L. Make sure no voltage is read between "neutral in" and "ground"; if not have the line voltage distribution checked.

M. Turn the line voltage supply switch of the equipment and of the room "OFF". The connection to a single phase mains supply line has ended.

2 phases supply

N. Connect the phase 1 and phase 2 wires to the input terminal block at bottom (L and N positions).

O. Remove (cut) the jumper deactivating fuse 2 to enable it.

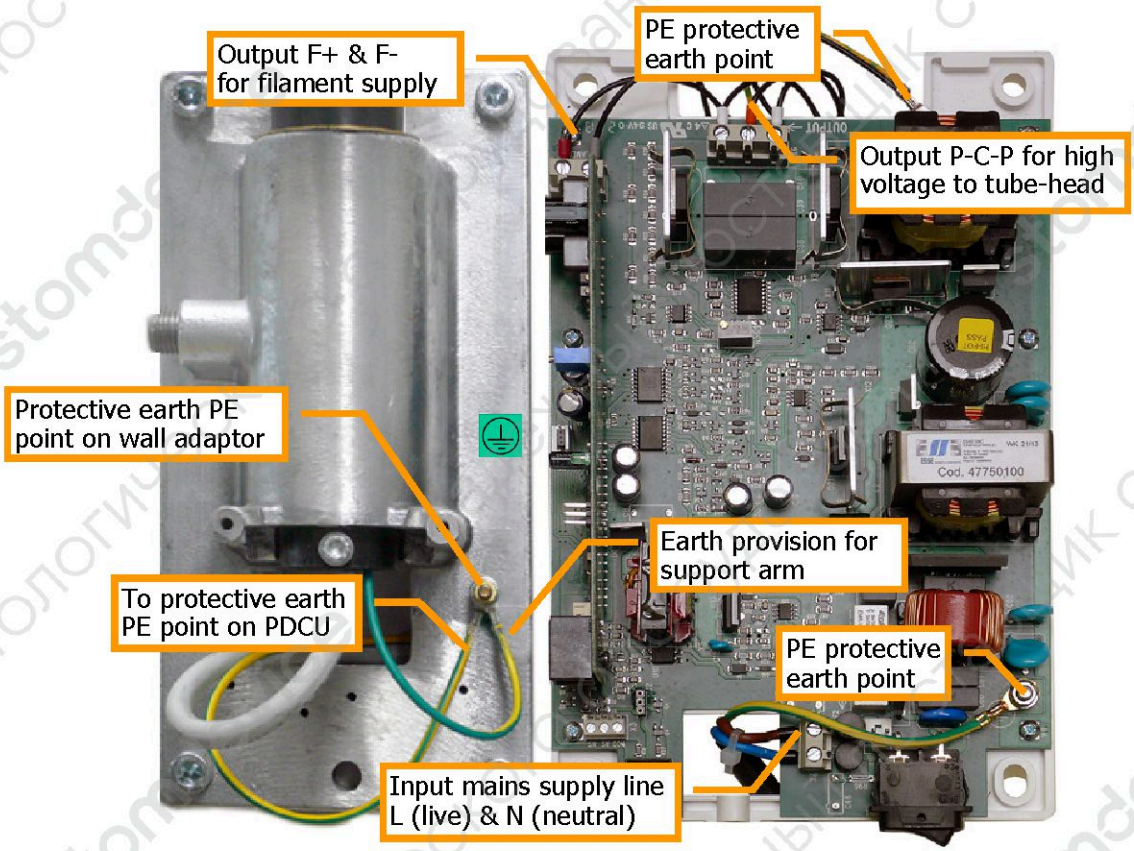
P. The 2 phases connection to the mains supply line has ended. Turn the line voltage supply switch of the equipment "OFF".

Q. ⚠ Risk of accidental isolation loss.

ⓘ Group the two supply leads close to their connection to the mains input block with a self-locking nylon tie strip in to order to prevent a loosen conductor to move around.

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3.5.8 Connecting the PDCU to the tube-head with WA at side



Output filament and high voltage supply

A. The terminal blocks to be considered are those at the top, the one for filament supply to the left and the one for high voltage supply to the center.

B. ⚠ Risk of electrical shock ℹ Turn the line voltage supply switch of the equipment and of the room "OFF".

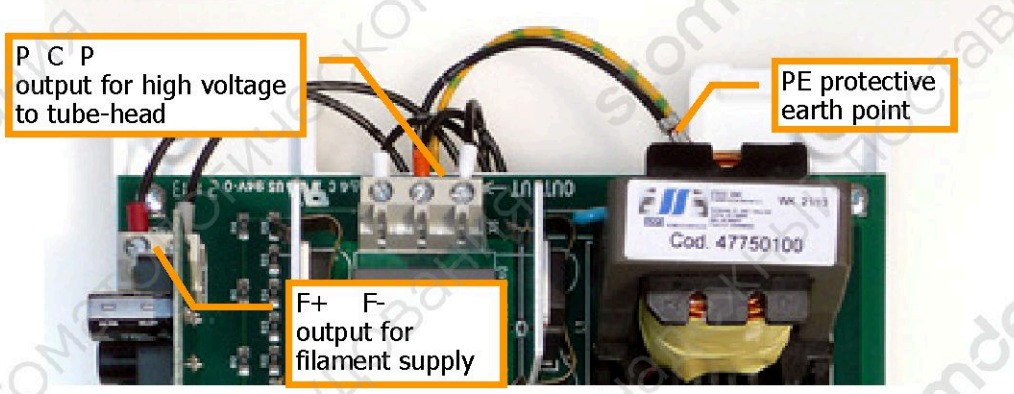
C. Pass the conductor of the earth provision for WA (already connected to the common bolt on the WA) into the PDCU and connect it to the PE point at top right on the PDCU.

D. Connect the earth provision of the support arm (SA) to the common bolt on the wall plate and block it in place with lock-washer and nut.

E. Pass through the tube-head supply cable of the arm into the PDCU and perform the following connections:
   a. P-C-P OUTPUT block: positions P, C, P to supply the primary of the transformer of the high voltage module into the tube housing assembly (THA)
   b. FILAMENT F+ and F-: plus (F+) and minus (F-) wires for the filament (heater) of the tube-head.

F. Wind the excess of cable or reduce its length in case.

G. Put back the PDCU cover with control panel and display.



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3.5.9 Connecting tube-head and PDCU remote

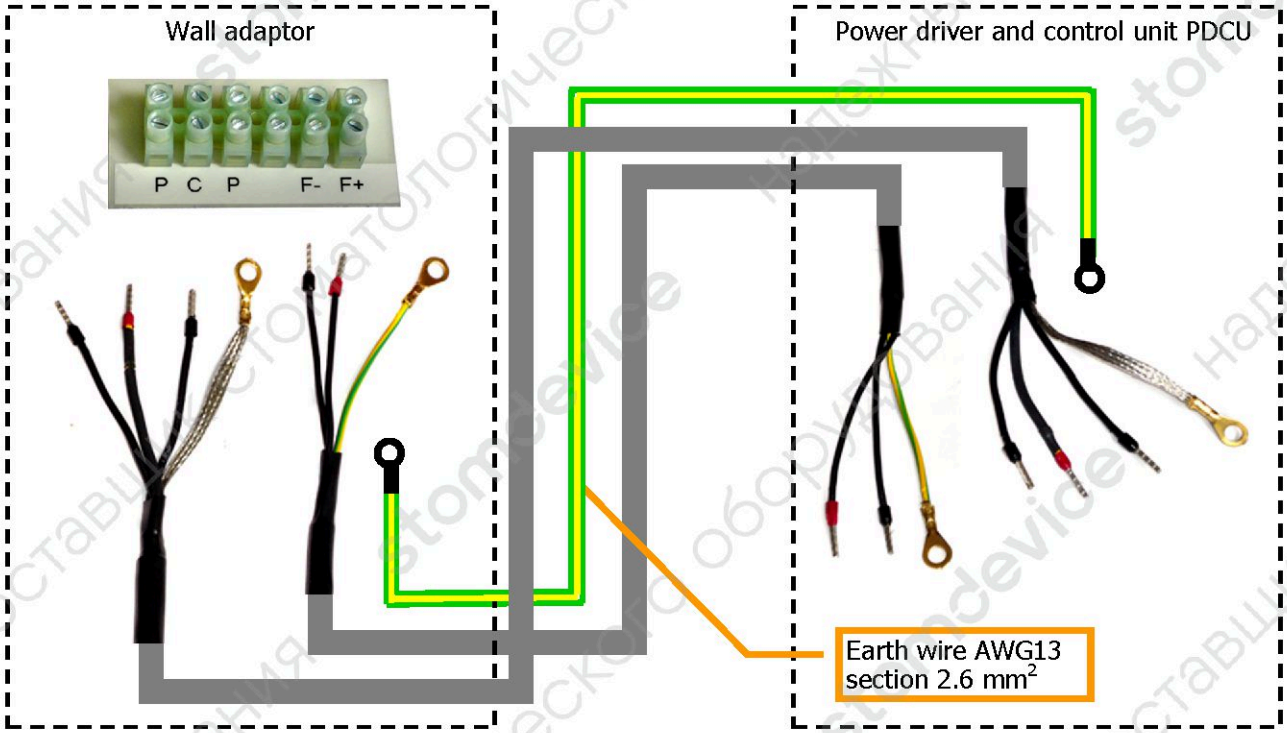
A. Turn the line voltage supply switch of the equipment and of the room "OFF".

B. Use the kit of supply cables for tube-head XDC, optionally provided, which includes the following:
   a. Cable for high voltage supply. 12 m maximum 3xAWG18 shielded cable to supply the transformer of the high voltage module into the THA, wires P to the sides of the primary winding, wire C to the central position of the primary winding and the shield for ground conductor.
   b. Cable for filament supply. 12 m maximum 3xAWG18 cable unshielded to supply the filament, wires F+, F-, and ground conductor.
   c. Wire for protective earth connection. 12 m AWG13 green-yellow wire.
   d. Interconnection block. 6 position block and mounting hardware and labels to be fixed onto the metal frame of the wall adaptor.

C. In the WA disconnect from the protective earth point the green-yellow conductor which has o be replaced by the longer one for remote connection.

D. Fasten to the common bolt for protective earth connection in the wall adaptor:
   a. Place first the additional AWG13 green-yellow wire for remote connection (up to 12 m)
   or alternatively an earth provision conductor directly from the mains line, and block it with unlocking washer and nut.
   b. Place then all the other green-yellow conductors, including the one for the support arm, conductor, and block them with unlocking washer and nut.

E. In the wall adaptor WA fix the mounting block with relevant shielding plate and label and connect the conductors marked P, C, P, F+, and F- as indicated.



F. Proceed now as per local connection to PDCU with tube-head at side, as described in the previous section.

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3.5.10 Connecting the Hand-Switch

The hand-switch is provided with a 3 m coiled cord with two terminations to be plugged in the body of the hand-switch and in the connector J7 at bottom of the power driver and control unit (PDCU).

3.5.11 Optional Remote Hand-Switch

⚠ Risk of having patient out of control.

ⓘ The hand switch can alternatively be mounted remote provided the radiographic unit is located in a room, for example, with window on the door, to enable visual contact with the patient and view of the control panel.

For wiring and connection details refer to sections 3.3.2 at page 14, and 3.4.2 at page 17.

Three installation possibilities are available:

A. Hand switch with yellow light enabled (3-wire connection to the remote box).
   a. Lay down an RJ45 cable with plug at one side and free termination on the other side.
   b. Plug the RJ45 connector into J1 at bottom left on the PDCU module and connect the applicable three wires to the block of the remote box.
   c. To operate plug the coiled cord of the X-ray hand-switch into the RJ11 plug in the remote box.

B. Hand switch with yellow light not enabled (2-wire connection to the remote box).
   a. Lay down a 2-wire cable to reach the remote box.
   b. At PDCU side connect the two wires to the central positions of the existing block of the CPU board (position "0" and position "switch").
   c. At the remote box connect the two wires to the central positions of the existing block (position "2" and "3").
   d. To operate plug the coiled cord of the X-ray hand-switch into the RJ11 plug in the remote box.

C. Hand switch without yellow light (2-wire connection of generic pushbutton).
   a. Lay down a 2-wire cable to reach the remote pushbutton.
   b. At PDCU side connect the two wires to the central positions of the block on the CPU board (position "0" and position "switch").
   c. At remote pushbutton side connect the two wires to the pushbutton.

3.5.12 Final set-up

A. Verify all the friction points and tune them, in case, as indicated in the maintenance section.
   a. Friction in the wall adaptor.
   b. Friction in the support arm.
   c. Set of frictions in the scissor arm.
   d. Friction disk for movement around its horizontal axis in the yoke of the tube-head.

B. Mount back all plastic covers and enclosures if not yet done:
   a. Cover of the wall support: fix it with the screw at bottom.
   b. Cover of the PDCU with display and control panel: fix it with the screw at bottom.
   c. Set of covers on the joints of the scissor arm: hook them in pairs.
   d. Side cover on the yoke of the tube-head: fix it with the screw at bottom.

C. Switch ON the power supply of the room.

The unit is now ready for functional test.

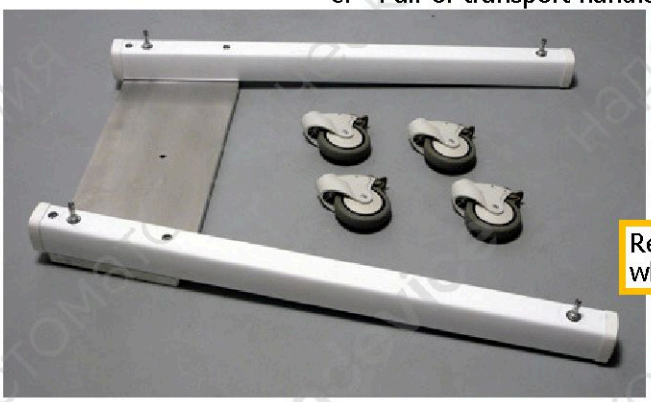
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3.6 Installation of mobile system

3.6.1 Assembling the Mobile Stand

A. Mount the legs under the central base.
B. Mount the four wheels with brakes.
C. Attach the pole with the PDCU mounting plate.
D. Complete the stand with:
   a. Cable gland with strain relief
   b. Pair of knobs to hang the mains cable
   c. Pair of transport handles





3.6.2 Mounting the scissor arm

A. Loosen the friction and push back the cylinder of the same not to interfere during shaft insertion.
B. Insert the arm having passed the cable through the hole at the centre of the metal box at the top of the stand.
C. Close the friction without tightening. The actual tuning of the friction to be done when the tube-head has been mounted.
D. Verify 40° rotation within legs opening.



3.6.3 Mounting the PDCU

A. Detach the control panel from the PDCU by removing the screw at bottom and disconnect the flat cable at the side.
B. Wind the and collect in the metal box the excess of the supply cable and of the earth conductor to the tube-head, blocking them with a nylon tie strip.
C. Fasten the PDCU module to the metal box.

3.6.4 Preparing the line voltage cable and the earth provision

A. The line voltage supply cord has to be completed with a plug provided with earth connection. For safety reason whenever feasible use a plug where the connection to the protective earth is made before and interrupted after the supply connections are made or interrupted.
B. Verify the proper connection of the protective earth conductors to the common bolt at the centre of the metal box:
   a. Fasten in first position with lock-washer and nut the protective earth conductor (the earth provision) of the mains cable.
   b. Fasten in second position the green-yellow conductor for connection to earth of the PDCU module.

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3.6.5 Connecting the PDCU

Input from the mains line

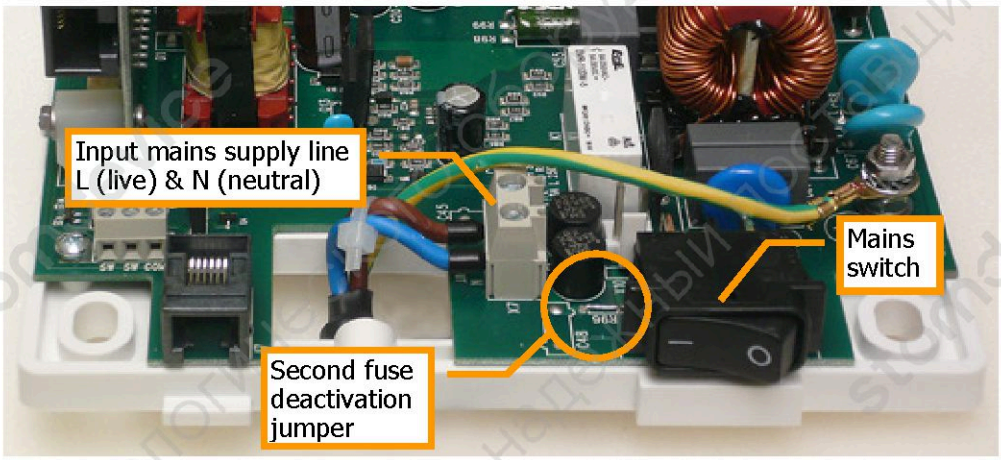
A. Connect the protective earth provision to the PE point at bottom right and block in place with lock-washer and nut.
B. Connect the live (L) and neutral (N) wires to the mains input block at bottom centre of the PDCU board.
C. Block the live (L) and neutral (N) wires just connected with a nylon tie strip to prevent an accidental movement in case of loosening.

Output filament and high voltage supply

D. Connect the high voltage and filament supply cable to the tube-head.
   a. Connect the ground provision to the PE point (at top, right) and block it with lock-washer and nut.
   a. Connect the three wires P, C, P to the OUTPUT block (at top, centre), with the C wire at the central position in the block.
   b. Connect the filament wires F+ and F- to the filament block (at top, left).

3.6.6 Activation of Fuse 2

Activate the second fuse F2 by cutting the fuse deactivation jumper R96 (zero Ohm resistor) on the left side of the mains switch.



⚠ Risk of electrical safety level degradation.

ℹ Units provided with supply cord and plug (which are not permanently connected) must be equipped with fuses on each supply lead, thus including the neutral conductor for single phase mains supply.

3.6.7 Mounting and Connecting the X-ray Head

Refer to the same procedure as for a wall mounted system, section 3.5.5 above at page 22.

3.6.8 Mounting the Beam Limiting Device

Refer to the same procedure as for a wall mounted system, section 3.5.6 above at page 22.

3.6.9 Final Set-Up

Refer to the same procedure as for a wall mounted system, section 3.5.12 above at page 26.

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4. Service

4.1 Line fuses

The two line fuses F1 and F2 are fixed and cannot be replaced in field.

In case a fuse blows the PDCU board is out of order and must be replaced with a good one.

Arrangement have to be made with FONA to return the board for its repair or to purchase a new one.

⚠ Risk of electrical shock.

ⓘ Do not try to replace a blown fuse. The fuse is a protection device and its failure indicates a malfunction has occurred.

The malfunction has to be removed before operating the unit again. Activating a defective unit like this one with power electronics by replacing a blown fuse can be dangerous due to the high of voltage and energy levels involved.

4.2 Control panel

Lights

- The three lights at top on the control panel, green for system ready, yellow for radiation on, and red for alarm condition, are exercised for testing at start up together with the green ones combined with the push buttons of the panel.
- The yellow light on the X-ray hand-switch directly connected to the power driver and control unit (PDCU) can only be tested during irradiation.
- Each green light combined with the key buttons on the control panel can be tested as feedback to the selection of the corresponding key button.

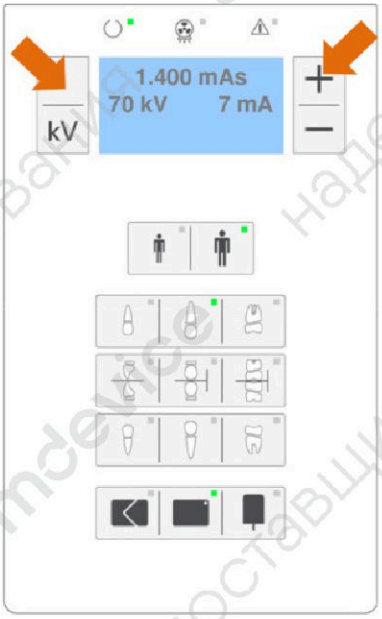
Key buttons

- Each push button key, excluding the kV, the plus and the minus keys, can be tested with the feedback light which indicates selection.
- The kV, plus, and minus pushbuttons do not have a light feedback and pressure is tested by the change of status of the affected parameter in the display.
- The X-ray hand switch can only be tested with X-ray irradiation.

4.3 Service data

A command is available to display the version of the software loaded on the PDCU and the values of the exposure counters:

- Activate the display function by pressing at the same time the two keys MENU and PLUS +.
- The exit is done by pressing the X-ray push button.
- Data reported include:
  - Version of CPU software
  - Version of Driver
  - Version of EEPROM
  - Counter with total number of exposures done
  - Energy counter with the total energy in kJ generated



4.4 Loading of the software

- New releases of the software can be loaded using a specific application on a computer connected via serial port.
- Please refer to the Technical Service Support in case of need.

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4.5 XDC test JIG

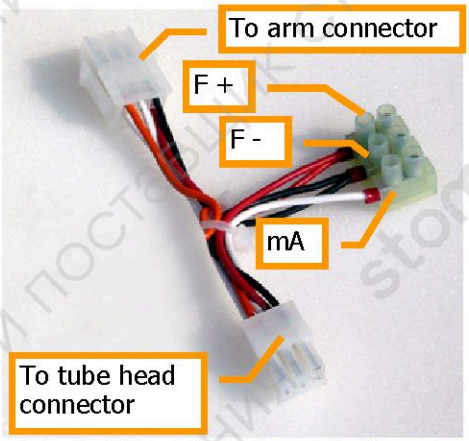
A tool is provided to support the measurement of filament voltage and of the anode current.

It has to be connected between the tube head and the arm cable.

The measurements are performed connecting the leads of the multi-meter to the block.

The points F-, also ground connection, is placed in the middle position of the block.

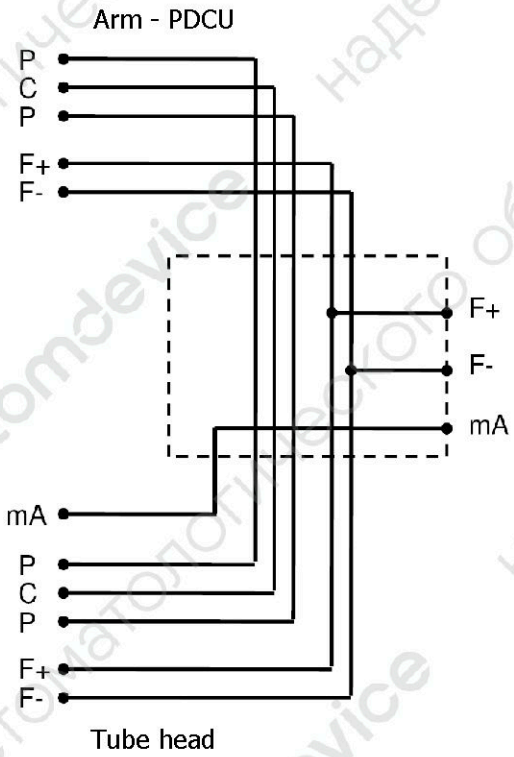
The points F+, filament supply voltage, and mA, anode current, are in the side positions of the block.

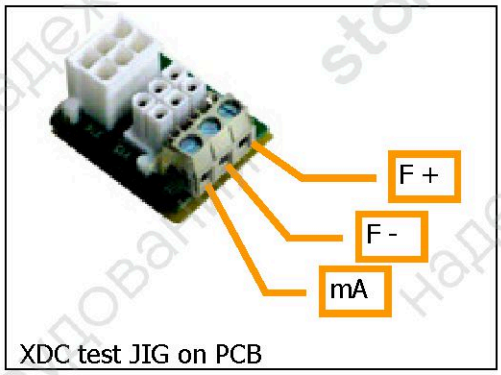


The XDC test JIG intercepts the output wires of the supply cable to let the measurement with a DC meter of:

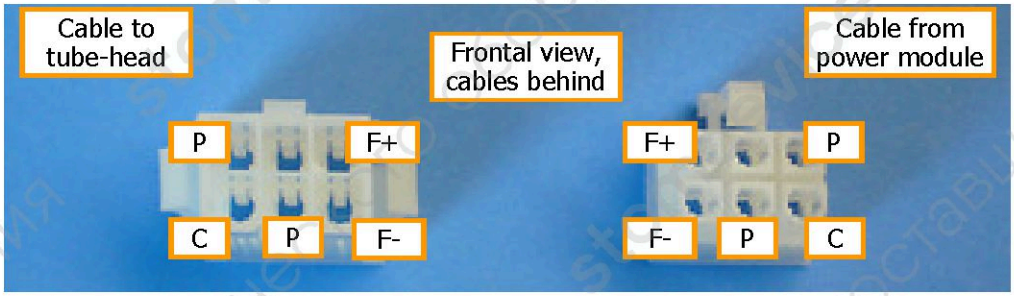
- filament supply voltage between the points F+ and F- for about 3 VDC
- anode current in mA for about 7 VDC (7 mA of anode current on a 1000 Ohm resistor mounted in the tube head correspond to the value of 7 VDC of anode current).

The point F- is at ground level and is used as a reference also for the voltage indicating the anode current.





XDC test JIG on PCB



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4.6 Replacement of tube-head XDC

WARNING

⚠ Risk of injury. The compressed springs in the scissor arm may cause injury to the installer as well as damage to the arm itself if the arm is not handled properly.

ℹ Keep a binding string at the bottom of the arm to prevent sudden opening when operating without tube-head mounted and do not stay in front of the arm when it is opened.



Instrumentation

A. Required to perform proper tuning of the unit
   - Multi-meter for DC voltage measurement, 10 V end of scale
   - Non invasive kV meter
   - XDC test JIG.

Mounting new tube head

B. Position the scissor arm open, remove the plastic cover from the joint, detach the cable connector and unscrew the earth conductor.

C. Hold the tube head while removing the holding fork, then take it apart letting the connector of the cable to pass through the mounting pipe.

D. Take the new tube head, pass the cable's connector through the mounting pipe, push it up and set it in place with the holding fork.

E. Fix the earth conductors to the protective earth point.

XDC test JIG

F. Mount the testing JIG for the measurement of filament supply voltage and anode current combining the connectors.

WARNING

G. To tune the unit X-ray exposures have to be made.

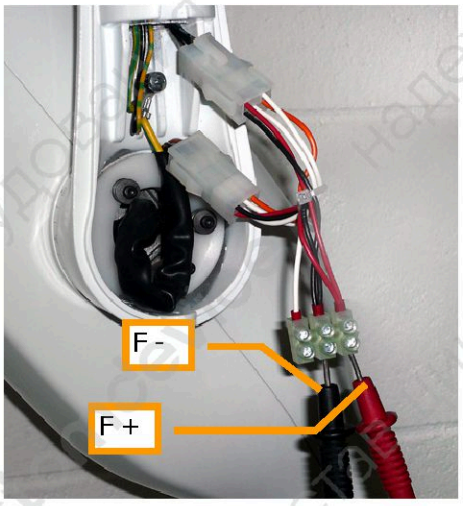
⚠ Risk of operator exposure to radiation if close to source.

ℹ Take the exposure hand-switch and move at least at 2 m from the source, out of the path of the X-ray beam, to avoid radiation.

Calibration of filament voltage

H. Connect a multi-meter for DC voltage measurement, 10 VDC end of scale, between the connecting points of filament plus and filament minus (GROUND).

I. Perform X-ray exposures at 60 kV, 7 mAs (1 s at 7 mA):
   a. Verify that filament supply voltage is from 2.9 to 3.1 VDC.
   b. Tune the FILAMENT CALIBRATION TRIMMER R104 to have a value in the indicated range.



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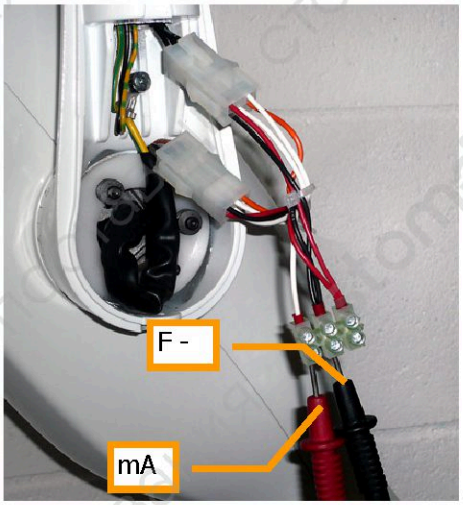
Calibration of anode voltage and anode current at 60 kV

J. Connect a multi-meter for DC voltage measurement, 10 VDC end of scale, between the connecting points of filament minus (GROUND) and mA.

K. Place the non invasive kV meter at about 50 cm in front of the output beam ready to measure the kV level.

L. Perform X-ray exposures at 60 kV, 7 mAs (1 s at 7 mA):

a. Verify that the measured voltage at the mA point is from 6.3 to 7.7 VDC, 1 V corresponding to 1 mA of anode current.
If not, tune the trimmer R104 to fall in the indicated range: turn it clockwise to reduce the current or counter-clockwise to increment it.



b. Verify that the measured kV level is from 57 to 63 kV.
If not, tune the HV CALIBRATION TRIMMER R56 to have a value in the indicated range: turn it clockwise to reduce the kV level or counter-clockwise to increment it

Calibration of anode voltage and anode current at 70 kV

M. Alignment at 70 kV to be done next. Perform X-ray exposures at 70 kV, 7 mAs (1 s at 7 mA):

a. Verify that the measured voltage at the mA point is from 6.3 to 7.7 VDC, 1 V corresponding to 1 mA of anode current.
If not, tune the trimmer R104 to have a value in the indicated range.

b. Verify that the measured kV level is from 66.5 to 73.5 kV.
If not, tune the HV CALIBRATION TRIMMER R56 to have a value in the indicated range.

N. Verify a second time the values of anode voltage and anode current at 60 kV:

a. Expose at 60 kV, 14 mAs (2s at 7 mA) and fine tune filament and high voltage supply if needed.

O. Verify a second time the values of anode current and anode voltage at 70 kV:

a. Expose at 70 kV, 14 mAs (2s at 7 mA) and fine tune filament and high voltage supply if needed.

Termination

P. Terminate the procedure when the values are in the stated ranges.

Non compliance

Q. In case it is not possible to calibrate the unit with values in the specified ranges put the unit out of service and call for technical assistance.

End of tube-head replacement

R. Disconnect the XDC testing JIG and connect the arm to the tube-head directly.

S. Perform one exposure to verify proper connection.

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4.7 Replacement of PDCU

Instrumentation

A. Instrumentation required to perform proper tuning of the unit
   - Multi-meter for DC voltage measurement 10 V end of scale a
   - kV meter and the
   - XDC test JIG.

Mounting new power board

B. Turn the unit OFF and the room switch OFF.
C. Remove the plastic cover with control panel from the PDCU module.
D. Disconnect the mains cable and its earth wire then the output cable for filament and high voltage supply and its earth wire.
E. Dismount the board from the back frame and mount the new one.
F. Connect the output cable for filament and high voltage supply and its earth wire (to the protective earth point) and the mains cable and its earth wire (to the protective earth point).
G. Turn the room switch ON and the unit switch ON.

XDC test JIG

H. Mount the testing JIG for the measurement of filament supply voltage and anode current on the tube head joint.

Sample exposures
Operator to stay far from X-ray source

I. To tune the unit X-ray exposures have to be made.

⚠ Risk of operator exposure to radiation if close to source.

ⓘ Take the exposure hand-switch and move at least at 2 m from the source, out of the path of the X-ray beam, to avoid radiation.

Calibration of filament supply voltage

J. Refer to corresponding point in previous section for replacement of tube head: same procedure.

Calibration of anode voltage and anode current at 60 kV

K. Refer to corresponding point in previous section for replacement of tube head: same procedure.

Calibration of anode voltage and anode current at 70 kV

L. Refer to corresponding point in previous section for replacement of tube head: same procedure.

Termination

M. Refer to corresponding point in previous section for replacement of tube head: same procedure.

Non compliance

N. In case it is not possible to calibrate the unit with values in the specified ranges put the unit out of service and call for technical assistance.

End of replacement of power board of PDCU

O. Disconnect the XDC testing JIG and connect the arm to the tube-head directly.
P. Put back the plastic cover on the tube head joint and the one with control panel.
Q. Perform one exposure to verify proper connection.

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4.8 Replacement of mains cable

The mains supply cord which is used on the mobile unit is a three core cable size AWG16 for mains connection.

Proceed as indicated for proper replacement:

Removing old cord

A. Make sure the plug of the supply cord is not connected to the mains line.
B. Remove the control panel to have access to the input mains connection block.
C. Disconnect the supply leads of the mains cable from the input block and the green-yellow one from the protective earth point in the PDCU module.
D. Remove the nuts holding in place the PDCU module and raise it to have access to the common bolt for protective earth connection (PE) in the frame behind.
E. Disconnect the green-yellow conductors bonded there, the one for the earthing of the PDCU module and the earth provision from the mains line, which is placed first.
F. Unscrew the gland with strain relief from the post.
G. Pull out the old cable from the post having attached to it a leading rope to pull the new cable in.

Mounting new cord

H. Pull the new cord in the gland with strain relief and then into the post.
I. Screw the gland with strain relief in place.
J. On the PDCU side terminate the two supply leads with pins and the green-yellow one with a 4 mm ring.
K. Fasten tightly with lock-washer and nut in first position (bottom) on the common bolt for earth connection and bonding the green-yellow conductor of the supply cord (earth provision).
L. Fasten tightly with lock-washer and nut in second position (top) on the common bolt for earth connection and bonding the other green-yellow conductor, for the PDCU module.
M. Secure the PDCU module to the chassis with the four screws at the corners.
N. Connect the two supply leads to the mains input block at bottom.
O. ⚠ Risk of accidental isolation loss.

ⓘ Group the two supply leads close to their connection to the mains input block with a self-locking nylon tie strip in to order to prevent a loosen conductor to move around.

P. Verify that the green-yellow conductor for earth provision to the PDCU is tightly secured to the common bolt for bonding and grounding.
Q. Mount back the outer cover of the PDCU with control panel.
R. Complete the mains supply cord with proper plug.

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5. Maintenance

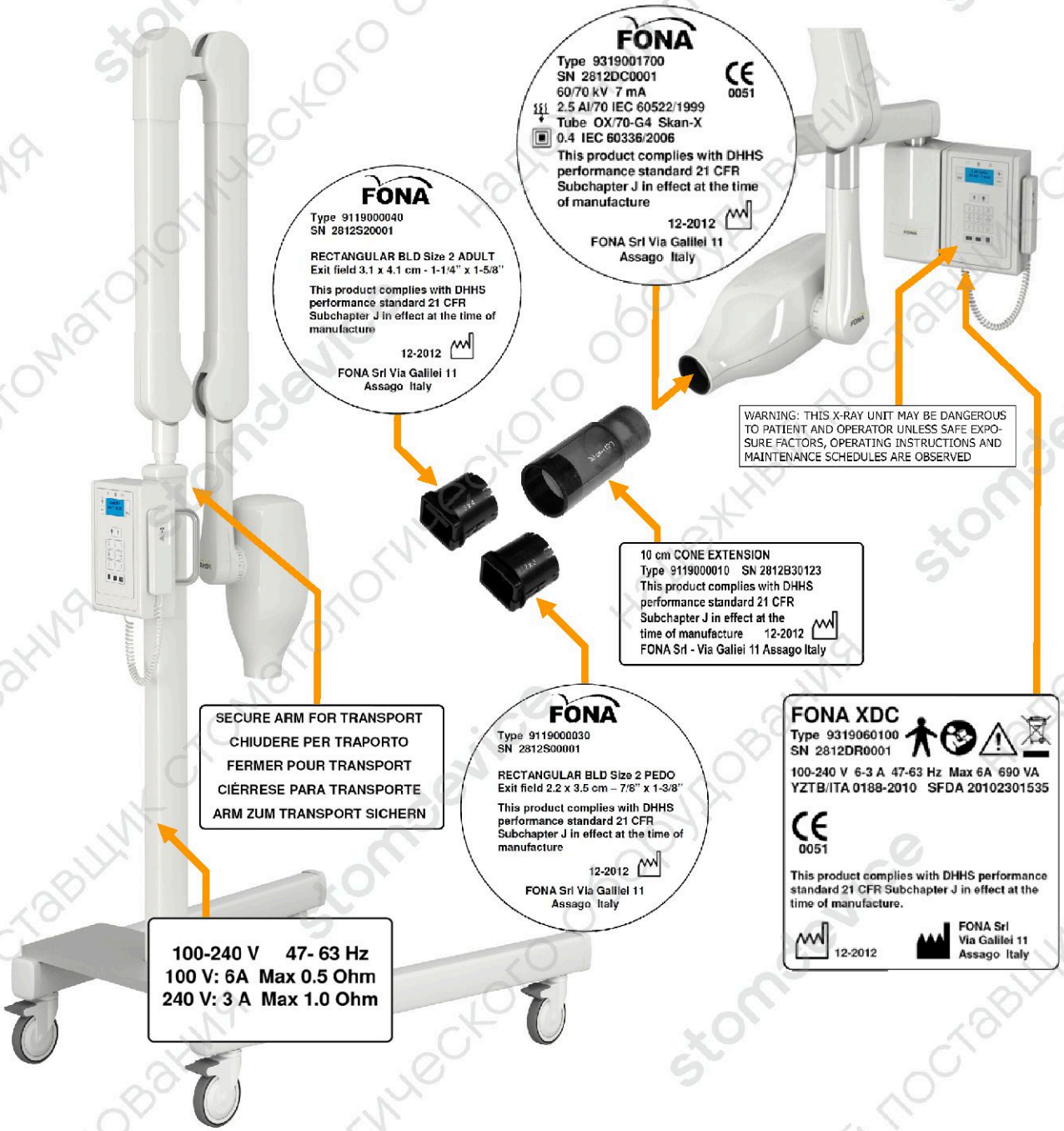
Safety degradation

Report any defect detected.

Risk safety degradation

In presence of defects which may constitute a safety hazard to the patient as well as to the operator do not use the unit until repairs are made.

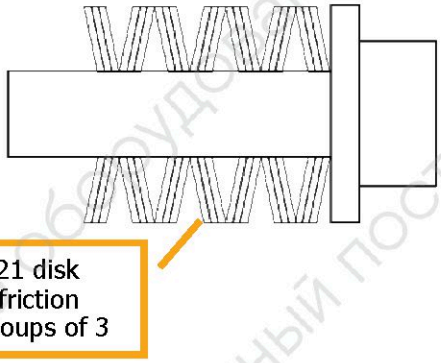
5.1 Checking labels



A. Verify that all labels are in place and legible.
B. Note. The warning label on the control panel is applicable for USA only.
C. Defaced labels must be replaced. Order same from FONA in writing stating:
   a. Customer name and address.
   b. Model and serial numbers still readable on the unit.

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5.2 Maintenance of wall adaptor

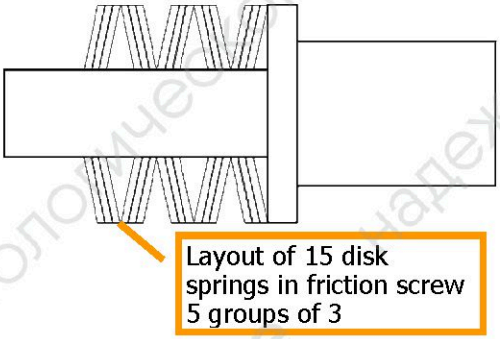




A. Remove the cover (screw under the unit) and verify that the mounting fully adheres to the wall and remains stable and firmly fixed during handling of the system.
B. Verify tight connection of green-yellow earth conductors to the common bolt for earthing and bonding (PE point).
C. Check the level of friction during movement of the support arm and adjust it if needed.

5.3 Maintenance of support arm







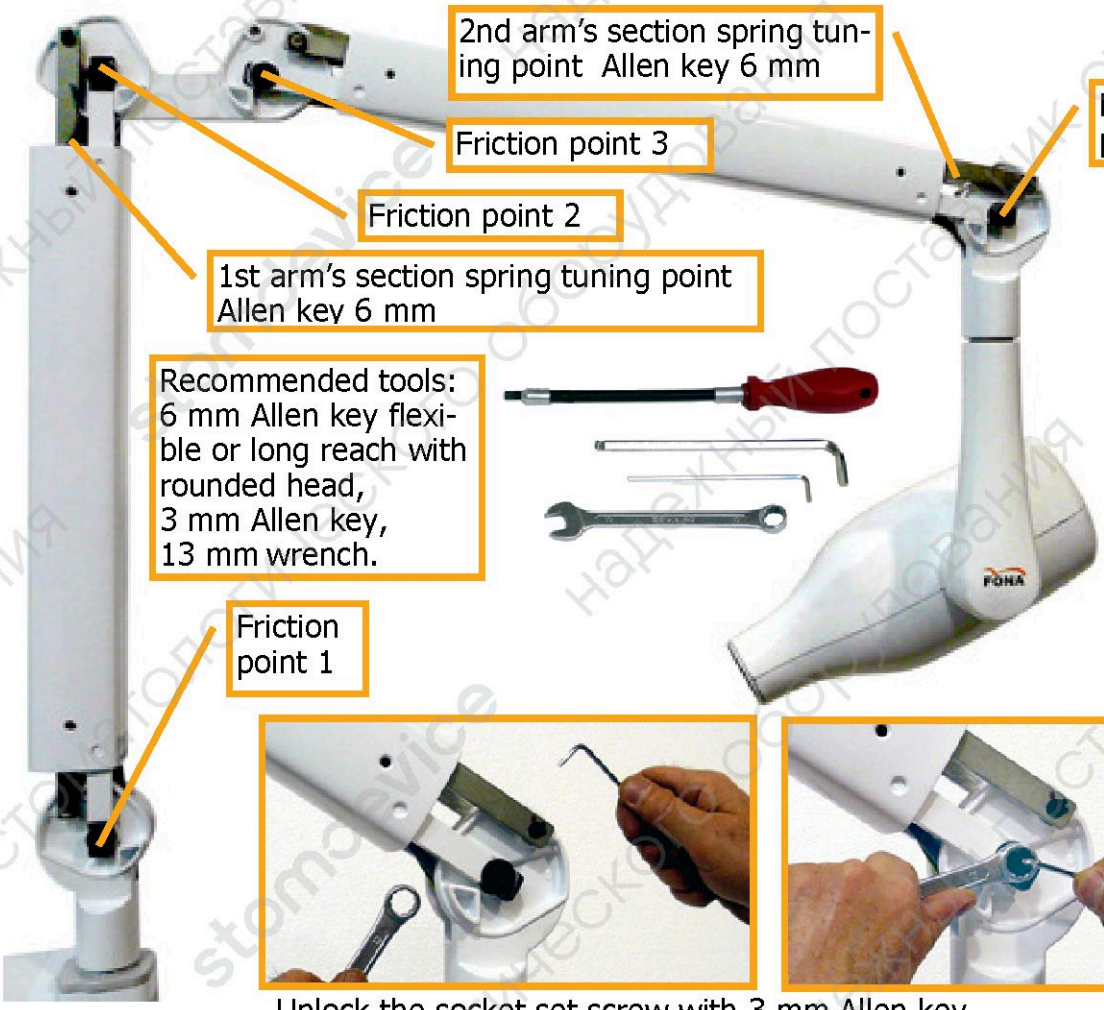
A. Check the level of friction during movement of the scissor arm and tune the relevant screw if needed.
B. Verify tight connection of the green-yellow earth conductor to the arm.
C. Verify 180° rotation of the support arm into the wall adaptor, without exceeding the limit.

5.4 Maintenance of scissor arm

A. Inspect for wear of pins and levers:
   a. Remove plastic covers.
   b. Check for wearing out of pin and levers.
   c. Make sure no part is loose.
   d. Apply silicon spray lubricant if needed.
B. Replace the worn out parts or the arm itself if damaged.
   To replace defective pins or levers:
   a. Have the X-ray head disconnected and the arm fully open.
   b. Loosen completely the two springs of the arm before extracting pins.
C. Eventually mount back the X-ray head and secure it with the retaining fork.
D. Verify 330° rotation of the scissor arm into the support arm or 40° into the pole of the mobile stand, without exceeding the limit.

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Unlock the socket set screw with 3 mm Allen key

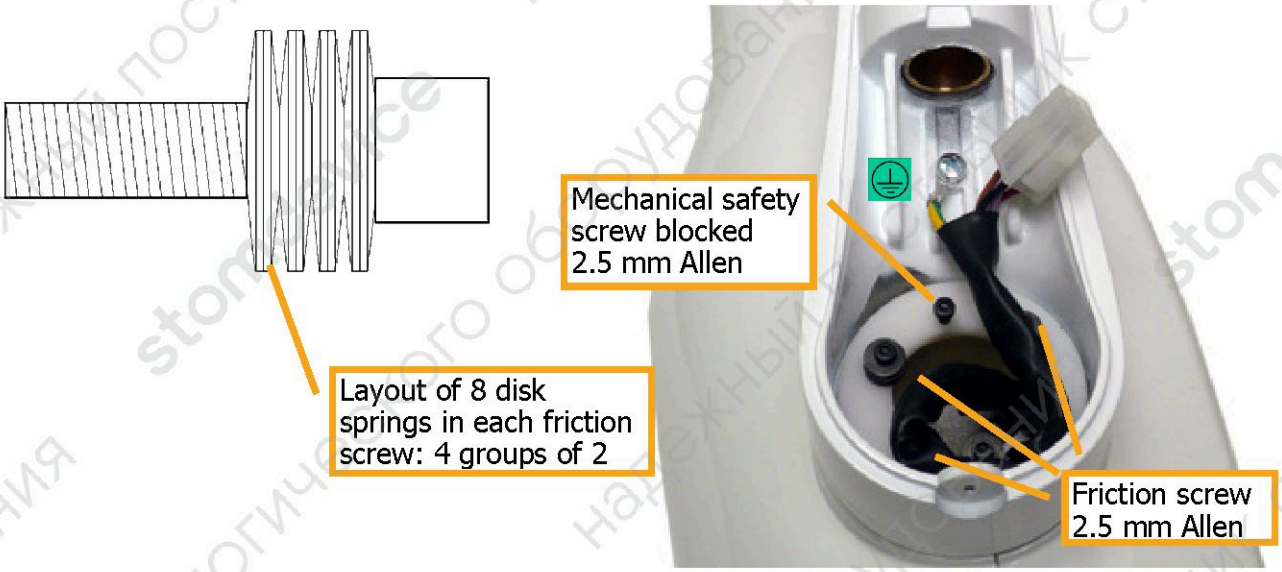


Spring loading with flexible or long reach Allen key

E. If the scissor arm is not supporting the load, do load the springs (2 sections) and tune frictions (4 points) if needed, with the tube head mounted.
To load the arm, for each arm's section:
   a. Remove plastic covers at the joints.
   b. Reduce the friction at the 2 relevant friction points by loosening the socket set screw (Allen 3 mm) into the female pin, then loosen both pins (13 mm wrenches).
   c. ⚠ Risk of breakage. ℹ Trying to loosen the friction pins without having loosen the socket set screw might lead to breaking the friction pins.
   d. Load the spring (using a 6 mm Allen key) for an even balancing of arm sections resting in an intermediate position.
F. Tighten the two friction pins introducing a little resistance to the movement, and eventually tighten the socket set screw to block the pins.
G. Check for any damage or worn out conditions of the electrical cable in the arm.
H. Make sure the protective earth wire it tightly connected to the arm.

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5.5 Maintenance of X-ray Head



A. Inspect for damages to the X-ray head and its support system.
B. Inspect the cone for possible damages and replace it if cracked.
C. Inspect for oil leakage and replace the head in case.
D. Check for smooth movement and position stability and tune frictions if necessary.
E. Remove the plastic cover of the joint (Phillips screw at bottom) and:
   a. Check the retaining clip and replace if damaged or worn down.
   b. Verify 500° rotation of the tube-head around the vertical axis, without exceeding the limit.
   c. Make sure the ground wires are tightly connected to the protective earth point.
   d. Check that electrical cables are not damaged and the wiring correctly twisted.
   e. Make sure the screw for mechanical safety is properly tightened.
   f. Verify that the three friction screws (with cup springs) are tightened properly for a smooth rotation.
   g. Verify 340° rotation of the tube-head around the horizontal axis, without exceeding the limit.

F. Eventually put back the plastic cover of the joint.

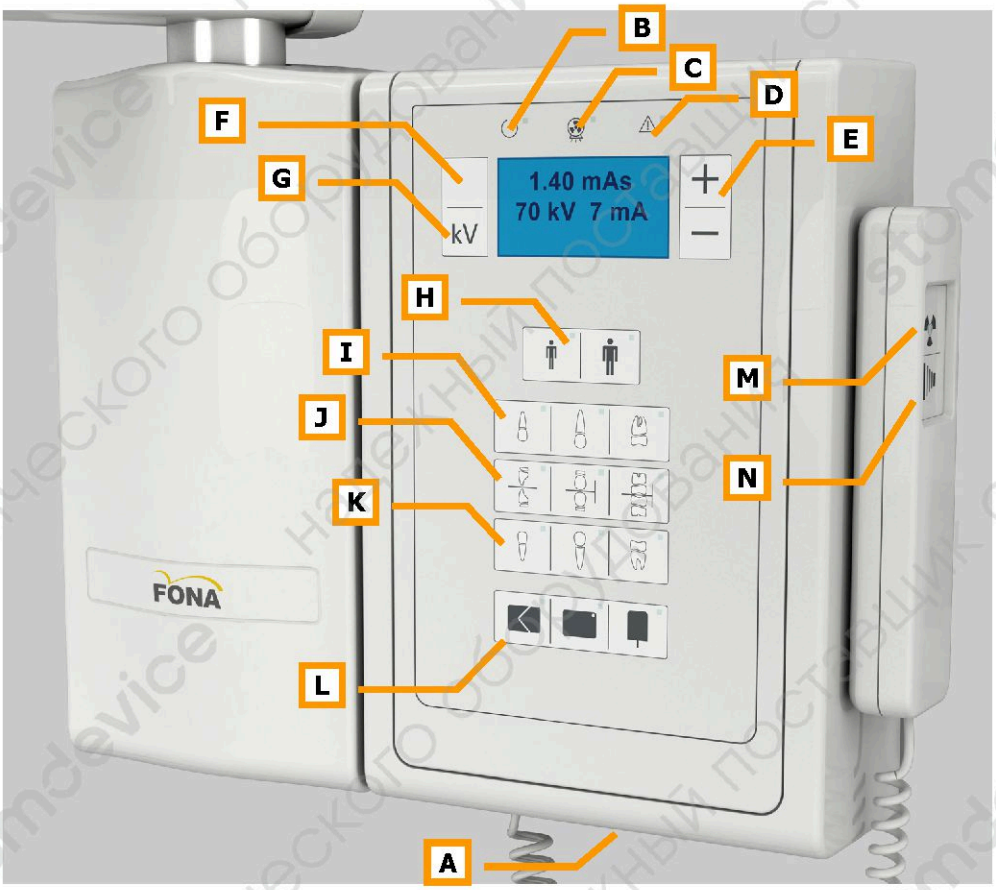
5.6 Maintenance of the mobile stand

A. Check that wheels and brakes are working properly
B. Make sure the earth wire it tightly connected to protective earth point and to the mechanical frame.
C. Verify that the gland with strain-relief of the power supply cord is properly tightened and is not damaged
D. Make sure the power supply cord and the plug are not damaged.

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5.7 Maintenance of the control unit



Turning System ON	A.	Turn the unit ON with mains switch (A) and verify that the green light (B) indicating system ready turns ON at the end of the initialization procedure.
Test keys and lights	B.	Press all the kV key (G) and verify the change of kV level.
	C.	Press plus key (E) and move to the maximum exposure value 3.2 s or 22.4 mAs.
	D.	Press the minus key and go to the minimum exposure value 0.01 s or 0.07 mAs.
	E.	Press each patient build key (H), change selection and verify green light.
	F.	Press each anatomical region key (I, J, K), change selection and verify green light.
	G.	Press each image receptor key (L), change selection and verify green light.
Test Radiation Light and sound	H.	Using plus and minus keys set for an exposure of 1 s (7 mAs) or more.
	I.	Direct the beam away making sure no one will be irradiated.
	J.	Press the exposure button (N) and keep it pressed until the end of the exposure. Check for yellow light a(C and M) and for the sound of the buzzer during irradiation.
Volunteer termination of irradiation (Dead Man functionality)	K.	Using plus and minus keys set for an exposure of 2.5 s. Direct the beam away making sure no one will be irradiated.
	L.	Press the exposure button (N) and release it during the exposure. Verify that:
		a. irradiation is terminated immediately, signalled by the yellow light turned OFF and the buzzer sound terminated,
		b. the red alarm light (D) is turned ON and the error message E08 for premature termination appears on the display.
	M.	Clear the error message and repeat the procedure in case.
Turning System OFF	N.	Turn the unit OFF with mains switch (A).
Out of service	O.	If the specified tests are not passed the unit cannot be used and has to be put out of service

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5.8 Mechanical checks

The examination to the mechanical parts of the system is divided in checks to be planned during the periodic inspection and activities to be carried out during preventive maintenance to be scheduled as recommended.

Periodic inspection

A. Mechanical status:
   a. Check for overall mechanical integrity of components and of plastic covers and that no part is being attacked by corrosion.
   b. Check for mechanical integrity of the beam limiting device (collimator).
B. Make sure tube-head movements are performed within limits without exceeding:
   a. 500° rotation of the tube-head around its vertical axis.

340° rotation of the tube-head around its horizontal axis
Call for technical service to fix any abnormality found.

Maintenance activities

A. Check and tuning of moving parts:
   a. Check friction in wall adaptor. Tune in case.
   b. Check friction in support arm. Tune in case.
   c. Inspect for wear of pins and levers of the scissor arm. Lubricate in case. Note. Only minor wear is expected to occur in lifetime and without prejudice to the use.
   d. Check springs and frictions in scissor arm. Tune in case.
   e. Check friction disk in tube-head yoke. Tune in case.
   f. Make sure the safety screw in the friction disk of the tube-head yoke is fully engaged. Set properly in case.

Make sure the retaining fork holding the tube-head is working well. Correct in case.
Call for technical service to fix any abnormality found.

5.9 Electrical Checks

The following checks are recommended during preventive maintenance:

Cables and conductors

A. Cabling integrity:
   a. Make sure the supply cable into the side yoke of the tube-head is winding correctly during rotation. Set properly in case.
   a. Check for integrity of supply cable and green-yellow conductor into the scissor arm. Replace them in case of damages.

Protective earth

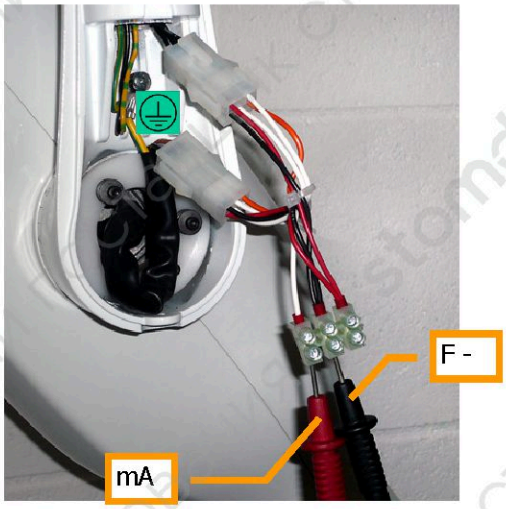
B. Check, and fix if necessary, for proper tightening of nuts and screws blocking the green-yellow conductors in PE points:
   a. PDCU module: PE points at bottom right and top right.
   b. Wall support: PE point on the right.
   c. Support arm: PE point behind the plastic cap at the mounting pin side.
   d. Side joint of the tube-head: PE point at top centre.
   e. Mobile stand: PE point in the metal frame behind the PDCU module.

Call for technical service to fix any abnormality found.

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5.10 Tube current verification





Turn System OFF	A. Turn the unit OFF with mains switch below the unit.
	B. Remove the plastic covers of the tube head joint.
	C. Mount the XDC test JIG for the measurement of filament supply voltage and anode current with a serial connection of the connectors of the supply cable to the tube head.
	D. Connect a multi-meter for DC voltage measurement, 10 VDC end of scale, between the connecting points of filament minus (GROUND) and mA.
Warning	⚠ Risk wrong measurement
	ℹ Measurements have to be done by trained personnel only to avoid the risk of electrical shock or radiation exposure.
	ℹ The tolerances on the measured values have to take into account the precision of each measurement instrument.
	ℹ The anode current is measured with a DC voltmeter set for 10 V DC, reading the voltage across the 1000 Ohm resistor in the anode circuit.
	ℹ The voltage measured indicates the current flowing: 1 V is corresponding to 1 mA.
Turn System ON	E. Turn the unit ON with mains switch below the unit.
Set long exposure	F. Using plus and minus keys set for an exposure of 2 s (14 mAs) or more.
	G. Direct the beam away making sure no one will be irradiated.
	H. Press the exposure button (M) and keep it pressed until the end of the exposure reading the value indicated on the multi-meter; during the exposure the value of 7 V ± 10% is read (in the range from 6.3 to 7.7 V).
Record	I. Record the readings
Turn System OFF	J. Turn the unit OFF with mains switch below the unit.
	K. Remove the measuring leads and put back the plastic cover.
Out of service	L. If the specified values are not obtained the unit cannot be used and has to be put out of service

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5.11 Exposure Time and kV verification

Non invasive kV and time meter

A. In order to verify the exposure time and to measure the kV level a non invasive kV and time meter is used.

Warning



Risk wrong measurement

Measurements have to be done by trained personnel only.

Place the radiation detector at about 50 cm (20") from the source (focal spot).

The tolerances on the measured values have to take into account the precision of each measurement instrument.

Set proper trigger level to measure the exposure time from the instant when the radiation dose rate for the first time reaches the 50% of the peak value and the instant when it finally drops below such value.

Turn System ON

B. Turn the unit ON with mains switch below the unit.

60 kV, 2.80 mAs (0.4 s a 7 mA)

C. Using plus and minus keys set for an exposure of 2.80 mAs (0.4 s at 7 mA) at 60 kV.
   a. Step back to a safe position
   b. Expose and read the values of kV and time indicated by the meter:
   c. Time to be 0.4 s ± 0.04 (range 0.36 to 0.44 s).
   d. kV value to be 60 kV ± 3 kV (range 57 to 63 kV).
   e. If the specified values are not obtained the unit cannot be used and has to be put out of service.

70 kV, 3.5 mAs (0.5 s a 7 mA)

D. Using plus and minus keys set for an exposure of 3.5 mAs (0.5 s at 7 mA) at 70 kV.
   a. Step back to a safe position
   b. Press the exposure button (M) and keep it pressed until the end of the exposure reading the value indicated on the kV and time meter.
   c. Time to be 0.5 s ± 0.05 (range 0.45 to 0.55 s).
   d. kV value to be 70 kV ± 3.5 kV (range 66.5 to 73.5 kV).
   e. If the specified values are not obtained the unit cannot be used and has to be put out of service.

Record

E. Record the readings.

Turn System OFF

F. Turn the unit OFF with mains switch below the unit.

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5.12 Radiation dose assessment

Dose meter

A. Use a dose meter to verify the dose emitted.

Warning



Risk wrong measurement

Measurements have to be done by trained personnel only

It is recommended to place the radiation detector at 50 cm (20") or at 71 cm (28") from the radiation source (focal spot).

The tolerances on the measured values have to take into account the precision of each measurement instrument.

Test object

In dental radiology a 6 mm Al filter (purity 99.9% or better) realizes a test object representative of an average patient. It can be placed in front of the output beam to evaluate the useful radiation level on the image receptor.

Turn System ON

B. Turn the unit ON with mains switch below the unit.

60 kV, 7 mAs

C. Using plus and minus keys set for an exposure of 7 mAs (7 mA at 1.0 s) at 60 kV.
   a. Step back to a safe position
   b. Expose 3 times and take the average of the three measurements.
   c. Acceptable values according to measurement distance in the table below.

	Dose rate at 60 kV			
Distance [cm]	20	50	71	100
Dose rate [µGy/s] ±20%	8400	1344	672	336
Dose rate with 6 mm Al filter [µGy/s] ±20%	1878	300	150	75

70 kV, 7 mAs

D. Using plus and minus keys set for an exposure of 7 mAs (7 mA at 1.0 s) at 70 kV.
   a. Step back to a safe position
   b. Expose 3 times and take the average of the three measurements.
   c. Acceptable values according to measurement distance in the table below.

	Dose rate at 70 kV			
Distance [cm]	20	50	71	100
Dose rate [µGy/s] ±20%	11200	1792	896	448
Dose rate with 6 mm Al filter [µGy/s] ±20%	2851	456	228	114

E. Record the readings.

Turn System OFF

F. Turn the unit OFF with mains switch below the unit.

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6. Reporting

The checklist forms for the servicing of the unit are provided in the following:

- FONA XDC Installation Report, to document proper assembly and installation.
- FONA XDC Checklist for Yearly Inspection, covering activities performed periodically every year.
- FONA XDC Checklist for Preventive Maintenance, covering the maintenance activities, when applicable.

6.1 Installation report

The installation report contains the list of the checks to be performed at installation after assembly of the unit which comes fully calibrated in manufacturing.

The form to be filled is structured as indicated..

Header

A. References
   a. Customer name and address
   b. Dealer name and address
   c. Serial number of Tube Housing Assembly (THA)
   d. Serial number of Power Driver and Control Unit (PDCU)
   e. FDA form 2579 identification number (USA only)

Instrumentation

B. List of test instrumentation in use:
   a. AC /DC Voltmeter
   b. kV and time meter
   c. X-ray radiation dose meter

Checks

C. List of checks to be performed as per manufacturer's indication:
   a. Availability of manuals.
   b. Proper instrumentation in use.
   c. Mechanical status.
   d. System labels.
   e. Permanent installation (without the use of cord with plug).
   f. Second fuse enabled (two phases supply or cord connected with plug).
   g. Green-yellow conductors tightly secured in protective earth (PE) points .
   h. Functionality of keys on control panel.
   i. Functionality of lights on control panel.
   j. Functionality of irradiation indicators (yellow light and buzzer).
   k. Volunteer termination of irradiation (dead man functionality).

Compliance

D. Compliance statement upon positive conclusion of installation, or rejection.

Out of service

E. If the specified values are not obtained the unit cannot be used and has to be put out of service.

Date and signature

F. The form is closed with:
   a. Date and signature by customer
   b. Date and signature by technician

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6.2 Periodic inspection and preventive maintenance report

Schedule

The FONA XDC unit is a maintenance free equipment, requiring little or no maintenance, for which the following activities are recommended:

- General inspections, by the operator, to be performed every year.
- Preventive maintenance, by a skilled and trained technician, to be performed after 4, 7, 10 years from the date of installation and then every 2 years.

The report for inspection and maintenance contains both the general checks do be done periodically and the maintenance actions, when applicable.

The form to be filled for the action items here listed is produced in the following.

Header

A. References
   a. Customer name and address.
   b. Dealer name and address.
   c. Serial number of Tube Housing Assembly (THA).
   d. Serial number of Power Driver and Control Unit (PDCU).
   e. FDA form 2579 identification number of the original form filled (USA only).

Instrumentation

B. List of test instrumentation in use:
   a. AC /DC Voltmeter
   b. kV and time meter
   c. X-ray radiation dose meter

Checks for general inspection

C. List of general checks to be performed yearly:
   a. Availability of manuals.
   b. Proper instrumentation.
   c. Mechanical status.
   d. System labels.
   e. Keys on control panel.
   f. Lights on control panel.
   g. Light and sound indicators upon irradiation .
   h. Activation and volunteer termination of irradiation.

Compliance upon inspection

D. Compliance statement upon positive conclusion of general inspection, or rejection.

Preventive maintenance schedule

E. When carried out, check the applicable time period for preventive maintenance: 4, 7, 10, 12, 14, 16, 18, or 20 years from the date of installation.

Checks for preventive maintenance

F. List of preventive maintenance activities to be performed as per schedule:
   a. Mechanical checks (balance, friction, wear).
   b. Verification of tight connection of green-yellow wires at protective earth (PE) points.
   c. Accuracy of anode voltage.
   d. Accuracy of anode current.
   e. Accuracy of exposure time.
   f. Adequacy of irradiation level

Compliance upon maintenance

G. Compliance statement upon positive conclusion of periodic maintenance or rejection.

Out of service

H. If the specified values are not obtained the unit cannot be used and has to be put out of service

Date and signature

I. The form is closed with:
   g. Date and signature by customer
   h. Date and signature by technician

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FONA XDC INSTALLATION REPORT

Customer:		Dealer:
	Serial number	Date of installation:
Tube housing assembly (THA)		Report of assembly FDA 2579 #
Power Driver and control Unit (PDCU)		

TEST INSTRUMENTATION

	Manufacturer	Model	Accuracy	Last calibrated
AC /DC Voltmeter				
kV and time meter				
X-ray dose meter				

SCHEDULE	Yes	No	REMARKS
All manuals are present	☐	☐	
Test instruments are as required	☐	☐	
No mechanical damage noticed	☐	☐	
All labels are present and legible	☐	☐	
The unit is permanently installed (without the use of plug)	☐	☐	
Second mains fuse enabled (on mobile due to use of plug)	☐	☐	
Green-yellow wires at PE points are tightly secured	☐	☐	
Keys on control panel are working properly	☐	☐	
Lights on control panel are working properly	☐	☐	
The light and sound indicators upon irradiation work	☐	☐	
The activation and volunteer termination of irradiation work	☐	☐	
Compliance to above listed performance and safety tests	☐	☐	

Notes:

Technician	Customer
Date: Signature:	Date Signature

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FONA XDC CHECKLIST for YEARLY INSPECTION

Customer:		Dealer:
	Serial number	Date of installation:
Tube housing assembly (THA)		Report of assembly FDA 2579 #
Power Driver and control Unit (PDCU)		

TEST INSTRUMENTATION

	Manufacturer	Model	Accuracy	Last calibrated
AC /DC Voltmeter				
kV and time meter				
X-ray dose meter				

SCHEDULE	yes	no	REMARKS
All manuals are present	☐	☐	
No mechanical damage noticed	☐	☐	
All labels are present and legible	☐	☐	
All pushbuttons on control panel are working properly	☐	☐	
All indicator lights on control panel are working properly	☐	☐	
X-ray radiation indicator lights up, the buzzer is audible	☐	☐	
X-ray hand-switch and dead-man functionality are working	☐	☐	
The unit complies with the above indicated tests	☐	☐	

FONA XDC CHECKLIST for PREVENTIVE MAINTENANCE

☐ 4 year ☐ 7 year ☐10 year ☐12 year ☐14 year ☐16 year ☐18 year ☐20 year

SCHEDULE	yes	no	REMARKS
Test instruments as required	☐	☐	
Mechanical checks (balance, friction, wear).	☐	☐	
Green yellow wires at PE points are tightly secured	☐	☐	
Anode Voltage at 60 kV is within specified limits	☐	☐	kV
Tube current at 60 kV is within specified limits	☐	☐	mA
Anode Voltage at 70 kV is within specified limits	☐	☐	kV
Tube current at 70 kV is within specified limits	☐	☐	mA
Exposure time at 0.5 s is within limits	☐	☐	s
Radiation dose rate at 70 kV at 71 cm /28" distance	☐	☐	µGy/s
The unit complies with the above indicated tests	☐	☐	

Technician	Customer
Date: Signature:	Date: Signature:

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We reserve the right to make any alterations which may be required due to clinical improvements

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