BLUEX

IntraOs 70
X-ray Equipment

Service & Installation Manual

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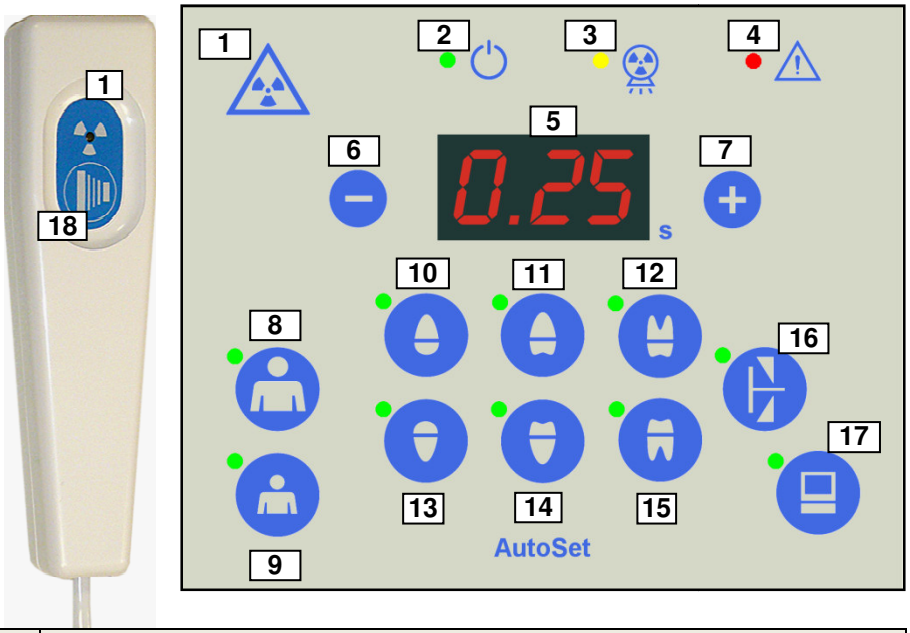
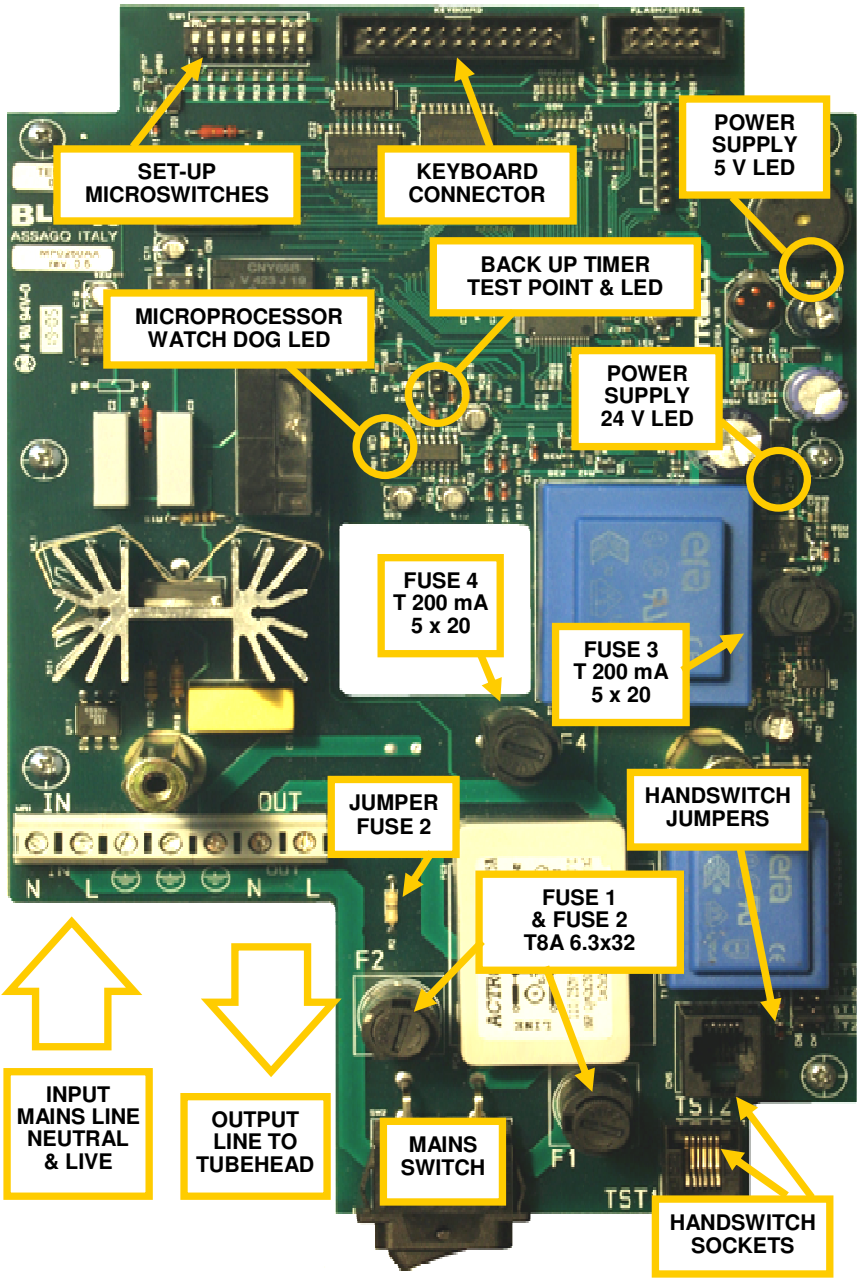
Control panel and exposure pushbutton



1	Medical device for emission of ionizing radiation on request
2	System turned ON and ready
3	Irradiation
4	Alarm
5	Exposure time in s
6	Manual decrease of exposure time
7	Manual increase of exposure time
8	Patient size large
9	Patient size small
10	Maxillary incisor
11	Maxillary canine or premolar
12	Maxillary molar
13	Mandibular incisor
14	Mandibular canine or premolar
15	Mandibular molar
16	Bite-wing premolar
17	Use of digital detector
18	Radiation exposure pushbutton

Layout Power Board Timer AutoSet



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Service & Installation Manual – English Edition

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Thank you for notifying us any error found in the document.

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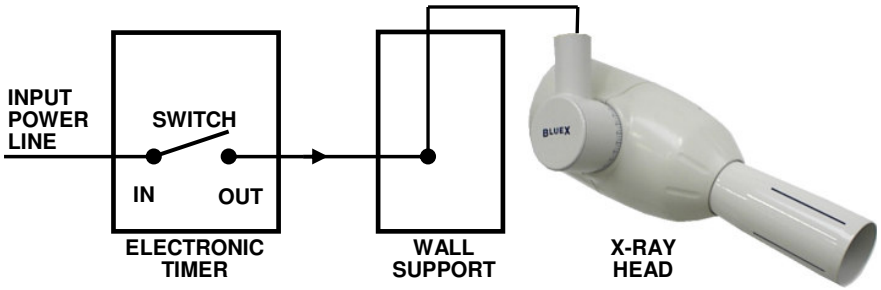
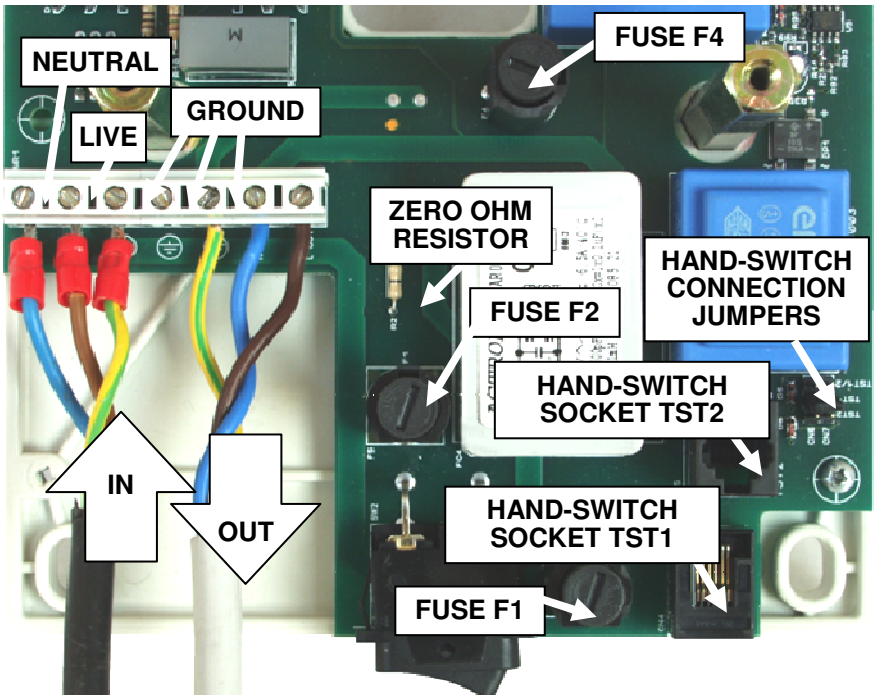


Electrical requirements: see section 3.1.3 at page 13.



To connect the timer see section 3.1.10 at page 19.

1. INTRODUCTION

1.1 Purpose

The IntraOs 70 X-ray Equipment is design to fulfil the needs for intra-oral radiography in the general dental practice.

The system can be configured for wall, unit or mobile solutions and different types of timers and tube-heads.

The features of the system make it easy to use, and grant long useful life with minimum maintenance.

1.2 Equipment Classification

- IEC: IntraOs 70 is a Class I, type B equipment
- FDA: IntraOs 70 is a Class II equipment (21 CFR 872-1800).

1.3 Applicable Standards

The IntraOs 70 system configurations, all equipped with the AutoSet timer, comply with the following standards.

IEC 601-1	General requirements for safety
IEC 601-1-2	Electromagnetic compatibility
IEC 601-1-3	General requirements for radiation protection in diagnostic X-ray equipment
IEC 601-2-7	Particular requirements for the safety of high voltage generators of diagnostic X-ray generators
IEC 601-2-28	Particular requirements for the safety of X-ray source assemblies and X-ray tube assemblies for medical diagnosis
21 CFR 1020.30	Diagnostic x-ray systems and their major components
21 CFR 1020.31	Radiographic equipment

1.4 Environmental Data

Applicable ranges of temperature, humidity, and atmospheric pressure are reported here below both for operation and transport conditions.

	Ambient	Transport & Storage
Temperature	from 10 to 40 °C	from –20 to +50 °C
Relative Humidity	from 30 to 75%	10 to 90%
Pressure	from700 to 1060 hPa	from 500 to 1060 hPa

1.5 Obligations of the Installer

Obligations of the Installer are:

A To make sure that the line voltage specified by the Manufacturer of the equipment is available and within the specified range.

B For safety reasons verify that a proper switch is available to disconnect from line voltage supply when needed during installation.

C Install and test the equipment with due diligence according to the installation instructions from the Manufacturer.

D To provide the Operator's Manual to the User.

1.6 Warning

X-ray equipment produce ionising radiation that may be harmful if not properly controlled. It is therefore recommended that the equipment be operated by trained personnel only in accordance with existing law.

Even if compliant to specifications of electromagnetic compatibility, it is recommended not to use the equipment in presence of external electromagnetic fields, such as those generated by cellular phones, which might interfere with the electronic circuits of the system.

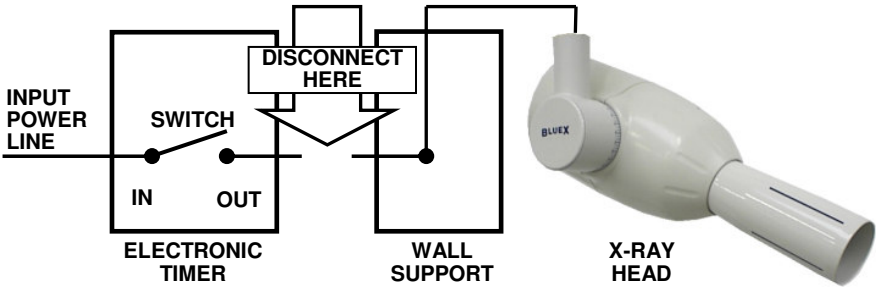
1.7 Demonstration

In order to use of the system for demonstration purposes radiation emission has to be inhibited by disconnecting the supply cables to the tube-head into the wall support or into the timer.

Cables to be disconnected are those leaving the connection block towards the tube-head and **not those coming in from the timer**.

Make sure that the disconnected cables are properly insulated to prevent undesired contacts with live points.

This task has to be done by trained personnel only to avoid the risk of electrical shock.



2. TECHNICAL DATA

2.1 System Supply

Line Voltage	115 V (from 99 V to 137 V in sub-ranges depending on tube housing assembly) 230 V (from 198 V to 275 V in sub-ranges depending on tube housing assembly)
Line Voltage Working Range	Limited to the working range of the THA: from108 V to 132 V for type 93 200 01300, from 207 V to 253 V for type 93 200 01700
Maximum Line Current	8 A at 115 V 5 A at 230 V
Fuse	8A slow blow at 115 V, 5 A slow blow at 230 V for two-phase supply or on mobile system, the second fuse to be activated by jumper cut
Line Frequency	50/60 Hz ± 2 Hz
Line resistance	≤ 0.4 Ohm at 115 V, ≤ 0.8 Ohm at 230 V

2.2 Tube Housing Assembly

Nominal Line Voltage	120 V for type 93 200 01300, 230 V for type 93 200 01700
Line Voltage Working Range	120 V ± 10% for type 93 200 01300, 230 V ± 10% for type 93 200 01700
Anode voltage	70 kVp ± 8% at nominal line voltage 66 kVp ± 8% at nominal line voltage – 10% 74 kVp ± 8% at nominal line voltage+ 10%
Anode current	7.0 mA ± 15% at at nominal line voltage 5.3 mA ± 15% at nominal line voltage – 10% 8.3 mA ± 15% at nominal line voltage + 10%
Maximum load	70 kVp, 7 mA, 3.2 s
X-ray insert	3 electrodes, grid control action models: OCX/70-G, RFG070
Focal Spot	0.8 (EN 60336:1995-04)
Inherent filtration	> 2.5 mm Al
Duty Cycle	1/30
Radiation Leakage	< 0.1 mGy/h a 1 m (< 11.5 mR/h a 1 m)

2.3 Beam Limiting Device

Round BLD	Metal cone with near-focus section
	Focus skin distance (FSD) 8.27”(21 cm)
	Circular radiation field size 2.35” diameter (6 cm)

Rectangular BLD	Metal body with near-focus section
	Focus skin distance (FSD) 8.27”(21 cm)
	Rectangular radiation field size 1.38”x1.81” (3.5x4.6 cm)

2.4 AutoSet Timer

Line Voltage Working Range	115 V ± 15% for type 93 300 60200 230 V ± 15% for type 93 300 60100
Exposure factor	Exposure time in s, 18 steps from 0.06 s to 3.2 s (R10 scale)
	0.06 0.06 0.06 0.08 0.08 0.08 0.10 0.10 0.10
	Time in seconds is converted to number of mains pulses with 1 pulse precision (20 ms at 50 Hz, 16.6 ms at 60 Hz.
Precision	± 0.02 s or 5% (whichever the greater)
Exposure factor setting	Automatic setting through tooth type selection and patient size, for use with traditional film or digital sensor, or manual setting moving up or down the scale with plus or minus keys.
Irradiation signal	Yellow light on hand-switch and on control panel plus acoustic buzzer
Preheating time	Set at installation (typical value 180 ms)
Hand-switch	Hand-switch with 3 m coiled cord, remote mounting possibility
Overall size	6” (15 cm) width, 9”½ (24 cm) height, 3”½ (9 cm) depth
Other features	Microprocessor controlled functionality Film speed setting 3 s minimum waiting time Energy management for cool down time Optional kit with 33 ft (10 m) cable for remote hand-switch mounting

2.5 Mechanical Suspension System

Wall Support	4.72” (12 cm) width, 9.45” (24cm) height, 3.54” (9 cm depth)
Extension arm, length	Short: 17”¾ (45 cm), medium:27”½ (70 cm), long 35”½ (90 cm), extra long 43”¼ (110 cm)
Folding arm; useful reach	55” (140 cm) with short extension arm 65” (165 cm) with medium extension arm 72”¾ (185 cm) with long extension arm 80” (205 cm) with extra long ext. arm
Mobile Stand	29” (74 cm) width, 42” (107 cm) height, 24”½ (62 cm) depth 65” (165 cm) total heath with folding arm

2.6 Weights

Timer	3.7 lb (1.7 kg)
Tube-head:	14.1 lb (6.4 kg)
Round BLD	0.22 lb (0.1 kg)
Rectangular BLD	0.44 lb (0.2 kg)
Folding Arm:	15.4 lb (7 kg)
Short Ext. Arm	7.7 lb (3.5 kg)
Medium Ext. Arm	9.3 lb (4.2 kg)
Long Ext. Arm	11 lb (5 kg)
Extra long Ext. Arm	12.7 lb (5.8 kg)
Wall Support:	2.9 lb (1.3 kg)
Mobile Stand	55.1 lb (25 kg)

3. ASSEMBLY AND INSTALLATION

3.1 Wall Mounted Systems

3.1.1 Unpacking

Unpack the components of the system and check the following:

A Each item is in good conditions and was not damaged during transportation.

B All the items for the desired system configuration are available.

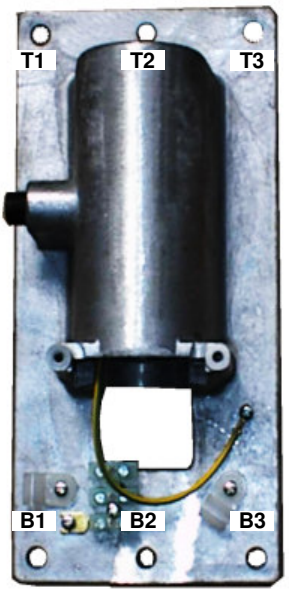
C The line voltage on the labels of timer and tube-head are corresponding to the existing local line voltage.

3.1.2 Structural Requirements

The wall support has to be mounted in a convenient position on left or right side of the chair or on back wall (head of the patient).

The maximum useful reach is of 80” (205 cm) from the wall when combining a 43”¼ (110 cm) extension arm with a folding arm.

The wall support can be mounted with 2, 4, or 6 bolts, depending on wall quality.



A Two bolts only (top and bottom central holes – T2, B2) are used when there is a solid slim column (e.g. iron mounting) with weak sides (e.g. wooden wall). Considering the requested safety factor, each one of the two bolts has to withstand a load of 5470 N, comprehensive of a safety factor, i.e. about 1240 lbs or 560 kg. 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 Four bolts, two on top sides (T1, T3) and two on bottom sides (B1, B3) is the regular mounting for solid (concrete) wall, but also on large metal plate. Considering the requested safety factor, each bolt has to withstand a load of 2735 N, comprehensive of a safety factor, i.e. about 620 lbs or 280

kg. Proper expansion screw to be selected for a solid connection to the concrete wall; the permissible load of each screw has to be greater than 308 lbs (about 140 kg).

- On solid concrete use heavy duty metal anchors.
- On hollow bricks use injection chemical fixing.

C Six bolts, three on top (T1, T2, T3) and three at bottom (B1, B2, B3) are required when the wall is not solid enough and the load has to be distributed on more points. Considering the requested safety factor, each bolt has to withstand a load of 911 N, comprehensive of a safety factor, i.e. about 210 lbs or 95 kg.

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 plate (counter plate) made of iron (2 mm thick) can be the solution. Make sure that the wall is solid enough to carry the load.

F The use of two reinforcing iron plates of about 4 times the surface of the wall support, one by each side of the wall, can help where one single plate looks not adequate; additional bolts have to be used to keep together the two plates.
Make sure that the wall is solid enough to carry the load.

Recommended bolts are listed below

Recommended Bolts		
Diameter	**Class**	**Core Section mm²**
M 8X1.25	**ISO 8.8**	**36.6**
M 8X1	**ISO 8.8**	**39.2**
5/16" – 18 UNC	**SAE- Grade 5**	**33.8**
5/16 –24 UNF	**SAE- Grade 5**	**37.41**

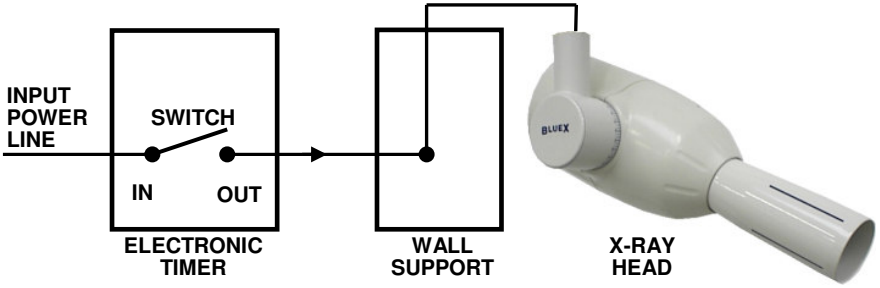
INSUFFICIENT WALL OR HARDWARE STRENGHT MAY CAUSE THE WALL MOUNT TO PULL OUT FROM THE WALL AND THE FULL SYSTEM TO FALL ON TO THE PATIENT OR THE OPERATOR CAUSING INJURIES.

3.1.3 Electrical Requirements

The power line cable must be connected to the input terminals (IN) of the timer to supply the timer itself and to make available power for the X-ray head at the output terminals (OUT), upon request by the operator (via the hand switch).

Power to the X-ray head is thus controlled by the timer (SWITCH).

The X-ray head is connected to the output terminals of the timer (OUT) through the connecting block in the wall support.



Cabling (2 poles plus ground) to connect the power line to the timer and the timer to the wall support is not provided and has to be procured. Cable with large section conductors keeps to minimum the wire resistance and the relevant voltage drop.

Wire Type	Square Section mm^2	Resistance Ohm/m
AWG 16	1.35	2x0.015
AWG 14	2.11	2x0.0094

The hand-switch too can be mounted far from the timer, provided the patient is in view and the sound of the buzzer can be heard.

3.1.4 Mounting and Connecting Sequence

A Mount the Wall Support
B Mount the Timer
C Mount the Extension Arm
D Mount the Folding/Simple Arm
E Connect the Wall Support
F Connect the Timer
G Connect the hand-Switch
H Optional Remote hand-Switch
I Mount and connect the Tube-head
J Mount the Beam Limiting Device
K Final Tuning and Set-Up

3.1.5 Mounting the Wall Support

A Remove the plastic cover unscrewing the screws under the logo label.

B Use the Wall Support plate or a template to mark the holes on the wall. Please note that the timer can be mounted close to the Wall Support on the right side or in a remote position. Cabling should have been laid out accordingly.

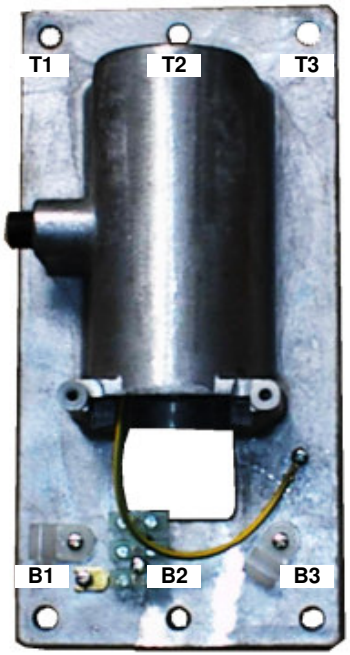
C Make the holes in the wall according to the applicable type of mounting:
- **a** Two bolts,
- **b** Four bolts,
- **c** Six bolts,
- **d** With or without reinforcing plate.

D Slide the logo-strip out from the plastic cover to access the screws and remove it from the metal frame.

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

F Secure it to the wall ensuring it is level. Improper levelling might cause the arm to move and swing out of position.

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



3.1.6 Mounting the Timer

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

B Slide the logo-strip out from the plastic cover to access the screws and remove the plastic cover from the plastic frame.

C Drill the four holes in the wall and secure the timer making sure it is level. Cabling should have been laid out in accordance to mounting requirements.

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

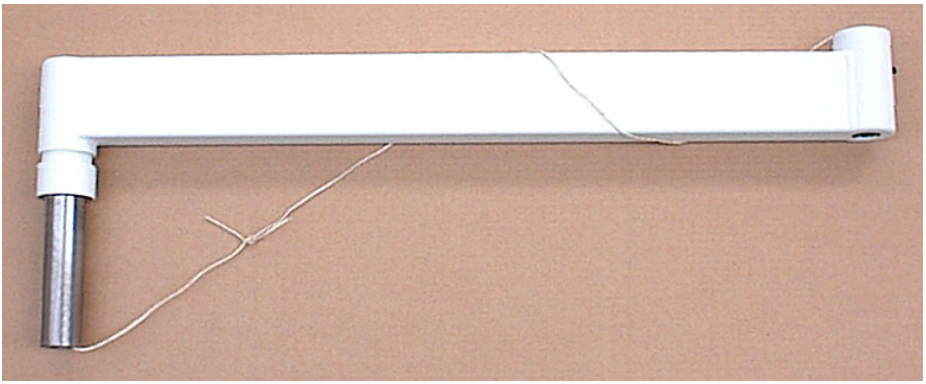
3.1.7 Mounting the Extension Arm

A Unpack the extension arm and check for completeness of parts.

B Cut, but do not remove, the string to be used later on to pull the cable from the Folding/Simple Arm through the Extension Arm to the Wall Support.

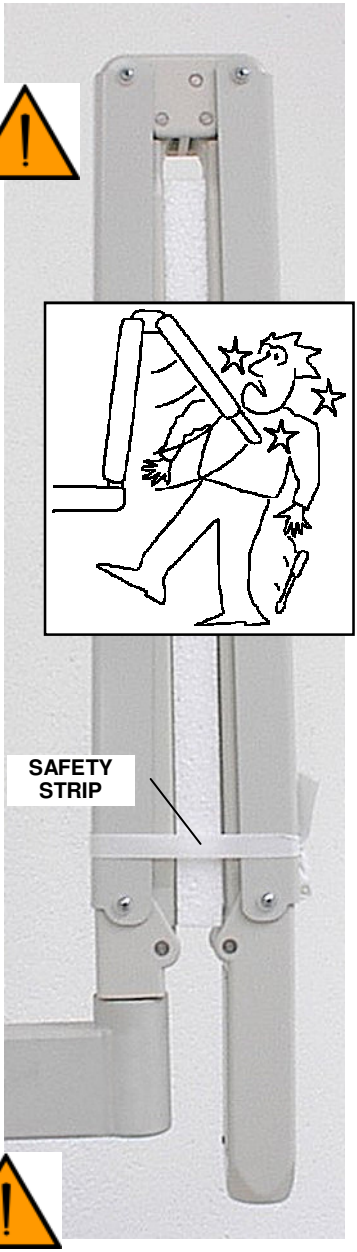
C Lightly grease the support tube at base of the extension arm and insert at top of wall mount.

D Insert, but without tightening, the locking and the friction screws.



3.1.8 Mounting the Folding Arm

WARNING.
THE SPRINGS IN THE FOLDING ARM MAY CAUSE INJURY TO THE INSTALLER AS WELL AS DAMAGE TO THE ARM ITSELF IF NOT HANDLED PROPERLY.
DO NOT REMOVE BINDING UNTIL WHEN NECESSARY AS INDICATED IN THE INSTRUCTIONS BELOW.



A Slide the blocking ring onto the support tube at base of the arm.

B Light grease the mounting pin at base of Folding Arm.

C Secure the driving string to the end of the electrical cable of the Folding Arm.

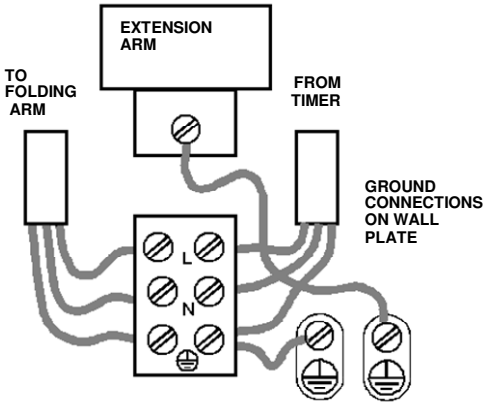
D Pull the other end of the string to drive the electrical cable of the Folding Arm through Extension Arm out into Wall Mount.

E Hold Folding Arm sections together and carefully remove binding allowing the arm sections to open slowly, away from people.

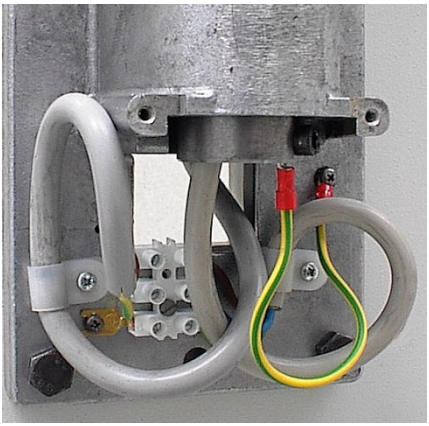
F Perform wire connection (into the wall Support) and final set-up complying with recommended sequence of actions reported in the following.

WARNING.
NEVER CONNECT THE CABLE OF THE FOLDING ARM DIRECTLY TO MAINS LINE.

3.1.9 Connecting the Wall Support



WALL SUPPORT CONNECTIONS

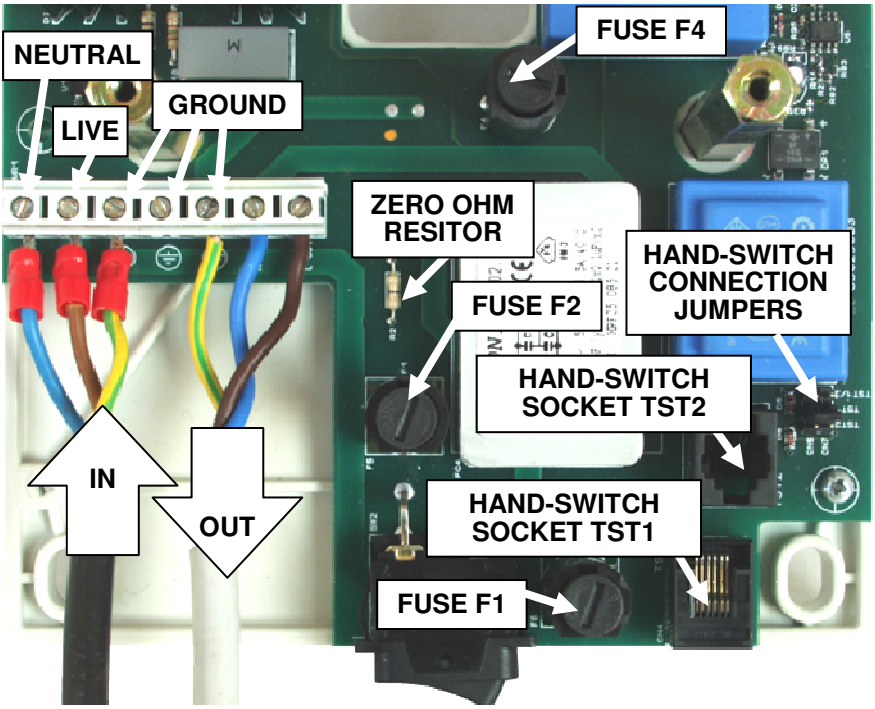


A Connect the three wires from the Timer (additional cable) to the terminal block and to the Folding/Simple Arm (Tube-head) as reported in the next figure.

B Connect the ground cable on the Wall Support to the blocking bolt on the extension arm

3.1.10 Connecting the Timer

A Turn-off the line voltage supply line.



B Connect the three wires from the line voltage supply to the terminal block (IN on the left) but do not connect any outgoing wire (OUT on the right) to Wall Support.

C Make sure that the “live” connector is the “hot” one:

- **a** Connect an AC voltmeter or a test light between the block terminal “live in” and “ground”.
- **b** Turn line voltage supply “ON”. If full line voltage is measured (test lamp lights) the wiring is correct. If not turn line voltage supply “OFF”, reverse “live in” and “neutral in” wires and repeat the measurement; eventually the full line voltage should be read between “line” and “ground” (test lamp lights).
- **c** Make sure no voltage is read between “neutral in” and “ground”; if not check line voltage distribution.

D Test the timer for full functionality keeping the output cables disconnected so that power is not provided to the load.

E Connect the load.

- Turn OFF the line voltage supply line,
- Connect the three wires of additional cable outgoing to the Folding Arm (Wall Support).
  Live and neutral wires to the folding arm (tube-head) can be interchanged.

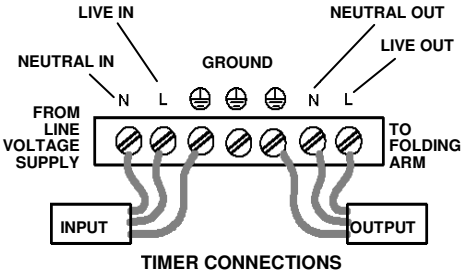


Table of Fuses for Timer AutoSet		
Fuse	**115 V**	**230 V**
F1	T8 A 6.3x32	T5 A 5x20
F2	T8 A 6.3x32	T5 A 5x20
F3, F4	T200 mA 5x20	T200 mA 5x20

3.1.11 Connect the Hand-Switch

The hand-switch is provided with a 3 m coiled cord the terminations can be plugged in the lower left corner of the board, either externally (connector TST1) or internally to the timer (connector TST2).
Jumpers are available to activate properly the hand-switch connection: Position TST1 for TST1, TST2 for TST2, TST1/2 for both.

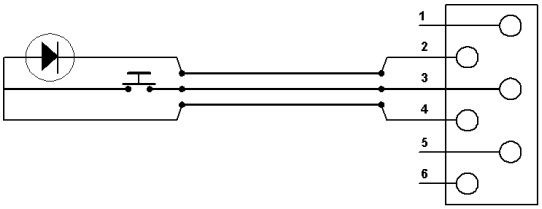
3.1.12 Optional Remote Hand-Switch

The hand-switch can be remotely mounted using the optional kit made of a remote box (wall holder) and connection cable.

- The wall holder (remote box) has a hook to hold the hand-switch and a plug below where to connect the coiled cable.
- A cable 10 m long is provided with a plug on one side, to connect to the socket on the timer, and free wires on the other side, to be able to place it conveniently around the room, and eventually to connect it to the block into the wall holder (remote box).

The connection of the wires is here indicated.

The wires of the switch are number 3 and 4 (those in the middle of the connector).



3.1.13 Mounting and Connecting the Tube-Head

A Remove retaining screws and cover plate on inner side of terminal pole (handgrip) of Folding/Simple Arm at tube-head side.
B Unscrew and slide out the U shaped retaining clip .
C Slightly lubricate the outer pin of the connecting socket of the tube-head.
D Slide the connecting socket into the terminal pole of the Folding/Simple Arm.
E Put back the U shaped retaining clip making sure it has entered the specific slot on the outer pin of the connecting socket and tighten the locking screw.
F Put back the cover plate and block it with the four retaining screws.

3.1.14 Mounting the Beam Limiting Device

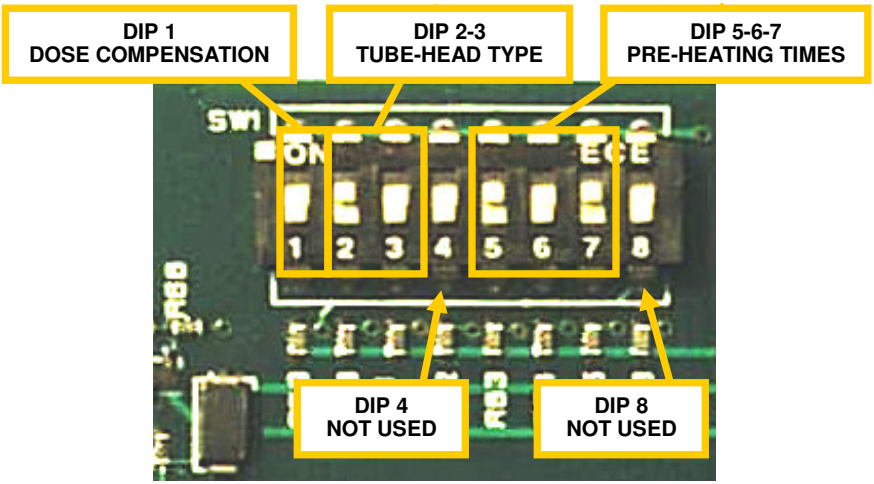
A Mount the beam limiting device on the tube-head and lock it close with a clock-wise rotation.

3.1.15 Final Tuning and Set-Up

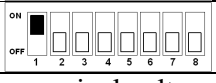
A Remove the line voltage fuse(s) from the timer
B Put back the cover plate on the folding/simple arm (tube-head side)
C Tighten locking screw and tune friction screw in Extension Arm.
D Tune friction screw on the folding arm for rotation around the vertical axis.
E Make sure the Timer switch is in the "off" position.
F Set the dip switches SW2 as indicated in the following to define:
- **a** Enable/disable correction of exposure time to compensate fluctuations of line voltage.
- **b** Indicate the nominal line voltage of the tube-head (see label).
- **c** Set the pre-heating time according to type of X-ray insert used in the tube-head assembly; the measured value is marked in front of the tube-head;

G Put back the line voltage fuse(s).
H Put back all plastic covers and logo strips.
I Connect the system to the line voltage by switching the general line voltage switch on and/or plug the power cord into the wall socket.
J Switch the timer "on".
K The system is now ready for Functional Check as described in the Operator's Manual.

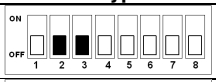
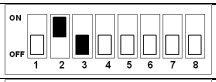
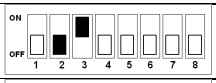
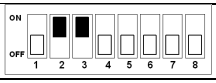
PRE-HEATING TIME SETTING - TYPICAL VALUES		
Type of insert	OCX/70-G	RF8G070
Pre-Heating Time	180 ms	160 ms



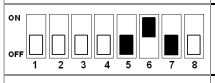
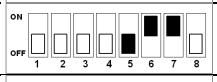
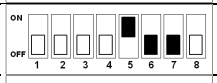
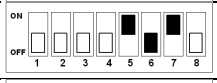
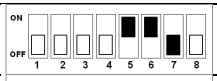
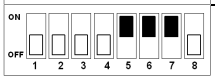
- Enable/disable exposure time correction to compensate fluctuations of mains voltage.

dip 1 Setting Dose Compensation	
Disabled	
Enabled	

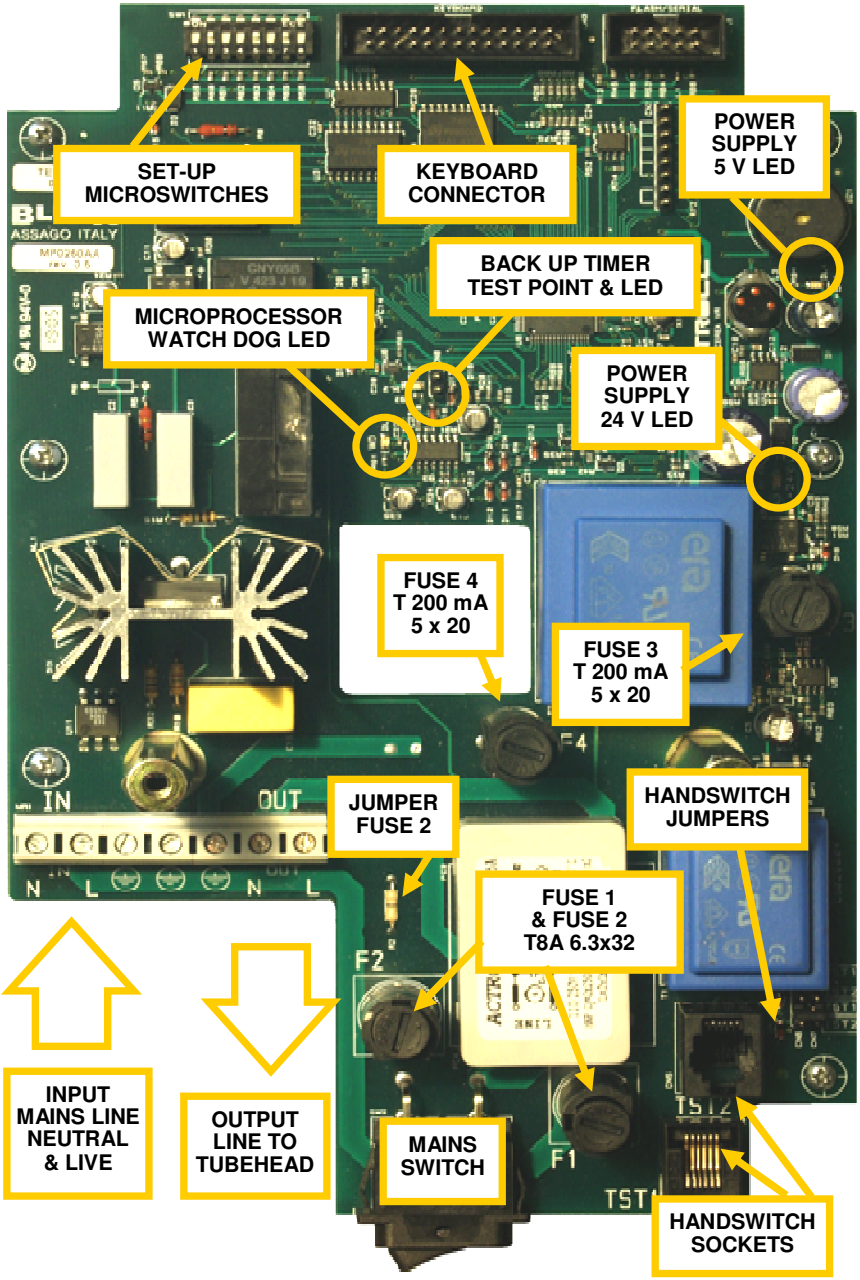
- Indicate the nominal voltage of the tube-head (see label).

dip 2 – dip 3 Setting Tube-Head Type	
110 or 220 VAC	
115 or 230 VAC	
120 or 240 VAC	
125 or 250 VAC	

- Set pre-heating time as indicated on label in front of the tube-head

dip 5 – dip 6 – dip 7 Setting Filament Pre-Heating Time	
100 ms	
120 ms	
140 ms	
160 ms	
180 ms	
200 ms	
220 ms	
240 ms	

3.1.16 Layout Power Board Timer AutoSet



3.2 Mobile Systems

3.2.1 Unpacking

Unpack the components of the system and check the following:

A Each item is in good conditions and was not damaged during transportation.

B All the items for the desired system configuration are available.

C The line voltage on the labels of timer and tube-head are corresponding to the existing local line voltage.

3.2.2 Room Preparation

Make sure that a wall socket is available close to the dental chair in reach of the mobile X-ray equipment to be connected.

Such a socket has to be provided with a ground connector to the protective earth point of the room. For the line voltage supply to the wall socket it is recommended the use of a cable with large section conductors to keep to minimum the cable resistance and the relevant voltage drop.

Wire Type	Square Section mm^2	Resistance Ohm/m
AWG 16	1.35	2x0.015
AWG 14	2.11	2x0.0094

3.2.3 Mounting and Connecting Sequence

The recommended sequence to mount and connect system modules is listed here below.

A Assembly the Mobile Stand.
B Mount the Timer.
C Mount the Suspension Arm.
D Connect the Line voltage Cable.
E Connect the Timer.
F Mount and connect the Tube-head.
G Mount the Beam Limiting Device.
H Final Tuning and Set-Up.

3.2.4 Assembling the Mobile Stand

The following sequence to be followed.

A Put together the base elements and tighten screw and washer.
B Mount the column (timer plate externally to the long legs – see picture) and tighten it with the screw and washer from below.
C Mount the front wheels and rear wheels with brake.
D Mount the manoeuvring handles.
E Connect the plug on the line voltage cable.

3.2.5 Mounting the Timer

A Refer to section 0 at page 18.

B The zero Ohm resistor R51 close to fuse F2 has to be cut for systems cord connected to the mains.

3.2.6 Mounting the Suspension Arm

Refer to section 3.1.8 at page 17.

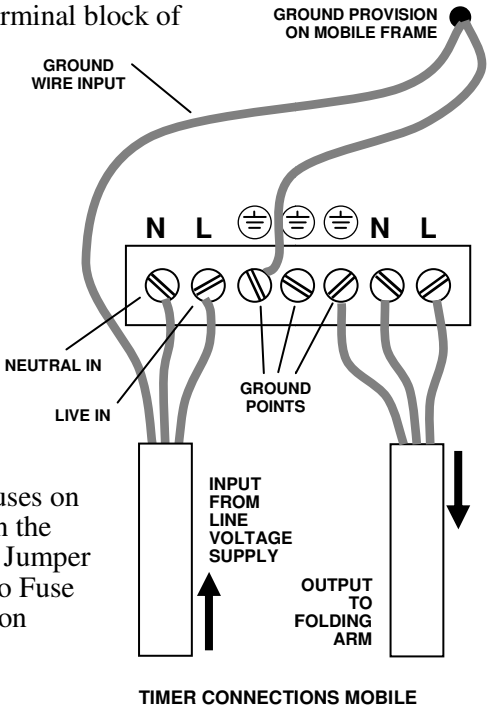
3.2.7 Connecting the Line voltage Cable

A The line voltage cable for the mobile unit is provided with plug.

B The grounding wire of the main cable has to be blocked (first) to the grounding provision (common bolt for bonding and grounding) using nut and lock-washer.

C The grounding wire for the timer is the placed on the common bolt for bonding and grounding and blocked (second) with nut and lock-washer.

D Connect the grounding cable for the timer to the ground provision on the terminal block of the timer and the two line wires from the mains cable to the input point for live and neutral connections.



TIMER CONNECTIONS MOBILE

3.2.8 Connecting the Timer

For the connection of the output cable to the timer please refer to section 0 at page 18.

3.2.9 Activation of Fuse 2

Units provided with supply cord and plug must be equipped with fuses on both line phases. The activation on the second fuse is done by cutting the Jumper Fuse 2 (zero Ohm resistor) close to Fuse F2. See position on layout in section 3.1.16 at page 24.

3.2.10 Connecting the Tube-Head

Refer to section 3.1.11 at page 20.

3.2.11 Mounting the Beam Limiting Device

Refer to section 3.1.14 at page 21.

3.2.12 Final Tuning and Set-Up

Refer to section 3.1.15 at page 22.

4. MAINTENANCE

It is the responsibility of the User to maintain the IntraOs 70 equipment in compliance with the performance standard.

Failure of the User to properly maintain the equipment may relieve the Manufacturer, or its Agent, from responsibility for any injury, damage or non compliance which may result.

The suggested frequency for checks of the IntraOs 70 system if of at least once every 12 months, with a specific maintenance of the folding arm every 24 months, performed by qualified personnel.
Any defect or malfunction should be corrected immediately by qualified personnel with adequate training.

WARNING. ANY DEFECTIVE ITEM AFFECTING A SAFE USE MUST BE REPAIRED OR REPLACED

Only original certified components and spare parts must be used for repairs or replacements.

Correction of damages to the identification labels to be handled with the Manufacturer.

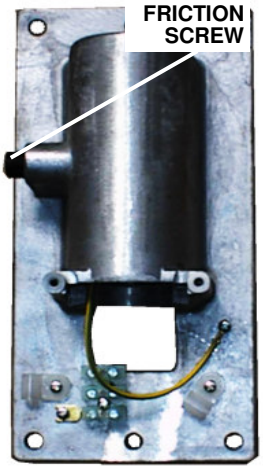
Any defect or non-compliance must be reported promptly to the Manufacturer or to its Local Agent.

ALWAYS DISCONNECT THE SYSTEM FROM THE LINE VOLTAGE SUPPLY USING THE GENERAL LINE VOLTAGE SWITCH FOR THE ROOM WHERE THE EQUIPMENT IS LOCATED BEFORE PERFORMING ANY MAINTENANCE ACTIVITY.

AVOID USING LIQUID OR SPRAY DETERGENTS WHICH MAY ENTER INTO THE EQUIPMENT AND CAUSE CORROSION.

AVOID THE USE OF SOLVENTS OR CORROSIVE DETERGENTS WHICH CAN DAMAGE PAINTED SURFACES AND PLASTIC COVERS.

4.1 Maintenance of the Wall Support



A Remove the cover and verify that the mounting is closely connected to the wall and stays firm and steady during various movements of the system.

B Verify that the ground cable of the wall support is properly connected to the wall plate and to the blocking bolt on the extension arm.

C Check friction during rotation of Extension Arm and adjust relevant screw if needed.

D Verify that the technical label with identification data outside the plastic cover at bottom is in place and is readable.

4.2 Maintenance of the Extension Arm

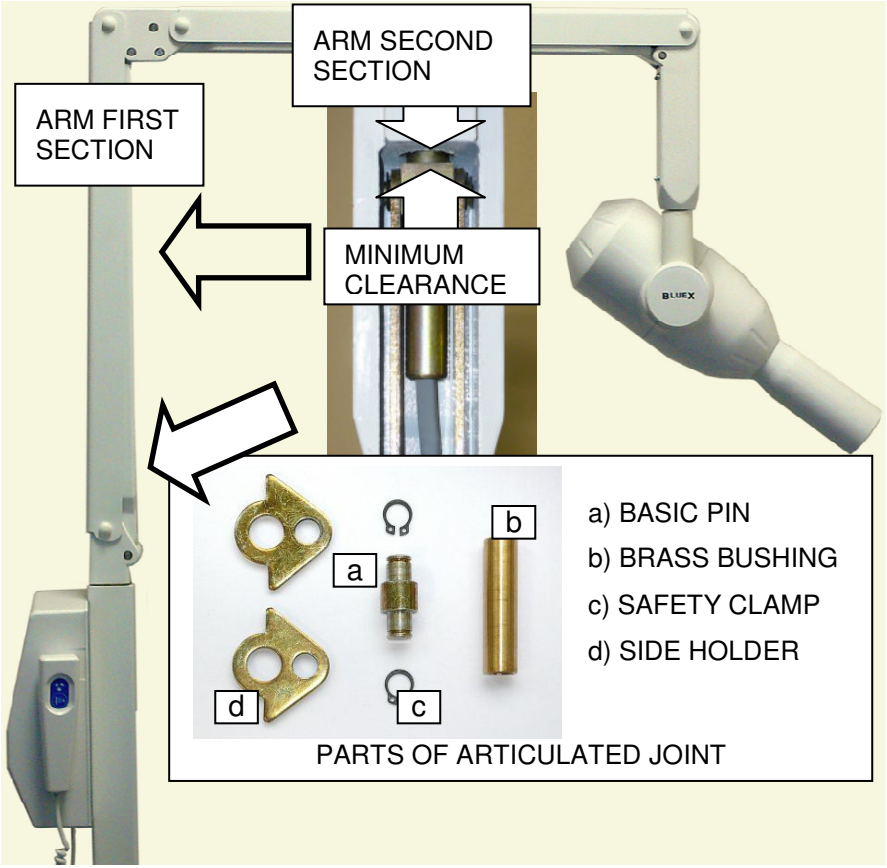
A Slide partially out the extension arm from wall mount, inspect for wear of the joint and lubricate for smooth rotation.

B Check friction during rotation of Folding Arm and adjust relevant screw if needed.

C Verify that the technical label with identification data is in place and is readable.

4.3 Maintenance of the Folding Arm

Specifically for the folding arm inspect for wear of pins and levers at least every 24 months, in case of normal use (about 6000 cycles). Replace the worn out parts or the arm itself if it appears damaged.



Maintenance can be performed with the arm mounted on the extension arm or on the mobile stand.

A Disconnect the tube housing assembly keeping the arm fully open to avoid the risk of injuries (fig.1) .

B Remove the snap-out caps of the first arm section, the blocking screws of the pins, then the metal cover by pushing the pins out paying attention to supporting the arm (fig. 2 and fig. 3).


Fig. 1

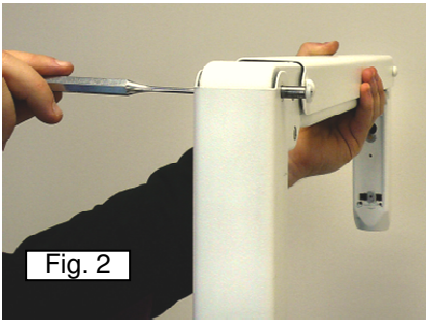


Fig. 2

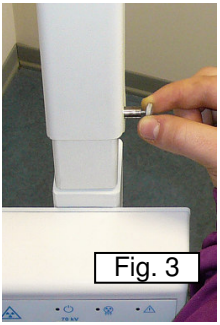


Fig. 3

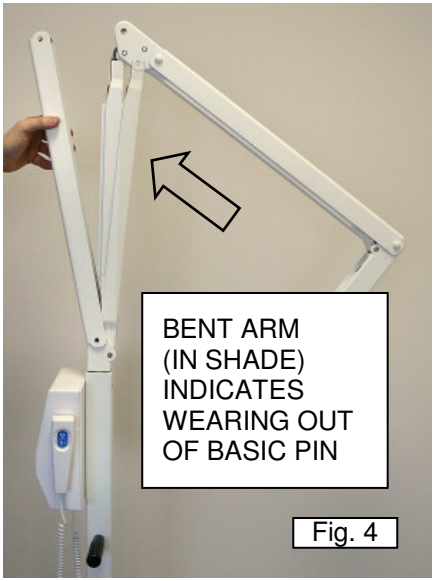


Fig. 4


Fig. 5


Fig. 6

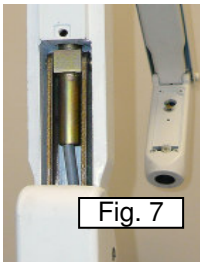


Fig. 7

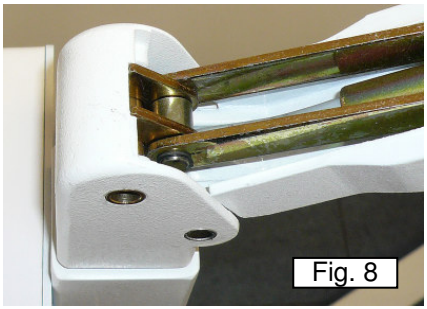


Fig. 8

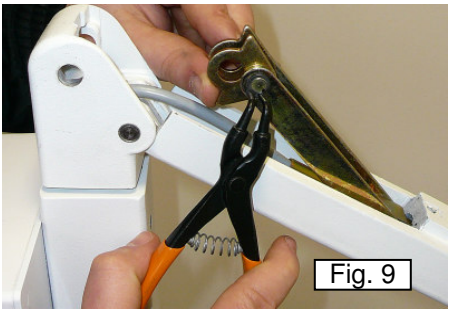


Fig. 9

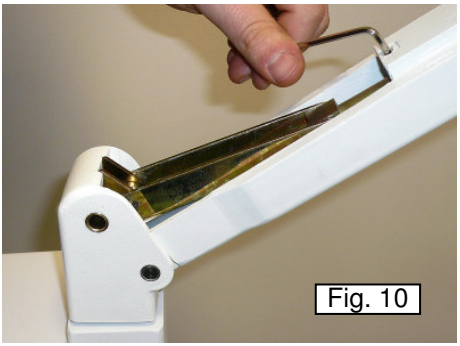


Fig. 10

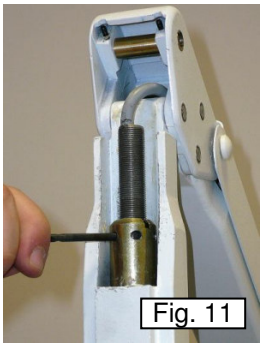


Fig. 11


Fig. 12

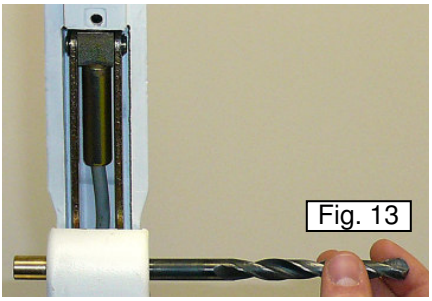


Fig. 13

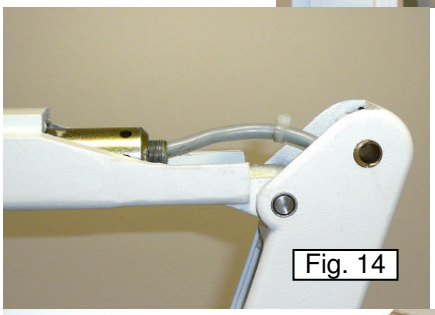


Fig. 14

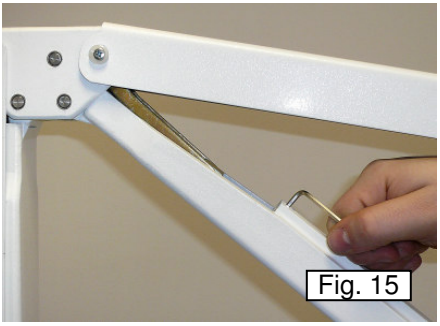


Fig. 15

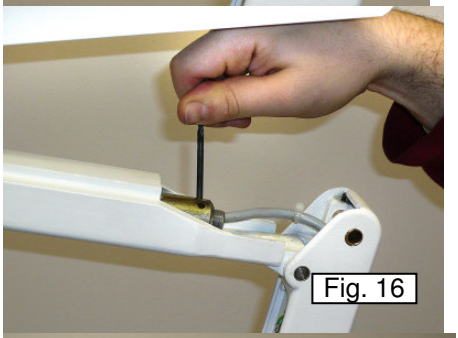


Fig. 16

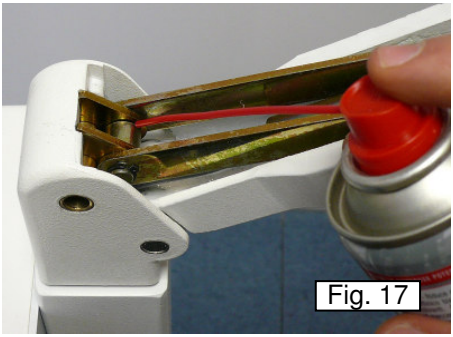


Fig. 17

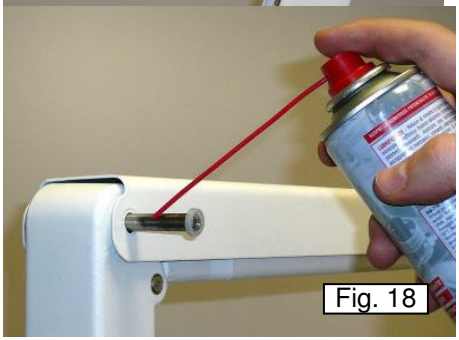
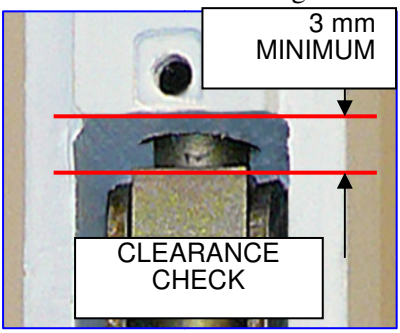


Fig. 18

C Be careful not to pinch fingers between the two sections of the arm while manoeuvring (fig. 4).

D In the second section of the arm remove the two snap-out caps on the tube-head side and the pin in order to raise the metal cover and tune friction (fig. 10) and spring (fig. 11). In case of removal, beware that the metal cover of the second section is different.

E Inspect the main joint at the base of the arm (fig. 8) for wearing out of pin and levers. A clearance lower than 3 mm of the block holding the two levers from the body of the first arm (fig. 7) indicates that the "basic pin" of the articulated joint is wearing out, and must be replaced. Also a parking position with the first section of the arm not standing vertical (fig. 4) but bent to some 5 degrees or more reveals that the basic pin is wearing out. To replace the pin of the articulated joint (fig. 8) proceed as follows:



- **a** Loosen the friction screw (fig. 10) and release the spring by rotating the spring cap (fig. 11) with a round tool of 4 mm diameter (the base of a drill is fine) until zero pressure on the basic pin (fig. 12, about 1 cm free thread left);
- **b** Keeping the first arm vertical, push the brass bushing out (fig. 13) and extract the supporting parts (round tool size 10 mm diameter);
- **c** Disassemble the parts of the joint and replace the basic pin;
- **d** Tension the spring as needed by screwing the spring cap to the desired distance (fig. 11, about 5 cm free thread left);

F Lubricate moving parts (fig. 17 and fig. 18) and the three pins to block the metal covers before their insertion.

G Mount the metal covers provisionally, with friction screws loosen

H Mount the tube-head and secure it with the holding fork (fig. 1)

I Verify proper balancing and in case tune tension of springs.

J Tune the friction screws of the two arms.

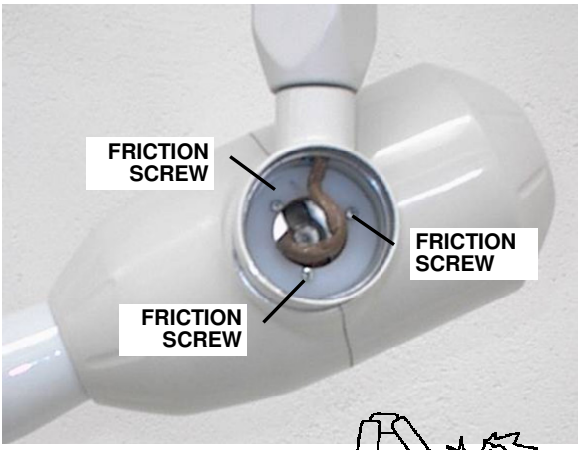
K Block tight the screws of metal covers and place the snap-out caps.

L Slide partially out the Arm from the Extension Arm, inspect for wear of the vertical joint and lubricate for smooth rotation.

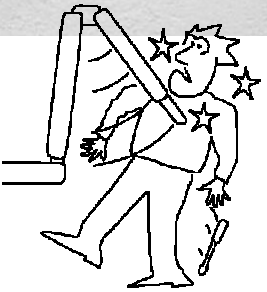
M Verify that the label with identification data is in place and is readable.

4.4 Maintenance of the Tube-Head

A Inspect for damage/wear to the X-ray tube-head and support system.
B Inspect for oil leakage. Replace tube-head if necessary.
C Check for position stability. Adjust friction for rotation around the horizontal axis if necessary.
D Check that electrical cables are correctly twisted and not damaged or wear out.
E Verify that the technical label with identification data is in place and is readable.



F Dismount the tube-head from the arm and lubricate the pin for smooth rotation. Warning: remove the tube-head with the arm completely open to avoid the risk of injuries.
G Check the U shaped retaining clip and replace if wear. Do not mount the tube-head until all checks of the suspension system are completed.



4.5 Maintenance of the Beam Limiting Device

A Verify that the collimator is properly mounted and, in case, lock it firmly closed.
B Verify that the internal cone is not damaged. Replace the collimator if necessary.
C Verify that the technical label with identification data is in place and is readable.

4.6 Maintenance of the Timer

A Inspect the panel for damages on the surface.
B Inspect the cable of the exposure switch for wear.
C Check that all lights (except the yellow one) are working when the system is switched on.
D Perform a Functional Check as described in the Operator's Manual. This check includes verification of: a) yellow light, b) buzzer, c) alarm

for “Exposure push button pressed at power on”, d) alarm for “Exposure stopped by the operator”.

E Verify that the fuses mounted comply with what specified in the table below.

F Verify that the technical label with identification data is in place and is readable.

Table of Fuses for Timer AutoSet		
Fuse	**115 V**	**230 V**
F1	T8 A 6.3x32	T5 A 5x20
F2	T8 A 6.3x32	T5 A 5x20
F3, F4	T200 mA 5x20	T200 mA 5x20

4.7 Checking Filament Pre-Heating Time

During the life of the system the wearing out of the filament may result in a different pre-heating time (PHT). The value set at installation needs therefore to be verified and in case corrected.

A At a fixed distance measure the X-ray dose for exposure of 2.0 s (nominal irradiation of 100 pulses at 50 Hz, 120 at 60 Hz).

B At same distance measure the dose for exposure of 0.2 s (nominal irradiation of 10 pulses at 50 Hz, 12 at 60 Hz).

C If dose at 0.2 s is 1/10 of dose at 2 s, the value set for PHT is fine.

D If dose at 0.2 s is lower than 1/10 of the dose at 2 s, PHT has to be increased. Proceed at steps of 20 ms until fine.

E If dose at 0.2 s is higher than 1/10 of the dose at 2 s, PHT has to be reduced. Proceed at steps of 20 ms until fine.

4.8 Special Service Functions

A Digital Volt Meter. This function allows the user to display the line voltage level (for example 224 V in the side picture).

a Enter this function by switching the system “on” while pressing at the same time the ⊕, the ⊖, and the ⊟ keys.

b Exit by switching the system off.

B Test of Control Panel. This function is intended to test lights, buttons, and segments of numerical display on the control panel.

- **a** Enter this function by switching the system "ON" while pressing at the same time the ⊕, the ⊖, and the adult keys.
- **b** By pressing the ⊕ or ⊖ keys all segments of the numerical display are scanned.
- **c** By pressing the X-ray pushbutton the "rAY" message is displayed.
- **d** By pressing each button on the panel, the corresponding lamp is turned "ON"; a second pressure would turn it "OFF".
- **e** At the last button pressed the system automatically exit this function.
  WARNING: Do not press the X-ray pushbutton as last button twice; the second time the timer becomes active and radiation is emitted.

5. MEASUREMENTS

All measurements to be done with the equipment supplied at nominal line voltage with specified line resistance (see section 2.2 at page 9). The tolerances on the measured values have to take into account the precision of the each measurement instrument. Measurements have to be done by trained personnel only to avoid the risk of electrical shock.

5.1 Line Voltage

The Line voltage can be measured using a Volt Meter for Alternate Current within the proper range. A service function can be activated on the AutoSet timer to display the current line voltage (see section 4.8 of this Manual).

5.2 Anode Voltage – KVp

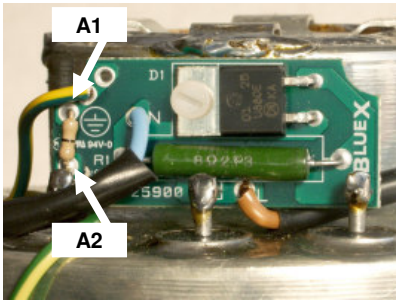
The kVp level is the actual peak value of the Anode voltage which stabilizes once the preheating time of the filament has elapsed (in about 0.2 s) and the high voltage transformer is actually loaded. The kVp level can be measured with a non-invasive kVp meter placed in front of the BLD following the instructions in the user manual of the instrument. A correct measure can be done with an exposure time of 500 ms or more having introduced a delay of the reading instrument of about 300 ms to allow the voltage level to stabilize after the pre-heating time has elapsed.

5.3 Anode Current – mA

WARNING. To prevent high voltage shock make sure the system is disconnected from the power supply when connections to the measurement points are performed. Electric discharge might

occur in case of improper operation

The Anode current in mA is the actual average value of the tube current which raises when the filament has warmed-up, after the preheating time has elapsed.



Remove the back cover of the tube-head, disconnect the jumper A1-A2 and replace it with a precision resistor of 1000 Ohm.

The anode current can be read with a DC voltmeter connected to points A1 and A2, with the 1 V corresponding to 1 mA.

After the measurement disconnect the 1000 Ohm resistor and put back the jumper.

5.4 Exposure Time

The actual exposure (loading) time is “determined as the time interval between the instant when the tube current first rises above the 25% of its maximum value and the instant when it finally falls below the same value”.

In order to assure the requested exposure time (irradiation), the pre-heating time of the used insert, set-up at installation, is automatically taken into consideration by the microprocessor.

The actual switch-on time (SOT) of the tube-head assembly is therefore the sum of the filament pre-heating time (PHT) and of the requested exposure time (RET).

$$SOT = PHT + RET$$

During filament pre-heating radiation is not emitted.

The measure of the exposure time can be correctly measured with kVp & Time meters with the ability to trigger when the kV level reaches 75% of its maximum.

Exposure time can also be measured after having connected a precision resistor of 1000 Ohm between points A1 and A2 on the small circuit board on the back of the tube-head, by monitoring the voltage across it (tube current) with an oscilloscope, and counting the number of pulses in the time interval, as per above definition.

When the compensation function to correct the effects of line fluctuations on the emitted X-ray dose is activated, the requested exposure time is corrected in order to assure dose consistency.

When the actual line voltage is lower than the nominal line voltage, the actual exposure time is increased.

When the actual line voltage is higher than the nominal line voltage, the actual exposure time is decreased.

Do disable the compensation function (dip switch number 1 of SW2 moved to OFF position) to verify exposure time accuracy.

This is not necessary in case a meter with the ability to trigger on 75% of the kVp level and the value read should be compared with the indication given by the timer for 3 seconds after the exposure (refer to the Operator's Manual to activate the function to display the actual exposure time after compensation).

5.5 Leakage Radiation

The value of leakage radiation of the X-ray tube assembly is measured at 1 m distance taking into account the energy provided in 1 hour. In case the measurement is performed at a distance different from 1 m, the value has to be properly corrected.

The applicable technique factors are of 70 kV and 7 mA. The point of maximum leakage has to be considered, excluding the direction of the primary beam. The duty cycle factor as reported in sections 2.2 has also to be taken into account for the computation of the actual dose rate.

In case for example a measure is done at 50 cm distance from the source with an exposure of 1 s, the following computations have to be performed:

- A duty cycle of 1/30 means maximum of 1 s exposure every 30 s, i.e. 120 s per hour.
- Dose at 100 cm is computed taking into account the inverse square law, i.e. at twice the distance the dose intensity is reduced to one quarter.
  D1h100cm = D1s50cm * 120 * (50/100)2 = D1s50cm * 30
  where: D1s50cm is the dose measured at 50 cm with 1 s exposure and D1h100cm is the dose computed at 1 m distance for the energy of 1 hour.

5.6 Earth Resistance

The measurement of the earth resistance to be done after having disconnected the system for the power supply line.

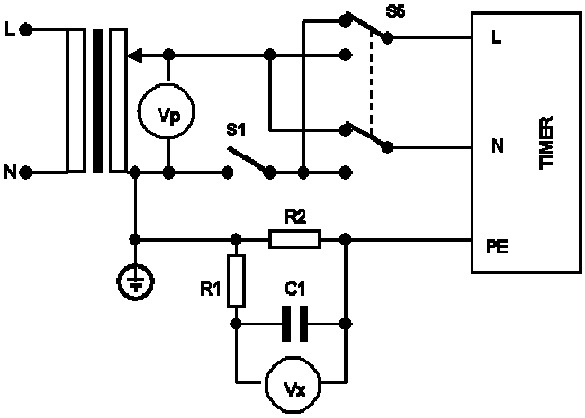
Using a voltage generator of not more than 6 V, 50/60 Hz, a current of 25 A is applied from 5 s to 10 s through the earth terminal to any metal part which can be in touch to the patient/operator.

The voltage drop is then measured and the earth resistance computed.

The system complies for values lower than 0,1 Ω (extended to 0,2 Ω in case the supply cable cannot be disconnected like in the cases of permanent installations).

5.7 Earth Leakage

Connect the Timer to the measuring circuit as shown in the figure (R1=10 kΩ ± 5%, R2=1 kΩ ± 1%, C1=0,015 µF ±5%)



A Set the input supply voltage (Vp) equal to 110% of the nominal supply voltage.

B Connect a voltmeter (Vx with 1 MOhm input impedance) to the indicated points

C Switch the Timer "ON"

D Make two measures in Normal Conditions (NC with S1 "ON")
- S5 "ON": live and neutral conductors in normal condition.
- S5 "OFF": swap of live and neutral conductors.

E Make two measures in Single Fault Condition (SFC with S1 "OFF").
- S5 "ON": live and neutral conductors in normal condition.
- S5 "OFF": swap of live and neutral conductors.

Please note that 1V equals to 1mA.

Make sure values of leakage currents fall within the limits shown in the table below.

LIMIT OF EARTH LEAKAGE CURRENT		
Type Of Device	**Normal Condition (S1 "ON")**	**Single Fault Condition (S1 "OFF").**
X-ray Equipment permanently connected to line voltage	5 mA	10 mA
Mobile X-ray Equipment	2,5 mA	5 mA

6. Spare Parts

6.1 Tube-Head

93 200 01700: G 230 V without BLD
93 200 01300: G 120 V without BLD

List of Spare Parts – Figure TH		
Item	**Description**	**Code**
A	Rear and Front Cover	**76 190 25110**
B	Round Beam Limiting Device, FFD 21 cm Output Field 6 cm diameter	**91 300 00020**
C	rectangular Beam Limiting Device, FFD 21 cm Output Field 3.5x4.6 cm	**91 300 00040**
D	Side cap tube-head holder	**76 190 25120**
E	Coupling with Concentric Pin	**76 190 25241**
	for SN lower than TK0501	**76 190 25240**
F	Friction Ring for tube-head with screws	**76 190 25450**
G	Wave Suppressor	**76 190 25600**

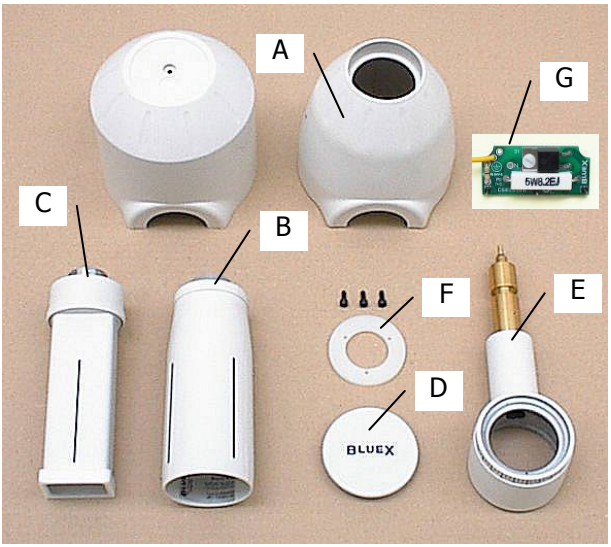


Figure TH

6.2 Folding Arm

93 100 12010: for Wall Mount

List of Spare Parts - Figure FA		
Item	**Description**	**Code**
A	Tube head support for folding arm	**76 190 25251**
	for SN lower than FA0501	**76 190 25250**
B	Cover Plate Tube-Head Holder	**76 190 25130**
C	Arm Cover Extension Side	**76 190 25140**
D	Arm Cover Tube-Head Side	**76 190 25150**
E	Retaining Clip With Screw	**76 190 25270**
F	Cable 2.8 m With Concentric Connector	**76 190 25431**
	for SN lower than FA0501	**76 190 25430**
G	Ring Spacer D 25 With Hole	**76 190 25460**
H	Snap Out Cap (set of 8)	**76 190 25160**
I	Friction Screw M6x10 For Arm (set of 2)	**76 190 25340**
L	Basic pin and seeger rings	**76 500 30010**

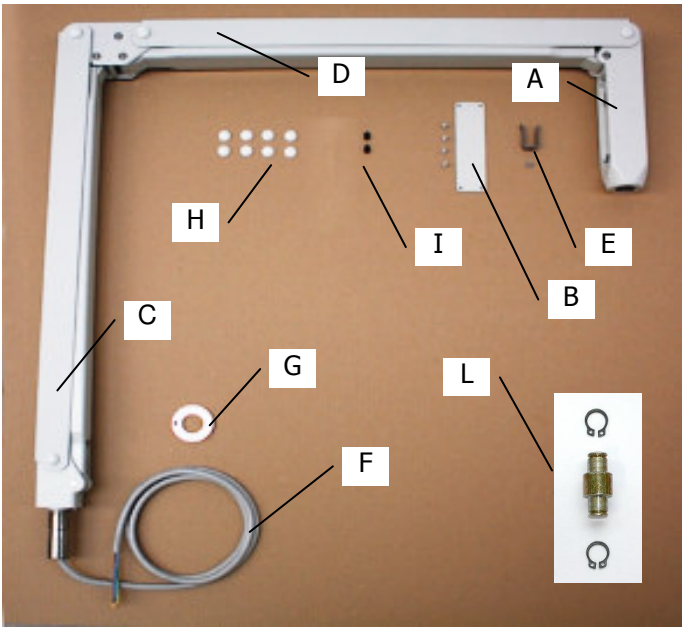


Figure FA

6.3 Extension Arm

93 100 17100 – 45 cm
93 100 17200 – 70 cm
93 100 17300 – 90 cm
93 100 17400 – 110 cm

List of Spare Parts – Figure EA		
Item	**Description**	**Code**
A	Large Ring Spacer D35	**76 190 25470**
B	Snap out Cap D25 (set of 8)	**76 190 25180**
C	Friction Screw Brass Cap M6x10 (set of 3)	**76 190 25331**
	Friction Screw Brass Cap M8x10 (set of 3)	**76 190 25332**

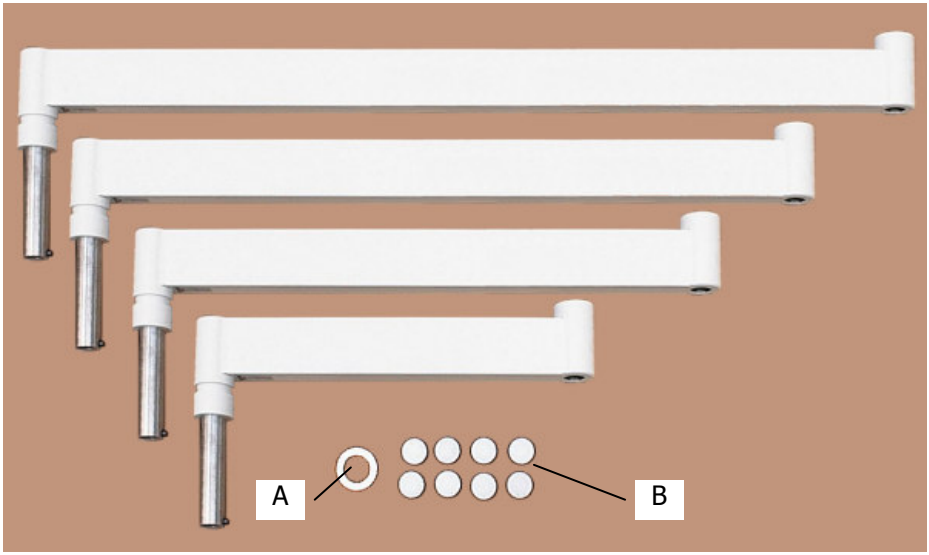


Figure EA

6.4 Wall Support

93 100 11000

List of Spare Parts - Figure WS		
Item	**Description**	**Code**
A	Plastic Cover Wall Mount	**76 190 25190**
B	Logo Strip Blue X	**76 190 25200**

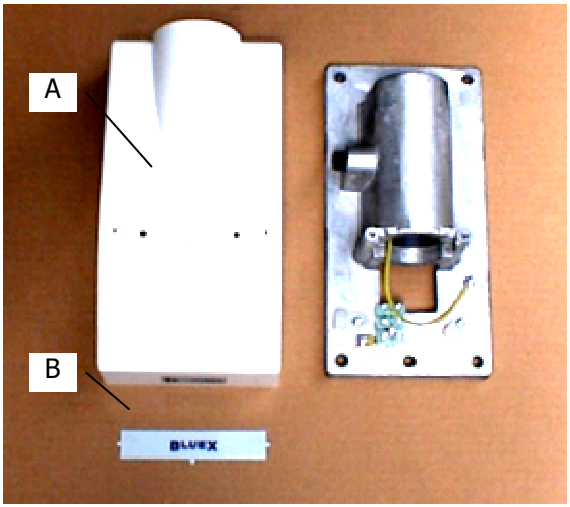


Figure WS

6.5 Mobile Base

93 100 20080
93 100 20090

List of Spare Parts – Figure MB		
Item	**Description**	**Code**
A	Transport Handle (set of 2)	**76 190 25280**
B	Cable Holder With Strain Relief	**76 190 25300**
C	Hook For Cable	**76 190 25290**
D	Wheel (set of 2)	**76 190 25410**
E	Wheel With Brake (set of 2)	**76 190 25420**

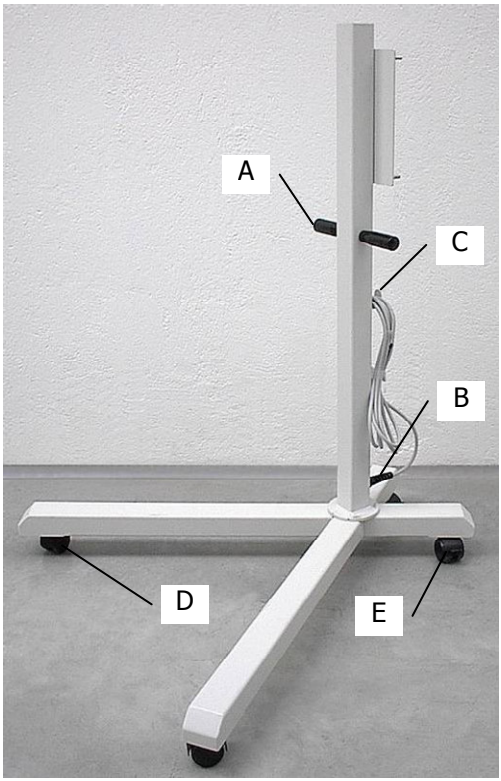


Figure MB

6.6 AutoSet Timer

93 300 60100: 230 V
93 300 60200: 115 V

List of Spare Parts – Figure AU			
Item	**Description**		**Code**
A	Front Cover		**76 190 25220**
B	Mounting Plate		**76 190 25230**
C	Mounting Columns		**76 190 25310**
D	230V	Power Control Board With Triac	**76 190 25510**
	115V	Power Control Board With Triac	**76 190 25511**
E	Keyboard Control Panel		**76 190 25530**
F	AutoSet Membrane		**76 190 25550**
G	Hand Switch Without Cable		**76 190 25590**
H	Coiled Cable		**76 190 25580**
I	Logo Strip IntraOs 70		**76 190 25210**
J1	230V	Fuse F1/F2 T5A 250V 5x20 (set of 10)	**76 190 25640**
	115V	Fuse F1/F2 T8A 250V 6.3x32 (set of 10)	**76 190 25641**
J2	Fuse F3/F4 T200mA 250 V 5x20 (set of 10)		**76 190 25630**

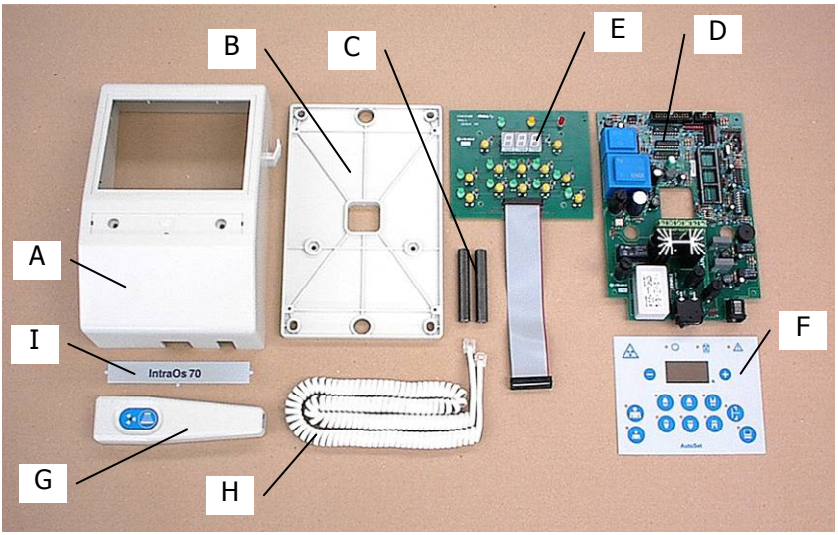


Figure AU

Appendix A
System Components

Article System Component	Type Code Catalogue Number
Wall Support	93 100 11000
Extension Arm 45 cm	93 100 17100
Extension Arm 70 cm	93 100 17200
Extension Arm 90 cm	93 100 17300
Extension Arm 110 cm	93 100 17400
Folding Arm	93 100 12010
Tube Head G 120 V	93 200 01300
Tube Head G 230 V	93 200 01700
20 cm Round BLD	91 300 00020
20 cm Rectangular BLD	91 300 00040
AutoSet Timer 115 VAC	93 300 60200
AutoSet Timer 230 VAC	93 300 60100
Mobile Base	93 100 20080
Mobile Base UL/CSA	93 100 20090
Wall Plate	86 100 11500

Appendix B
Icons

	IEC Type B Equipment		Compliance to European Community Requirements
	X-ray On		Compliance to Canadian and US Standards
	Examine Annexed Documentation		Line voltage supply On - System Ready
	Increase Exposure Time (one step)		Off (Disconnected from Line voltage Supply)
	Decrease Exposure Time (one step)		On (Connected to Line voltage Supply)
	Child – Small Patient	~	Alternate Current
	Adult – Large Patient		Fuse
	Upper Incisor		Protective Earth
	Upper Canine/Premolar	**N**	Neutral Point (for equipment permanent connected to line)
	Upper Molar	**L**	Live Point (for equipment permanent connected to line)
	Lower Incisor		Inherent Filtration
	Lower Canine/Premolar	■	Focal Spot
	Lower Molar		Fragile, Handle With Care
	Bite Wing - Interproximal		Fear of Humidity
	Digital Receptor		Up Do Not Overturn
	Radiography Push Button		Stacking Limit
	Ionizing Radiation		Separate Collection, Do Not Dispose

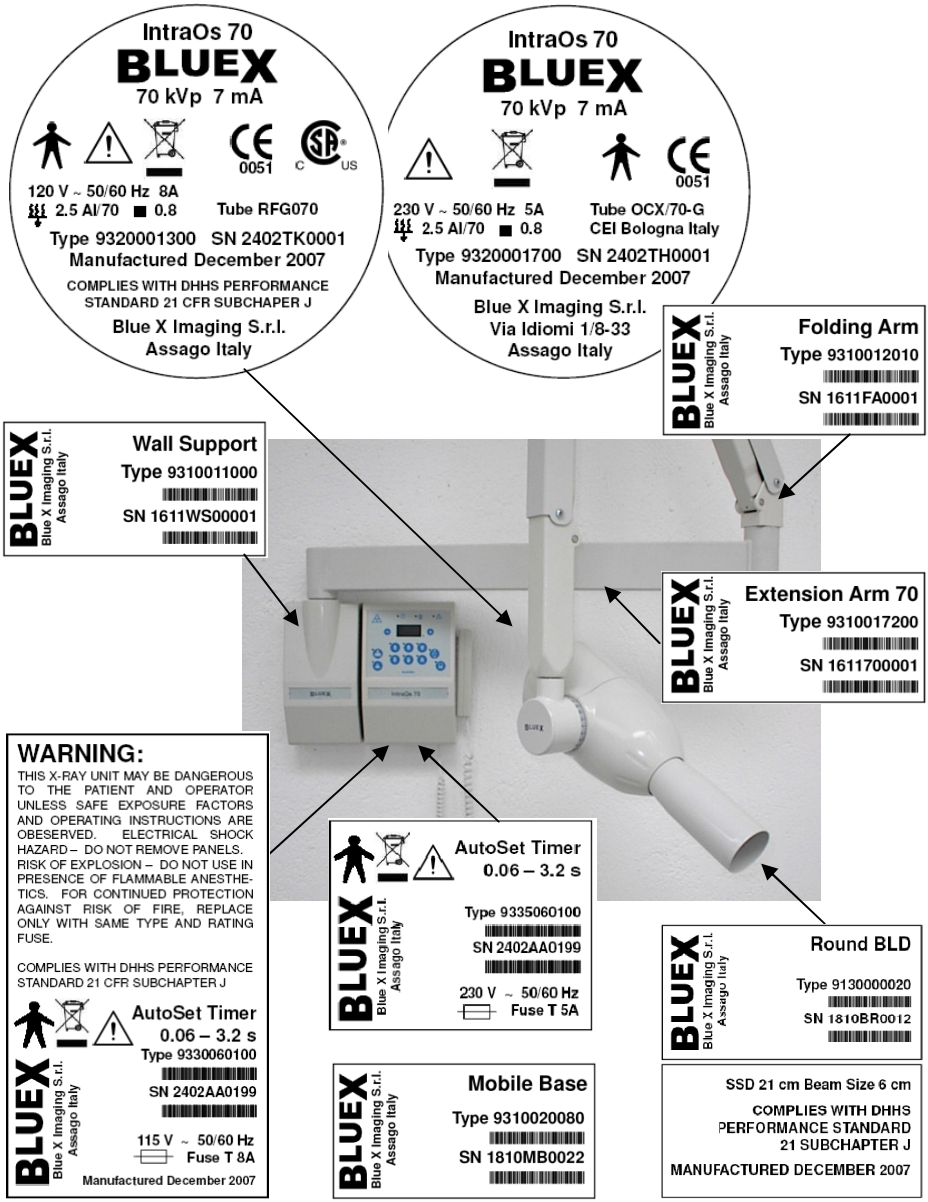
Appendix C
Exposure Table

IntraOs 70 - 70 kVp, 7 mA - Exposure Times in s												
Focus-Film Distance 23 cm						D Film			E Film		Digital	Small Patient
					D Film			E Film		Digital		
				D Film			E Film		Digital			Large Patient
	3,20	2,50	2,00	2,60	1,25	1,00	0,80	0,64	0,50	0,40	0,32	
	2,50	2,00	2,60	1,25	1,00	0,80	0,64	0,50	0,40	0,32	0,25	
	2,00	2,60	1,25	1,00	0,80	0,64	0,50	0,40	0,32	0,25	0,20	Upper Molar
	1,60	1,25	1,00	0,80	0,64	0,50	0,40	0,32	0,25	0,20	0,16	Upper Premolar
Lower Molar	1,25	1,00	0,80	0,64	0,50	0,40	0,32	0,25	0,20	0,16	0,12	Bite Wing
Lower Premolar	1,00	0,80	0,64	0,50	0,40	0,32	0,25	0,20	0,16	0,12	0,10	Upper Incisor
Lower Incisor	0,80	0,64	0,50	0,40	0,32	0,25	0,20	0,16	0,12	0,10	0,08	
	0,64	0,50	0,40	0,32	0,25	0,20	0,16	0,12	0,10	0,08	0,06	
Focus-Film Distance 33 cm			D Film			E Film		Digital				Small Patient
		D Film			E Film		Digital					
	D Film			E Film		Digital						Large Patient

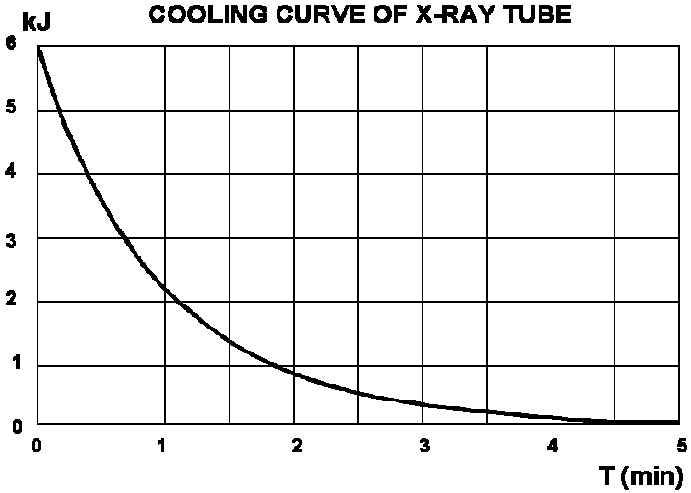
Appendix D
Alarm Conditions

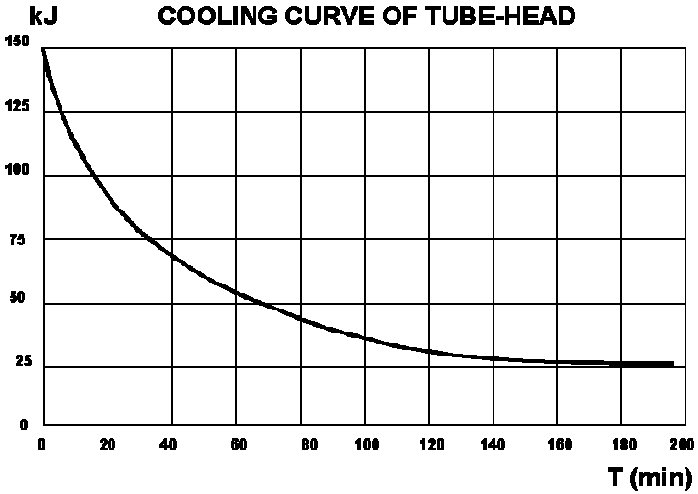
AutoSet Timer Alarm Conditions				
Code	**Fault /Error**	**Signal**	**Action**	**Reset**
A 01	X-ray requested during cool-down period	Green lamp (System Ready) flashing	System inhibited	By acknowledgement on the panel or when system cooled down
A 02	Line voltage below lower limit	Green lamp (System Ready) and red lamp (Alarm) flashing	System inhibited	Automatically when line voltage back in range
A 03	Line voltage above upper limit	Green lamp (System Ready) and red lamp (Alarm) flashing	System inhibited	Automatically when line voltage back in range
A 04	Corrected exposure time lower than 60 ms	Green lamp (System Ready) and red lamp (Alarm) flashing	0.06 s forced.	By acknowledgement on the panel
A 05	Corrected exposure time greater than 3.2 s	Green lamp (System Ready) and red lamp (Alarm) flashing	3.2 s forced.	By acknowledgement on the panel
A 06	Line Frequency Detection Failure	System Ready (green) lamp and Alarm (red) lamp flashing	System inhibited	By switching system off and on again
A 07	Exposure push button pressed at power on	Red lamp (Alarm) flashing	Exposure inhibited.	By acknowledgement on the panel
A 08	Exposure stopped by the operator	Red lamp (Alarm) flashing	System inhibited	By acknowledgement on the panel or after 1 m
A 09	Exposure stopped by the back-up timer	Red lamp (Alarm) switched on	System inhibited	By switching system off and on again
A 10	Back-up relay failure	Red lamp (Alarm) switched on	System inhibited	By switching system off and on again
A 11	Power switching device failure	Red lamp (Alarm) switched on	System inhibited	By switching system off and on again
A12	Line dips during exposure	Red lamp (Alarm) switched on	Exposure inhibited	By acknowledgement on the panel

Appendix E
Identification Labels



Appendix F
Cooling Curves





IntraOs 70

Dental X-ray Equipment
Service & Installation Manual
English Edition
Version 4.0

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