CE 0051

XFM

Digital mobile diagnostic X-ray system

TECHNICAL MANUAL

Cod. **MTE-XFM**
Revision **05**

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In both cases, the system starts in about 15 seconds after pressing the ON / OFF button. During this period, it is possible to hear an audible signal that will stop when the ignition is complete. The power button lights up in blue.

6.3.3 SHUTDOWN

Once the work session is over, for the **correct shutdown and parking** of the device it is necessary to:

1. Park the XFM device near the wall power supply;
2. Press the ON / OFF button; an audible signal will accompany the system shutdown and will stop when the shutdown is complete;
3. Set the key switch to OFF;
4. Place the device in charge by connecting the power cable.

By performing these operations, the device enters the system's battery charging mode, necessary for motorized movement and for performing exposures without using the power cable.

NOTE: *In case of prolonged non-use, keep the device connected to the mains to use it at its maximum performance (with a charged battery).*

IMPORTANT: *when XFM is turned off and connected to the mains, the magnetothermic switch must be left armed to allow the batteries to recharge. If the switch is lowered, it is NOT possible to recharge the system batteries, because the power cable is excluded.*

IMPORTANT: *When the system is connected to the wall power supply, the motorization controls are disabled for safety reasons.*

it is however possible to make the device perform movements in manual modeF

6.4 PRE-USE CHECKS

WARNING

Before using the device, check whether the exposure cycles indicated here must be performed. Failure to follow the instructions can cause damage to the engine block

Before using the device, if the device has not been used for a number of days longer than indicated below, this exposure cycle must be performed.

If during the operation there are noises of discharges from the x-ray unit or other irregularities, the procedure must be interrupted and resumed after an hour.

IMPORTANT: *During the exposure cycle indicated below, it is advisable to close the collimator, to limit the emission of radiation into the environment.*

If the device has not been used for more than **15 days**, the preheating cycle indicated below must be carried out.

Select the large fire and perform the 6 exposures in the sequence shown below (total duration 2 min):

kVp	mAs	Esp	Intervallo
60	4	1	20 sec
60	10	1	20 sec
80	4	1	20 sec
80	10	1	20 sec
100	4	1	20 sec
100	10	1	20 sec

Monobloc preheating cycle

If the unit hasn't been used for more than **3 months**, run the **formation** cycle indicated below.

Perform the following exposures in the sequence indicated below (total time 1h and 10min):

kVp	mAs	Esp	range
40	6.3	3	20 sec
	pause		120 sec
50	6.3	3	20 sec
	pause		120 sec
60	6.3	3	20 sec
	pause		120 sec
70	6.3	3	20 sec
	pause		120 sec
80	6.3	3	20 sec
	pause		120 sec
90	6.3	3	20 sec
	pause		120 sec
100	6.3	3	20 sec
	pause		120 sec
110	6.3	3	20 sec
	pause		120 sec
120	6.3	3	20 sec
	pause		120 sec

125	6.3	3	20 sec
Pause			**30 min**
40	20	1	180 sec
50	20	1	180 sec
60	20	1	180 sec
70	20	1	180 sec
80	20	1	180 sec

Monoblock formation cycle

If there are no errors the equipment is ready for ordinary operation.

7 MAINTENANCE AND PERIODICAL CONTROLS

WARNING

The installation, the updating and the repairs of the X-ray equipment, must be carried out by personnel authorized by the manufacturer and in any case by technicians aware of the safety regulations on medical electrical equipment

This paragraph explains the list of preventive maintenance controls performed by technical assistance.

7.1 VISUAL CONTROLS

We suggest carrying out the below controls every year.

Part	Control
• Power cable	• Visual control for good condition (no cuts, abrasions, cracks)
• Labels	• Visual control for integrity and clarity
• X-ray monoblock	• Visual control for oil leaks. • Functional control for anode rotation (unusual noise during preparation phase)
• Collimator	• Follow maintenance plan indicated in the manufacturer's manual
• Control desk panel	• Visual control for panel integrity. • Clarity of symbols and characters on display.
• Wheels	• Visual control for integrity
• Fairing	• Visual control for good condition (no cuts, abrasions, cracks, dents, fixing)
• Touch screen	• Visual control for good condition (no cuts, cracks)

Visual controls

7.2 FUNCTIONAL CONTROLS – MECHANICAL ADJUSTAMENTS

We suggest carrying out the below controls every year. The parts of the equipment are in the following table:

Part	Control
1. Collimator	A. Functional control for light operation. B. Functional control for collimator rotation. C. Functional control for fixing of monoblock to flange. D. Functional control for light field-X-ray filed matching
2. X-ray monoblock	A. Functional control for stability of position on the rotation axis and its maximum rotation. B. Functional control for fastening of positioning handle.
3. Arm	A. Functional control for vertical stability and maximum height. B. Functional control for fastening of locking block.
4. Transportation handle	A. Functional control for brake operation (engagement/disengagement)
5. Wheels	A. Proper operation of rotation of front wheels on axis

Functional controls/mechanical regulation

7.2.1 CONTROLS PART 1 (COLLIMATOR)

Control A:

Switch on the machine and light the collimator lamp to verify the operation of the light.
If the light does not work see the manufacturer's manual.

Control B:

The collimator can rotate +/- 90° around the axis of the x-ray beam. The collimator's rotation travel is limited by a mechanical stopper.
If the collimator does not rotate contact the dealer of the machine.

Control C:

Verify that the collimator fixed to the monoblock does not move in other ways than those foreseen. If so, work on the fastening nuts on the collimator (see collimator manual)

Control D:

Verify that the light field matches the X-ray field following the instructions indicated on the collimator manual.

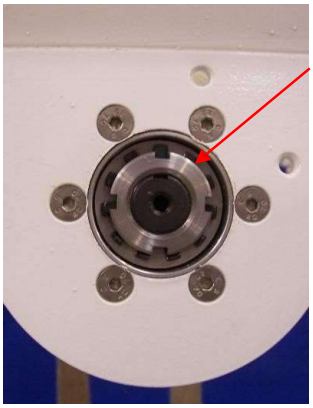
7.2.2 CONTROLS PART 2 (MONOBLOCK)

Control A:

The rotation of the monoblock group on the horizontal axis is ±180°.

Movement on horizontal axis

If the monoblock does not stay in the desired position work on the ring nut (detail indicated by arrow) placed on the fork support to adjust the friction.



Ring nut of horizontal position

The rotation of the monoblock group on the vertical axis is 0° ÷ +90°.

If the monoblock does not stay in the desired position work on the ring nut (detail indicated by arrow) placed on the fork support to adjust the friction.

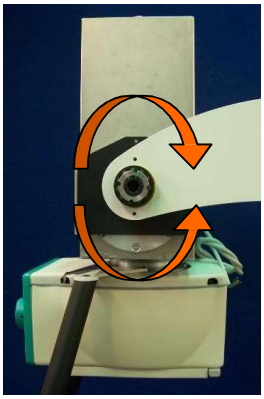


Figure 8 - Movement on vertical axis

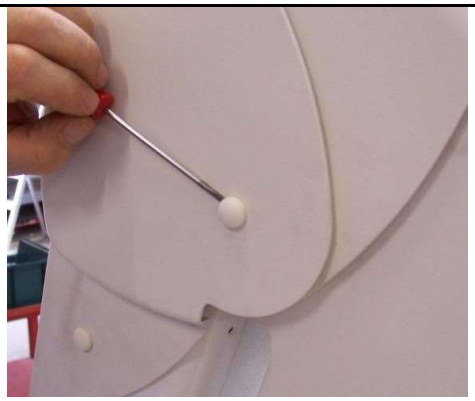
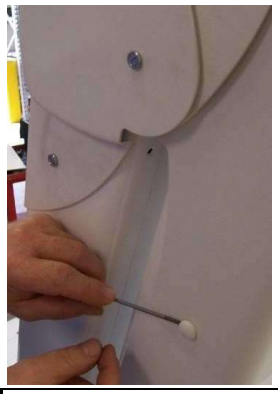
Control B:

Verify that the handle does not move from its seat. If it moves tighten the nuts and the fastening screws

7.2.3 CONTROLS PART 3 (ARM)

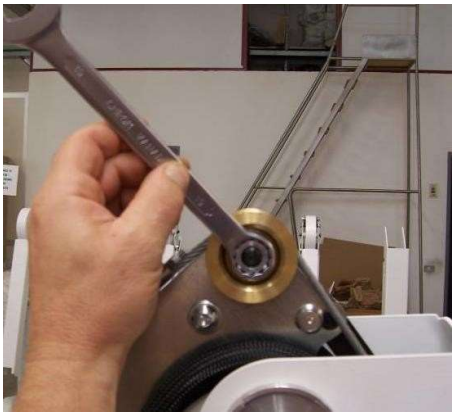
Control A:
Verify that the arms keeps the vertical position for the entire travel up to the maximum height foreseen (2 meters). If the arm does not keep the set vertical position follow the sequent instruction:

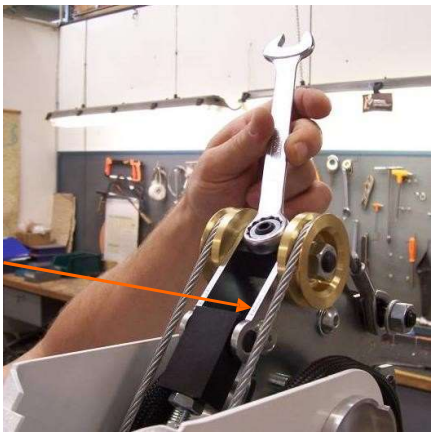
- Remove the arm cover and the articulation cover. Follow the sequent steps:

A Take away the plug on the articulation	**B** Take away the plug on the arm	**C** Unscrew the screw on the articulation cover
		
D Unscrew the screw on the articulation	**E** Take apart the second cover	**F** Take apart the third cover
		

Without the cover is possible to start the regulation.

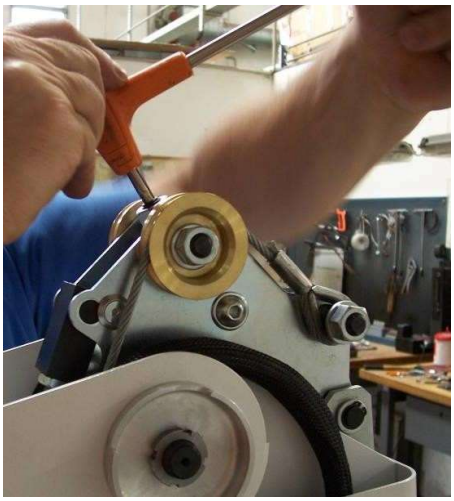
- Loose the nuts to left and right, whit a 19mm key





- Lose the nut but do not remove it

- Tightly the nut whit a 16mm key and make the balance regulation.
- Tight all the nut loosed before
- After this operation restore all the arms covers removed before the balance adjust operation



IMPORTANT: *If after have tight to maximum tension the nut, the arm do not take the right position to balance IS NECESSARY TO REPLACE THE GAS SPRIG KIT.*

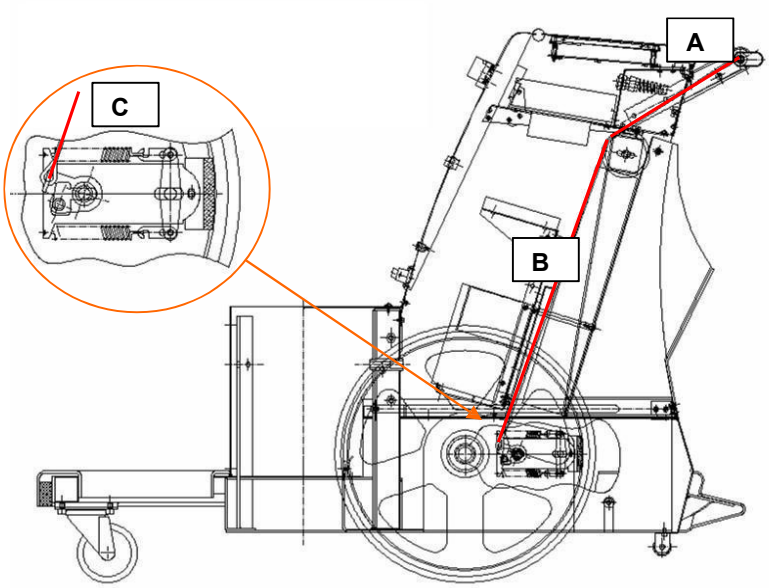
Control B:

Check that the hook of the arm takes the arm in block position to the column the loose hooking is the cause of deterioration of the components, is necessary to replace the hooking system.

7.2.4 CONTROLS PART 4 (TRANSPORTATION HANDLE)

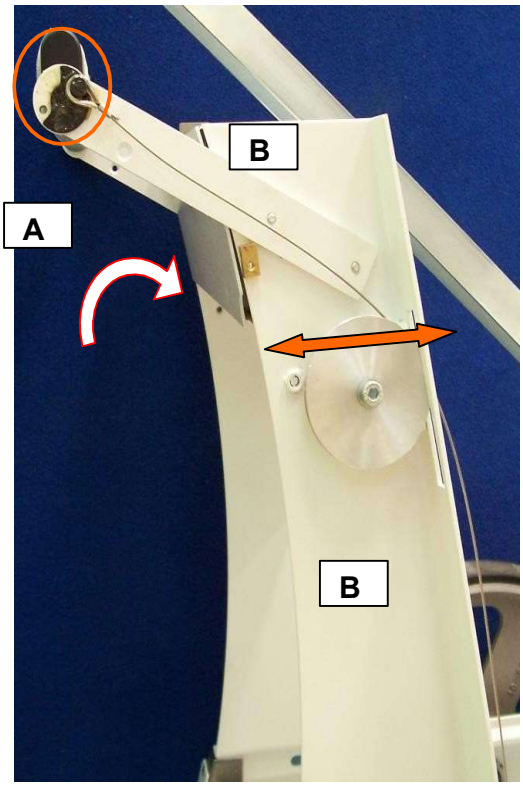
Control A: Check that the unit do not move whit the transport handle (Pos.3) in rest position; for a good functionality can you move the unit only whit a rotation of the handle to the floor.

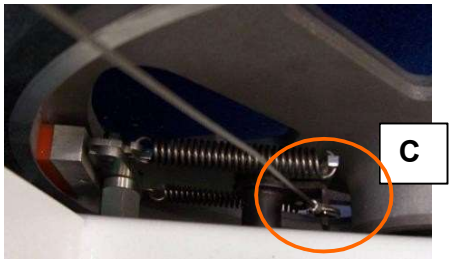
If the condition of the brake system is no good maybe the iron cord of the brake system is broken.



For replace the brake iron cord is necessary to remove the cover of the unit. After the remove of the cover for change the iron cord of the brake is necessary:

- Loose the broken iron cord to unhook the buttonhole A and C.
- For to adjust the new iron cord lose the nut B for to slide the pulley in back.
- Adjust the new iron cord between the part B and hooking the buttonhole A and C
- Move the part B for take in tension the iron cord. Tight the screw for adjust the pulley in good position.





IMPORTANT: *For have a good functionality of the brake is necessary to have a little tension of the iron cord.*

7.2.5 CONTROLS PART 5 (WHEEL)

Control A:
Check whit all the movements of the front wheels (rotation and rolling condition) and of the rear wheels (rotation), see the pictures paragraph Mechanical parts.

To replace the front wheels, loose the 4 screws indicated whit the arrows.

To replace or remove the rear wheels is necessary remove the wheels cover and loose the iron ring indicated whit red arrow.
For remove or restore the wheel is necessary to unhooking the brake.

Part	Control
Power cable	• Earth connection impedance • Leakage current
Control desk panel	• Functional, increase and decrease in the following values: • kVp, mA, sec, mAs, anatomic techniques. • Functional for keys. • Functional for LEDs.
Magnetothermal	• Functional, on and off
mAs	Stability – see next paragraph
kV	Stability – see par. Calibration kV
mA	Stability – see par. Calibration mA
RX time exposure	Stability – see par. Time Calibration

7.2.6 MAS CONTROL

Instrument to use: mAs meter d.c. (es. KEITHLEY 35035).

Remove jumper JP2 from Logic Board S100015, and connect the prods of the instrument.
Set reading on mAs

Perform an x-ray exposure using the parameters in the table

Values	Set values
60 kV	4 mAs
60 kV	10 mAs
60 kV	20 mAs
80 kV	4 mAs
80 kV	10 mAs
80 kV	20 mAs
100 kV	4 mAs
100 kV	10 mAs
100 kV	32 mAs

If the values do not fall within a 10% tolerance range, verify the adjustment of the mA.

NOTE: *At the end of the control, don't forget to reconnect jumper JP2.*

7.2.7 kV CONTROL

Instrument to use: kilovoltmeter (PMX-I/R).

Modality: position the instrument perpendicular to the radioactive source centering it on the collimator's cross at a distance of 100 cm from the focus, measured using the collimators meter.

Perform x-ray exposures using the parameters in the table:

60 kV	10 mAs	80 kV	10 mAs	100 kV	10 mAs

If the values do not fall within a 5% tolerance range, adjust the trimmer P4 of the Logic Board S100015 to bring them back within the range. This adjustment affects the entire kV range. If the values to adjust refer to the high or low values, see the CONFIGURATION instructions (kV I° step range adjust and kV II° step range adjust).

7.2.8 mA CONTROL

Instrument to use: mAs d.c. meter (es. KEITHLEY 35035).

Modality: connect the instrument to the Logic Board S100015, remove jumper JP2 and connect the prods of the instrument.

Power the unit, select modality 3P (KV, mA, s)

Perform x-ray exposures using the parameters in the table.

Verify that at the end of every x-ray exposure the display shows the correct value of the real mAs.

60 kV	50 mA	0,100 s	5 mAs
80 kV	50 mA	0,100 s	5 mAs
100 kV	50 mA	0,100 s	5 mAs
60 kV	100 mA	0,100 s	10 mAs
80 kV	100 mA	0,100 s	10 mAs
100 kV	100 mA	0,100 s	10 mAs
60 kV	200 mA	0,100 s	20 mAs
70 kV	200 mA	0,100 s	20 mAs
60 kV	320 mA	0,100 s	32 mAs
80 kV	320 mA	0,100 s	32 mAs
60 kV	400 mA	0,100 s	40 mAs
70 kV	400 mA	0,100 s	40 mAs

If the values do not fall within a 10% tolerance range, verify the adjustment of the mA to perform this operation (see paragraph ***mA adjustment***).

NOTE: *At the end of the control, don't forget to reconnect jumper JP2.*

7.2.9 X-RAY TIMES CONTROL

Instrument to use: Oscilloscope.

Modality: on Logic Board S100015

- Connect the probe to the test point TP20
- Take mass from test point TP12
- Suggested configuration of oscilloscope:
    - TP20, times base 1 msec/div, amplitude 1V/div, for exposures up to 0,006 s
    - TP20, times base 2 msec/div, amplitude 1V/div, for exposures at 0,012 s
    - TP20, times base 5 msec/div, amplitude 1V/div, for exposures at 0,040 s

Power the unit, select modality 3P (KV, mA, s). Perform x-ray exposures using the parameters in the table:

60 kV	200 mA	0,003 s	0,6 mAs
80 kV	200 mA	0,003 s	0,6 mAs
60 kV	200 mA	0,006 s	1,2 mAs
75 kV	200 mA	0,006 s	1,2 mAs
60 kV	200 mA	0,012 s	2,4 mAs
75 kV	200 mA	0,012 s	2,4 mAs
60 kV	200 mA	0,040 s	8 mAs
75 kV	200 mA	0,040 s	8 mAs

Verify the times on the oscilloscope, counting the beginning of the beams starting from 75% of the amplitude value read on the TP20. If the values do not fall within a 5% tolerance range, replace the CPU board.

NOTE: *At the end of the control, don't forget to reconnect jumper JP2.*