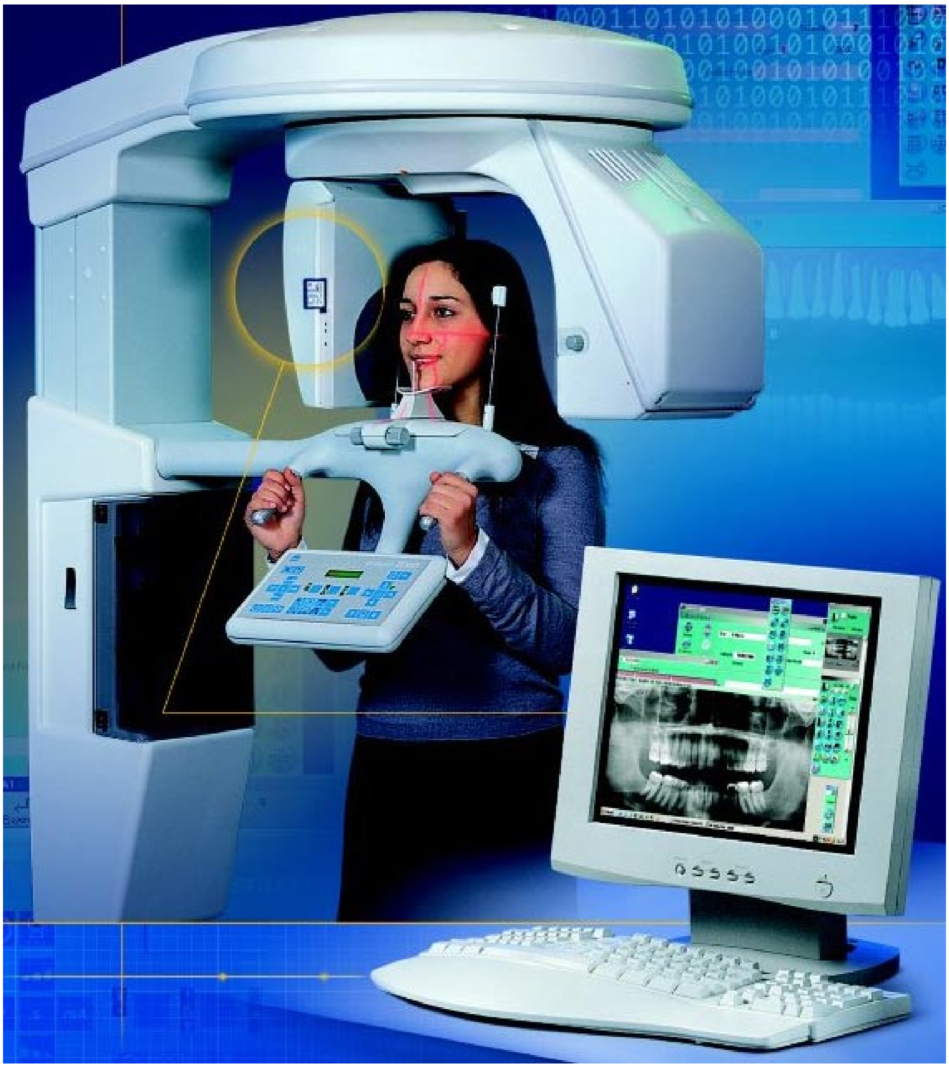
STRATO 2000 CE 0051

Digital



Service Manual

Release 30 January 2008 (Rev. 3)

Revision history

Rev.	Date	Page/s	Modification description
0	05.05.06	-	Document approval.
1	05.09.06	i, ii, iii, iv, 3-20, 3-21, 4-1, from 6-15 to 6-24, from 7-12 to 7-54, from 8-1 to 8-106, from 9-3 to 9-49, 9-85, 10-12, 10-16, 10-17, 12-2	Release of SW version 6.02 (Ceph arm calibration procedure, Soft Tissue Filter setting procedure, password 93 - Soft Tissue Filter motor selection). Release of SW version 6.03 (password 95 – Minimum kV value setting). (Ref. RDM 6447, RDM 6483)
2	11.01.07	iv, 1-1, 1-2, 2-5, 3-2, 3-3, 3-4, 3-17, 3-18, 3-19, from 4-1 to 4-5, from 6-18 to 6-22, 7-6, 7-21, from 7-27 to 7-31, 7-33, 7-34, from 7-44 to 7-54, 8-2, 8-4, 8-9, 8-25, 8-87, 8-88, 8-89, 9-85, 10-10, 10-16, 10-17	Improvement of Installation, Maintenance and servicing and Troubleshooting procedure. Release of "DXP 2007 Edition" kit including Implant examination. (Ref. RDM 6540, RDM 6566)
3	30.01.08	All	New CPU board. Improvement of Ceph arm mounting procedure. New Implant bite block. Schematics and drawings update. Spare Parts update. Modified name from "STRATO 2000 D" to "STRATO 2000 Digital". (Ref. RDM 6554, RDM 6639, RDM 6666, RDM 6679, RDM 6680, RDM 6684, RDM 6768)

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Contents

1. INTRODUCTION

NOTE:
The present manual is updated for the product it is sold with in order to grant an adequate reference in performing diagnostics and repair operations normally carried out by the service engineer.
The manual may not reflect changes to the product not impacting service operations.

STRATO 2000 Digital is an X-ray device for the radiographic examinations of the maxillo-facial complex.
The device is designed to operate in conjunction with the Direct Digital System, manufactured by Owandy – France.

Two models are available:

- PAN ONLY model equipped with a fixed primary collimator (NOT upgradable with CEPH arm)
- PAN UPGRADABLE to DIGITAL CEPH model equipped with a slit primary collimator that has two slots one for PAN type examinations and the other for CEPH type examinations

The following options are available and must be ordered separately:

- Digital Extended Program (DXP); it allows the execution of the following examinations:
  - **TMJ**: Specific examinations for temporo-mandibular joint
  - **SINUS**: Examination of nasal sinus
  - **A.D.A.**: Advanced Dental Applications including: improved orthogonal projection, frontal dentition and reduced dose panoramic examinations
  - **IMPLANT**: Linear Tomography for implantation procedure.
- DIGITAL CEPH (only on PAN UPGRADABLE machines); it allows the execution of the following examinations, all available in high resolution and normal resolution (high speed) modality:
  - CEPH exam in different formats
  - CARPUS exam.

This manual is limited to the description of the X-ray device; instruction on the Digital Acquisition System are given in the relevant Manuals, supplied with the Direct Digital Sensor.

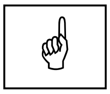
The device must be used complying with the procedures described and never be used for purposes different from those herewith indicated.

Please read this manual thoroughly before starting using the machine; it is advisable to keep the manual near the device to refer to it while operating.

STRATO 2000 Digital is an electro-medical device and it can be used only under the supervision of a physician or of highly qualified personnel, with the necessary knowledge on X-ray protection.

The user is liable as concerns legal fulfilment related to the installation and the operation of the device.

1.1. Icons appearing in the manual



This icon indicates a NOTE; please read thoroughly the items marked by this picture.

This icon indicates a WARNING message; the items marked by this icon refer to the safety aspects of the patient and/or of the operator.

1.2. How to contact VILLA SISTEMI MEDICALI technical service

For any technical quieries please contact the following:

- Telephone number +39 02 48859288
- Fax number +39 02 48859222
- E-mail: dentalservice@villasm.com

2. SAFETY INFORMATION

WARNING:
Please read this chapter thoroughly.

Villa Sistemi Medicali designs and builds its devices complying with the related safety requirements; furthermore it supplies all information necessary for a correct use and the warnings related to danger associated with X-rays generating units.

Villa Sistemi Medicali, has not to be held responsible for:

- use of STRATO 2000 Digital different than the intended use,
- damages to the unit, to the operator, to the patient, caused both by installation and maintenance procedures different than those described in this manual and in the service manual supplied with the unit, and by wrong operations,
- mechanical and/or electrical modifications performed during and after the installation, different than those described in the service manual.

Installation and any technical intervention must only be performed by qualified technicians authorised by Villa Sistemi Medicali.

Only the authorised personnel can remove the covers and/or have access to the components under tension.

2.1. Warnings

This device has not been designed for use in environments where vapours, anaesthetic mixes flammable with air, or oxygen and nitrous oxide can be detected.

Avoid pouring water, even accidentally, or other liquids into the device, as this could cause short-circuits.

Before cleaning the device, be sure that main power supply has been disconnected to the equipment. Pushing the ON/OFF button on the basement of the equipment, it doesn't have to switch on.

Wherever necessary, use the fit accessories, such as the leaded aprons, to protect the patient from radiations.

While performing the radiography, no one, apart from the operator and the patient, must remain in the room.

STRATO 2000 Digital has been built to support a continuous operation at intermittent load; therefore please follow the described use cycles to enable the device cooling down.

Though this unit has been designed with a quite acceptable protection level from electromagnetic interference, it is advisable to install it at a certain distance from electric energy transformation chambers, from Uninterruptible Power Supply (UPS) units, from receiving-transmitting units for amateurs use. Mobile telephones are only admitted at a distance of more than 1,5 mt. from any component of the device.

Other medical instruments and devices that could be used in the installation area of the device, must comply the Electromagnetic Compatibility rules in force. Non-complying instruments, of which the poor immunity from electromagnetic fields is well known, must be installed at least 3 mt far from the STRATO 2000 Digital and supplied by a different electrical line.

STRATO 2000 Digital must be off while using devices such as electrical lancets or similar.

Please clean and disinfect, when necessary, all parts that can be in contact with the patient.

Never try to rotate the moving arm manually when the units is switched on, to avoid permanent damage to the unit.

After use, please replace the bite and the ear-centring devices.

The authorised technician must be sure that the unit is disconnected from the main power supply before removing the coverings.

Though the X-ray quantity supplied by dental X-ray units is quite low and distributed on a small surface, the operator must adopt the precautions and/or fit protections for the patient and himself, during the execution of radiography. It is advisable to control the X-ray emission from a protected area, by means of a remote control. In case it is necessary to operate near the patient, please stay as far as the cable of the remote control allows it, or at least 1,5 mt far both from the X-ray source and from the patient, as shown in the pictures below.

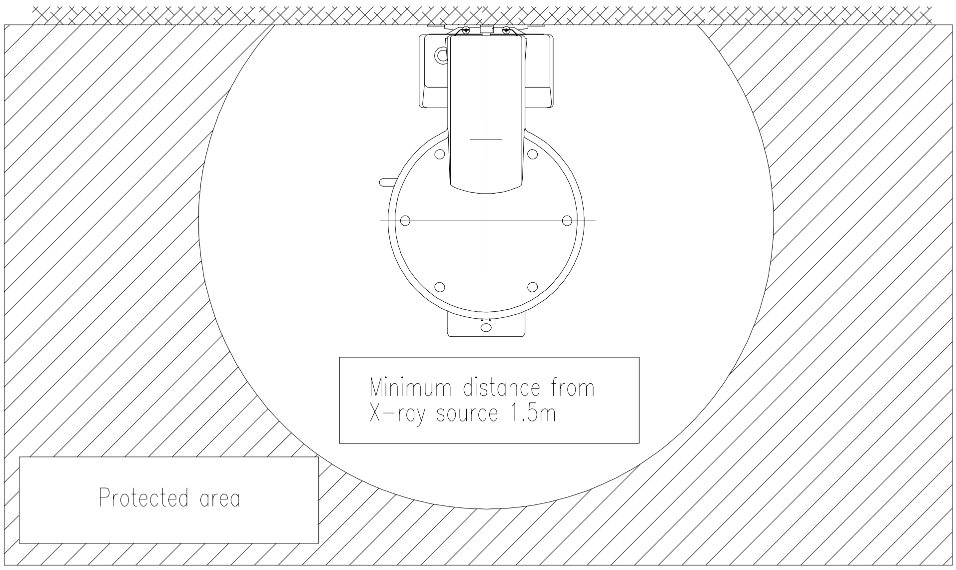


Figure 2-1 - Panoramic version

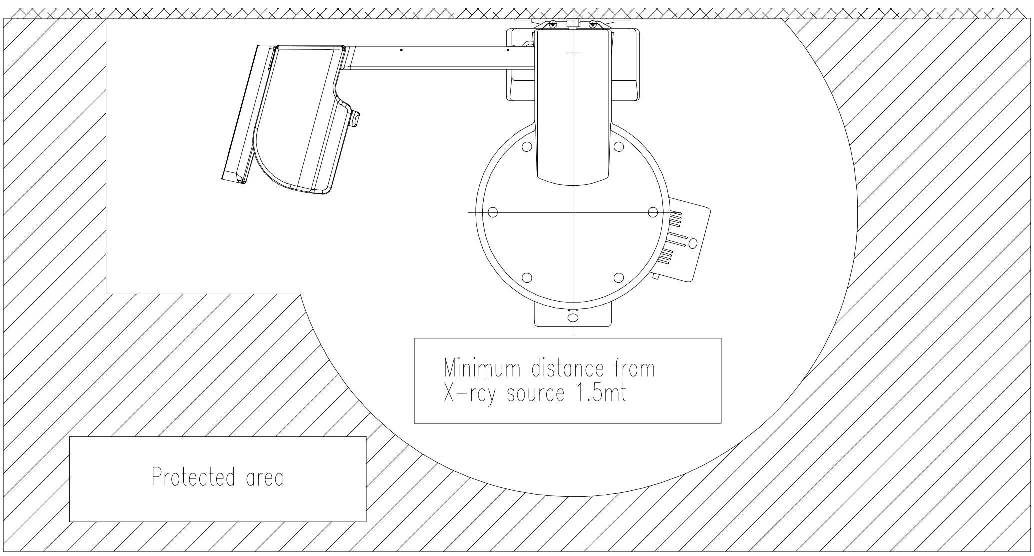


Figure 2-2: Cephalometric version

WARNING: PRECAUTIONS WHILE USING LASER CENTRING DEVICES

- It is necessary an adequate illumination in the room.
- Do not look into the output windows of laser centring units.
- Do not stare at the reflections of laser pointers.
- Instruct the patient to keep his/her eyes closed as long as the laser pointers are active.
- Before starting an examination, the patient must remove earrings, glasses, necklaces and whatever else could reflect the laser beam or be impressed on the radiographic image.
- Do not clean the openings of laser centring devices with tools that could modify the optics. Necessary cleaning must be performed only by authorised technicians. Different operations than those indicated could cause the ejection of dangerous non-ionising radiations.

WARNING: PRECAUTIONS DURING INSTALLATION AND SERVICE INTERVENTIONS

- Please take highest care while mounting the column at the wall and strictly follow the instructions included in this manual.
- Before removing the covers of the supply unit located at the base of the column, or before removing the covers of the HF generating board, disconnect the supply to the device, both switching the main switch and the magneto-thermal differential off, and wait at least 1 minute.
- Once removed the covers, pay the highest attention since high tension is generated in the supply unit, and the voltage is at about 360 Vdc on the HF generator board. This is indicated by the green LED H1. Should the LED be off, before any other intervention, disconnect the device from the main power supply, wait at least 1 minute, then check the fuses F2 (10A) in the supply unit, or F1 (500mA) on the HF generator board (see circuit diagram code 58094016).
- Each intervention must be performed after having disconnected the device from the main power supply and after LED H1 is OFF. It is anyway advisable to wait at least 1 minute from the LED's switching off.

2.2. Environmental risks and displacement

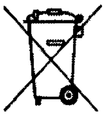
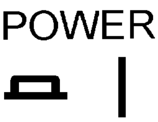
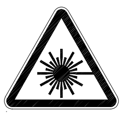
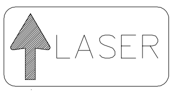
The device contains in some of its parts, materials and liquids that at the end of the units life, must be disposed of at the fit disposal centres.

Particularly the device contains the following materials and/or components.

- **Tubehead:** dielectric oil, lead, copper, iron, aluminium, glass, tungsten.
- **Control panel and remote control:** iron, copper, aluminium, glass-resin, non-biodegradable plastic material packaging.
- **Column, rotating arm, and extensions:** iron, lead, aluminium, copper, glass-resin, and non-biodegradable plastic material.

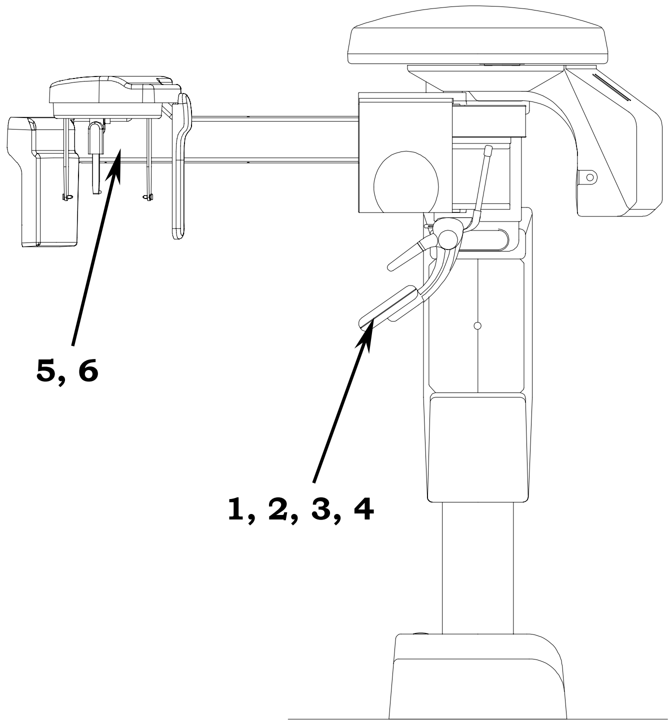
2.3. Symbols used

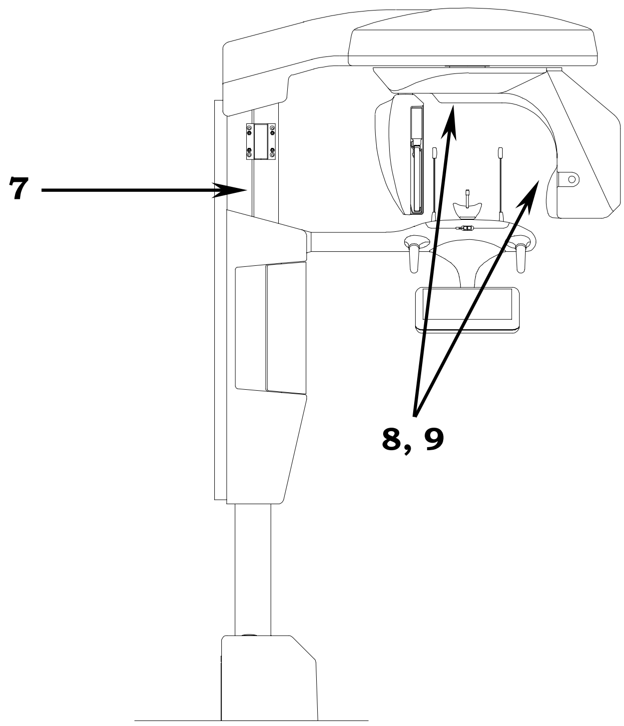
In this manual and on the STRATO 2000 Digital itself, apart from the symbols indicated on the control panel, also the following icons are used:

Symbols	**Description**
	Device with type B applied parts
	The device contains in some of its parts, materials and liquids that at the end of the units life, must be disposed of at the fit disposal centres
~	A.C.
N	Connection point to the neutral conductor
L	Connection point to the line conductor
	Protection grounding
	Operation grounding
	OFF ; device not connected to the main power supply
	ON ; device connected to the main power supply
	Laser
	Laser source output
	Dangerous voltage
CE 0051	Conformity to the CE 93/42 Directive

3. DESCRIPTION

3.1. Identification labels and laser labels





1a
STRATO 2000 Digital
identification label (230V version)

STRATO X: Model STRATO 2000 Digital
Line: 230 V~ 8 A 50 Hz
Duty Cycle: 1/16 max exposure time: 15s
Manufactured: MMMMYYYY
Type: 93093153AB
S/N: XXYYZZZZ
20090 Buccinasco MILANO - ITALIA CE 0051

1b
STRATO 2000 Digital
identification label (100V version)

STRATO X: Model STRATO 2000 Digital
Line: 100 V~ 17 A 50/60 Hz
Duty Cycle: 1/16 max exposure time: 15s
Manufactured: MMMMYYYY
Type: 93093153AB
S/N: XXYYZZZZ
20090 Buccinasco MILANO - ITALIA CE 0051

2
PAN Digital Sensor
identification label

owandy MADE IN FRANCE
Pano. Digital Sensor
Type: K1VSMPLUS
Nominal Voltage : 24V⎓
Nominal Current : 0,7 A
S/N: XXX
Manufactured : YYYY / WW
6 Allée Képler 77420 Champs/M France CE

3
Tube-head
identification label

DIAGNOSTIC SOURCE ASSEMBLY
Model: MS05 Type: 84096000
S/N: XXYYZZZZ Manufactured: MMMM YYYY
Output max: 80kVp - 12mA
Total filtration: ≥2.5mmAl eq IEC522
X-RAY TUBE OPX/105
Manufacturer CEI - Bologna Italy
■ 0.5 IEC336 Inherent Filtr.: 0.5mmAl eq
S/N:
20090 Buccinasco MILANO - ITALIA

4a
DXP - Digital Extension Program -
identification label

KIT DIGITAL EXTENDED PROGRAMS DXP
P/N: 7609505100
S/N: XXYYZZZZ
Manufacturer: MMMM YYYY
20090 Buccinasco MILANO - ITALIA CE 0051

4b
DXP - Digital Extension Program -
2007 Edition
identification label

KIT DIGITAL EXTENDED PROGRAMS
DXP 2007 EDITION
P/N: 7609505200
S/N: XXYYZZZZ
Manufacturer: MMMM YYYY
20090 Buccinasco MILANO - ITALIA CE 0051

5
CEPHALOMETRIC device
identification label

CEPHALOMETRIC DEVICE for
STRATO 2000 Digital
Model: XXXXXXXXXX S/N: XXYYZZZZ
Manufactured: MMMMYYYY
20090 Buccinasco MILANO - ITALIA

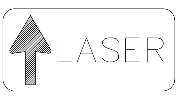
6
CEPH Digital Sensor
identification label

owandy MADE IN FRANCE
Cephalo Digital Sensor
Type: K1VSMCEPH
Nominal Voltage : 24V⎓
Nominal Current : 0,7 A
S/N: XXX
Manufactured : YYYY / WW
6 Allée Képler 77420 Champs/M France

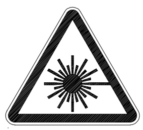
7
Laser
Warning
label

–RADIAZIONI LASER–
NON FISSARE IL FASCIO
NE' AD OCCHIO NUDO
NE' TRAMITE
STRUMENTI OTTICI.
APPARECCHIO LASER
DI CLASSE 2M
Norma EN 60825–1 ed.4
Po < 5 mW
Lungh. d'onda 635 nm ±10 nm
–LASER RADIATION–
DO NOT STARE
AT THE BEAM
NEITHER WITH THE
NAKED EYE
NOR WITH
OPTICAL DEVICES.
2M CLASS
LASER APPARATUS
Norm. EN 60825–1 ed.4
Po < 5 mW
Wave Length 635 nm ±10 nm

8
(N° 2) Spot Laser
identification label



9
(N° 2) Laser
symbol label



3.2. Function, Models and Version

3.2.1. Panoramic examination

The Panoramic and DXP tests are carried out using a single slot of the primary collimator.
The user can select between Adult and Child and among 3 sizes and 3 dental arch types for a total of 18 combinations in Automatic selection; in manual selection it is possible to select high voltage between 50 kV and 80 kV, in 2 kV steps and anodic current from 4 mA to 10 mA in 1 mA steps.
The basic version performs Panoramic and Emi-panoramic (for right or left dental arch) examinations.

3.2.2. Version with cephalometric device

The version with cephalometric device enables to perform the following examinations:

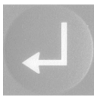
- Panoramic with the same characteristics described for the panoramic examinations (paragraph 3.2.1)
- Digital cephalometry for Adult and Child with 3 Sizes. For each combination it is possible the selection between High Resolution and Normal Resolution for up 12 combinations in automatic selection. In the Normal Resolution modality the scanning time is lower than in High Resolution with a greater dose reduction. The Manual mode enables to change the high voltage from 60kV to 80kV in 2kV steps and the anode current from 4mA to 10mA or 12mA (on the basis of selected kV) in 1mA steps. The positioning of slit primary collimator, secondary collimator and sensor (placed inside its cover) is automatic according to the selected image size and exam projection; the Soft tissue filter (STF) is motorized and can be adjusted to get the best projection of the face profile.
- Digital Carpus exam only for Child with 3 sizes. It is possible the selection between High Resolution and Normal Resolution for up 6 combinations in automatic selection. In the Normal Resolution modality the scanning time is lower than in High Resolution with a greater dose reduction. The Manual mode enables to change the high voltage from 50kV to 80kV in 2kV steps and the anode current from 4mA to 10mA or 12mA (on the basis of selected kV) in 1mA steps. The positioning of slit primary collimator, secondary collimator and sensor (placed inside its cover) is automatic according to the selected image size and exam projection.

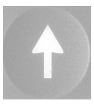
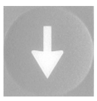
3.2.3. DXP (Digital Extended Program)

The DXP tests are carried out using the same primary collimator single slot used for Panoramic tests.
This option adds the following examinations:

- **A.D.A. (Advanced Dental Applications)**
  Allowing to perform improved orthogonality Panoramic examination, frontal dentition and reduced dose panoramic examination.
  The improved orthogonality Panoramic examination reduces the overlapping of teeth in order to improve diagnosis of interproximal caries.
  The reduced dose panoramic examination allows the examination of the dental arch exluding the temporo-mandibular joint structure.
  The frontal dentition examination allows to get a better view of the frontal part of the dental arch (aproximately from canine to canine) thanks to a wider focal through in this region than in standard panoramic examination.
- **Sinus**
  Used to obtain images of the paranasal sinusis in frontal (front/back) or lateral projection for right or left side.
- **Implant**
  Used to obtain images of cross-sections of the dental arch, for Implant medical treatment.
- **TMJ**
  Used to carry out the following examinations:
  - TMJ closed/open mouth in lateral projection
  - TMJ in biaxial projection.

NOTE:
The code inserted into STRATO 2000 Digital to enable the optional examinations is protected by an Unique Identification Code (UIC); in case the UIC is not present or is faulty, an error **E601** will be shown.

The Enter key "23"  pressure will reset this condition, but at the end of the start-up procedure only standard Panoramic examinations will be enabled.

The UIC can be visualized on the system console by pressing at the same time the Column up "27"  and Column down "29"  arrows.

The UIC is simply an identifier of the single STRATO 2000 Digital unit; in case of error **E601** contact Villa Sistemi Medicali Service department.

3.3. Parts location

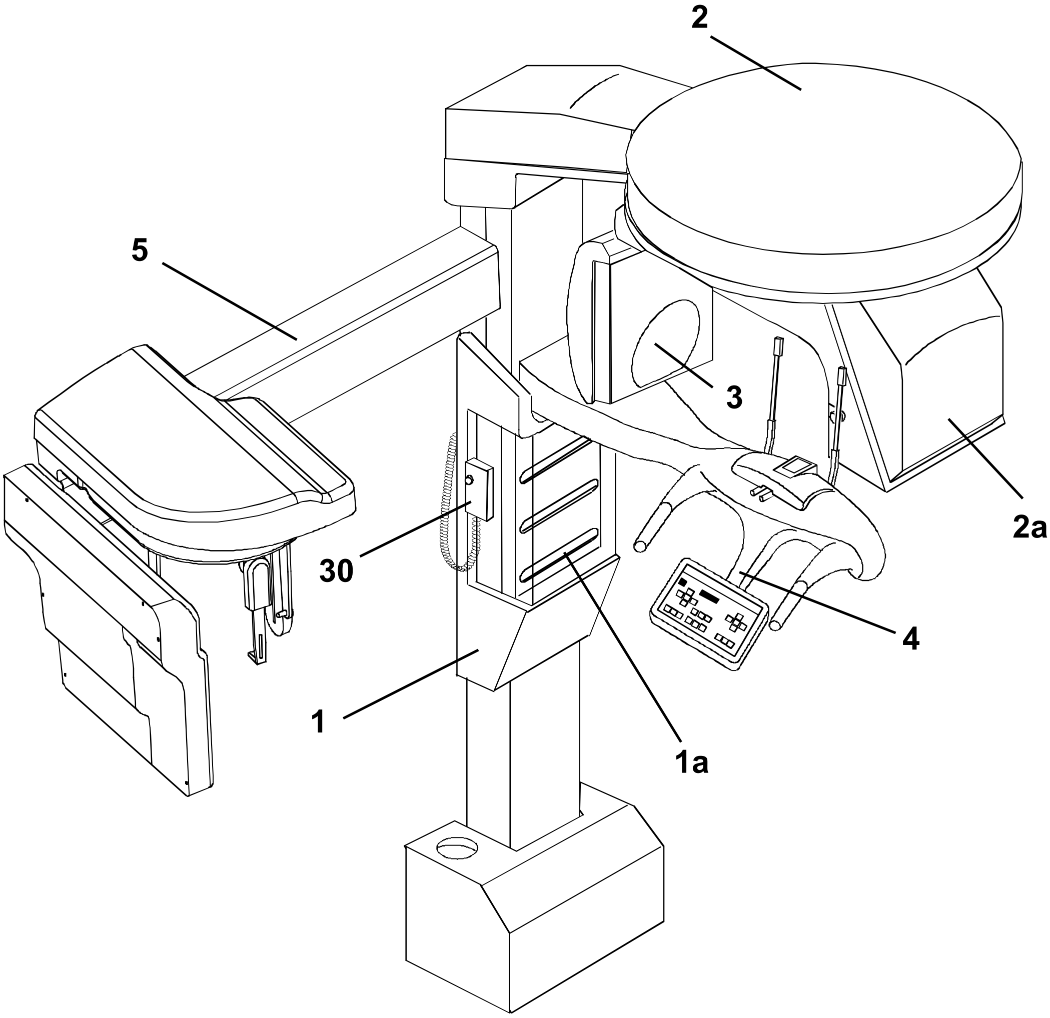


Figure 3-1

1 - Column with base equipped with electrical power part and cursor with motorised vertical movement. The column must be fixed at the wall by 4 dowels, two fixing the upper part and two fixing the lower. The front part of the column is equipped with an housings closed by two covers, within which it is possible to set 4 trays (1a) containing the consumables (bites, rods, etc.) and options (supports, etc.).

2 - X, Y axes movement unit and rotation support, (CPU board) with rotating arm equipped with: HF tubehead with power supply board (2a), primary collimator and laser centring devices.

3 - Digital sensor holder.

4 - Chin support arm equipped with: control keyboard, temple support, chin-rest, centring bite and handles. The control panel is equipped with a soft-key keyboard, indication LED for the selected functions and an alphanumeric two-row display for all technical, operative and warning messages.

5- Cephalometric arm (optional - not available on PAN ONLY version), including cephalometric device, digital sensor, secondary collimator and patient centering device (with laser alignment pointer directly from the rotating arm), positioned on the left of the column.

30 - X-ray push button equipped with extendible cable, which allows the user to operate the unit from proper distance as required by the safety rules.

3.4. Location of electronic components

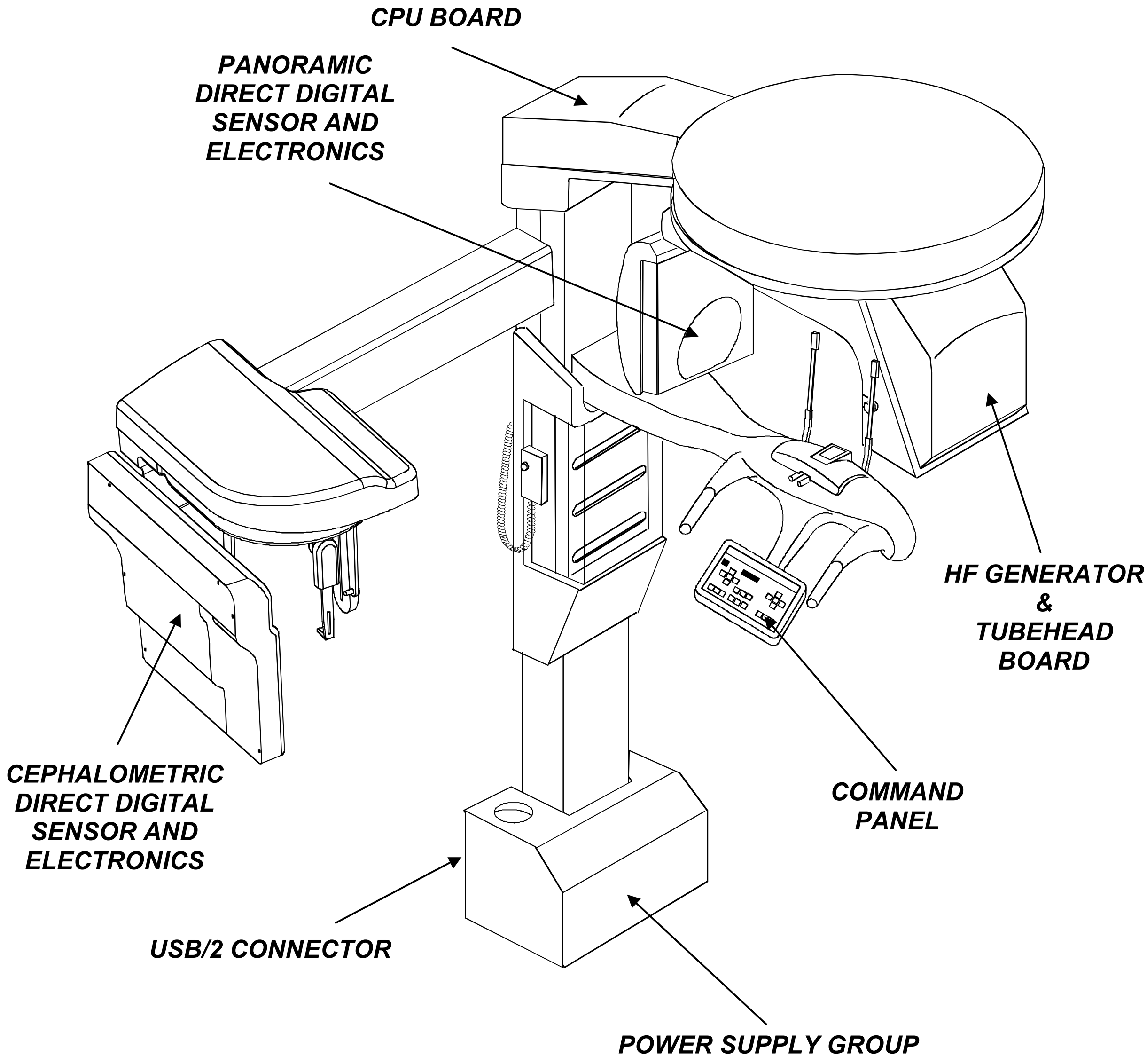


Figure 3-2

3.5. Block diagram

This paragraph provides a brief description, at block diagram level, of the STRATO 2000 Digital. Aim of this paragraph is to provide a brief description of the system. More details about the electronic circuits which compose the system can be obtained by analyzing the schematics provided in chapter 9.
During the description of the block diagram, please refer to Figure 3-4.

From the electrical point of view, the system can be divided into 4 main blocks:

- Power supply assembly
- CPU board (A1)
- HF board (A2) and tubehead
- Keyboard

Each of the main blocks above listed is here after described.

For information on the electronics of the Direct Digital Sensors, make reference to the relevant Manual.

3.5.1. Power supply assembly

It is located in the base of the system and is mainly composed by the mains switch (S1), a 24Vdc 7A switching mode power supply which supplies all circuits of the machine excluding the column motor, and a further power supply which supplies the column motor and the enabling circuit for X-ray emission.
A further voltage of 230Vac is directly provided to the HF board and is aimed at suppling the HF group (A2 board and tubehead).
The power supply assembly also acts as interface with a number of external signals and circuits like:

- Input for remote X-ray push button (S31) and output to the CPU of the same signal.
- Outputs for an "X-ray ON" external buzzer and for the "Ready" and "X-ray ON" lamps.
- Driving of the DC column motor (M1): this motor can be activated either through the CPU board, in case the movement is requested by the operator acting on the keyboard, or through the switch S2 located in the rear part of the column base. This switch can be used to raise/lower the column during the installation phase when the CPU has not been yet connected to the system.
- Input for the emergency column motor microswitches (S2 and S3): these microswitches indicates the limit for the movement of the column. If for any reason, the column goes beyond these microswitches, the motor is de-activated by cutting the voltage. Normally, the position of the column is also monitored by other two microswitches (S26 and S27) that, as for all the other positioning sensors, provide their signals to the CPU board.

The unit does not include a voltage selector circuit for the mains voltage. Therefore, the unit is manufactured in different versions, depending on the line voltage of the installation place.

3.5.2. CPU Board (A1)

The STRATO 2000 Digital carries a dedicated CPU Board which can be interfaced with the Digital Sensor.
It is located in the arm movement assembly on top of the unit. Main tasks are:

- General controlling of the unit, receiving the signals from the keyboard and from the different microswitches.
- Driving of the motors (combination of DC and stepper motors) which compose the system.
- Monitoring the functioning of the motors through the analysis of the signals coming from the positioning sensors.
- Driving of the HF group (HF board and tubehead) in order to provide the X-ray doses set by the operator on the keyboard (kV and mA set point) and in the meantime, check the functioning of this group through the managing of the relevant alarm signals.
- Activation of the 3 luminous centering devices.
- Managing of the alarms that can be generated by anomalous conditions present in the unit and caused by the operator or by a fault.

The CPU board is based on a 32 bit Motorola Microprocessor MC68332, mounted on a piggy-back PCB, which also includes:

- 512 Kbytes of Flash EPROM, containing the software and the system configuration data (2 EPROM's for ODD and EVEN data)
- 512 Kbytes of RAM, (2 chips, ODD and EVEN)
- 12 bit, 8 channel serial A to D converter
- 2 channel, 8 bit serial D to A converter
- three bus transceivers
- a 32 kHz quartz
- other logic and passive components.

The CPU board also includes a number of input/output channels necessary for the functioning of the system and stepper motors driving stages based on integrated motor drivers. Each of these motors is associated to positioning sensors that monitor their functioning. The signals of these sensors is fed back to the CPU board, except the signals of microswitches S2 and S3 (column motor) that, as already described are fed back to the power supply assembly.
The number and the type of sensors depend on the function of each motor, in general, microswitches are used.

Depending on the physical location of the motors on the machine, their signals and the ones of the relevant positioning sensors are routed directly to the CPU through dedicated cables, or passing through interconnection boards located nearby.

The transmission of the motion from the motor to the relevant movement assemblies is achieved through toothed belts (rotation motor, X axis motor and Y axis motor) or through actuators (column motor and primary collimator, soft tissue filter, secondary collimator and ceph sensor).

The functioning of the different motors and relevant positioning sensors can be tested through the use of the Service Programs (Passwords). For more details, please refer to paragraph 8.3.

The circuits of the CPU board are supplied starting from the +24Vdc provided by the Power supply assembly and generating on board the requested voltages (+5V, +5VS and +12VS). Three LED's on the board indicate the presence of these 3 voltages (+5V=LED H11, +12VS=LED H13, +5VS=LED H10).

3.5.3. HF Board (A2) and Tubehead

The HF board and the tubehead are located on the rotating arm, very close to each other. The power supply voltage (230Vac) is directly provided by the Power supply assembly, passing through a filtering box having the function to rectify the input voltage to generate a 360Vdc voltage.

Dedicated switching circuits, directly located on the board, generate the voltage used on the board itself (+12V/-12V).

Managing of the HF board is done by the main CPU board of the unit.

The high frequency (HF) circuit is based on an inverter circuit working at the frequency about 30kHz, which drives the tubehead through an output stage based on IGBT components.

The HF board receives the signals concerning the X-ray dose to provide (kV and mA), directly from the CPU board. The HF board provides to the tubehead the voltages that drive the high voltage transformers that then drive anode and filament of the X-ray tube, also giving the relevant timing.

The tubehead is composed by the radiogenic tube (CEI OPX/105) inserted in a sealed container, together with the high voltage transformers, filled with dielectric oil.

Checking of proper functioning of the X-ray emitting system is achieved through the analysis of feed back signals generated inside the tubehead and transmitted to the HF board. Possible anomalous conditions are then communicated to the CPU board which in turn generates error codes to alert the operator.

3.5.4. Keyboard

The keyboard is the interface with the operator, and is composed by the following items:

- Matrix of keys, constituted by microswitches with short stroke, necessary to activate the different available functions
- Signalling LED integrated in the touch panel
- LCD display equipped with back-light, composed by a matrix of 16 characters and 2 rows
- Keyboard PCB.

The keyboard PCB is directly connected to the CPU board which controls it. The language of the messages shown on the display can be selected among 5 different options (English, Italian, French, German and Spanish). The language selection is only available for the messages dedicated to the user. The messages relative to the service programs (Password) are always in English.

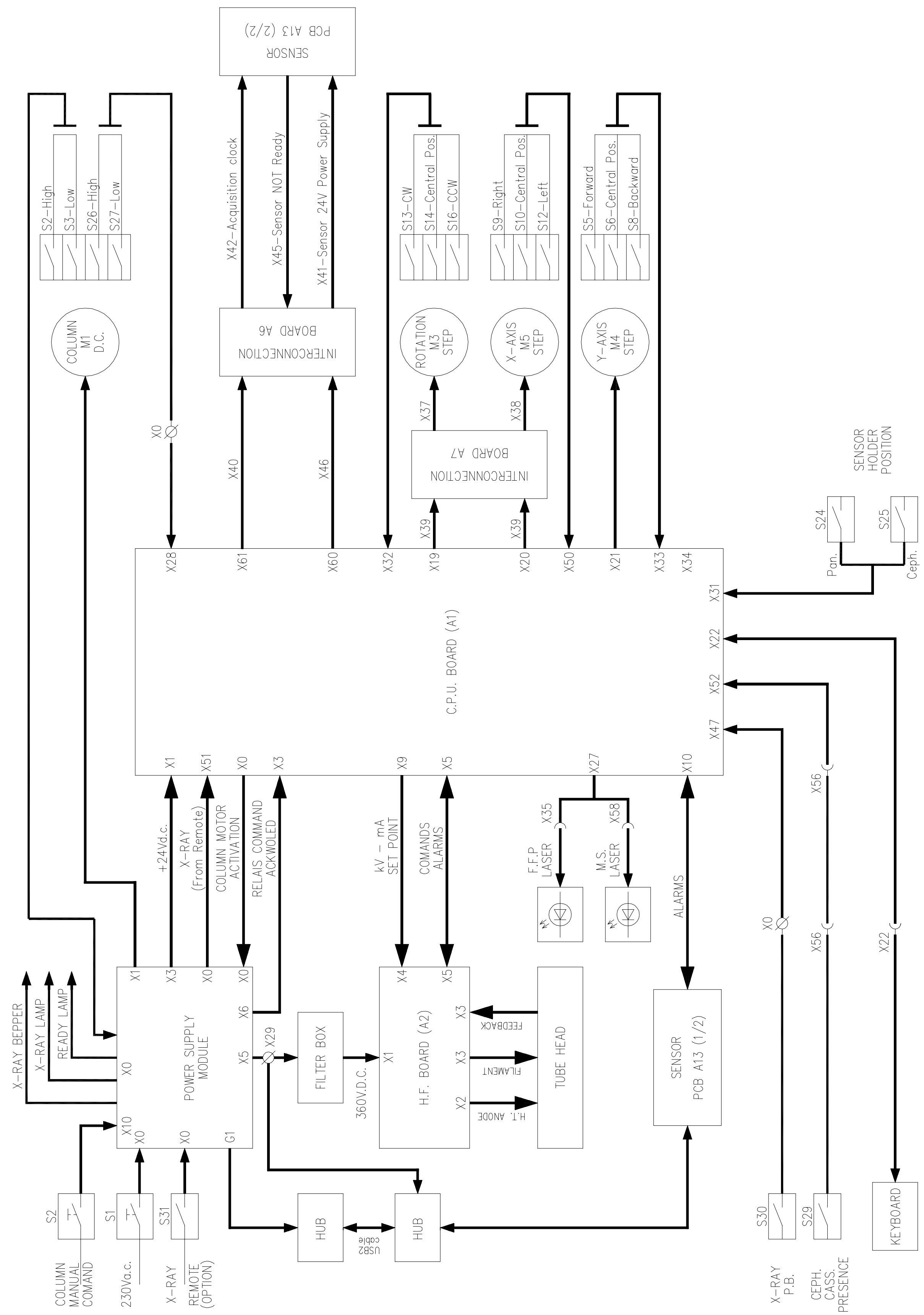


Figure 3-3 - Block diagram PAN only version

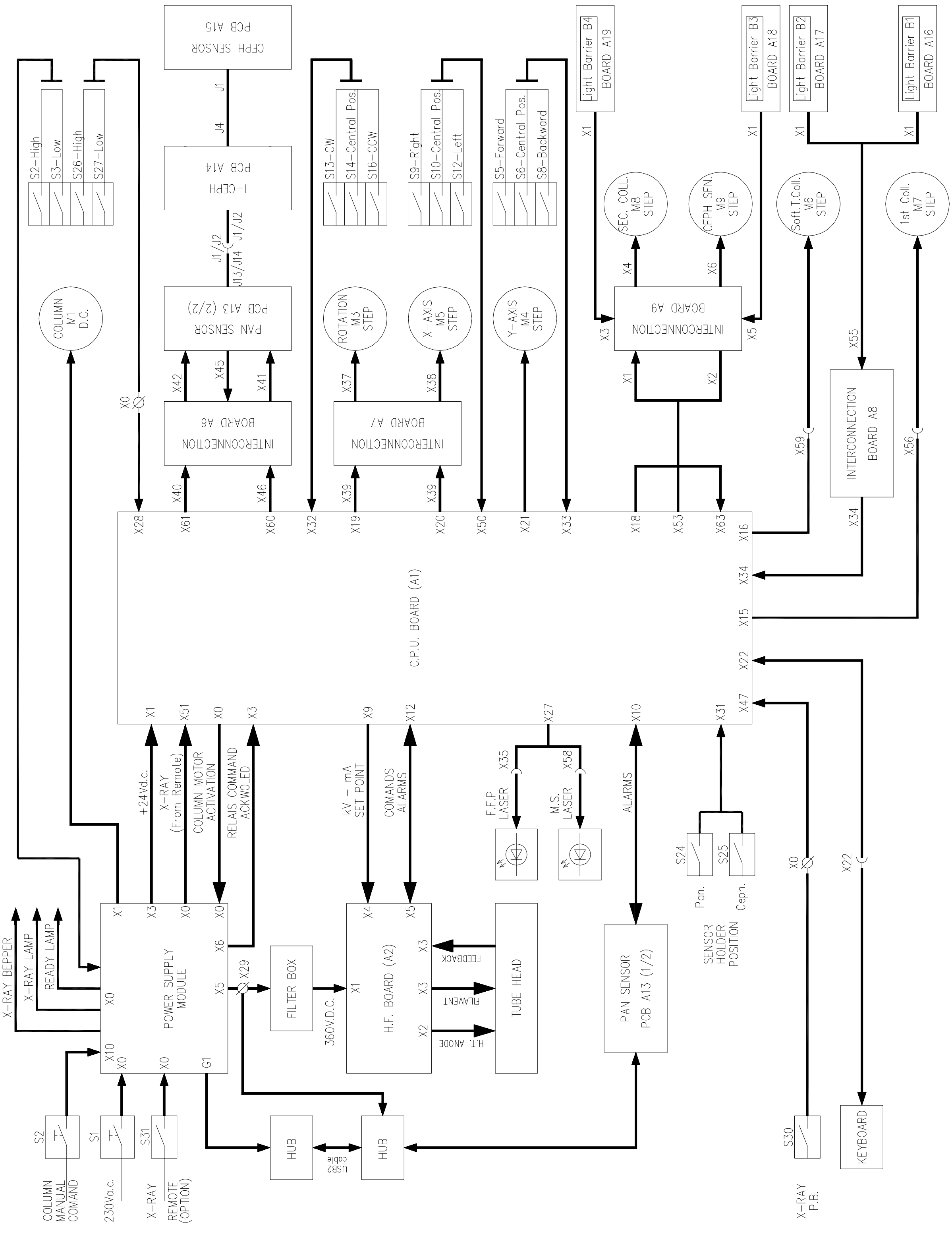


Figure 3-4 – Block diagram CEPH version

3.6. Control panel - Descriptions and functions

STRATO 2000 Digital keyboard is divided into 8 functions areas, and a display to view the messages and the error codes.
Next figure shows a general view of the keyboard, while details an each functional area are provided in the following pages.

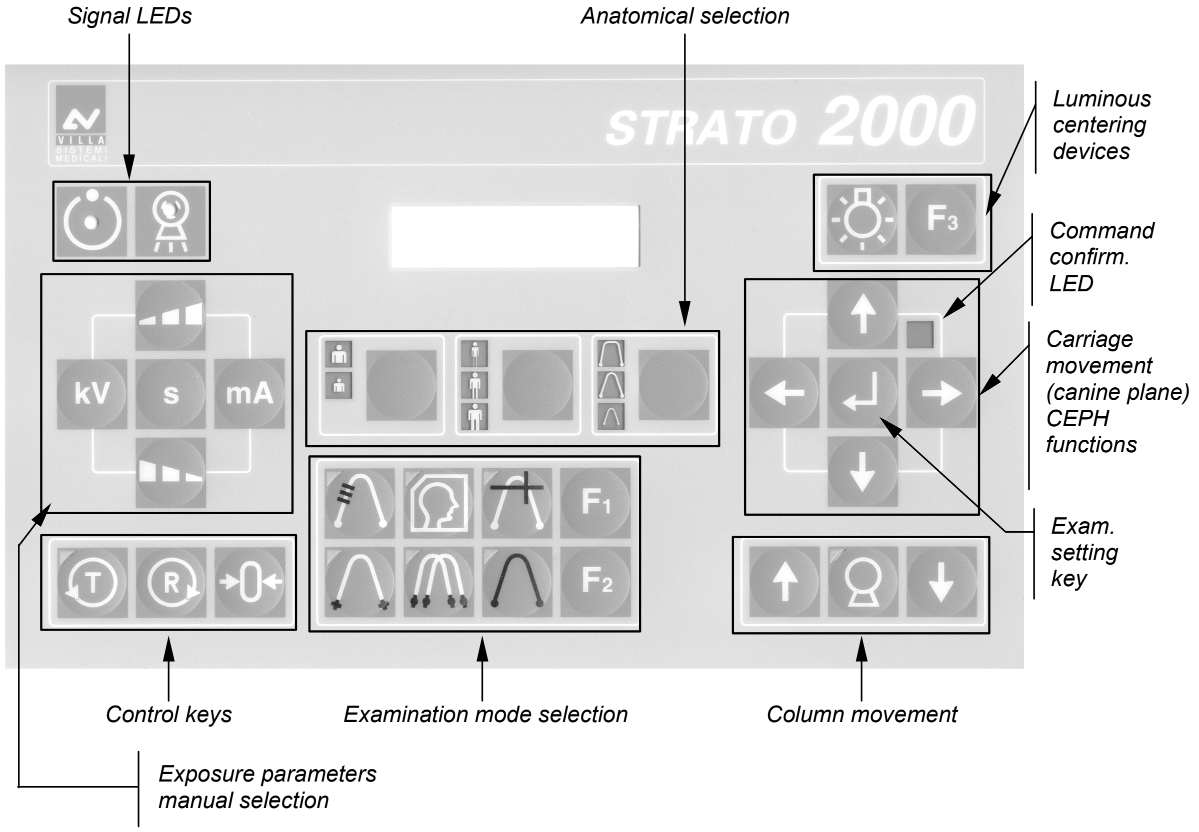
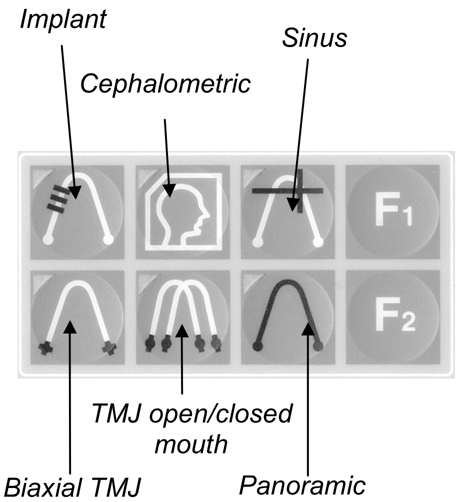
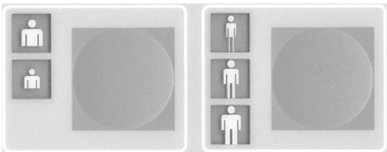


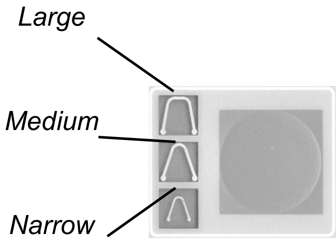
Figure 3-5



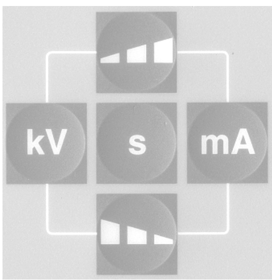
Each key enables the selection of a specific examination. The pre-set examinations are:
Panoramic, TMJ open/closed mouth, TMJ biaxial, Sinus, Implant and Cephalometry.



It is possible to select the examinations automatically (anatomic selection) using pre-fixed exposure values. This kind of selection enables to choose between Adult/Child, each with three different sizes (small, medium, large).



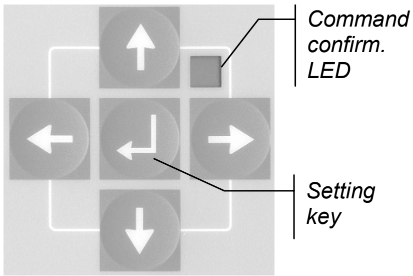
In panoramic, TMJ and Implant examination mode, the system allows the selection of the type of the dental arch.
The arch key allows the selection among 3 different mouth conformations: narrow - medium - large.
The selection made is confirmed by the activation of the corresponding LED.
The arch selection does not influence the values of kV and mA but acts on the position of the focus layer.

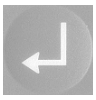


Furthermore there is the possibility to select manually the exposure parameters; in this case select at first the parameter to be changed and secondly, using the increasing and reducing keys, set the required value.
The parameters available are: kV and mA.

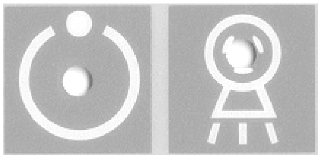
This area contains the keys which:

- control the tubehead arm movements (canin plane) during the patient positioning
- select IMPLANT tooth
- select the exam format in cephalometry
- set the position of the Soft Tissue Filter

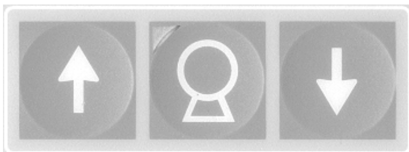


and the relevant confermation key. When the "Command confirmation LED" is lit, it means that the key  must be pressed to confirm the selected command.

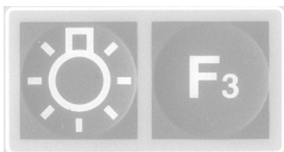
There are two light indicators; the first one on the left indicates the condition "Machine Ready", indicating the user that by pressing the X-ray button key once more, X-rays emission will start; the second led indicates the emission of X-rays.



The movement of the column is controlled by the related keys; for safety's sake, this control is performed pressing two keys at the same time, the central one and one of the two lateral.



The left button is dedicated to the center of sagittal, canine and Frankfurt planes, thus adapting the STRATO 2000 Digital to the patient anatomy. The right button is reserved for future use.



Apart from the keys dedicated to the selection of the examination functions, part of the STRATO 2000 Digital keyboard is dedicated to the services. From left to right, we have: the "Test" key (which disables the X-ray emission during arm rotation), the "Reset" key (to be pressed after the unwanted release of the X-ray push button "30" during exposure) and the "Arm return" (to prepare the system for the next examination).

3.6.1. Key functions description

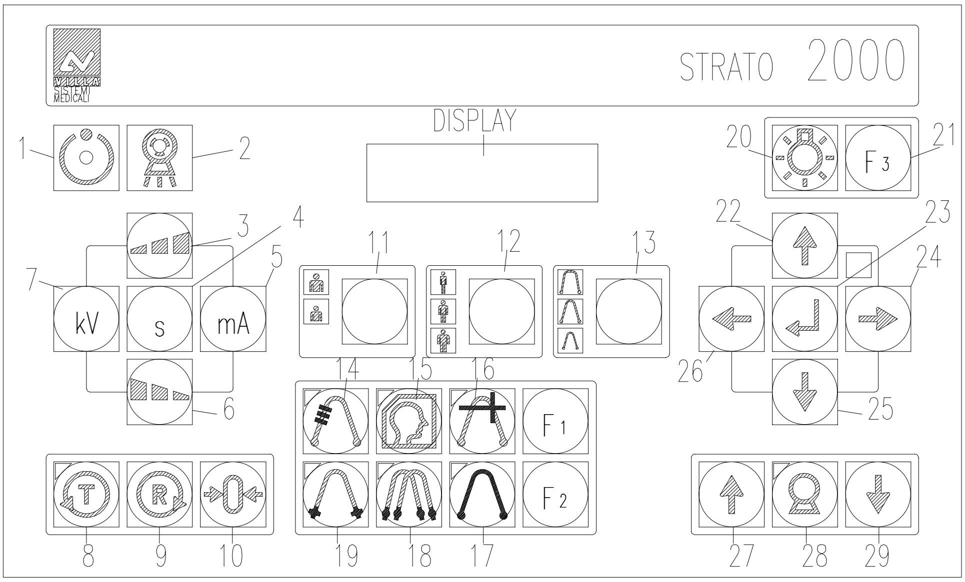


Figure 3-6 - Control panel

LEGEND:

Messages
Display: indicates operative messages, warnings and exposure parameters.

Signal lights
1 - Led indicating the machine is ready for X-ray emission (green LED)
2 - Yellow LED indicating X-rays emission

Manual setting of exposure parameters
3 - kV or mA increasing
4 - Seconds
5 - mAmpere
6 - kV or mA reduction
7 - KVolt

Preparation functions
8 - Key to set Test function
9 - Reset, axes alignment and enabling to modify exam modes
10 - Positioning of the rotation unit to start the selected examination or return of the unit for a new setting

Anatomic selection
11 - Adult or Child (green LED)
12 - Small, medium or large size (green LED)
13 - Wide, normal or narrow arch (for Panoramic, TMJ closed / open mouth and Implant exposure) (green LED)

Examination mode
14 - Implant (optional)
15 - Cephalometry (optional – not enabled on PAN ONLY version)
16 - Sinus examination (optional)
17 - Panoramic
18 - TMJ closed mouth – open mouth (optional)
19 - TMJ biaxial (optional)

Centring devices
20 - Saggital, Frankfurt and Canine Plane centring unit
21 - Button not active

Patient centring
22 - Moving canine plane, selection of quadrant (Implant) and Cephalometry exam selection
23 - Confirmation key
24 - Soft Tissue Filter positioning and selection of tooth (Implant)
25 - Moving canine plane, selection of quadrant (Implant) and Cephalometry exam selection
26 - Soft Tissue Filter positioning and selection of tooth (Implant)

Height adjustment
27 + 28 - Column up
29 + 28 - Column down

3.7. Service programs description

STRATO 2000 Digital allows the authorised technicians to access to the different functional parameters of the unit through a dedicated software composed by the following service programs. Each service program can be accessed through a dedicated password.

The service programs available are the following:

- ***Password 94:*** test of a number of HW components in the system
- ***Password 102:*** allows reading of the parameters stored into the non-volatile memory of the unit (e.g. motor offset)
- ***Password 118:*** test on motors/positioning sensors, setting of the zero offsets of the axes and the collimators
- ***Password 124*** *(not enabled on PAN ONLY version)*: digital ceph zero offsets and test on motors/positionig sensors of the ceph arm.
- ***Password 130:*** language setting for the displayed messages (the Service messages are always in English)
- ***Password 143:*** display and reset of the counters for the various examinations. Display of total time of the system's exposure.

The above mentioned programs are described at paragraph 8.3 of this manual.

3.7.1. Hardware configuration password

Four special passwords are used to configure the proper hardware for the Digital Version.
These configuration is accessed in a different way with respect to the above listed service program passwords:

- ***Password 89:*** primary collimator type selection
- ***Password 90:*** digital version selection
- ***Password 92:*** CPU type selection
- ***Password 93:*** Soft Tissue Filter motor type selection
- ***Password 95:*** kV minimum value setting.

The above mentioned programs are described at paragraph 8.3 of this manual.

3.8. Service tools

The unit is supplied equipped by the following tools:

Code	Description	Function
39099004	Upper template	Template for the upper fixing of the column

Furthermore, the following service kit is available:

Code	Description	Function
54099005	Fluorescent screen	Used for Panoramic function adjustment and calibration
54089021	Round centering tool	
54099002	Flat centring tool	
52099009	Sensor centering tool	Used for Cephalometric arm adjustment and calibration
61099021	Sensor calibration tool	
58093221	Calibration programs CD	

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4. TECHNICAL DATA

General features		
Type	STRATO 2000 Digital	
Manufacturer	VILLA SISTEMI MEDICALI Buccinasco (MI) Italia	
Class	Class I with type B applied parts according to IEC 60601-1	
Protection degree	IP20	
Rated line voltage	**230V~**	**100V~**
Line frequency	50Hz	50-60 Hz
Maximum line current	8 AT	17 AT
Power consumption	1.8 kVA	1.9 kVA
Protection fuse (F2)	10 AF	10 AT
Transformer protection fuse T1 (F1)	0.8 A T	3 AT
Controls supply protection fuse (F5)	0.5 A T	0.5 A T
Column motor protection fuse (F3, F4)	7 A T	7 A T
Line apparent resistance	0.5 Ω max	0.25 Ω max
Rated output voltage (kVp) (see Note)	50 ÷ 80 kVp in 2 kVp steps	
Anodic current	4 ÷ 10 mA in 1 mA steps for PAN, TMJ, SINUS and IMPLANT 4 ÷ 12 mA in 1 mA steps for Ceph (up to 76kV_p) 4 ÷ 10 mA in 1 mA steps for Ceph (up to 80kV_p)	
CEPH sensor cover additional filtration	0.4 mm Al eq. @ 70 kV_p	

NOTE:
During installation, the rated output voltage range can be reduced to 60 ÷ 80 kVp in 2 kVp steps according to the local rules.

Exposure time	
Panoramic (PAN)	15 s PAN Adult / 13.5 s PAN Child
Emi Panoramic	8 s Adult / Child
Improved orthogonality Panoramic	11.5 s Adult / Child
Reduced dose panoramic	11.8 s Adult / Child
Frontal Dentition	7.7 s Adult / Child
TMJ open/closed mouth	5.3 s Adult / Child per image for left and right joint in open and closed condition (total time 11 s)
TMJ biaxial	10.6 s (total time) Adult /Child
Sinus P/A projection	10.3 s Adult /Child
Sinus lateral projection	5.2 s Adult / Child each side
Implant	Exposure time variable according to the mode set and the tooth selected
Cephalometry	Exposure time variable according to the type of resolution and format selected
Exposure time accuracy	± 10 %
Examination programs	
Examination selection	• Automatic selection for Adult and Child, 3 sizes, 3 arches (in Panoramic and TMJ) • Automatic selection for Adult and Child, 3 sizes (in biaxial TMJ, Sinus and Cephalometry) • Automatic selection for Adult, 3 sizes, 3 arches (in IMPLANT) • Automatic selection for Child, 3 sizes (Carpus) • Manual selection • Collimator with automatic positioning
Panoramic	• Standard Panoramic • Emi Panoramic • Improved orthogonality Panoramic • Reduced Dose Panoramic • Frontal Dentition
TMJ (Temporal Mandibular Joint)	• TMJ open and closed mouth • TMJ biaxial
SINUS	• Maxillary SINUS • Lateral SINUS

Examination programs	
IMPLANT	• 2 section (one longitudinal and one transversal) • 4 section (one longitudinal and three transversal)
Cephalometry and Carpus (not available on PAN ONLY version)	• Normal Resolution Cephalometry Latero-Lateral or Antero-Posterior projections (different formats) • High Resolution Cephalometry Latero-Lateral or Antero-Posterior projections (different formats) • Normal and High Resolution Carpus exam
Image magnification	
PAN and TMJ open/closed mouth, Maxillary/Lateral SINUS	1 : 1.23 (constant)
TMJ biaxial	1 : 1.20 (average)
IMPLANT	1 : 1.27 (constant)
Cephalometry	1: 1.1 (average)
No. of images in TMJ (open/closed mouth/biaxial)	4
X-ray tube characteristics	
Manufacturer	CEI Bologna (Italia)
Type	OPX 105
Nominal focus size	0.5 IEC 336
Inherent filtration	0.5 mm Al eq.
Anode tilt	5°
Anode material	Tungsten
Nominal maximum voltage	105 kV_p
Filament max current	4 A
Filament max voltage	8 V
Anode thermal capacity	30 kJ

Tubehead characteristics	
Model	MS 05
Manufacturer	Villa Sistemi Medicali S.p.A. 20090 Buccinasco (MI) Italia
Maximum tube voltage	80 kV_p
kV_p accuracy	± 8 %
Max. anodic current	12 mA
Anodic current accuracy	± 10 %
Duty cycle	1 : 16
Nominal power	0.96 kW (80 kV_p - 12 mA)
Total filtration	2.5 mm Al eq. @ 70 kV_p
HVL (Half value layer)	>2.5 mm Al eq. @ 80 kV_p
Transformer insulation	Oil bath
Cooling	By convection
Leakage radiation at 1 m	< 0.5 mGy/h @ 80 kV_p - 12 mA - 3 s duty cycle 1/16
Reference time product current	1.2 mAs (6mA for 200msec)
Laser centering devices	
3 laser beams are used for the patient positioning; beams align mid Sagittal, Frankfurt and Canine Planes (please refer to relevant paragraphs for detailed explanation).	
Wave length	635 nm
Optical power of laser diode	5 mW
Optical power of the collimed beam	4.5 nW
Divergence	6.67 mRad
Optical power on the working surface	< 3 mW
Laser class	2 M
DNRO in 30 s application period	0.05 m

Mechanical characteristics	
Focus-receptor distance (PAN, TMJ, SINUS and IMPLANT)	51 cm (20")
Focus-receptor distance (CEPH)	165 cm (65")
Telescopic motorized column run	67 cm (26.4")
Total height max.	232 cm (91.3")
Width x Length	• 100 x 125 cm (39.4" x 49.2") without CEPH version • 177x 125 cm (39.4" x 49.2") with CEPH version
Weight	• 130 kg without CEPH • 145 kg with CEPH
Column weight	72 kg
Weight of arm support, rotating arm and tubehead	48 kg
Weight of the chin rest arm	8 kg
Environmental features	
Working area (please refer to paragraph 5.3)	• 130 x 130 cm (51.2"x51.2") without CEPH • 190 x 130 cm (74.8" x 51.2") with CEPH
Minimum height ceiling (please refer to paragraph 5.3)	250 cm (98.5")
Temperature in working condition	+ 10° ÷ + 40°
RH (related humidity) in working condition	30% ÷ 75%
Temperature for transport and storing	- 20° ÷ + 70°
Humidity for transport and storing	< 95% without condense
Min. atmospheric pressure for transport and storing	630 hPa

4.1. Applied safety regulations

STRATO 2000 Digital complies with the following standards:

- General safety:
  IEC 60601-1
  IEC 60601-2-7
  IEC 60601-2-28
  IEC 60601-2-32

- Electromagnetic compliance:
  IEC 60601-1-2

- Protection against radiation:
  IEC 60601-1-3

- Laser safety:
  IEC 60825-1

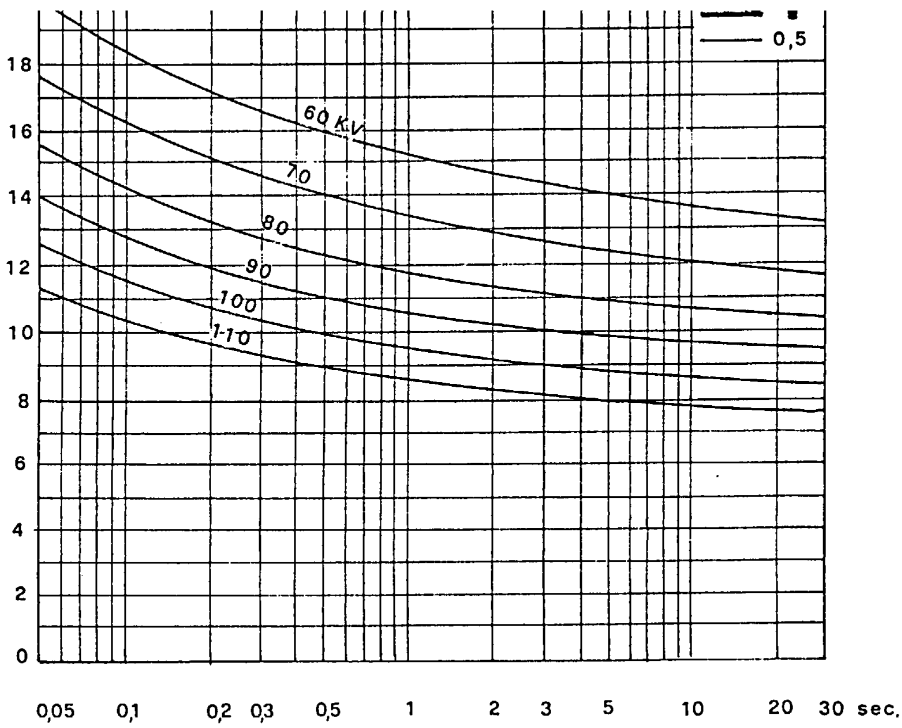
CE 0051 The symbol CE grants that STRATO 2000 Digital complies with directives 93/42 for medical devices issued by the European Community.

Classification
STRATO 2000 Digital is an electro-medical X-ray device belonging to Class 1 and Type B as per classification IEC 601-1, foreseen for a continuous working at intermittent load.
According to CE 93/42 directive for medical devices, the equipment belongs to class II B.

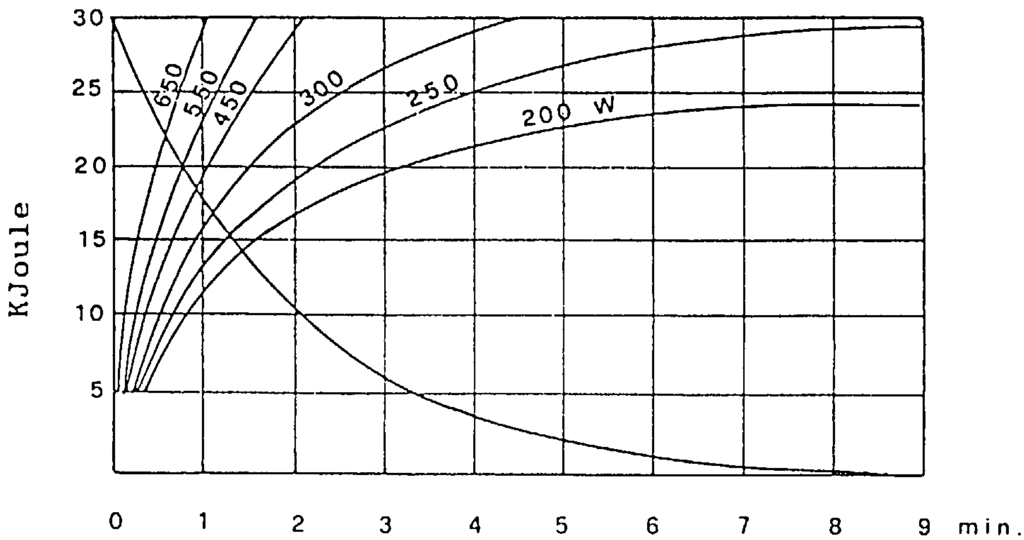
4.2. Loading curve of the tube and cooling curve of the anode

Tube "CEI - OPX / 105" (0.5 IEC 336)

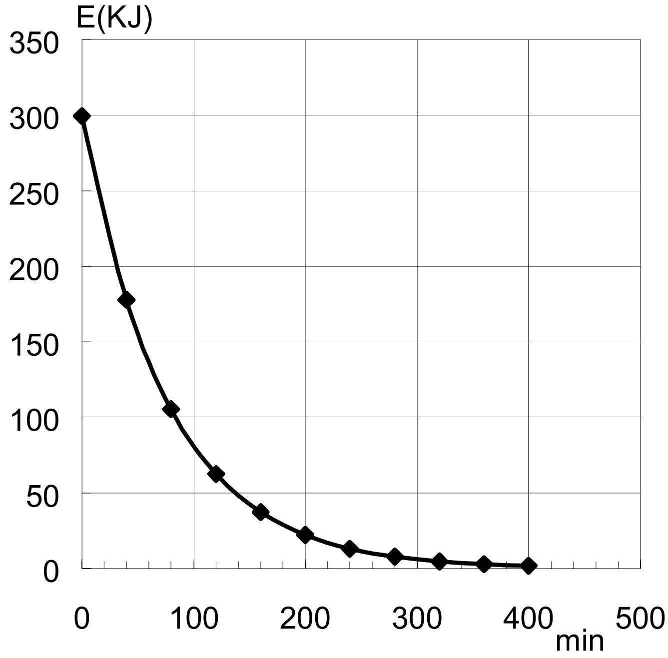
Load



Anode cooling curve



Cooling curve of Tubehead

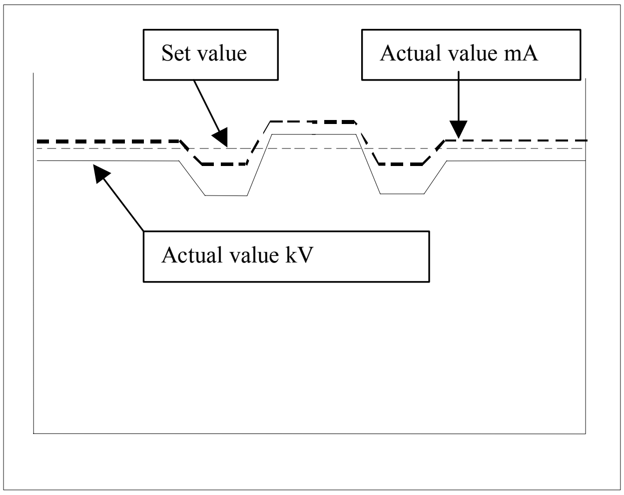


4.3. Measurement method of technical factors

WARNING:
These measurements require the removal of the HF group covers; this means to gain access to internal parts where high voltage are normally present.

For the measurement of the exposure parameters with the invasive method, please follow the procedure described in paragraphs 7.2 and 7.3 of this manual.

WARNING:
During the panoramic examination, the set value of kV and tube current varies according to a pre-determined curve in order to compensate the different absorption of X-ray beam due to different anatomical structures. In this way, it is possible to obtain a good uniformity of the image's contrast. Particularly, the chosen value is lowered on the initial phase of the panoramic and increased on the scissors/canine zone, in order to compensate the effect of the cervical spine.
The value displayed during the panoramic examination corresponds to the to chosen one, while the istantaneusly value can be different; these effects must be considered in case of measure of the exposure factors using standard diagnostic mode. As an example, the variation follows the curve hereafter:

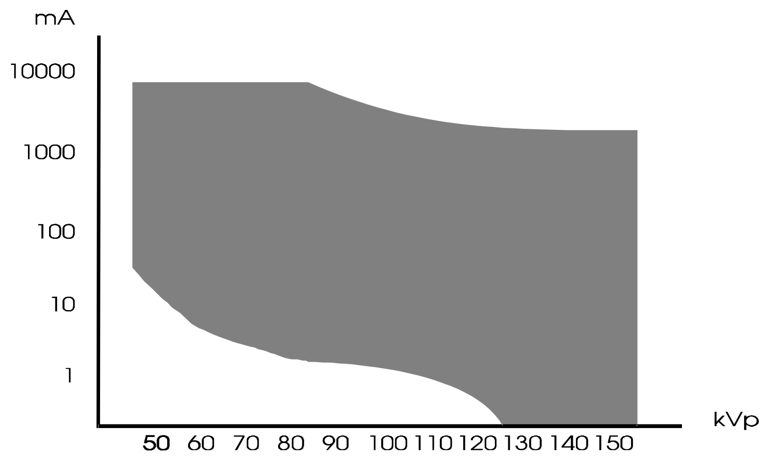


Accuracy declared on the section "Technical data" is referred to the actual value of kV and/or mA. In any case, manufacturer guarantees that the accuracy of loading factors is always compliance with the international standard for safety of medical devices IEC 601-1. Particularly, in accordance with IEC 601-2-7, the maximum deviation (including the correction and instrument's accuracy) is less than or equal to ±10 for kV, while for tube current is less than or equal to ± 15%.

4.4. Verify method of exposure parameters

The exposure parameters can also be verified using the so called "non-invasive method".

NOTE:
The instruments normally used for the measurement of the exposure parameters (kVp) with the non-invasive method, have an intrinsic measurement non-linearity when used to measure low dose radiations. This non-linearity can lead to measuring errors clearly not due to the STRATO 2000 Digital.
As example, please see the next diagram where the sensitivity curve of a normal measuring instrument is shown. Working outside the dark area, the instrument is not linear.

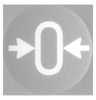
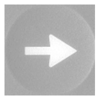


The exposure parameters can be checked with a non-invasive instrument.

WARNING:
The machine primary collimator, both the fix one on PAN ONLY machine and the slit primary collimator, give a narrow X-ray beam.
Measurement by a non invasive kV meter on a very narrow beam can be difficult and/or unreliable and special probes with reduced sensitive area must be used.
It may result helpful to use a fluorescent screen to locate the X-ray beam and consequently position the probe of the kV meter.

The procedure to measure kVp by a non-invasive kV meter is the following:

1. With the unit on, select the Panoramic examination mode by pressing key "17"  .

2. Press keys "10"  , "28"  and "24"  at the same time. LED's of "patient type", "patient size" and "Arch" switch off and the display shows the following two messages alternatively

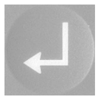
				R	E	M	O	V	E						
			C	H	I	N		R	E	S	T				

and

					C	L	O	S	E						
	T	E	M	P	L	E		S	U	P	P	O	R	T	

NOTE:
The following operations is a confirmation that the above points have been performed.

NOTE:
This program allows you to carry out the measuring of the exposure parameters having the tubehead-arm in a fixed position (not rotating).

3. Carry out the actions mentioned above; press key "23"  ; the unit will carry out a movement to reach the "zero" position.

   During this phase, the display shows:

P	L	E	A	S	E		W	A	I	T	.	.	.		

   At the end of this phase , the display shows:

						O	P	E	N						
	C	A	S	S	E	T	T	E		U	N	I	T		

4. After having opened to Ceph position the sensor support the display shows:

P	L	E	A	S	E		W	A	I	T	.	.	.		

while the primary collimator is placed in PAN position and the Soft Tissue Filter outside the X-ray field.

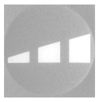
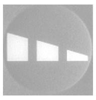
5. The display shows:

	R	X		P	A	R	A	M	E	T	E	R	S		
	7	0	k	V		0	8	m	A		1	.	0	0	S

6. Place the measuring instrument over the chin support.

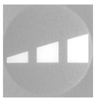
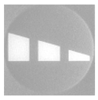
7. Acting on keys "4" 

and "7" 

and on keys "3"  or "6"  set the exposure parameters to carry out the desidered checks.
The variation range of the parameters is shown in the following table (see also NOTE at page 4-10):

Parameter	Minimum value	Maximum value
kV	50	80
s	0,2	15

NOTE:
Acting on key "5" 

and then on keys "3"  or "6"  the mA value can be changed.
The mA value ranges from 4 to 12 (1 mA step).

WARNING:
X-ray will be emitted during the performance of the following operations. Authorised technicians are therefore recommended to use the greatest caution and to comply with the safety regulations and laws of their country.

8. Perform an exposure; the emitted parameters (kV and Time) can be read on the measuring instrument.

NOTE:
The performances are guaranteed if the measurement of kV and mA is done with the invasive method (see paragraph 7.2 and 7.3).

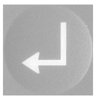
---

9. To quit this routine, press key "9"  ; the display will show:

	C	L	O	S	E		C	A	S	S	E	T	T	E	
		T	O		P	A	N	O	R	A	M	I	C		

In case of fixed collimator jump to step 10.
After closing the sensor holder to Panoramic position (the position is sensed by the unit), the display will show the following message:

P	R	E	S	S		E	N	T	E	R					

Press key "23"  ; the unit will carry out the zeroing and will set itself in the patient entry position; the display will show:

P	L	E	A	S	E		W	A	I	T	.	.	.		

10. The display will show:

S	T	D	.		P	A	N	O	R	A	M	I	C		
	x	x	k	V		x	x	m	A		1	5	.	0	s

and the unit returned at a standard mode.

4.5. Dimensions

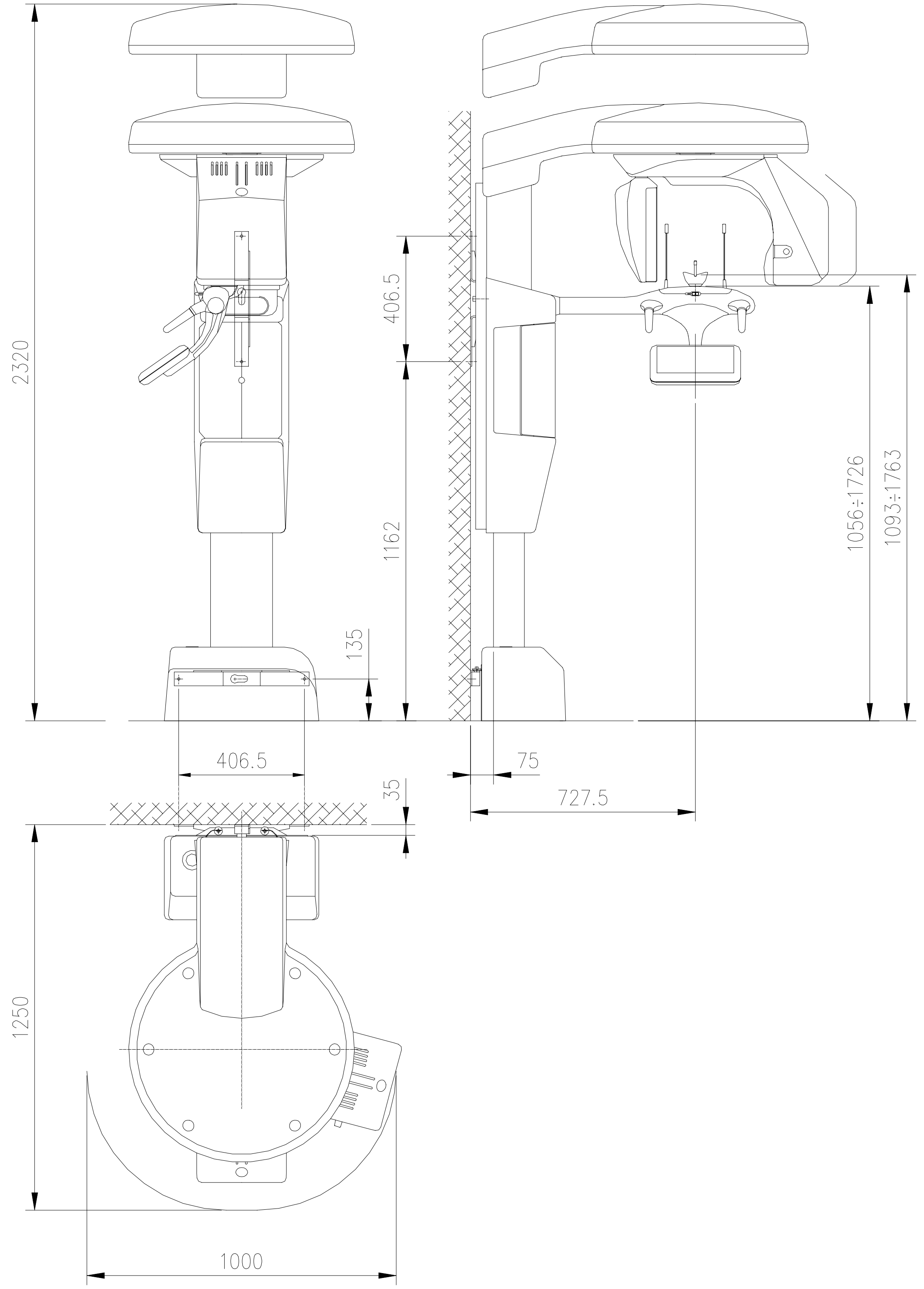


Figure 4-1 - Base version

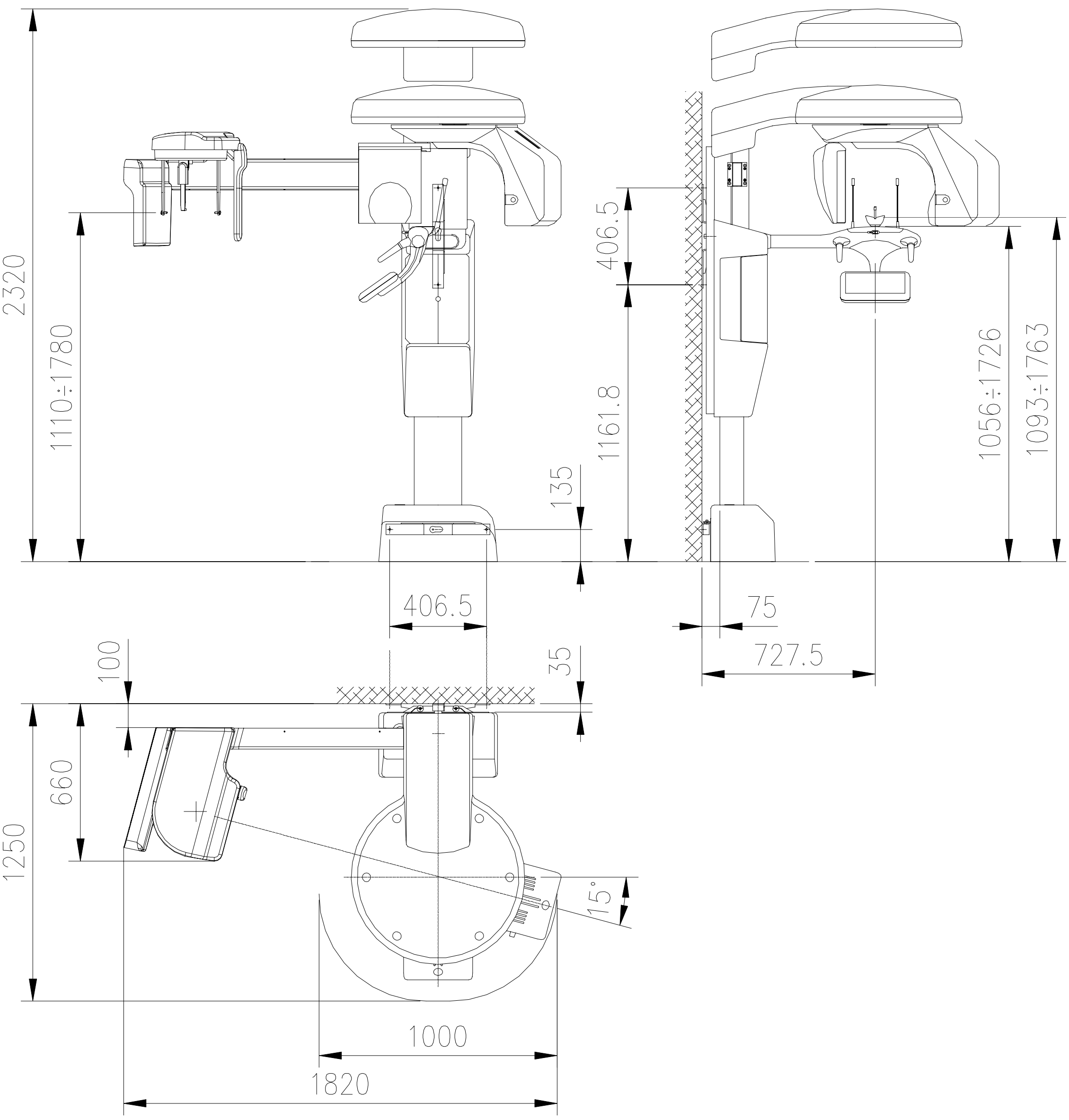


Figure 4-2: Version with Cephalometric unit

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5. PRE-INSTALLATION

The instructions indicated in this and in the following chapter enable to perform a correct installation in order to grant a regular operation of STRATO 2000 Digital.
The supplier can supply the assistance and the necessary technical advice for pre-installation, all masonry works and the pre-installation phase are at the customer’s charge and must be performed complying with the indications given below.

The requirements for a correct installation of STRATO 2000 Digital are:

- minimum height of the room: 2.5 mt. and a surface as indicated in the picture at paragraph 5.3
- a certain distance from heating devices
- the entries in the room, for the transport of the unit, must have a minimum width of 80 cm.

WARNING:
In all its versions, STRATO 2000 Digital must be fixed at the wall by the two brackets supplied, which have to be fixed by the dowels enclosed.
Each dowel must support a max. extraction force of 120 kg.
The fixing dowels to be employed, for any kind of wall, are the following:

- **full bricks:** supplied dowels (cast-iron dowels for the upper bracket and plastic dowels for the lower one)
- **wood mountings:** self tapping screws
- **hollow bricks:** optional chemical dowels (code VSM 6660132000).

5.1. Electrical setting up

	230V ~	100V ~
• Single-phase grounding supply	**230V ~**	**100V ~**
• Frequency	50Hz	50-60Hz
• Power consumption	1840VA	1900VA
• Current consumption	8A	17A
• Apparent line resistance	0.5 Ω max	0.25 Ω max

NOTE:
The device is supplied as unit to be installed permanently.
Please DO NOT connect the unit to the line using a normal socket, to avoid compromising the electrical safety.

The unit must be connected to a differential magneto-thermal switch, to divide the unit from the supply. This switch must comply the electrical regulations in force in the country of installation.

- **Minimal characteristics a 230V : working voltage 250V, current 16 A and differential current: 30 mA.**
- **Minimal characteristics a 100V : working voltage 150V, current 25 A and differential current: 30 mA.**

The supply conductors must have a 1,5 mm^2 section.
The general grounding must comply with the rules in force; a wrong quality of the grounding could be dangerous for the operator's safety and cause a bad function of the electrical devices.

NOTE:
STRATO 2000 Digital, complying with **IEC 60601-2-7** standard, IS SET TO connect, at the entrance of the X-ray room, the following control and warning devices:

- **REMOTE X-RAYS BUTTON:** "Dead-man" remote control, enables to perform the exam at a distance, the operator can stand outside the X-ray emission area. Terminal board X0 pin 8 and 9.
- **READY light:** Green light (24V 40W max.), it signals that the machine is ready to perform the exam. Terminal board X0 pin 10 and 11 (contact N.O.).
- **X-RAYS light:** Yellow light (24V 40 W max.) it signals the entry in the X-ray room is forbidden, since an exposure is on the run. Terminal board X0 pin 12 and 13 (contact N.O.).
- **BEEPER:** Outer acoustical signal (24V max.), it indicates entrance in the X-ray room is forbidden since an exposure is on the run. Terminal board X0 pin 14 and 15 (contact N.O.).

NOTE:
The electrical connection must be done on the terminal board X0 (see operation circuit diagram – chapter 9).

NOTE:
The unit only provides the closing contacts relative to the above mentioned functions. Power voltages for the relevant devices have to be provided from outside, making sure not to exceed the indicated ratings.

To connect all control and warning devices it is advisable to set 8 wires with 0.5 mm^2 section.

5.2. Packaging

STRATO 2000 Digital in base version is delivered in two carton-board boxes; the device equipped with Cephalometric unit will be delivered in three boxes. Net weight, gross weight and the contents of the packaging are indicated in the following table:

Contents	Weight	
	Net	**Gross**
- Axis movement device, complete with tubehead - Digital sensor holder - Accessories	55 kg	90 kg
- Column complete with base - Chin-rest arm and keyboard - Various coverings	105 kg	130 kg
- Cephalometric device - Secondary collimator - Coverings - Accessories for Cephalometric device	25 kg	42 kg

WARNING:
Before unpacking the different components of the equipment, read carefully paragraph 6.3 of this manual.
Villa Sistemi Medicali will not bear any responsibility for damages caused to the equipment due to improper unpackaging procedure, and for the relevant costs.

5.3. Space requirements

5.3.1. Version without CEPH

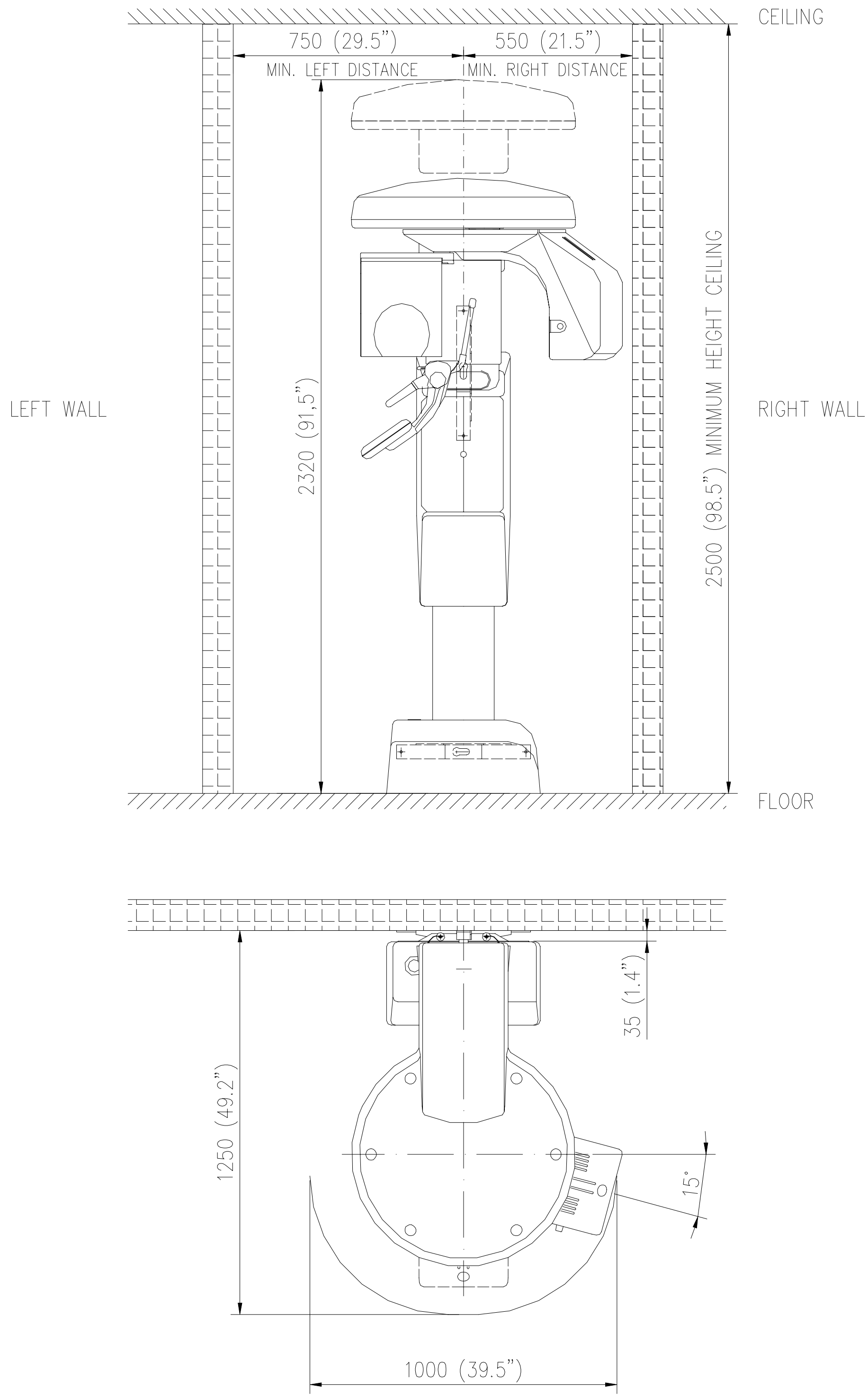
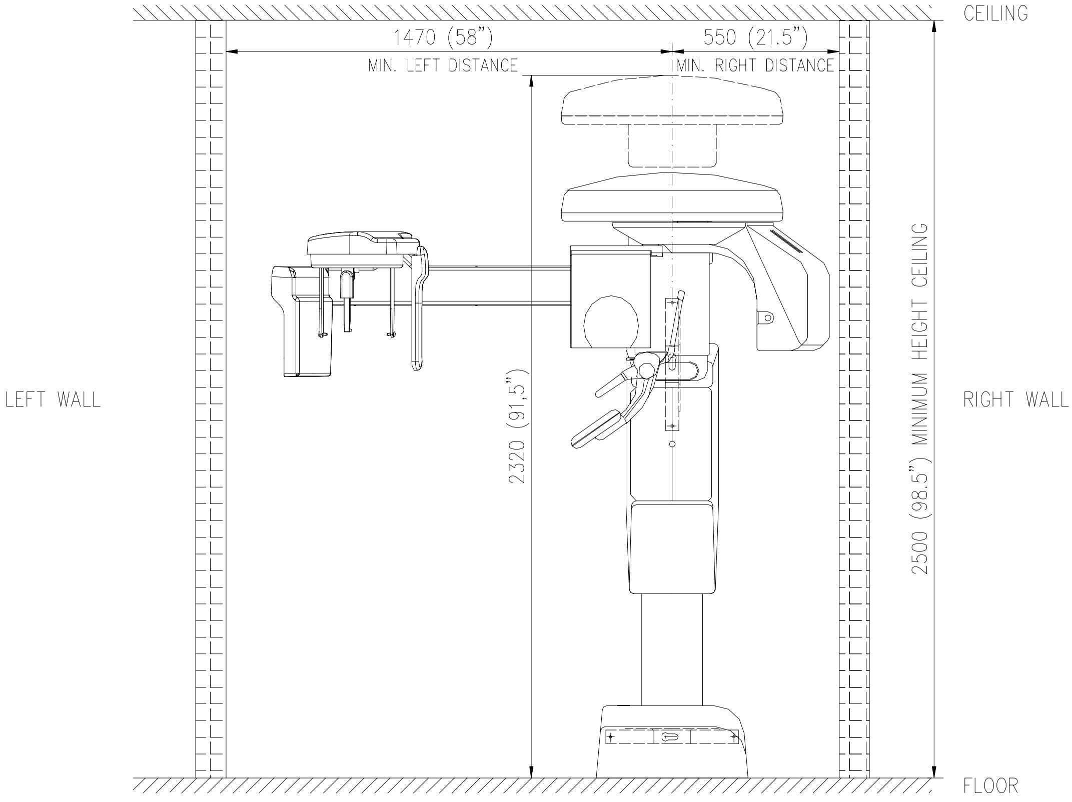


Figure 5-1

5.3.2. Version with CEPH



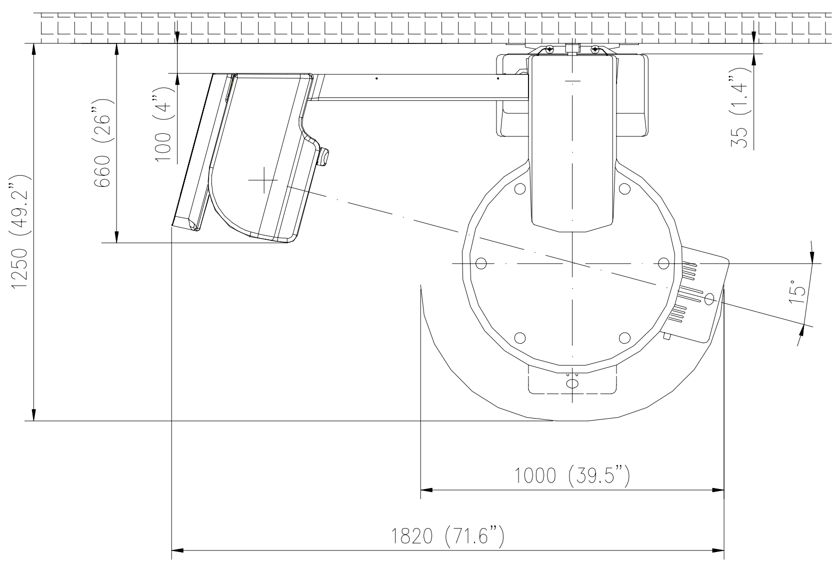


Figure 5-2

6. INSTALLATION

NOTE:
STRATO 2000 Digital is delivered pre-mounted in groups.
The mechanical mounting consists exclusively in assembling the above mentioned groups. Bearings adjustment and the adjustment of possible fixing couplings are therefore carried out in factory; each intervention on these particulars is useless and could damage the device.
Two technicians will be necessary to perform some procedures; the phases requiring the intervention of two men are identified in the related chapters.

6.1. Setting of the wall

NOTE:
STRATO 2000 Digital has been designed for a wall fixing by two brackets, each of which requires to be fixed by two dowels. This initial setting foresees the fixing of the upper bracket; the lower one will be set just after having fitted the column in the upper.

1. Position the paper template "A" enclosed to the manual (Code 39099004) on wall, and mark the position of the holes to drilled. The template must be set on the wall setting the dotted line at 1365 mm from the floor as indicated on the same template.
2. Then mark the wall by a centre punch, at the level of the fixing holes, use drill "B" to hole the wall according to the type of dowels (see chapter 5).
3. Mount wall bracket "C".

NOTE:
The bracket is to be mounted positioning the wider part of the eye upwards, as shown in the picture.

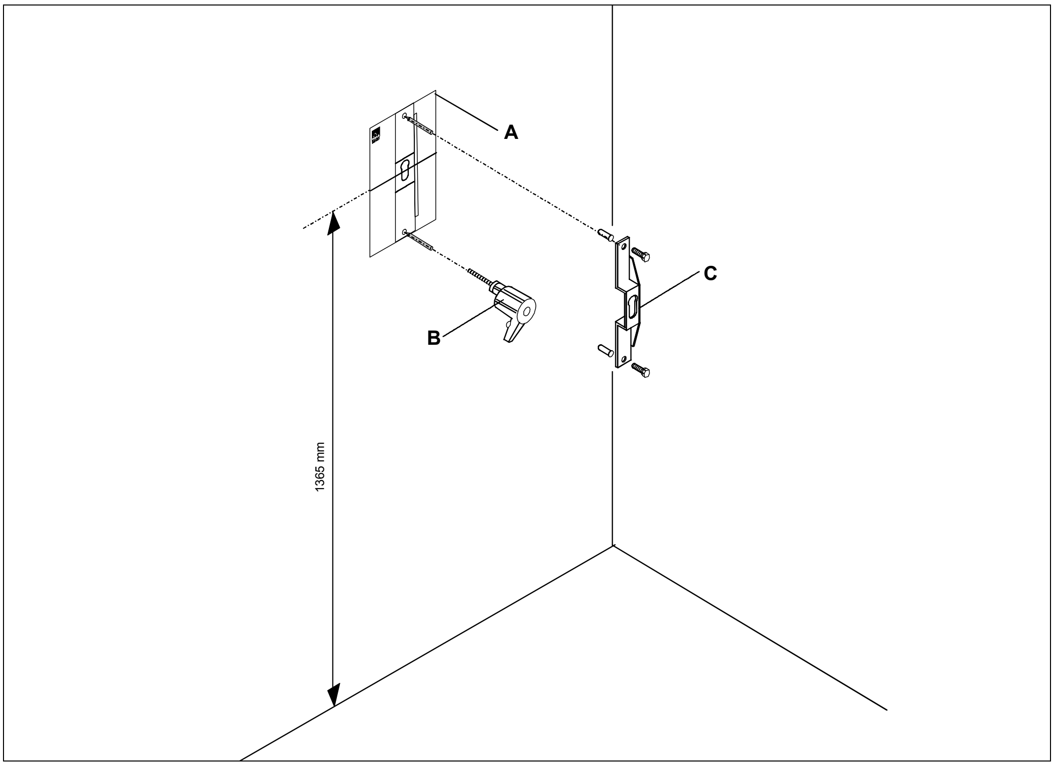


Figure 6-1

6.2. Column mounting

NOTE:
Check that bracket "C" is fixed correctly.

1. Fix on the base of the column the trapezoidal square "D" by the two side screws.
2. Fix the four handles "F" equipped with the unit, on the sides of column "E".
3. Grasp the handles (operation to be done by two persons) and make the rear pin "G" get into the eye on the wall bracket "C".

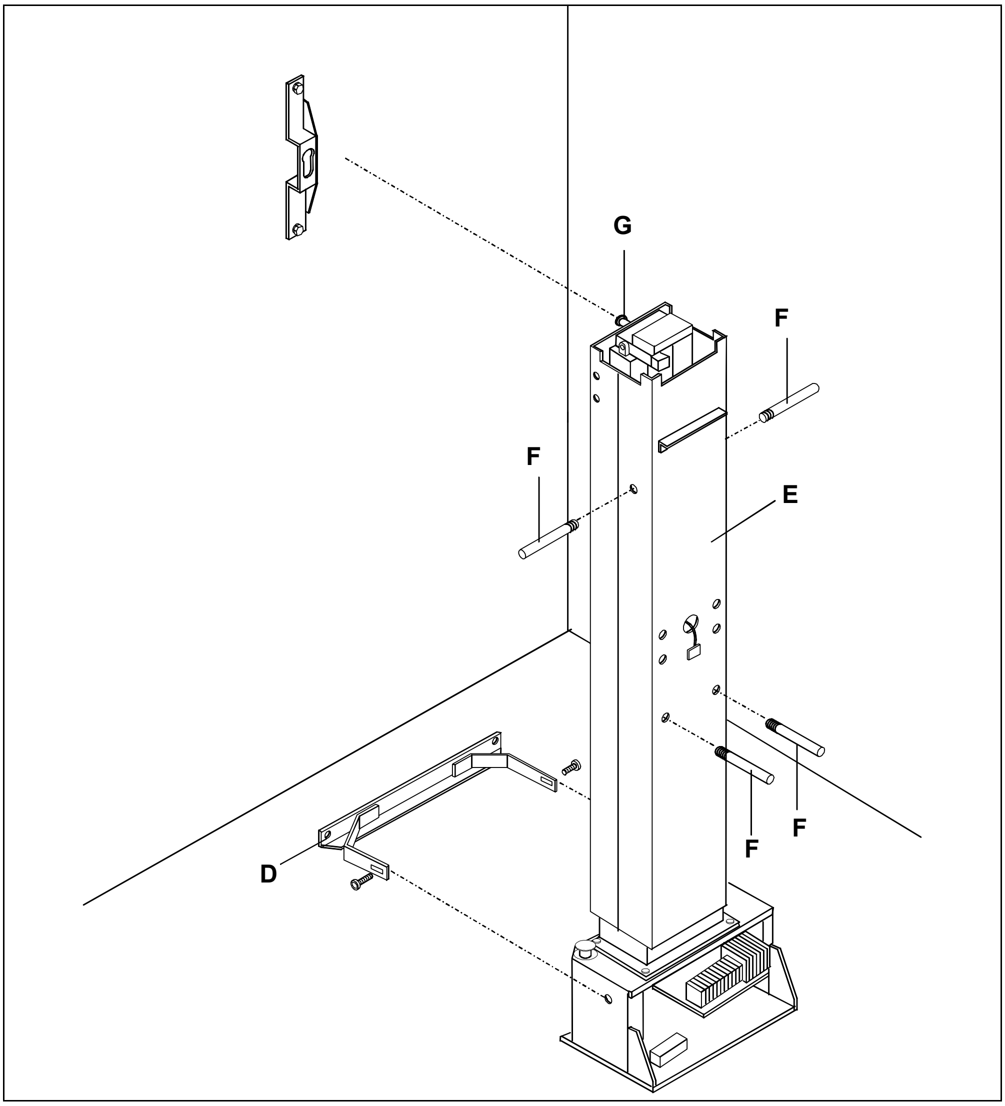


Figure 6-2

4. Remove the four side handles "F" from the column.

5. Use the level "H" to position the column vertical.
6. Mark the lower fixing points on the wall and then drill the wall, with drill "B" according to the kind of dowels to use (see chapter 5).
   To perform the drilling three different methods are available:
   a. Remove the column and drill the wall. At the end of the operation, position the column again.
   b. Move the column rightwards and drill the left hole, then slant it leftwards and drill the right hole.
   c. Keep the column in its position and with a long point drill, drill the wall.
7. <u>Tighten the column to the wall making sure that the level bubble "H" is aligned; sign the checklist in Appendix B.</u>

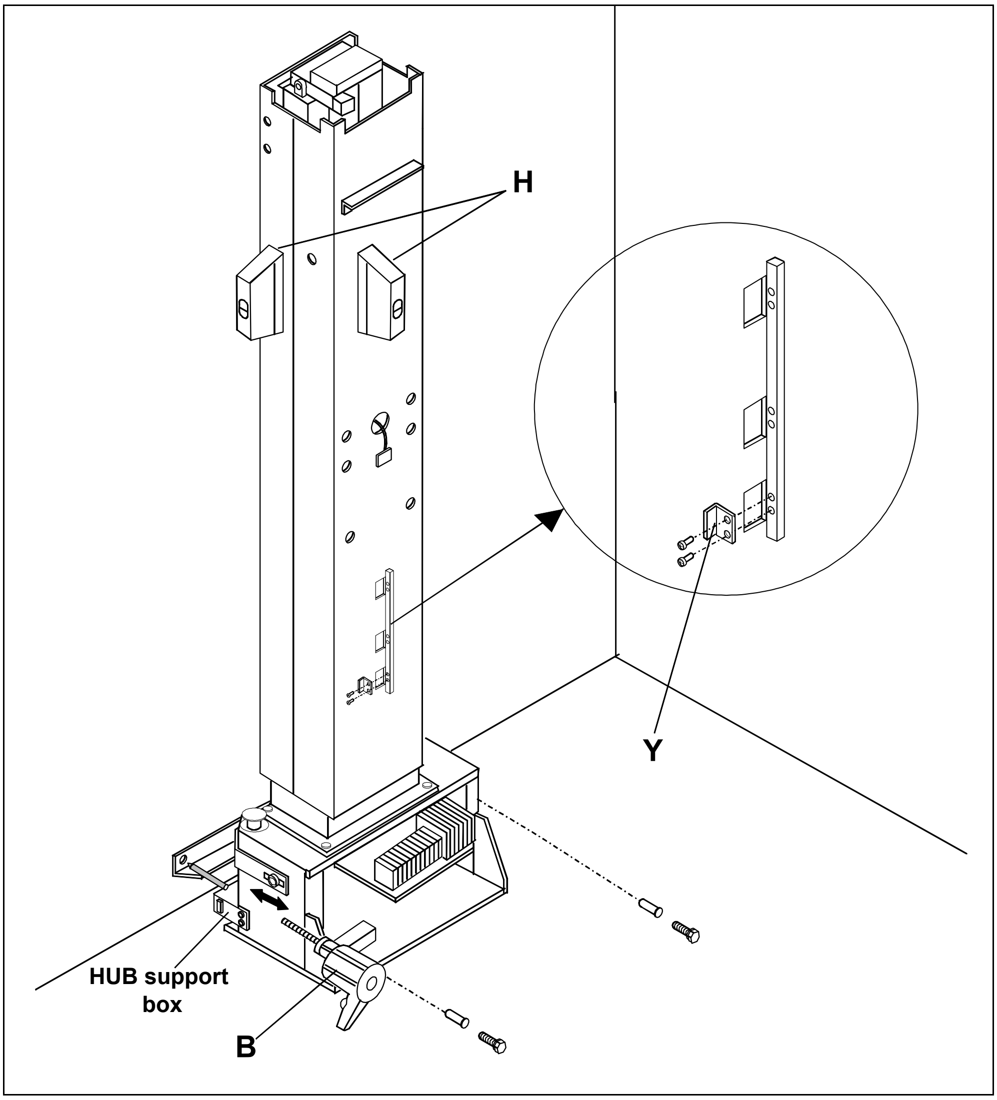


Figure 6-3

8. Install the HUB support box (normally resting on the side of the mains switch during shipment) in its location just under the exit of the mains cable (see previous Figure 6-3) and fix it with the two relevant fixing screws.
9. Power the HUB using the cable coming from the power supply board in the base of the unit.
10. Connect the USB/2 cable coming down along the column and the output USB/2 cable (L=5mt) that will go to the PC (the connection to the PC must be done only when requested by the Digital Panoramic software installation procedure).

NOTE:
Normally, the unit is shipped pre-set for the maximum stroke of 670mm. This stroke will bring the unit to the maximum height of 2320mm from the floor.
Whenever the stroke has to be reduced (e.g. in case of lower ceiling), act on plate "Y" (Figure 6-3), located on the front side of the column.
Normally, plate "Y" is fixed in the lower position (thus activating later the end travel microswitches and allowing the longer stroke). It can be fixed in the intermediate position, thus limiting the stroke of 130mm (maximum height of the unit 2190mm) or in the highest position, thus limiting the stroke of 230mm (maximum height of the unit 2090mm).

6.3. Mounting of the rotating arm assembly

1. Unscrew the 4 fixing screws "Z" of the carton box "K" from the lower pallet. Raise the carton box to gain access to the wooden frame "J" that holds the rotating arm.
2. Remove the fixing device (6 screws and wooden piece) of the wooden frame " J" to the pallet.

WARNING:
Do not remove from the rotating arm assembly "I" the wooden structure "J" since together with the related carton box "K" it will be used to fix the moving unit on the column.
Damages to the unit (e.g. uncentering of some positioning sensors) with possible failures can occur if the rotating arm assembly rests on the floor without the presence of the protective wooden frame. Therefore do not remove the latter from the rotating arm assemly until is clearly requested by the installation procedure.

3. Fix the four handles "F" equipped with the unit and used before to setup the column, on the side of the unit "I".
4. Position the carton box "K" near the column, set the rotating arm "I" complete with the wooden structure "J" over the box, using handles "F" to hold it all (this operation requires the intervention of two persons).
5. Remove the metal plate support located behind the tubehead by loosening the relevant fixing screw.
6. Set the rear part of the movement unit at the level of support "L" set on the column.
7. While a person will keep the unit in position, the other one will fix it to the column by 6 M6 screws.
8. Tighten first screws "M1" and later screws "M2" so that the rotation arm assy is as more horizontal as possible along both direction.
9. Remove handles "F", the wooden structure "J" (first remove the wooden piece "W"), the safety blocking screw "N" and the three safety blocks (against translation) "O".

WARNING:
If safety device "N" and "O" are not properly removed, damages to the unit can occur.

10. Connect the cables from the column to the related connectors set on the movement unit. The signal cables and the supply cable X29 exit the column. X29 has to be connected to the related connector set on the left of the movement unit, after having removed the protection caps.

NOTE:
The STRATO 2000 Digital is equipped with a service microswitch (S2) which allows to move the column vertically even when the signal cables are not connected to the Chin support arm.
To do this, just connect the mains voltage to terminal block X0 and act on the mentioned microswitch, located on the rear right part of the base of the unit.
During the "manual" activation of the column motor, make sure not to exceed the limits given by the limit microswitches, as these are not connected and therefore cannot stop the movement of the column itself.

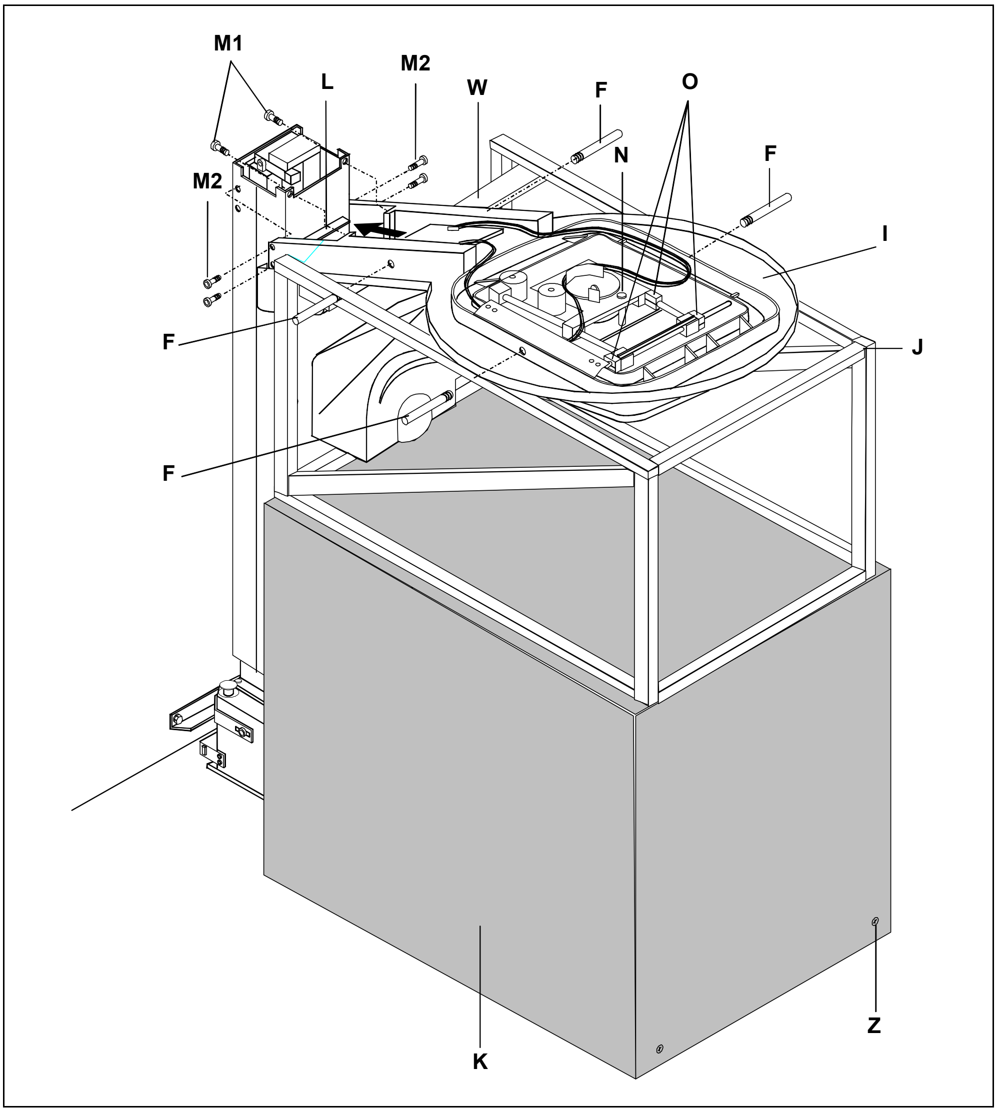


Figure 6-4

6.4. Mounting of the chin-rest arm

1. Remove the four screws "P" set on the front of the column.
2. Position the chin-rest arm "Q" complete with control panel "R" near the column, connect the connector from the column to the one from the arm and then insert the cable into the arm.
3. Fix the chin-rest arm with the four previously removed screws. <u>Check that the chin support is horizontal using a level bubble; sign the checklist in Appendix B.</u>

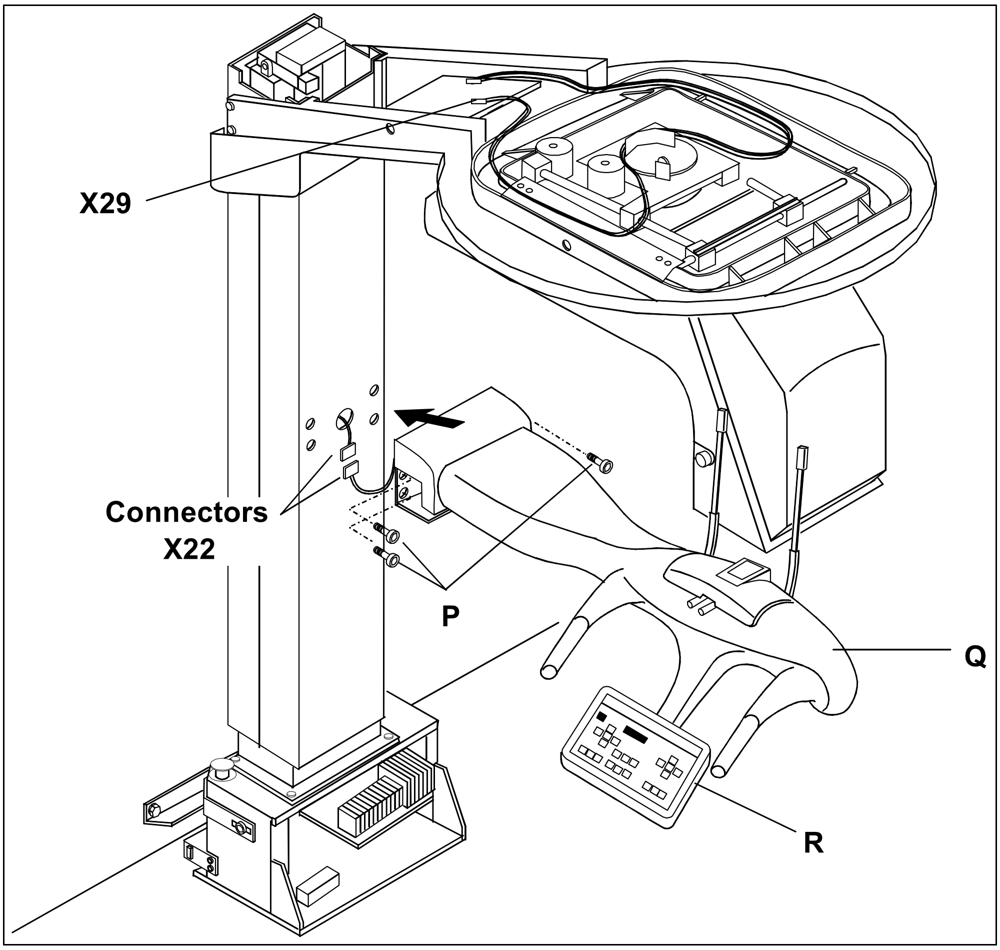


Figure 6-5

6.5. Digital sensor holder mounting

1. Remove the fixing square "T" from the sensor holder.
2. Insert the cables from the rotating unit into the pin of the sensor holder "S".
3. Insert the pin of the sensor holder into the hole of the rotating unit making the tab on the pin match with the groove on the hole.
4. Mount the fixing square "T".
5. Connect the cables X40 and X46 to the related connectors set in the sensor holder A6 board (code 58094162).

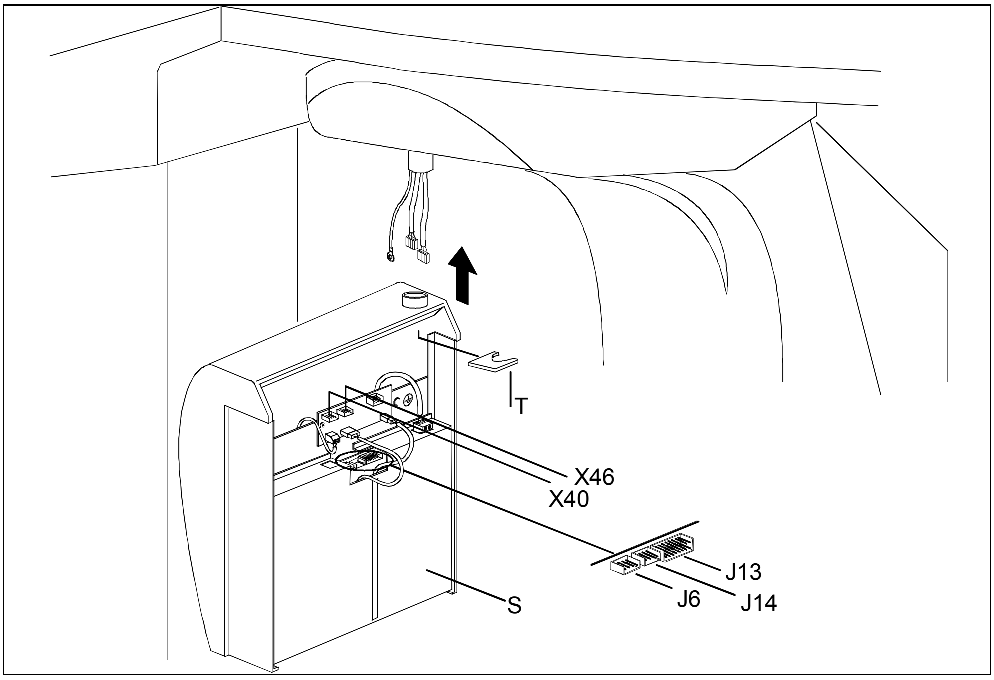


Figure 6-6

6. Connect the cables J6, J13 and J14 to the related connectors on the sensor board.
7. Connect USB/2 cable on the sensor board.
8. Connect the grounding cable to the ground node on the metal support.

6.6. Mounting of ceph-arm (Optional)

The digital CEPH arm can be installed only on an upgradable machine both during the first installation and later as updating of the device.

In case the STRATO 2000 Digital is shipped already with the Ceph arm, it will be necessary only to verify the centering between the X-ray beam, the secondary collimator and the digital sensor because the arm has been already adjusted and pinned on the unit during the final test done in the factory.

In case the arm is provided later (unit upgrade), the unit is already pre-set to accept it, but the centering procedure must be completely performed in the field.

The Ceph device is shipped in a dedicated packaging and is already preassembled in a single piece apart of the secondary collimator.

Before installing the CEPH arm some cables have to be prepared on the machine according to the following instruction:

1. Insert cables X1-X2 and J1-J2 caming from rotating arm assembly in the metal channel guide (Figure 6-8) inside the column from the top side.
2. Bring J1-J2 cable through the column and estract it from the hole in the column; perform the same operation for cable X1-X2.
3. In case of a machine upgrade connect the cable X18, X53, X63 to the relevant connectors on the CPU board and fasten them.

Once the cables are out of the column, the CEPH arm can be installed. The following operations need the presence of two persons.

4. Bring the CEPH arm from the two red handles mounted on the arm and remove it from the package.
5. Position the CEPH arm close to the column; remove the handle "A" (Figure 6-7) and bring the device using the handle "B" and the arm in the handling area. Take the cable J1-J2 and make it pass in the hole of the arm fixing plate and outside the square lateral hole in the arm (Figure 6-8). Reapet the same operation with the X1-X2 cable.

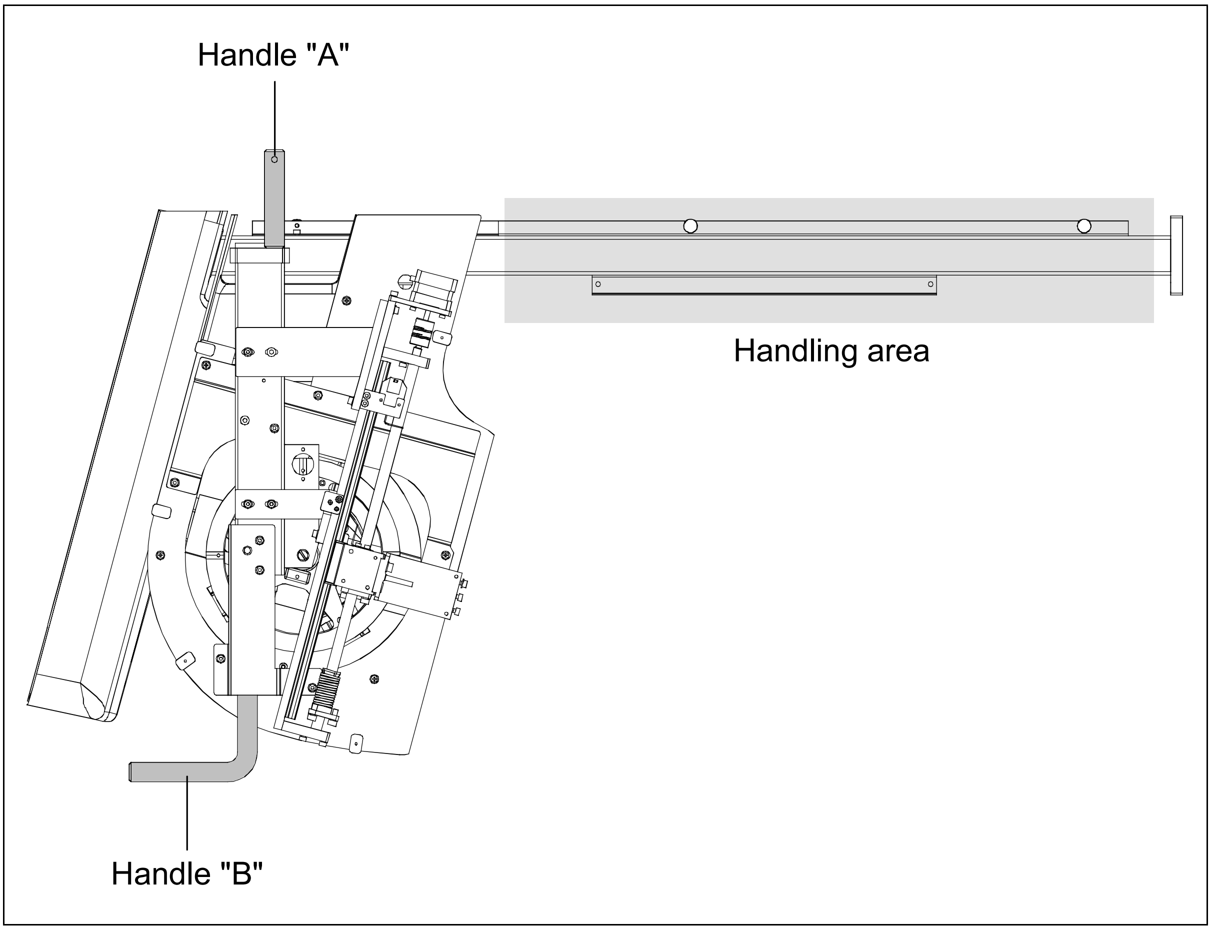


Figure 6-7

6. Place the CEPH arm on the column and fix it with the two screw and with bolts on the two pins. Remove the handle "B".

7. Using a bubble level check that the X axis guide of the rotating arm and the CEPH skull clamp disk have the same inclination as shown in Figure 6-8. If this is not the case act on the fixing screws and bolts of the CEPH arm to the column; when alingment is achived sign the checklist in Appendix B.

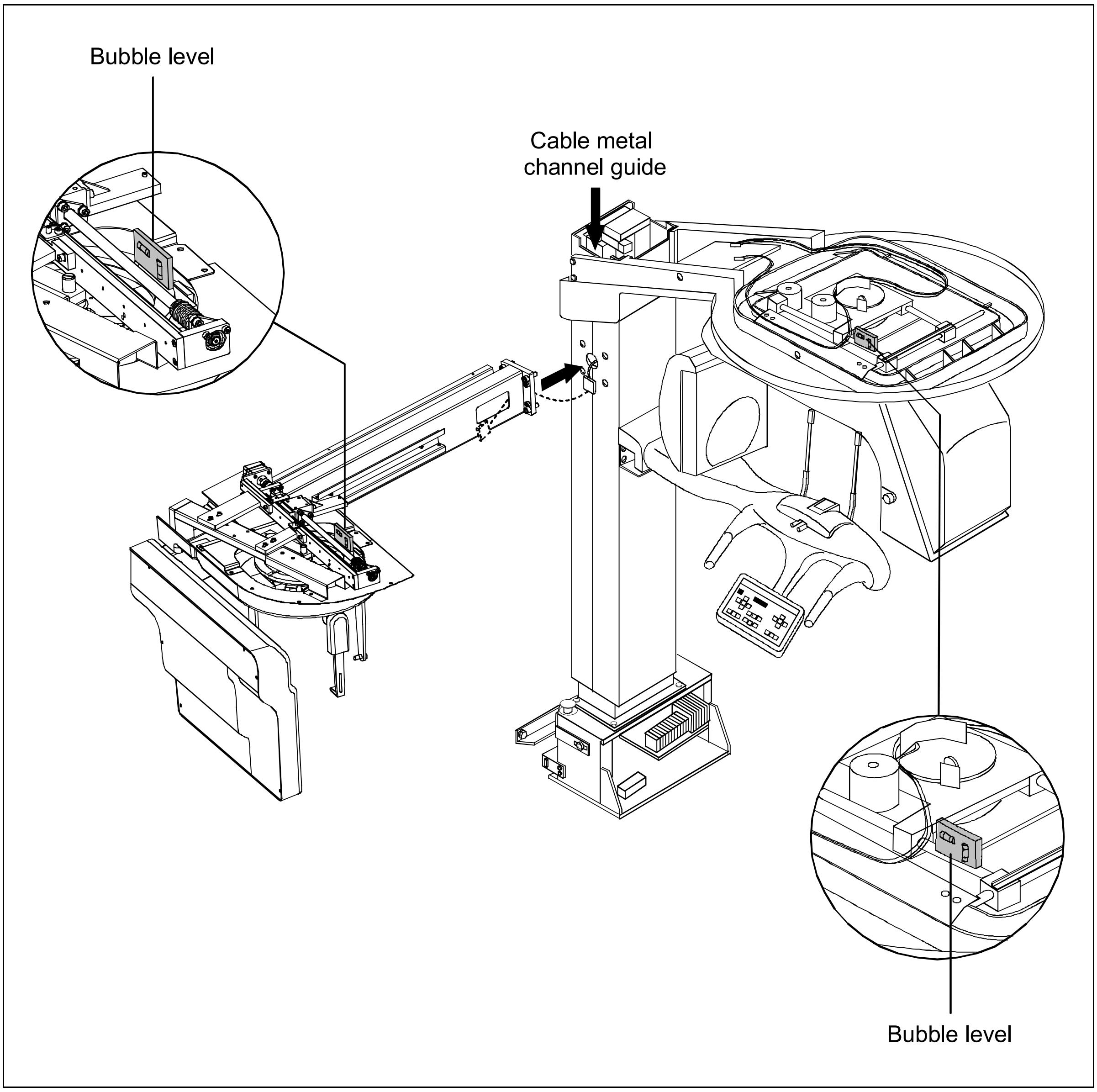


Figure 6-8

8. Fix the secondary collimator on its support taking care that the reference screw on the secondary collimator is positioned against the regulation pin (factory adjusted).

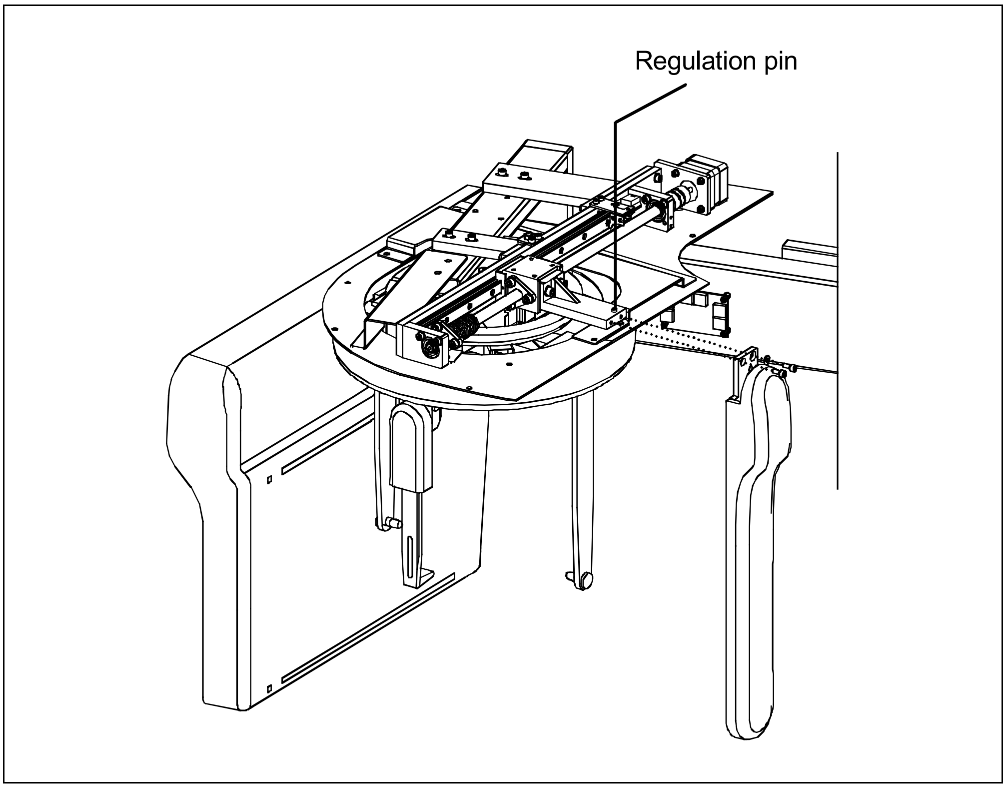


Figure 6-9

In case the STRATO 2000 Digital is sold already equipped with the Digital Ceph arm, follow the instructions of paragraph 6.7.2 to check the digital ceph arm centering.

In case the arm is provided later (unit upgrade), follow the instructions of paragraph 7.1.3 to perform the full centering procedure in the field.

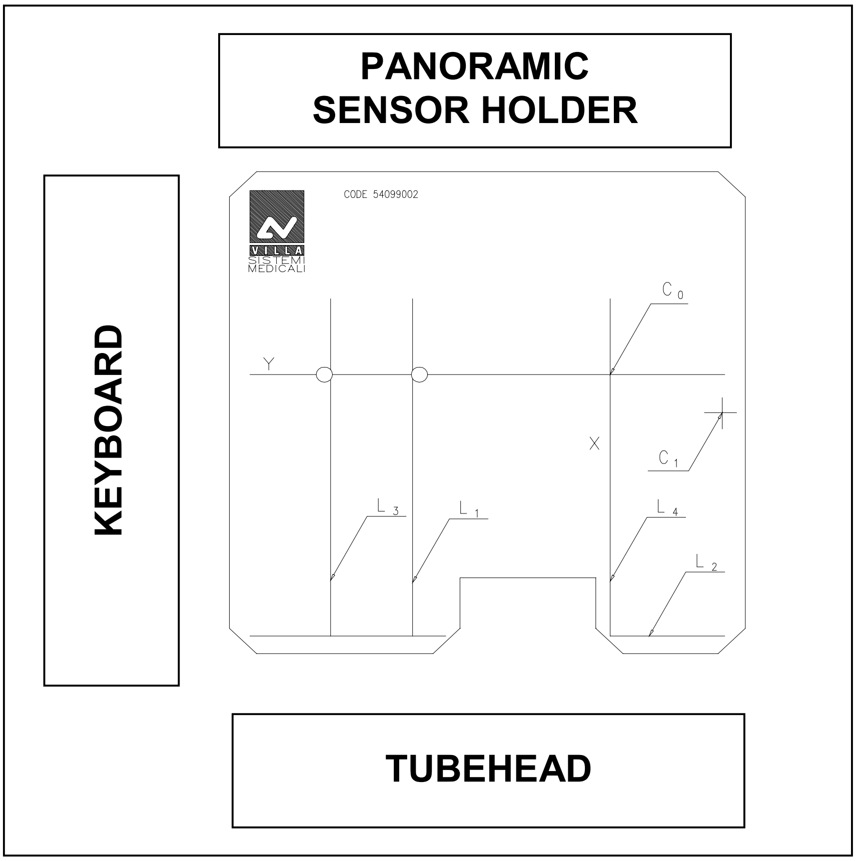
6.7. Mechanical alignment check

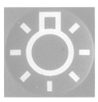
6.7.1. PANORAMIC alignment check

1. Switch ON the machine and go to "Exam Selection".

   Press key "17"  to select the Panoramic function.

2. Open the temple support, position the centering template (code 54099002) with fastening pins on the chin rest arm. If there are no fastening pins, place the centering tool under the chin rest. Close the temple support which will hit against the centering tool.



3. Press key "20"  , the laser centering devices light up.

4. Verify that the sagittal median laser projection corresponds with the Y line (X axis) and the canine laser projection corresponds with the L1 line (Y axis) of the centering device. If even one of these conditions does not correspond, loosing the screws "M1" and "M2" Figure 6-4, adjust the position of the rotating arm so that all the laser beams are as close as possible to the reference lines of the centering tool.

5. In case it will be necessary a fine adjustment of the laser position perform the controls indicated at paragraphs 7.1.1 and 7.1.2.

6. With an level bubble, verify the parallelism between chin rest arm and rotating arm and if they do not match, check again their mechanical mounting on the column.

Once completed sign the checklist in Appendix B.

6.7.2. CEPH alignment check

WARNING:
X-rays will be emitted during the performance of the following operations. Authorised Technicians are therefore recommended to use the greatest caution and to comply with the safety regulations and laws of their country.

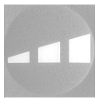
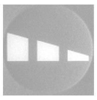
NOTE:
This adjustment needs a personal computer directly connected to STRATO 2000 Digital (refer to "Digital Panoramic" Installation Manual) where the "QuickVision" program is installed and the use of the CD (P/N 58093221) supplied with the centering tools kit.

1. Switch on the unit. The following will be displayed:

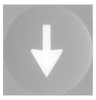
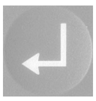
R	E	L	E	A	S	E		*	.	*	*	*			

After 3 seconds the following message will be displayed:

					>	T	E	S	T	<					

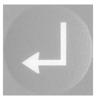
2. When this message appears, press the increase key "3"  and decrease key "6"  simultaneously. After 3 seconds, the following message will be displayed

				S	E	T		U	P						
P	A	S	S	W	O	R	D	?			1	0	0		

3. Using keys "22"  and "25"  select the password number 124 and press key "23"  to confirm this selection.

   The following message appears on the display:

M	A	C	H	I	N	E		S	E	T	T	I	N	G	

Then press key "23"  ; the unit will carry out some movements and the display will show:

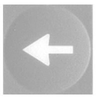
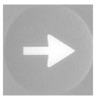
			W	A	I	T		F	O	R					
M	A	C	H	I	N	E		S	E	T	T	I	N	G	

When the unit stop moving the following message will be displayed:

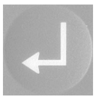
D	I	G	I	T	A	L		C	E	P	H				
E	N	A	B	L	E		S	E	N	S	O	R			

4. Check the alignment of the Ear centering circles as indicated in paragraph 7.1.3.2.
   At the end of this check, the following message will be displayed:

D	I	G	I	T	A	L		C	E	P	H				
L	I	N	I	N	G		U	P		T	E	S	T		

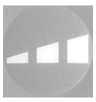
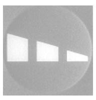
5. Press key "26"  or "24"  until the following is displayed:

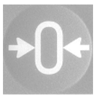
D	I	G	I	T	A	L		C	E	P	H				
C	E	P	H		S	.	C	O	L	.		Z	E	R	O

6. Press key "23  and the following message will be displayed:

S		Z	E	R	O		[	f	f	]		a	b	c	d
Z	E	R	O		O	F	F	S		±	e	e	e	e	e

NOTE:
After entering the "CEPH S.COL. ZERO" function, the keyboard is inactive for some seconds. Wait a few time and repeat the action.

7. Open the Panoramic sensor holder and moves the skull clamp in the A/P position.
8. Select with key "7"  and key "5"  respectively kV and mA and use key "3"  and key "6"  to set values for the exposure (suggested values: 50kV and 4mA).
9. Open QuickVision and activate the Virtual Keyboard.

10. Press key "10"  on the machine keyboard. The primary collimator and the CEPH sensor will be automatically placed in the CEPH central position and the system get ready to take the secondary collimator test.

11. Press the X-ray button and keep it depressed until the end of the exposure.

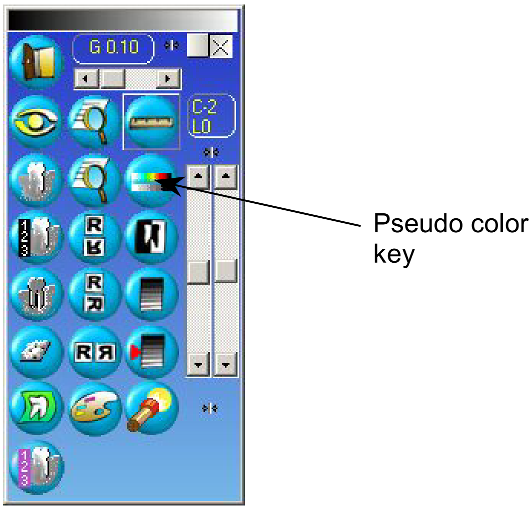
NOTE:
If the following message will be displayed:

	D	I	G	I	T	A	L		B	O	A	R	D		
			I	S		N	O	T		R	E	A	D	Y	

check the connection with the PC.

Press key "9"  to reset the message.

12. On the image taken with QuickVision, using the instruction in paragraph 7.1.2, measure the distances between the borders of the image and the borders of the central vertical stripe (Figure 6-10); to take the measure easely, you can use the QuickVision pseudo color function.



13. The right and left distances must not differ more than ±3mm. If it is not the case, refer to paragraph 7.1.3.3 to correct the CEPH secondary collimator setting.

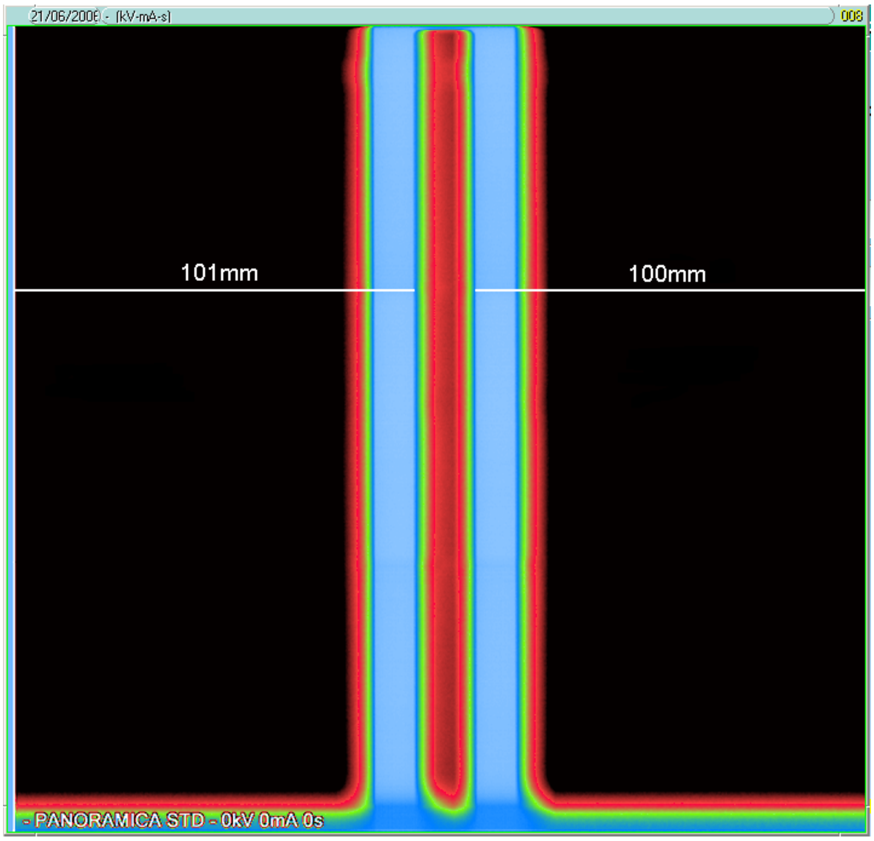


Figure 6-10

14. When the right setting is reached press key "9" to exit the menu item and if modifications have been performed the following message will be displayed:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

15. Press key "23" to store the changes. While key "9" to cancel them.

16. The following message is now displayed:

D	I	G	I	T	A	L		C	E	P	H				
C	E	P	H		S	.	C	O	L	.		Z	E	R	O

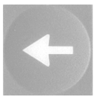
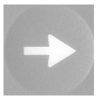
17. Press key "9" to exit password 124, the following message will be displayed

C	O	N	F	I	R	M		E	X	I	T	?			
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

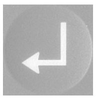
press key "23" to exit the program and store the changes.

18. Switch OFF the unit.

19. Switch ON the unit and perform the steps 2 and 3.

20. Press key "26"  or "24"  until the following is displayed:

D	I	G	I	T	A	L		C	E	P	H				
C	E	P	H		S	E	N	S	O	R		Z	E	R	O

21. Press key "23  and the following message will be displayed:

S		Z	E	R	O		[	f	f	]		a	b	c	d
Z	E	R	O		O	F	F	S		±	e	e	e	e	e

22. Press key "8"  .The primary and secondary collimators and the ceph sensor go to the ceph central position. Place the centering tool code 52099009 on the secondary collimator.

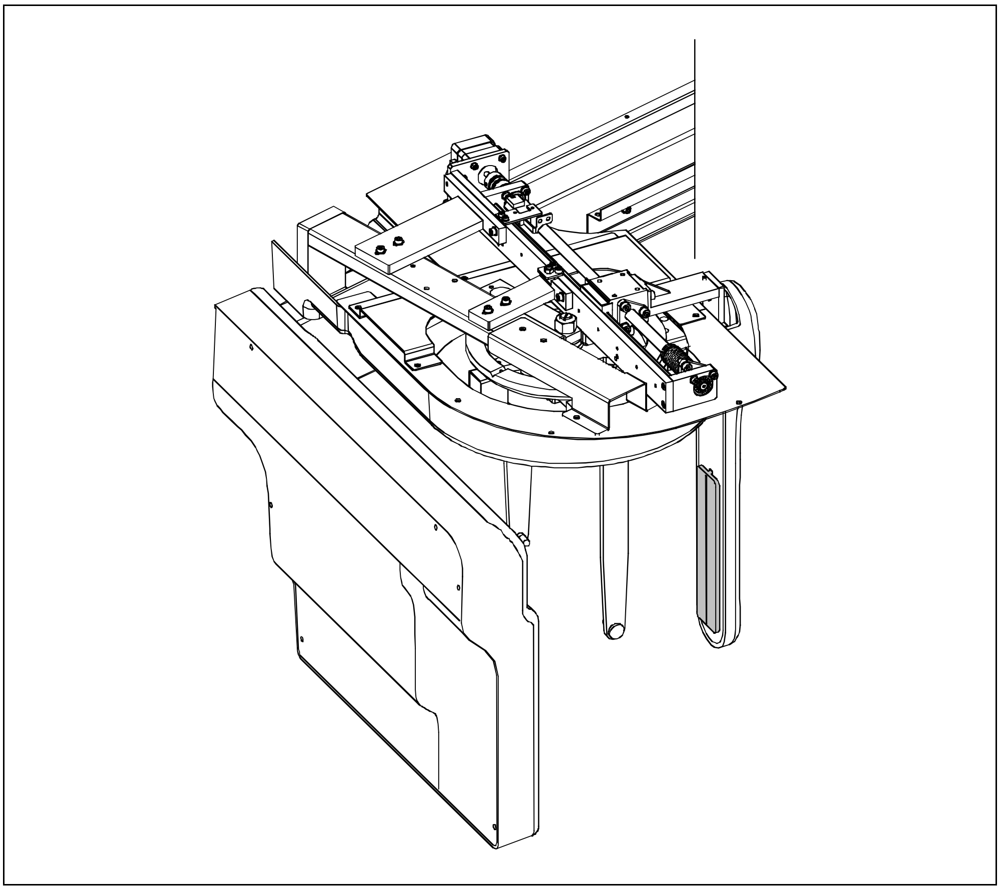
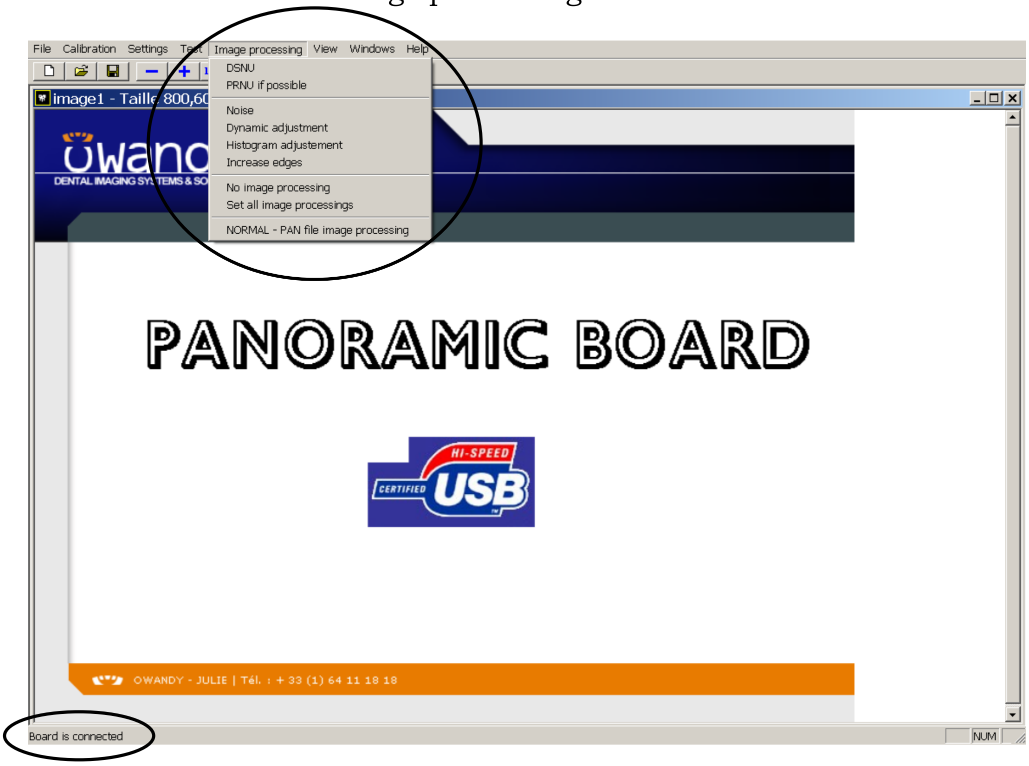


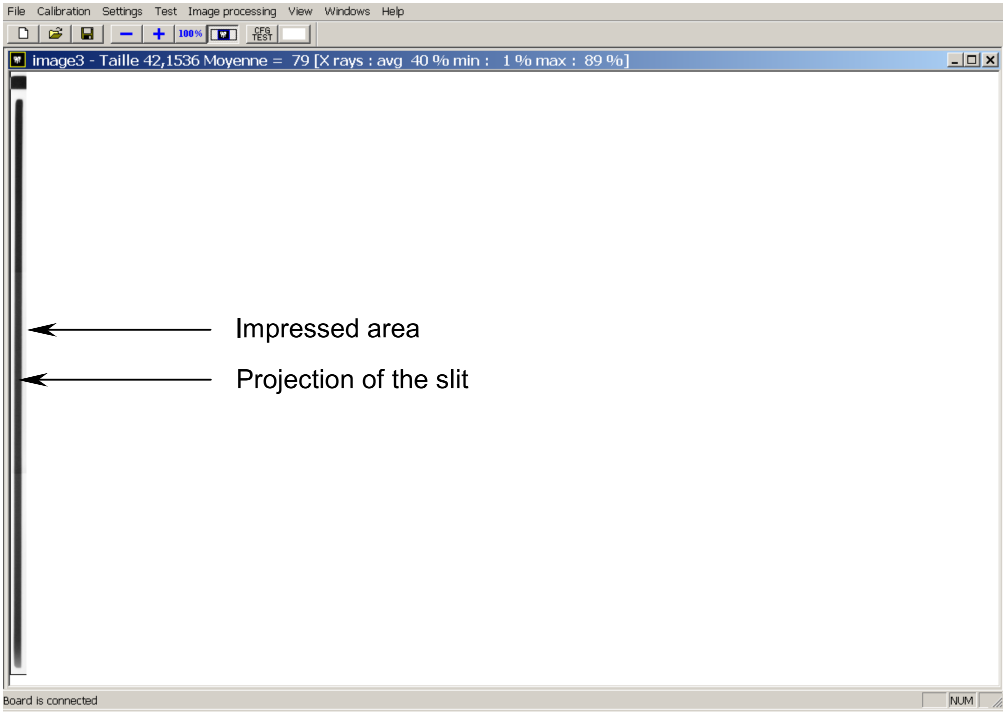
Figure 6-11

23. Select with key "7" kV, key "5" mA and key "4" s respectively kV, mA and exposure time and use key "3" and key "6" to set values for the exposure (suggested values: 50kV, 4mA and 0.2s).

24. Open the "Sensor Centering" program from the CD (P/N 58093221) supplied with the centering tools kit and wait that the message "Board is connected" is diplayed on the bottom bar of the program. Ckech that in menu "Image processing" all the items are not selected.



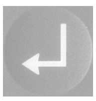
25. Press the X-ray button and check if in the obtained narrow image the projection of the slit of the centering template is vertical and in the middle of the impressed area.



26. In case the alignment is not right refer to paragraph 7.1.3.4 to correct the CEPH sensor setting.

27. When the right setting is reached press key "9"  to exit the menu item and if modifications have been performed the following message will be displayed:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

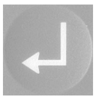
28. Press key "23"  to store the changes. While key "9"  to cancel them. The following message will be displayed:

D	I	G	I	T	A	L		C	E	P	H				
C	E	P	H		S	E	N	S	O	R		Z	E	R	O

29. Ceck the Soft Tissue Filter setting as explained in paragraph 7.1.3.5.

30. Press key "9"  to exit password 124, the following message will be displayed

C	O	N	F	I	R	M		E	X	I	T	?			
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

press key "23"  to exit or key "9"  to stay in the password 124 menu.

<u>Once completed sign the checklist in Appendix B.</u>

6.8. How to mount the coverings

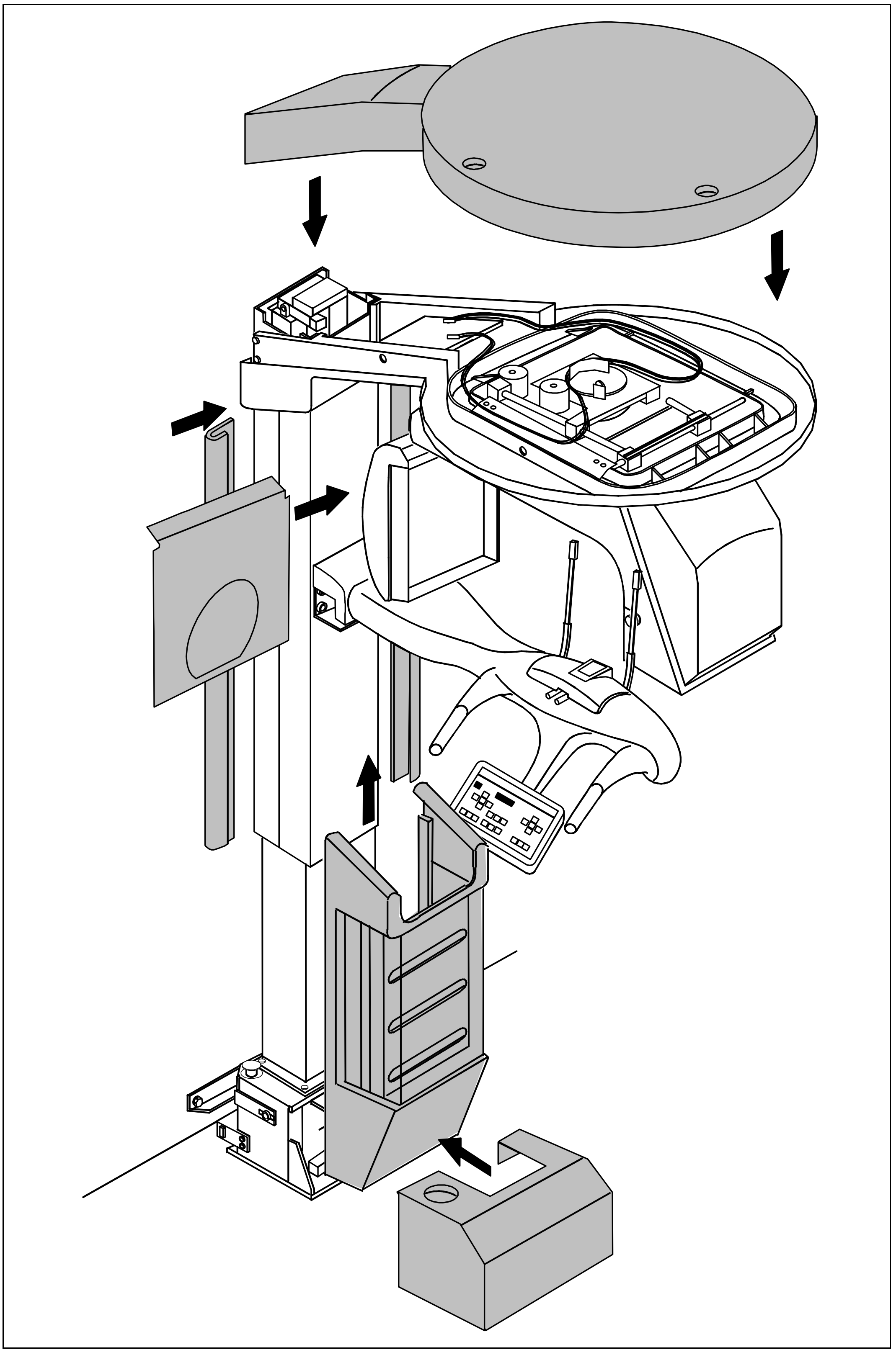


Figure 6-12

6.9. Covering mounting for the Ceph arm

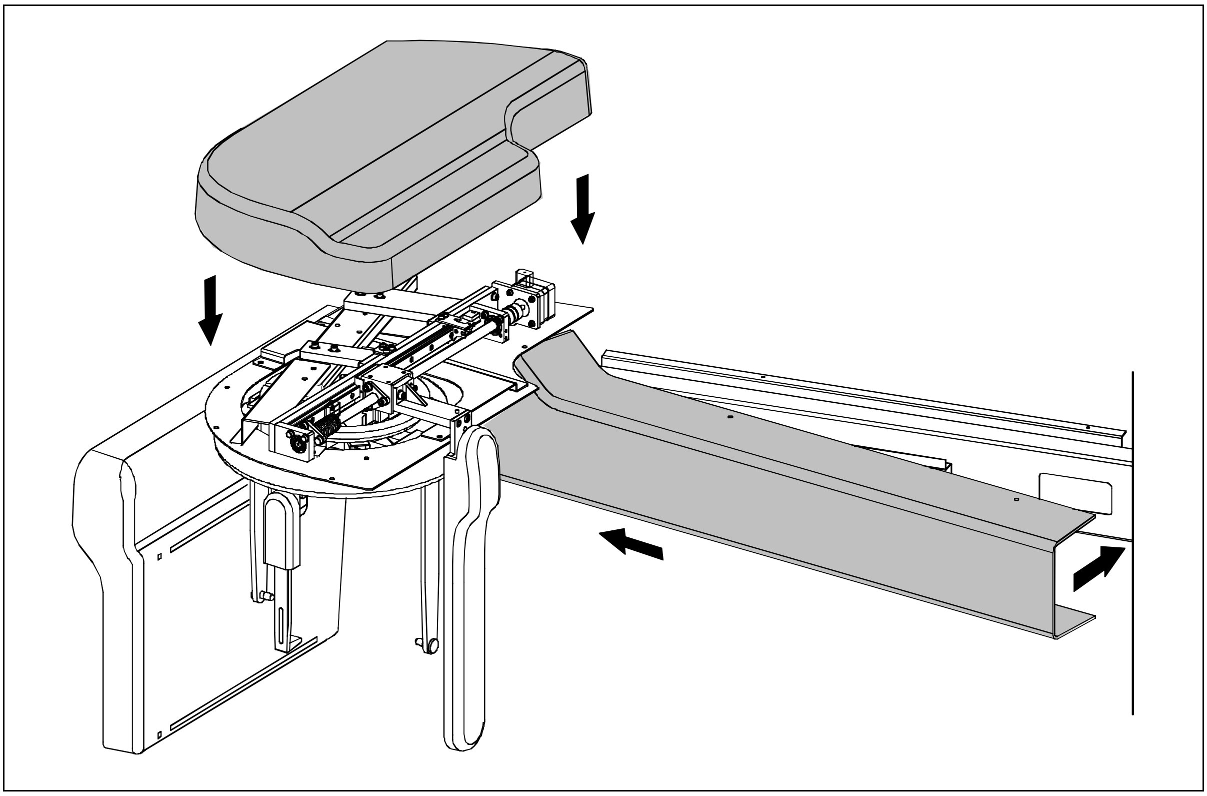


Figure 6-13

If it is necessary to remove the Ceph sensor covers, in order to do it easely, rotate the skull clamp as indicated in figure (Ceph centering device rod perpendicular to the arm) and remove the arm cover.
To mount the front cover, position it from the lower side perpendicular to the arm and rotate until it reach the correct position.

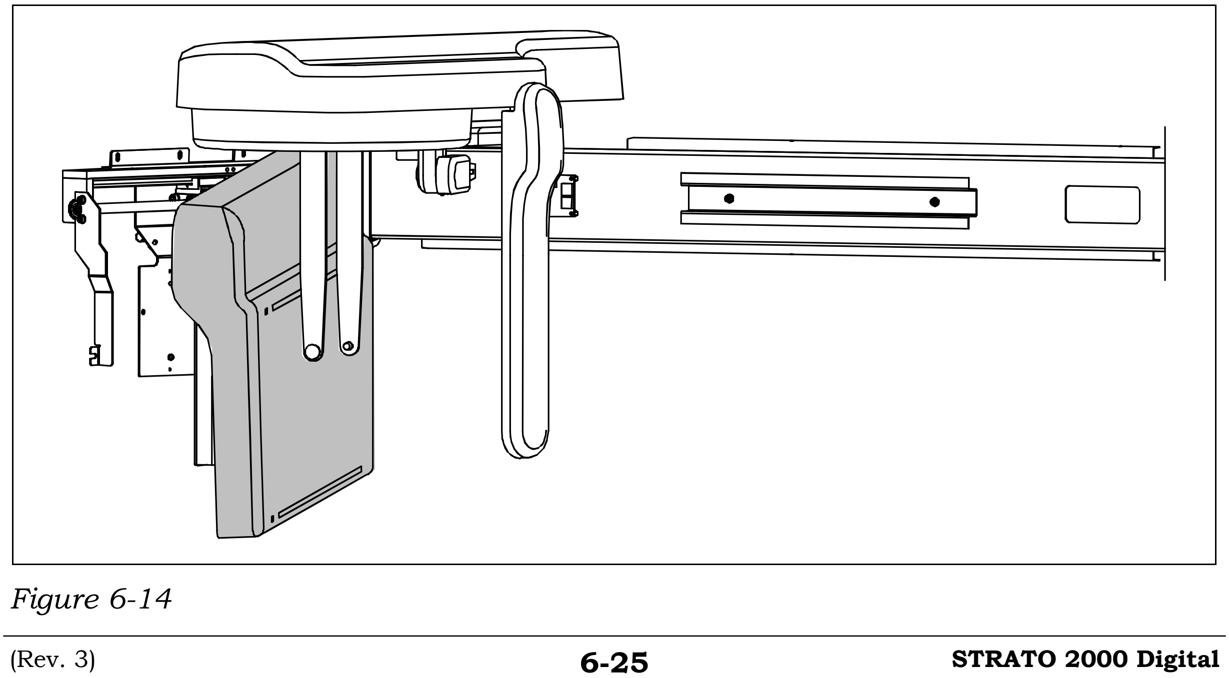


Figure 6-14

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7. MAINTENANCE AND SERVICING

As with all electrical appliances, this unit must be used correctly and maintenance and inspections must be effected at regular intervals. Such precautions shall guarantee the safe and efficient function of the appliance.

Periodic maintenance consists in inspections made directly by the operator and/or Technical Service Department.

The inspections made directly by the operator are the following:

- ensure that the rating labels are intact and correctly fastened
- check whether there are any traces of oil on the tubehead
- check to ensure that the X-rays push-button switch cable is not split or damaged
- check to ensure that there is no external damage to the appliance which could jeopardise protection from radiation.
- check if the Ceph secondary collimator is not evidently displaced.

WARNING:
The operator is recommended to perform these inspections before each session of operations.
If the operator detects irregularities or damage, he should immediately inform the Technical Service Department.

The appliance's performance is checked and, where necessary corrected, during the maintenance activities performed by the Technical Service Department, in accordance with the indications provided in the following chapters. Such interventions are recorded in the "Maintenance Logbook" in the User's Manual.

The periodic maintenance performed by the Technical Service Department comprises the performance of the following additional inspection activities to made yearly:

- general visual inspection
- grounding of all the accessible conductive parts
- condition of the internal and external cables: wear and tear and fastenings
- the tightening of the primary bolts and screws such as the wall fastening systems, the moving mechanisms and the chin rest arm
- the status of cleanness of the console
- the correct functioning of the luminous indicators of the console
- verification of the exposure parameters: kV, mA, time
- verification of the correct function and status of cleanness of the laser centering devices
- verification of the correct centering of the secondary collimator and of the Ceph sensor.

WARNING:
Components may only be replaced by original spare parts.

NOTE:
The Service Engineer has to take special care for all what concerns electrical safety of the device and must make sure of restoring all provisions for electrical safety which may be affected during a service intervention and to solicit the customer to have the electrical safety tests repeated every time the intervention has caused the replacement of important parts or the intervention has significantly affected safety provisions of the device.

7.1. Verification and centering adjustment

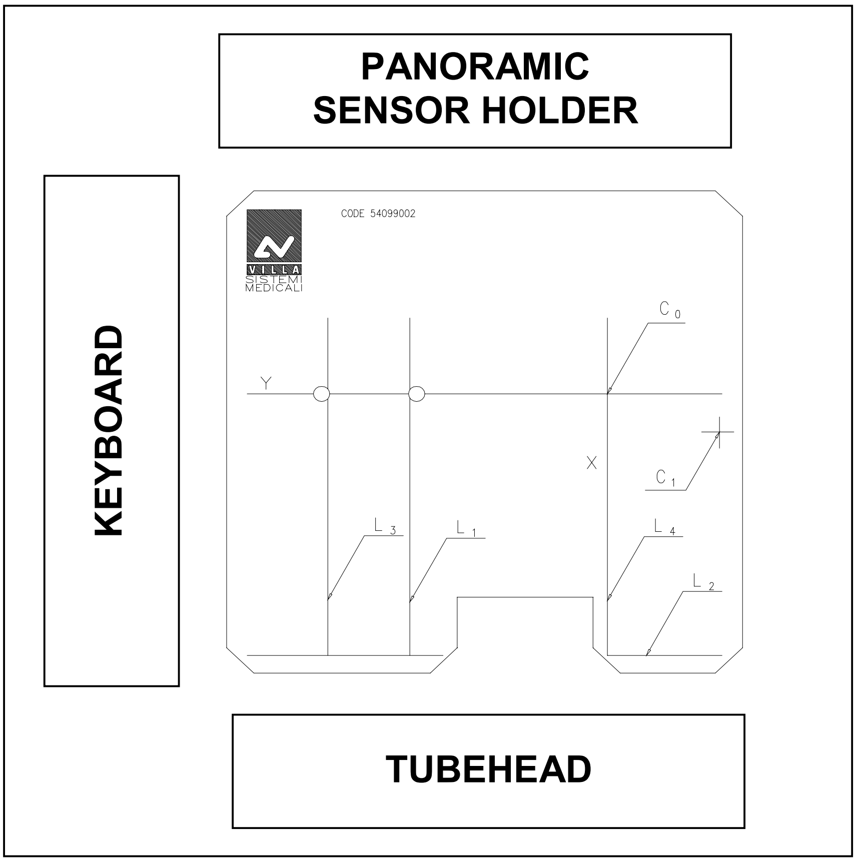
The STRATO 2000 Digital does not require any adjustment to be made to the laser beam but, should any problem of centering be encountered, the verifications described in the following paragraphs may be made.

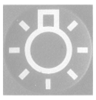
7.1.1. Axes alignment for the PANORAMIC function

To verify the panoramic function centering proceed as follows:

1. Switch on the machine and go to "Exam Selection". Press key "17" to select the Panoramic function.

2. Open the temple support, position the centering template (code 54099002) with fastening pins on the chin rest arm. If there are no fastening pins, place the centering tool under the chin rest. Close the temple support which will hit against the centering tool.



3. Press key "20"  , the laser centering devices light up.
4. <u>Verify that the sagittal median laser projection corresponds with the Y line (X axis) and the canine laser projection corresponds with the L1 line (Y axis) of the centering device; sign the checklist in Appendix B.</u> If even one of these conditions does not correspond, switch off the unit and follow the procedures described in the following chapters.

The following chapters require access to the service password programs of the STRATO 2000 Digital system. Following is described the sequence of operations for accessing these programs.

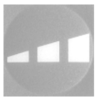
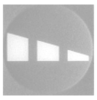
The following procedure must be followed to access the service program:

1. Switch on the unit. The following message will be displayed:

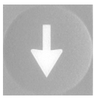
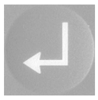
R	E	L	E	A	S	E			*	.	*	*	*		

After 3 seconds, the following message will be displayed:

					>	T	E	S	T	<					

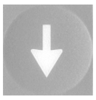
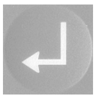
2. When this message appears, press the increase key "3"  and decrease key "6"  simultaneously. After 3 seconds, the following message will be displayed

				S	E	T		U	P						
P	A	S	S	W	O	R	D	?			1	0	0		

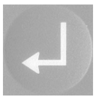
3. Using keys "22"  and "25"  select the password number for the desired Service Program and press key "23"  to confirm this selection.

7.1.1.1. Centering the RO(tation), AX (X-axis) and AY (Y-axis) axes via the laser

NOTE:
All changes made and stored result in the loss of the original calibration data. The user is therefore recommended to make and store only those changes that are deemed necessary.
If changes are made and stored but the user quits password 118 by switching the system off and not going through the normal quitting procedure, the stored data will be lost and the system will be reset to the previous data.

1. Access the Service Program as described in the previous page. With keys "22"  and "25"  go to password 118 an confirm the selection by pressing key "23"  . The following message appears on the display:

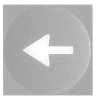
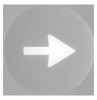
M	A	C	H	I	N	E		S	E	T	T	I	N	G	

Then press key "23"  ; the unit will carry out some movements and the display will show:

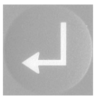
			W	A	I	T		F	O	R					
M	A	C	H	I	N	E		S	E	T	T	I	N	G	

When the unit stop moving the following message will be displayed:

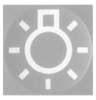
S	E	R	V	I	C	E		M	E	N	U				
X		Z	E	R	O										

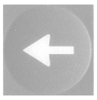
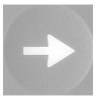
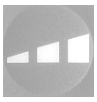
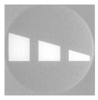
2. Press keys "26"  or "24"  until the following message is displayed:

S	E	R	V	I	C	E		M	E	N	U				
R	O	T	A	T	I	O	N		Z	E	R	O			

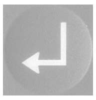
3. Press key "23"  and the following message will be displayed:

T		Z	E	R	O		[	f	f	]		a	b	c	d
Z	E	R	O		O	F	F	S			±	e	e	e	e

4. Press key "20"  . The laser centering device will be activated and will project two laser beams at right angles to each other onto the centering tool.

5. Using key "26"  or "24"  position the laser beam parallel or superimpose to the L2 line. When keys "26" and "24" are pressed the arm will rotate. Press increase key "3"  or decrease key "6"  to change the rotation speed. The speed variation is represented on the display in the [ff] position.
This figure can vary between 0 (single-step, slow speed - best for micro-adjustments) and 16 (high speed - ideal for large adjustments/movements). When the laser beam is parallel to the L2 line press key "9"  to store the position . The following message will be displayed:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

Press key "23"  to store the changes or press key "9"  if these changes are not to be stored. The rotation group will return to its previous position and the following message will be displayed:

S	E	R	V	I	C	E		M	E	N	U				
R	O	T	A	T	I	O	N		Z	E	R	O			

<u>Sign the chekclist in Appendix B; remind to write down the new value in the relavant box in Appendix A.</u>

6. Once the ROtation axis has been adjusted, press key "26" or "24" until the following is displayed:

S	E	R	V	I	C	E		M	E	N	U				
X		Z	E	R	O										

7. With the Panoramic sensor holder open and the laser centering device on, press key "23" : the following will be displayed

X		Z	E	R	O		[	f	f	]		a	b	c	d
Z	E	R	O		O	F	F	S			±	e	e	e	e

8. Press key "26" or "24" to superimpose the laser beam on line L2. When keys "26" and "24" are pressed, the arm will translate. Change the translation speed using the increase key "3" or decrease key "6" . The speed variation is represented on the display in the [ff] position.
This figure can vary between 0 (single-step, slow speed - best for micro-adjustments) and 16 (high speed - ideal for large adjustments/movements). When the laser beam is parallel to the L2 line press key "9" to store the position. The following message will be displayed:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

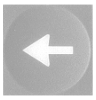
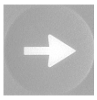
Press key "23" to store the changes or key "9" if these changes are not to be stored. The rotation group will return to its previous position and the following messages will be displayed:

R	E	S	T	O	R	I	N	G							
A	X	I	S		P	O	S	I	T	I	O	N	.	.	.

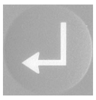
and

S	E	R	V	I	C	E		M	E	N	U				
X		Z	E	R	O										

<u>Sign the chekclist in Appendix B; remind to write down the new value in the relavant box in Appendix A.</u>

9. Once the X-axis had been regulated, close sensor holder too panoramic and press key "26"  or "24"  until the following message is displayed:

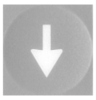
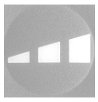
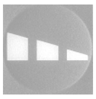
S	E	R	V	I	C	E		M	E	N	U				
Y		Z	E	R	O										

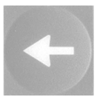
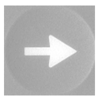
10. Press key "23" . The machine will rotate once and the following message will be displayed:

S	E	R	V	I	C	E		M	E	N	U				
P	L	E	A	S	E		W	A	I	T	.	.	.	.	.

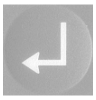
11. When the unit stops rotating the following message will be displayed:

Y		Z	E	R	O		[	f	f	]		a	b	c	d
Z	E	R	O		O	F	F	S			±	e	e	e	e

12. Press key "25"  or "22"  to superimpose the laser beam on line L3. Using keys "25" and "22" the arm will translate. Change the translation speed using the increase key "3"  or decrease key "6" . The speed variation is represented on the display in the [ff] position.
This figure can vary between 0 (single-step, slow speed - best for micro-adjustments) and 16 (high speed - ideal for large adjustments/movements).

13. Before going on to store the Y position, it is necessary to ensure that the sagittal Median laser beam is superimposed on the Y line (X-axis) of the centering tool. If the laser beam is not superimposed on the Y line, adjust it with key "26"  or "24" . When the beam is superimposed press key "9"  and the following message will be displayed:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

Press key "23"  to store the changes or key "9"  if these changes are not to be stored. The rotation group will return to its previous position and the following messages will be displayed:

R	E	S	T	O	R	I	N	G							
A	X	I	S		P	O	S	I	T	I	O	N	.	.	.

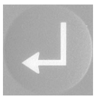
and

S	E	R	V	I	C	E		M	E	N	U				
Y		Z	E	R	O										

<u>Sign the chekclist in Appendix B; remind to write down the new value in the relavant box in Appendix A.</u>

14. Press key "9"  to quit Password. The following message will be displayed:

C	O	N	F	I	R	M		E	X	I	T	?			
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

Press key "23"  to quit Password and access the program's Start-Up function or press key "9"  to remain in password 118 mode.

NOTE:
All changes made and stored result in the loss of the original calibration data. The user is therefore recommended to make and store only those changes that are deemed necessary.
If changes are made and stored but the user quits password 118 by switching the system off and not going through the normal quitting procedure, the stored data will be lost and the system will be reset to the previous data.

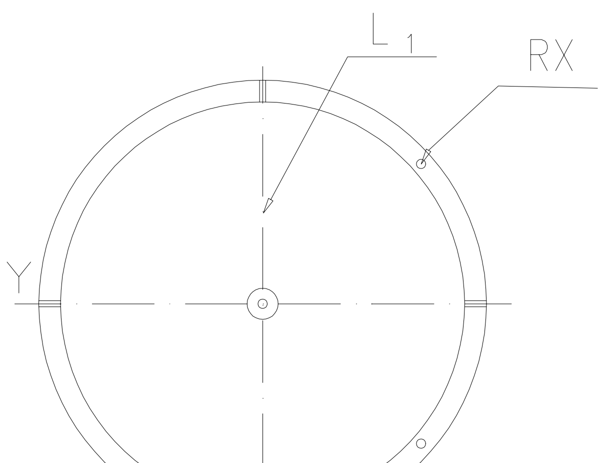
NOTE:
If the system has been correctly aligned, the rotation center will be at point C_0.

7.1.2. Centering the X-ray beam for the PANORAMIC function

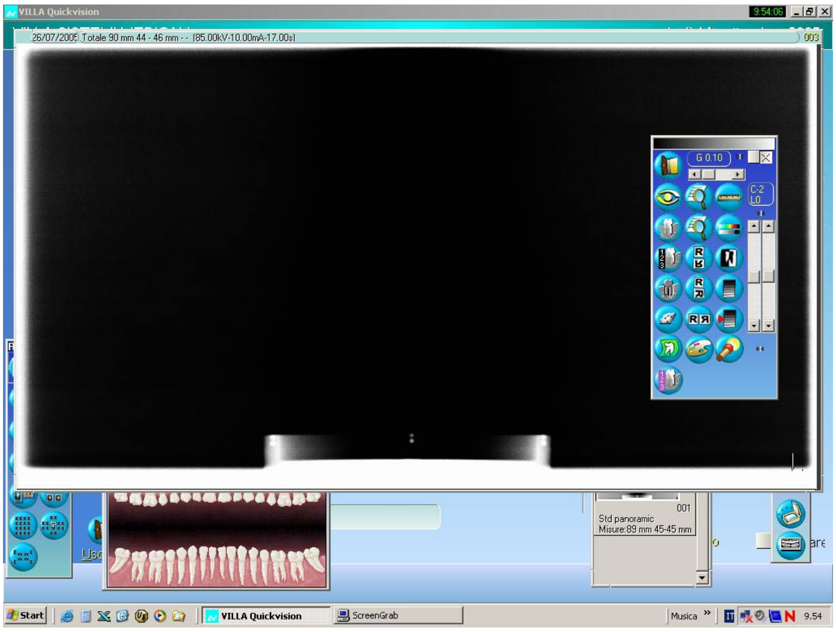
WARNING:
X-rays will be emitted during the performance of the following operations. Authorised Technicians are therefore recommended to use the greatest caution and to comply with the safety regulations and laws of their country.

Upon completion of the laser beam centering for the Panoramic function, the X-ray beam must also be centered as follows:

1. Switch on the machine and go to Exam Selection.
2. Press key "17"  to select the Panoramic function.
3. Place the centering tool (P/N 54089021) on the chin rest and the sensor calibration tool (P/N 51099008) on the window in front of the sensor.

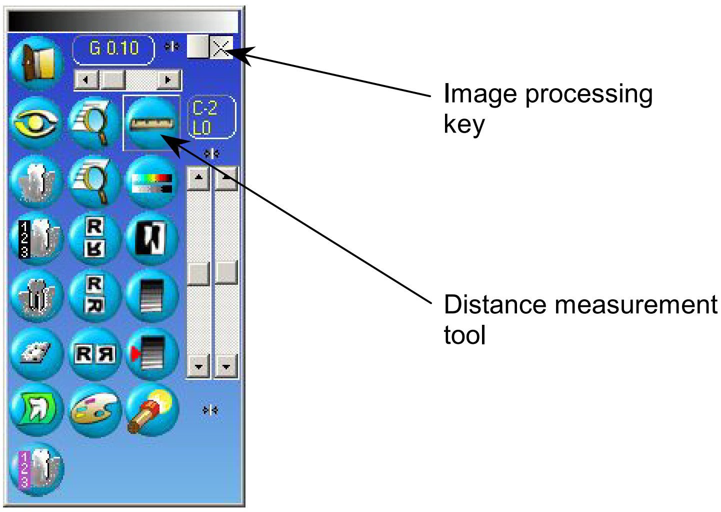


4. Make an exposure in Adult mode at 72 kV – 6mA, acquired by the Quickvision program; the following image will be displayed.



5. Set contrast and brightness level to have good visibility of all centering balls.

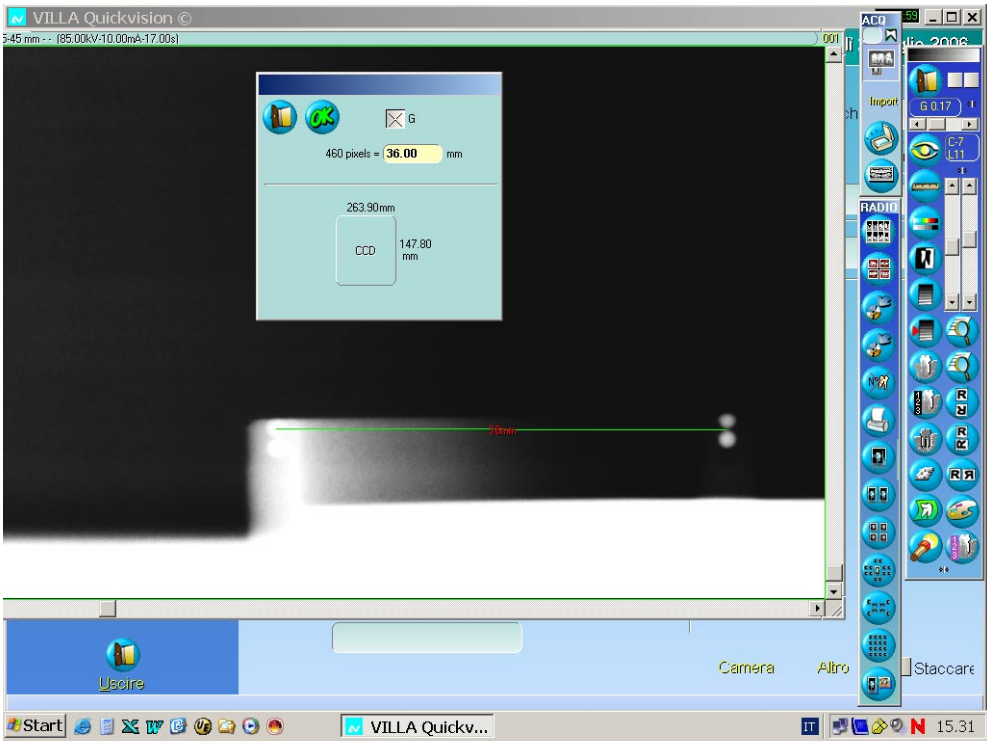
6. Pressing the key in the upper–right region of the instruments box for image processing, it is possible to view the image in the scale 1:1 which facilitates the next steps.



7. Using the dedicated cursors, position the image to see the balls of the left side.

8. Select the instrument which measures distance and position the cursor on the center of the ball on the left of the image.

9. Click on the right button of the mouse and keeping it pressed, drag the pointer to the center of the central ball. Releasing the button, the following image shows up, where it is possible to read the distance in mm, which must be in the range 36 ± 1 mm.



In the measuring window the number of pixel measured is also reported and this measurement is more sensitive, so this is a preferred method. Record the number of pixel (460 in the example).

10. Repeat the measurement on the right side of the image.

11. If the distance between the projection of the side spheres with that of central sphere is not symmetrical (and not within the tolerance range of ±1mm or 11 pixel), check the centering of the sagittal Median axis (Line Y of the centering tool).

12. Make a measurement also of the distance between the right and left ball: it must be inside the range 72 ± 1 mm.

13. If distance is outside the tolerance range, check the alignment of the Canine axis (line L1 of the centering tool).

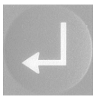
<u>Once completed sign the checklist in Appendix B.</u>

7.1.3. Axes alignment for the CEPH function

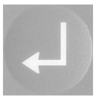
NOTE:
When these operations are performed during Maintenance it will be necessary to remove some of the covers.

NOTE:
This adjustment needs a personal computer directly connected to STRATO 2000 Digital (refer to "Digital Panoramic" Installation Manual) where the "QuickVision" program is installed and the use of the CD (P/N 58093221) supplied with the centering tools kit.

To verify the centering of the Cephalometric function it is necessary to:

1. Switch on the machine and access Password 124 following the operations sequence described in paragraph 7.1.1. Once Password 124 is reached, close the Panoramic sensor holder, if open, and press key "23"  .The following message will be displayed:

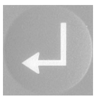
M	A	C	H	I	N	E		S	E	T	T	I	N	G	

2. Press key "23"  . The machine will move and the following message will be displayed:

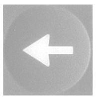
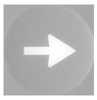
			W	A	I	T		F	O	R					
M	A	C	H	I	N	E		S	E	T	T	I	N	G	

When the machine stops moving, the following message will be displayed:

D	I	G	I	T	A	L		C	E	P	H				
E	N	A	B	L	E		S	E	N	S	O	R			

3. Press key "23"  , the following message will be displayed:

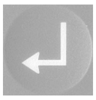
D	I	G	I	T	A	L		C	E	P	H				
D	I	G	I	T	A	L		C	E	P	H		O	F	F

4. Using keys "26"  or "24"  select the following option to enable the digital CEPH:

D	I	G	I	T	A	L		C	E	P	H				
D	I	G	I	T	A	L		C	E	P	H		O	N	

5. Press key "9"  and if the setting has been changed the following message will be displayed:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

6. Press key "23"  to store the changes; the following message will be displayed:

D	I	G	I	T	A	L		C	E	P	H				
E	N	A	B	L	E		S	E	N	S	O	R			

The digital ceph centering complete procedure is composed by the steps reported on the following table, perform them in the correct order:

Step	Action	Reference paragraph
I	Rotation arm alignment	7.1.3.1
II	Ear centering circles setting	7.1.3.2
III	Secondary collimator centering	7.1.3.3
IV	Ceph sensor centering	7.1.3.4
V	Soft Tissue Filter adjustment	7.1.3.5

WARNING:
DO NOT MODIFY THE FOLLOWING ITEMS OF PASSWORD 124:
- **Digital CEPH X offset**
- **Digital CEPH Y offset**
- **Digital CEPH sensor speed 2x2**
- **Digital CEPH sensor speed 3x3**

FUNCTIONALITY CAN BE SEVERELY IMPAIRED.

WARNING:
X-rays will be emitted during the performance of the following operations. Authorised Technicians are therefore recommended to use the greatest caution and to comply with the safety regulations and laws of their country.

7.1.3.1. Rotation arm alignment

To perform the rotation arm alignment start from point 6 of paragraph 7.1.3 and:

7. Press key "26" or "24" until the following is displayed:

D	I	G	I	T	A	L		C	E	P	H				
R	O	T	A	T	I	O	N		O	F	F	S	E	T	

8. Press key "23" . The following message will be displayed

P	L	E	A	S	E		W	A	I	T	.	.	.		

while the slit primary collimator moves to the DIGITAL CEPH central position.
Then the following message will be displayed:

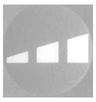
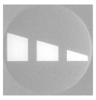
T		Z	E	R	O		[	f	f	]		a	b	c	d
Z	E	R	O		O	F	F	S		±	e	e	e	e	e

NOTE:
After entering the "ROTATION OFFSET" function, the keyboard is inactive for some seconds. Wait a few time and repeat the action.

9. Open the Panoramic sensor holder and moves the skull clamp in the A/P position.

10. Press key "20" to light ON the laser lines . With key "3" and key "6" set a speed value (suggested value 3).

Then with key "26" and key "24" turn the tubehead arm until the vertical laser line is about 10mm on the left of the 18x22S reference on the CEPH sensor cover; light OFF the laser lines.

11. Now a more precise setting have to be performed with X-ray: select with key "7"  and key "5"  respectevely kV and mA and use key "3"  and key "6"  to set values for the exposure (suggested values: 50kV and 4mA).

12. Open QuickVision and activate virtual keyboard.

13. Press key "8"  on the machine keyboard; the system get ready to take the Rotation Arm aligment test.

14. Press the X-ray button and keep it depressed until the end of the exposure.

NOTE:
If the following message will be displayed:

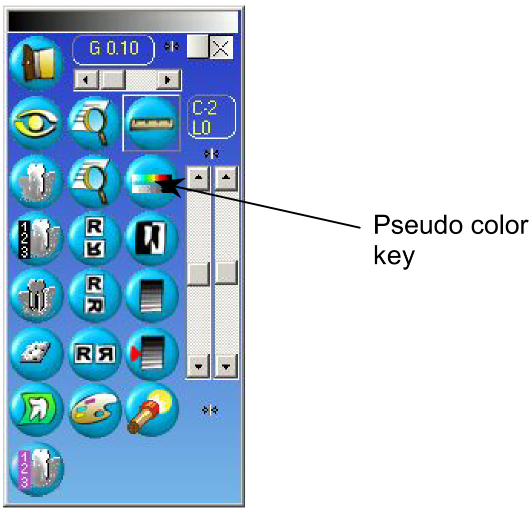
	D	I	G	I	T	A	L		B	O	A	R	D		
			I	S		N	O	T		R	E	A	D	Y	

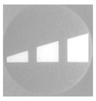
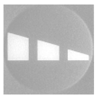
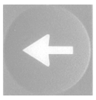
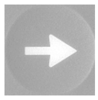
check the connection with the PC.

Press key "9"  to reset the message.

---

15. On the image taken with QuikVision, using the instruction in paragraph 7.1.2, measure the distance between the borders of the image and the borders of the central vertical stripe (Figure 7-1); to take the measure easely, you can use the QuickVision pseudo color function.



16. The right and left distance must not differ more than ±3mm. If it is not the case, with key "3"  and key "6"  set a speed value (suggested value 2) and with key "26"  and key "24"  turn the tubehead arm, increasing the displayed offset value if the left distance is lower than the right one or viceversa; repeat the test from point 11.

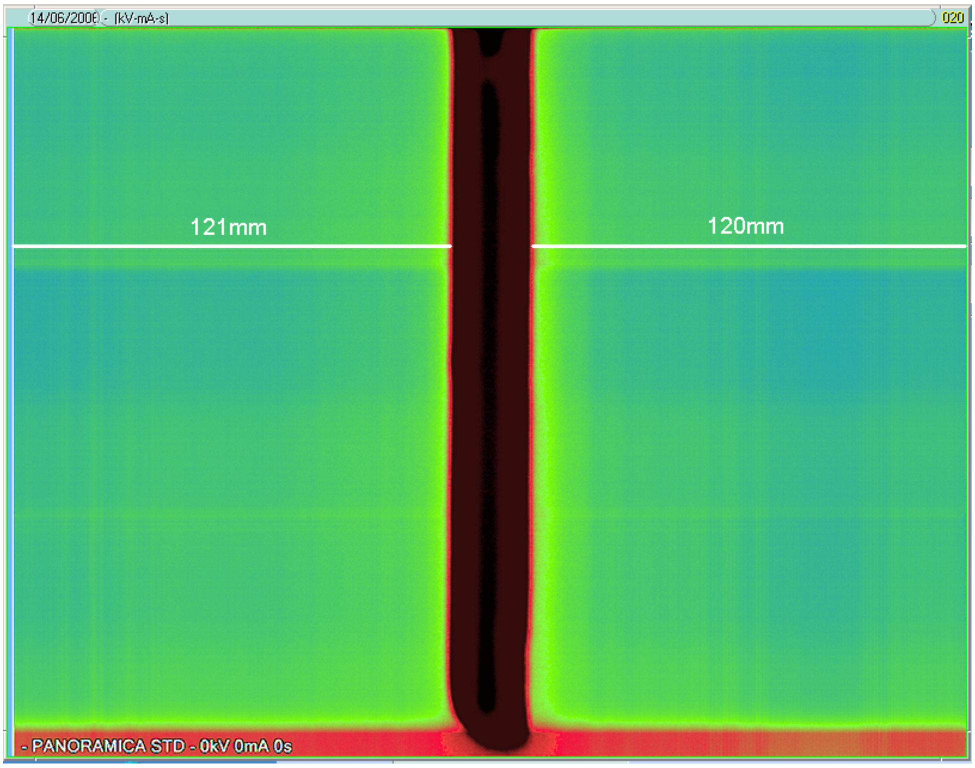
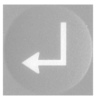


Figure 7-1

17. When the right setting is reached press key "9"  to exit the menu item and if modifications have been performed the following message will be displayed:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

18. Press key "23"  to store the changes. While key "9"  to cancel them.

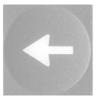
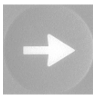
<u>Sign the chekclist in Appendix B; remind to write down the new value in the relavant box in Appendix A.</u>

7.1.3.2. Ear Centering Circles setting

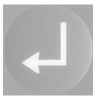
NOTE:
This adjustment needs a personal computer directly connected to STRATO 2000 Digital (refer to "Digital Panoramic" Installation Manual) where the "QuickVision" program is installed and the use of the CD (P/N 58093221) supplied with the centering tools kit.

Place the Ear Centering device in a Latero-Lateral position with the Ear Centering Circles in a complitely open position.

To perform the ceph sensor alignment start from point 18 of paragraph 7.1.3.1 and:

19. Press key "26"  or "24"  until the following is displayed:

D	I	G	I	T	A	L		C	E	P	H				
L	I	N	I	N	G		U	P		T	E	S	T		

Press key "23" . The following message will be displayed:

L	I	N	I	N	G		U	P		T	E	S	T		
P	R	E	S	S		T	E	S	T						

This is a short exam specific to take images to adjust the Ear Centering Circle

20. Open the "Ear centering" program on the CD (P/N 58093221) and wait the message "Board is connected" is diplayed on the bottom bar of the program.Ckech that in menu "Image processing" all the items are not selected except for DNSU and PRNU.

21. Press key "8"  . The machine get ready to take a 10x22 exam.

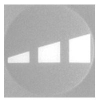
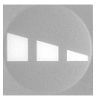
NOTE:
If the following message will be displayed:

	D	I	G	I	T	A	L		B	O	A	R	D		
			I	S		N	O	T		R	E	A	D	Y	

check the connection with the PC.

Press key "9"  to reset the message and press key "8"  again.

NOTE:
After entering the "LINING UP TEST" function, the keyboard is inactive for some seconds. If when key "8" is pressed no movement take place just wait some seconds and repeat the action.

22. Acting on keys "5"  and "7"  and on key "3"  or "6"  set the exposure parameters, as suggestion set 50kV, 4mA.

WARNING:
X-rays will be emitted during the performance of the following operations. Authorised Technicians are therefore recommended to use the greatest caution and to comply with the safety regulations and laws of their country.

23. Press the X-ray push button and keep it depressed until the end of the exposure.

24. Evaluate the image and if the X-ray beam is vertically displaced (i.e. more than 10mm upper or lower white border present); it will be necessary to change the height of the CEPH arm using the upper or lower grubs "B" (Figure 7-2), moving them symmetrically in pairs (above or below) after having previously loosened nuts "C". If the white border is present on the lower, turn the lower pair after having slightly loosened (portion of a turn) the two lower arm fastining screws "D". Perform this procedure in reverse if the white border is present on the upper part.
Once vertically alignment has been completed, tighten the loosened screws "D" and block adjustment grubs "B" with the relevant nuts "C".

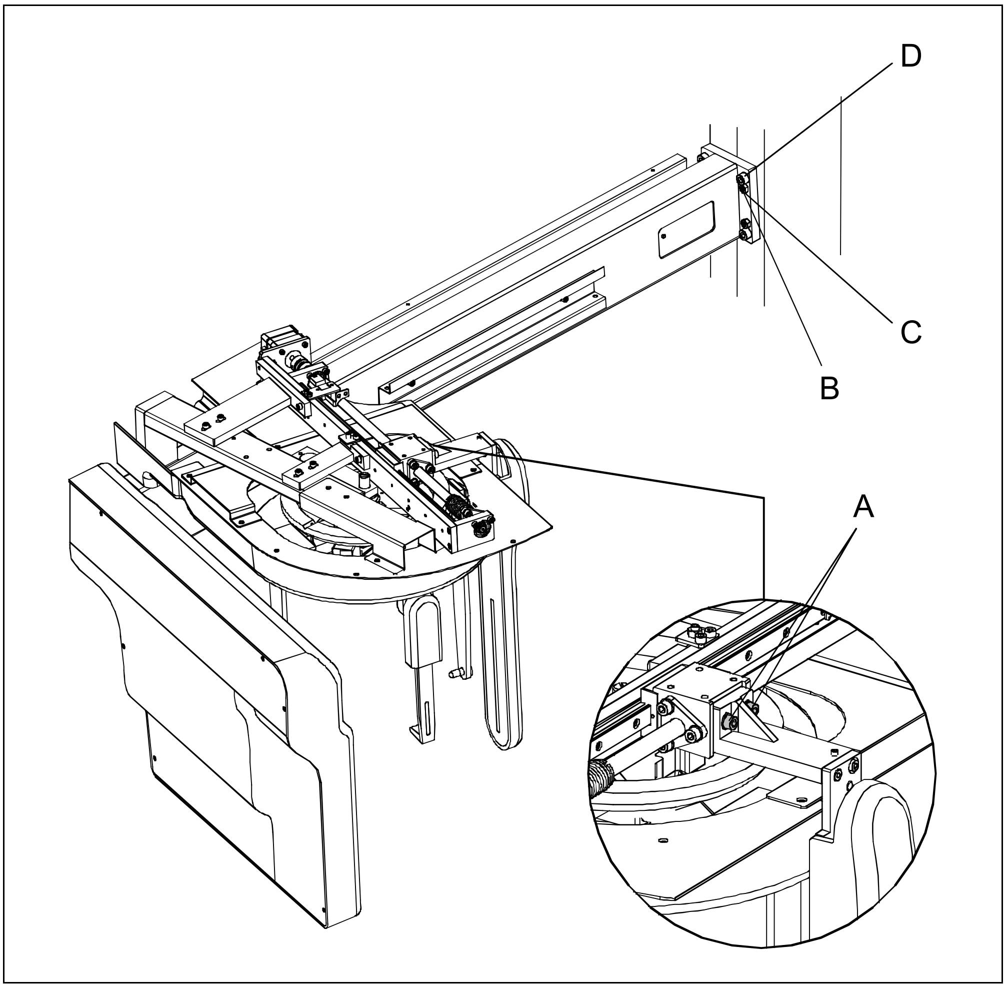


Figure 7-2

25. Repeating steps from point 20 to point 22, take a new image and if the Ear Cenetring Circles are not concentric perform the setting actions described in paragraphs 7.1.3.2.1 and 7.1.3.2.2.

26. When the right setting is reached press key "9"  to exit the menu item.

<u>Sign the chekclist in Appendix B.</u>

7.1.3.2.1. Projection of Non-Concentric Ear Centering Circles

Loosen the fixing screws "A" of positioning sphere (max. 1 turn) and using adjustment screw "C" adjust (rotate) skull-stand unit "B".
If the greater diameter (ear set farthest from the sensor) is shifted more towards the nose-rest with respect to the smaller diameter (ear-rest nearer to the sensor), screw adjustment screw "C" and manually turn sphere holder "E" anticlockwise. In the opposite case, unscrew adjustment screw "C" and the sphere holder will shift automatically.
Once the correct centering is obtained (a test exposure is required), fix screw "A" and block adjustment screw "C" using security nut "D".

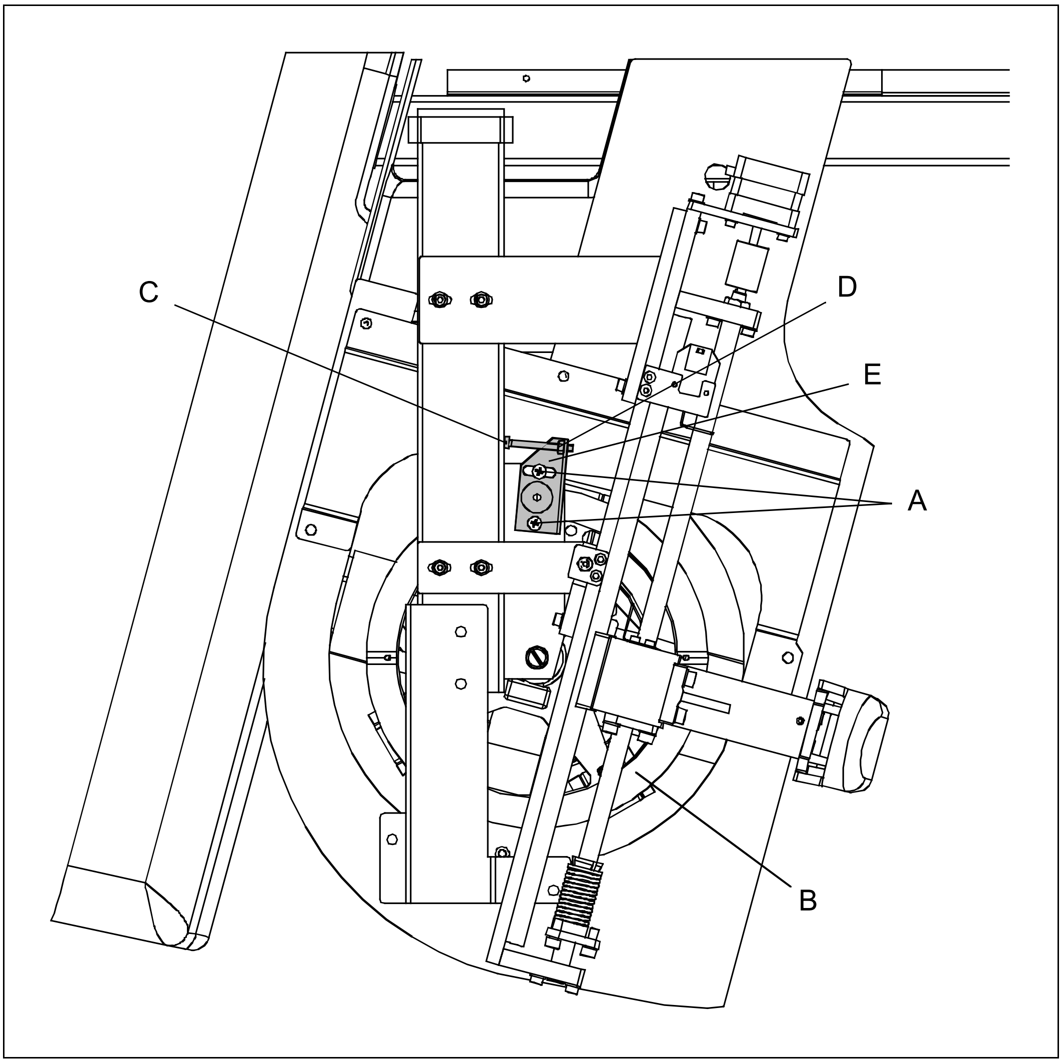


Figure 7-3a (Top view)

7.1.3.2.2. Projection of Vertically Non-Concentric Ear Centering Circles

Loosen screws "F" (Figure 7-2b). Adjust position of the arm acting on screw "G" (Figure 7-2b) on the side. Once the aligned position has been reached tighten bolt "H" (Figure 7-2b). Upon completion of the adjustment a test exposure is required, to verify it. Tighten screws "F".

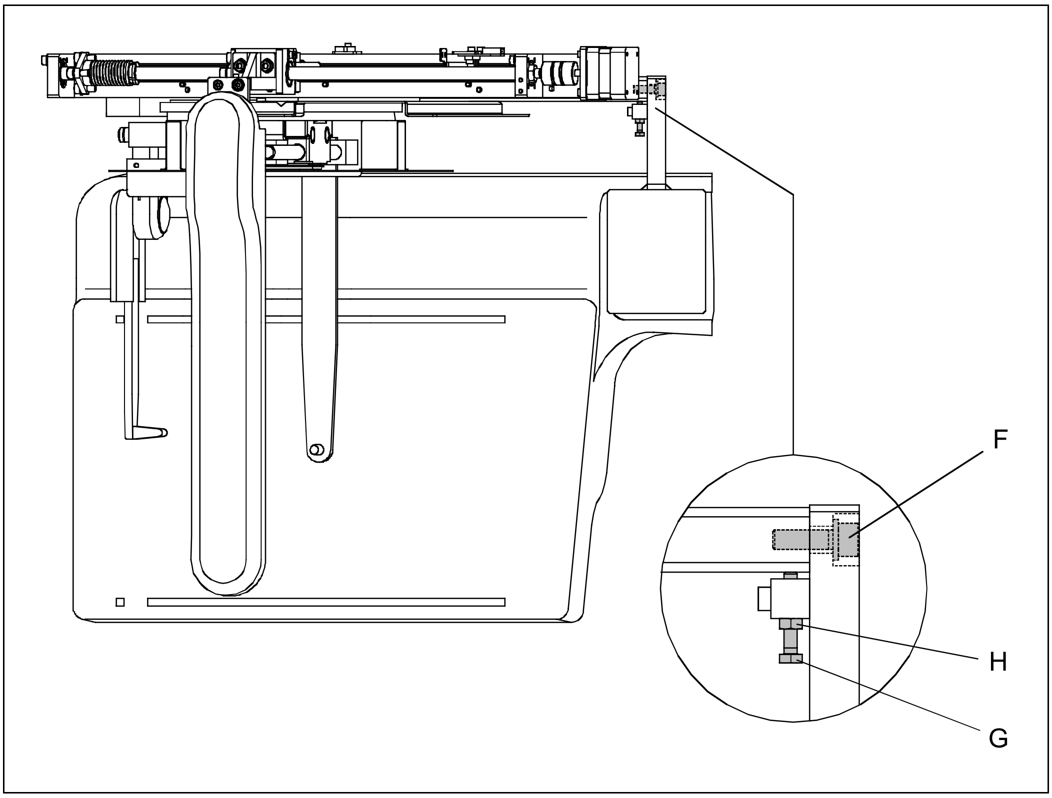


Figure 7-2b (Side view)

7.1.3.3. Secondary collimator centering

To perform the ceph secondary collimator alignment start from point 26 of paragraph 7.1.3.2 and:

27. Press key "26" or "24" until the following is displayed:

D	I	G	I	T	A	L		C	E	P	H				
C	E	P	H		S	.	C	O	L	.		Z	E	R	O

28. Press key "23" and the following message will be displayed:

S		Z	E	R	O		[	f	f	]		a	b	c	d
Z	E	R	O		O	F	F	S		±	e	e	e	e	e

NOTE:
After entering the "CEPH S.COL. ZERO" function, the keyboard is inactive for some seconds. Wait a few time and repeat the action.

29. Select with key "7" kV and key "5" mA respectively kV and mA and use key "3" and key "6" to set values for the exposure (suggested values: 50kV and 4mA).

30. Open QuickVision and activate the Virtual Keyboard.

31. Press key "10" on the machine keyboard. The primary collimator and the CEPH sensor will be automatically placed in the CEPH central position and the system get ready to take the secondary collimator test.

32. Press the X-ray button and keep it depressed until the end of the exposure.

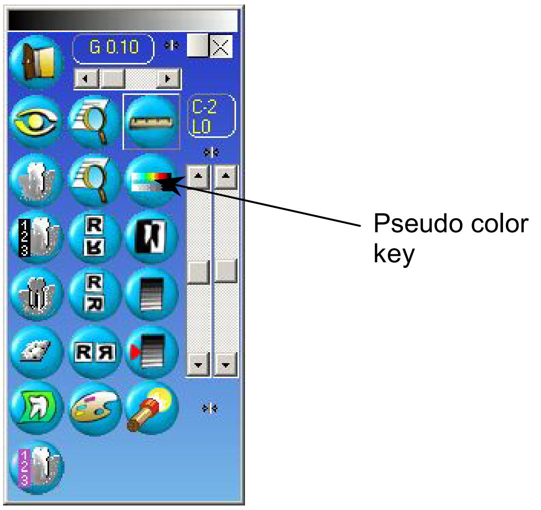
NOTE:
If the following message will be displayed:

	D	I	G	I	T	A	L		B	O	A	R	D		
			I	S		N	O	T		R	E	A	D	Y	

check the connection with the PC.

Press key "9" to reset the message.

33. On the image taken with QuickVision, using the instruction in paragraph 7.1.2, measure the distances between the borders of the image and the borders of the central vertical stripe (Figure 7-4); to take the measure easely, you can use the QuickVision pseudo color function.



34. The right and left distances must not differ more than ±3mm.

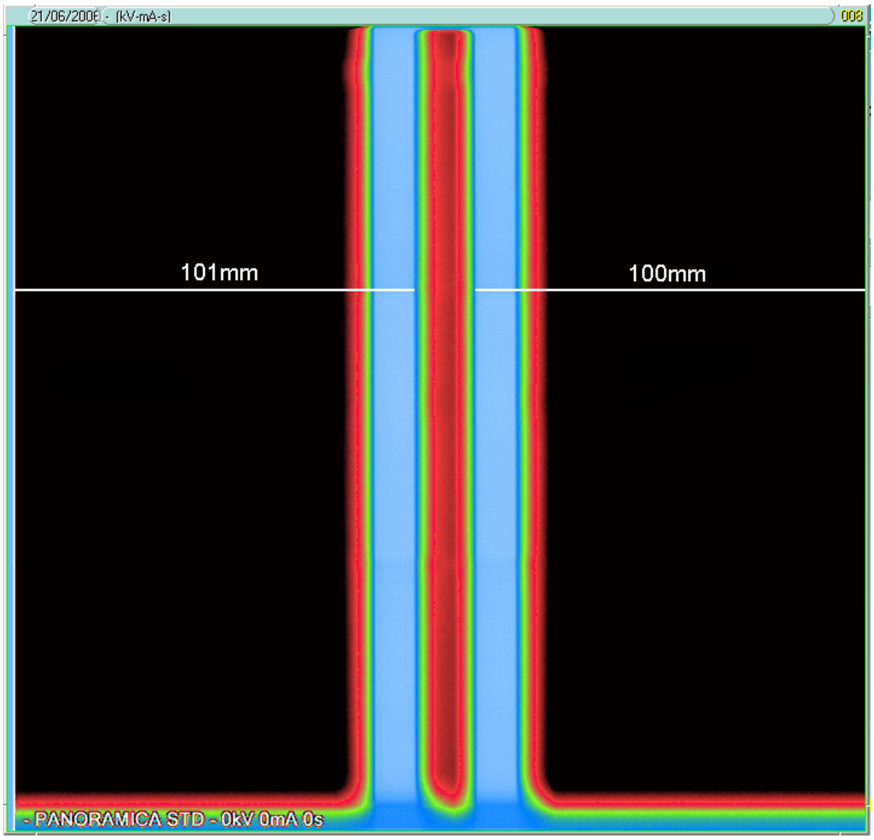


Figure 7-4

35. If it is not the case, with key "3" and key "6" set a speed value (suggested value 3) and with key "26" and key "24" move the secondary collimator, increasing the displayed offset value if the left distance is lower than the right one or viceversa; repeat the test from point 29.

NOTE:
This is a fine setting; if the zero offset (±eeeee) is lower than –1000 steps or greater than 1000 steps repeat the first step of ceph arm centering described in 7.1.3.1.

If the X-ray beam is vertically displaced; for fine adjustment act on the 2 secondary collimator fixing screws "A" (Figure 7-2).

36. When the right setting is reached press key "9" to exit the menu item and if modifications have been performed the following message will be displayed:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

37. Press key "23" to store the changes. While key "9" to cancel them.

<u>Sign the chekclist in Appendix B; remind to write down the new value in the relavant box in Appendix A.</u>

38. Press key "9" to exit password 124, the following message will be displayed

C	O	N	F	I	R	M		E	X	I	T	?			
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

press key "23" to exit the program and store the changes.

39. Switch OFF the unit.

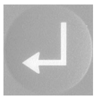
7.1.3.4. CEPH Sensor centering

NOTE:
This adjustment needs a personal computer directly connected to STRATO 2000 Digital (refer to "Digital Panoramic" Installation Manual) where the "QuickVision" program is installed and the use of the CD (P/N 58093221) supplied with the centering tools kit.

To perform the ceph sensor alignment start from point 39 of paragraph 7.1.3.3 and:

40. Switch ON the unit and access Password 124 following the operations sequence described in paragraph 7.1.1. The following message will be displayed:

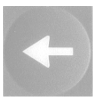
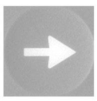
M	A	C	H	I	N	E		S	E	T	T	I	N	G	

41. Press key "23"  . The machine will move and the following message will be displayed:

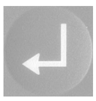
			W	A	I	T		F	O	R					
M	A	C	H	I	N	E		S	E	T	T	I	N	G	

When the machine stops moving, the following message will be displayed:

D	I	G	I	T	A	L		C	E	P	H				
E	N	A	B	L	E		S	E	N	S	O	R			

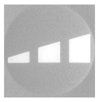
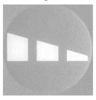
42. Press key "26"  or "24"  until the following is displayed:

D	I	G	I	T	A	L		C	E	P	H				
C	E	P	H		S	E	N	S	O	R		Z	E	R	O

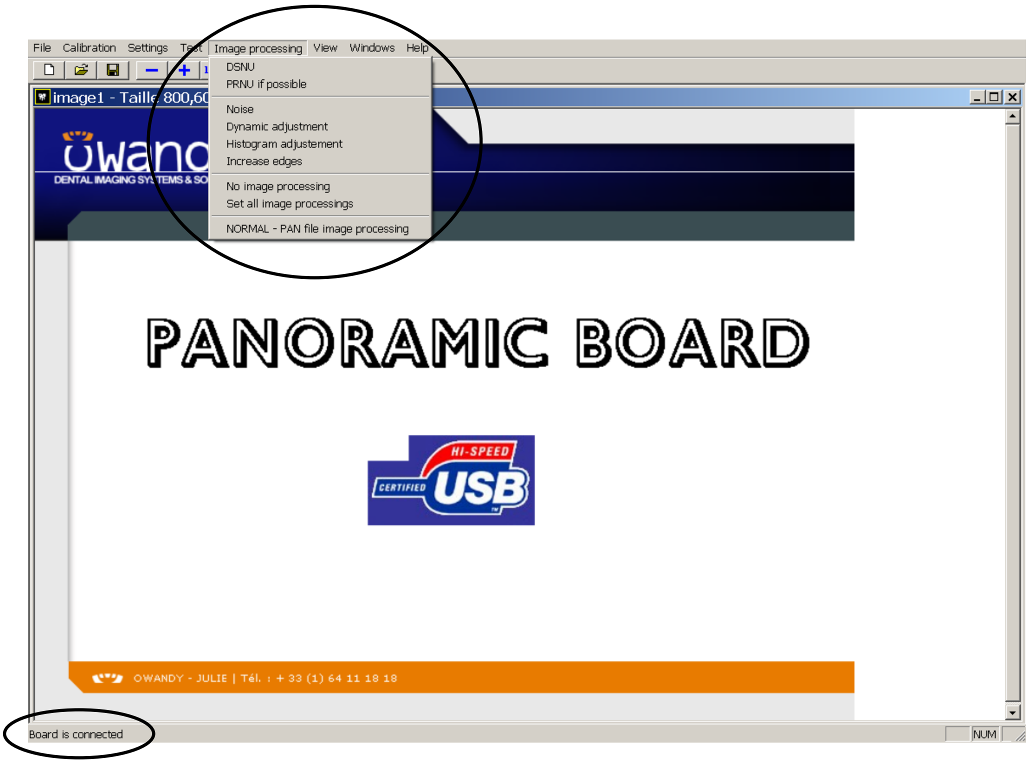
43. Press key "23"  and the following message will be displayed:

S		Z	E	R	O		[	f	f	]		a	b	c	d
Z	E	R	O		O	F	F	S		±	e	e	e	e	e

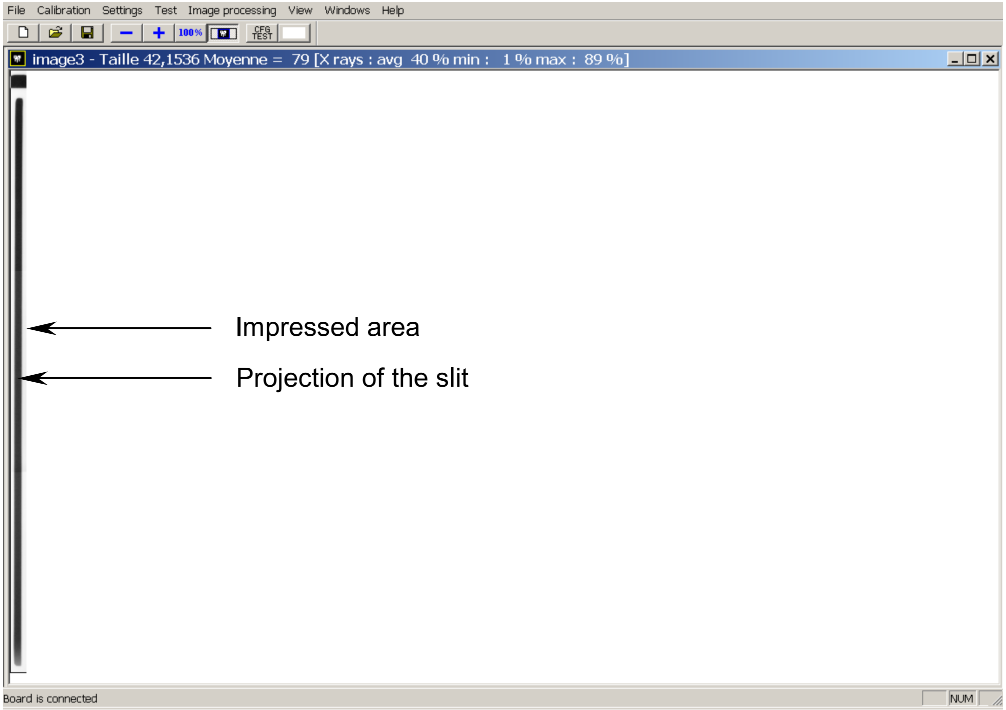
44. Press key "8"  .The primary and secondary collimators and the ceph sensor go to the ceph central position. Place the centering tool code 52099009 on the secondary collimator (see Figure 6-11).

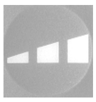
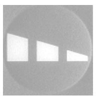
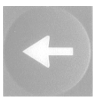
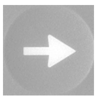
45. Select with key "7"  , key "5"  and key "4"  respectively kV, mA and exposure time and use key "3"  and key "6"  to set values for the exposure (suggested values: 50kV, 4mA and 0.2s)

46. Open the "Sensor Centering" program on the CD (P/N 58093221) and wait the message "Board is connected" is diplayed on the bottom bar of the program.Check that in menu "Image processing" all the items are not selected.



47. Take X-ray pressing the X-ray button and check if in the obtained narrow image the projection of the slit of the centering tool is vertical and in the middle of the impressed area.



If it is horizontally displaced the CEPH sensor offset has to be corrected following this instruction: with key "3"  and key "6"  set a speed value (suggested value 3) and with key "26"  and key "24"  move the CEPH sensor.

NOTE:
If the image taken is totally white, perform the step 47 without the tool (code 52099009) in order to make a rough centering.
Then place again the tool on the secondary collimator and repeat step 47 to perform a fine setting.

NOTE:
This is a fine setting, so be sure to have well performed the two previous steps.

If the projection of the slit is oblique, unscrew the 2 screws "A" and adjust the secondary collimator tilt acting on grub "B", in order to have a vertical projection of the slit.

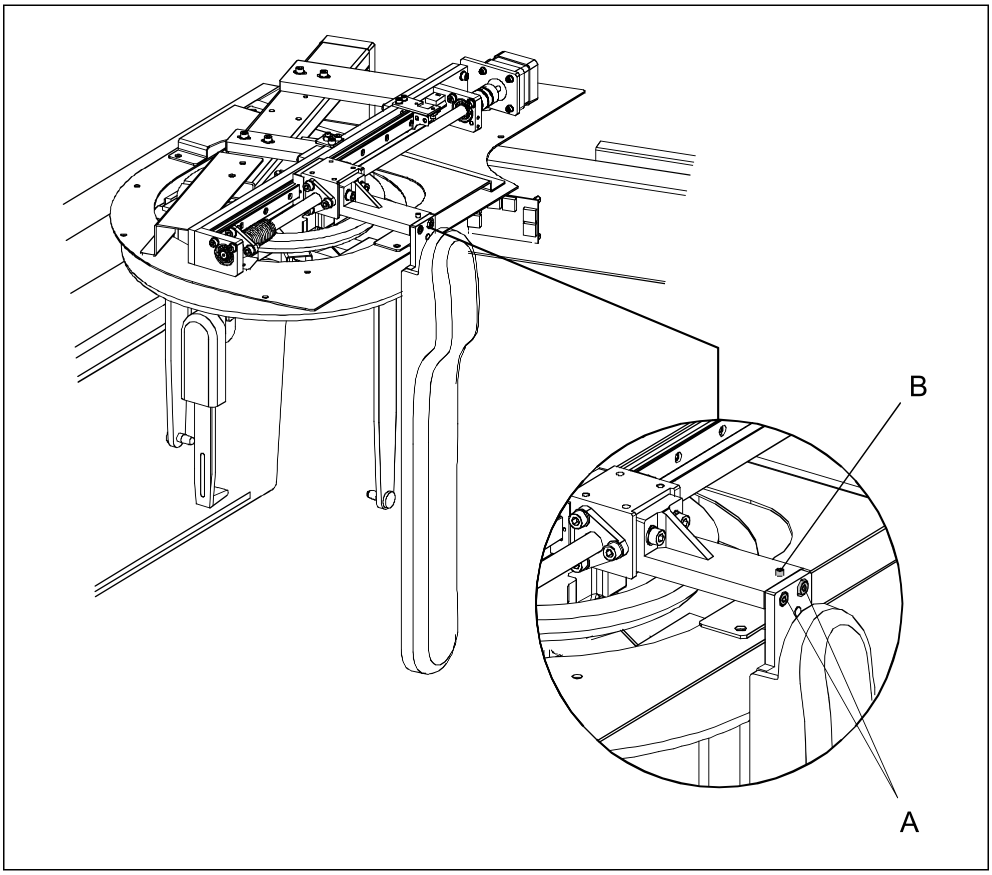
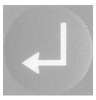


Figure 7-5

48. When the right setting is reached press key "9"  to exit the menu item and if modifications have been performed the following message will be displayed:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

49. Press key "23"  to store the changes. While key "9"  to cancel them.

Fix the grubs "B" with their nuts if they had been adjusted and tighten the 2 screws "A".

<u>Sign the chekclist in Appendix B; remind to write down the new value in the relavant box in Appendix A.</u>

7.1.3.5. Soft Tissue Filter (STF) adjustment

NOTE:
This adjustment needs a personal computer directly connected to STRATO 2000 Digital (refer to "Digital Panoramic" Installation Manual) where the "QuickVision" program is installed.

This adjustment is accessed in by activating password 124 as described at paragraph 7.1.3.

1. When in password 124 scroll the menu items pressing key "26" or "24" until reaching the following display:

D	I	G	I	T	A	L		C	E	P	H				
S	T	F		Z	E	R	O		O	F	F	S	E	T	

2. Press key "23" . The following message will be displayed:

S	T	F		Z	E	R	O		O	F	F	S			a
O	F	F	S	E	T		±	x	x	x					

3. Open QuickVision and activate the Virtual Keyboard.

4. Press key "8" on the machine keyboard. The machine get ready to take a 18x22A exam and the soft tissue filter will be automatically placed in the X-ray field.

NOTE:
If the following message will be displayed:

	D	I	G	I	T	A	L		B	O	A	R	D		
			I	S		N	O	T		R	E	A	D	Y	

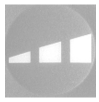
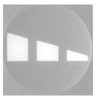
check the connection with the PC.

Press key "9" to reset the message and press key "8" again.

NOTE:
After entering the "STF ZERO OFFSET" function, the keyboard is inactive for some seconds. If when key "8" is pressed no movement take place just wait some seconds and repeat the action.

5. Acting on keys "5" 

and "7" 

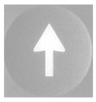
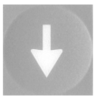
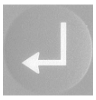
and on key "3"  or "6"  set the exposure parameters, as suggestion set 50kV - 4mA.

WARNING:
X-rays will be emitted during the performance of the following operations. Authorised Technicians are therefore recommended to use the greatest caution and to comply with the safety regulations and laws of their country.

6. Press the X-ray button and keep it depressed until the end of the exposure; the following message will be displayed:

E	N	T	E	R		I	M	G		O	F	F	S	E	T
O	F	F	S	E	T		(	m	m	)				5	0

7. On the image taken with QuickVision, using the instruction in paragraph 7.1.2, measure the distance "A" (Figure 7-6) between the Soft Tissue Filter (STF) edge and the center of the rings; perform the measure in "mm".

8. If the distance "A" is different from 50±2mm, press key "22"  and key "25"  up to reach the measured value; press key "23"  to store the change.

The system will calculate automatically the new Soft Tissue Filter offset.
If distance "A" is 50±2mm no correction is needed; press key "9" 

to exit.
In both cases the following message will be displayed

S	T	F		Z	E	R	O		O	F	F	S			a
O	F	F	S	E	T		±	x	x	x					

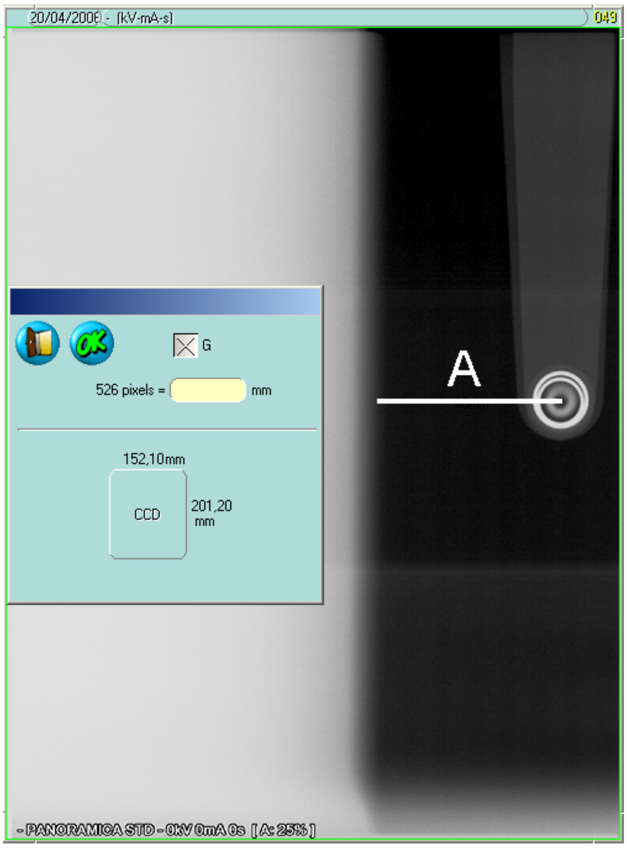
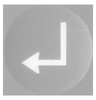


Figure 7-6

9. Check proper alignment of the Soft Tissue Filter by performing a new exposure (repeat the actions from point 3 to point 8).
If the alignment is correct, store it into the non-volatile memory of the unit by pressing key "9"  . The display will show:

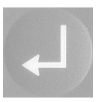
U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

Press key "23"  to permanently store the change.

<u>Sign the chekclist in Appendix B; remind to write down the new value in the relavant box in Appendix A.</u>

10. Press key "9"  to exit password 124, the following message will be displayed

C	O	N	F	I	R	M		E	X	I	T	?			
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

press key "23"  to exit the program and store the changes.

7.2. Verify of kV and exposure time

kVp and time can be measured directly (invasive method) on the HF generator board, more precisely the following procedure must be performed.

NOTE:
If the following actions are performed during maintenance some covers have to be removed:

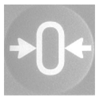
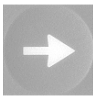
a. Remove the outer covering of the tubehead.

b. Remove the protection grid of the HF generator board.

WARNING:
The HF board has a working voltage of about 360V.

The exposure parameters can be checked with the following procedure:

1. With the unit on, select the Panoramic examination mode by pressing key "17"  .

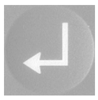
2. Press contemporaneously keys "10"  , "28"  and "24"  ; LED's of "patient type", "patient size" and "Arch" switch off and the display shows the following two messages alternatively:

				R	E	M	O	V	E						
			C	H	I	N		R	E	S	T				

and

					C	L	O	S	E						
	T	E	M	P	L	E		S	U	P	P	O	R	T	

NOTE:
This program allows you to carry out the measuring of the exposure parameters having the tubehead-arm in a fixed position (not rotating).

3. Carry out the actions mentioned above; press key "23"  ; the unit will carry out a movement to reach the "zero" position. During this phase, the display shows:

P	L	E	A	S	E		W	A	I	T	.	.	.		

At the end of this phase , the display shows:

						O	P	E	N						
	C	A	S	S	E	T	T	E		U	N	I	T		

After having opened to Ceph position the sensor support the display shows:

P	L	E	A	S	E		W	A	I	T	.	.	.		

while the primary collimator is placed in PAN position and the Soft Tissue Filter outside the X-ray field.

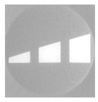
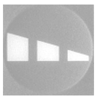
4. The display shows:

X	-	R	A	Y		P	A	R	A	M	E	T	E	R	S
	7	0	k	V		0	8	m	A		1	.	0	0	S

Acting on keys "4" 

, "7" 

, "5" 

and on keys "3"  or "6"  set the exposure parameters to carry out the desidered checks.
The variation range of the parameters is shown in the following table:

Parameter	Minimum value	Maximum value
kV	50	80
s	0,2	15
mA	4	12

WARNING:
X-ray will be emitted during the performance of the following operations. Authorised technicians are therefore recommended to use the greatest caution and to comply with the safety regulations and laws of their country.

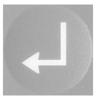
For the execution of measurement follow instruction at paragraphs 7.2.1, 7.2.2 and 7.3.

5. To quit this routine, press key "9"  ; the display will show:

	C	L	O	S	E		C	A	S	S	E	T	T	E	
		T	O		P	A	N	O	R	A	M	I	C		

In case of fixed collimator jump to step 6.
After closing the sensor holder to Panoramic position (the position is sensed by the unit), the display will show the following message:

P	R	E	S	S		E	N	T	E	R					

Press key "23"  ; the unit will carry out the zeroing and will set itself in the patient entry position; the display will show:

P	L	E	A	S	E		W	A	I	T	.	.	.		

6. The display will show:

S	T	D	.		P	A	N	O	R	A	M	I	C		
	x	x	k	V		x	x	m	A		1	5	.	0	s

and the unit returned at a standard mode.

7.2.1. kVp

Use a multimeter (R input >= 10MΩ) in working conditions VDC and end of scale 20V, position the cold pole on TP4 (GND) and the hot pole on TP3 (kV) on the HF generator board. Set the following parameters: 60kV-6mA-3s as described in paragraph 7.2, item 4.
Perform an exposure and considering that the ratio between the value on the voltmeter and high voltage is 1V= 10kV, verify that the value indicated by the multimeter ranges from 5.7÷6.3V (6V±5%).
In case the read value is outside the specified range, shift the hot pole of the voltmeter on TP5 (set kV). Once a new exposure is done, the voltage on TP5 must range from 5.76÷6.24V (6V±4%).
Should this last value be outside the specified limit, detect the "set kV" voltage supplied by CPU, connecting the voltmeter between GND test points and kV (set nearby X10). The tension on these points must range from 5.82 and 6.18 V (6V±3%). If it is out of tolerance replace the CPU, otherwise replace the HF generator board.
If all measures are within the specified range, and there is an evidence of a performance loss, measure the high tension of the tubehead, and the exposure time using a non-invasive kilovoltmeter with ≤ ±3kVp tolerance.

WARNING:
Measurement by a non invasive kV meter on a very narrow beam can be difficult and/or unreliable and special probes with reduced sensitive area must be used.
It may result helpful to use a fluorescent screen to locate the X-ray beam and consequently position the probe of the kV meter.

The high voltage value must be within 8% of the set value, while the time value must be within 10% of the set value. If the voltage is not within the expected range, replace the tubehead; otherwise replace CPU board.

NOTE:
The tubehead has always to be replaced together with the HF board because there are adjustments needed to match the two components.

7.2.2. Time

Verify the accuracy of the exposure time using an oscilloscope connected at the same test points used to measure kV (TP4 and TP5) of the HF generator board. The exposure time calculated at about 75% of the maximum kV value, must correspond to the set one ±10%. In case the time is outside the prescribed values, replace the CPU.

7.3. mA Check

mA can be measured directly (invasive method) on the tubehead by the test points on the HF generator board after having performed the following procedures:

a. Remove the outer covering of the tubehead.

b. Remove the metal protection grid of the generator board.

WARNING:
The board has a working voltage of about 360V.

Use a multimeter (R input >= 10MΩ) in working conditions VDC and end of scale 20V, position the cold pole on TP4 (GND) and the hot pole on TP1 (mA). Set the following parameters: 60kV-4mA-3s as described in paragraph 7.2, item 4.
Perform an exposure and considering that a ratio 1V DC = 2 mA, verify that the value indicated by the multimeter ranges from 1.84÷2.16V (4mA±8%).
Set 80kV - 12mA - 3s. The value read must range from 5.52 to 6.48V (12mA±8%).

In case the detected values are outside these ranges, check that the voltage on TP2 is -4V ± 0.02V. Otherwise, adjust trimmer R165 to obtain this value. After having adjusted the trimmer, check again the current during the emission.

7.4. Storing of automatical exposure parameters

At the end of mechanical installation and functional check the stored exposure parameters can be modified depending on the operator needs.

7.4.1. Exposure parameter

To modify the automatic exposure parameters, please follow the indicated procedure:

1. Select the exam, the type of patient and the size to be modified.
2. According to the parameter to be modified press "7" 

and/or "5" 

. On display, on the left of the selected parameter value, a reference character will be displayed.

NOTE:
The pressure of one of the three parameters setting keys will cause the de-activation of the patient size LED and the blinking of the patient type and function/examination LED's. This LED's will be reactivated only when storing parameters (paragraph 7.4.3).

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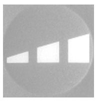
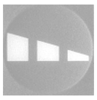
3. Press "3"  or "6"  to set the value to store.

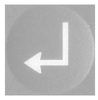
NOTE:
For Cephalometric exams the parameter modifications are common to high resolution and to normal resolution selection since both modality requires the same exposure parameters.

7.4.2. Soft Tissue Filter

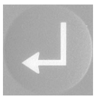
It is possible set the default value of the Soft Tissue Filter in function of patient size (small, medium, large) and of exam format.

NOTE:
The value of Soft Tissue Filter is stored for all Asymmetric projections. For the symmetrical projections instead, the default position of the STF is out (the display shows OUT).

7.4.3. Storing parameters

To store the set value, press the key "28"  e "23"  , at the same time, the display will show the following message:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

press key "23"  to confirm, the LED's will lit again, or the key "9"  to cancel the setting; in this case the LED's blink and the display still shows the same value.

7.4.4. Table of pre-set anatomic parameters

PANORAMIC EXAMINATIONS

	Adult	Child
Thin	68 kV 6 mA	64 kV 4 mA
Normal	72 kV 6 mA	66 kV 4 mA
Robust	74 kV 6 mA	68 kV 5 mA

TMJ open/close mouth

	Adult	Child
Thin	68 kV 6 mA	58 kV 6 mA
Normal	72 kV 6 mA	64 kV 6 mA
Robust	76 kV 6 mA	68 kV 6 mA

TMJ BIAXIAL

	Adult	Child
Thin	68 kV 6 mA	58 kV 6 mA
Normal	72 kV 6 mA	64 kV 6 mA
Robust	76 kV 6 mA	70 kV 6 mA

Maxillary SINUS

	Adult	Child
Thin	66 kV 6 mA	62 kV 5 mA
Normal	70 kV 6 mA	64 kV 5 mA
Robust	72 kV 6 mA	66 kV 5 mA

Lateral SINUS

	Adult	Child
Thin	68 kV 6 mA	62 kV 5 mA
Normal	72 kV 6 mA	66 kV 5 mA
Robust	74 kV 6 mA	68 kV 5 mA

CEPHALOMETRY (L.L)

	Adult	Child
Thin	72 kV 6 mA	70 kV 5 mA
Normal	74 kV 6 mA	72 kV 5 mA
Robust	76 kV 6 mA	74 kV 5 mA

CEPHALOMETRY (A/P- P/A)

	Adult	Child
Thin	74 kV 12 mA	72 kV 10 mA
Normal	76 kV 12 mA	74 kV 10 mA
Robust	80 kV 10 mA	76 kV 10 mA

Maxilla IMPLANT

	Tooth 11/21 L	Tooth 11/21 T	Tooth 12/22 L	Tooth 12/22 T	Tooth 13/23 L	Tooth 13/23 T	Tooth 14/24 L	Tooth 14/24 T	Tooth 15/25 L	Tooth 15/25 T	Tooth 16/26 L	Tooth 16/26 T	Tooth 17/27 L	Tooth 17/27 T	Tooth 18/28 L	Tooth 18/28 T	
Thin	68	50	68	50	64	50	56	58	56	62	56	62	56	62	56	62	kV
	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	mA
Normal	70	50	70	50	66	50	58	62	58	64	58	64	58	64	58	64	kV
	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	mA
Robust	72	52	72	52	68	52	60	64	60	66	60	66	60	66	60	66	kV
	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	mA

L = Longitudinal
T = Transversal

Mandible IMPLANT

	Tooth 31/41 L	Tooth 31/41 T	Tooth 32/42 L	Tooth 32/42 T	Tooth 33/43 L	Tooth 33/43 T	Tooth 34/44 L	Tooth 34/44 T	Tooth 35/45 L	Tooth 35/45 T	Tooth 36/46 L	Tooth 36/46 T	Tooth 37/47 L	Tooth 37/47 T	Tooth 38/48 L	Tooth 38/48 T	
Thin	62	50	62	50	64	50	64	58	66	66	66	60	66	60	66	60	kV
	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	mA
Normal	64	52	64	52	66	52	66	62	68	68	68	62	68	62	68	62	kV
	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	mA
Robust	66	54	66	54	68	54	68	64	70	70	70	64	70	64	70	64	kV
	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	mA

L = Longitudinal
T = Transversal

7.5. STRATO 2000 Digital Software Utilities

The STRATO 2000 Digital Software Utilities is a special software program that allows the user to perform special functions like the U.C.A. upgrade. This software also allows viewing the calibration data of STRATO 2000 Digital; there is a special pop-up menu, named "Service", to perform this operation.

Power on the STRATO 2000 Digital and let it reach the Patient's entering position.
To install the software on the PC, insert the CD named "STRATO 2000 Digital Software Utilities" (P/N 58093220) shipped among with the STRATO 2000 Digital on the CD reader of the PC; the software installation procedure will start automatically; if not, start it using the "Start", "Run" procedure and selecting the "Autorun" program on the CD.

Figure 7-7

Select the language to be used during the installation and also on the program itself by clicking on the corresponding flag.
The Software will try to determine if the STRATO 2000 Digital is connected to the PC; click on "Test Connection" tab.

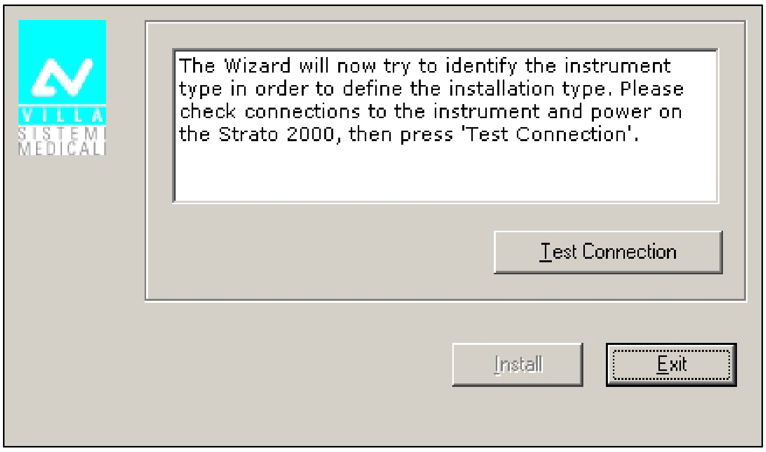


Figure 7-8

Once the connection procedure has been terminate, the following windows will appear.

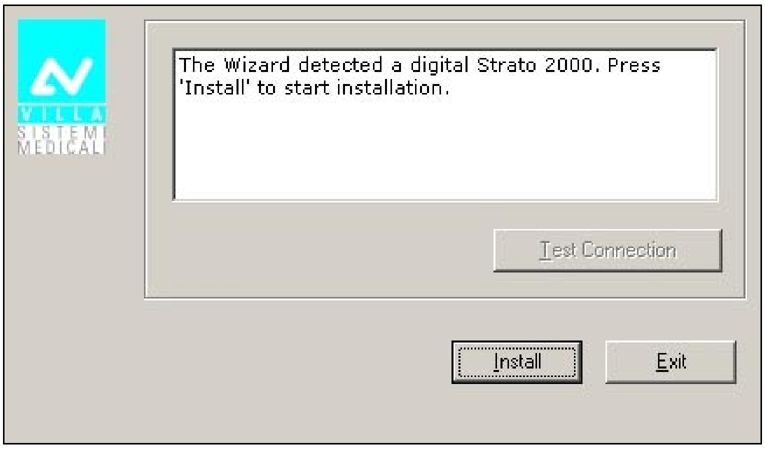


Figure 7-9

Clicking on "Install", the software will be installed on the PC; please follows the steps of the installation.

At the end of installation process, the STRATO 2000 Digital Software Utilities package will be installed; the normal folder is: "C:\Programs\VSM\Strato2000D\

Execute the package using the standard Windows process. The following windows will open.

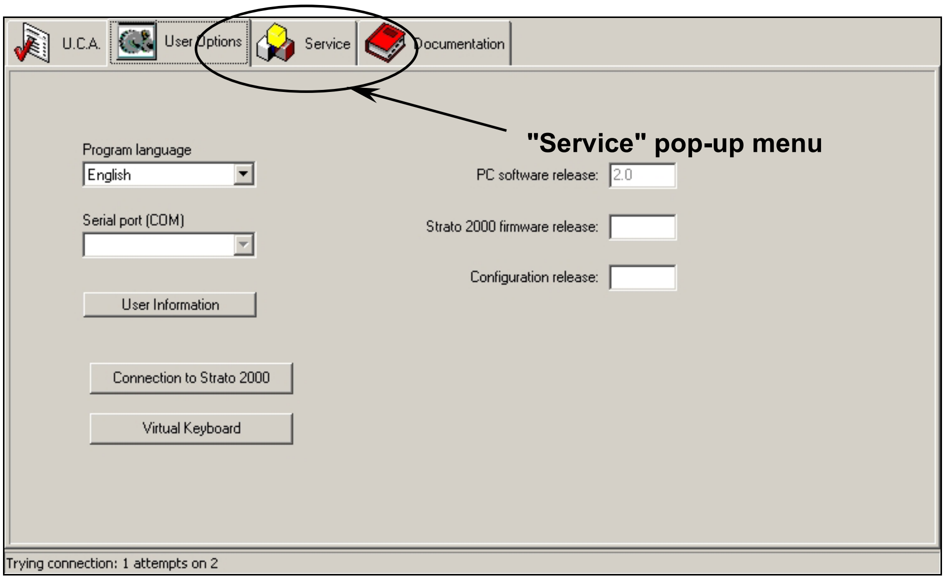


Figure 7-10

Pushing a "Service" tag; a new window will be displayed, asking for a password (Figure 7-11). This password is used to protect from unwanted access to this area that can be dangerous for the system.
The final customer must not know the password.

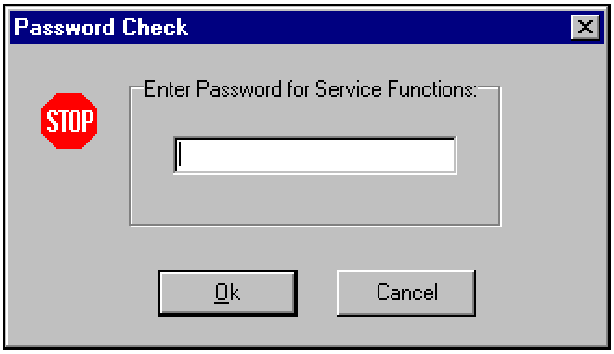


Figure 7-11

Input the name "PLUTO" (capital characters) and confirm by selecting OK or pressing the "Enter" key on the keyboard to enter into the services menu; the SoftwareUtilities program will take some seconds to receive the configuration data from the STRATO 2000 Digital.
At the end of the communication, the following windows will appear.

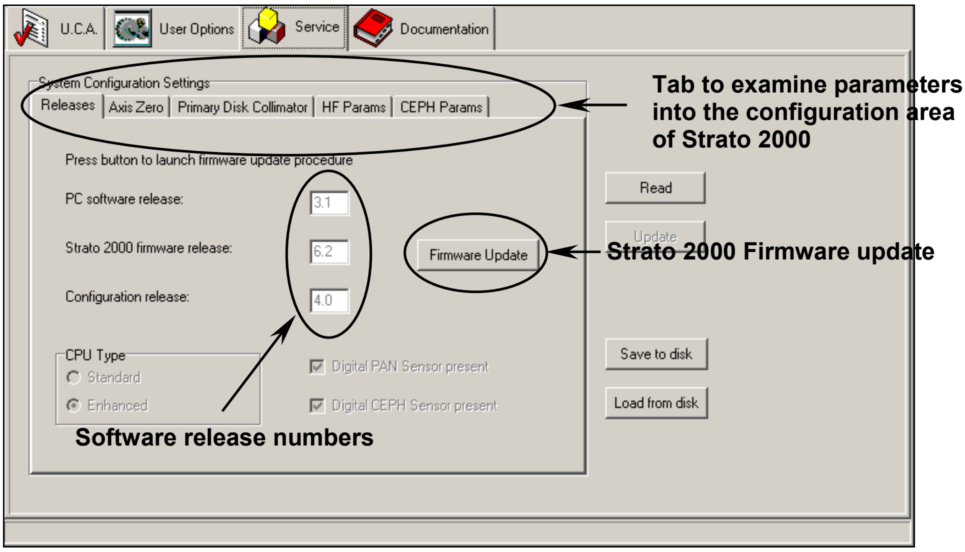


Figure 7-12

By selecting one of the Tab to examine the configuration parameters, one of the following figures will be displayed.

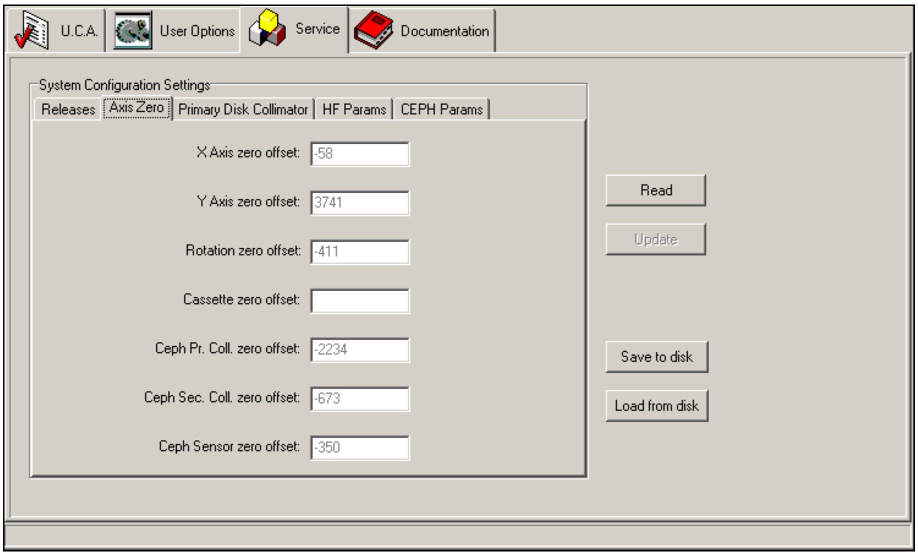


Figure 7-13: Axis Zero

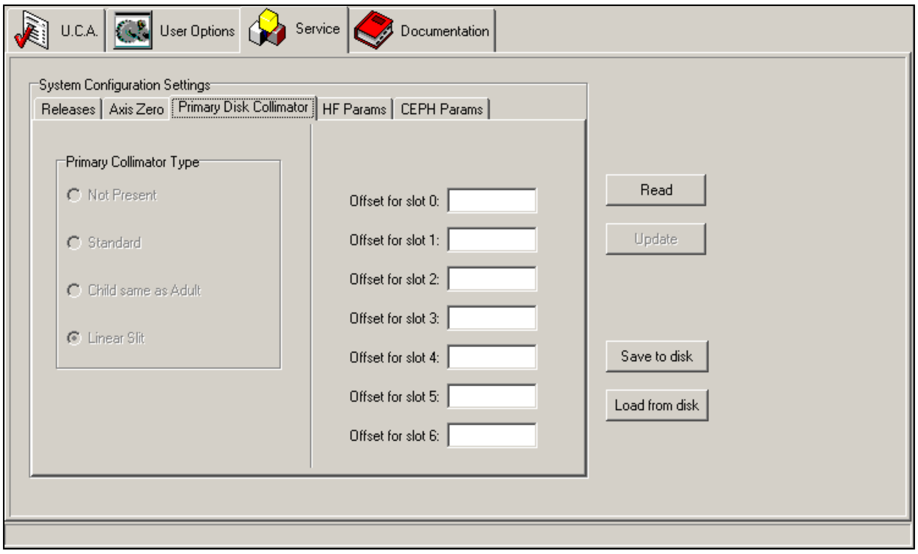


Figure 7-14: Primary Disk Collimator

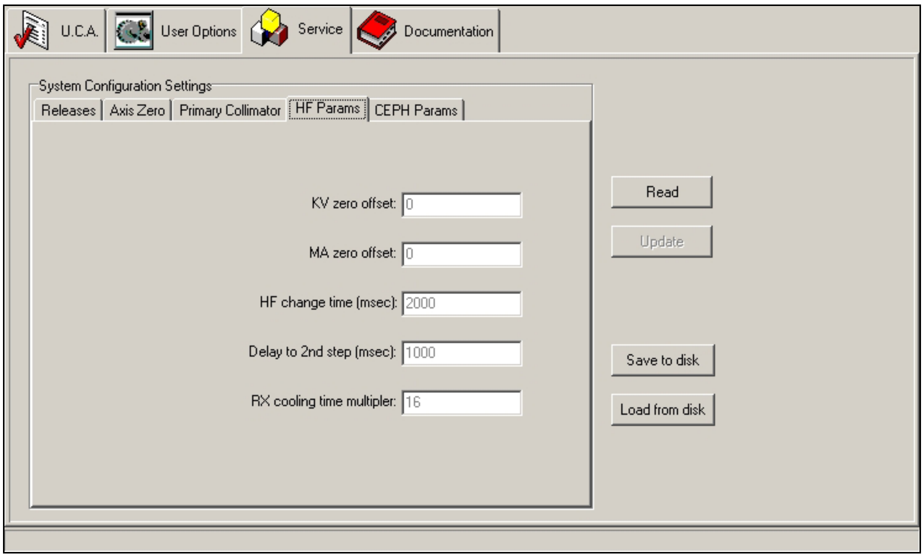


Figure 7-15: HF Params

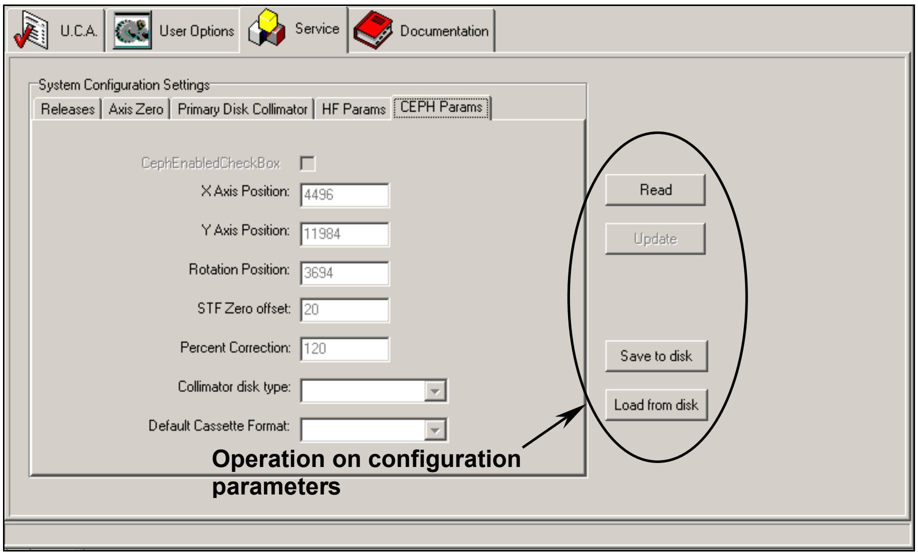


Figure 7-16: CEPH Params

NOTE:
The STRATO 2000 Digital Software Utilities there does not have the possibility to modify parameters.

The four buttons on the right side of the screens are useful to manage configuration files:

- "**Read**" button performs a new reading of the parameters from the STRATO 2000 Digital; it can be used to verify the functionality of the Upload function
- "**Save to disk**" is used to store on a file, on the hard disk or in a floppy or different media, the configuration data.
  Pressing this button, the following window appears:

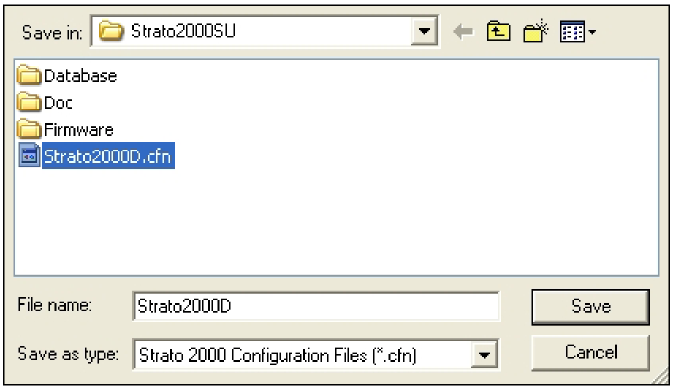


Figure 7-17

Using the stardard Windows commands, store the file with ".cfn" extension on the disk/directory selected.
As a suggestion, the doctor's name can be used to specify the file.

NOTE:
We strongly suggest to use this feature to save configuration data.

- "**Read from disk**" is the function that allows reading the configuration file from the disk (*.cfn).

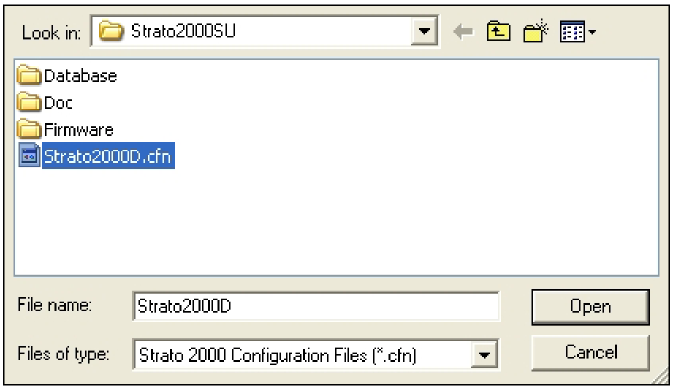


Figure 7-18

In the above picture, the file *"Strato2000D.cfn"* data will be loaded from the directory of hard disk.

- The "**Update**" button is automatically enabled every time the SW detects a change in the data; pressing it data displayed in the various windows will be uploaded into the STRATO 2000 Digital.

The last function is the Firmware updolad; this can be used in case there the need to load a new firmware release on the STRATO 2000 Digital. Selecting the button "**Firmware Update**" (Figure 7-12), the following picture will be displayed:

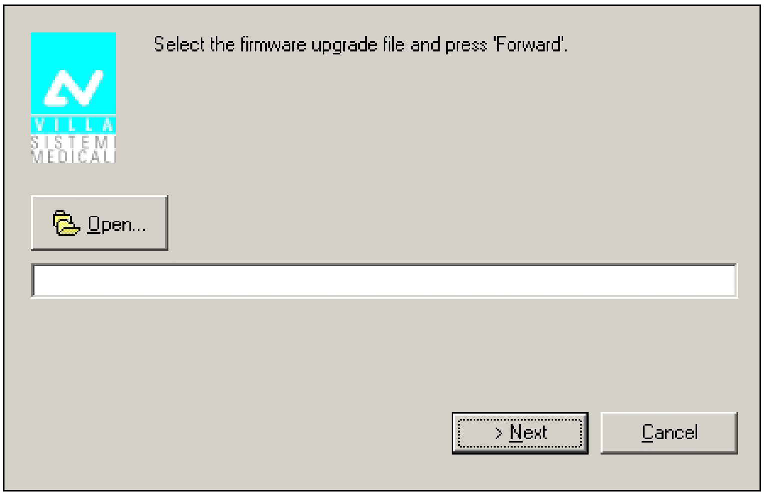


Figure 7-19

Clicking on the "Open" tab, it is possible to select the firmware file using standard window commands; the software locates automatically a folder named "Firmware" where may be contained the file, but it is possible to select it in other folders; choose the correct one. This files have the ".txt" extension.

As an example, following the file *"v5_06.txt"* is selected.

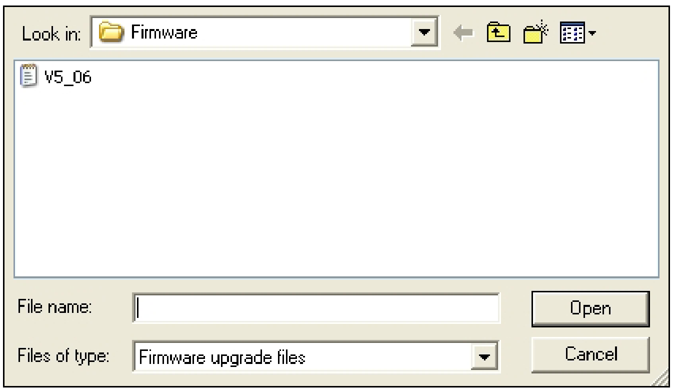


Figure 7-20

NOTE:
For STRATO 2000 Digital, the release 6.xx should be selected.

By confirming, the Firmware update procedure will start. The following windows is displayed, showing that the USB port is in use.

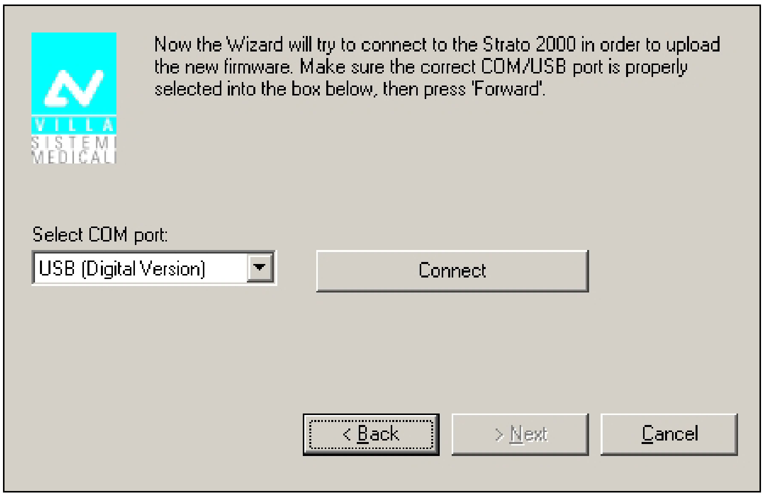


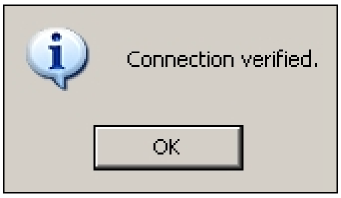
Figure 7-21

Clicking "Back" is possible to return to file update selection; click on "Connect" to start the communication with the firmware upgrade procedure on the STRATO 2000 Digital.

NOTE:

- The STRATO 2000 Digital keyboard is locked during Firmware update procedure.
- The update procedure will last for at least 25 minutes; during this time no other operations can be performed on the PC and/or the STRATO 2000 Digital.
- During the operation, a scrolling bar and a numerical indication of elapsed and remaining time is displayed.
- If the following message is displayed, please switch off the STRATO 2000 Digital, power on it again and let it reach the patient's centering position; click on "OK" and "Connect" again.

If the communication is well established, the appropriate message is showed.



Click on "OK" and a new windows will appear.

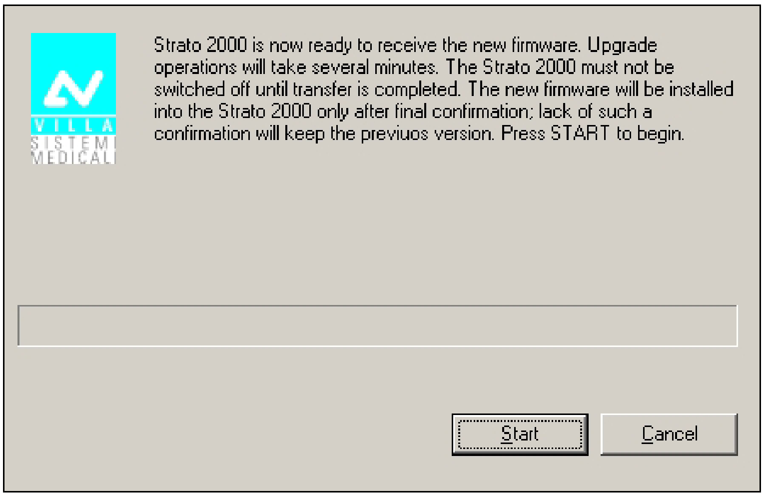


Figure 7-22

Click on "Start" to begin the software transfer procedure.
During the operation, a window showing the progress of the transfer is displayed.

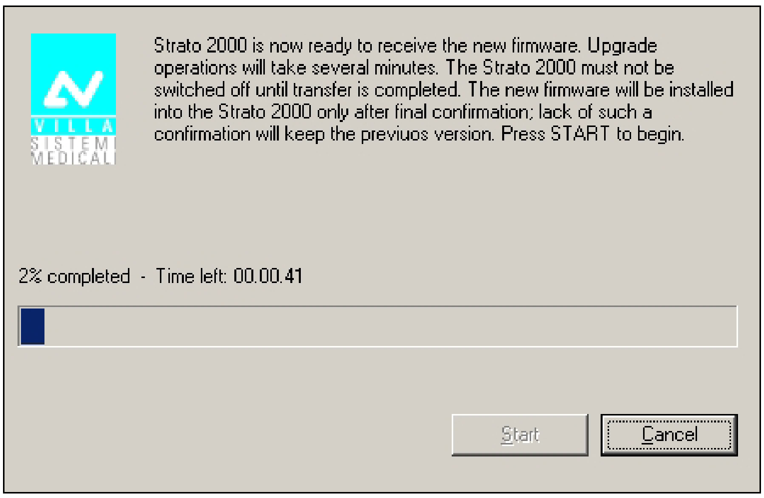


Figure 7-23

At the end, windows will appear asking to confirm the upload process.

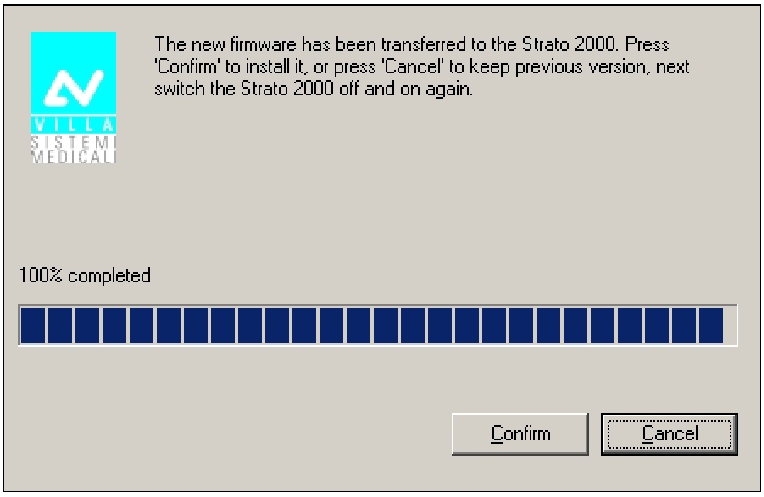


Figure 7-24

Confirming by pressing on "Confirm" or pressing the "Enter" key on the keyboard will complete the upload operation.

Now the STRATO 2000 Digital has to be reset from the main keyboard; it will boot again; the display should visualise the new software release.
There is no need to adjust the calibration of the STRATO 2000 Digital, because the previous data are maintained.
The Software Utilities program was automatically terminated so if you need to verify other data, it must be restarted again.

8. TROUBLESHOOTING

8.1. Displayed messages

STRATO 2000 Digital is fully driven by a microprocessor which controls the programming of the emission parameters and indicates via displayed messages the different conditions of the unit and any defects and errors that occur.

The messages are divided into two groups:

- **Operational messages**: messages that guide the operator in setting up the unit for performing an examination (see User Manual).
- **Error messages**: messages that are displayed when an error occurs. There are three types of error messages:

1 - Messages that could have been caused by the operator when releasing the X-ray button or pressing key "9"  when a movement is in progress.
This message will be displayed as follows:

E		x	x	x											
P	R	E	S	S		R	E	S	E	T					

xxx code number of the error message

Operating conditions are reset by pressing key "9"  .

2 - Messages arising from a system defect. In this case, the Technical Service must be called.
The messages that require the intervention of the Technical Service are displayed as follows:

E		x	x	x											
C	A	L	L		T	E	C	H		A	S	S	.		

xxx code number of the error message

3 - Messages related to problems regarding the HF board. In this case, the unit must be switched off. Wait a few seconds for the circuit capacitors to discharge and then switch the unit on again. If the problem persists, call the Technical Service.

E		x	x	x											
S	W	I	T	C	H		O	F	F		S	Y	S	T	.

xxx code number of the error message

The following table illustrates the various messages that require the intervention of the Technical Service and the reference chapters where the diagnostic procedure and the corrective actions are given.

Motors movement		
Code	**Error description**	**Reference chapter**
500	Unexpected limit switch activation X-axis	**8.3.8.1.1**
501	Unexpected limit switch activation Y-axis	**8.3.8.2.1**
502	Unexpected limit switch activation Rotation	**8.3.8.3.1**
504	X-Y-Rotation time-out motor zeroing	**8.3.8.4.1**
505	Time-out motor Y zeroing	**Action as per E501**
506	Time-out motor R zeroing	**Action as per E502 or 8.5.2**
508	Time-out motor X zeroing	**Action as per E500**
542	Collision of rotation arm with patient	**8.3.8.3.2**
Primary collimator		
Code	**Error description**	**Reference chapter**
546 (*)	Primary slit collimator Limit sensor not found	**8.3.8.5.1**
580 (*)	The zero sensor of slit primary collimator always active	**8.3.8.5.1**
592 (*)	Unexpected limit switch activation slit primary collimator motor	**8.3.8.5.1**
595 (*)	Primary slit collimator zeroing timeout.	**8.3.8.5.1**
Soft tissue filter		
Code	**Error description**	**Reference chapter**
520 (*)	Soft tissues filter timeout	**8.3.8.6.1**
521 (*)	The movement of the soft tissues filter stops at the limit switch	**8.3.8.6.1**
522 (*)	Limit switch not found during reset of soft tissues filter	**8.3.8.6.1**
523 (*)	Soft Tissue Filter zero sensor always active	**8.3.8.6.1**

***(*)** Errors related to slit primary collimator are not present in PAN ONLY machines.*

Secondary collimator		
Code	**Error description**	**Reference chapter**
545 (**)	CEPH secondary collimator Limit sensor not found	**8.3.9.2.1**
581 (**)	The zero sensor of ceph secondary collimator is always active	**8.3.9.2.1**
591 (**)	Unexpected limit switch activation CEPH secondary collimator motor	**8.3.9.2.1**
594 (**)	CEPH secondary collimator zeroing timeout	**8.3.9.2.1**
CEPH sensor		
Code	**Error description**	**Reference chapter**
544 (**)	CEPH sensor motor limit sensor not found	**8.3.9.3.1**
582 (**)	The zero sensor of ceph sensor is always active	**8.3.9.3.1**
590 (**)	Unexpected limit switch activation CEPH sensor motor	**8.3.9.3.1**
593 (**)	CEPH sensor zeroing timeout	**8.3.9.3.1**

(**) *Errors related to digital ceph arm are not present in machines without digital ceph arm.*

H.F. Board & Tubehead		
Code	**Error description**	**Reference chapter**
550	"No power supply" alarm H.F. generator board	**8.3.6.3.1**
551	H.F. generator board "overvoltage" alarm	**8.3.6.3.2**
552	H.F. generator board "overload" alarm	**8.3.6.3.3**
553	H.F. generator board "broken filament" alarm	**8.3.6.3.4**
554	H.F. generator board "no X-ray emission" alarm	**8.3.6.3.5**
555	"X-ray emission too long" alarm	**8.3.6.3.6**

Buttons		
Code	**Error description**	**Reference chapter**
560	One or more keys are reported as pressed during the switching-on phase (see following table)	**8.3.6.2.1**
561	RX key released during X-rays examination	**8.3.6.2.2**
562	RX key short-circuited during start-up and/or during examination programming	**8.3.6.2.3**
563	Remote RX key pressed during start-up and/or during examination programming	**8.3.6.2.4**
Memory checksum		
Code	**Error description**	**Reference chapter**
570	Checksum error on Flash EPROM	**8.4.1**
571	Writing error on Flash EPROM	**8.4.2**
572	Error during erase of Flash EPROM	**8.4.2**
573	Error during the verification phase of Flash EPROM	**8.4.2**
574	Unspecified error of Flash EPROM	**8.4.2**
575	Configuration data corrupted on Flash EPROM	**8.4.2**
Code	**Error description**	**Reference chapter**
503	X30 connector (jumpers) not present or not well connected	**8.5.1**
507	Wrong setup configuration (Password 90)	**8.5.3**
515	Wrong setup configuration (Password 92)	**8.5.2**
541	Panoramic sensor holder not in panoramic position	**8.3.8.3.4**
543	Panoramic sensor holder not in ceph position	**8.3.8.3.4**
600	Reset key pressed during movement	**8.3.8.3.4**
601	U.I.C. not found and/or faulty	**8.5.4**
602	Menu item not available	**8.5.5**
9xx	Protocol Error	**8.5.6**

NOTE:
The CPU board contains a non-volatile memory where all the calibration data of the unit (e.g. motor offset) and all the preference settings performed by the user (e.g. exposure parameters different from the default ones) are stored. This non-volatile memory is mounted on a small piggy-back board fitted on the CPU board through a socket. In case of replacement of the CPU board, the piggy-back board containing the non-volatile memory must be removed from the defective CPU board and installed on the new CPU board in place of the existing one which contains a blank non-volatile memory. In this way, the calibration data will be automatically loaded in the new board (otherwise these data will be lost). When removing/fitting the piggy-back board, pay attention not to damage it or the CPU board.
If the failure of the CPU is due to the non-volatile memory or to the piggy-back board, and therefore stored data are lost, see Appendix A of this manual where calibration data are listed. This information can be manually entered into the new CPU board through the service programs of the machine (passwords).

WARNING:
If the original flash Eproms cannot be reused the first operation after having replaced the full CPU is to setup the hardware configuration using Password 92 (see paragraph 8.3.3).
If this configuration is not correct the CPU board will result not operative.

If error E560 occurs, the keys pressed during start-up will also be displayed as follows:

E		5	6	0		(	x	x	x	x	x	x	x	x	)
C	A	L	L		T	E	C	H		A	S	S	.		

xxxxxxxx code number of error message 560

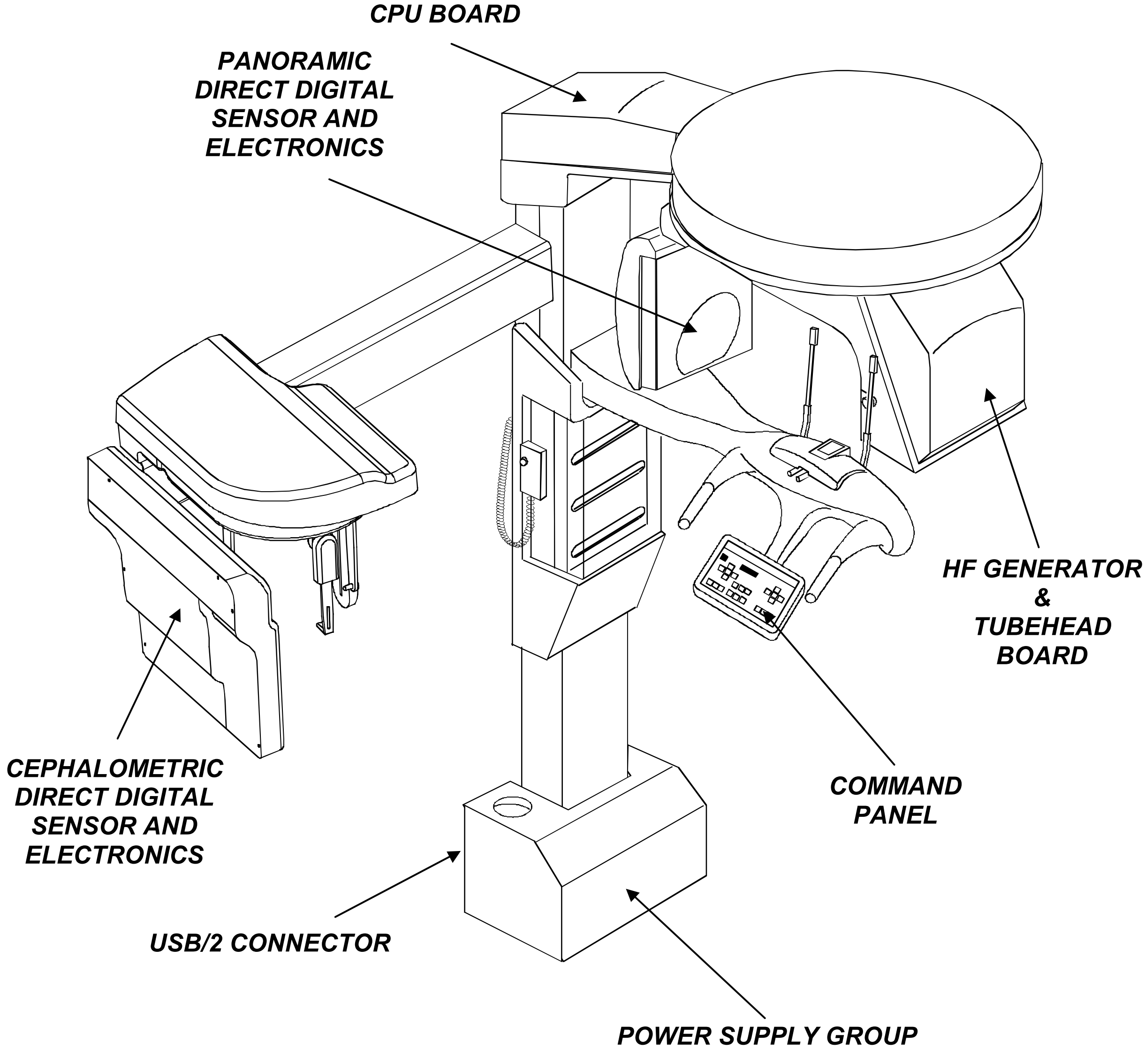
Code	Key description	Key no. (Figure 3-6)
0000000**1**	Not used	21
0000000**2**	PANORAMIC centering device	20
0000000**4**	Arrow up	22
0000000**8**	Arrow right	24
000000**10**	ENTER	23
000000**20**	Arrow left	26
000000**40**	Arrow down	25
00000**100**	Selection of arch type (wide, normal, narrow)	13
00000**200**	Column key	28
00000**800**	TMJ translateral examination selection	16
0000**1000**	Size selection (small, standard, large)	12
0000**2000**	Adult/Child selection	11
0000**4000**	CEPHALOMETRY selection	15
0000**8000**	IMPLANT selection	14
000**10000**	Column down	29
000**80000**	PANORAMIC selection	17
00**100000**	TMJ open/closed mouth selection	18
00**200000**	TMJ BIAXIAL selection	19
00**400000**	Patient input	10
00**800000**	Reset	9
0**2000000**	Increase by steps	3
0**4000000**	Column up	27
0**8000000**	kV selection	7
10000000	Exposure time selection	4
20000000	mA selection	5
40000000	Reduction by steps	6
80000000	Test	8

8.2. LEDs

This paragraph describes the diagnostic significance of the LEDs on the STRATO 2000 Digital boards.
The chapter includes the following paragraphs:

- 8.2.1 CPU board LED
- 8.2.2 HF board LED
- 8.2.3 Power supply group LED

The location of the boards is as follows:



NOTE:
The LED on the keyboard are not described in this chapter. These are described in paragraph 3.6.1. These LEDs are tested by activating password 94 (see paragraph 8.3.6.2).
The LEDs of the Direct Digital Sensor board are described on the relevant Manual.

8.2.1. CPU board LED

The following table shows the LED that are present on the CPU board, their colors, their significance and the recommended corrective actions in case of defects. To locate the LEDs, refer to the CPU A1 board illustrated in chapter 9, drawing #4, of this manual:

LED	Colour	Function	Status of the LED under normal condition	Corrective actions in case of defect
H8	Yellow	Microprocessor Watchdog circuit	ON	- The microprocessor does not work. Change the CPU board.
H10	Green	"+5VS" presence generated inside the CPU	ON	- Verifies +24V presence. - Verifies +5VS stabilizer circuit on the CPU (IC N1).
H11	Green	"+5V" presence generated inside the CPU	ON	- Verifies +24V presence. - Verifies +5V stabilizer circuit on the CPU (IC N2).
H12	Green	"+24V" presence from power supply group	ON	- Verifies +24V output from the power supply group and relative wiring system.
H13	Green	"+12VS" presence generated inside the CPU	ON	- Verifies +24V presence. - Verifies +12V stabilizer circuit on the CPU (IC N3).

In case no LEDs are turned ON no activity can be observed on the keyboard check the wiring X3 (Power Supply group) –X1 (CPU board) and the green LED on the base of the device

8.2.2. H.F. board LED

The following table shows the LED that are present on the H.F. board, their colours, their significance and the recommended corrective actions in case of defects. To locate the LEDs, refer to the layout of the HF board (A2) illustrated in chapter 9, drawing #8, of this manual:

LED	Colour	Function	Status of the LED under normal conditions	Corrective actions in case of defect
H1	Green	"Power"; correct function of the switching power supply oscillator (IC U1)	ON	- Check fuse F2 on the power supply group. - Check fuses F1 and F2 on the HF board.
H2	Green	"Filament OK"	ON	X-ray tube filament broken. Change tubehead.
H3	Red	"Overvolt"	OFF	Tubehead power supply tube overvoltage. Switch off the unit, then switch on again. If the error persist, change the H.F. board.
H4	Yellow	"X-ray ON"	ON with X-rays emission	Check the X-ray button and cable.
H5	Red	"Overload"	OFF	Tubehead power supply circuit overload. Switch off the unit, then switch on again. If the error persists, change the H.F. board.

8.2.3. Power supply LED group

The led shown in the following table is on the +24V switching power supply located at the base of the column (the layout of the +24V switching power supply module is shown in chapter 9, drawing #21, of this manual).

LED	Colour	Function	Status of the LED under normal conditions	Corrective actions in case of defect
LED	Green	Correct functioning of the +24V switching power supply.	ON	Check the presence of +24V output from the +24V switching power supply module. Disconnect the CPU (X3) board. If the defect persists, change the switching power supply module.

8.3. Service programs descriptions

This paragraph provides a brief description of the service programs (password) of the unit.
There are two levels of password; one level is used for the hardware configuration and should be used only when the entire CPU board has been replaced.
The second level enables the service engineer to perform a series of tests of the machine's functions, for example, providing the possibility of activating the various motors and verifying the correct working of the relative positioning sensors.

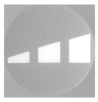
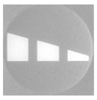
Access to the hardware configuration and service programs is as follows:

1. Switch on the unit. The following message will be displayed:

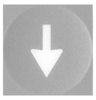
R	E	L	E	A	S	E			*	.	*	*	*		

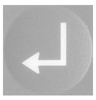
After 3 seconds, the following will be displayed:

					>	T	E	S	T	<					

2. When this message is displayed, increase key "3"  and decrease "6"  must be pressed simultaneously. After 3 seconds, the following will be displayed:

				S	E	T		U	P						
P	A	S	S	W	O	R	D	?			1	0	0		

3. Using key "22"  or "25"  , set the number of the Password relative to the desired Service Program.

- For the service programs confirm the selection by pressing key "23"  .

- For hardware configuration password confirm the selection by pressing **at the same time** keys "7" 

and "5" 

.

The hardware configuration password are the following:

- **Password 89:** collimator type selection
- **Password 90:** digital version selection
- **Password 92:** CPU type selection
- **Password 93:** Soft Tissue Filter motor type selection
- **Password 95:** kV minimum value setting.

The service programs available are the following:

- **Password 94:** test of a number of HW components in the system
- **Password 102:** allows reading of the parameters stored into the non-volatile memory of the unit (e.g. motor offset)
- **Password 118:** test on motors/positioning sensors, setting of the zero offsets of the axes and the collimators
- **Password 124:** digital ceph zero offsets and test on motors/positionig sensors of the ceph arm.
- **Password 130:** language setting for the displayed messages (the Service messages are always in English)
- **Password 143:** display and reset of the counters for the various examinations. Display of total time of the system's exposure.

The activation of the various functions provided by the service programs is made using the keyboard. The function of each key is described in the following sub-sections dedicated to the various passwords. In this phase, the console display will present data regarding the password/selected function. The relative description is given in the following paragraphs.

In this chapter, inside the specific service program description, it is possible to find a more detailed description of the different error messages listed in the table of paragraph 8.1 and suggestions for troubleshooting of the problem and correct it

8.3.1. Password 89

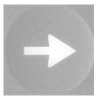
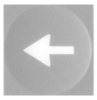
The display will show alternatively:

P	R	.		C	O	L	L	.		M	O	D	E		
N	O	T		P	R	E	S	E	N	T					

P	R	.		C	O	L	L	.		M	O	D	E		
L	I	N	E	A	R		S	L	I	T					

P	R	.		C	O	L	L	.		M	O	D	E		
S	T	A	N	D	A	R	D		M	O	D	E			

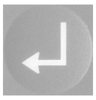
P	R	.		C	O	L	L	.		M	O	D	E		
C	H	I	L	D		A	S		A	D	U	L	T		

To move from one selection to another use keys  and  .

To confirm selection and exit from password press key "9"  .

The following message will be displayed:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

Press key "23"  to store the changes or press key "9"  if these changes are not to be stored.

Select **"NOT PRESENT"** for the PAN ONLY model.

Select **"LINEAR SLIT"** for the PAN UPGRADABLE to DIGITAL CEPH model.

WARNING:
DO NOT MODIFY FACTORY SELECTION; FUNCTIONALITY CAN BE SEVERELY IMPAIRED.

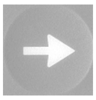
8.3.2. Password 90

The display will show:

D	I	G	I	T	A	L		S	E	T	U	P			
D	I	G	I	T	A	L		M	O	D	E		O	F	F

or

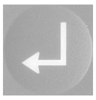
D	I	G	I	T	A	L		S	E	T	U	P			
D	I	G	I	T	A	L		M	O	D	E		O	N	

To move between selection, use key  as a toggle.

To confirm selection and exit from password press key "9"  .

The following message will be displayed:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

Press key "23"  to store the changes or press key "9"  if these changes are not to be stored.

Select "**DIGITAL MODE ON**".

WARNING:
DO NOT MODIFY FACTORY SELECTION; FUNCTIONALITY CAN BE SEVERELY IMPAIRED.

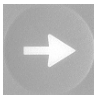
8.3.3. Password 92

The display will show:

C	P	U		T	Y	P	E		S	E	T	U	P		
E	N	H	A	N	C	E	D		C	P	U				

or

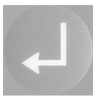
C	P	U		T	Y	P	E		S	E	T	U	P		
S	T	A	N	D	A	R	D		C	P	U				

To move between selection, use key  as a toggle.

To confirm selection and exit from password press key "9"  .

The following message will be displayed:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

Press key "23"  to store the changes or press key "9"  if these changes are not to be stored.

Select "**ENHANCED CPU**".

WARNING:
DO NOT MODIFY FACTORY SELECTION; FUNCTIONALITY CAN BE SEVERELY IMPAIRED.

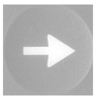
8.3.4. Password 93

The display will show:

S	T	F		M	O	T	O	R		S	E	T	U	P	
T	Y	P	E		2										

or

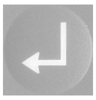
S	T	F		M	O	T	O	R		S	E	T	U	P	
T	Y	P	E		1										

To move between selection, use key  as a toggle.

To confirm selection and exit from password press key "9"  .

The following message will be displayed:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

Press key "23"  to store the changes or press key "9"  if these changes are not to be stored.

Select **"TYPE 1"** or **"TYPE 2"** according with Soft Tissue Filter motor type indicated in Appendix B.
Default setup is **"TYPE 2"**.

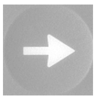
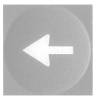
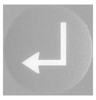
8.3.5. Password 94

This password is used for testing a number of system components. Upon access to this function, the following menu is displayed:

T	E	S	T		M	E	N	U							
<	m	e	n	u		o	p	t	i	o	n	>			

where <menu option> indicates one of the following selectable functions:

- <Test Input Ports>: Input ports test
- <Test Keyboard>: Keyboard test
- <Test kV circuit>: XR tube piloting voltage generation circuit test
- <Test mA circuit>: XR tube filament current generation circuit test

Scrolling through the various functions is made using the keys:  (forward scroll) and  (backward scroll). Scrolling is made in rotation. To enter a function press key "23"  .

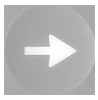
8.3.6. Password 95

This password is used for setting the minimum kV value that can be selected in exam mode. Upon access to this function, the following menu is displayed:

F	O	R	C	E		M	I	N		6	0		k	V	
F	O	R	C	E		M	I	N		k	V		O	F	F

or

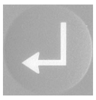
F	O	R	C	E		M	I	N		6	0		k	V	
F	O	R	C	E		M	I	N		k	V		O	N	

To move between selection, use key  as a toggle.

To confirm selection and exit from password press key "9"  .

The following message will be displayed:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

Press key "23"  to store the changes or press key "9" 

if these changes are not to be stored.

Select **"OFF"** to set the minimum kV value to 50kV.

Select **"ON"** to set the minimum kV value to 60kV.

NOTE:
The minimum value in service programs is always 50kV.

8.3.6.1. Input ports test

This function is used to carry out diagnostics at low level of the various input signals of the CPU board. It may be used, for example, to verify the limit switches without necessarily moving the axes but manually activating the microswitches.

The display will be updated as follows:

T	E	S	T		I	N	P	U	T		P	O	R	T	S
D	y	y						8	7	6	5	4	3	2	1

NOTE:
The characters presented on the display have been substituted with letters in this figure, so that the significance/function of each one can be described more clearly:

- **yy**= selected port code (D9, D10, D11, D12, D17)
- **87654321**= logic status of the port inputs.

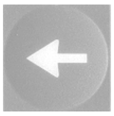
The port code correspond to the chip initials as per the wiring diagram, while the status of the bits describes the logic level of the inputs on the selected port.

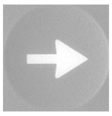
NOTE:
The following table describes the correspondence between the displayed figures and the corresponding input signal. The digits are numbered from 8 to 1. The eighth digit corresponds to the character furthest to the left on the display, while digit 1 corresponds to the character furthest to the right.

Port	Bit	Association	µSwitch/sensor initials	Logic status at rest
D9	8	Y-axis forward limit switch	S5	0
	7	Y-axis backwards limit switch	S8	0
	6	Y-axis back with respect to zero	S6	see Note
	5	Y-axis forward with respect to zero	S6	see Note
	4	X-axis left limit switch	S9	0
	3	X-axis right limit switch	S12	0
	2	X-axis to right of zero	S10	see Note
	1	X-axis to left of zero	S10	see Note
D10	8	Right rotation limit switch (clockwise)	S13	0
	7	Left rotation limit switch (anti-clockwise)	S16	0
	6	Rotation to right of zero	S14	see Note
	5	Rotation to left of zero	S14	see Note
	4	Left cassette limit switch	S18	NOT USED
	3	Right cassette limit switch	S17	NOT USED
	2	Left secondary collimator - IMPLANT position	S20	NOT USED
	1	Right secondary collimator - PANORAMIC position	S21	NOT USED
D11	8	Primary collimator in zero position	S22	NOT USED
	7	Soft tissue filter all in field	S23	NOT USED
	6	Limit switch column all down	S27	0
	5	Limit switch column all up	S26	0
	4	Sensor holder NOT in PANORAMIC position	S25	1
	3	Sensor holder in PANORAMIC position	S24	1
	2	X-rays button on column		1
	1	Sensor ready	S19	0
D12	8	not used		
	7	not used		
	6	not used		
	5	not used		
	4	not used		
	3	not used		
	2	not used		
	1	Remote control X-rays button		0
D17	8	X-rays presence sensor		1
	7	X-ray tube filament broken alarm		0
	6	H.F. board overload alarm		1
	5	H.F. board overvoltage alarm overvoltage		1
	4	H.F. board - no power supply		0
	3	not used		
	2	Soft Tissue Filter zero sensor	B2	0
	1	Slit primary collimator zero sensor	B1	0

NOTE:
The logic status of these signals depends on the physical position of the relevant microswitch with respect to the "0" position. Check the functioning of the microswitch by moving the relevant axis (motor/movement) and checking that the logic status changes.

The keys active for this test are:


Displays the preceding port in the list of ports present (key "26")

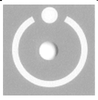

Displays the next port in the list of ports present (key "24")

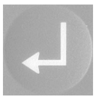

Returns to the main menu (key "9")

8.3.6.2. Keyboard test

This function is used to verify the functions of the keys and the relative light indicators.
Upon access, only the title of the function is displayed:

K	E	Y	B	O	A	R	D		T	E	S	T			

After which the system awaits the pressing of a key. Each time a key is pressed the description of the key (character string) and the code (hexadecimal numeric value) is displayed and for those keys associated with a LED, the corresponding LED lights up. In order to be able to verify the light indicators "1"  and "2"  that are not associated to keys, the system lights up the two LEDs upon entering the function.

For example, when key "23"  is pressed, the display shows the following message:

K	_	E	N	T	E	R									
C	O	D	E	:		0	x	0	0	0	0	0	0	1	0

The function is exited by pressing key "9" . Before quitting, the following message is displayed:

K	_	R	E	S	E	T									
C	O	D	E	:		0	x	0	0	8	0	0	0	0	0

To enable the reading of the "RESET" key code. After two seconds, the display returns to the main menu.

There are a set or errors, grouped in the range E560 to E563 for the diagnostics of the functionality of the keyboard; E560 is specifically for a problem related only to the keyboard functionality, while the others are related to emission buttons (local and remote).

8.3.6.2.1. ERROR 560: One or more buttons pressed at start-up

If error E560 occurs, the keys pressed during start-up will also be displayed as follows:

E		5	6	0		(	x	x	x	x	x	x	x	x	)
C	A	L	L		T	E	C	H		A	S	S	.		

xxxxxxxx code number of error message 560

The xxxxxxxx characters are used to identify the pressed button, according to the following table:

Code	Key description
0000000**1**	IMPLANT centering device
0000000**2**	PANORAMIC centering device
0000000**4**	Arrow up
0000000**8**	Arrow right
000000**10**	ENTER
000000**20**	Arrow left
000000**40**	Arrow down
00000**100**	Selection of arch type (wide, normal, narrow)
00000**200**	Column key
00000**800**	TMJ translateral examination selection
0000**1000**	Size selection (small, standard, large)
0000**2000**	Adult/Child selection
0000**4000**	CEPHALOMETRY selection
0000**8000**	IMPLANT selection
000**10000**	Column down
000**80000**	PANORAMIC selection
00**100000**	TMJ1-TMJ2 selection
00**200000**	TMJ BIAXIAL selection
00**400000**	Patient input
00**800000**	Return
0**1000000**	Not used
0**2000000**	Increase by steps
0**4000000**	Column up
0**8000000**	kV selection
10000000	Exposure time selection
20000000	mA selection
40000000	Reduction by steps
80000000	Test

1. Try to unlock the pressed buttons.
2. Check the cable from keyboard to CPU, looking especially to the connector between chin rest and column.

NOTE:
The usual fault of the cable is a poor contact on this connector and the result can be an unreadable message but the machine looks functional, or the column does not move, etc..

3. Check also the cable up to the CPU X22 connector.
4. If the cabling is OK, replace the keyboard.

8.3.6.2.2. ERROR 561: X-ray button released during emission

This message appears only if, during an examination with or without emission, the X-ray button has been released.
Press the reset button and restart the operation as suggested by the control system.

8.3.6.2.3. ERROR 562: X-ray button pressed during start-up or during exam preparation

This message is displayed if the X-ray button is sensed pressed during the power on or during the preparation of the exam, that is during the movements of the rotating arm to reach the initial position.

1. If the button was not intentionally pressed, power off the machine, disconnect the connector X47 on the CPU and power on the machine again. If the message continues to be displayed, replace the CPU.
2. Check the cable from X51 up to the local button and replace it if faulty.
3. In case the X-ray button is faulty because always closed, replace it.

8.3.6.2.4. ERROR 563: Remote X-ray button pressed during start-up or during exam preparation

This message is the equivalent of the above message but applies to the remote one.

1. Repeat the above steps, but disconnect the cable from connector X51.
2. Check the cable from X51 up to the X0 connector on the main base.
3. Disconnect the remote X-ray button from X0 connector on the main base plate and verify that the error disappear; if remains, check the cable from power board to CPU.
4. In case the X-ray button is faulty because always closed, replace it.

8.3.6.3. kV / mA Piloting Circuits Test

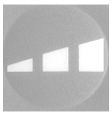
The two functions are described together as they behave in exactly the same way. This test is aimed at verifying the functionality of the CPU and the connection between the CPU board and the HF board.

The H.F. board piloting signals (anode voltage and filament current) is generated by an 8-bit D/A converter (i.e. at 256 levels). The two functions described change the output level and therefore piloting voltage of the H.F. board within the range: 0 - 255 that corresponds to a variation of between 0 to 10 Volts at the converter output.

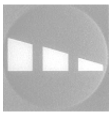
Upon access to this function, the current setting of the output level and the corresponding voltage value is displayed:

T	E	S	T		m	A		C	I	R	C	U	I	T	
L	E	V	E	L	=	6	4				2	.	5	V	

The active keys for this test are the following:



Increases the output level by one unit to a minimum of zero (key "3")



Decreases the output level by one unit to a maximum of 255 (key "6")

Returns to the main menu (key "9")

The voltage values set via this test can be measured with a DVM on the following test points on the CPU board X35 (see chapter 9, drawing #3):

- TP1 = GND
- TP2 = kV
- TP3 = mA

The voltages set with this test must be measured on the above test points with a tolerance of ± 10%. Each increment bit causes a variation of 39mV.
Check different settings to see the correspondence between the level set and the Volt value displayed and measured; in case there is no correspondence or no variation changing the settings, replace the CPU board.
Making reference to the HF board layout and schematics, connect the DVM probes to test points TP4 (ground) and TP5 (kV), repeat setting variations and check the correspondence of values; if there is no correspondence or no variations it is likely that the cabling between the CPU and the HF board is broken, so replace it.

NOTE:
When this function is quit the voltage value present at the moment of access to the function is reset. Therefore, this function cannot be used to permanently change the piloting voltages. Furthermore, it is possible that when the piloting voltages are changed, this could activated the HF board protection system (e.g. OVERVOLTAGE), with the consequent block of the X-rays emission. It is therefore recommended that the unit be reset upon completion of the diagnostic procedure of the piloting voltages.

There is a set of errors which help diagnose the functionality of the HF power supply section of the STRATO 2000 Digital. The HF board is located on the rotating arm, just above the tubehead/collimator assy. To access it, remove the upper plastic cover of the rotating arm and remove also the metal cover; in this way it will be possible to look at the various LEDs mounted on the board.

WARNING:
In the HF power board a voltage of 400 V is present; this voltage is also applied during a discharging period of the high voltage capacitor filter that feed the board, so caution has to be taken also if mains has been cut off in advance.

8.3.6.3.1. ERROR 550: No voltage present on HF board

This message means that there is no voltage feeding the board; this can be checked looking at the LED H1 that must be ON.
If ON, check the cable X5 from the board to CPU and replace it if interrupted.

1. If the LED H1 is off, check fuse F1 on the power supply group located on the base; check also fuses F1 and F2 on the board itself and replace the blown one.

WARNING:
If one of the above fuses blown, may be that a short circuit on the board/tubehead occur, so carefully power on the system after the replacement, because the failure can replicate.

2. Check resistor R9 (4R7 1W) of the HF power board; if broken, replace it with another one of the same value and power dissipation.
3. If the LED H1 is ON and the error message is still present, check the status of bit 4 of port D17, using the password 94. The normal condition is 0; if 1, check the cable X5 from the HF power board to CPU. If the cable is OK and the signal is still 1, a possible fault of the CPU is the cause.
4. If fuse F1 on the base is blown, check the cable X5 from the base to X29 on the filter box located on the rotating arm; disconnect carefully X29 and verify that the fuse does not blow. If yes, means that the cable itself is short circuited.
5. Power off the system; reconnect X29 and disconnect X1 on the HF board. Power on the system and verify that the fuse do not blow; if it blows, a short circuit on the filter box occur, so replace the filter and/or the cable.
6. Power off the machine and reconnect X1, disconnecting the cables feeding the tubehead, X2 and X3 of the HF board; repeat the power on procedure. A blown fuse means a short circuit on the HF power board, so replace it. **A fault in this board can also be caused by a discharge on the tubehead. Please notice that the HF board has always to be replaced together with the tubehead because there are adjustments needed to match the two components.**

8.3.6.3.2. ERROR 551: Overvoltage

This message can occur during a power on state if the system was switched off and on with a rapid sequence; switch off the system and wait for half a minute before powering it on again.

1. If the error remains; look at LED H3 that should be ON; if it is OFF, check the cable X5 from the HF board to the CPU.
2. If ON, possible cause can be a fault on the cable X4 (HF) to X9 of the CPU; check all contacts looking for loosen wires.
3. Verify the status of bit 5 of D17 using the password 94; it must be 1 in normal status (no error present) and 0 when there is an error. If there is a difference between the status bit and the LED, check the cable X5 from HF power board to CPU; eventually replace the cable or CPU.
4. If all test failed (that is, all cables are OK), check the values of kV set on the output of the CPU board, using a digital meter set to VDC and following the steps described on paragraph 7.2 and 7.3.

8.3.6.3.3. ERROR 552: Overload

1. Check the LED H5, that should be ON; in case it is OFF, check cable X5.
2. If ON, performs the steps from 2 to 4 described for error E551, looking at the status of bit 6 (normal status 1) of the port D17.

8.3.6.3.4. ERROR 553: Broken filament

This message means that the system detects a fault on the circuit feeding the X-ray tube filament; a small current is always circulating in the filament to reduce the pre heating time and reduce temperature stress; if the circuit is interrupted, the above message is displayed.

1. Power off the machine; using a digital meter check the ohm value between X3.5 and X3.6 of the connector X3 of the HF power board. A low value has to be measured. If an open circuit is sensed, disconnect the connector X3 and check the continuity of the wires from X3.5 and X3.6 to the tubehead.
2. If a broken cable is sensed, replace it, otherwise the tubehead has to be replaced.
3. Check that LED H2 is ON; if off, check the cable X5.
4. If the Led is ON, check the cable X3 from the HF power board to the tubehead.
5. Look at the status of bit 7 of port D17, using the password 94. Normal status of the bit is 0 (with no error condition) and 1 if there is an error. If there is a difference between the bit the LED status, and the cable X5 from HF power to CPU.
6. Replace the tubehead. **Please notice that the HF board and the tubehead have always to be replaced together because there are adjustments needed to match the two components.**

8.3.6.3.5. ERROR 554: No X-ray output

This message is visualised if, during examination, the system does not sense the X-ray ON signal at the preset time.

1. Check the fuse F2 on the HF power board; eventually replace it. If the fuse continues to blow out, try to perform an exposure with the connector X3 disconnected. If the fuse continues to blow, means that there is a short circuit on the HF power board, so it must be replaced. Otherwise, there is a possible short circuit on the tubehead. Note that also in case of faulty HF power board, the tubehead can be defective.
2. Performs an exposure, looking at LED H4, the yellow one. It must light up during the emission. If the LED is lit and the message is displayed, check the cable X5 up to the CPU.
3. If the LED does not light up and the fuse F2 is OK, the problem can be caused by a loose contact on the cable X5; check the cable X5, looking carefully to signal coming from the CPU to the HF generator.
4. If the cable X5 is OK, verify the input bit 8 of port D17 using password 94; if it is always 1, means that the input port or the cable is broken. If input the input port is broken, replace CPU.
5. If the LED is off and the error message is still present, repeat the above test on port D17.

8.3.6.3.6. ERROR 555: X-ray output too long

This message means that the control system senses the signal of "X-ray on" also after the allowed time for that signal to go off. **This is a dangerous situation because an unwanted emission can be present up to the intervention of safety backup timer, that disconnect the HF power.**

1. Check the yellow LED H4 of the HF power board; if it is still ON, power off the STRATO 2000 Digital immediately.
2. Check cable X3 and X4 from the HF power board to the CPU; if incorrect replace the faulty cable, otherwise replace the HF power board. **Please notice that the HF board and the tubehead have always to be replaced together because there are adjustments needed to match the two components.**

8.3.7. Password 102

This password allows the service engineer to read all parameters stored into the non-volatile memory of the system.

Parameters that can be read are the following:

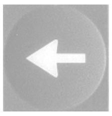
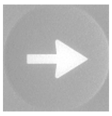
- Motor offsets
- Status of optional examination (OFF=disable, ON=enabled)
- Language selection
- Status of the machine system settings
- Exam counters.

NOTE:
Same of displayed data are meaning less in this software release.

When accessing password 102 the following message appears on display:

L	A	N	G	U	A	G	E								
x	x	x	x	x	x	x									

The active keys for this test are the following:

 or 

Selection of the different parameters (key "26" or "24")

Quits password (key "9")

To quit Password 102, press "9" . The unit returns to normal working condition.

8.3.8. Password 118

WARNING:
All movements of the STRATO 2000 Digital controlled by stepper motors are based on counting the number of steps starting from a reference position defined by a zero sensor transition.
The mechanical centering of the different movements is achieved determining the number of steps between the zero sensor transition position and the centering position. This reference steps number is called OFFSET and is a calibration parameter of each motor.

This password activates the motors present in the unit except those of the ceph arm, verifies the functions of the relative positioning sensors (microswitches or optoisolators) and performs a series of operations necessary for the calibration phase.

The following functions are verified with password 118:

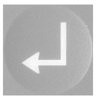
- X-axis motor and relative sensors (identified with X Zero)
- Y-axis motor and relative sensors (identified with Y Zero)
- Rotation motor and relative sensors (identified with Rotation Zero)
- Primary collimator motor and relative sensor (identified with PR.COLL. SETUP) (*)
- Soft Tissue Filter motor and relative sensor (identified with TEST STF) (*)
- Column movement motor and relative sensors (identified with Test Column).

***(*)** Only for machine with slit primary collimator.*

Each of the above motor is described in detail here below.

Upon access to this password the following message is displayed:

M	A	C	H	I	N	E		S	E	T	T	I	N	G	

Press key "23"  , the machine will move and the following message will be displayed:

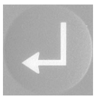
		W	A	I	T		F	O	R						
M	A	C	H	I	N	E		S	E	T	T	I	N	G	

When the machine stops, the following message will be displayed:

S	E	R	V	I	C	E		M	E	N	U				
X		Z	E	R	O										

When quitting each function (press key "9" ), and if data has been changed, the following message will be displayed:

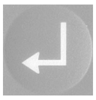
U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

Press key "23"  to store the changes made or press key "9"  not to store them. The rotation group will return to its previous position and the following message will be displayed:

R	E	S	T	O	R	I	N	G							
A	X	I	S		P	O	S	I	T	I	O	N	.	.	.

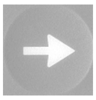
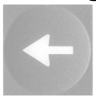
Press key "9"  to quit Password 118. The following message will be displayed:

C	O	N	F	I	R	M		E	X	I	T	?			
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

Press key "23"  to quit the password or key "9"  to remain in password 118.

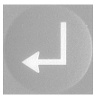
NOTE:
All changes made and stored result in the loss of the original calibration data. The user is therefore recommended to make and store only those changes that are deemed necessary.
If changes are made and stored but the user quits password 118 by switching the system off and not going through the normal quitting procedure, the stored data will be lost and the system will be reset to the previous data.

8.3.8.1. X-Axis Zero (M5 Motor)

The movement of the X-axis is perpendicular to the column. It therefore moves to the right () when it moves away from the column, and to the left () when it moves towards the column. The concept of right and left is given in relation to the operator who is positioned in front of the keyboard/patient.

This test is accessed by activating password 118. When the following message is displayed:

S	E	R	V	I	C	E		M	E	N	U				
X		Z	E	R	O										

Press key "23"  . The following message will be displayed:

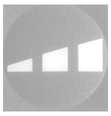
X		Z	E	R	O		[	f	f	]		a	b	c	d
Z	E	R	O		O	F	F	S		±	e	e	e	e	e

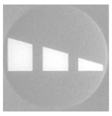
NOTE:
The characters presented on the display have been substituted with letters in this figure, so that the significance/function of each one can be described more clearly.

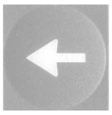
NOTE:
The components described here below (microswitches) can be seen on the block diagram in paragraph 3.5 and in Figure 8-1.

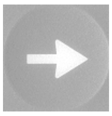
- **a** = S9 microswitch status (N.O.: 0= contact open; 1=contact closed)
- **b** = S10 microswitch-switch status (N.O.: 0= contact open; 1=contact closed)
- **c** = S10 microswitch-switch status (N.C.: 0= contact open; 1=contact closed)
- **d** = S12 microswitch status (N.O.: 0= contact open; 1=contact closed)
- **eeeee** = number of correction steps (of the motor) (offset)
- **ff** = speed of motor shift
- **X ZERO** = indicates the selected motor. In this case the X-axis motor.

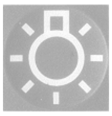
The active keys for this test are the following:

 Increases the speed of the motor (key "3")

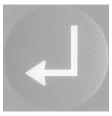
 Decreases the speed of the motor (key "6")

 Shifts the carriage to the left (key "26")

 Shifts the carriage to the right (key "24")

 Switches ON/OFF the Panoramic/TMJ centering device (key "20")

 Quits the motor function, does not save the changes made and returns to the "Service Menu" display (key "9")

 Upon quitting saves the changes made (key "23")

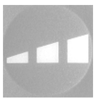
8.3.8.1.1. ERROR 500

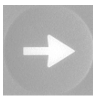
This error is displayed when there is an unexpected transition of limit switches S9 or S12 of X-axis

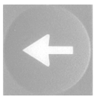
Entering in the X-axis service program it is possible to check the cause of the error.

In normal conditions the display must visualise "0XX0" instead of characters "abcd"; that is, status of "b" and "c" depend on the current position. These values are linked to opposite side of the same microswitch, so the possible status can be "0100" or "0010"; the situation "0110" is possible only for a short time.

- If a, b, c, and d are all 1, check the cable harness X50 up to the connector on the CPU board
- if a and/or d are set to 1 at the same time; verify that switches S9 and/or S12 can be activated/deactivated; this test can be performed using a DVM set to measure Ω. If glued, replace the microswitch, otherwise check cable X50
- if the cable is OK, check input port D9, bits 4 and 3; eventually activate/deactivate manually the switch looking at the corresponding bit, that must change its status
- if switch and cable are OK but bit doesn't change, the CPU port is broken; replace the CPU.

1. Using key  , set speed (ff) equal to 5.

2. Pressing the  key, the arm must move to right, so away from the column; continue to press it until the arm stops; the display must show 0011; if not check the switch S12 and/or the cable X50, as described before.

3. Pressing the  key, the arm must move toward the column; continue until the arm stops the end and the display must show 1100; if not, check the switch S9 and/or the cable X50, as described before.

4. Check that, during the movement the bits b and c change the status; as these are linked to a single switch, S10, so they must change at the same time. If they do not change, check S10.
   - check the functionality of S10.
   - if glued, replace it.
   - if not, verify the port D9, bits 1 and 2. If the displayed value do not change also if the switch is activated and the cable has been tested OK, the CPU port is broken; replace it.

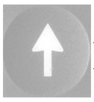
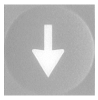
   If the switch S10 does not change its status, the control system will not be able to determine the zero position of X axis, so the message error E508 will be displayed.

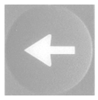
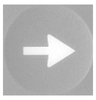
5. If there is no variations of above signals, if arm does not move or moves with difficulty or jumps:
   - check the belt and verify that it is not broken; if the belt is loose, adjust its tension
   - check cables X39 and X38; there can be a short circuit or a broken wire; check also for a loosen contact. In case of short circuit, replace the cable, verifying also that no damage has been caused to the motor driver (D25) on the CPU.

6. If there is no variation of the above signals and the arm moves, verify the cable X50 up to the CPU board. If still there is no variation of the signals when there is an activation of the switches, change the CPU board.

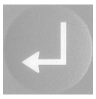
In case of no motion, it is possible that the problem is related to the motor: in order to check this connect the driver of the X-axis motor to the rotation motor putting X20 cable on X19 connector on the CPU board.
Try to move the motor and look at the rotation arm: if it rotates the problem is either on the motor (or in its mechanism) or in the interconnecting board A7; if the arm does not rotate the problem is in the electronics, but it should have already been detected in steps 1-6.
Take care to restore the correct connections.

8.3.8.2. Y-Axis Zero (M4 Motor)

The movement of the Y-axis is parallel to the column. It therefore moves forward () when it goes nearer to the patient or backwards () when it goes nearer to the operator. The concept of back and forth is given in relation to the movement along the operator/patient direction.

This test is accessed in password 118 by pressing key "26"  or key "24"  until the following message is displayed:

S	E	R	V	I	C	E		M	E	N	U				
Y		Z	E	R	O										

Press key "23"  . The following message will be displayed:

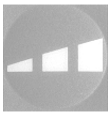
Y		Z	E	R	O		[	f	f	]		a	b	c	d
Z	E	R	O		O	F	F	S		±	e	e	e	e	e

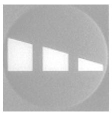
NOTE:
The characters presented on the display have been substituted with letters in this figure, so that the significance/function of each one can be described more clearly.

NOTE:
The components described herebelow (microswitches) can be seen on the block diagram in paragraph 3.5 and in Figure 8-1.

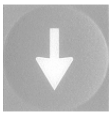
- **a** = S8 microswitch status (N.O.: 0= contact open; 1=contact closed)
- **b** = S6 microswitch-switch status (N.O.: 0= contact open; 1=contact closed)
- **c** = S6 microswitch-switch status (N.C.: 0= contact open; 1=contact closed)
- **d** = S5 microswitch status (N.O.: 0= contact open; 1=contact closed)
- **eeeee** = number of correction steps (of the motor) (offset)
- **ff** = speed of motor shift
- **Y ZERO** = indicates the selected motor. In this case the Y-axis motor.

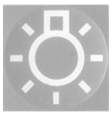
The active keys for this test are the following:


Increases the speed of the motor (key "3")


Decreases the speed of the motor (key "6")

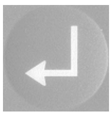

Shifts the carriage towards the patient (key "22")


Shifts the carriage towards the operator (key "25")

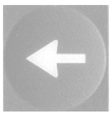

Switches on/off the panoramic centering device/TMJ (key "20")

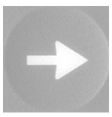

Allows to carry out a 180° rotation, to check the proper alignment of the "Y" axis with respect to the "0" position. This can be verified by measuring the distance between the sensor holder and the "Y" line on the centering tool (code 54099002). The two distances measured in position 0° and after the 180° rotation must be the same (± 1mm) (key "8")


Quits the motor function, does not save the changes made and returns to the "Service Menu" display (key "9")


Upon quitting saves the changes made (key "23")

The X-axis motor function can be accessed directly from the Y-axis function using the following keys:


Access X-axis motor test and shift the carriage towards the column (key "26")


Access the X-axis motor and shift the carriage away from the column (key "24")

When one of the two above keys are pressed, the following will be displayed:

X		Z	E	R	O		[	f	f	]		a	b	c	d
Z	E	R	O		O	F	F	S		±	e	e	e	e	e

After a few seconds key "26 or 24" has been released, the display will return to the following message:

Y		Z	E	R	O		[	f	f	]		a	b	c	d
Z	E	R	O		O	F	F	S		±	e	e	e	e	e

NOTE:
When this function is quit and the settings are stored, the system will store any variations made both to the offset of the Y-axis motor and that of the X-axis motor.

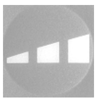
8.3.8.2.1. ERROR 501

This error is displayed when there is an unexpected transition of limit switches S5 or S8

Entering in the Y-axis service program it is possible to check the cause of the error.

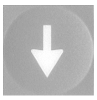
In normal conditions the display must visualise "0XX0" instead of characters "abcd"; that is, status of "b" and "c" depend on the current position. These values are linked to opposite side of the same microswitch, so the possible status can be "0100" or "0010"; the situation "0110" is possible only for a short time.

- If a, b, c, and d are all 1, check the cable harness X33 up to the connector on the CPU board
- if a and/or d are set to 1 at the same time; verify that switches S5 and/or S8 can be activated/deactivated; this test can be performed using a multimeter set to measure Ω. If glued, replace it, otherwise check cable X33
- if the cable is OK, check input port D9, bits 7 and 8; eventually activate/deactivate manually the switch looking at the corresponding bit, that must change its status
- if switch and cable are OK but bit doesn't change, the CPU port is broken; replace the CPU.

1. Using key  , set speed (ff) equal to 5.

2. Pressing the  key, the arm must move away from operator;

continue to press it until the arm stops; the display must show 0011; if not check the switch S5 and/or the cable X33, as described before.

3. Pressing the  key, the arm must move toward the column;

continue until the arm stops the end and the display must show 1100; if not, check the switch S8 and/or the cable X33, as described before.

4. Check that, during the movement the bits b and c change the status; as these are linked to a single switch, S6, so they must change at the same time. If they do not change, check S6.
   - check the functionality of S6
   - if glued, replace it
   - if not, verify the port D9, bits 6 and 5. If the displayed value do not change also if the switch is activated and the cable has been tested OK, the CPU port is broken; replace it.

   If the switch S6 does not change its status, the control system will not be able to determine the zero position of Y axis, so the message error E505 will be displayed.

5. If there is no variations of above signals, if arm does not move or moves with difficulty or jumps:
   - check the belt and verify that it is not broken; if the belt is loose, adjust its tension
   - check cables X21; there can be a short circuit or a broken wire; check also for a loosen contact. In case of short circuit, replace the cable, verifying also that no damage has been caused to the motor driver (D27) on the CPU.

6. If there is no variation of the above signals and the arm moves, verify the cable X33 up to the CPU board. If still there is no variation of the signals when there is an activation of the switches, change the CPU board.

In case of no motion, it is possible that the problem is related to the motor: in order to check this connect the driver of the Y-axis motor to the rotation motor putting X21 cable on X19 connector on the CPU board.
Try to move the motor and look at the rotation arm: if it rotates the problem is either on the motor (or in its mechanism) or in the interconnecting board A7; if the arm does not rotate the problem is in the electronics, but it should have already been detected in steps 1-6.
Take care to restore the correct connections.

8.3.8.3. Rotation Axis Zero (M3 Motor)

The movement of the rotation axis is towards the right ( ) when the tubehead rotates towards the right of the operator, and towards the left ( ) when it rotates towards the left of the operator. The same concept can be expressed by saying that the rotation is towards the right when it is made clockwise in relation to an operator who is looking at the arm from above (from above the unit).
This test is accessed in password 118 by pressing key "26" or key "24" until the following message is displayed:

S	E	R	V	I	C	E		M	E	N	U				
R	O	T	A	T	I	O	N		Z	E	R	O			

Press key "23" . The following message will be displayed:

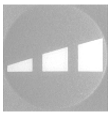
T		Z	E	R	O		[	f	f	]		a	b	c	d
Z	E	R	O		O	F	F	S		±	e	e	e	e	e

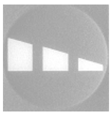
NOTE:
The characters presented on the display have been substituted with letters in this figure, so that the significance/function of each one can be described more clearly.

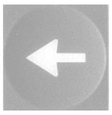
NOTE:
The components described herebelow (microswitches) can be seen on the block diagram in paragraph 3.5 and in Figure 8-1.

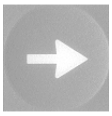
- **a** = S16 microswitch status (N.O.: 0= contact open; 1=contact closed)
- **b** = S14 microswitch-switch status (N.O.: 0= contact open; 1=contact closed)
- **c** = S14 microswitch-switch status (N.C.: 0= contact open; 1=contact closed)
- **d** = S13 microswitch status (N.O.: 0= contact open; 1=contact closed)
- **eeeee** = number of correction steps (of the motor) (offset)
- **ff** = speed of motor rotation
- **T ZERO** = indicates the selected motor. In this case the rotation motor.

The active keys for this test are the following:

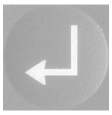

Increases the speed of the motor (key "3")

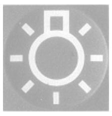

Decreases the speed of the motor (key "6")


Rotates the arm anti-clockwise (key "26")


Rotates the arm clockwise (key "24")

Quits the motor function, does not save the changes made and returns to the "Service Menu" display (key "9")


Upon quitting saves the changes made (key "23")


Switches on/off the panoramic centering device/TMJ (key "20")

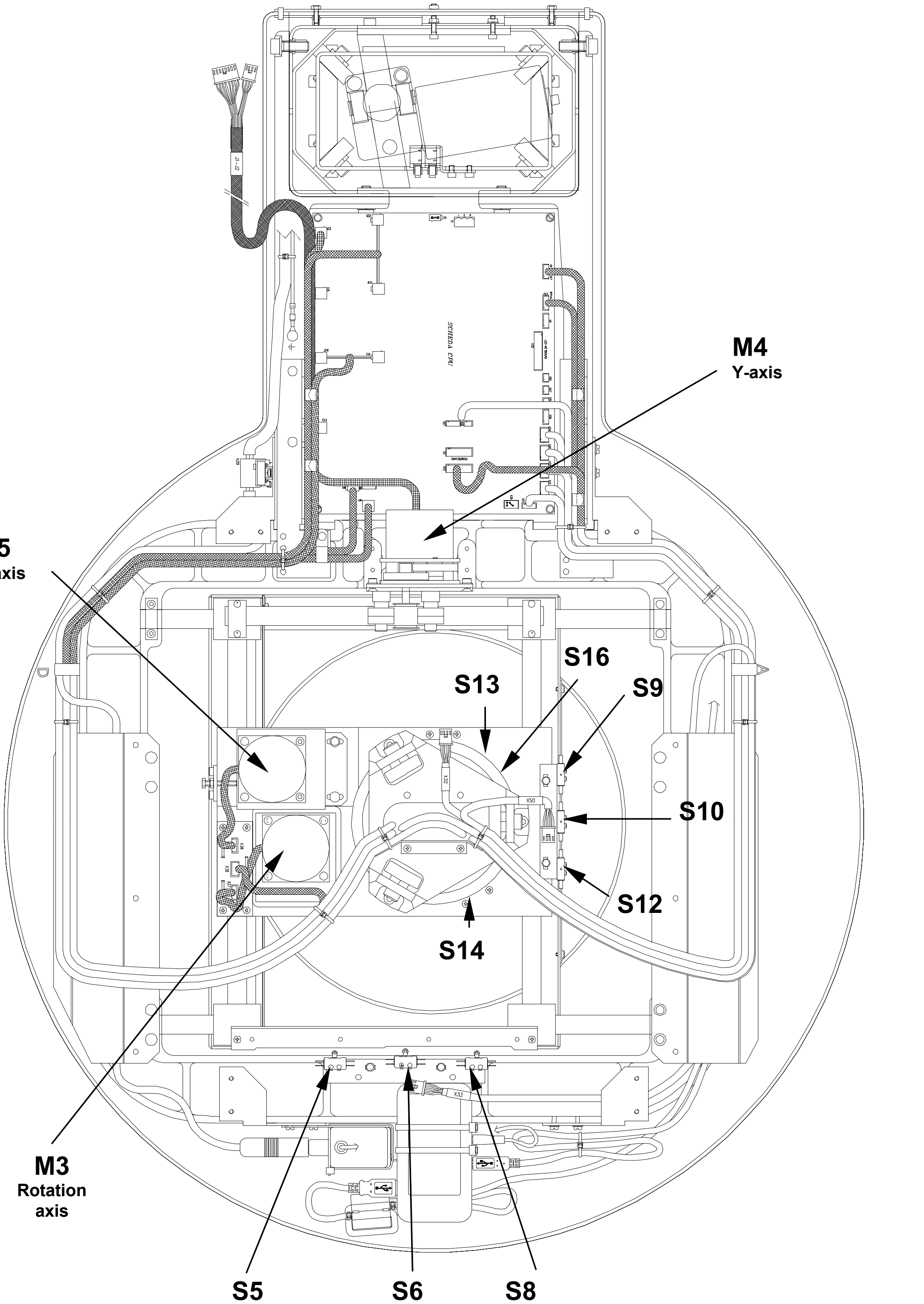

M4
Y-axis
M5
X-axis
S16
S13
S9
S10
S12
S14
M3
Rotation
axis
S5
S6
S8

Figure 8-1

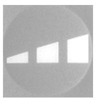
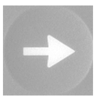
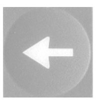
8.3.8.3.1. ERROR 502

This message means that, during the rotation, there is an unexpected activation of switch S13 and/or S16.
The movement of the rotation axis is defined as right when the tubehead rotates towards the right of the operator, and defined as left when it rotates towards the left of the operator. The same concept can be expressed by saying that the rotation is towards the right when it is clockwise with respect to an operator who is looking at the arm from above the unit).

Entering the rotation motor service program it is possible to check the casue of the error.

In normal conditions the display must visualise "0XX0" in place of characters "abcd"; that is, status of b and c depend on the current position. These values are linked to the current position on the opposite side of the same microswitch, so the possible status can be "0100" or "0010"; the situation "0110" is possible only for a short time.

- If a, b, c, and d are all 1, check the cable X32 up to the connector on the CPU board
- if a and/or b are set to 1 at the same time; verify that switches S13 and S14 can be activated/deactivated; if glued, replace it, otherwise check cable X32
- if the cable is OK, check input port D10, bits 7 and 8; eventually activates/deactivates manually the switch looking at the corresponding bit, that must change
- if the cable is OK and the bit doesn't change, the CPU port is broken; replace the CPU.

1. Using key  , set speed (ff) equal to 5.
2. Pressing the  key, the arm must rotate in clockwise direction; continue to press it until the arm stops; the display must show 0011; if not check the switch S16 and/or the cable X32, as described before.
3. Pressing the  key, the arm must rotate in the anticlockwise direction; continue until the arm stops the end and the display must show 1100; if not, check the switch S13 and/or the cable X32, as described before.

4. Check that, during the movement the bit b and c changes the status; as these are linked to a single switch, S14, so they must change quite at the same time. The change of a and b must occur quite in the front of the operator. If they do not change in a few steps, check S14.

- check the functionality of S14
- if glued, replace it
- if not, verify the port D10, bits 6 and 5. If the displayed values do not change also if the switch is activated and the cable has been tested OK, the CPU port is broken; replace it.

If the switch S14 do no change its status, the control system will not be able to determine the zero position of the rotation axis, so the message error E506 will be displayed.

5. If there is no variations of above signals, if arm does not move or moves with difficulty or jumps:

- check the belt and verify that it is not broken; if the belt is loose, adjust its tension
- check cable X21; there can be a short circuit or a broken wire; check also for a loosen contact. In case of short circuit, replace the cable, verifying also that no damage has been caused to the motor driver (D23) on the CPU.

6. If the arm moves, verify the cable X32 up to the CPU board. If still continue to haven't a variation of the signals when there is an activation of the switches, change the CPU board.

In case of no motion, it is possible that the problem is related to the motor: in order to check this connect the driver of the rotation motor to the X-axis motor putting X19 cable on X20 connector on the CPU board. Try to move the motor and look at the X arm: if it moves the problem is either on the rotation motor (or in its mechanism) or in the interconnecting board A7; if the arm does not move the problem is in the electronics, but it should have already been detected in steps 1-6.
Take care to restore the correct connections.

8.3.8.3.2. ERROR 542: Collision of the rotating arm

During the panoramic examination the system checks that the rotating arm is functioning checking that the transition of the zero switch for that movement occurs at the correct position; if this does not happens, it indicates a possible collision between the rotating arm and, for instance, the shoulder of the patient. Reset the machine pressing the appropriate button,  ; the rotating arm will position at the normal status and the exam can be repeated.
If the system does not reset correctly, the error message E502 will be displayed, so performs the test already described under error 502.

8.3.8.3.3. ERROR 541 / ERROR 543: panoramic sensor holder not in Panoramic / Ceph position

These messages are displayed when during an examination the panoramic sensor holder is accidentally moved from its correct position (panoramic or cephalometric); in this case, the examination is ended to avoid unnecessary radiation to the patient.
Press Reset key "9" to cancel the error message; the machine will instruct the user to perform a standard power up sequence after which it will restart its functionality.

8.3.8.3.4. ERROR 600: Reset button pressed during movement or exam preparation

This message is displayed during a motion of the rotating arm or during the exam preparation; in this case, the button is used as a safety button to interrupt the motion or to avoid collision between the system and the patient. Another pressure of the button will instruct the machine to perform a standard power up sequence and restart the functionality.

8.3.8.4. X-Y-Rotation time-out motor zeroing

8.3.8.4.1. ERROR 504

During the power on procedure, or after a request of "press Reset" message, the control system performs a check of the "zero" position; this check is needed to correctly position the equipment. During this phase, the control system moves, at the same time, the motors for X, Y and Rotation and looks to find the transition of zero position switches; this sensing must occur during a certain time and the control system is waiting for it. If at least one of the transition is not sensed, a timeout error is displayed and the system stops.

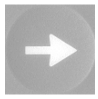
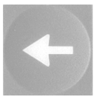
Possible causes can be from the following:

- zero sensors for a movement not functioning
- a motor is not running
- transmission belt loose or broken.

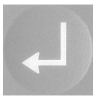
Power off the machine and on again, observing that all motors move; if one of the motor is not moving, perform the appropriate service program already described under the error 500, 501, 502.

8.3.8.5. Primary Collimator motor (M7)

NOTE:
This program is dedicated to models carrying the slit primary collimator. Note be sure that if the machine has the slit primary collimator the password 89 is set to “linear slit” selection to enter the correct primary collimator setup program.
This program is disabled for PAN ONLY machines that carry the fix primary collimator.

This test is accessed in password 118 by pressing key "26"  or key "24"  until the following message is displayed:

S	E	R	V	I	C	E		M	E	N	U				
P	R	.		C	O	L	L	.		S	E	T	U	P	

Press key "23"  . The following message will be displayed:

P	C	C		Z	E	R	O	[	f	f	]				a
Z	E	R	O		O	F	S		±	e	e	e	e	e	e

NOTE:
In case of PAN ONLY machine this menu item is disabled: by pressing key "23" the warning message E602 is displayed.

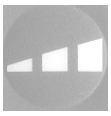
NOTE:
The characters presented on the display have been substituted with letters in this figure, so that the significance/function of each one can be described more clearly.

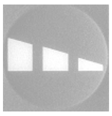
NOTE:
The component described here below (zero sensor) can be seen on the block diagram in paragraph 3.6 and in Figure 8-2.

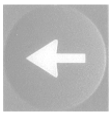
- **a** = B1 light barrier zero sensor status (0=light barrier lit; 1=light barrier darkened)
- **eeeeee** = number of correction steps of the motor (offset)
- **ff** = speed of motor shift
- **PCC ZERO** = indicates the selected motor. In this case the primary collimator motor.

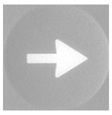
> **WARNING:**
> In this menu item X-ray are active.

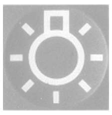
The active keys for this test are the following:


Increases the speed of the motor and the exposure factors (key "3")

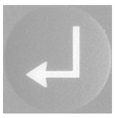

Decreases the speed of the motor and the exposure factors (key "6")


Shifts the carriage to the left (key "26")
i.e. towards the zero sensor


Shifts the carriage to the right (key "24")
i.e. away from the zero sensor


Switches ON/OFF the Panoramic/TMJ centering device (key "20")

Quits the motor function, does not save the changes made and returns to the "Service Menu" display (key "9")


Upon quitting saves the changes made (key "23")

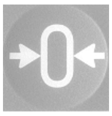
(5),


(4) and


(7) Change the exposure parameters since X-rays can be emitted during this phase

X-RAY BUTTON Emit X-rays in order to center the pano diaphragms of the principal collimator

WARNING:
The following keys are active but must not be pressed.



Patient exit deactivate the motor to perform a factory offset calibration of the collimator.
Don’t use this key. The factory calibration could be lost.

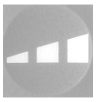
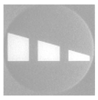
Test key moves the primary collimator bringing the ceph slit in the center of X-ray field (if digital ceph sensor is enabled test key moves also secondary collimator and sensor).

To exit from the submenu press key "9"  .

NOTE:
The slit primary collimator has two positions: Panoramic slit and Ceph slit, but there is just one zero offset corresponding to the Panoramic position, while the Panoramic to Ceph offset is considered constant.
The check of which slit is in field is performed through a zero resetting at machine setting, after each Ceph exam and passing from Ceph to Panoramic exam.

8.3.8.5.1. ERROR 580: Zero sensor always darkened / ERROR 592: Unexpected limit switch activation / ERROR 595: Motor timeout during slit primary collimator movement / ERROR 546: Primary slit collimator limit sensor not found

The Slit Primary Collimator program in password 118 (paragraph 8.3.8.5) can be used:

- To test if the zero sensor of the slit primary collimator works correctly checking if the digit "a" changes its status passing from sensor darkened to lit and viceversa;
- To test if the motor of the slit prymary collimator works using the key "24" and/or "26" to move it; to perform this test, set speed (ff) equal to 4 using key "3"  and key "6"  .

WARNING:
Since there is one zero sensor, perform limited runs (e.i. ±eeeeee = +080000) when testing the primary collimator with the cover of the tubehead mounted and always, at first, move it to the left direction.

NOTE:
To access the primary collimator, the plastic cover of the tubehead has to be removed; to do that, the sensor holder unit has to be removed prior to remove the cover itself.

ERROR 580 / ERROR 592

These errors can happen either if the zero sensor or its wires are broken or if the Primary Collimator is blocked inside the zero sensor.
Check the wire from X1 of Primary Collimator zero board (A16) up to connector X55 of board A8 and from X34 of the same board up to X34 of the CPU.
If the cables are right in order to check if the zero sensor is working measure with a DVM setted in "Volt DC" the voltage between pin 2 and pin 3 of the zero sensor board (A16): the sensor works properly if there are 0V when the sensor is lit and 4V when it is darkened (to darken the zero sensor insert a piece of paper or something else inside the zero sensor fork).
If it is not a cable or a sensor fault check if the Primary Collimator motor moves.

In case of no motion, it is possible that the problem is related to the motor or to the CPU: in order to check where the problem is connect to the driver of the Primary Collimator motor the X-axis motor inserting X19 cable on X15 connector of the CPU board.
Try to move the motor inside the PR. COLL. SETUP item and look at the rotation arm: if it moves along the X-axis the problem is on the motor (or in its mechanism or in its cable from X15 to X56); if the arm does not move the problem is in the CPU so replace it.
Take care to restore the correct connections.

ERROR 595 / ERROR 546

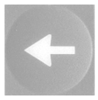
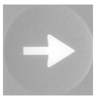
These errors can happen if the motor of primary collimator is not working. This fault can be caused by a failure of the motor or of the CPU or of the cables from X15 on CPU side to X56 on the motor side; refer to instructions explained for ERROR 580/ERROR 592.

8.3.8.6. Soft Tissue Filter motor (M6)

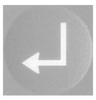
NOTE:
This program is dedicated to models carrying the slit primary collimator. Note be sure that if the machine has the slit primary collimator the password 89 is set to "linear slit" selection to enter the correct Soft Tissue Filter test program.
This program is disabled for PAN ONLY machines that carry the fix primary collimator.

NOTE:
This function is used only to test the functionality of the Soft Tissue Filter, to adjust/check the alignment use the dedicated menu item in password 124.

WARNING:
In this menu item X-ray are active. Pay attention not to press X-ray button.

This test is accessed in password 118 by pressing key "26"  or key "24"  until the following message is displayed:

S	E	R	V	I	C	E		M	E	N	U				
T	E	S	T		S	T	F								

Press key "23"  . The following message will be displayed:

S	T	F		T	E	S	T								a
O	F	F	S	E	T		+	e	e	e					

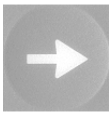
NOTE:
In case of PAN ONLY machine this menu item is disabled: by pressing key"23" the warning message E602 is displayed.

NOTE:
The characters presented on the display have been substituted with letters in this figure, so that the significance/function of each one can be described more clearly.

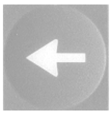
> **NOTE:**
> The component described herebelow (optoisolator) can be seen on the block diagram in paragraph 3.5 and in Figure 8-2.

- **a** = B2 light barrier zero sensor status (0=light barrier lit; 1=light barrier darkened)
- **+eee** = number of steps of the motor

The active keys for this test are the following:



Shifts the filter out of field in steps (key "24")



Shifts the filter in field in steps (key "26")

Quits the motor function, does not save the changes made and returns to the "Service Menu" display (key "9")

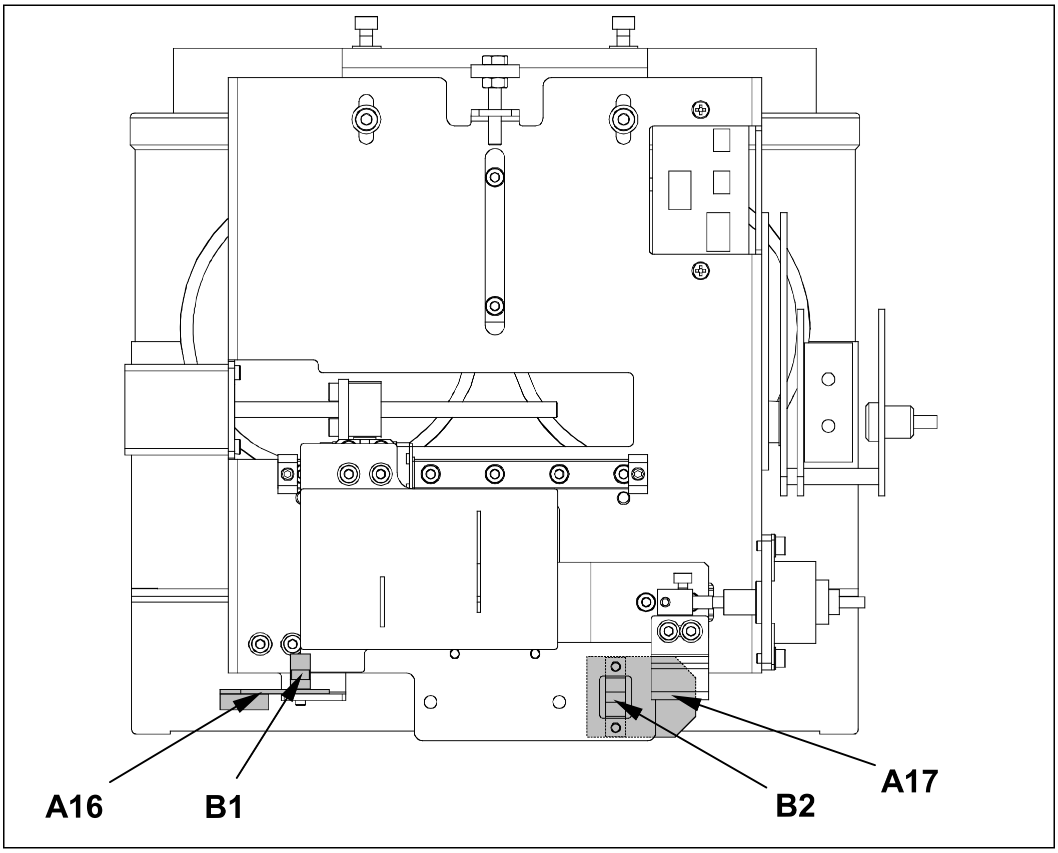
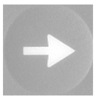
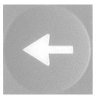


Figure 8-2

8.3.8.6.1. ERROR 520: Motor time out during STF movement / ERROR 521: STF stopped at the limit switch / ERROR 522: Limit switch not found / ERROR 523 Soft Tissue Filter zero sensor always active

STRATO 2000 Digital contains a motorised Soft Tissue Filter used during the execution of cephalometric exam; this filter has the function to avoid the overexposure of the soft part of the patient during a latero-lateral cephalometric exam.
The normal position of the soft tissue filter is "ON", that is inserted; the condition is sensed at the power on, when the control system checks the zero position switch B2 and after that moves the filter out.

The Soft Tissue Filter program in password 118 (paragraph 8.3.8.6) can be used:

- To test if the zero sensor of the Soft Tissue Filter works checking if the digit "a" changes its status passing from sensor darkened to lit and viceversa
- To test if the motor of the Soft Tissue Filter works using the key "24"  and/or "26"  .

NOTE:
To access the primary collimator, the plastic cover of the tubehead has to be removed; to do that, the sensor holder unit has to be removed prior to remove the cover itself.

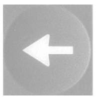
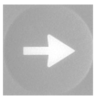
ERROR 521 and **ERROR 523** mean that the sensor B2 is sensed darkened when it should be lit.
These errors can happen either if the zero sensor or its wires are broken or if the Soft Tissue Filter is blocked inside the zero sensor.
Check the wire from X1 of Soft Tissue Filter zero board (A17) up to connector X55 of board A8 and from X34 of the same board up to X34 of the CPU.
If the cables are right in order to check if the zero sensor is working measure with a DVM setted in “Volt DC” the voltage between pin 2 and pin 3 of the zero sensor board (A17): the sensor works properly if there are 0V when the sensor is lit and 4V when it is darkened (to darken the zero sensor insert a piece of paper or something else inside the zero sensor fork).
Check if the Soft Tissue motor moves and its wires are right as explained for ERROR 520/ERROR 522 errors.
If it is not a cable or a sensor fault neither a motor problem the CPU may be broken. So replace it.

ERROR 520 / ERROR 522

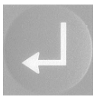
- Check that the motor is running
- Check that the gear is engaged and there is no mechanical obstacle to prevent the movement

If the motor doesn't run check the motor cable from X59, near the motor to X16 on the CPU.
If the motor cable is right the motor can be broken or the CPU can be broken.

8.3.8.7. Column motor (Column test)

This test is accessed in password 118 by pressing key "26"  or key "24"  until the following message is displayed:

S	E	R	V	I	C	E		M	E	N	U				
T	E	S	T		C	O	L	U	M	N					

Press key "23" . The following will be displayed:

C	O	L	U	M	N		T	E	S	T				a	b

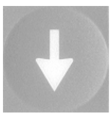
NOTE:
The characters presented on the display have been substituted with letters in this figure, so that the significance/function of each one can be described more clearly.

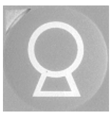
NOTE:
The components described herebelow (microswitches) can be seen on the block diagram in paragraph 3.5 and in Figure 8-3.

- **a** = S27 microswitch status (0= contact open; 1=contact closed)
- **b** = S26 microswitch status (0= contact open; 1=contact closed)

The active keys for this test are the following:


Raises the column (key "27")


Lowers the column (key "29")


Enables the shift of the column (press together with one of the two previous keys (key "28")


Quits the motor function and returns to the "Service Menu" display (key "9")

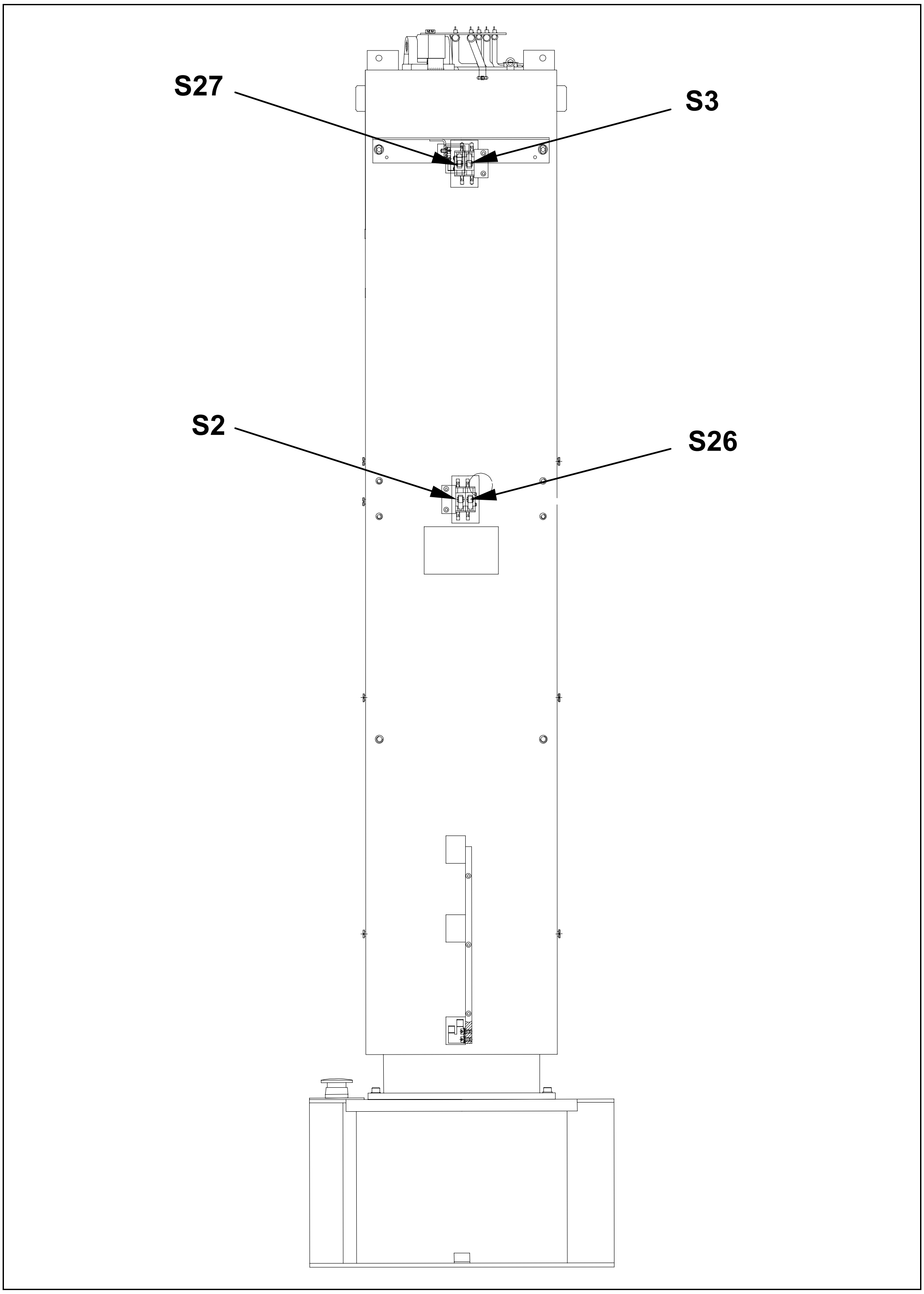
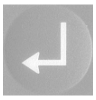


Figure 8-3

NOTE:
To quit Password 118 press key "9"  . The following message will be displayed:

C	O	N	F	I	R	M		E	X	I	T	?			
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

Press key "23"  to quit the password or press key "9"  to remain in password 118.

8.3.9. Password 124

NOTE:
This program can be accessed only in models carrying the slit primary collimator; trying to enter this program on a fixed collimator Pan only unit, after the machine setting, the message ERROR 602 will be displayed.

This password allows to enable/disable and optimise the DIGITAL Cephalometric examination mode. It allows to perform:

- positioning of the rotation axis
- positioning of the secondary collimator
- positioning of the DIGITAL ceph sensor
- a short exam to center the ear rings of the ceph head support
- offset adjustment of the Soft Tissue Filter (STF)
- adjustment of the % of the Soft Tissue Filter (STF) in-field depth.

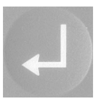
WARNING:
DO NOT MODIFY THE FOLLOWING ITEMS OF PASSWORD 124:

- **DIGITAL CEPH X OFFSET**
- **DIGITAL CEPH Y OFFSET**
- **DIGITAL CEPH SENSOR SPEED 2x2**
- **DIGITAL CEPH SESNRO SPEED 3x3**

FUNCTIONALITY CAN BE SEVERELY IMPAIRED.

Whenever any data has been modified, exiting from each single function (by pressing the key "9" ) the display will show the following message:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

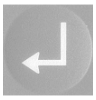
Press key "23"  to store the modifications introduced, or press key "9"  to cancel the changes; the function related axis will return to the previous position and the display will show:

R	E	S	T	O	R	I	N	G							
A	X	I	S		P	O	S	I	T	I	O	N	.	.	.

Optimisation of the DIGITAL Cephalometric examination consists of the proper positioning of the tubehead arm with respect to the CEPH arm and of the secondary collimator and CEPH sensor, by acting on the different motors associated to the positioning of the tubehead arm and of the CEPH arm.

Accessing password 124, the following message appears on the display:

M	A	C	H	I	N	E		S	E	T	T	I	N	G	

Then press key "23"  ; the unit will carry out some movements and the display will show:

			W	A	I	T		F	O	R					
M	A	C	H	I	N	E		S	E	T	T	I	N	G	

When the unit stops moving the following message will be displayed:

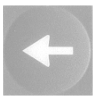
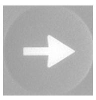
D	I	G	I	T	A	L		C	E	P	H				
E	N	A	B	L	E		S	E	N	S	O	R			

Press key "23" to enter this menu item and the following message will be displayed:

D	I	G	I	T	A	L		C	E	P	H				
D	I	G	I	T	A	L		C	E	P	H		x	x	x

NOTE:
The characters presented on the display have been substituted with letters in this figure, so that the significance/function of each one can be described more clearly.

xxx = Corresponds to the possibility of activating=ON or deactivating=OFF the DIGITAL Cephalometric examination.

Press key "26"  or key "24"  to move from one option to the other.

If **OFF** is set (DIGITAL CEPH device not present or not activated) and confirmed with key "9" the following message will be displayed:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

Press key "23" to permanently store the changes or press key "9" not to store them.

Setting xxx=OFF all the others password 124 menu items are disabled.

If **ON** is set (DIGITAL CEPH device present and activated) and confirmed with key "9" the following message will be displayed:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

Press key "23" to permanently store the changes or press key "9" not to store them.

After this selection the following message is displayed:

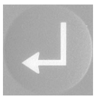
D	I	G	I	T	A	L		C	E	P	H				
E	N	A	B	L	E		S	E	N	S	O	R			

If xxx=ON all the password 124 menu items are enabled and they can be scrolled using the key "26" or key "24" .

To access a function of this password press key "23" . Then proceed with following paragraphs.

Press instead key "9" to quit Password 124. The following message will be displayed:

C	O	N	F	I	R	M		E	X	I	T	?			
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

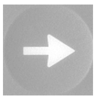
Press key "23"  to quit the password or key "9"  to remain in password 124.

NOTE:
All changes made and stored result in the loss of the original calibration data. The user is therefore recommended to make and store only those changes that are deemed necessary.
If changes are made and stored but the user quits password 124 by switching the system off and not going through the normal quitting procedure, the stored data will be lost and the system will be reset to the previous data.

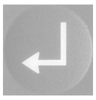
8.3.9.1. Rotation axis position

This function is accessed in by activating password 124 as described at paragraph 8.3.9. When next display is shown:

D	I	G	I	T	A	L		C	E	P	H				
E	N	A	B	L	E		S	E	N	S	O	R			

Press key "24"  until reaching the following display:

D	I	G	I	T	A	L		C	E	P	H				
R	O	T	A	T	I	O	N		O	F	F	S	E	T	

Press key "23"  . The following message will be displayed

P	L	E	A	S	E		W	A	I	T	.	.	.		

while the slit primary collimator moves to the DIGITAL CEPH central position.
Then the following message will be displayed:

T		Z	E	R	O		[	f	f	]		a	b	c	d
Z	E	R	O		O	F	F	S		±	e	e	e	e	e

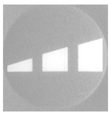
NOTE:
The characters presented on the display have been substituted with letters in this figure, so that the significance/function of each one can be described more clearly.

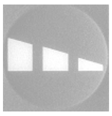
WARNING:
In this menu item X-ray are active. Pay attention not to press X-ray button.

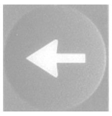
NOTE:
The components here after indicated (microswitches) can be identified on the block diagram of paragraph 3.5 and in Figure 8-1.

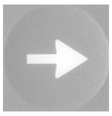
- **a** = S16 microswitch status (N.O.: 0= contact open; 1=contact closed)
- **b** = S14 microswitch-switch status (N.O.: 0= contact open; 1=contact closed)
- **c** = S14 microswitch-switch status (N.C.: 0= contact open; 1=contact closed)
- **d** = S13 microswitch status (N.O.: 0= contact open; 1=contact closed)
- **eeeee** = number of correction steps (of the motor) (offset)
- **ff** = speed of motor shift.

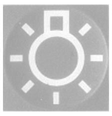
The active keys for this test are the following:


Increases the speed of the motor and the exposure factors (key "3")


Decreases the speed of the motor and the exposure factors (key "6")

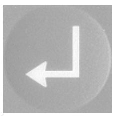

Rotates the carriage anti-clockwise (key "26")


Rotates the carriage clockwise (key "24")


Switches on/off the panoramic centering device/TMJ (key "20")

Prepare the system to take the Rotation Arm aligment test in Ceph mode (key "8")

Quits the setup program, does not save the changes made and returns to the "Service Menu" display (key "9")


Upon quitting saves the changes made (key "23")

(5),

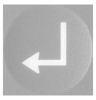

(4) and


(7) Change the exposure parameters since X-rays can be emitted during this phase

X-RAY BUTTON — Emit X-rays in order to take the Rotation Arm aligment test in Ceph mode (key "30")

If any change has been introduced, after pressing key "9"  the display shows:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

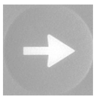
Press key "23"  to permanently store the changes or press key "9"  not to store them. The system will exit from this routine in both cases and the display returns to:

D	I	G	I	T	A	L		C	E	P	H				
R	O	T	A	T	I	O	N		O	F	F	S	E	T	

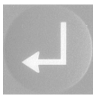
8.3.9.2. Secondary Collimator motor (M8)

This test is accessed in by activating password 124 as described at paragraph 8.3.9. When next display is shown:

D	I	G	I	T	A	L		C	E	P	H				
E	N	A	B	L	E		S	E	N	S	O	R			

Press key "24"  until reaching the following display:

D	I	G	I	T	A	L		C	E	P	H				
C	E	P	H		S	.	C	O	L	.		Z	E	R	O

Press key "23"  . The following message will be displayed:

S		Z	E	R	O		[	f	f	]		a	b	c	d
Z	E	R	O		O	F	F	S		±	e	e	e	e	e

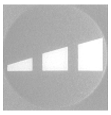
NOTE:
The characters presented on the display have been substituted with letters in this figure, so that the significance/function of each one can be described more clearly.

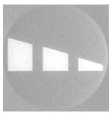
NOTE:
The component described here below (zero sensor) can be seen on the block diagram in paragraph 3.6 and in Figure 8-4.

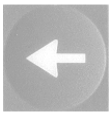
- **a** = B4 light barrier zero sensor status (0=light barrier lit; 1=light barrier darkened)
- **b** = not used (by default 0)
- **c** = not used (by default 0)
- **d** = not used (by default 0)
- **eeeee** = number of correction steps of the motor (offset)
- **ff** = speed of motor shift
- **S ZERO** = indicates the selected motor. In this case the primary collimator motor.

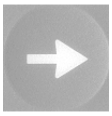
WARNING:
In this menu item X-ray are active.

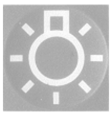
The active keys for this test are the following:

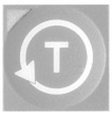

Increases the speed of the motor and the exposure factors (key "3")


Decreases the speed of the motor and the exposure factors (key "6")

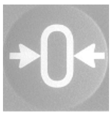

Looking at the keyboard, shifts the carriage to the left (key "26")
i.e. towards the zero sensor


Looking at the keyboard, shifts the carriage to the right (key "24")
i.e. away from the zero sensor

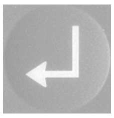

Switches ON/OFF the Panoramic/TMJ centering device (key "20")



Moves the slit primary collimator, the secondary collimator and the ceph sensor to the ceph central position (key "8")


Prepare the system to take the secondary collimator test (key "10")

Quits the motor function, does not save the changes made and returns to the "Service Menu" display (key "9")


Upon quitting saves the changes made (key "23")

(5),


(4) and

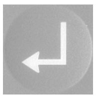

(7) Change the exposure parameters since X-rays can be emitted during this phase

X-RAY BUTTON Emit X-rays in order to center the secondary collimator axis

If any change has been introduced, after pressing key "9"


the display shows:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

Press key "23"  to permanently store the changes or press key "9"  not to store them. The system will exit from this routine in both cases and the display returns to:

D	I	G	I	T	A	L		C	E	P	H				
C	E	P	H		S	.	C	O	L	.		Z	E	R	O

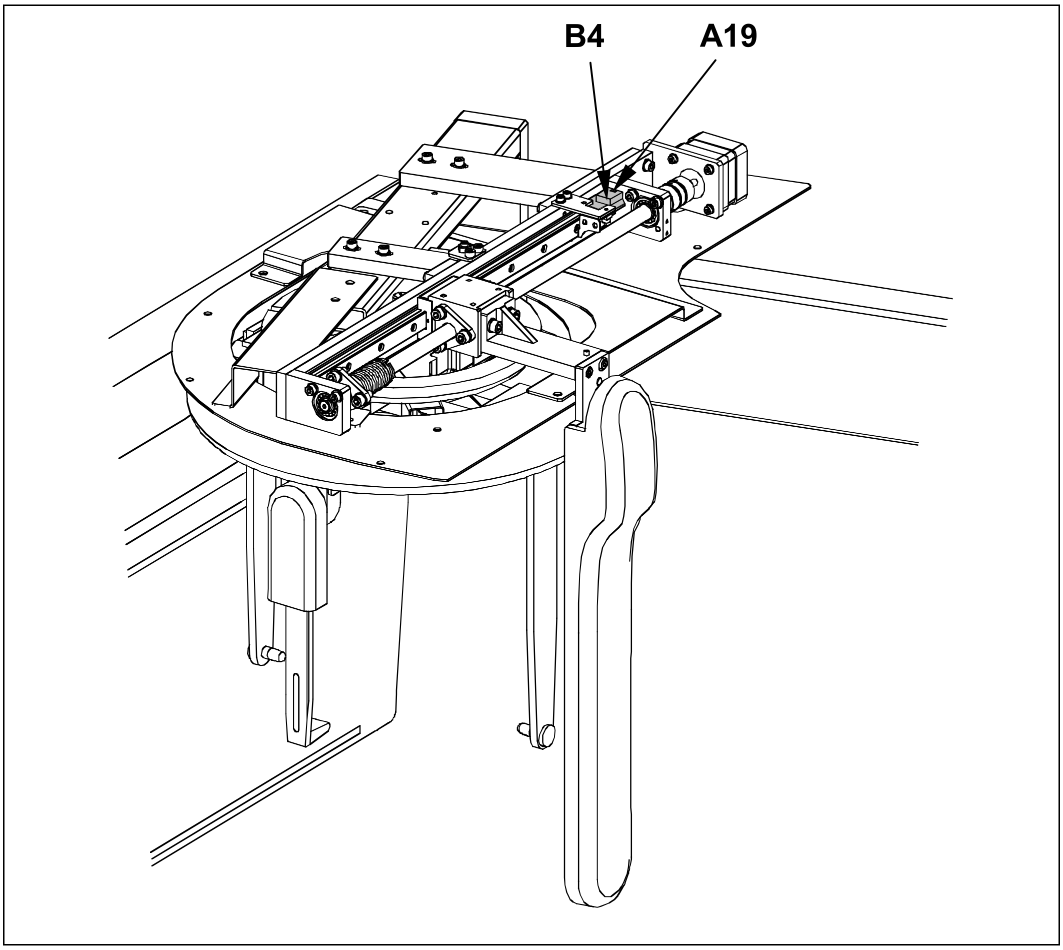
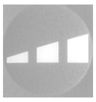
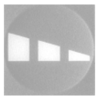


Figure 8-4

8.3.9.2.1. ERROR 581 The zero sensor of ceph secondary collimator is always active / ERROR 591 unexpected limit switch activation CEPH secondary collimator motor / ERROR 594 CEPH secondary collimator Motor timeout / ERROR 545 CEPH secondary collimator Limit sensor not found

The CEPH S. COL. ZERO program in password 124 can be used:

- To test if the zero sensor of the secondary collimator works correctly checking if the digit "a" changes its status passing from sensor darkened to lit and viceversa;
- To test if the motor of the secondary collimator works using the key "24" and/or "26" to move it; to perform the test, set speed (ff) equal to 30 using key "3"  and key "6"  .

ERROR 581 / ERROR 591

These errors can happen either if the zero sensor or its wires are broken or if the Secondary Collimator is blocked inside the zero sensor.
Check the wire from X1 of Secondary Collimator zero board (A19) up to connector X3 of board A9 and from X2 of the same board up to X63 of the CPU.
If the cables are right in order to check if the zero sensor is working measure with a DVM setted in "Volt DC" the voltage between pin 2 and pin 3 of the zero sensor board (A19): the sensor works properly if there are 0V when the sensor is lit and 4V when it is darkened (to darken the zero sensor insert a piece of paper or something else inside the zero sensor fork).
If it is not a cable or a sensor fault check if the Secondary Collimator motor moves.
In case of no motion, it is possible that the problem is related to the motor or to the CPU: in order to check where the problem is connect to the driver of the Secondary Collimator motor the CEPH sensor motor inserting X18 cable on X53 connector of the CPU board.
Try to move the motor inside the DIGITAL CEPH S. COL. ZERO item and look at the ceph sensor: if it moves the problem is on the motor of the secondary collimator (or in its mechanism or in its cable from X4 of A9 board to X53 of CPU board); else the problem is in the CPU so replace it.
Take care to restore the correct connections.

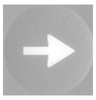
ERROR 594 / ERROR 545

These errors can happen if the motor of secondary collimator is not working. This fault can be caused by a failure of the motor or of the CPU or of the cables from X53 on CPU side to X1 on A9 board to X4 on the motor side; refer to instructions explained for ERROR 581/ERROR 591.

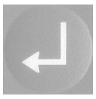
8.3.9.3. CEPH sensor motor (M9)

This test is accessed in by activating password 124 as described at paragraph 8.3.9. When next display is shown:

D	I	G	I	T	A	L		C	E	P	H				
E	N	A	B	L	E		S	E	N	S	O	R			

Press key "24"  until reaching the following display:

D	I	G	I	T	A	L		C	E	P	H				
C	E	P	H		S	E	N	S	O	R		Z	E	R	O

Press key "23"  . The following message will be displayed:

S		Z	E	R	O		[	f	f	]		a	b	c	d
Z	E	R	O		O	F	F	S		±	e	e	e	e	e

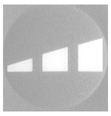
NOTE:
The characters presented on the display have been substituted with letters in this figure, so that the significance/function of each one can be described more clearly.

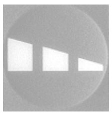
NOTE:
The component described here below (zero sensor) can be seen on the block diagram in paragraph 3.6 and in Figure 8-5.

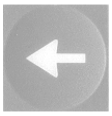
- **a** = B3 light barrier zero sensor status (0=light barrier lit; 1=light barrier darkened)
- **b** = not used (by default 0)
- **c** = not used (by default 0)
- **d** = not used (by default 0)
- **eeeee** = number of correction steps of the motor (offset)
- **ff** = speed of motor shift
- **S ZERO** = indicates the selected motor. In this case the primary collimator motor.

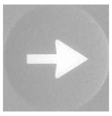
WARNING:
In this menu item X-ray are active.

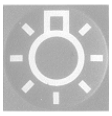
The active keys for this test are the following:


Increases the speed of the motor and the exposure factors (key "3")


Decreases the speed of the motor and the exposure factors (key "6")

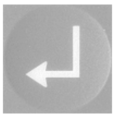

Looking at the keyboard, shifts the carriage to the left (key "26")
i.e. towards the zero sensor


Looking at the keyboard, shifts the carriage to the right (key "24")
i.e. away from the zero sensor


Switches ON/OFF the Panoramic/TMJ centering device (key "20")

Moves the slit primary collimator, the secondary collimator and the ceph sensor to the ceph central position (key "8")

Quits the motor function, does not save the changes made and returns to the "Service Menu" display (key "9")


Upon quitting saves the changes made (key "23")

(5), 

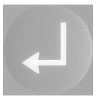
(4) and 

(7) Change the exposure parameters since X-rays can be emitted during this phase

X-RAY BUTTON Emit X-rays in order to center the sensor axis

If any change has been introduced, after pressing key "9"  the display shows:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

Press key "23"  to permanently store the changes or press key "9"  not to store them. The system will exit from this routine in both cases and the display returns to:

D	I	G	I	T	A	L		C	E	P	H				
C	E	P	H		S	E	N	S	O	R		Z	E	R	O

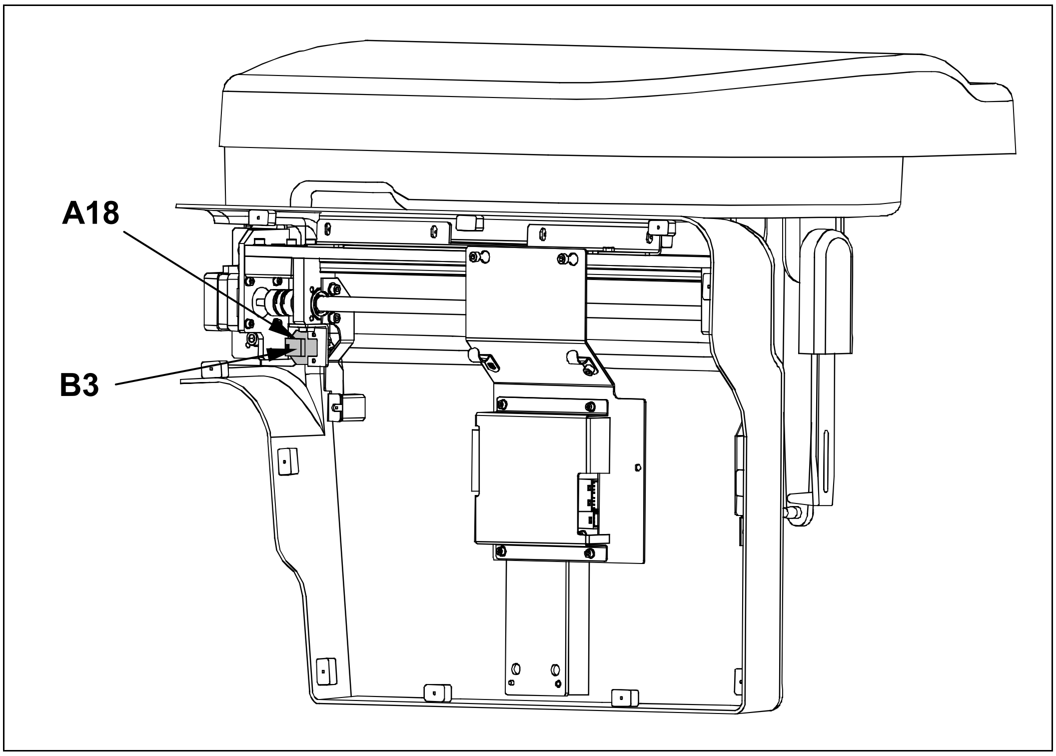
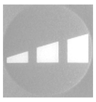
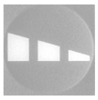


Figure 8-5

8.3.9.3.1. ERROR 582 The zero sensor of ceph sensor is always active / ERROR 590 Unexpected limit switch activation CEPH sensor motor / ERROR 593 CEPH sensor zeroing timeout / ERROR 544 CEPH sensor motor limit sensor not found

The CEPH SENSOR ZERO program in password 124 (paragraph 8.3.9.3) can be used:

- To test if the zero sensor of the CEPH sensor works correctly checking if the digit "a" changes its status passing from sensor darkened to lit and viceversa;
- To test if the motor of the CEPH sensor works using the key "24" and/or "26" to move it; to perform the test 2, set speed (ff) equal to 30 using key "3"  and key "6"  .

ERROR 582 / ERROR 590

These errors can happen either if the zero sensor or its wires are broken or if the CEPH sensor is blocked inside the zero sensor.
Check the wire from X1 of CEPH sensor zero board (A18) up to connector X5 of board A9 and from X2 of the same board up to X63 of the CPU.
If the cables are right in order to check if the zero sensor is working measure with a DVM setted in “Volt DC” the voltage between pin 2 and pin 3 of the zero sensor board (A18): the sensor works properly if there are 0V when the sensor is lit and 4V when it is darkened (to darken the zero sensor insert a piece of paper or something else inside the zero sensor fork).
If it is not a cable or a sensor fault check if the CEPH sensor motor moves.
In case of no motion, it is possible that the problem is related to the motor or to the CPU: in order to check where the problem is connect to the driver of the CEPH sensor motor the Secondary Collimator motor inserting X53 cable on X18 connector of the CPU board.
Try to move the motor inside the DIGITAL CEPH SENSOR ZERO item and look at the secondary collimator: if it moves the problem is on the motor of the CEPH sensor (or in its mechanism or in its cable from X6 of A9 board to X18 of CPU board); else the problem is in the CPU so replace it.
Take care to restore the correct connections.

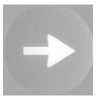
ERROR 593 / ERROR 544

These errors can happen if the motor of the CEPH sensor is not working.
This fault can be caused by a failure of the motor or of the CPU or of the cables from X18 on CPU side to X1 on A9 board to X6 on the motor side; refer to instructions explained for ERROR 582/ERROR 590.

8.3.9.4. Lining-up test

This test is accessed in by activating password 124 as described at paragraph 8.3.9. When next display is shown:

D	I	G	I	T	A	L		C	E	P	H				
E	N	A	B	L	E		S	E	N	S	O	R			

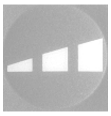
Press key "24"  until reaching the following display:

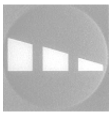
D	I	G	I	T	A	L		C	E	P	H				
L	I	N	I	N	G		U	P		T	E	S	T		

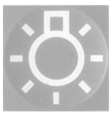
This menu item is used to center the ear rings of the CEPH head positioning device and its functionality is described in paragraph 7.1.3.2. No data is saved in this menu item.

WARNING:
In this menu item X-ray are active.

The active keys for this test are the following:

 Increases the exposure factors (key "3")

 Decreases the exposure factors (key "6")

 Switches ON/OFF the Panoramic/TMJ centering device (key "20")

 Prepare the system to execute the short exam dedicated to ear rings centering (key "8")

 Quits the function (key "9")

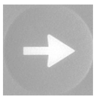
 (5),  (4) and  (7) Change the exposure parameters since X-rays can be emitted during this phase

X-RAY BUTTON — Starts the short exam dedicated to ear rings centering ("key 30")

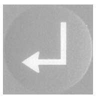
8.3.9.5. Soft Tissue Filter (STF) offset

This test is accessed in by activating password 124 as described at paragraph 8.3.9. When next display is shown:

D	I	G	I	T	A	L		C	E	P	H				
E	N	A	B	L	E		S	E	N	S	O	R			

Press key "24"  until reaching the following display:

D	I	G	I	T	A	L		C	E	P	H				
S	T	F		Z	E	R	O		O	F	F	S	E	T	

Press key "23"  . The following message will be displayed:

S	T	F		Z	E	R	O		O	F	F	S			a
O	F	F	S	E	T		+	e	e	e					

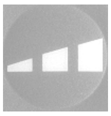
NOTE:
The characters presented on the display have been substituted with letters in this figure, so that the significance/function of each one can be described more clearly.

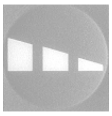
NOTE:
The component here after indicated (optoisolator) can be identified on the block diagram of paragraph 3.5 and in Figure 8-2.

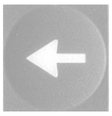
- **a** = B2 light barrier zero sensor status (0=light barrier lit; 1=light barrier darkened)
- **eee** = number of correction steps of the motor with signum (offset)

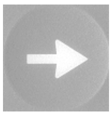
NOTE:
The procedure to set the correct value of the Soft Tissue Filter offset is described on paragraph 7.1.3.5. Please refer to that if adjstment is needed.

The active keys for this test are the following:

 Increases the exposure factors (key "3")

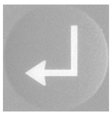
 Decreases the exposure factors (key "6")

 Shifts the filter in field in steps (key "26")

 Shifts the filter out of field in steps (key "24")

Test button prepare the system to execute the exam dedicated to set the Soft Tissue Filter offset (key "8")

Quits the setup program, does not save the changes made and returns to the "Service Menu" display (key "9")

 Upon quitting saves the changes made (key "23")

(5), 

(4) and 

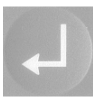
(7) Change the exposure parameters since X-rays can be emitted during this phase

X-RAY BUTTON Starts the exam dedicated to set the Soft Tissue Filter offset (key "30").
WARNING: Emits X-rays

If any change has been introduced, after pressing key "9" 

the display shows:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

Press key "23"  to permanently store the changes or press

key "9" 

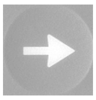
not to store them. The system will exit from this routine.

8.3.9.6. Soft Tissue Filter (STF) % of correction

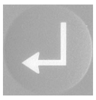
This data is used to increase/decrease the functionality of the Soft Tissue Filter. A value of 100% means no action on the set value for STF, while a value higher than 100% will reduce the insertion of STF so reducing the area interested by the filter. Otherwise a lower than 100% will introduce more the filter.

This test is accessed in by activating password 124 as described at paragraph 8.3.9. When next display is shown:

D	I	G	I	T	A	L		C	E	P	H				
E	N	A	B	L	E		S	E	N	S	O	R			

Press key "24"  until reaching the following display:

D	I	G	I	T	A	L		C	E	P	H				
S	T	F		%		C	O	R	R	E	C	T	I	O	N

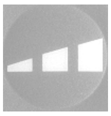
Press key "23"  . The following message will be displayed:

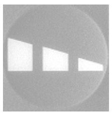
S	T	F		%		C	O	R	R	E	C	T	I	O	N
V	A	L	U	E	=		a	a	a	%					

NOTE:
The characters presented on the display have been substituted with letters in this figure, so that the significance/function of each one can be described more clearly.

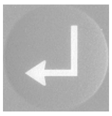
aaa= percentage of correction of in-field depth of Soft Tissue Filter (dafault value = 100%)

The active keys for this test are the following:


Increases percentage of correction (key "3")

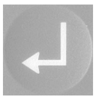

Decreases percentage of correction (key "6")


Quits the setup program, does not save the changes made and returns previous display (key "9")


Upon quitting saves the changes made (key "23")

If any change has been introduced, after pressing key "9"  the display shows:

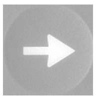
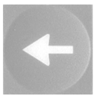
U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

Press key "23"  to permanently store the changes or press key "9"  not to store them. The system will exit from this routine in both cases and the display returns to:

D	I	G	I	T	A	L		C	E	P	H				
S	T	F		%		C	O	R	R	E	C	T	I	O	N

8.3.10. Password 130

This password enables the operator to change the language in which the messages are displayed during normal working use. The Technical Services messages are always in English.

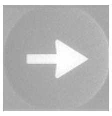
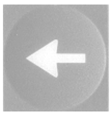
To change this setting press key "24"  or key "26"  .

The languages that may be selected are: ENGLISH, ITALIANO, FRANCAIS, DEUTSCH, ESPANOL.

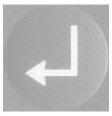
A typical message displayed is:

S	E	L	E	C	T		L	A	N	G	U	A	G	E	
I	T	A	L	I	A	N	O								

The active keys in this password are the following:

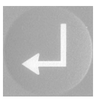
 o  Sets the desired language for the display of the operational messages (key "24" or "26")

 Quits the function (key "9")

 Upon quitting saves the changes made (key "23")

Press key "9"  to quit Password 130. If no changes have been made, the system will quit the password mode, otherwise the following message will be displayed:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

Press key "23"  to permanently store the changes made or press key "9"  not to store them (maintain previous language).

The system will quit password 130 in both cases.

8.3.11. Password 143

With this password, the operator can keep a centralised control of the readings and resetting of the counters for the various examinations and of the overall exposure of the system.

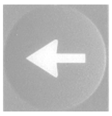
The following message is displayed upon access to this function:

P	A	N		C	O	U	N	T	E	R					
V	A	L	U	E	=	n	n	n							

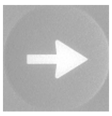
NOTE:
The characters presented on the display have been substituted with letters in this figure, so that the significance/function of each one can be described more clearly.

- **PAN** = indicates the type of examination to which the counter refers
- **nnn** = indicates the current number of exposures made for the type of examination indicated in the first line.

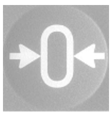
The active keys for this password are the following:



Selects the counter relative to the previous examination (key "26")

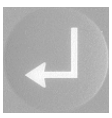


Selects the counter relative to the next examination (key "24")



Resets the selected counter (excluding the overall time of activation of the tubehead. **This parameter cannot be reset**)

Quits the counter function, quits the password, does not save the changes made and returns to the "Service Menu" display (key "9")



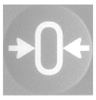
Upon quitting saves the changes made (key "23")

The reading of the overall exposure time of the system is indicated on the display as follows:

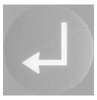
R	X		T	U	B	E		U	S	A	G	E			
h	h	:	m	m	:	s	s								

where:

- **hh** = hours of use
- **mm =** minutes of use
- **ss=** seconds of use.

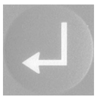
After each reset request (key "10" ) the following message will be displayed:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

Press key "23"  to permanently change the settings made or press key "9"  not to store them.

Press key "9"  to quit Password 143. The following message will be displayed:

C	O	N	F	I	R	M		E	X	I	T	?			
E	N	T	E	R	=	Y			R	E	S	E	T	=	N

Press key "23"  to quit the password or press key "9"  to remain in password 143 mode.

8.4. Memory errors

The group of error messages with code range E570 to E574 is related to errors occurring on the Flash Eprom; this memory stores both program and data. Of these group of error messages, only the first one (E570) can be reset, while all others are related to a severe error on the chip, so they require to replace of the Smart Card CPU or at least of the Flash Eprom chips. The memory chips have to be replaced with programmed ones.

NOTE:
In all cases, when the original flash Eproms of the system have failed, the data stored in the memory are lost or replaced with default values, so a complete calibration of the machine has to be performed.

8.4.1. ERROR 570: Checksum error on flash eprom

This error message is dispalyed if the control system, at power up, verifies that the memory contains no valid data; the system can try to correct the error related to the memory section used to store current functional data; in this case the message "Press Reset button" to restore data will be visualised. At the button pressure, the default values for data will be stored in the memory, so a complete calibration of the machine will be needed. The calibration has to be performed using service programs.

If after the storing of the new values the error message persists, it means that a severe error occurred on the chips, so replace the Memory chips or the Smart Card complete.

8.4.2. ERROR 571-572-573-574-575

All these errors suggest an anomaly in the CPU or in the Flash Eprom: replace the CPU board.

8.5. Generic errors

8.5.1. ERROR 503

This error is shown when the jumpers of connector X30 on the CPU board are not well connected. Check and, if necessary, replace the jumper.

8.5.2. ERROR 506 / 515

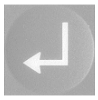
These errors are shown when, in password 92, is set "STANDARD CPU". Refer to paragraph 8.3.3 to set the correct parameter.

8.5.3. ERROR 507

This error is shown when, in password 90, is set "DIGITAL MODE OFF". Refer to paragraph 8.3.2 to set the correct parameter.

8.5.4. ERROR 601

This error is shown when the firmware of the STRATO 2000 Digital does not sense the presence of the U.I.C.; the U.I.C. is an hardware components, mounted on the CPU card A11 (Smart CPU) on connector/jumper X6. This components holds a unique code that is read, with its check byte, from the control system at the start-up; if the check byte is incorrect, the system displays the above error number.

In case this error is displayed, a pressure of the key "23"  allows the system to continue its functioning, but only standard base examination will be possible.

Verify that the U.I.C. component is well inserted.

Verify that the U.I.C. is correctly inserted on the connector X6: the component shows a flat side on the upper part; the U.I.C. must be inserted having this flat side on the inner part of the CPU board. The reset of the situation is performed switching off and on the system.

In case there is a fault on the U.I.C. components itself, the U.I.C. must be replaced. **In this case, all the optional features must be re-enabled with proper codes linked to the new U.I.C.** Before requesting a new U.I.C. device, the S/N of the equipment and/or the U.I.C. itself must be recorded and reported to Villa Sistemi Medicali.

8.5.5. ERROR 602

This error is shown when the sub-menu item selected is not available.

Press key "9"  to reset the error message.

8.5.6. ERROR 9xx

These errors are displayed when there are no compatibility between the Digital Sensor firmware and the Imaging Management program running on the PC.

8.6. Search and correction of possible defects in dental radiographies

8.6.1. Defects due to incorrect position of the patient

Problem	Description	Solution
Incisors too large and blurred.	The patient is not positioned correctly. He is too far back from the optimal focal plane.	Position the patient correctly, and verify that he is holding the bite with his incisors on the fit notch and that the bite holder rod is vertical.
Incisors too small and blurred.	The patient is not positioned correctly. He is too far forward of the optimal focal plane.	Position the patient correctly, and verify that he is holding the bite with his incisors on the fit notch and that the bite holder rod is vertical.
Radiography with blank central area.	The patient's spine inhibits the passage of the X-rays because it is too compressed.	Check the alignment of the Frankfurt plane. Try to stretch out the cervical tract of the spine correcting the height of the cursor and moving the patient's feet forward (see 6.4.3.3/4/6/7 of the User Manual).
Dental arch not symmetrical.	The median sagittal line does not correspond to the laser centering beam.	Realign the patient (see 6.4.3.6 of the User Manual).
Upper apical area too dark.	The patient does not keep his lips closed and his tongue is not against the palate.	See paragraph 6.4.3.8 of the User Manual.
Upper central apical area out of focus.	The patient's head is turned backwards (Frankfurt plane not aligned).	Position the patient correcting the Frankfurt plane.
The image is slanted with respect to the longitudinal axis of the image frame and some of the anatomical structures are not symmetrical.	The patient's head is slanted (not vertical).	Position the patient correcting the sagittal plane.
The teeth are bigger on one side than the other.	The patient's head is turned with respect to the axis of the bite.	Position the patient correcting the sagittal plane and checking that the test is not turned.
White area on the lower part of the image (only in CEPH examination).	Panoramic chin-rest mounted.	Repeat the examination removing the PAN chin-rest.

8.6.2. Defects due to incorrect radiological data input

Problem	Description	Solution
Under or overexposed image.	The set kV values are not suitable for the size of the patient.	Try to modify the image with the image acquisition software tools or repeat the examination changing the kV and/or mA values. Set higher values if the image is too light or lower values if the image is too dark. If the problem persists call Technical Assistance
Completely black image.	No X-ray emission	Check the if the acoustic and led signal (led "2") indicating the X-ray emission are active. If the problem persists call Technical Assistance
Soft Tissues not or poorly visible in L-L projection.	The STF value is not correct.	Refer to paragraph 6.8.3 of the User's Manual to adjust the position of the "STF". If the value is correct but the effect on the image is poor retake the exposure setting a lower value for the STF.
	A symmetric cassette size was selected.	Select an asymmetrical cassette size (which will enable the STF filter).

8.6.3. Defects due to the unit

1. The Panoramic or Cephalometric image results in a light one also if the exposure parameters are correctly selected for the patient size may mean a not corrected alignment between X-ray beam and a sensor (PAN or CEPH) or a partial or total lack of X-ray; call the Technical assistance to solve the problem.

2. For Cephalometric examinations in latero lateral projections if soft tissue structure are poorly visible an adjusting of the STF setting may be requested to the Technical assistance. An alternative solution can be setting a lower STF value than that read on the nasion ruler; in this way the filter give an higher attenuation in the soft tissue area.

8.7. Analysis of the problems on the panoramic examinations

This chapter is aimed at giving a more detailed and in depth description of defects affecting panoramic images; basically this chapter deals with the same type of problems described in paragraph 8.6 adding a more detailed explanation of the cause and corrective actions to take.

The panoramic radiography is the examination of the maxillo-facial region normally used to view the dental region inside the complete head and sinuses-orbital complex. A good panoramic examination allows distinguishing the main anatomical structures that are shown in the next drawing:

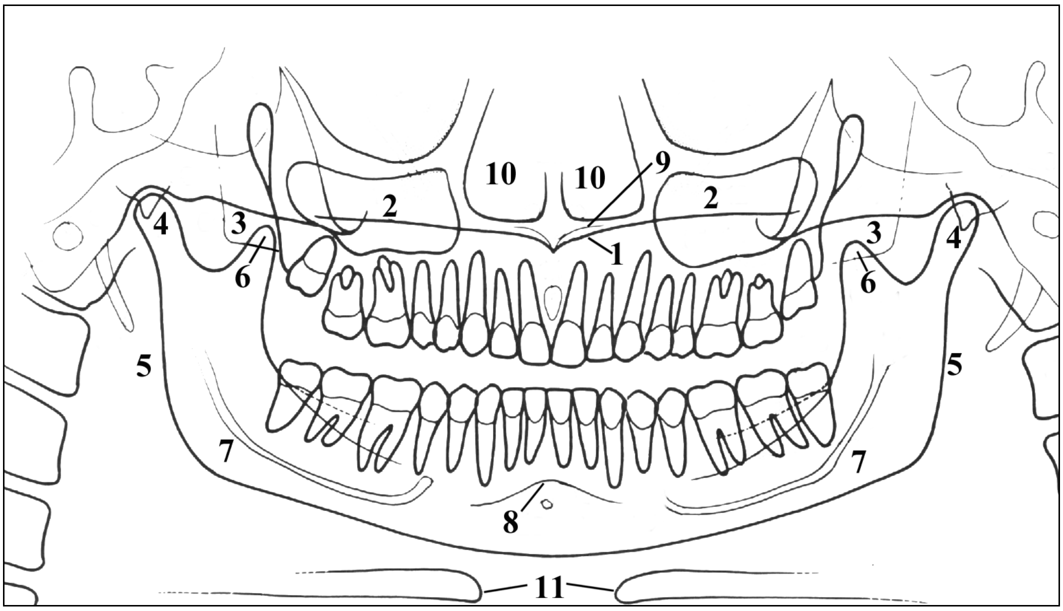


Figure 8-6

Ref.	***Anatomic structure***
1	*Hard palat plane*
2	*Maxillary sinus*
3	*Mandible*
4	*Temporo mandibular condyle*
5	*Ascending ramus of the TMJ*
6	*Coronoid process*
7	*Mandibular canal*
8	*Foramen*
9	*Nasal anterior spine*
10	*Nose*
11	*Ioid bone (normally duplicated)*

8.7.1. Proper positioning of the patient

The proper positioning of the patient during the panoramic examination is very important in order to get good quality radiography. This is due to the fact that the shape of the focussed area, e.g. of the layer clearly shown on the image, tends to follow the dental arch and has a non-constant deepness.
The objects outside this focussed area will therefore appear blurred on the resulting radiography.

1. The patient should not dress clothes that may interfere with the X-ray beam, also to leave more space between the patient's shoulders and the rotating arm of the machine. Care must be taken in order to avoid interference between the X-ray beam and the protective apron worn by the patient.
2. Metal objects (neck chain, ear-ring) must be avoided; this objects not only create radio-opaque images in their own position but also false images projected in other parts of the radiography, so disturbing the correct view of the anatomy.
3. The patient's head must be lightly tilted downward in order to have the Frankfurt plane horizontal. In this way, the hard palatal ceiling will be projected slightly over the superior apex of anterior teeth. If the patient has a low palatal ceiling, slightly increase the tilting downward.
4. Align the middle sagittal plane with centre of the chin support, normally indicated by the relevant light beam.
5. Check that the vertical light beam falls on the canine and lays between the third and fourth teeth. This will insure that the apex of the anterior teeth are positioned within the focussed area and therefore will be properly reproduced on the radiography. Normally, the panoramic equipment has a narrower focussed layer in the front area, and therefore a proper positioning of the anterior teeth is of the utmost importance.

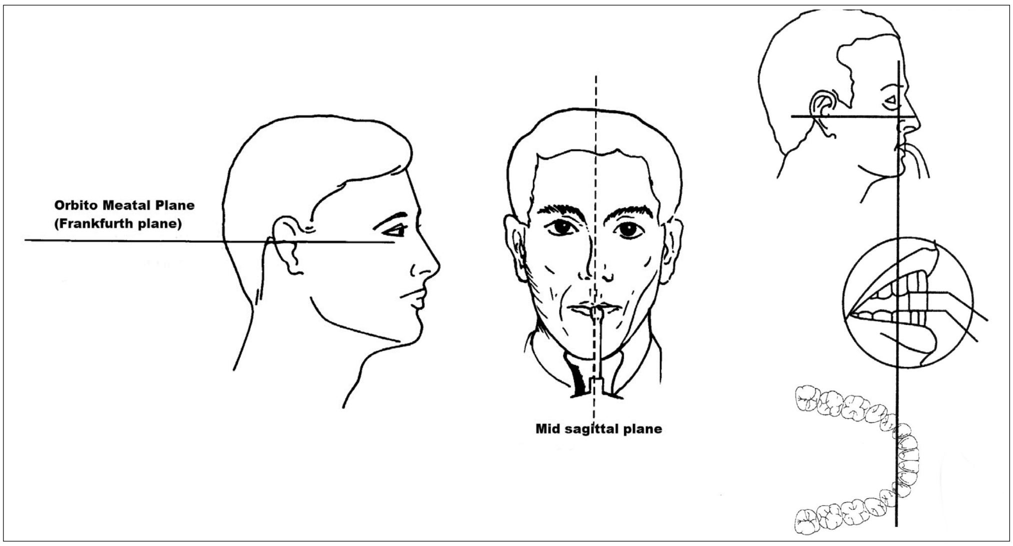


Figure 8-7

6. The patient must extend the spine; this is normally obtained by asking the patient to step forward, making sure that all other conditions are unchanged. If not properly extended, the spine will cause the appearing of a lower exposed area (clearer) in the front part of the image.
7. The patient's tongue must be positioned against the palate, otherwise the air between the tongue and the palate will create a lower absorbance area which will result on the image as a darker area which in turn will hide the apex of the superior incisor teeth.

The result of all the above listed actions will be radiography where all the parts are properly exposed are well identifiable as in the schema of Figure 8-8.

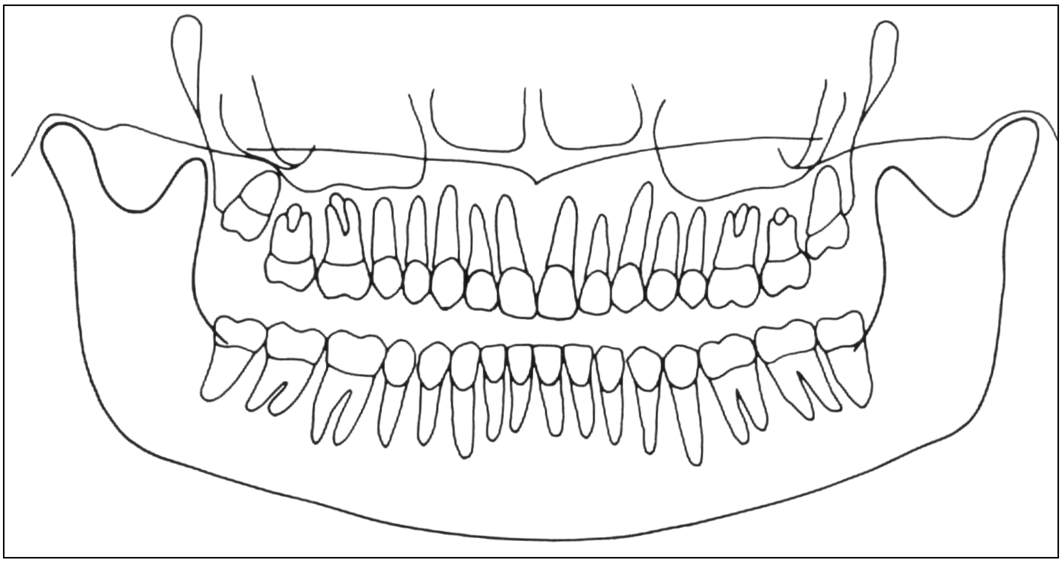


Figure 8-8

It must be noted that radiography is quite symmetrical, with the ascending rami of temporo mandibular joints almost parallel. The occlusal plane is shown slightly tilted upward, the palatal plane does not overlap the apex of the upper arch and therefore allows a good sight of the same.

8.7.2. Error due to a bad patient's positioning

- **The image shows the anterior teeth with reduced megnification and not well defined. The cervical spine is shown an evident white shadow.**

In addition, on the molar zone there are too much shadows, disturbing the view.

The resulting image is similar to the schema shown on Figure 8-9.

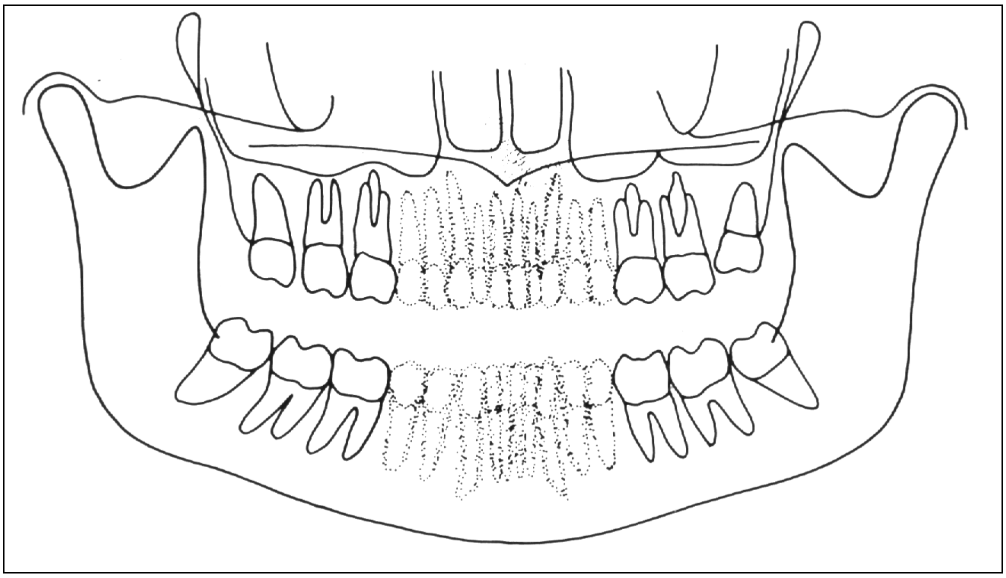


Figure 8-9

Possible cause:

The patient is positioned too forward, e.g. the centring light beam falls at the back as shown in the drawing, the anterior teeth will result unfocussed and reduced.

Remedy:

Check the patient positioning by using the light beams and the adjustment knob of the canine light beam.

If, after the correct patient's positioning, the problem still remain, check the alignment of the centering laser lights, as described on paragraph 7.1.2.

A fast check can be performed lighting on the beams and verifying its positioning. The mid sagittal line must lay on the center of chin rest while the canine one has to lay on the terminal part of the bite block.

A more accurate check can be performed using the rounded service tool and verifying that the distance between the two lateral metal parts.

- **Anterior teeth are enlarged and blurred**

The Figure 8-10 depicts the resulting image.

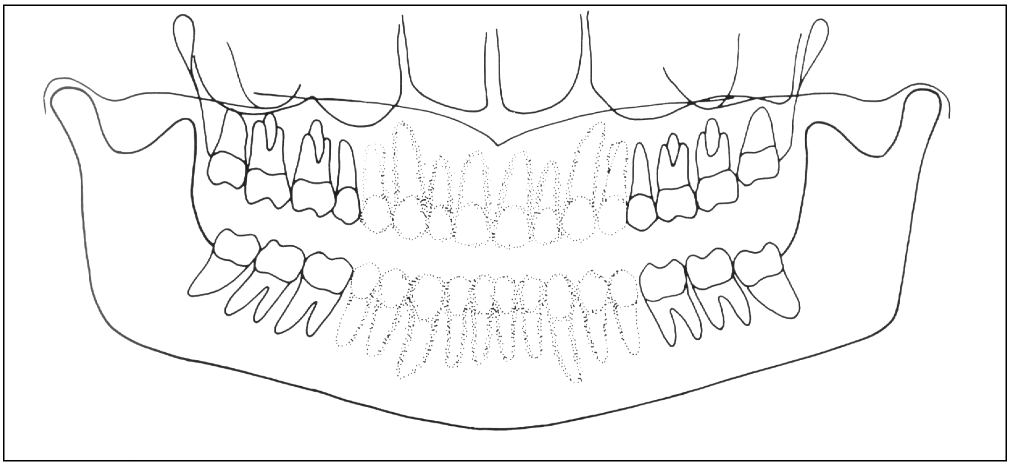
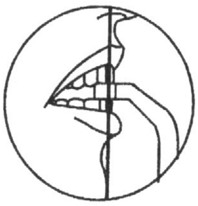


Figure 8-10



Possible cause:

In the case the patient is positioned too backward, e.g. the centring light beam falls at the beginning of the anterior teeth, as shown in the drawing.

Remedy:

Check the patient positioning by using the light beams and the adjustment knob of the canine light beam as above described.

- **Part of the image is enlarged while the other one is reduced**

The schema described on Figure 8-11 the image obtained; it is possible to observe that one part of the radiography is blurred and enlarged, while the other one is reduced and seems to be on focus; the two condiles are at the same height on the image.

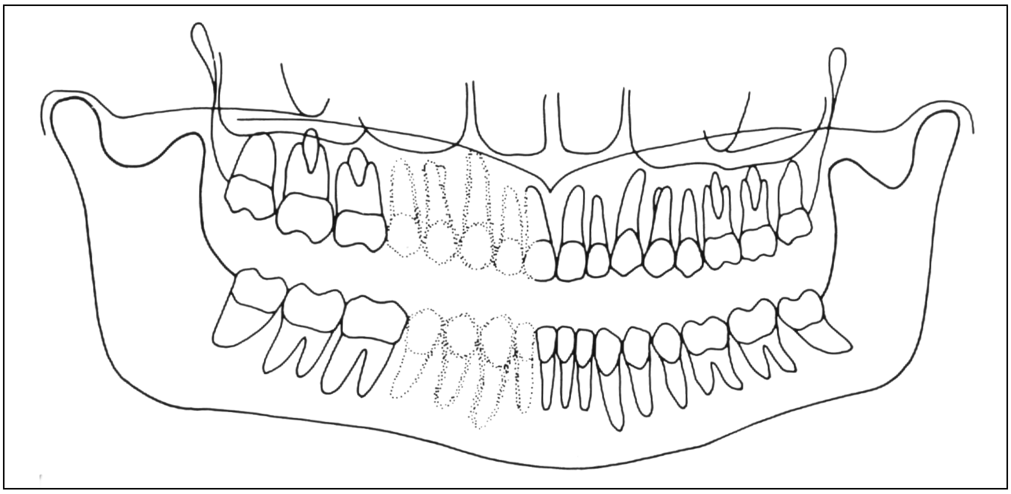
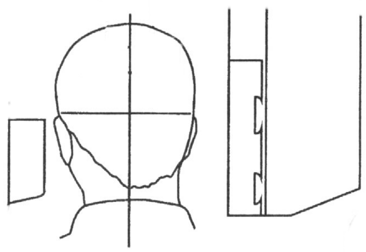


Figure 8-11

Possible cause:



This effect can be due to two different causes.
In the first one, the median-sagittal plane is not aligned with the relevant centring light beam, which falls at the centre of the chin support.
In the second case instead, the centre of the median-sagittal plane matched the centre of the chin support, but the patient's head is rotated.

In both cases, one side is closer to the image plane than the other, thus resulting in a different magnification of the two sides; the part more distant from the image will be more magnified while the part closer to the image plane will result smaller. This error in positioning the patient will result in a radiography as shown in the next drawing: the right-most area of the image shows a bigger magnification that can be noticed either on the teeth and on the ascending rami of the TMJ.

Remedy:

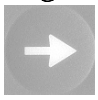
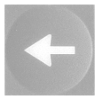
Check the positioning of the median-sagittal plane by using the relevant centring light beam.
Check also the position of the middle sagittal beam; lighted, it must fall down on the center of the chin rest and also on the center of the byte.

A more accurate check is performed using the special rounded tool and making a image; the dimensiuons measured on the obtained image must match those reported on the service manual, with a ±1mm tolerance.

In case these dimensions are not respected, perform a calibration of the X and Rotation axis; particularly X axis has to be checked if the mid sagittal beam is off center, while the rotation must be checked if the two measures (center to right against center to left) are different.

In case of rotation adjustment, the X axis position must be always cheched; this can be accomplished using the program for Y axis and measuring the distance between , with the beam lighted, pressing the Test button  to perform a rotation of 180°, looking at the intersection of the laser beam with the reference line of the flat template. The intersection point must not drift more than 2 mm, measure this drift.

If this does not happens, means that the sigittal laser is not aligned with the rotation center, so it must be adjusted; to perform it, remove the upper cover of the STRATO 2000 Digital.

Still in the Y axis position, using the  and/or , moves the X axis half of the above measure and on the opposite direction of the drift; save the new position of the X-axis. At this point, the mid sagittal laser will not be in the correct position and it must be aligned using the four screws of the laser support; this operation must be performed in such a way that all the laser beam falls on the reference line.

- **The image shows TMJ at different height**

This fact is described in Figure 8-12.

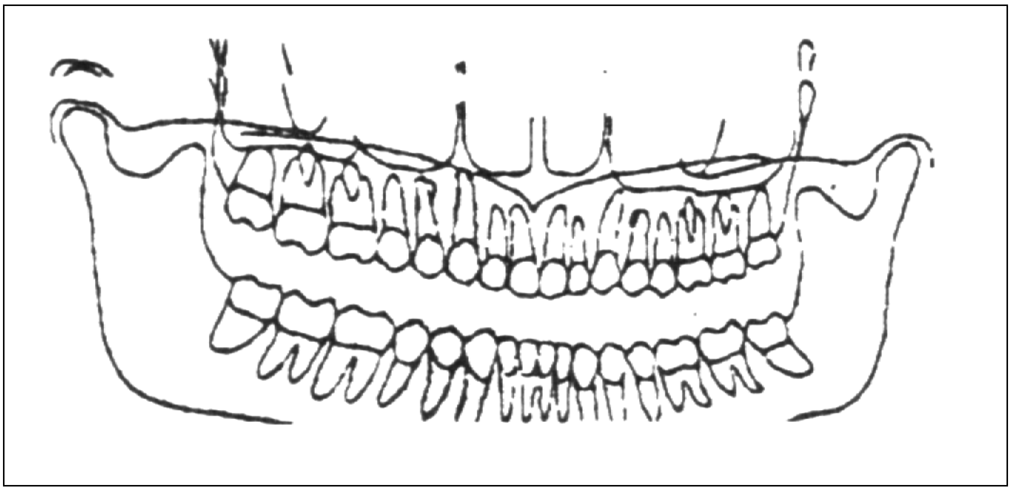


Figure 8-12

Possible cause:

The mid sagittal plane is not vertical. This can be a patient's problem, but if the defect is always present, check the laser beam.

Remedy:

Verify that the laser beam is vertical; this check can be performed very quicly using the laser beam and verifying that falls on the center of the chin support; remove the chin support itself and check that the beam falls on the center of the holes used to fix the chin itself.

If not, a possible cause can be due to a non perfect horizontally of the chin arm, that must be adjusted using the relevant screws.

- **The image shows undulated teeth rows**

As can be seen on Figure 8-13, the upper teeth are magnified and unfocussed, with the shadow of the hard palate positioned over the superior apex. The temporo-mandibular joints are exposed outward, with lines divergent upward. In some cases, the condile vertex might not appear on the image.

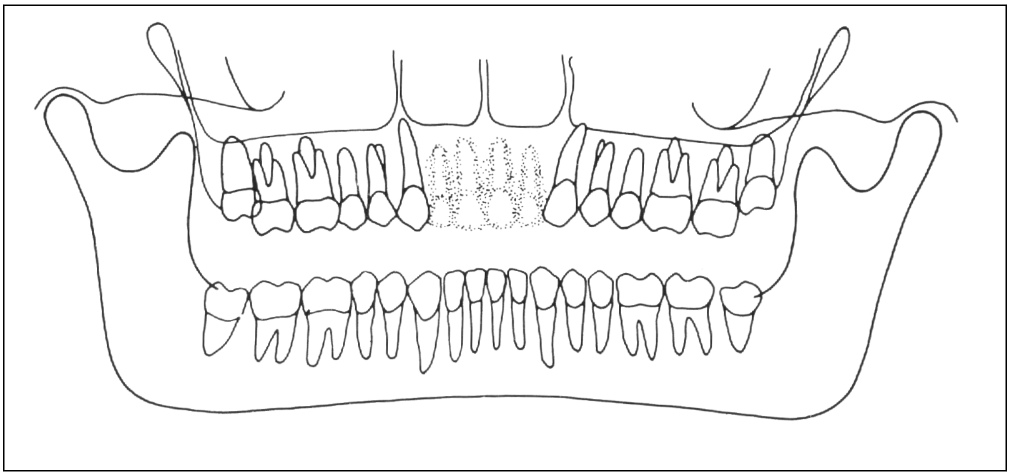


Figure 8-13

Possible cause:

Patient's head tilted upward.

A Frankfurt plane too tilted upward produces different anomalies that may also appear contemporaneously. A chin support plane too high during the patient positioning or when extending the spine may generate this mistake. In this condition, the rear side of the patient's head may also interfere with rotating arm of the panoramic equipment.

- **The radiographic image shows the teeth row too curved upward with the lower incisor non-focussed**

Additional defects shown on Figure 8-14, the temporo-mandibular joints will be positioned too high with lines converging upward. In some cases the upper condile might not be visible in the image.

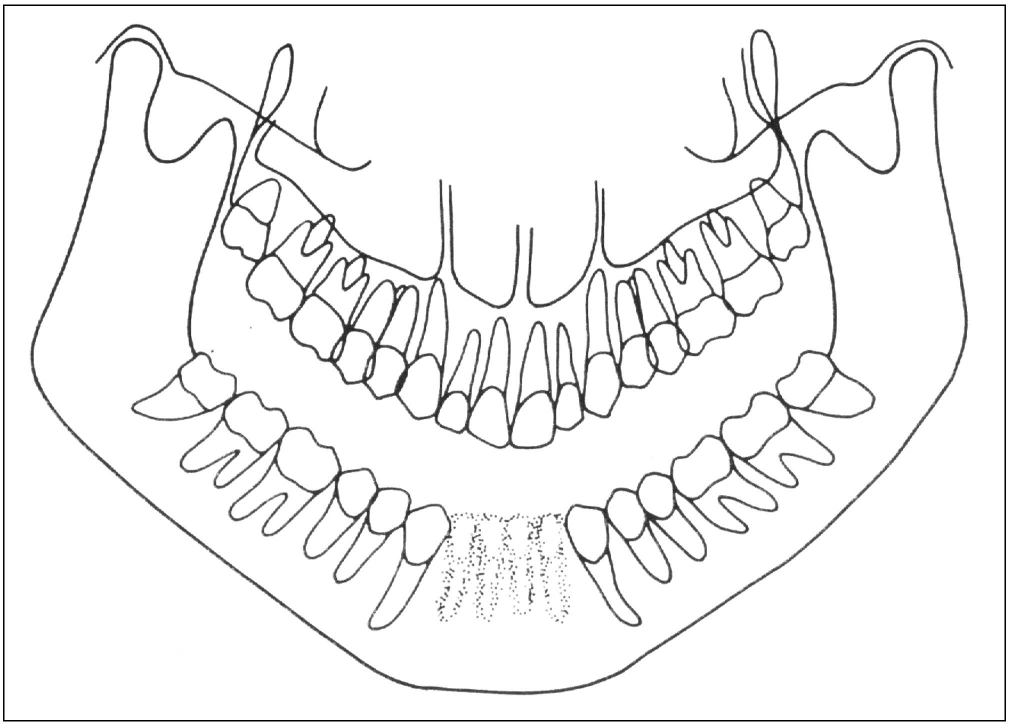


Figure 8-14

Possible cause:

Patient's head tilted downward, as on the aside schema.

Remedy:

Check the positioning of the patient by aligning it with the help of the corresponding light beam.

NOTE:
In some cases the positioning of the Frankfurt plane too tilted downward produces a correct image of the lower incisors, but the projection of the palate falls on the lower teeth apex, as shown on Figure 8-15.

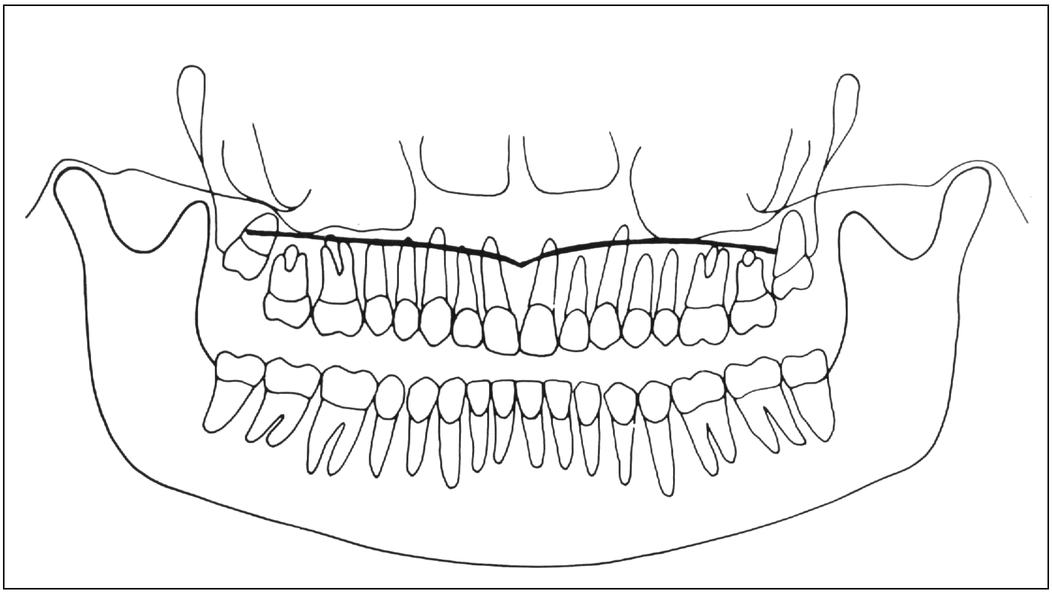


Figure 8-15

In this case, a light tilting downward of the Frankfurt plane causes the palate to be projected over and too far from the root of the teeth of the maxilla arch, without distortion of the incisor teeth, as on Figure 8-16.

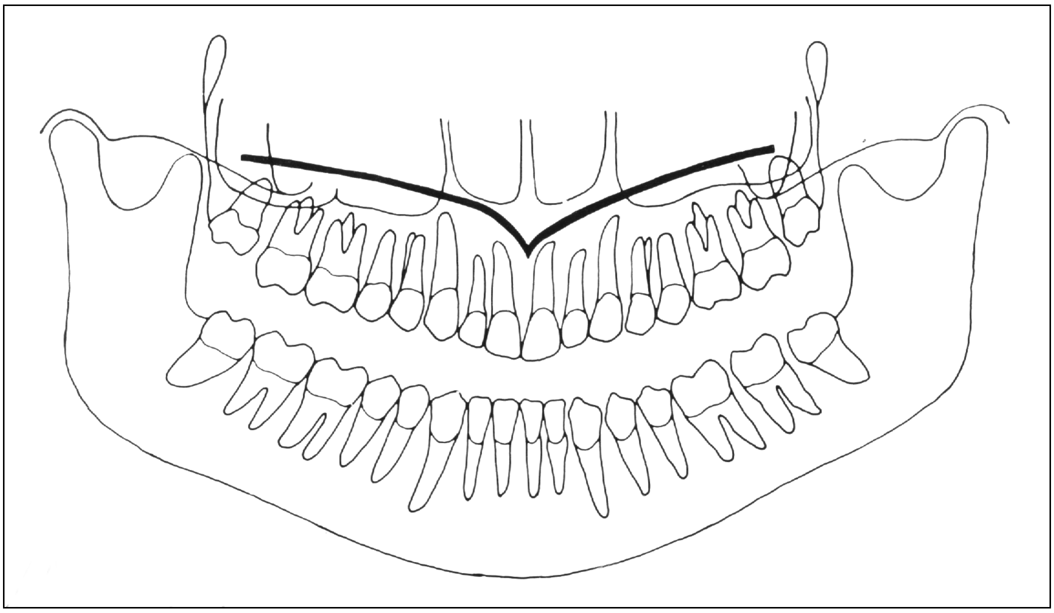


Figure 8-16

8.7.3. Images with artefacts

- **Radiographs that show images with soft tissues or artefacts**

The radiographs may show anatomical parts of the soft tissues or show radiographic artefacts.
Normally the soft tissues might be more or less present depending on the patient positioning, while the presence of artefacts is strictly dependent on the presence of foreign objects on the trajectory of the X-ray beam.
Next figure shows these cases; please consider that all structures have a bilateral duplicate.

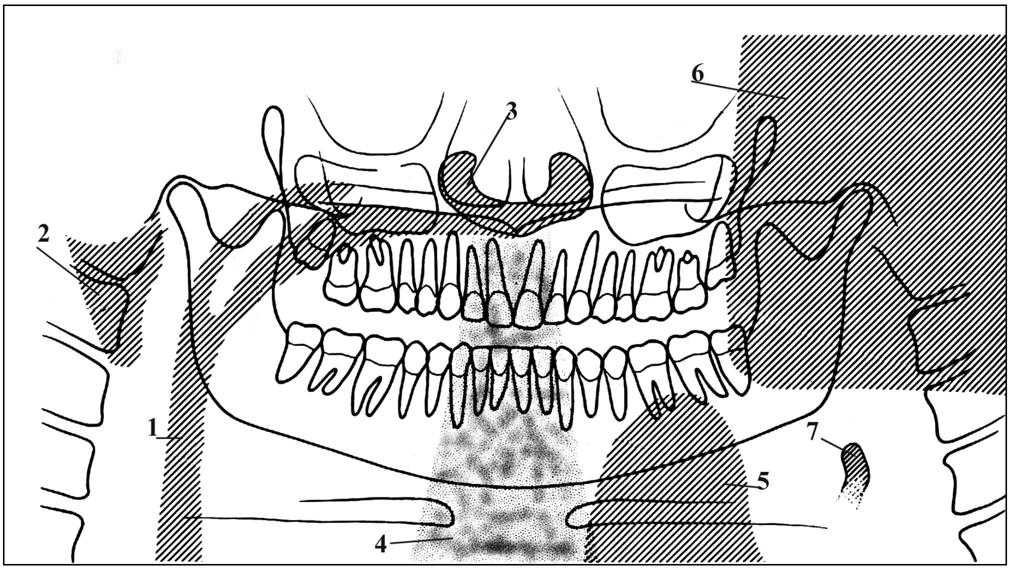


Figure 8-17

Where different references are described among with the cause/remedy, if any.

Soft tissue	Description	Artifacts	Description
2	Hear soft tissue	1	Dark shadows due to the air gap between tongue and palat
3	Nose soft tissue	4	Spine column
7	Epiglottis	5	Leaded apron too high

The part identified with "6" in Figure 8-17 represents the image of the controlateral mandible (the other side of the mandible). That therefore results as a clearer area overlapped to the real image. Very often the resulting darker area in the bottom corner is noticed and is considered as an artefact of the radiological image.

This is not true, because it is derived from the projection geometry used to obtain the panoramic image. The effect can be more evident if the image in underexposed due to wrong radiological parameters.

With reference to the previous Figure 8-17, let's analyse the cause and remedy.

- **Wrong positioning of the spine**

In the case the image shows a too clear and unfocussed area in the central portion (see point "4" - Figure 8-17), this is probably caused by the wrong position of the spine that has not been properly extended by the patient. In this case, the spine absorbs a too big quantity of radiation that therefore causes the image to be too clear. This lightness can be noticed especially in the lower part of the image, while it's normally less visible on the upper part of the image.

Remedy:

Ask the patient to step forward thus extending the spine, in order to reduce X-ray absorption.

- **Shadows or bright artefacts**

The most common cause for the presence of these artefacts is the presence of metal objects worn by the patient (ear-rings, necklace). The necklace worn on the neck of the patient can normally result in a radio-opaque arch positioned in the chin area. This arch normally overlaps the chin itself and the shadow of the spine, disturbing the diagnosis of possible problems in the chin area and in the area of the superior apex.

The ear-rings instead creates real images in the proper position and shadow images projected in the contro-lateral area, thus hiding possible problems or generating bright areas within the paranasal sinuses.

In some cases, that may depend either on the trajectory of the panoramic machine or on the position of the metal objects, they can generate up to three images (one real ad two shadows), thus further disturbing the correct diagnosis.
This situation may occur especially if the patient has large prothesis or metal cures and if it is associated to a positioning error, that projects the shadow of the metal part on wide area of the image.

- **Non-exposed area in the lower-central part of the image**

  If the problem appears as shown in point "5" of the previous Figure 8-17, it indicates that there has been interference between the leaded apron worn by the patient and the X-ray beam.

  Remedy:

  Properly position the leaded apron (it must be worn well tight to the shoulder and neck of the patient) then carry out a new examination.

- **The teeth rows are overexposed**

  As already described, if the tongue is not positioned against the palate during the exposure, it will create an air chamber between the tongue and the palate; this air gap creates a less absorbing area that overlaps the teeth, often in the apex area. This area is identified with reference "1" in Figure 8-17.

  Remedy:

  Ask the patient to position the tongue against the palate during the exposure.

9. SCHEMATICS AND DRAWINGS

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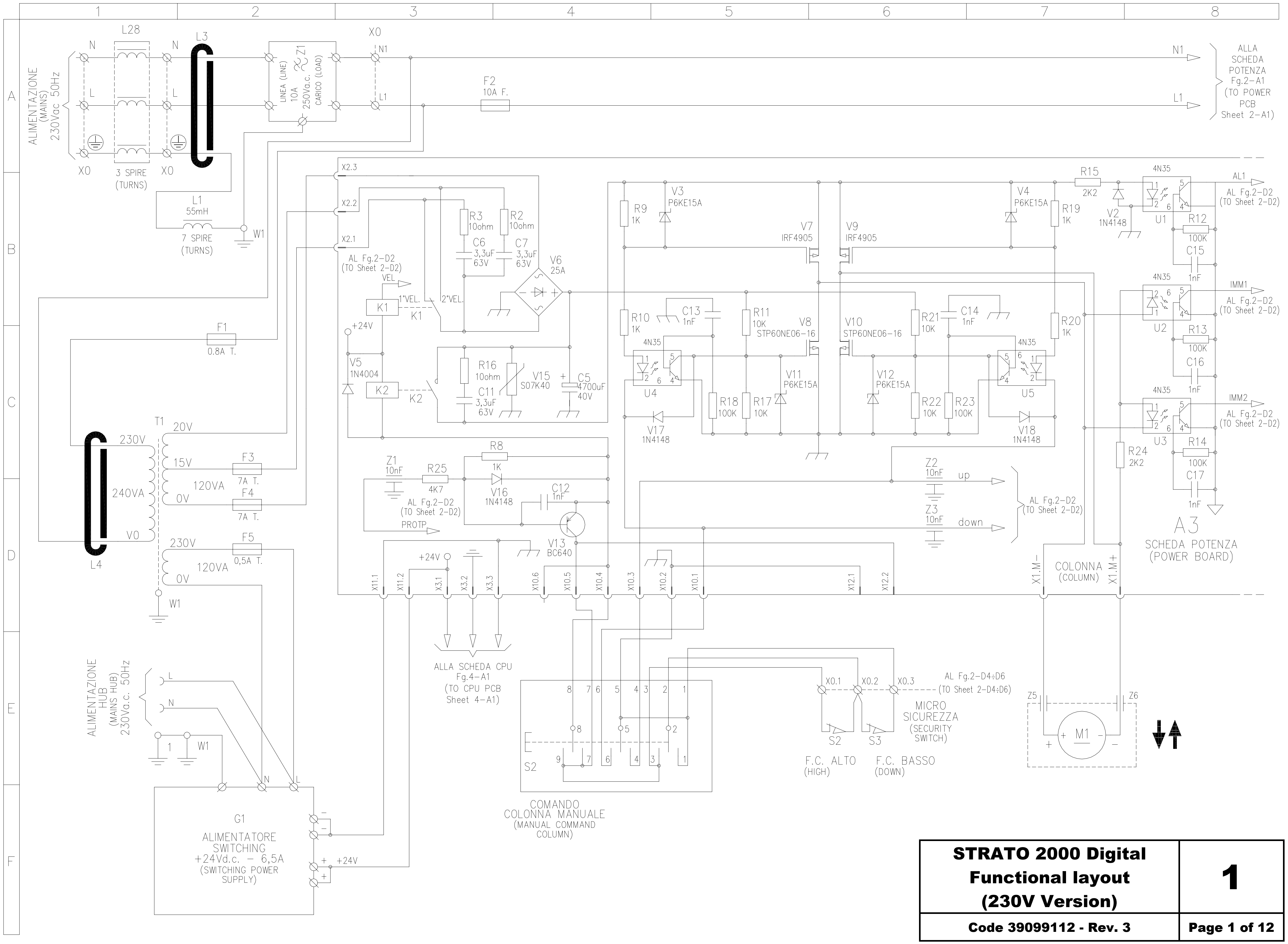

STRATO 2000 Digital Functional layout (230V Version)	1
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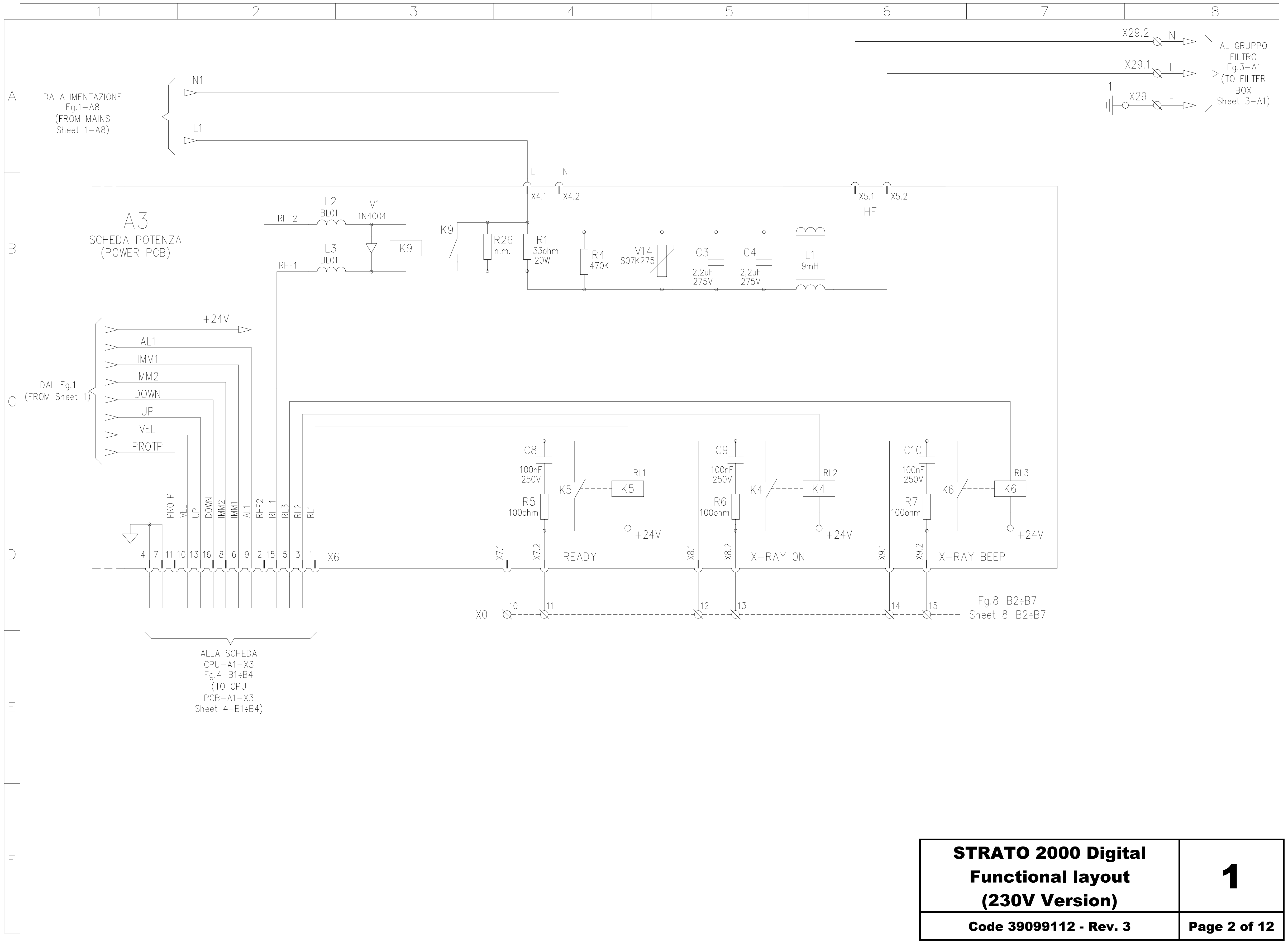

STRATO 2000 Digital Functional layout (230V Version)	1
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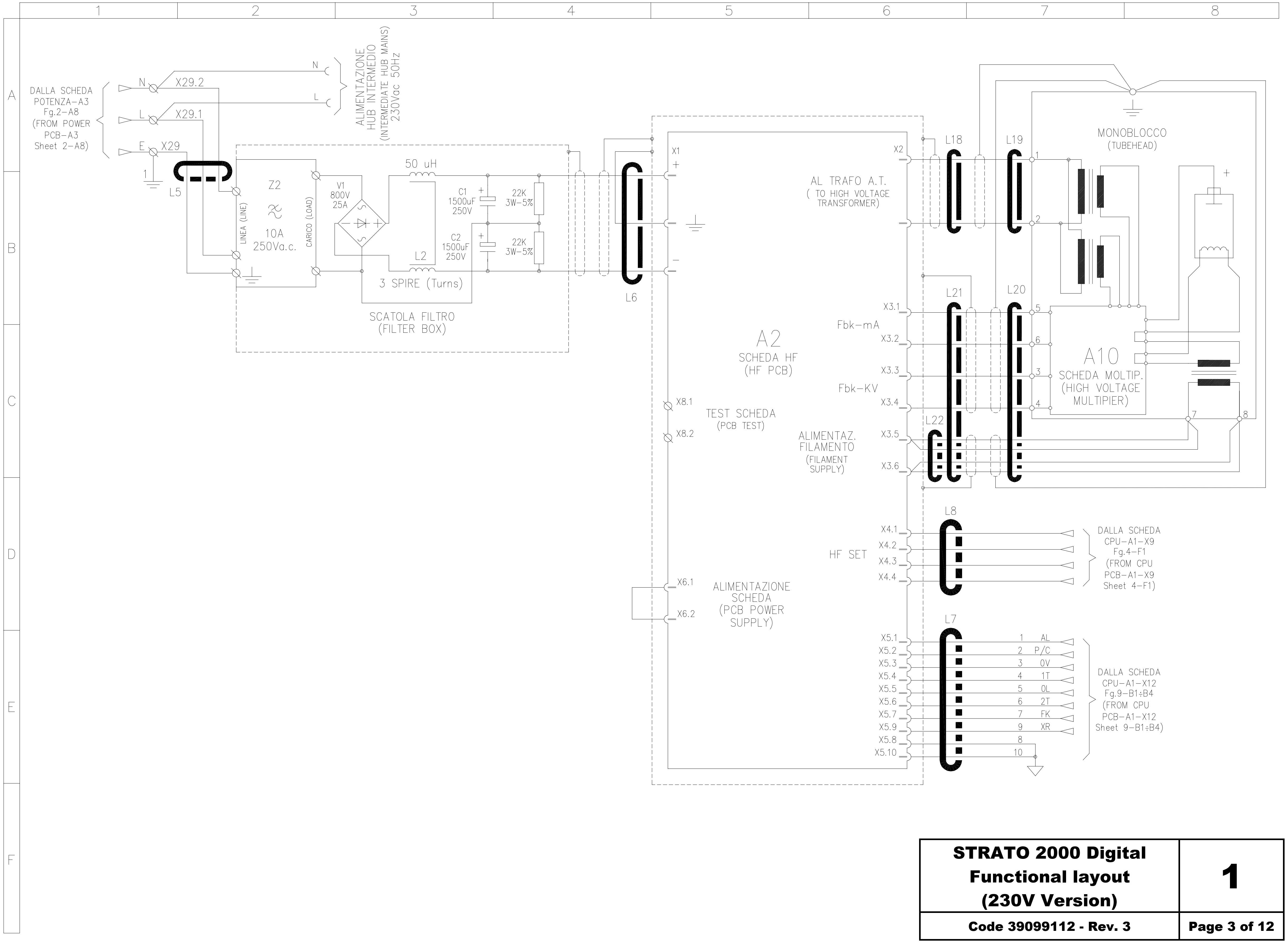

STRATO 2000 Digital Functional layout (230V Version)	1
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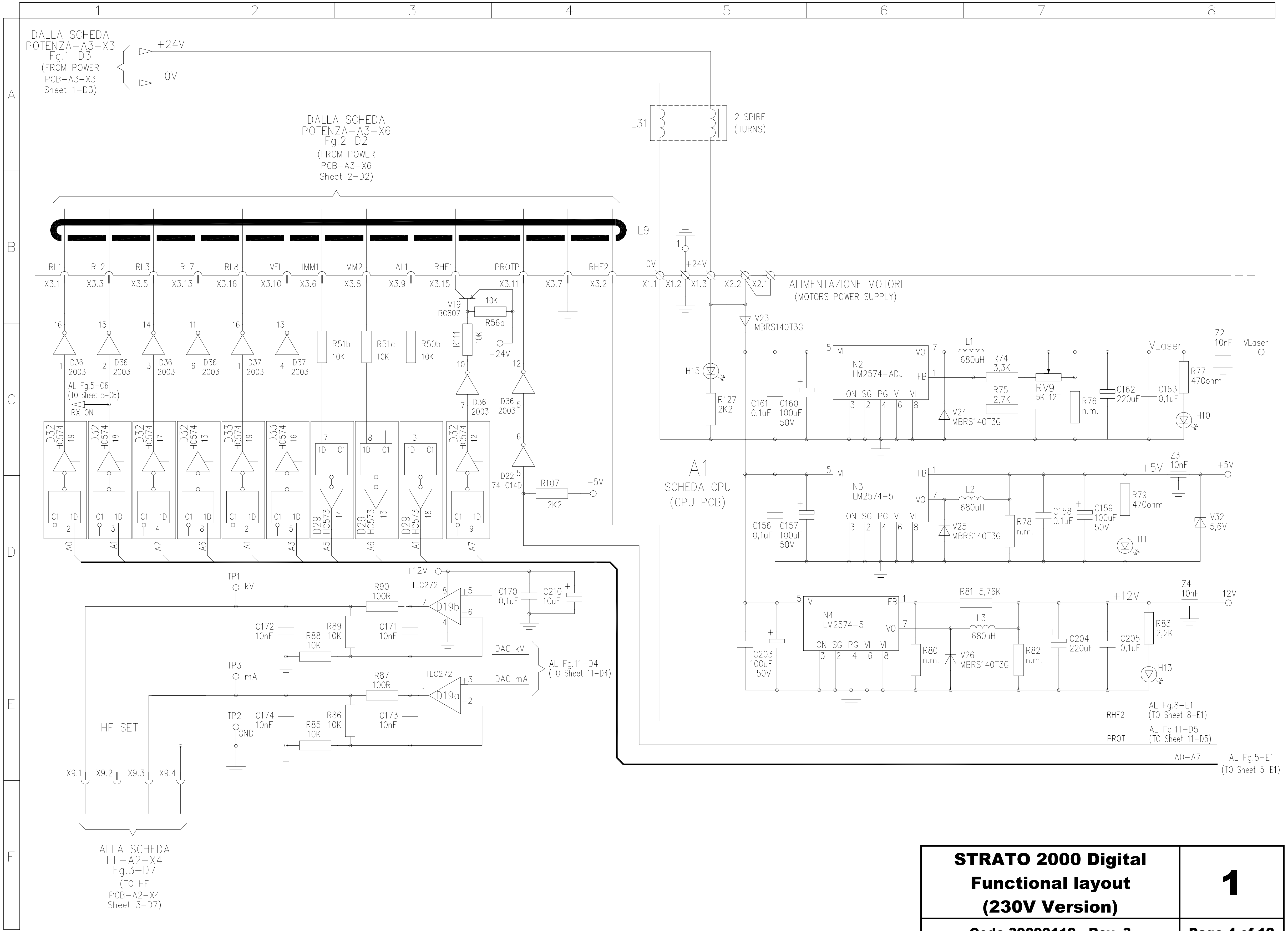

STRATO 2000 Digital Functional layout (230V Version)	1
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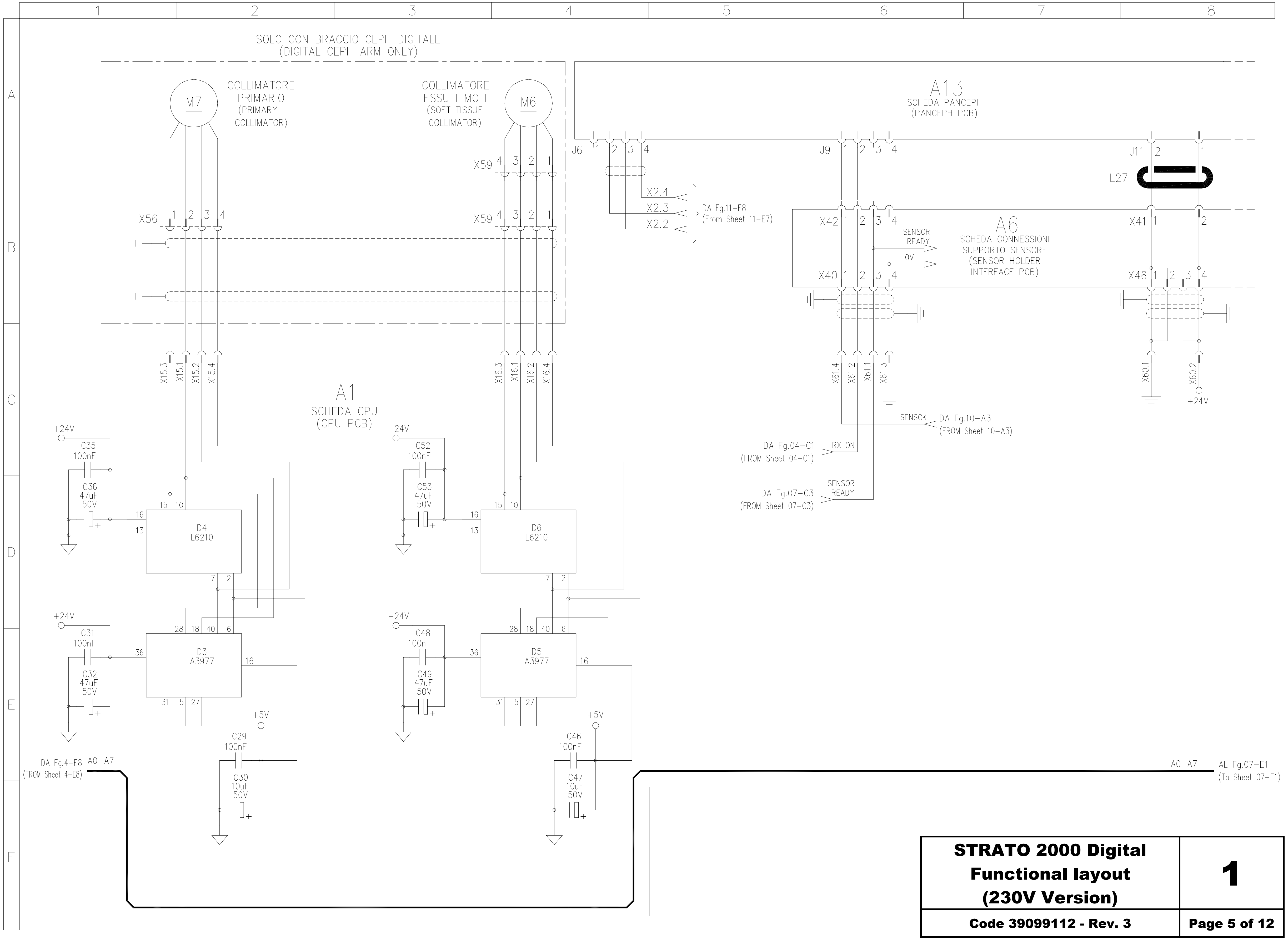

STRATO 2000 Digital Functional layout (230V Version)	1
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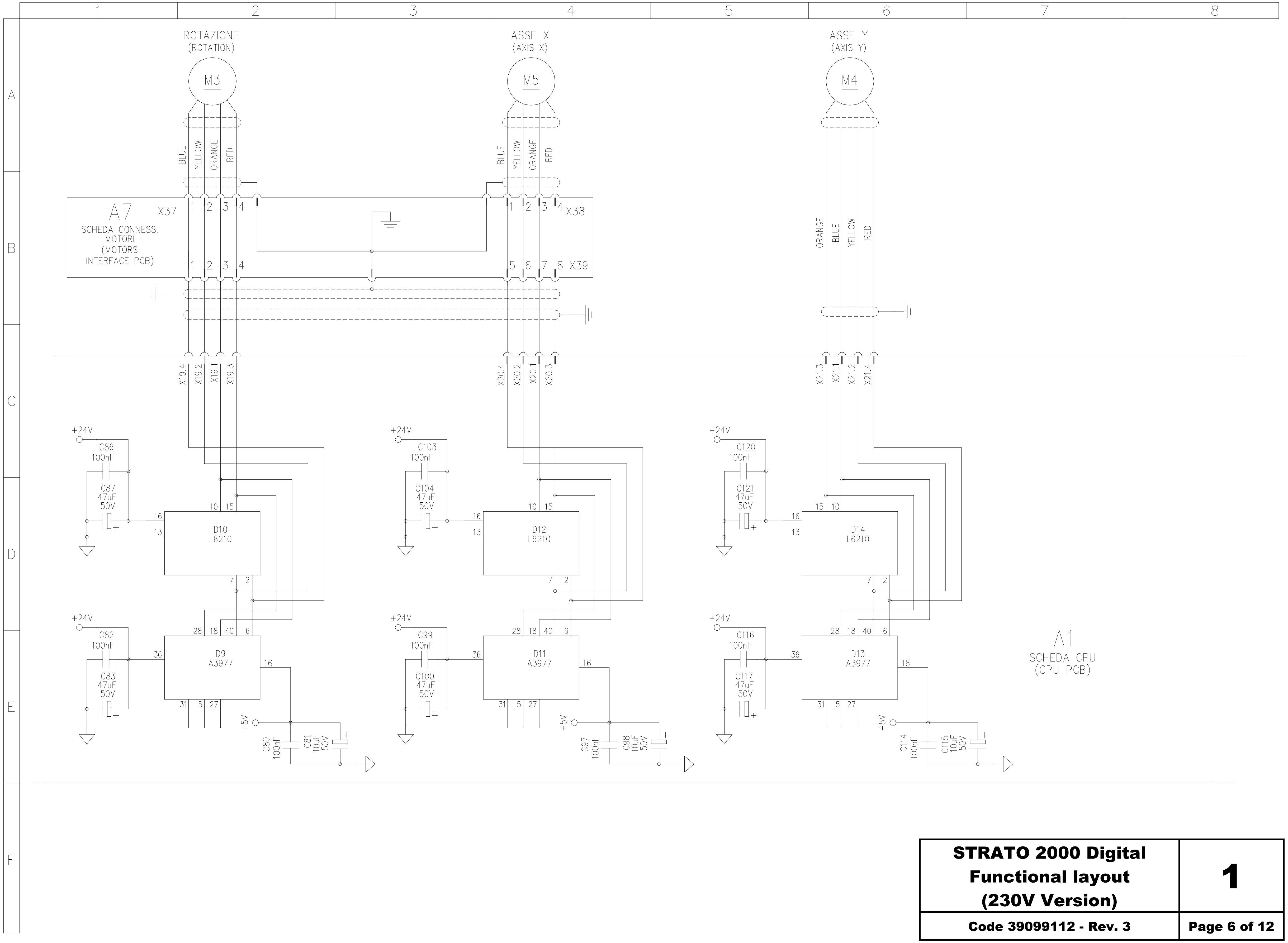

STRATO 2000 Digital Functional layout (230V Version)	**1**
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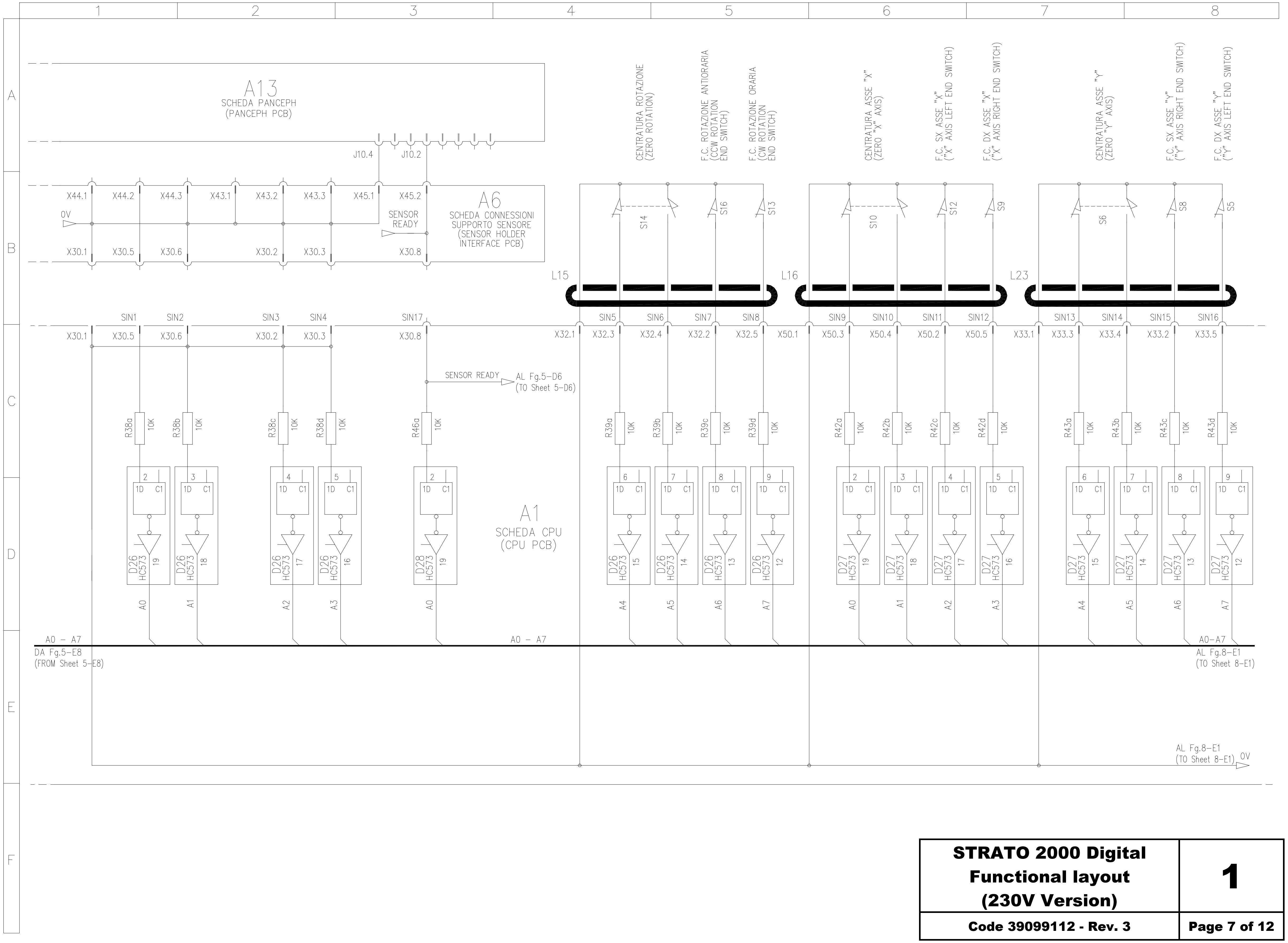

STRATO 2000 Digital Functional layout (230V Version)	1
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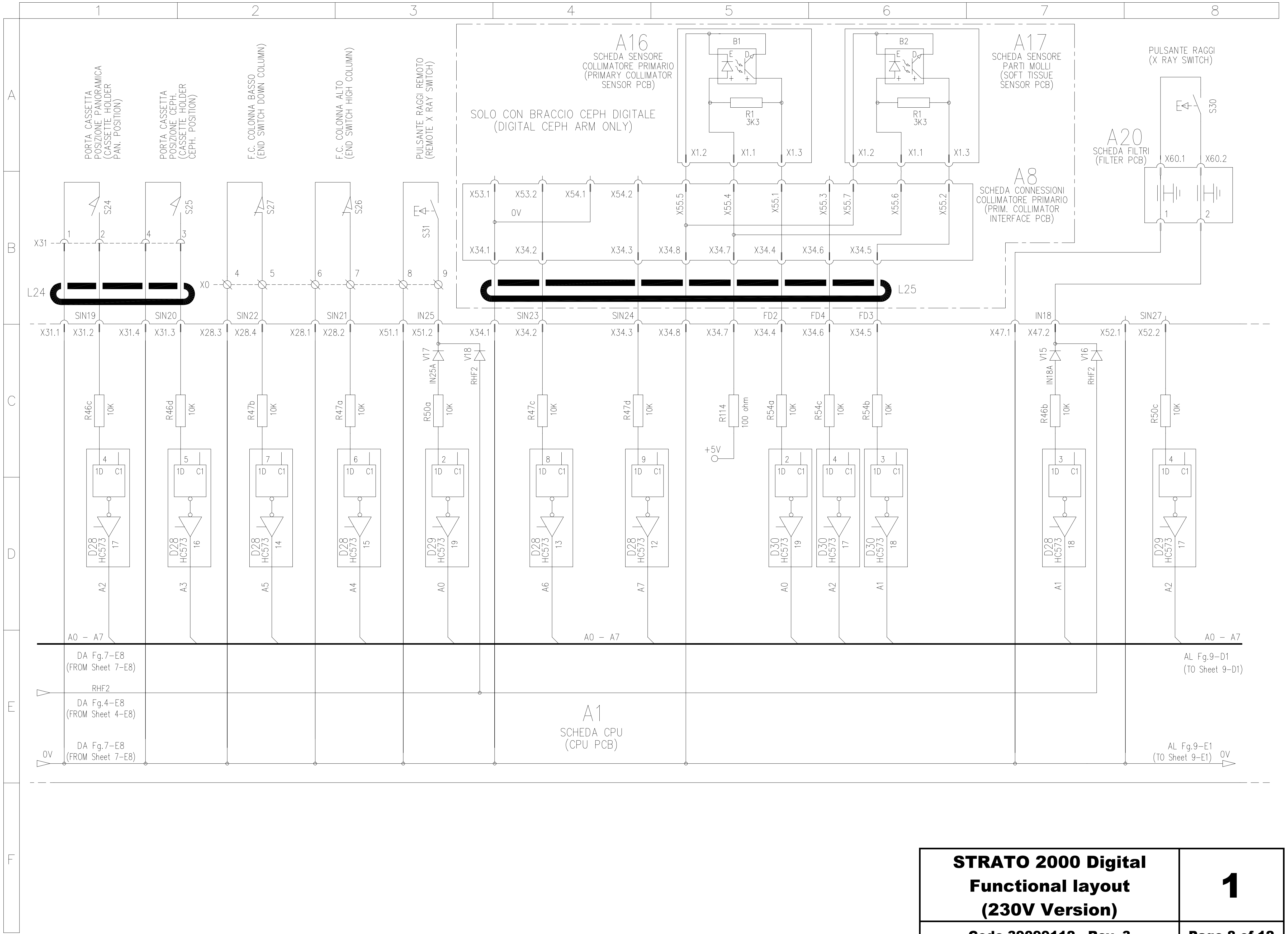

STRATO 2000 Digital Functional layout (230V Version)	1
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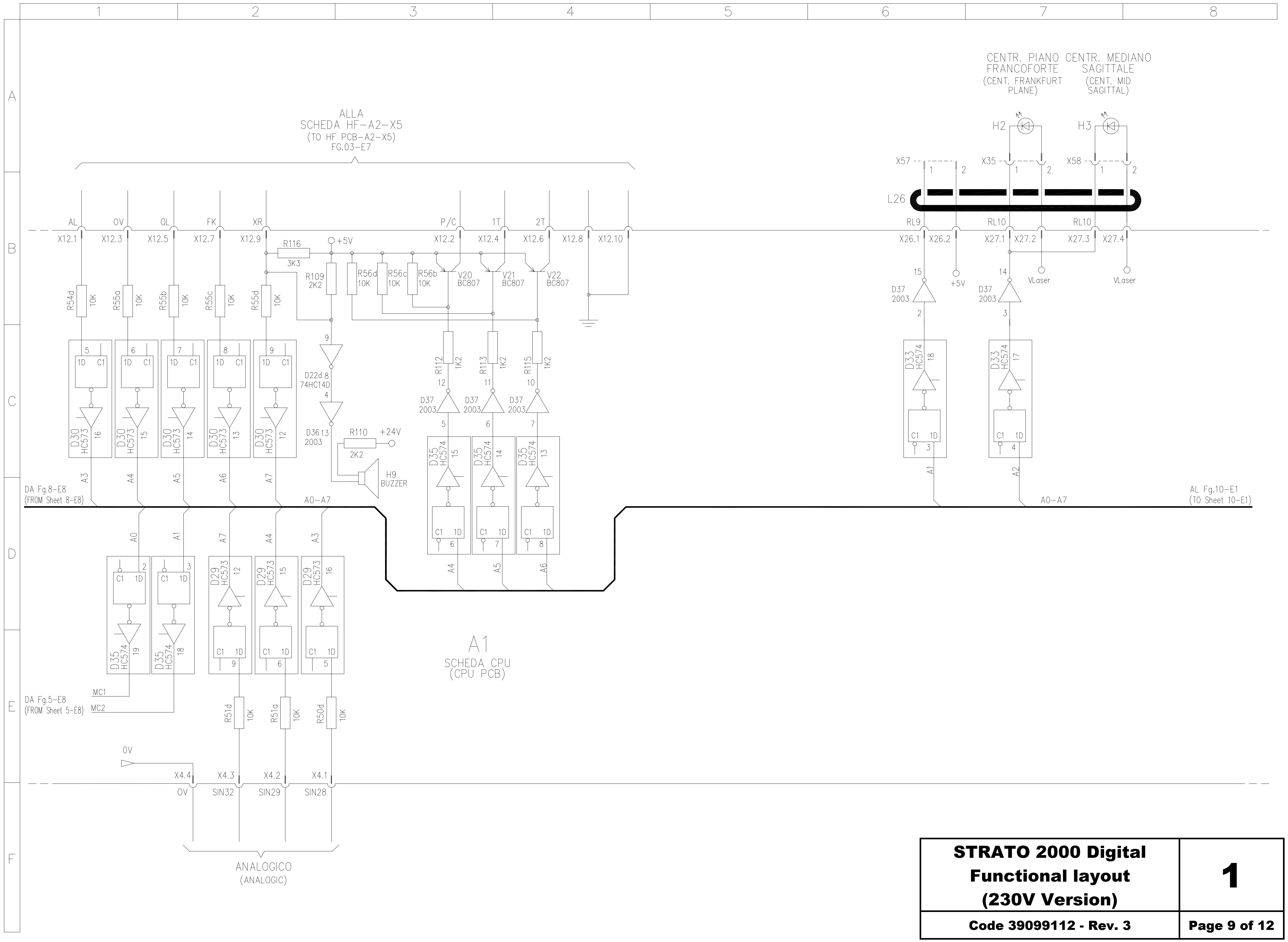

STRATO 2000 Digital Functional layout (230V Version)	1
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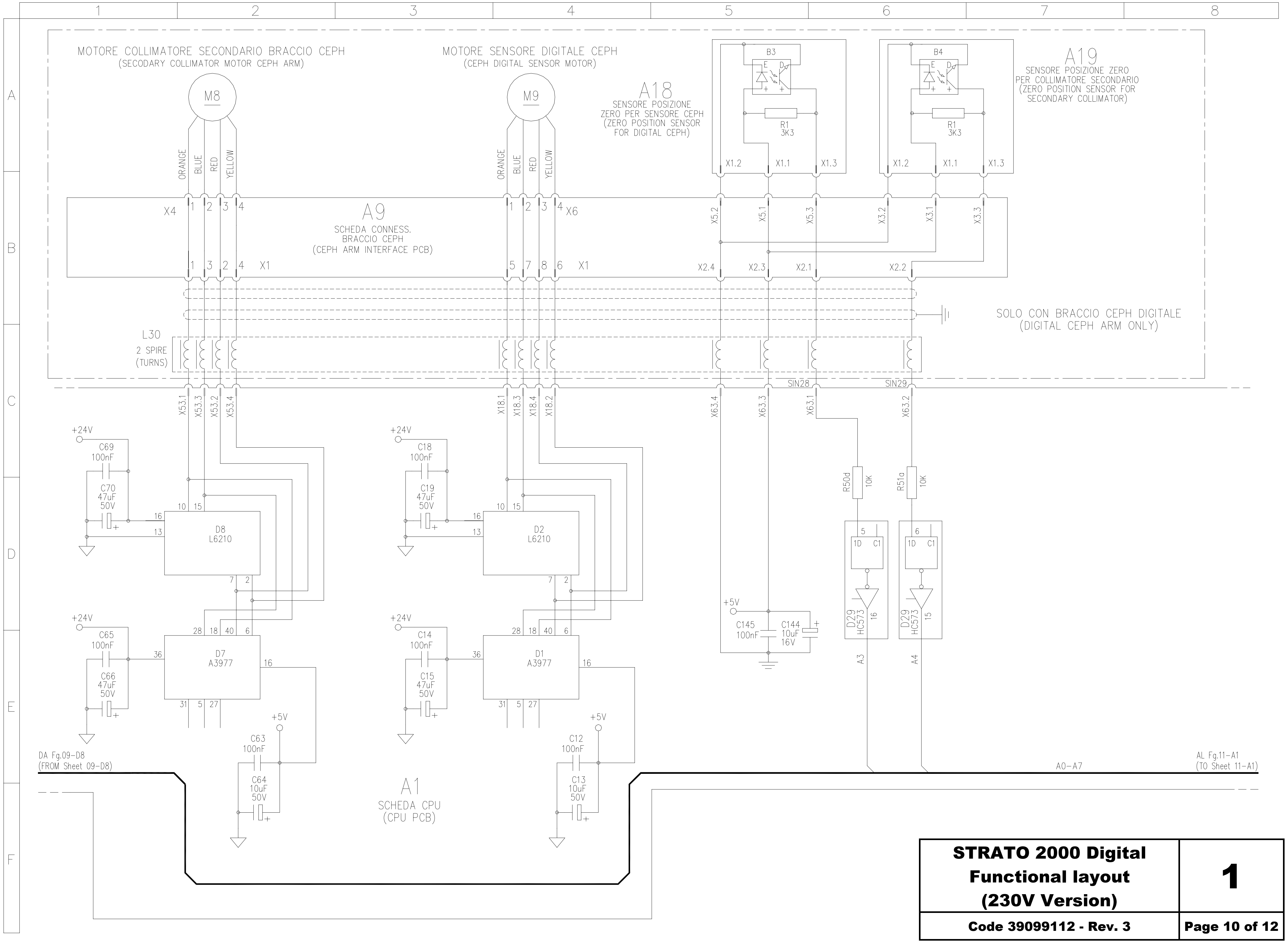

STRATO 2000 Digital Functional layout (230V Version)	1
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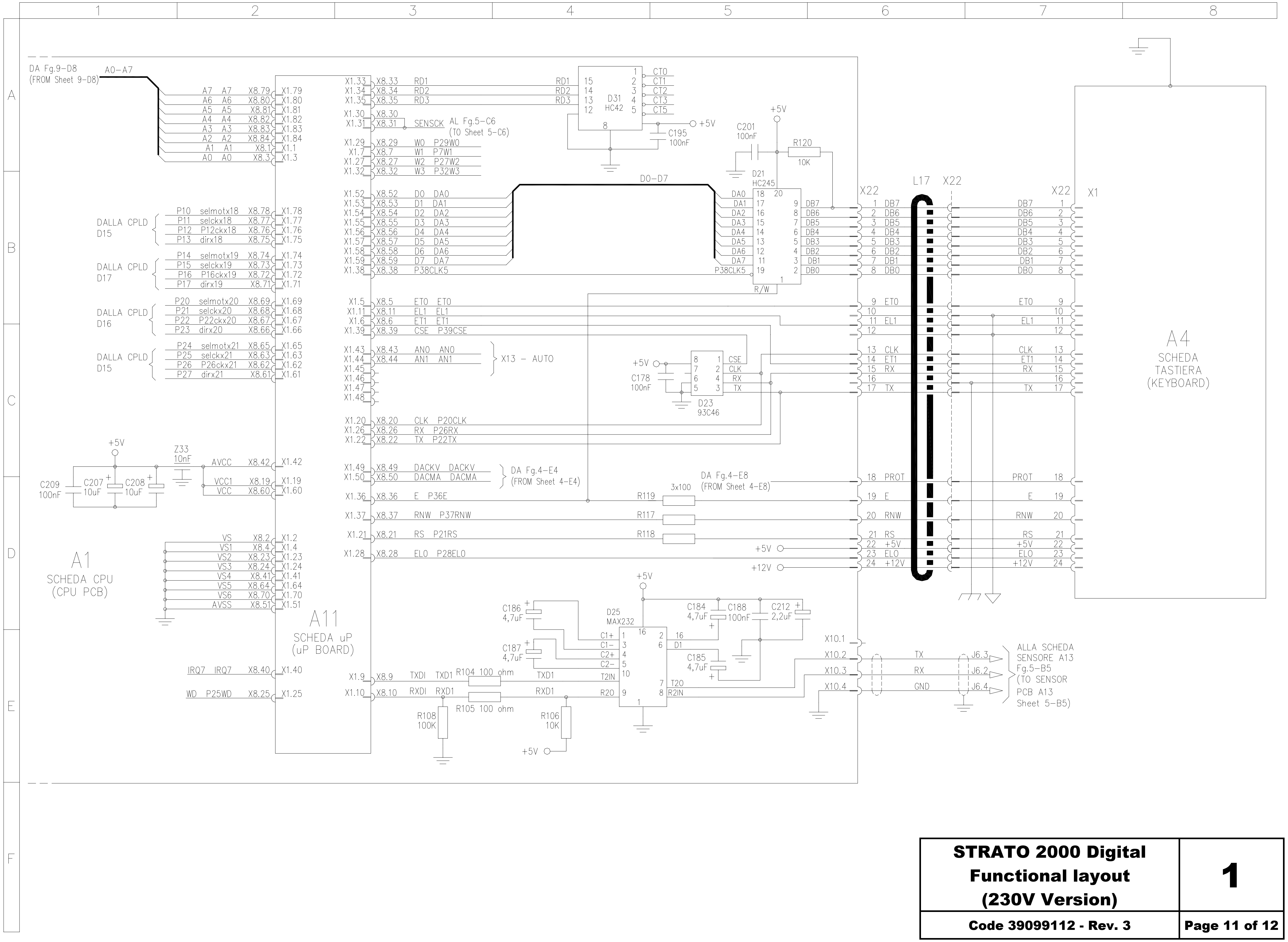

STRATO 2000 Digital Functional layout (230V Version)	**1**
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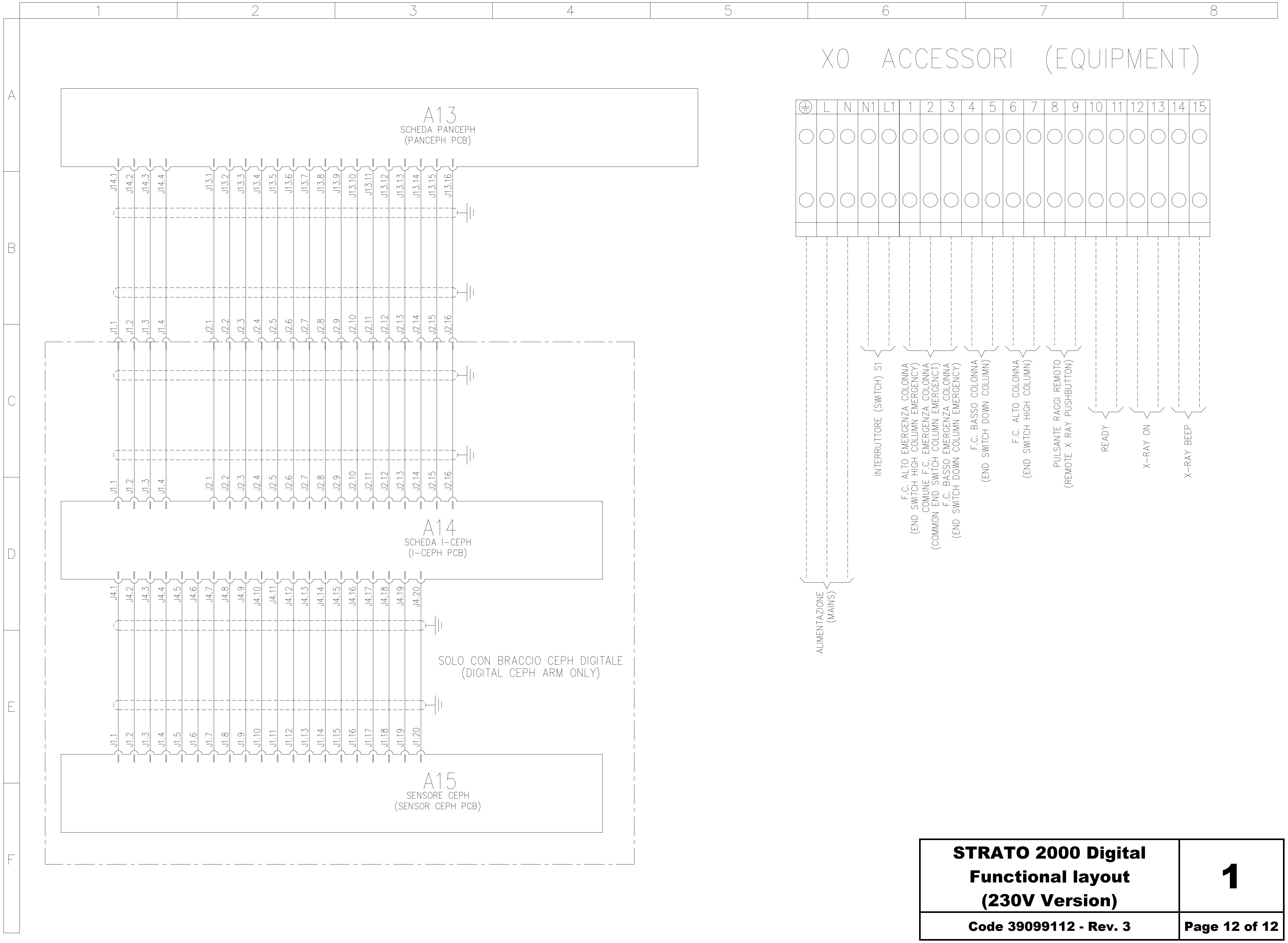

STRATO 2000 Digital Functional layout (230V Version)	1
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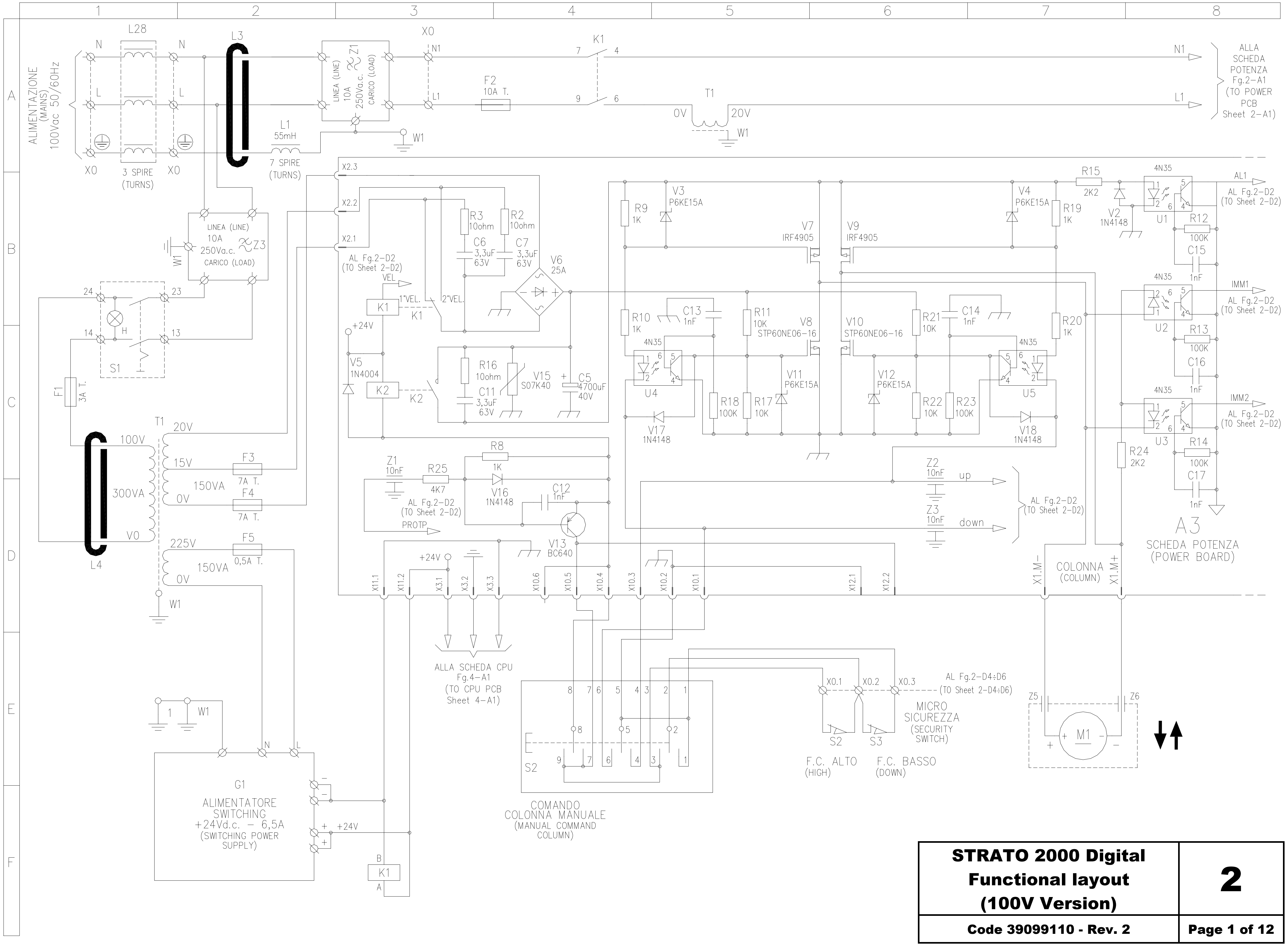

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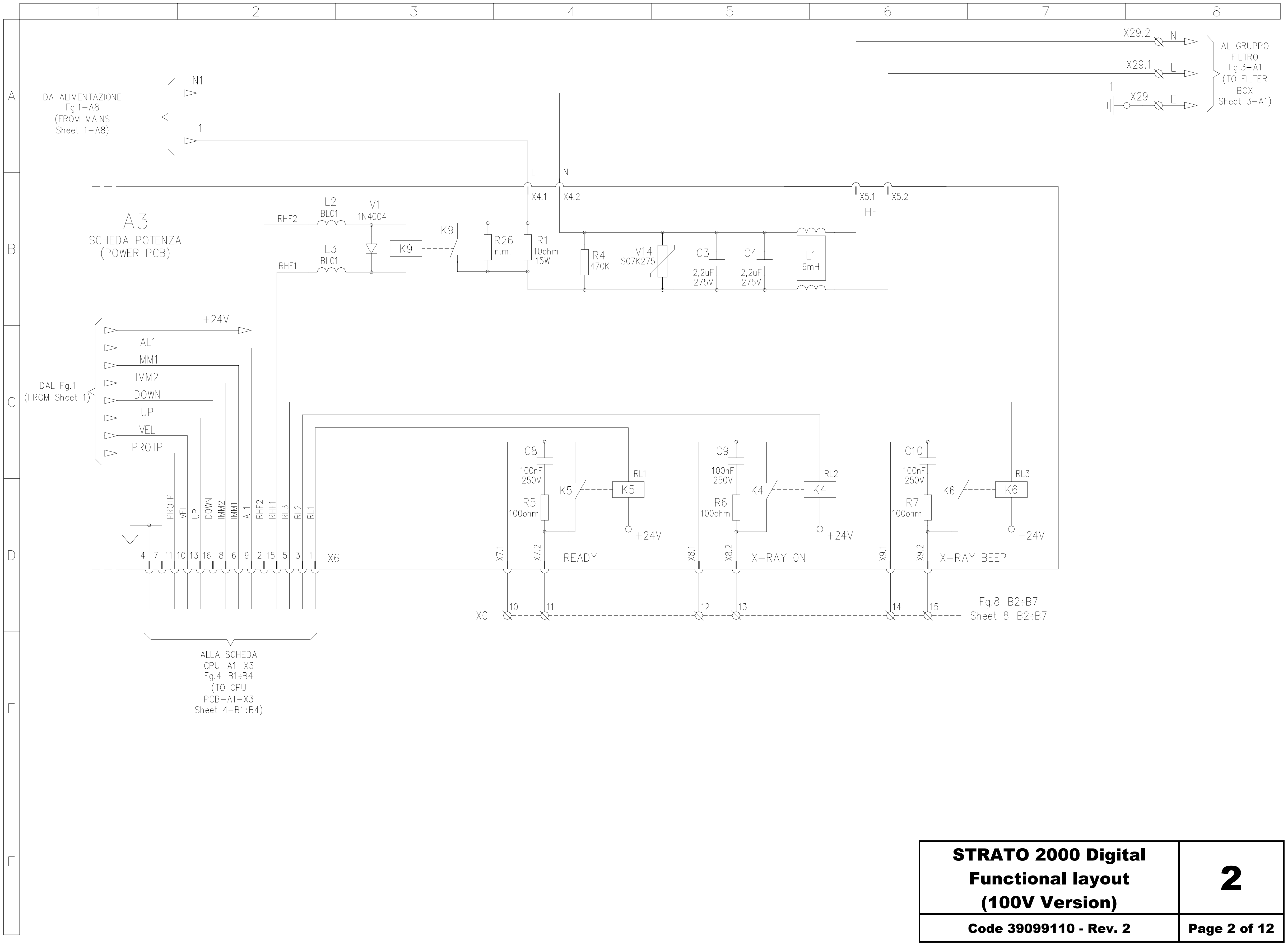

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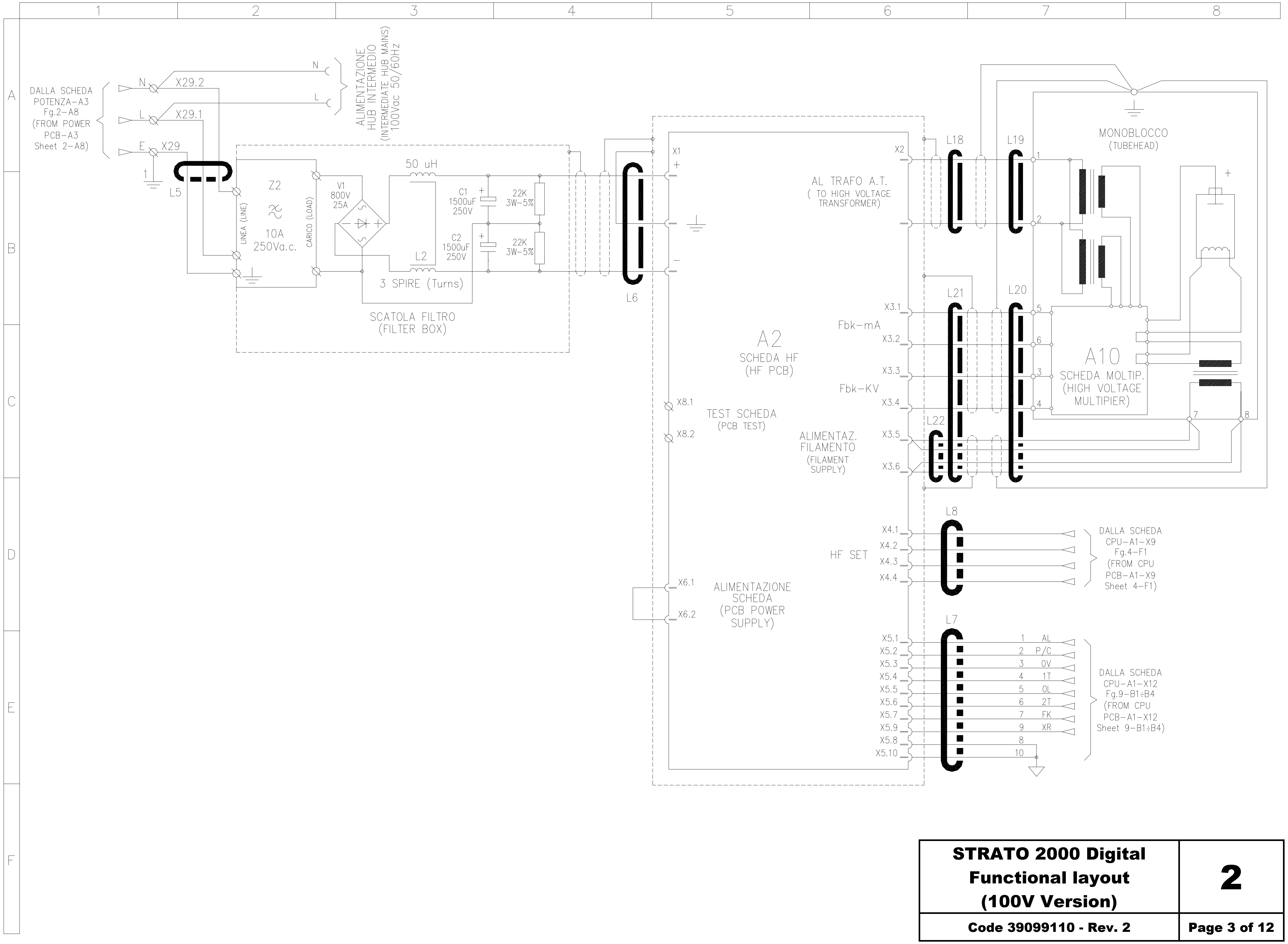

STRATO 2000 Digital Functional layout (100V Version)	2
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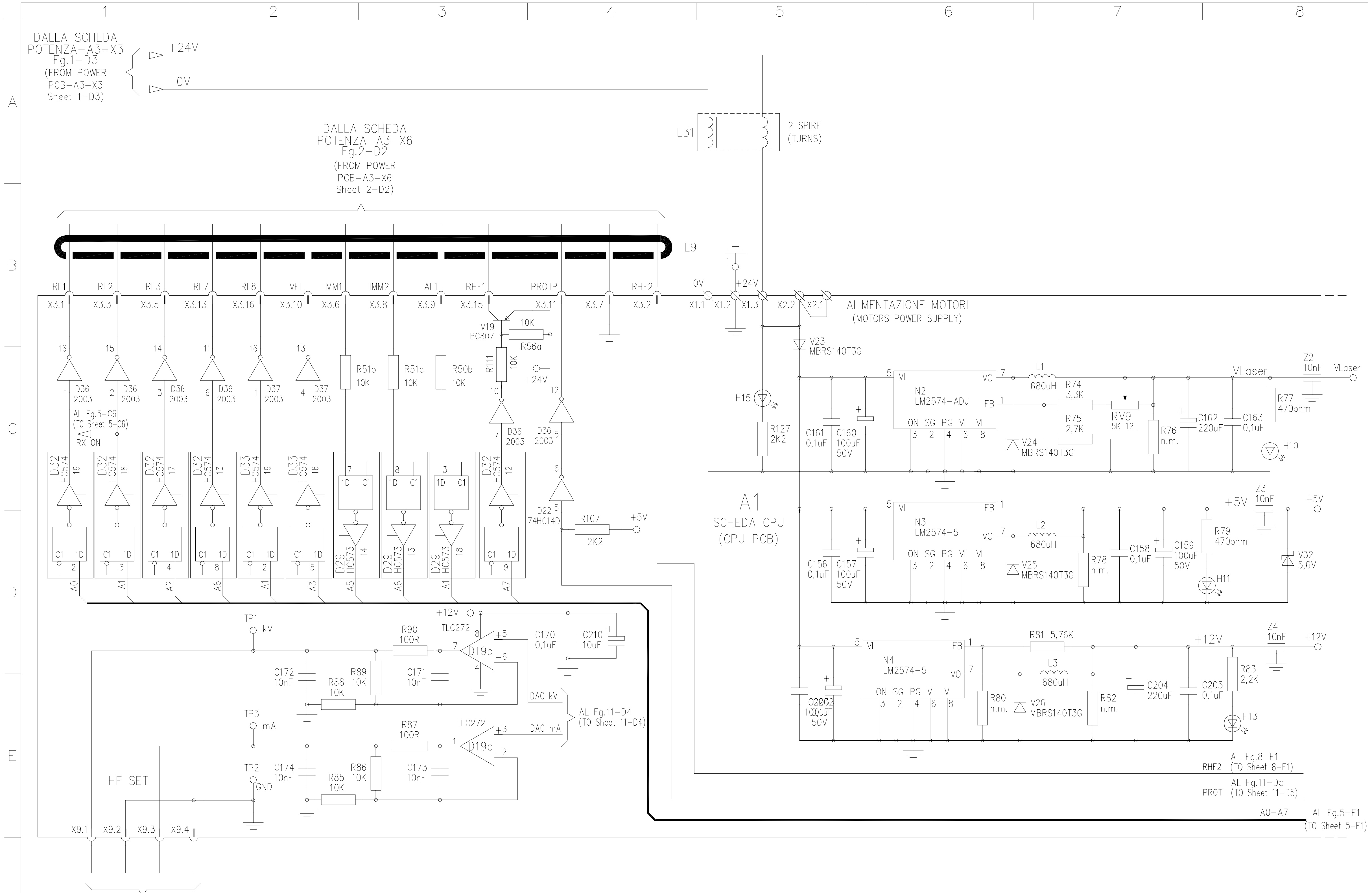

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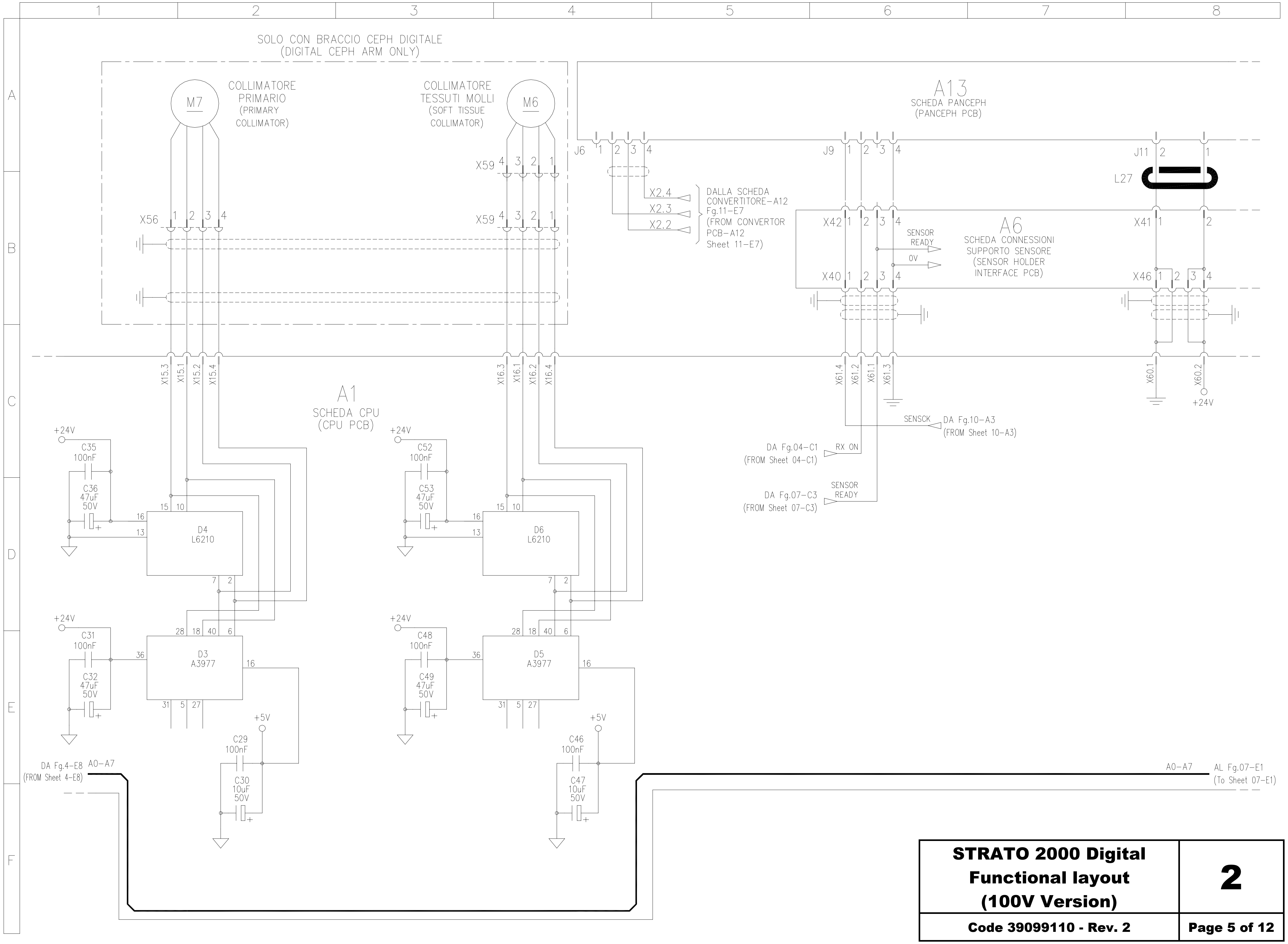

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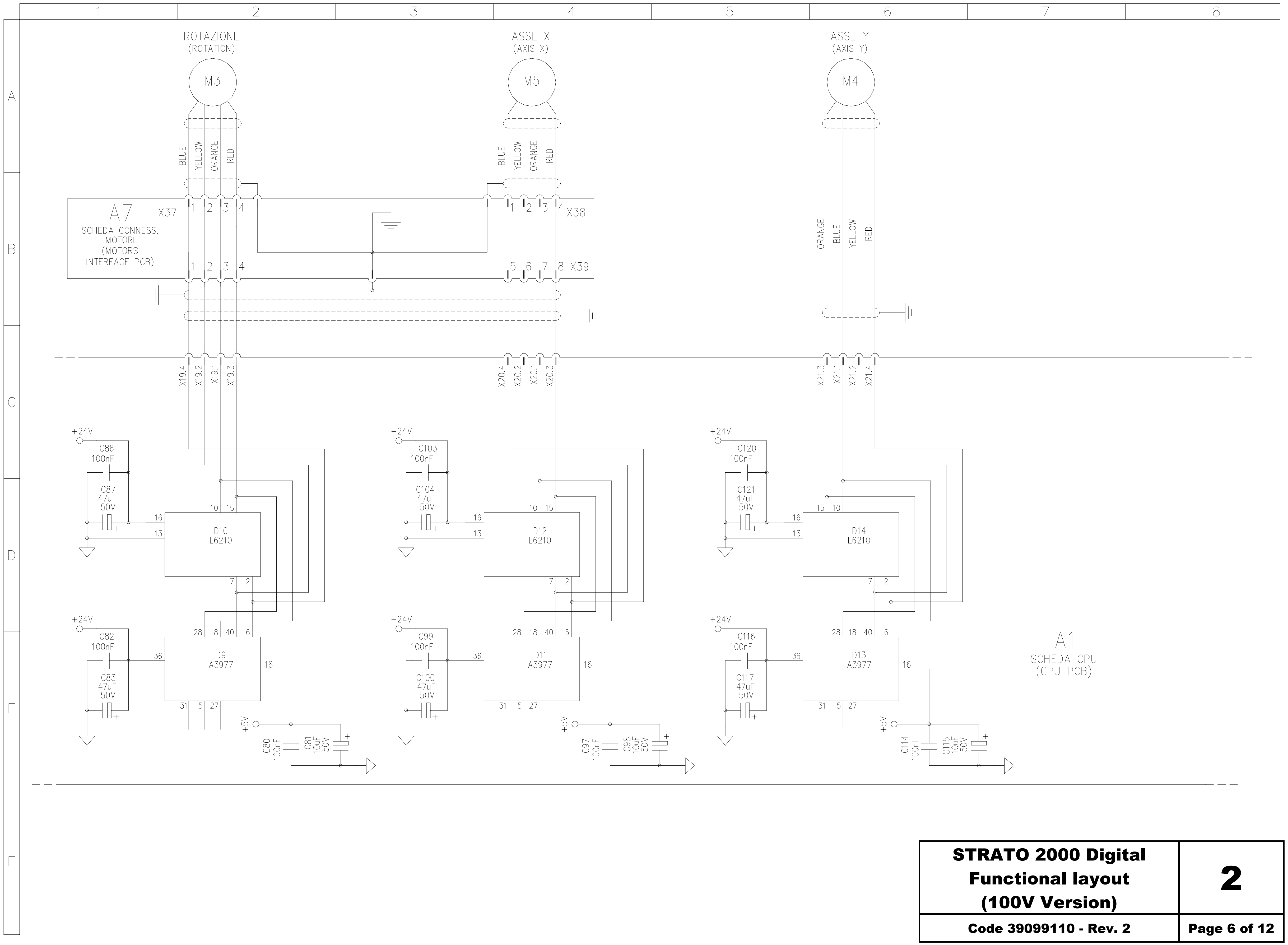

STRATO 2000 Digital Functional layout (100V Version)	2
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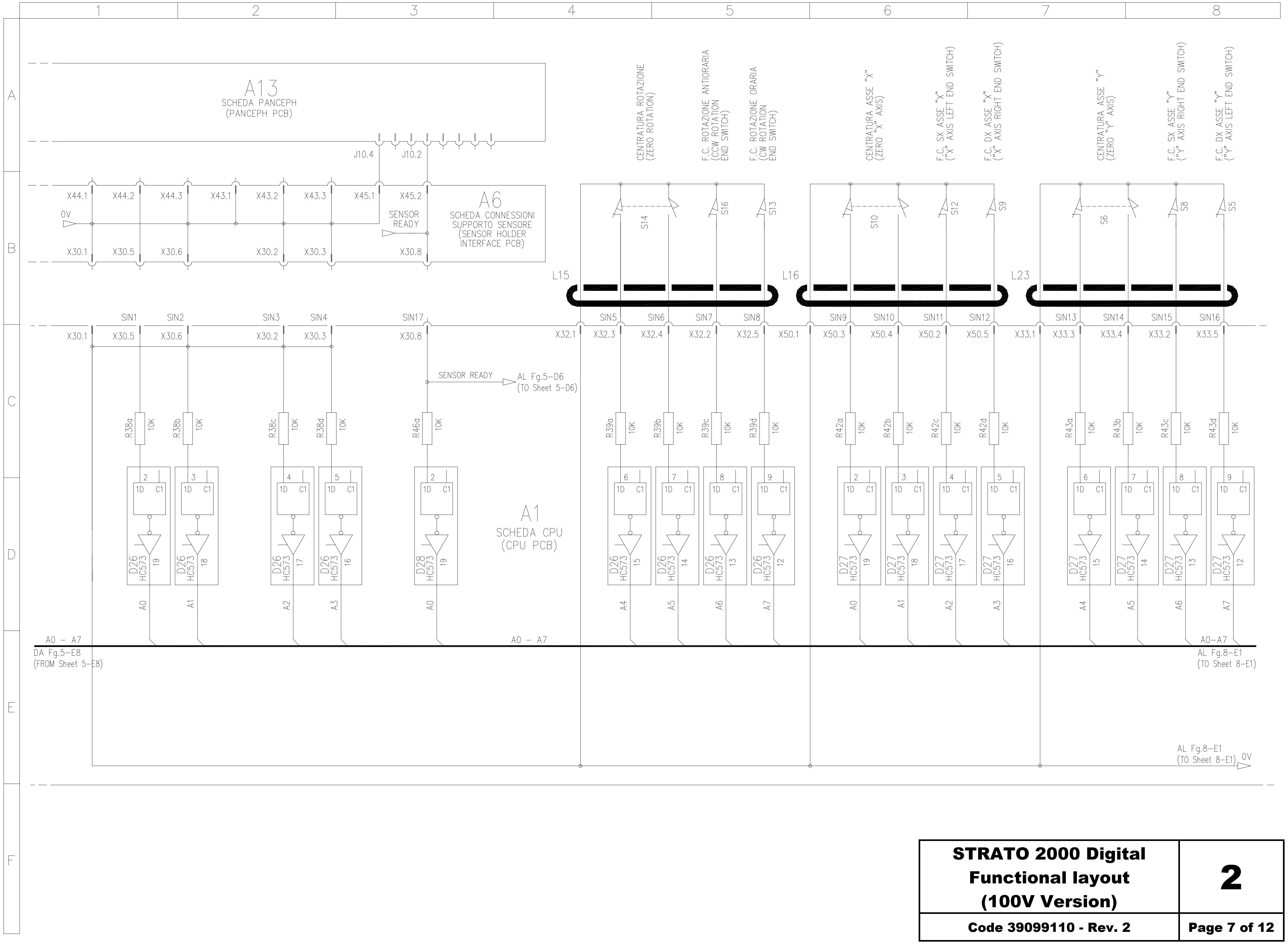

STRATO 2000 Digital Functional layout (100V Version)	**2**
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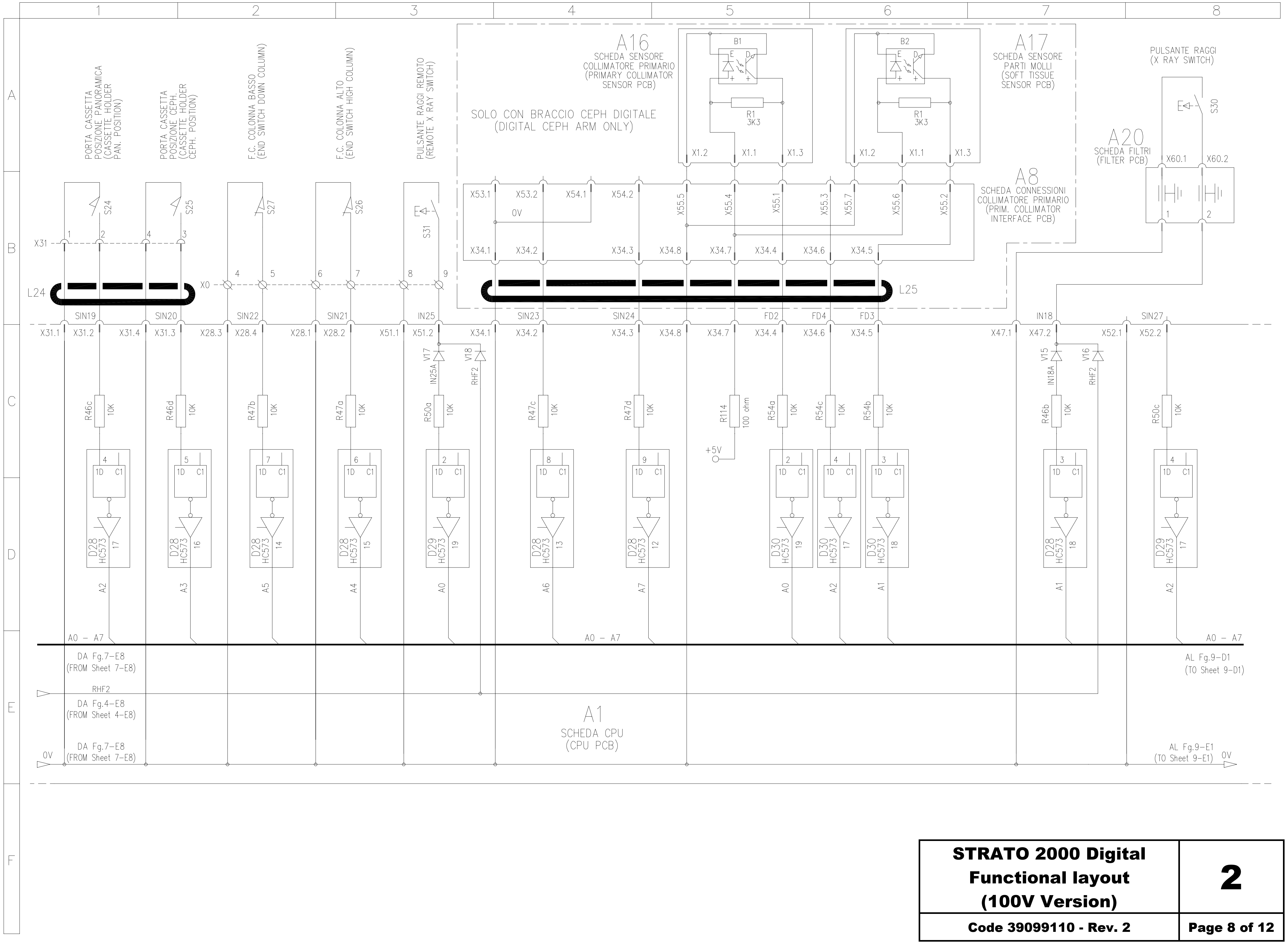

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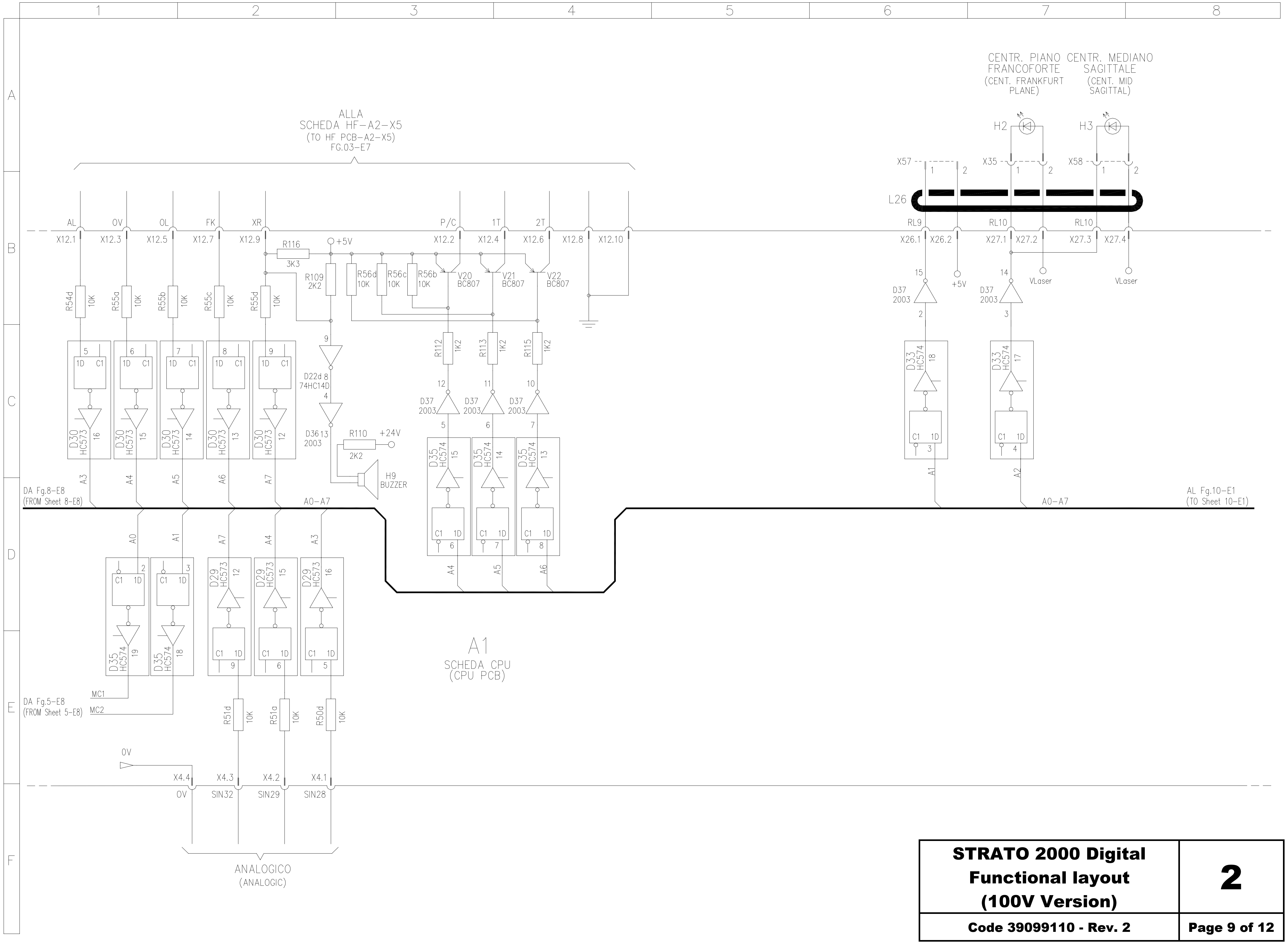

STRATO 2000 Digital Functional layout (100V Version)	**2**
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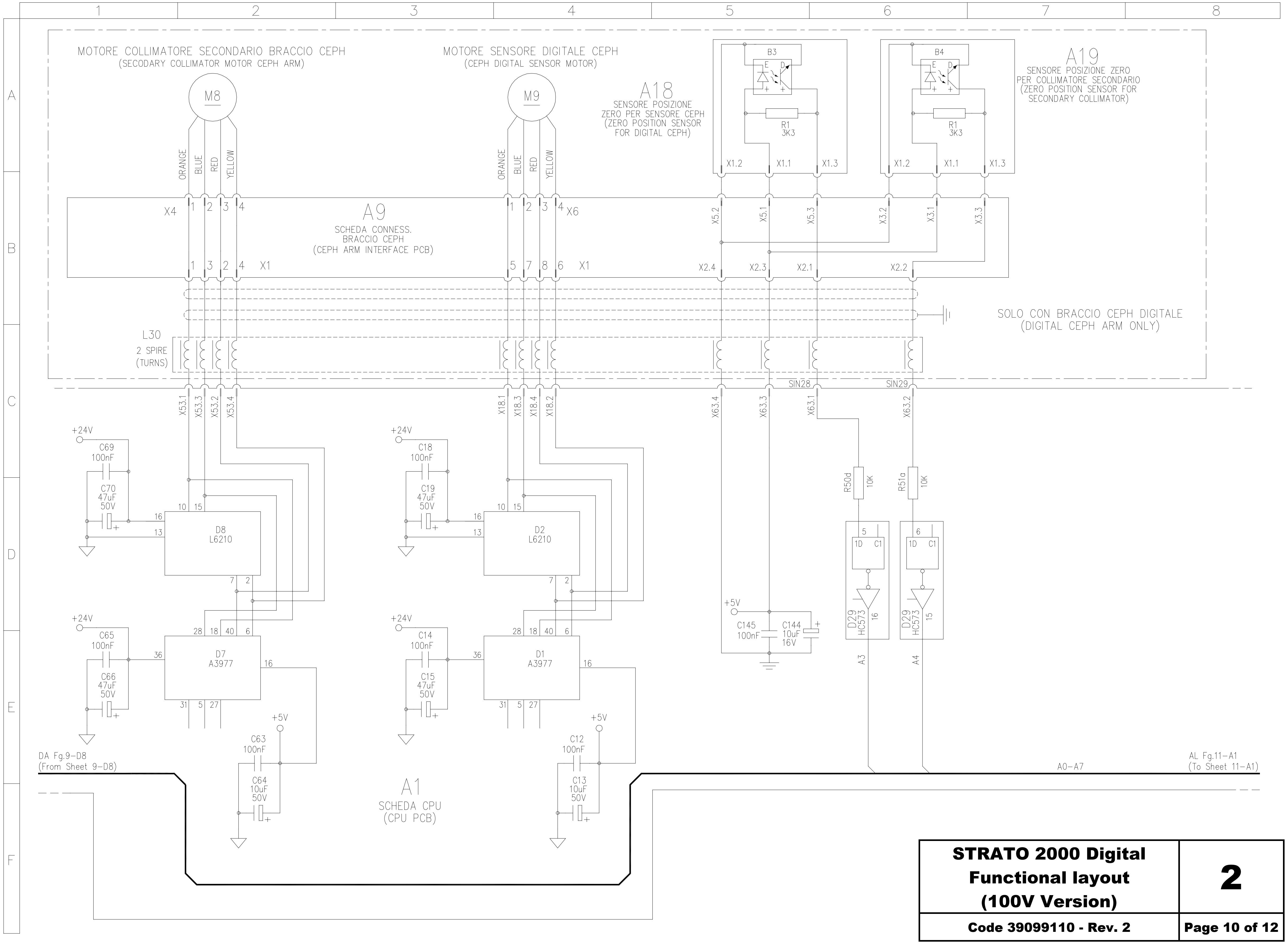

STRATO 2000 Digital Functional layout (100V Version)	2
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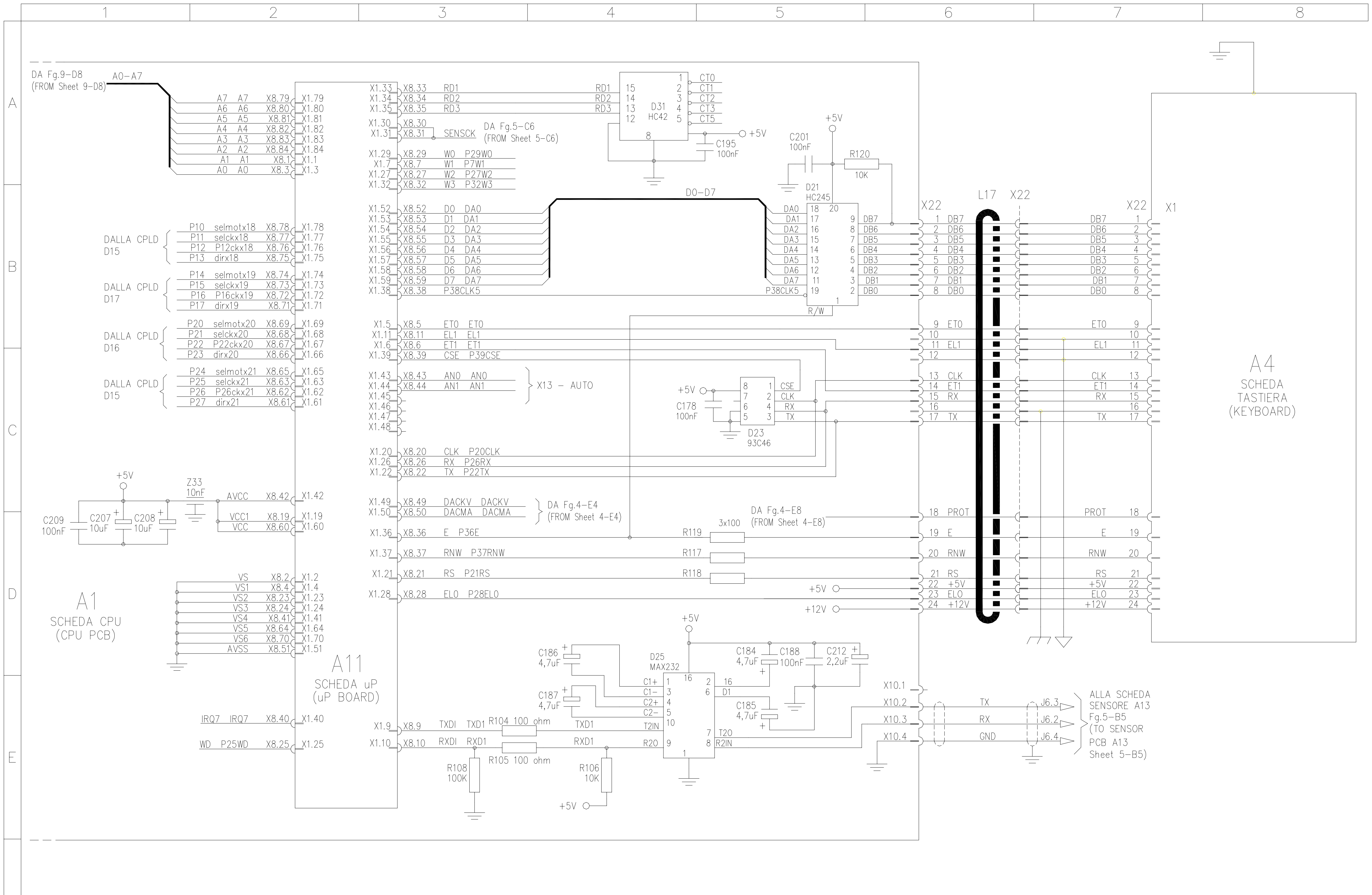

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Functional layout
(100V Version)

2

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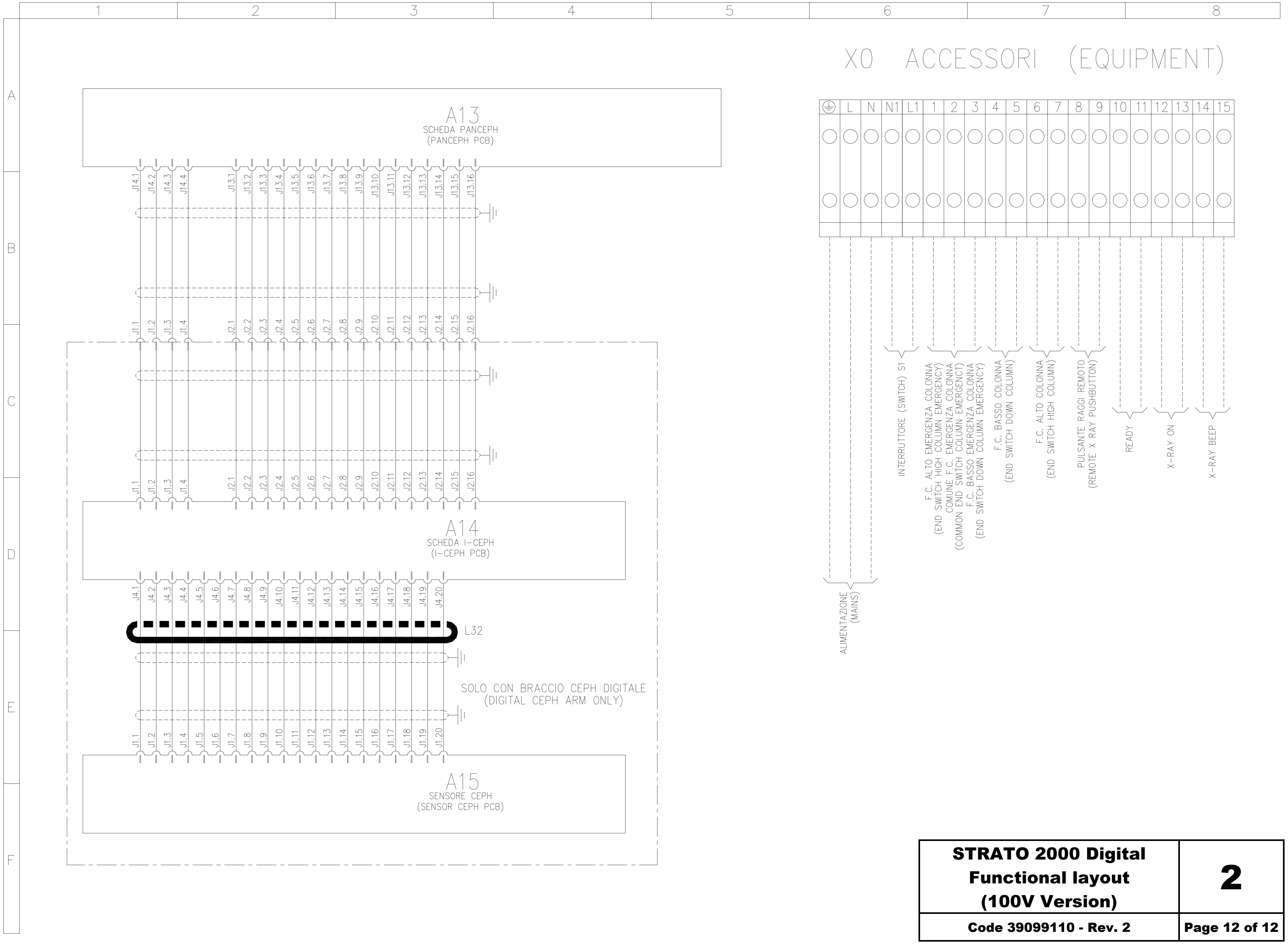

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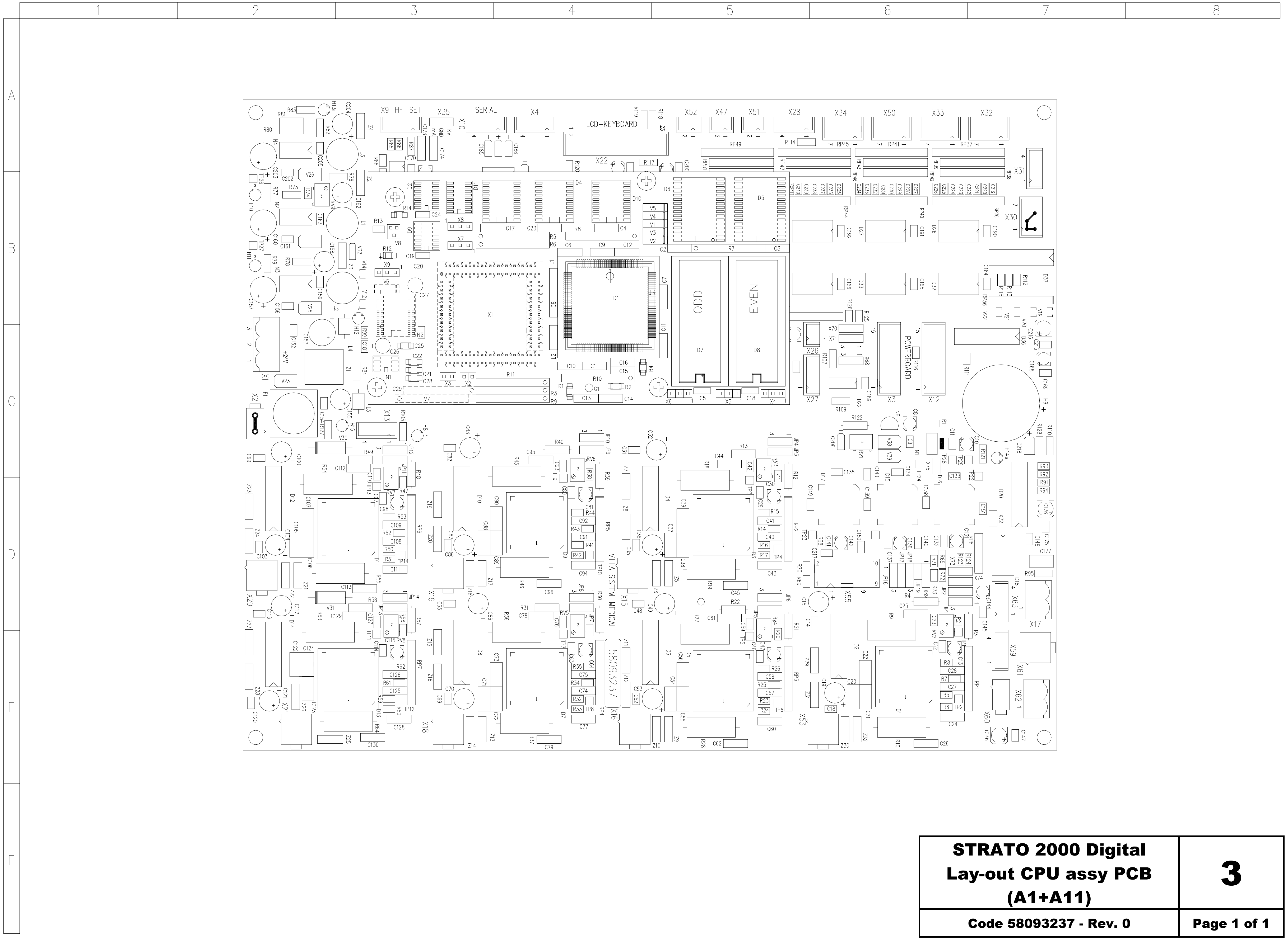

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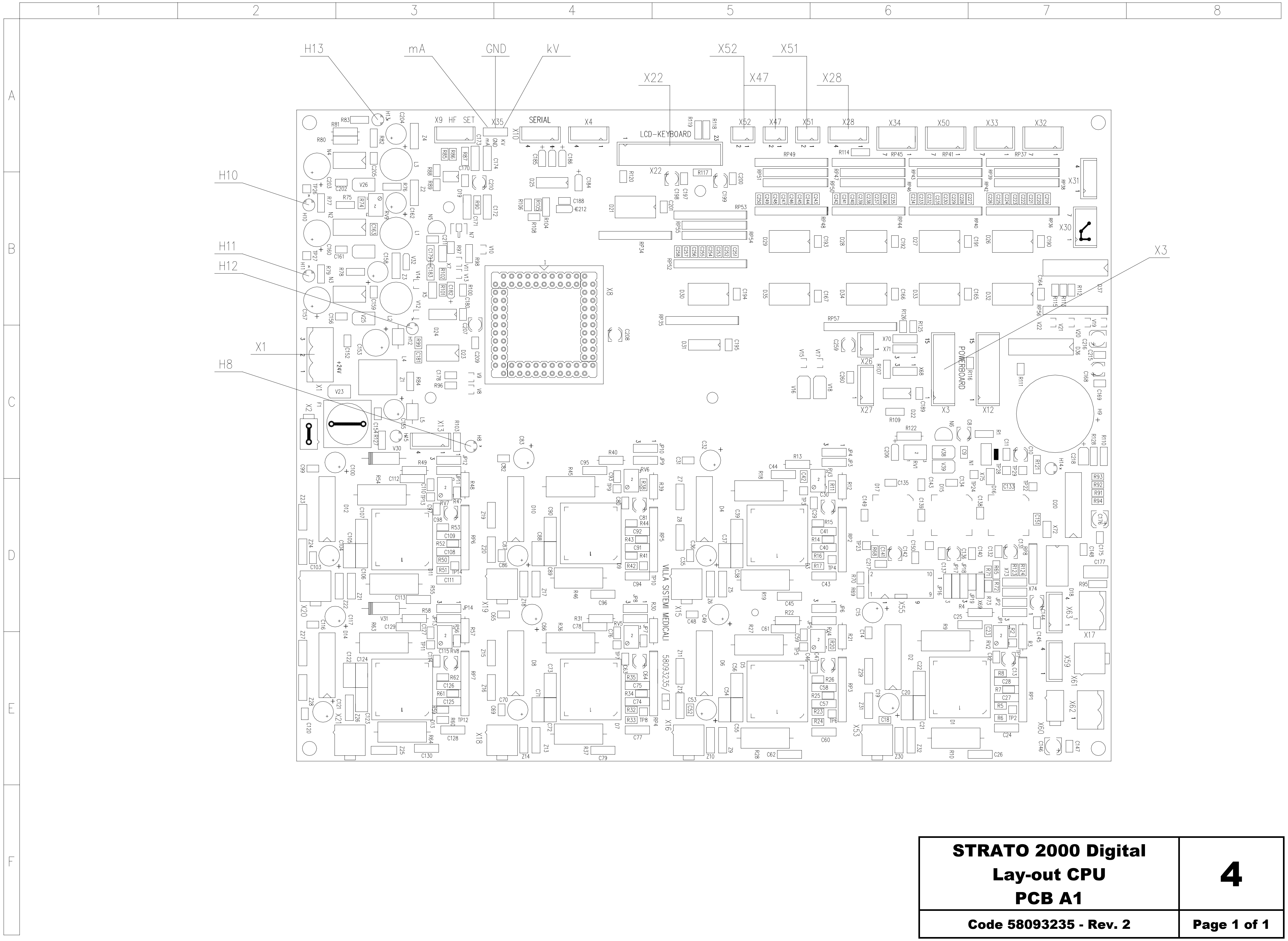

STRATO 2000 Digital Lay-out CPU PCB A1	4
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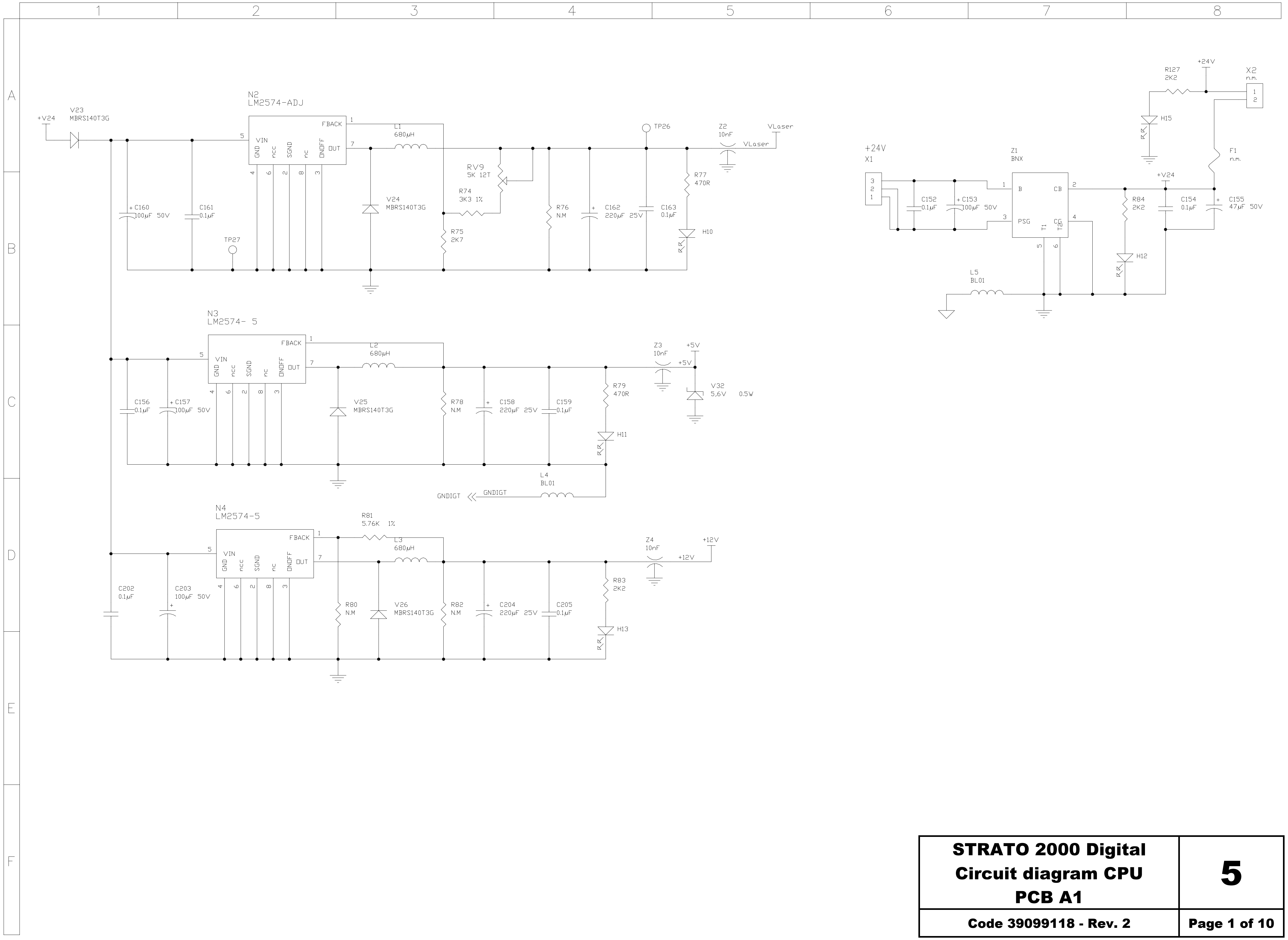

STRATO 2000 Digital Circuit diagram CPU PCB A1	5
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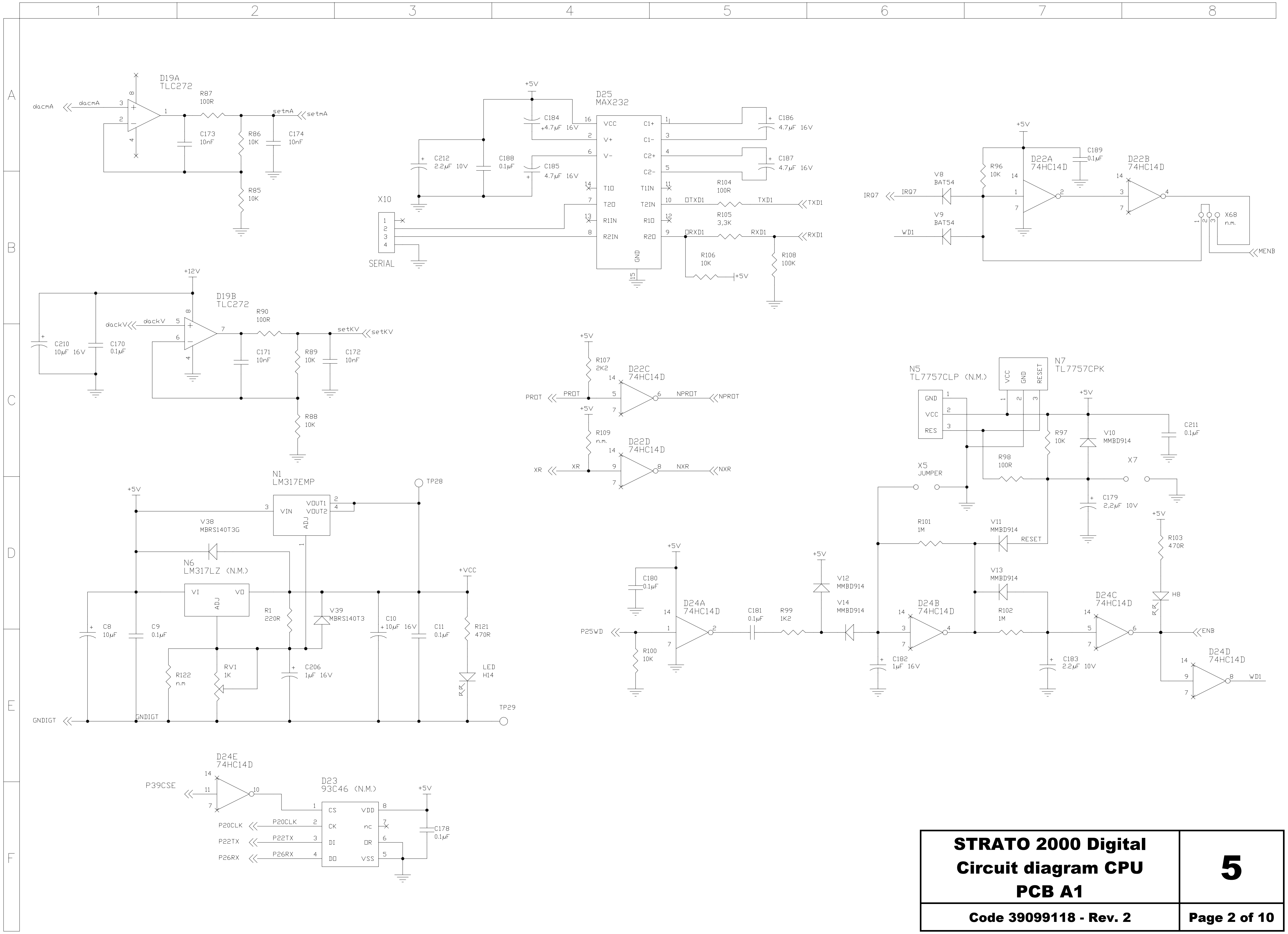

STRATO 2000 Digital Circuit diagram CPU PCB A1	5
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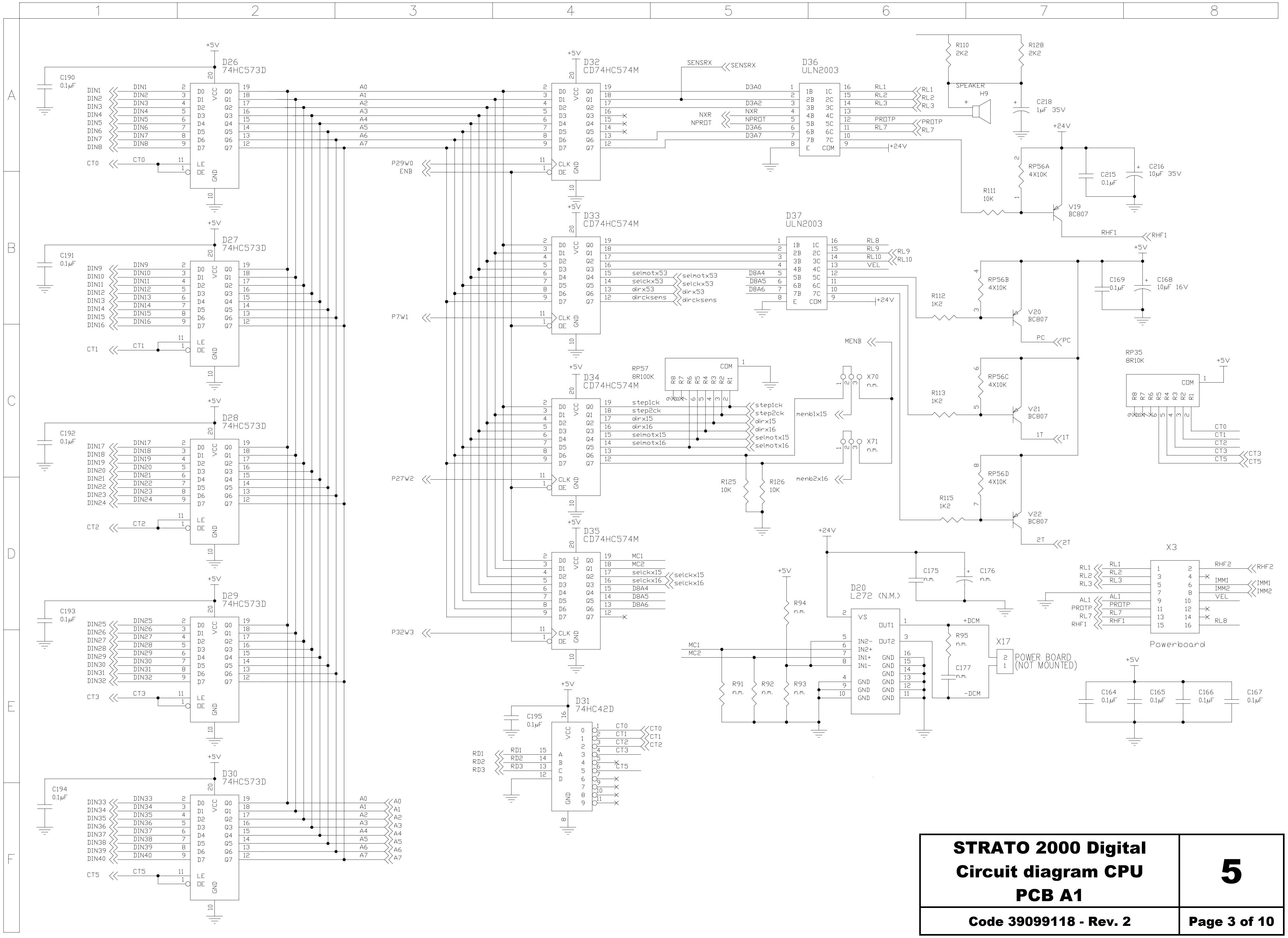

STRATO 2000 Digital Circuit diagram CPU PCB A1	5
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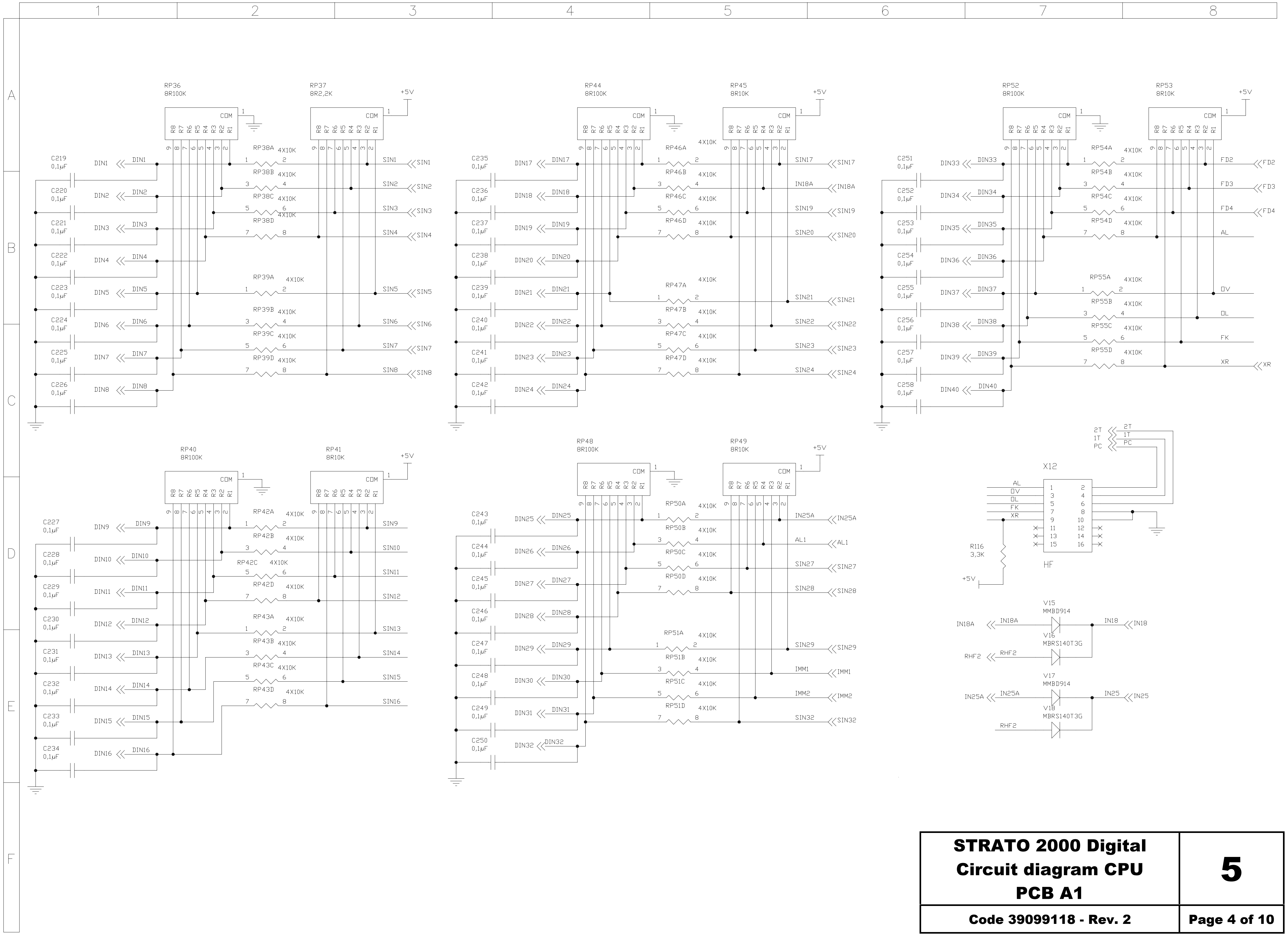

STRATO 2000 Digital Circuit diagram CPU PCB A1	5
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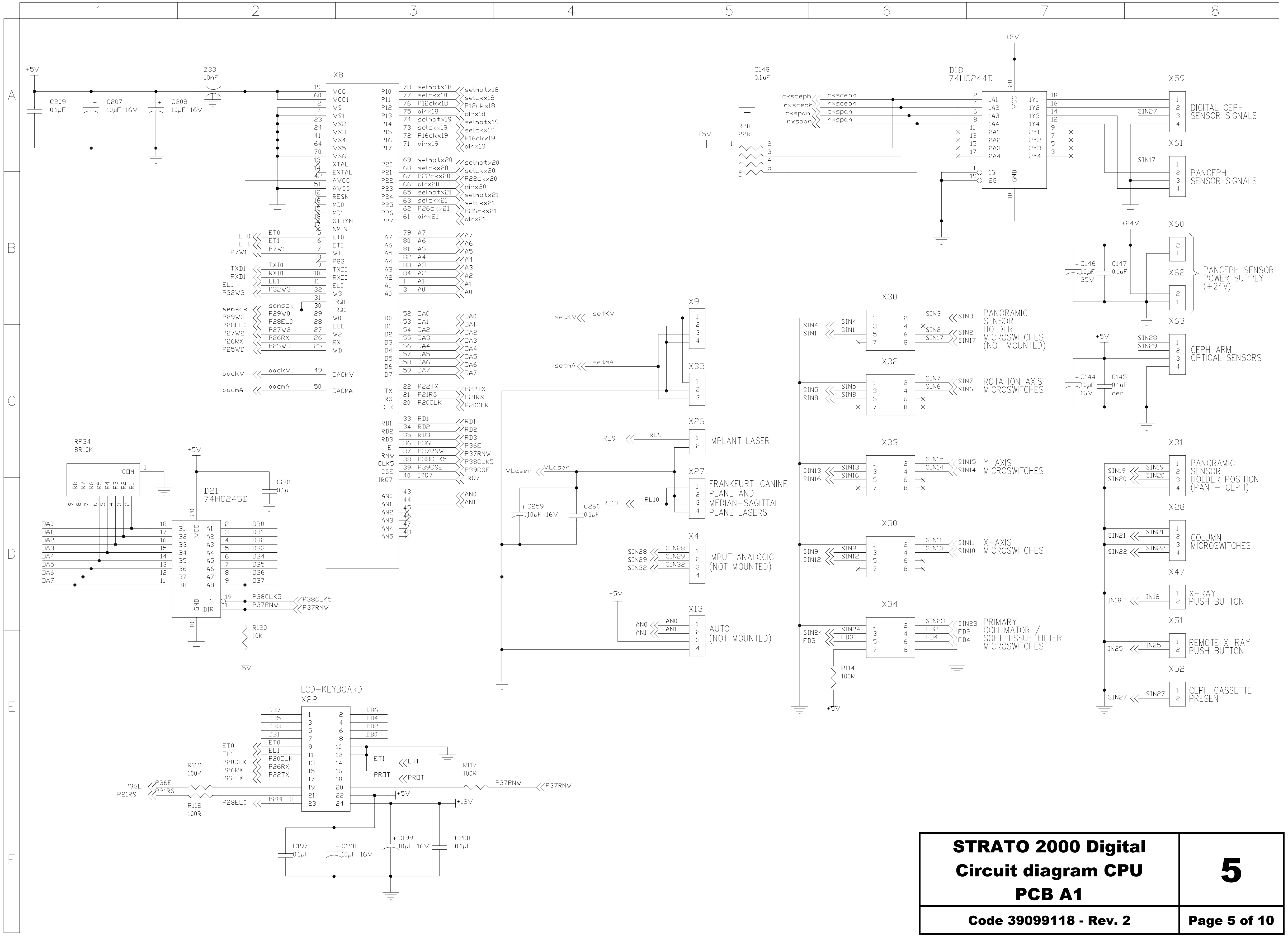

STRATO 2000 Digital Circuit diagram CPU PCB A1	5
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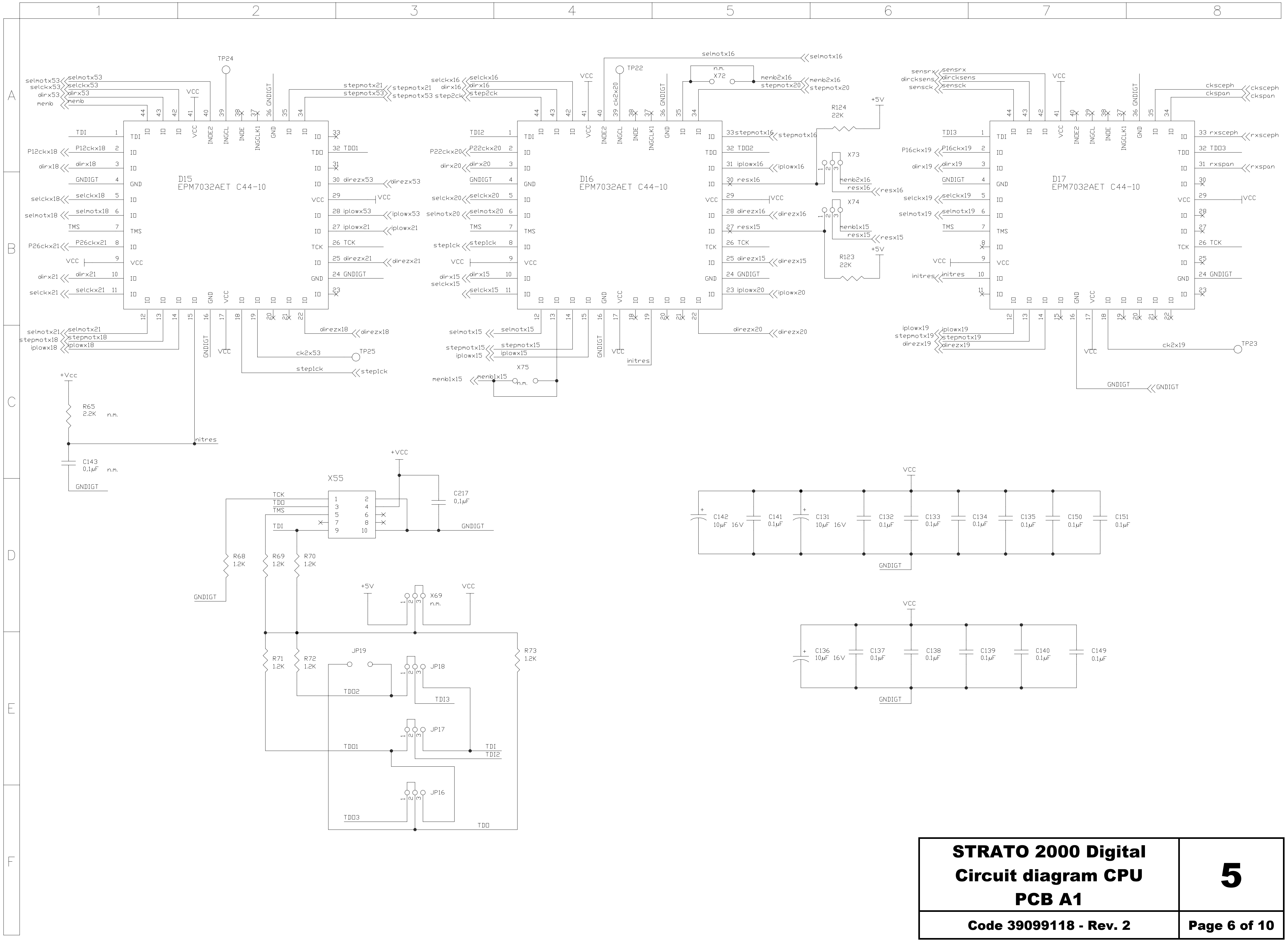

STRATO 2000 Digital Circuit diagram CPU PCB A1	5
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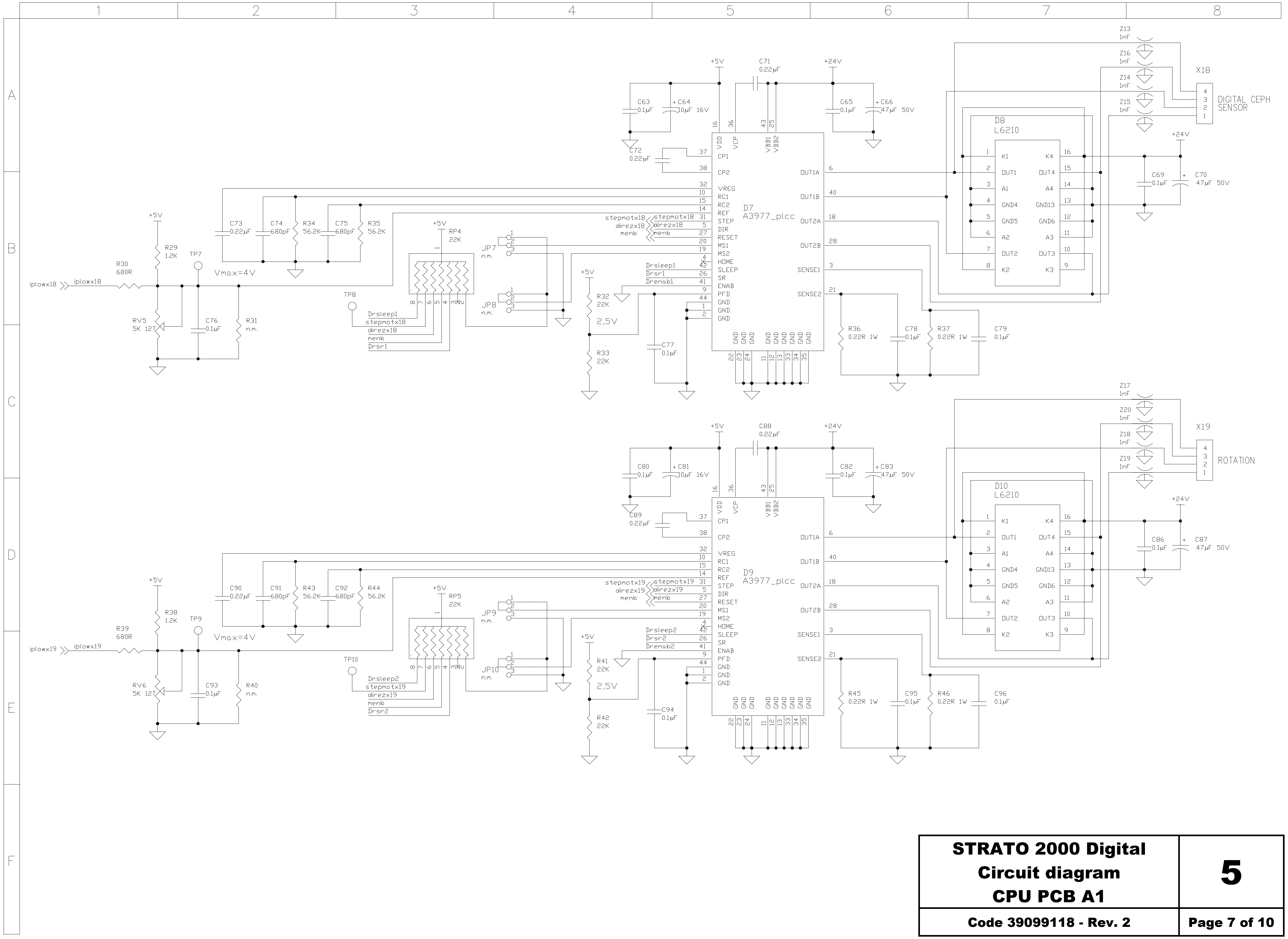

STRATO 2000 Digital Circuit diagram CPU PCB A1	5
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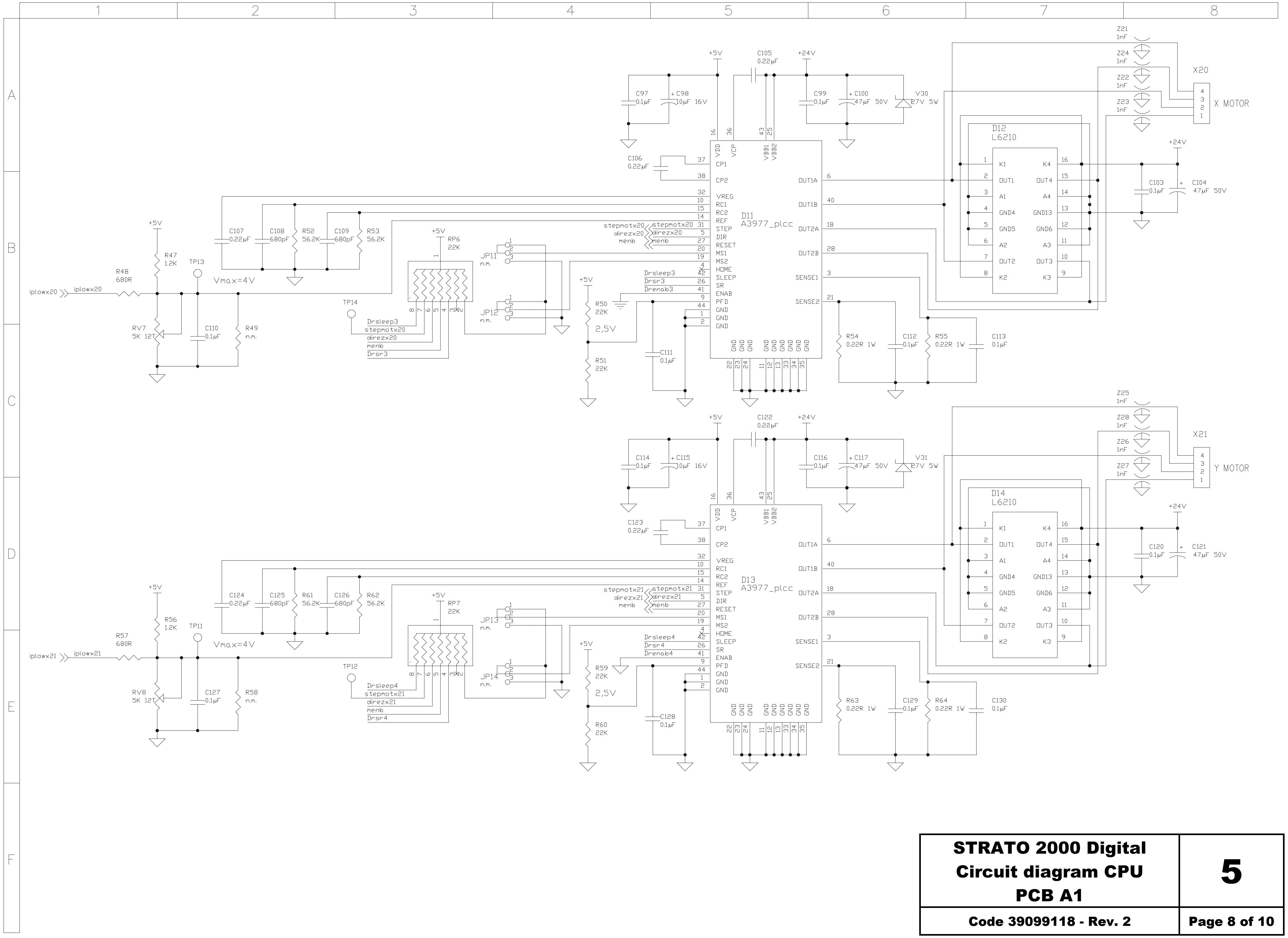

STRATO 2000 Digital Circuit diagram CPU PCB A1	5
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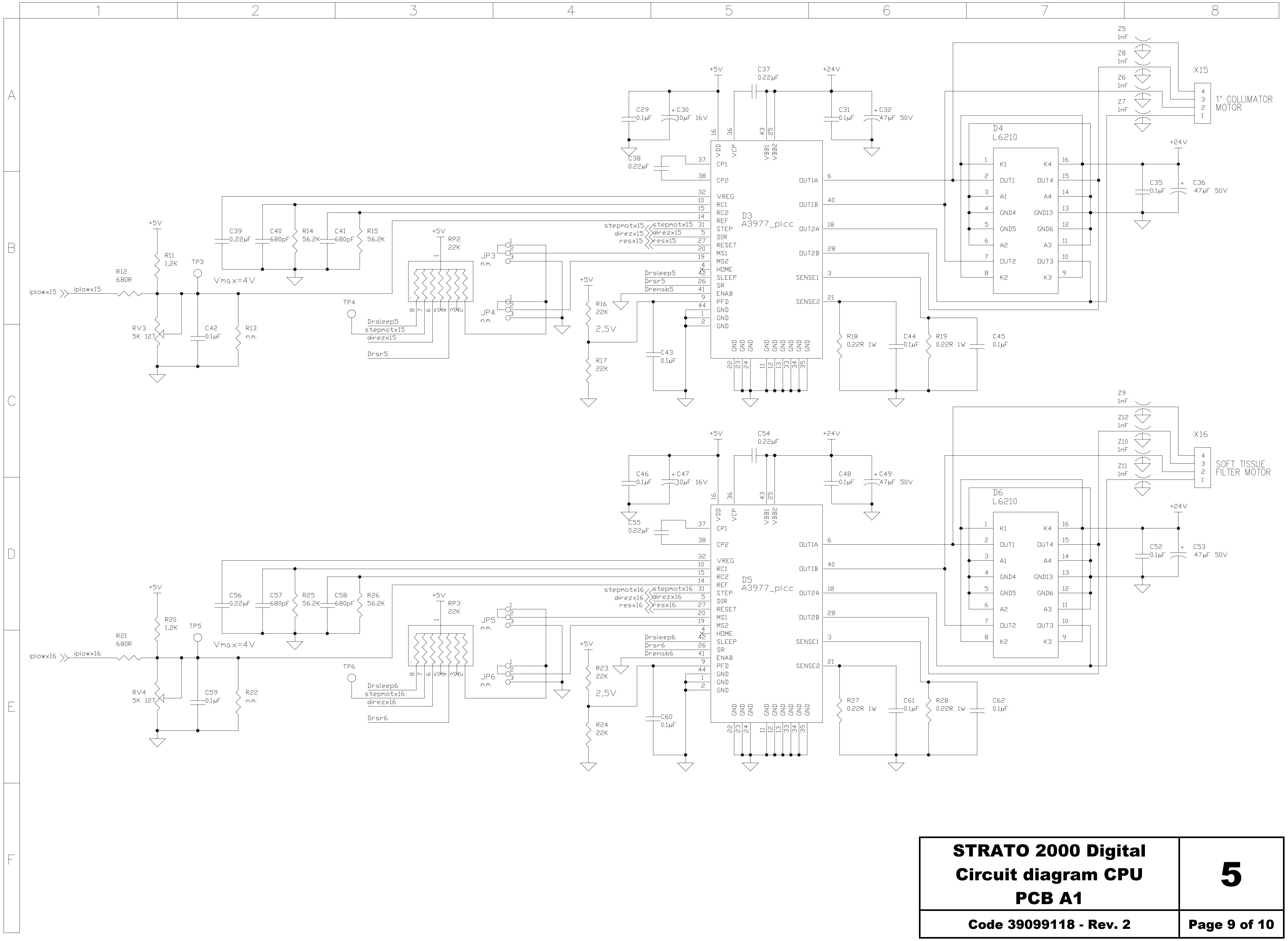

STRATO 2000 Digital Circuit diagram CPU PCB A1	5
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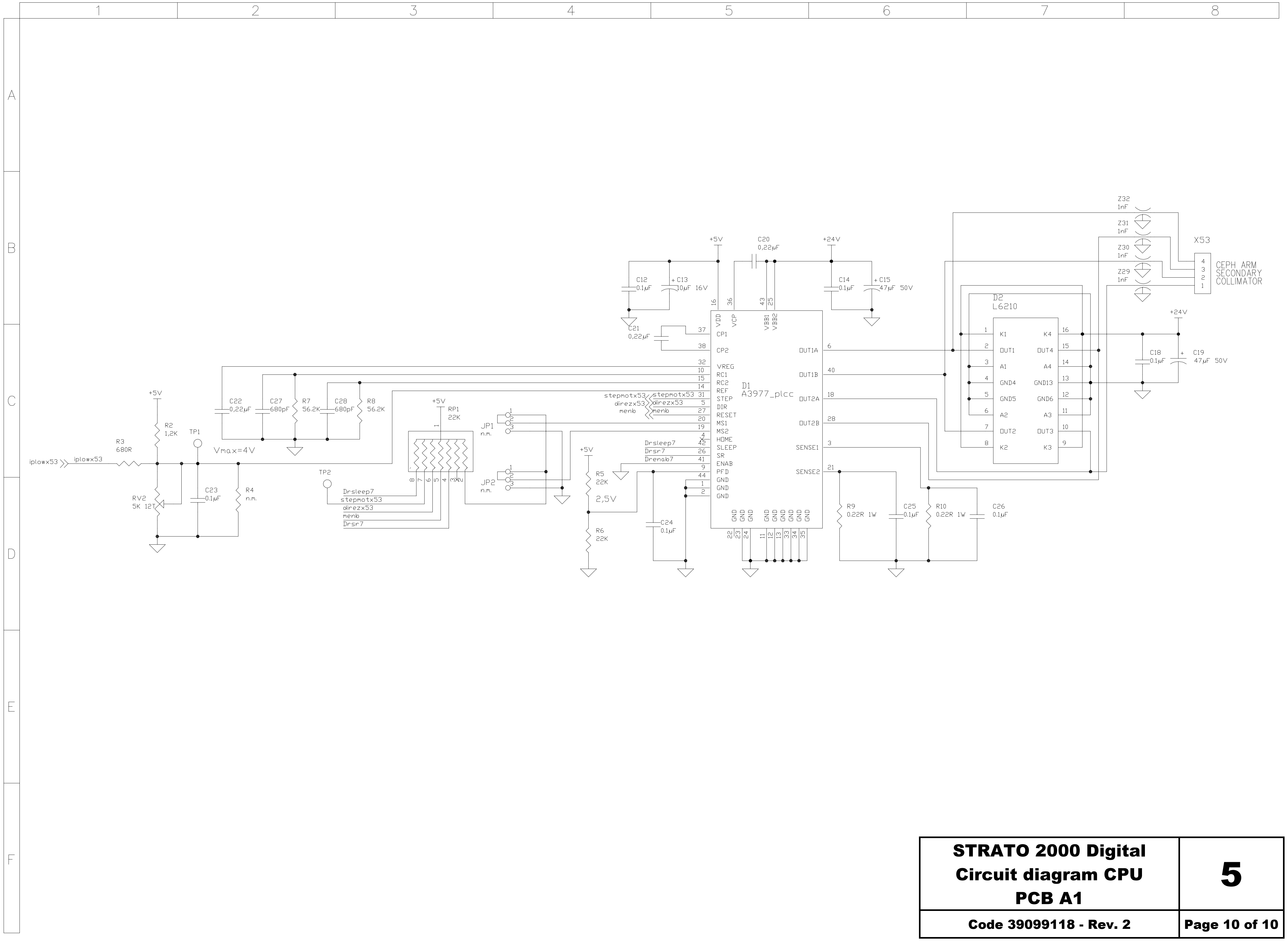

STRATO 2000 Digital Circuit diagram CPU PCB A1	5
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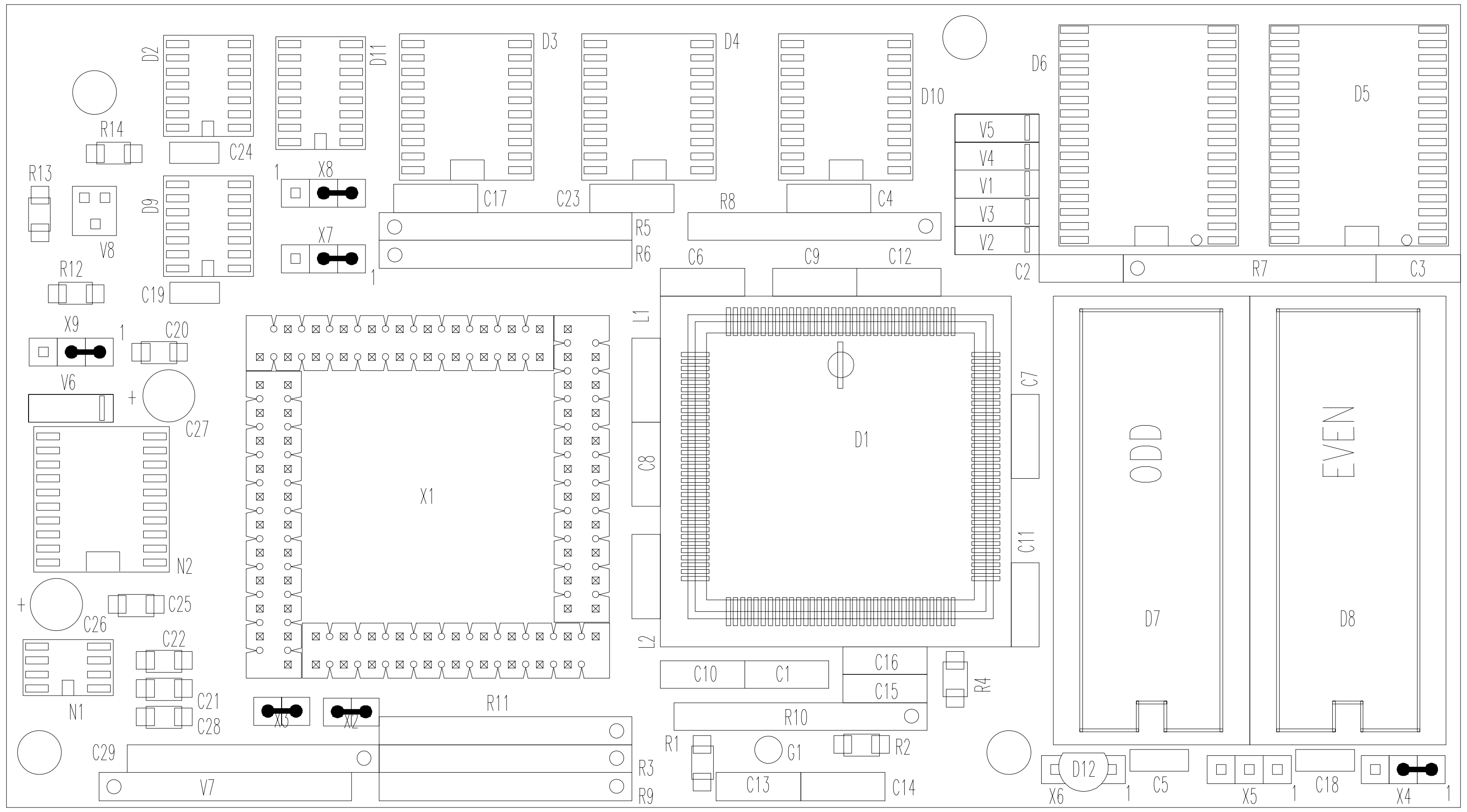

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CONNECTOR X1 MOUNTED ON SOLDERING SIDE

STRATO 2000 Digital **Lay-out microprocessor** **PCB A11**	**6**
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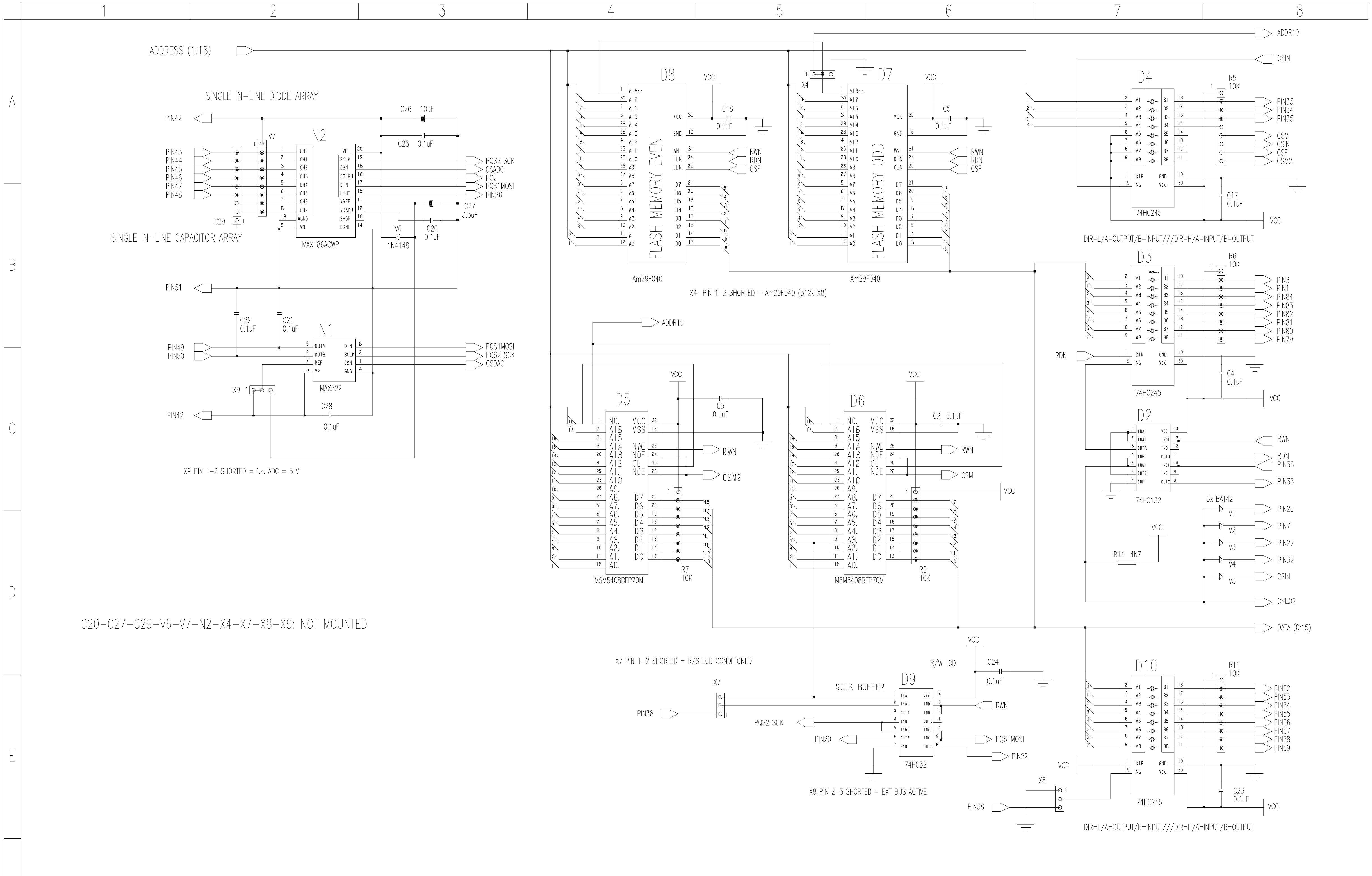

STRATO 2000 Digital Circuit diagram microprocessor PCB A11	7
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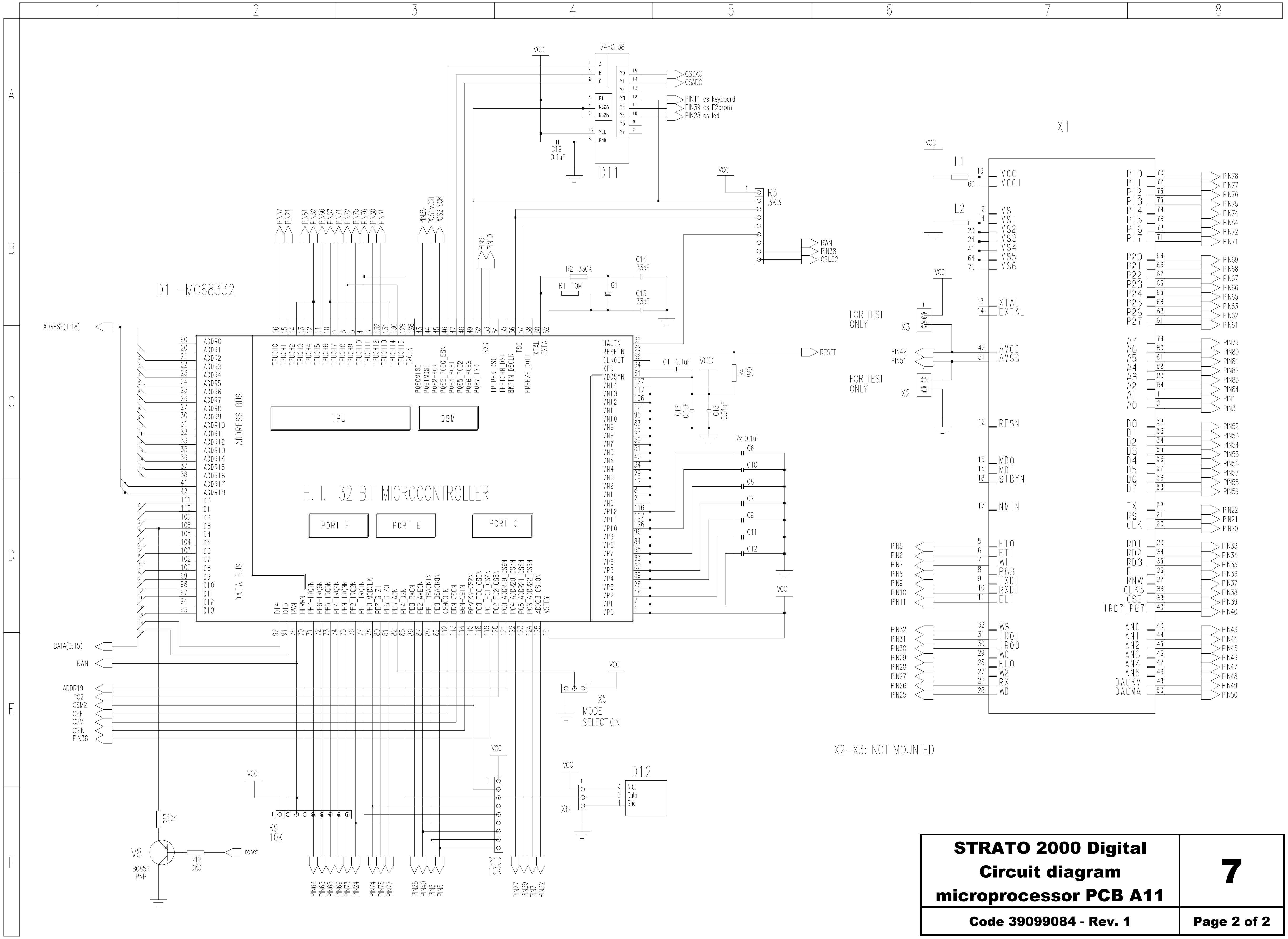

STRATO 2000 Digital Circuit diagram microprocessor PCB A11	7
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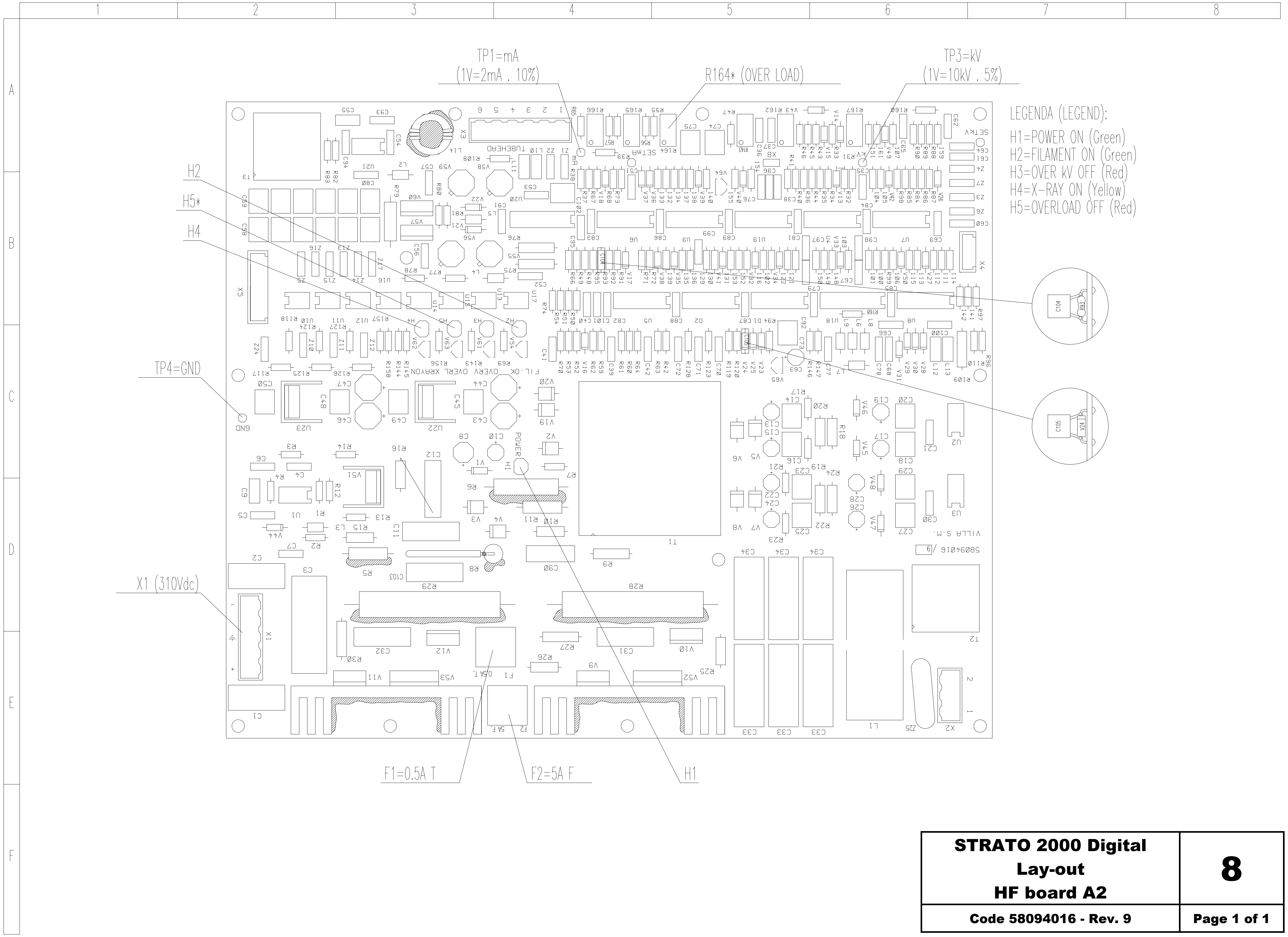

STRATO 2000 Digital Lay-out HF board A2	8
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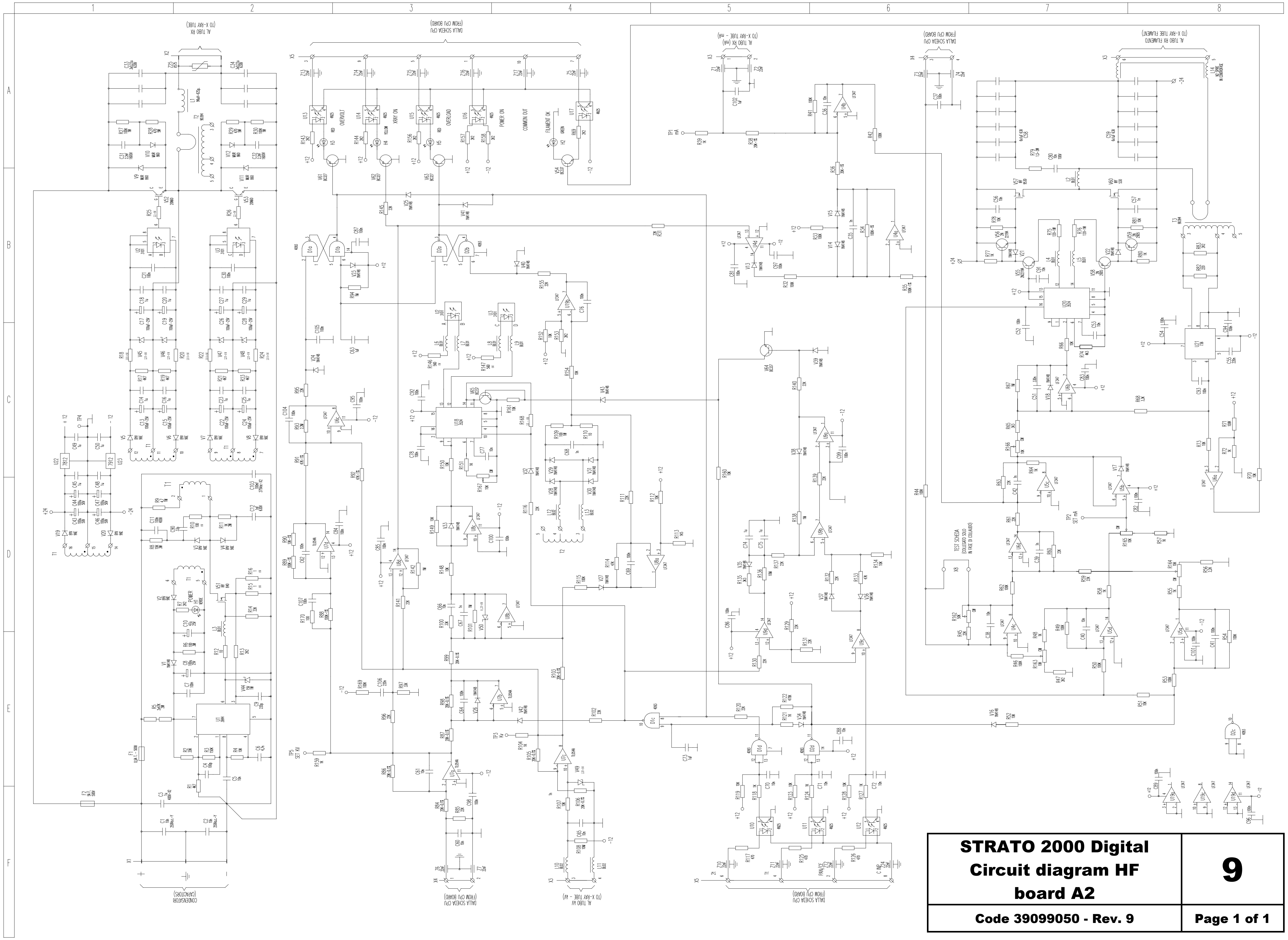

STRATO 2000 Digital Circuit diagram HF board A2	9
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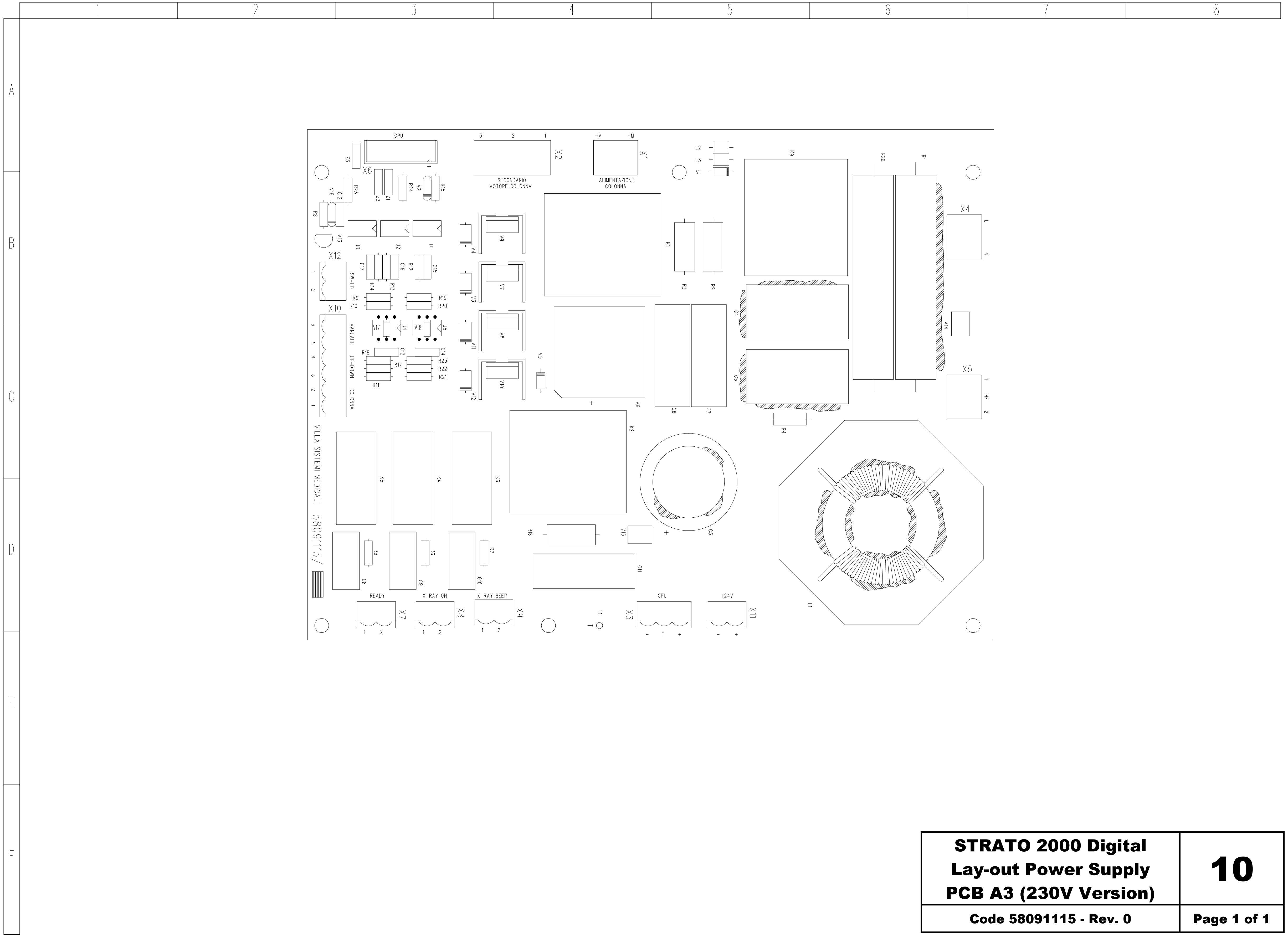

STRATO 2000 Digital Lay-out Power Supply PCB A3 (230V Version)	10
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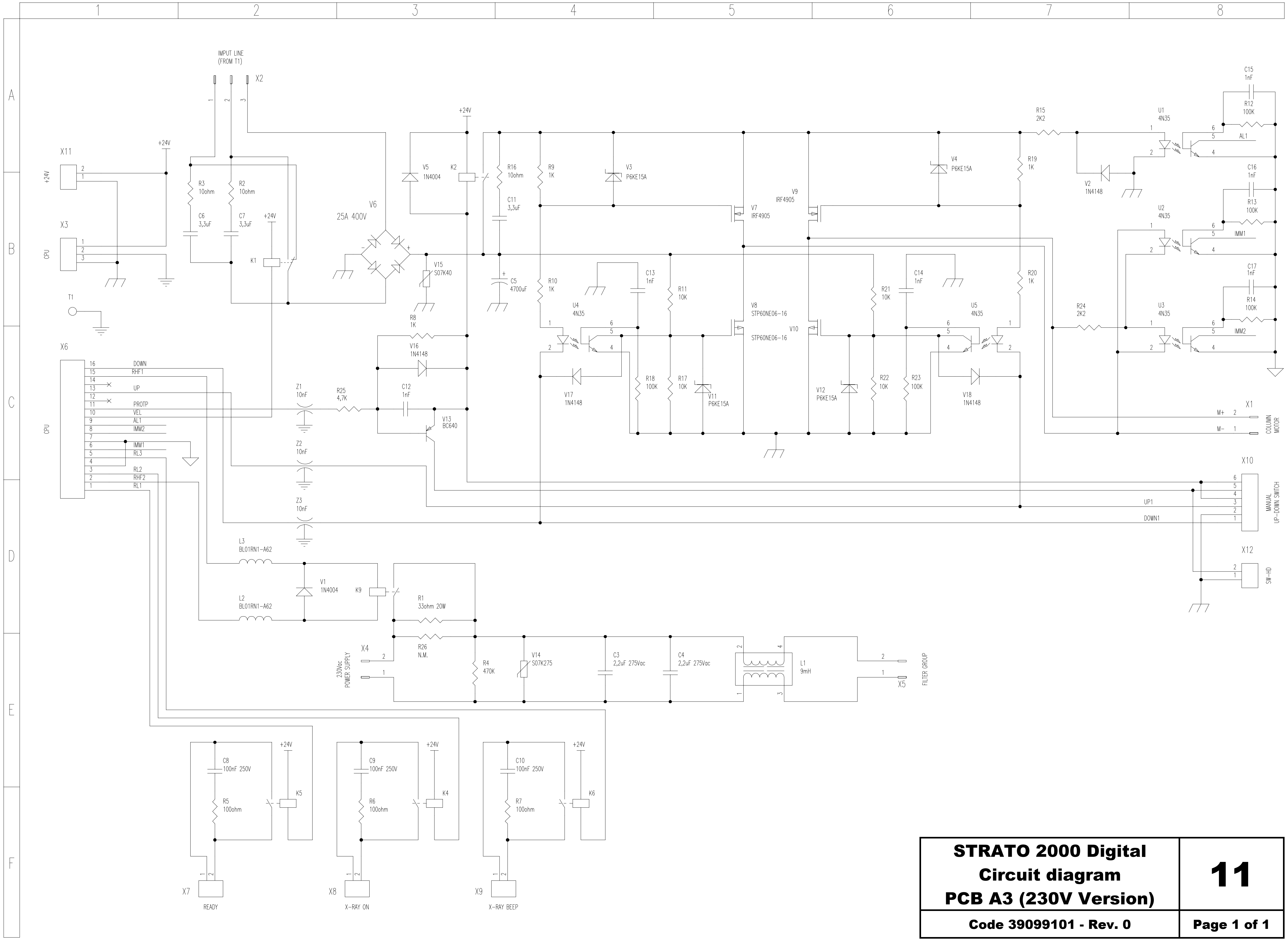

STRATO 2000 Digital **Circuit diagram** **PCB A3 (230V Version)**	**11**
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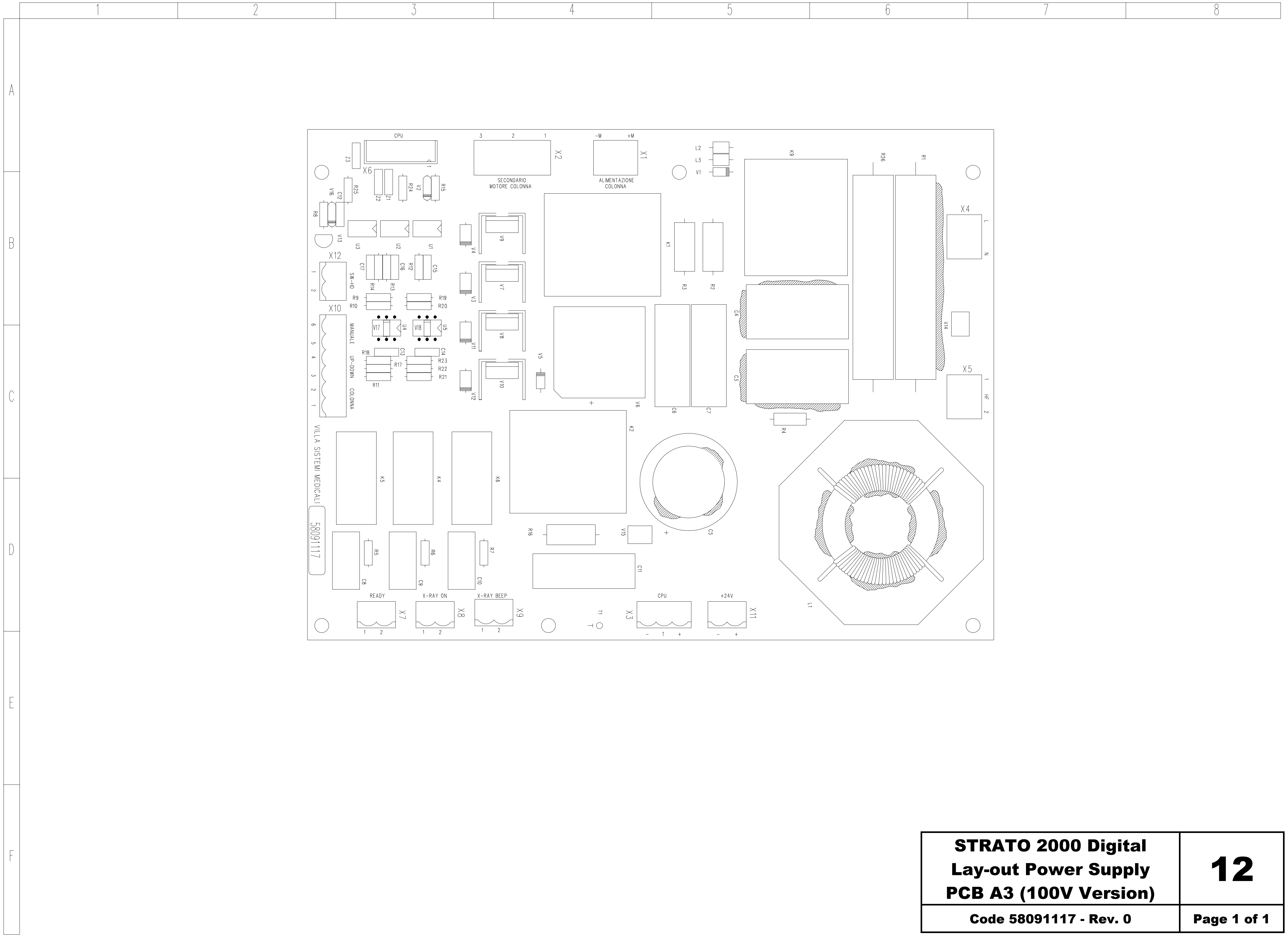

STRATO 2000 Digital Lay-out Power Supply PCB A3 (100V Version)	12
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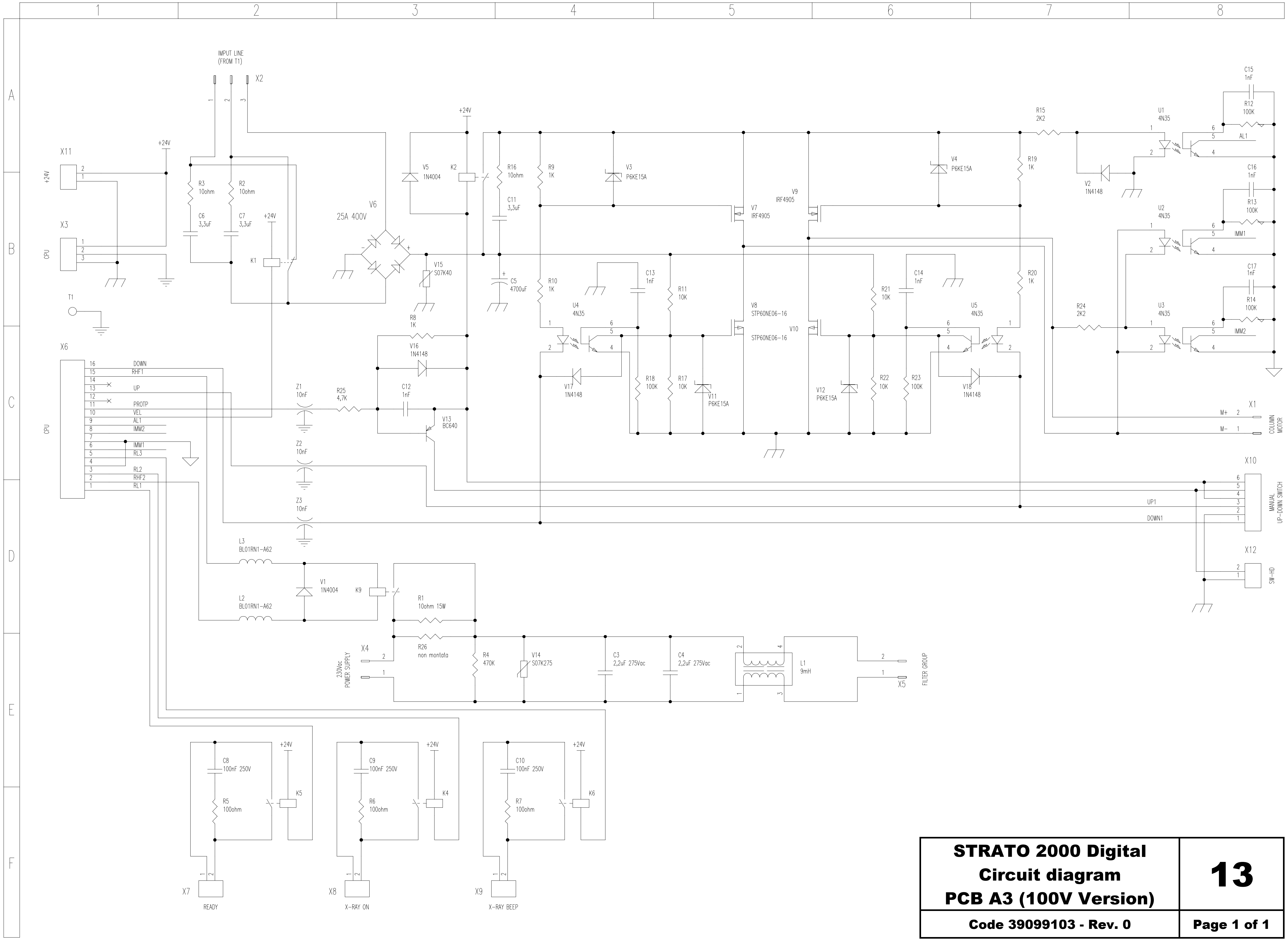

STRATO 2000 Digital Circuit diagram PCB A3 (100V Version)	13
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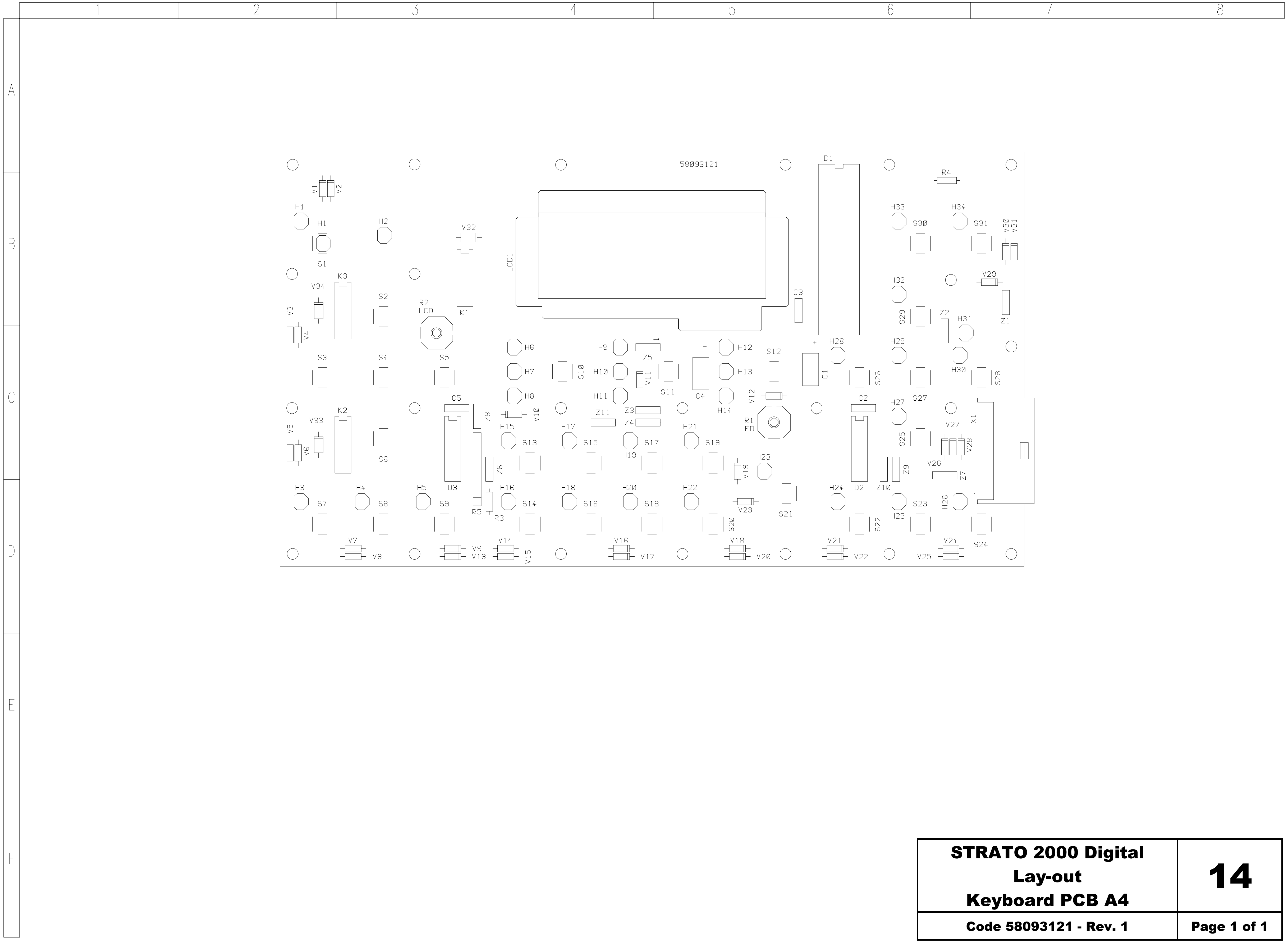

STRATO 2000 Digital Lay-out Keyboard PCB A4	14
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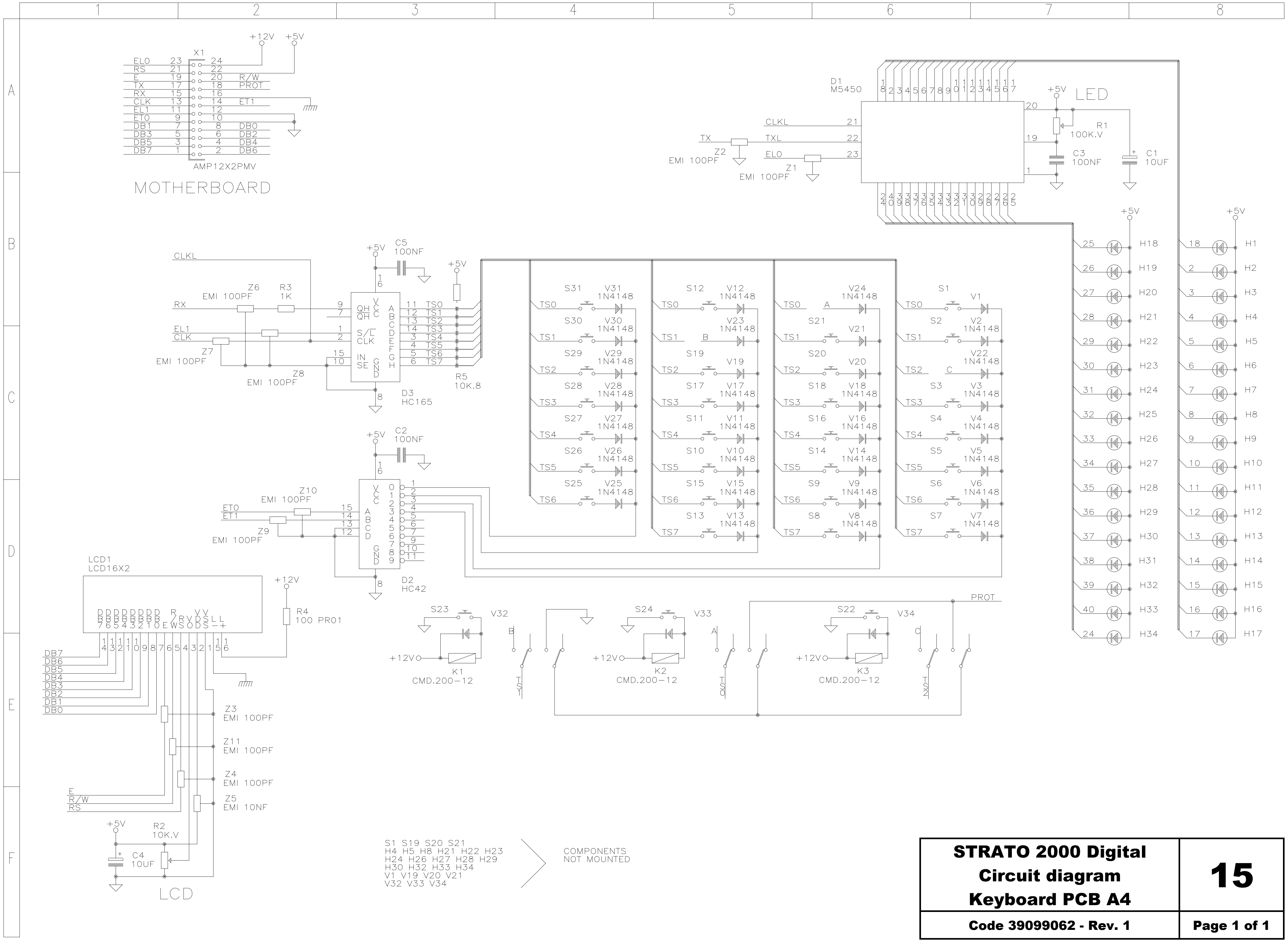

STRATO 2000 Digital **Circuit diagram** **Keyboard PCB A4**	**15**
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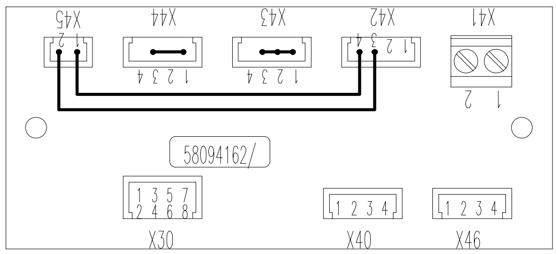

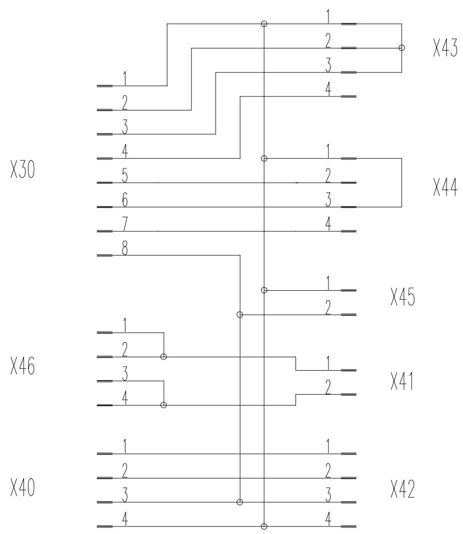

STRATO 2000 Digital Lay-out and circuit diagram PCB A6	16
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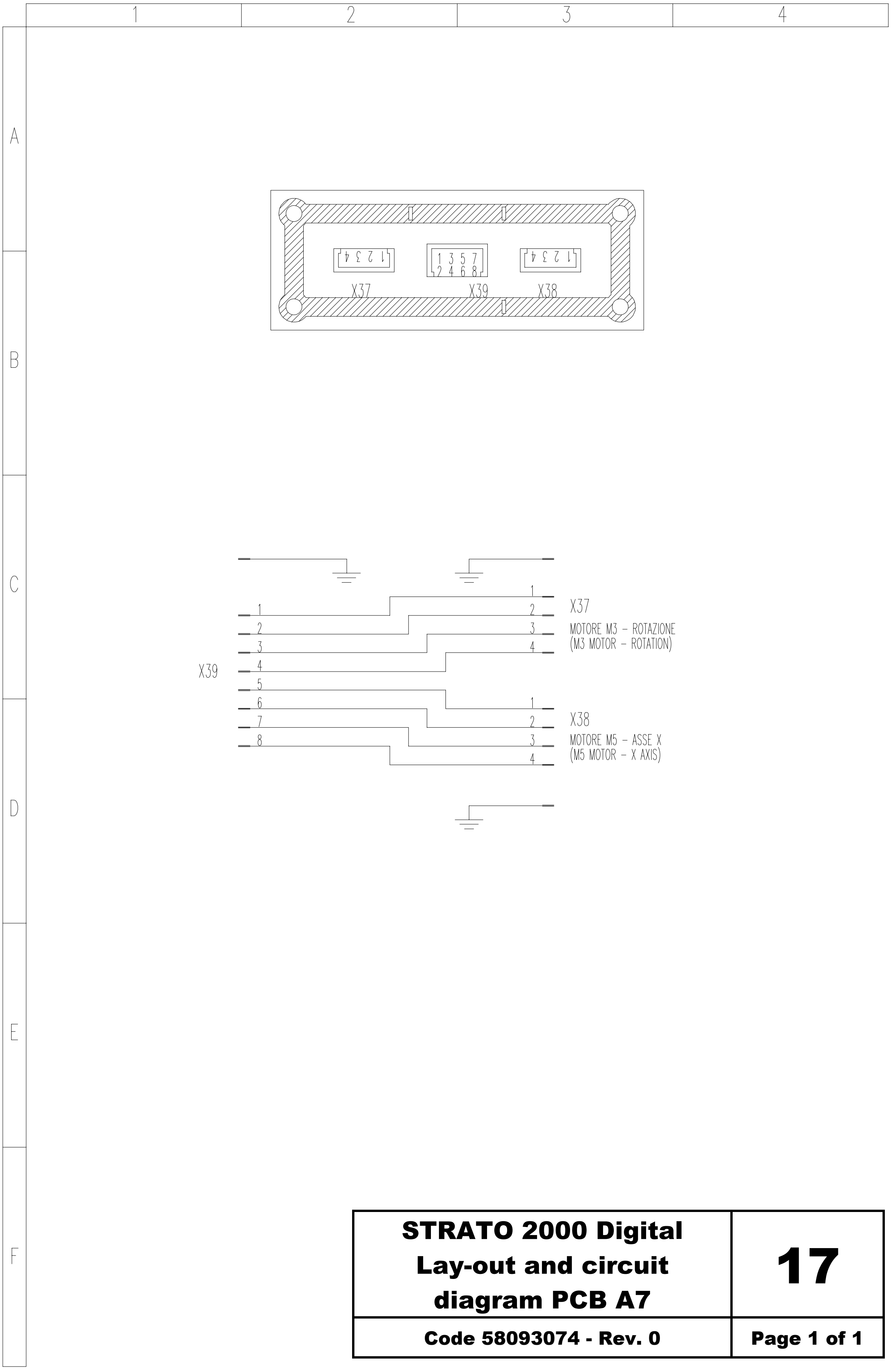

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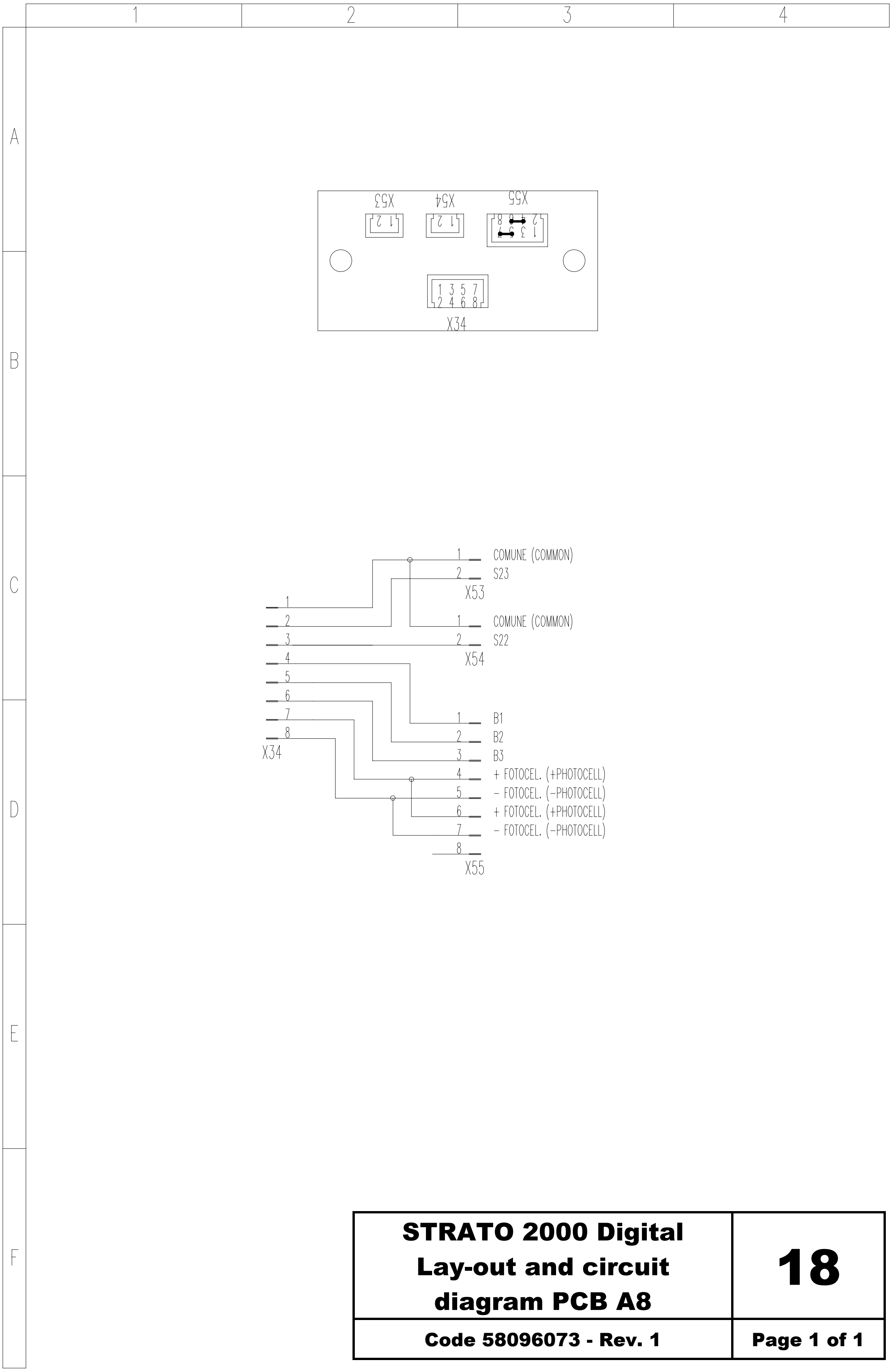

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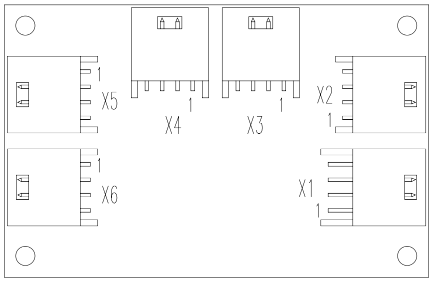
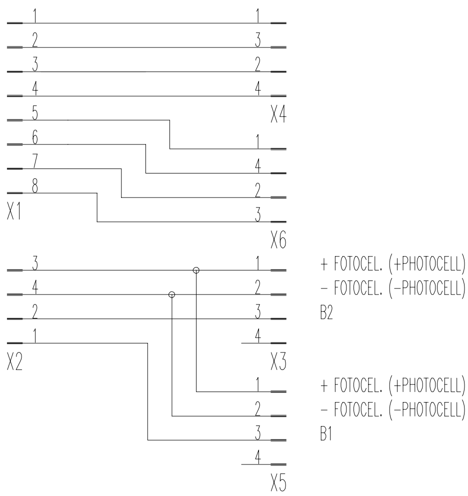
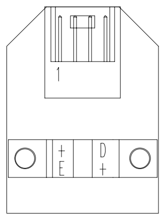
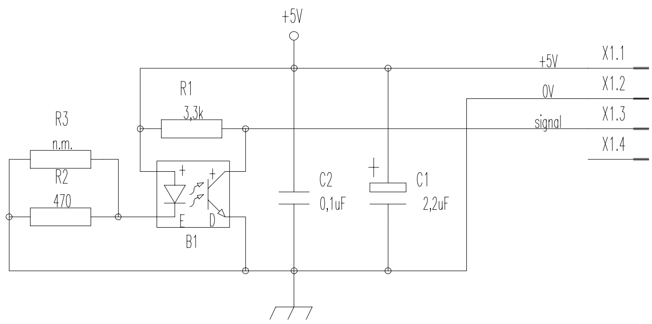


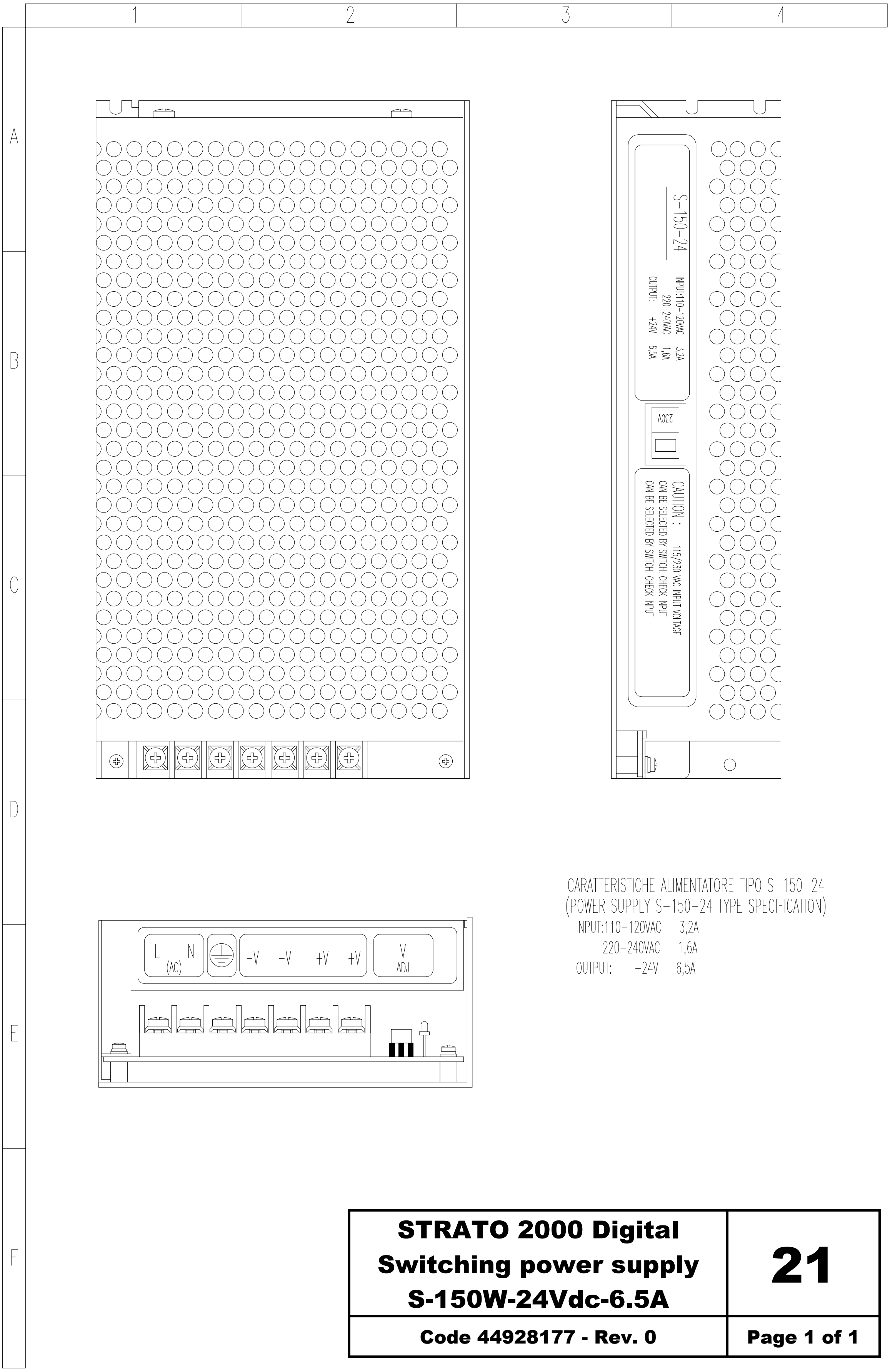


STRATO 2000 Digital Lay-out and circuit diagram PCB A9	**19**
Code 58098150 - Rev. 0	**Page 1 of 1**





STRATO 2000 Digital Lay-out and circuit diagram PCBs A16/A17/A18/A19	20
Code 58096162 - Rev. 0	Page 1 of 1

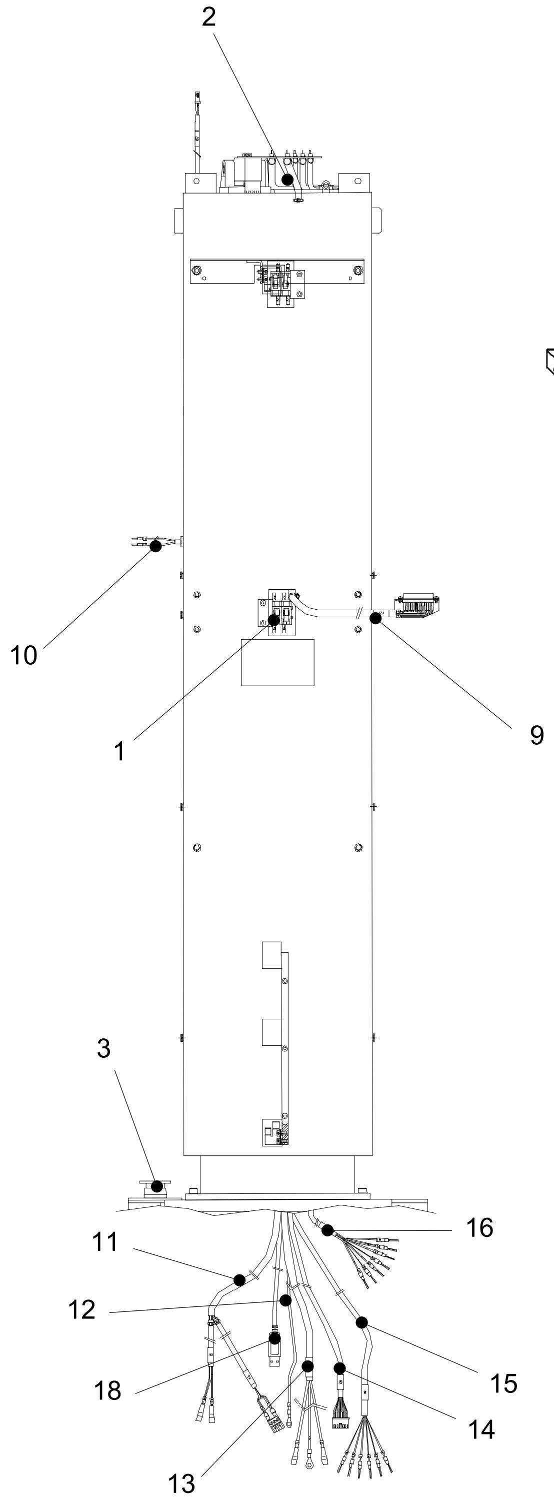


STRATO 2000 Digital Switching power supply S-150W-24Vdc-6.5A	**21**
Code 44928177 - Rev. 0	**Page 1 of 1**

10. SPARE PARTS

1 - COLUMN AND BASE

Rif.	Order code	Description	Note
1	4208404000	Column and travel microswitch (S2/S3)	
2	6609101800	Column actuator M1	
3	4291418400	Mains switch	
4	4492817700	+24V switch mode power supply	
5	6609107600	Fuses kit (230V version)	
	6609107700	Fuses kit (100V version)	
6	5809111500	Power supply board A3 (230V ver.)	
	5809111700	Power supply board A3 (100V ver.)	
7	4492818200	Transformer (230V version)	
	4492822100	Transformer (100V version)	
8	8027001021	Line filter	
9	6209317100	Cable X22 (console connection)	
10	6209103600	Cable X47/X60 (X-ray push button cable)	
11	6209114000	General supply cable	
12	6209109900	Ground cable #1	
13	6209103200	Cable X5/X29 (filter box connection)	
14	6209103500	Cable X3/X6 (CPU board connection cable)	
15	6209105100	Cable X28/X51	
16	6209105200	Column end-travel microswitch cable	
17	6609112300	X-ray push button	
18	5009318300	USB2 cable	
-	4492706700	HUB USB2	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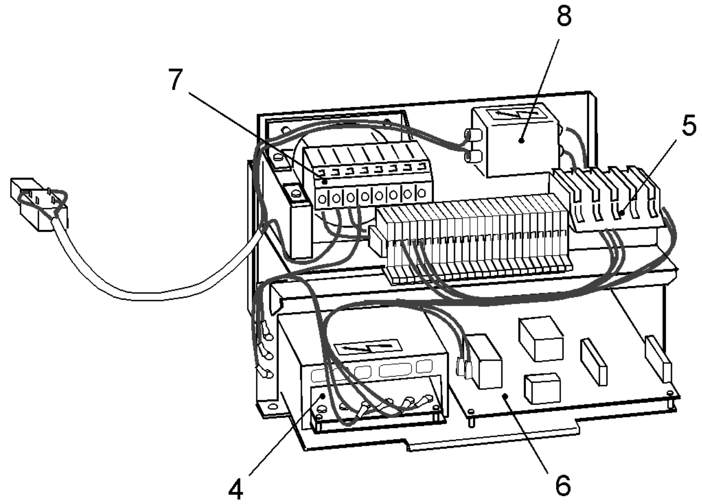
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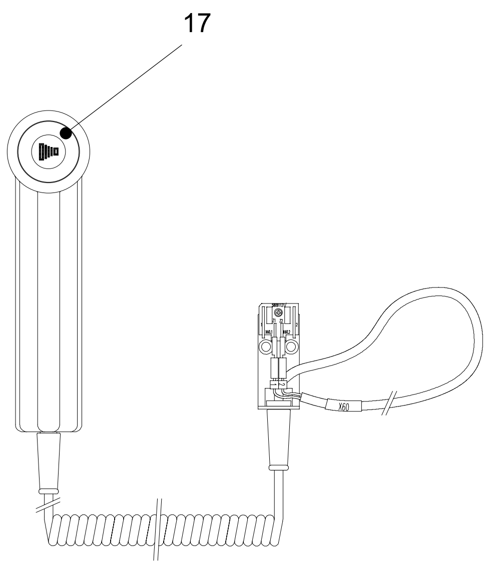
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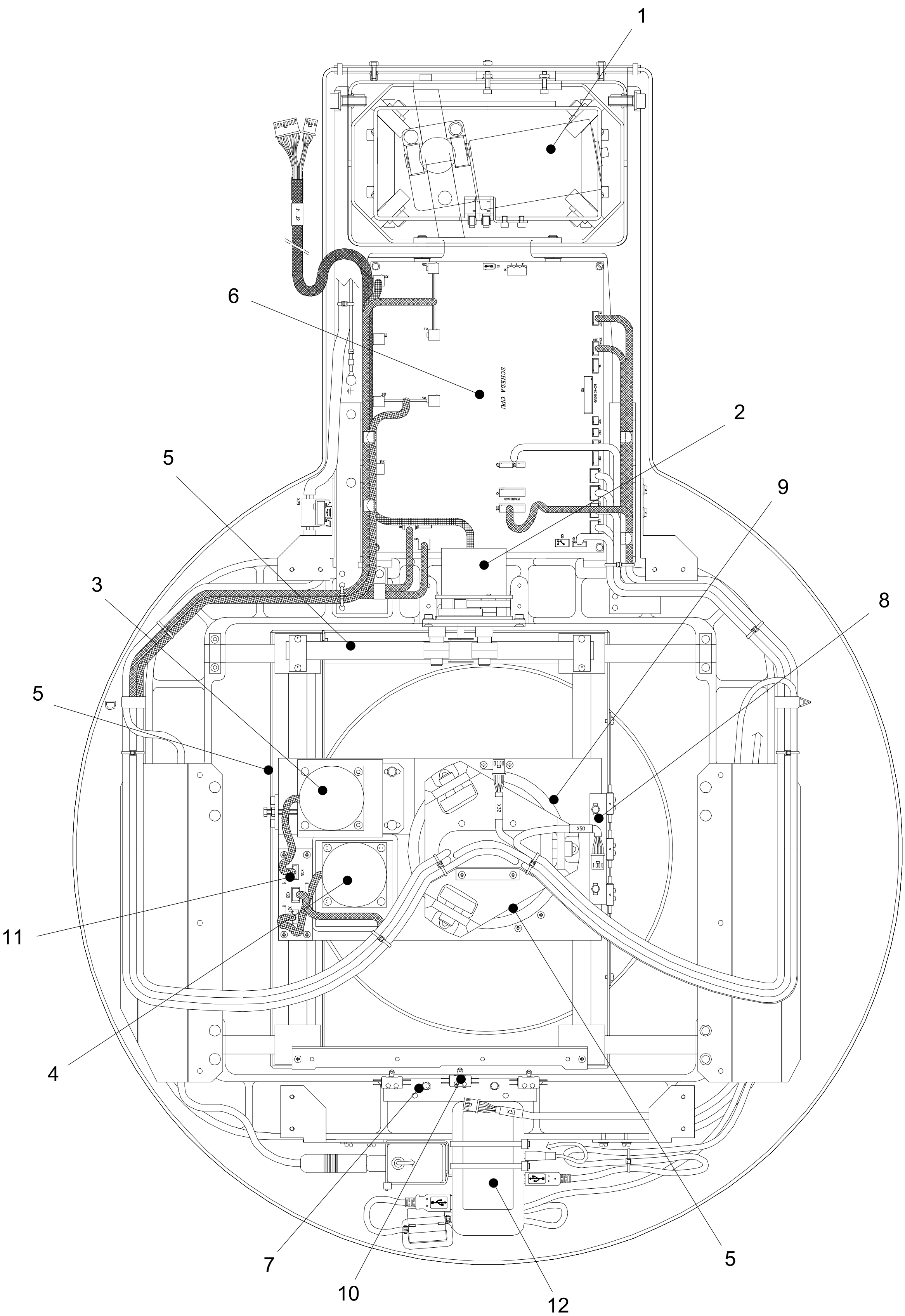
2 - UPPER MOVEMENT ASSY

Electrical and mechanical parts

Ref.	Order code	Description	Note
1	6609101800	Column actuator	
2	6609321900	M4 Y-Axis stepper motor assy	
3	6609314500	M5 X-Axis stepper motor assy	
4	6609314500	M3 rotation stepper motor assy	
5	4990805200	Carriage belt	
6	6609323700	CPU PCB A1 assy	
7	6109311000	Y-Axis microswitches assy	
8	6109305000	X-Axis microswitches assy	
9	6209314300	RO Axis microswitches assy	
10	4291308500	Microswitch	
11	5809307400	Interconnection PCB RO-Y	
12	4492706700	HUB USB2	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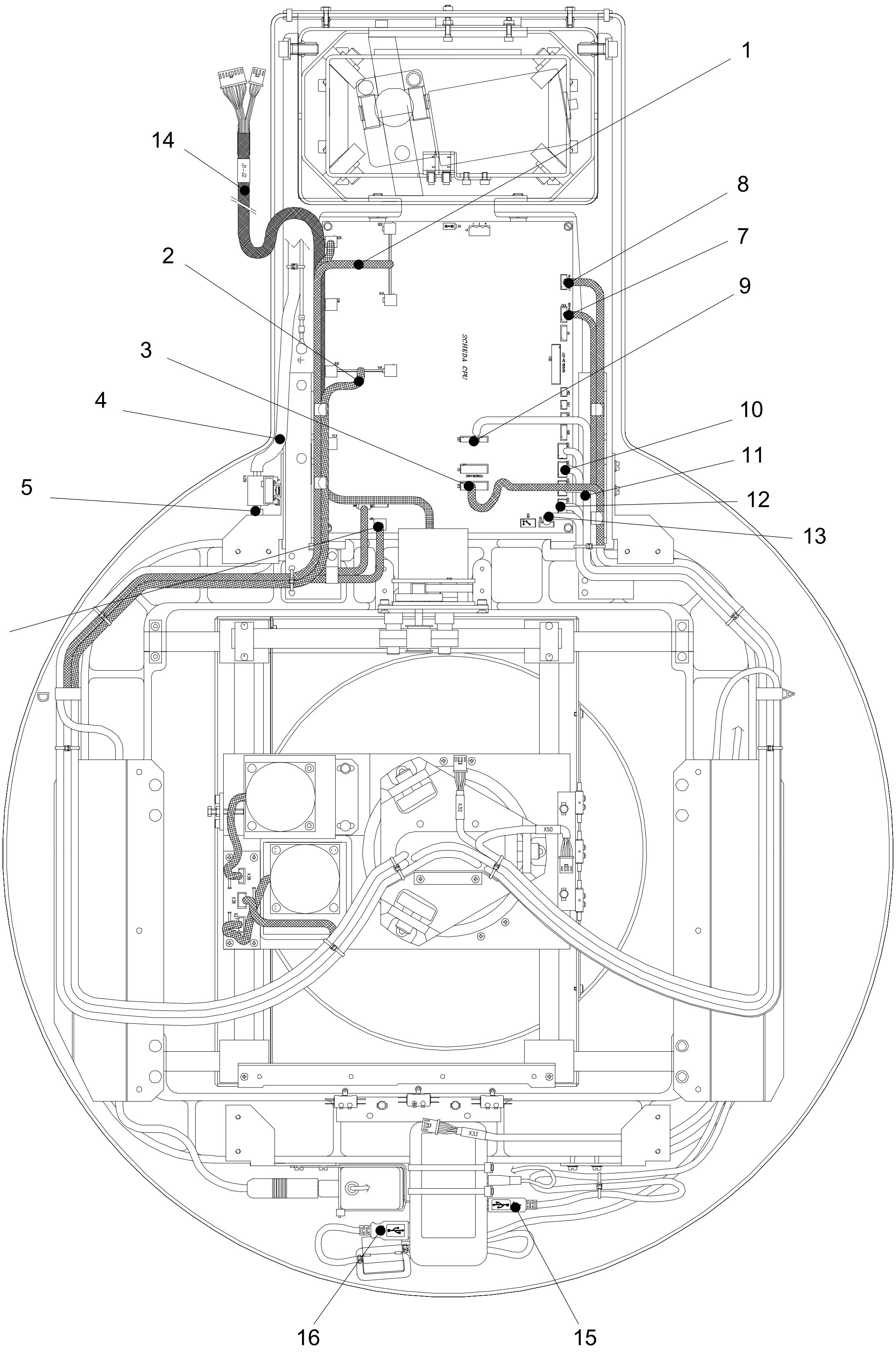
Cables

Ref.	Order code	Description	Note
1	6209320700	Cable X19-X20/X39 (rotation and X axis motor supply)	
2	6209416400	Cable X61/X40 (sensor PCB input signals)	
3	6209310400	Cable X5/X12 (HF board signals)	
4	6209103200	Cable X5/X29 (filter box connection)	
5	6209305400	Cable X29 (filter box)	
	6209318300	HUB power connection cable	
6	6209416300	Cable X60/X46 (+24V sensor supply)	
7	6209415700	RS232 cable	
8	6209306300	Cable X9/X4 (kV/mA signals)	
9	6209305200	Cable X26-X27/X35-X57-X58 (laser spot connections)	
10	6209301400	Cable X50 (X axis microswitches connection)	
11	6209305300	Cable X33 (Y axis microswitches connection)	
12	6209304700	Cable X32 (rotation microswitches connection)	
13	6209402400	Cable X31 (panoramic sensor holder position microswitches connection)	
14	6209416500	Cable J1-J2/J13-J14 (PANCEPH digital sensor connection)	
15	5009318300	HUB USB2 cable	
16	6209321000	HUB – Sensor connection cable	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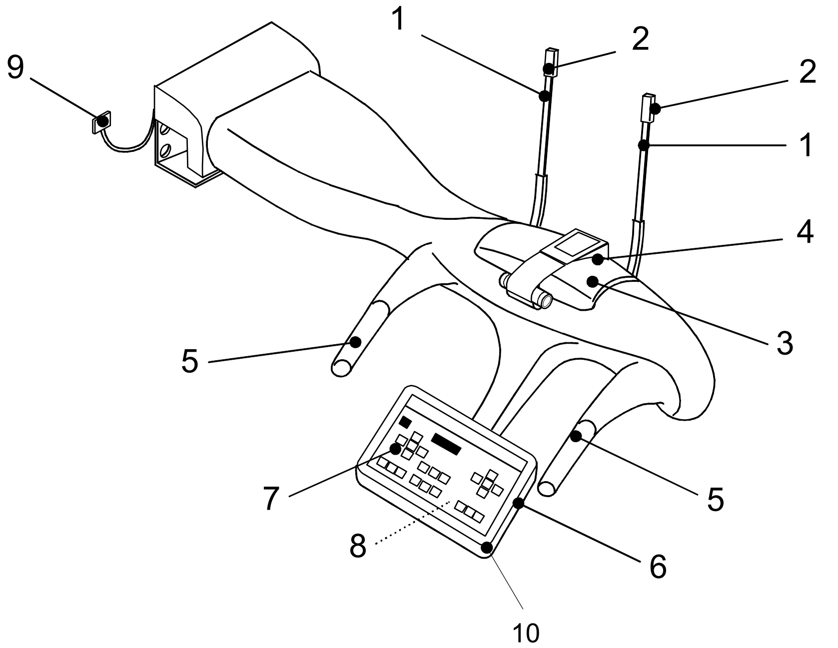
3 - CHIN REST ARM / SENSOR HOLDER

Ref.	Order code	Description	Note
1	5909513100	Temple support rod	
2	5409513200	Skull clamp plastic cup (1 pc.)	
3	6609515006	Skull clamp assy	
4	6309514906	Skull clamp cover	
5	5209502000	Handle for patient (1 pc.)	
6	6609507000	Keyboard assy	
7	5409506100	Keyboard panel	
8	6609312100	Keyboard PCB (A4)	
9	6209317200	Cable X1/X22 (console connection)	
10	5409505106	Console bottom box	
11	5809416200	Sensor interconnection PCB	
12	6609904000	PAN Acquisition PCB + CCD sensor	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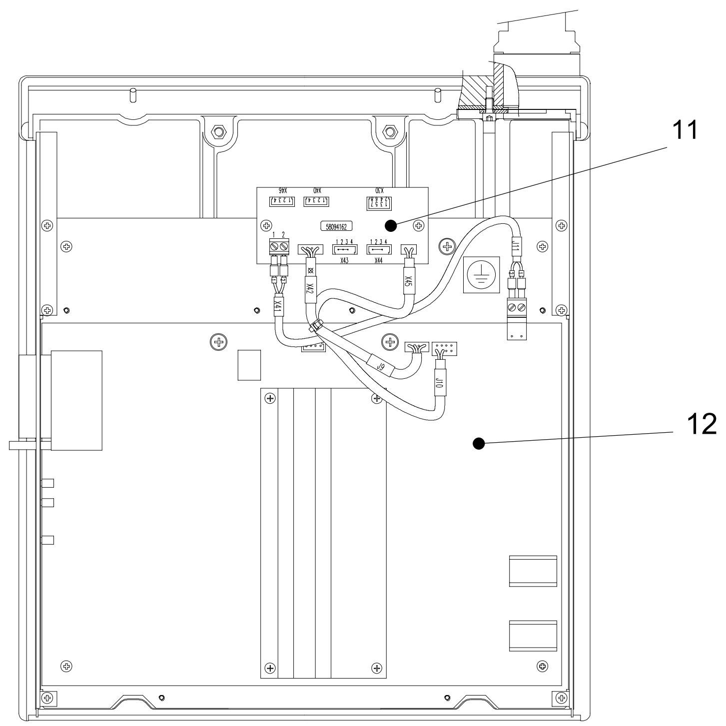
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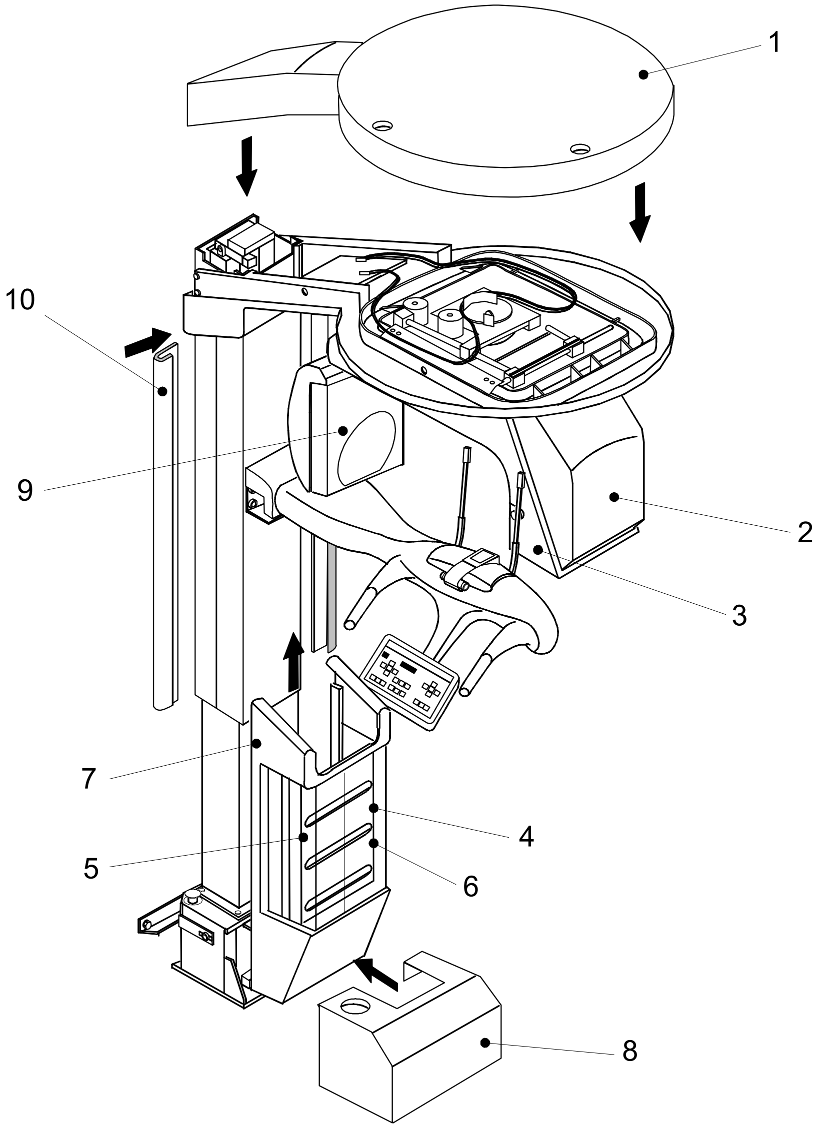
4 - COVERS

Ref.	Order code	Description	Note
1	5409300705	Upper cover	
2	5409400505	Tubehead back cover	
3	5409400405	Arm cover	
4	6609200900	Right door assy	
5	6609200800	Left door assy	
6	5409200700	Tray for consumable	
7	6109201505	Column cover assy	
8	5409100505	Base cover	
9	6109406205	Sensor cover	
10	5609105503	Protection cover for rear cable	
11	5409814500	Ceph device upper cover	
12	5409814900	Ceph arm cover	
13	5409815100	Ceph sensor holder front cover	
14	5409814600	Ceph sensor holder rear cover	
15	5409815000	Secondary collimator cover	
-	6609839400	Covers rubber profile (Length=8mt)	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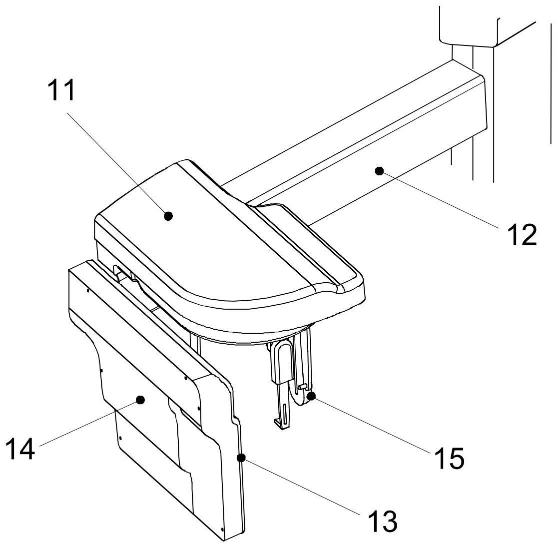
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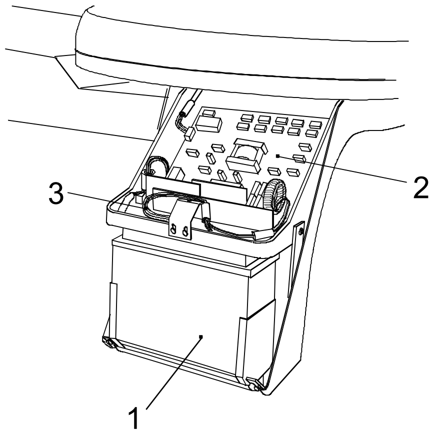
5 - ROTATION ARM

Ref.	Order code	Description	Note
1	6609600000	HF Tubehead	
2	6609401600	HF PCBoard (A2)	
3	6609603200	Tubehead cable	
4	6209409000	Filter box	
5	6609311200	Sagittal laser centering device	
6	6609608700	Frankfurt laser centering device	
7	4208422900	Microswitch S24 (sensor holder in PAN position) S25 (sensor holder in CEPH position)	
8	5809607300	Primary collimator connection PCBoard A8	
9	6209617100	Light barrier board connection cable	
10	6209617200	Soft Tissue Filter motor M6	
11	6209616900	Primary collimator motor M7	
12	5809616200	Light barrier PCBoard A16/A17	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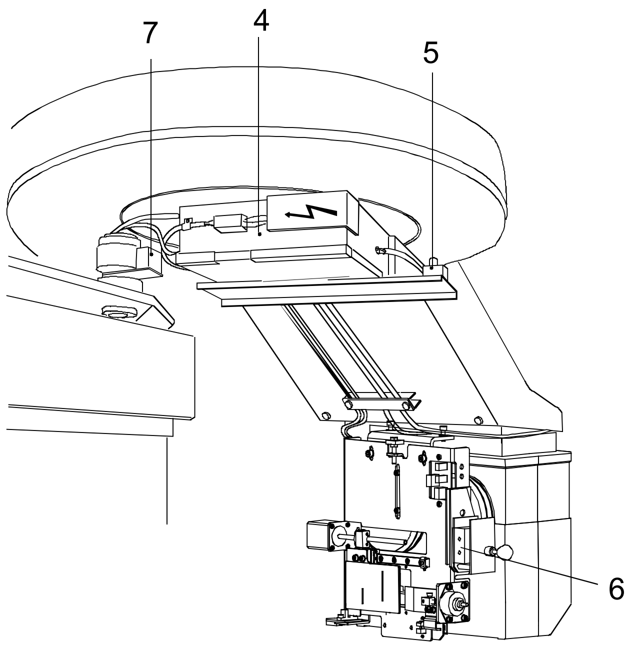
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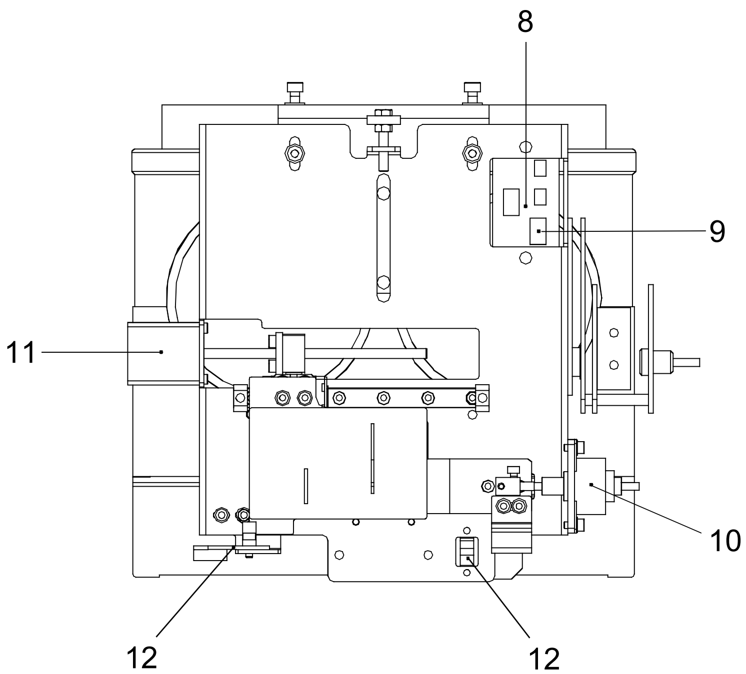
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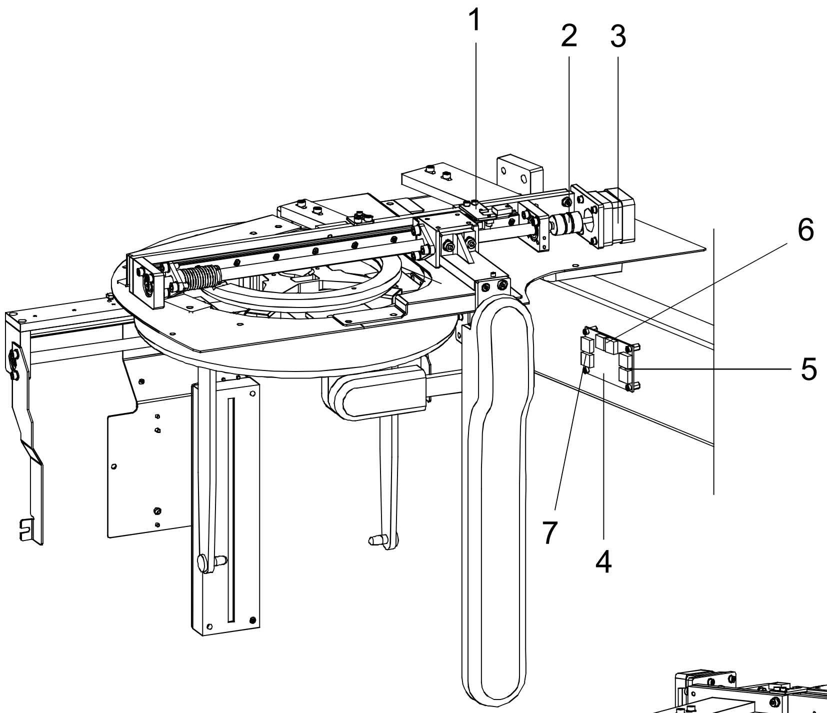
6 – CEPH DEVICE

Ref.	Order code	Description	Note
1	5809616200	Light barrier PCBoard A18/A19	
2	5209811800	Motor joint	
3	6209815600	Secondary collimator motor M8	
4	5809815000	Interconnection PCBoard A9	
5	6209815200	Ceph arm motor and signals cable X1-X2	
6	6209815300	Secondary collimator light barrier cable X1/X3	
7	6209815400	Ceph sensor light barrier cable X1/X5	
8	6209815500	Ceph Sensor motor M9	
9	6609904100	Ceph Acquisition PCB + CCD sensor	
10	6209815800	ICEPH-PCC cable	
11	6209815700	J1-J2 Ceph arm cable	
12	6609802900	Rod for Ceph centering device	
13	6608906100	Ceph ear pivot (10 pcs)	
14	5909803800	Nose-rest rod	
15	6609803500	Nose-rest rod assy	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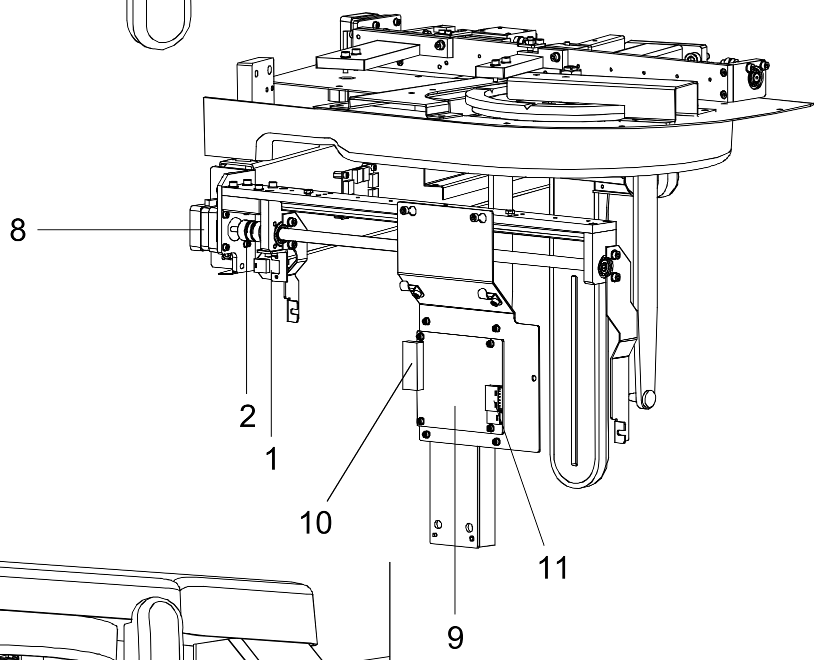
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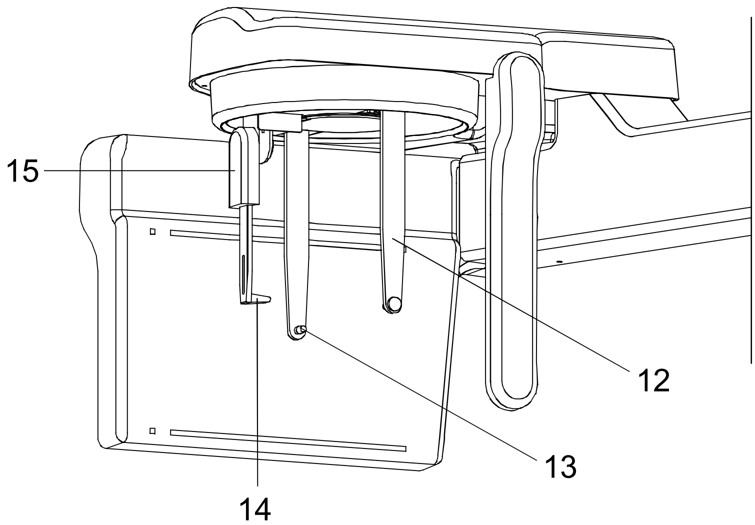
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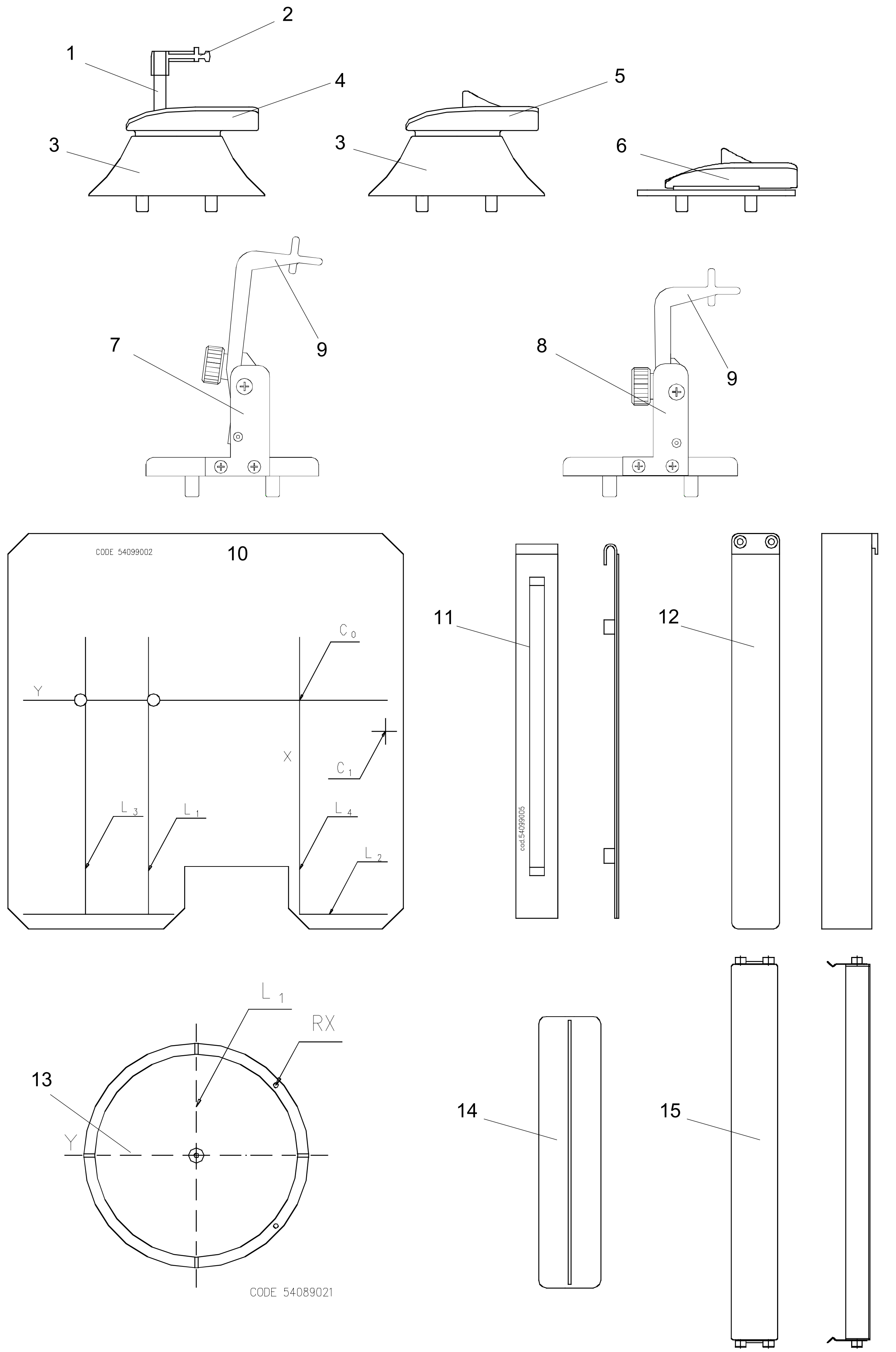
7 - ACCESSORIES AND SERVICE TOOLS

Ref.	Order code	Description	Note
1	6608906000	Kit for 50 centering bite rods	
2	4099927000	Kit for 500 centering bites	
3	5409501400	Base for chin rest	
4	5409501500	Panoramic chin rest	
5	5409501600	Edentulous chin rest	
6	6109502800	SINUS/ATM chin rest	
7	6609502600	Mandible Implant bite block assy	
8	6609502500	Maxilla Implant bite block assy	
9	6609503600	Implant centering bites (2 pcs)	
10	5409900200	Flat centering tool	
11	5409900500	Fluorescent screen for X-ray beam centering	
12	5109900800	PAN sensor calibration tool	
13	5408902100	Round centering tool	
14	5209900900	CEPH sensor centering tool	
15	6109902100	CEPH sensor calibration tool	
-	5809322100	CEPH calibration programs CD	
-	6609903400	PAN adjustment and calibration tools kit	
-	6609903600	CEPH adjustment and calibration tools kit	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11. FIXING TEMPLATE

This system is equipped with a set of templates, composed of the following elements:

Code	**Description**
39099004	Upper template

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12. APPENDIX

12.1. Appendix A: Setup parameters table

The following table lists those adjustment parameters stored in the unit during factory testing and that must be re-entered into the non-volatile memory in case of replacement of the CPU board. This is due to the fact that the new CPU board, provided as a spare part, has been factory tested from the functional point of view, but contains only default parameters which are not related to the unit where it will be installed. Entering of the listed parameters can be performed through the service programs (passwords).

NOTE:
The information listed in the table are the technical parameters set during factory testing. Preferences set by the user (e.g. exposure parameters different than the default ones) are not listed.

The table also has columns with blank cells. These cells must be filled in when, during installation or during the life on the unit, any of the listed parameters will be modified (e.g. after replacing a motor or a positioning sensor).

STRATO 2000 Digital

Unit code:______________________________

Unit S/N:_______________________________

U.I.C.:_________________________________

Parameter	**Factory setting**	**New setting**	**New setting**	**New setting**	**New setting**
Date					
CPU type					
X axis motor offset					
Y axis motor offset					
Rotation axis motor offset					
Primary collimator type					
Primary collimator motor offset					
Soft Tissue Filter (STF) motor type					
Soft Tissue Filter (STF) motor offset					
Soft Tissue Filter (STF) % correction					
Digital Ceph status (OFF=disabled; ON=enabled)					
Digital ceph Rotation offset					
Digital ceph secondary collimator offset					
Digital ceph sensor offset					
Language (English, Italian, French, German, Spanish)					

12.2. Appendix B: Installation checklist

- Vertical alignment of COLUMN (par. 6.2) .... ☐
- Horizontal alignment of CHIN SUPPORT (par. 6.4) .... ☐
- Horizontal alignment of CEPH ARM (par. 6.6) .... ☐
- PANORAMIC mechanical ALIGNMENT CHECK (par. 6.7.1) .... ☐
- CEPH mechanical ALIGNMENT CHECK (par. 6.7.2)...................... ☐
- Alignement of PANORAMIC AXIS (par. 7.1.1) .... ☐
  - ROtation AXIS (par. 7.1.1.1) .... ☐
  - X AXIS (par. 7.1.1.1)... ☐
  - Y AXIS (par. 7.1.1.1)... ☐
- X-RAY BEAM centering (par. 7.1.2)... ☐
- Alignement of CEPH AXIS
  - ROtation OFFSET (par. 7.1.3.1).. ☐
  - Ear Centering Circle SETTING (par. 7.1.3.2)........................... ☐
  - Secondary Collimator CENTERING (par. 7.1.3.3).................... ☐
  - CEPH Sensor CENTERING (par. 7.1.3.4) .... ☐
  - Soft Tissue Filter (STF) ADJUSTMENT (par. 7.1.3.5).............. ☐

Date and sign

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VILLA
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MEDICALI

Cod. 6909908903_Rev.3 CE 0051

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SYSTEMS GROUP