

**BEST-X LINE** INSTALLATION AND USER MANUAL

Mod. MQI006-0 Doc. HBE071-2

# mod. BEST-X-DC

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## GENERAL ASPECTS

### Introduction

Dear Customer,

Thank you for the preference granted to our product. We invite you to attentively read the present instructions that will help you to get the maximum of your X-ray diagnostic information with minimal x-ray use.

This manual has the purpose to provide the User with instructions for proper, safe and efficient operation.

The equipment must be used in accordance with the procedures contained in the manual and never for purposes other than those specified herein.

The User is responsible for what concern the fulfilments in legal matters facing installation and equipment functioning.

The plant can only be used by medical personnel in possession of the related licenses enablers and aware of the risks associated with the use of ionizing radiation sources. The use of X-ray sources for purpose of medical diagnostics is subject to specific authorizations and/or communications to the Authorities responsible for vigilance. The User is responsible for the use unauthorized of the plant. The User of the X-ray plant for dental complementary radiology is also required, without exception, to observe the regulations governing the safety of exposure to ionized radiations sources for workers, for member of the public, for population and patients.

If the equipment is not operated correctly or it is not made proper maintenance, the manufacturer can not be held responsible for any breakages, lesions and mal functioning.

### Descriptions

**“CAUTION: Do not modify this equipment without the manufacturer’s permission.”**

BEST-X-DC radiological monoblock is an equipment designed to obtain intraoral dental radiographs arranged to be used with acquisition systems (conventional films, phosphor plates and videoradiografie).

According to Directive 2007/47/CE (Legislative Decree 37/2010) it is classified in CLASS IIb.

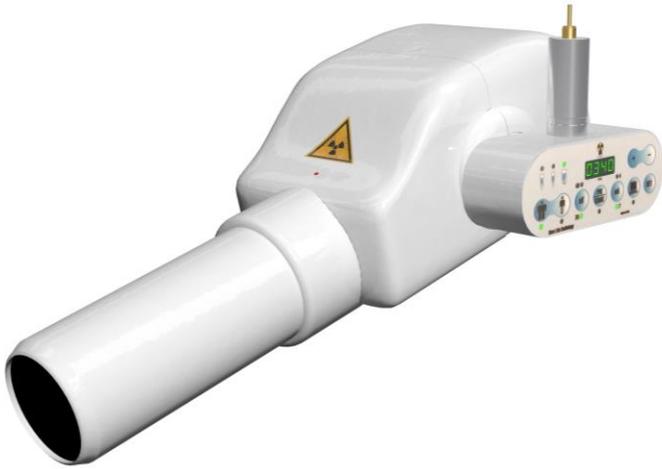
The unit is manufactured in accordance with the actual international standards on the protection of ionizing radiation, electrical safety, mechanical safety and electromagnetic compatibility for electromedical equipment.

The equipment consists of the following parts:



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## Monoblock



BEST-X-DC Monobloc require the use of X-ray tubes Toshiba DG-073B-DC; Toshiba D-045; Kailong KL11; Kailong KL21.

BEST-X-DC complies with EU directives on electromagnetic compatibility.

However, it may be appropriate to avoid installing the equipment in the immediate vicinity of other electrical equipment with which they could generate electromagnetic fields of mutual disturbance. It is also important to avoid using electrical appliances (eg. electrosurgery, cell phones, etc...) in the immediate vicinity of the apparatus during its use.

## Timer



The timer of the BEST-X-DC Unit is



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integrated in the monoblock, it allows managing the exposure times and adjustment of kV(60/70) and mA (4/7) and at the same time it guarantees maximum safety in the use of X-ray tubes for electromedical purposes for intraoral diagnostic;

The management of the timer occurs through the use of the RF radio control;

The control panel of the timer is provided with membrane digital buttons so as to facilitate its use;

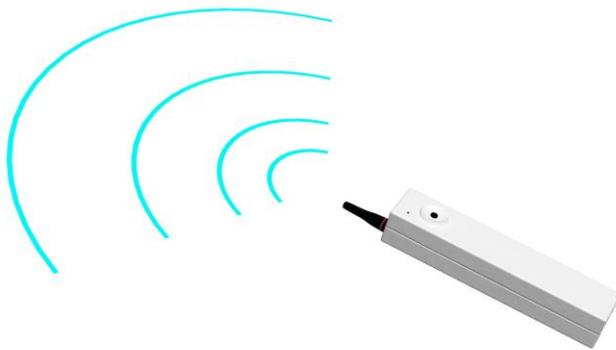
The functioning of the timer is managed by RF radio control to vigilant device better known as dead man's device, in such a way as to guarantee maximum safety for both, the operator and the patient;

The timer does not permit use in the X-ray scopy;

The time scale set by the values of the factory complies with scale R10 relative to the standard EN60601-2-7 (IEC 60601-2-7);

The exposure times shown on the display of the timer are expressed in ms.

The maximum time that can be set is 3 s (the display will read 3000) while the minimum time is 20 ms. (the display will read 0020);



**BEST-X-DC has a unique safety system against short circuits or malfunction of the unit, this system is the automatic fuse THERMOSWITCH.**



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This device intervenes in case of conduction for a time longer than 6 sec. In this situation it blocks the continuity between the control unit and the monoblock, thus preventing the emission of anomalous X-ray.

In case of intervention of the THERMOSWITCH, this will be replaced, this operation requires a service call to technical assistance.

### Drawings, schematics, components lists, instructions for repairs:

**New Life Radiology** is committed to providing, upon request, drawings, circuit diagrams, component parts lists, instructions, or other information that can serve for qualified technical personnel, to perform the repair of any parts that can be repaired.

The Manufacturer reserves the right to make changes at any time without notice.

### Technical data

Classification:	Electro medical equipment of Class I With part applied type B
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Head:	Monoblock with potential constant 100KHz model Toshiba DG-073B-DC; Toshiba D-045; Kailong KL11; Kailong KL21
Type:	60-70 kV <sub>p</sub> selectable (±5%)
Feeding voltage:	230 V~ (50 Hz) monophasic
Maximum Power absorbed from the net:	0,800 KW
Cone diameter:	60 mm
Max symmetrical rays field:	Ø60 mm to SSD 200 mm
Anodic current:	4 mA – 7 mA selectable
Anodic voltage:	60, 70 kV selectable
Emission time:	from 20 mS to 3000 mS scale R10
Exposition time:	predefined
Max anodic voltage:	70 kV
Reference current time:	7mAs to 70 kV, 7mA, 1 s
Max supplied power:	0,49 KW a 70 KV, 7mA
Maximum apparent resistance of the power supply:	0.44 Ω
Weight:	6 kg

### Accuracy Load Factors

Voltage accuracy	± 5 %
Current accuracy	± 3 %
Time accuracy	± 5 %
Dose accuracy	± 5 %

### Other Data

Maximum current automatic switches for the feeding net	Magnetic thermal switch from 10 A (CEI 23-3)
High voltage measure method:	Not invasive method

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Current measure method in the radiogenic pipe:	See page 25
Charge application time determination method:	Not invasive method
Interposition aluminium filter between rays window and cone collimator:	Al 1 mm (AIP99,9 UNI3567)

## INSTALLATION AND USE

### Use Conditions



**The equipment is designed for continuous operation with intermittent charge.**

**The operating times are with intermittent charge with a duty cycle of 1.30 (for each working period will correspond to 30 pause)**

<b>Classification according to Directive 2007/47 / EC (Legislative Decree no. 37/2010)</b>	<b>Class IIb</b>
Protection against electrical dangers:	Class I
Protection degree against the direct and indirect contacts:	Equipment with parts applied type B
Protection degree against water penetration:	Common equipment IPX0
Use safety degree in presence of inflammable anaesthetic mixture:	Equipment not suitable to an use in presence of an inflammable anaesthetic mixture with air or with oxygen or with nitrogen protoxide
Use conditions:	Equipment for continuous operation with intermittent charge
Installation:	Permanent e mobile

### General symbols



Caution: consult annexed documentation



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Ionizing radiation



Apparatus with Type B part applied



Earth protection



Switch open(disconnected from mains supply)



Switch close(connected to mains supply)



Red point, placed on the cover of the unit, indicate focal spot



Alternating current



Radiation emission symbol



Follow annex instructions



Symbol in conformity with European Directive 2002/96/EC (WEEE). The symbol indicates that this product should not be treated as household waste but should be handed in at the appropriate collection centre for the recycling of electrical and electronic equipment. Discard it according to local regulations for waste disposal.



Manufacturer



Symbol in conformity with Community Legislation. The symbol is followed by a number which identifies the notified organism which certifies and monitors such compliance

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**REF**

Product Code

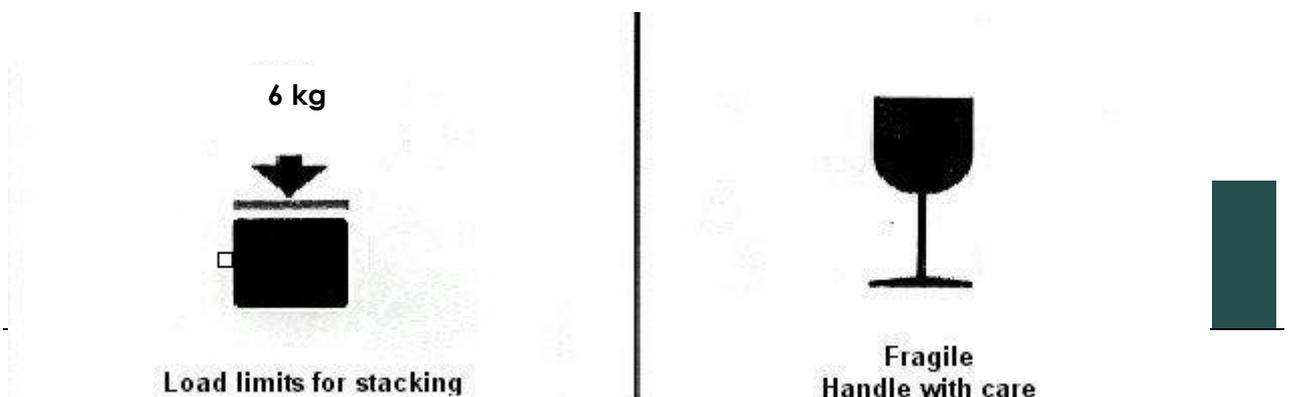
**SN**

Equipment Serial Number. To be used for all communication with manufacturer / service technician

**TUBE**

X-ray Tube Serial number

### Symbols for transportation and storage



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## Installation

**“CAUTION: To avoid the risk of any electric shock, this device must be connected only to power mains giffed with ground protection.”**

### Monoblock installation



- ✓ **Before inserting the monoblock it is essential to work in safety by opening the double pantograph arm as shown in fig. 1, to avoid that it snaps abruptly since it has the springs charged and calibrated to support the weight of the monoblock.**

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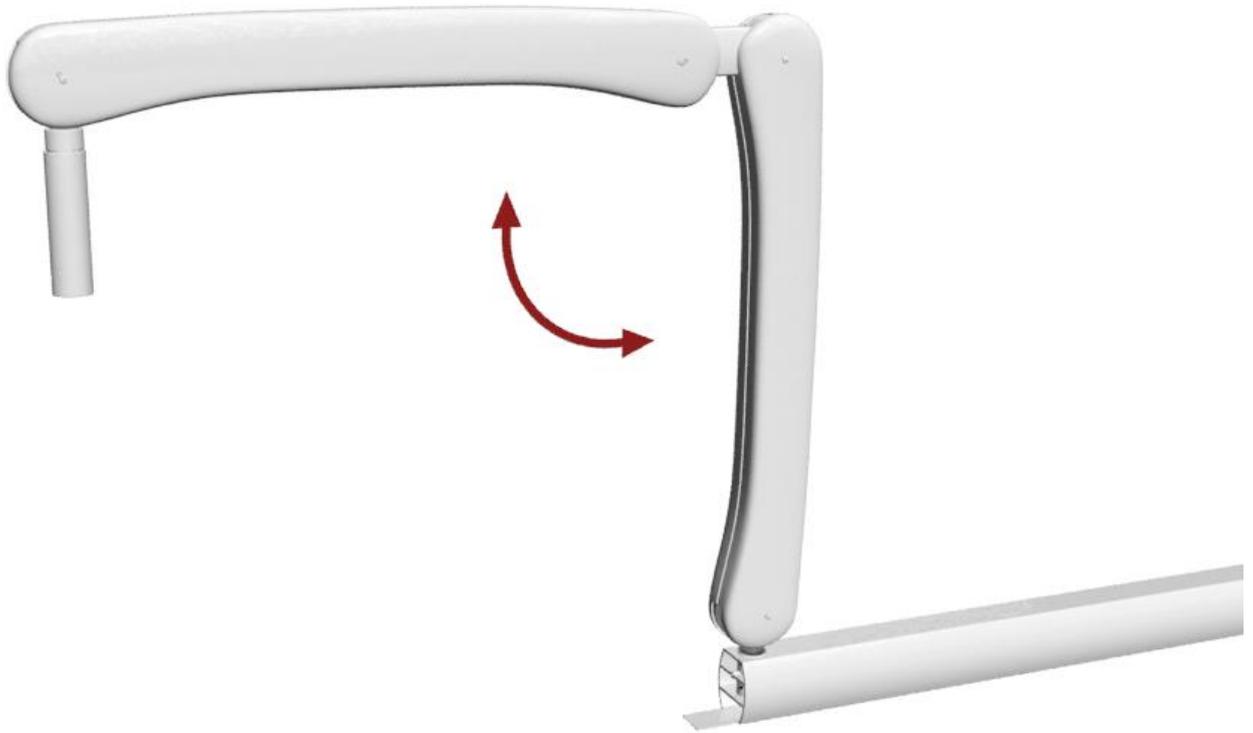


fig. 1

- ✓ Insert Monoblock in the double pantograph arm as shown in Fig. 2



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fig. 2

## Timer operation

- ✓ The timer of the device allows the management of the exposure times of the monoblock and the regulation of kV (60/70) and mA (4/7), at the same time guarantees maximum safety in the use of X-ray tubes for electromedical purposes for intraoral diagnostic;
- ✓ The timer control panel is provided with membrane digital buttons so as to facilitate its use;
- ✓ The timer functioning is managed by radio-frequency remote control to dead man's device in such a way as to ensure maximum safety for both the operator and

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patient;

- ✓ The timer does not allow the use of X-ray in scopy;
- ✓ The time range set by the factory values complies with R10 range relative to standard EN60601-2-7 (IEC 60601-2-7);
- ✓ The exposure time displayed on the timer are expressed in ms
- ✓ The maximum time that can be set is 3 sec. (the display will read 3000) while the minimum time is 20 ms. (the display will read 0020);



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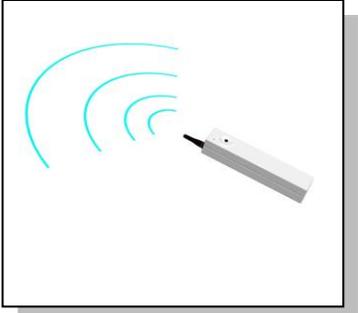
Description of the timer control panel

Following is the symbolism used on the front panel of the timer:

**B**



**A**



**C**



fig.3

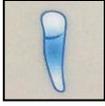
<b>A</b>	Radio control
<b>B</b>	Light emission radiation
<b>C</b>	Pre Start Button



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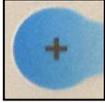
Tooth type: Incisor



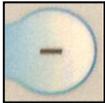
Tooth type: Pre molar



Tooth type: Molar



Selection button: increasing manual mode



Selection button: decreasing manual mode



Patient selection button: Normo-type



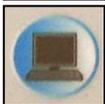
Patient selection button: Child



Selection button kV



Selection button mA



Selection button: Digital radiography



Times memorization button



Pre-Start button



4-digit display (the exposure time expressed in ms)

## Timer use instructions

- ✓ **SWITCHING ON:** The timer starts running simultaneously when the appliance on which it was mounted. When powering up the display will show, for about a sec, the number 325 that indicates the version of software installed; subsequently it will be referred to an exposure time (which can vary from 0020 to 3000 ms) which indicates the last time of exposure carried out. At this point the timer is ready for use.
- ✓ **FUNCTIONING E TIME SCALE:**  
On timer, by default, it is installed R10 time scale (in milliseconds [ms]), these values are intended as recommended values to get with less exposure time maximum image quality, they can be modified depending on the needs of the operator. In the tables below the time scales shows programmed depending on the type of film or sensor used with the relative dose value, expressed in milligray [mGy] which has to 20 cm from the fire tube (this value is to be considered an estimate of the dose issued and should not be understood as a measure of the same):

Film D			
70 kV / 7 mA	Tooth type		
Patient type			
	340 [ms] 3.25 [mGy]	220 [ms] 2.10 [mGy]	160 [ms] 1.53 [mGy]
	240 [ms] 2.29 [mGy]	180 [ms] 1.72 [mGy]	120 [ms] 1.14 [mGy]

Film D			
70 kV / 4 mA	Tooth type		
Patient type			
	600 [ms] 3.26 [mGy]	440 [ms] 2.39 [mGy]	320 [ms] 1.74 [mGy]
	480 [ms] 2.61 [mGy]	360 [ms] 1.95 [mGy]	240 [ms] 1.30 [mGy]

Film D			
60 kV / 7 mA	Tooth type		
Patient type			
	340 [ms] 2.27 [mGy]	240 [ms] 1.60 [mGy]	180 [ms] 1.20 [mGy]
	260 [ms] 1.74 [mGy]	200 [ms] 1.34 [mGy]	140 [ms] 0.93 [mGy]

Film D			
60 kV / 4 mA	Tooth type		
Patient type			
	600 [ms] 2.28 [mGy]	480 [ms] 1.82 [mGy]	360 [ms] 1.36 [mGy]
	500 [ms] 1.90 [mGy]	400 [ms] 1.52 [mGy]	280 [ms] 1.06 [mGy]

The timer is designed to work with systems of video radiography, by selecting the button  the times are reduced so as to be compatible with such systems. The following tables show the scales used for digital film and phosphor:

Digital			
70 kV / 7 mA	Tooth type		
Patient type			
	60 [ms] 0.57 [mGy]	40 [ms] 0.38 [mGy]	40 [ms] 0.38 [mGy]
	60 [ms] 0.57 [mGy]	40 [ms] 0.38 [mGy]	40 [ms] 0.38 [mGy]

Digital			
70 kV / 4 mA	Tooth type		
Patient type			
	100 [ms] 0.54 [mGy]	80 [ms] 0.43 [mGy]	80 [ms] 0.43 [mGy]
	100 [ms] 0.54 [mGy]	80 [ms] 0.43 [mGy]	80 [ms] 0.43 [mGy]

Digital			
60 kV / 7 mA	Tooth type		
Patient type			
	100 [ms] 0.67 [mGy]	100 [ms] 0.67 [mGy]	100 [ms] 0.67 [mGy]
	100 [ms] 0.67 [mGy]	100 [ms] 0.67 [mGy]	100 [ms] 0.67 [mGy]

Digital			
60 kV / 4 mA	Tooth type		
Patient type			
	180 [ms] 0.68 [mGy]	180 [ms] 0.68 [mGy]	180 [ms] 0.68 [mGy]
	180 [ms] 0.68 [mGy]	180 [ms] 0.68 [mGy]	180 [ms] 0.68 [mGy]

Phosphorus			
70 kV / 7 mA	Tooth type		
Patient type			
	200 [ms] 1.91 [mGy]	100 [ms] 0.95 [mGy]	100 [ms] 0.95 [mGy]
	100 [ms] 0.95 [mGy]	80 [ms] 0.76 [mGy]	80 [ms] 0.76 [mGy]



Phosphorus			
70 kV / 4 mA	Tooth type		
Patient type			
	300 [ms] 1.63 [mGy]	200 [ms] 1.08 [mGy]	100 [ms] 0.54 [mGy]
	180 [ms] 0.97 [mGy]	160 [ms] 0.87 [mGy]	120 [ms] 0.65 [mGy]

Phosphorus			
60 kV / 7 mA	Tooth type		
Patient type			
	200 [ms] 1.34 [mGy]	150 [ms] 1.00 [mGy]	120 [ms] 0.80 [mGy]
	180 [ms] 1.20 [mGy]	100 [ms] 0.67 [mGy]	100 [ms] 0.67 [mGy]

Phosphorus			
60 kV / 4 mA	Tooth type		
Patient type			
	400 [ms] 1.52 [mGy]	300 [ms] 1.14 [mGy]	200 [ms] 0.76 [mGy]
	300 [ms] 1.14 [mGy]	200 [ms] 0.76 [mGy]	200 [ms] 0.76 [mGy]

To change the time, you just select the type of patient and the type of tooth,

The tooth and the patient selected will be highlighted by the green LED in their correspondence;

To vary the type of tooth, simply press the patient button several times and in sequence will



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be selected molar, premolar, incisor.

If you have the need to manually increase or decrease the exposure time without following the preset scale, this can be done by pressing the button  to increase the time or by pressing the button  to decrease it; any increase/decrease of the time takes place in steps of 20 ms.. Press button  to save your edits of time.

When using the appliance we recommend the use of protective devices such as collars or aprons. Once placed the cone along the monoblock on the area to be examined and after setting the time and set the appropriate kV and mA, you must press the button pre-start **(C)**, to perform exposure; at this point the LED below will light and will activate a buzzer which takes about 30 seconds; to perform the exposure move away to an appropriate safety distance (minimum 2 meters) and press the button of the remote control **(A)** for the whole duration of the beep sound. If the exposure is not performed within the time that the horn is on, you must repeat the procedure from the beginning by pressing the pre start button **(C)**. During the exposure time, the yellow led light emission will switch on **(B)**. After exposure the timer pauses; during this time the display will flash the set time in the last exposure. At the end of the pause time the last time selected will remain fixed on the display and will be ready for the next exposure.

If the timer is left on without performing any activity for about 15 minutes, it will be on standby. In this mode, the display will be turned off and only the adult patient led will be turned on. To disable the standby mode, simply select any button.

## ERROR TABLE



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ERROR CODE	CAUSE	SOLUTION
Err_1	The remote control button <b>(A)</b> is released before the end of the set time	Turn off and on the equipment;  If the problem persists there is an anomaly in the transmission of the signal going from the radio control to the receiver. One possible cause is a low-power signal due to flat batteries. Replace batteries
Err_2	Button <b>(A)</b> it's pushed even after exposure time and for all timer's pause period;	Release the button;  If the problem persists there's an anomaly on the button which is always running, replace the remote control;
Err_3	The radio control button <b>(A)</b> is held down while pressing the pre-start button <b>(C)</b>	Release the radio control button;

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### Possible failures

- ✓ Below there are some possible failures that might occur, and their recovery procedures



**Must always disconnect the unit from the mains supply before starting any maintenance or inspection activities.**

### TIMER DISPLAY DOES NOT SWITCH ON

If the timer display does not turn on, first check that the fuses the plant on which the BEST-X-DC-piece is mounted are intact.

### LOSS OF DATA SET IN THE TIMER

If there is a loss of data set on the timer, a possible solution is to reset it bringing it to the factory settings. This is done by turning on the equipment while holding down the button "-" for about a sec, as shown in fig. 4

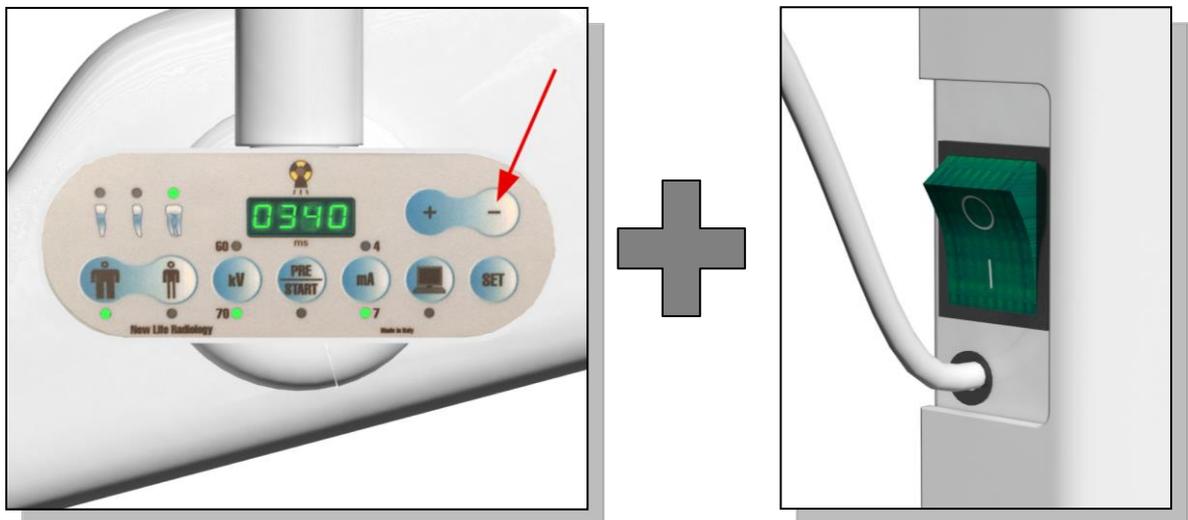


fig. 4

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**THE MONOBLOCK DOES NOT EMIT X-RAYS**

If the monoblock does not emit X-rays, as first check the continuity of the **THERMOSWITCH**; if this test is negative, you must bypass it as shown in fig.5

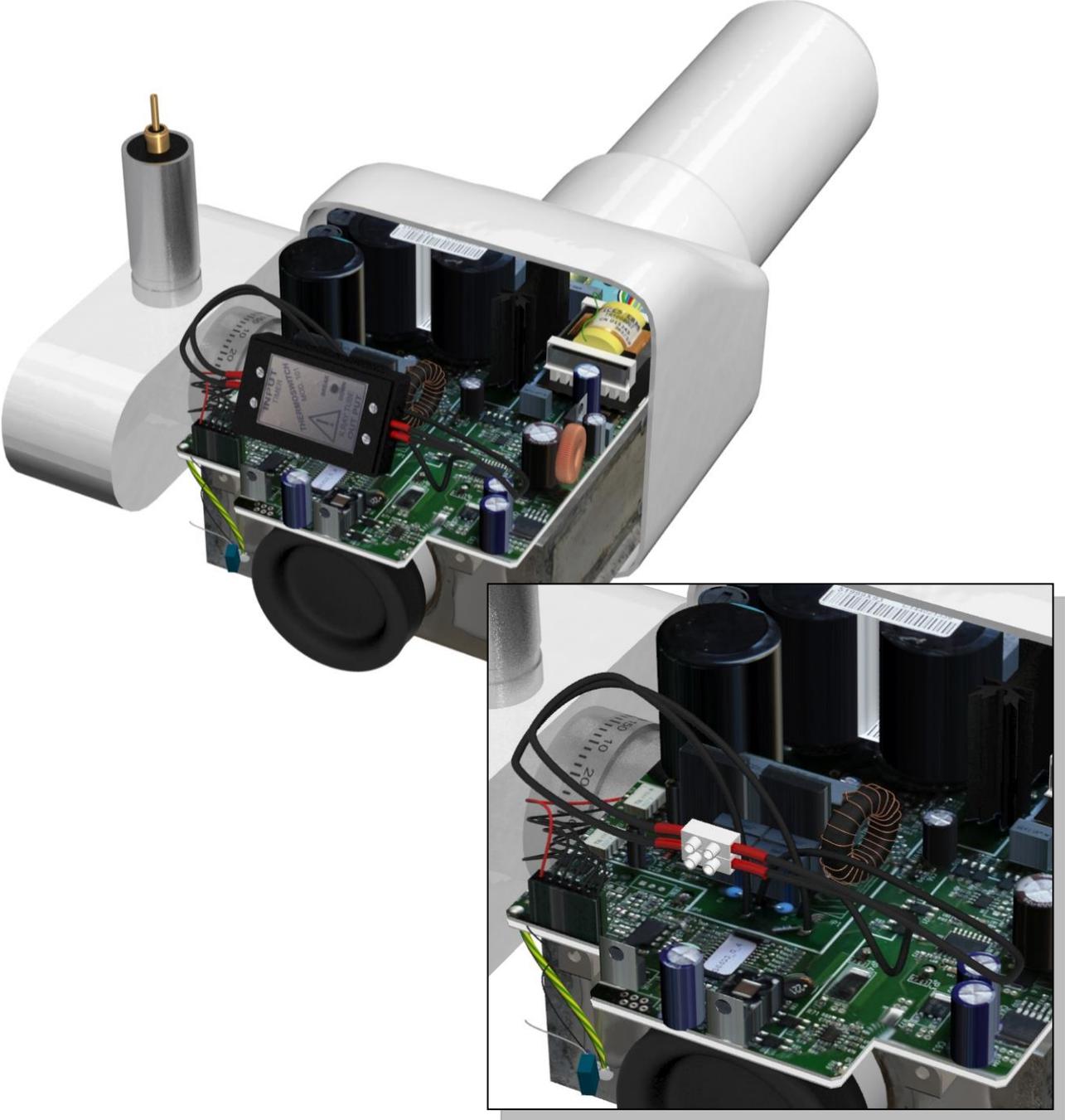


fig. 5





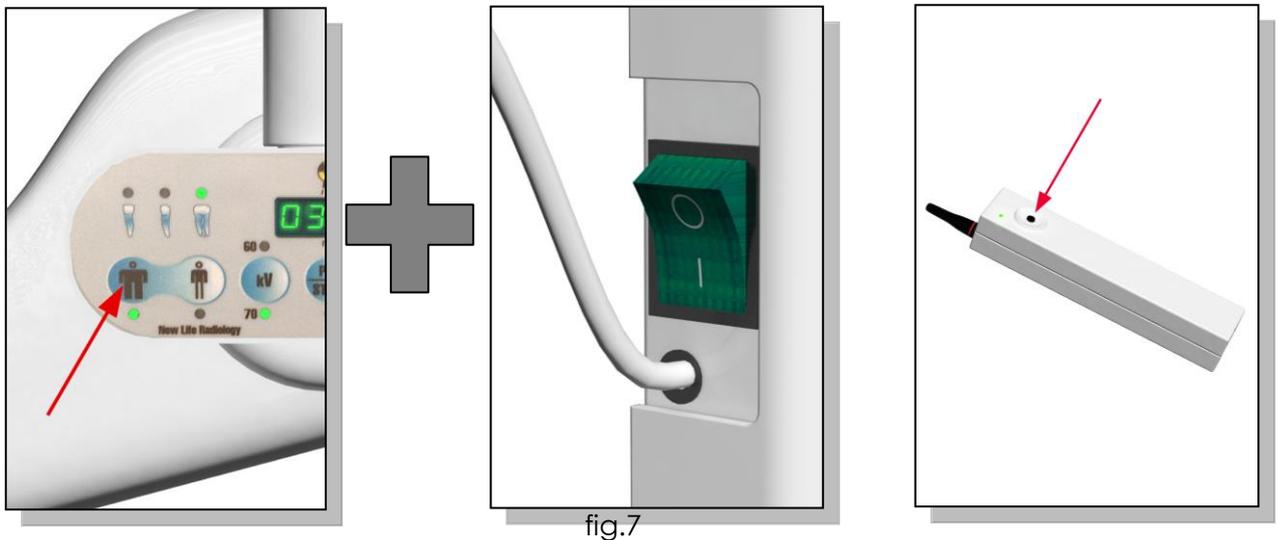
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- The batteries used are AAA-LR03-1.5 V "

## Coding of a new radio control

If you need to associate an additional radio control to the timer or to replace the one supplied at the time of sale, proceed as shown in fig.7:

- As you turn the equipment on, hold the timer button  for about a second; in these conditions the leds of the teeth will begin to flash for about ten seconds; in this time hold down the radio control button until the led of the same stops blinking. At the end of this operation the new radio control is associated with the timer.



## Procedures for the filament current measures:

### Measurement of the filament current

The measurement of the filament current can be carried out through the use of an oscilloscope or by means of a digital multimeter. To perform this measurement, proceed as follows:

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- ✓ After removing the back cover, making reference to fig.8, connect oscilloscope / tester terminals across the resistor to 1K $\Omega$ .

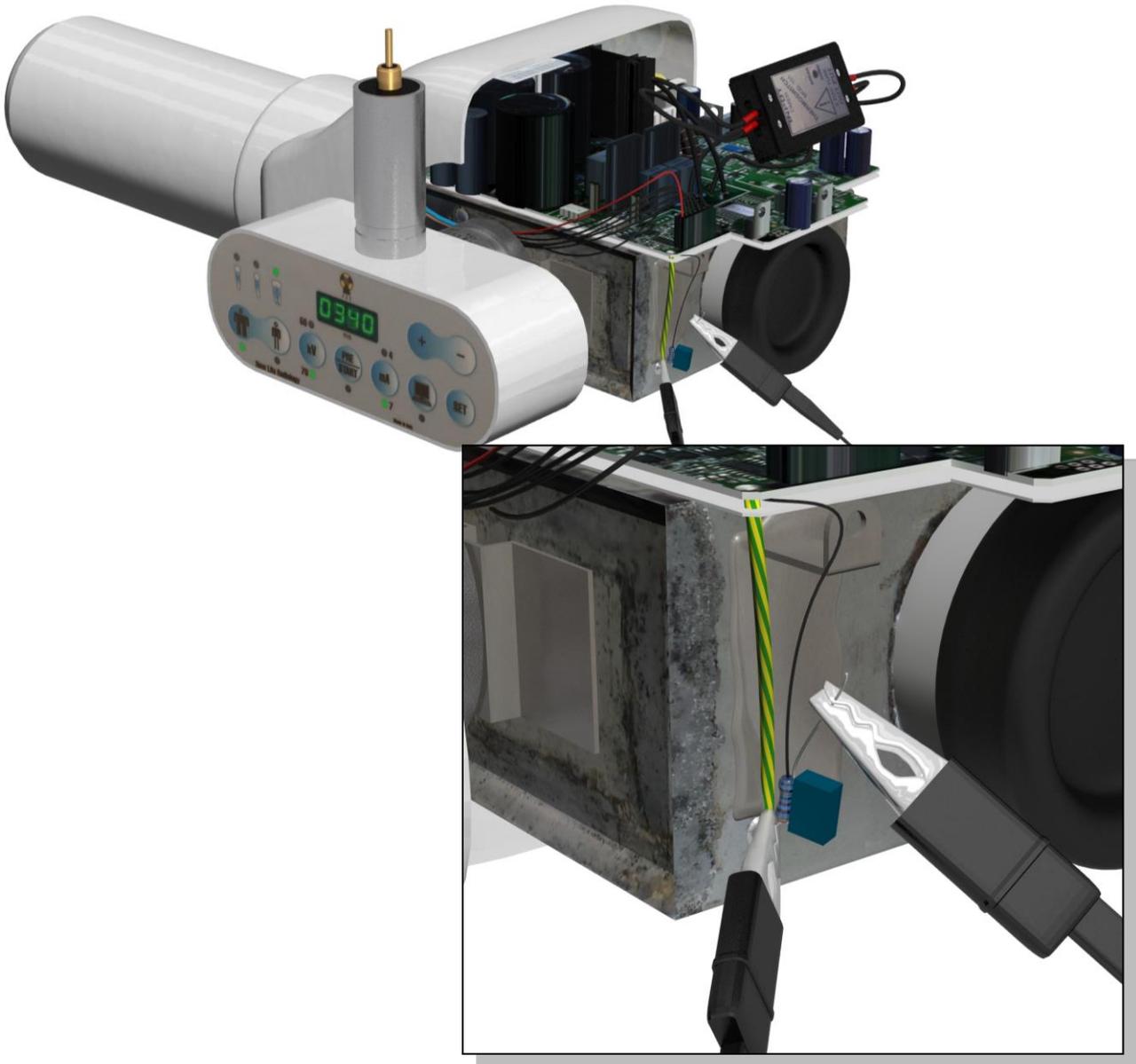


fig. 8

### Measurement using the oscilloscope:

Measure across the resistor the voltage value. To make the measurement with an oscilloscope, you need:

set the time base [SEC/DIV] and Volt time scale [VOLTS/DIV] of the oscilloscope in an appropriate manner, so that the waveform of the measured voltage fills the screen of the

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oscilloscope, as shown in fig.9 (the order of magnitude of exposure time to perform the current measurement is of a few hundred ms)

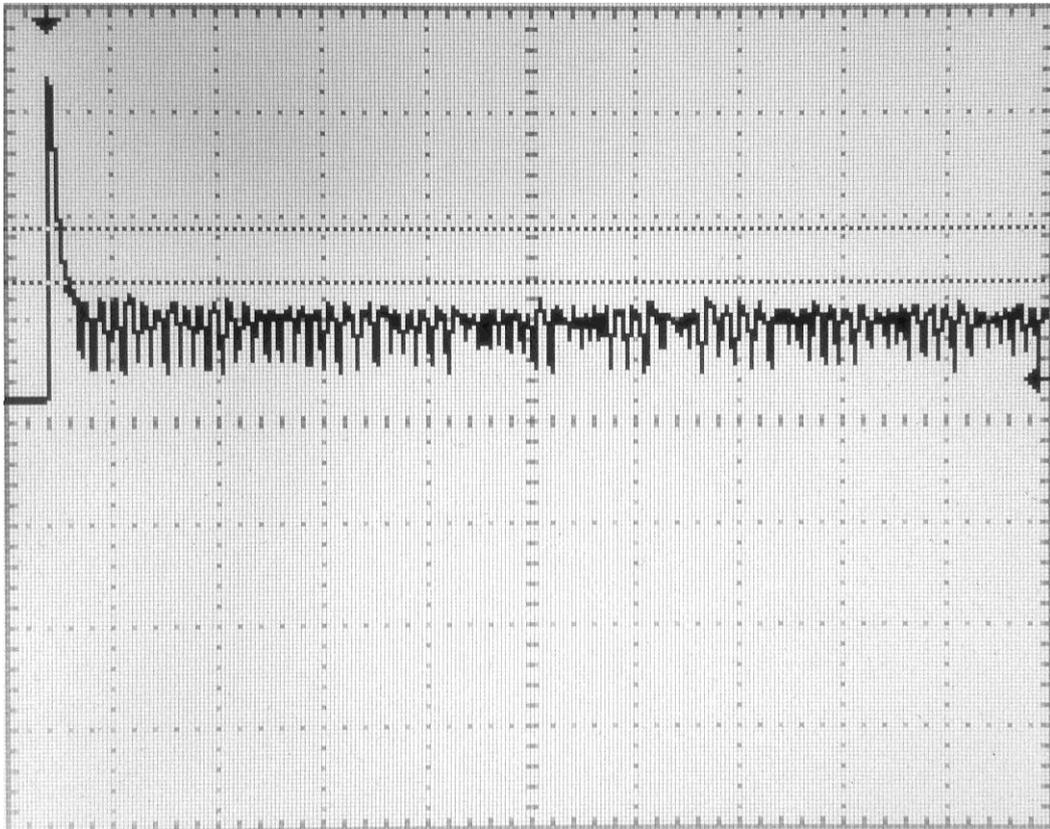


fig. 9

By setting the timer on 7 mA, if the measurement is performed correctly it is expected to see an average value of about 7 V (to each V corresponds 1 mA). As if 4 mA are set on timer the average value that is expected to read is about 4 V.

### Measurement using the digital multimeter:

It is necessary to set the full scale of the multimeter in an appropriate manner in order to measure the voltage across the resistance; then after positioning the end sleeves of the multimeter across the resistor (as shown previously in fig.5) set an exposure time long enough to allow the multimeter to read this voltage (the order of magnitude of the exposure is approximately 1 sec). The value that is expected to read is like in the previous

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case of about 7 V / 4 V depending on the current value set on the timer (to each V corresponds 1 mA)

### Procedure for dosimetric measurements:

During an inspection test are carried out dosimetric measurements to verify correct operation. These measures are carried out by a special instrument cluster with the following procedure:

- ✓ The instrument used for dosimetric measurements is the RTI ELECTRONICS PIRANHA 255;
- ✓ Is positioned the instrument at a distance of 50 cm from the fire hose and found the dose values expressed in mGy;
- ✓ It checks the performance of the X-ray tube is in compliance with the project specifications;
- ✓ The tests are stored in digital format and made available for those who request them;

Fig. 10

#### Description plate fields:

##### 1. TUBE:

It indicates the model of the X-ray tube used;



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**2. MAT: XXXXXXXX**

It indicates the serial number of the X-ray tube;

**3. TIMER: XX. D XYZ**

XX It indicates the year of manufacture;

D XYZ It indicates the number of the timer series;

**4. S/N XX.XY.XYZ (It represents the device serial number)**

XX It indicates the year;

XY It indicates the month;

XYZ indicates the serial sequential number;



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## Preventive maintenance

CARRIED OUT BY THE DENTAL LABORATORY OPERATOR, WITH ANNUAL CADENCE

Informations for programming routine maintenance on the plant are provided to ensure the best conditions of use by fully exploiting the diagnostic potential, without compromising any safety and reliability aspect that characterize the Company.

The verifications and controls are divided into blocks and the operator before starting the procedures of controls must ensure the availability of the instruction manual:

### Radiogenic head monoblock:

plate integrity with the identification data;

Ionizing radiations warning signals integrity;

oil leaks absence verification;

complex integrity: covers shells, spacer cone attachment, rotation system;

monoblock's correct anchoring verification at the pantograph;

verify the correct 360 ° rotation of the monoblock;

### Supply unit

plate integrity with the identification data;

verify the integrity of the snap command and its spiral cable;

integrity of the signal lights (yellow);

integrity of the acoustic signaling system;

If that anomalies are found on the plant during all of the above checks, these should be reported to your distributor maintenance technician's New Life Radiology.

The extraordinary maintenance interventions are not carried out by the operator



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## Extraordinary maintenance

CARRIED OUT BY THE NEW LIFE RADIOLOGY SRL TECHNICAL ASSISTANCE IN CASE OF NEED  
AND IN ANY CASE AFTER RELEVANT REPAIRS .

We provide a guideline on controls, on minimum checks that are to be performed in any technical intervention on the plant:

monoblock, support and pantograph stability;

wear of the joints of rotation, of the plant balance and of the springs;

power supply's sliding contact of the head;

power cord of the head and of the control unit;

## TESTING SERVICES

The frequency of checks carried out by a qualified expert on the performance of the X-ray (high voltage values, the dose rate, etc ..) will allow to always obtain perfect images. The X-ray, and in particular the single unit, does not contain parts subject to maintenance or external assistance.

## Manufacturer responsibility

- ✓ The manufacturer is responsible for the effects of safety, reliability and performance of the equipment only if:
- ✓ assembly and any intervention on the equipment have been made by specialists;
- ✓ if the environment electrical system in which the equipment is installed is in compliance with current standards in the field of plant safety;
- ✓ if the equipment is used in accordance with use

## Parts of input and output signal

It is not provided for the equipment connections with other parts of entry and exit signal outside.



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## Cleaning and disinfection of the unit and the parts in contact with the patient



**You should always disconnect the unit from the mains power supply before starting cleaning activities and / or disinfection.**

The method used for disinfection must meet the regulations and the recommendations in force, including those regarding the prevention of risks of explosion.

### Cleaning and disinfection of the parts in contact with the patient

- ✓ The parts in contact with the patient are represented by the cone collimator (cod. CL01). This part should be carefully disinfected after the use through disposable disinfectant wipes category "medical surgical".

### Cleaning and disinfection of the unit

- ✓ For these operations can be used a cloth moistened with neutral water-based detergent products. Make sure that no liquid seeps inside the equipment because it may cause short circuits and corrosion. Do not use abrasive polishing.
- ✓ The accessories and connection cables must be disinfected only with a cloth soaked in disinfectant solution. Do not use solvents or corrosive disinfectants.
- ✓ Spray disinfectants are not recommended because they may enter into the device and cause short circuits and corrosion. If the spray use is essential, take the following precautions:
- ✓ If the room where the appliance is installed is subjected to disinfection treatment, the same must be carefully covered with a protective sheet, taking care to turn it off well in advance so as to cool completely.
- ✓ After the dispersion of the vaporized disinfectant, remove the protective sheet and disinfect the device as described above.
- ✓ Do not use the device in the presence of disinfectants which vaporize to form explosive mixtures and wait until the vapors have dissipated before using it.

### Environmental protection

- ✓ The monoblock unit is made of lead parts and contains oil. The disposal at end-of-life

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of these parts must be done in a controlled way through authorized disposal companies according to current regulations.

- ✓ In case of monoblock's damage for impact or crushing with a consequent oil leaking, prevent dispersal into the environment, proceeding to disposal as indicated above.

## Radio control characteristics

### **RX BUTTON:**

The device is powered by 2 batteries AAA-LR03-1.5 V.

Make sure of the polarity in the assembly.

Battery life is a few years, it is advisable to replace the batteries once a year; when the brightness of the LED becomes low, it is time to replace the batteries.

### **DESCRIPTION:**

AM OOK transmitter module, with quartz through SAW resonator

"Buffer" phase which ensure power and low harmonics on output allowing high immunity to mismatching.

### **TECHNICAL SPECIFICATIONS:**



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Characteristics:	Min	Type	Max	Unit
Power supply Unit:	1.8	3	3.5	Vdc
Current Absorbed with Modulation:	2.4	5.5	7	mA
Transmission Frequency:	433.82	433.92	434.02	MHz
RF spurious emissions in antenna:			-36	dBm
Working temperature:	-20		+80	°C

Characteristics of the X-ray tubes Toshiba DG-073B-DC, Toshiba D-045, Kailong KL11, Kailong kl21

### X-ray tube Technical description

Target material that characterizes the radiation spectrum :	Tungsten
Reference axis for target angle and focal spot characteristics:	Orthogonal to the anode-cathode axis
Target angle compared to the reference axis:	12.5° (Toshiba D-045); 12° (Kailong KL11); 16° (Kailong KL21); 20° from the axis (Toshiba DG-073B-DC)
Focal spot value for the reference axis:	0,7mm (Toshiba DG-073B-DC, Kailong KL21); 0.4 mm (Toshiba D-045, Kailong KL11)
Filtration:	eq. 1 mm + 1 mm Al added, not removable without tools
X-ray tube nominal voltage:	70kV
Current intensity and frequency:	4mA-7mA 50 Hz
Operating cycle:	1/30

### X-ray tube- sheath assembly technical description

Reference axis for angle of the target and characteristics of the focal spot:	Orthogonal to the anode-cathode axis
Target angle compared to the reference axis:	12.5° (Toshiba D-045); 12° (Kailong

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	KL11); 16° (Kailong KL21);20° from the axis (Toshiba DG-073B-DC)
Focal spot value for the reference axis:	0,7mm (Toshiba DG-073B-DC, Kailong KL21); 0.4 mm (Toshiba D-045, Kailong KL11)
Load factors values concerning radiation leakage:	1/30
Classification:	Class IB (IEC 60601-1)
Data for high voltage connections:	See detailed figures
High voltage connection polarity:	Phase and Neutral (sinusoidal alternating current)
Precautions to be observed to installation completed before the first load:	None

## Beam limiting devices technical description

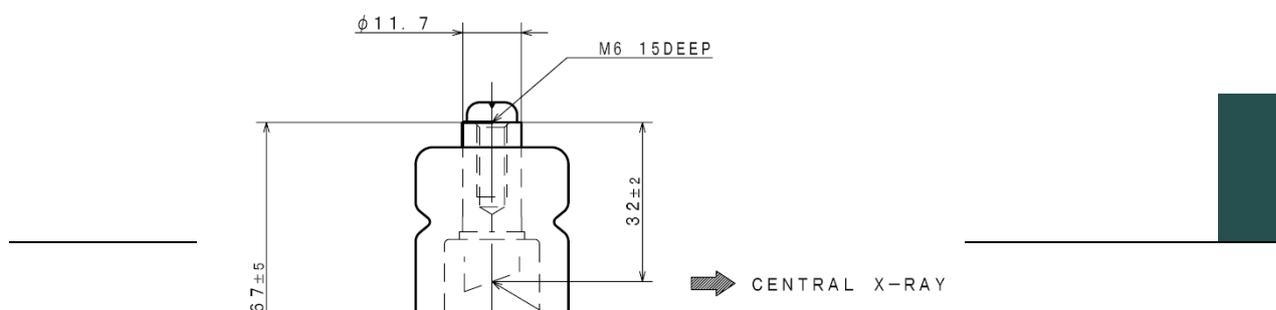
Limiter beam (cone collimator) coated in lead:	distance FFD 200 mm max $\varnothing$ 60 mm mod. C.L.01
--	---

## Technical description of the X-ray radiant complex for diagnostic

Reference axis at which the slope of the anode and the characteristics of the focal spot refer:	Orthogonal to the anode-cathode axis
Anode slope compared to the specific reference axis:	12.5° (Toshiba D-045); 12° (Kailong KL11); 16° (Kailong KL21);20° from the axis (Toshiba DG-073B-DC)
Focal spot position on the reference axis:	See detailed figures
Valore nominale della macchia focale per l'asse di riferimento:	0,7mm (Toshiba DG-073B-DC, Kailong KL21); 0.4 mm (Toshiba D-045, Kailong KL11)

### X-ray tube type Toshiba DG-073B-DC

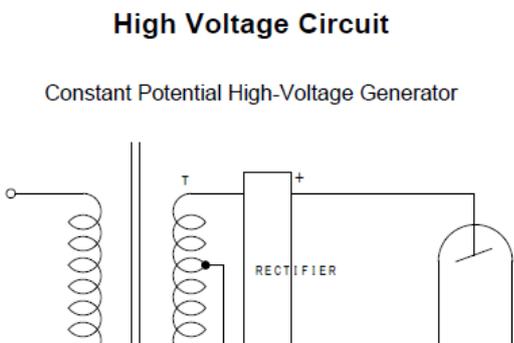
Unit: mm



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fig.12

**Reference curves**



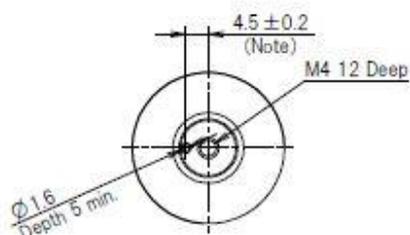
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fig.13

fig.14

**X-ray tube type Toshiba D-045**

Unit: mm



$\varnothing 11.75$



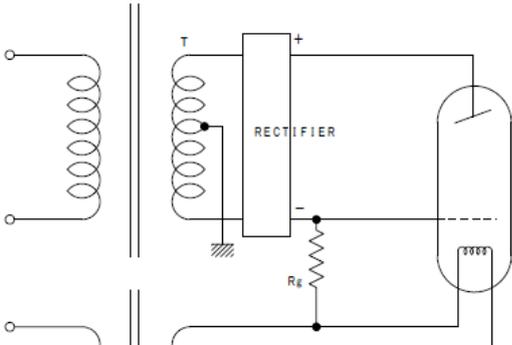
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fig.15

**Reference curves**

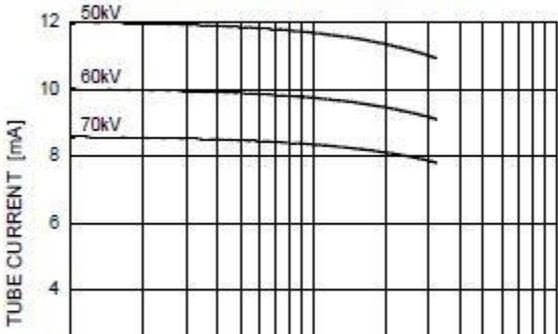
**High Voltage Circuit**

Constant Potential High-Voltage Generator



**Maximum Rating Charts  
(Absolute maximum rating charts)**

Constant Potential High-Voltage Generator  
Nominal Focal Spot Value: 0.4

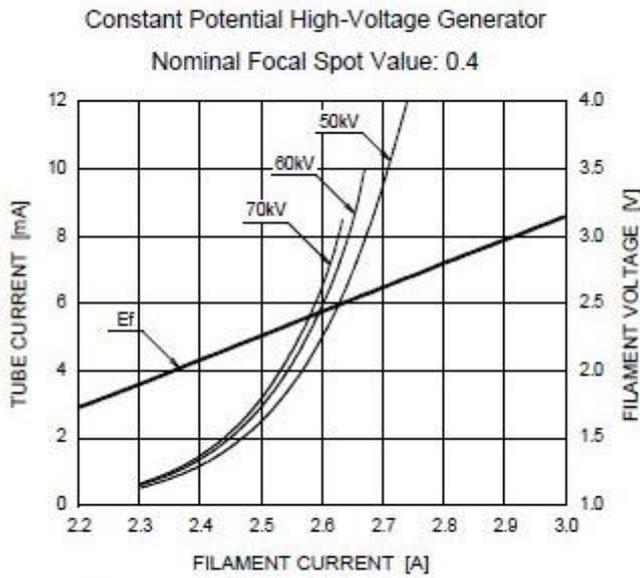


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fig.16

fig.17

**Emission & Filament Characteristics**



Note1) This graph indicates typical characteristics.  
Note2) Refer to IEC60613:2010

fig.18

**Anode Heating / Cooling Curve**

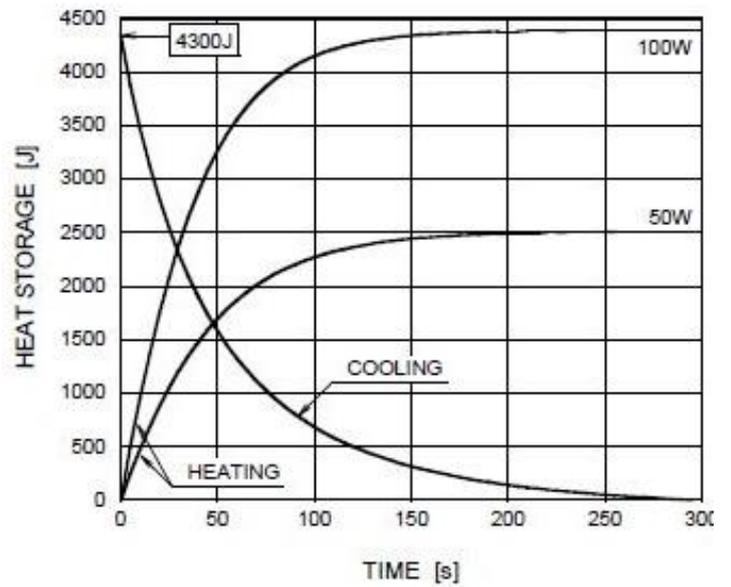
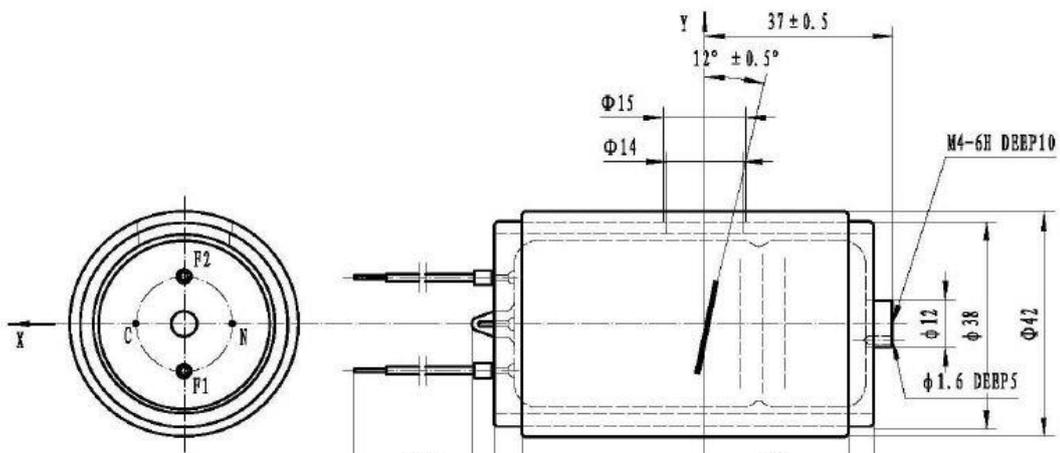


fig.19

**X-ray tube type Kailong KL11**

Unit mm



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fig.20

**Reference curves**

**Anode Thermal Characteristics**

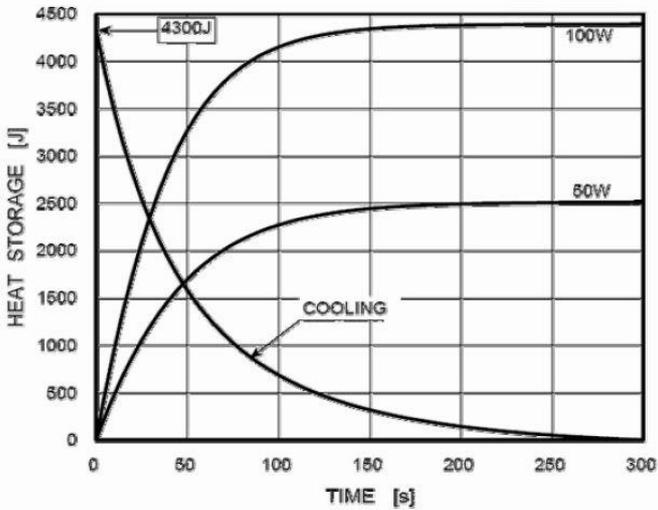


fig.21

**Maximum Rating Charts**

(Absolute maximum rating charts)

Focus Spot : 0.4 mm

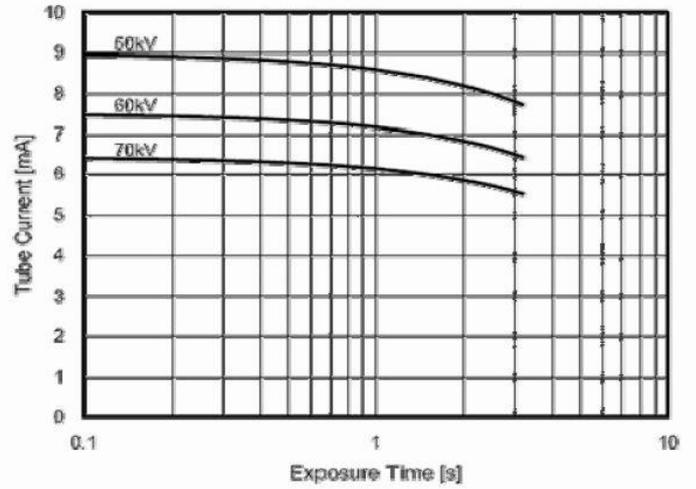


fig.22

**X-ray tube type Kailong KL21**

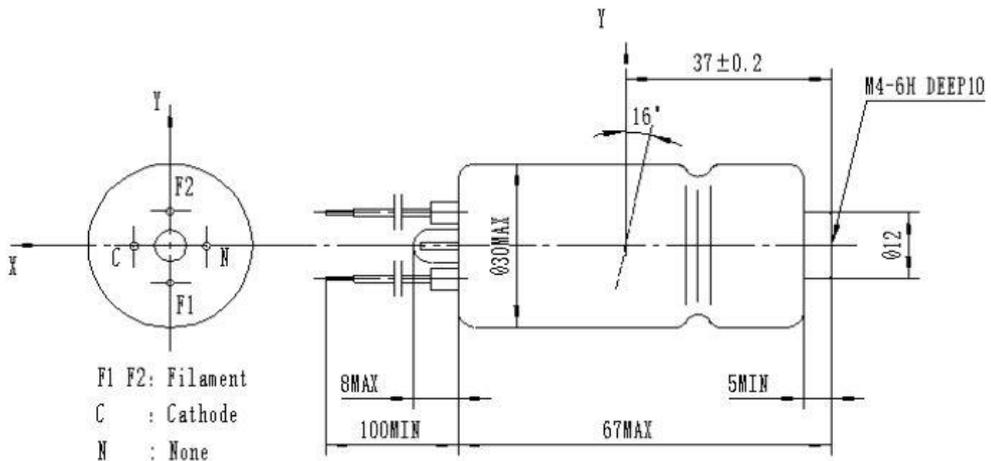


fig.23

### Reference curves

Anode thermal characteristics

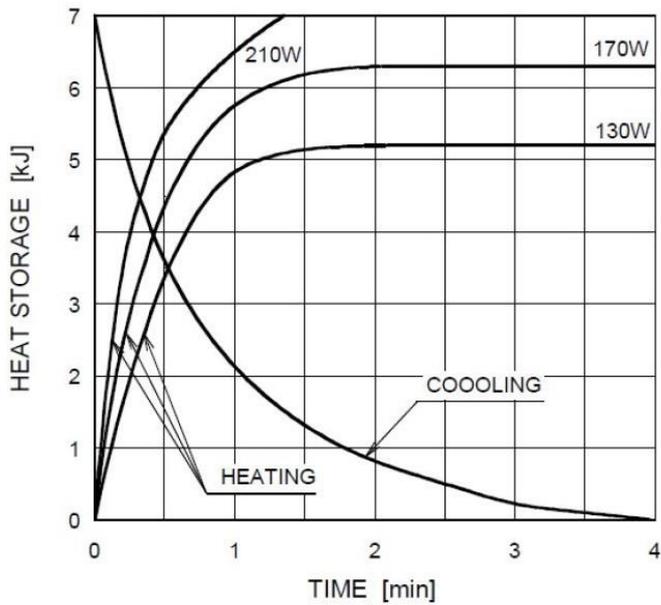


fig.24

Maximum rating charts (Absolute maximum rating charts) (DC)

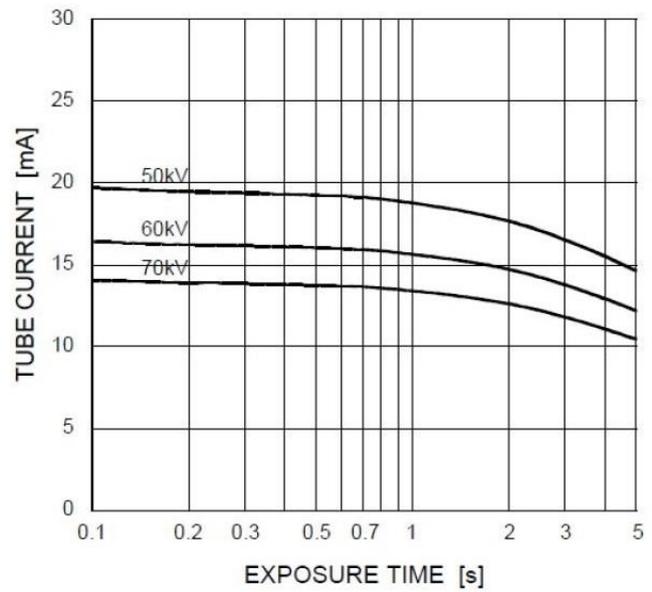


fig.25

### Safety aspects

- ✓ The equipment is not designed to be used in the presence of explosive gases or vapours.
- ✓ It is forbidden to pour water or other liquids on the equipment so as not to cause short circuits and corrosion
- ✓ Only service technicians are authorized to remove the monoblock from its support.

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- ✓ The personnel authorized to the radiological examinations performance must observe the protection rules against radiation.
- ✓ To protect the patient from diffused radiations, it is recommended the adoption of protective clothing for dental use.
- ✓ While executing x-ray examinations, there must not be other people in the room in addition to the patient.
- ✓ All personnel present during an x-ray examination must comply with safety regulations concerning protection against radiation. For their own safety, the operator must always keep a distance of more than 2 meters and out of the path of the x-ray beam, in order to avoid the exposition to the stray radiation.
- ✓ The plate must be placed in the oral cavity of the patient, and must be kept on site by the patient.
- ✓ Before using this x-ray system please refer to the regulation in force in your area concerning paediatric patients, pregnant women and anyone with health issues that contraindicate the use of x-rays. Investigate and make sure of this condition before starting the exposure.

## Possible drawbacks found in the intraoral radiographs results

### **Clear image**

Possible causes:

- Exhausted development liquid
- Excessive dilution of the developing liquid
- Too short exposure time to X-rays
- Insufficient development time
- Exposure liquid temperature below the recommended range

### **Dark image**



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Possible causes:

- Wrong dilution of developing liquid
- Too long exposure time to X-rays
- Excessive development time
- Exposure liquid temperature higher than the recommended

### **Not detailed image**

Possible causes:

- Patient movement
- Monoblock movement

### **Radiography partially exposed**

Possible causes:

- Error in the centering between rays's beams and film
- Liquid development too low with a consequent film partial development
- Contact between two or more films during development

### **Veiled Image**

Possible causes:

- Films that exceeded the expiration date
- Film accidental exposure to rays
- Film accidental exposure to heat sources
- Film accidental exposure to daylight or safety lamp darkroom no longer suitable

### **Black line occurrence on X-rays**

Possible causes:

- A sharp film folding can be the cause of the appearance of a black line on the film

### **Radiography with elongated apexes of the teeth**

Possible causes:

- Excessive film folding in the oral cavity



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## Recommendations

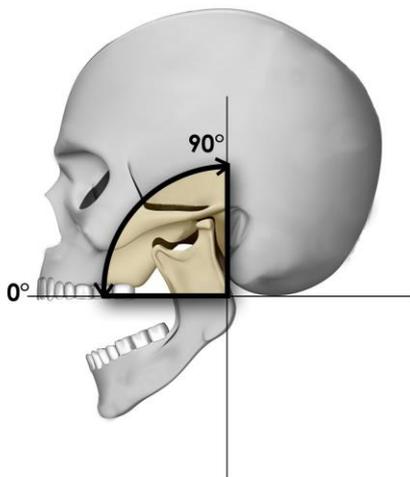
For maximum radiological image quality with minimal X-ray dose, we recommend the use of films with high sensitivity and the respect of development time proposed by the manufacturer of the films, shaking continuously films during the development itself. If the image thus obtained is too dark, it is necessary to decrease the X-ray exposure time and not the development duration.

In the case of manual development it is good to know that the developer liquid preserves its efficiency in average for a week regardless of the number of films processed. Please note that the treatment liquids are harmful to the environment and must be disposed of as indicated by the manufacturer

## Film positioning

During normal operation, the film must be positioned at 90 ° with respect to the cone collimator, as shown in fig.26

*Upper jaw*



*Lower jaw*

