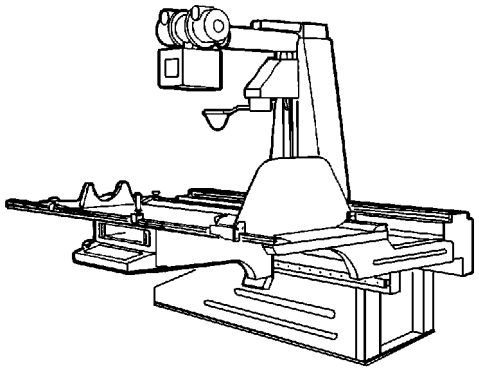
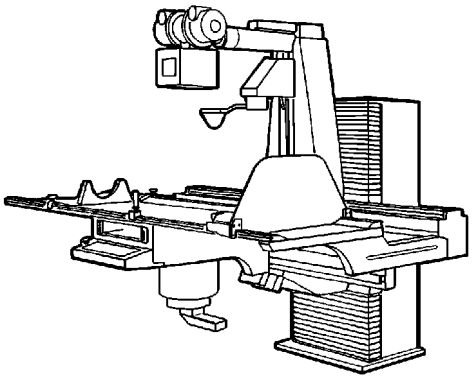


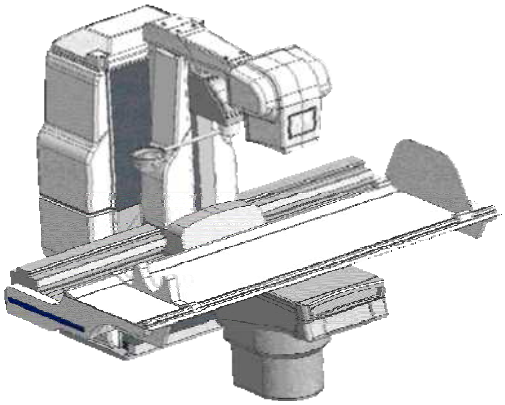
*Remote-control table*

# DELTA 30



*Remote-control table*

# DELTA 90



*Remote-control table*

# DELTA 90 PLUS

# *Service manual*

MAN056 - rev.2 dated 10/05/2010

CE

0051

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# Summary

# PART 3: ELECTRICAL ADJUSTMENTS

# PART 4: MECHANICAL ADJUSTMENTS

# PART 5:TECHNICAL DOCUMENTATION AND SUPPLIED MATERIAL

# PART 6: FUNCTIONAL INTERLOCKS



# PART 7: MAINTENANCE



# PART 8: MAIN CONSOLLE SET-UP

Spare page.

# *INTRODUCTION.*

The DELTA 90 (90 Plus and 30) table described in this manual is a medical device, and was designed, manufactured and protected for radiological use on the human body.

The Service Manual is intended for anyone who has to carry out testing, setting up and maintenance operations on the *DELTA 90-90PLUS and DELTA 30* Remote-control Tables. The contents and the use of this manual presume appropriate mechanical, electromechanical and computer knowledge. This manual is in no way a replacement for the training course, but it should be considered as a completion in training technicians, with appropriate technical-practical preparation, to carry out interventions on the machine independently. CAT MEDICAL SYSTEMS S.p.A. is not responsible for any modifications made to the machine by third parties and, consequently, to the manual subsequent to its issues.
The information contained in this manual is intended for the setting up of the machine and to provide the necessary support in resolving any faults, enabling the technician to intervene by replacing faulty parts or, in some cases, units.
The manual does not foresees the repair of faulty components. They must be returned to CAT MEDICAL SYSTEMS S.p.A., where they will be inspected and, if possible, repaired.

The DELTA 90 PLUS remote-control table is functionally the same as the DELTA 90 table, so all the instruction for using for one of them, are valid also for the other one.

# *CONSULTATION NOTES*

Before to start any intervening on the table, carefully read this manual operating instructions, that were written to ensure a rational and safe use of the machine.
Keep his manual in an well known and obvious place; it should be referred to whenever even the slightest doubt occurs.
This manual should follow the entire life of the machine and be kept in any case for at least 10 (ten) years.

For quick and rational reading, symbols have been used to indicate situations requiring maximum attention, practical advice or simple information.
These symbols may be alongside a section of text (thus referring only to that section) or alongside a figure (thus referring to the subject illustrated in the figure and to the relative text) .

ATTENTION! Pay maximum attention to the meaning of the symbols: their function is to avoid repeating technical concepts or safety warnings, and they should therefore be considered as actual "memos". Refer to this page whenever any doubt arises as to their meaning.

## Explanation of the symbols

ATTENTION! This indicates an important description regarding technical interventions, dangerous conditions, safety warnings, precautionary advice and/or very important information.

FIRE DANGER

DANGER OF ELECTRIC SHOCK. During all operations requiring the removal of high voltage connections, take great care to avoid electric shock. Remember that high voltage cables can hold an electric charge or be directly connected to parts that hold an electric charge even after the equipment has been switched off.

MACHINE STOPPED! Any operation highlighted by this symbol must only be carried out with the machine stopped.

RISK OF RADIATION AND SAFETY PRECAUTIONS. It is dangerous for anyone to use this equipment in any way without having received appropriate training, including the procedures for the use of X-rays, so as not to cause damage to the patient, the user and anyone present in the X-ray room.

DANGER OF EXPLOSION. This equipment is not classified as anesthetic-proof and may set inflammable anesthetics on fire. Inflammable products used for cleaning or disinfecting the skin may also constitute a danger of explosion.

SPECIALIZED PERSONNEL! Any operation highlighted by this symbol must only be carried out by a specialized technician sent by the manufacturer or by personnel that have attended a specific training course organized by the manufacturer.

# *SAFETY.*

ATTENTION

RISK OF RADIATION AND SAFETY PRECAUTIONS.

It is dangerous for anyone to use this equipment in any way without having received appropriate training, including the procedures for the use of X-rays, so as not to cause damage to the patient , the user and anyone present in the X-ray room.

DANGER OF ELECTRIC SHOCK

During all operations requiring the removal of high voltage connections, take great care to avoid electric shock.
Remember that high voltage cables can hold an electrical charge or be directly connected to parts that hold an electrical charge even after the equipment has been switched off.

DANGER OF EXPLOSION

This equipment is not classified as anesthetic-proof and may set inflammable anesthetics on fire. Inflammable products used for cleaning or disinfecting the skin may also constitute a danger of explosion.

- Before using the radiological equipment, make sure that the protective screens are installed.
- The operator must not stand in the area occupied by moving parts of the equipment.
- All personnel not directly involved in the use of the equipment must leave the X-ray room or stay behind the protective shields.

**IMPORTANT !**
**DO ALWAYS WEAR THE DOSIMETRIC DEVICE.**

# PART 1

# MOVEMENT AND INSTALLATION

*DELTA 90, DELTA 90 PLUS, DELTA 30*

| Revisioni: | | |
|---|---|---|
| Name of file | Num. | Date |
| MAN056 | 2 | 10/05/2010 |
| DELTA 30: MAN005-1 | 1 | 1/09/1998 |
| DELTA 90:MAN003-1 | 2 | 10/01/2003 |

# 1. MOVEMENT AND INSTALLATION.

Foreword:

On delivery of the machine, make sure (visually together with the courier) that none of the units have been damaged in any way: if any damage is noted, this should be reported to the person responsible.

The Manufacturer is not responsible for damage caused by transport operations that do not comply with the indications reported.

The units must be lifted and moved by means of a forklift truck only, except for the main upright which is fitted with eye bolts for lifting from above. For lifting and movement in difficult conditions, additional personnel must be used to control the movements to be made and avoid dangerous situation.
Particular attention should be paid to protruding parts and to jerks, bumps and uneven surfaces, etc...

## 1.1 PACKING CHARACTERISTICS.

The *DELTA 90-90 PLUS and DELTA 30* are prepared for transport divided into functional units, wrapped and protected in nylon and carton for long transports, and in particular conditions vacuum bags with plastic and wooden crates are used.

## 1.2 DISPOSAL OF THE PACKING.

After unpacking, all the packing material must be disposed of in accordance with the current regulations for environment protection.

## 1.3 MOVEMENT AND LIFTING OF THE PACKING WHEN CRATES ARE USED.

The crates are marked with pictograms indicating the correct movements to be made.

The fork-positioning points are indicated with pictograms since the crates must be moved with a forklift truck in a balanced load condition.

### 1.3.1 *DELTA 90-90PLUS case*:

The units that make up the DELTA 90-90PLUS are packed into two crates with the contents indicated in the figures and with the dimensions and weights reported in the table below.

Crate1 (fig.1.1):
Electrical cabinet
Vertical upright
Connecting cables
X-ray tube column

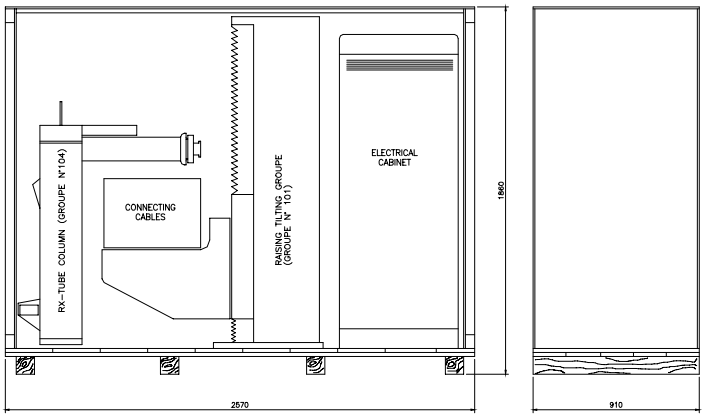



fig.1.1

Crate 2 (fig.1.2):
Column translator unit on a support to be returned
Compressor unit
Patient table
Console, Spot film device and Accessories

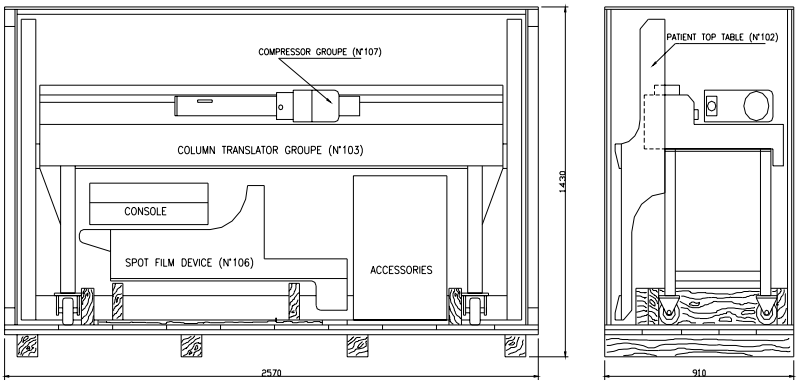



fig.1.2

Table of packed weight and dimensions of the DELTA 90-90PLUS

| PACKAGE No. | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| DESCRIP | Patient table | Foot-rest Shoulder-rest Hand-grips | Spot film device | Compressor | X-ray tube column | Column translator |
| BASE | 2450 | 780 | 1400 | 950 | 1250 | 2360 |
| WIDTH | 1300 | 340 | 620 | 200 | 600 | 800 |
| HEIGHT | 250 | 380 | 640 | 340 | 1250 | 1000 |
| WEIGHT | 70 | 12 | 71 | 19 | 84 | 265 |

| PACKAGE No. | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|
| DESCRIP | Vertical up-right | Compress. band | Electrical cabinet | Collimator | Console | I.I. support |
| BASE | 1380 | 430 | 600 | 350 | 600 | 1200 |
| WIDTH | 900 | 50 | 660 | 280 | 500 | 620 |
| HEIGHT | 1800 | 120 | 1620 | 340 | 1100 | 640 |
| WEIGHT | 535 | 4 | 173 | 12 | 23 | 30 |

LARGE CRATE: (2560x910x1900) 156 kg
SMALL CRATE: (2560x910x1470) 141 kg

All the dimensions are expressed in mm.
All the weights are expressed in Kg. and include the electrical cables.

Condition of the packed unit groups:

- The connecting cables protruding from the column and spot film device ducts are already the correct length and inside the sheath.
- The connecting cables between the electrical cabinet and the machine during transport are packed in a crate.
- All the connections are complete inside each unit.

### 1.3.2 *DELTA 30 case*:

The units that make up the DELTA 30 are packed in one crate with contents indicated in the figures and with the dimensions and weights reported in the table below.

Crate 1 (fig.1.3):

1. Main chassis.
2. Spot film device.
3. X-ray tube column.
4. Patient table
5. Compressor
6. Accessories.

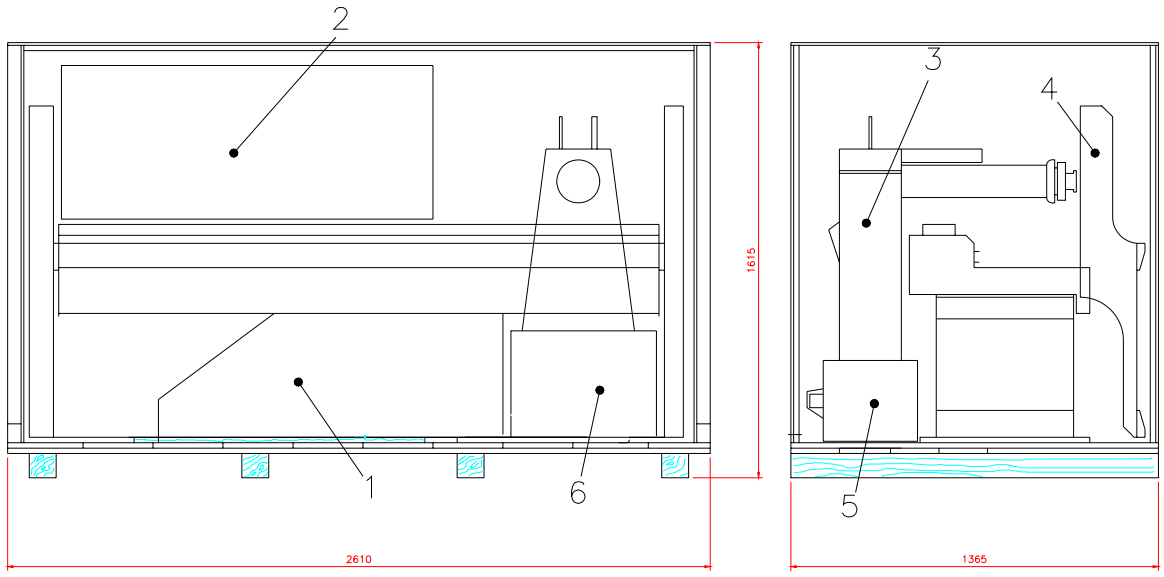



fig.1.3

Table of packed weights and dimensions of the DELTA 30

| PACKAGE No. | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| DESCRIP. | Patient table | Foot-rest Shoulder-rest Hand-grips | Spot film device | Compressor | X-ray tube column | Main chassis |
| BASE | 2450 | 780 | 1400 | 950 | 1250 | 2360 |
| WIDTH | 1300 | 340 | 620 | 200 | 600 | 900 |
| HEIGHT | 250 | 380 | 640 | 340 | 1250 | 1000 |
| PESO | 70 | 12 | 71 | 19 | 84 | 760 |

| PACKAGE No. | 7 | 8 | 9 | 10 |
|---|---|---|---|---|
| DESCRIP. | Compressor band | Collimator | Console | I.I. (dig.) support |
| BASE | 430 | 350 | 600 | 1200 |
| WIDTH | 50 | 280 | 500 | 620 |
| HEIGHT | 120 | 340 | 1100 | 640 |
| WEIGHT | 4 | 12 | 23 | 30 |

CRATE: (2560x910x1900) Kg.250

All the dimensions are expressed in mm.
All the weights are expressed in Kg. and include the electrical cables.

Condition of the packed unit groups:

- The connecting cables protruding from the column an spot film device ducts are already of correct length and inside the sheath.
- All the connections are complete inside each unit.

### 1.3.3 MOVEMENT INFORMATION NOTES:

- The conditions to which the contents must not be subjected and the weight are marked on each crate.
- The fork-positioning points for the forklift truck are indicated on the packing.
- Lifting and movement must be carried out by means of a forklift truck, respecting the fork-positioning points to ensure movement with a balanced load.
- The weight indicated on the crates is purely indicative.
- The equipment is wrapped in plastic inside the crates.
- On delivery of the machine make sure (visually together with the courier) that none of the units have been damaged in any way: if any damage is noted, this should be reported to the person responsible; any damage to the crate could indicate damage to its contents.
- During movement and assembly of the machine, work shoes and gloves, and appropriate clothing should be worn; the current accident-prevention regulations should in any case be carefully respected.

## 1.4 MOVEMENT AND LIFTING OF THE INDIVIDUAL UNITS.

After removing the crate packing, move the units according to the following indications:

### 1.4.1 *DELTA 90-90PLUS case*:

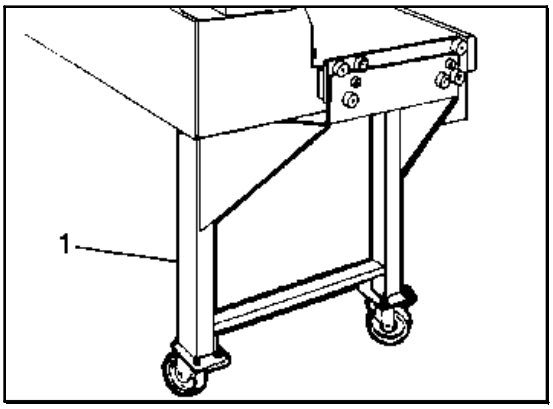



fig.1.4

Electrical cabinet: forklift truck required.

Procedure: insert the forks in the close-together points indicated on the long side of the nylon wrapping.

Take care not to damage the adjustable feet.

X-ray Tube Column: forklift truck required.

Procedure: tilt the column and insert the forks close together under the base.

Move the column in a fixed and balanced load condition.

Main upright: forklift truck with lifting chains required or equivalent.

Procedure: raise the upright by means of the relative eye bolts and taking into account the weight indicated on the packing.

Main translator column: (with packages on top)

Procedure: move using the support with wheels which must be removed when installation is complete and kept for subsequent movement.

If the remaining packages are moved manually, each operator should not carry more than 25 Kg.

N.B.: After positioning the main upright, replace the eye bolts with the plugs provided to ensure protection against water infiltration.

1.4.2 *DELTA 30 case*:

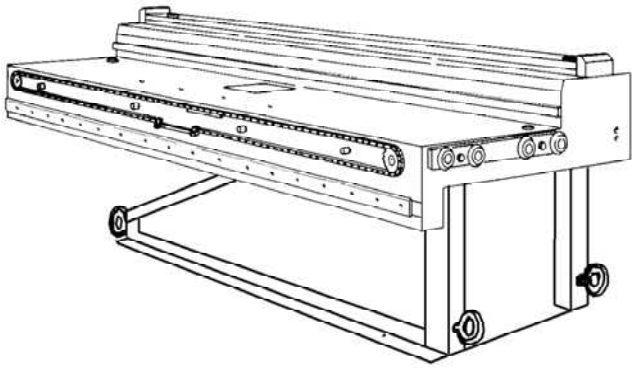


fig.1.5

X-ray Tube Column: forklift truck required.

Procedure: tilt the column and insert the forks close together under the base.
Move the column in a fixed and balanced condition.

Main chassis: forklift truck with lifting chains required or equivalent.

Procedure: raise the chassis by means of the relative eye bolts and taking into account the weight indicated on the packing.

If the remaining packages are moved manually, each operator should not carry more than 25 Kg.

N.B.: After positioning the main chassis, replace the eye bolts with the plugs provided to ensure protection against water infiltration and tilting of the patient table during the movements to +90° and to –30°.

## 1.5 OVERALL DIMENSIONS OF THE MOVING PARTS.

### 1.5.1 *DELTA 90-90PLUS case*:

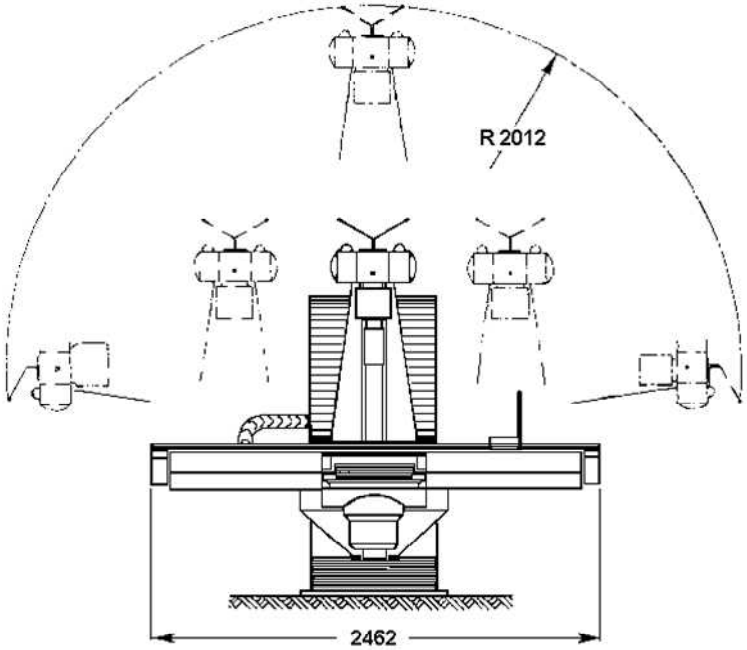



fig.1.6

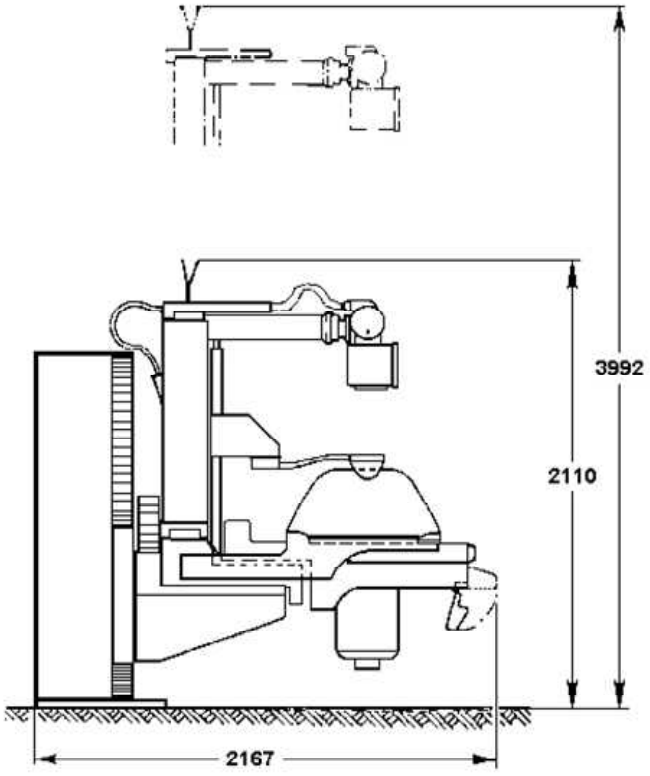



fig.1.7

1.5.2 *DELTA 30 case*:

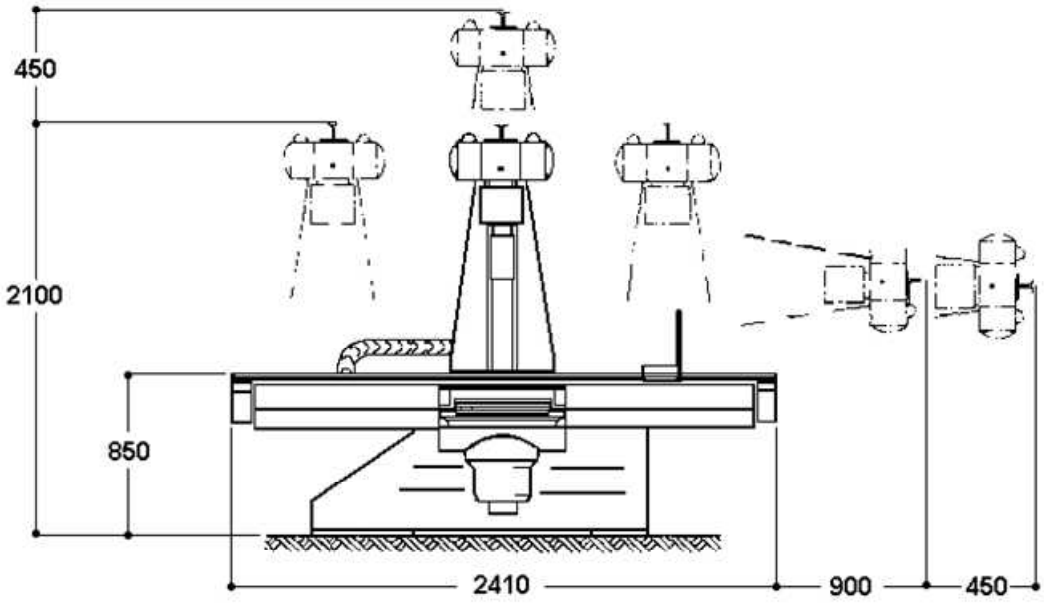



fig.1.8

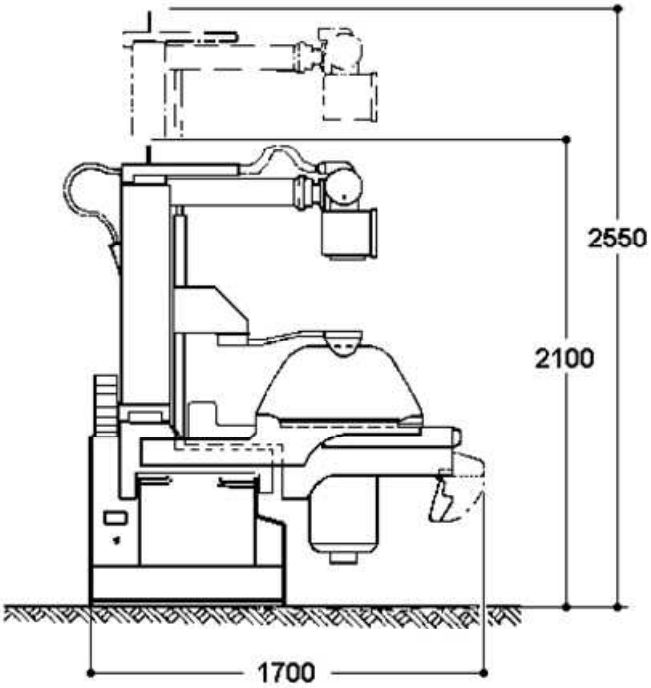



fig.1.9

## 1.6 POSITIONING: CHARACTERISTICS OF THE ROOM.

Respecting the minimum requirements for machine positioning and functioning, always check the following first: surrounding conditions, temperature, humidity, lighting, vibrations, dust, radiation emissions and the cleanliness of the room where the machine will be installed. DELTA 90 90PLUS, DELTA 30 must be installed in an appropriate room (with no infiltration of water from the ceiling), with controlled temperature and degree of humidity, and with no presence of gas mixtures that can constitute a danger of fire or explosion (e.g. Operating rooms, or inflammable anesthetics) in strict accordance with the current regulations regarding radiation emission (X-rays) (see example fig. 1.10 and 1.11).
A visual indicator must be positioned outside the room to warn that X-rays are being taken.

- Area occupied by the equipment: 4.8 sqm.
- Fig. 1.10 and 1.11 show the measurements (indicative) of the working spaces needed for safe use and rational maintenance of the machine.
- Minimum dimensions of the room: 380x390x260(h) cm.

The floor must be perfectly leveled, vibration-free and able to support the overall weight of the machine (+4 people).

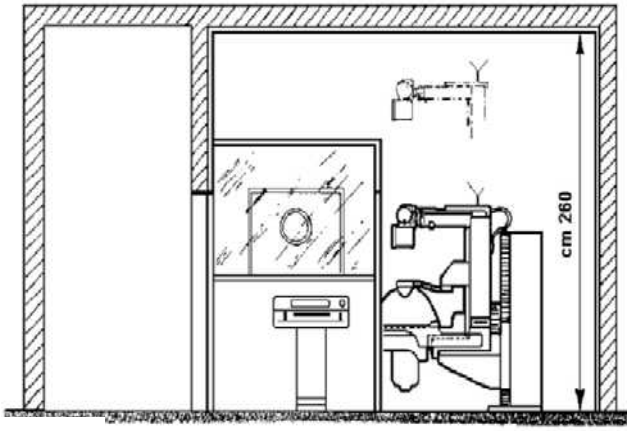



fig.1.10

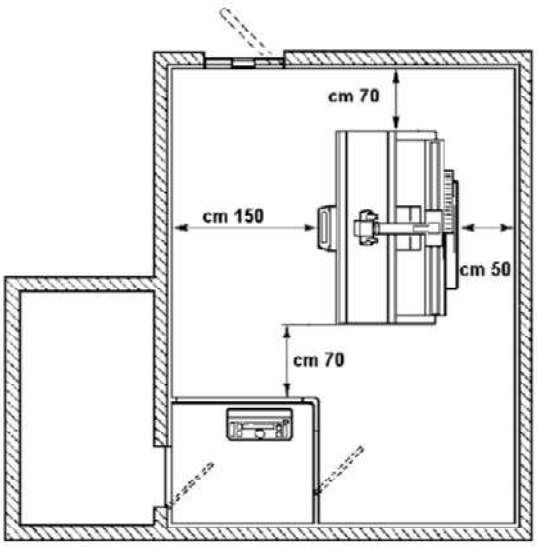



fig.1.11

## 1.7 INSTALLATION.

At this stage it is necessary to have a PC available with CATWIN software installed and to consult the specific tables (Ref. List of attached documents).

### Operative stage.

### 1) Installation :

Position the crates close to the installation area, remove the plastic wrapping from the individual units, which must be moved according to the indications in paragraph 1.3

DELTA 90-90 PLUS case: Position and fix the vertical upright to the ground as indicated in the following paragraph 1.8. Place the electrical cabinet in position, lay the cables connecting the cabinet to the vertical upright along their pre-arranged route, and connect as shown in the specific tables.

DELTA 30 case: Position and fix the chassis to the ground as indicated in the following paragraph 1.8. The DELTA 30 does not have an electrical cabinet apart from the machine. All the electrical components are integrated in the main chassis. Therefore, the two compartments front and rear of the main chassis that contain the electrical components and electronic of control will be called electrical cabinet.

The machine is supplied (unless specific otherwise) with connecting cables of different length that depends on the machine positioning inside the X-ray room.

As regards the connection of the cables of the X-ray tube column, the installer is advised to insert the power and x-ray tube control cables with the machine completely dismantled and the generator cabinet in its final position. The power cables must follow those of unit 2, (X-ray tube column) inserting them in the flexible duct and making them 20cm shorter than XC11/12/13.

N.B. Only for the DELTA 90-90PLUS: check that the high voltage cables and anode start cables were inserted preventively. Otherwise, it is necessary to install the cables, forming a not too tight loop between the compartment of the vertical upright and the entry into the flexible duct ( fig. 1.12), following the pre-installed cables.

fig.1.12

Do not lock for any reason, any cable inserted in the sheath.

Connect the electrical cabinet to the main power supply as shown in fig.1.13 in case of DELTA 30 and as shown in fig. 1.14 in case of DELTA 90-90PLUS.

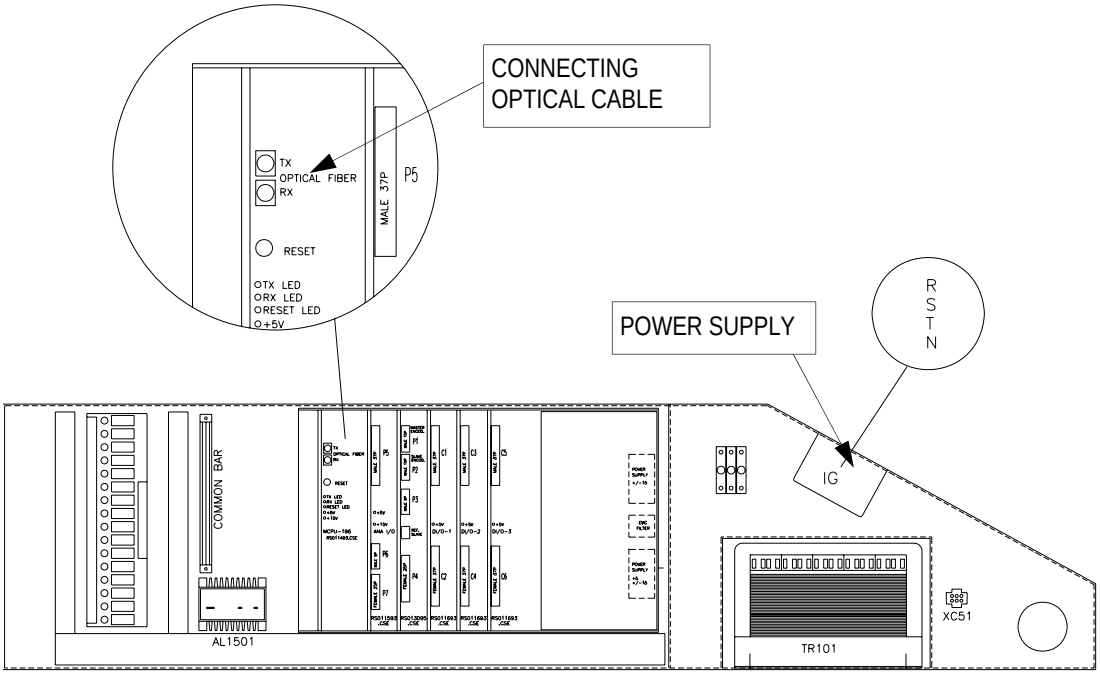
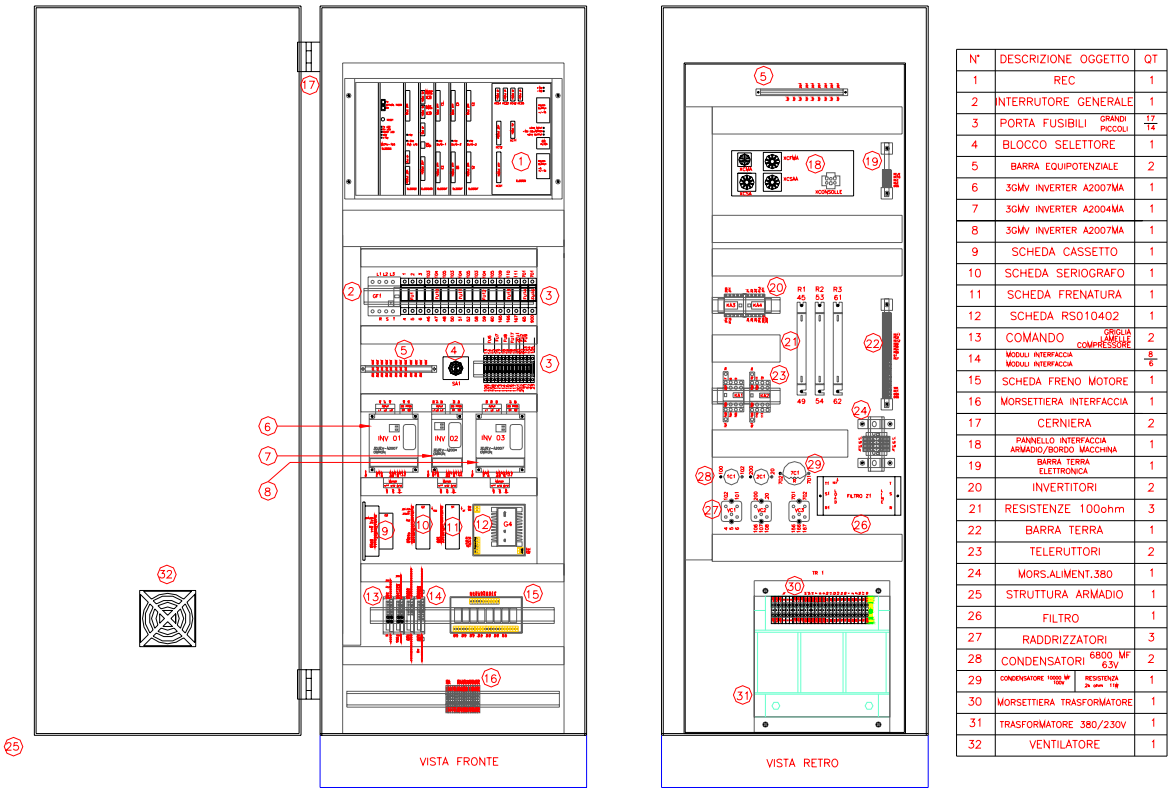



fig.1.13: DELTA 30




| N° | DESCRIZIONE OGGETTO | QT |
|---|---|---|
| 1 | REC | 1 |
| 2 | INTERRUTORE GENERALE | 1 |
| 3 | PORTA FUSIBILI GRANDI / PICCOLI | 1/4 |
| 4 | BLOCCO SELETTORE | 1 |
| 5 | BARRA EQUIPOTENZIALE | 2 |
| 6 | 3GMV INVERTER A2007MA | 1 |
| 7 | 3GMV INVERTER A2004MA | 1 |
| 8 | 3GMV INVERTER A2007MA | 1 |
| 9 | SCHEDA CASSETTO | 1 |
| 10 | SCHEDA SERIOGRAFO | 1 |
| 11 | SCHEDA FRENATURA | 1 |
| 12 | SCHEDA RS010402 | 1 |
| 13 | COMANDO GRIGLIA LAMELLE COMPRESSORE | 2 |
| 14 | MODULI INTERFACCIA / MODULI INTERFACCIA | 6/6 |
| 15 | SCHEDA FRENO MOTORE | 1 |
| 16 | MORSETTIERA INTERFACCIA | 1 |
| 17 | CERNIERA | 2 |
| 18 | PANNELLO INTERFACCIA ARMADIO/BORDO MACCHINA | 1 |
| 19 | BARRA TERRA ELETTRONICA | 1 |
| 20 | INVERTITORI | 2 |
| 21 | RESISTENZE 100ohm | 3 |
| 22 | BARRA TERRA | 1 |
| 23 | TELERUTTORI | 2 |
| 24 | MORS.ALIMENT.380 | 1 |
| 25 | STRUTTURA ARMADIO | 1 |
| 26 | FILTRO | 1 |
| 27 | RADDRIZZATORI | 3 |
| 28 | CONDENSATORI 6800 MF 63V | 2 |
| 29 | CONDENSATORE 10000 MF 100V / RESISTENZA 2k ohm 11W | 1 |
| 30 | MORSETTIERA TRASFORMATORE | 1 |
| 31 | TRASFORMATORE 380/230V | 1 |
| 32 | VENTILATORE | 1 |

fig.1.14: DELTA 90-90PLUS

Position and connect the Console as shown in the specific documentation (Ref. to Part 5 of this manual).
Attach the" set up connectors" as indicated in part 5 of this manual (Tab.2).

Turn on the electrical cabinet by means of the main switch.

Press the" Power On " button on the console an command:

In case of DELTA 90-90 PLUS: lowering of the column translator by maintaining it in a horizontal position, till the minimum height from the ground.
If no anomalies are encountered, assemble the column translator and the column, spot film device and patient table.

In case of DELTA 30: check the tilting range –30°÷0° and the range +90°÷ 0°.
If no anomalies are encountered, assemble the column, spot film device and patient table.

*If movement problems are encountered following the installation of the individual units, it is necessary to proceed step by step checking the connections of the cables as specified below:*

*- Connect the PC with the CATWIN software installed to the optical fiber like in DELTA 90-90PLUS on the micro-card inside the electronic rack, and in case of DELTA 30 as shown in fig.1.13. Turn on the PC and launch the program using the PC keyboard, check whether the status inputs are configured according to Table 1. part 5, if not check the service connectors referring to Table 2 part 5.*

## 2) Cable Connection

Before connecting the cables to their respective connectors, check that all the contacts have been perfectly inserted and locked to the connectors, thus obtaining a correct contact between the pins.

- Insert the cables in the pre-arranged positions, following the layout provided.
- First connect the cables of:

DELTA 90-90 PLUS case:

- vertical upright
- column translator
- column
- spot film device
- tube/collimator

DELTA 30 case:

- chassis
- spot film device
- tube/collimator

- It is however necessary to check the correct length of the tube/collimator cables, before forming the external loop (X-ray column and collimator), which allows the cables to move up, down and follow the rotation without any obstacles.
- The I.I. cables and the imaging system, if fitted, must be inserted in an orderly fashion and parallel to each other, in order to prevent them from overlapping each other and detaching the sections of the duct.
- It is indispensable that the length of the unit connecting cables be correctly arranged inside the machine.

The cables must be left free to move inside cable guides, do not fix cables FOR ANY REASON with plastic lockers to pack cables inside cable guides.

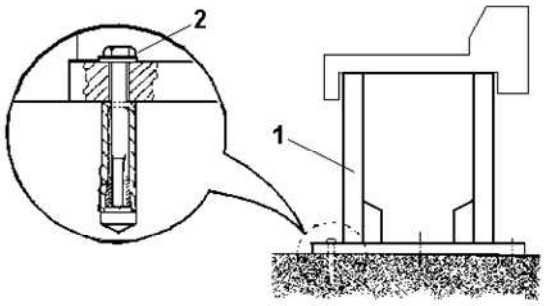
## 1.8 FIXING TO THE FLOOR.

To ensure good working results, the machine must be fixed to the floor since it has to function in totally stable conditions and with no vibrations whatsoever.

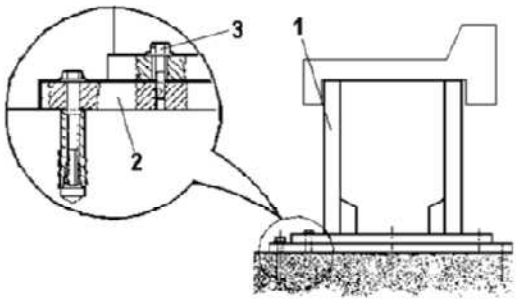
Depending on the type of the floor, the fixing systems of the base (vertical upright for the DELTA 90-90PLUS and chassis for the DELTA 30) can be:
A) Direct fixing by means of expansion bolts (fig.1.15), suggested only for the DELTA 30.
B) Fixing to a steel counter-plate previously fixed to the floor (fig.1.16).
C) Fixing to steel bars buried inside the floor.

The types of fixing B) and C) are suggested for the DELTA 90-90PLUS and are to be used for the DELTA 30 if the load capacity of the floor is low.

DELTA 30

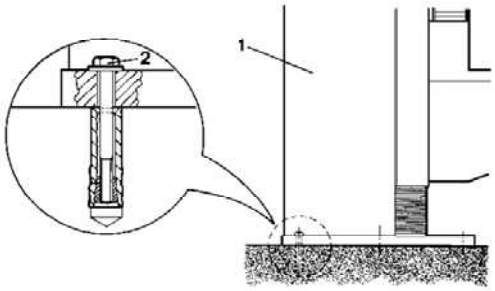



1) Base fig.1.15
2) n° 6 Fischer
SL-M12 bolts (c.l. 8.8)

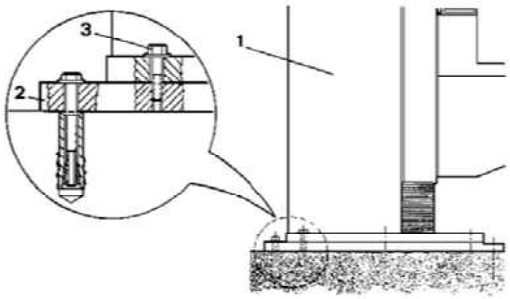



1) Base fig.1.16
2) Counter-plate
3) 6 M12x50 screws

DELTA 90-90PLUS




1) Base fig.1.15
2) n° 6 Fischer
SL-M12 bolts (c.l. 8.8)




1) Base fig.1.16
2) Counter-plate
3) 6 M12x50 screws

## 1.9 LEVELLING.

- Fix, not yet definitively, the base with an overload towards the rear part (about 1 degree) in order to reach the correct and definitive leveling.
- Check by means of a spirit level.
- Make the definitive fixing.
- Install the units of the machine.

For correct functioning of the remote-control table it is indispensable to maintain the correct positioning of all the relative electrical connections, particularly the ground and earth connections, following the layouts and indications provided by the Manufacturer and respecting the current regulations regarding electromagnetic compatibility.

## 1.10 MAIN COLUMN TRANSLATOR BASE ASSEMBLY (ONLY FOR THE DELTA 90-90 PLUS).

This operation is possible when the mobile surface of the tilting base is in a perfectly horizontal position.
Connect the upright unit connectors with the rack through the cables supplied with the equipment, insert service connectors into group cables, so to bypass the positioning safety inputs.
Connect the main console to the rack and fiber optics to the microcontroller board, and press the "POWER ON" command from the main keyboard.
If all the connections have been correctly set-up, it will be possible to move the translation base.

Proceed as follows:

- Lower the mobile surface of the tilting base to the minimum height from the ground by keeping the related key of the console pressed.
- Position the column translator, with the mobile support supplied, on the mobile surface of the tilting base, aligning the fixing holes (n° 8) and checking that the connecting cables correspond with the central trough-hole.
- Before tightening the bolts in the 8 fixing holes, make sure that the column translator is perfectly centered on the raising unit.
- Raise the column translator by means of the control on the console.
- Complete the fixing of the column translator and connect the cables relative to unit 3.
- Remove the mobile support.

## 1.11 X-RAY TUBE COLUMN ASSEMBLY

- Insert the column on the guide and fix it to the double translation chain, fig. 1.17

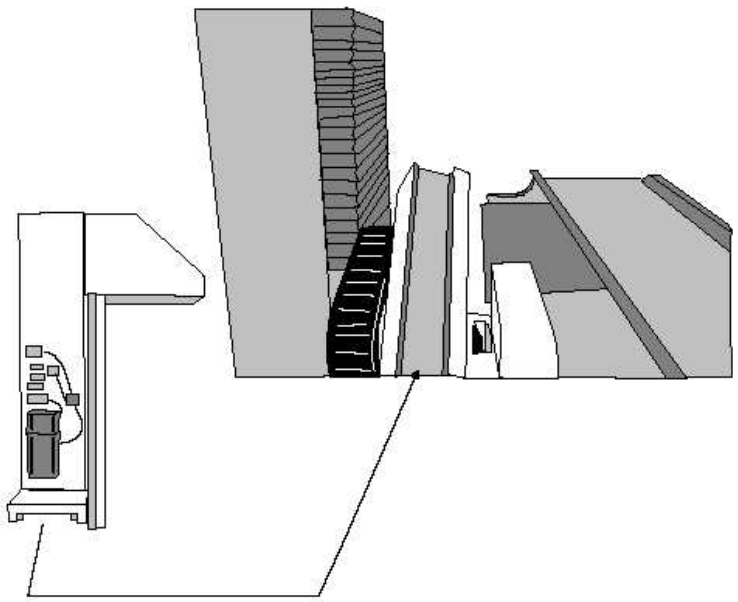


Fig 1.17

When inserting the column on the guide, particular attention should be paid to the limit switches so as to avoid damaging them.

- After fixing the column to the chain, connect and check the cables relative to the column unit, the collimator and the X-ray tube.
- Fix the flexible cable duct to the relative supports.

## 1.12 SPOT FILM DEVICE ASSEMBLY.

- The spot film device carriage should be installed on the right-hand side of the machine and moved to the centre so that the fixing holes are aligned with those of the column translator. After this operation the compressor should be installed, taking care not to rotate the compressor rod excessively. The spot film device cables should then be attached to the relative connectors.
- Fix the column of the compressor to the spot film device and the rod to the X-ray tube unit.
- Then attach the connector of the two rod extension micro-switches to the spot film device and the compressor to the XC26 connector .
- After having mechanically fixed the spot film device to the simple front chain, connect the image intensifier and the I.I. safety micro-switches.

## 1.13 PATIENT TABLE ASSEMBLY.

After having correctly installed the previous units and carrying out the necessary checks, proceed with the patient table assembly in this way:

- Insert it in the two guides of the column translator unit.
- Press it until the rack presses against the two pinions.
- Keeping the table pressed down, press the “table backward” key (D fig. 1. 18) on the spot film device keyboard until the rack engages on the pinion to allow independent movement of the patient table.
- Check that the internal and external micro-switches intervene.
- Install the two covers which close the ends of the table.

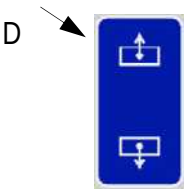


fig. 1.18

When all the installation stages are complete, the final configuration of the machine is as shown in fig.1.19 and in fig.1.20.

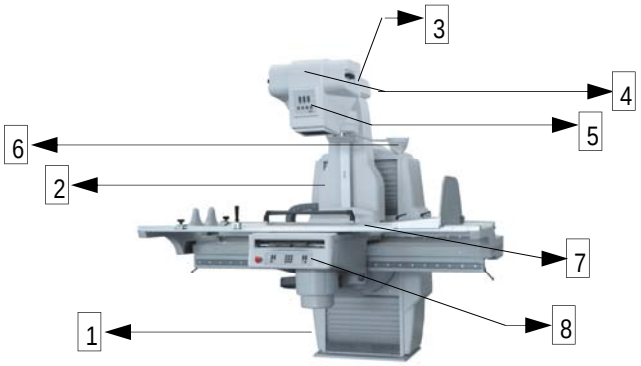



fig.1.19:*DELTA 90 –90 PLUS*

The DELTA 90 (PLUS) radiological table is essentially composed of:

1) Patient table raising column
2) X-ray tube raising column
3) X-ray tube rotation unit
4) X-ray tube
5) Collimator unit
6) Patient compression unit
7) Patient table
8) Spot film device (in the DIG version is replaced with an I.I. carriage)

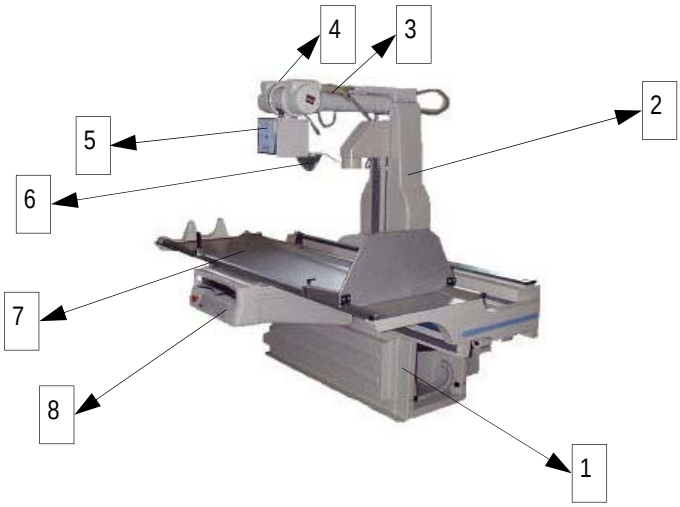



fig.1.20:*DELTA 30*

The DELTA 30 radiological table is essentially composed of:

1) Main chassis
2) Tube raising column
3) Tube rotation unit
4) X-ray tube
5) Collimator unit
6) Patient compression unit
7) Patient table
8) Spot film device (in the DIG version is replaced with an I.I. carriage)

# PART 2

# SET-UP

*DELTA 90, DELTA 90 PLUS, DELTA 30*

| Revisions: | | |
|---|---|---|
| Filename | No. | Date |
| MAN056 | 2 | 10/05/2010 |
| DELTA 30: MAN005-2 | 1 | 1/09/1998 |
| DELTA 90:MAN003-2 | 2 | 10/01/2003 |

# 1. RAISING AND TILTING AXES SET-UP.

## 1.1 INTRODUCTION.

When installation is complete, the preliminary set up operations of the machine must be carried out by checking the main functioning parameters of the individual units.

The following must be available:

- Reference documents, including the following wiring diagrams on the specific tables:

DELTA 90-90PLUS case:

| | |
|---|---|
| SCH 1001 | - Wiring diagrams . |
| DCE 0019 | - Component lay-out in the cabinet. |
| DBM 0007V01 | - Connections on the machine. |
| DBM 0008V01 | - Cable composition on the machine. |
| DBM 0009V01 | - Analog signals and shielded cables. |
| DBM 0010 | - System ground wiring. |
| DBM 0011V01 | - Components lay-out on the machine. |

DELTA 30 case:

- Reference documents, including the following wiring diagrams on the specific tables:

| | |
|---|---|
| SCH 3001: | wiring diagram. |
| DCE 0001: | components lay-out. |
| DBM 0001: | connections on the machine. |
| DBM 0002: | connectors. |
| DBM 0003: | cable composition. |
| DBM 0004: | analog signals connection. |
| DBM 0005: | ground collector. |
| DBM 0006: | components lay-out. |

- Instruction manual.
- PC and CATWIN s/w provided.

The following preliminary operations must be carried out:

- The optical fiber serial cable must be connected to the PC and the microprocessor board (fig.2.1)
- The machine data must always be loaded on the PC from the E²ROM on the microprocessor board.
- By means of the CATWIN program, monitor the status of the inputs and the potentiometers. The right menu path is: "*Data Handling", "Axis Travels",* then select *the potentiometer of interest.*
- For partial adjustments, following the replacement of some components, the use of the set-up connectors is not necessary.

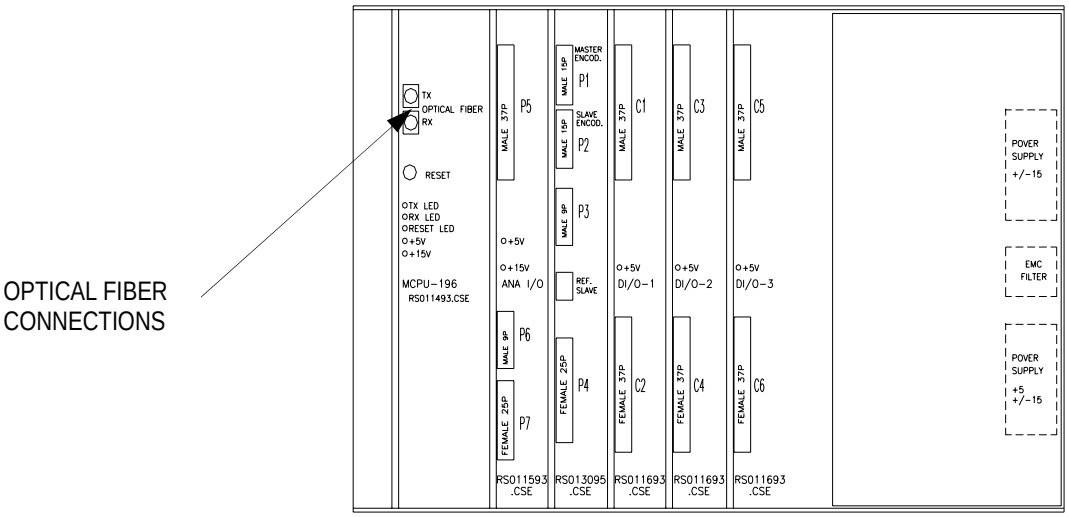



fig. 2.1

## 1.2 RAISING AXIS CHECK (*ONLY FOR DELTA 90-90PLUS*).

- Conditions:
  Machine tested by the manufacturer before dismantling of the units for transport.

- Aim:
  Check the stroke range controlled by potentiometer extends outwards to the positions of the limit switches and inwards to the positions of the overtravel microswitches. To check the correct intervention of the safety devices ( brake and overtravel microswitches).

- Foreword:
  During the check, make sure that the reference value of the potentiometer relative to the tilting axis corresponds to the 0° position of the column translator and is central with respect to the total stroke range of the potentiometer.

IMPORTANT: if the reference value of the tilting potentiometer does not correspond to the central value during raising-lowering of the remote-control table, the column translator will also rotate while it is being raised. This is due to the software link between the two movements, which prevents interference with the ground.

- Procedure:
  Check the stroke range of the potentiometer as follows:

  - Launch the CATWIN s/w.
  - Load the data stored in the $E^2$ROM on the microprocessor board.
  - Display the maximum, minimum stroke range and the present values of the potentiometer, recorded during testing.
  - On the spot film device keyboard, press the raising/lowering key until it stops at the top/bottom after a proper decelerating ramp, controlled by the s/w, and check the potentiometer values (channel read values) and the intervention on the cams of the upper/lower limit switches.

    If the stroke range is correct (stopping due to intervention of the cams of the limit switches with channel read values respectively 3 / 4 units more and less than the $E^2$ROM reference values, and corresponding to the upper and lower limit switch position) the check is complete.
    If, on the other hand, the read values are very different or stop does not occur or occurs in advance with respect to the procedure guided by the s/w, new reference values must be entered and the movement repeated until the correct stroke range is achieved.

    Check the correct intervention of the limit switches and, manually, the intervention of the overshoot switches by disconnecting the power supply to the inverter.

## 1.3 TILTING AXIS CHECK.

- Conditions:
  Machine tested by the manufacturer before dismantling of the units for transport.

- Aim:
  To check that the stroke range controlled by the potentiometer extends beyond the positions of the limit switches and inwards to the positions of the overtravel microswitches. To check .the correct intervention of the safety ( brake and overtravel microswitches).

- Procedure:
  Proceed as for point 1.2, enabling tilting from the spot film device keyboard and checking that the maximum and minimum potentiometer values cover a stroke of 180° (+90°/-90°) in the delta 90-90PLUS case and of 120° (+90°/-30°) in the DELTA 30 case, greater therefore than the stroke range between the two overtravel microswitches.
  Check the correct intervention of the limit switches and, manually, the intervention of the over-travel switches by disconnecting the power supply to the inverter.
  Using a spirit level, make sure the column translator is perfectly horizontal.

In this condition, the reset control should not cause any movement, merely the lightning up of the "zero tilting" LED.

# 2. COLUMN TRANSLATOR SET-UP.

- Conditions:

  Machine tested by the manufacturer before dismantling of the units for transport.
  Carry out the following operations after installing the X-ray tube column, the spot film device and the compressor.

- Aim:

  To check that the stroke range controlled by the potentiometer extends beyond the positions of the limit switches.
  To check the correct intervention of the safety devices (brakes).

- Procedure:
  - After checking that the cables correspond correctly to the connectors on the machine, check the release of the brakes (Master and Slave).
  - Center the angle of incidence column/spot film device. Move the mobile arm of the compressor until it is longitudinally centered with respect to the column (visual check). In this condition the angle of incidence is 0°, corresponding to the "zero" value of the E²ROM.
  - Center the X-ray tube column with respect to the column translator. Move the angle of incidence to zero, centering between them the X-ray tube column and the spot film device. Move the column/spot film device group, visibly to the center of the translation base. Check that the "*Actual position* " of the potentiometer of the column does not exceed the values within ± 50 units from the "*Central travel value in E²ROM*". If the required position is not reached, adjust the value in E²ROM by writingit in the "*Actual position*" potentiometer ("*Column positioning*" menu).
  - Check the maximum range of the angle of incidence.
    Aim: with the maximum stroke of the column/spot film device unit the angle of incidence should not exceed the values of +40° and -40°. Hold down the *"COLUMN/SPOT FILM DEVICE CLOCK WISE/COUNTERCLOCKWISE INCLINATION*" key. When it stops there should be a distance of 580mm as shown in fig. 2.2. If this does not occur, increase or decrease (as needed) the angle of incidence until the previous case is not reached, see condition fig. 2.2 and change the maximum value (or minimum) in E²ROM as "Actual position" potentiometer shows.
  - Move the X-ray tube column to the left limit switch and to the right limit switch. Read the respective numerical values on the potentiometer and compare them with the E²ROM reference values. Bear in mind that the channel read value must always be respectively 3 / 4 units more and less than the E²ROM reference values corresponding to the left and right limit switch positions.

If the potentiometer does not reach this value when the column translator has been moved to the limit switch by means of the spot film device keyboard, then the E²ROM reference values must be changed. This procedure applies to the calibration of both the column unit and the spot film device.

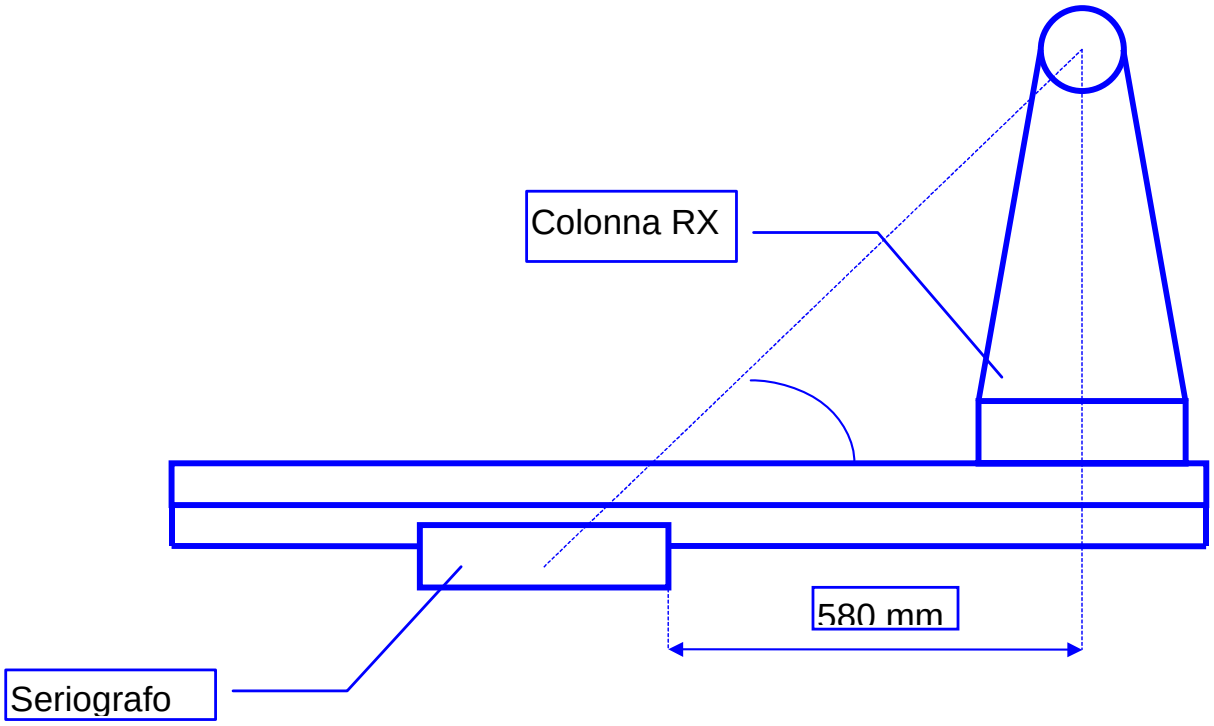



fig. 2.2

# 3. X-RAY TUBE COLUMN SET-UP.

## 3.1 INTRODUCTION.

The X-ray tube column unit contains various components that are involved not only in moving the column but also in rotating the X-ray tube arm. The mechanical stroke for raising the X-ray tube column is 450 mm; the rotation of the X-ray tube is 180°. Check the efficiency of the tube microswitch at 0°.

## 3.2 X-RAY TUBE RAISING CHECK.

Check that command correspond to the rotation direction of the three-phase motor M401. Check that the channel and reference read values coincide with the contact with the upper (Tube at 1500mm) and lower (Tube at 1050mm) limit switches. Check the potentiometer values "*Tube height*" respect with: tube in position 1050mm the read value on the "*Actual position*" screen must be about 5 units higher than the setup value in $E^2$ROM as limit switch position; and tube in position 1500mm, the value on "*Actual position*" must be lower of about 5 units to the setup maximum value in $E^2$ROM. If this does not occur, change the values in $E^2$ROM consequently.

# 4. SPOT FILM DEVICE SET-UP.

## 4.1 INTRODUCTION.

Check that the cables of Unit 04 (spot film device) are connected correctly.

## 4.2 LIMIT SWITCH CHECK.

- Start the CATWIN s/w and load the values memorized in the E²ROM.
- Activate the "*Data Handling*" and select the "*Axis Travels*"menu, and then "*Cassette*".
- Insert and extract a film cassette by pressing the relative pushbutton on the spot film device keyboard until it comes into contact with the inner/outer limit switches.
- Check that "channel reading" value is close to the "reference reading" value. If not, modify the reference reading value.

## 4.3 FILM SIZE DETECTION.

Use the "CATWIN" service software:

- From "*Data Handling*" select "Film Size".

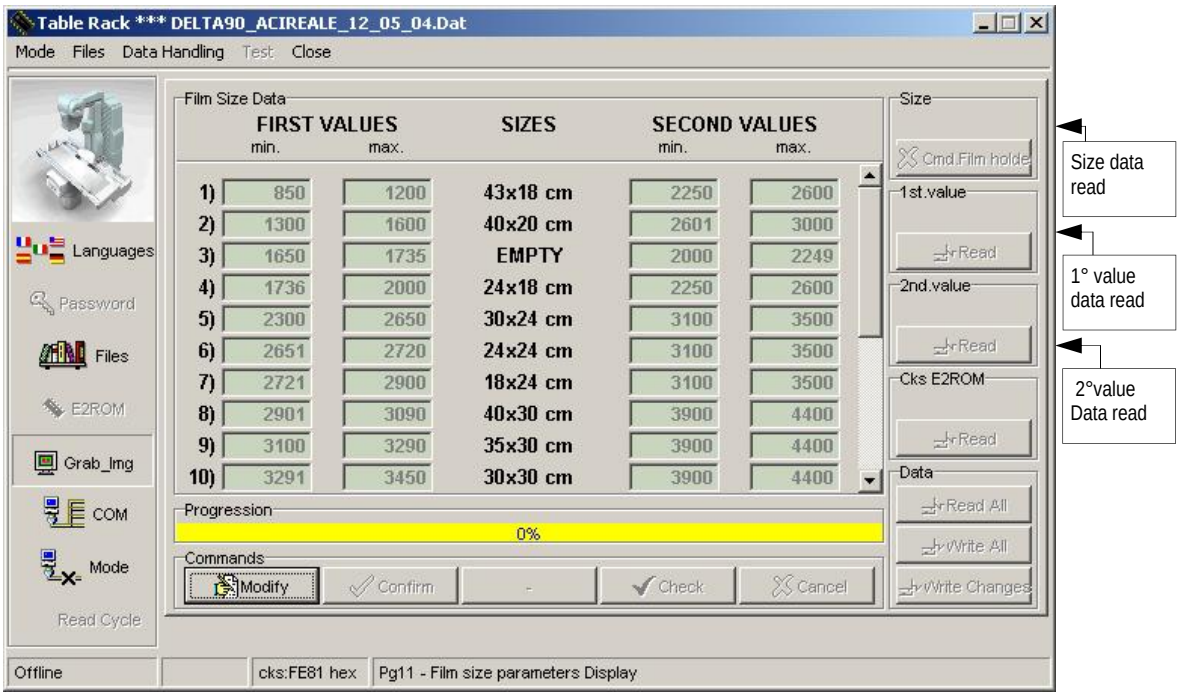



fig. 2.3: Format page

When the cassette has been parked inside the spot film device, the program calculates the film size , and displays it in the "Size" window through the "Film size detection" proximity switch and reading the cassette position potentiometer.

If the film size displayed in the "Size" window (upper right part of the window in fig. 2.3) does not correspond to the correct size , it is necessary to modify the values in the "min" and "max" windows of the "Film size data" (***"FIRST VALUE"*** and ***"SECOND VALUE"*** columns), in correspondence of the inserted film size: correct those data based on the "*First value*" and "*Second value*" windows, located in the column at the right of the table, as shown in fig. 2.3

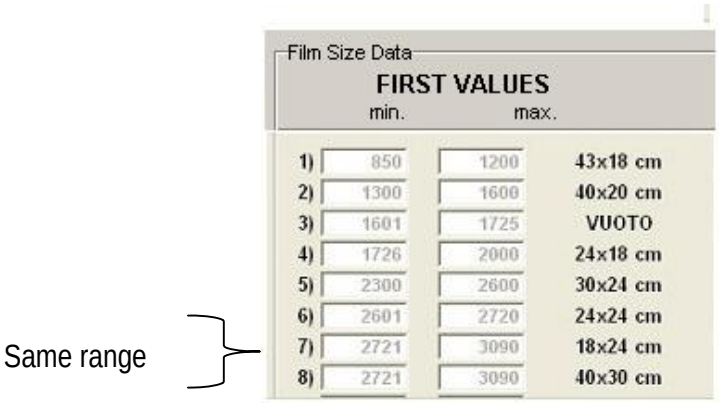
In order to achieve a correct behavior of the program, it is necessary that the range of all the ***"First Value"*** size ranges must not overlap in any case; check that the minimum value of each size must ALWAYS be higher than the maximum value of the preceding size, while the maximum value must ALWAYS be lower than the minimum value of the following size.

This general rule admits 3 exceptions, related to the following range of sizes:

- 18 x 24 and 40 x 30
- 43 x 35 and 24 x 30
- 35 x 43 and 20 x 40

For each of those three couples, the ranges can overlap.

*Sample:*




As it can be seen in the above sample table, the ***"First value"*** range of said sizes are the same.

The ***"Second Value"*** ranges are directly related to the width of each cassette size as shown in *fig. 2.3* all range of sizes.

*NN x 24 cm* are the same, just like *NN x 30 cm* will be, x 40, x43 and so on. This to explain that the ***"Second Value"***, makes a measurement of the cassette size only on one side, while

the ***"First Value"*** is made between an interval of values that depends upon both dimensions.

## 4.4 SHUTTER OPENING.

*Initial situation:* Tube and collimator are already assembled on the equipment; tabletop and spot film cover must be not assembled.

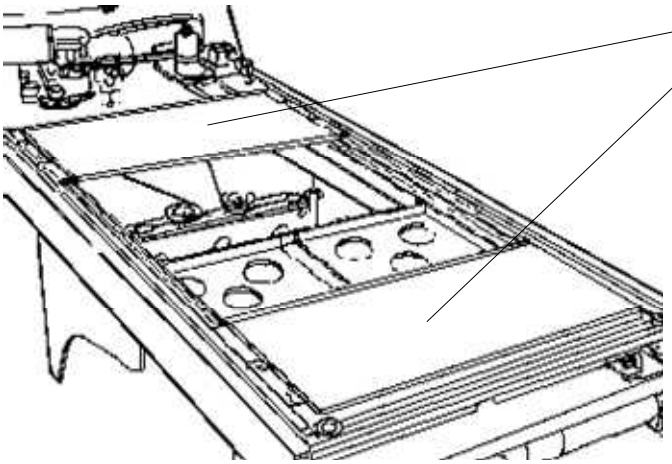



fig. 2.4

With the machine already tested and set up , the check of the shutters opening in a first moment can be made "at sight" by inserting a cassette inside the spot film device and checking that the shutters opening is slightly smaller than the film size, when on the console a "full area" exposure has been chosen. The opening of the shutters also depends on other settings, like "*Delta Shutters*" or the '"Film *Edge Offset*", for a cassette of 430 mm, the opening must be around 410/415 mm. A more exact evaluation of the shutters opening will be made after the film exposure.

## 4.5 FILM EDGE OFFSET CHECK.

The FILM EDGE OFFSET is the distance between the outer edge of the film cassette and the film itself. The default value is 14 mm. To modify this value, proceed as follows:

- Activate "*DATA HANDLING*" - "*GENERAL PARAMETERS*", "*Cassette Edge Offset*" . The current offset value will appear. Modify appropriately. Final setup is done on the basis of the results obtained on the X-rays.

## 4.6 SHUTTERS DELTA CHECK.

The shutters delta is the distance obtained on the same film between one exposure and the next one.

- "*Data Handling*" - "General Parameters", "*Space between two exposures on the film ( SHUTTER DELTA)*" The shutter delta value is obtained on the basis of the results obtained on the X-rays. Never go below the value *"3"*.

## 4.7 PHOTOCELL CHECK.

- By inserting any object between the photocell and the reflecting surface, the beam is interrupted and the film cassette is locked; at the same time the "W5" "Hand Security Photocell." warning message is displayed on the console.
- To reset, remove the obstacle and press the "Cassette Insertion" key.


fig. 2.5

## 4.8 FINAL SET UP.

The equipment is delivered already tested by means of a functional test. The final calibration and setup of the equipment is to be made only when the machine is completely installed in its configuration, and consists of checking the focus-film and the collimator centering.
The final part of calibration and set up is carried out by Qualified Personnel who have attended a specific training course held by CAT Medical Systems, or directly by the personnel of CAT Medical Systems.

The X-ray tube is supplied with proper spacers to be correctly centered, depending upon the size of the Image Intensifier to be installed. The tube focal spot must be exactly aligned with the input screen center of the I.I., in most cases, this center corresponds to the mechanical center of the spot film device, which is located at the 450mm from the front part of the spot film device structure (keyboard side).
The central axis tube/I.I. is used as reference center of the spot film device, from this point is derived the position of the cassette corresponding to "*E²ROM middle value*" and consequently also the value of *"Film holder pot. value 410mm from zero position to outside"*.

These values are always factory-set; it is anyway advisable to check them by exposing some films for testing; Slight adjustments could be needed.

A film would be exposed in a panoramic modality, in order to control the centering of the cassette and the complete exposure of the film. If the centering is not good, repeat the procedure with setting up the cassette parameters; if the centering is correct, but the film wasn't exposed in all its surface, an eventual check and adjustment of the OFFSET CASSETTE value is needed, and an eventual setup of shutters.

Once the film exposure in a "full area" mode is correct, pass to the exposure check by dividing the film in sectors and checking that the space between is the desired one.

If twoconsecutive exposures on the same film are too much spaced between, and the user would like to reduce this distance, it will be necessary to reduce the parameter called "*Space between two exposures (DELTA SHUTTER)*" as per paragraph 4.6 , page 12.
If the exposures are too distant, but the above cited value has already been set to the minimum, it is advisable to modify the parameter called *"Film holder pot. value 410mm from zero position to outside"*, high or low, in order to achieve the best compromise for both big and small size films.

Spare page.

# PART 3

# ELECTRICAL ADJUSTMENTS

*DELTA 90, DELTA 90 PLUS, DELTA 30*

| Revisions: | | |
|---|---|---|
| Name of file | Num. | Date |
| MAN056 | 2 | 10/05/2010 |
| DELTA 30: MAN005-3 | 1 | 1/09/1998 |
| DELTA 90:MAN003-3 | 3 | 10/01/2003 |

# 1. ELECTRICAL ADJUSTMENTS TO RAISING (DELTA 90-90PLUS ONLY) AND TILTING AXES FOLLOWING COMPONENT REPLACEMENTS.

## 1.1 INTRODUCTION.

Following the replacement of components, it may be necessary to carry out electrical adjustments and to then check the main functioning parameters of the individual units.
Therefore, these tools must be available :

- Reference documents, including the following wiring diagrams on the specific tables:

case DELTA 90-90PLUS:

| | |
|---|---|
| SCH 1001 | - Wiring diagrams. |
| DCE 0019 | - Component lay-out in the cabinet. |
| DBM 0007V01 | - Connections on the machine. |
| DBM 0008V01 | - Composition of cables on the machine. |
| DBM 0009V01 | - Analog signals and shielded cables. |
| DBM 0010 | - System ground wiring. |
| DBM 0011V01 | - Component lay-out on the machine. |

case DELTA 30:

- Reference documents, including the following wiring diagrams on the specific tables:

| | |
|---|---|
| SCH 3001: | Wiring diagrams. . |
| DCE 0001: | Component lay-out. |
| DBM 0001: | Connections on the machine. |
| DBM 0002: | Connectors. |
| DBM 0003: | Composition of cables. |
| DBM 0004: | Analog signals connection. |
| DBM 0005: | Ground collector. |
| DBM 0006: | Components lay-out. |

- Instruction manual.
- PC and CATWIN s/w provided.

Preliminary operations.

- ✓ Connect the optical fiber serial cable to the PC and the microprocessor board (fig.2.1).
- ✓ Launch CATWIN s/w and load the "preset configuration data" selecting the items from the menu in the order indicated below.
- ✓ *Before turning on the equipment, or anyway with the machine turned off, change the write-lock jumper, which is located in the lower part of the board on component side, from the READ ONLY position to READ/WRITE position, i.e. insert it between the central and the lower pins.*
  *Once completed the modifications, turn OFF the equipment and move the jumper to the READ ONLY position, i.e. connect the central and upper pins. See fig 3.1*

The jumper in the picture is in the WRITE/READ position.

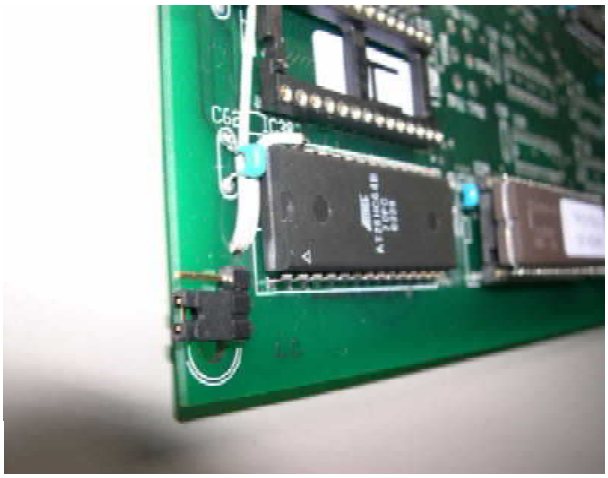


fig.3.1

Once the filename has been assigned (see "CATWIN User Manual"), select the E²ROM icon, from the window "*Read/ Write E²ROM"* select the *"Read E²ROM" icon.*

## 1.2 RAISING AXIS CALIBRATION (*DELTA 90-90 PLUS ONLY*)

Components which may need to be replaced:

- ✓ Limit switches (see fig. 3.2).
- ✓ Overtravel switches (see fig. 3.2).
- ✓ Inverter.
- ✓ Potentiometer.

Machine condition: already correctly functioning.

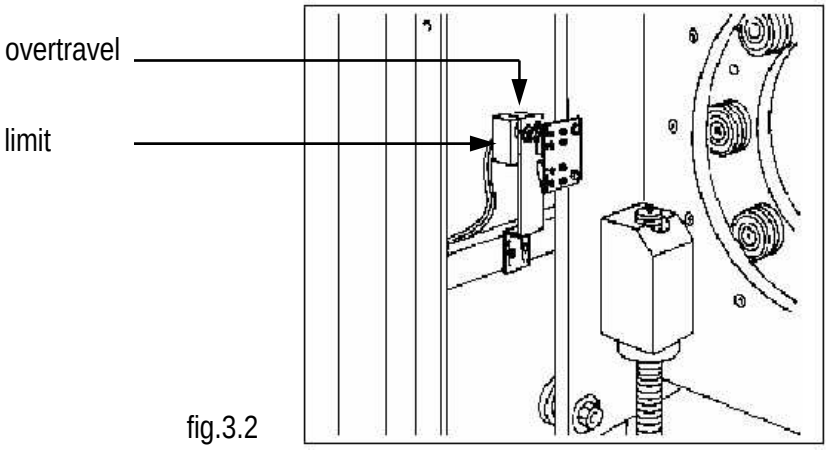



fig.3.2

### 1.2.1 LIMIT SWITCH REPLACEMENT.

Foreword:

If possible, measure the distance between the head of the microswitch to be replaced and the support for comparison with the dimensions of the new part.

Operative phase.

After fitting the limit switch in its housing and connecting it electrically, check the stroke range of the potentiometer as follows:

1. Start the CATWIN s/w, load the E²ROM data as in paragraph 1.1 page 3, and from menu "*Data Handling"* select "*Axis travel*" in from the window "*Axis Selection"* select *"Raising".*
2. On the spot film device keyboard, press the raising/lowering key until it stops in the upper/lower position, controlled by the s/w, and check both the "channel read" and the intervention of the cams on the upper/lower limit switches.

The stroke range is correct if the movement stops due to intervention of the cams with "channel read" respectively 3/4 units higher and lower than the present values on the E²ROM and corresponding to the upper and lower limit switches positions: the check is complete.

If this is not the case, mechanically adjust the microswitch until the correct stroke range is achieved.

In case that after the mechanical adjustment when the movement stops, the read value of the potentiometer in the "*Actual Position"* is incorrect or it does not stop, or stops beforehand the guided by s/w procedure, it is necessary to setup the E²ROM values and repeat the movement until the stroke range is correct.

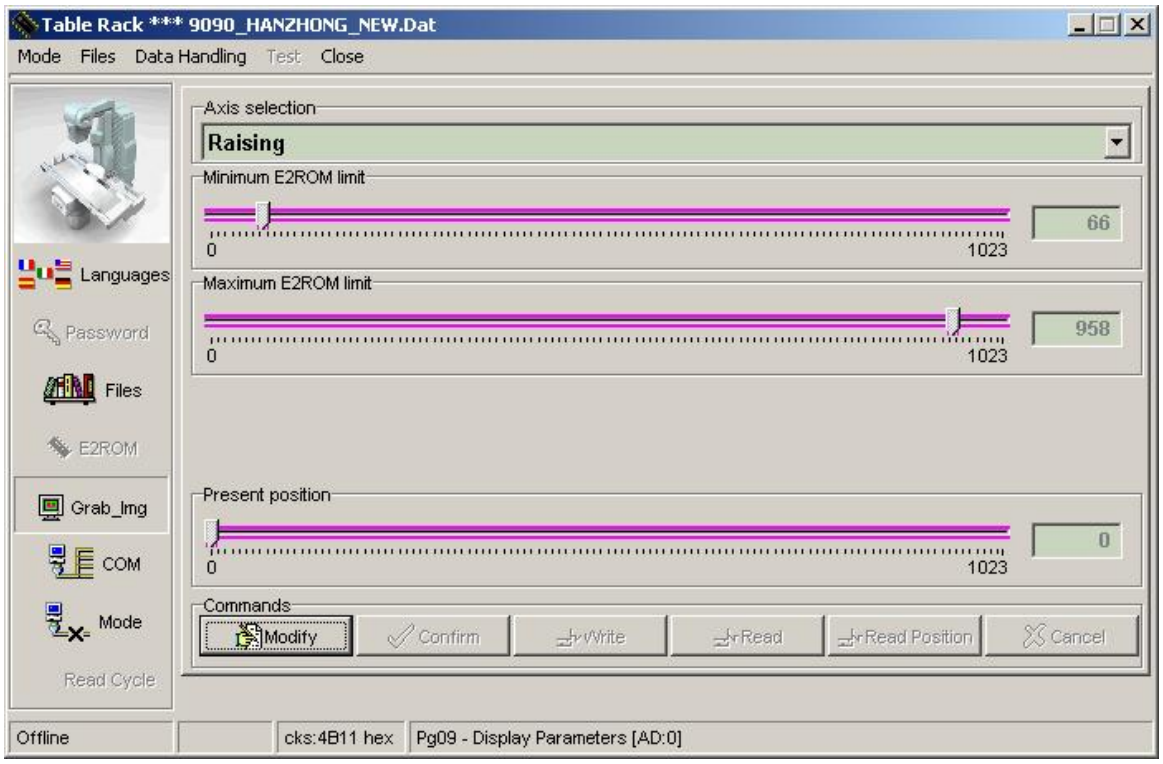



fig.3.3

To modify the preset values:

- Select "*Modify",* select the data to be changed, type the new value.
- Select "*Confirm".*
- Select "*Write"* (see fig. 3.3).
- Verify if the data has been properly modified, by selecting "*Read".*

After this last operation, check in the window of the modified data if it has been accepted. If it has not been accepted, check that the write-lock jumper is in "*READING/WRITING" position (1.1 "Preliminary Operations).*

### 1.2.2 OVERTRAVEL SWITCH REPLACEMENT.

The overtravel switch must intervene after the limit switch.

Recommendation:

*Once replacement is complete, check that the distance between the support and the head corresponds to the one replaced.*

*Make sure that the head of the overtravel switch is aligned with the head of the limit switch. If not, adjust the position of the latter to ensure mechanical safety during movement.*

### 1.2.3 INVERTER REPLACEMENT.

After checking that the connections are correct like in the scheme SCH1001, calibrate the raising inverter INV03 according to the following instructions:
Change the settings of the parameters according to the following table.
Factory Default Setting in all the other parameters.

*Inverter Omron type 3G3MV*

**3G3MV-A2007-**

| | | |
|---|---|---|
| n001 | Parameter Write Protect Selection / Initialization | 4 |
| n002 | Control Mode Selection | 1 |
| n003 | RUN Command Selection | 1 |
| n004 | Frequency Reference Selection | 2 |
| n011 | Maximum Frequency (FMAX) | 85,0 Hz |
| n012 | Maximum Voltage (VMAX) | 220,0 V |
| n013 | Maximum Voltage Frequency (FA) | 85,0 Hz |
| n014 | Middle Output Frequency (FB) | 3,0 Hz |
| n015 | Middle Output Frequency Voltage (VC) | 11,0 V |
| n016 | Minimum Output Frequency (FMIN) | 1,0 Hz |
| n017 | Minimum Output Frequency Voltage (VMIN) | 4,3 V |
| n019 | Acceleration Time 1 | 0,3 Sec |
| n020 | Deceleration Time 1 | 0,3 Sec |
| n092 | Stall prevention during deceleration | 1 |
| n104 | Torque compensation primary delay time constant | 0,2 Sec |
| n111 | Slip Compensation Gain | 1,0 |
| n112 | Slip compensation primary delay time | 0,2 Sec |

Tab. 1.1

Once the values have been changed, as per “Tab.1.1”, press the raising or lowering key on the spot film device keyboard, and verify the correct direction.
If the direction is wrong, change the two phases directly on the inverter.

### 1.2.4 POTENTIOMETER REPLACEMENT.

Replace the potentiometer referring to drawing DBM7V01 page 4 (pot. A38RP7).
After replacing the pot, DO NOT couple the pot group to the equipment.
Turn the potentiometer manually until a read value close to 500 is displayed; this corresponds to a mid-stroke position.

- Minimum value calibration:
  Command the lowering of the column translator by means of the “ Lowering“ key, until it stops on the lower limit switch.

In the last phase, carry out the approach to the limit switch with small movements since the s/w does not enable the deceleration ramp, because the potentiometer is disconnected and stopped at the reading channel equal to 500 and does not therefore provide information as to the height of the table.

Adjust the potentiometer so that the read value is equal to or slightly higher or lower than the preset minimum value in the E²ROM.
Mechanically couple and fix the potentiometer group to the equipment.
Once the group is fixed, unscrew the three screws which fix the potentiometer with the support, not completely, but enough to rotate the pot itself.
Rotate the pot, checking through CATWIN the value of "*Actual Position",* until it is 5 units lower than "*Minimum value in E2ROM".* Finally fix the pot to its support again.

- Maximum value calibration:

Stop with limit switch intervention.

Enable the raising of the column translator by means of the " Raising" key until it stops on the upper limit switch.

In the last phase, carry out the approach to the limit switch with small movements since the s/w may not enable the deceleration ramp because the ohm value of the potentiometer is too different from the previous one.

When it stops, check whether the reading channel is 5 units lower then the preset maximum value in the E²ROM. If so, calibration is complete.

If not:

If the reading is only slightly different (<= 20 units), the maximum value in the E²ROM can be adjusted as follows:

- ·Select "*Modify",* select the data to be changed, type the new value.
- ·Select "*Confirm".*
- ·Select "*Write*" (see fig. 3.3).
- ·Verify the operation through the "*Read"* command.

If the read value is very different, then it is necessary to adjust the Trimmer positioned on the RS012993.CSE (fig. 3.4) board in the electrical cabinet, turning it clockwise to increase or anticlock-wise to decrease the voltage at the terminals of the potentiometer until the "*Actual Position" read* is not less than 5 units from the preset value.

Stop without intervention of the limit switch.

If the movement stops before hitting the limit switch, increase the preset value in the "*Max value E2ROM"* to the maximum, "*Modify",* by inserting the value *"1023"* that represents the scale values of A/D values.
Repeat the raising movement.

Once the limit switch position is reached, change the "*Max Value in E2ROM",* by pressing the "*Modify"* key *and* inserting a value 5 units higher than the read value in *"Actual Position".* If it does not reach the limit switch position and the read value results equal, adjust the trimmer on theRS012993.CSE (fig 3.4) board in the electrical cabinet and repeat the movement.

Fig 3.4 shows the position of the various trimmers on the RS012993.CSE board located at the rear of the electrical cabinet.

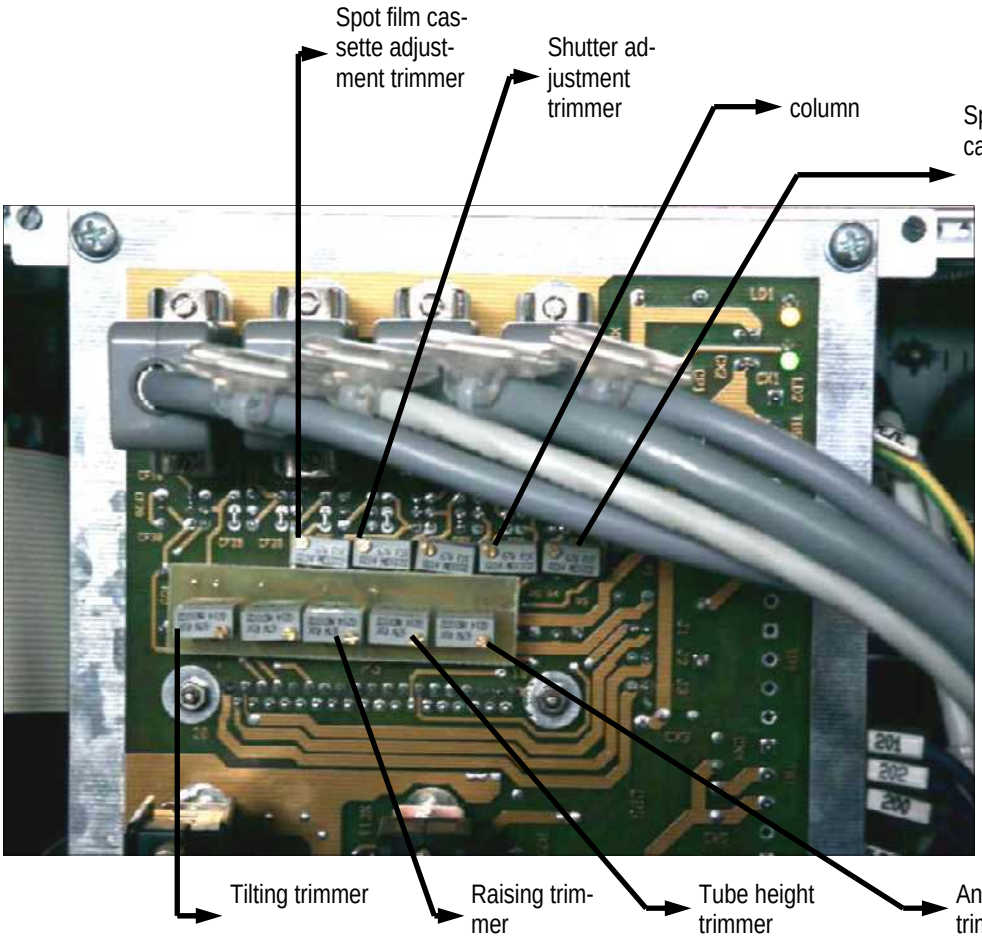



Fig.3.5: Trimmer identification.

*IN ORDER TO ACHIEVE THE BEST WORKING CONDITIONS, IT IS ADVISABLE TO USE A E2ROM MIN/MAX RANGE OF 50/950, FOR ALL THE CHANNELS USING A/D CONVERSION; FOR THE CHANNELS ADOPTING V/F CONVERSION, THE OPTIMUM E2ROM RANGE IS 50/9950*

## 1.3 TILTING AXIS CALIBRATION.

Components which may need to be replaced :

- ✓ Limit switches.
- ✓ Overtravel switches.
- ✓ Inverter.
- ✓ Potentiometer.

Machine condition:already fully functioning.

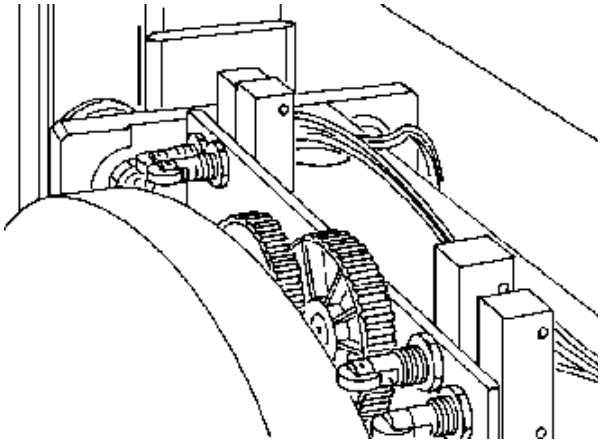


fig 3.6

### 1.3.1 LIMIT SWITCH REPLACEMENT.

Repeat the procedure of paragraph. 1.2.1 ( in full ).

### 1.3.2 OVERTRAVEL SWITCH REPLACEMENT.

Repeat the procedure of paragraph. 1.2.2 ( in full ).

### 1.3.3 INVERTER REPLACEMENT

- case of DELTA 90-90PLUS:

After checking the correct cabling of wires to the inverter, as per drawing SCH1001, proceed to calibrate the tilting inverter INV02 as follows:
Change the settings of parameters according to the following table.
Leave the Factory Default Setting in all the other parameters.

**Inv 3G3MV RIBALTAMENTO 9090.sdd [3G3MV-A2004-PRG24]**

| | | Index | Description | Value | Inverter Value | Units | Default | Range |
|---|---|---|---|---|---|---|---|---|
| | | n001 | Parameter Write Protect Selection / Ini | 4: n001 - n179 | --- | | 1 | 0 to 13 |
| | | n002 | Control Mode Selection | 1: Open Loop V | --- | | 0 | 0 to 1 |
| | | n003 | RUN Command Selection | 1: Multi-function | --- | | 0 | 0 to 3 |
| | | n004 | Frequency Reference Selection | 2: Control Term | --- | | 1 | 0 to 9 |
| | | n011 | Maximum Frequency (FMAX) | 55,0 | --- | Hz | 50,0 | 50,0 to 400,0 H |
| | | n012 | Maximum Voltage (VMAX) | 220,0 | --- | V | 200,0 | 0,1 to 255,0 V |
| | | n019 | Acceleration Time 1 | 0,3 | --- | Sec | 10,0 | 0,0 to 6000,0 S |
| | | n020 | Deceleration Time 1 | 0,3 | --- | Sec | 10,0 | 0,0 to 6000,0 S |
| | | n036 | Rated Motor Current | 2,1 | --- | A | 1,9 | 0,0 to 4,5 A |
| | | n092 | Stall Prevention during Decel | 1: Disabled | --- | | 0 | 0 to 1 |
| | | n140 | Energy Saving Coefficient | 223,7 | --- | | 288,2 | 0,0 to 6550,0 |
| | | n158 | Motor Code | 3 | --- | | 2 | 0 to 70 |

Tab. 1.2

Once the values have been modified as per “Tab.1.2 ”, press the tilting key on the spot film device keyboard verifying the direction.
If the direction is wrong, invert, eventually, the two phases directly on the inverter.

- case of DELTA 30:

After checking the correct cabling of wires to the connectors on the machine, proceed to calibrate the tilting inverter INV02 as follows:
Change the settings of the parameters according to the following table. Leave the Factory Default Setting in all the other parameters.

3G3MV-A2007-

| | | |
|---|---|---|
| n001 | Parameter Write Protect Selection / Initialization | 3 |
| n003 | RUN Command Selection | 1 |
| n004 | Frequency Reference Selection | 2 |
| n011 | Maximum Frequency (FMAX) | 90,0 Hz |
| n012 | Maximum Voltage (VMAX) | 220,0 V |
| n013 | Maximum Voltage Frequency (FA) | 90,0 Hz |
| n019 | Acceleration Time 1 | 0,3 Sec |
| n020 | Deceleration Time 1 | 0,3 Sec |
| n092 | Stall prevention during deceleration | 1 |
| n093 | Stall prevention level during acceleration | 200 % |
| n094 | Stall prevention level during operation | 200 % |

Press the tilting key on the spot film device keyboard and verify the direction of the commanded movement. If the direction is wrong, invert, eventually, the two phases directly on the fixed XC51 connector on the machine .

### 1.3.4 POTENTIOMETER REPLACEMENT.

- case of DELTA 90-90PLUS:

Preliminary operation:
Raise the table midway so that the tilting check operations can be carried out easily. The table should be in horizontal position.

Replace the potentiometer as per drawing DBM7V01 page 4 (pot. A38RP8).
After replacing it DO NOT couple mechanically the potentiometer unit to the equipment.
Turn the potentiometer until a read value close to 500 (preset value of zero) is displayed; this corresponds to a horizontal position of the translation unit.

- Minimum value calibration:

Enable tilting by means of the " Table anticlockwise tilting ", until it stops on the minimum angle limit switch ( -90° ).

In the last phase, carry out the approach to the limit switch with small movements since the s/w does not enable the deceleration ramp because the potentiometer is disconnected and stopped at the reading channel equal to 500 and does not therefore provide information as to the tilting position of the table.

Adjust the potentiometer so that the reading channel is equal or slightly higher than the preset minimum value in $E^2ROM$ .
Mechanically couple and fix the potentiometer to the machine.
Once it is fixed, unscrew the three screws which fix the potentiometer with the support, not completely, but enough to rotate the potentiometer itself.
Rotate the potentiometer, checking through CATWIN the value "*Actual Position",* until it is 5 units lower than the "*Minimum value in E2ROM".* Fix the potentiometer to its support.

- Maximum value calibration:

Stop with limit switch intervention.
Start the tilting of the table by means of the "Table clockwise tilting " key until it stops on the maximum angle switch (+90°).

In the last phase, carry out the approach to the limit switch with small movements since s/w could not enable the decelerating ramp because the ohm value of the potentiometer is too different from the previous one.

When it stops, check whether the read value is 5 units lower than the maximum preset value n $E^2$ROM.
If so, the calibration is complete.

If not:
If the read value is only slightly different (<= 20 units), the preset maximum value in the $E^2$ROM can be adjusted as follows:

- ·Select "*Modify",* select the data to be changed, type the new value.
- ·Select "*Confirm".*
- ·Select "*Write*" (see fig. 3.3).
- ·Verify if the status is really updated by selecting "*Read".*

If the read value is very different then it is necessary to adjust the trimmer positioned on the RS012993.CSE (fig. 3.4) board in the electrical cabinet, turning it clockwise or anticlockwise to increase or decrease the voltage at the ends of the potentiometer until the "*Actual Position " read value* is 5 units lower than the setup value in $E^2$ROM.

Stop without intervention of the limit switch.
If the movement stops before hitting the limit switch, increase the present value in the "*Maximum value in E2ROM"* to the maximum by pressing the "*Modify"* key, inserting the *"1023"* value that represents the full scale value of A/D.
Repeat the tilting movement.
Once the limit switch position is reached, change the "*Maximum Value in E2ROM",* by pressing "*Modify",* and inserting a value 5 units higher than the read value in *"Actual Position".* If it does not reach the limit switch position because the read value results equal to value in E2ROM,adjust the trimmer on the RS012993.CSE (fig. 3.4) board in the electrical cabinet and repeat the movement.

- Zero value calibration.

Command tilting until the translation unit is in horizontal position; verify with a spirit level.

Work with the "*Modify*" command and update the *"Zero value in E2ROM"* to a value equal to the read one.
The calibration is correct if, by pressing the "Zero Tilting " key the translation unit does not move and the corresponding LED on the spot film device keyboard lit up.

- case of DELTA 30:

If there is a different ohm value of the potentiometer, it is necessary to check of the complete travel and compare the values of the read values with the " preset configuration data".
When replacement is done, do not install the load on the base of the potentiometer.
Turn manually the potentiometer until a read value close to 300 is displayed; this corresponds to the horizontal position of translation unit.

- Minimum value calibration:

Stop with limit switch intervention
Command the tilting of the table anticlockwise (–30°), until the limit switch is reached.

In the last phase, carry put the approach to the limit switch with small movements since the s/w does not enable the deceleration ramp because the potentiometer is disconnected and stopped at the reading channel equal to 300, and does not provide information about the position.

Adjust the potentiometer so that the read value is close to the preset minimum value in the $E^2$ROM.
Install the counterweight on the potentiometer shaft and control that the read value does not change.
Rotate the potentiometer, checking through CATWIN the value of "*Actual Position",* until it is 5 units lower than the "*Minimum Value in E2ROM".* Fix the potentiometer to its support.

- Maximum value calibration:

Stop with limit switch intervention.
Enable the tilting of the table clockwise (+90°), until it stops on the limit switch.

In the last phase, carry out the approach to the limit switch with small movements since the s/w does not enable the deceleration ramp because the ohm value of the potentiometer is too different from the last one.

When it stops, check whether the reading channel is 5 units lower than the maximum preset value in $E^2$ROM.
If so, the calibration is complete.

If not:
If the reading is only slightly different (<= 20 units), the preset maximum value in $E^2$ROM can be adjusted as follows:

- Select "*Modify",* select the data to be changed, type the new value.
- Select "*Confirm".*
- Select "*Write*" (see fig. 3.3).
- Verify if the data was really updated by selecting "*Read".*

If the reading is very different, then it is necessary to adjust the Trimmer, positioned on the RS012993.CSE (fig. 3.4) board in the electrical cabinet, turning it clockwise or anticlockwise in order to increase or decrease the voltage at the ends of the potentiometer until the reading of "*Actual Position",* is 5 units lower than the preset value in $E^2$ROM.

Stop without intervention of the limit switch.

If the movement stops before contact with the limit switch, increase the preset value in "*Maximum Value in E2ROM"* to the maximum, by pressing "*Modify",* and inserting the *"1023"* value that represents the full A/D scale value.
Repeat the tilting movement.
Once the limit switch is reached, vary the "*Maximum Value in E2ROM",* by pressing "*Modify",* and inserting a value 5 units higher than the read value in *"Actual Position".* If it does not reach the limit switch position because the read value results equal to the value in E2ROM, adjust the trimmer on the RS012993.CSE (fig. 3.4) board in the electrical cabinet and repeat the movement.

- Zero value calibration.

Command tilting until the translation unit is in horizontal position; verify with a spirit level. Verify that the stop in horizontal position is carried out when the fulcrums, on which the translation unit alternatively leans on when tilting from +90° to –30°, are correctly positioned in their places. Work with the "*Modify"* command and update the *"Zero value in E2ROM"* to a value equal to the read one.
The calibration is correct if, by pressing the "Zero Tilting " key, the translation unit does not move , and the corresponding LED on the keyboard of the spot film device lit up.

### 1.3.5 TILTING SPEED CALIBRATION.

- case of DELTA 90-90PLUS:

- Aim:
  To prevent the safety microswitches on the translator unit from hitting the ground during tilting.

- Procedure:
  -lower the table to the minimum value.
  -enable tilting in both directions.
  If the microswitches do not hit the ground, calibration is complete and the speed is correct.
  If they hit the ground, it is necessary to adjust the inverter (manual supplied) and decrease the value of the parameter “n011”.

- case of DELTA 30:

- Aim:
  To increase or decrease the tilting speed preset by the manufacturer, it is possible to adjust it by setting INV02 inverter parameters .

- Procedure:
  Adjust the parameter “n24” (maximum frequency) of the inverter INV02 according to the table as in paragraph 1.3.3. Case Delta 30.

  Important: avoid in any case values higher than 100 Hz.

# 2. TRANSLATION UNIT CALIBRATION (column-spot film device).

## 2.1 INTRODUCTION.

Following the replacement of components, it may be necessary to carry out electrical adjustments and then check the main functioning parameters of the individual units.
The following must therefore be available :

- reference documents, wiring functional diagrams on the dedicated tables:

case DELTA 90-90PLUS:

| | |
|---|---|
| SCH 1001 | - Wiring functional diagrams. |
| DCE 0019 | - Component lay-out in the cabinet. |
| DBM 0007V01 | - Connections on the machine. |
| DBM 0008V01 | - Composition of cables on the machine. |
| DBM 0009V01 | - Analog signals and shielded cables. |
| DBM 0010 | - System ground wiring. |
| DBM 0011V01 | - Component lay-out on the machine. |

case DELTA 30:

- reference documents, wiring functional diagrams on the dedicated tables:

| | |
|---|---|
| SCH 3001: | wiring functional diagram. |
| DCE 0001: | component lay-out. |
| DBM 0001: | connections on the machine. |
| DBM 0002: | connectors on the machine |
| DBM 0003: | composition of cables on the machine. |
| DBM 0004: | analog signals connection. |
| DBM 0005: | ground collector. |
| DBM 0006: | component lay-out on the machine. |

- Instruction manual.
- PC and CATWIN s/w provided.

Preliminary operations.

- ✓ Connect the optical fiber serial cable to the PC and the microprocessor board (fig.2.1).
- ✓ Start the CATWIN s/w and load the "preset configuration data" selecting the items from the menu in order indicated below.
- ✓ *Before turning on the equipment, change the write-lock jumper, which is located in the lower part of the board on component side, from the READ-ONLY position to READ/WRITE position, i.e. insert it between the central and the lower pins.*
  *Once completed the modifications, turn OFF the equipment and move the jumper to the READ ONLY position, i.e. connect the central and upper pins. See fig 3.1*

Once the filename has been assigned (for references see MAN016 "CATWIN User Manual"), select the E²ROM icon, from the window "*Read / Write E²ROM"* select the *"Read E²ROM"* icon.

Components which may need to be replaced:

- Limit switches.
- Overtravel switches.
- Inverter.
- Potentiometers.

Machine condition: already fully functioning.

## 2.2 LIMIT SWITCH REPLACEMENT.

Repeat the procedure of p. 1.2.1 (in full).

## 2.3 OVERTRAVEL SWITCH REPLACEMENT.

Repeat the procedure of p. 1.2.2 (in full).

## 2.4 INVERTER REPLACEMENT.

Proceed with the translation column inverter calibration INV01 according to the following instructions. Change setup of parameters on the inverter INV01 according to the following table. Leave all the other parameters at their Factory Default Setting.

**3G3MV-A2007-**

| | | |
|---|---|---|
| n001 | Parameter Write Protect Selection / Initialization | 4 |
| n002 | Control Mode Selection | 1 |
| n003 | RUN Command Selection | 1 |
| n004 | Frequency Reference Selection | 2 |
| n011 | Maximum Frequency (FMAX) | 100,0 Hz |
| n012 | Maximum Voltage (VMAX) | 220,0 V |
| n013 | Maximum Voltage Frequency (FA) | 60,0 Hz |
| n014 | Middle Output Frequency (FB) | 3,0 Hz |
| n015 | Middle Output Frequency Voltage (VC) | 11,0 V |
| n016 | Minimum Output Frequency (FMIN) | 1,0 Hz |
| n017 | Minimum Output Frequency Voltage (VMIN) | 4,3 V |
| n019 | Acceleration Time 1 | 0,3 Sec |
| n020 | Deceleration Time 1 | 0,3 Sec |
| n036 | Rated Motor Current | 3,7 A |
| n062 | Analogue frequency reference filter time constant | 0,00 Sec |
| n092 | Stall prevention during deceleration | 1 |
| n104 | Torque compensation primary delay time constant | 0,2 Sec |
| n111 | Slip Compensation Gain | 1,0 |
| n112 | Slip compensation primary delay time | 0,2 Sec |

Tab. 2.1

The value n011, related to the maximum frequency, must not be modified.

Once the values have been changed, as per “Tab.2.1”, press the translation key on the spot film device keyboard, and verify the direction of the movement.
If the direction is wrong, change two main phases directly on the inverter.

## 2.5 "SLAVE" CONTROL CALIBRATION

The AXOR MS60 14/28 (10/20) control is normally configured as follows:

| jumper | configuration |
|---|---|
| JP1 | closed |
| JP2 | open |
| JP3 | closed |
| JP4 | closed |
| JP5 | closed |

| jumper | configuration |
|---|---|
| JP6 | open |
| JP7 | open |
| JP8 | open |
| JP9 | open |
| JP10 | open |

All the customization sockets must be removed from the control and the trimmers on the front panel must be disabled.

## 2.6 REPLACEMENT OF THE MASTER POTENTIOMETER.

*The minimum value of the potentiometer must be equal to 50 (± 20 units), while the maximum value must be as close as possible to 9950 (± 20 units).*

- case DELTA 90-90PLUS:
  Replace the potentiometer as per drawing DBM7V01 page 2 (pot. A36RP5).

- case DELTA 30:
  Replace the potentiometer as per drawing DBM1 page 1 (pot. 6001).

Preliminary operation:
Position the column and spot film device with zero angle of incidence at the centre of the translation plane.
When replacement is complete, do not mechanically couple the potentiometer unit to the machine.
Turn the potentiometer manually until a read value close to 5000 (preset zero value) is displayed; this corresponds to a central position with respect to the translation plane.

Procedure:

- Minimum value calibration.

Load an incidence angle so that the left switch of the column is in external position with respect to the corresponding one on the spot film device.
Move the translator unit to the left verso until it stops due to the intervention of the limit switch on the position cam.

In the last phase, carry out the approach to the limit switch with small movements since the s/w does not enable the deceleration ramp because the potentiometer is disconnected and stopped at the reading channel equal to 5000, and does not therefore provide information as to the position of the column.

Adjust the potentiometer so that the reading channel is equal or slightly higher than the preset minimum value in $E^2$ROM.
Mechanically couple and fix the potentiometer unit to the equipment.
Once the unit is fixed, unscrew the three screws which fix the potentiometer with the support, not completely, but enough to rotate the potentiometer itself.
Rotate the potentiometer, checking through CATWIN the value of "*Actual Position",* until it is 5 units lower than "*Minimum Value in E2ROM".* Fix the potentiometer to its support.

- Maximum value calibration:

Stop with limit switch intervention.
Translate the group in central position.
Load an angle until the right limit switch is more external than the corresponding one on the spot film device.
Move the translation group to right, until it stops on the limit switch on cam of maximum position.

In the last phase, carry out the approach to the limit switch with small movements since the in s/w may not enable the deceleration ramp because the ohm value of the potentiometer is too different from the last one.

When it stops, check whether the reading channel value is 5 units less than the preset maximum value in $E^2$ROM. If so, the calibration is complete.

If not:

If the reading is only slightly different (<= 20 units), the preset maximum value in $E^2$ROM can be adjusted as follows:

- Select "*Modify",* select the data to be changed and type the new value.
- Select "*Confirm".*
- Select "*Write*" (see fig. 3.3).
- Verify if the data has been really updated by selecting "*Read".*

If the reading is very different (>20 units), then it is necessary to adjust the trimmer, positioned on the RS012993.CSE (fig. 3.4) board, in the electrical cabinet, turning it clockwise or anticlockwise to increase the voltage at the ends of the potentiometer until the read value "*Actual Position"* is 5 units lower than the preset value in $E^2$ROM.

Stop without limit switch intervention.

If the movement stops before contact with the limit switch, increase the preset value in the "*Maximum Value in E2ROM"* to the maximum by selecting "*Modify",* inserting the value *"10000"* which represents the full V/F scale value.
Repeat the translation movement.
Once the limit switch position is reached, vary the "*Maximum Value in E2ROM",* by selecting "*Modify",* inserting a value of 5 units higher than the read value in *"Actual Position".* If it does not reach the limit switch position, adjust the trimmer on the RS012993.CSE (fig. 3.4) board in the electrical cabinet and repeat the movement.

- Zero value calibration.

Translate the column in the opposite direction and center it with the translation unit, read the reading channel and update the value in $E^2$ROM.
The calibration is correct if, by pressing the "column centering" key, the column unit and spot film device units do not move.

## 2.7 REPLACEMENT OF THE SPOT FILM DEVICE POTENTIOMETER

*The minimum value of the potentiometer must be equal to 50 (± 20 units), while the maximum value must be as close as possible to 9950 (± 20 units).*

- case DELTA 90-90PLUS:
  Replace the potentiometer as per drawing DBM7V01 page 2 (pot. A36RP5).

- case DELTA 30:
  Replace the potentiometer as per drawing DBM1 page 1 (pot. 6001).

Preliminary operation:

Position the column and spot film device with zero angle of incidence at the centre of the translator plane.
When replacement is complete, do not mechanically couple the potentiometer unit to the machine.
Rotate the potentiometer manually until a read value close to 5000 (preset zero value) is displayed; this corresponds to a central position with respect to the translator plane.

Procedure:

- Minimum value calibration:

Maintain the angle of incidence at zero.
Move the translator unit to the left until it stops due to intervention of the limit switch on the minimum position.

In the last phase, carry out the approach to the limit switch with small movements since the s/w does not enable the deceleration ramp because the potentiometer is disconnected and stopped at the reading channel equal to 5000 and does not therefore provide information as to the position of the spot film device.

Adjust the potentiometer so that the read value is equal or slightly higher than the preset minimum value in $E^2ROM$ .
Mechanically couple and fix the potentiometer unit to the equipment.
Once the potentiometer is fixed, unscrew the three screws which fix the potentiometer with the support, not completely, but enough to rotate the potentiometer itself.
Rotate the potentiometer, checking through CATWIN the value of *"Actual Position",* until it is 5 units lower than the "*Minimum Value in E2ROM".* Fix the potentiometer to its support.

- Maximum value calibration:

Stop with limit switches intervention.
Move the translation unit to the right until it stops due to the intervention of the limit switch on the maximum position cam.

In the last phase, carry out the approach to the limit switch with small movements since the s/w does not enable the deceleration ramp because the ohm value of the potentiometer is too different from the previous one.

When it stops, check whether the reading channel value is lower of 5 units with respect to the preset maximum value in $E^2ROM$. If so, the calibration is complete.
If not:

If the reading is slightly different (<= 20 units), the preset maximum value in $E^2ROM$ can be adjusted as follows:

- Select "*Modify",* select the data to be changed and type the new value.
- Select "*Confirm".*
- Select "*Write*" (see fig. 3.3).
- Verify if the data has been really updated by selecting "*Read".*

If the reading is very different (>20 units), then it is necessary to adjust the trimmer, positioned on the RS012993.CSE (fig. 3.4) board, in the electrical cabinet; turning it clockwise or anticlockwise in order to increase or decrease the voltage at the ands of the potentiometer until the reading "*Actual Position",* is 5 units lower than the preset value in $E^2$ROM.

Stop without limit switch intervention.

If the movement stops before contact with the limit switch, increase the preset value in "*Maximum Value in E2ROM",* by selecting "*Modify"* and inserting the value *"10000"* that represents the V/F full scale value.
Repeat the translation movement.
Once the movement is stopped by limit switches vary the "*Maximum value in E2ROM",* selecting "*Modify",* and inserting a value 5 units higher than the read value in *"Actual Position".* If it does not reach the limit switch position, adjust the trimmer RS012993.CSE (fig. 3.4) board in the electrical cabinet and repeat the movement.

- Zero value calibration.

Hold down the " column centering " key until the column-spot film device unit stops.
The centering action does not directly involve the spot film device unit. If the angle of incidence is loaded, only the column will be moved to the centre of the translator base. To check and if necessary, correct the 0 value of the spot film device, the angle of incidence must first be centered, then centre the unit, read the value of the potentiometer and store the new value.

# 3. SPOT FILM DEVICE UNIT CALIBRATION.

## 3.1 INTRODUCTION.

Following the replacement of components, it may be necessary to carry out electrical adjustments and to then check the main functioning parameters of the individual units.
Therefore, the following must be available :

- Reference documents, with electrical functional diagrams on dedicated tables:

case DELTA 90-90PLUS:

| | |
|---|---|
| SCH 1001 | - Wiring functional diagrams. |
| DCE 0019 | - Component lay-out in the cabinet. |
| DBM 0007V01 | - Connections on the machine. |
| DBM 0008V01 | - Composition of cables on the machine. |
| DBM 0009V01 | - Analog signals and shielded cables. |
| DBM 0010 | - System ground wiring. |
| DBM 0011V01 | - Component lay-out on the machine. |

case DELTA 30:

- Reference documents, with electrical functional diagrams on dedicated tables:

| | |
|---|---|
| SCH 3001: | electrical functional scheme. |
| DCE 0001: | component lay-out. |
| DBM 0001: | connections on the machine. |
| DBM 0002: | connectors on the machine. |
| DBM 0003: | composition of cables on the machine. |
| DBM 0004: | analog signals connection . |
| DBM 0005: | ground collector. |
| DBM 0006: | component lay-out on the machine. |

- Instruction manual.
- PC and CATWIN s/w provided.

Preliminary operations

- ✓ Connect the optical fiber serial cable to the PC and the microprocessor board (fig.2.1).
- ✓ Start the CATWIN s/w and load the "preset configuration data" selecting the items from the menu in the order indicated below.
- ✓ *Before turning on the equipment, change the write-lock jumper, which is located in the of the board on component side, from the READ_ONLY position to READ/WRITE, i.e. insert it between the central and the lower pins.*

  *Once completed the modifications, turn off the equipment and move the jumper to the READ_ONLY position, i.e. connect the central and upper pins. See fig 3.1*

Once the filename has been assigned (for different references, use MAN016 "CATWIN User Manual"), select the E²ROM icon, from the window "*Read / Write E²ROM"* select the *"Read E²ROM"* icon.

Components which may need to be replaced:

- Limit switches ( cassette insertion and eject ).
- Potentiometers ( angle of incidence, cassette and shutters ).
- Sensors ( cassette size and Grid Proximity ).
- Photocell ( hand safety ).
- Limit switches " left and right I.I. floor safety".

Machine condition: already fully functioning.
The following procedures for the replacement of internal, external and of the potentiometer microswitches are basically the same, the thins to check and eventual changes on setup are equal for all the activities.

## 3.2 REPLACEMENT OF THE CASSETTE INSERTION AND EJECT LIMIT SWITCHES, REPLACEMENT OF THE CASSETTE POTENTIOMETER.

### 3.2.1 REPLACEMENT OF THE CASSETTE INSERTION LIMIT SWITCHES.

To carry out this operation, remove the two EPROMs (L and H) containing the DELTA 90-90PLUS-30 operating program from the microcontroller board and replace them with the two SETUP EPROMs (L and H). The setup EPROMs allow:

- Data Read/Write
- The slow Insertion-Eject movement of the spot film device cassette, by means of the Raising Unit keys.
- The slow movement of the shutters by means of the Translation Unit key.
- The movement of the grid by means of the "Cassette Insertion-Extraction" key.

If the Compressor Raising key and the spot film device Insertion-extraction keys are held down simultaneously, the cassette speed increases.

Start CATWIN s/w, load E2ROM data like in paragraph 1.1 page 2, then select "*Data Handling"* from the menu, select "*Axis Ranges*" from window "*Select Axis"* select *"Cassette".* Decouple the cassette potentiometer from the motor gearing.

Install the microswitch on its support, just like the previous one.
Move the film holder toward the inner position.
The microswitch has to stop the movement when external board of the film holder is at 9 mm from the spot film device.

Proceed for potentiometer calibration like from the procedure 3.2.4, page 30.

### 3.2.2 REPLACEMENT OF THE CASSETTE EJECT LIMIT SWITCH.

To carry out this operation, remove the two EPROMs (L and H) containing the DELTA 90-90PLUS-30 operating program from the microswitch board and replace them with the two SETUP EPROMs (L and H). The setup EPROMs allow :

- Data Read/Write
- The slow Insertion-Eject movement of the spot film device cassette, by means of Raising Unit keys.
- The slow movement of the shutters, by means of the Translation Unit keys.
- The movement of the grid by means of the "Cassette Insertion-Eject "key.

If the Compressor Raising key and the spot film device cassette Insertion-Eject keys are held down simultaneously, the cassette speed increases.

Start CATWIN s/w, load the E2ROM data like in paragraph 1.1 page 2, and from menu "*Data Handling"* select "*Axis Ranges*" , from window "*Select Axis"* select *"Cassette".* Decouple the cassette potentiometer from the motor gearing.

Move the film holder so to have room enough to have access for dismounting and mounting of steel cover (Fig. 3.7).
Fix the microswitch maintaining the distance of the wheel from the structure of the spot film device same as the previous microswitch. Mount again the steel cover, move the film holder towards the external position.
The microswitch must stop the movement when the front edge of the cassette completely covers the screw which fixes the steel cover on the left side. In that position the cassette should be out enough to easily allow the insertion of a 43 size cassette, without any resistance from the film centering leverages. If not so, lower the microswitch in order to have the film holder more extracted.
Proceed with the potentiometer calibration according to procedure 3.2.4 page 30.

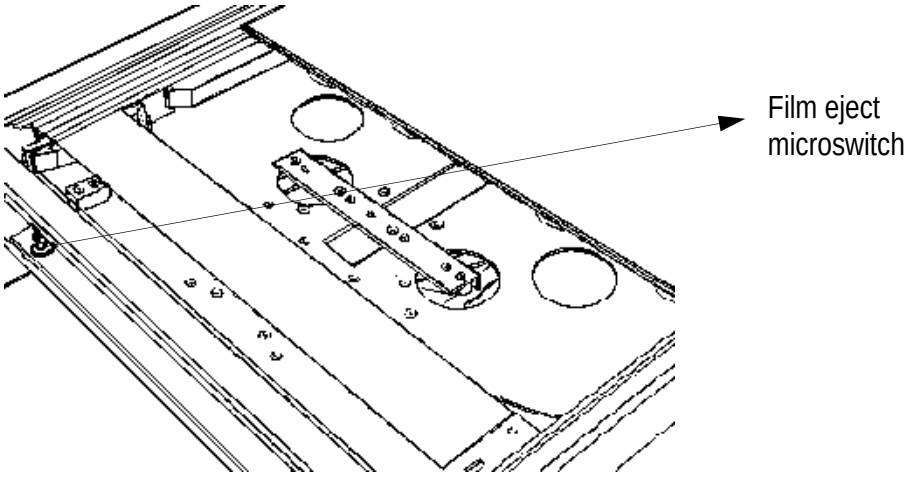



fig. 3.7

### 3.2.3 REPLACEMENT OF CASSETTE POTENTIOMETER.

To carry out this operation, remove the two EPROMs (L and H) containing the DELTA 90-90PLUS-30 operating program from the microswitch board and replace them with the two SETUP EPROMs (L and H). The setup EPROMs allow:

- Data Read/Write
- The slow Insertion-Eject movement of the spot film device cassette, by means of the Raising Unit keys.
- The slow movement of the shutters, by means of the Translation Unit keys.
- The movement of the grid by means of "Cassette Insertion-Eject" key.

If the Compressor Raising key and the spot film device cassette Insertion-Eject keys are held down simultaneously, the cassette speed increases.

Start CATWIN s/w, load the E2ROM data like in paragraph 1.1 page 2, and from menu "*Data Handling"* select "*Axis Ranges*" , then "*Select Axis"* select *"Cassette".*

Replace the whole potentiometer unit, refer to drawing DBM007V01 page 3, potentiometer A36ARP3 in case of DELTA 90-90PLUS, while in case of DELTA 30 refer to drawing DBM1 page 1 (pot. 6001).. Mount the potentiometer unit without mechanically coupling it the motor.
Proceed with potentiometer calibration according to procedure 3.2.4 page 30.

### 3.2.4 CASSETTE POTENTIOMETER CALIBRATION PROCEDURE.

- Adjustment of position A. Decouple the potentiometer from the cassette motor and command movement until 9 mm from the microswitch.
  Turn manually the potentiometer until reading 70 on the PC and then couple it to the motor. Insert a value of at least 30/40 units lower from the read "*Minimum Value in E2ROM*"
- Adjustment of position B. Enable movement towards the external position until a stop microswitch is activated, making sure that there is a space before the mechanical stop. Adjust the microswitch if necessary. Make sure that the value of the potentiometer in this position is 9950. Adjust if necessary by means of the trimmer (see Fig. 3.5). Insert a value 10÷20 units higher than the "*Maximum Value in E2ROM".*
- Adjustment of position C.
  This position is obtained by aligning the X-ray tube index line with the outer edge of the film cassette. Insert the read value in this position as the "*Central Value in E2ROM*". Final setting up is carried out during functioning, on the basis of the results obtained on the X-ray films.
- Adjustment of position D.
  From position C, move the cassette 410 mm outwards. Enter the value read in this position in "*Data Handling", "General Parameters", "Cassette Potentiometer Value on 410mm from the zero position towards outing edge".*
  The final setting up is carried out during functioning, on the basis of the results obtained on the X-ray films.

### 3.2.5. Adjusting the positioning speed.

Adjust the positioning speed, in order to achieve the best compromise between the precision of the film divisions and movement time. The value is expressed as a percentage of the maximum speed.

### 3.2.6. Adjusting the eject speed.

Adjust the eject speed, in order to maintain a sufficient speed of cassette movement, enough to overcome the resistance of the film cassette centering springs. The value is expressed as a percentage of the maximum speed. These values are usually set as follows during calibration:

- 35% eject
- 15% positioning

*Remember to move the spot film device cassette to position B (external) before removing the calibration EPROMs.*

## 3.3 REPLACEMENT OF THE "SHUTTER" POTENTIOMETER.

To carry out this operation, remove the two EPROM (L and H) containing the DELTA 90 operating program from the microswitch board and replace them with the two SETUP EPROMs (L and H). The setup EPROM allow:

- Data Read/Write
- The slow Insertion-Eject movement of the spot film device cassette, by means of the Raising Unit keys.
- The slow movement of the shutters, by means of the Table Translator Unit keys.
- The movement of the grid by means of the "Insertion-Eject X-ray film" key.

If the Compressor Raising key and the spot film device Insertion-Eject keys are held down simultaneously, the cassette speed increases.
Launch CATWIN s/w, load E2ROM data like in paragraph 1.1 page 2, and from menu "*Data Handling"* select "*Axis Ranges*" from window "*Select Axis"* select *"Spot Film Device Shutters".*

### 3.3.1 POTENTIOMETER REPLACEMENT.

- <u>case DELTA 90-90PLUS</u>:
  Replace the potentiometer following the drawing DBM007V01 page 3 (pot. A36ARP2).

- <u>case DELTA 30:</u>
  Replace the potentiometer following the drawing DBM0001 page 3 (pot. 6104).

Once it has been connected, assemble the gearing on the pot shaft and position it correctly, without tightening the screws too much, so that the pot can be rotated.

Procedure:

- Minimum value calibration:

Loosen the screws that fix the shutters to the 1.5 mm cable. Enable the shutter closing movement, with slow speed, until the chain-cable tension adjuster is 20 mm from the transmission pulley.
Rotate the potentiometer, checking the value "*Actual Position"* through CATWIN, until the it corresponds to the "*Minimum Value in E2ROM".* Fix the potentiometer on its support.

Position both shutters 30 mm from the X-ray tube index line, thus defining the dimension of the smallest size (60mm), then fix the shutters to the cable.
Command the shutters opening by means of the "*Table towards" key.*

- Maximum value calibration:

Open the shutters to the maximum opening position of 415 mm. If the reading of "*Actual Position",* is very different (<>20 units) from the reference value 9950, then it is necessary to adjust the Trimmer positioned on the RS012993.CSE (fig. 3.2)board *"trimmer of shutter adjustment*", in order to obtain the wanted value, modify, if necessary the *"Maximum Value in E2ROM"*

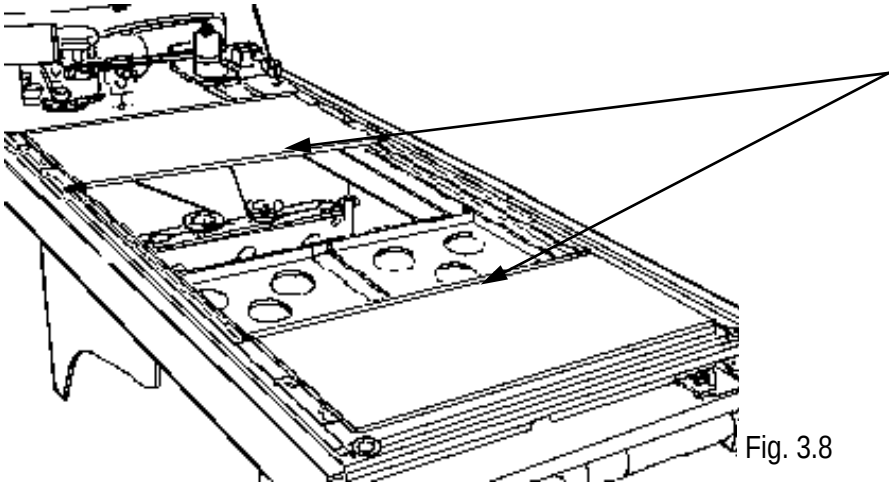



Fig. 3.8

*Remember to move the spot film device cassette to position B (external) before removing the calibration EPROM. Update the data on the backup disk.*

## 3.4 REPLACEMENT OF "ANGLE OF INCIDENCE" POTENTIOMETER.

### 3.4.1 REPLACING THE POTENTIOMETER.

- case DELTA 90-90PLUS:
  Replace the potentiometer following the drawing DBM007V01 page 3 (pot. A36ARP1).

- case DELTA 30:
  Replace the potentiometer following the drawing DBM0001 page 3 (pot. 6103).

Once it has been replaced, do not mechanically couple the potentiometer unit to the machine.
Rotate the potentiometer, checking the value "*Actual Position"* through CATWIN, until a read value of approximately 500 has been displayed.

Procedure:

- Minimum value calibration:

Press the "angle loading" key and move the spot film device to the right and the column to the left until there is a distance of 580 mm between the left outer edge of the spot film device and the centre of the column. Rotate the potentiometer until the reading channel value is close to the minimum value on the $E^2$ROM.
Mechanically couple the potentiometer unit.

- Maximum value calibration:

Press the "Angle loading " key and move the spot film device to the left and the column to the right until there is a distance of 580mm between the left outer board of the spot film device and the centre of the column. (see fig 3.9).
Check whether the channel reading value is close to the maximum preset value in the $E^2$ROM.
If so, the calibration is complete.
If not:
If the reading is slightly different (<= 20 units), the preset maximum value in $E^2$ROM can be adjusted as follows:

- Select "*Modify",* select the data to be changed, type the new value.
- Select "*Confirm".*
- Select "*Write*" (see fig. 3.3).

·Check if the data has been really updated by means of "*Read"* key.
If the reading is very different, then it's necessary to adjust the Trimmer positioned on the RS012993.CSE (fig. 3.5) board in the electrical cabinet, turning it clockwise or anticlockwise in order to increase or decrease the voltage to the potentiometer cables until the reading channel in *"Actual Position",* is equal to the preset value in *"Maximum Value in E2ROM"*.

- Zero value calibration:

Press " Angle loading " key until the column and the spot film device units are centered.
If the read value in "*Actual Position"* corresponds to the "*Central Value in E2ROM"*, the calibration is complete; otherwise, change the "*Central Value in E2ROM"* by inserting the read value in "*Actual Position".*

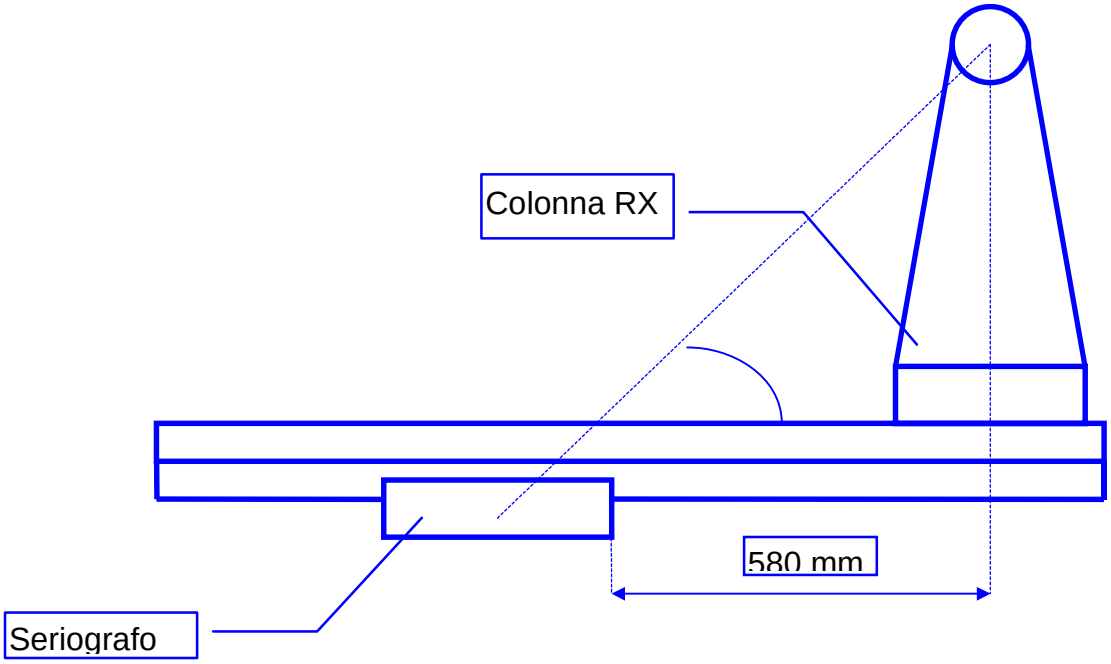



Fig. 3.9

## 3.5 FINAL SETUP OF THE SPOT FILM DEVICE AND SIZE CALIBRATION.

Changing the type of the film cassette may require a fine adjustment of film size recognition parameters. The sizes are being recognized during the insertion movement, calculating the recognizing value, given by the difference of the read values that the potentiometer assumes between the 2 sides of the cassette (First Value) and the measure of a side (Second Value).
For all the other calibration operations, refer to PART 2 - Cap. 4.3 "FILM SIZE RECOGNITION" in this Manual.

## 3.6 OFFSET CALIBRATION.

The OFFSET is the distance between the outer boarder of the film holder and the film itself. The default value is 14 mm. To change this value, do as follows:
For all the other calibration operations make reference to PARTE 2 - Cap. 4.5 "OFFSET CASSETTE EDGE" in this Manual.

## 3.7 SHUTTERS CALIBRATION.

The shutter delta is the distance between two exposures on the same film.
"*Data Handling*" - "General Parameters", "*Space between two exposures on the film (SHUTTERS DELTA)*". The value of shutters delta is basically obtained on basis of results on the films. Never go below value "*3".*

## 3.8 PHOTOCELL CALIBRATION.

1 Turn the sensitivity adjustment trimmer to the maximum.
2 Position the output signal status selector to "L=ON".


Fig. 3.10

# 4. X-RAY TUBE COLUMN CALIBRATION.

## 4.1 REPLACEMENTS OF THE PARTS INSIDE THE X-RAY TUBE COLUMN

Components which may need to be replaced :
- Limit microswitches.
- Tube height potentiometer.

Machine condition:already fully functioning.

### 4.1.1 LIMIT SWITCH REPLACEMENT.

Repeat the procedure of p. 1.2.1 page 4

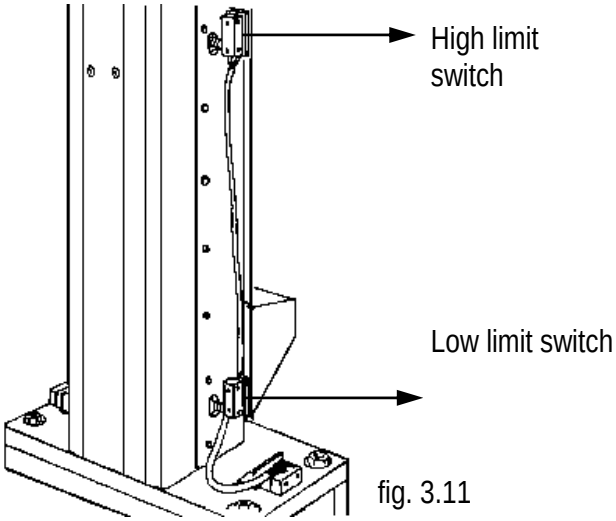



fig. 3.11

### 4.1.2 POTENTIOMETER REPLACEMENT

- case DELTA 90-90PLUS:
  Replace the potentiometer as per drawing DBM007V01 page 1 (pot. A38RP6).

- case DELTA 30:
  Replace the potentiometer as per drawing DBM0001 page 1 (pot. 6001).

When replacement is complete, do not mechanically couple the potentiometer unit to the machine. Turn the potentiometer, checking through CATWIN the value of *"Actual Position",* until a read value close to 500 is displayed; this corresponds to a half travel of the translation unit position.

Procedure:

- Minimum value calibration:

Enable lowering of the X-ray tube unit by means of the "X-ray tube lowering " key, until it stops on the lower limit switch.
Adjust the potentiometer until the reading channel is 5 units higher than the stored value in *"Minimum Value in E2ROM"*. If this is not possible, adjust this value as close as possible to the stored value and modify the last one by inserting a value 5 units lower than the read one.
Mechanically couple to the column and fix the potentiometer unit.

- Maximum value calibration:

Enable the tube raising by means of the "X-ray tube raising "key.
When it stops, check whether the read value is 5 units less than the maximum preset value in $E^2$ROM. If so, the calibration is complete.
If not:
If the reading is slightly different (<= 20 units), the preset maximum value in $E^2$ROM can be adjusted as follows:

- Select "*Modify",* select the data to be changed, type the new value.
- Select "*Confirm".*
- Select "*Write*" (see fig. 3.3).
- Check if the data has been really updated by selecting "*Read".*

If the reading is very different, then it is necessary to adjust the Trimmer positioned on the RS012993.CSE (fig. 3.5) board in the electrical cabinet , turning it clockwise or anticlockwise in order to increase or decrease the tension at the ends of the potentiometer until the read value in "*Actual Position"* is not 5 units higher than the preset value in *"Maximum Value in E2ROM"*.

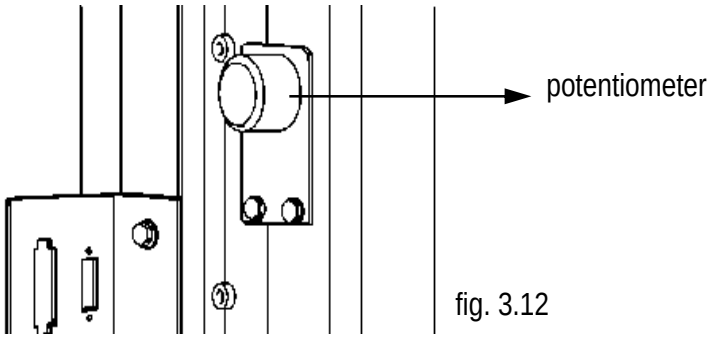



fig. 3.12

## 4.2 COMPRESSOR.

### Replacement of the compression limit switch.

The microswitch must be positioned keeping it in contact with the base (end of the slot) to maintain the movement of pressure interruption on the patient unchanged.

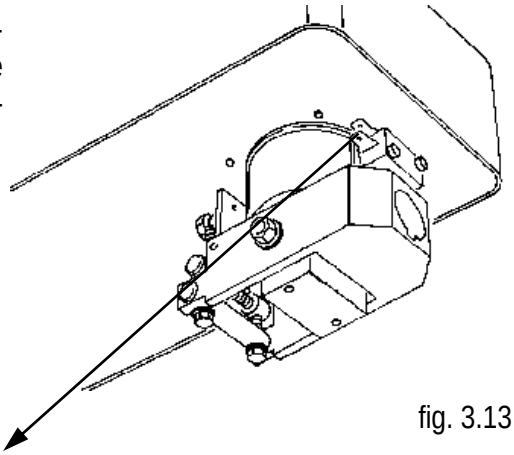



fig. 3.13

### Limit switch replacement

The limit switches must be positioned so that they intercept the cams for stopping.

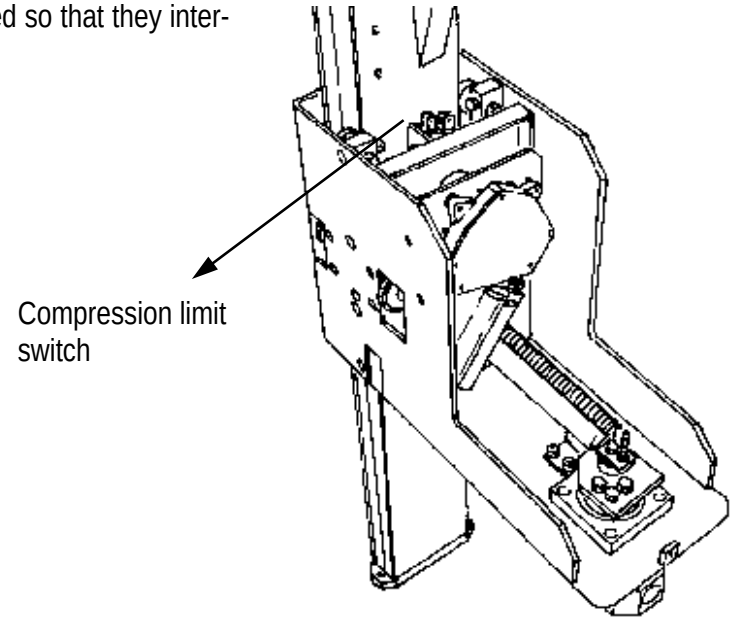



fig. 3.14

## 4.3 X-RAY TUBE ROTATION CALIBRATION.

This movement is not controlled by any potentiometer; it is therefore sufficient to calibrate the limit switches.

Position the 2 upper fixing holes of the tube-holder plate in a horizontal position, using 2 screws and a spirit level. The screws are inserted in the holes to provide a surface for the spirit level.
Another 2 long-shank screws are inserted in the two lower holes and used to rotate the tube-holder until the spirit level is in a horizontal position.
Turn the left cam until the microswitch is triggered: the 0° position is now set and calibration is complete.

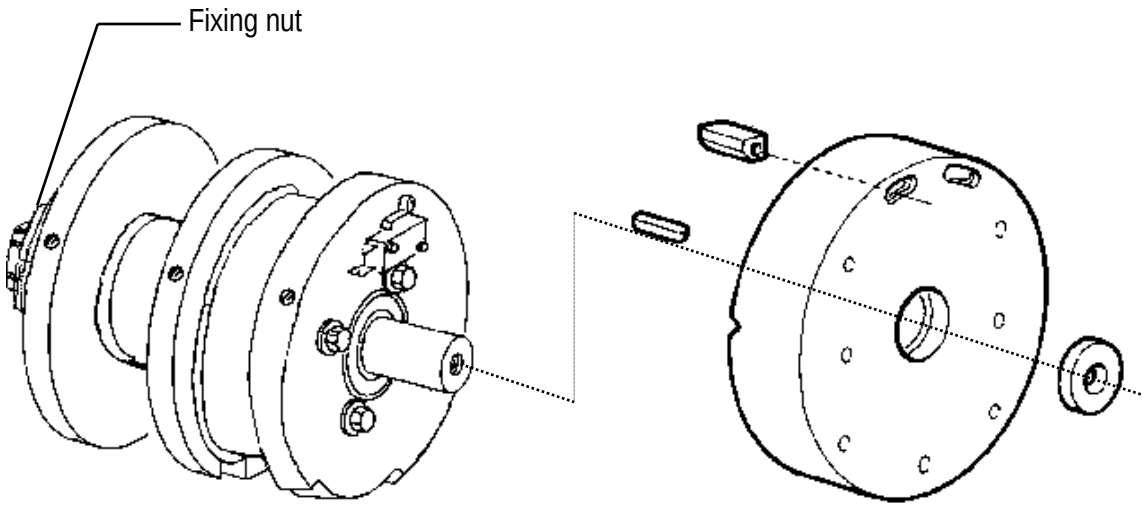



fig. 3.15

## 4.4 X-RAY TUBE ROTATION CLUTCH ADJUSTMENT.

By means of the self-locking nut shown in the fig. 3.15 it is possible to adjust the preloading force, necessary for the rotation of the X-ray tube . This clutch makes it possible to lighten the weight caused by the misalignment of the collimator with respect to the rotation axis and at the same time to reduce the strain of the mechanical brake when locked in the position required by the operator.
The self-locking nut is factory-locked at around 20 Nm, sufficient to maintain braking of a normal collimator fitted on the X-ray tube.
If a different preloading calibration is necessary, it is sufficient to extract the entire rotation unit and adjust the self-locking nut indicated in the figure.
This operation must be carried out only after the following have been disconnected:

- The tube limit switch at 0°
- The brake handle
- The brake shoe

# 5. COLLIMATOR SET UP.

## 5.1 INTRODUCTION.

Check the correct rotation direction of the motors and the potentiometer signals with respect to the command given, taking into account that the value read must increase with the opening of the shutters and the iris. It is best to carry out this operation with the collimator dismantled from the table.

Preliminary operations.

- ✓ Connect the optical fiber serial cable to the PC and the microprocessor board (fig.2.1).
- ✓ Start the CATWIN s/w and load the "preset configuration data" selecting the items from the menu in the order indicated below.
- ✓ *Before turning on the equipment, change the write-lock jumper, which is positioned in the lower part of the board on component side, from the READ-ONLY position to READ/WRITE position, i.e. insert it between the central and the lower pins.*
  *Once completed the modifications, turn off the equipment and move the jumper to the READ_ONLY position, i.e. connect the central and the upper pins. See fig 3.1*

Once the filename has been assigned (see MAN016 "CATWIN User Manual"), select the E²ROM icon, from the window "*Read / Write E²ROM"* select the *"Read E²ROM"*icon.

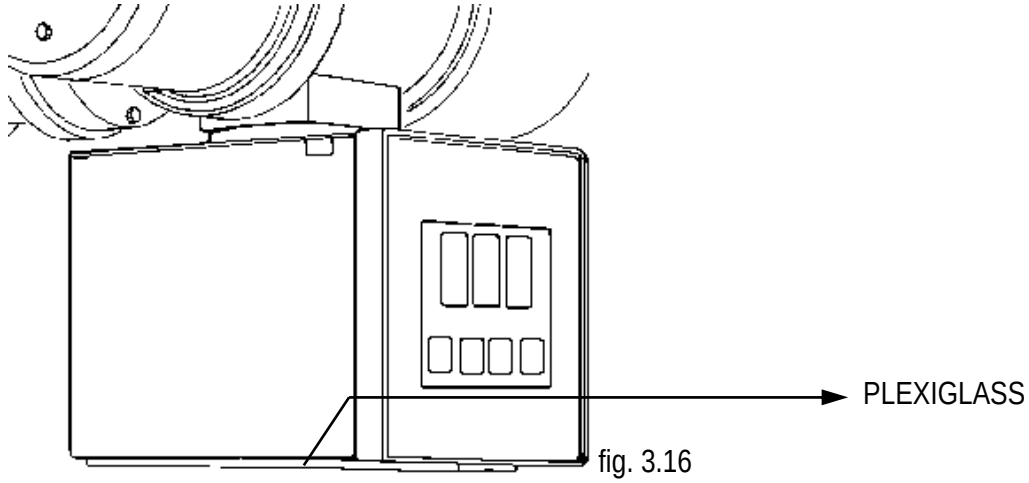



fig. 3.16

Machine condition:already fully functioning.

## 5.2 AXIS X AND AXIS Y SHUTTER CHECK.

### Check operations of setup:

The collimator must be calibrated with machine on and power OFF, and all the connectors XC11/ XC12/XC13 inserted and the Bypass limit selector inserted. In these conditions the **"**MANUAL**"** LED should be on.

- *shutters closing on axis X:*

*a)* Write 10 as *"Minimum Value in E2ROM"*

b) Enable closing of the X shutters until they are completely closed and to mechanical clutch intervention.

c) Insert the read value in "*Actual Position*" as *"Minimum Value in E2ROM"*

d) Command the shutters opening of a few centimeters. Command again the closing until it stops. Check that the shutters are completely closed. In case they are not completely closed, repeat the procedure from c); in case they are closed, command again their closing paying attention to the acoustic sound of relay excitement. If this noise is present, increase of 1 unit the *"Minimum Value in E2ROM"* as follows*:*

- *"Modify"*
- Change the value in *"Minimum Value in E2ROM"* like described previously
- *"Confirm"*
- *"Write"*

Control if the value in E2ROM was really written, by selecting the *"Read"* key.

and repeat the procedure from d) until the shutters are completely closed and the closing command does not excite the relay.

- *shutters opening on axis X:*

*a)* Write 1023 as *"Maximum Value in E2ROM"*

b) Enable the opening of X shutters until their complete opening and to mechanical clutch intervention.

c) Insert the read value in "*Actual Position*" as *"Maximum Value in E2ROM"*

d) Command the closing of shutters of a few centimeters. Command again the opening until the movement stops. Check that the shutters are completely opened. In case they are not, repeat the procedure from c); in case they are completely opened, command again their opening paying attention to the acoustic noise of the relay excitement. If this noise is present, decrease of 1 unit the *"Maximum Value in E2ROM"* following the instructions*:*

- *"Modify"*
- Change the value in *"Maximum Value in E2ROM" like described previously*
- *"Confirm"*
- *"Write"*

check if the value in E2ROM has been really written, by selecting the *"Read"* key.

and repeat the procedure from d) until the shutters are completely opened and the opening command does not excite the relay.

*- close-open of shutters on axis Y:*

To adjust the travels and the values of the potentiometer of the Y shutters, use the same procedure described in the two cases above.

### 5.2.1 COLLIMATOR SHUTTERS X STROKE AND COLLIMATOR SHUTTERS Y STROKE.

Collimator shutters X stroke and Collimator shutters Y stroke are values to be stored in $E^2$ROM, and are used by the program for precise adaptation of the shutters to the film sizes and to compensate for a change in film focus distance. These values are the difference of the distance between the shutters when open at their maximum value and the distance at their minimum value expressed in mm measured directly on the plexiglass of the collimator. Normally, the shutters at their minimum value are completely closed, so the distance between them is equal to 0; the value to be memorized is therefore the maximum value.

Procedure:

- *"Data Handling"*
- *"Modify"*
- Change data in "*"Collimator shutters X stroke" (Collimator shutters Y stroke)*
- *"Confirm"*
- *"Save Modif.."*
- *"Write"*
- *"Read"*

## 5.3 IRIS CALIBRATION.

The initial conditions must be the same as in p. 5.1.
For minimum and maximum value calibration, follow the previous paragraph.
IRIS- zero value. This potentiometer value is obtained by closing the iris enough to form a circle inside the square, obtained by having the X-Y shutters completely opened , on the transparent plexiglass (fig. 3.16). Store the read value in *"Actual Position"* in the window *"Central Value in E2ROM"*.
IRIS– stroke in mm. This is the difference in millimeters between the diameter of the circle created on the plexiglass in the zero position and the minimum value position.

NOTE.
It's possible to exclude functioning of the iris on the CATWIN in the window:

- *"Data Handling"*
- *"General Parameters"*
- *(Data)*
- *"Modify"*
- *(Data)* insert *"NO"*
- *"Confirm"*
- *"Save Modif"*
- *"Write"*
- *"Read"*

During calibration of the collimator, it is necessary to store some parameters that depend on values given by the cassettes and the system generally.
These data allow the equipment to adjust the opening or closing of the shutters and the iris automatically, and with precision, according to the decrease or increase in FILM/FOCUS distance and to adjust to different film sizes.

In the CATWIN program, the following data must be inserted:

- *"Data Handling"*
- *"General Parameters"*
- *(Data)*
- *"Modify"*
- *(Data)*
- *(Distance spot focus tube-shutter X) or (Distance spot focus tube-shutter Y) or (Distance spot focus tube-shutter Iris)*
- *"Save Modif"*
- *"Write"*
- *"Read"*

These data are relative to three programming boxes in which the distance expressed in

millimeters x 10, between the point that corresponds to the focus of the X-ray tube and shutters X,Y and IRIS must be entered.

For reasons of "non-ideality" due to potentiometer inaccuracy and mechanical inaccuracy, during final setting up in the X-ray room, the parameters in question may be modified to the point of being a long way from the "ideal" value.

Please note that, by increasing the *Distance spot focus tube-shutter X(Y, Iris)* values, the absolute opening of the shutters increases the same as the inserted film or I.I. selected field, while by decreasing, the beam will become narrower.
This kind of calibration is typically executed only once, with a big film (i.e. 35x43), single exposure, then checking that the collimator beam error is not higher than 2% of SID.

Spare page.

# PART 4

# MECHANICAL ADJUSTMENTS

*DELTA 90, DELTA 90 PLUS, DELTA 30*

| Revisions: | | |
|---|---|---|
| File name | Num. | Date |
| MAN056 | 1 | 10/05/2010 |
| DELTA 30: MAN005-4 | 1 | 1/09/1998 |
| DELTA 90:MAN003-4 | 3 | 10/01/2003 |

- To carry out the operations described in this part, it is advisable to switch off the mains of power supply at the electrical cabinet, unless otherwise specified .
-

# 1. MAIN UPRIGHT *DELTA90-90PLUS.*

Refer to the tables in the "Spare Parts" Manual.

## 1.1 INSTALLATION.

Refer to Part One, paragraph "Installation".

## 1.2 REPLACEMENT OF THE RAISING MOTOR

(Warning: without the motor, the descent movement is reversible)

- Switch off and dismantle the motor.
- Position the two aluminum spacers in correspondence with the screws.
- Disconnect the motor electrically and remove it, taking care to block the reverse movement of the screws with the appropriate tool.
- Allow the carriage to move down until it rests on the aluminum spacers.
- Clean and grease the motor shaft and the reduction gear housing before fitting the new motor.

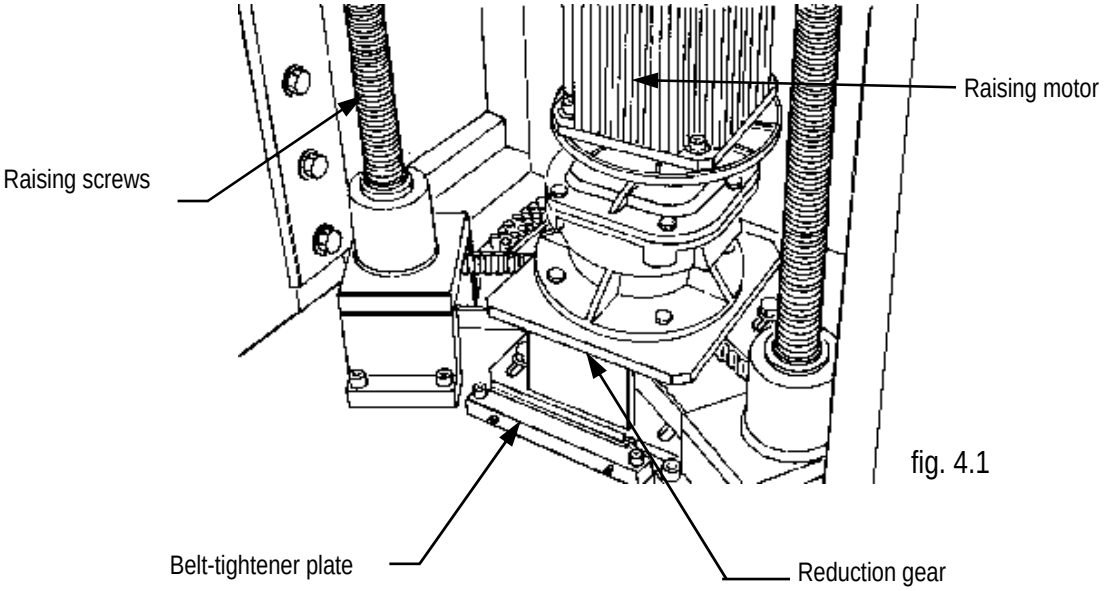



fig. 4.1

## 1.3 REMOVING AND REPLACING PROTECTIVE BELLOWS.

Lower bellows:

- Remove the two countersunk screws that fix bellows to the base of the upright.
- Remove the two countersunk screws on the front part of the protective guard (note the spacers).
- Remove the 4 Allen screws at the sides of the protective guard.
- Extract the bellows from the guides, moving them sideways.

Upper bellows:

- Remove the 4 countersunk screws that fix the bellows to the upper plate of the upright.
- Remove the 2 countersunk screws on the front part of the protective guard (note the spacers).
- Extract the bellows from the guides, moving them sideways.

For mounting, carry out the same operations in reverse order.

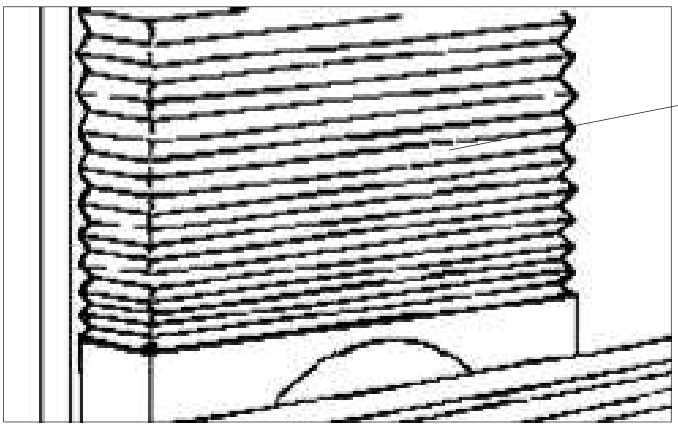



fig. 4.2

## 1.4 REPLACEMENT OF THE RAISING REDUCTION GEAR.

- Remove the motor as described in point 1.2.
- Remove the lower protective bellows as described in point 1.3.
- Remove the reduction gear from its base, removing the fixing screws.
- Clean and grease the reduction gear shaft and the housing of the gear motor shaft before fitting the new part.
- Replace the motor: see point 1.2.
- Replace the bellows.

## 1.5 REPLACEMENT OF BELTS.

- Remove the motor as described in p. 1.2.
- Remove the lower protective bellows as described in p. 1.3.
- Remove the reduction gear from its base, removing the fixing screws.
- Remove the belt-tighten plate (fig.4.1).
- Loosen the fixing screws of the gear motor base.
- Remove the belts from the pulleys on the ball screw side.
- Remove the raising reduction gear (fig.4.1).
- Before mantling, clean and grease the housing, the shafts and the bearings.
- Insert the raising reduction gear(fig.4.1) with the new belts in its housing.
- Mantle the reduction gear: see point 1.4.
- Insert the belts on the relative ball screw pulleys.
- Replace and lock the belt-tighten plate.
- Adjust the tension on the belts by means of the two counter-screws, making sure that both belts have the same degree of tension.
- Lock the reduction gear base.
- Replace the motor as per point 1.2.
- If the raising movement is excessively noisy, check the tension of the belts again.

## 1.6 REPLACEMENT OF THE RAISING BALL SCREWS.

Replacement of the raising ball screws requires particular attention, as it involves heavy mechanical operation in a radiology environment.

A) Remove the upper and the lower bellows as described in point 1.3

B).

1) Completely remove the translator base, placing adequate supports at the sides, and move it away from the raising stroke area.
2) Raise the carriage to its highest point, keeping the roller wheels at the end of the two side guides without allowing them to slip out of the guides.

Before continuing with the subsequent mechanical operations, the carriage should be propped up.

## 1.7 REPLACEMENT OF THE VERTICAL MOVEMENT SLIDING ROLLERS.

Replacement of the sliding rollers requires maximum attention, because difficult mechanical operation are carried out in a radiological environment.

- Carry out the operations described at point 1.6 paragraph B.
- Remove the side sliding guides.
- Remove the damaged rollers and replace them.
- Place the carriage with the front machined side down on a bench.
- Insert the guides in the rollers and check that they are aligned with each other and with respect to the bench by means of calibrated blocks positioned between the guides and the bench.
- The eccentric rollers must be sufficiently preloaded so that the weight does not cause any play.

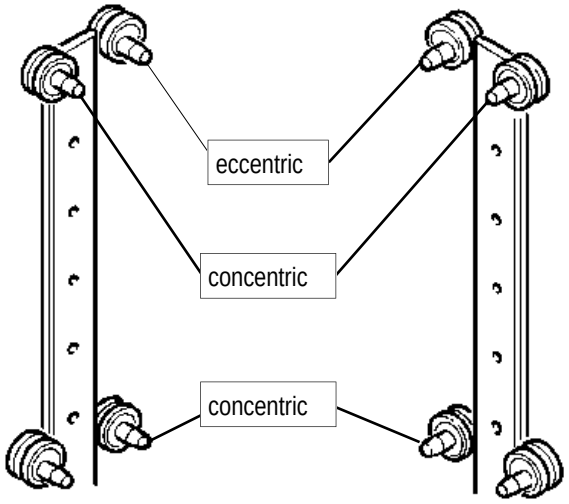



fig. 4.3 rear view as by fig. 4.1

## 1.8 REPLACEMENT OF THE TILTING ROLLERS.

Replacement of the tilting rollers requires maximum attention, because difficult mechanical operation are carried out in a radiological environment

- Remove the upper and lower bellows, as described in point 1.3.
- Remove the mobile surface, unscrewing the 11 M10 fixing screws.
- Disconnect the tilting motor electrically.
- Proceed by removing the disc, unscrewing the 12 M8 Allen screws which fix the toothed wheel (fig.4.4) to the raising carriage.
- Place it on a suitable surface so that the reduction gear is facing downwards.
- Remove the reduction gear-motor unit by unscrewing the 4 M10 bolts which fix it to the disc.
- Remove the toothed ring by loosening the roller fixing nuts.
- Replace the new rollers, taking care to insert the concentric rollers at the sides of the reduction gear.
- The rollers must be slightly preloaded.

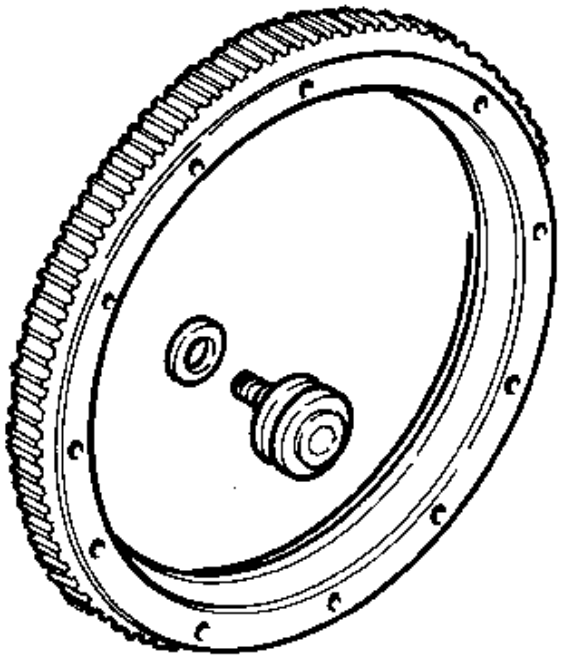


fig. 4.4

## 1.9 REPLACEMENT OF THE MOTOR AND/OR TILTING REDUCTION GEAR.

This operation can be carried out with the machine assembled (fig. 4.5), taking care to center the column-spot film device and to place adequate supports at the sides of the translator base, to prevent accidental tilting when the reduction gear is removed.

- Remove the tilting surface protective guard.

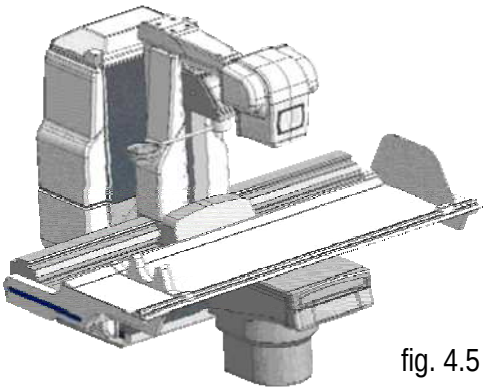


fig. 4.5

Motor:

- It is necessary to create enough space for the motor extraction in the rear part of the upright. So, the wire holders must be removed and move the wires.
- Disconnect the wires.
- Remove the 4 M8 Allen screws which fix the motor to the reduction gear plate.
- Extract the motor from the rear part of the upright.
- Remove the motor pulley fig.4.7.

fig. 4.6

Tilting surface without protective guard

Reduction gear:

- Remove the motor without disconnecting it electrically.
- Remove the driven rotation pulley fig.4.7.
- Remove the reduction gear plate.
- Remove the reduction gear.
- Separate the reduction unit from the gear and from the fixing plate fig.4.7.

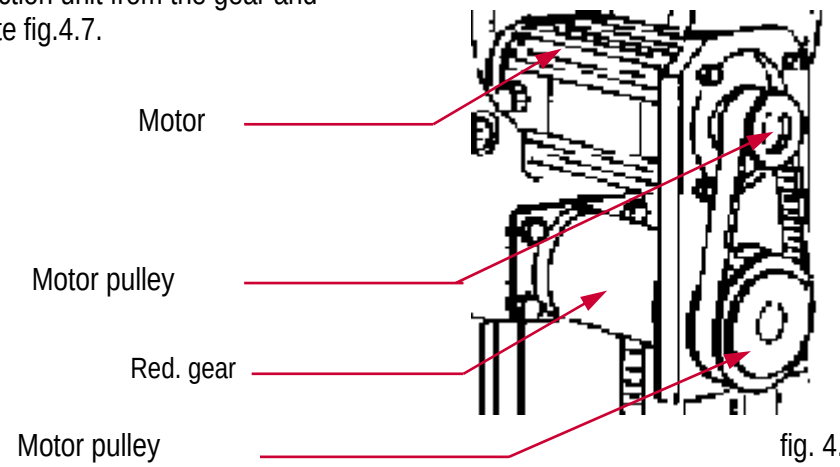



fig. 4.7

# 2. MAIN UPRIGHT *DELTA 30.*

Refer to the tables in the "Spare Parts" Manual.

## 2.1 INSTALLATION.

Refer to Part One paragraph "Installation".

## 2.2 REPLACEMENT OF THE RAISING MOTOR

(Warning: without the motor, the descent movement is reversible)

- Proceed with the dismantling, after switching off the machine.
- Disconnect the motor electrically through the connector XC51 and remove it, taking care to position the translation base in a horizontal position, avoiding the danger of the reverse movement of the screws.
- Clean and grease the motor shaft and the reduction gear housing before mantling.

## 2.3 REPLACEMENT OF THE RAISING REDUCTION GEAR.

- Remove the motor as described in point 2.2.
- Remove the reduction gear from its base, removing the fixing screws.
- Remove the pulley, taking care not to damage the belts ring, remove the fixing screws from the slow shaft.
- Replace the pulley.
- Replace the reduction gear.
- Replace the motor: see the last point in p. 2.2.

## 2.4 REPLACEMENT OF BELTS.

- Extract the pin that supports the entire telescopic unit with screws, by loosening the ones in the angles taking care of the pin itself. The belt-tightener plate must be extracted until the it is possible to remove the belt for its replacement.
- Loosen the fixing screws of the reduction gear.
- Remove the belt from the pulley.
- Replace the belt and position the belt-tightener plate like in the previous position.
- Lock the belt-tightener plate. .

- ADJUSTMENT: before tightening the fixing screws again, check the correct tension of the belt. Its distance must be almost 1 cm.

## 2.5 REPLACEMENT OF THE TILTING BALL SCREWS.

Replacement of the tilting ball screws requires particular attention, as it involves heavy mechanical operations in a radiology environment.

First of all, remove the unit from the main base completely.
It is possible by following these operations:

A) Completely remove the 4 screws which fix the lower support angles, taking care to the positioning pins, which must stay the same when finishing the operation.
B) Completely remove the 6 + 6 screws on the higher part of the unit which couples it to the translation base, taking care to the positioning pins which must stay the same when finishing the operation.

Extract the screw unit from the main base and position it on an adequate working surface, supporting it well because it is heavy.

C)
1) Remove the motor as described in p.2.2
2) Remove the reduction gear as indicated in p.2.3
3) Remove the belts as described in p. 2.4

D) On the bench
1) Remove preventively the high pin by means of the bearing tapers.
2) Remove the protection in plastic.

E) Remove the pulley on the screws by removing the locking nut.

F)
1) Loosen the screw that locks the rotation of the high cap, and remove the cap.
2) Remove the brass part of the limit switch fixed on the summit of the screws.

G)
1) Remove the nut from the inferior part of the cylinder, which locks the internal part of the screw.
2) It is possible to extract the screw from the cylinder and proceed with its replacement.

H) The new screw must be accurately cleaned and greased. It must be introduced in the cylinder with the appropriate tool.

I) Lock again the nut on the screws with a force not inferior to 65 Nm.

L) Carry out the operation in retreating, taking care to clean and grease all the mechanical parts to be assembled.

M)

1) Test the tilting system electrically.
2) Mount the main base paying attention to the position of the extracted pins, before tightening all the screws.

N) Use the lubricator on the cylinder to grease well the screws.

# 3. COLUMN-SPOT FILM DEVICE TRANSLATOR UNIT.

Refer to the tables in the "Spare Parts" Manual.

## 3.1 DISMANTLING OF THE PATIENT TABLE.

- Remove the covers from the two side arms of the patient table.
- Press the "table forward" pushbutton on the spot film device until it stops automatically.
- Manually press the forward limit switch of the table and press the "table forward" pushbutton again.
- The entire patient table can now be removed without any particular difficulty, sliding it on the side bearings.
- The operations of re-insertion of the patient table are the same as described above, carried out in reverse order, pressing the "table back" pushbutton.

## 3.2 REPLACEMENT OF MASTER MOTOR.

- Remove the translator rear covers.
- Dismantle the spot film device.
- Remove the front protective guard of the single chain for spot film device movement and remove the chain.
- Remove the double chain of the column movement.
- Remove the snap ring and extract the idle pinion, the related bearings and the spacer.
- Remove the potentiometer support plate fig.4.8, paying attention to the spacer.
- Unscrew the Allen screws on the translator side.
- Disconnect the motor and the encoder electrically.
- Unscrew the 4 Allen screws that fix the motor to the support , inserting the key through the relative holes.
- Do not dismantle the entire motor/shaft unit, but remove only the motor fixing screws.
- Extract the reduction gear/ shaft unit.
- Remove the motor fixing screws and separate it from the reduction gear.
- Before fitting the new motor, clean the silicone from the motor coupling and apply new silicon.

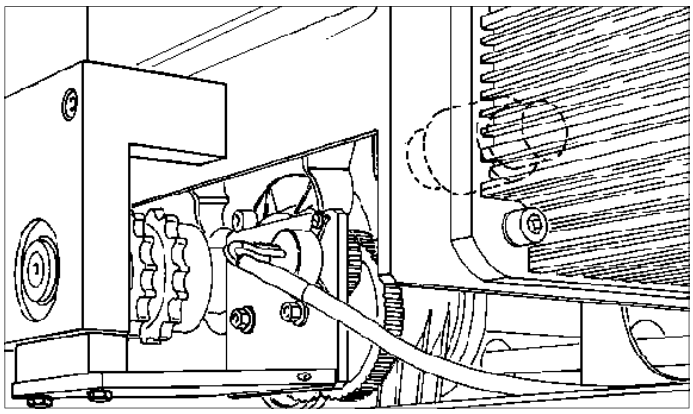


fig. 4.8

## 3.3 REPLACEMENT OF MASTER REDUCTION GEAR.

- Carry out the dismantling operations described in points 3.1 and 3.2.
- Remove the left-end support and extract the shaft.
- Remove the 4 screws that fix the reduction gear to the motor support.
- It is sufficient to remove the single bolt that fixes the reduction gear to the translator base.

*The dismantling and assembly operations described above make it possible to replace any component of these units.*

## 3.4 REPLACEMENT OF THE SLAVE MOTOR.

- Remove the translator rear covers.
- Remove the spot film device.
- Remove the front protective guard of the single chain for the spot film device movement and remove the chain.
- Remove the double movement chain.
- Remove the snap ring and extract the motor pinion, the relative bearings and the distance piece.
- Remove the potentiometer support plate fig.4.9, paying attention to the spacer.
- Unscrew the Allen screw on the translator side.
- Disconnect the motor, the encoder and the speedometer dynamo electrically.

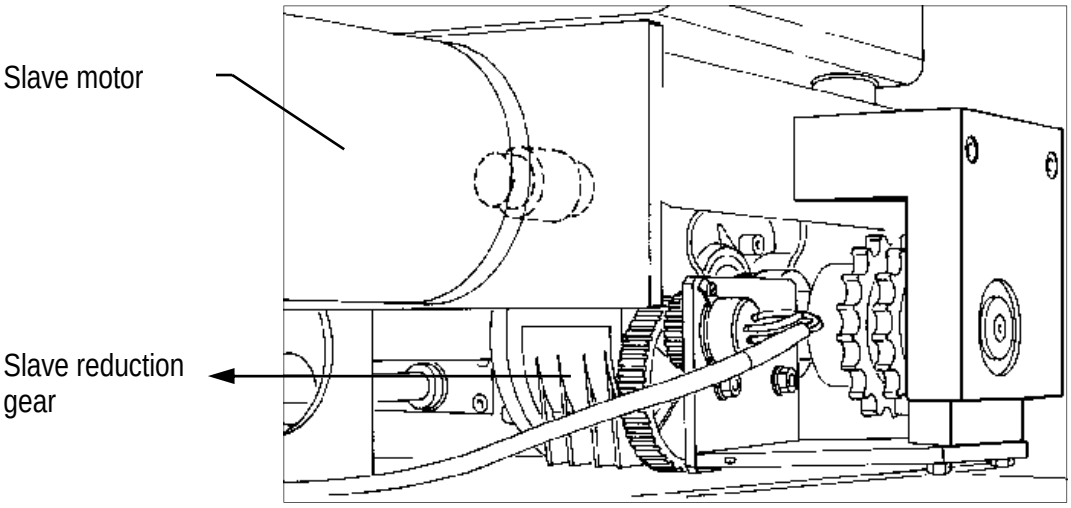



fig. 4.9

- Unscrew the 4 Allen screws that fix the motor to the support, inserting the key through the relative holes.
- Extract the reduction gear/shaft unit.
- Remove the motor fixing screws and decouple the motor from the reduction gear unit.

## 3.5 REPLACEMENT OF THE SLAVE REDUCTION GEAR.

- Carry out the dismantling operations described in point 3.4.
- Remove the right-hand support (fig.4.9) and extract the shaft.
- Remove the 4 screws that fix the reduction gear to the motor support.

*The dismantling and assembly operations described above make it possible to replace any component of these units.*

## 3.6 REPLACEMENT OF THE TABLE MOVEMENT CENTRAL CHAIN.

- Remove the table (see point 3.1).
- Remove the protective guard of the reduction gear situated in the central upper part of the translator.
- Loosen the chain-tightener (fig.4.10) and remove the coupling link.
- Remove the two grub screws that fix the chain pinion to the shaft.
- Assembly: replace the chain, carrying out the operations in reverse order.

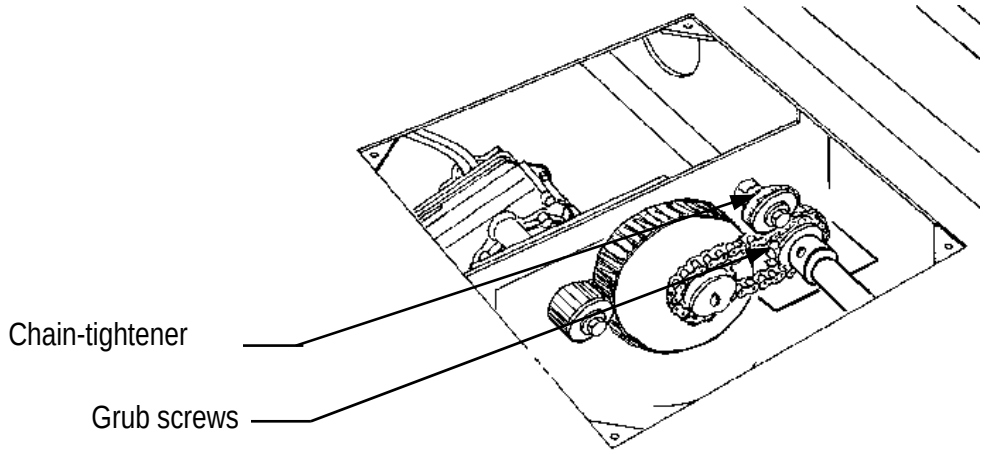



fig. 4.10

## 3.7 REPLACEMENT OF THE GEAR MOTOR AND DRIVE PINIONS.

To replace the gear motor:

- Disconnect the power cables
- Remove the smallest gear and unscrew the 3 fixing screws.
- Fit the new gear motor
- Reconnect the power cables.

The side drive pinions should be dismantled as follows:

- Loosen the two grub screws on the bushing that connects the pinion unit to the main shaft.
- Remove the cursor (fig.4.11) to which the pinion unit is connected.
- On the bench, remove the two screws that fix the pinion unit to the cursor and remove the snap ring.
- Extract the damaged pinion and fit the new one.
- Re-assemble carrying out the operations in reverse order, remembering to tighten the two grub screws that fix the bushing to the main shaft, in their original position.

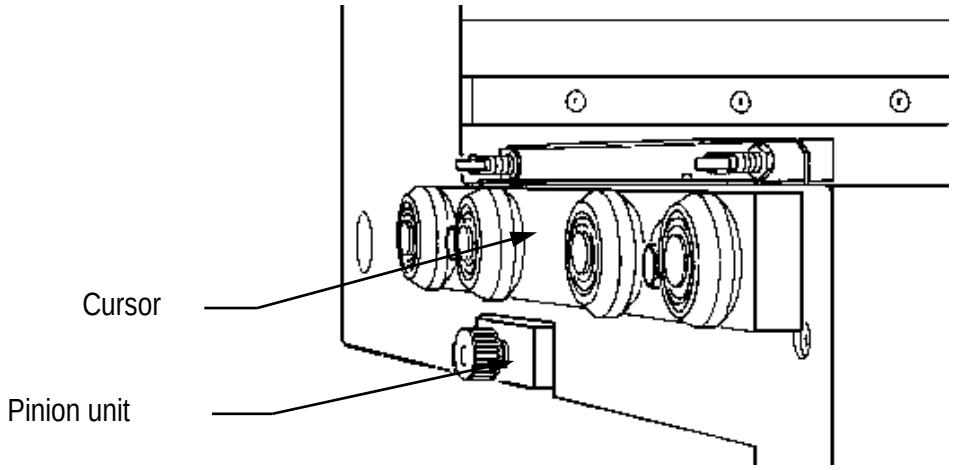



fig. 4.11

If it is necessary to also replace the main shaft of the table movement, the entire gear motor must be removed, by unscrewing the grub screws on the central pinion and the grub screws of the side connection bushings. When the new shaft has been fitted, it is necessary to make two housings, in correspondence with the two threaded holes of the central pinion, using a 3.5 mm drill bit, to prevent the locking screws from damaging the shaft, preventing subsequent dismantling.

# 4. TELESCOPIC COLUMN UNIT.

## 4.1 REPLACEMENT OF THE MOTOR.

- Remove the telescopic column protective guard.
- Disconnect the motor electrically (fig.4.12).
- Remove the 4 fixing bolts and extract the motor, releasing it from the belt.
- Make sure that the belt is correctly positioned on the driven pulley before fitting the new motor.

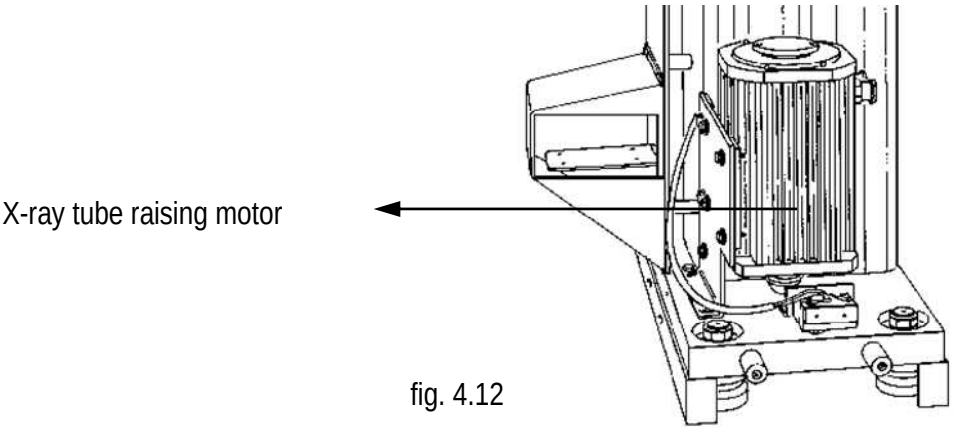



fig. 4.12

## 4.2 REPLACEMENT OF THE BALL SCREWS.

- Before dismantling, position the column to the right of the upright.
- Remove the X-ray tube and the collimator with their respective cables.
- Remove the telescopic column protective guard.
- Remove the compressor unit (see paragraph 7.1).
- Remove the duct cover, extract all the cables and remove the duct from its support.
- Remove the crosspiece.
- Remove the two M12 screws that fix the base of the column to the chain fixing plate.
- Remove the right guide head.
- Extract the column towards the right, lowering the chain fixing plate so that it passes under the sliding roller.
- Provide appropriate supports: weight is approx. 80 kg!
- Place the column on two supports so that the head rotation arm is facing downwards.
- Remove the motor: see point 4.1.
- Remove the 4 M10 screws that fix the support plate to the base plate.
- Extract the telescopic column.
- Remove the screw from the column, unscrewing the Allen screws that fix the auger.
- Remove the self-locking nut so as to release the screws and auger from the parts (fig.4.13).

Assembly: insert the belt before fixing the screw support plate to the base plate.

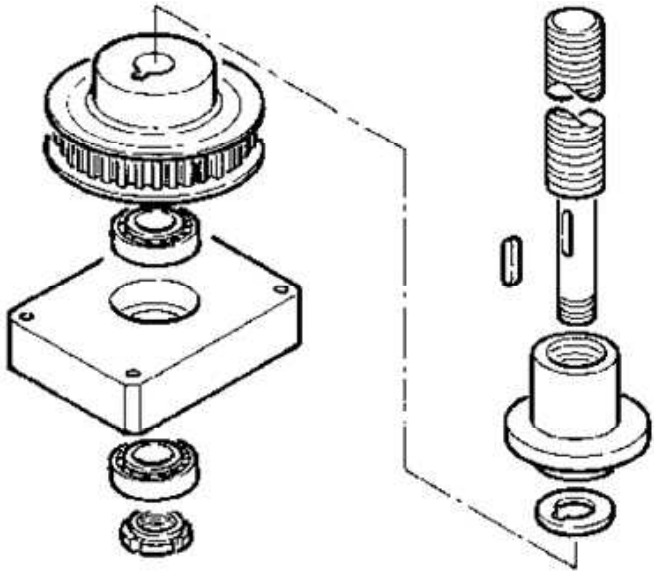


fig. 4.13

## 4.3 REPLACEMENT OF THE SLIDING ROLLERS.

- Carry out the dismantling operations described in point 4.2 as far as extraction of the telescopic column.
- Remove the closing covers and the rear plate.
- Remove the rollers and fit the new ones, taking care to fit the concentric rollers in their original position and lock them in position. Do not tighten the eccentric rollers.

Adjustment: insert the column in its housing. Adjust the eccentric rollers in order to obtain a play-free and slightly preloaded sliding movement .

# 5. HEAD ROTATION ARM UNIT.

## 5.1 CLUTCH ADJUSTMENT.

- Remove the X-ray tube and the collimator with their respective cables.
- Remove the head fixing flange (fig.4.14).
- Remove the 8 screws, 4 of which are under the locking ring and move it back sufficiently to unscrew the shoe of the parking brake and the relative release handle.
- Extract the rotation unit and adjust the self-locking nut on the back of the shaft for sufficient force to provide a preload torque to back up the mechanical brake.
- When re-assembling, respect the initial timing of the limit switches and the locking ring.

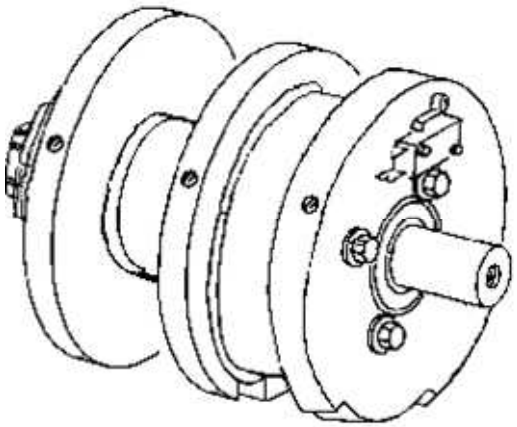


fig. 4.14

## 5.1 REPLACEMENT OF THE ARM ROTATION BEARINGS.

- Remove the X-ray tube and the collimator with their respective cables.
- Unscrew the 8 screws at the rear part around the rotation arm and extract it, freeing the inner cable.
- Remove the self-locking nut from the arm pin and extract the inner arm coupling.
- Replace the bearings after removing the snap rings.

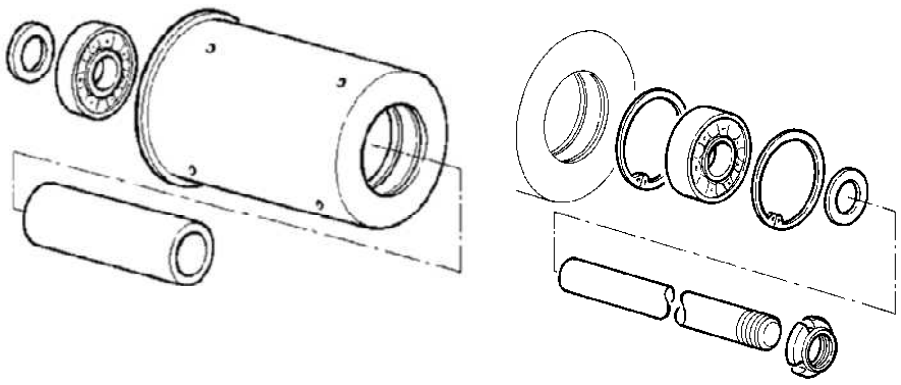


fig. 4.15

# 6. SPOT FILM DEVICE UNIT.

## 6.1 REPLACEMENT OF THE CASSETTE MOVEMENT GEAR MOTOR UNIT.

- Remove the front cover.
- Loosen the belt by means of the belt-tightener.
- Disconnect the motor electrically; remove the potentiometer unit (fig.4.16).
- Remove the gear motor by removing the fixing screws.

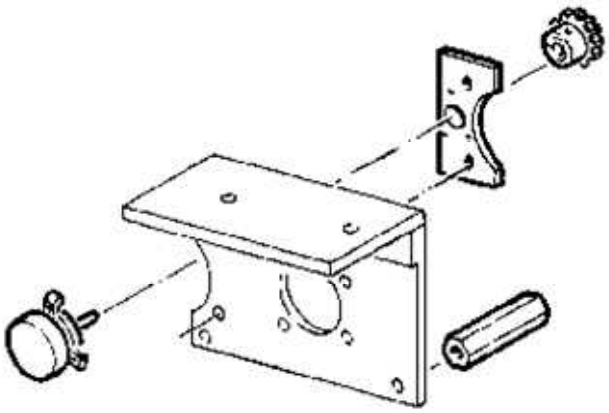


fig. 4.16

## 6.2 REPLACEMENT OF THE SHUTTER GEAR MOTOR UNIT.

- Remove the patient table.
- Remove the upper cover.
- Remove the potentiometer unit (fig.4.17).
- Release the chain from the flexible cable diam.1.5.
- Disconnect the motor electrically.
- Remove the 4 fixing screws of the motor coupling plate.

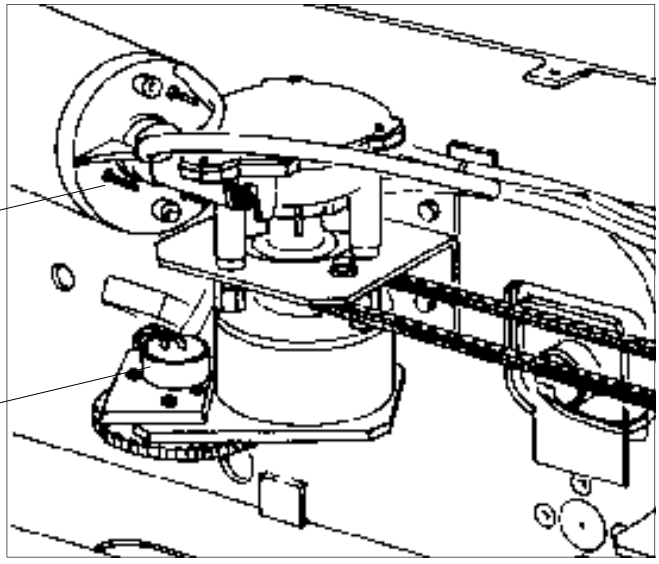



fig. 4.17

## 6.3 REPLACEMENT OF THE GRID MOVEMENT GEAR MOTOR UNIT.

- Disconnect the motor electrically.
- Remove the fixing screws of the upper and lower levers and remove the parts of the unit.
- Remove the fixing screws of the gear motor.
- When re-assembling, take care to position the sensor plate at 90° (fig.4.18) respect to the terminal.
- When the plate enables the sensor, the grid reference line must be aligned with the collimator reference line.

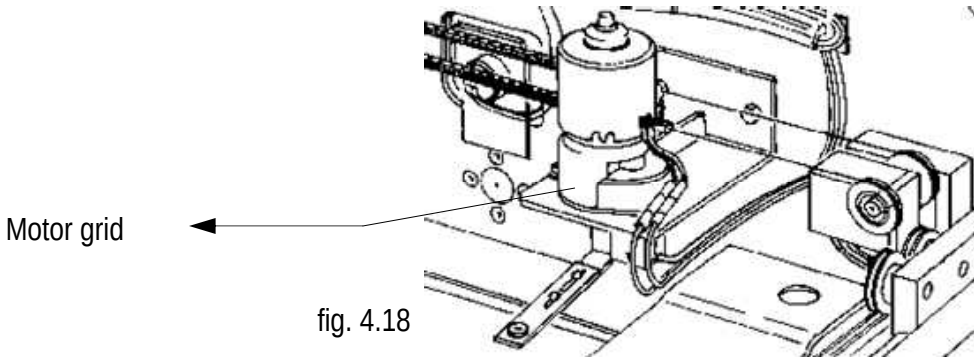



fig. 4.18

## 6.4 REPLACEMENT OF THE FLEXIBLE CABLE DIAM.1.5.

- Remove the patient table.
- Remove the cover.
- Release the chain from the flexible cable diam.1.5.
- Loosen the locking screws of the cable locking plates.
- Extract the cable and fit the new on, respecting the pathway indicated in the diagram below (fig.4.19).

N.B: <u>if the cable brakes frequently, it is necessary to check the correct alignment of the pulleys and/or the appearance of any burring on their edge. The entire cable pathway system should however be kept well-lubricated.</u>

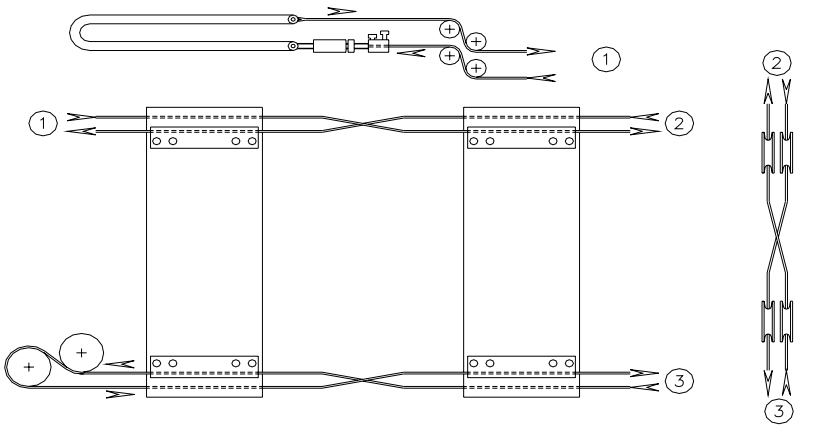



fig. 4.19

## 6.5 REPLACEMENT OF THE FLEXIBLE CABLE DIAM.3.2.

- Remove the spot film device.
- Release the 3.2 flexible cable from tension rods (fig.4.20).
- Loosen the cable-stop plate and remove the cable.
- When fitting the new cable, make sure that it does not twist. .

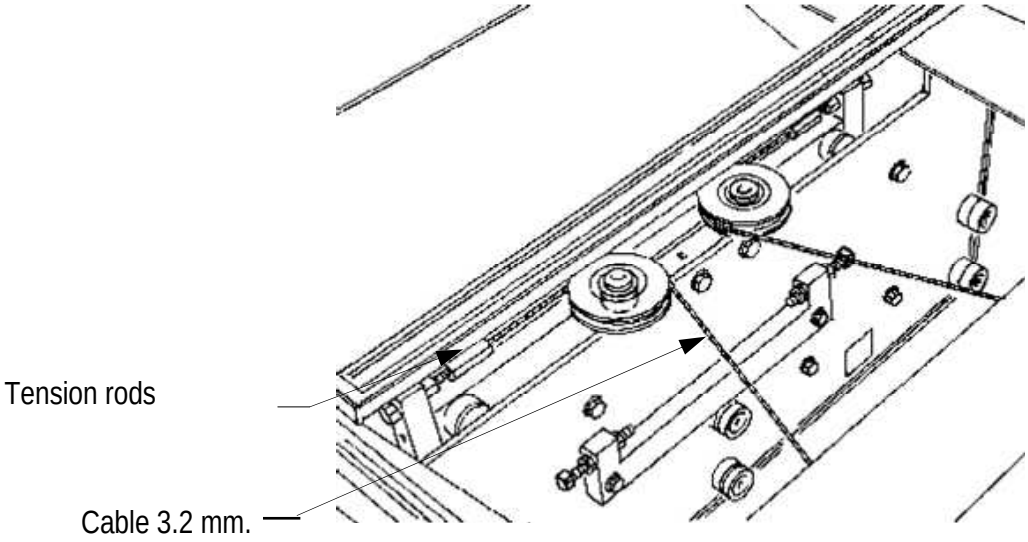



fig. 4.20

## 6.6 REPLACEMENT OF THE UPPER AND/OR LOWER SLIDING ROLLERS.

- Remove the spot film device.
- Fit the new upper rollers (fig.4.21) after removing the rear protective guards.

To replace the lower rollers, the image intensifier must also be removed.

- To fit the new lower rollers (fig.4.21), remove the I.I. support plate: release the flexible cable by removing the tension rod; remove the lower sliding rollers of the plate and release it from the guides.

Calibration of the upper rollers is carried out by trials , two rollers at a time, extracting the rollers from the guide and adjusting the position of the eccentric rollers until slight preloading is achieved.
Adjust the lower rollers before replacing the I.I. support plate.

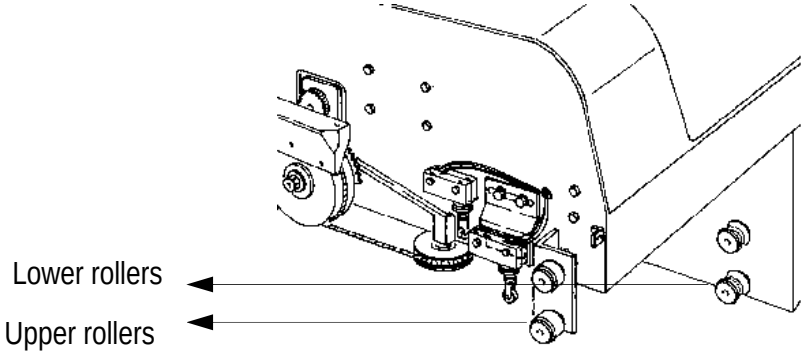



fig. 4.21

## 6.7 DISMANTLING AND ASSEMBLY OF THE MOBILE UNITS.

The spot film device consists of the following mobile units:
- film-holder frame
- ionization chamber frame
- grid movement frame
- grid frame
- blades

*The preliminary operations are:*

1) Removal of the photocell front protection plate.
2) Removal of the 1.5 flexible cable .
3) Removal of the front crosspiece.

*The mobile units should be dismantled in the following order:*

1) Front blade
2) Ionization chamber frame, sliding the grid movement frame outwards after mechanically disconnecting it from the control motor.
3) Rear blade
4) Grid frame together with the grid movement frame
5) Film-holder frame, removing the drive pulley, releasing the toothed belt from the belt-tightener pulley, sliding the film-holder frame outwards with the belt and releasing it from the belt by removing the locking plates.

# 7. COMPRESSOR UNIT.

## 7.1 DISMANTLING.

- Remove the left-hand protective guard of the column to access the connector.
- Unscrew the two M6 screws.
- Extract the entire unit from the steering bar.

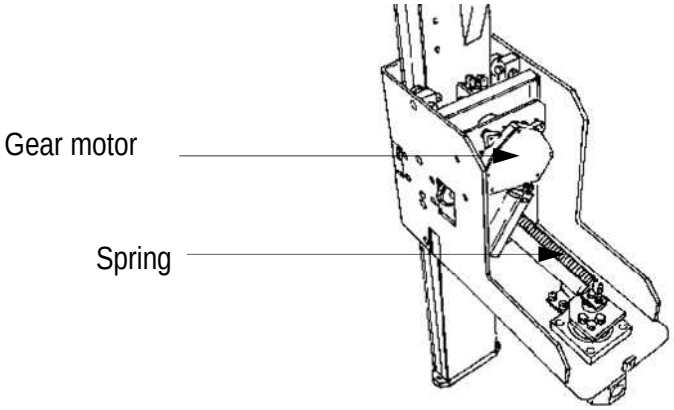



fig. 4.22

## 7.2 REPLACEMENT OF THE GEAR MOTOR.

- Carry out the indications in point 7.1 and remove the cover.
- Unscrew the two fixing screws of the motor support and extract the motor, releasing it from the chain. .

## 7.3 REPLACEMENT OF THE CHAIN.

- Carry out the indications in points 7.1 and 7.2 without removing the motor completely.

## 7.4 REPLACEMENT OF THE SPRINGS

- Remove the cover for access and remove the protective casing.
- Free the springs by removing the head.

It is possible to modify the compression force (calibrated by the manufacturer with a value of around 12 kg) by turning the screw of the clutch spring.

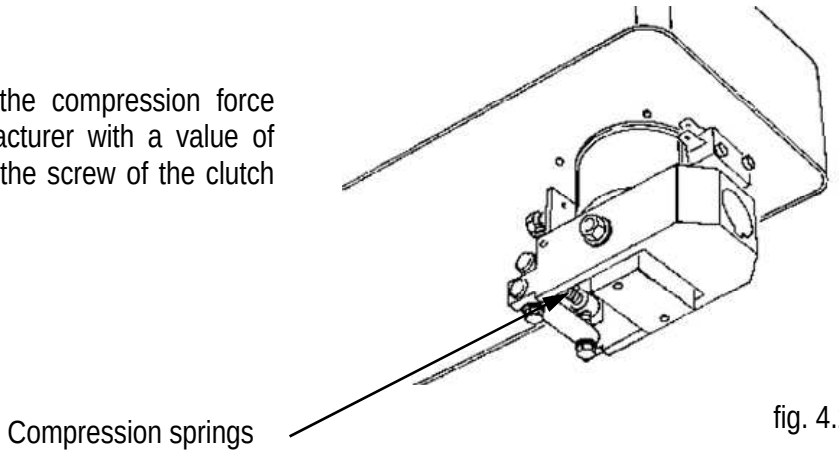



fig. 4.23

Spare page.

# PART 5

# TECHNICAL DOCUMENTATION AND SUPPLIED MATERIAL

*DELTA 90, DELTA 90 PLUS, DELTA 30*

| Revisions: | | |
|---|---|---|
| File name | Num. | Date |
| MAN056 | 2 | 10/05/2010 |
| DELTA 30: MAN005-5 | 2 | 22/09/1999 |
| DELTA 90:MAN003-5 | 3 | 10/01/2003 |

# 1. ELECTRICAL CONNECTIONS FOR SET-UP AND INTERFACING.

## 1.1 LIST OF DIGITAL INPUTS TO BE KEPT HIGH DURING SETTING UP .

If it is necessary to move the raising/tilting unit for DELTA 90-90PLUS, for DELTA 30 only tilting, before fitting the other units, the following digital inputs must be kept high during setting up, signed with X:

| Code | Type of input | DELTA 30 | DELTA 90-90 PLUS |
|---|---|---|---|
| E 00 | Magneto-thermal switches enabled. | X | X |
| E 0.1 | axis not in overshoot. | X | X |
| E 0.2 | overshoot safety device enabled. | X | X |
| E 0.3 | right floor side safety device. | NOT USED | X |
| E 0.4 | 1500 mm column limit switch. | X | X |
| E 0.5 | 1050 mm column limit switch. | X | X |
| E 0.6 | tube rotated to 0°limit switch. | X | X |
| E 0.7 | max. bar extension limit switch. | X | X |
| E 1.0 | bar top overshoot. | X | X |
| E 1.1 | ceiling safety limit switch. | X | X |
| E 1.4 | left floor side safety device | NOT USED | X |
| E 2.3 | right floor I.I. safety device. | X | X |
| E 2.7 | left floor I.I. safety device. | X | X |
| E 3.4 | compression limiter limit switch. | X | X |
| E 3.5 | table forward limit switch. | X | X |
| E 3.6 | table back limit switch. | X | X |
| E 5.3 | hand safety photocell. | X | X |

Tab.1

Connect all the PINs together also for DELTA 30-90-90PLUS, to keep high the previous digital inputs:

| Connector name | PIN name |
|---|---|
| XC 25 | PIN 1 PIN 4 PIN 6 PIN 7 PIN 8 PIN 10<br>PIN 11 PIN 12 |
| XC 25 | PIN 2 PIN 3 |
| XC 41 | PIN 3 PIN 4 |
| XC 46 | PIN 1 PIN 2 PIN 3 |
| XC 43 | PIN 1 PIN 2 PIN 3 |
| XC 30 | PIN 1 PIN 2 PIN 3 |
| CONNECTOR CONSOLLE | PIN 1 PIN 4 |

Tab.2

# 2. SPECIFICATIONS FOR INTERFACING TO OTHER EQUIPMENT.

## 2.1 LIST OF INTERFACE DIGITAL INPUTS.

Tab.3

| Drawing Ref: wire interface terminal | I/O ref | Function | Description |
|---|---|---|---|
| 290 | E8.0 | GENERATOR READY | Connected to the 'READY' output of the X-ray generator. Without this there is no way to command any radiography or fluoroscopy from the main console. |
| 291 | E8.1 | INFO RX | Connected to the 'X-RAYS' output of the generator. It is used to inform the remote table that the generator issued "rays" so that the next setup function could be carried out. The signal from the generator must be positive logic (1 during exposure, 0 when there is no exposure). The function linked to this input is enabled only after the descent front. |
| 292 | E8.2 | ———— | Formerly STEP-ANGIO RIGHT |
| 293 | E8.3 | ———— | Formerly STEP-ANGIO LEFT |
| 294 | E8.4 | DIG | Forces digital status of the equipment, and has priority on the command of the main console (see Instruction Manual). |
| 295 | E8.5 | EXT LOCK | External lock. It is usually used as a safety device. If it is low, the machine cannot carry out any movement. If it is not used, it must be connected directly to terminal 105. |
| 296 | E8.6 | ———— | Formerly STEP-ANGIO |
| 297 | E8.7 | EXT COMMAND | Generator priority external command. When active, the generator can be used in "DIRECT" modality: the collimator is forced to work in manual modality, the local exposure commands are disabled. In this way, the operator can take exposures externally to the spot film device, or with wall-stands etc. The behavior of the equipment is the same as manually moving the tube from the centered position. If it is not used, it must connected directly to terminal 105. |

## 2.2 LIST OF INTERFACE DIGITAL OUTPUTS.

For all these signals, controlled by relays, both contacts are available on the terminal board (NO=Normally open, NC=Normally closed).

| Drawing Ref: wire interface terminal | I/O ref | Function | Description |
|---|---|---|---|
| EMR6-C11 A33KA14 | A 5.1 | FLUORO MAN/ AUTO | Indication of the FLUORO function status |
| EMRR8-C12 A33KA5 | A 5.2 | TOMO | Indication of the TOMO function status |
| EMR8-A12 A36KA6 | A 8.0 | FLUOROSCOPY | Fluoroscopy command: enables after pressing the relative control on the main console. Should be connected to the 'FLUOROSCOPY' input of the generator. |
| EMR8-A11 A36KA7 | A 8.1 | PREPARATION | Preparation command: enables after pressing the relative control on the main console, and, at the same time the machine begins to carry out the preparatory movements to radiographic exposure. Should be connected to the 'PREP' input of the generator. |
| EMR8-A11 A36KA9 | A 8.2 | RADIOGRAPHY | Radiography command: enables after the request from the main console, when the machine has completed all the preparatory movements for radiography. Should be connected to the 'EXPOSURE' input of the generator. |
| EMR6-A11 A36KA9 | A 8.3 | kV+ | Should be connected to the relative input of the X.-ray generator. If Manual Fluoroscopy is selected (see Instruction Manual ), it enables raising of the Fluoroscopy kV and/or mA. |
| EMR6-A12 A36KA10 | A 8.4 | kV- | Should be connected to the relative input of the X-ray generator. If the Manual Fluoroscopy is selected (see Instruction Manual MAN001), it enables lowering of the Fluoroscopy kV and/or mA. |
| EMR8-A9 A36KA11 | A 8.5 | DIG | Indication of the DIG function status (if 1, DIG=ON). |
| EMR6-A10 A36KA12 | A 8.6 | VIDEO INV 1. | It should be connected to an inversion input of the television chain monitor. |
| EMR6-C12 A36KA13 | A 8.7 | VIDEO INV 2. | It should be connected to an inversion input of the television chain monitor. |

Tab.4

## 2.3 CONNECTION FOR I.I. FIELD ON THE RS013095 BOARD.

In order to use the contacts of the relays mounted on the card, follow the present chart:

| P4 connector pin No. | relay | relay contact | use |
|---|---|---|---|
| 4 | RL1 | COM. | RAPID SEQUENCE |
| 5 | RL1 | N.O. | |
| 6 | RL1 | N.C. | |
| 3 | RL2 | COM. | FIELD 2 |
| 8 | RL2 | N.O. | |
| 7 | RL2 | N.C. | |
| 2 | RL3 | COM. | FIELD 1 |
| 10 | RL3 | N.O. | |
| 9 | RL3 | N.C. | |
| 1 | RL4 | COM. | FIELD 0 |
| 12 | RL4 | N.O. | |
| 11 | RL4 | N.C. | |
| 17 | RL5 | COM. | START/STOP COMMUTING |
| 19 | RL5 | N.O. | |
| 18 | RL5 | N.C. | |
| 16 | RL6 | COM. | STEP ANGIO |
| 21 | RL6 | N.O. | |
| 20 | RL6 | N.C. | |
| 15 | RL7 | COM. | LATERAL AEC CHAMBERS ZONE EXCLUSION |
| 23 | RL7 | N.O. | |
| 22 | RL7 | N.C. | |
| 14 | RL8 | COM. | FLUOROSCOPY PEDALS |
| 25 | RL8 | N.O. | |
| 24 | RL8 | N.C. | |

Tab.5

# 3. TECHNICAL REFERENCE DOCUMENTS.

For the maintenance of the remote control table, the following documents must be referred to:

case DELTA 90-90PLUS:

| | |
|---|---|
| SCH 1001 | - Wiring diagrams. |
| DCE 0019 | - Component layout in the cabinet. |
| DBM 0007V01 | - Connections on the machine. |
| DBM 0008V01 | - Composition of the cables on the machine. |
| DBM 0009V01 | - Analog signals and screened cables. |
| DBM 0010 | - System ground wiring. |
| DBM 0011V01 | - Component layout on the machine |

case DELTA 30:

- reference documents, including the electrical functional schemes on dedicated tables:

| | |
|---|---|
| SCH 3001: | electric functional diagram. |
| DCE 0001: | component layout. |
| DBM 0001: | connections on the machine. |
| DBM 0002: | connectors on the machine. |
| DBM 0003: | composition of cables on the machine. |
| DBM 0004: | analog signals connection. |
| DBM 0005: | conductor to the ground. |
| DBM 0006: | component layout on the machine. |

- Instruction Manual: MAN001.
- PC and CATWIN s/w.

# 4. MAINTENANCE MATERIAL NEEDED.

* PLUGS TO REPLACE THE EYE-BOLTS.
* 1 40-200 NEWTON DYNAMOMETRIC KEY.
* BALL SCREW BLOCKING TOOL.
* 1 PC ( Min. Pentium 2) WITH ONE OR MORE SERIAL PORTS.
* CATWIN PROGRAM.
* “SETUP ” EPROMS.
* OPTICAL FIBER COMMUNICATION CABLE.
* 1 ADAPTER FOR O.F. CABLE
* SET-UP CONNECTORS.

*The normal set of tools for mechanical and electrical interventions is also necessary.*

# PART 6

# FUNCTIONAL INTERLOCKS

*DELTA 90, DELTA 90 PLUS, DELTA 30*

| Revisions: | | |
|---|---|---|
| File Name | Num. | Date |
| MAN056 | 2 | 10/05/2010 |
| DELTA 30: MAN005-6 | 1 | 01/09/1998 |
| DELTA 90:MAN003-6 | 2 | 10/01/2003 |

# 1. ENABLING AND INHIBITING SIGNALS.

## 1.1 CHECKS WHEN SWITCHING ON.

When the machine is switched on, the following checks are carried out:

*A . Potentiometer reading channel check:*

- The four VF channels check the following movements: column, carriage, spot film device shutters and cassette movement.
- The seven AD channels check the following movements: raising (only for the Delta 90-90 PLUS), tilting, X-ray tube raising, the 3 collimator potentiometers (2 for collimators with no iris) and angle of incidence.

*B . Centering check.*

- If the conditions are correct, the relative LED lit up.

*C . Keyboards.*

- When the equipment is switched on, all the movements are disabled until the "POWER ON" pushbutton on the main keyboard is pressed. If necessary, an authorized technician can enable the movements by inserting the special by-pass key (see Instruction Manual) without pressing "POWER ON".

## 1.2 RAISING *(Delta 90-90PLUS only ).*

*A . Enabling signals.*

- Command signal ([1])
- Inverter OK
- The potentiometer value must be lower than the maximum value memorized in the $E^2ROM$
- The input signal E8.5 (External Block) of the connector C5/22 ([2]) must be present.

*B . Inhibition signals.*

- Upper limit switch
- Antenna microswitch signal

([1]) Signal that can be checked on the PC or visually by means of the red-green TX-RX LED. The control signals of a movement are inter-blocked with the control signals of the same movement in the opposite direction.

([2]) All the movements of the machine that can interfere with other equipment present in the radiology room are blocked if this signal is not present.

## 1.3 LOWERING – TILTING.

| | | *DELTA 30* *TILTING* | *DELTA 90-90PLUS* *LOWERING-TILTING* |
|---|---|---|---|
| *Enabling signals.* | Command signal (1) | Yes | Yes |
| | Inverters OK | Yes | Yes |
| | The potentiometer value of lowering must be higher than the value stored into the E²ROM. | No | Yes |
| | The input signal E8.5 (External Lock) of the connector C5/22 (2) must be present | Yes | Yes |
| | Correct calibration of the tilting potentiometer values. | Yes | Yes |
| *Inhibition signals* | Both limit switches pressed | Yes | Yes |
| | Signals from one of the 2 I.I. ground safety sensors. | Yes | Yes (in this case the signal can come also from 2 sensors of the translation base) |
| | Antenna microswitch signal | Yes | Yes |

## 1.4 TRANSLATION ([3])

### *A . Enabling signals* (Common to the column and carriage)

- Command signal ([1])
- Master Inverter and Slave control OK
- The potentiometers values of the column and carriage must be within the values stored into the E²ROM.
- Tomography "OFF"
- With the console, by moving the column spot film device unit, the compressor if it is not already out of range, will take automatically that position.
- Correct functionality of the axis board.
- Correct acquisition of the encoder signals.

### *B . Inhibition signals*

- Right or left limit switch
- Signals from one of the 2 I.I. ground sensors (and 2 safety micro-switches of translation base in the case of DELTA 90-90PLUS).
- Antenna micro-switch signal.
- Software limit switch

## 1.5 ANGLE OF INCIDENCE (*)

### *A . Enabling signals*

- Command signal ([1])
- Master Inverter and Slave control OK
- The potentiometer values of the column, the carriage and the tomography angle must be within the values memorized in the E²ROM.
- With the console, by moving the column spot film device unit, the compressor if it is not already out of range, will take automatically that position.
- Correct functioning of the axis board.
- Correct acquisition of the encoder signals.

### *B . Inhibition signals*

- Incidence rod limit switch.
- Signal from one of the 2 I.I. ground sensors (and 2 safety micro-switches of translation base in the case of DELTA 90-90PLUS).
- Antenna micro-switch signal.
- Software limit switch

(*) The angle loading movement cannot be carried out at the same time as the cassette and spot film device shutter movements.

([3]) The translation movement cannot be carried out at the same time as the cassette and spot film device shutter movements.

## 1.6 X-RAY TUBE RAISING.

### *A . Enabling signals.*

- Command signal ([1])
- The potentiometer value of the column must be within the values memorized in the E²ROM.
- Tomography "OFF"

### *B . Inhibition signals.*

- Tomography bar limit switch.
- Antenna microswitch signal.
- X-ray tube column upper limit switch.
- Software limit switch

## 1.7 PATIENT TABLE MOVEMENT.

### *A . Enabling signals.*

- Command signal (if the movement is controlled from the console). ([1])

### *B . Inhibition signals.*

- Limit switch

## 1.8 COLLIMATOR: SHUTTERS AND IRIS.

### *A . Enabling signals.*

- The potentiometer values must be within the values stored into the E²ROM.
- For the movement of the shutters:
  - Selection of the manual shutter functioning or manual iris functioning.
- For the movement of the iris:
  - Selection of the manual iris functioning.
  - Iris presence selected by means of the CATWIN program.

### *B . Inhibition signals.*

- Inhibition of the shutter and iris movement can only be due to problems of a mechanical nature.
- Software limit switch.

NOTE 1: For the correct functioning of the iris, the I.I. fields must be correctly programmed.

NOTE 2: When the X-ray tube is rotated with respect with its central position, the manual functioning mode is used.

NOTE 3: The functioning precision of the collimator depends on the correct calibration of **all** the relative parameters.

# 2. CHECKS CARRIED OUT ON THE SPOT FILM DEVICE (**).

## 2.1 CASSETTE: INSERTION AND EJECT.

### *A . Enabling signals.*

- Command signal (1).
- The potentiometer value of the cassette must be within the values stored into the E²ROM.
- Drive OK.
- DIG "OFF".

| | |
|---|---|
| NOTE 1: | In case of incorrect size recognition, check the relative tables in the E²ROM. |
| NOTE 2: | Calibration of the positioning and discharge percentage speeds affect the correct functioning of the cassette in radiography and the discharge of the cassette. |
| NOTE 3: | Centering of the film in radiography is adjustable by means of the central value of the potentiometer, the value on about 410 in output from the potentiometer, the “Cassette Offset” parameter. |

### *B . Inhibition signals.*

- Limit switch.
- Photocell signal.

(**) The movements cannot be made at the same time as translation.

## 2.2 SHUTTERS.

### *A . Enabling signals.*

- The potentiometer value of the shutters must be within the values memorized in the E²ROM.
- Function "F2" OFF.

### *B . Inhibition signals.*

- Inhibition of the shutter movement can only be due to problems of a mechanical nature.
- Software limit switch.

NOTE 1: The correct positioning of the shutters at the various divisions and at the various I.I. diameters strictly depends on the correct switching of the motor power supply from 24 volts to 5 volts and on the correct programming of the I.I. fields.

NOTE 2: The spacing between the various exposures on the same film is calibrated with the relative "Shutter Delta" parameter by means of the CATWIN program.

## 2.3 CASSETTE RAPID SEQUENCE.

### *A . Enabling signals.*

- Tomography OFF.
- Rectangular wave pulsating signal on the X-ray info terminal in the inputs available to the user.

# 3. CHECKS CARRIED OUT ON THE FUNCTIONS (4).

## 3.1 TOMOGRAPHY.

### *A . Angle validation conditions.*

- The " Angle of incidence centering" LED must be lit.
- The height of the tube must be less than 120 cm.
- There must be sufficient space to allow the travel of the column and the spot film device according to the angle selected: the distance from the limit switches must be greater than the distance necessary for loading the angle.
- The "TAB" function must be OFF.

### *B . Movement conditions.*

- The same conditions as for the angle of incidence apply.

## 3.2 PREPARATION.

### *A . Enabling signals.*

- DIG must be ON and/or there must be a recognized cassette size.
- The enabling signals of the shutters and the iris.
- The enabling signals of the cassette and shutter movements.
- If TOMO=ON, all the enabling signals for validity of the tomography angle are necessary to obtain the "TOMO READY" signal.

| | |
|---|---|
| NOTE : | The operations have been completed correctly if the preparation LED on the main console is on. |

## 3.3 RADIOGRAPHY.

### *A . Enabling signals.*

- The preparation LED on the main console must be on.
- "Generator READY" signal.
- Tube centered.
- Grid enabled.
- If rapid sequence is ON, the “INFO RX” signal is necessary (see part 5).
- If TOMO is ON, all the enabling signals relative to the angle of incidence loading movements are necessary.

(4) The movements cannot be made at the same time as translation.

## 3.4 FLUOROSCOPY.

### *A . Enabling signals.*

- "Preparation" OFF.
- Tube centered.
- Enabling signals of the shutter and iris movements.
- Enabling signals of the cassette shutters.
- If TOMO is ON, all the enabling signals relative to the angle of incidence loading movements are necessary.

NOTE : When the cassette is in the parking position, the inner limit switch must be activated.

## 3.5 TAB FUNCTION.

### *A . Enabling signals.*

- All the enabling signals of Preparation and Radiography.
- All the enabling signals of the translation movement.
- Correct programming of the carriage movement STEP by means of the CATWIN program.

### *B . Inhibition signals.*

- TOMO=ON

NOTE : This function can be carried out with tilting angles between -10° and + 10°. To use this function with higher or lower angles, the relative option must be purchased.

# PART 7

# MAINTENANCE

*DELTA 90, DELTA 90 PLUS, DELTA 30*

| Revisions: | | |
|---|---|---|
| File Name | Num. | Date |
| MAN056 | 2 | 10/05/2010 |
| DELTA 30: MAN005-8 | 1 | 01/09/1998 |
| DELTA 90:MAN003-8 | 2 | 10/01/2003 |

# 1. MAINTENANCE.

## 1.1 PERIODICAL MAINTENANCE OPERATIONS.

The maintenance interventions on the DELTA 30, DELTA 90-90PLUS consist mainly of thorough periodic checks of the equipment and of the electrical and electronic connections, of the safety devices, the tightness of the screws and the correct functioning in general.

It is advisable to record all the maintenance operations carried out on the machine on the relative form.

### 1.1.1 Six-monthly checks.

a. Collimator.
Make checks, unless indicated otherwise, on the alignment for the definition of the X-ray emission area.

b. Registrations.

b.1) Check the right tension of the chain (A) and eventually adjust by means of the adjusting screw (B) (see fig. 7.1). Lubricate with grease.

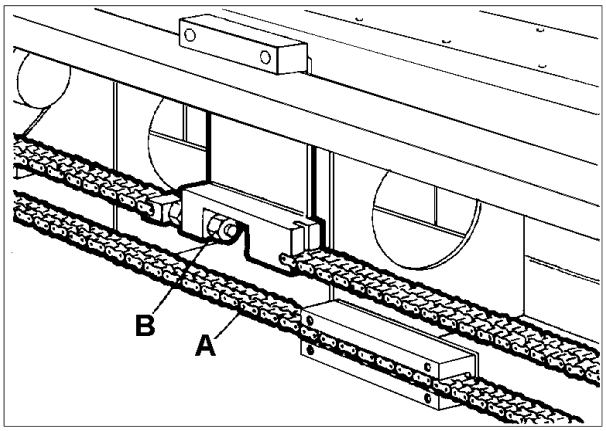



fig.7.1

SPECIALIZED PERSONNEL! Each operation indicated by this symbol must be carried out exclusively by specialized personnel of the Manufacturer, or personnel who have attended a specific training course one held by the manufacturer.

DANGER OF ELECTRICAL SHOCK. During all the service operations which require the removal of high voltage connections, great care should be taken to avoid the risk of electric shock. Remember that high voltage cables can retain an electric charge, or may be directly connected to parts that retain an electric charge even after the equipment has been switched off.

POWER OFF! Before any operation on the machine, it is obligatory to switch off the power supply to the machine.

b.2) Check the tension of the front chain (A) and if necessary adjust it by means of the adjusting screw (B) (see fig.7.2). Lubricate with grease.

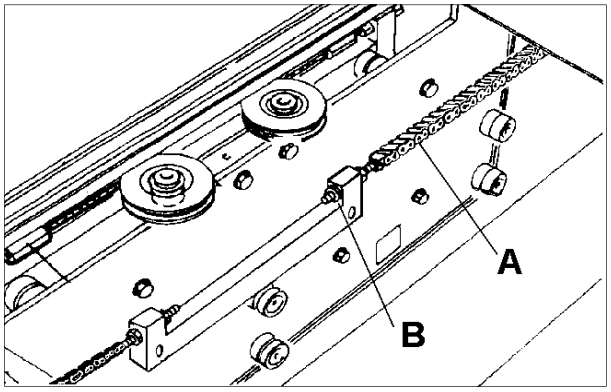



fig.7.2

b.3) Check the tension of the cables (A) and if necessary adjust it by means of the adjusting screw (B), (see fig.7.3).

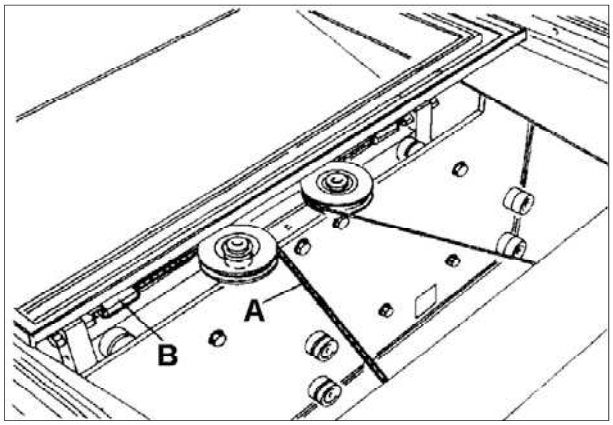



fig.7.3

b.4) DELTA 90-90PLUS only . Check the tension of the raising belts (A) by means of a turnbuckle (B), (see fig.7.4).

Incorrect tension may lead to an increase of noise during the raising movement of the table.

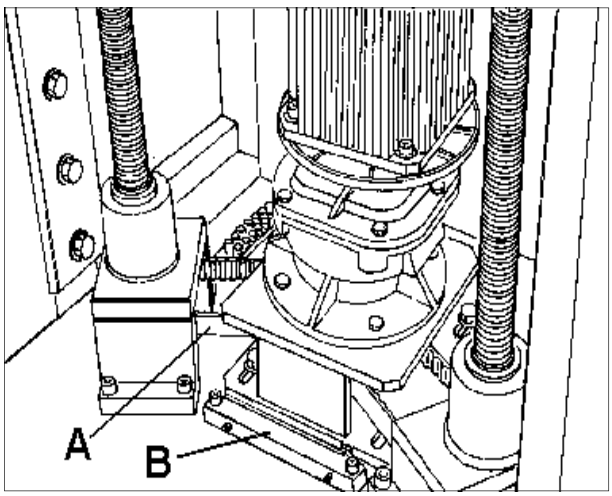



fig.7.4

b.5) DELTA 90-90PLUS only . Check the right tension of the tilting belt (C); if necessary, adjust it by means of the screws (D). (see fig.7.5).

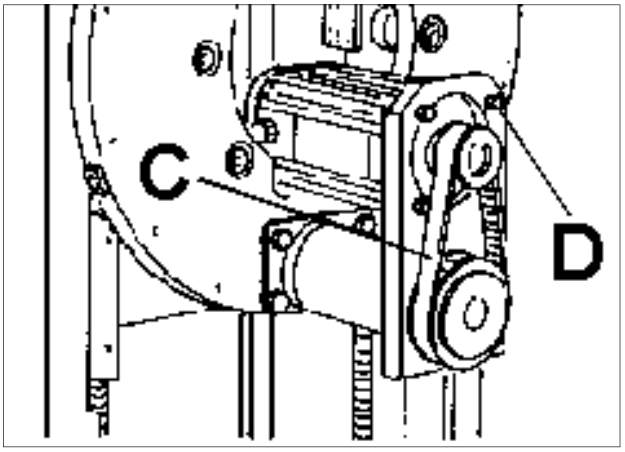



fig.7.5

⚠ Incorrect tension may lead to an increase of noise during the raising movement of the table.

c Lubrications.

c.1) - DELTA 90-90PLUS. The screws (A) (see fig.7.6) of the main upright should be cleaned and lubricated by means of the relative lubricating screw and the lever lubricator. Use "BEROLUB FR16" grease or the equivalent.

- DELTA 30. The ball screw of the main tilting upright should be lubricated by means of the relative lubricating screw and the lever lubricator. Use "BEROLUB FR16" grease or the equivalent.

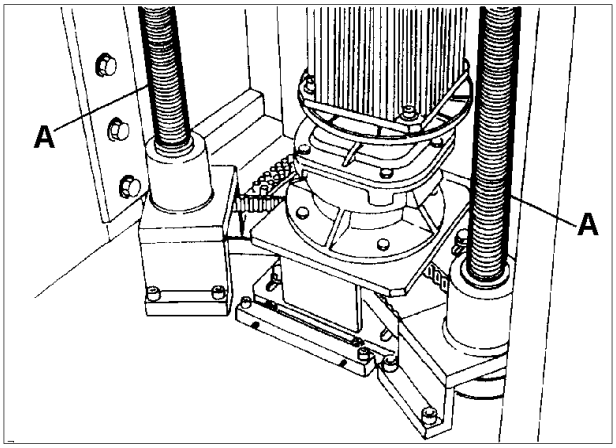



fig.7.6

c.2) DELTA 90-90PLUS only . Grease the tilting wheels (B), see fig. 7.7.

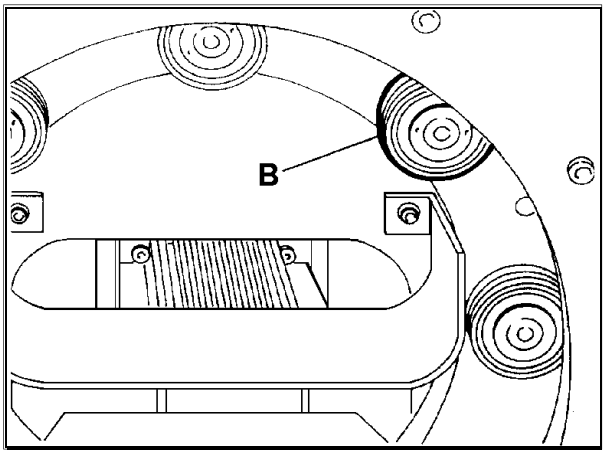



fig.7.7

c.3) DELTA 90-90PLUS only. Grease the rack (D), see fig.7.8.

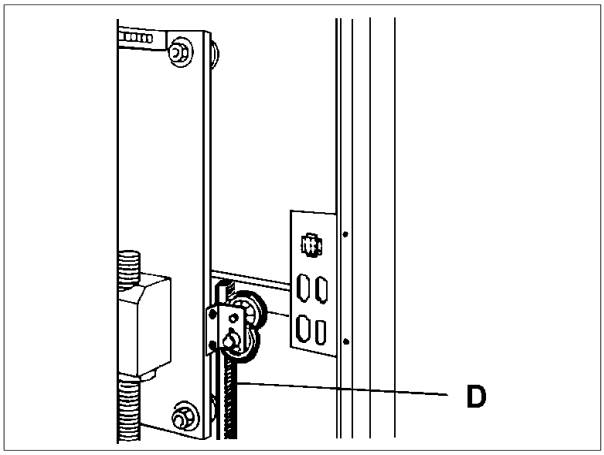



fig.7.8

c.4) DELTA 90-90PLUS only . Lubricate the toothed wheels (E) and the raising wheels (E1),.see fig.7.9.

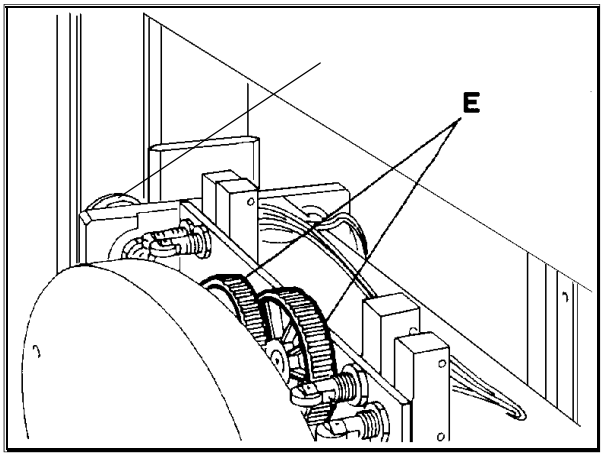



fig.7.9

c.5) Grease the chain (C) of the spot film device unit and the cable (C1).see fig. 7.10.

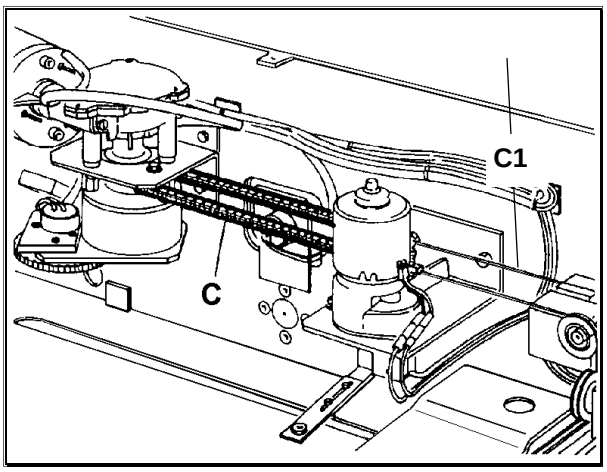



fig.7.10

c.6) Grease the sliding wheels (F) and the pinion (G), see fig.7.11.

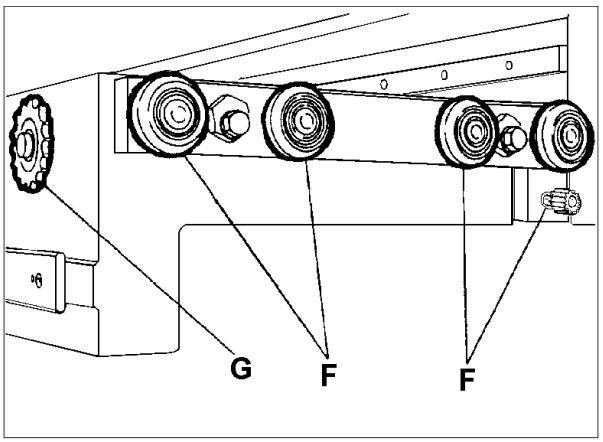



fig.7.11

c.7) Grease the toothed wheels (H), (I), see fig.7.12.

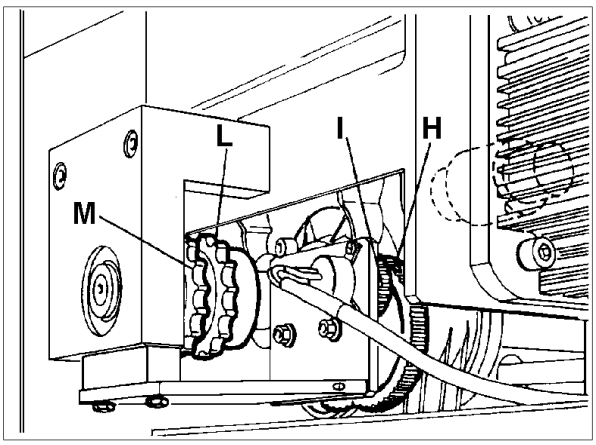



fig.7.12

c.7) Grease the toothed wheels (M), (O), (P) (Q). see fig.7.13.

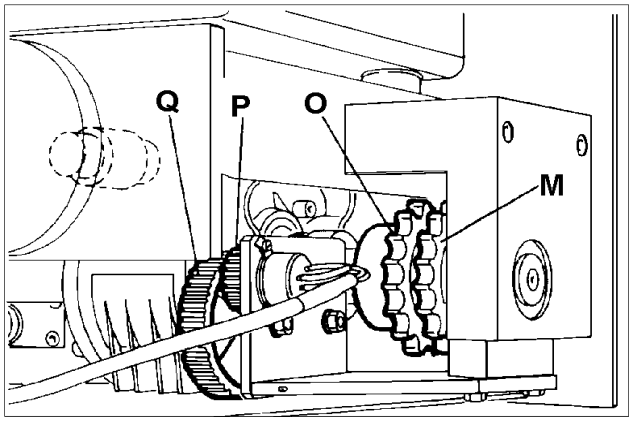



fig.7.13

c.8) Grease the chain (R). see fig.7.14.

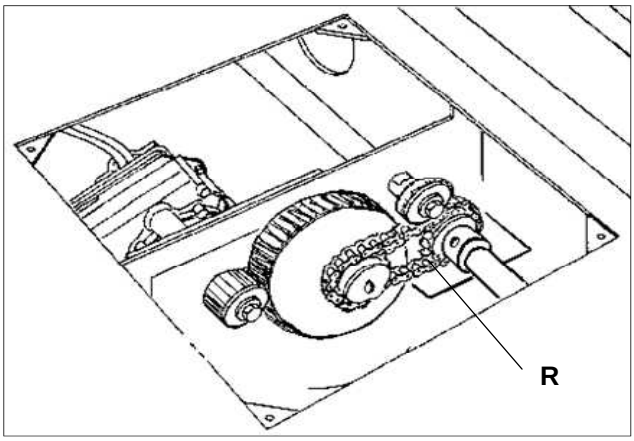



fig.7.14

## 1.2 LONG PERIODS OF INACTIVITY.

If the machine is to be inactive for a long period, it is advisable to cover it with a dust cover of appropriate dimensions.
After long periods of inactivity, check the perfect functioning of all the units before using the machine with a patient.

## 1.3 LIST OF REFERENCE DOCUMENTS FOR MAINTENANCE.

Technical sheets (example):……..Matr.RS011598
Instruction manual……..……..Latest revision
Spare parts manual……..Latest revision
Wiring diagram of the CPU RS011493 board……RS/CSE/0020/95
RS012993 rack connections……..RS/CSE/0021/95
Diagram of the I/O RS0111693 board……..RS/CSE/0022/95
Diagram of the CPU RS012094 console……..……RS/CSE/0023/95
Diagram of the AXE RS013095 board……...RS/CSE/0001/96
Diagram of the AD/DA RS011593 board……RS/CSE/0025/95
Inverter Instruction Manual……..……(according to the type of inverter)
AXOR command Instruction Manual..……..(MS./60– manual)

<u>case DELTA 90-90PLUS:</u>

wiring diagrams……..……...SCH 1001
component lay-out in the electrical cabinet ……..DCE 0019
connections on the machine…..……DBM 0007V01
composition of cables on the machine……...DBM 0008V01
analog signals and screened cables……..DBM 0009V01
system ground wiring……...DBM 0010
component lay-out on the machine…… ……...DBM 0011V01

<u>case DELTA 30</u>

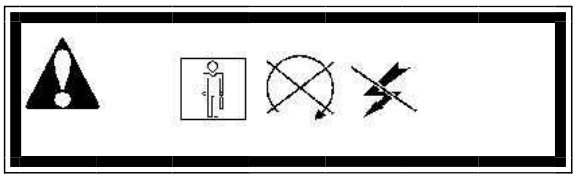
wiring diagrams……..……..SCH 3001
components lay-out…..……..DCE 0001
connections on the machine…..……DBM 0001
connectors on the machine……DBM 0002
composition of cables on the machine……..DBM 0003
analog signals connections……...DBM 0004
conductor to the ground……DBM 0005
components lay-out on the machine……DBM 0006

# PART 8

# MAIN CONSOLE SET-UP

*DELTA 90, DELTA 90 PLUS, DELTA 30*

| Revisions: | | |
|---|---|---|
| File Name | Num. | Date |
| MAN056 | 2 | 10/05/2010 |
| MAN056 | 1 | 15/11/2007 |
| DELTA 30: MAN005-9 | 2 | 17/03/2000 |
| DELTA 90:MAN003-9 | 3 | 10/01/2003 |



# 1. GENERAL .

Main features:

- Step-by-step analog joystick column control.
- Key functions can be customized
- Functions:
    - Error display mask.
    - Joystick orientation according to the operator's requests.
    - Test LEDs.
    - Autotest with keyboard check and luminous indications.
    - Diagnostic function for keyboard and LEDs checks.
    - Test cycle setup, storage and execution for factory testing.
- Compatibility with configuration software and remote control for Windows 95/98, 2000,XP, "CATWIN".

## 2. COMPOSITION.

The console consists of, see fig. 8.1:

1. Support foot
2. Vertical upright
3. Upper section fixed to the vertical upright consisting of:
   3.1. Support plate with hinge for upper casing, support for toroidal transformer and connection terminal board.
   3.2. Upper casing with two slots to house the keyboard and the display panel (see fig.8.2).

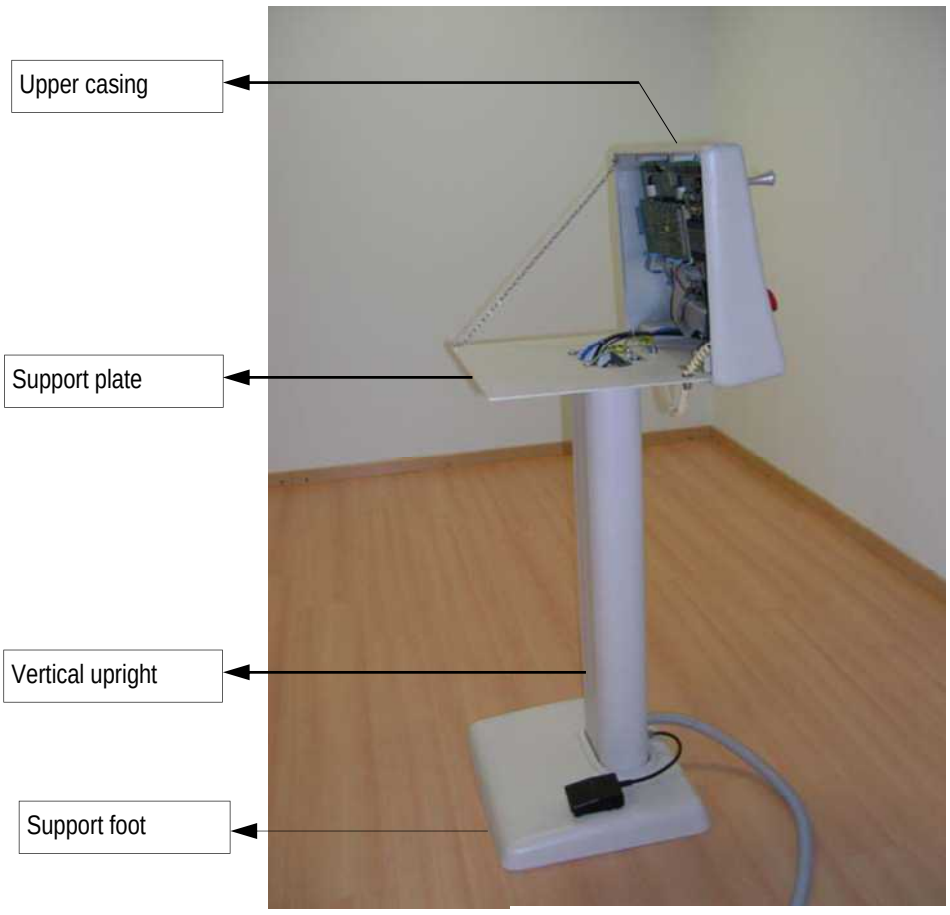



Fig.8.1: lateral view of the console

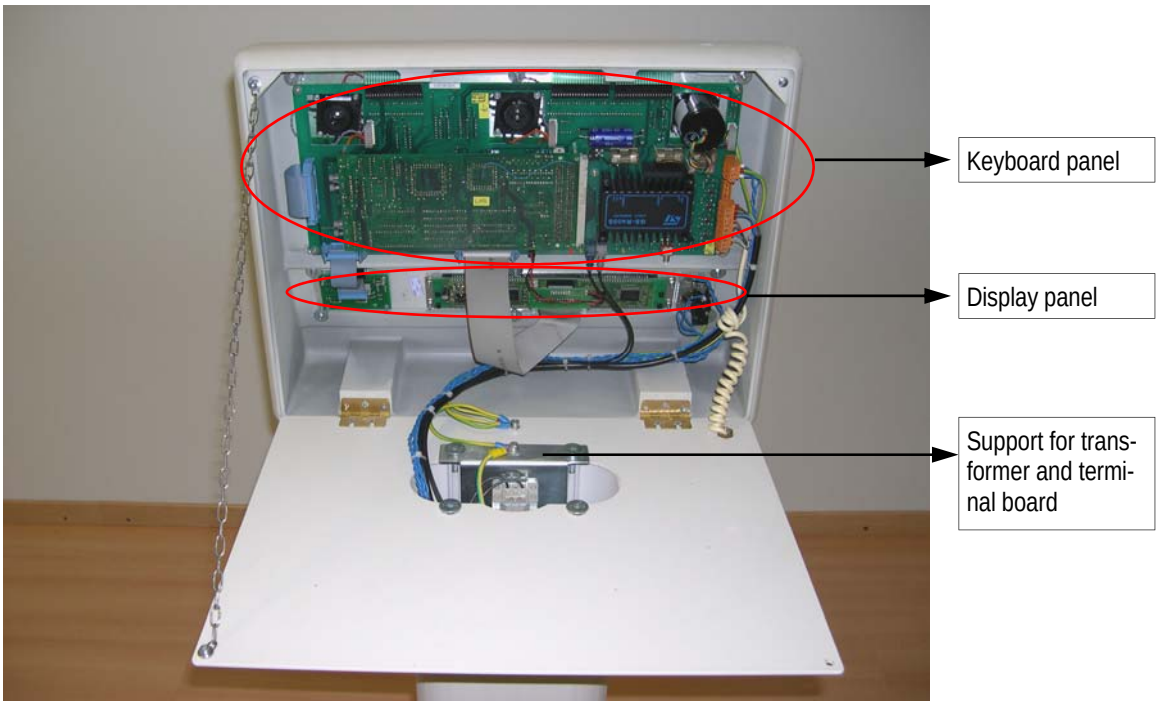



fig.8.2: internal of the upper casing

3.3. Display panel consists of, see fig. 8.3:

3.3.1. RS940401 board for three keys and three LEDs.

3.3.2. 2x40 NORITAKE character fluorescent display

3.3.3. NEC-NORITAKE RS010403 adaptor

3.3.4. Mushroom emergency pushbutton.

3.4. RS960701 keyboard panel equipped of, see fig. 8.3:

3.4.1. RS960402 LED board (part not visible from the figure)

3.4.2. RS960601 console board

3.4.3. CPU RS970001 board

3.4.4. 2 contact Joysticks for the 4 directions

3.4.5. 1 XY analog Joystick

The support plate, on which the keyboard casing is hinged, is equipped with wire connection terminals for:

- power supplies leading from the "CONSOLE" connector
- ground
- mushroom pushbutton
- 220 input of the toroidal transformer
- 9+9V outputs of the toroidal transformer for the console board.

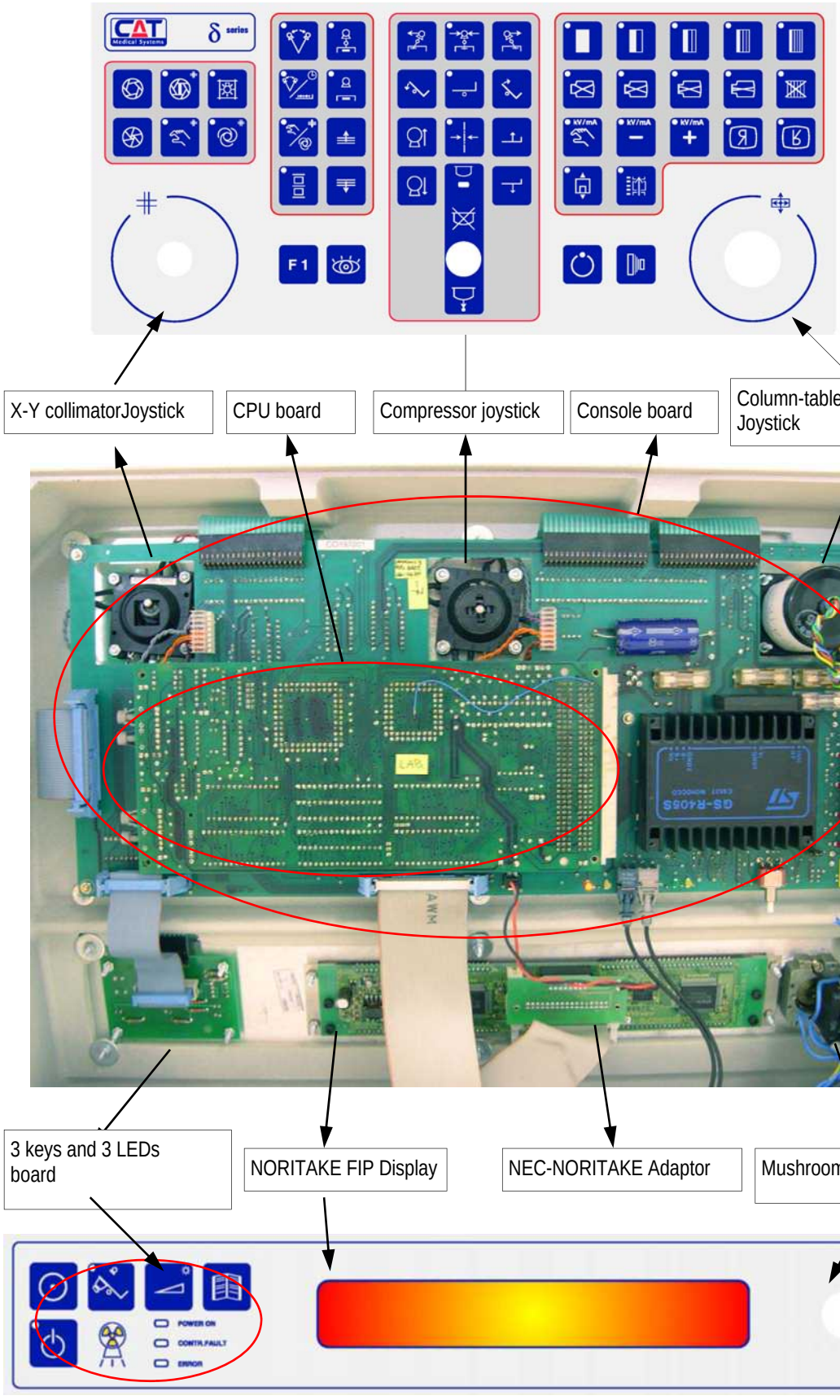

X-Y collimatorJoystick
CPU board
Compressor joystick
Console board
Column-tabletop Analog Joystick
3 keys and 3 LEDs board
NORITAKE FIP Display
NEC-NORITAKE Adaptor
Mushroom pushbutton

fig. 8.3

# 3. WORKING MODALITIES.

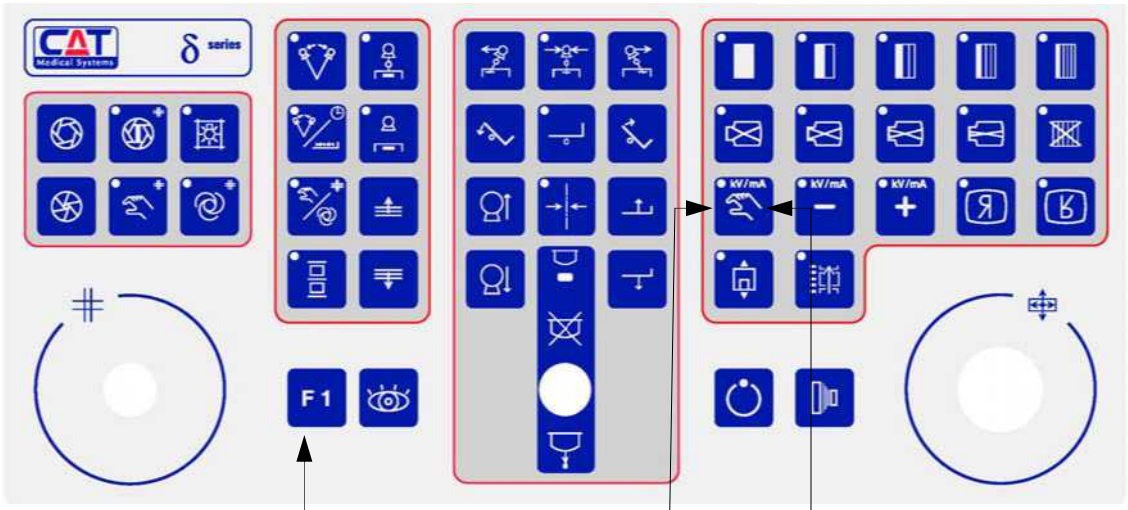
The modalities are as follows:

- Off: not powered.
- Stand-by: powered but not operative; the control section is on but not operative.
- Power ON: powered and operative; control and command sections enabled.
- Power up or cold restart (cold reset): transitory phase of electronic light up of control, from the "off" condition to the "stand-by" condition.
- Hot restart (hot reset): the re-starting of the operative program is forced, by pressing the reset pushbutton (fig.8.9) in condition of power supply present and stable.

# 4. FUNCTION OF THE STATUS KEYS.

(see also MAN001)

fig. 8.4: keyboard layout




STAND BY Mode:

- Reset alarms if present and displayed.
- TEST LEDS.

POWER ON Mode:

Error messages canceled. (cfr.MAN001 cap.4 page 20/54).

STAND BY Mode:

FREEZE film divisions ON-OFF (automatic setup of the divisions based on the memory of the last choice), (cfr.MAN001 cap.5 page 39/54).

POWER ON Mode:

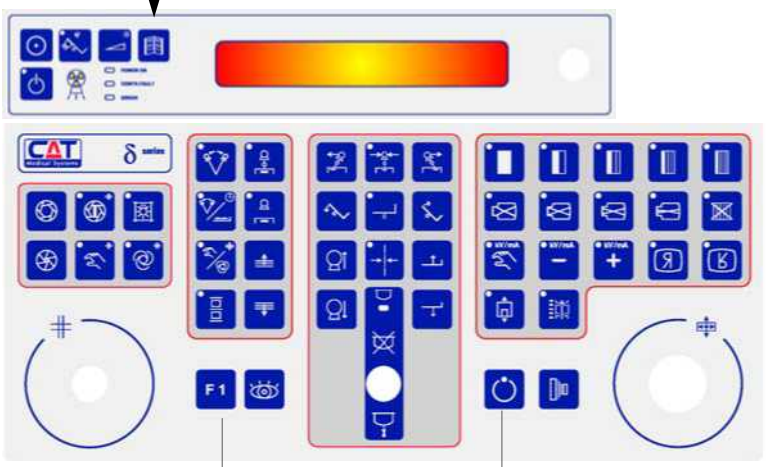
MANUAL CONTROL OF kV. (cfr.MAN001 cap.4 page 31/54).

TEST LEDS.

The TEST LEDS function causes all the LEDs to flash, except the the CPU FAIL on, which lits up only in the event of an unrecoverable CPU fault.

# 5. MULTIPLE FUNCTION KEYS (see also MAN001).

fig. 8.5: keyboard layout




Main function:
Fluoroscopy command

Additional function:
When pressed during the power-up phase, it gives access to diagnostic function for keyboard and leds control.

Main function:
Radiography preparation command

Additional function:
When pressed during the power-up phase, it gives access to error display inhibition program (part 7),.

Main function:
When pressed successively this key, different "INFO SCREENS" are displayed.

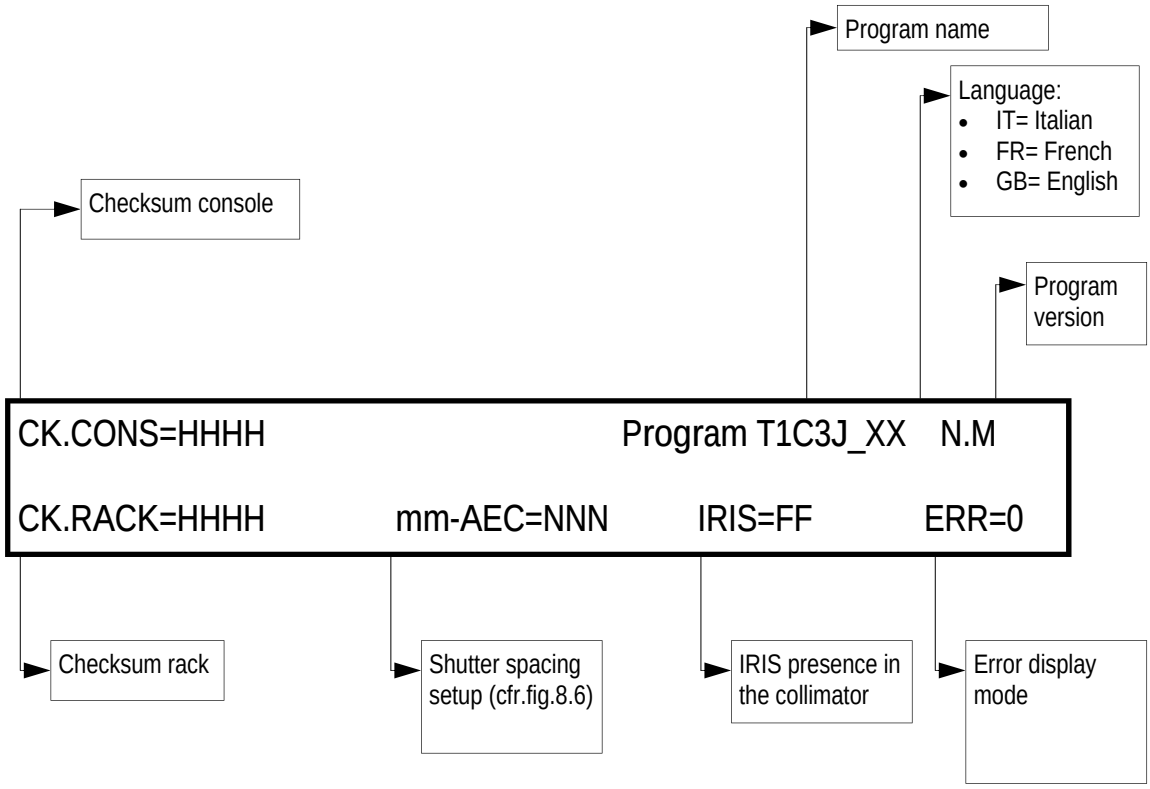
Additional function "SPECIAL INFO" (par. 6):
When pressed for several seconds, the SW version is displayed.

# 6. "SPECIAL INFO" FUNCTION.

In any operative mode, except for error presence and joystick setup, when the "F1" key is pressed for a few seconds, the "SPECIAL INFO" message is displayed.
This message displays the following information:

- Checksum console data
- Program name
- Language
- Version
- Variables of the rack section:
  - Checksum data
  - Setup of shutter spacing in millimeters to ensure the control of AEC side parts covering.
  - IRIS presence in the collimator: 0 = ABSENT. FF = PRESENT.
- Error display mode with or without inhibition:
  0 = Disabled. FF = Enabled

The rack section variables are stored into the rack memory, and are transmitted from the cabinet during the power-up phase.



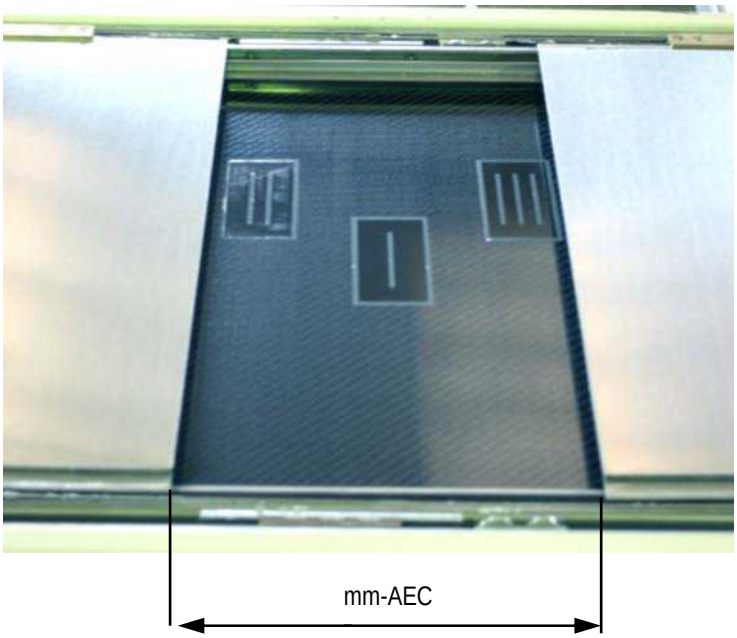
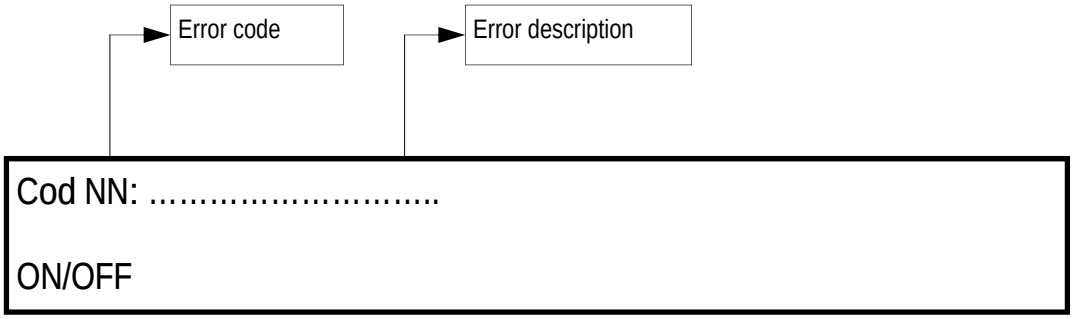



fig. 8.6

When the F1 key pressed simultaneously with the “DISPLAY” key, it’s possible to change the status of the ERR variable. Only if ERR=FF all the errors are displayed independently of the inhibition mode. Every time the keyboard is switched on or reset, ERR=0 is displayed (inhibited errors not displayed).

# 7. ALARM CODE INDIVIDUAL INHIBITION PROGRAM.

To enter this mode, hold down the “PREPARATION” key during the power up phase or forcing a hot restart.
In the relative screen, the following information are displayed:




To change the display mode, use the following keys:

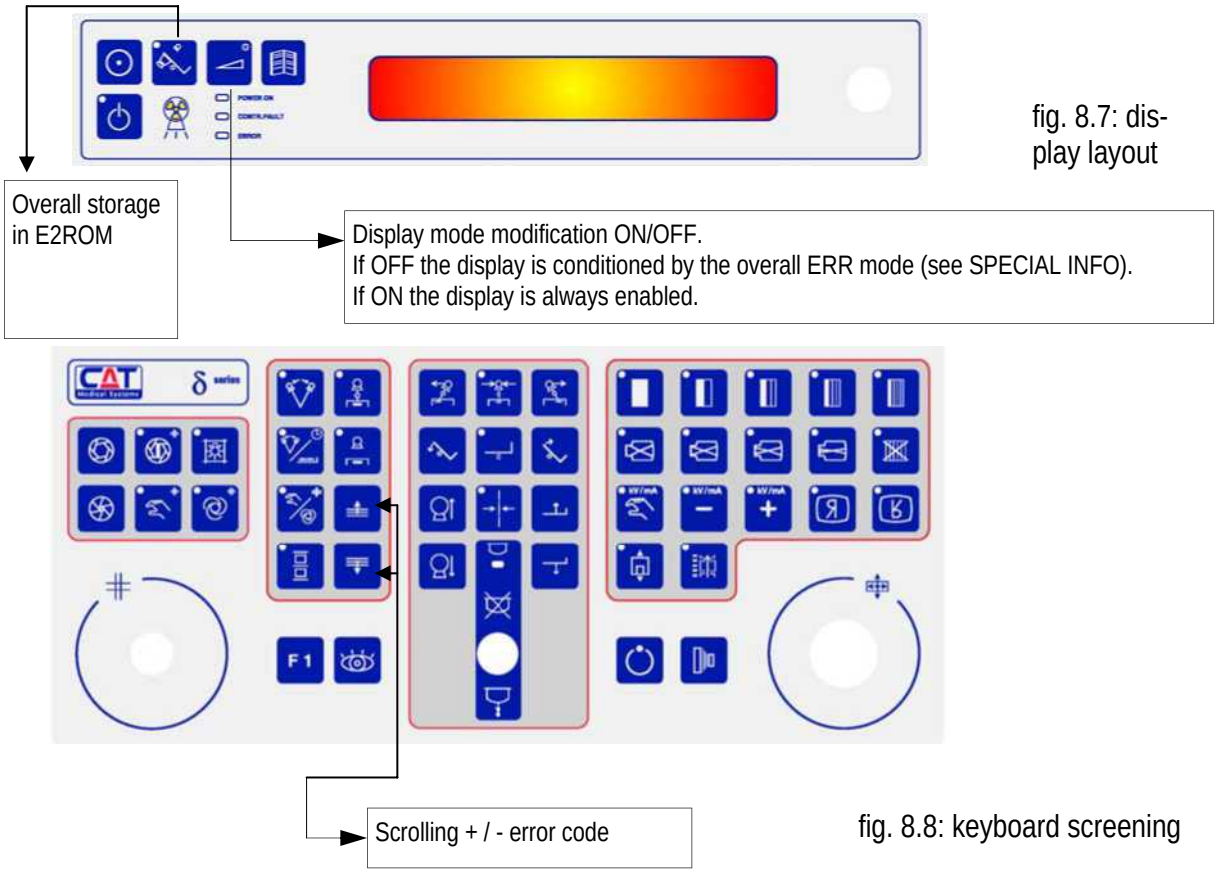



fig. 8.7: display layout

fig. 8.8: keyboard screening

To exit this mode, turn off or reset the console without pressing any key.

# 8. ANALOG JOYSTICK SETUP FOR TABLE MOVEMENT.

This procedure cannot be activated by the operator in normal working conditions but, being a Service procedure, it is activated by placing a jumper on pin 1 and 3 of the CN10 connector. The conditions for obtaining this operative situation are unaffected by "POWER ON" or "STAND-BY". Change-over from the normal display to the analog setup display is automatic and is displayed when the jumper is removed.

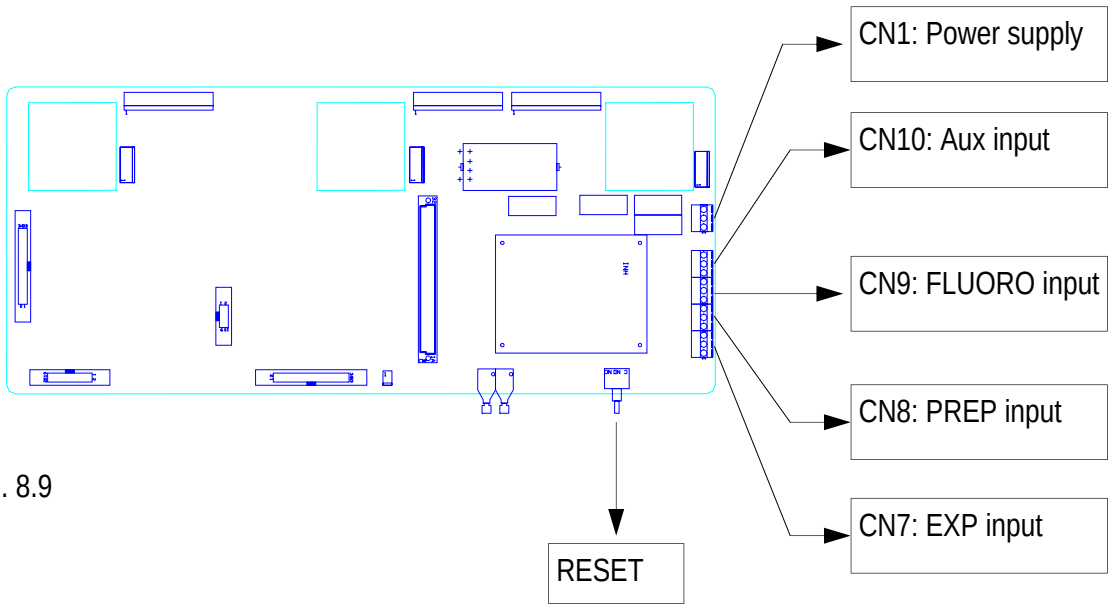



fig. 8.9

Figure 8.9 refers to the console board, without the micro-switch board, as seen when the keyboard is opened.

## 8.1 ANALOG JOYSTICK POSITIONING PROCEDURE.

### 8.1.1 Basic Positioning

The criteria for choosing the joystick direction in the space is based on a tight relation with the variables of the table control program.

| | | | |
|---|---|---|---|
| COLUMN= [XXX] | | CK= [XXX] | TABLE= [XXX] |
| MIN= [XXX] | ZERO= [XXX] | MAX= [XXX] | ZERO= [XXX] |

With the joystick not mounted on the console, it IS NECESSARY that the X axis corresponds to the movement of the column and the Y axis to the movement of the patient table, Where X,Y are part of a Cartesian system as showed below.

*The relation between the joystick direction and the variables of the program, in the basic position, is absolutely independent from the relative position between the table and the console.*

After determining the joystick direction in order to check the above described relation , fix it by means of its screws (see fig.8.10) to the console according to that direction.

NOTE: If the joystick is replaced, with the device electrically connected but not fixed to the panel, cancel any previous inversion setting and, once the correct orientation has been found, fix it mechanically.

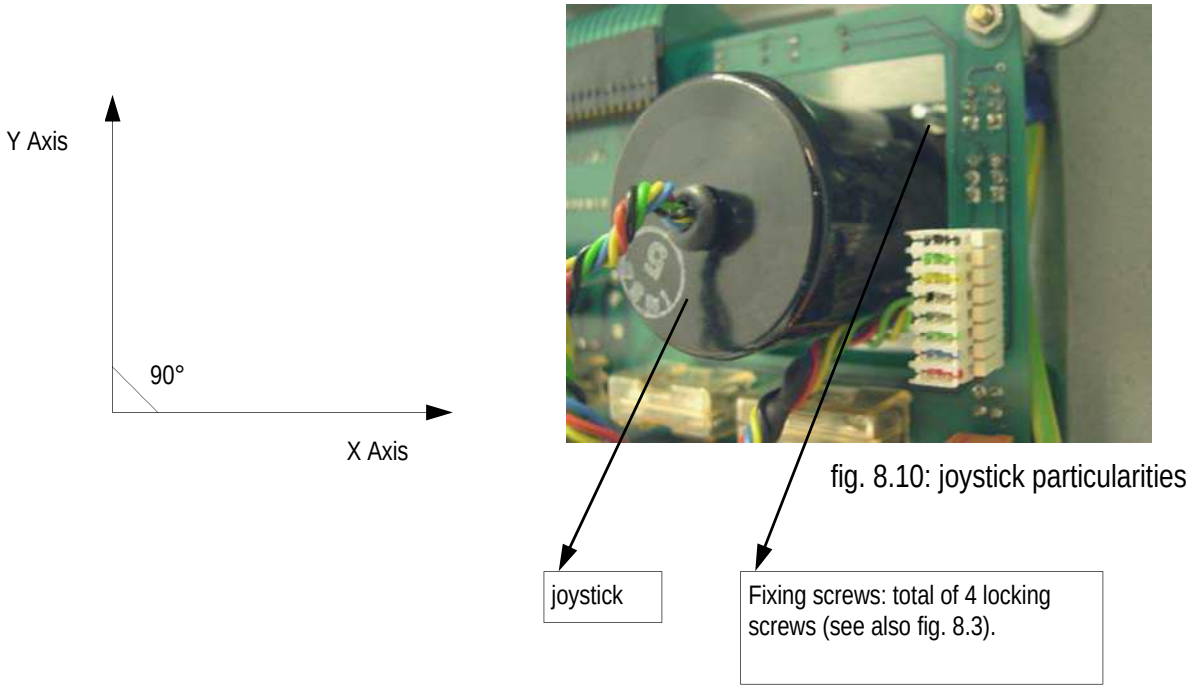



fig. 8.10: joystick particularities

### 8.1.2 Active range detection and storage.

Now it is possible to store the analog values of the potentiometer joystick, proceeding as follows:

| | | | |
|---|---|---|---|
| COLUMN= [XXX] | | CK= [XXX] | TABLE= [XXX] |
| MIN= [XXX] | ZERO= [XXX] | MAX= [XXX] | ZERO= [XXX] |

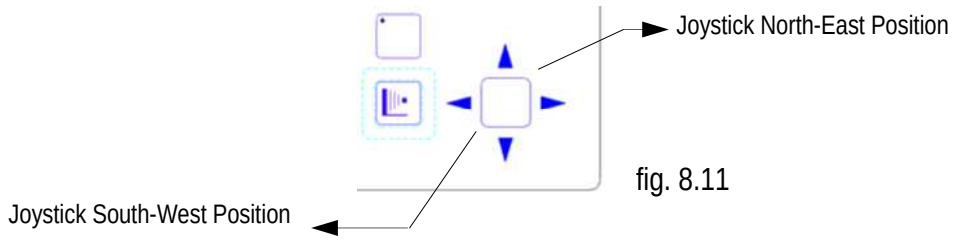



fig. 8.11

With the analog joystick lever in the central position, store the column zero value by pressing the proper key (see fig.8.12). The data will be stored in the ZERO= variable for the Column.

With the analog joystick lever in the central position, store the patient table zero value by pressing the proper key (see fig.8.12). The data will be stored in the ZERO= variable for the patient table.

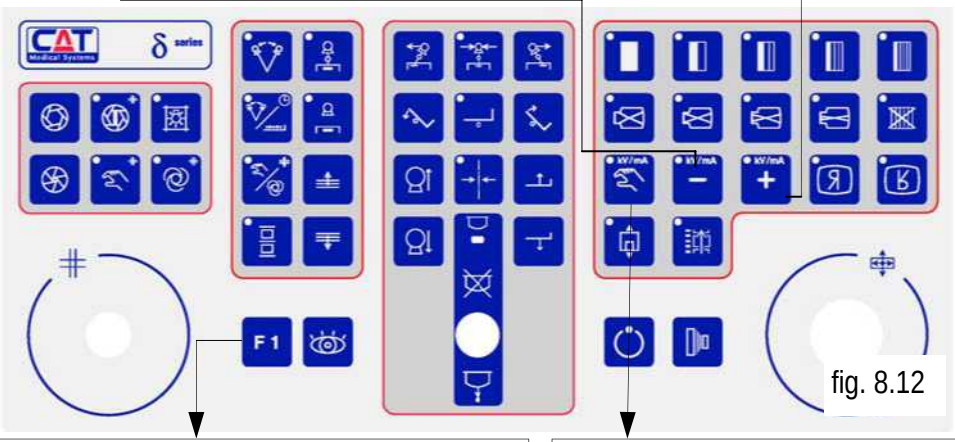



fig. 8.12

Move the analog joystick lever towards "South-West", like in fig. 8.11; move around this point and read the "COLUMN" value. With the lever steady on the lowest value (normally < 250) store it by pressing this key. The data will be stored in the MIN= variable.

Move the analog joystick lever towards "North-East", like in fig. 8.11; move around this point and read the "COLUMN" value. With the lever steady on the highest value (normally > 700) store it by pressing this key. The data will be stored in the MAX = variable.

To check the joystick operation, remove the jumper and test the commands.

The use of the keys indicated in par. 8.1.2 is independent from their functional meaning.

### 8.1.3 Movement adoption of the analog joystick to the operator requirements.

It is possible to program the direction of the Column and table movements with the direction of joy-stick, according to the operator requirements. To do this, reinsert the jumper on CN10 and operate the commands on the console. The activation of each command is indicated both visually and acoustically. If the display is not shown, press the INFO key.

| | | |
|---|---|---|
| ASSI= inv X: XX | inv Y:= XX | rot.: XX |
| CONS_POS= X | JOY_XRAY= XX | Service = XX |

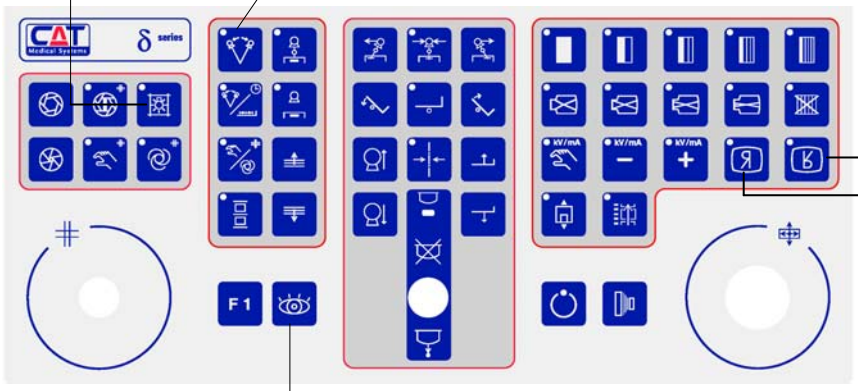



fig. 8.13

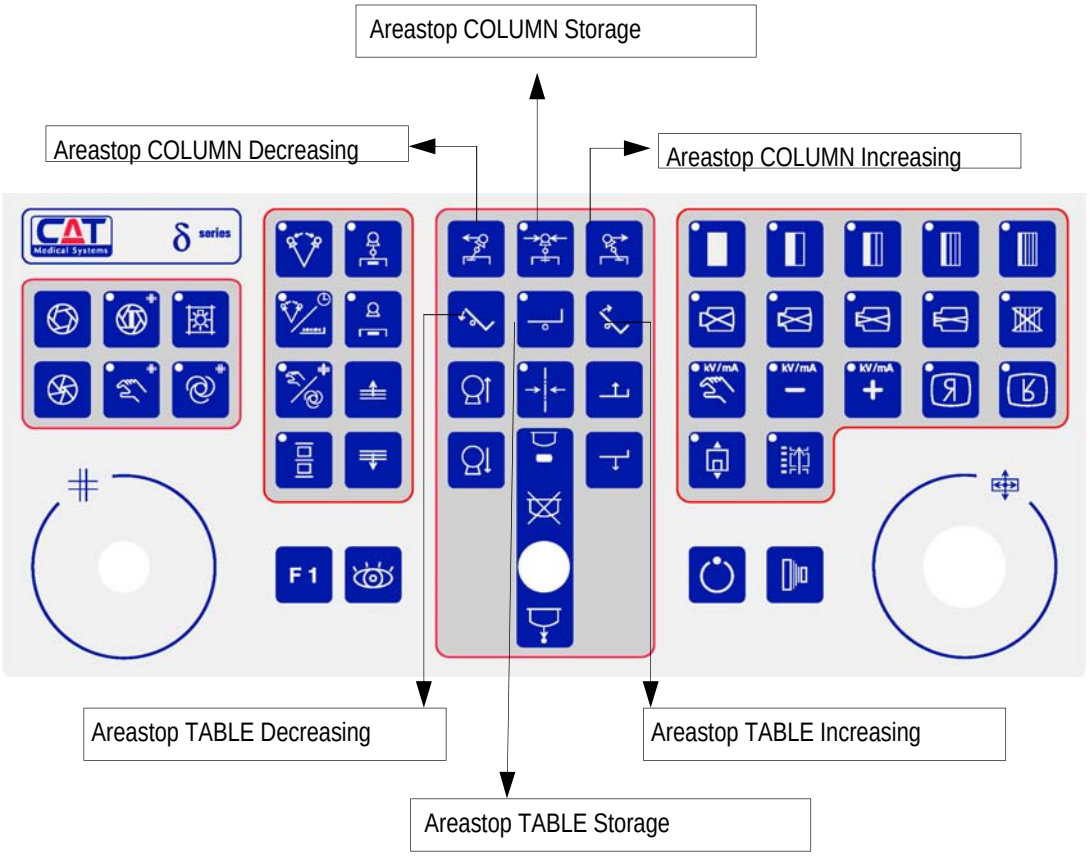
The use of the indicated keys is independent from their functional meaning.

### 8.1.4 Analog joystick working area.

For the analog axis of the joystick there are two variables, named Areastop, that help to determine the inactivity area of the commands and the default setting is 100. The higher these values, the more it is necessary to move the joystick from the central position for the corresponding movement to begin.
The "Areastop" variable for the patient table is found at the address 81FEH. The numerical range of the axis, after analog conversion, is between 700 and 800. When setting the variable, never go below 50 and never above the mid-point of the range value
The “Areastop” variables can thus be adjusted to modify the table-column command activation areas, improving the operative “feeling”.
The use of the indicated keys is independent from their functional meaning.

Areastop COLUMN= nnn

Areastop TABLETOP= nnn




This operation can also be carried out on the machine, in Joystick calibration (Connector CN10 attached) and display accessed with the F1 key. The address area between “8106” and “810C” and between “8162 and 8166” contains the analog joystick calibration values, see chap.11.
NB: this storage area is a back-up for the values obtained form the joystick calibration procedure and must not be modified arbitrarily by the configuration program.

# 9. COLLIMATOR SHUTTERS MOVEMENT ADAPTATION TO THE OPERATOR REQUIREMENTS.

This setting operation must also be carried out with the CN10 jumper inserted and tested by removing the jumper. No display is foreseen for these settings, because it is based on the dynamic reassignment of the keys already structured by the operative program. To display the result of the realignment, refer to the keyboard testing procedure described further on.

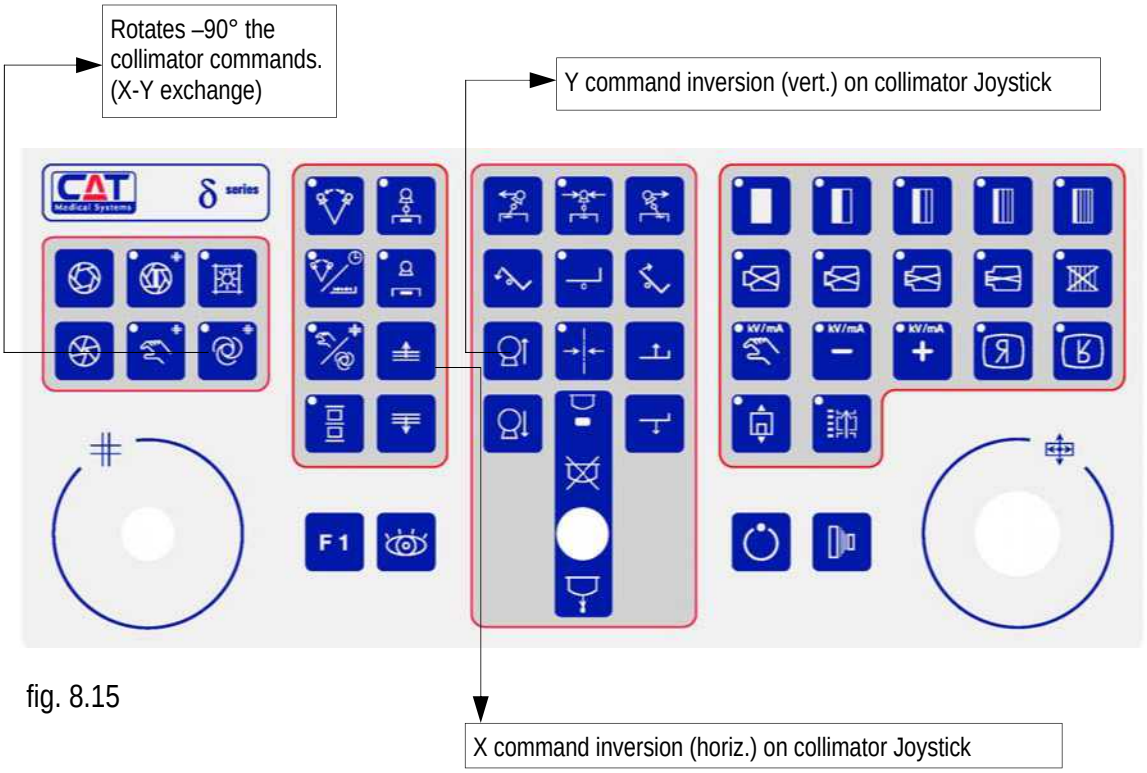



fig. 8.15

The use of the keys is independent from their functional meaning (cfr. chap 10).

# 10. PUSHBUTTON FUNCTION ALLOCATION.

It is possible to customize the relationship between keys (key code) and commands (assigned code), see tab.2, including the digital joysticks, by programming different key codes to those normally foreseen.
All the commands normally work according to the printed indications on the panel. Table 2 shows all the key codes present on the visible panel in par. 13. The key code corresponds to the key position on the serigraphy, while the assigned code indicates the function that is carried on. In correspondence with each key, the code relative to the allocation is shown, together with its address in the memory. As it can be seen from table 2, the allocation codes are the same as the key codes, but this correspondence can be modified due to different requirements. The data table stored in the console can be modified in three ways; with the appropriate direct procedure, as for example for the collimator, or by accessing the variables directly or by downloading a configuration file from a PC. In the last two cases the programs must be used the CATWIN PC application.

Example: reset of the keys function with CATWIN.

Step 1: launch the CATWIN program and access to the Remote Control Console display following the instructions described in the manual.


fig. 8.16

Step 2: access to the display from which the keys functions can be obtained following the indications in the manual. By positioning the mouse on the relative key, it is possible to read the preset function code and the reassigned code.

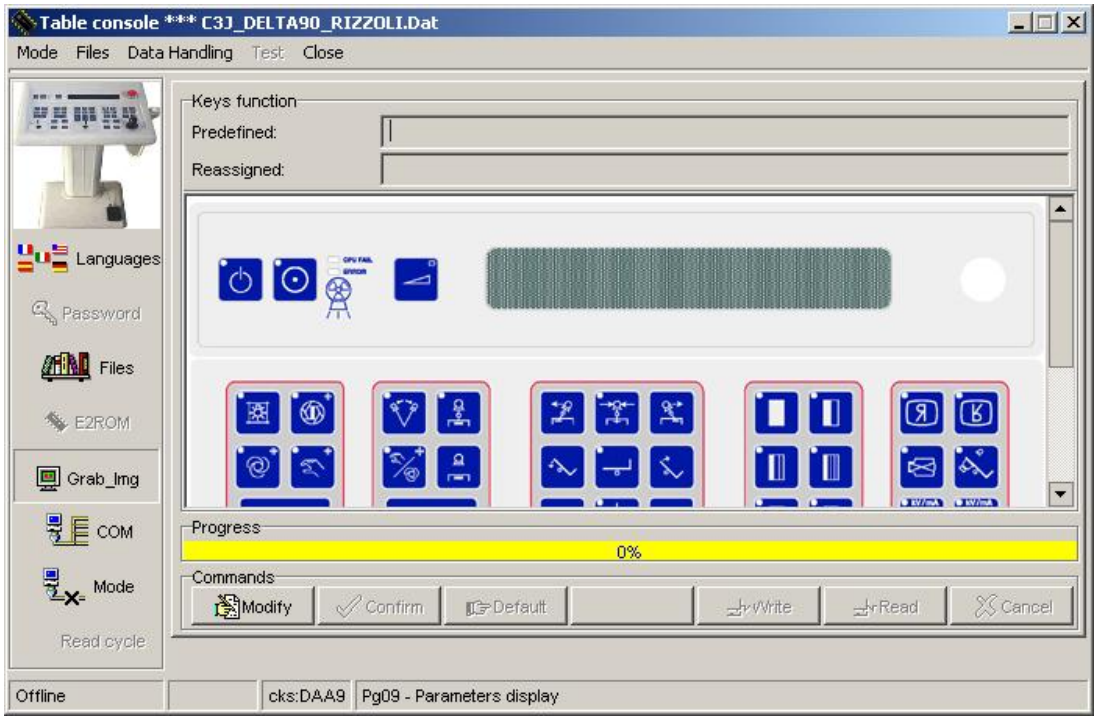



fig. 8.17

Step 3: in the display above, select with the mouse the relative key. It is possible now to reassign the function by inserting the new code in the relative space.

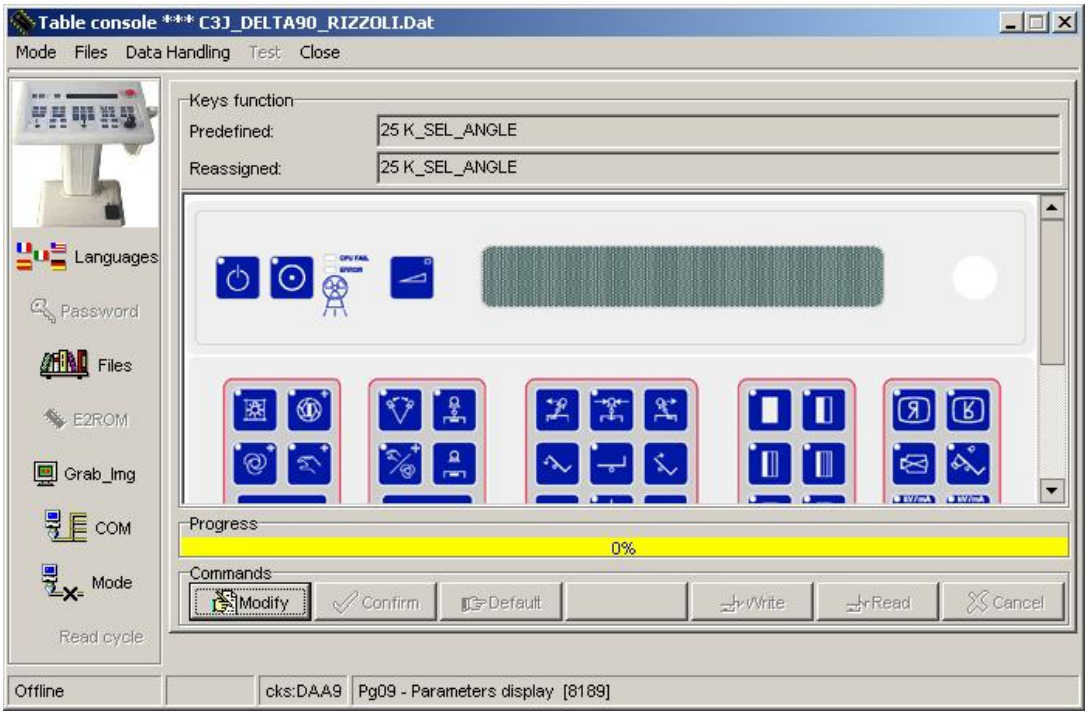



fig. 8.18

# 11. CONSOLE KEY CONFIGURATION TABLE. ( Catwin 2.2.2.0)

N.B: the voices in boldface type inside the tables are not managed from the menu, but separately ( man. CATWIN)

Tab.1

| *General configuration data* | *UM* | *Value* | *E2ROM address* |
|---|---|---|---|
| FIP type: 0=Nec otherwise=Noritake | Num. | | 8000 |
| Spot film device surface – patient table distance | Mm * 100 | | 8002 |
| II surface – patient table distance | Mm * 100 | | 8004 |
| Maximum column speed in cm * 100 per second | Cm *100 | | 8006 |
| Table type: 0 = 9090; 1 = 9030 | Num. | | 8008 |
| Carriage type: 0 = spot film device; 1 = II support | Num. | | 800A |
| No. of speeds available in tomography, max 8 | Num. | | 800C |
| Joy dynamic management option: 0=normal, otherwise diff. for X-rays | Yes/No | | 800E |
| Max. percentage value for speed 1 (value from 1 to 100) | Num.% | | 8010 |
| Max. percentage value for speed 2 (value from 1 to 100) | Num.% | | 8012 |
| Max. percentage value for speed 3 (value from 1 to 100) | Num.% | | 8014 |
| Max. percentage value for speed 4 (value from 1 to 100) | Num.% | | 8016 |
| Max. percentage value for speed 5 (value from 1 to 100) | Num.% | | 8018 |
| Max. percentage value for speed 6 (value from 1 to 100) | Num.% | | 801A |
| Max. percentage value for speed 7 (value from 1 to 100) | Num.% | | 801C |
| Max. percentage value for speed 8 (value from 1 to 100) | Num.% | | 801E |
| Number of inches for field 1 | Num. | | 8020 |
| Number of inches for field 2 | Num. | | 8022 |
| Number of inches for field 3 | Num. | | 8024 |
| Number of inches for field 4 | Num. | | 8026 |
| Number of inches for field 5 | Num. | | 8028 |
| Number of inches for field 6 | Num. | | 802A |
| Number of inches for field 7 | Num. | | 802C |
| Number of inches for field 8 | Num. | | 802E |
| Console orientation with respect to Table: 0=left side 1=Front 2=right side 3 = User | Num. | | 8030 |
| Service Mode | Yes/No | | 8032 |
| | | | |
| Single key option Prep + Exp. on single key Exp. or Pedal | Yes/No | | 8054 |
| Joystick mode option patient table: 0 = in 4 contacts 1 = Analogic | Num. | | 8056 |
| Step Angio in Vertical Inhibition option: 0 = accepted 1 = denied | Num. | | 8058 |
| | | | |
| FIP luminosity | Num. | | 8100 |
| Sound option on XRAY | Yes/No | | 8102 |
| Sound option on Keys | Yes/No | | 8104 |
| Joystick A/D value in table stop position (jstop_letto) | Num. | | 8106 |
| Joystick A/D value in translation stop position (jstop_trasla) | Num. | | 8108 |
| Joystick A/D value at minimum translation value (jmin_trasla) | Num. | | 810A |
| Joystick A/D value at maximum translation value (jmax_trasla) | Num. | | 810C |

| *General configuration data* | *UM* | *Value* | *E2rom address* |
|---|---|---|---|
| Freeze Divisions option | Yes/no | | 8160 |
| Analog Joystick +90° rotation mode (jrt90) | Yes/no | | 8162 |
| Analog Joystick X axis "mirror" mode (jmrx) | Yes/no | | 8164 |
| Analog Joystick Y axis "mirror" mode (jmry) | Yes/no | | 8166 |
| Numerical value of the translation inactivity area (areastop_trasla) | Num. | | 81FE |
| Numerical value of the table inactivity area (areastop_letto) | Num. | | 8200 |
| Warning 2 string display option: 0=default 1= "USER" | Num | | 8202 |
| Cyclic valid sequence presence mode | Yes/no | | 8300 |
| Number of stored test cycle implementation steps | Num. | | 8302 |

## Matrixes and Strings section

| *Operator information data* | *Start E2rom address* | *End E2rom address* | *No. characters* |
|---|---|---|---|
| Company heading (string byte) | 8110 | 8137 | 40 |
| Warning 2 "USER" (string byte) | 8204 | 822B | 40 |
| (1) Matrix of error display inhibition (array byte) | 8034 | 8043 | 30 |
| (2)Key operation allocation matrix (array byte) | 8170 | 81B7 | 71 |
| (3) Area for command storage for test cycle (struct. 3 word/step) | 8304 | 8A0B | 300 |
| (4) LEDS allocation matrix area | 8A10 | 8A2F | 32 |

*Notes:*

(1): The operative function of the list of errors is directly implemented on the machine. The code, description and reset actions are shown in appendix A of the manual MAN001.
(2): The relative matrix is explicated as follows (tab. 2).
(3): Contains a sequence of commands. There is no connection between the allocation address and the command:

- Self-learning function: the command codes, activation mode and time of a sequence of commands that the operator wants to carry on, are memorized automatically (cfr. Program of test cycles activation par. 14)
- Storage of a sequence library (cfr. CATWIN manual, imp/exp commands).

(4): The relative matrix is explicated as follows (tab. 3).

# Matrix of key Function Assignment.

Tab.2

| Key | | EEPROM |
|---|---|---|
| T0 | K_LUCE | 8170 |
| T1 | K_VOLE | 8171 |
| T2 | K_STRATO_DOWN | 8172 |
| T3 | K_DOWN | 8173 |
| T4 | K_T4 | 8174 |
| T5 | K_SKIPDIV | 8175 |
| T6 | kV - | 8176 |
| T7 | K_INVY_VID | 8177 |
| T8 | K_SEMIAUTO | 8178 |
| T9 | K_AUTOSTEP | 8179 |
| T10 | K_T10 | 817A |
| T11 | K_TOTAL | 817B |
| T12 | K_T12 | 817C |
| T13 | K_T13 | 817D |
| T14 | K_DUEDIV | 817E |
| T15 | K_STOPGRID | 817F |
| T16 | K_COLLAUTO | 8180 |
| T17 | K_STRATO_UP | 8181 |
| T18 | K_TUBO_DOWN | 8182 |
| T19 | K_UP | 8183 |
| T20 | K_T20 | 8184 |
| T21 | K_CASS | 8185 |
| T22 | K_CAMPO3 | 8186 |
| T23 | K_FIVEDIV | 8187 |
| T24 | K_COLLMAN | 8188 |
| T25 | K_STEPANGIO | 8189 |
| T26 | K_RADIOGRAFIA | 818A |
| T27 | K_ROT_RES | 818B |
| T28 | K_ORA | 818C |
| T29 | K_KVMANUAL | 818D |
| T30 | kV + | 818E |
| T31 | K_QUADIV | 818F |
| | | |
| T32 | K_CLOSEIR | 8190 |
| T33 | K_SEL_ANGLE | 8191 |
| T34 | K_TUBO_UP | 8192 |
| T35 | K_INV | 8193 |
| T36 | K_LOAD_DX | 8194 |
| T37 | K_CAMPO1 | 8195 |
| T38 | K_CAMPO2 | 8196 |
| T39 | K_CAMPO4 | 8197 |
| | | |

| Key | | EEPROM |
|---|---|---|
| T40 | K_COMPR_DOWN | 8198 |
| T41 | K_INV_JOY | 8199 |
| T42 | K_COMPR_UP | 819A |
| T43 | K_ORA_JOY | 819B |
| T44 | K_OPENY | 819C |
| T45 | K_CLOSEX | 819D |
| T46 | K_CLOSEY | 819E |
| T47 | K_OPENX | 819F |
| T48 | K_STANDBY | 81A0 |
| T49 | K_ON | 81A1 |
| T50 | K_DIGIT | 81A2 |
| T51 | K_FIPBRIGHT | 81A3 |
| T52 | K_INFO | 81A4 |
| T53 | K_T53 | 81A5 |
| T54 | K_T54 | 81A6 |
| T55 | K_T55 | 81A7 |
| T56 | K_OPENIR | 81A8 |
| T57 | K_F1 | 81A9 |
| T58 | K_ENTERTOMO | 81AA |
| T59 | K_LOAD_SX | 81AB |
| T60 | K_LOAD_RES | 81AC |
| T61 | K_UNDIV | 81AD |
| T62 | K_TREDIV | 81AE |
| T63 | K_INVX_VID | 81AF |
| T64 | | 81B0 |
| T65 | | 81B1 |
| T66 | | 81B2 |
| T67 | | 81B3 |
| T68 | | 81B4 |
| T69 | | 81B5 |
| T70 | | 81B6 |
| | | 81B7 |

# Matrix of LEDS Assignment

| Index | Assignment of Led Normally Interpreted | Ind.EEPROM |
|---|---|---|
| | | |
| 0 | LED_FIVEDIV | 8A10 |
| 1 | LED_CASSETTO | 8A11 |
| 2 | LED_INVX | 8A12 |
| 3 | LED_QUADIV | 8A13 |
| 4 | LED_CAMPO3 | 8A14 |
| 5 | LED_KVMENO | 8A15 |
| 6 | LED_DUEDIV | 8A16 |
| 7 | LED_CAMPO1 | 8A17 |
| 8 | LED_COLLMAN | 8A18 |
| 9 | LED_AUTOSTEP | 8A19 |
| 10 | LED_CENTROROT | 8A1A |
| 11 | LED_SERIOGMODE | 8A1B |
| 12 | LED_STEPANGIO | 8A1C |
| 13 | LED_ENTERTOMO | 8A1D |
| 14 | LED_LUCE | 8A1E |
| 15 | LED_SELANGLE | 8A1F |
| 16 | LED_SEMIAUTO | 8A20 |
| 17 | LED_CENTROTOMO | 8A21 |
| 18 | LED_CENTROTOT | 8A22 |
| 19 | LED_COLLAUTO | 8A23 |
| 20 | LED_UNODIV | 8A24 |
| 21 | LED_KVMANUAL | 8A25 |
| 22 | LED_CAMPO2 | 8A26 |
| 23 | LED_TREDIV | 8A27 |
| 24 | LED_KVPIU | 8A28 |
| 25 | LED_CAMPO4 | 8A29 |
| 26 | LED_VOLE | 8A2A |
| 27 | LED_SKIPDIV | 8A2B |
| 28 | LED_STOPGRID | 8A2C |
| 29 | LED_INVY | 8A2D |
| 30 | LED_DIGIT | 8A2E |
| 31 | LED_ON | 8A2F |
| 32 | LED_STANDBY | 8A30 |
| 33 | LED_FAIL | 8A31 |

Tab.3

# 12. GENERAL SET-UP.

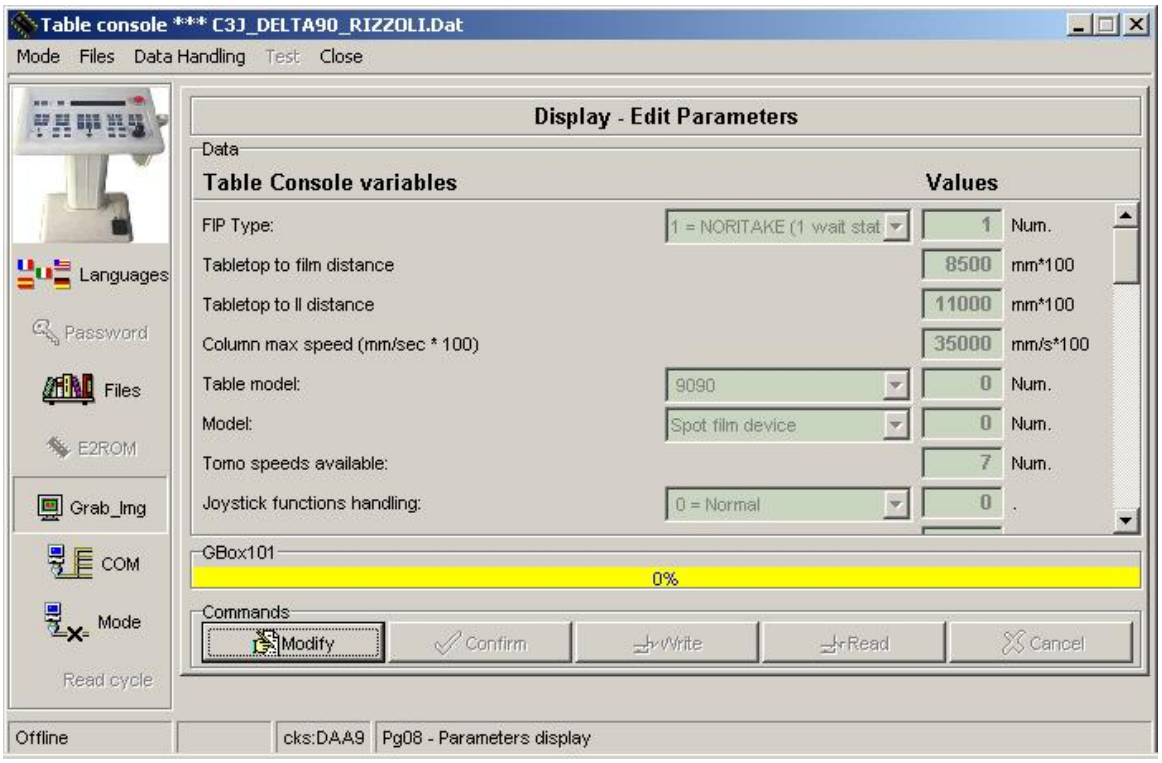



fig. 8.19

To setup the parameters like those in tomography, of patient table-spot film device distance, II surface-patient table distance, follow the menu of CATWIN, where some data have been setup already in CAT MEDICAL SYSTEMS. The inserted data are for reference and can be modified at installation time.
Some of these reference data are:

- maximum column speed expressed in mm x 100 per second. The column currently travels at 35 cm/sec. The parameter is therefore set at 35000.
- distance in mm x 100 between the patient table and the X-ray plate. Parameter set at 6666, estimating a value of 66.66 mm consequent to the calculation of mechanic tolerance.
- distance in mm x 100 between the patient table and the image intensifier. Parameter setup at 3333 , estimating a value of 33.33 mm for the distance, only when a particular type of “DIGITAL” carriage without spot film device is used.

For further details, see “CONFIGURATION PARAMETER TABLE OF DELTA CONSOLE” for Catwin 2.2.2.0” version pag.20

In order to obtain a correct estimation of the X-ray times in tomography, it is necessary to enter the parameters described below:

- Address "8006 Address "8002":
- Address "8004": Address "800A": type of carriage used.
    - 0 = Spot film device with II support.
    - 1 or different from 0 = II support only

    On the basis of this type of configuration, the system can choose the correct parameter from those set previously, for correct estimation of the tomography time.
- Address "800C" the number of speeds available to the operator, in Tomography, is set; goes from 1 to 8.
- Address "8010-801e", in increments of 2: the tomography speeds, expressed as percentages of the maximum column speed. The numerical range thus varies from 1% to 100%. If for example only one speed is programmed, then “1” must be entered at 800C and “100” at 8010. If two speeds are programmed, then “2” is entered at 800C and:
    - As the first speed “100” is entered at 8010.
    - As second speed, for example “75” is entered at 8012.

For further details, see “CONFIGURATION PARAMETER 3 JOYSTICK CONSOLE “DELTA” for Catwin 2.2.2.0” version pag.19

# 13. DIAGNOSTIC FUNCTION FOR KEYBOARD AND LEDS CHECK.

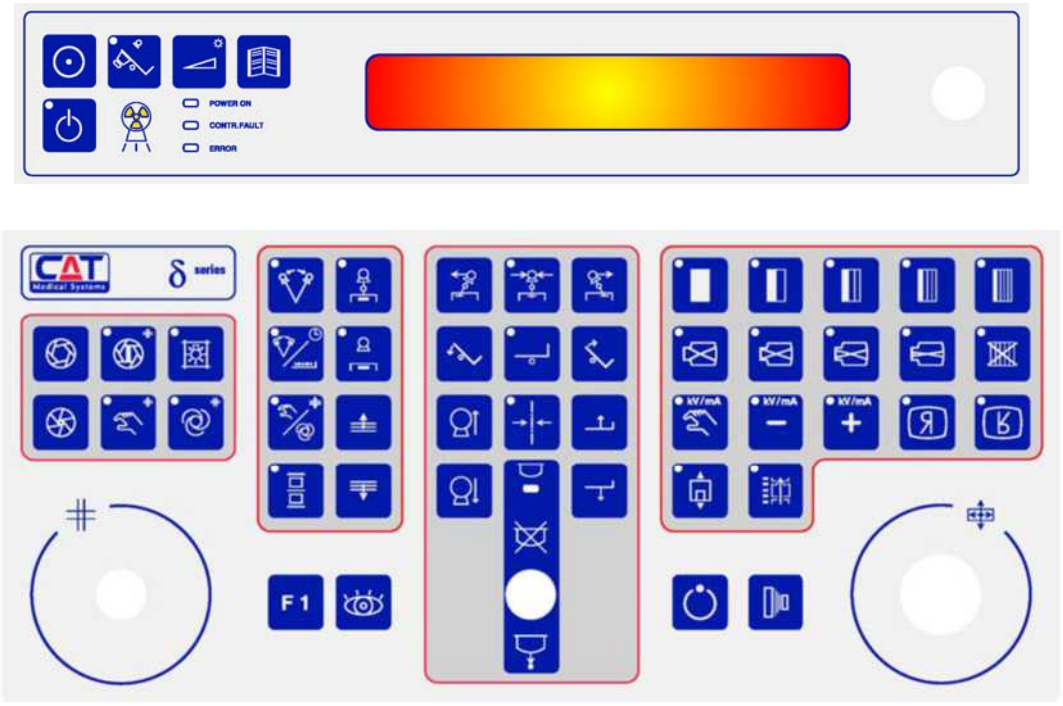



fig. 8.20

To check the function of the keys, proceed as at page 8.

In these conditions, the following will be displayed:

| | | |
|---|---|---|
| COLUMN= [XX] | ROW= [XX] | KEY= [XX] |
| ICO= [K_XXXXXXXXXXX] | DEF= [K_YYYYYYYYYYY] | |

Any time a key is pressed, the following will be displayed:

1. Column and Line corresponding to the 8x8 matrix
2. Key code as described in Tab.2
3. ICO Key linked to the symbolic representation of the printed indication (ICONS)
4. DEF Redefinition of the key according to the various uses

To exit from the KEYBOARD CONTROL mode, reset by means of the RESET key (fig.8.9) or switch the console off and on.
In order to operate quicker, the communication is programmed at 19200 baud instead of regular 4800 baud which allow quick operations of data up/down load (valid from sw 2.1 versions of the T1C3J program and sequent).

# 14. TESTING CYCLE PROGRAMMING AND IMPLEMENTATION.

| | | |
|---|---|---|
| TASTO= XX | STATO= 0 | TEMPO= 0 |
| COUNT= NN | LEARN= ON | Index=0 |

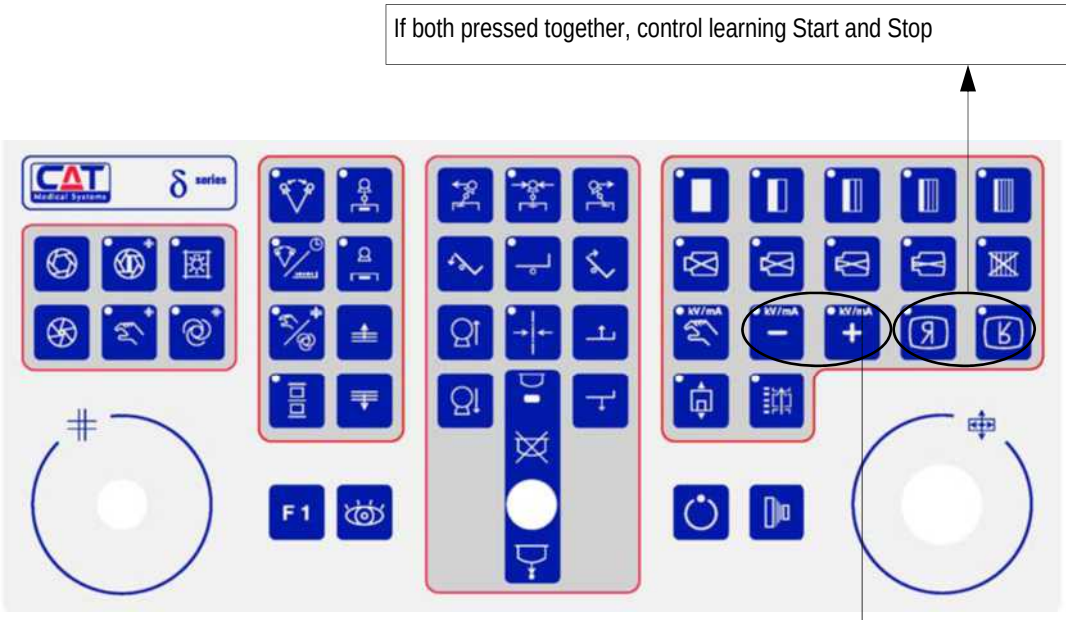



fig. 8.21

| | | | | |
|---|---|---|---|---|
| Elapsed Time | H= 0 | M= 0 | S= 0 | tc= 0 |
| CYCLE= 0 | | | | |

Implementation of this particular mode is obtained by selecting the address “C” with the machine switched off and the microswitch board removed, in the hexadecimal rotary switch situated next to the connector dedicated to the CPU board. After replacing the CPU board and turning on the machine, it can be noted that all the display messages include the word <SERVICE>, to remind the operator of the particular operative function enabled.
The particular functions of this mode are:

1. Functional procedure identical to the official operator program.
2. “SELF-LEARN” function: pressing the keys as shown in fig.8.21 enables the self-learn function; all the keys that are pressed on the console not only produce a contemporaneous action, but are also recorded with a time lapse of one second. If a command is enabled and disabled within the one second interval, counted by the console, it will not be recorded. To proceed correctly, it is sufficient to observe the information shown on the FIP at page 26 which shows:

   2.1. TASTO = XX : code of key pressed.
   2.2. STATO = : inactive status 0 and active status FF.
   2.3. TEMPO = : cycle time in one second interval.
   2.4. COUNT = NN : time counter in seconds.
   2.5. LEARN = ON : self-learning mode enabled.
   2.6. Index = 0 : Recorded commands counter.

   When the sequence to be stored is complete, press the same keys used to enable the function again. The control software will start the storage sequence which will be indicated by the flashing FIP. The duration of the flashing period will depend on the length of the sequence to be stored and the special cycle closing and repetition commands will be automatically added at the end.

3. “CYCLE IMPLEMENTATION” function: pressing the specific commands as in fig.8.21 enables the stored cyclic implementation function; all the commands that have been recorded or which are in any case present in the specific memory area, are carried out cyclically. The values on FIP at page 26 are shown on the display:

   3.1. Elapsed Time:
      3.1.1. H = 00: Time counter in actual hours from the start of enabling
      3.1.2. M = 00: Time counter in actual minutes from the start of enabling
      3.1.3. S = 00: Time counter in actual seconds from the start of enabling
   3.2. TC: Cycle time counter which shows the step in seconds of implementation in the stored cycle. (Reset every time the implementation of each cycle is finished and the carried out cycle counter is updated).
   3.3. CICLO = 0: Counter of cycles carried out correctly without errors. (If an error is detected while a cycle is being carried out, the sequence stops).

To reset the actual times, press Power OFF.

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