VILLA SISTEMI MEDICALI

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Rotograph EVO D CE 0051

Service Manual

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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.

Rotograph EVO D, produced by VILLA SISTEMI MEDICALI S.p.A., is an X-ray device for the radiographic analysis of the maxillo-facial complex.

The basic version of the Rotograph EVO D performs Panoramic, Sinus and TMJ examinations of the maxillo-facial complex.

The following options are available, and must be ordered separately:

- EVO XP (Extended Projection Package); it allows the execution of the following examinations: Emi-panoramic, Reduced dose Panoramic, Frontal dentition, Improved orthogonality Panoramic and Bitewing.
- IMPLANT; it allows to perform images of cross-sections of the dental arch, for Implant medical treatment.
- DIGITAL CEPH; it allows the execution of the following examinations:
  - CEPH exam in different formats, all available in high resolution and normal resolution (high speed) modality
  - CARPUS exam, available in high resolution modality.

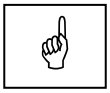
This manual provides to the technical personnel the instructions for proper and safe installation and maintenance of the appliance.
This manual is limited to the description of the X-ray device; instruction on the Digital Acquisition System are given in the relevant Manuals, supplied with the Direct Digital Sensor.

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

Rotograph EVO D 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 queries please contact the following:

- Telephone number +39 02 48859.1
- 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 Rotograph EVO D 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/or by wrong operations,
- mechanical and/or electrical modifications performed during and after the installation, different than those described in this Manual.

Installation and any technical intervention must only be performed by qualified technicians authorized 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 the main power supply has been disconnected from the equipment. Pushing the ON/OFF button on the basement of the equipment, it mustn't switch on.

Wherever necessary, instruct the customer regarding the following:

- to use the proper 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
- to clean and disinfect, when necessary, all parts that can be in contact with the patient
- **to replace the bite or the bite protective sleeve and the ear-centring devices after the use.**

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

Rotograph EVO D must be switched off while using devices such as electrical lancets or the like.

Never try to rotate the moving arm manually when the unit is switched on, to avoid permanent damage to the unit.
Movement is only possible in case of Error 362 because motors are disabled to permit the patient exit.

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

The high frequency generator, located on the rotating arm, can hold dangerous voltage for more than 2 minutes from the power off.

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 a 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 m (4.92') both from the X-ray source and from the patient, as shown in the picture below.

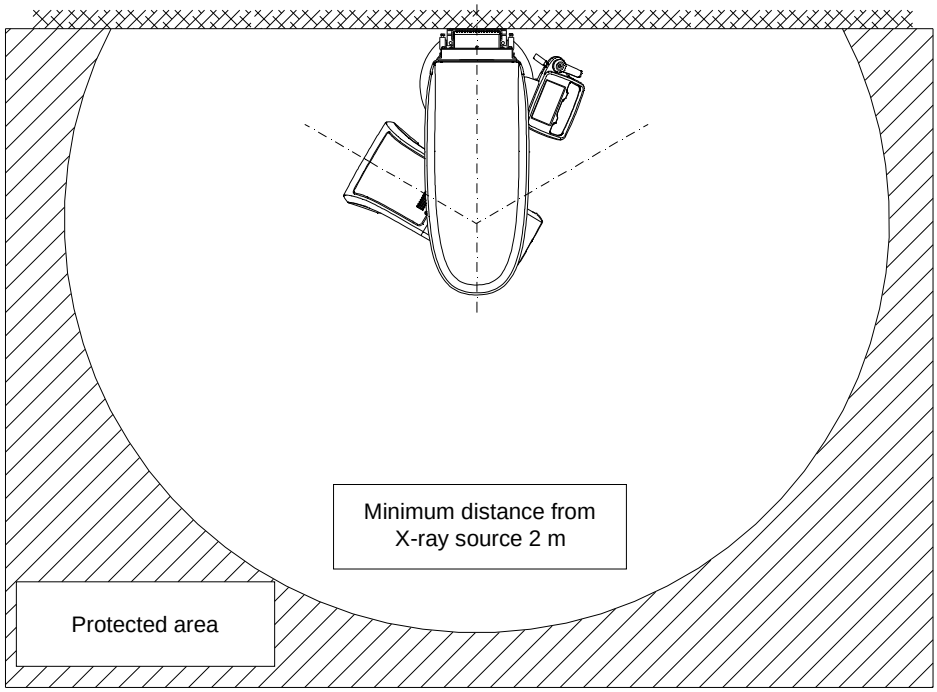


Figure 2-1 - Panoramic version

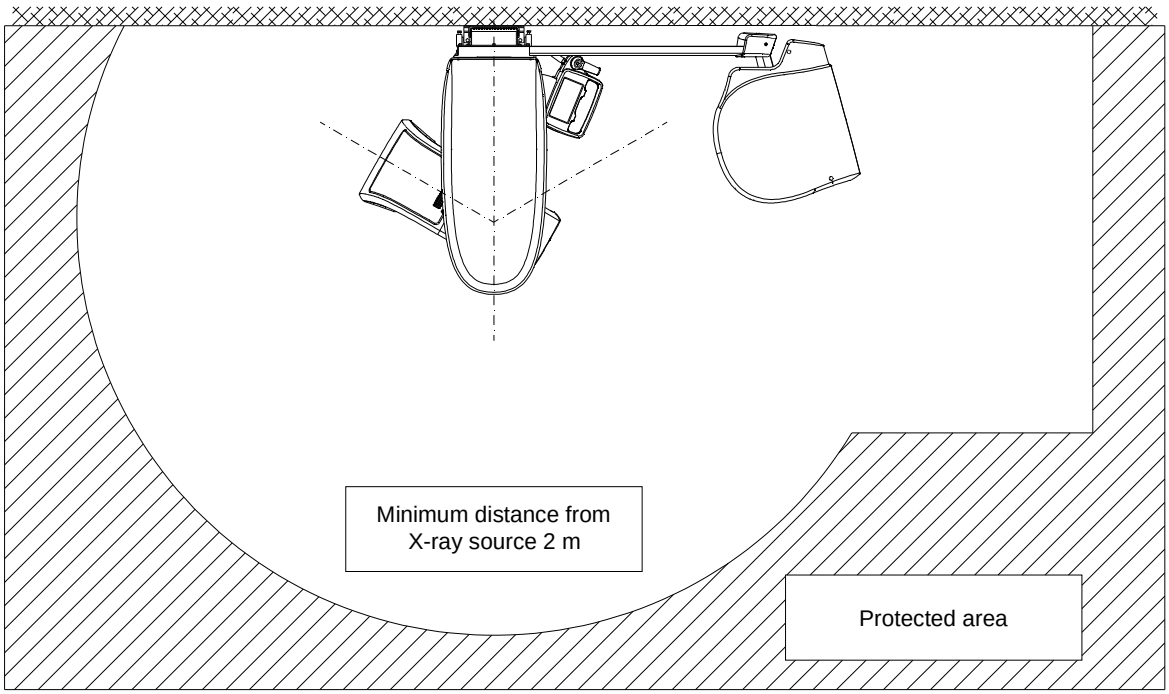


Figure 2-2 - Cephalometric version

WARNING: PRECAUTIONS WHILE USING LASER CENTRING DEVICES

Also if the laser devices, according to IEC60825-1, are in Class I:

- It is necessary to have 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 the laser centring devices with tools that could modify the optics. Necessary cleaning must be performed only by authorised technicians. Operations different than those indicated could cause the ejection of dangerous non-ionising radiations.

WARNING: PRECAUTIONS DURING INSTALLATION AND SERVICE INTERVENTIONS

- Please take the highest care while mounting the column to the wall and strictly follow the instructions listed in this manual.
- Before removing the covers of the column, or before removing the covers of the Generator board (A10), disconnect the power supply to the device, both switching the main switch and the magneto-thermal differential off, and wait at least 2 minutes.
- When the device is supplied without the above mentioned coverings, pay the highest attention since high voltage is generated in the supply unit, and the voltage is at about 400 Vdc on the Generator board. This is indicated by the green LED H1. Should the LED be off and before any other intervention, disconnect the device from the net, wait at least 2 minute, then check the fuses F1 (10AF) in the supply unit, or F2 (5AF) on the Generator board (see circuit diagram).
- Each intervention must be performed after having disconnected the device from the supply net and after LED H1 is OFF. It is anyway advisable to wait at least 2 minutes from the LED's switching off.
- **The system construction does not allow the repair of faulty/damaged parts, that must be replaced using original spare parts supplied by Villa Sistemi Medicali. Only trained personnel are authorized to make service interventions on the unit, following the instructions contained in this manual.**

WARNING:
The USB port on the keyboard MUST NOT be used with an external Hard Disk with own mains connection. It has to be used only with USB Pen Drives.

2.1.1. Distribution of stray radiation in Panoramic examination

	-1.5	-1	-0.5	0	0.5	1	1.5m	
	0,000233	0,000297	0,00053	0,000445	0,000423	0,000331	0,000201	
1.5	0,000268						0,000197	1.5m
1	0,000546						0,000248	1
0.5	0,000666						0,000282	0.5
0	0,00049			C			0,000163	0
-0.5	0,000474						0,000266	-0.5
-1	0,000376						0,000248	-1
-1.5	0,00025	0,000449	0,000655	0,000588	0,000447	0,000182	0,000434	-1.5
	0,000318						0,000228	
	-1.5	-1	-0.5	0	0.5	1	1.5m	

Figure 2-3: Distribution of stray radiation in Panoramic examination

The Figure above illustrates the distribution of scatter radiation in the horizontal plane at the centre of rotation of the scanning unit in the area of a 3 x 3m rectangle.
The measurement was performed using as scattering element an anthropomorphic phantom complete of soft tissues simulating the head of the typical patient (in size, dimensions and tissues) of the intended use of the machine.
This phantom was placed in the same position as a patient taking a panoramic exam. C is the center of patient head.
The measures were taken during a panoramic exam setting the following parameters: 86kV, 10mA, 14.4s.

NOTE:
They are the maximum kV and mA that can be set on the equipment.

The distribution values in the table are expressed as air Kerma for mAs (µGy/mAs).

2.1.2. Distribution of stray radiation in Ceph examination

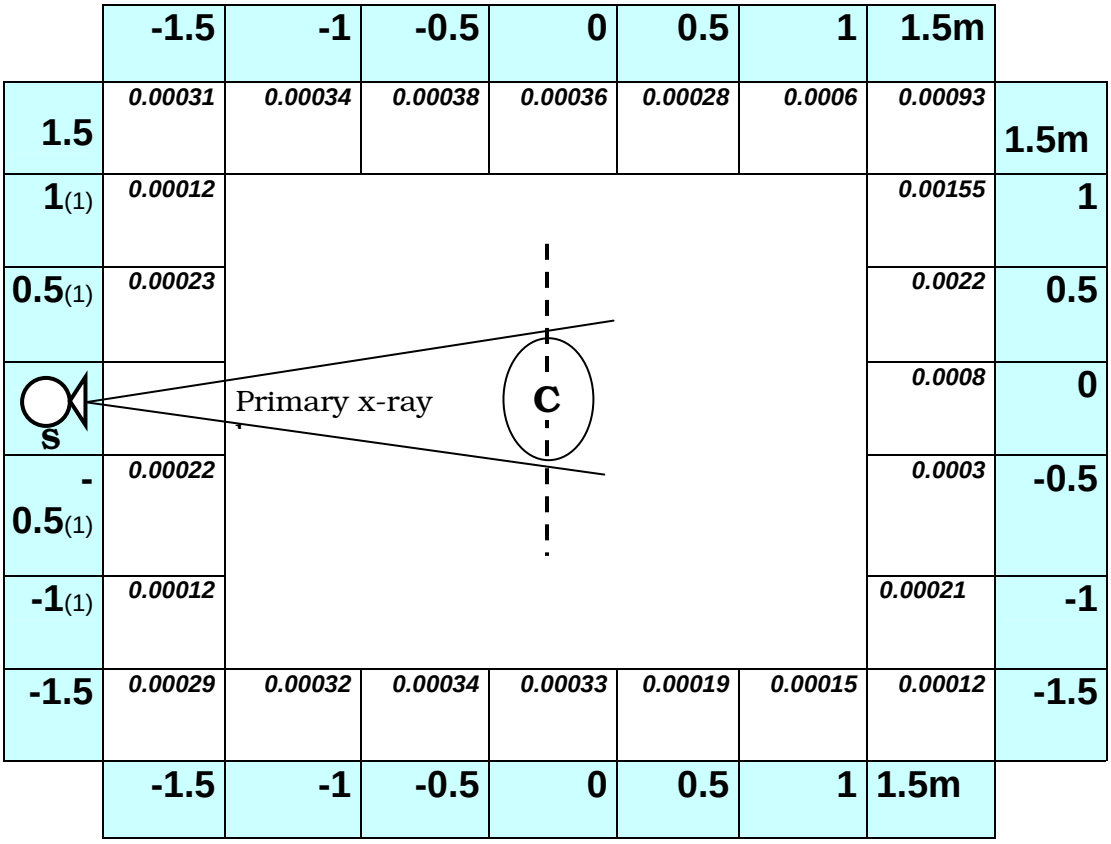


Figure 2-4: Distribution of stray radiation in Ceph examination

NOTE (1):
The doses reported on the source side (S) are just the head scattering term and these values doesn' take into account of tubehead leakage radiation.

The Figure above illustrates the distribution of scatter radiation in the horizontal plane at the centre of rotation of the scanning unit in the area of a 3 x 3m rectangle.
The measurement was performed using as scattering element an anthropomorphic phantom complete of soft tissues simulating the head of the typical patient (in size, dimensions and tissues) of the intended use of the machine.
This phantom was placed in the same position as a patient taking a 30x22 cephalometric exam; this exam is the maximum in size among those the user can select.
C is the center of patient head; S is the X-ray source and the primary X-ray beam is also represented in Figure above.

The measures were taken during a cephalometric exam setting the following parameters: 86kV, 12mA, 7.5s.

NOTE (1):
They are the maximum kV and mA that can be set on the equipment.

The distribution values in the table are expressed as air Kerma for mAs (µGy/mAs).

2.1.3. Electromagnetic emissions

In accordance with the IEC 60601-1-2 standard, the Rotograph EVO D is suitable for use in the specified electromagnetic environment.
The purchaser or user of the system should assure that it is used in an electromagnetic environment as described below.

Emissions test	Compliance	Electromagnetic environment
Radiated and conducted RF emissions CISPR 11	Group I	Rotograph EVO D uses RF energy only for its internal function. Therefore, the R.F. emissions is very low and not likely to cause any interference in nearby electronic equipment.
	Class A	Rotograph EVO D is suitable for use in all establishments other than domestic and those directly connected to the low voltage power supply network which supplies buildings used for domestic purposes.
Harmonics emissions IEC 61000-3-2	Not applicable	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Not applicable	

2.1.4. Electromagnetic immunity

In accordance with the IEC 60601-1-2 standard, the Rotograph EVO D is suitable for use in the specified electromagnetic environment.
The purchaser or user of the system should assure that it is used in an electromagnetic environment as described below.

Immunity test	**IEC 60601-1-2 Test level**	**Compliance level**	**Electromagnetic Environment**
Electrostatic discharge (ESD) IEC 61000-4-2	± 6 kV contact ± 8 kV air	± 6 kV contact ± 8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%
Electrical fast transient/burst IEC 61000-4-4	± 2 kV for power supply lines ±1 kV for input/output lines	± 2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment
Surge IEC 61000-4-5	±1 kV lines to lines ± 2 kV lines to earth	± 1 kV lines to lines ± 2 kV lines to earth	Mains power quality should be that of a typical commercial or hospital environment
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	0 % U_n for 0.5 cycles 40 % U_n for 5 cycles 70 % U_n for 25 cycles 0 % U_n for 5 s	0 % U_n for 0.5 cycles 40 % U_n for 5 cycles 70 % U_n for 25 cycles 0 % U_n for 5 s	Mains power quality should be that of a typical commercial or hospital environment. If the user of the Rotograph EVO D requires continued operation during power mains interruptions, it is recommended that the Rotograph EVO D be powered from an uninterruptible power supply or battery
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency megnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment
Note: U_n is the AC mains voltage prior to application of the test level.			

Immunity Test	IEC 60601-1-2 Test level	Compliance level	Electromagnetic Environment
			Portable and mobile RF communications equipment should be used no closer to any part of the Rotograph EVO D, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance:**
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	$d = 1.2 \times \sqrt{P}$ 80 MHz to 800 MHz $d = 2.3 \times \sqrt{P}$ 800 MHz to 2.5 GHz
Conducted RF IEC 61000-4-6	3 V 150 kHz to 80 MHz	3 V	$d = 1.2 \times \sqrt{P}$
			where "*P*" is the maximum output rating of the transmitter in watts (W) according to the transmitter manufacturer and "*d*" is the recommended separation distance in meters (m). Field strength for fixed RF transmitter, as determined by an electromagnetic site survey, should be less than the compliance level in each frequency range. Interference may occur in the vicinity of equipment marked with the following symbol: 

2.1.5. Recommended separation distances for non-life supporting equipment

Rotograph EVO D is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled.
The customer or the user of the Rotograph EVO D system can help prevent electromagnetic interference by mantaining a minimum distance between portable and mobile RF communication equipment (transmitter) and the Rotograph EVO D as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of the transmitter (W)	**Separation distance according to frequency of transmitter (m)**		
	150kHz to 80MHz $d = 1.2 \times \sqrt{P}$	**80MHz to 800MHz** $d = 1.2 \times \sqrt{P}$	**800MHz to 2.5GHz** $d = 2.3 \times \sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

For transmitters rated at the maximum output power not listed above, the recommended separation distance"*d*" in meters (m), can be estimeted the equation applicable to the frequency of the transmitter, where "*P*" is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

Note:

(1) at 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

(2) these guidelines may not apply to all situations. Electromagnetic propagation is affected by absorption and reflection of structures, objects and people.

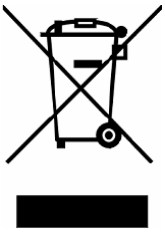
2.2. Environmental risks and displacement

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 appropriate disposal centres.

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

- **Tubehead:** dielectric oil, lead, copper, iron, aluminium, glass, tungsten.
- **Control panel:** 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.

Information for users of the European Community according to 2011/65/EU Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment.



The symbol of the crossed waste container on the equipment or on the packaging, shows that the product, at the end of its lifecycle, must be collected separately from other type of waste.

The separate collection of this equipment at the end of its lifecycle is organised and managed by the manufacturer. Users who need to dispose of this equipment, should therefore contact the manufacturer and follow the procedure adopted by the manufacturer themselves for the separate collection of the equipment at the end of its lifecycle.

The proper separate collection for the subsequent recycling, treatment and compatible environmental disposal of the equipment, contributes to avoid possible negative effects on the environment and on health and it encourages the reuse or recycling of materials the equipment consists of. Illegal disposal of the product by the possessor of the equipment, results in the application of administrative sanctions provided by the regulations in force

2.3. Symbols used

In this manual and on the Rotograph EVO D itself, apart from the symbols indicated on the control panel, the following icons are also 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 unit's life, must be disposed of at the appropriate 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 net
	ON ; device connected to the net
	Laser
	Laser source output
	Dangerous voltage
	Manufacturer's reference number
	Manufacturer's serial number
	Date of manufacturer (year and month)
	Name and address of the manufacturer
	Filtration
	Diagnostic source assembly
	X-Ray tube
	Consult instruction for use
CE 0051	Conformity to the CE 93/42 Directive and its revised version

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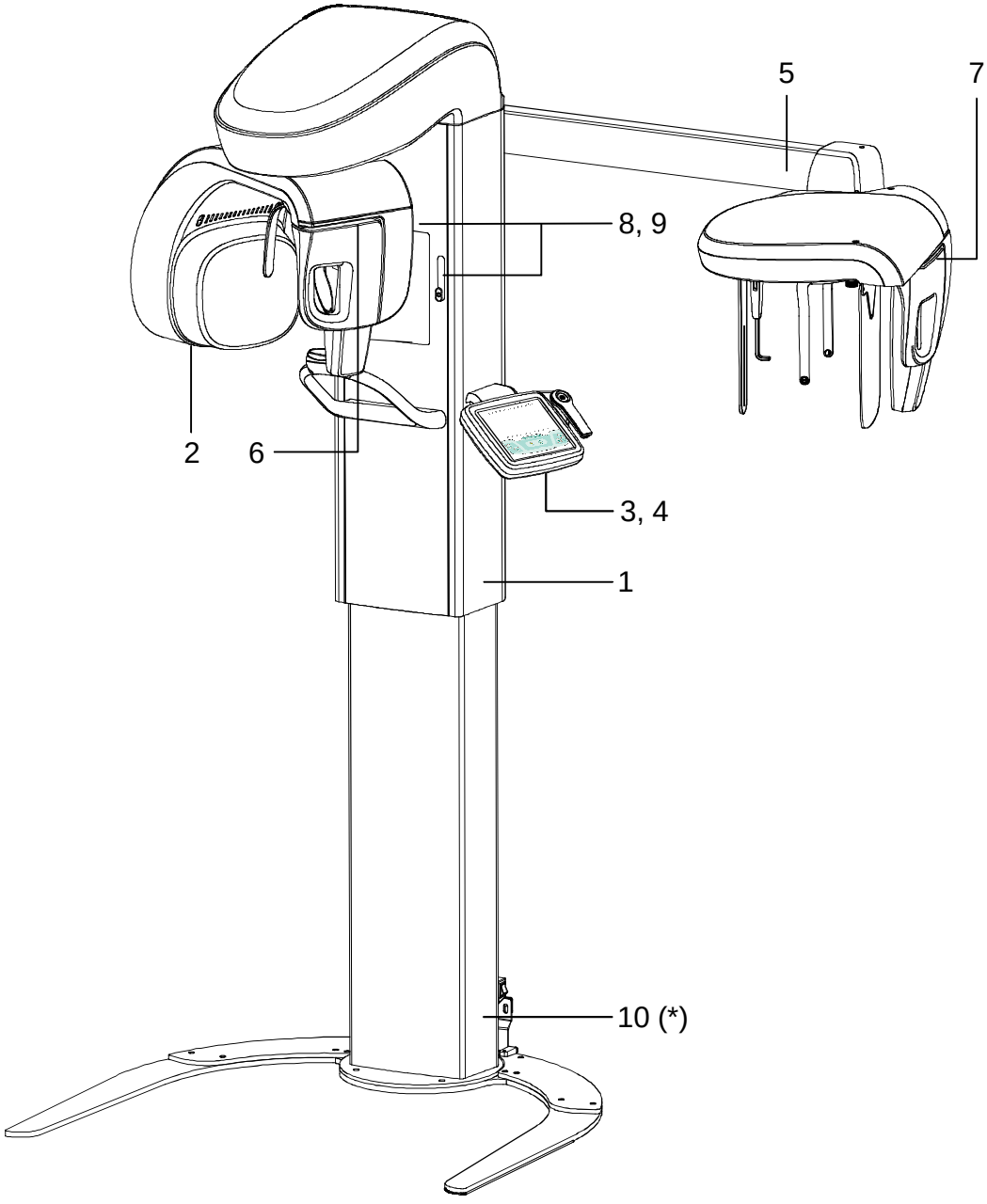
3. DESCRIPTION

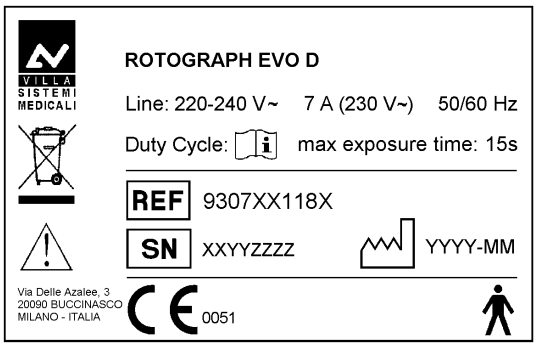
3.1. Identification labels and laser labels



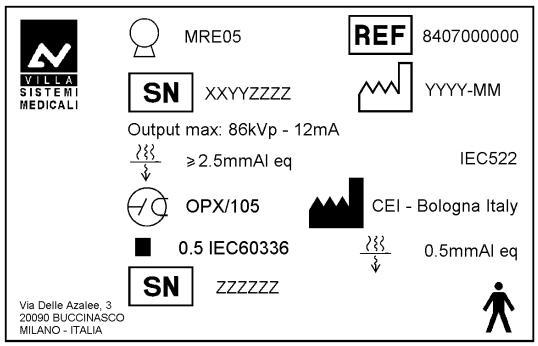
(*) Only for 110-120V version

3.1.1. Identification labels and laser labels "220-240V" version

1
Rotograph EVO D
identification label

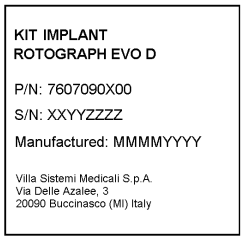


2
Tube-head
identification label

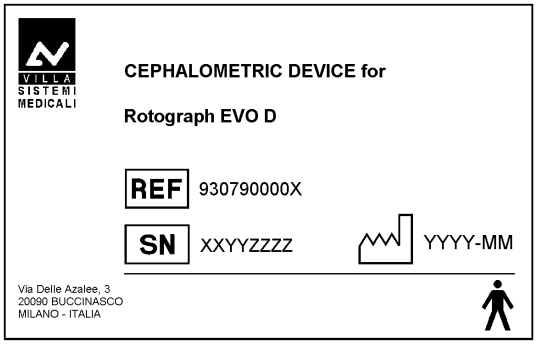


3
EVO XP – Extended Projection Package
identification label

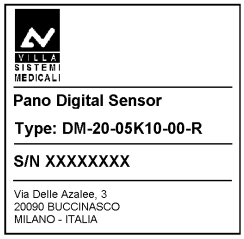
4
IMPLANT Package
identification label



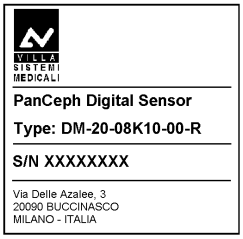
5
CEPHALOMETRIC device
identification label



6
PANO
Digital Sensor
identification label



7
PANCEPH.
Digital Sensor
identification label

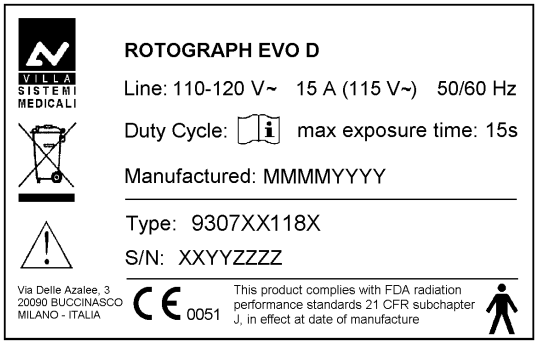


8
(N° 2) Spot Laser
identification label

9
(N° 2) Laser
symbol label

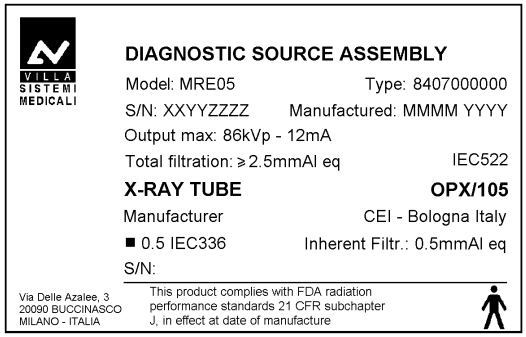
3.1.2. Identification labels and laser labels "110-120V" version

1a
Rotograph EVO D identification label



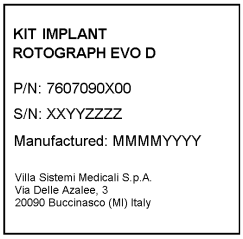
1b
ETL certification label

2
Tube-head identification label

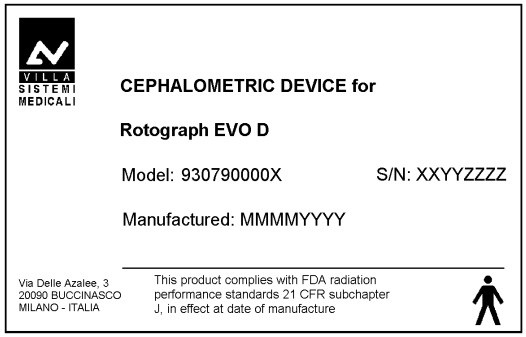


3
EVO XP – Extended Projection Package identification label

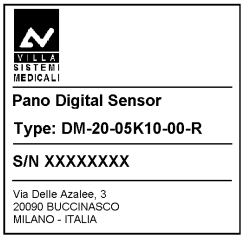
4
IMPLANT Package identification label



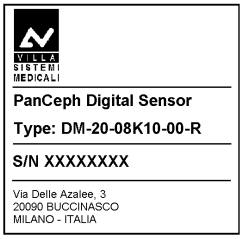
5
CEPHALOMETRIC device identification label



6
PANO Digital Sensor identification label



7
PANCEPH. Digital Sensor identification label



8
(N° 2) Spot Laser identification label

9
(N° 2) Laser symbol label

10
WARNING label

COMPLIES WITH DHHS PERFORMANCE STANDARD 21 CFR SUBCHAPTER J

WARNING:

THIS X-RAY UNIT MAY BE DANGEROUS TO THE PATIENT AND OPERATOR UNLESS SAFE EXPOSURE FACTORS AND OPERATING INSTRUCTIONS ARE OBSERVED.
ELECTRICAL SHOCK HAZARD - DO NOT REMOVE PANELS. EISK OF EXPLOSION - DO NOT USE IN PRESENCE OF FLAMMABLE ANESTHETICS.
FOR CONTINUED PROTECTION AGAINST RISK OF FIRE, REPLACE ONLY WITH SAME TYPE AND RATING OF FUSE.

DANGER:

CET APPAREIL DE RADIODIAGNOSTIC PEUT ETRE DANGEREUX POUR LE PATIENT ET L'OPERATEUR SI LES FACTEURS D'EXPOSITION ET LES INSTRUCTIONS NE SONT PAS SUIVIS. RISQUE D'EXPLOSION
- NE PAS EMPLOYER EN PRESENCE D'ANESTHESIQUES INFLAMMABLES POUR ASSURER UNE PROTECTION CONTINUE CONTRE LE RISQUE D'INCENDIE.
UTILISER UNIQUEMENT UN FUSIBLE DE RECHARGE DE MEME TYPE ET DE MEMES CARACTERISTIQUES NOMINALES.

3.2. Function, Models and Version

Rotograph EVO D, produced by VILLA SISTEMI MEDICALI, is a complete panoramic system, which enables to perform all radiographies commonly necessary in dental field (except for endoral X-rays).
In some versions, certain examination modes are not available but the device (thanks to its computerised control system) can be expanded and updated with new releases, directly at the Dentist premises.

The basic version performs Panoramic, Sinus and TMJ examination. Optional functions enable the system to perform the following additional examinations:

- **EVO XP (Extended Projection Package)**
  Allows you to carry out the following additional examinations: Emi-panoramic, Reduced dose Panoramic, Frontal dentition, Improved orthogonality Panoramic and Bitewing.
- **IMPLANT**
  Allows to perform images of cross-section of the dental arch, for Implant medical treatment.
- **CEPH**
  Allows you to carry out the following examinations:
  – CEPH exam in different formats
  – CARPUS exam.

3.2.1. Basic version

The basic version enables to perform the following examinations:

- Panoramic Adult or Child, with 3 sizes and 3 types of biting for a total of 18 combinations in Automatic selection; in manual selection it is possible to select high voltage between 60kV and 86kV, in 2kV steps and anodic current from 6 mA to 10 mA in 1 mA steps.
- Sinus enables to perform images of the paranasal sinuses with front projection (postero/anterior).
- TMJ mouth closed/open in lateral projection.

3.2.2. Version with cephalometric device

The version with cephalometric device allows you to perform the following examinations:

- Panoramic, Sinus, and TMJ, Adult and Child, with the same characteristics described for the base version.
- Digital Cephalometry for Adult and Children with 3 Sizes each. Within each combination, it is possible to select an examination in Hight or Normal Resolution, for a total of 12 combinations in Automatic selection. In Normal Resolution, the examination is carried out with a lower scanning time, allowing a further reduction of the dose. In Manual selection it is possible to vary the Hight Voltage from 60kV to 86kV, with 2kV steps, the anodic current from 6mA to 12mA with 1mA steps. The positioning of the sliding primary collimator, the secondary collimator and the Digital Sensor (inside the relative sensor holder) is automatic according to the selected format projection. The Soft Tissues Filter is motorized, to obtain the best possible emphasis of the face profile.
- Examination to evaluate the bone growth (Carpus) only Child with 3 Sizes. It is possible to select an examination in High Resolution, for a total of 3 combinations in Automatic selection. In Manual selection it is possible to vary the High Voltage from 60kV to 86kV, with 2kV steps, the anodic current from 6mA to 12mA with 1mA steps. The positioning of the sliding primary collimator, the secondary collimator and the Digital Sensor (inside the relative sensor holder) is automatic according to the selected image size and exam projection.

3.2.3. EVO XP (Extended Projection Package) - Optional

The unit, both the base and the version with cephalometric device, is prearranged to be fitted with the EVO XP (Extended Projection Package) function, which enables to perform the following examinations:

- The right or left Emi-panoramic is used when the patient is known to have a problem only on one side of the arch, in order to reduce the radiation
- The reduced dose Panoramic reduces the dose radiated on the dentition by excluding the TMJ's ascending rami from the exams
- The frontal dentition enables to perform examinations of the front part (roughly from canine to canine)
- The Panoramic with improved orthogonality reduces the overlap of the teeth, thereby improving the diagnosis of interproximal decay
- Bitewing left or right, allows the execution of examination of the lateral dentition (generally from eighth to fourth) with a trajectory that reduces the overlap of the teeth
- Bitewing (left and right) sequentially performs both bitewings, showing them on the same image.

NOTE:
All these examinations can be added to Rotograph EVO D systems already installed in the field.

NOTE:
The code inserted into Rotograph EVO D to enable the optional examinations is protected by a Unique Identification Code (UIC); in the event the UIC is not present or is faulty, an error **E107** will be shown.

Pressing the "Patient Entrance" (6) push-button  will reset such condition, although at the end of the start-up position, only the Panoramic, Sinus, and TMJ functions will remain active.

The UIC is simply an identifier of the single Rotograph EVO D unit; in order to enable the optional functions it is necessary to request the activations code from Villa Sistemi Medicali, which derives from the Unique Identification Code or from the device serial number.

3.3. Block diagram

This paragraph provides a brief description, at block diagram level, of the Rotograph EVO D. 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 3-2.

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

- Power supply assembly
- Main CPU board (A5)
- Generator board (A10), Generator CPU board (A9) and tubehead
- Column CPU board (A1)
- Touch Screen with its control board (A4).

All control boards above listed are equipped with a local microcontroller that shares information with the main CPU using a CANBUS transmission line and protocol.
Each of the main blocks above listed is here after described.

3.3.1. Power supply assembly

It is located in the rear part of the column 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.
The power supply assembly also acts as an interface with a number of external signals and circuits like:

- Input for remote X-ray push button (S7) and output to the CPU of the same signal.
- Outputs for the "Ready" and "X-ray ON" lamps (X3).
- Driving of the DC column motor (M1): this motor can be activated either through its control board (A1), 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 (S3 and S5): these microswitches indicate 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 two other microswitches (S4 and S6) that, as for all the other positioning sensors, provide their signals to the Column CPU board (A1).

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.

The power supply assembly module also includes the Column CPU board (A1) that is dedicated to the control of the vertical column motion during all phases (slow speed, ramp up to high speed, ramp down from high to low speed, end run microswitches control, etc.).

3.3.2. CPU Board (A5 and A6)

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 3 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 (Generator 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 2 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. These signals are sensed by the local CPUs and signalled using specific CANBus messages.

The CPU board is based on a 32 bit Motorola Microprocessor MCF5232, mounted on a piggy-back PCB (A6), which also includes the Flash EPROM, the RAM and other logic and passive components.

The CPU board also includes a number of input/output channels necessary for the functioning of the system and 3 stepper motor 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 are fed back to the CPU board.
The number and the type of sensors depend on the function of each motor. In general, optical switches 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 and Y axis motor) or through actuators (column motor, 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 (LED H12) provided by the Power supply assembly and generating on board the requested voltages (+5V, +3.3V and +1.5V). Three LED's on the board indicate the presence of these 3 voltages (+5V=LED H2, +3.3V=LED H3, +1.5V=LED H5).

3.3.2.1. CPU board jumper configuration

In the CPU board are present same jumpers that define the system configuration.
Wrong setting may affect the system functionality.

- **XJ1** = Open
- **XJ2** = Closed
- **XJ6** = 2-3
- **XJ8** = 2-3
- **XJ11** = Open
- **XJ12** = Closed
- **XJ13** = Closed
- **XJ15** = Open PAN-CEPH version / Closed PAN only version
- **XJ16** = Closed

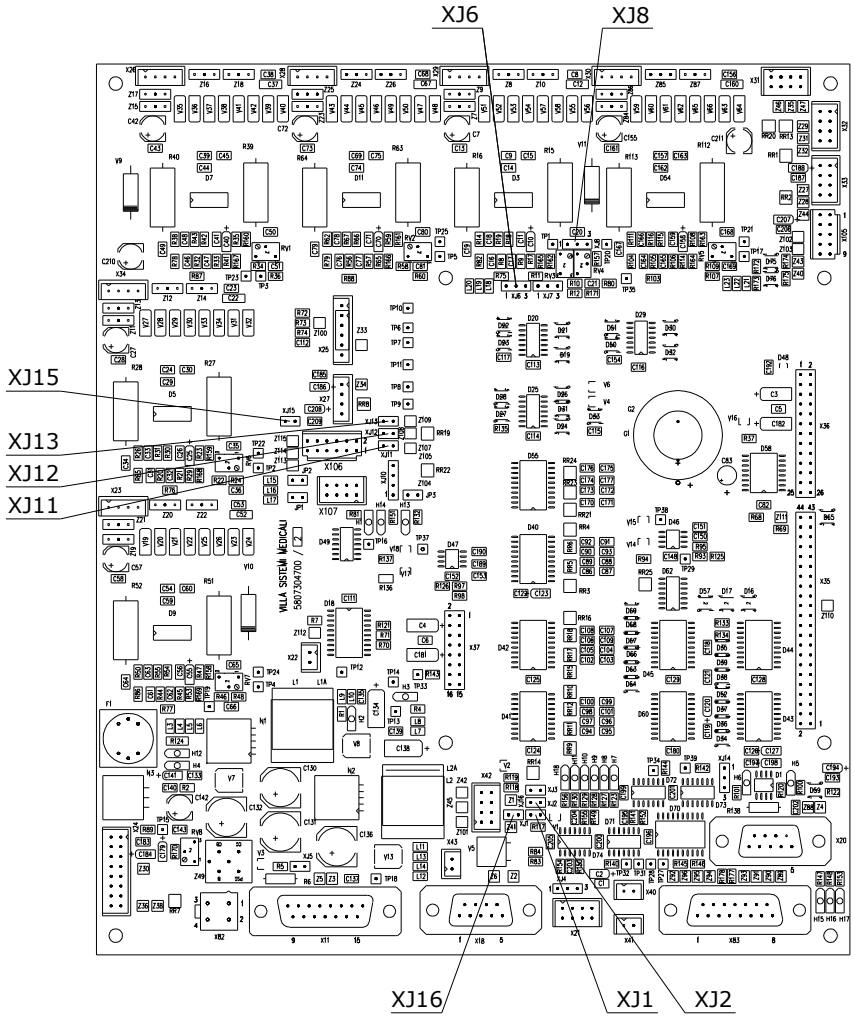


Figure 3-1

3.3.3. Generator Board (A10) and Tubehead

The Generator board and the tubehead are located on the rotating arm, very close to each other. The power supply voltage is directly provided by the Power supply assembly.
Dedicated switching circuits, directly located on the board, generate the voltage used on the board itself.

Managing of the Generator board is done by the dedicated Generator CPU board (A9) that is interfaced with the main CPU board (A5) using the CANBus cable (X20-X20). This cable also has a dedicated wire to bring the X-ray button signal to this board, so the "dead man switch" method is generated directly on the board.

The high frequency (HF) circuit is based on an inverter circuit working at the frequency about 100kHz, which drives the tubehead through an output stage based on IGBT components.

The Generator board receives the signals concerning the X-ray dose to provide (kV and mA), from the CPU board through CANBus messages; it is the Generator CPU that generates the commands used for the X-ray emission. The Generator 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 X-ray 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 Generator board and relevant Generator CPU. Possible anomalous conditions are then communicated to the main CPU board (A5) which in turn generates error codes to alert the operator.

3.3.4. Control panel

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

- Membrane keys necessary to activate the movements and laser
- Ready for X-ray and X-ray in progress signalling LED
- Touch Screen
- Touch Screen control PCB.

The Touch Screen control PCB is directly connected to the main CPU board (A5) which controls it. The language of the messages shown on the display can be selected among different options (English, Italian, French, German, Spanish, Portuguese, Dutch, Turkish, Russian, simplified Chinese, Arabic and Farsi). 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.

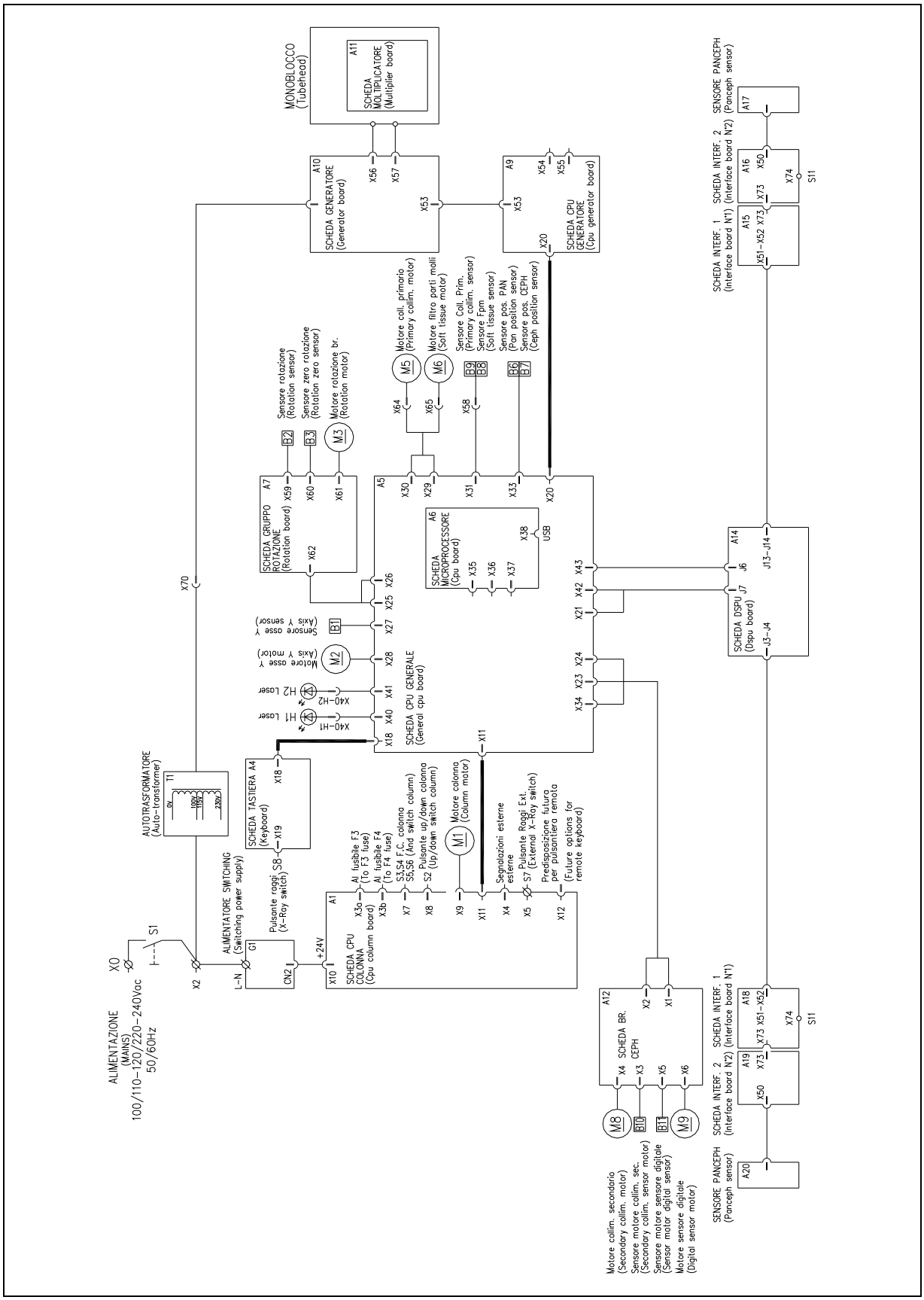


Figure 3-2 – Block diagram

3.4. Control panel - Descriptions and functions

The Rotograph EVO D keyboard is divided into function areas.
The next figure shows a general view of the keyboard, while details on each functional area are provided in the following pages.

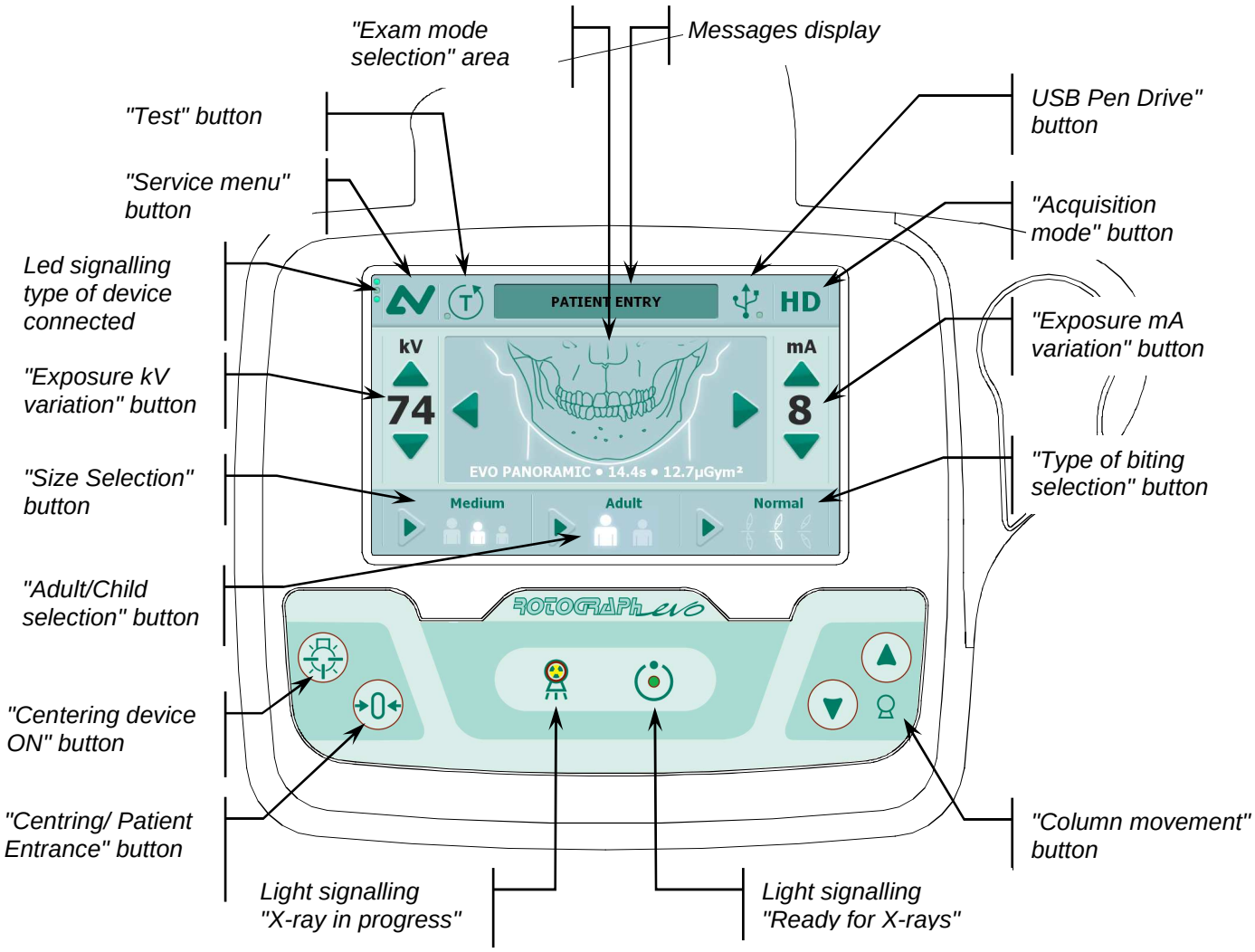


Figure 3-3

WARNING:
The USB port on the keyboard MUST NOT be used with an external Hard Disk with own mains connection. It has to be used only with USB Pen Drives.

The next figure shows a general view of the display of the Service menu.

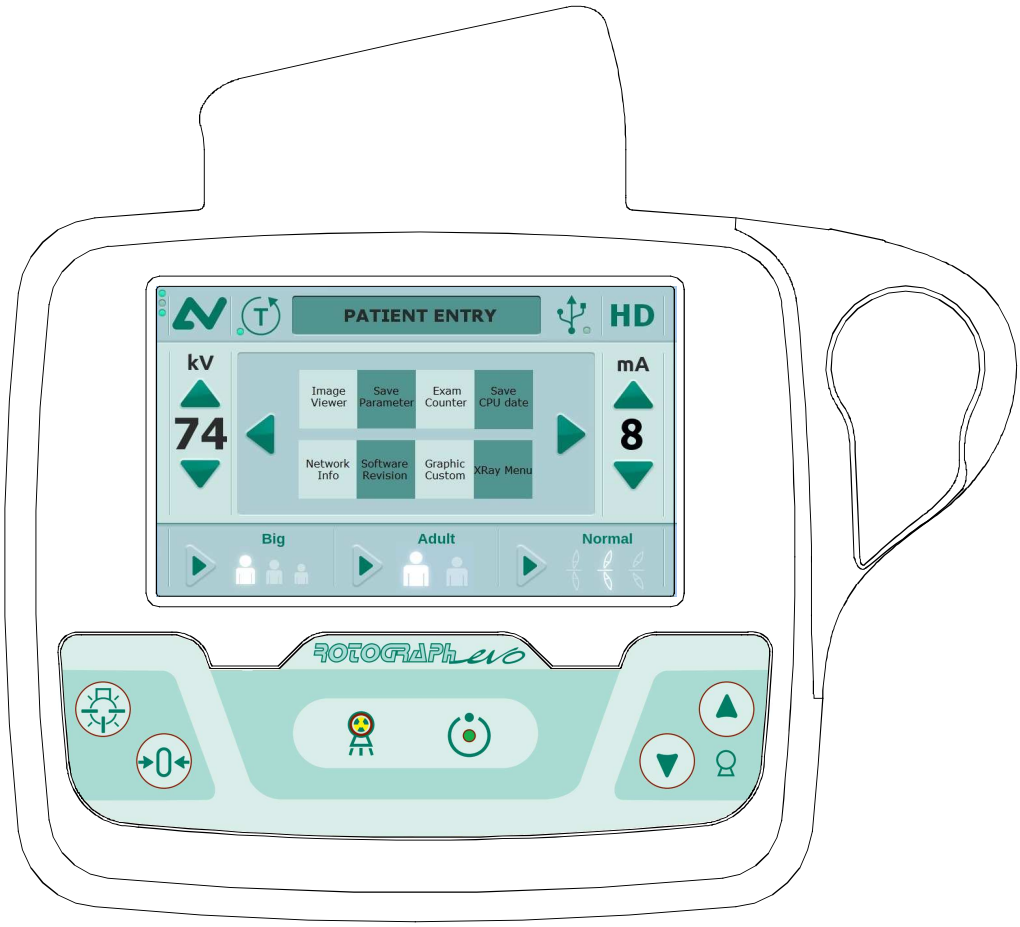


Figure 3-4

Here following a sample description of each key functionality:

- **Image viewer**: enabled only when the USB Pen Drive is present in the relevant port
- **Save parameter**: allows to store the automatic exposure parameters (see paragraph 7.5)
- **Exam counter**: allows to display the numbers of exam performed in each exam mode
- **Network info**: allows to display the IP addresses and SubNet mask of the devices connectet to the Network
- **Software revision**: allows to display the software revision of the Rotograph EVO D system microcontroller
- **Graphic Custom**, **XRay Menu** and **Save CPU Date** (not active): these keys are reserved to authorised personnel.

Press key "Home" to go back to the "Service Menu".

Pressing key (18)  the unit will return to standard mode.

The next figure shows a general view of the machine setup display.

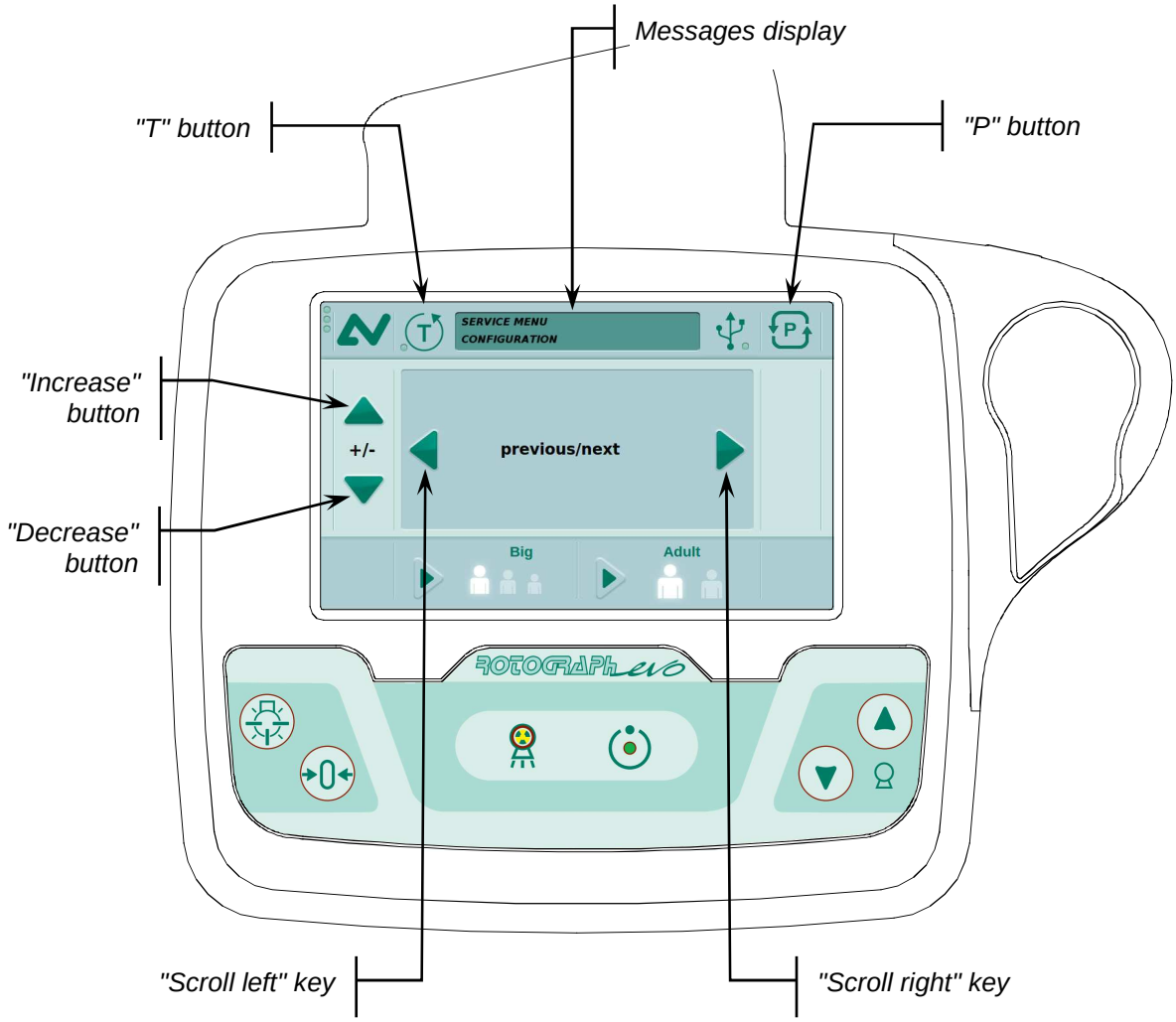
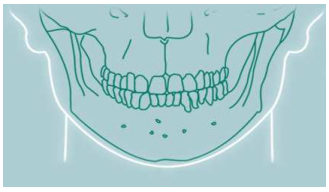


Figure 3-5

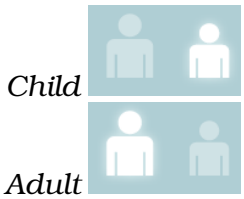
The "Centring/Patient Entrance" key is used to:

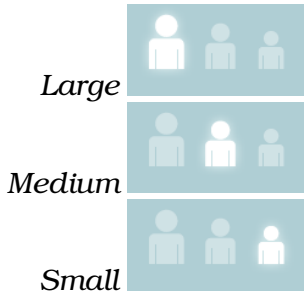
- start/stop the start examination procedures
- bring the rotation arm to the patient entrance position at the end of the exam.

The "Exam Selection Mode" area takes place by means of three keys: the first one, the main area, helps select the exam mode between Panoramic, TMJ, Sinus, Implant and Cephalometric.
The other two, identified by the arrows, help navigate within the exams of each mode.

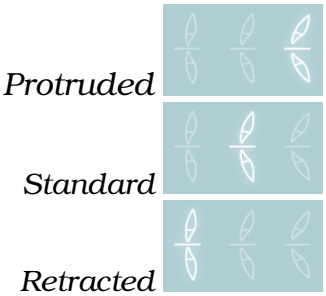


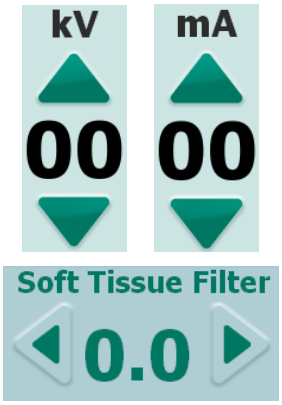
It is possible to select the anatomic mode examinations (anatomic selection), using prefixed exposure values.
This kind of selection enables to choose between Adult/Child, each with three different sizes (small, medium, large).





The Panoramic mode enables to select the patient's type of biting between: protruded, standard or retracted, as indicated within the button.
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 manually select the exposure parameters; in this case, it is possible to set the parameter with the desired value.
The parameters available are: kV and mA (Soft Tissue Filter position only in cephalometry).

There are two light indicators; the first one on the right 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 indicates the effective emission of X-rays.

The movement of the column is controlled by the appropriate keys.
The speed has two set values.
The movements are enabled during equipment setting.

The key "Luminous centring device" helps turn ON/OFF the laser centring devices that allow the correct positioning of the medial-sagittal and Frankfurt planes, by adapting Rotograph EVO D to the patient's anatomy.

The key "Test" is used to avoid the X-rays emission, in order to check the absence of collisions with the patient. When the LED is green, the test function is enabled.

This key displays the "Service Menu": the main menu area is replaced by the service menu area.
Use this key also to return to the control panel (main menu).

This key is used to un-mount the Pen Drive inserted in the USB connector of the control panel.
When the LED is green, the pen drive is recognised.

In Cephalometric mode, this key allows to perform the exam in High Definition modality or in High Speed (normal resolution) modality.

High Definition

High Speed

In the setup screen the navigational buttons allow the user to navigate through the menus and submenus as indicated in the manual (increase, decrease, sroll left, scroll right).

In the setup screen the following buttons are used to change parameters as indicated in the manual.

3.4.1. Key functions description

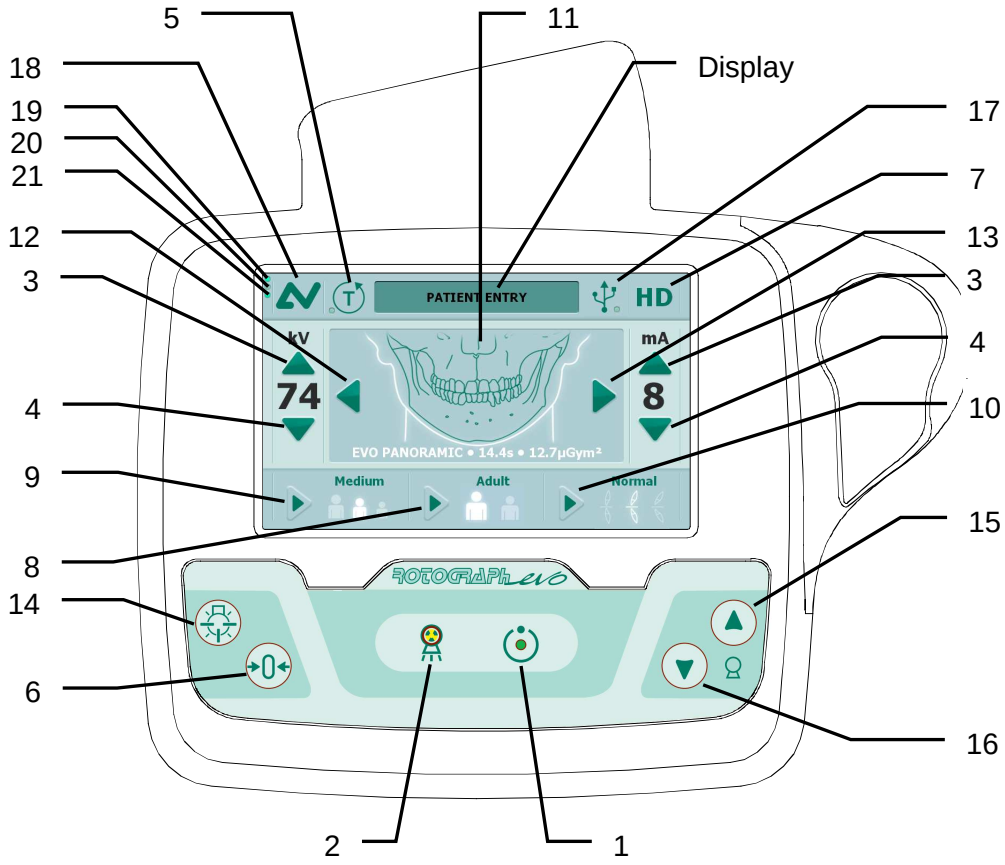


Figure 3-6 - Control panel

LEGEND:

Messages
Display: indicates operative messages and warnings

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

Manual setting of exposure parameters
3 - kV/mA increase key
4 - kV/mA decrease key

Preparation functions
5 - Key to set Test function (green LED)
6 - Key for:
> Resetting and realigning the device's axes (in case of collision with patient or in case of release of rays button)
> Repositioning the rotation group (to bring the group to the initial position after the examination and to exit from the "making an exposure") mode
> Confirmation
7 - Key to select the modality in use (High Definition or High Speed)

Anatomic selection
8 - Patient selection key: Adult or Child
9 - Size selection key: Small, Normal, or Large
10 - Arch selection key: Protruded, Standard or Retracted (for panoramic execution)

Examination mode
11 - Exam mode selection area
12 +13 - Type of exam selection keys

Centring devices
14 - Sagittal and Frankfurt plane centring device ON/OFF key

Column height adjustment
15 - Column up key
16 - Column down key

Other
17 - USB Pen Drive key
18 - Service menu key
19 - Virtual keyboard active (green LED)
20 - Presence of PAN only sensor (only for dual sensor unit) (green LED)
21 - Presence of sensor (green LED)

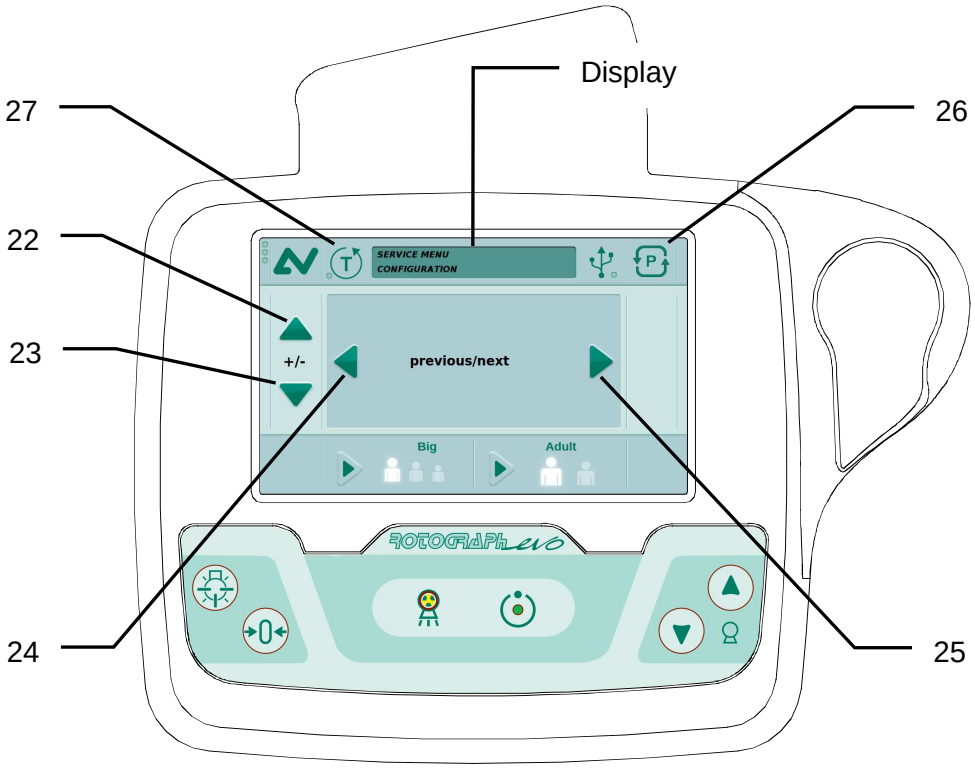


Figure 3-7 – Setup display

LEGEND:

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

Setup display
22 - Increase key
23 - Decrease key
24 - Scroll left key
25 - Scroll right key
26 - "P" key
27 - "T" (cancel) key

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4. TECHNICAL DATA

General features		
Type	Rotograph EVO D	
Manufacturer	VILLA SISTEMI MEDICALI Buccinasco (MI) Italia	
Class	Class II B for European Directive for Medical Devices 93/42 Class II for Canadian MDR Class I with type B applied parts according to IEC 60601-1 Class II according to 21CFR-subchapter J (for 110-120V version) 	
Protection degree	IPX0 standard device	
Rated line voltage	220-240 V~	110-120 V~
Line frequency	50/60 Hz	
Maximum line current	7 A @ 230V~ 50/60 Hz	15 A @ 115 V~ 50/60 Hz
Power consumption	1.6 kVA @ 230V~ 50/60 Hz	1.7 kVA @ 115 V~ 50/60Hz
Protection fuse (F1)	7 A T	15 A T
Protection fuse (F2) **of switching power supply**	1.6 A T	3 A T
Generator board protection fuses	F1: 10 A F F2: 5 A HF F3: 2 A T	
Line apparent resistance	0.5 Ω max	--
Line voltage regulation	--	< 3 % at 99 V~
Rated output voltage (kVp)	60 ÷ 86 $kV_{p,}$ with 2 kV_p steps	
Anodic current	6 ÷ 10 mA, with 1 mA steps for PAN, TMJ, and Sinus 6 ÷ 12 mA in 1 mA steps for Ceph (up to 76 kVp) 6 ÷ 10 mA in 1 mA steps for Ceph (from 78 kVp to 86 kVp)	
Sensor cover additional filtration	0.1 mm Al eq @ 70 kV_p	

Exposure times	
EVO Panoramic	14.4 s Adult / 13.3 s Child
Panoramic STD	13.8 s Adult / Child
EVO EmiPanoramic	7.8 s Adult / 7.3 s Child
STD EmiPanoramic	7.4 s Adult / 7.3 s Child
Improved orthogonality Panoramic	11.9 s Adult / Child
EVO Reduced dose Panoramic	11.9 s Adult / 10.8 s Child
STD Reduced dose Panoramic	11.4 s Adult / Child
Frontal Dentition	4.4 s Adult / Child
Bitewing	3.2 s right / left 6.3 s right and left
TMJ mouth closed/open	2.44 s per image for left and right joint in open and closed condition, total of 9.7 s
Sinus P/A projection	9.4 s
Implant	9.2 s for incisive e canine 7.3 s for pre-molars an molars
Cephalometry (Ceph)	Exposure time variable according to the type of resolution and format selected. Minimum 4.5 s (18x22 nR), maximum 15 s (30x22 HR)
Exposure time accuracy	± 10 %
Examination modes	
Examination selection	• Automatic selection for Adult and Child, 3 Sizes • 3 biting modes (in Panoramic) • Automatic selection for Adult, 3 Sizes (in Implant) • Manual selection • Collimator with automatic positioning
Panoramic NOTE: Some of these exams are optional and depend on the system configuration.	• EVO Panoramic • Standard Panoramic • Half Panoramic L/R • Improved orthogonality Panoramic • Reduced dose Panoramic • Frontal dentition • Bitewing L/R • Bitewing L and R

Examination modes		
TMJ (Temporal Mandibular Joint)	TMJ open and closed mouth	
Sinus	Sinus P/A projection	
Cephalometry and Carpus	• Normal resolution cephalometry in Latero-Lateral or Antero-Posterior projection (different formats) • High resolution cephalometry Latero-Lateral or Antero-Posterior projection (different formats) • High Resolution Carpus exam • Motorized Soft Tissue Filter.	
Image magnification	**Geometric magnification**	**Magnification after software correction**
Adult/Child standard Panoramic	1 : 1.23 (standard over dentition part)	1 : 1 **(*)**
TMJ open/closed mouth, 4 images	1 : 1.20 (nominal)	1 : 1 **(*)**
Sinus	1 : 1.22 (nominal)	1 : 1 **(*)**
Implant	1 : 1.32 (constant)	1 : 1 **(*)**
Ceph (on the sagittal median plane in LL projection)	1 : 1.10	1 : 1 **(*)**

(*) WARNING:
The declared image magnification value is valid ofter proper software calibration.

Tube-head characteristics	
Model	MRE 05
Manufacturer	Villa Sistemi Medicali S.p.A. 20090 Buccinasco (MI) Italia
Maximum tube voltage	86 kV_p
kV_p accuracy	± 8 %
Maximum anodic current	12 mA
Anodic current accuracy	± 10 %
Duty cycle	Adaptive Duty Cycle according to exposure factors: from 1 : 8 (at 60kV, 6mA) up to 1 : 20 (at 76kV, 12mA). Further reduction for three consecutive exposures: from 1 : 36 (at 60kV, 6mA) up to 1 : 9 (at 76kV, 12mA)
Nominal power	1.032 kW (86 kV_p - 12 mA)
Total filtration	2.5 mm Al eq. @ 70 kV_p
HVL (Half value layer)	> 3.1 mm Al eq. @ 80 kV_p
Transformer insulation	Oil bath
Cooling	By convection
Leakage radiation at 1 m	< 0.5 mGy/h @ 86 kV_p - 12 mA - 3 s duty cycle 1/16
Tube-head maximum thermic capacity	310 kJ
X-ray tube characteristics	
Manufacturer	CEI Bologna (Italy)
Type	OPX 105
Nominal focus size	0.5 IEC 60336
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

Digital Sensor	
Sensible area (H x L)	• PAN sensor: 151 x 7 mm • PANCEPH sensor: 220 x 7 mm
Pixel dimensions	27 µm, 81 µm in binning 3x3 (PAN and PANCEPH HD), 135 µm in binning 5x5 (CEPH HS)
Pixel (H) NOTE: Number of horizontal pixels depends on the exam and resolution on CEPH.	• PAN: 1860 • CEPH: 1632 in HS, 2720 in HD
Laser centring devices	
2 laser beams are used for the patient positioning; beams align mid Sagittal and Frankfurt planes (please refer to relevant paragraphs for detailed explanation).	
Wave length	650 nm ± 10 nm
Divergence	< 2.0 mRad
Optical power	< 1 mW
Classification	Class 1 laser product according to IEC Standard 60825-1:1993 + A1:1997 + A2:2001
Mechanical characteristics	
Focus-receptor distance (PAN, TMJ and Sinus)	50 cm (19.7")
Focus-receptor distance (CEPH)	165 cm (65")
Telescopic motorised column run	85 cm (33.5")
Maximum total height	245 cm (96.2")
Weight	• 157 kg (346 lbs) base version • 177 kg (390 lbs) version with Ceph
Column weight	87 kg (192 lbs)
Weight of arm support, rotating arm and tube head	74 kg (163 lbs)
CEPH arm	25 kg (55 lbs)
Legs (optional)	30 kg (66 lbs)
Sensor holder weight	2 kg (5 lbs)

Working conditions	
Minimum room size (please refer to paragraph 5.3 of the Service Manual)	• 130x120 cm (51.2"x47.2") without CEPH • 145x202 cm (57.1"x78.7") with CEPH
Recommended room size (please refer to paragraph 5.3 of the Service Manual)	• 130x140 cm (51.2"x55.1") without CEPH • 160x222 cm (63"x86.6") with CEPH
Maximum working temperature range	+ 10° ÷ + 40°
Relative working humidity (RH) range	30% ÷ 75%
Temperature range for transport and storing	- 20° ÷ + 70°
Humidity range for transport and storing	< 95% without condense
Minimum atmospheric pressure for transport and storing	630 hPa

4.1. Applied safety regulations

Rotograph EVO D complies with the following standards:

CE 0051 The symbol CE grants that Rotograph EVO D complies with directives 93/42 and its revised versions for medical devices issued by the European Community.

- Canadian Medical Device Regulations
- 21 CFR Subchapter J (for 110-120V version)

- General safety:
  IEC 60601-1:1988 + A1:1991 + A2:1995
  IEC 60601-2-7:1998
  IEC 60601-2-28:1993
  IEC 60601-2-32:1994

- Electromagnetic compliance:
  IEC 60601-1-2:2001

- Protection against radiation:
  IEC 60601-1-3:1994
  IEC 60825-1:1993 + A1:1997 + A2:2001

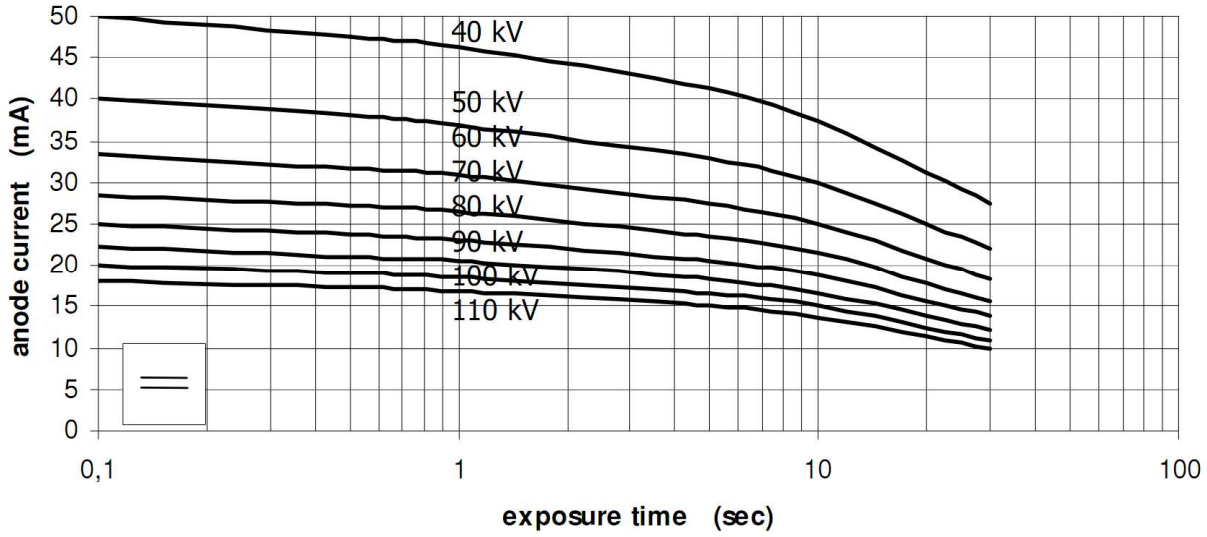
Classification

Rotograph EVO D is an electro-medical X-ray device belonging to Class 1 and Type B as per classification IEC 60601-1, foreseen for a continuous working at intermittent load.
According to CE 93/42 directive for medical devices, the equipment belongs to class II B.
According to Canadian MDR, the equipment belongs to class II.
According to FDA 21 CFR, the equipment belongs to class II (for 110-120V version).

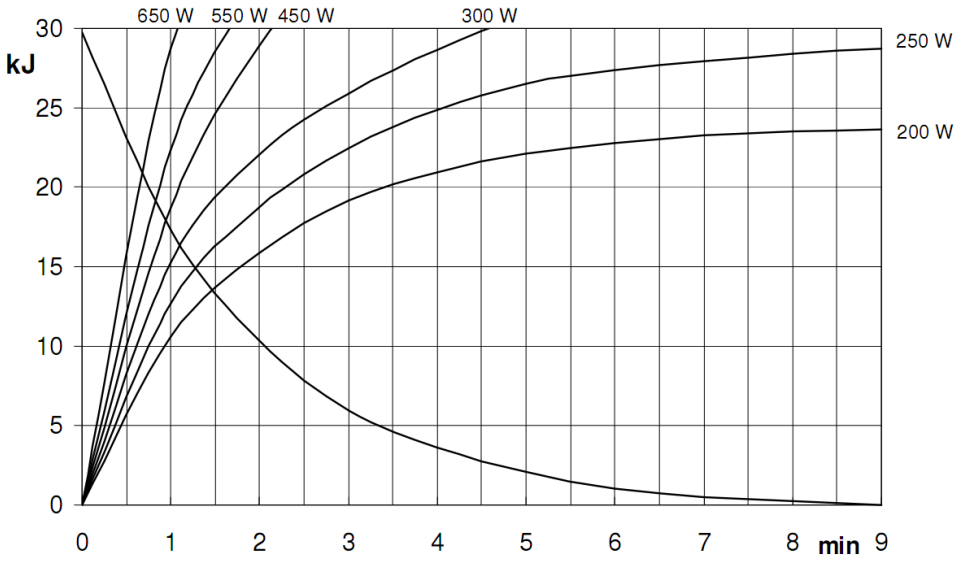
4.2. Loading curve of the tube and cooling curve of the anode

Tube "CEI - OPX / 105" (0.5 IEC 60336)

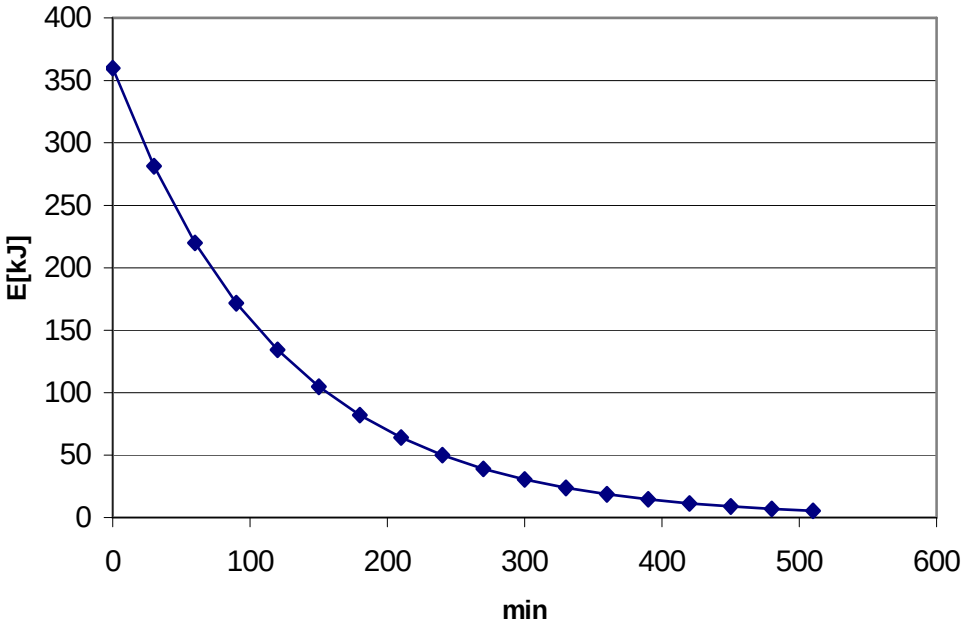
Load



Anode cooling curve



Tube-head heating and cooling curve

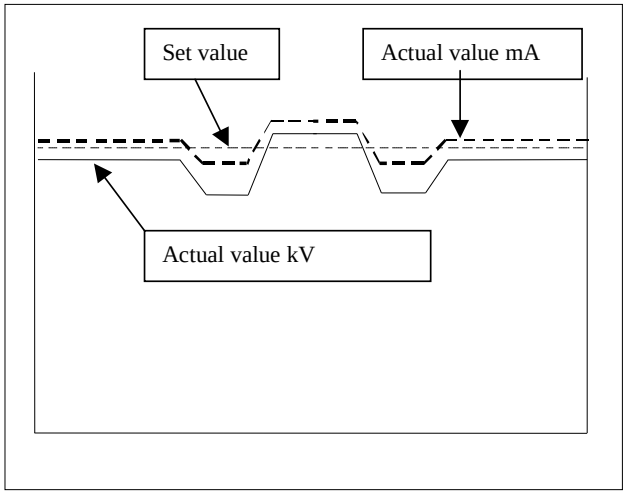


4.3. Measurement method of technical factors

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 7.4.1, 7.4.3 and 7.4.2 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 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 one chosen by the user, while the real 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:



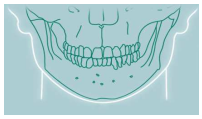
Accuracy declared on the section "Technical data" is referred to the actual value of kV and/or mA. In any case, the manufacturer guarantees that the accuracy of the loading factors is always in compliance with the international standard for safety of medical devices IEC 60601-1. Particularly, in accordance with IEC 60601-2-7, 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%.

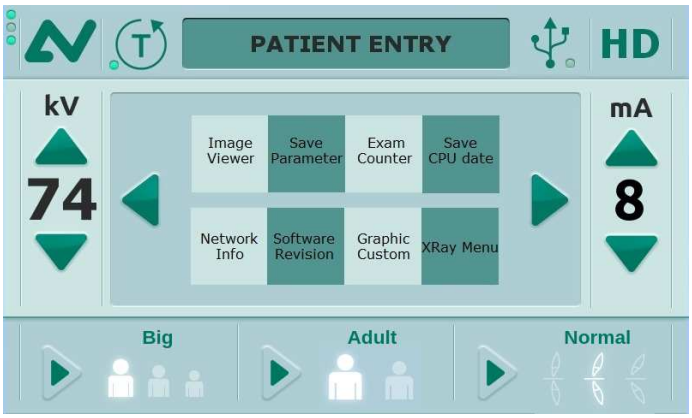
4.4. Verification method of exposure parameters

The exposure parameters (kV, time and dose) can be checked using the so-called "non-invasive method".

WARNING:
The device collimator gives a narrow X-ray beam.
Measurements taken with a non-invasive instrument and a narrow beam can be difficult and/or unreliable; it is therefore necessary to use a special probe with a reduced sensitive area.
It may be helpful to use a fluorescent screen to locate the X-ray beam, and consequently position the probe of the kV meter.
If the unit is ready to Ceph or is equipped with Ceph arm, place the kV meter probe in the lower part of the sensor since the Ceph collimator window is used in this function.

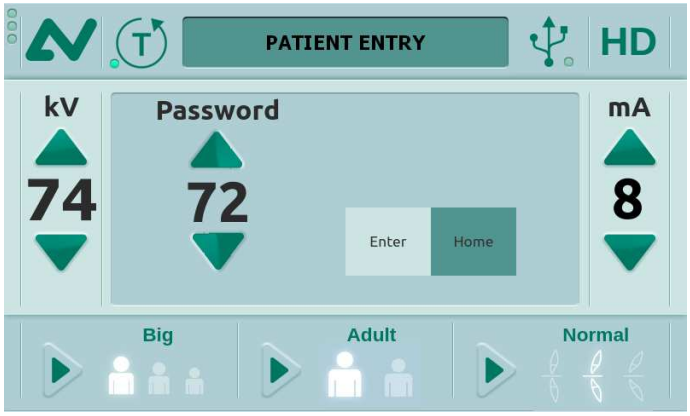
The procedure to measure the exposure parameters by a non-invasive kV meter is the following:

1. With the unit switched ON, select the Panoramic Examination mode by pressing the "Exam Mode Selection" area (11)  .
2. Press the key "Service Menu" (18)  ; the following image will be displayed:

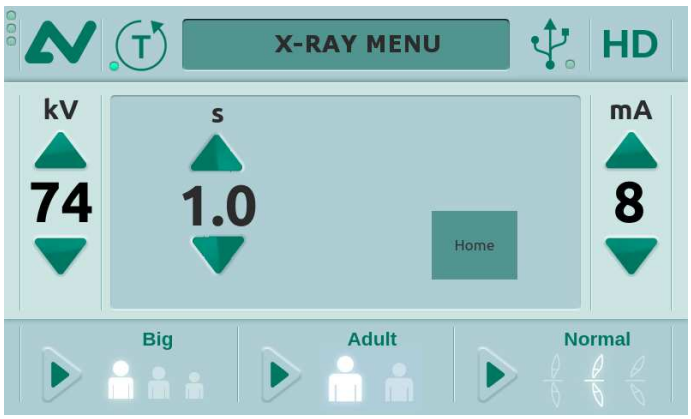


3. Select "Xray Menu".

4. Using the relevant increase/decrease arrows  , select the password equal to "72".



5. Confirm with key "Enter". The following image will be displayed:



WARNING:
The following operations involve the emission of X-rays, so the Authorised Technician must pay the greatest attention and respect the protection regulations in force in that country.

NOTE:
This program allows you to carry out the measuring of the exposure parameters with the tube-head arm in a fixed position (not rotating) without variation due to spine compensation.

6. Place the measuring instrument.

7. The kV, mA and s parameters can be modified by pressing the increase key and the decrease key  of the kV, mA and s on the display.
The parameters can vary within the limits shown in the following table:

Parameter	Minimum value	Maximum value
kV	60	86
mA	6	12
s	0.2	15

Table 1

8. Perform an exposure; technical factors can be read on the measuring instrument.

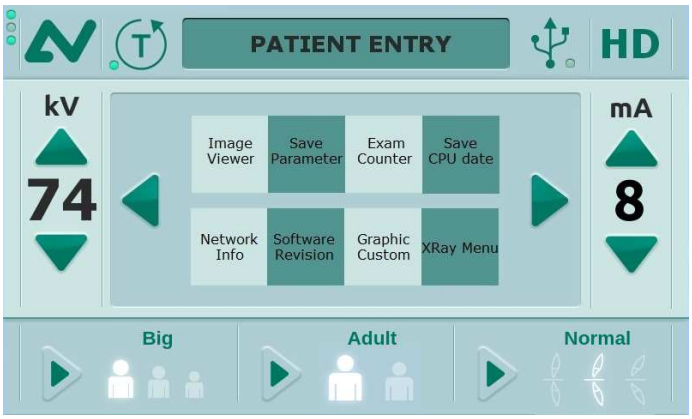
NOTE:
The performance is guaranteed only if the measurement of kV and time is done with the invasive method, due to the fact that non-invasive method may introduce errors for instruments tolerance or wrong measurement condition.

9. Press key "Home" to end the control program, the display will visualize the "Service Menu". Pressing key (18)  the unit will return to standard mode.

4.4.1. Verification method of Panoramic X-ray beam centering and dimension

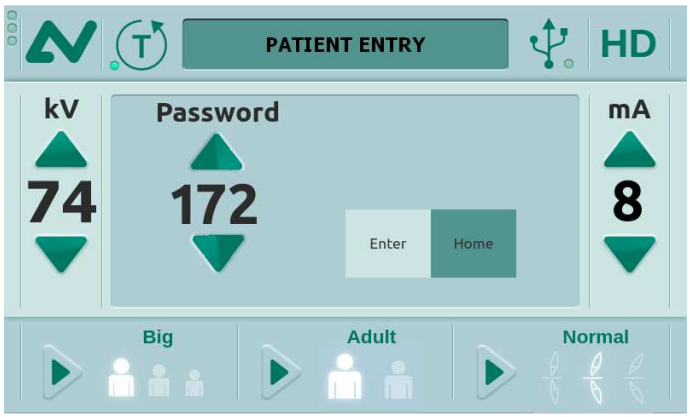
1. On Dental Studio program, open a test patient used to make the test images and select the "Panoramic" icon to open the virtual keyboard.

2. On the unit keyboard, press key "Service Menu" (18)  ; the following image will be displayed:

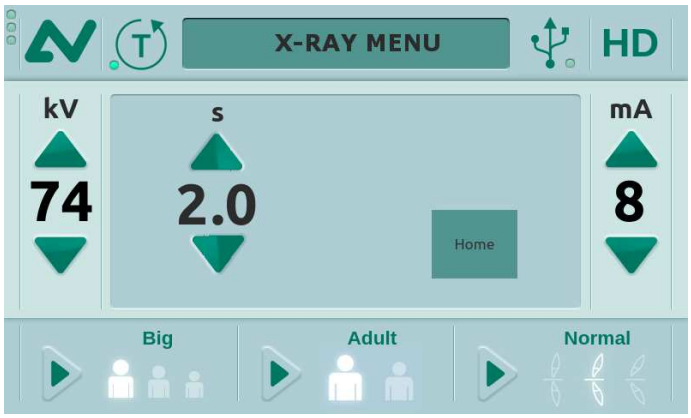


3. Select "Xray Menu".

4. Using the relevant increase/decrease arrows  , select the password equal to "172".



5. Confirm with key "Enter". The following image will be displayed:



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

7. On Dental Studio program, press "Accept Image", then "Yes".

8. On the "LUT" option, select button "  " to improve the image contrast and brightness.

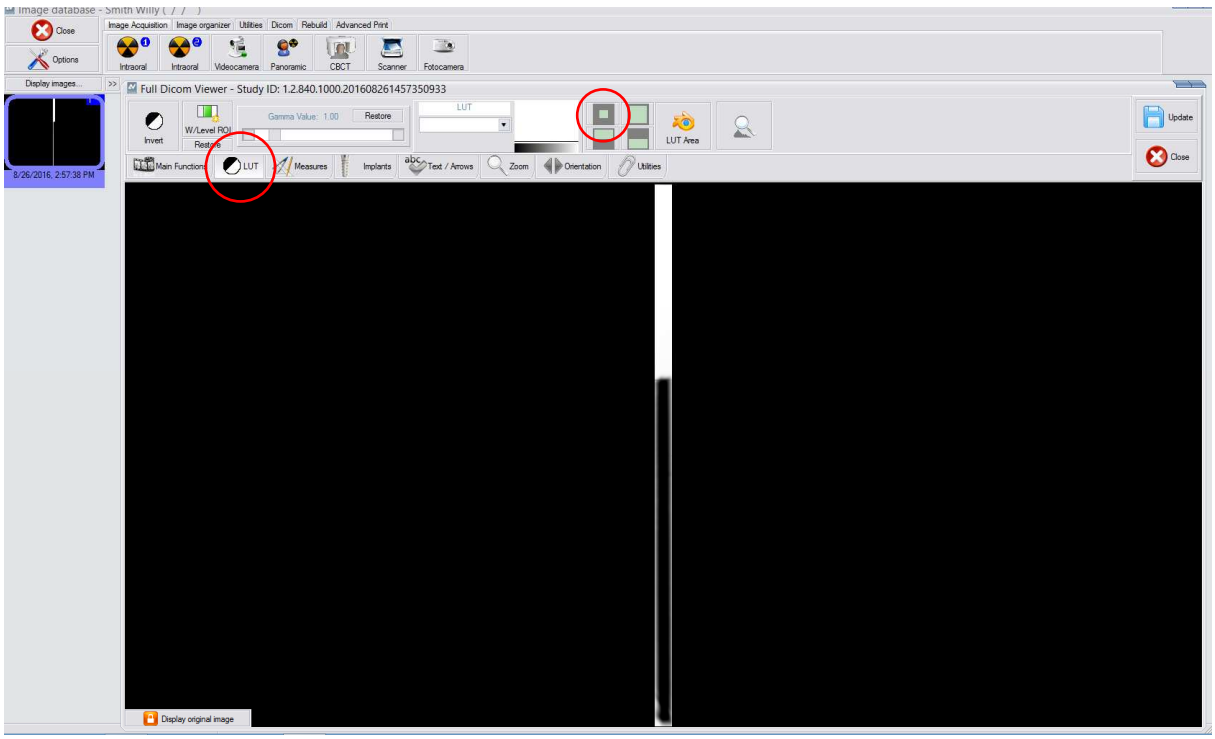
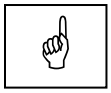


Figure 4-1

9. Verify that the obtained narrow image of the X-ray beam is vertical and centered in left/right direction and that there is a small unexposed border in the bottom of the white sensor area.

At the end of the exposure the unit automatically exit the menu. To take a new exposure, repeat steps from 1 to 8.



NOTE:
If the virtual keyboard display the message "SENSOR NOT READY", exit from "Service Menu" and repeat steps from 1.

4.5. Dimensions

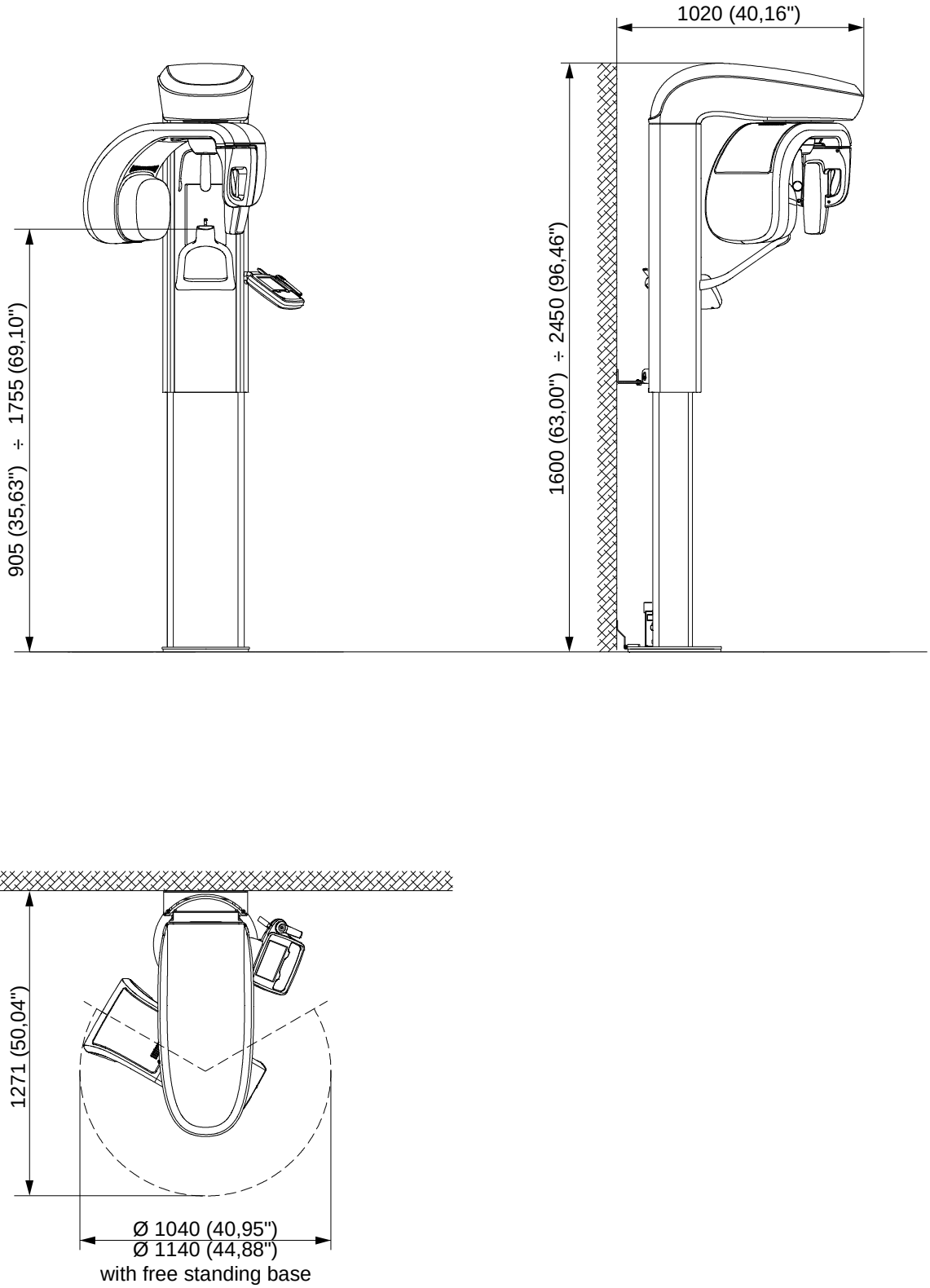
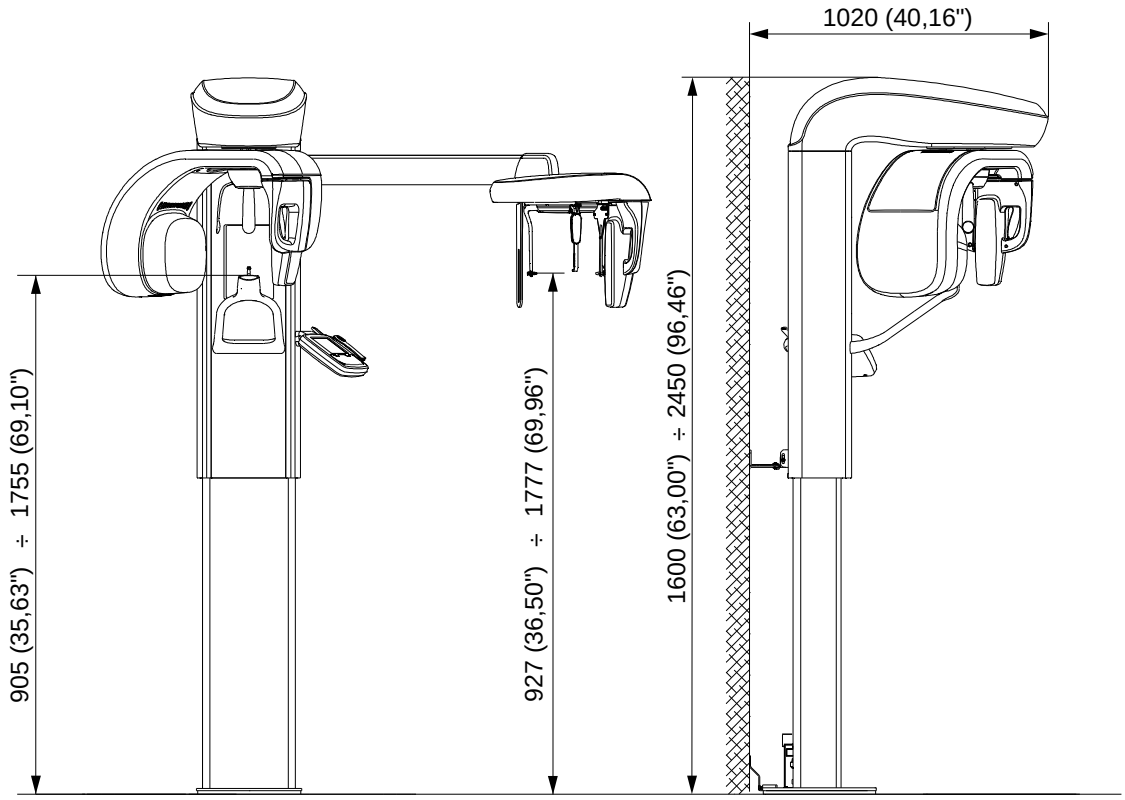


Figure 4-2 - Base version



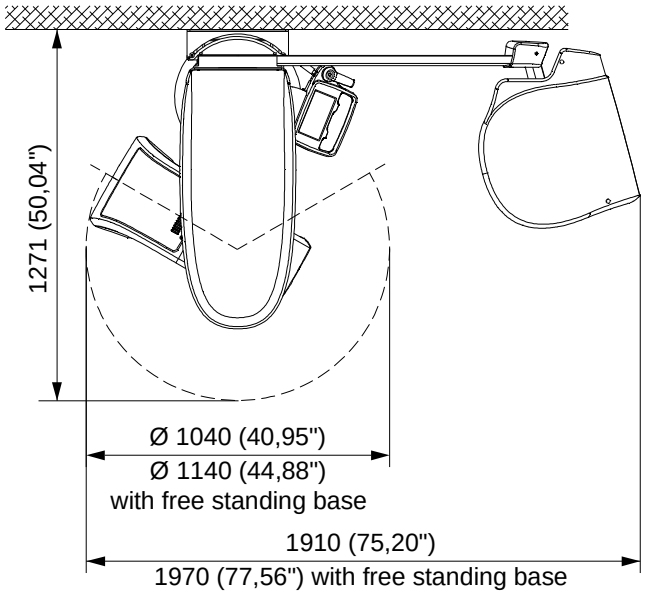


Figure 4-3 - Version with cephalometric unit

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 Rotograph EVO D.
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 Rotograph EVO D are:

- minimum height of the room: 2.5 m (8.20') and a surface variable according to the configuration of Rotograph EVO D to be installed, 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 (31.50").

WARNING:
In its standard versions, Rotograph EVO D must be fixed to the wall with the two brackets supplied. Each dowel must support a max. extraction force of 120 kg (264 lbs).
The fixing dowels to be employed, for any kind of wall, are the following:

- **full or concrete bricks:** screw anchors (provided with the installation kit) in cast iron M6 or chemical screws WURTH (not provided)
- **wood mountings:** self-threading screws (not provided)
- **hollow bricks:** chemical dowels (not provided).

A special floor mount option is available; in this case the equipment MUST be fixed to the floor.

The manufacturer is not responsible for any installations that do not comply with the specifications stated above.

5.1. Electrical setting up

• Single-phase grounding supply	220-240 V ~ 110-120 V ~
• Frequency	50/60 Hz
• Power consumption	1.6 kVA (at 230 V) 1.7 kVA (at 115 V)
• Current consumption	7 A (at 230 V) 15 A (at 115 V)
• Apparent line resistance	0.5 Ω max (for 220-240 V version)
• Line voltage regulation	< 3 % at 99 V ~ (for 110-120 V version)

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

The unit must be connected to a differential magneto-thermal switch, to separate the unit from the supply. This switch must comply with the electrical regulations in force in the country of installation.
The supply conductors must have a 1,5 mm² (16 AWG) 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:
The electrical connection must be done on the terminal board X0 (see operation circuit diagram – chapter 9).

NOTE:
Rotograph EVO D, IS SET TO connect, at the entrance of the X-ray room, the following control and warning devices:

- **REMOTE X-RAYS BUTTON:** "Dead man switch" remote control, enables to perform the exam at a distance, the operator can stand outside the X-ray emission area. This button must be suitable to prevent unwanted emission. The standard X-ray button supplied with the unit has the above characteristic.
- **READY light:** Green light (24V 40W max.), it signals that the machine is ready to perform the exam. (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 (contact N.O.).

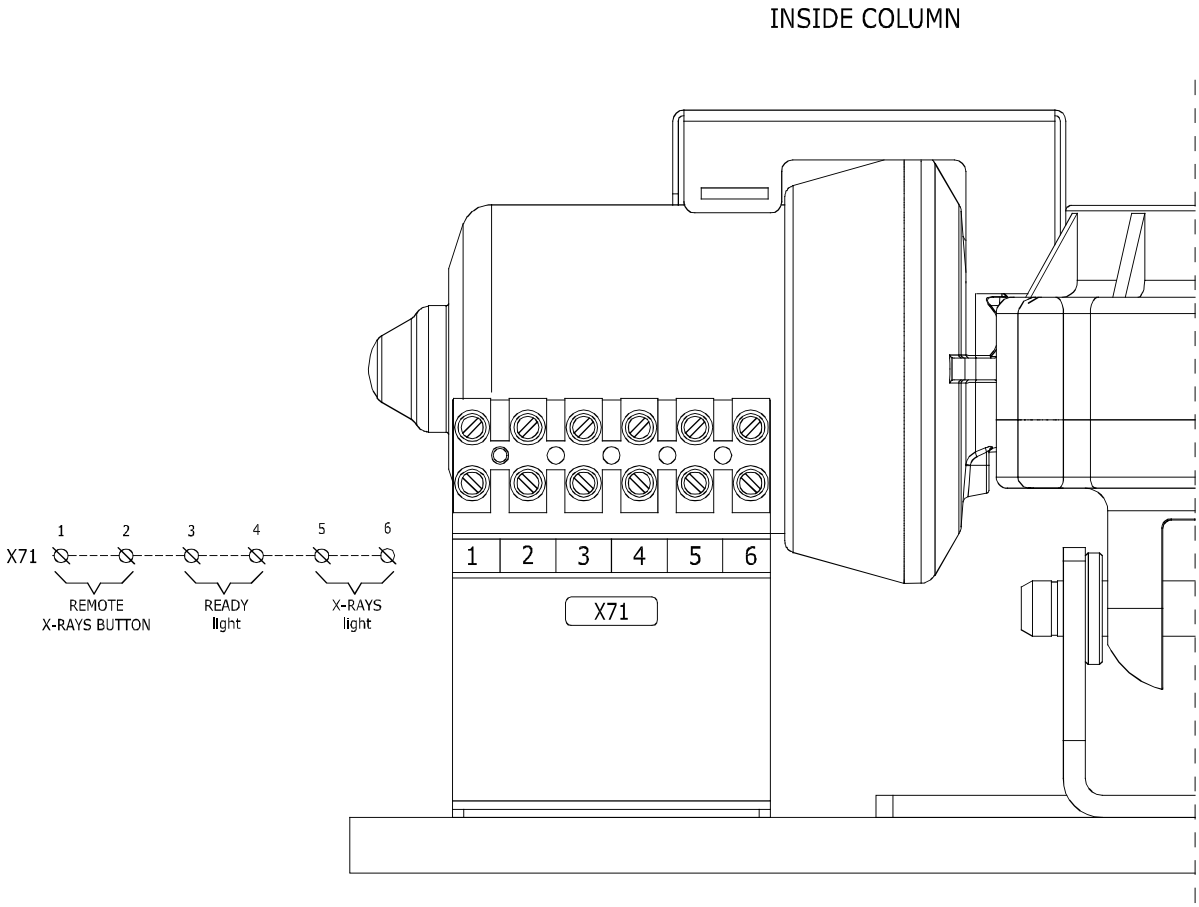


Figure 5-1

WARNING:
It is installer's responsibility to check the characteristics of the remote X-ray button

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

To connect all control and warning devices it is advisable to set 6 wires with 0.5 mm² section minimum.

5.2. Packaging

Rotograph EVO D is delivered in two carton-board boxes.

PAN only version			
Contents	Packing dimension	Weight	
		Net	Gross
- Axis movement device, complete with tubehead - Digital sensor holder - Covers	120x80x67 cm (47.3"x31.5"x26.4")	80 kg (176 lbs)	90 kg (198 lbs)
- Column complete of touch screen - Covers - Accessories	145x67x87 cm (57"x26.4"x34.3")	85 kg (187 lbs)	95 kg (209 lbs)

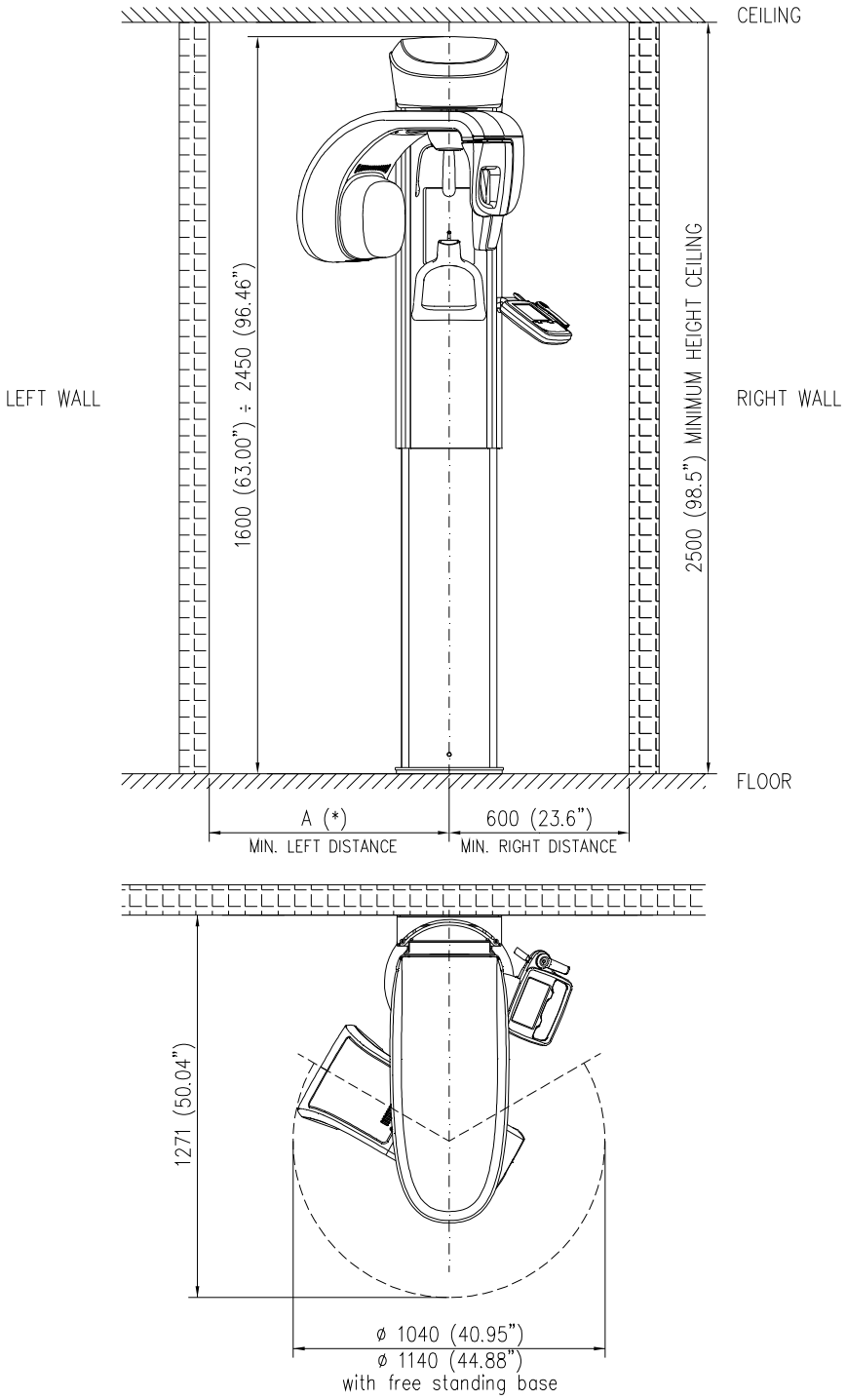
PAN + CEPH version			
Contents	Packing dimension	Weight	
		Net	Gross
- Axis movement device, complete with tubehead - Digital sensor holder - Covers	120x80x67 cm (47.3"x31.5"x26.4")	80 kg (176 lbs)	90 kg (198 lbs)
- Column complete of touch screen - Cephalometric device - Covers - Accessories	162x72x112 cm (63.8"x28.4"x44")	130 kg (286 lbs)	145 kg (319 lbs)

NOTE:
All boxes mount shock detectors.
At the receiving and before opening boxes, verify that those sensors have not been activated.

WARNING:
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

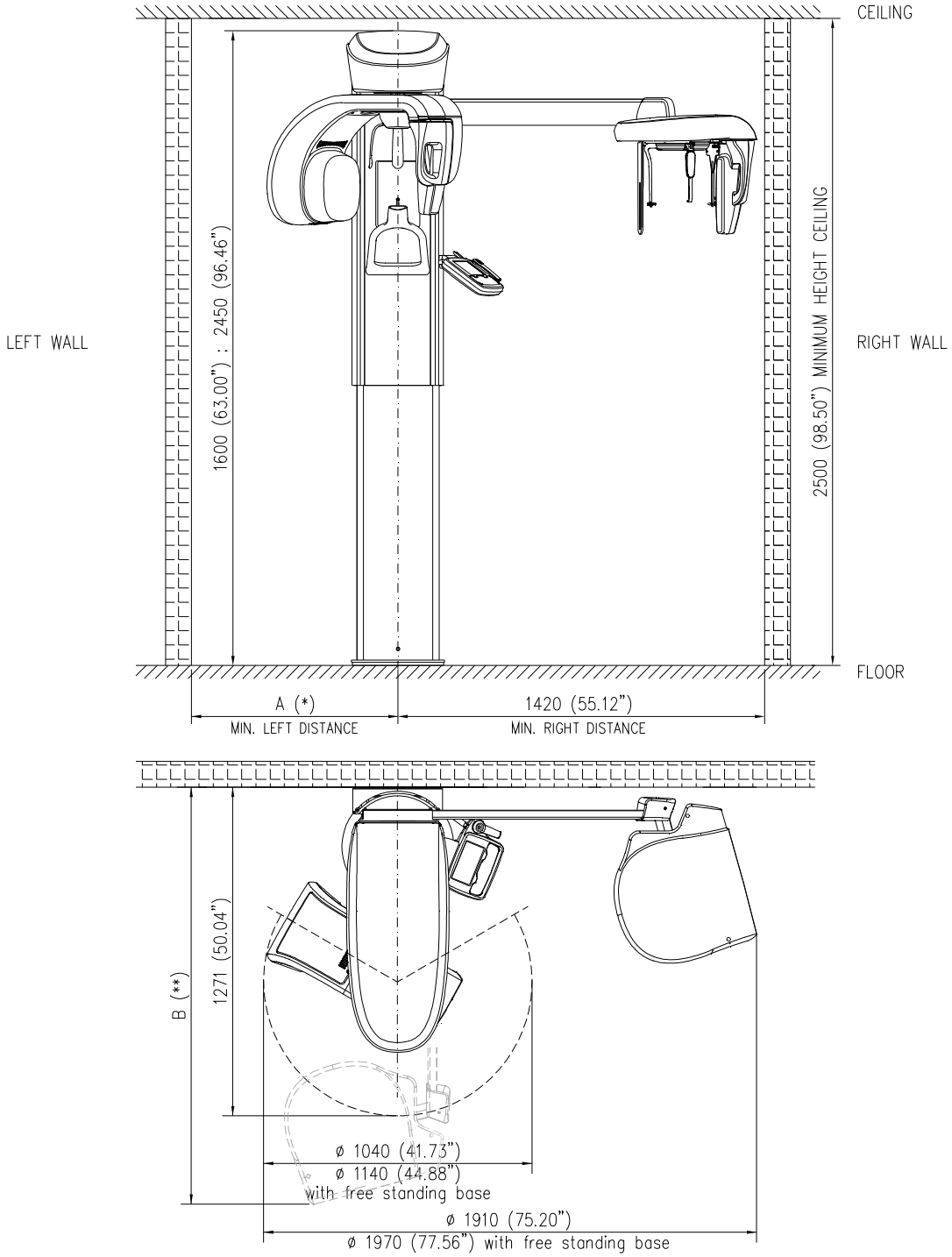
5.3.1. Version without CEPH



***(*) A** = minimum 600 mm (23.6"), recommended 800 mm (31.5") for service purpose*

Figure 5-1

5.3.2. Version with CEPH



(*) A *=600 mm (23.6") minimum, 800 mm (31.5") recommended for service purpose*
(**) B *=1460 mm (57.52") minimum front space, 1610 mm (63.39") recommended front space for service purpose*

Figure 5-2

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6. INSTALLATION

NOTE:
Rotograph EVO D is delivered pre-mounted in groups; it is contained in 2 (PAN version) or 3 boxes (CEPH version).
The mechanical mounting consists exclusively in assembling the above mentioned groups. Most of the adjustment are carried out in factory.
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:
This paragraph is valid only for wall mounted version.

NOTE:
Rotograph EVO D has been designed for a wall fixing by two brackets, each of which requires to be fixed by three dowels. In order to find the right position of the brackets, it is necessary to use the quotes indicated in the Figure 6-1.
It is very important the vertical alignment of the central holes and the perpendicularity with the floor; it is strictly suggested to use a plumb.

1. Mark the wall by a centre punch, at the level of the fixing holes; drill the wall according to the type of dowels (see chapter 5).

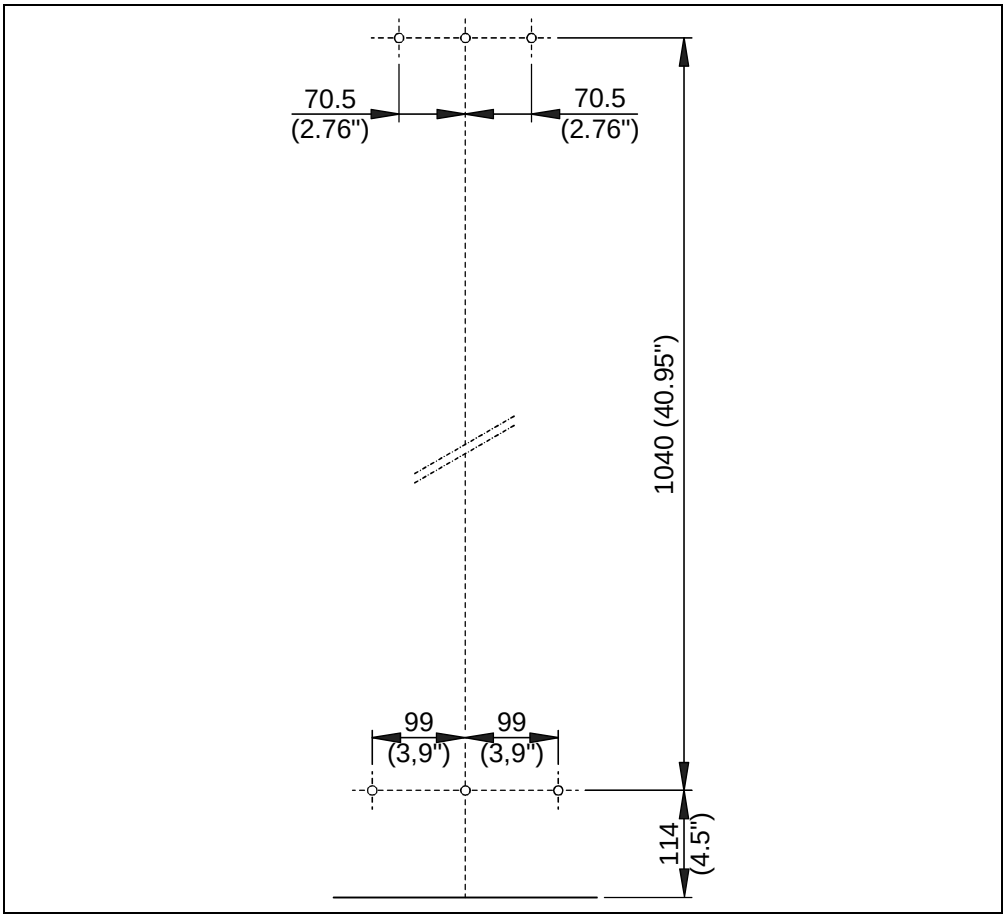


Figure 6-1

6.2. Column mounting

The column is delivered in a carton box containing the column itself, the patient support arm and the keyboard. All those parts are fixed to a wooden palled using two fixing brackets (A); an additional retaining bracket (B) is fixed at the upper part of the column (Figure 6-2).
Verify the presence of the four adjustment feet grub screws in the lower side of the column.

NOTE:
In case of free standing base version, it is necessary to remove the four feet grub screws before to raise up the column.

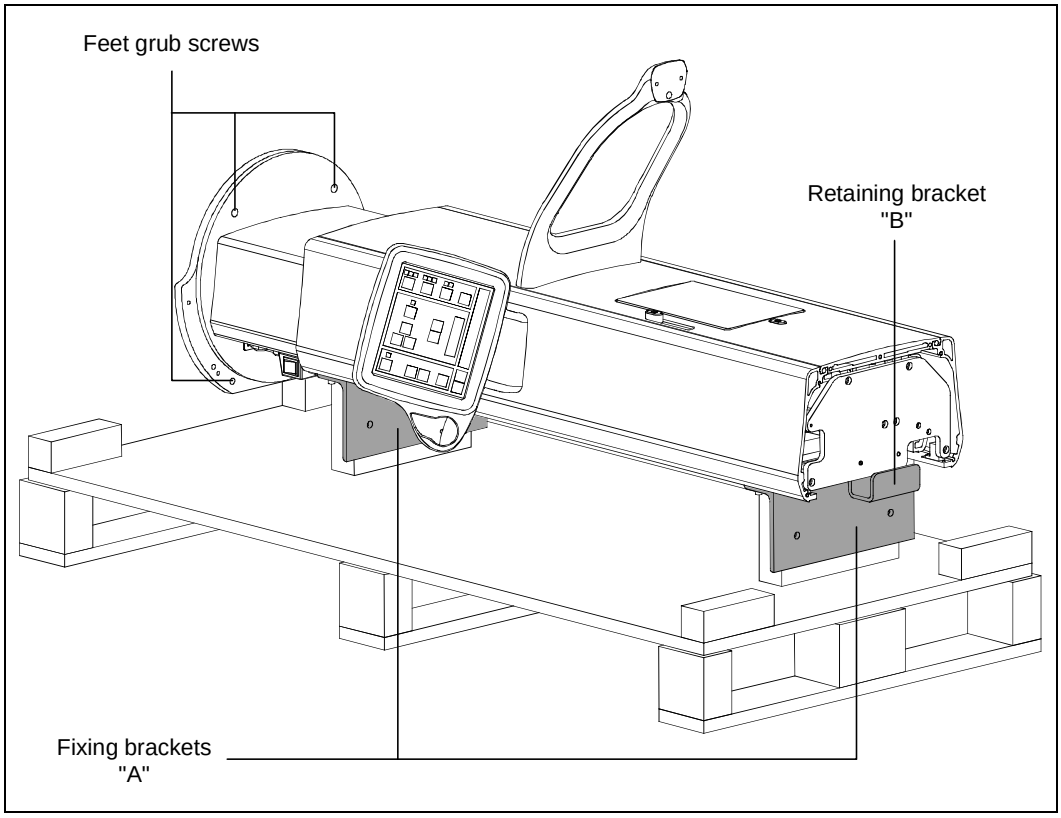


Figure 6-2

1. Remove the screws used to fix the column to the wooden pallet and raising it (this operation requires the presence of two persons).
2. With the column in vertical position, remove only the two fixing brackets "A".

NOTE:
Leave the retaining bracket "B" in place, because it will be necessary for the following operations of support arm mounting.

NOTE:
The following procedure is not valid for free standing base version.

3. Mount on the column basement the lower fixing plate "D" and mount on the column the upper fixing plate "E" (Figure 6-3).
4. Insert the external back cover on the upper fixing plates "E" without fixing it. You will fix it at the end of the mechanical and electrical installation.
5. Mount the upper wall bracket "C" on the fixing plates "E" (Figure 6-3), without tighten the screws.
6. Position the column close to the wall.
7. Fix the upper wall bracket "C" to the wall. Then tight the screws between upper fixing plates "E" and wall bracket "C".
8. Fix the lower fixing plate "D" to the wall, without tighten the screws.
9. Verify the parallelism between column and wall positioning a bubble level on the chin rest support.
   In order to correct this position, it is possible to insert some spacers (Figure 6-3 - provided with the column) between the lower bracket and wall. Once the position is reached, tighten the screws.
10. Acting on the feet grub screws (Figure 6-2), adjust them in order to level the feet on the floor. At the end, cover the grub screws with the provided cups.

To easily reach the back side of the column leaving it hook to the wall, remove the fixing screws located in the back side of the column basement and remove the two screws "F" (Figure 6-3) from the upper bracket "C". Rotate the column.

NOTE:
Rotograph EVO D is equipped with a switch (S2) which allows to move the column vertically for service use. It is located in the back lower side of the column, protected by a metallic cover.

NOTE:
Rotograph EVO D is shipped with the column pre-set at the minimum height.
In case the room layout permit to reach higher position, it is possible to increase the stroke adjusting the reference cams located in the column, close to the end-run microswitches plate.
Remove the microswitches plate and lift properly the column in order to access the reference cams holes.

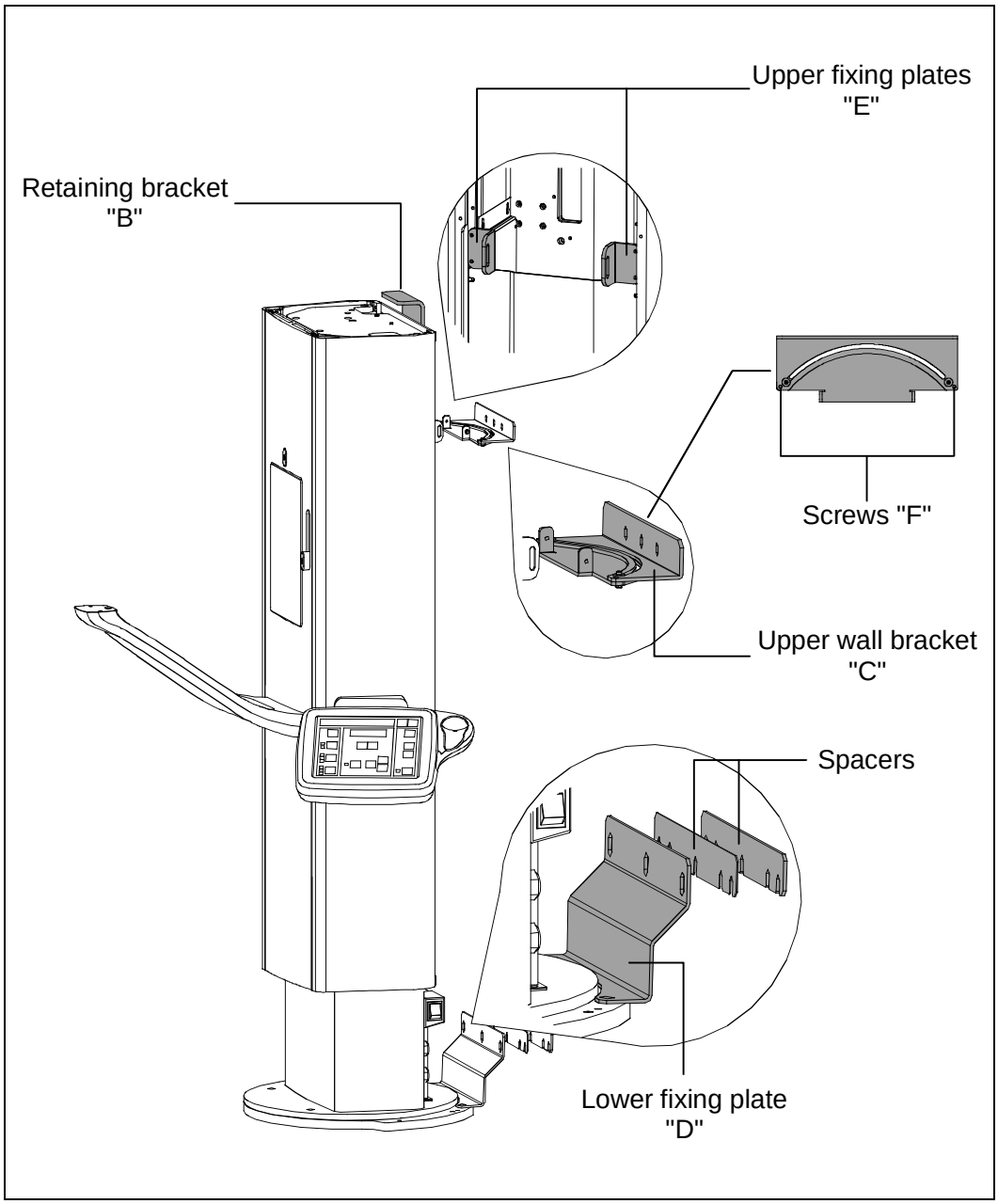

Upper fixing plates
"E"
Retaining bracket
"B"
Screws "F"
Upper wall bracket
"C"
Spacers
Lower fixing plate
"D"

Figure 6-3

6.3. Mounting of the rotating arm assembly

1. Unscrew the fixing screws of the carton box from the lower pallet. Raise the carton box to gain access to the wooden frame that holds the rotating arm.

2. Remove the screws fixing the rotating arm to the wooden frame. Raise up the support/rotating arm using the designated handling zones (Figure 6-4 - This operation requires the presence of two persons).

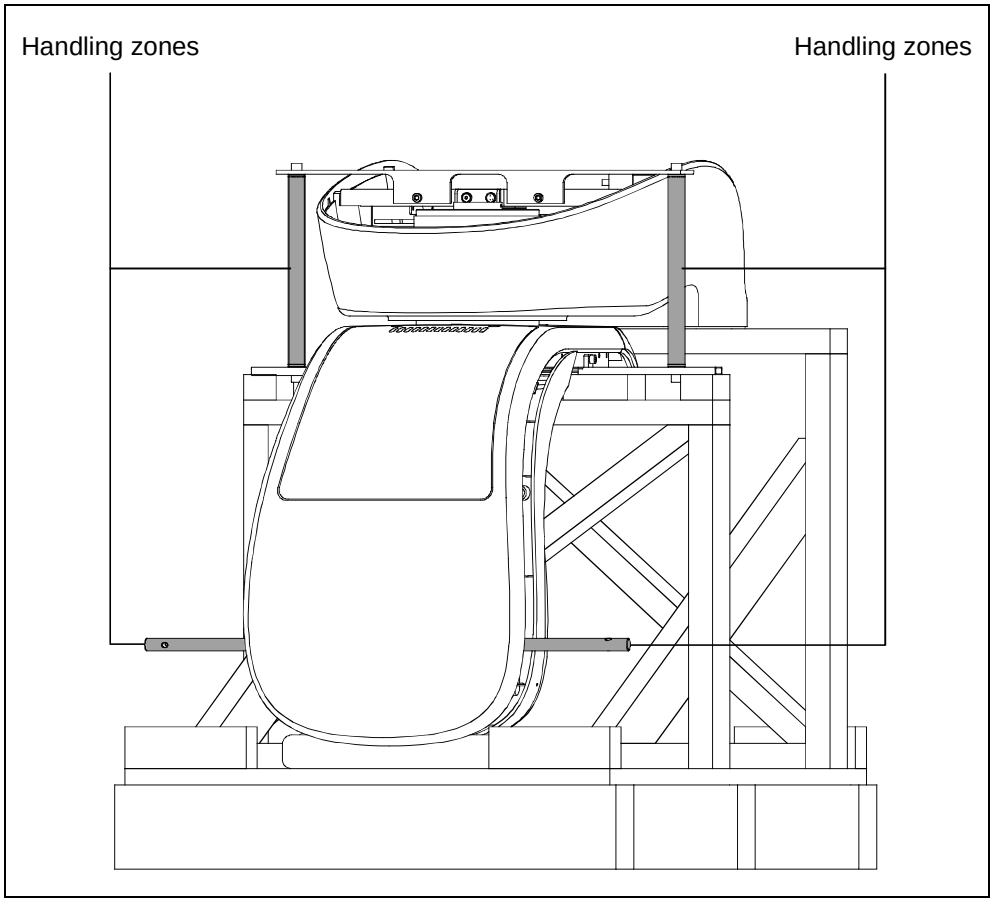


Figure 6-4

3. Move the rotating arm near the column from lateral side in order to avoid contacts between the Digital Sensor holder and the chin support.

4. Position the rotating arm on the column inserting it in the retaining bracket (Figure 6-5). While a person keeps it in position, the other has to fix the two backside screws "A" (Figure 6-6) to the column without tightening them.

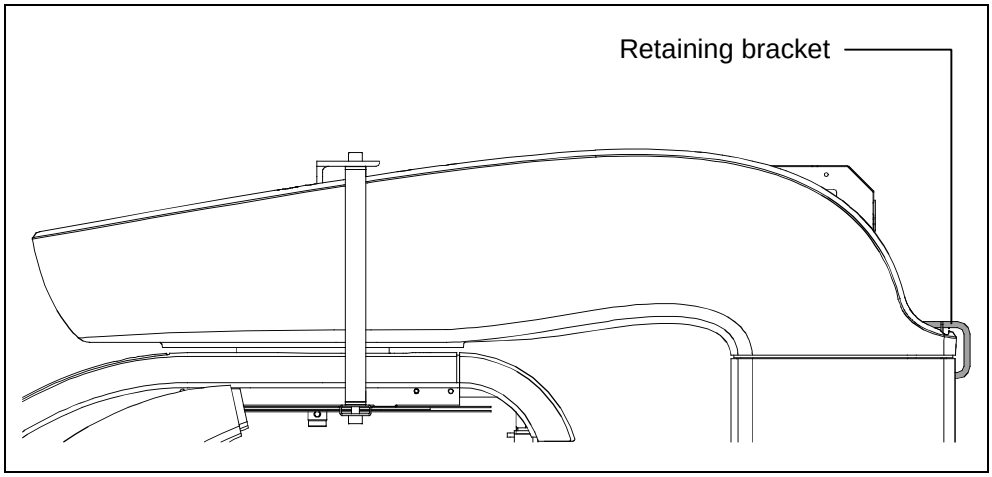


Figure 6-5

5. Remove the two posterior screws fixing the CPU board support plate to the rotating arm and tilt it at about 75°; lock the support plate to the lateral frame.

6. Insert the reference pins "B" (Figure 6-6) between the rotating arm and column using a hammer. Insert the remaining two screws "C" (Figure 6-6) and tighten all the fixing screws.

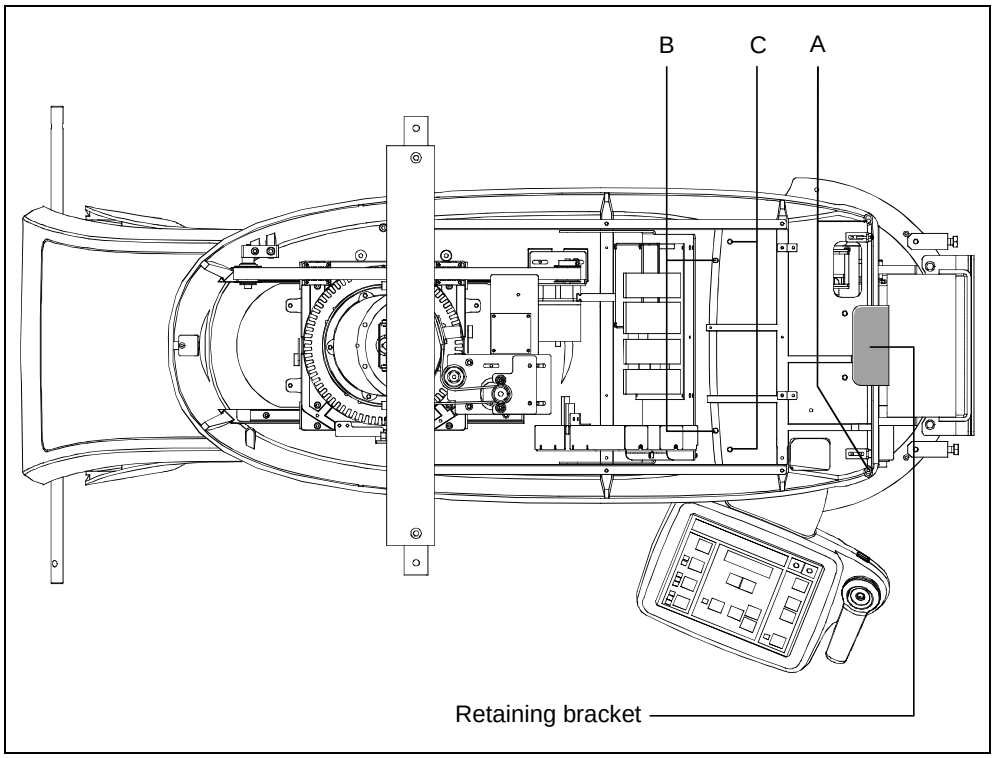


Figure 6-6

7. Remove all brackets and rotate the rotating arm about 90° in clockwise direction in order to reach easily the covers screws.

8. Remove the tubehead cover; remove the two spacers "D" and the lower fixing bracket "E" (Figure 6-7).

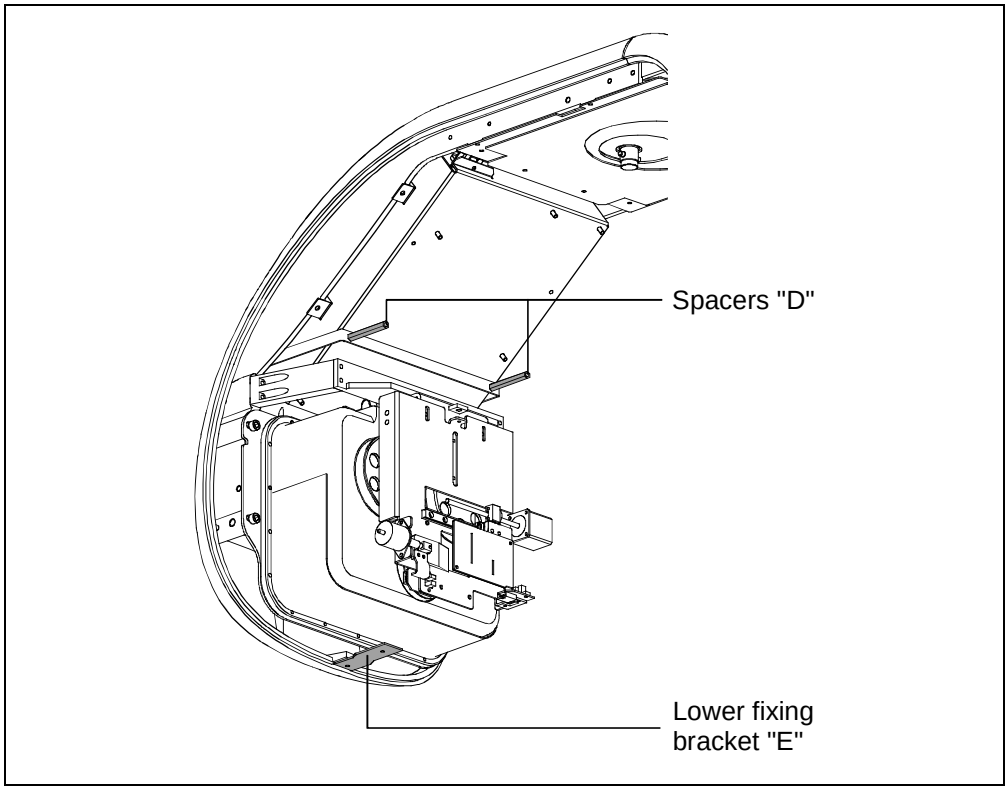


Figure 6-7

9. Open the sensor holder and mount the rotating arm lower cover (Figure 6-8).

NOTE:
In case of Ceph up-gradable version or single sensor version, in order to mount the rotating arm lower cover, it is necessary to remove the sensor holder internal covers.

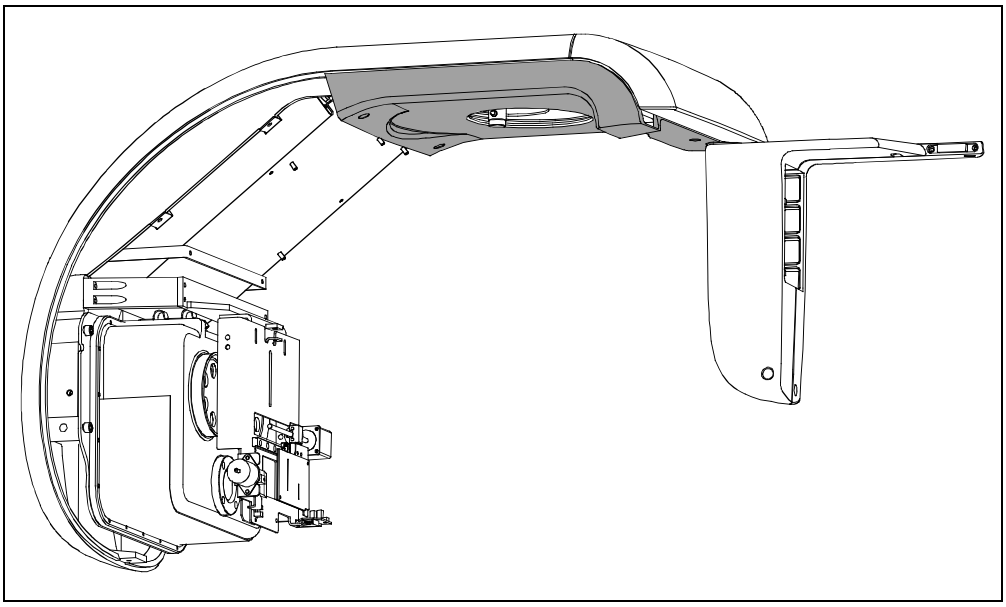


Figure 6-8

10. Mount the temple support group inserting and rotating it in the relevant shaft (Figure 6-9) until the group is locked.

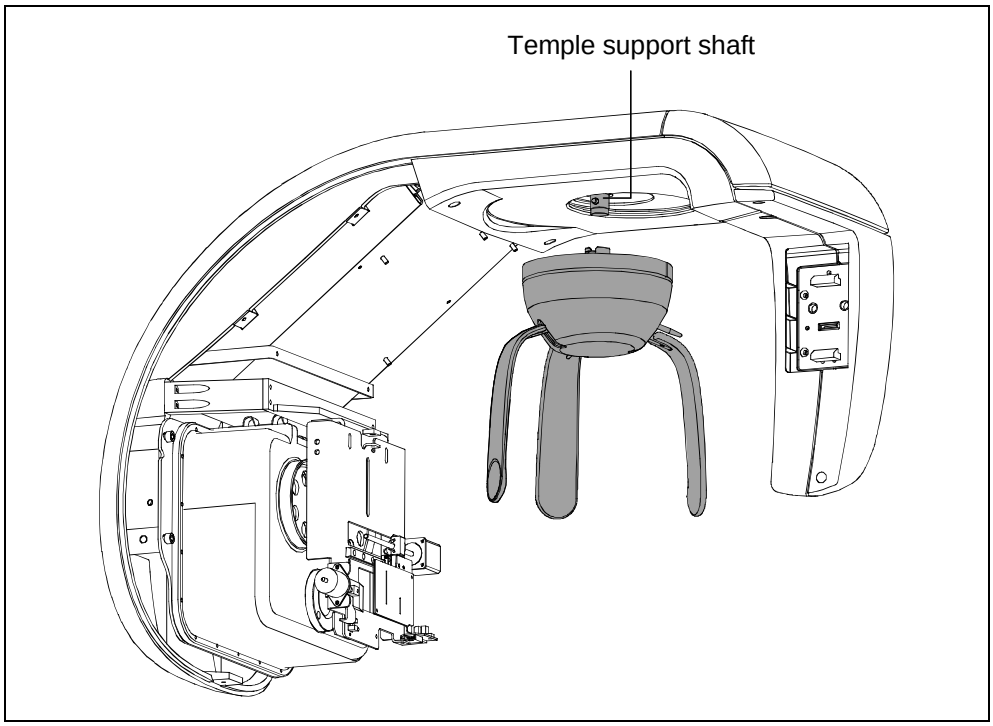


Figure 6-9

11. Insert the cables between column and rotating arm through the holes present in the rotating arm; reposition and fix the CPU board and connect the cables to the related connectors.

NOTE:
For 110-120V version, to access to the CPU board connectors, it is necessary to remove the metallic cover.
At the end of the connections, position the cables in the relevant seating and remount the cover.

6.4. Mounting of CEPH-arm (Optional)

The CEPH kit can be installed on the machine both during the first installation and later as updating of the device. In case the Rotograph EVO D is sold already equipped with the Ceph arm, centering between the X-ray beam and the Sensor will be very quick as the arm is already adjusted and pinned in the factory.
In case the arm is provided later (unit upgrade), the unit is already pre-set to accept it, but the centering between the X-ray beam and the Sensor must be performed in the field.

The Ceph device is shipped in a dedicated packaging and is already pre-assembled in a single piece composed of the following parts:

- Ceph arm including the handle for installation
- Skull clamp and ear centering device
- Arm covers
- Sensor holder.

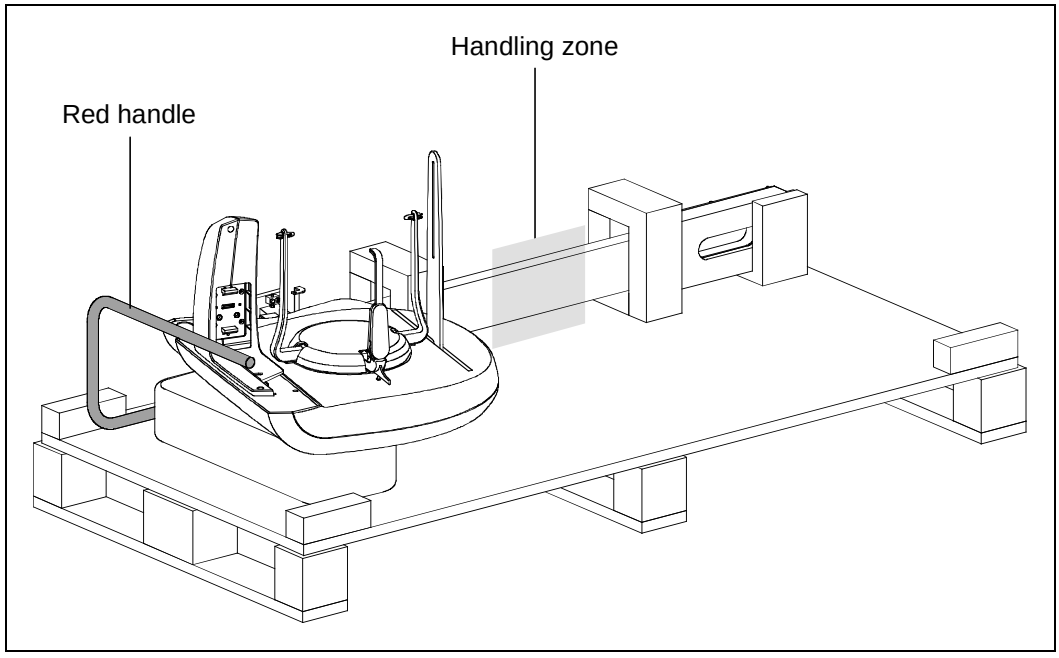


Figure 6-10

NOTE:
Do NOT remove the handle before the complete installation of the Ceph arm on the column.

1. Remove the column rotation fixing screw, located in the back side of the column basement and remove the two screws "F" (Figure 6-3) from the upper bracket "C".
2. Rotate the column in clockwise direction in order to reach the column back side.
3. Lift the Ceph arm with the red handle and the handling zone and remove it from the package (Figure 6-10).
4. Position the Ceph arm near the column and using the reference pins and screws, fix the Ceph arm to the column (Figure 6-11).
5. Insert the cables in the hole between column and rotating arm and connect them to the relevant connectors on the CPU and Digital boards.
6. Remove the red handle.

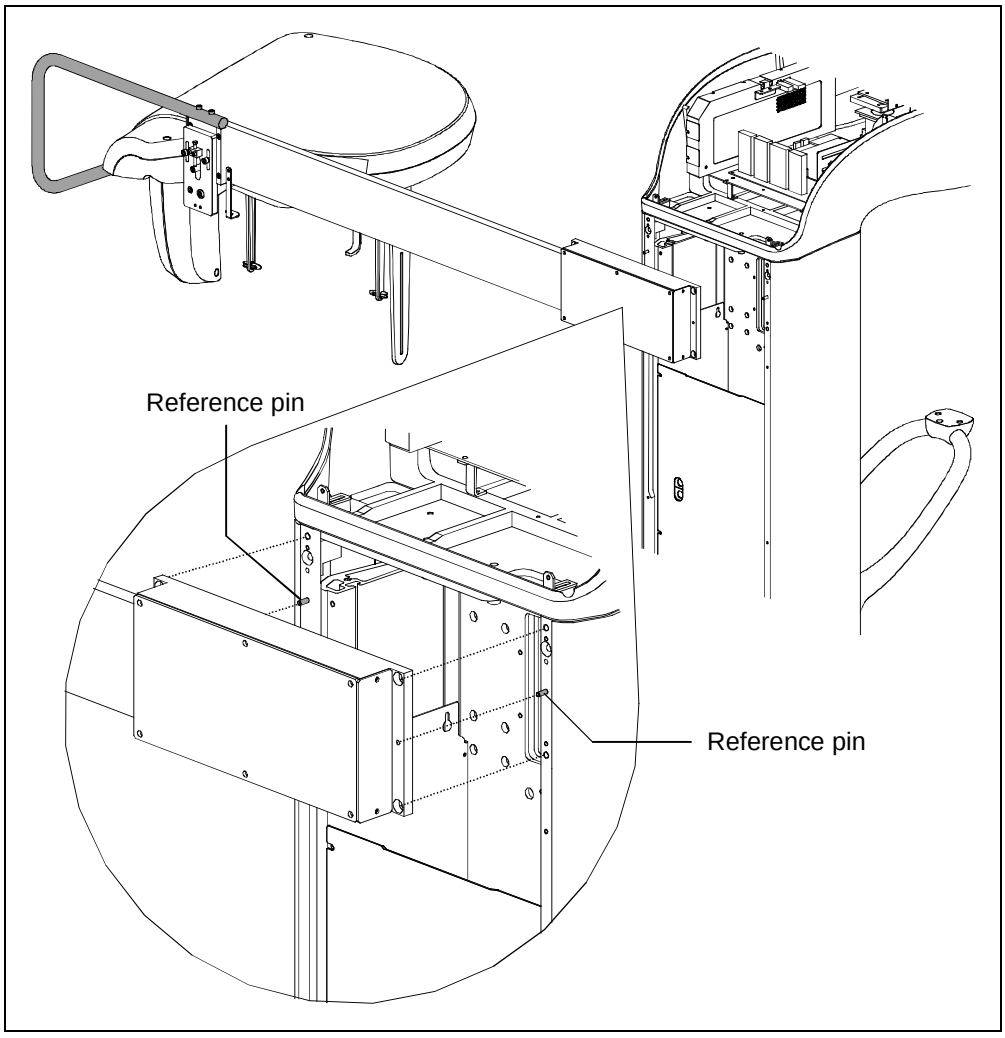


Figure 6-11

6.5. How to mount the coverings

NOTE:
If necessary, to easily access to the covers back side screws, remove the column rotation fixing screw, located in the back side of the column basement and remove the two screws "F" (Figure 6-3) from the upper bracket "C". Rotate the column in clockwise direction in order to reach the column back side.

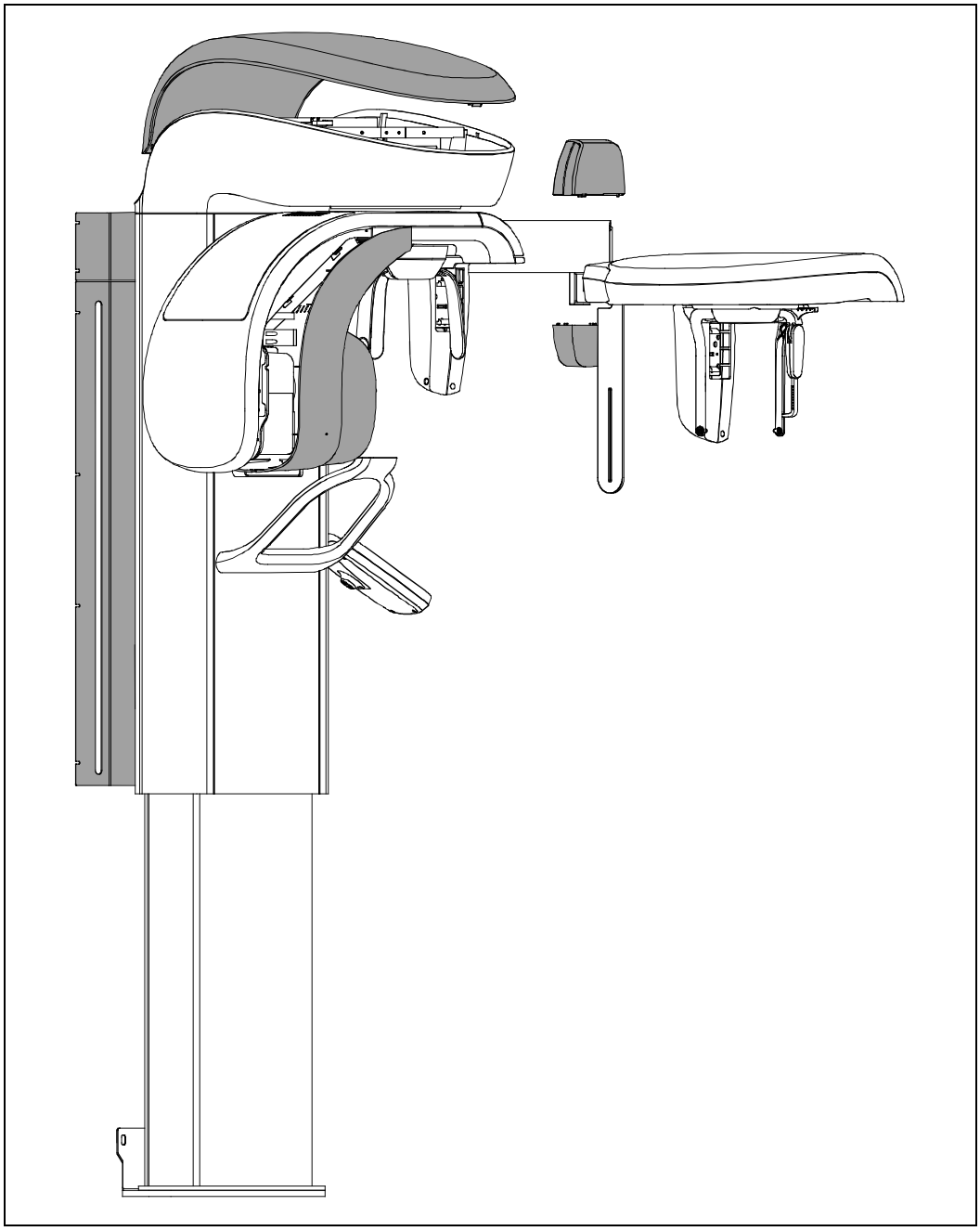


Figure 6-12

6.6. Inserting the sensor in the sensor holder

NOTE:
Not valid for PAN only version.

In order to insert the sensor in the desired station, carry out the following operations:

1. Grip the sensor by the appropriate handgrip; close your fingers to form a fist, by engaging the control lever and bring it to the position where the lever disappears inside the handgrip, so that the whole mobile system retracts.
2. Keep the sensor with the relative handgrips vertical, so that the upper plane is parallel to the horizontal part of the sensor holder, bring the sensor close to the fixed station, by engaging the protruding part of the mobile sensor into the relative casing.
3. Push the sensor mobile part to the very end, in order to engage the mobile part onto the fixed hooking system.
4. Carry out a movement towards the lower part, ensuring that the movement is complete.
5. **Only at this point, release the hooking lever,** checking that the sensor is correctly engaged before releasing the handgrip.

WARNING:
During the lever releasing operation, hold the sensor firmly, to prevent the sensor from falling during the insertion phase due to possible errors.

NOTE:
In case of single sensor unit, moving the sensor from PAN to CEPH position or viceversa, it is necessary to wait about 40 second (LED 20/21 light ON) before to start the device alignment phase pressing key "Patient Entrance" (6)  .

Faster pressure may provide "SENSOR NOT READY" error.

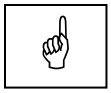
NOTE:
All sensor types are equipped with a shock detection sensor; this sensor is also visible from the outside to enable to operator to perform checks. Possible shocks are displayed by a change in colour (from transparent/white to red) of this sensor. The digital sensor can still function correctly also when the colour changes, displaying a fall that might also not have damaged the sensor.

NOTE:
The fall sensor colour change interrupts the warranty on the sensor.

6.7. Acquisition software installation and configuration

At the end of the mechanical installation of the equipment, it is necessary to install the SW in the PC and make the correct configurations of the system.
The **minimum hardware and software requirements** are the following:

- CPU: Intel I3 Dual Core
- RAM: 2 GB or more
- Hard Disk: 40 GB or more (500 GB suggested)
- Operative system: Windows XP SP2
  Windows 7 32 bit
  Windows 7 64 bit
  Windows 8 32 bit
  Windows 8 64 bit
- Video: Wide Screen (1280x768 32 bits)
- Connectivity: Ethernet 10/100



NOTE:
In case of connection to DICOM network or LOCAL network are required two network boards inside the PC.

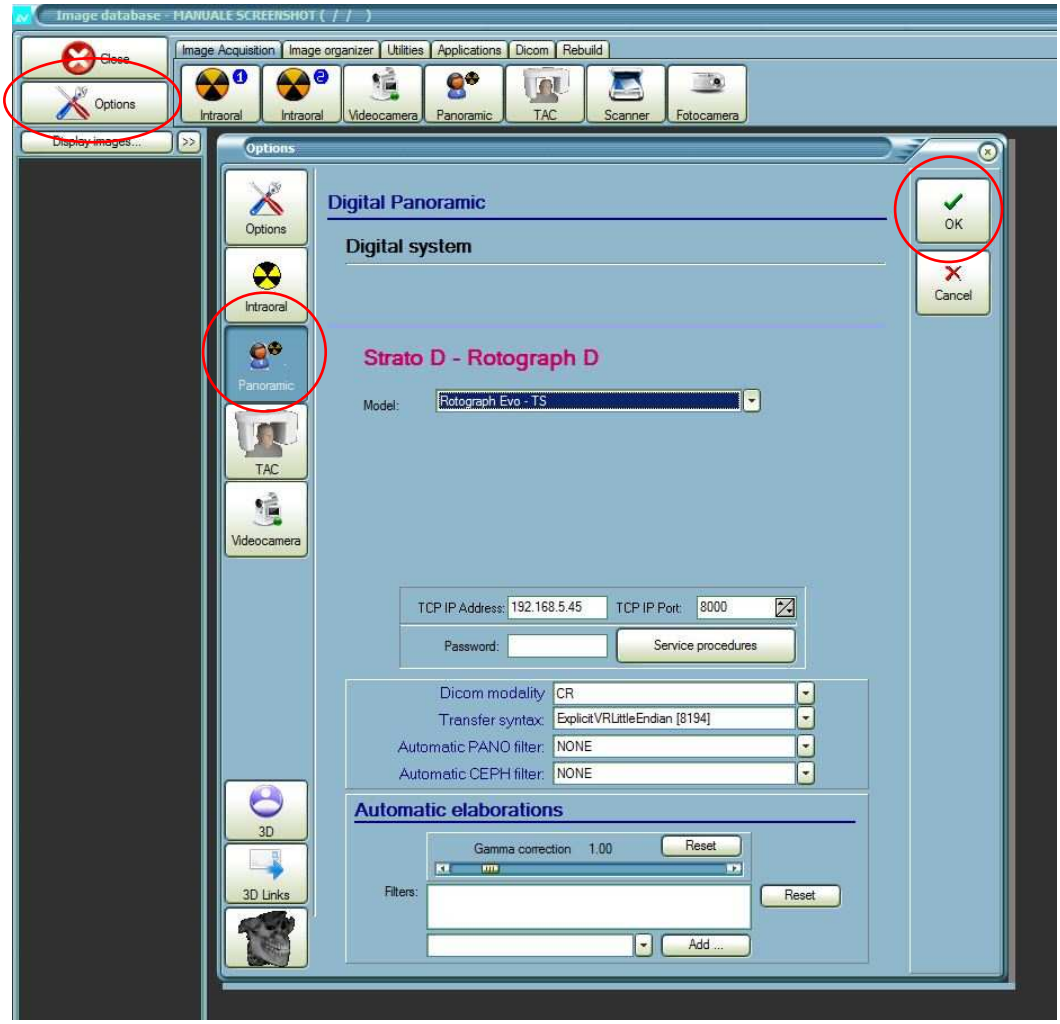
Here following a procedure used to describe the operations to be done in order to start the use of the system.

6.7.1. Dental Studio software installation

Insert the Dental Studio CD-Rom in the CD-Rom Drive, the interface will start automatically.
Click on "Program Installation" button to run the installation of the software.
At the end of program installation, click on "USB Dongle Driver Installation" to run the installation of the license key.

The software has to be configured to communicate with the control touch screen:

1. On Dental Studio program, open a test patient.
2. Select the "Options" button, then "Panoramic" button; the following window will be displayed:



3. Set the following values:
   - "Model" field = Rotograph Evo – TS
   - "TCP IP Address" field = 192.168.005.45
   - "TCP IP Port" field = 8000
4. Press button "OK" to save the settings.

6.7.2. PC - Rotograph EVO D communication set-up

NOTE:
The USB connection located in the back side of keyboard is used ONLY to connect an USB pen drive to acquire images without computer.

NOTE:
It is strictly recommended to take note of default setting changes. Lost data cannot be restored.

The Rotograph EVO D supports different network components wired via Ethernet: the touch screen and the sensor (1 or 2 depending by the configuration).

The equipment has a static IP and so the Network Ethernet adapter of the PC has to be set with a static IP.
Each component can be set taking care the following convention:

- Sensor 1: is the Panoramic sensor. The default IP address is 192.168.005.099
- Sensor 2: is the Ceph sensor. The default IP address is 192.168.005.100.

Depending on the system configuration, the touch screen will try to retrieve the communication towards a single sensor or both:

- PAN only unit: the touch screen will try to communicate with the sensor 1
- PANCEPH unit with two sensors: the touch screen will try to communicate with both sensor 1 and sensor 2
- PANCEPH unit single sensor: the touch screen will try to communicate with sensor 2.

NOTE: Router connection not supported. Connection to a network switch for a single detector is supported.
To connect the machine into a LAN you need to use a switch that support jumbo package.
You can also use a router but you need to properly setup the router so that the IP address lease does not expire, etc. A router requires more sophisticated system level configuration and you would need to test with your particular router you plan to use.

6.7.2.1. Sensor setup

1. Switch ON the unit accessing the "Service menu configuration" (see paragraph 8.3.1 and 8.3.3).

2. Select the option "Sensor X IP Address" to check the current setting (see paragraph 8.3.3.15 and/or 8.3.3.16).

NOTE:
DO NOT modify the sensor IP address.

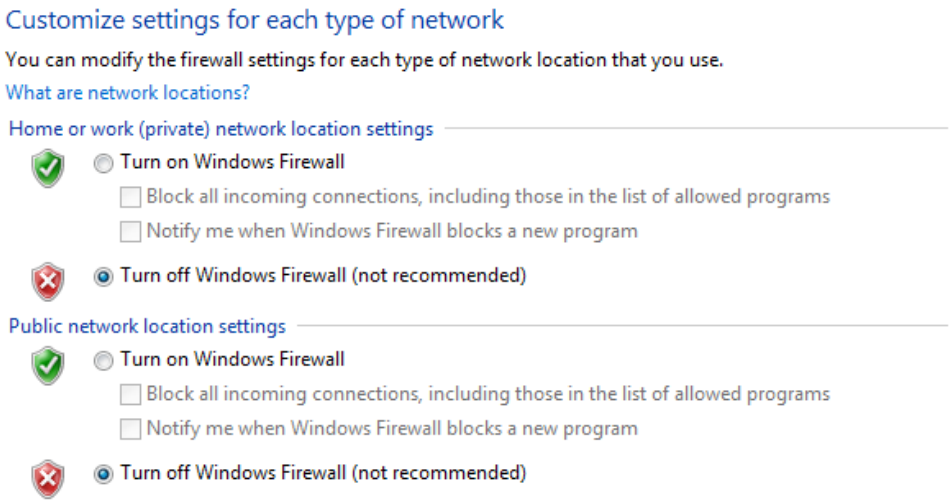
6.7.2.2. Touch screen setup

3. Switch ON the unit accessing the "Service menu configuration" (see paragraph 8.3.1 and 8.3.3).

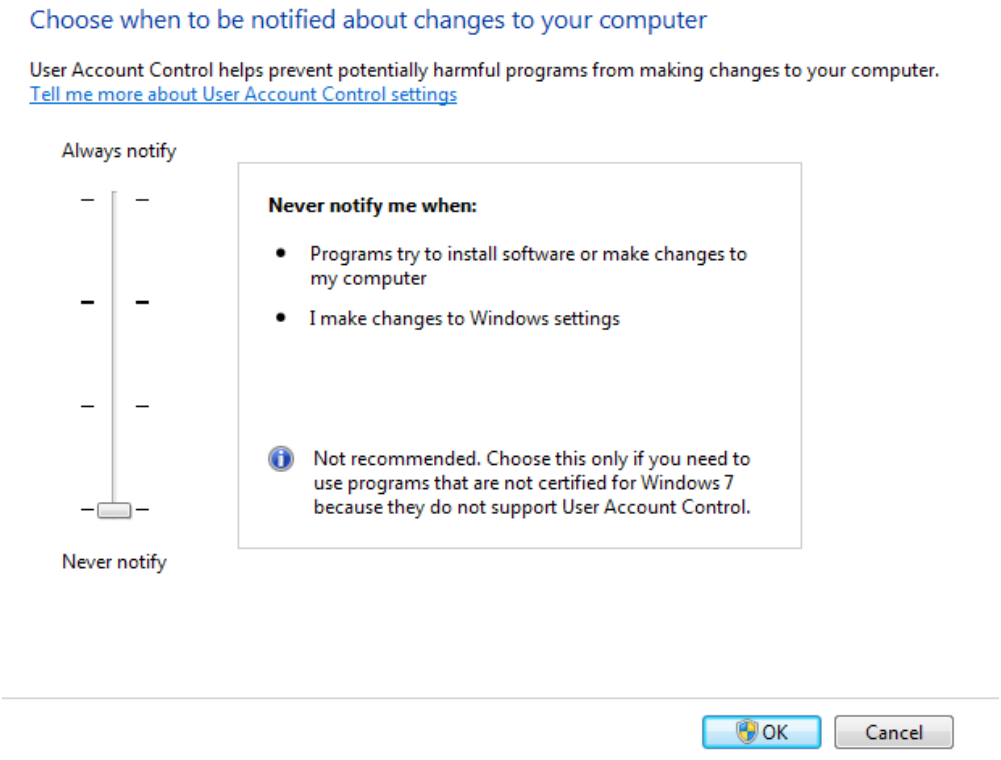
4. Select the option "TSEVO IP Address" to check the current setting (see paragraph 8.3.3.13).

6.7.2.3. PC configuration

1. Disable the Windows Firewall control: open the Windows Control Panel and select *System and Security / Windows Firewall*

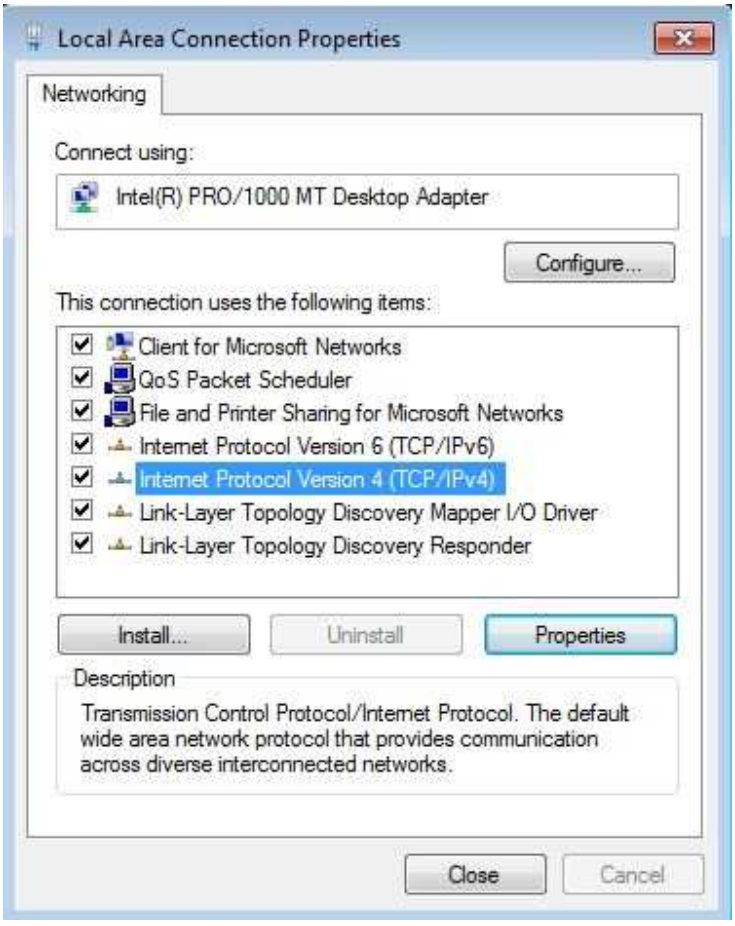


2. Disable the User Account control (set the value as "Never notify"): open the Windows Control Panel and select *User Accounts and Family safety / User Accounts / User Accounts Control Settings*

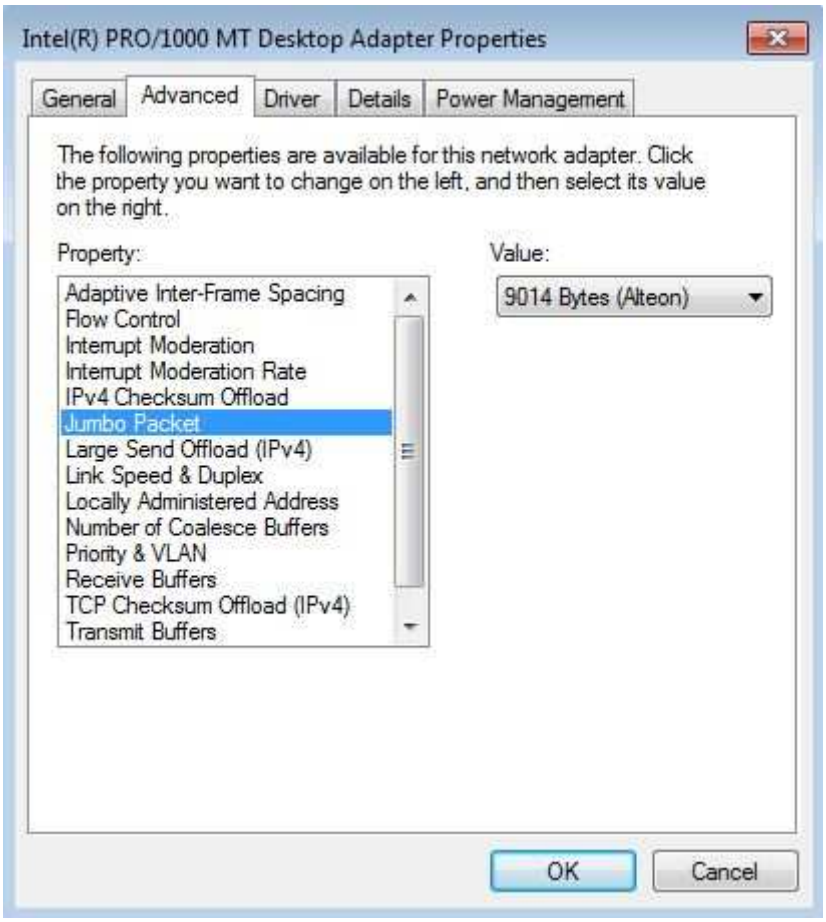


3. From the "Device Manager", disable the power management settings of the following devices:
- Display adapter
- Generic USB Hub

4. Right click on the Network card in use and select "Properties" to open the LAN set-up menu:

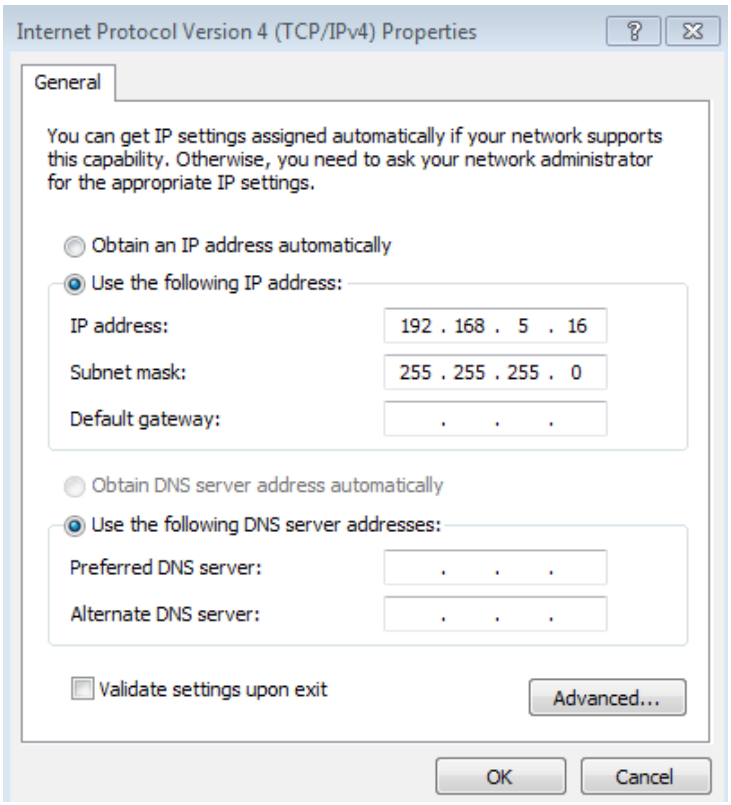


5. Click on "Configure" button and select "Advanced" tab. Select "Jumbo Packet" from the available list of settings and set the parameter "Value" greater than 9000 bytes and confirm with "OK".



6. Select "Internet Protocol Version 4 (TCP/Ipv4)" and click "Properties" button (see image at point 4).

7. Enter the PC IP address as 192.168.005.xxx, where "xxx" can assume a value in the range 001 ÷ 254, excluding any host already reserved by the touch screen or the sensors.



6.7.3. Calibration file installation

Each unit is provided with a sensor installation CD that includes the sensor calibration data.
The CD has to be used ONLY with the unit with which it is shipped.

The calibration files have to be copied into the PC in the following path according to the Operating System:

NOTE:
Application Data is an hidden folder, so be sure that Microsoft Explorer has the option "Display Hidden File and Folders" active.

- **WINDOWS XP**

  C:\Documents and Settings\All Users\Application Data\
  Villa Sistemi Medicali\Rotograph\Calibration

- **WINDOWS 7 and 8**

  C:\Program Data\Villa Sistemi Medicali\
  Rotograph\Calibration

The calibration files are provided using the following naming convention:

– *PXCE_3_XXXXXXXX = CEPH – Binning mode 3 – sensor S/N XXXXXXXX*
– *PXCE_5_XXXXXXXX = CEPH – Binning mode 5 – sensor S/N XXXXXXXX*
– *PXPA_3_XXXXXXXX = Panoramic – Binning mode 3 – sensor S/N XXXXXXXX*

7. MAINTENANCE AND SERVICING

As with all electrical appliances, this unit must be used correctly and maintenance and inspections must be made 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.

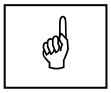
WARNING:
The operator is recommended to perform these inspections before each session of operations.
If the operator detects irregularities or damage, he should immediately inform the Technical Service Department.

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 be 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. Service tools

In order to perform a correct system calibration, is necessary the use of the following tools:

Code	Description	Function
6107900100	Laser centering tool	Used for Panoramic function adjustment and calibration
6107900200	Symmetry check tool	
5209900900	Digital sensor centering tool	Used for Sensor calibration and Cephalometric arm checks
5607900800	Copper filter for Digital sensor	

7.2. Verification and centering adjustment

7.2.1. 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.

NOTE:
This adjustment needs a personal computer directly connected to Rotograph EVO D where the "Dental Studio" program is installed.

NOTE:
In case both Panoramic trajectories (EVO + Standard or Standard + EVO) are enabled (see paragraph 8.3.3.18), this procedure has to be performed first selecting Panoramic STD trajectory and then EVO Panoramic.

1. Switch ON the unit and go to Exam Selection.
2. On Dental Studio program, open a test patient used to make the test images and select the "Panoramic" icon to open the virtual keyboard.

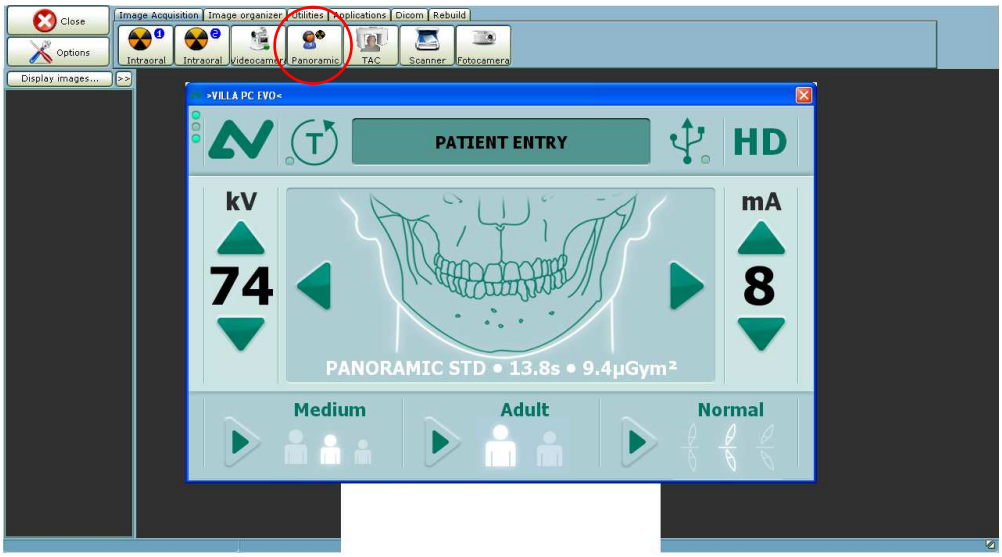


Figure 7-1

3. Place the centering tool (P/N 6107900200 - Figure 7-2) on the chin rest and the sensor calibration tool (P/N 5607900800 - Figure 7-3) in front of the sensor fixing it with tape.

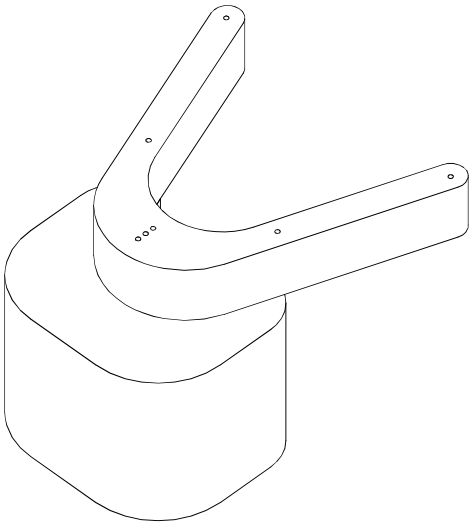


Figure 7-2
Centering tool P/N 6107900200

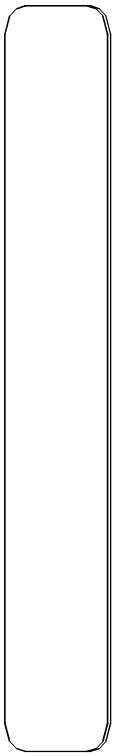


Figure 7-3
Sensor Calibration tool
P/N 5607900800

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

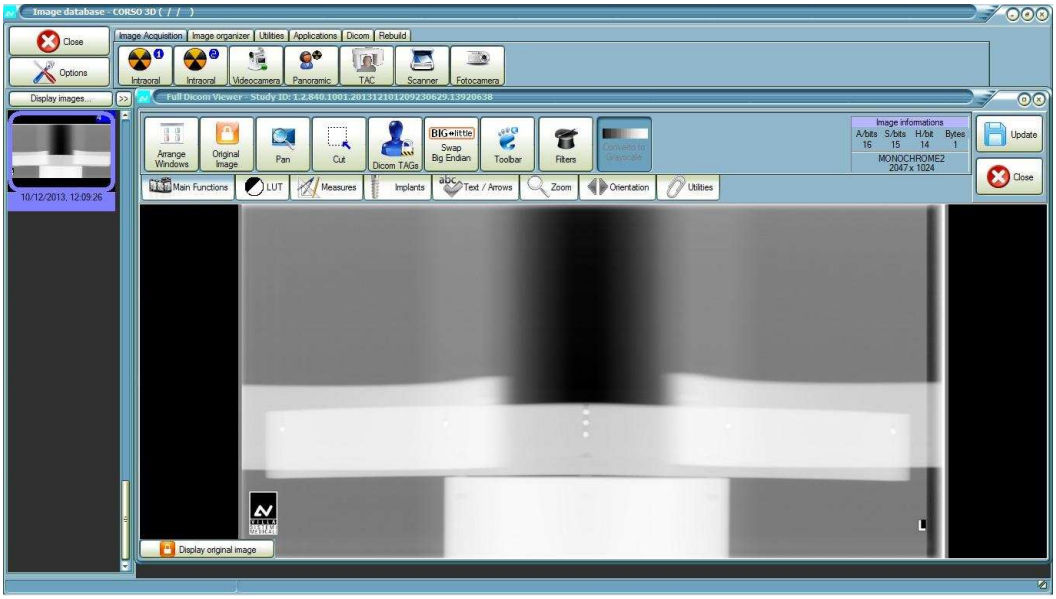


Figure 7-4

3. Using the option "Filters", "PlugIn", "EVO 3D Basic", set contrast and brightness level to have good visibility of all centering balls.

4. Select from the menu "Measure" the icon "Single" and measure the distance between the left side sphere and the central sphere: it must be inside the range 94 mm ± 1 mm with Panoramic STD trajectory selected.

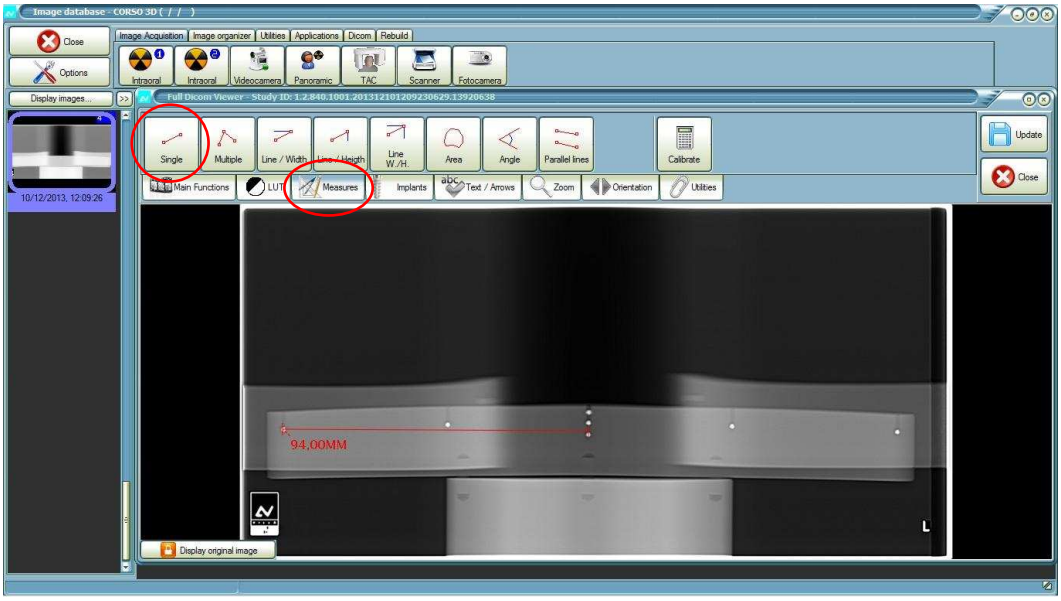


Figure 7-5

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

6. 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 ± 1 mm), adjust the rotation axis (see paragraph 8.3.4.1) accordingly and repeat the exposure.

7. Make a measurement also of the distance between the most right and most left ball: it must be inside the range 188 mm ± 2 mm.

8. If distance is outside the tolerance range, adjust the Y axis (see paragraph 8.3.4.2) accordingly and repeat the exposure.

9. Set the parameter "Y Axis zero Evo" to +600 step (see paragraph 8.3.4.3).

10. Make a new exposure selecting EVO Panoramic function. The distance between the most right and most left ball has to be 172 ± 2 mm.

7.2.2. 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 Rotograph EVO D where the "Dental Studio" program is installed.

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

1. Switch on the unit and access "CEPH SETTING" service program following the operations sequence described in paragraph 8.3.1.

Using the increase key (22) and the decrease key (23)  set the password equal to 124 and confirm with the "Patient entrance" (6) key  ; the following message will be displayed:

" MACHINE SETTING
PRESS >0< "

2. Press key (6)  . The machine will move and the following messages will be displayed:

" WAIT FOR
MACHINE SETTING "

followed by

" CEPH POSITIONING
PLEASE WAIT... "

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

" DIGITAL CEPH
ENABLE SENSOR "

3. Press key (6)  , the following message will be displayed:

"DIGITAL CEPH
CEPH IS DISABLED "

4. Using increase key (22) and the decrease key (23)  select the following option to enable the digital CEPH:

"DIGITAL CEPH
CEPH IS ENABLED "

5. Press key "T" (27)  and if the setting has been changed the following message will be displayed:

"UPDATE CHANGES ?
>0< = Y, T = N "

6. Press key (6)  to store the changes; the following message will be displayed:

"DIGITAL CEPH
ENABLE SENSOR "

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	Ear rings alignment	7.2.2.1
II	Ceph sensor centering	7.2.2.2
III	Secondary collimator centering	7.2.2.3
IV	Soft Tissue Filter adjustment	7.2.2.4

WARNING:
Do NOT modify the "Digital CEPH Y offset" of Password 124: 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.

7.2.2.1. Ear rings alignment

To perform the ear rings alignment it is necessary to enter in Rotation Offset menu following the procedures from point 6 of paragraph 7.2.2 and:

7. Place the ear centering device in a Latero-Lateral position with the ear centering circles in a completely open position.

8. Press keys "Scroll right" (25) or "Scroll left" (24)  until the following is displayed:

" DIGITAL CEPH
ROTATION OFFSET "

9. Press "Patient entrance" (6)  . The following message will be displayed:

" PLEASE WAIT... "

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

" T ZERO [ff] a
ZERO OFFS ±eeeee "

10. A more precise setting have to be performed with X-ray: pressing on key "P" (26)  and on keys increase (22) and decrease (23)  set values (kV and mA) for the exposure (suggested values: 60kV and 6mA).

11. On Dental Studio program, open a test patient used to make the test images and select the "Panoramic" icon to open the virtual keyboard.

12. Press on the touch screen central area 

the system gets ready to take the Rotation Arm alignment test, moving the sensor to a correct position.

NOTE:
If message:

" DIGITAL SENSOR IS NOT READY "

is present on the display, it means that the Digital Sensor is not properly inserted or configured.
If message:

" MEDIA IS NOT READY "

is present on the display, it means that none of the possible acquisition media (virtual keyboard on the PC or USB Pen Drive) is enable.
LEDs 19 and 20 or 21 (Figure 3-6) indicate the status of connection.

Press key (6)  to reset the message and press on the touch screen

central area 

again.

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.

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

14. On Dental Studio program, press "Accept Image", then "Yes".

15. Evaluate on the image if the X-ray beam is vertically displaced.

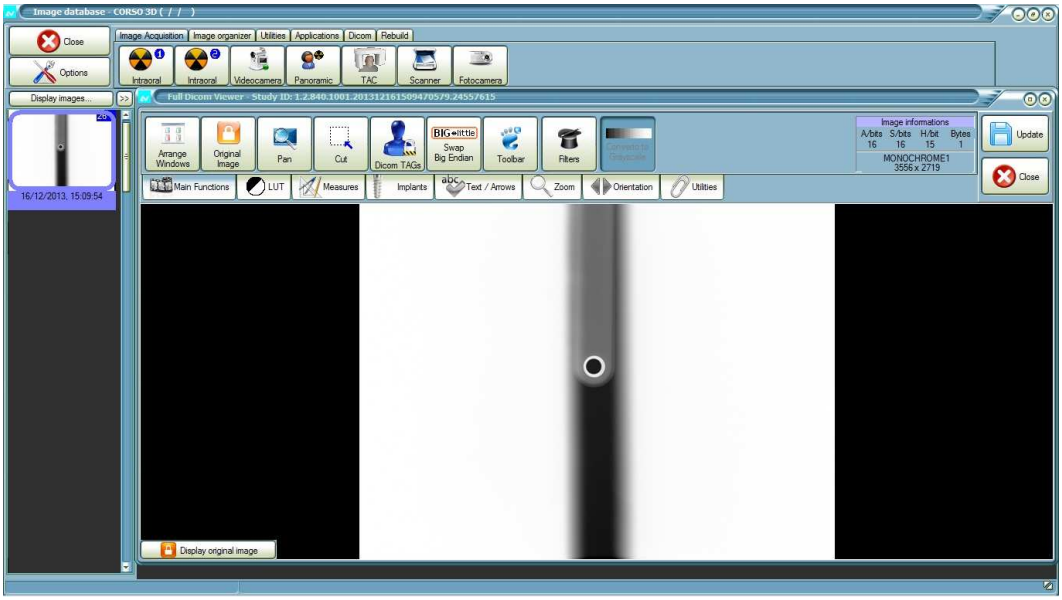


Figure 7-6

16. If it will be necessary to change the height of the CEPH arm, loose the two screws "A" (Figure 7-7), and acting on the screw "B" adjust the height of the Ceph group. Repeat from step 10 until the vertical alignment is reached. Tighten the loosened screws "A".

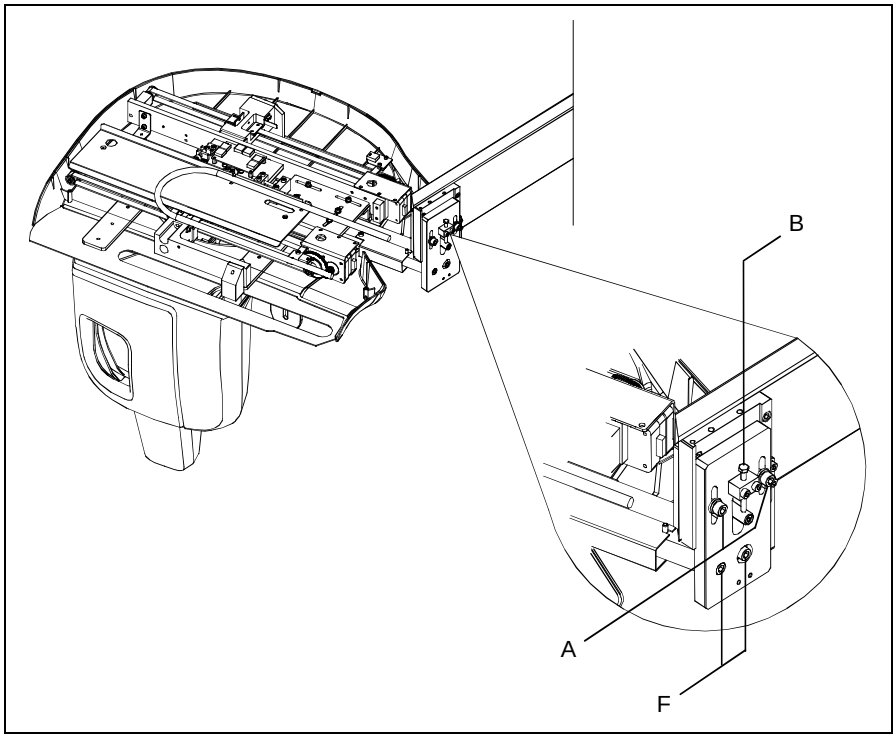


Figure 7-7

17. Check on the image if the Ear Centering Circles are concentric (small circle inside the big circle – i.e. as shown in Figure 7-6).

18. To adjust the vertical alignment between the two rings, loose the two screws "F" (Figure 7-7) and adjust the position of the arm acting on screw "G" (Figure 7-8). Once the aligned position has been reached (test exposures are required), tighten bolt "H" (Figure 7-8) and tighten screws "F".
The performance of this adjustment could require the reiterate of step 15.

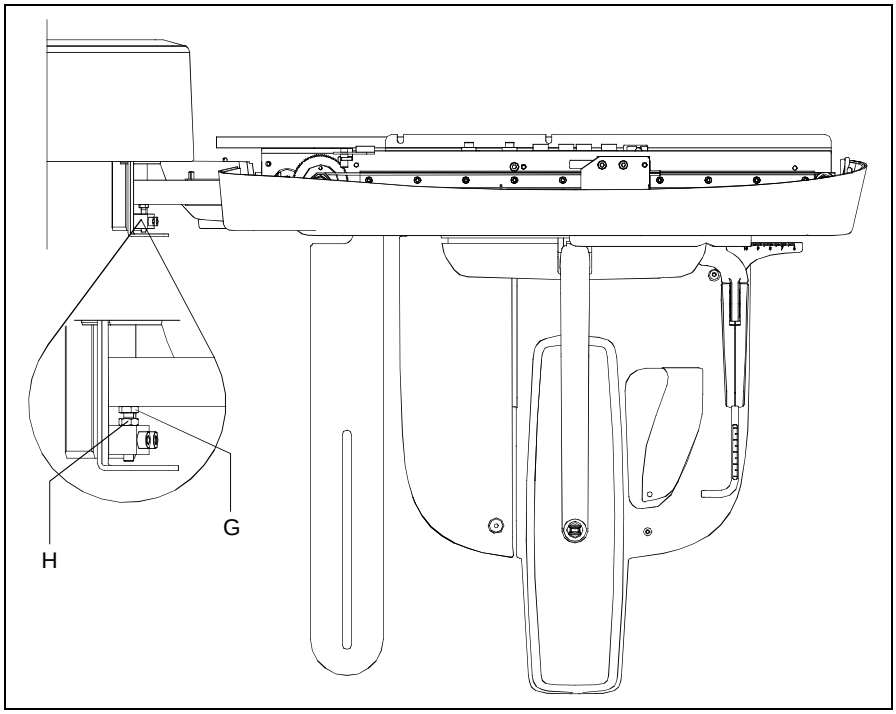


Figure 7-8

19. Making reference to the big circle, if it is not positioned horizontally in the middle of the X-ray beam, it will be necessary to turn the tubehead arm.

With keys increase (22) and decrease (23)  set the speed value (suggested value 2) and with keys (25) and (24)  turn the tubehead arm, increasing the displayed offset value if the left distance is lower than the right one or viceversa.

20. In order to reset the unit to the new parameter, exit from Password 124 pressing key "T" (27)  ; the following message will be displayed:

"UPDATE CHANGES ?
>0< = Y, T = N "

Press key (6)  to store the changes and press key "T" (27)  to exit definitively from Password 124.

21. Enter again in Password 124 following procedure explained on paragraph 7.2.2 and enter in "Rotation Offset" menu as for point 8 and 9.

22. Take a new image and repeat the test from point 18 until the circle is well centered.

<u>Write down the new value in the relevant box in Appendix A.</u>

23. To adjust the horizontally alignment between the two rings, loose the two screws "C" (Figure 7-9) and rotate the ear rings support group acting on screw "D". Once the aligned position has been reached (test exposures are required), tighten screws "C".

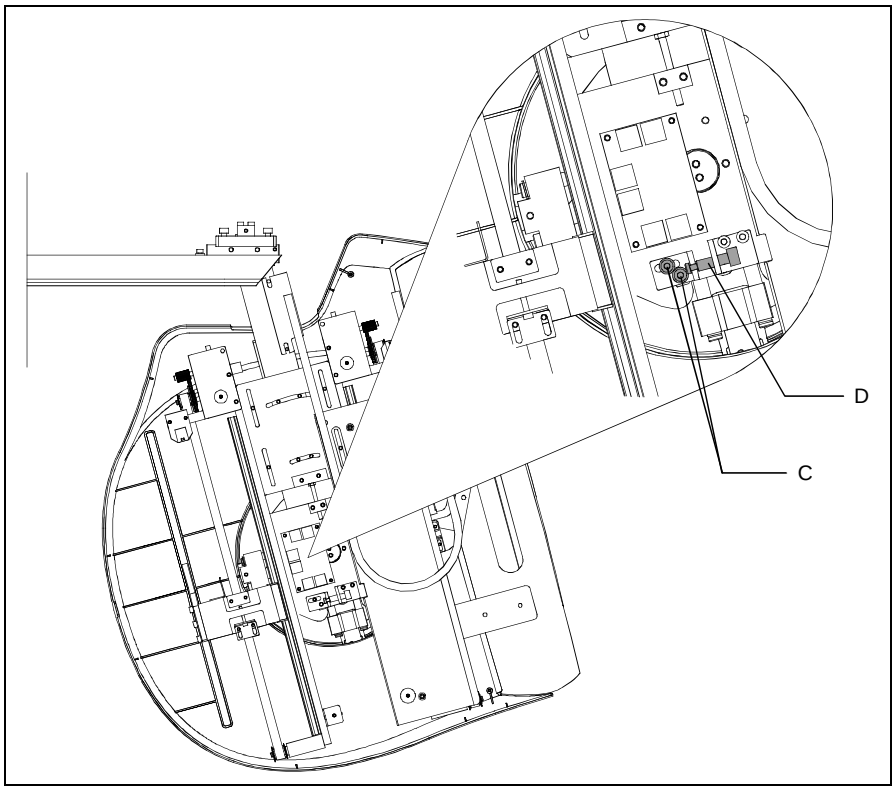


Figure 7-9

7.2.2.2. CEPH Sensor centering

To perform the CEPH Sensor centering, on the image taken with Dental Studio program following procedure of paragraph 7.2.2.1:

24. Select from the menu "Measure" the icon "Single" and measure the distance between the borders of the image and the borders of the central vertical stripe (Figure 7-10).

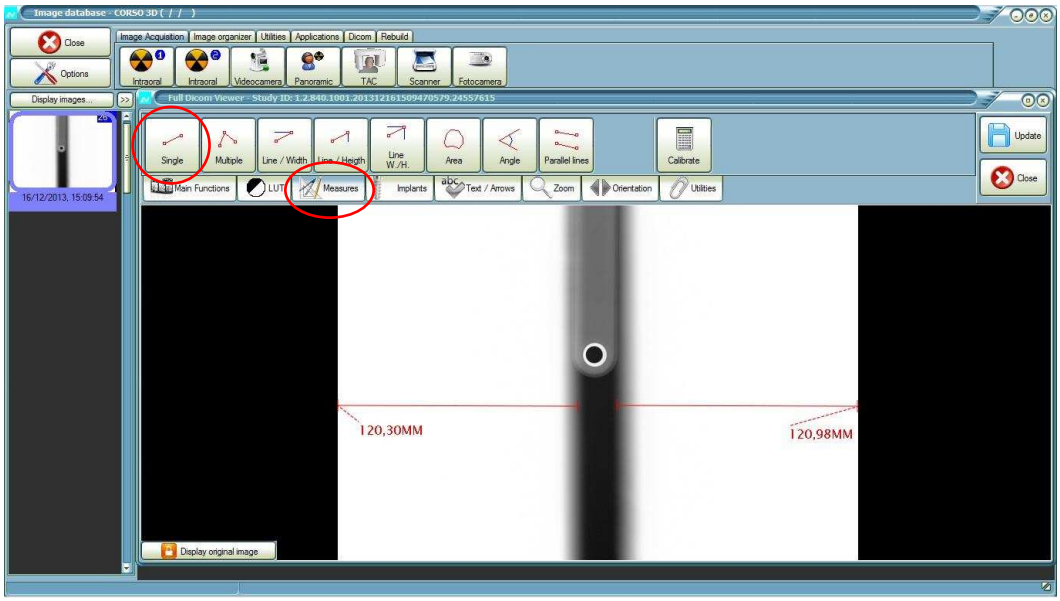


Figure 7-10

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

25. In case it is not centered, press key "Adult/Child Selection"

(8) 

to select "CEPH SENSOR ZERO" menu; the

display will show:

"S ZERO [ff] a
ZERO OFFS ±eeeee "

26. With keys increase (22) and decrease (23)  set the speed

value (suggested value 2) and with keys (25) and (24) 

move the CEPH Sensor, increasing the displayed offset value if the left distance is higher than the right one or viceversa.

27. Close the sensor holder, if open and press key "Size Selection"

(9) 

, the following message will be displayed:

" UPDATE CHANGES ?
>0< = Y, T = N "

Press key (6)  to store the changes and reset axis position.

28. Press on the touch screen central area 

to move the Ceph sensor in the acquisition start position.

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.

29. Press the X-ray button to take a new image.

30. Repeat the test as per points 23, 25, 26, 27 and 28 until the image is well centered.

31. Once the aligned position has been reached, press key "T" (27) 

to exit from the Rotation offset menu and return in the main menu:

" DIGITAL CEPH
ROTATION OFFSET "

Write down the new value in the relevant box in Appendix A.

7.2.2.3. Secondary collimator centering

To perform the ceph secondary collimator alignment start from point 30 of paragraph 7.2.2.2 and:

32. Place the ear centering device in a Antero-Posterior position with the ear centering circles in a completely open position. Rotates the nose-rest and drive it completely into the parking position.

33. Press keys "Sroll right" (24) or "Scroll left" (25)  until the following is displayed:

"DIGITAL CEPH
CEPH S.COL. ZERO "

34. Press key "Patient entrance" (6)  and the following message will be displayed:

"C ZERO [ff] abcd
ZERO OFFS ±eeeee "

35. Press key "Patient entrance" (6)  : the secondary collimator and the CEPH sensor will be automatically placed in the CEPH central position and the system gets ready to take the secondary collimator test.

36. Place the centering tool P/N 5209900900 on the secondary collimator.

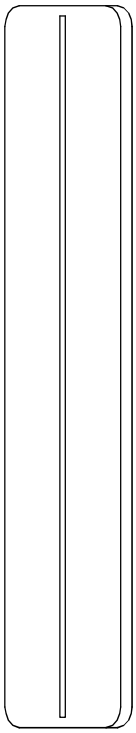


Figure 7-11
Centering tool P/N 5209900900

37. Select with key "P" (26)  respectively kV, mA and exposure time and use keys increase (22) or decrease (23)  to set values for the exposure (suggested values: 60kV, 6mA and 0.5s).

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.

38. On Dental Studio program, open a test patient used to make the test images and select the "Panoramic" icon to open the virtual keyboard.

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

40. On Dental Studio program, press "Accept Image", then "Yes".

41. On the "LUT" option, select button "  " (Figure 7-12) to improve the image contrast and brightness.

42. Check if in the obtained narrow image the projection of the slit of the centering tool is vertical and centered with the arc (Figure 7-12 and Figure 7-13).

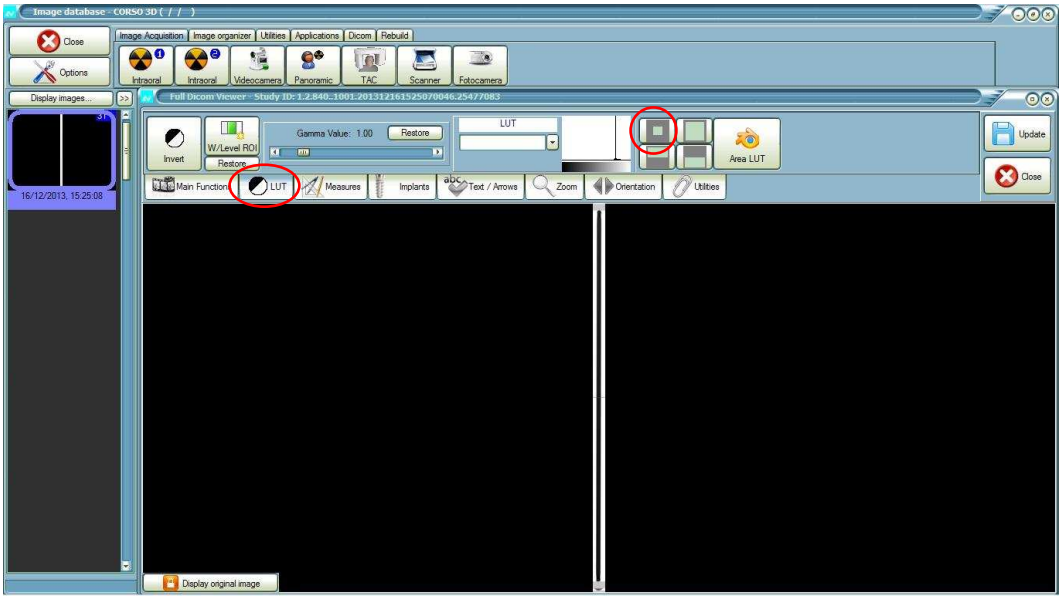


Figure 7-12

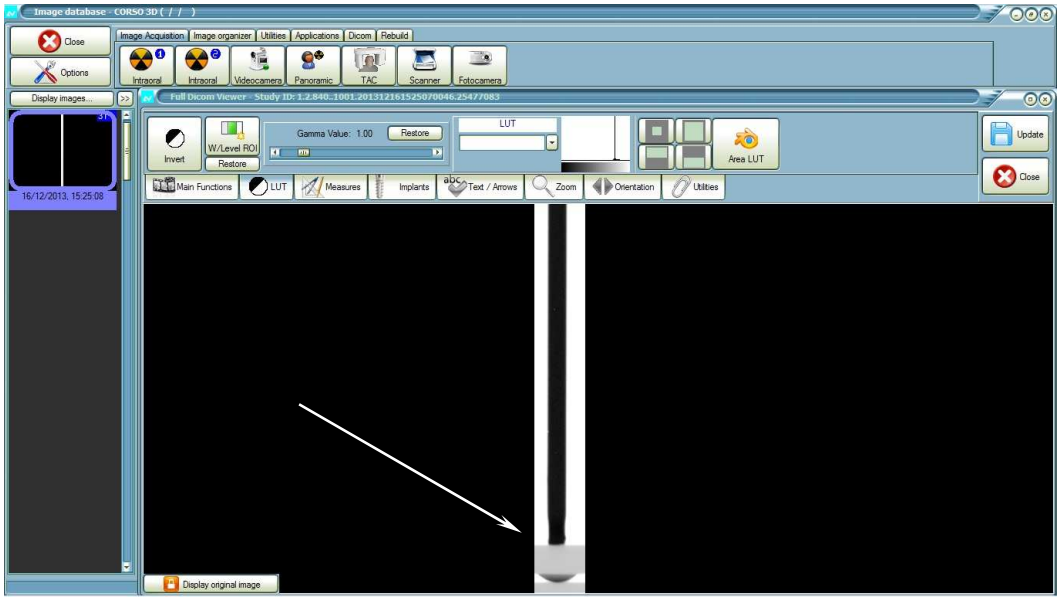


Figure 7-13

31. If it is not the case, with keys increase (22) and decrease (23) 

set a speed value (suggested value 3) and with keys (24) and (25)  move the secondary collimator, increasing the displayed offset value if the left distance is lower than the right one or vice versa; repeat the test from point 34.

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 7.2.2.1.

32. When the right setting is reached press key "T" (26)  to exit the menu item and if modifications have been performed the following message will be displayed:

"UPDATE CHANGES ?
>0< = Y, T = N "

Press key (6)  to store the changes. While key (27)  to cancel them.

Write down the new value in the relevant box in Appendix A.

7.2.2.4. Soft Tissue Filter (STF) adjustment

NOTE:
This adjustment needs a personal computer directly connected to Rotograph EVO D where the "Dental Studio" program is installed.

This adjustment is accessed by activating password 124 as described in paragraph 7.2.2.

1. When in password 124 scroll the menu items pressing the "Scroll right (25) and "Scroll left" (24) keys  until reaching the following display:

   "DIGITAL CEPH
   STF ZERO OFFSET "

2. Press key "Patient entrance" (6)  . The following message will be displayed:

   "PLEASE WAIT... "

   and at the end of positioning

   "STF ZERO [xx] x
   ZERO OFS ±xxxxxx "

3. Place the ear centering device in a Latero-Lateral position.
4. Acting on the key "P" (26)  and on keys increase (22) or decrease (23)  set the exposure parameters, as suggestion set 60kV - 6mA.
5. On Dental Studio program, open a test patient used to make the test images and select the "Panoramic" icon to open the virtual keyboard.
6. Press the central area of the touch screen 

.

   The Soft Tissue Filter will be automatically placed in the X-ray field.

NOTE:
If message:

" DIGITAL SENSOR IS NOT READY "

is present on the display, it means that the Digital Sensor is not properly inserted or configured.
If message:

" MEDIA IS NOT READY "

is present on the display, it means that none of the possible acquisition media (virtual keyboard on the PC or USB Pen Drive) is enable.
LEDs 19 and 20 or 21 (Figure 3-6) indicate the status of connection.

Press key (6)  to reset the message and press on the touch screen

central area 

again.

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

" ENTER IMG OFFSET
OFFSET (mm) 50 "

8. Select from the menu "Measure" the icon "Single" and measure the distance "A" (Figure 7-14) between the Soft Tissue Filter (STF) edge and the center of the rings; perform the measure in "mm".

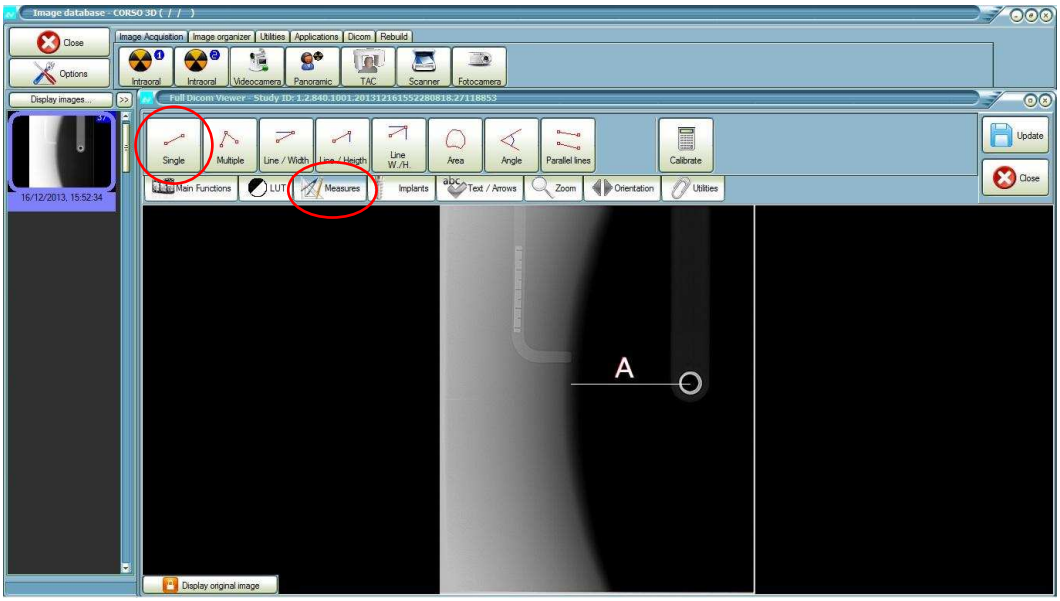


Figure 7-14

9. If the distance "A" is different from 50±2mm, press keys increase (22) or decrease (23)  up to reach the measured value; press key (6)  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 "T" (27)  to exit.

In both cases the following message will be displayed

"STF ZERO [xx] x
ZERO OFS ±xxxxx "

10. 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 "T" (27)  . The display will show:

" UPDATE CHANGES ?
>0< = Y, T = N "

Press key (6)  to permanently store the change.

Write down the new value in the relevant box in Appendix A.

11. Press key (27)  to exit password 124.

7.3. Detector calibration

NOTE:
The calibration procedure needs a personal computer directly connected to Rotograph EVO D where the "Dental Studio" program is installed.

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.

7.3.1. Panoramic mode

1. Switch ON the unit and select the "EVO Panoramic" examination, Adult mode.

2. On Dental Studio program, open a test patient used to make the calibration.

3. Select the "Options" button, then "Panoramic" button; the following window will be displayed:

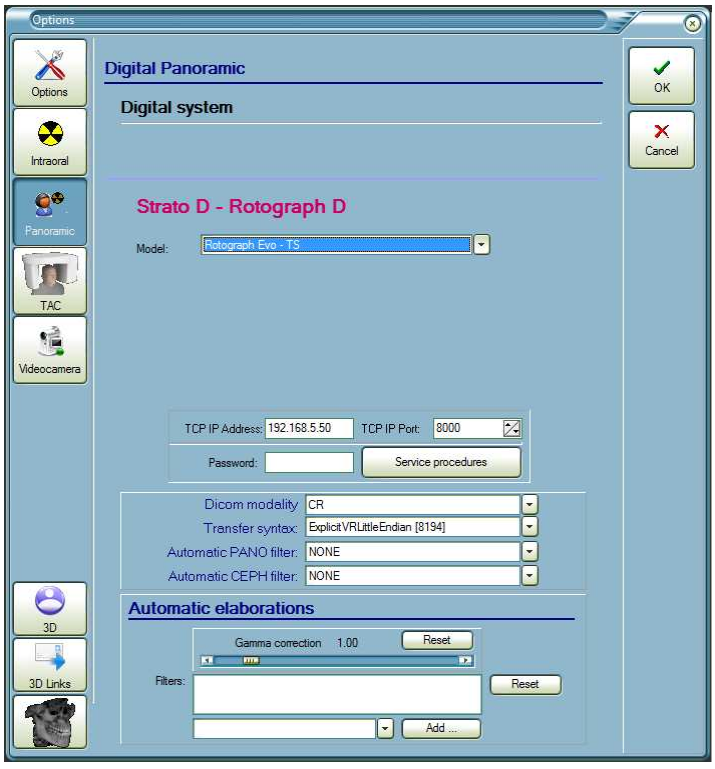


Figure 7-15

4. On "Password" field, insert the value "1771".

5. Press "Service procedures" button to open the calibration program; the "Exam Family" menu will be displayed:

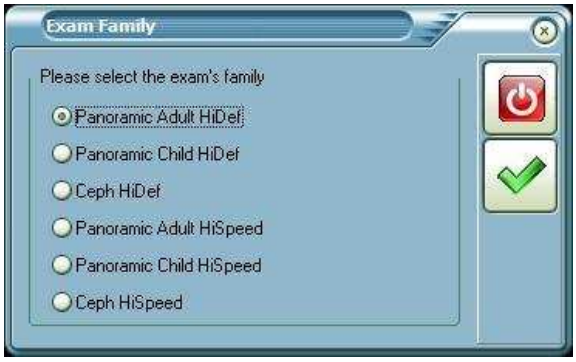


Figure 7-16

Select "Panoramic Adult HiDef", then press button "  " (Confirm).

6. On the left side menu of the displayed window, select "Acquire" button: the virtual keyboard will be displayed.

7. Place the sensor calibration tool (P/N 5607900800 - Figure 7-3) in front of the sensor fixing it with tape.

8. Make an exposure at 70 kV – 6mA, acquired in the Dental Studio program; the following image will be displayed:

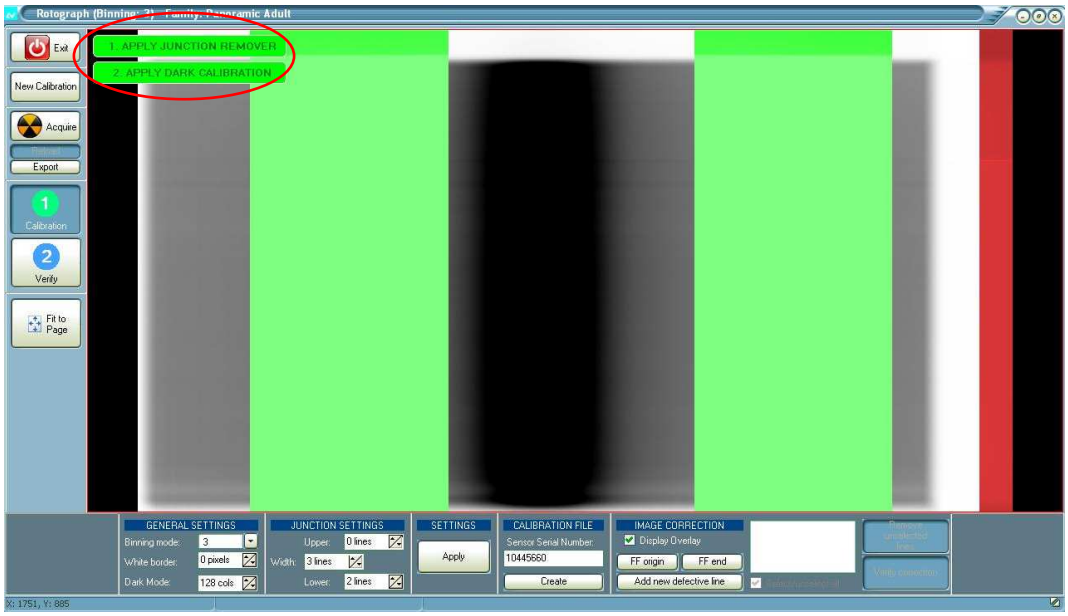


Figure 7-17

9. Press the button "APPLY JUNCTION REMOVER" and "APPLY DARK CALIBRATION" (Figure 7-17).

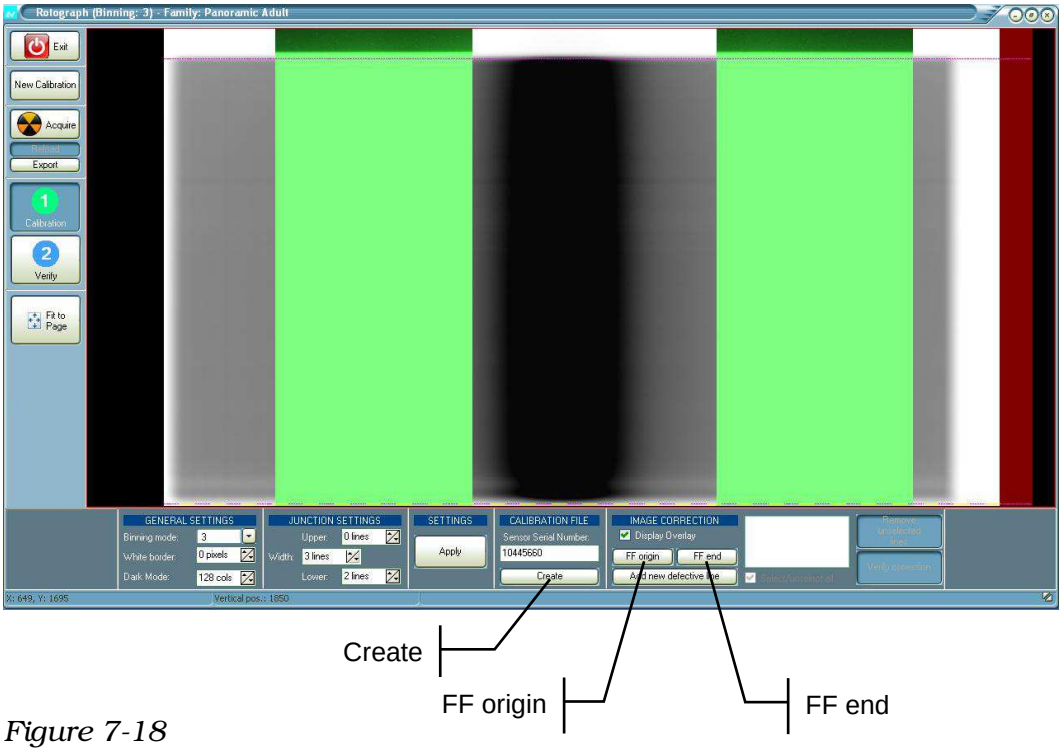


Figure 7-18

10. Holding pressed the "Ctrl" button on the keyboard, with the mouse left click on the upper limit of the exposed area: a dashed line will be added indicating the current selection. Press button "FF origin" (Figure 7-18) to save the current selection.

11. Holding pressed the "Ctrl" button on the keyboard, with the mouse left click on the lower limit of the exposed area: a dashed line will be added indicating the current selection. Press button "FF end" (Figure 7-18) to save the current selection.

12. Using the scroll whell of the mouse, zoom the image and holding pressed the mouse left button, drag the image for finding possible defective lines. In case of defective lines, proceed as described in paragraph 7.3.4, otherwise press button "Create" (Figure 7-18), then "Save" to create (or replace if already present) the calibration file.

7.3.2. CEPH HD mode

1. Switch ON the unit and select the "CEPH 24x22PA" examination, "HD" (High Definition) mode.

2. Place the ear centering device in a Antero-Posterior position with the ear centering circles in a completely open position.

3. On Dental Studio program, open a test patient used to make the calibration.

4. Select the "Options" button, then "Panoramic" button. On "Password" field, insert the value "1771" (Figure 7-15) and press "Service procedures" button to open the calibration program; the "Exam Family" menu will be displayed:

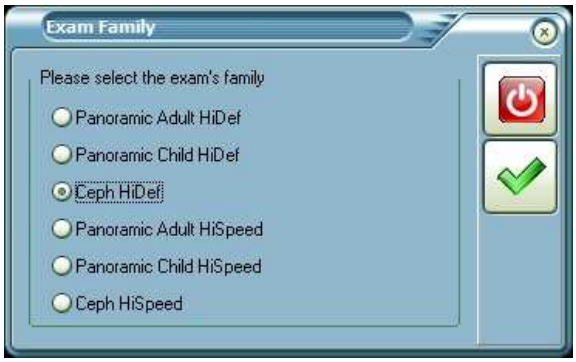


Figure 7-19

Select "Ceph HiDef", then press button "  " (Confirm).

5. On the left side menu of the displayed window, select "Acquire" button: the virtual keyboard will be displayed.

6. Place the sensor calibration tool (P/N 5607900800 - Figure 7-3) in front of the sensor fixing it with tape.

7. Make an exposure at 74kV – 7mA, acquired in the Dental Studio program.

8. Press the button "APPLY JUNCTION REMOVER" and "APPLY DARK CALIBRATION" (Figure 7-17).

9. Holding pressed the "Ctrl" button on the keyboard, with the mouse left click on the upper limit of the exposed area: a dashed line will be added indicating the current selection. Press button "FF origin" (Figure 7-18) to save the current selection.

10. Holding pressed the "Ctrl" button on the keyboard, with the mouse left click on the lower limit of the exposed area: a dashed line will be added indicating the current selection. Press button "FF end" (Figure 7-18) to save the current selection.

11. Using the scroll whell of the mouse, zoom the image and holding pressed the mouse left button, drag the image for finding possible defective lines. In case of defective lines, proceed as described in paragraph 7.3.4, otherwise press button "Create" (Figure 7-18), then "Save" to create (or replace if already present) the calibration file.

7.3.3. CEPH HS mode

1. Switch ON the unit and select the "CEPH 24x22PA" examination, "HS" (High Speed) mode.

2. Place the ear centering device in a Antero-Posterior position with the ear centering circles in a completely open position.

3. On Dental Studio program, open a test patient used to make the calibration.

4. Select the "Options" button, then "Panoramic" button. On "Password" field, insert the value "1771" (Figure 7-15) and press "Service procedures" button to open the calibration program; the "Exam Family" menu will be displayed:

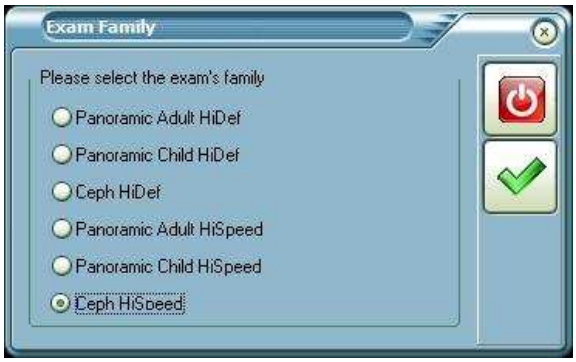


Figure 7-20

Select "Ceph HiSpeed", then press button "  " (Confirm).

5. On the left side menu of the displayed window, select "Acquire" button: the virtual keyboard will be displayed.

6. Place the sensor calibration tool (P/N 5607900800 - Figure 7-3) in front of the sensor fixing it with tape.

7. Make an exposure at 74kV – 7mA, acquired in the Dental Studio program.

8. Press the button "APPLY JUNCTION REMOVER" and "APPLY DARK CALIBRATION" (Figure 7-17).

9. Holding pressed the "Ctrl" button on the keyboard, with the mouse left click on the upper limit of the exposed area: a dashed line will be added indicating the current selection. Press button "FF origin" (Figure 7-18) to save the current selection.

10. Holding pressed the "Ctrl" button on the keyboard, with the mouse left click on the lower limit of the exposed area: a dashed line will be added indicating the current selection. Press button "FF end" (Figure 7-18) to save the current selection.

11. Using the scroll whell of the mouse, zoom the image and holding pressed the mouse left button, drag the image for finding possible defective lines. In case of defective lines, proceed as described in paragraph 7.3.4, otherwise press button "Create" (Figure 7-18), then "Save" to create (or replace if already present) the calibration file.

7.3.4. Defective lines correction

NOTE:
The sensor junction is automatically marked as defective line (blu dashed line on the image) and corrected by the software.

Any defective line found on the image during sensor calibration, can be corrected as described below.

1. On the aquired image, holding pressed the "Ctrl" button on the keyboard, with the mouse left click on the defective line, a red dashed line will be added indicating the current selection.

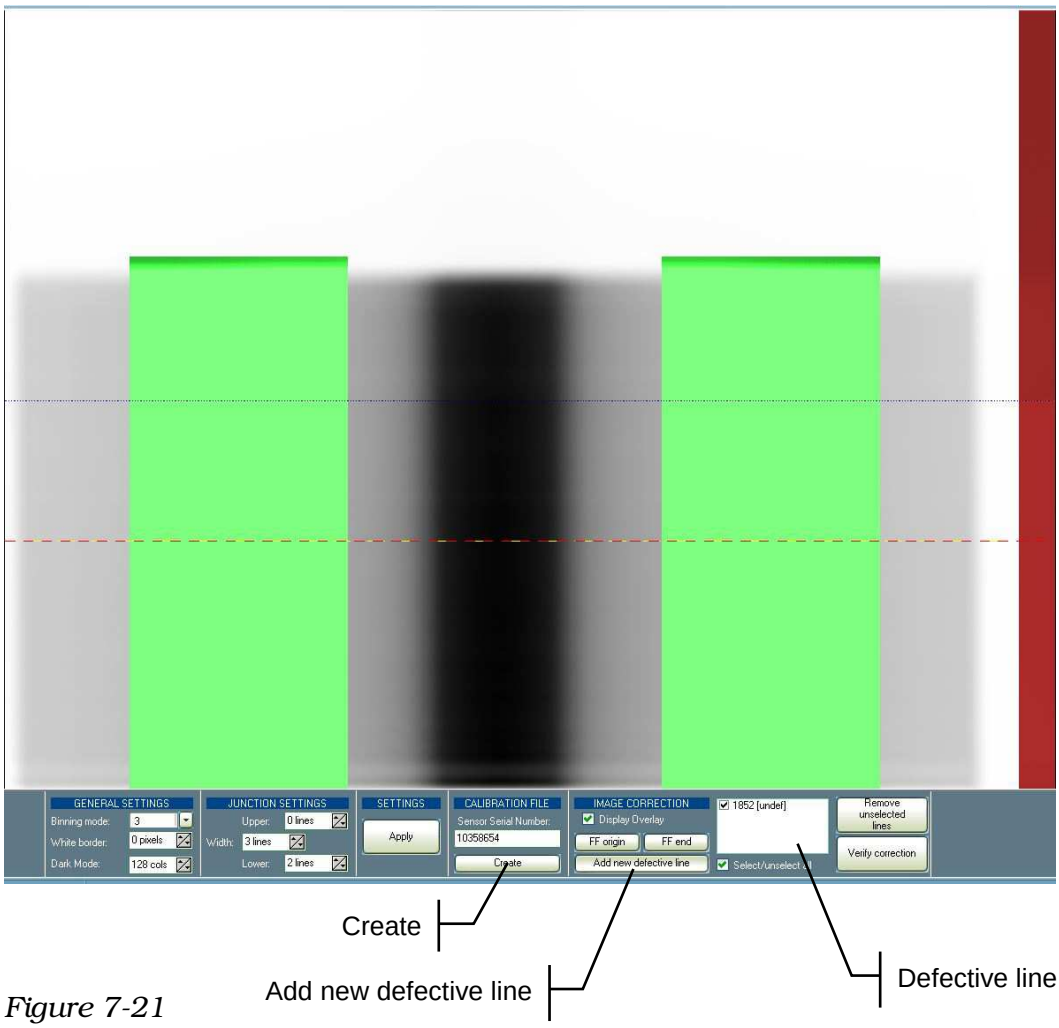


Figure 7-21

2. Press button "Add new defective line" (Figure 7-21) to add the selected defective line to the relevant list.

3. Repeat point 1 and 2 for any defective line.

4. The following operations can be done on the defective lines added to the list:
- select/unselect the single defective line
- select/unselect all the defective lines
- remove unselected lines.

5. Press button "Create" (Figure 7-21), then "Save" to create (or replace if already present) the calibration file.

7.4. Verification of exposure time parameters

kVp and time can be measured directly (invasive method) on the Generator board (A10); this method has higher accuracy than the so called non-invasive mode. The system accuracy is guaranteed by this measuring method.

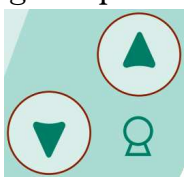
NOTE:
If the following actions are performed during maintenance some covers have to be removed:

a. Remove the outer covering of the H.F generator placed on the rotating arm.

b. Remove the protection grid of the Generator board.

WARNING:
The Generator board has a working voltage of about 400V.

The exposure parameters can be checked with the procedure described:

1. Power OFF and ON the unit: the display shows the starting image for about 1 minute. After this time the "Ready for X-ray" and the "X-ray emission" LEDs blink two times and on the display will be present the Villa logo.
During this phase, press the column up and column down keys  simultaneously and hold them pressed. After 3 seconds, the setup display will be visualized (Figure 3-7).

2. Using the scroll right (25) and scroll left (24) keys  to change the message displayed until the following menu is displayed:

" SERVICE MENU
TROUBLESHOOTING "

Pressing the key "Patient Entrance" (6)  the next message is displayed:

" SET UP
PASSWORD? 100 "

3. Using the increase/decrease (22/23) keys, set the password equal to 112 and confirm with the key "Patient Entrance" (6).

4. Using the scroll right (25) and scroll left (24) keys  go to the "RX EMISSION" menu and confirm with the key "Patient Entrance" (6).
At the selection of the X-ray emission test, the display will show the following message:

" 74kV 08mA 1.00s
X-RAY EMISSION "

WARNING:
From now, the emission is enabled; it starts with the X-ray button press, so take care of this situation.

Pressing the "P" (26) key  , it is possible to choose a different combination of parameters. Once pressed, the display will show:

">74kV 08mA 1.00s
X-RAY EMISSION "

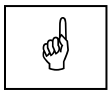
Where the symbol ">" is showing the parameter to be changed; in this case the kV. To move to mA and exposure time, press parameter changes key once or twice again.

In this situation, the increase (22) key and the decrease (23) key  will change the parameter.

Pressing the X-ray button will start the emission.

The allocable values for exposure parameters are on the following table

Parameter	Minimum value	Maximum value
kV	6	86
s	0,2	15
mA	6	12



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

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.

7.4.1. kVp

Use a multimeter (R input >= 10MΩ) in working conditions VDC and end of scale 5/10V (maximum value 4.3 V); position the cold pole on TP40 (GND) and the hot pole on TP44 (kV) on the Generator board (A10). Set the following parameters: 60kV-6mA-3s.
Perform an exposure and considering that the ratio between the value on the voltmeter and high voltage is 1V= 20kV, verify that the value indicated by the multimeter ranges from 2.85÷3.15 V (3V±5%).

Should this last value be outside the specified limit, detect the "set kV" voltage supplied by CPU, connecting the voltmeter between TP40 GND test points and TP46 kV (set nearby X57). The value on these points must range from 2.7 and 3.3 V (3V$\pm$3%). If it is out of tolerance replace the Generator CPU board (A9), otherwise replace the Generator board.

Measured values for different set values are contained in the following table.

kV	Nominal value	Minimum value	Maximum value
60	3	2.85	3.15
70	3.5	3.325	3.825
80	4.0	3.8	4.2
86	4.3	4.085	4.515

If all measures are within the specified range, and there is an evidence of a performance loss, measure the high voltage supplied by the tubehead, and the exposure time using a non-invasive kilovoltmeter with $\leq$ $\pm$3kVp tolerance. 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 Generator CPU board.

7.4.2. mA Check

Use a multimeter (R input >= 10MΩ) in working conditions VDC and end of scale 5/10 V (maximum value 4VDC), position the cold pole on TP40 (GND) and the hot pole on TP29 (mA). Set the following parameters: 60kV-6mA-3s.
Perform an exposure and considering that a ratio 1V DC ≈ 3 mA, verify that the value indicated by the multimeter ranges from 1.86÷2.138V (6mA±8%).
Set 80kV - 12mA - 3s. The value read must range from 3.643 to 4.276 V (12mA±8%).

Measured valued for different set values are contained in the following table.

mA	Nominal value	Minimum value	Maximum value
6	1.98	1.822	2.138
7	2.31	2.125	2.495
8	2.64	2.429	2.851
9	2.97	2.732	3.208
10	3.30	3.036	3.564
11	3.63	3.340	3.920
12	3.96	3.643	4.277

In case the detected values are outside these ranges, check that the voltage between TP40 (GND) and TP34 (ma) is contained on the above ranges. If not, replace the Generator CPU board (A9).

7.4.3. Time

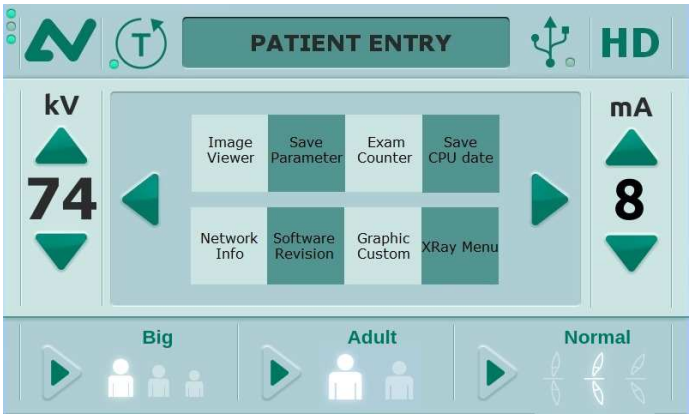
Verify the accuracy of the exposure time using an oscilloscope connected at the same test points used to measure mA (TP40 for GND and TP29 mA) of the Generator board (A10). The exposure time calculated at about 75% of the maximum kV value, must correspond to the set one $\pm$10%. In case the time is outside the prescribed values, replace the CPU.

7.5. Storing of automatic exposure parameters

The pre-set technical exposure factors can be varied according to the needs of the user, or the aim for somewhat contrasted images.

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

1. Select the examination, the type of patient and the size to be modified.
2. Press any of the increase (3)  or decrease (4)  arrows to modify the kV and/or mA parameters to suit your needs; the values change their color from black to green.
3. Press the key "Service Menu" (18)  ; the following image will be displayed:



4. Press the "Save Parameter" key to store the modified parameters for the examination and type and size of patient you have selected.
5. After pressing the key, the display will show the following message:

" SAVE THE NEW PARAMETERS?
Y=PRESS >0<; N=PRESS T "

Press the "Patient Entrance" (6) key  to confirm or the "Test" (5) key  to cancel the setting.

Pressing key (18)  the unit will return to standard mode.

7.5.1. Table of pre-set anatomic parameters

PANORAMIC

	Adult	Child
Small	70 kV 8 mA	66 kV 8 mA
Medium	74 kV 8 mA	68 kV 8 mA
Large	76 kV 8 mA	70 kV 8 mA

TMJ open/close mouth

	Adult	Child
Small	70 kV 8 mA	62 kV 8 mA
Medium	74 kV 8 mA	66 kV 8 mA
Large	78 kV 8 mA	70 kV 8 mA

SINUS

	Adult	Child
Small	68 kV 8 mA	64 kV 8 mA
Medium	72 kV 8 mA	66 kV 8 mA
Large	74 kV 8 mA	68 kV 8 mA

CEPHALOMETRY (L.L.)

	Adult	Child
Small	74 kV 8 mA	72 kV 8 mA
Medium	76 kV 8 mA	64 kV 8 mA
Large	78 kV 8 mA	66 kV 8 mA

CEPHALOMETRY (A/P - P/A)

	Adult	Child
Small	76 kV 12 mA	74 kV 12 mA
Medium	78 kV 12 mA	76 kV 12 mA
Large	82 kV 12 mA	78 kV 12 mA

Maxilla IMPLANT

	Tooth 11/21	Tooth 12/22	Tooth 13/23	Tooth 14/24	Tooth 15/25	Tooth 16/26	Tooth 17/27	Tooth 18/28	
Small	9.20	9.20	9.20	9.20	7.30	7.30	7.30	7.30	s
	62	62	68	68	64	64	64	64	kV
	8	8	8	8	8	8	8	8	mA
Medium	9.20	9.20	9.20	9.20	7.30	7.30	7.30	7.30	s
	62	62	72	72	66	66	66	66	kV
	8	8	8	8	9	9	9	9	mA
Large	9.20	9.20	9.20	9.20	7.30	7.30	7.30	7.30	s
	62	62	74	74	68	68	68	68	kV
	8	8	9	9	10	10	10	10	mA

Mandible IMPLANT

	Tooth 31/41	Tooth 32/42	Tooth 33/43	Tooth 34/44	Tooth 35/45	Tooth 36/46	Tooth 37/47	Tooth 38/48	
Small	9.20	9.20	9.20	9.20	7.30	7.30	7.30	7.30	s
	62	62	62	62	68	62	62	62	kV
	8	8	8	8	8	8	8	8	mA
Medium	9.20	9.20	9.20	9.20	7.30	7.30	7.30	7.30	s
	62	62	62	64	70	64	64	64	kV
	8	8	8	9	9	9	9	9	mA
Large	9.20	9.20	9.20	9.20	7.30	7.30	7.30	7.30	s
	62	62	62	66	72	66	66	66	kV
	8	9	9	10	10	10	10	10	mA

7.5.2. Touch screen calibration

To calibrate the touch screen of the control panel, proceed as follow:

1. Create in an USB Pen Drive a file named "calib" (without extension).
2. With the unit switched OFF, insert the USB Pen Drive in the USB port of the control panel.
3. Switch ON the unit: the touch screen will start automatically in calibration mode and the followng image will be displayed:

4. Tap with a finger on the crosshair symbol displayed alternatively in different positions of the screen. After the last point has been touched, the unit will automatically start in standard mode.
5. Un-mount the USB Pen Drive pressing key (17)  : the USB Pen Drive can be removed when the key LED switch OFF.

8. TROUBLESHOOTING

8.1. LEDs

8.1.1. Generator board A10 LED

The following table shows the LED that are present on the Generator board, their significance and the recommended corrective actions in case of defects. To locate the LEDs, refer to the layout of the Generator board illustrated in chapter 9, drawing 13, of this manual:

LED	Status of the LED under normal conditions	Corrective actions in case of defect
H1	ON	Check fuse F1 and F2 on the Generator board. - If they are not blown, check the line voltage to the board and to the unit. Replace the Generator board if the line voltage is present and OK. - If blown, replace with new ones respecting the value and types; perform a new exposure and check if they blow again. If they blow, check, on the Generator board, if V6 and/or V31 and V36 are short-circuited and in this case replace the tubehead and Generator board. If not short circuited, replace the tubehead.
H2	ON	As per H1 above.
H3	ON	If OFF, check fuse F3 of the Generator board. - If not blown, replace the Generator board. - If blown, replace it with a new one of the same value and type, make another exposure and, if it will blow again, replace the Generator board.
H4	OFF	Check that connector X53 of the board is well inserted. Power off the unit and power it ON again after few seconds; if the LED will glow again (it may take some seconds), replace the Generator CPU board and then the Generator board.
H5	OFF (ON during emission)	Check the correct insertion of X53 and X57; if it is correct, replace the tubehead, otherwise insert it correctly and make another exposure. Replace the tubehead if it will glow again.
H6	OFF	As per H5 above.

8.1.2. CPU board A5 LED

The following table shows the LED that are present on the CPU board A5, their significance and the recommended corrective actions in case of defects. To locate the LEDs, refer to the layout of the CPU board A5 illustrated in chapter 9, drawing 4, of this manual:

LED	Function	Status of the LED under normal conditions	Corrective actions in case of defect
H2	"+5V" presence generated inside the CPU	ON	Verify that motors cables and zero position sensor cables are well inserted and not in short-circuit to ground.
H3	"+3.3V" presence generated inside the CPU	ON	Replace the CPU.
H4	"Laser power supply" presence	ON	Verify that lasers cables are well inserted and not in short-circuit to ground.
H5 + H6	"CAN-BUS" status	Blinking	Disconnect one-to-one CAN-BUS cables (see actions for LEDs from H7 to H10) and verify in which case the LEDs start blinking; verify the relative cable. Otherwise replace the Microprocessor board A6.
H7	"Column CAN-BUS" device	OFF	If blinks, check the X11 cable on both side. If it is OK, replace the column CPU board A1.
H8	"Keyboard CAN-BUS" device	OFF	If blinks, check the X18 cable on both side. If it is OK, replace the Keyboard PCB A4.
H9	"CPU Generator CAN-BUS" device	OFF	If blinks, check the X20 cable on both sides. If it is OK, check that the Generator CPU board A9 is powered ON; if it is OFF, verify the presence of 230V on the filter L2 on Generator board A10 and verify the status of the LED H3 (see paragraph 8.1.1). If all the previows checks are positive, replace the Generator CPU board A9.
H10	"DSPU CAN-BUS" device	OFF	If blinks, check the cable between DSPU and cannectors X42 / X21 and the cable X43 on both sides. If they are OK, replace the DSPU board.
H12	"Motor power supply" presence	ON	Check fuse F1: if blown, replace with new one respecting the value and types. If it blows again, replace the CPU.

NOTE:
If all the LEDs are OFF, verify the column fuse F3; if it is OK, verify cable X11 between column CPU board A1 and CPU board A5, on both sides. Verify the column CPU board A1.

8.2. Displayed messages

Rotograph EVO D 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 "Patient entrance"

(6)  when a movement is in progress.

This message will be displayed as follows:

" ERROR: xxx PRESS >0< "

Operating conditions are reset by pressing key (6)  .

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:

" ERROR: xxx CALL TECH SUPP "

3 - Messages related to problems regarding the Generator board (A10). 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.

" ERROR: xxx POWER OFF "

The error messages are divided into different areas that can be distinguished by the error number; the following table contains the different errors with meanings.

Main CPU board (A5)		
Code	**Error description**	**Reference chapter**
108	Hardware key A13 fault or missing	**8.2.1.1**
110	Main CPU board battery low or fault	**8.2.1.2**
124	System setting error	**8.2.1.3**
Rotation motor		
Code	**Error description**	**Reference chapter**
200	Zero position optical sensor of rotation axis always activated	**8.2.2.1**
201	Zero position optical sensor never activated	**8.2.2.1**
204	Unexpected activation of rotation optical sensor	**8.2.2.1**
205	Timeout on rotation	**8.2.2.2**
206	Patient collision	**8.2.2.3**
Y motor		
Code	**Error description**	**Reference chapter**
240	Zero position micro Y always active	**8.2.2.4**
241	Zero position micro Y never active	**8.2.2.4**
242	Unexpected activation of Y axis	**8.2.2.4**
243	Timeout on Y axes	**8.2.2.4**
Ceph digital Sensor		
Code	**Error description**	**Reference chapter**
280	Unexpected activation of optical sensor Ceph Sensor	**8.2.2.5**
281	Timeout on ceph sensor optical sensor	**8.2.2.5**
282	Sensor ceph micro never active	**8.2.2.5**
283	Sensor ceph micro always active	**8.2.2.5**
Secondary collimator on Digital CEPH		
Code	**Error description**	**Reference chapter**
300	Unexpected activation of optical sensor secondary collimator	**8.2.3.1**
301	Timeout on ceph secondary collimator	**8.2.3.1**
302	Secondary collimator micro never active	**8.2.3.1**
303	Secondary collimator micro always active	**8.2.3.1**

Primary slit collimator		
Code	**Error description**	**Reference chapter**
320	Unexpected activation of optical sensor primary collimator for CEPH	**8.2.3.2**
321	Timeout on primary collimator for CEPH	**8.2.3.2**
322	Primary collimator for CEPH micro never active	**8.2.3.2**
323	Primary collimator for CEPH micro always active	**8.2.3.2**
Sensor holder		
Code	**Error description**	**Reference chapter**
340	Sensor holder not on PAN	**8.2.3.3**
X-ray Controls		
Code	**Error description**	**Reference chapter**
360	RX button pressed on start-up or before exam	**8.2.3.4**
361	Remote RX button pressed on start-up or before exam	**8.2.3.4**
362	RX button released during emission	**8.2.3.5**
364	Sensor connection lost during pre-heating	**8.2.3.6**
365	Sensor connection lost during exposure	**8.2.3.6**
CanBus		
Code	**Error description**	**Reference chapter**
380	Invalid CANBus message	**8.2.3.7**
381	Timeout on activating CAN unit of Generator board (A10)	**8.2.3.8**
382	Generator board (A10) not answering	**8.2.3.8**
Soft Tissue filter		
Code	**Error description**	**Reference chapter**
400	Timeout of zero position optical sensor of STF	**8.2.4.1**
401	STF zero position sensor always active	**8.2.4.1**
Code	**Error description**	**Reference chapter**
420	Wrong setting in PAN + CEPH system configuration	**8.3.3.7**

Generator Board A10		
Code	**Error description**	**Reference chapter**
750	Alarm "power loss" on Generator board	**8.2.5.1**
751	Alarm "overvoltage kV"	**8.2.5.2**
752	Alarm "overload on filament" on Generator board	**8.2.5.3**
753	Alarm "overload anodic current"	**8.2.5.3**
754	Alarm "filament not OK"	**8.2.5.4**
755	Alarm "backup timer"	**8.2.5.6**
756	Alarm "PFC not OK"	**8.2.5.5**
758	Alarm "NO X-ray"	**8.2.5.6**
759	Alarm "unexpected emission"	**8.2.5.6**
760	Alarm "NO RX button command"	**8.2.5.7**
762	Alarm "NO X-ray feed back"	**8.2.5.8**
771	Frame longer that expected	Protocol errors; power off the unit and on again. If error is still present, call Technical Assistance
772	Invalid Analogue channel selection	
773	Unknown command	
774	RX button not pressed on Generator board	**8.2.5.9**
775	RX button released during emission (on Generator board)	**8.2.5.10**
776	Watch dog CAN intervention	Action as per E771
Vertical motor		
Code	**Error description**	**Reference chapter**
800	Timeout on CAN activation for vertical motor	**8.2.6.1**
801	ON/OFF command for vertical motor not changed on planned time	**8.2.6.2**
Keyboard		
Code	**Error description**	**Reference chapter**
850	More than one key pressed on Power on	**8.2.7.1**
851	Column up and/or Column down pressed on power on	**8.2.7.2**
852	Key RESET (patient centering) pressed during movement	**8.2.7.3**

8.2.1. Errors with code from E000 to E199

All these are errors related to the main CPU board (A5) and its internal peripheral.
Power off the unit and, after 1 minute delay, power it ON again; if the error is displayed again, replace the Microprocessor CPU board (A6).

8.2.1.1. E108: Hardware key fault

This error is shown when the firmware of the Rotograph EVO D does not sense the presence of the U.I.C. (Unique Identification Code).
The unique code is read, with is 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 key " Patient entrance "

(6)  allows the system to continue its functioning, but only standard base examination will be possible. Verify the presence of the key and that is well inserted.

In case there is a fault on the hardware key itself, it must be replaced. **All the optional features must be re-enabled with proper codes.** Before requesting a new hardware key, the S/N of the equipment and/or the U.I.C. itself must be recorded and reported to Villa Sistemi Medicali.

8.2.1.2. E110: Battery fault

This message means that the clock battery on main CPU board (A5) is low or fault.
If after the power ON, a 90 second cooling time starts, wait until the end of the time; then the display will show "E110 – Press >0<".
Follow the message shown on the display and perform an examination.
At the end of the examination, power OFF the machine and wait a couple of minutes before powering ON again.

1. If the message is not yet present, it means that the battery is low. Leave the machine powered ON to recharge it.

2. If the message is still present, it means that the battery is fault. Replace the main CPU board (A5).

8.2.1.3. E124: System setting error

This message means that on Password 92, the "ENABLE 3D SENSOR" setting is ON.
To reset the error, proceed as follow:

1. Power OFF and ON again the unit: the message "ERROR 124: CALL TECH SUPP" will be displayed.
2. Press key "Patient entrance" (6)  : the message "ERROR 124: POWER OFF" will be displayed.
3. Press together the keys: "Patient entrance" (6)  , "Centring devices ON" (14)  , "Column up movement" (15)  .
   Wait until the start sequence of the unit will be complete.
4. Switch the unit OFF and ON again and verify that the error is not still present.

8.2.2. Errors with code from E200 to E299

These errors are related to the various axis movements and require the replacement of some parts; only the following error message E206 can be generated by a special condition and can be reset.

8.2.2.1. E200: Zero position optical sensor of rotation always active / E201: Zero position optical sensor of rotation never active / E204: Unexpected activation of zero position rotation sensor

These messages mean that, during the rotation, there is no change or an unexpected activation of the optical sensor B3.
The position of rotation is controlled by the optical sensor B3, that is activated at the start of the rotation travel; if this sensor is found active at the start up phase, and it is never sensed de-activated, the E200 message error is displayed, meaning that the sensor itself is broken or that the motor is not running.
In case that it is never sensed activated, the E201 is displayed, and the reasons are the same.
E204 means that, during some movements, the sensor changes its status to activated in an abnormal condition.

Entering the rotation motor service program it is possible to check the cause of the error.

"T ZERO [ff] a
ZERO OFFS ±eeee "

In normal conditions the display must visualise "X" in place of the character "a".
In all cases, the sensor's functionality can be checked by placing an opaque thin material in the optical path and looking at the voltage coming out from the sensor.
Using the left and right arrows it is possible to rotate the arm, checking if the status of sensor changes accordingly.

1. If there is no variation of the above signals, if the 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 of stepper motor; 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 on the CPU.

2. If the arm moves, verify the cable up to the CPU board (A5). If it still continues to have no variation of the signals when there is an activation of the switches, change the CPU board.

8.2.2.2. E205 Timeout on rotation

This message means that no change on the rotation's signal is detected; please follow the steps described above.

8.2.2.3. E206 Patient collision

It is caused by a possible collision between the patient and the rotating arm. After having the patient removed from the system, press the patient centering key to restart the power on procedure to correctly set the unit.

If the error message is again displayed, there is a fault on the rotation sensing circuit and perform the following steps:

1. Check that rotation motor M3 is rotating; if not, check the cable from the motor to Rotation Group board (A7), connector X61 up to the main CPU board (A5), connector X25/X25.
2. If the motor is running, check the optical sensor B2 and its cables to X60 of A7 up to connector X25/X26 of main CPU board (A5). Replace the sensor or the faulty cables.

8.2.2.4. E240: Zero position sensor for Y axes always active / E241: Zero position sensor for Y axes never active / E242: Unexpected activation of Y axes / E243: Timeout of Y axes

These errors are signalling a problem on the Y axis movement.

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

"T ZERO [ff] a
ZERO OFFS ±eeee "

In normal conditions the display must visualize "X" instead of the character "a".

Using the left and right arrows it is possible to rotate the arm, checking if the status of the sensor changes accordingly.

1. If there is no variation of the above signal, if the 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 of the Y axes motor; 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.

2. If there is no variation of the above signal and the arm moves, verify the cable from the optical sensor up to the CPU board (A5). 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 cable X28 into connector X26 on CPU board (A5).

8.2.2.5. E280: Unexpected activation of zero position sensor on CEPH / E281: Timeout of zero position sensor on CEPH / E282: Zero position sensor for CEPH never active / E283: Zero position sensor for CEPH always active

All the messages refer to the optical barrier that is sensing the zero position of the Digital Ceph sensor holder; differences between their meanings are that the first one (E280) may occur during the examination, meaning that the senor activation has occurred before the expected time. This can be caused by the loss of motion of the stepper motor due to a collision with the patient or a fault of the motor stepper driver.
In case that no collision has been observed or the message is frequently displayed, follow the procedure.

The last 3 messages are displayed during the power on phase, when the system is controlling the functionality of the whole system.
E281 and E282 mean that the zero position sensor is never activated; due to a motor not running or to a fault of the optical barrier (the sensor or its harness); E283 means that this sensor is always activated. Also in this case the fault can be the motor or the optical barrier.

- Check that during the power on phase there are movements on these axes; the normal motion is going to engage the sensor and a reverse motion to disengage it. If no motion is observed, the fault can be the stepper motor or the cable connecting it to the main CPU. Check that the cables between the motor M9 and X6 of board A12 is well inserted, as for the cable X1-X2 of A12 to X23, X24 and X34 of the main CPU A5
- Check continuity of the above cables, from M9 to board A12 and from X1-2 of board A12 up to X23, X24 and X34 of the main CPU (A5)
- Repeat the power on sequence, verifying the motion.

If still there is no motion, replace the stepper motor and, if not fixed, replace the CPU.

If a motion has been observed, but messages are displayed, this can be the sensor or its wiring:

- Power off the system and try to manually disengage the sensor, taking care of a smooth motion.
- Power on the system and check the functioning of the sensor, measuring the DC voltage on the terminal of the sensor B10, with and without an obstacle manually inserted. A variation of about 3.5 V minimum should be observed. If not, replace the sensor.
- If the variation is observed and the message still continues to be displayed, check the correct insertion of cable X5 on A12 board and from X1-2 of the board up to X23, X24 and X34 of the main CPU; check the continuity of the interested wires and replace the faulty one (if any).
- If all cables are OK, the fault is on the CPU, so replace it.

8.2.3. Errors with code from E300 to E399

8.2.3.1. E300: Unexpected activation of zero position sensor on secondary CEPH collimator / E301: Timeout of zero position sensor on secondary CEPH collimator / E302: Zero position sensor for secondary CEPH collimator never active / E303: Zero position sensor for secondary CEPH collimator always active

The X-ray beam coming out from the tube head assembly is collimated to the area under exam by a secondary collimator that is moving synchronously with the CEPH sensor holder; this collimator is moved by a stepper motor M8.
All the above messages refer to this mechanism; all the considerations above described for E280 to E283 for patient's collision.

In case of absence of collision between the secondary collimator and the patient, the cause can be a fault on motor M8 and/or optical sensor barrier B11.

- Check that during the power on phase there are movements on these axes; the normal motion is going to engage the sensor and a reverse motion to disengage it. If no motion is observed, the fault can be the stepper motor or the cable connecting it to the main CPU (A5). Check that the cables between the motor M8 and X4 of board A12 is well inserted, as for the cable X1-X2 of A12 to X23, X24 and X34 of the main CPU.
- Check continuity of the above cables, from M8 to X4 board A12 and from X1-2 of A12 up to X23, X24 and X34 of the main CPU A5.
- Repeat the power on sequence, verifying the motion.

If still there is no motion, replace the stepper motor and, if not fixed, replace the CPU.

If a motion has been observed, but messages are displayed, this can be the sensor or its wiring.

- Power off the system and try to manually disengage the sensor, taking care of a smooth motion.
- Power on the system and check the functioning of the sensor, measuring the DC voltage on the terminal of the sensor B11, with and without an obstacle manually inserted. A variation of about 3.5 V minimum should be observed. If not, replace the sensor.
- If the variation is observed and the message still continues to be displayed, check the correct insertion of cable X3 on A12 board and from X1-2 of the board up to X23, X24 and X34 of the main CPU; check continuity of the interested wires and replace the faulty one (if any).
- If all cables are OK, the fault is on the CPU, so replace it.

8.2.3.2. E320: Unexpected activation of zero position sensor on primary collimator/ E321: Timeout of zero position sensor on primary collimator / E322: Zero position sensor for CEPH never primary collimator / E323: Zero position sensor for CEPH always active collimator

All the messages refer to the optical barrier that is sensing the zero position of the primary beam collimator, that is moved by a stepper motor. This mechanism is located in front of the tube head assembly. The slit collimator does not move during the PAN examination, while it has a scanning motion during Ceph exams, synchronously with the secondary collimator and CEPH sensor holder.

Also in this case, the first one (E320) may occur at the end of an examination, while the system is checking the correctness of the motion, meaning that the senor activation has occurred before the expected time. This can be caused by the loss of motion of the stepper motor.

The last 3 messages are displayed during the power on phase, when the system is controlling the functionality of the whole system.
E321 and E322 mean that the zero sensor position is never activated; due to a motor not running or to a fault of the optical barrier (the sensor or its harness); E323 means that this sensor position is always activated. Also in this case the fault can be the motor or the optical barrier.

- Power off the system and remove the frontal cover of the tubehead assembly.
- Check that during the power on phase there are movements on the primary slit collimator; the normal motion is going to engage the sensor and a reverse motion to disengage it. If no motion is observed, the fault can be the stepper motor M5 or the cable connecting it to the main CPU. Check that the cables between the motor M5 and X64 is well inserted, as for the cable X64 to X29 and X30 of the main CPU A5.
- Check continuity of the above cables, from M5 to X64 and from X64 up to X29 and X30 of the main CPU A5.
- Repeat the power on sequence, verifying the motion.

If still there is no motion, replace the stepper motor and, if not fixed, replace the CPU.

If a motion has been observed, but messages are displayed, this can be the sensor or its wiring.

- Power off the system and try to manually disengage the sensor, taking care of a smooth motion.
- Power on the system and check the functioning of the sensor, measuring the DC voltage on the terminal of the sensor B8, with and without an obstacle manually inserted. A variation of about 3.5 V minimum should be observed. If not, replace the sensor.

- If the variation is observed and the message still continue to be displayed, check the correct insertion of the cable from the sensor B8 to X58 and from that connector to X31 of the main CPU A5; check continuity of the interested wires and replace the faulty one (if any).
- If all cables are OK, the fault is on the CPU, so replace it.

8.2.3.3. E340: Sensor holder not in PAN position

An examination requiring the sensor holder in PAN position has been selected, but it is not sensed in the proper position.

Close the PAN sensor holder to its position and press the Patient centering key to restart the power on procedure.

If this does not reset the error message:

- Check the proper function of optical sensor B6.
- Check continuity of cables from optical sensor to A8 board, connector X48, and from that board to main CPU board (A5), connector X33.

8.2.3.4. E360 and E361: X-ray button pressed during power on

This message is displayed if, during the power on procedure, the X-ray button, local (E360) or remote (E361) have been sensed as pressed. Release the button if it was pressed: the error condition is reset powering off the unit and on again.
If the error is still present, check the continuity of cables of the interested button. For the local one, S8, it is connected to X18 of the keyboard and it is transferred to the main CPU using the CANBus cable.

- Check that the cable X18-X18 to the main CPU is well inserted and its continuity.
- From the main CPU, the signal is routed to the Generator board (A10), using the CANBus cable X20-X20; check also that this cable is well inserted and its continuity. Replace it if damaged.
- If the error is still present, check the correct insertion of the flat cable between the Generator CPU board (A9) to the Generator board (A10). The cable is labelled X53-X53; replace it if damaged.

WARNING:
On the Generator board (A10) there are dangerous high voltages, 230 VAC and 400 VDC.
Before accessing the Generator CPU and power board (A9 and A10), it is mandatory to switch off the mains and wait up to 2 minutes in order to allow the discharge of the capacitor.

8.2.3.5. E362: X-ray button released during the examination procedure

X-ray emission is commanded using the technique called "dead man's switch", that means that it must be held pressed down until the end of the emission, also during the interrupted emission phase of TMJ.
If this does not happen, the above error message is displayed; the emission is stopped and all motors released in order to allow for the patient's exit.
Press the reset button and restart the operation as suggested by the control system.

8.2.3.6. E364 and 365: Sensor connection lost

These two messages have the same meaning, that is sensor connection lost, but they occur may have two timing: E364 is generated during pre-heating time, while E365 is generated during exposure.
In both cases, the error can be generated by a bad connection of the sensor: check the electrical connection between sensor and unit (interface board, cables, ecc.).
Check that the IP address is "static" (see paragraph 6.7.2.3).

8.2.3.7. E380: Invalid CANBus message (from Generator CPU board A9)

This error is displayed when the main CPU board (A5) receives an invalid message from the Generator board (A10); that is a message which contents is not listed on the valid data dictionary of the unit.
This can be generated by a bad connection or by a fault of the local Generator CPU board (A9).
Check the CANBus cable X20-X20 and replace it if faulty, otherwise replace the Generator CPU board or then the Generator board.

8.2.3.8. E381: Timeout on activating CAN protocol on Generator board / E382: HF not answering to CAN protocol

These two messages have the same meaning, that is a no answer to main CPU from CAN messages, but their occurring is in different times.
E381 is generated during power on, while E382 is displayed after a regular power on sequence.
In both cases, the error can be generated by a bad connection of the CANBus or a fault on the local Generator CPU board or a fault on the Generator board, so the steps above described for E380 are applied.

8.2.4. Errors with code from E400 to E499

8.2.4.1. E400: Timeout of zero position sensor on Soft Tissue Filter / E401: Zero position sensor for Soft Tissue Filter always active

The Soft Tissue Filter for cephalometric examinations is controlled by the stepper motor. During the power on, the system checks the correctness of the motion, sensing the activation and deactivation of the optical sensor B9. If it is not sensed activated, the timeout message E400 is displayed, while if it is always active, the E401 is displayed.
In both cases, the error can be generated by the loss of movement of the stepper motor or by a fault of the sensor B9.

- Power off the system and remove the frontal cover of the tubehead assembly.
- Check that during the power on phase there are movements on the primary slit collimator; the normal motion is going to engage the sensor and a reverse motion to disengage it. If no motion is observed, the fault can be the stepper motor M6 or the cable connecting it to the main CPU. Check that the cables between the motor M6 and X65 is well inserted, as for the cable X65 to X29 and X30 of the main CPU A5.
- Check continuity of the above cables, from M6 to X65 and from X65 up to X29 and X30 of the main CPU A5.
- Repeat the power on sequence, verifying the motion.

If still there is no motion, replace the stepper motor and, if not fixed, replace the CPU.

If a motion has been observed, but messages are displayed, this can be the sensor or its wiring.

- Power off the system and try to manually disengage the sensor, taking care of a smooth motion.
- Power on the system and check the functioning of the sensor, measuring the DC voltage on the terminal of the sensor B9, with and without an obstacle manually inserted. A variation of about 3.5 V minimum should be observed. If not, replace the sensor.
- If the variation is observed and the message still continues to be displayed, check the correct insertion of the cable from B9 in X33 of the main CPU and the continuity of the connection.
- If all cables are OK, the fault is on the CPU, so replace it.

8.2.5. Errors with code from E700 to E799

WARNING:
Those errors are related to the X-ray generator, so they can be safety related.
In case of Error messages E759 and E755, the system must be immediately powered off, because there is an unexpected emission (E759) or the emission has not been terminated into the expected time.

WARNING:
On the Generator board (A10) there are dangerous high voltage, 230 V AC and 400 VDC.
Before accessing the Generator CPU and power board (A9 and A10), it is mandatory to switch off the mains and wait up to 2 minutes in order to allow the discharge of the capacitor.

8.2.5.1. E750: No power to the Generator board

This message is signalling that the Generator board (A10) is not powered.

Check that if LED H3 of the Generator board is ON; in affirmative case, check connector X53 insertion and insert it correctly. Check the voltage between TP21 and TP22; it should be 10 V DC ± 2 V; if the value is inside the range, replace the Generator CPU board (A9). If the value is zero (or very low), replace the Generator board.
If LED H3 is off, perform the appropriate operations as described in the previous chapter.

8.2.5.2. E751: Over voltage kV

This message is displayed when a value higher than expected has been detected on the Generator board (A10).

Check that connector X57 is well inserted. With the connector inserted, measure the resistance between pins 2 and 4 of connector (harness to tubehead) that should be 13.3k ± 2% while is 14.3k ± 2% between pins 4 and 3 of the same connector; if correct values are measured, replace before the tubehead and, eventually, the Generator board.
If incorrect values are measured, replace the tubehead and then the Generator board.

8.2.5.3. E752: Filament overload / E753: Overload on Anodic current

These messages are displayed when an abnormal value of filament current or anodic current have been detected.

Replace the tubehead and then the Generator board.

8.2.5.4. E754: Broken filament

This message is displayed when there is a fault on the power circuit of the filament, not only the filament itself.

Check that connector X56 is well inserted.
Check the continuity of wires from X57 to the tubehead.
Verify the correctness of pre heating parameters.
If all OK, replace the tubehead.

8.2.5.5. E756: PFC failure

This message is signalling that the PFC (Power Factor Control) circuit is not correctly functioning.

If the error is present in stand-by mode, replace the Generator board (A10).
If the error appears during an exposure, reset the error and repeat the exposure; if the error still appears, replace the Generator board and then the tubehead.

8.2.5.6. E755: Alarm “Backup timer intervention” / E758: Alarm “No X-ray” / E759: Alarm “Unexpected emission”

The correctness of X-ray emission is checked by the Generator board (A10) measuring the anodic current against the set nominal value. When the system is in the idle mode, that is in a non emitting state, this signal must be low, and the Generator CPU board (A9) is checking this condition. If this does not happen, the E759 message is displayed.

When the CPU command for the emission, the X-ray on signal is set to on condition when it reaches the 75% of its set value at the beginning and is higher than 25% at the end of emission.
If the first condition is not met, the exam is halted and the system has to be reset, and the **message E758 "No X-ray"** is displayed.
In this case, check the correct insertions of X56 and X57 between the Generator board to the tubehead and X53-X53 (flat cable) between Generator board (A10) and Generator CPU board (A9).
Check the CANBus connection between the Generator CPU board (A9), and the main CPU A5 (cable X20-X20).
If all connections are OK and the fault is repetitive, same as for LED H1 in paragraph 8.1.1.

If the second condition is not met, that is, the X-ray emission do not fall under the value in a pre set time, the **message E759 "Unexpected emission"** is displayed. This message can be also displayed if the signal X-ray on is sensed during the idle state.
In this case, check the main CPU board (A5) and the Generator CPU board (A9) and the cable X20-X20. If all OK, replace the Generator board.

The emission is controlled also through a safety backup timer that interrupts the power to the tubehead also in case of a fault (hardware or software) to the Generator CPU board. The intervention of the backup timer, **message E755**, is signalled by a lighting of the red LED H4.
This alarm can be reset only by powering off the unit, wait for few seconds and power it on again. If the LED H4 continues to be ON, replace the Generator board.
If the LED, after the power ON is not lighted, repeat an emission and, if the message is appearing again, replace the Generator board.

8.2.5.7. E760: Alarm "NO RX button command"

This message is displayed when the Generator CPU board (A9) is not detecting the RX button during the emission start-up.

In this case, check the correct insertions of X53-X53 (flat cable) between Generator board and Generator CPU board (A9).
Check the CANBus connection between the Generator CPU board (A9) and the main CPU A5 (cable X20-X20).
If the error is still present, check the cable of the RX button. It is connected to X18 of the keyboard and it is transferred to the main CPU.
If all connections are OK and the fault is repetitive, replace the Generator CPU board (A9).

8.2.5.8. E762: Alarm "NO X-ray feedback"

This message is displayed when the Generator CPU board (A9) is not detecting the X-ray emission feedback signal.

In this case, check the correct insertions of X53-X53 (flat cable) between Generator board and Generator CPU board (A9).
Check the CANBus connection between the Generator CPU board (A9) and the main CPU A5 (cable X20-X20).
Check the correct insertion of X56 and X57 between the Generator board to the tubehead.
If all connections are OK and the fault is repetitive, replace the Generator CPU board (A9).

8.2.5.9. E774: RX button not pressed

This error message is displayed when the Generator CPU board (A9) is not detecting the X-ray button pressed also if the main CPU (A5) has commanded the emission with the corresponding CANBus message.
In this case a possible interruption on cable X20-X20 from main CPU A5 to control CPU A9 is possible.

From the main CPU, the signal is routed to the Generator board, using the CANBus cable X20-X20; check also that this cable is well inserted and its continuity. Replace it if damaged.

If the error is still present, check the correct insertion of the flat cable between the Generator CPU board to the Generator board. The cable is labelled X53-X53; replace it if damaged.

8.2.5.10. E775: RX button released during the emission

This message has the same meaning as the corresponding error E362, but it is generated by the Generator CPU board (A9), that is signalling a possible broken connection with the main CPU (A5).
Repeat the test as per error E774 above.

8.2.6. Errors with code E800 and E801

These messages are signalling an error caused on the column movement.

8.2.6.1. E800: Timeout on CAN activation for vertical motor

This error is displayed when there is no answer to main CPU board (A5) from CAN messages during power on.
The error can be generated by a bad connection of the CANBus or a fault on the Column CPU board (A1).

Check the CANBus cable X11-X11 and replace it if faulty, otherwise replace the Column CPU board.

8.2.6.2. E801: ON/OFF command for vertical motor not changed on planned time

This message is displayed when there is a fault on the column movement.

Check that the column movement power supply fuse F4 is not blown.
Check the safety column movement microswitches work correctly, otherwise replace the microswitches assy (microswitch + cable).
CANBus cable X11-X11 and replace it if faulty, otherwise replace the column CPU board.

8.2.7. Errors with code E850, E851 and E852

These messages are signalling an error caused on the operator's interface.

8.2.7.1. E850: More than one button pressed during power on

During the power on phase, the local control board of the keyboard is controlling that during power on no more than 1 button is pressed. Only the case of column up/column down is allowed and used to enter the set up procedure, so if this procedure is started without an explicit request, it means that those buttons are pressed.
In this case, replace the control panel membrane and after the control board.

8.2.7.2. E851: Column up or Column down pressed at power on

This message is signalling that only one of the two buttons is pressed. Release the pressed button and power off the system and power on it again. If the message is displayed again, replace first the keyboard membrane and after the control board.

8.2.7.3. E852: One key pressed during the movement

During the system monuments, the keyboard is inactive, but at the pressure of one button all movements are stopped and this message is displayed.
This is useful in case an abnormal motion is detected, for instance the column does not stop at the release of the corresponding button but still continues to move.
Check if one button has been involuntary been pressed and restart the operation with a new power on procedure.
In case there is a stuck key, one of the previous message E850 and E851 must be displayed, so acts accordingly.

8.3. Service programs descriptions

Rotograph EVO D 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.

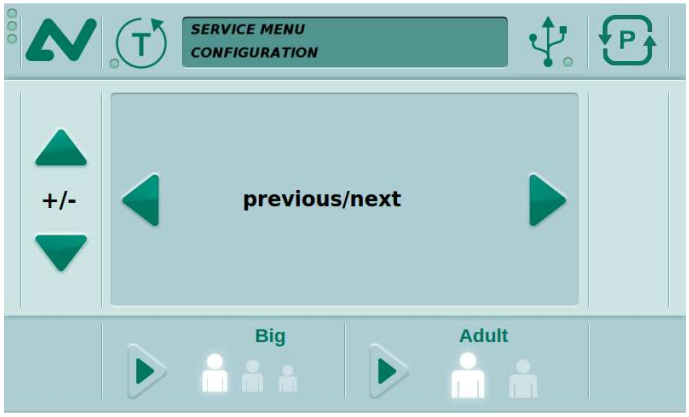
The service programs available are the following:

- ***Password 92:*** Configuration of the system (see paragraph 8.3.3)
- ***Password 112:*** Fault check (see paragraph 8.3.6)
- ***Password 118:*** Test on motors/positioning sensors, setting of the zero offsets of the axes and the collimators (see paragraph 8.3.4)
- ***Password 124:*** Definition of the parameters for the cephalometric examination (see paragraph 8.3.5).

8.3.1. Accessing the service programs

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

5. Power OFF and ON the unit: the display shows the starting image for about 1 minute. After this time the "Ready for X-ray" and the "X-ray emission" LEDs blink two times and on the display will be present the Villa logo.
During this phase, press the column up and column down keys  simultaneously and hold them pressed. After 3 seconds, the setup display will be visualized:



The service menu is directly accessed, but some functions are protected by further password.

6. Using the scroll right and scroll left keys  it is possible to select the service program to be used; the list is as follows:

CONFIGURATION ⇔ AXIS ALIGNMENT ⇔ CEPH SETTINGS ⇔ TROUBLESHOOTING ⇔ SYSTEM ⇔ BURN IN ⇔ SHOW CONFIG ⇔ CONFIGURATION ⇔

Select the desired Service Program and press key  to confirm the selection; for each selection, different operations are possible.

NOTE:
SYSTEM and BURN-IN operations are used only during factory set-up; there are special passwords not accessible to Service Engineers. For this reason, they are not explained on the manual.

8.3.2. General information on the use of keyboard

In all menus of the service programs, the keyboard keys provide the following usage.

 (6)	**Patient centering (>0<)**: is used to confirm the chosen selection or, exiting from a service program going to the upper level of menu. If some parameters have been changed into the quitting service program, it will confirm the changes storing new values on the configuration area. This operation is generally signalled by a specific message on the display.
 (27)	**Test (T)**: it is used to quit a service program, passing to an upper level. It is also used, alternatively to the Patient Centering, to discard the performed changes on the interested parameters. This operation is signalled by a specific message on the display.
	**Left/Right scroll**: are used to scroll into different parameters or menus.
	**Parameter increment and decrement**: are used to change the value of the selected parameter.
	**Adult/Child selection:** is used in Password 124, menu "Rotation offset", to switch between "Rotation zero" and "Sensor zero" settings.
	**Size selection:** is used in Password 124, menu "Rotation offset", to perform an axis zero reset.

8.3.3. Password 92: Configuration menus

When the following menu is displayed,

" SERVICE MENU
CONFIGURATION "

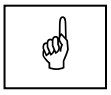
pressing the Patient centering key (>0<) the next message is displayed:

" SET UP
PASSWORD? 100 "

Using the increase/decrease keys  , set the password equal to "92"

and confirm with the Patient centering key  ; now it is possible to access the configuration menus of the following list:

LANGUAGE ⇔ DATE-TIME SET ⇔ DISABLE X-RAY ⇔
MANAGE PANO OPT. ⇔ MANAGE IMPL OPT. ⇔ TOOTH STYLE ⇔
DIGITAL MODE ⇔ COLL SETUP TYPE ⇔ COLL TECHNOLOGY ⇔
STF SETUP TYPE ⇔ SENSOR HANDLING ⇔ COLUMN VERSION ⇔
TSEVO IP ADDRESS ⇔ TSEVO NET MASK ⇔ QSD IP ADDRESS ⇔
QSD NET MASK ⇔ SENSOR 1 IP ADDR ⇔ SENSOR 2 IP ADDR ⇔
XRAY 3D TIME ⇔ XRAY CAL 3D TIME ⇔ ENABLE 3D SENSOR ⇔
ENABLE PAN PLUS ⇔ SKIP SENSOR RDY ⇔ PANO ORDER ⇔
LANGUAGE .....



NOTE:
Of these submenus, QSD IP address, QSD Net mask, XRAY 3D time, XRAY CAL 3D time, Enable 3D sensor and Skip sensor ready are dedicated to 3D system.
Do NOT modify these parameters: functionality can be severely impaired.

The selection is confirmed pressing the Patient centering (>0<) key.
The exit from each menus is performed using the Test (T) button; the value is updated or not by pressing the appropriate button as an answer to the following message:

" UPDATE CHANGES ?
>0< = Y, T = N "

In both cases, the upper level of service menu is reached.

8.3.3.1. Language

In this menu, it is possible to select the language of displayed message of the user's panel (language of service menus is always English) in one of the following:

ENGLISH ⇔ ITALIANO ⇔ FRANCAIS ⇔ DEUTSCH ⇔ ESPANOL ⇔ PORTUGUES ⇔ NETHERLAND ⇔ TURKCE ⇔ CHINESE SEMPL. ⇔ RUSSIAN ⇔ ARABIC SAUDI ARA ⇔ FARSI IRAN ⇔ ENGLISH …

8.3.3.2. Date-Time set

In this menu, it is possible to adjust the internal Real Time Clock (RTC); this RTC is used to check the correctness of the Cooling Down time of the tubehead.

NOTE:
It will take care of standard operation (hour and date change, leap year calculation, etc.) but does not consider Summer Time Hour Changes.

The RTC clock is set at the Factory hour/date (Central Europe date/time) during the final test of the equipment. It is the installer's responsibility to set, if wanted, the local date/time.

Once selected, the following message is displayed:

" SET DATE & TIME
DATE: DD/MM/YEAR "

It is possible to scroll between the date and time set.

Confirming the Date change, the display changes as follows:

" ADJUST DATE
D>XX M YY Y ZZ "

The ">" symbol is signalling which parameter is going to be modified; in this case the day, while the month and year are to be modified if one of the following message is displayed, respectively.

" ADJUST DATE
D XX M>YY Y ZZ "

" ADJUST DATE
D XX M YY Y>ZZ "

8.3.3.3. Disable X-ray

This selection is used to enable or disable the emission; this operation is useful for exhibitions, leaving the unit functioning as in the normal mode.

NOTE:
If the emission is OFF, a warning message will be displayed just after the initial message one and before the TEST message. The display is cleared by pressing the Patient centering (>0<) key.

8.3.3.4. Manage pano opt.

This menu allows to enable the additional Panoramic examination projections; those are enabled only if the protection key match the hardware value.
In case this option has been already enabled, the display will visualize the already stored value, otherwise it will show the default value. In both cases, it is possible to change and set the value according to the protection key received.

" FFFFFFFFFFFFFFFF
VALUE [x] = FF "

Where VALUE[x] is the value assigned to the couple of digits, with "x" ranging from 0 to 7, and "FF" is the hexadecimal value assigned to the specific couple. Using the standard buttons to move into the selected field, set its value equal to the one received for the appropriate position. Values are displayed and changed using a couple of digits, with a variation of one unit for each pressure of the parameter increase/decrease key; the auto repeat function for fast changes is enabled.

8.3.3.5. Manage Impl opt.

This menu allows to enable the Implant examination, that is enabled only if the protection key match the hardware value.
In case this option has been already enabled, the display will visualize the already stored value, otherwise it will show the default value. In both cases, it is possible to change and set the value according to the protection key received.

" FFFFFFFFFFFFFFFF
VALUE [x] = FF "

The values of the first line have to be reset according to the values reported on the document you received with the kit. Such values, expressed in hexadecimal references, are changed in two-digits steps.

1. Using the increase/decrease keys  , set the first couple of digits (VALUE[x]) as reported on the relevant value present in the document you received with the kit.

2. By means of the keys Arrow right/Arrow left  set VALUE[1] and using the increase/decrease keys  , set the second couple of digits equal to the relevant value.

3. Repeat point 2 until VALUE[7].

8.3.3.6. Tooth style

In this menu, it is possible to set the system for EUROPEAN tooth style or AMERICAN tooth style.
After the selection, the display will show the following message:

**"TOOTH STYLE OPT
EUROPEAN STYLE "**

or

**"TOOTH STYLE OPT
AMERICAN STYLE "**

according to the factory setting.

It is possible to change the set value using the increase/decrease keys  .

8.3.3.7. Digital mode

In this menu, it is possible to set the system for digital or film base; the selection is performed using parameter increase/decrease  keys and is confirmed in the usual way.

WARNING:
Changing the set mode will affect the complete system functionality.

8.3.3.8. Collimator setup type

In this menu, it is possible to set the primary collimator type.
After the selection, the display will show the following message:

"COLL SETUP TYPE
CHILD SYSTEM "

or

"COLL SETUP TYPE
PAN ONLY SYSTEM "

or

"COLL SETUP TYPE
PAN-CEPH SYSTEM "

or

"COLL SETUP TYPE
3D SYSTEM "

according to the factory setting.

It is possible to change the set value using the parameter increase/decrease  keys; select "PAN ONLY SYSTEM" for PAN only system or "PAN-CEPH SYSTEM" for PAN ready for Digital CEPH or PAN + CEPH systems (see also paragraph 8.3.3.10).

WARNING:
Wrong setting provides message "Close cassette to Panoramic" at the start-up for PAN only system, or Error 420 for PAN+CEPH system when Cephalometric exam is selected.

8.3.3.9. Collimator technology

WARNING:
Do NOT modify this parameter: functionality can be severely impaired.

In this menu, it is possible to set the primary collimator movement type. After the selection, the display will show the following message:

" COLL TECHNOLOGY
SCREW "

or

" COLL TECHNOLOGY
BELT "

according to the factory setting.

8.3.3.10. STF setup type

NOTE:
If "COLLIMATOR SETUP TYPE" menu (paragraph 8.3.3.8) has been selected on "PAN ONLY SYSTEM", this menu is disabled.
Trying to enter will generate error "E 420"; press Patient centering key  to reset.

In this menu, it is possible to set the Soft Tissue Filter type.
After the selection, the display will show the following message:

" STF SETUP TYPE
3D SYSTEM "

or

" STF SETUP TYPE
WITHOUT SYSTEM "

or

" STF SETUP TYPE
PAN-CEPH SYSTEM "

according to the factory setting.

It is possible to change the set value using the parameter increase/decrease  keys; **select "PAN-CEPH SYSTEM"**.

NOTE:
Wrong setting affect the system's functionality.

8.3.3.11. Sensor handling

NOTE:
For PAN only system, changes on this menu do not have any effect on system functionality.

This menu allows to set the system for 1 mobile sensor or 2 fixed sensors configuration.
After the selection, the display will show the following message:

" SENSOR HANDLING
SENSOR IS MOBILE "

or

" SENSOR HANDLING
SENSOR IS FIXED "

according to the factory setting.

It is possible to change the set value using the parameter

increase/decrease  keys; select "SENSOR IS MOBILE" for 1 sensor

configuration or "SENSOR IS FIXED" for 2 fixed sensors configuration.

WARNING:
Wrong setting provide operative messages not consistent with the equipment configuration.

8.3.3.12. Column version

WARNING:
Do NOT modify this parameter: functionality can be severely impaired.

This menu is still working in the background and not yet available.

8.3.3.13. TSEVO IP address

It is the static IP address assigned to the touch screen, that is used enabling the communication with the others network elements (Sensor and external PC). The default set value for IP address is 192.168.005.045.

8.3.3.14. TSEVO NET mask

The default NET mask 255.255.255.000 hasn't to be modified.

8.3.3.15. Sensor 1 IP address

It is the static IP address assigned to the Sensor 1, that is used enabling the communication with the others network elements (touch screen and external PC). The default set value for IP address is 192.168.005.099.

NOTE:
DO NOT modify the sensor IP address.

8.3.3.16. Sensor 2 IP address

It is the static IP address assigned to the Sensor 2, that is used enabling the communication with the others network elements (touch screen and external PC). The default set value for IP address is 192.168.005.100.

NOTE:
DO NOT modify the sensor IP address.

8.3.3.17. Enable PAN plus

This menu is used to increase the panoramic spine compensation. After the selection, the display will show the following message:

"ENABLE PAN PLUS
PAN PLUS IS ON "

or

"ENABLE PAN PLUS
PAN PLUS IS OFF "

according to the factory setting.

It is possible to change the set value using the parameter increase/decrease  keys.

8.3.3.18. Pano order

In this menu, it is possible to set the most used Panoramic trajectory type.
After the selection, the display will show the following message:

"PANO ORDER
EVO + STANDARD "

or

"PANO ORDER
STANDARD + EVO "

or

"PANO ORDER
EVO "

or

"PANO ORDER
STANDARD "

according to the factory setting.

It is possible to change the set value using the parameter

increase/decrease  keys.

In case both trajectory (EVO + Standard or Standard + EVO) are enabled, the operator will have the possibility to select one of the two trajectory, but depending on the trajectory sequence, all EVO XP programs will refer to the first trajectory.
Selecting single trajectory (EVO or Standard), only the selected one will be enabled to the user.

8.3.4. Password 118: Axis alignment menu

When the following menu is displayed,

" SERVICE MENU
CONFIGURATION "

Using the left/right scroll key is possible to change the message, use the keys until to the following message is visualized:

" SERVICE MENU
AXIS ALIGNEMENT "

Pressing the Patient centering (>0<) key the next message asking for the correct password is shown.

" SET UP
PASSWORD? 100 "

Using the increase/decrease key  , set the password equal to "118"

and confirm with the Patient centering key  . Before entering the relevant menu, the system centering functions are performed; those operations can be interrupted, if needed, by pressing once again the Patient centering (>0<) key.

NOTE:
Interruption of this operation must be performed only in case those functions are used to check some hardware faults. If the system needs to be centered, the operation must be completed.

Once the operation is finished (or interrupted), it is possible to access the following list of submenus:

ROTATION ZERO ⇔ Y AXIS ZERO ⇔ Y AXIS ZERO EVO ⇔
Y AXIS ZERO BW ⇔CASSETTE ZERO ⇔ PR. COLL. PAN ⇔
PR. COLL. 3D ⇔ROTATION ZERO ..

NOTE:
Of these submenus, PR. COLL. 3D is dedicated to 3D system.
Do NOT modify this parameter: functionality can be severely impaired.

The selection is confirmed pressing the Patient centering (>0<) key.

The exit from each menus is performed using the Test (T) button; the value is updated or not by pressing the appropriate button as an answer to the following message:

" UPDATE CHANGES ?
>0< = Y, T = N "

In both cases, the upper level of service menu is reached.

WARNING:
Changes to one or more offset values affect the system's functionality, so take care to not alter those values if not needed. Normally only the replacement of faulty parts (motors, belts, zero optical sensors, etc.) will require to act on those data.

8.3.4.1. Rotation zero

In this menu, it is possible to set the offset of rotation axis in order to set the correct starting value of emission.
Once the Patient centering (>0<) key is pressed, the following message is displayed:

"T ZERO [YY] a
ZERO OFFS ±xxxxx "

where:

- "YY" is the stepper motor speed, that can be changed using the parameter increase/decrease  keys.
- "a" is the status of the zero optical barrier; 1 means engaged (i.e. barrier interrupted), 0 otherwise.
- "xxxxx" is the current value of the offset, that can be changed with the left/right  keys.

8.3.4.2. Y Axis zero

This function allows the set of the offset of Y axis for Panoramic STD, the motion along mid sagittal plane of the patient, in order to place the correct position of the central path.
Once the Patient centering (>0<) key is pressed, the following message is displayed:

"Y ZERO [YY] a
ZERO OFFS ±xxxxx "

where:

- "YY" is the stepper motor speed, that can be changed using the parameter increase/decrease  keys.
- "a" is the status of the zero optical barrier; 1 means engaged (i.e. barrier interrupted), 0 otherwise.
- "xxxxx" is the current value of the offset, that can be changed with the left/right  keys.

8.3.4.3. Y Axis zero Evo

NOTE:
This setting is strictly connected to the "Y Axis zero" parameter.
The "Y Axis zero Evo" offset value must be +660.
Before perform any adjustment on this parameter, be sure that the "Y Axis zero" setting has been properly set.

This function allows the set of the offset of Y axis for EVO Panoramic, the motion along mid sagittal plane of the patient, in order to place the correct position of the central path.
Once the Patient centering (>0<) key is pressed, the following message is displayed:

" Y ZERO [YY] a
ZERO OFFS ±xxxxx "

where:

- "YY" is the stepper motor speed, that can be changed using the parameter increase/decrease  keys.
- "a" is the status of the zero optical barrier; 1 means engaged (i.e. barrier interrupted), 0 otherwise.
- "xxxx" is the current value of the offset, that can be changed with the left/right  keys.

8.3.4.4. Y Axis zero BiteWing

WARNING:
Do NOT modify this parameter: functionality can be severely impaired.

This function allows the adjustment of the Bitewing Y axis offset.
Once the Patient centering (>0<) key is pressed, the following message is displayed:

"Y ZERO [YY] a
OF ±xxxx ±yyyyyy "

8.3.4.5. Cassette zero

This function is not active on the digital mode; if selected it will generate an error message.

8.3.4.6. Primary collimator PAN

WARNING:
In this menu the emission is enabled; it starts with the X-ray button press, so take care of this situation.

This function allows to center the offsets of the linear slit collimator. Once the Patient centering (>0<) key is pressed, the following message is displayed:

" PCC ZERO [YY] a
ZERO OFFS ±xxxxx "

where:

- "YY" is the stepper motor speed, that can be changed using the parameter increase/decrease  keys.
- "a" is the status of the zero optical barrier; 1 means engaged (i.e. barrier interrupted), 0 otherwise.
- "xxxxx" is the current value of the offset, that can be changed with the left/right  keys.

This function is used to check the beam alignment; the emission is started by the X-ray button pressing and the exposure parameters can be set by pressing the key  ; when it has been pressed, the normal change procedure to set manual exposure parameters is followed.

NOTE:
The position of the primary slit is set to the correct value during the factory final test; changes on the stored value must be done only in case of:

- Replacement of one part of the linear slit collimator (motor, zero barrier sensor, etc.); in this case the beam must be aligned to the sensor entrance acting on the offset value.
- Replacement of a defective tubehead; in this case, the beam aligned moving the tubehead **leaving the offset value unchanged.**

8.3.5. Password 124: CEPH settings

NOTE:
The complete procedure to enter in password 124 is described on paragraph 7.2.2 and following.

When the following menu is displayed:

" SERVICE MENU
CEPH SETTINGS "

Pressing the Patient centering (>0<) key the next message is displayed, asking for the correct password.

" SET UP
PASSWORD? 100 "

Using the increase/decrease  keys, set the password equal to "124" and confirm with the Patient centering  key. The system will begin the sequence to align the X-ray beam to the Ceph arm.
The operations contained in this menu are useful to enable the Ceph examination and perform all operation to center the Ceph.
Once completed the zeroing, the following message is visualized:

" DIGITAL CEPH
ENABLE SENSOR "

And it is possible to select one of the following operations:

ENABLE SENSOR ⇔ ROTATION OFFSET ⇔ CEPH S.COL. ZERO ⇔
STF ZERO OFFSET ⇔ CEPH MEAS. UNIT ⇔ Y OFFSET ⇔
LINING UP TEST ⇔ CEPH SENSOR ZERO ⇔ DIGITAL CEPH HD ⇔
SENS EXTRA-RUN ⇔ ENABLE SENSOR …

The selection is confirmed pressing the Patient centering (>0<) key.
The exit from each menus is performed using the Test (T) button; the value is updated or not by pressing the appropriate button as an answer to the following message:

" UPDATE CHANGES ?
>0< = Y, T = N "

In both cases, the upper level of service menu is reached.

8.3.5.1. Enable sensor

This menu is used to enable or disable the digital Ceph examination. After the selection, the display will show the following message:

" DIGITAL CEPH
CEPH IS ENABLED "

or

" DIGITAL CEPH
CEPH IS DISABLED "

according to the factory setting.

It is possible to change the set value using the parameter increase/decrease  keys.

Pressing the  key will quit the menu and the disabled/enabled status is temporarily stored in volatile memory. The system will return to the upper level, that is the Ceph menu where it is possible to proceed with the other operations.

8.3.5.2. Rotation offset

In this menu, it is possible to set the offset of rotation axis in order to set the correct starting value of emission. It is also possible to set the sensor zero offest.
Once the Patient centering (>0<) key is pressed, the following message is displayed:

"T ZERO [YY] a
ZERO OFFS ±xxxxx "

where:

- "T" indicates that you are setting the rotation offset. To change to sensor zero offset setting, use key 

, "s" character will be displayed instead of "T".
- "YY" is the stepper motor speed, that can be changed using the parameter increase/decrease  keys.
- "a" is the status of the zero optical barrier; 1 means engaged (i.e. barrier interrupted), 0 otherwise.
- "xxxxx" is the current value of the offset, that can be changed with the left/right  keys.

NOTE:
Use key 

to reset rotation axis and sensor movements.

8.3.5.3. CEPH secondary collimator zero

This menu allows to adjust the zero offset for the secondary collimator (the collimator that is used to limit the X-ray beam before patient on CEPH).
Once the Patient centering (>0<) key is pressed, the following message is displayed:

"c ZERO [YY] abcd
ZERO OFFS ±xxxxx "

where:

- "YY" is the stepper motor speed, that can be changed using the parameter increase/decrease  keys.
- "xxxxx" is the zero offset actual value, that can be changed with the left/right  keys.
- "abcd" represents the status of various optical barrier sensors; "a" is the one of the secondary collimator, that is 0 when not engaged and 1 otherwise.

8.3.5.4. STF zero offset

This program is used to adjust the offset of the Soft Tissue motorized filter.

8.3.5.5. CEPH measuring unit

In this menu, it is possible to set the Ceph exam format selection in "CM" or "INCH".
After the selection, the display will show the following message:

**" CEPH MEAS. UNIT
METER "**

or

**" CEPH MEAS. UNIT
INCHES "**

according to the factory setting.

It is possible to change the set value using the increase/decrease keys  .

8.3.5.6. Y Offset

WARNING:
Do NOT modify this parameter: functionality can be severely impaired.

This function allows the set of the offset of Y axis, the motion along the mid sagittal plane of the patient, but its function is to center the X-ray beam on the ceph sensor. Once the Patient centering (>0<) key is pressed, the following message is displayed:

" Y ZERO [YY] a
ZERO OFFS ±xxxxx "

where:

- "YY" is the stepper motor speed, that can be changed using the parameter increase/decrease  keys.
- "a" is the status of the zero optical barrier; 1 means engaged (i.e. barrier interrupted), 0 otherwise.
- "xxxxx" is the current value of the offset, that can be changed with the left/right  keys.

8.3.5.7. CEPH sensor zero

In this menu, it is possible to set the offset of rotation axis in order to set the correct starting value of emission.
Once the Patient centering (>0<) key is pressed, the following message is displayed:

" s ZERO [YY] abcd
ZERO OFFS ±xxxxx "

where:

- "YY" is the stepper motor speed, that can be changed using the parameter increase/decrease  keys.
- "xxxx" is the zero offset actual value, that can be changed with the left/right  keys.
- "abcd" represents the status of various optical barrier sensors; "b" is the one of the zero of digital sensor, that is 0 when not engaged and 1 otherwise.

8.3.5.8. Digital CEPH HD

This menu is used to enable or disable the Hight Resolution in digital Ceph examination.
After the selection, the display will show the following message:

"DIGITAL CEPH HD
HD IS DISABLED "

or

"DIGITAL CEPH HD
HD IS ENABLED "

according to the factory setting.

It is possible to change the set value using the parameter increase/decrease  keys; **select "HD IS ENABLED"**.

WARNING:
Wrong setting affect the system's functionality.

8.3.5.9. Sensor extra-run

In this menu, it is possible to set the acquisition start position offset for Ceph exam in LL mode.
Once the Patient centering (>0<) key is pressed, the following message is displayed:

" E ZERO [YY] a
ZERO OFFS ±xxxxx "

where:

- "YY" is the stepper motor speed (value not editable).
- "a" is the status of the zero optical barrier; 1 means engaged (i.e. barrier interrupted), 0 otherwise.
- "xxxxx" is the current value of the offset, that can be changed with the left/right  keys.

NOTE:
The acquisition start position offset is set to the correct value during the factory final test; changes on the stored value must be done only in case Ceph exam in adult patients are supposed to be performed.

8.3.6. Password 112: Troubleshooting

When the following menu is displayed:

" SERVICE MENU
TROUBLESHOOTING "

Pressing the Patient centering (>0<) key the next message is displayed:

" SET UP
PASSWORD? 100 "

Using the increase/decrease  keys, set the password equal to "112"

and confirm with the Patient centering  ; now it is possible to

access the configuration menus of the following list:

TEST COLUMN ⇔ TEST INPUT PORTS ⇔ TEST SENS. CLOCK ⇔
PRE-HEATING TIME ⇔ PREHEATING LEVEL ⇔ PAN RX EMISSION ⇔
CEPH RX EMISSION ⇔ AUTO-CALIBRATION ⇔
I2C BUS TEST ⇔ TEST COLUMN ….

NOTE:
Of these submenus, actually only the Test Column, Test Input Ports, PAN RX emission, CEPH RX emission, Pre-heating time and Preheating level are active.

The selection is confirmed pressing the Patient centering (>0<) key
The exit from each menus is performed using the Test (T) button.

8.3.6.1. Test column

This function is used to verify the functionality of the column UP / DOWN end run microswitches.

The display will be updated as follows:

" COLUMN TEST
IDLE 000ab "

Using the column up/column down keys  verify that the

last two digits change status:

- **a** = 1, column up
- **b** = 1, column down.

8.3.6.2. Test input ports

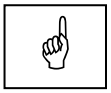
This function is used to carry out diagnostics at low level of the various input signals of the CPU board A5. It may be used, for example, to verify the limit switches without necessarily moving the axes but manually activating the optical sensor / microswitches.

The display will be updated as follows:

"TEST IMPUT PORTS
Ry 76543210 "

where:

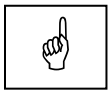
- **Ry=** selected port code (R4, R5, R6, R7)
- **76543210=** logic status of the port inputs.



NOTE:
The following table describes the correspondence between the displayed figures and the corresponding input signal. The digits are numbered from 7 to 0. The 7 digit corresponds to the character furthest to the left on the display, while digit 0 corresponds to the character furthest to the right.

Port	Bit	Association	µSwitch / Optical sensor	Logic status
R4	7	not used		-
	6	not used		-
	5	DSPU board initialization		0 for Analog 1 for Digital
	4	Motor +5V power supply (0 = alarm status)		1
	3	Column CPU board A1 initialization		1
	2	Generator board A10 initialization		1
	1	not used		-
	0	not used		-
R5	7 (*)	Primary collimator position optical sensor	B8	0
	6 (**)	Soft tissue filter 0 position	B8	1
	5	not used		-
	4	not used		-
	3	not used		-
	2 (**)	Digital Sensor ready		0
	1	not used		-
	0	not used		-
R6	7 (*)	Panoramic cassette start position	B5	1
	6 (*)	Panoramic cassette end position	B4	1
	5 (*)	CEPHALOMETRIC cassette present	S10	0
	4 (*)	PANORAMIC cassette present	S9	0
	3	Cassette / Sensor holder in CEPHALOMETRIC position	B7	1
	2	Cassette / Sensor holder in PANORAMIC position	B6	1
	1	Remote control X-rays button	X71-1 / X71-2	1
	0	X-rays button on column	S8	1
R7	7	not used		1
	6 (**)	Ceph sensor holder start position	B11	1
	5	not used		1
	4 (**)	Ceph secondary collimator start position	B10	1
	3 (**)	Slit primary collimator 0 position	B9	1
	2	Y axis start position	B1	1
	1	not used		-
	0	Rotation arm 0 position	B3	1

(*) Functionality only on Analog version
(**) Functionality only on Digital version



NOTE:
The logic status of these signals depends on the physical position of the relevant optical sensor / microswitch with respect to the "0" position.

8.3.6.3. Pre-heating time

WARNING:
Do NOT modify this parameter: functionality can be severely impaired.

This function allows the set of the Tubehead pre-heating time. After the selection, the display will show the following message:

" PRE-HEATING TIME
VALUE = 2000 "

It is possible to change the set value using the increase/decrease keys  .

8.3.6.4. Preheating level

In this menu, it is possible to set the Tubehead pre-heating values. The value must be set according to the data reported on the "Equipment parameters table" supplied with the Service Manual.
Once the patient centering (>0<) key is pressed, the following message is displayed:

" IDEL FIL LEVEL
LEVEL = 30 "

NOTE:
DO NOT modify the "LEVEL" value in this step.

Pressing the right  key, the next message is displayed:

" FIL LEVEL @ XXmA
LEVEL = YYY "

where:

- "XX" is the Tubehead filament current value, that can be changed using the left/right  keys.
- "YYY" is the Tubehead pre-heating value, that can be changed with the increase/decrease keys  .

8.3.6.5. PAN RX emission / CEPH RX emission

These menus is used to test the X-ray emission excluding all interlocks that are active during examination. It is used to test the function of the X-ray generator and tube head assembly.
At the selection of the X-ray emission test, the display will show the following message

" 74kV 08mA 1.00s
X-RAY PARAMETERS "

WARNING:
In this menu the emission is enabled; it starts with the X-ray button press, so take care of this situation.

Pressing the parameter changes  key, it is possible to choose a different combination of parameters. Once pressed, the display will show:

">74kV 08mA 1.00s
X-RAY PARAMETERS "

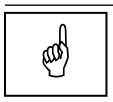
Where the symbol ">" is showing the parameter to be changes; in this case the kV. To move to mA and exposure time, press  key once or twice again.
In this situation, the keys increase and decrease will change the parameter.
Pressing the X-ray button will start the emission.

8.3.7. System / Burn-in

Both those menus are used only for factory set and testing, so they are not available for field service.
In any case, accession to those is protected by a special password, to avoid the risk of dangerous operations.

8.3.8. Show configuration

This menu allows to show all parameters with its own set value; there is no possibility to change the parameters. This menu is useful to record on a paper sheet the condition of the machine.
Its usage is suggested at the end of installation to review and record the parameters.
Using the right/left scroll keys, it is possible to view all parameters and exams counters.



NOTE:
In this menu it is also possible to get the Hardware Protection Key (INSTRUMENT) code.

8.4. Detection and correction of possible defects in dental radiographies

8.4.1. 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 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 head is not turned.
(In CEPH examination) white area on the lower part of the film.	Panoramic chin-rest mounted.	Repeat the examination removing the PAN chin-rest.

8.4.2. Defects due to radiological data input

Problem	Description	Solution
Under or overexposed plate.	The set kV values are not suitable for the size of the patient. Possible error during development.	Repeat the examination changing the kV values. See paragraph 6.4.4 of the User Manual.
Completely white image.	No X-ray emission.	Check if the acoustic and led signal (led "2") indicating the X-ray emissions 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 6.9.3 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 format was selected.	Select an asymmetrical format (which will enable the STF filter).

8.4.3. Defects due to the unit

The experience from field problems observed on the Rotograph EVO D has allowed to list under this chapter some possible typical problems that can affect the radiological quality.

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. Refer to the described procedure to check the X-ray emission, beam alignment and senor functionality.

2. For Cephalometric examinations in latero lateral projections if soft tissue structures 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 gives a higher attenuation in the soft tissue area.

8.5. 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 8.4 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:

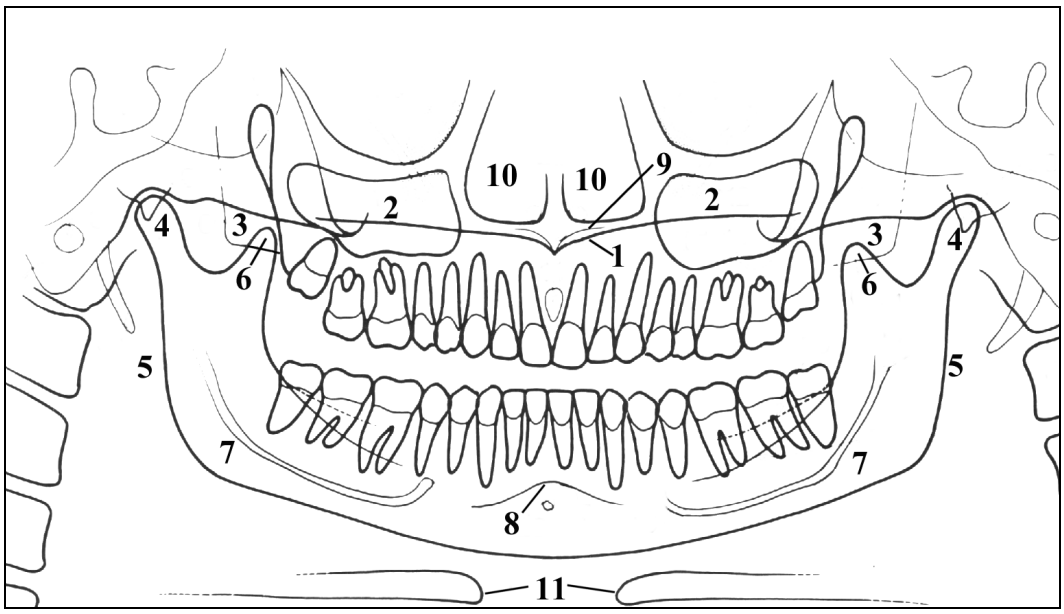


Figure 8-1

Ref.	***Anatomic structure***
1	*Hard palatal 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)*

8.5.1. Proper positioning of the patient

The proper positioning of the patient during the panoramic examination is very important in order to get a 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 film, 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 wear clothes that may interfere with the X-ray beam, also 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; these 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 slightly 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 the anterior teeth. If the patient has a low palatal ceiling, slightly increase the tilting downward.
4. Align the middle sagittal plane with the centre of the chin support, normally indicated by the relevant light beam.
5. Check that the vertical light beam falls on the canine and lies 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.

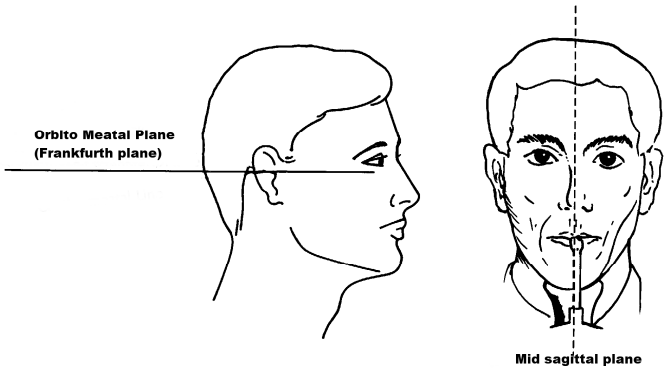


Figure 8-2

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 film.
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 film 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 a radiography where all the parts are properly exposed and are well identifiable as in the schema of Figure 8-3.

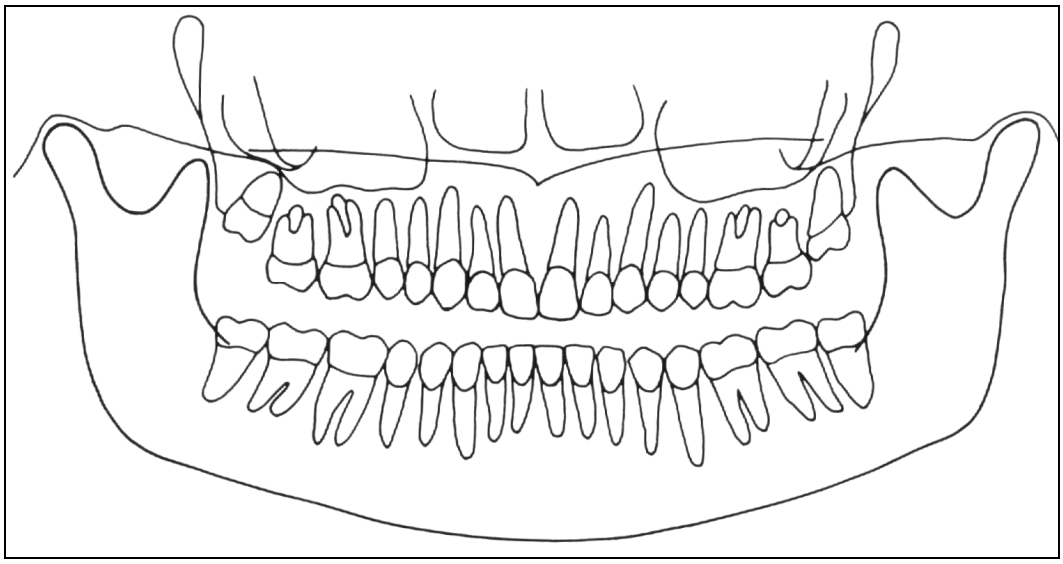


Figure 8-3

It must be noted that the radiography is quite symmetrical, with the ascending rami of the 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 view of the same.

8.5.2. Error due to a bad patient's positioning

- **The film shows the anterior teeth with reduced magnification and not well defined. The cervical spine is showing an evident white shadow.**

  In addition, on the molar zone there are too many shadows, disturbing the view.

  The resulting image is similar to the schema shown on Figure 8-4.

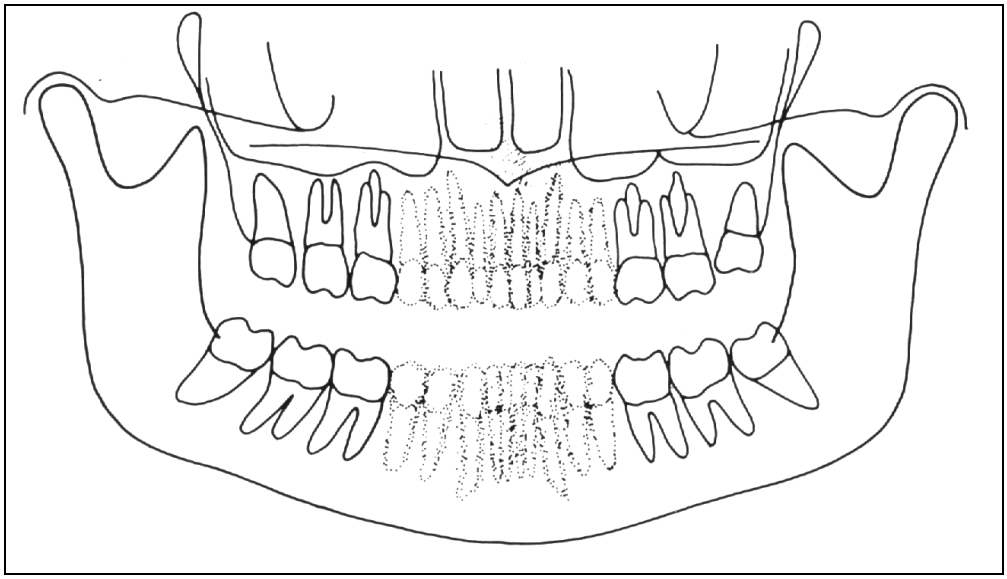


Figure 8-4

Possible cause:

The patient is positioned too forward, the anterior teeth will result unfocussed and reduced.

Remedy:

Check the patient positioning.

If, after the correct patient's positioning, the problem still remain, check the alignment of rotating arm.

A more accurate check can be performed using the service tool and verifying the distance between the two lateral metal parts.

- **Anterior teeth are enlarged and blurred**

  The Figure 8-5 depicts the resulting image.

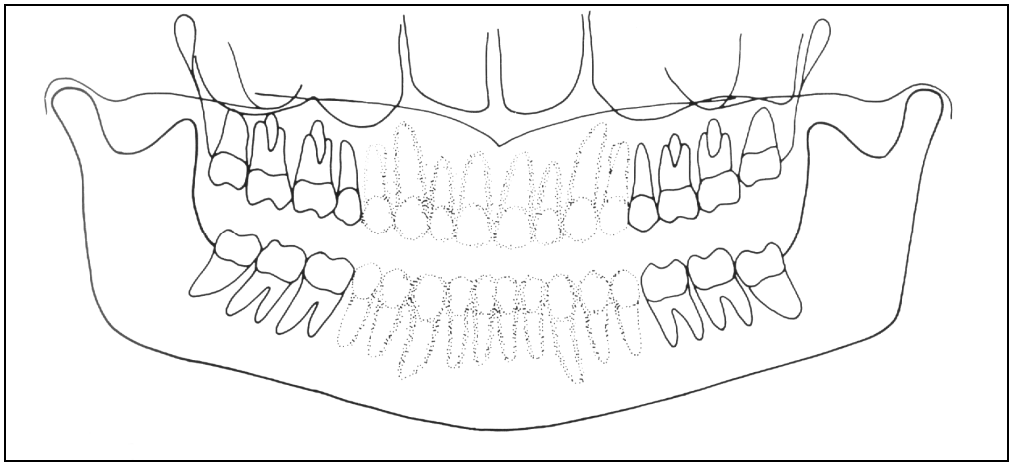
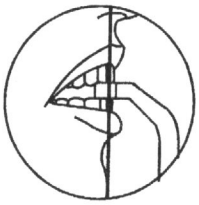


Figure 8-5



Possible cause:

In this case the patient is positioned too backward

Remedy:

Check the patient positioning.

If, after the correct patient's positioning, the problem still remain, check the alignment of rotating arm.

A more accurate check can be performed using the service tool and verifying the distance between the two lateral metal parts.

- **Part of the image is enlarged while the other one is reduced**

The schema described on Figure 8-6 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 film.

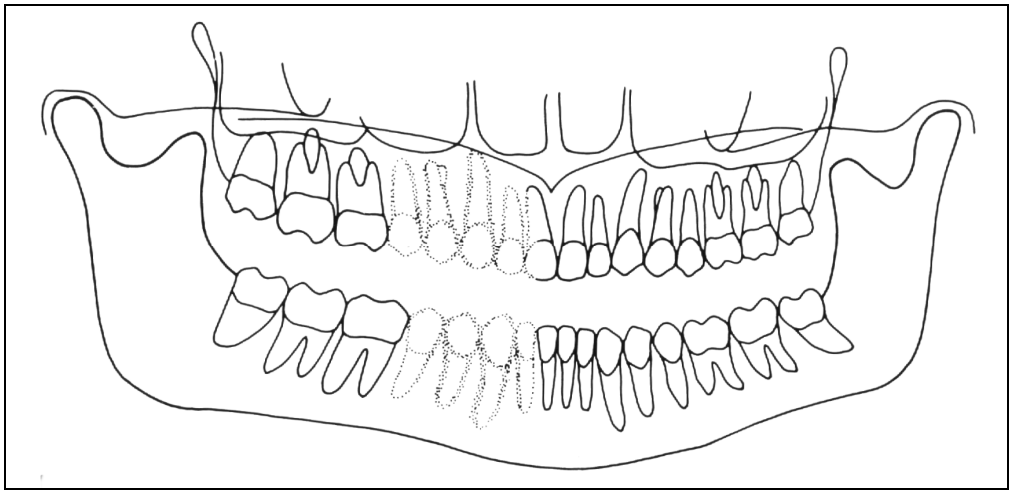
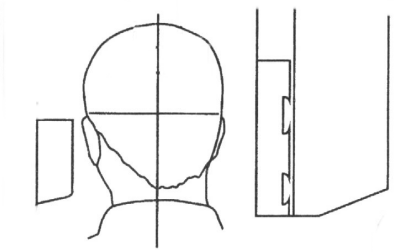


Figure 8-6

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 sensor 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 picture above: 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.

A more accurate check is performed using the special tool and making an image; the dimensions measured on the obtained image must match those reported in the paragraph 7.2.1.

- **The image shows the TMJ at different height**

This fact is described in Figure 8-7.

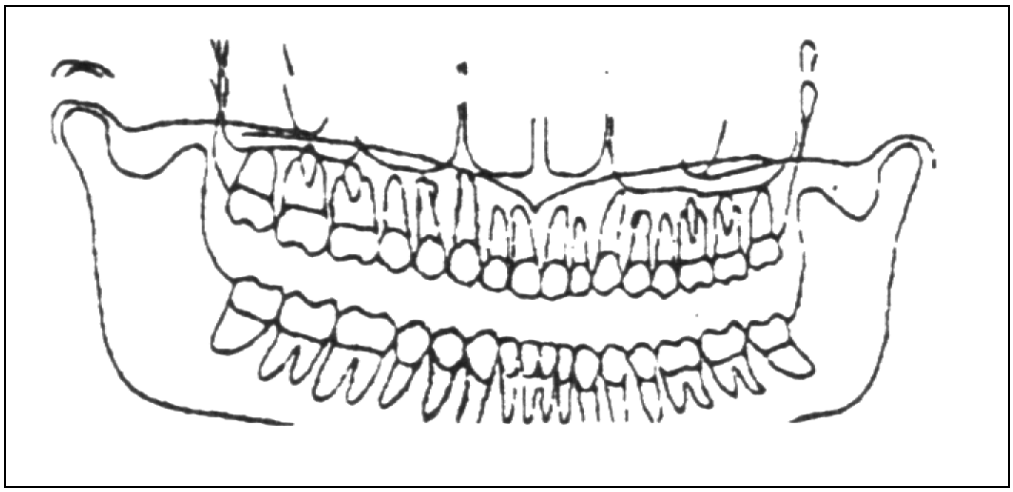


Figure 8-7

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 quickly 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 horizontality of the chin arm that must be adjusted using the relevant screws.

- **The image shows undulated teeth rows**

As can be seen on Figure 8-8, 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.

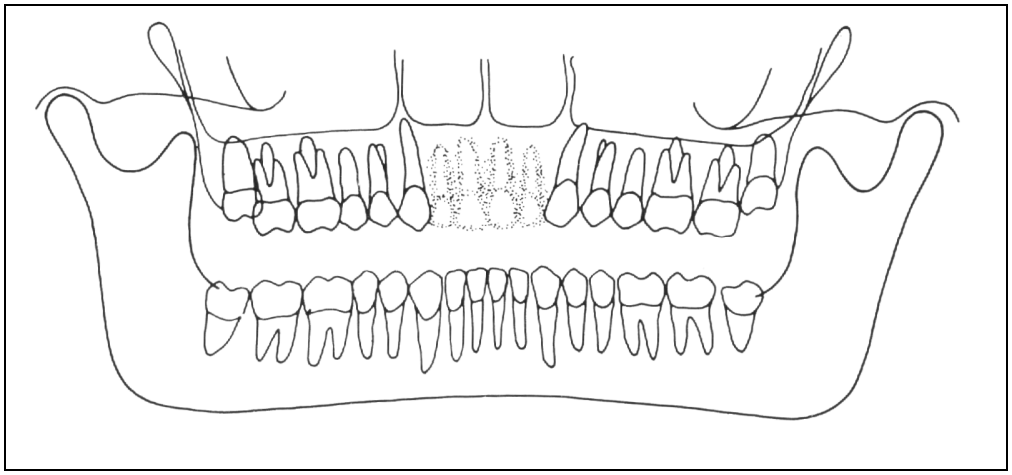


Figure 8-8

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 the 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 8-9, 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.

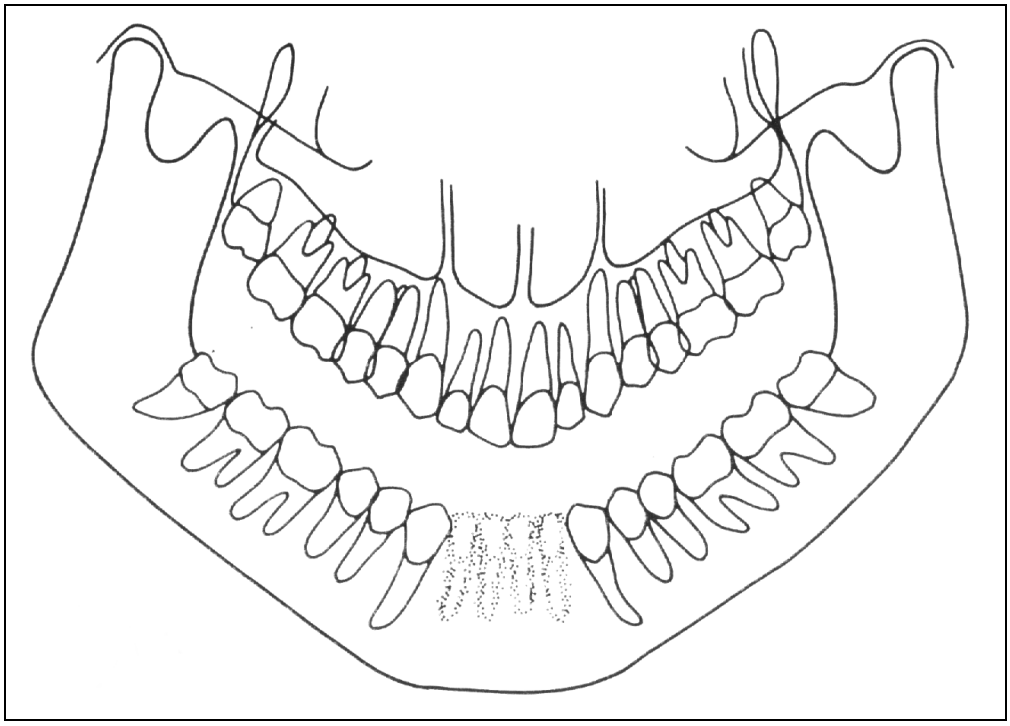


Figure 8-9

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 8-10.

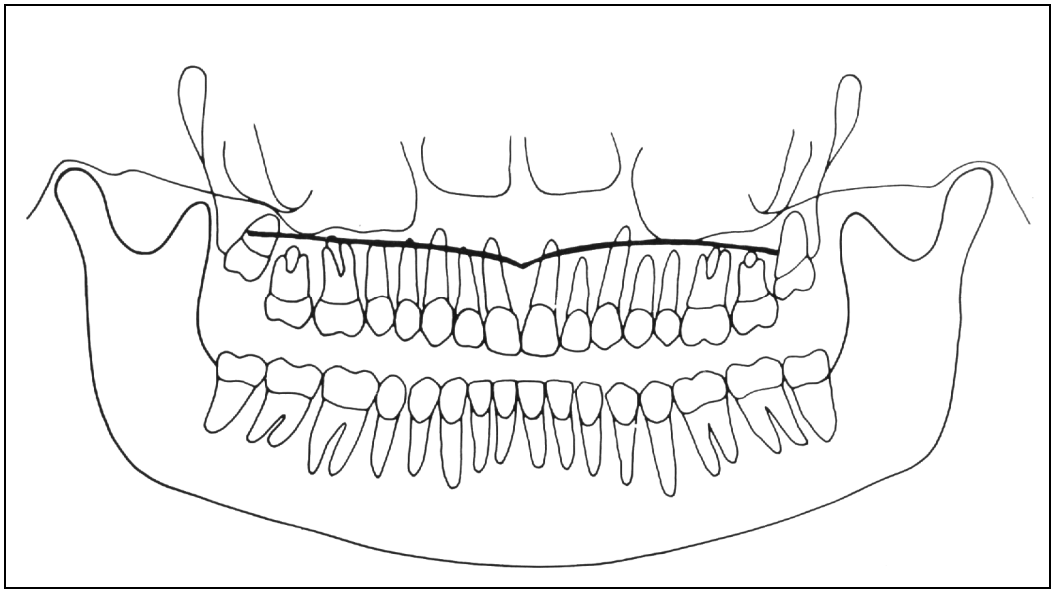


Figure 8-10

In this case, a light tilting downward of the Frankfurt plane causes the palate to be projected over and far enought from the roots of the teeth of the maxillary arch, without distortion of the incisor teeth, as on Figure 8-11.

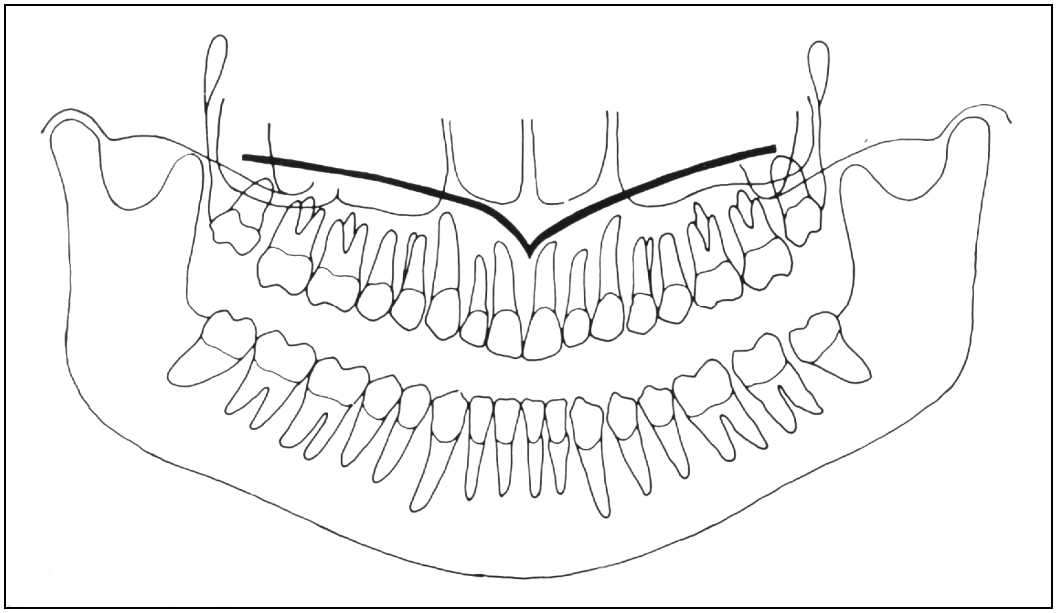


Figure 8-11

8.5.3. 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.

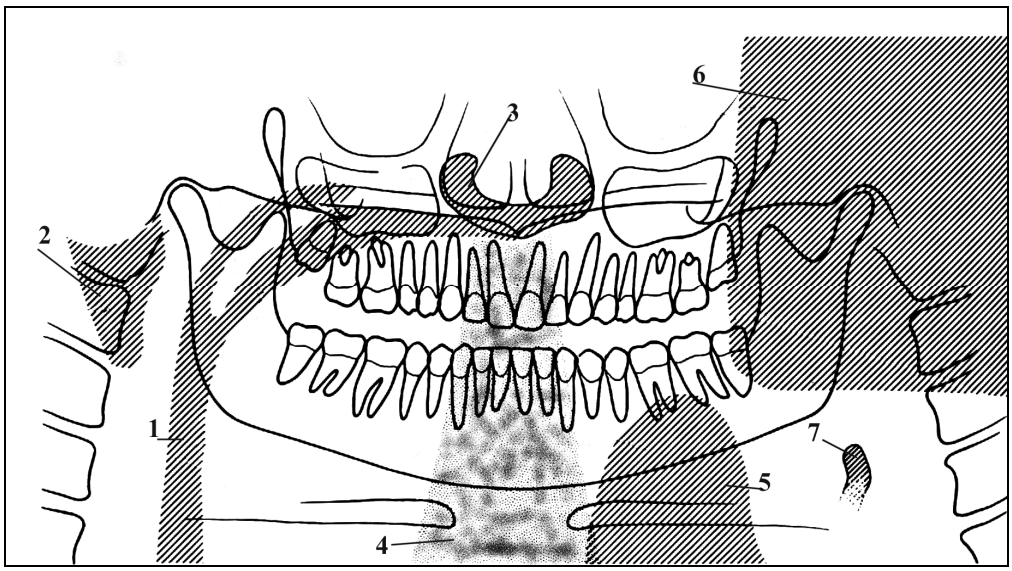


Figure 8-12

Where different references are described among with the cause/remedy, if any.

Soft tissue	Description	Artifacts	Description
2	Ear soft tissue	1	Dark shadows due to the air gap between tongue and palate
3	Nose soft tissue	4	Spine column
7	Epiglottis	5	Leaded apron too high

The part identified with "6" in Figure 8-12 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 film in underexposed due to wrong radiological parameters.

With reference to the previous Figure 8-12, 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 8-12), 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 film, while it's normally less visible on the upper part of the film.

  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 create 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 and two shadows), thus further disturbing the correct diagnosis.
  This situation may occur especially if the patient has large prosthesis or metal cures and if it is associated to a positioning error that projects the shadow of the metal part on a 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 8-12, 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 8-12.

  Remedy:

  Ask the patient to position the tongue against the palate during the exposure.

9. SCHEMATICS AND DRAWINGS

1. General diagram

2. Lay-out Column CPU PCB A1

3. Circuit diagram Column CPU PCB A1

4. Lay-out Touch Screen Control PCB A4

5. Lay-out CPU PCB A5

6. Circuit diagram CPU PCB A5

7. Lay-out Microprocessor PCB A6

8. Circuit diagram Microprocessor PCB A6

9. Lay-out and Circuit diagram Rotation Group PCB A7

10. Lay-out Generator CPU PCB A9

11. Circuit diagram Generator CPU PCB A9

12. Lay-out Generator PCB A10

13. Circuit diagram Generator PCB A10

14. Lay-out and Circuit diagram CEPH arm connection PCB A12

15. Lay-out Power HUB PCB A21

16. Circuit diagram Sensor power PCB A21

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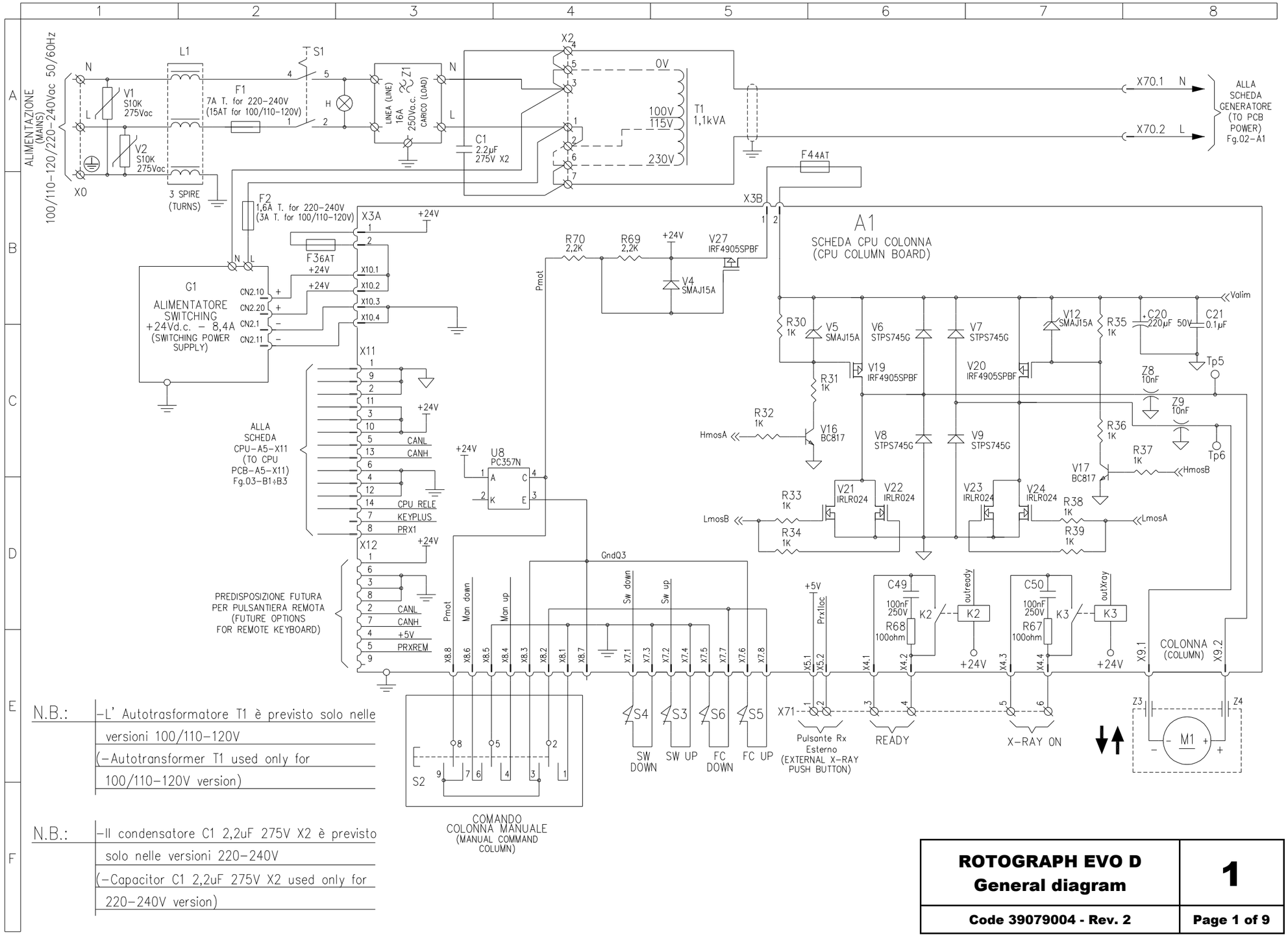
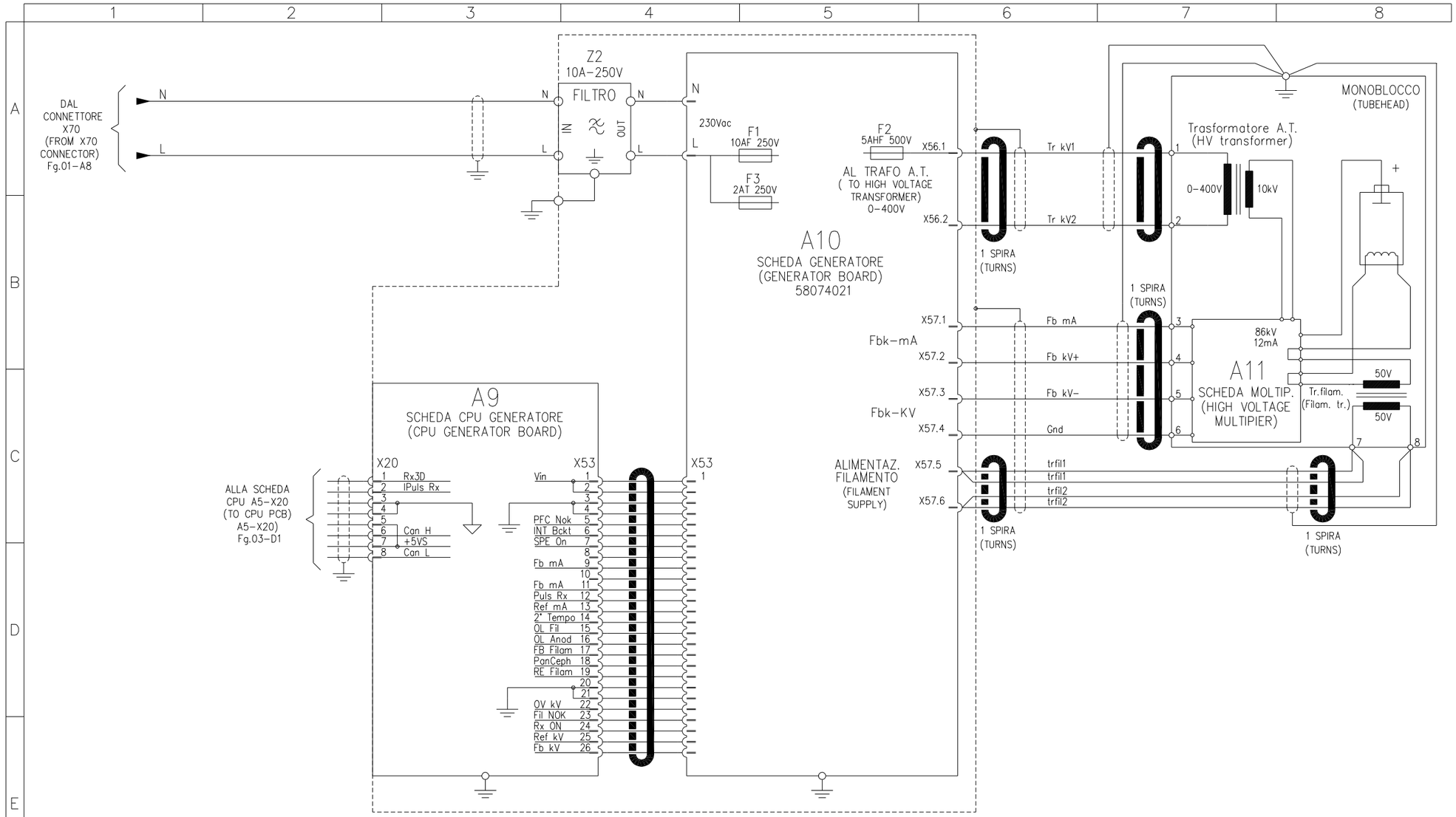


N.B.: -L' Autotrasformatore T1 è previsto solo nelle versioni 100/110-120V
(-Autotransformer T1 used only for 100/110-120V version)

N.B.: -Il condensatore C1 2,2uF 275V X2 è previsto solo nelle versioni 220-240V
(-Capacitor C1 2,2uF 275V X2 used only for 220-240V version)

ROTOGRAPH EVO D **General diagram**	**1**
Code 39079004 - Rev. 2	**Page 1 of 9**



ROTOGRAPH EVO D General diagram	1
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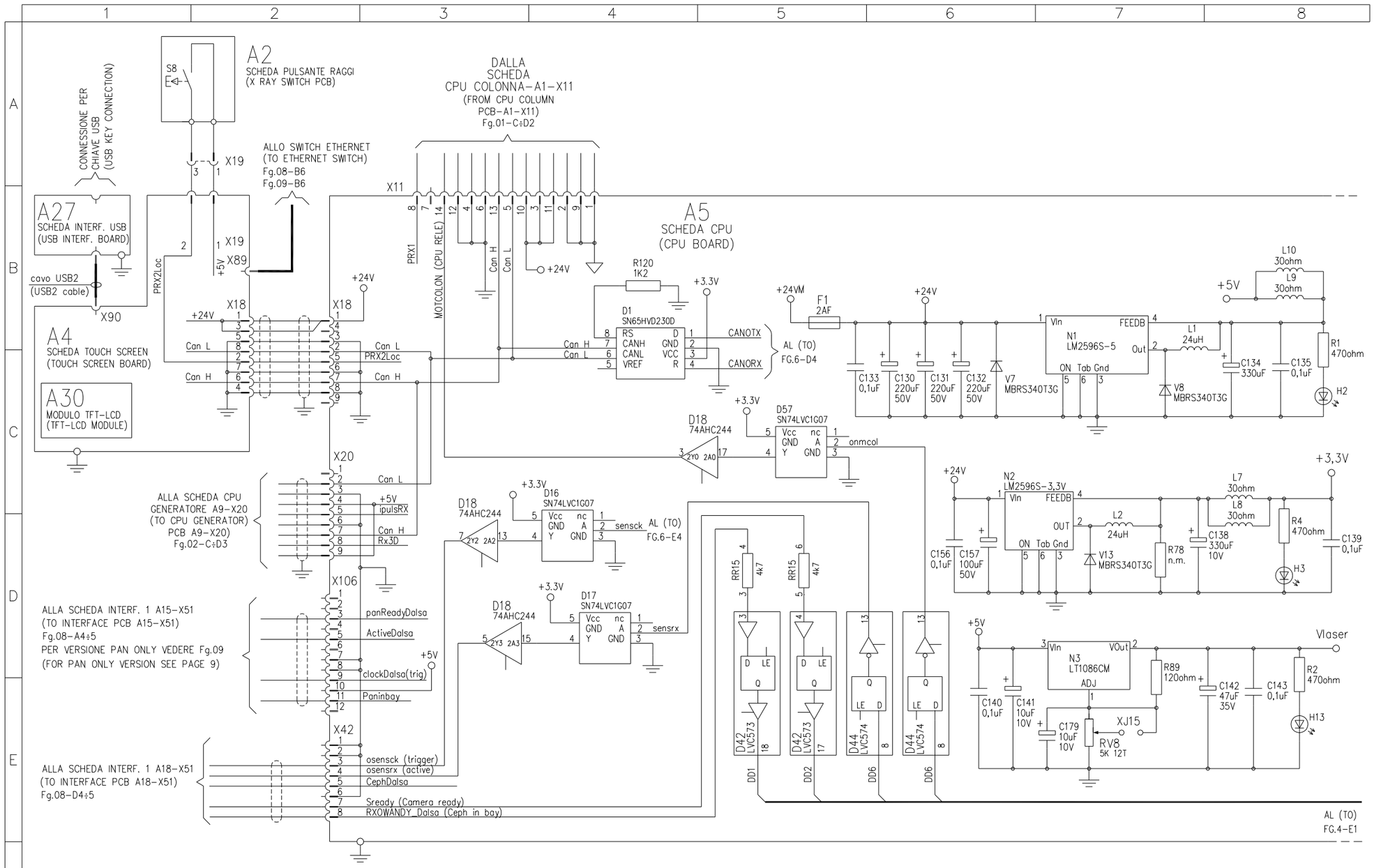
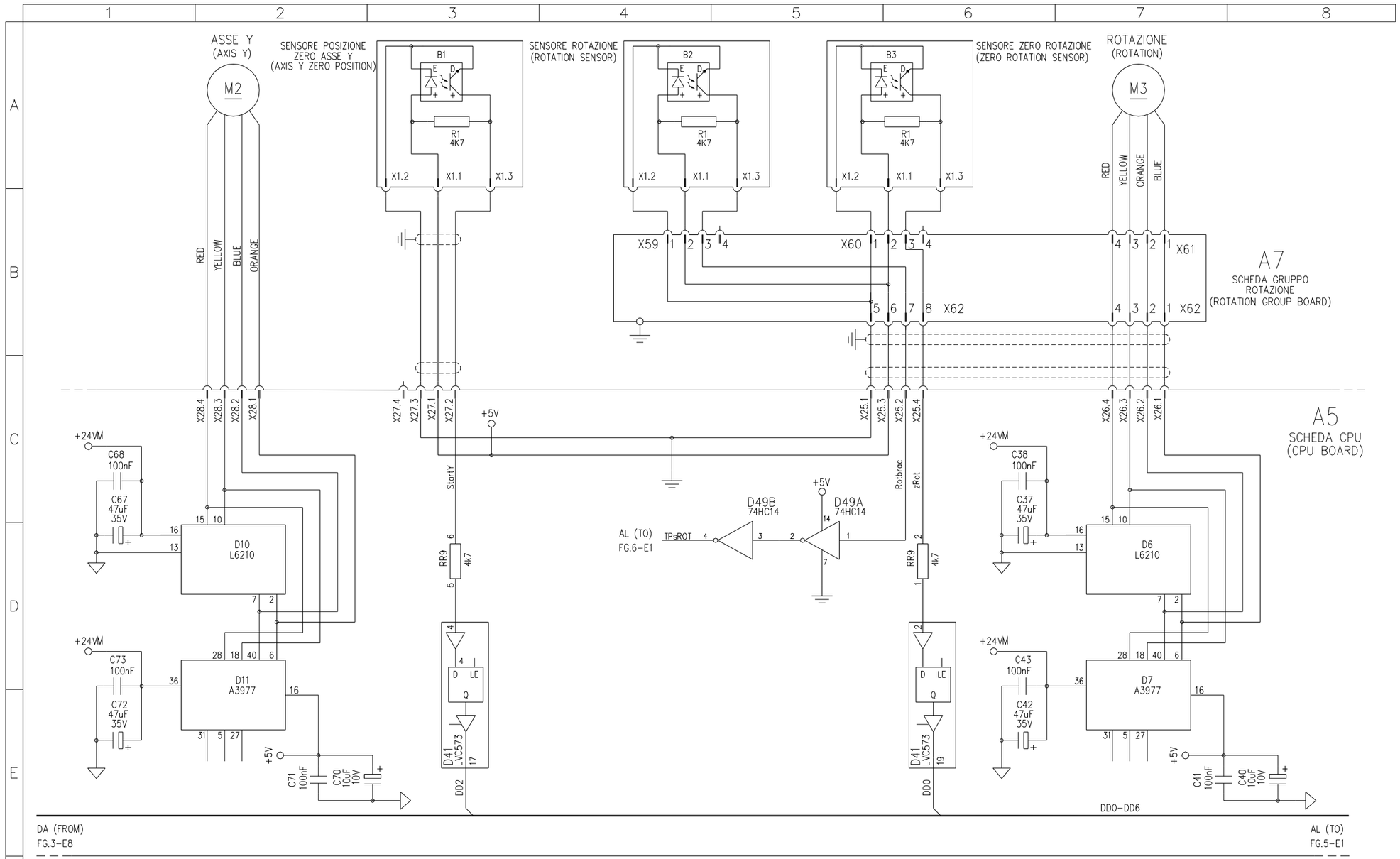


ROTOGRAPH EVO D **General diagram**	**1**
Code 39079004 - Rev. 2	**Page 3 of 9**



ROTOGRAPH EVO D **General diagram**	**1**
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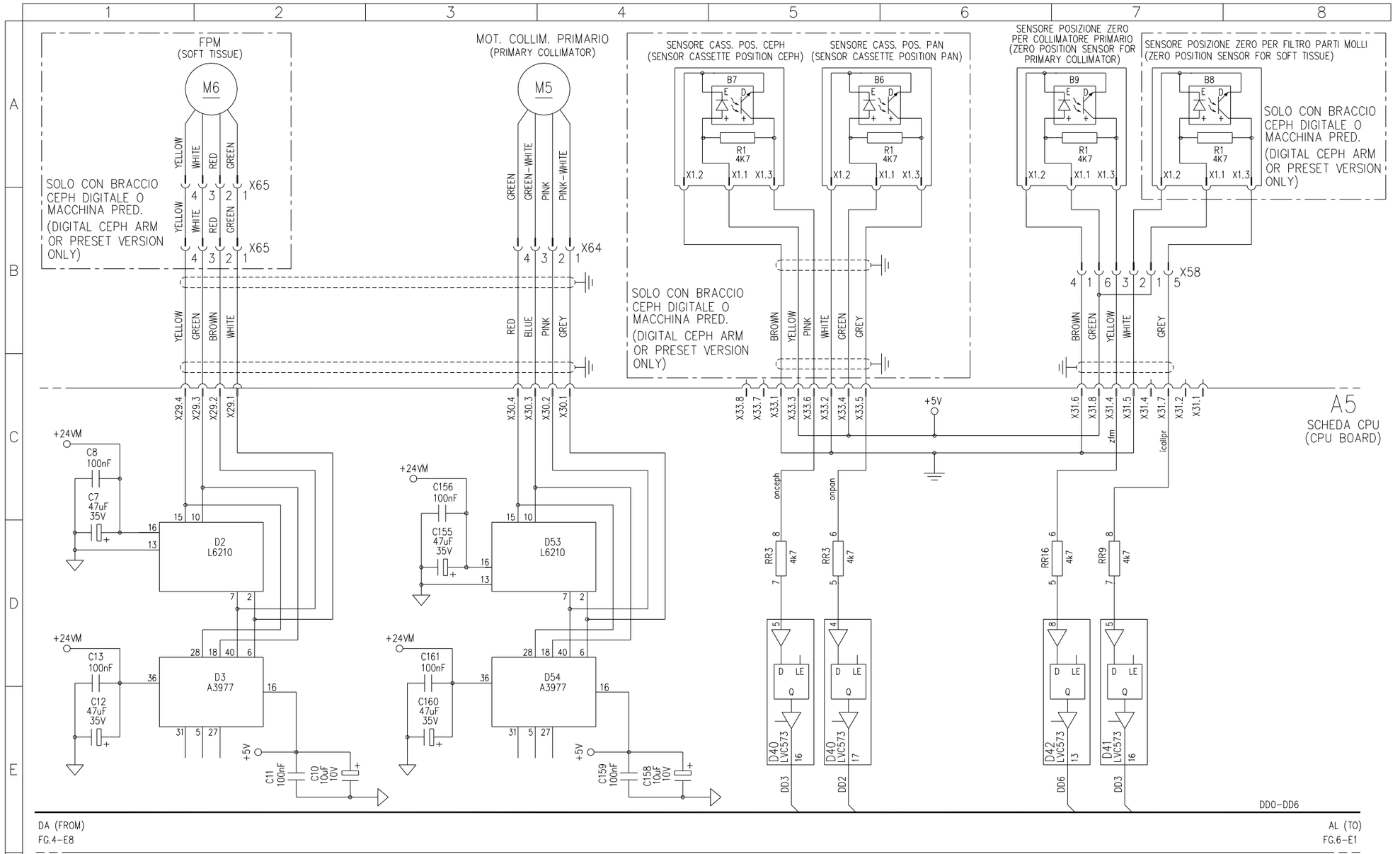
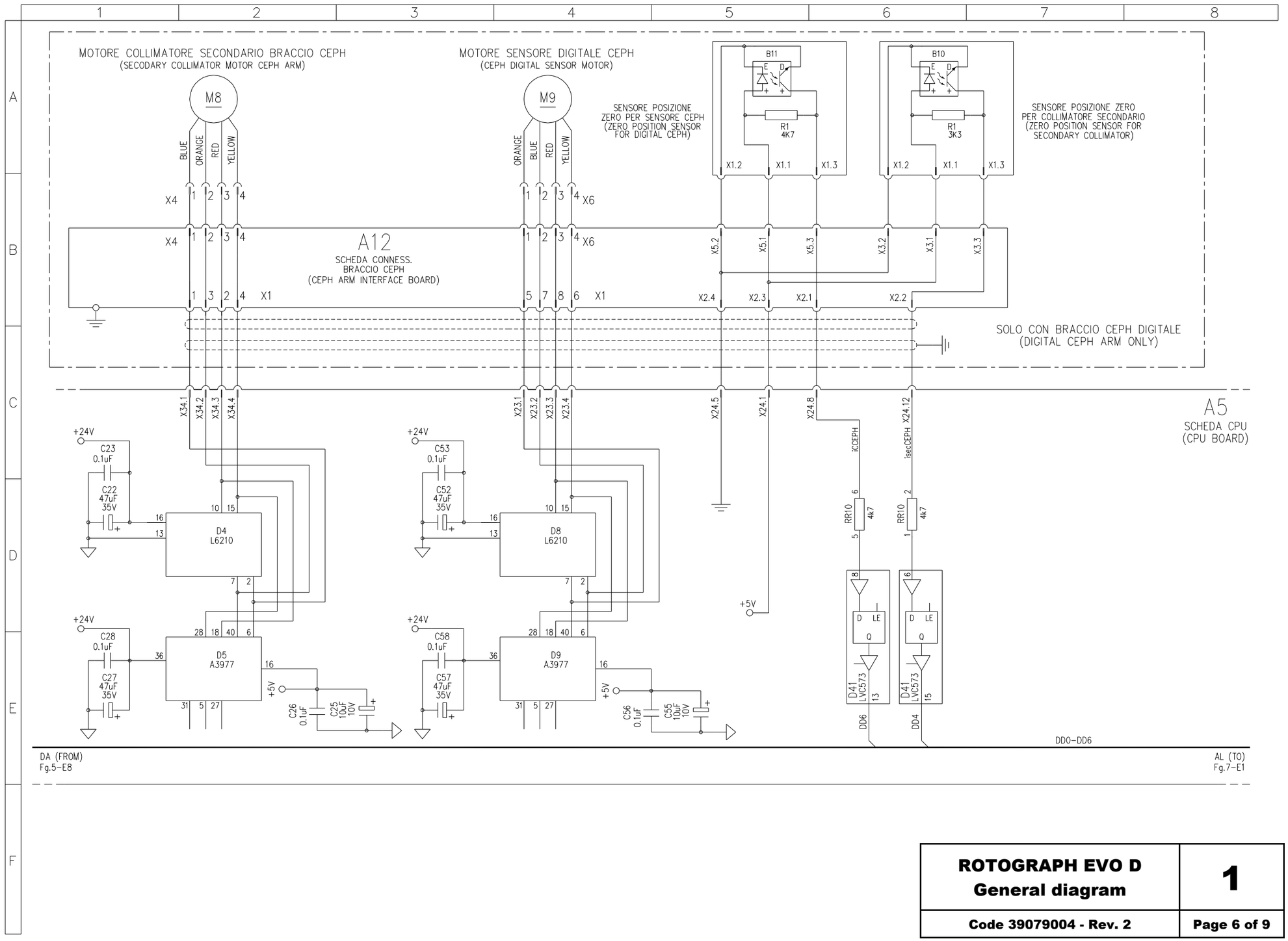


ROTOGRAPH EVO D **General diagram**	**1**
Code 39079004 - Rev. 2	**Page 5 of 9**



ROTOGRAPH EVO D General diagram	1
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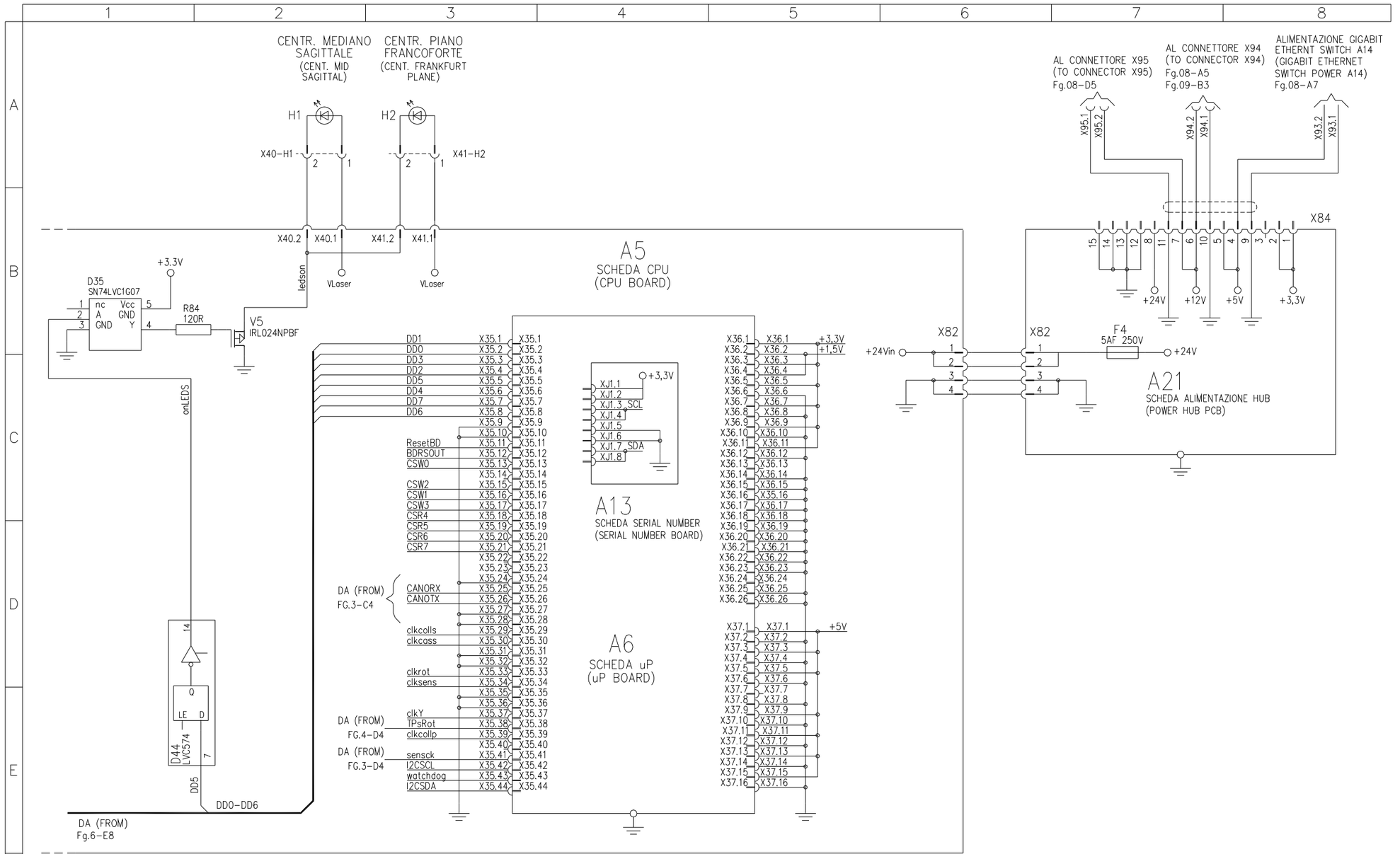

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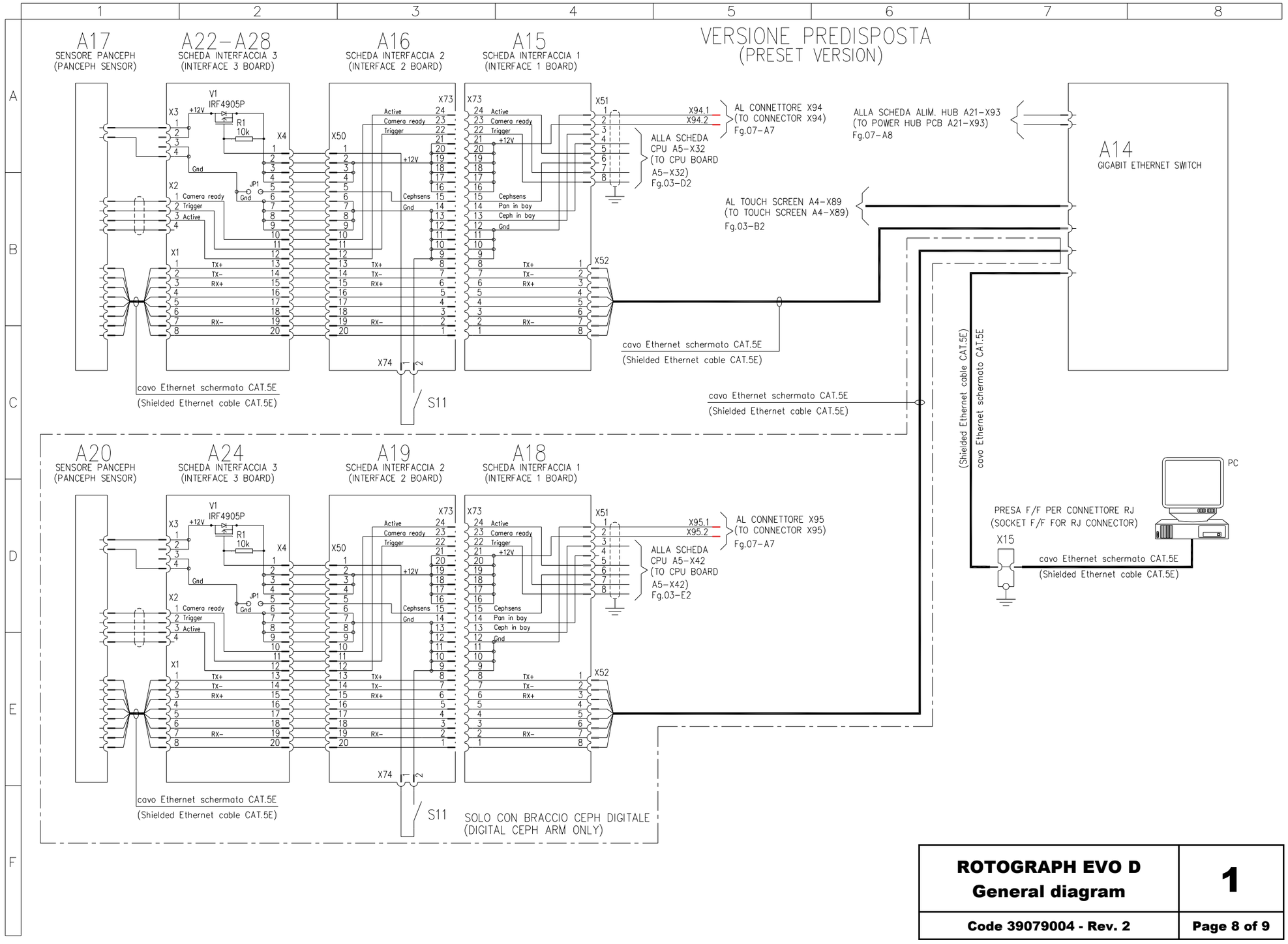

ROTOGRAPH EVO D **General diagram**	**1**
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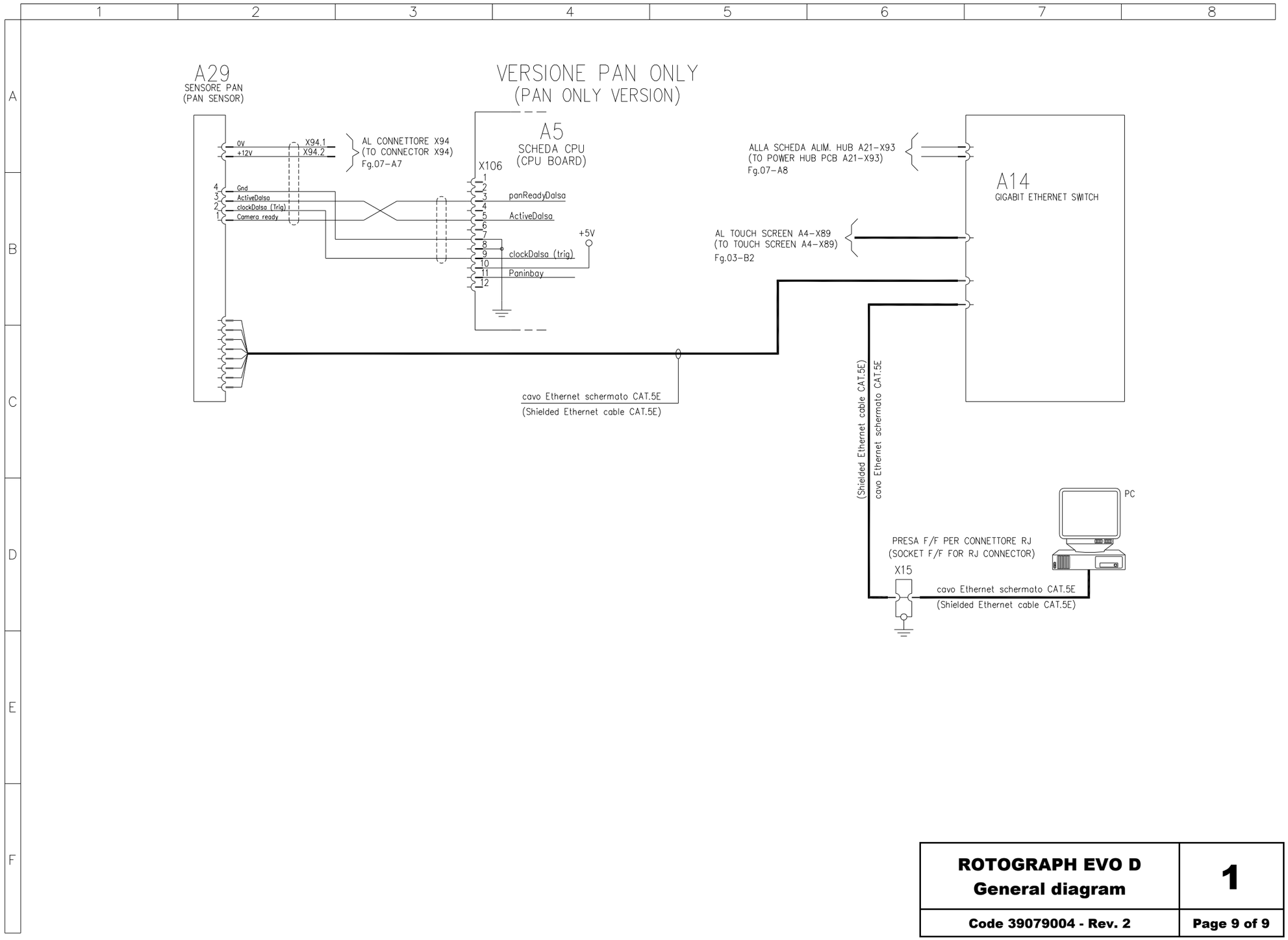
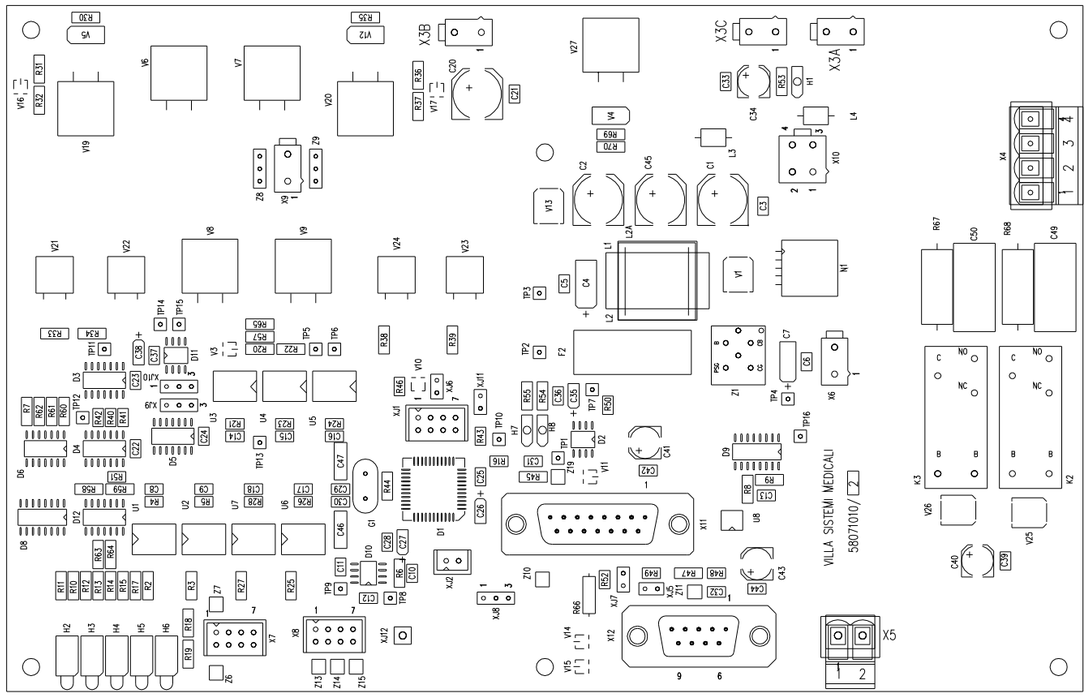
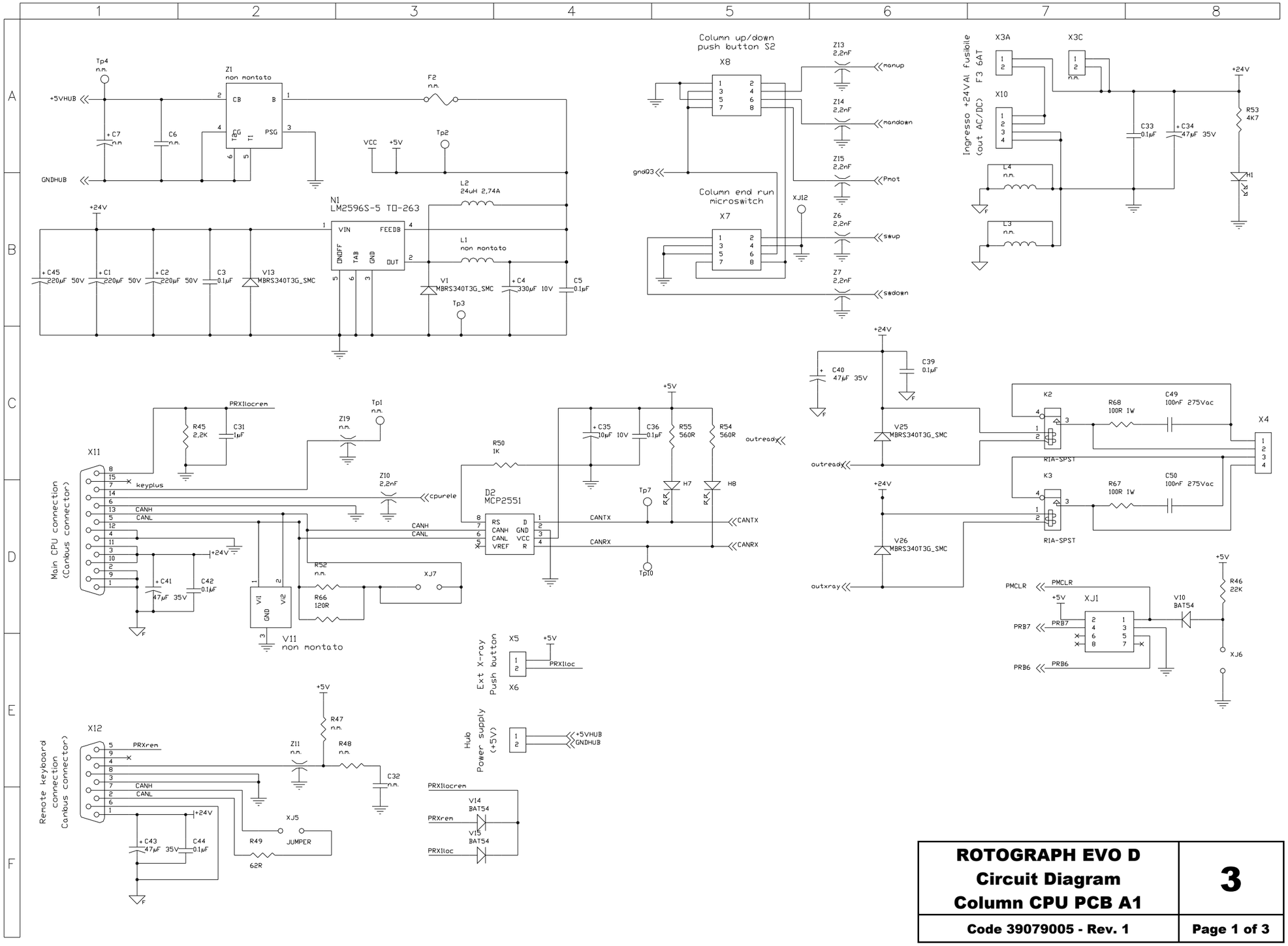


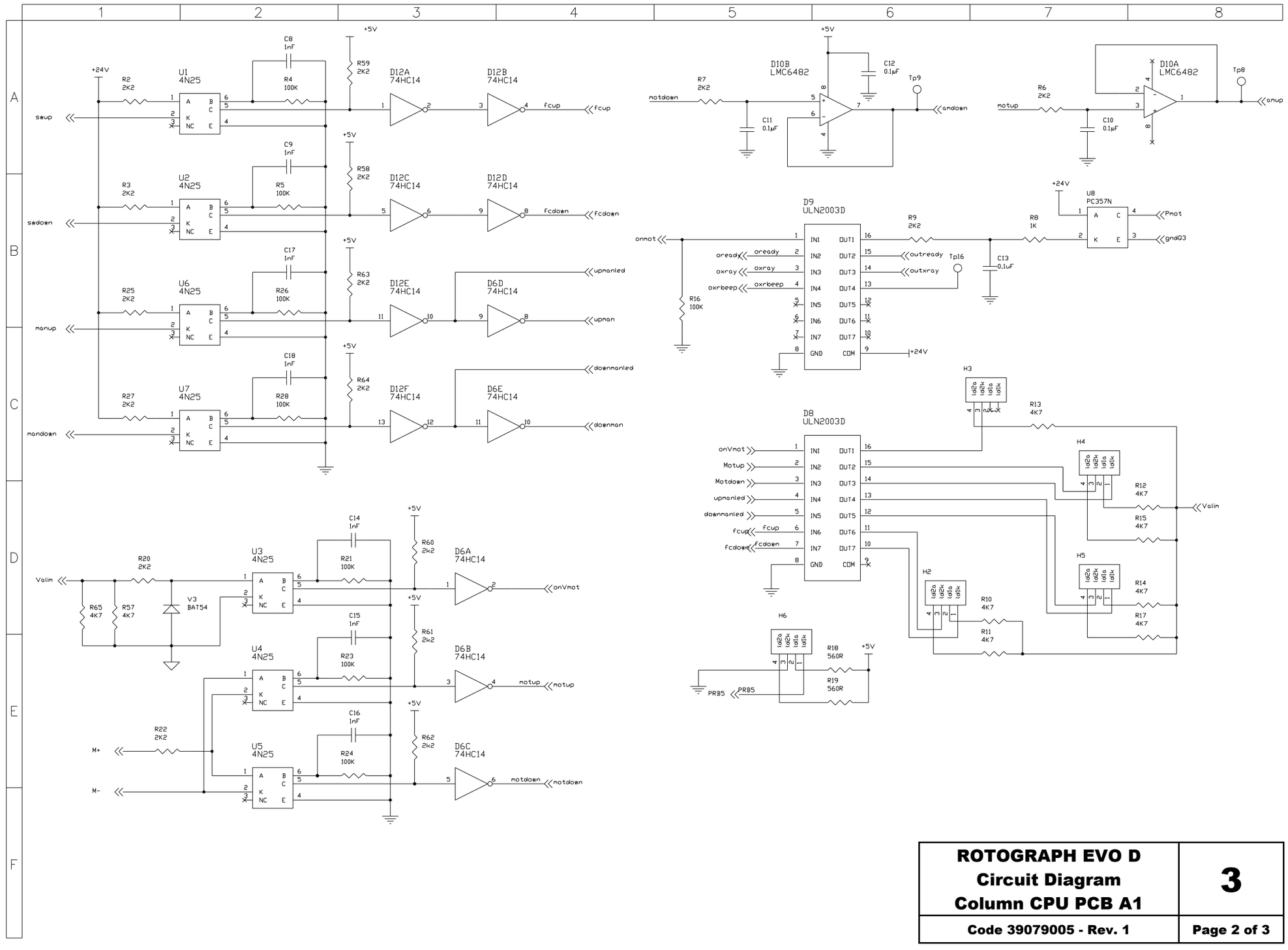
ROTOGRAPH EVO D **General diagram**	**1**
Code 39079004 - Rev. 2	**Page 9 of 9**



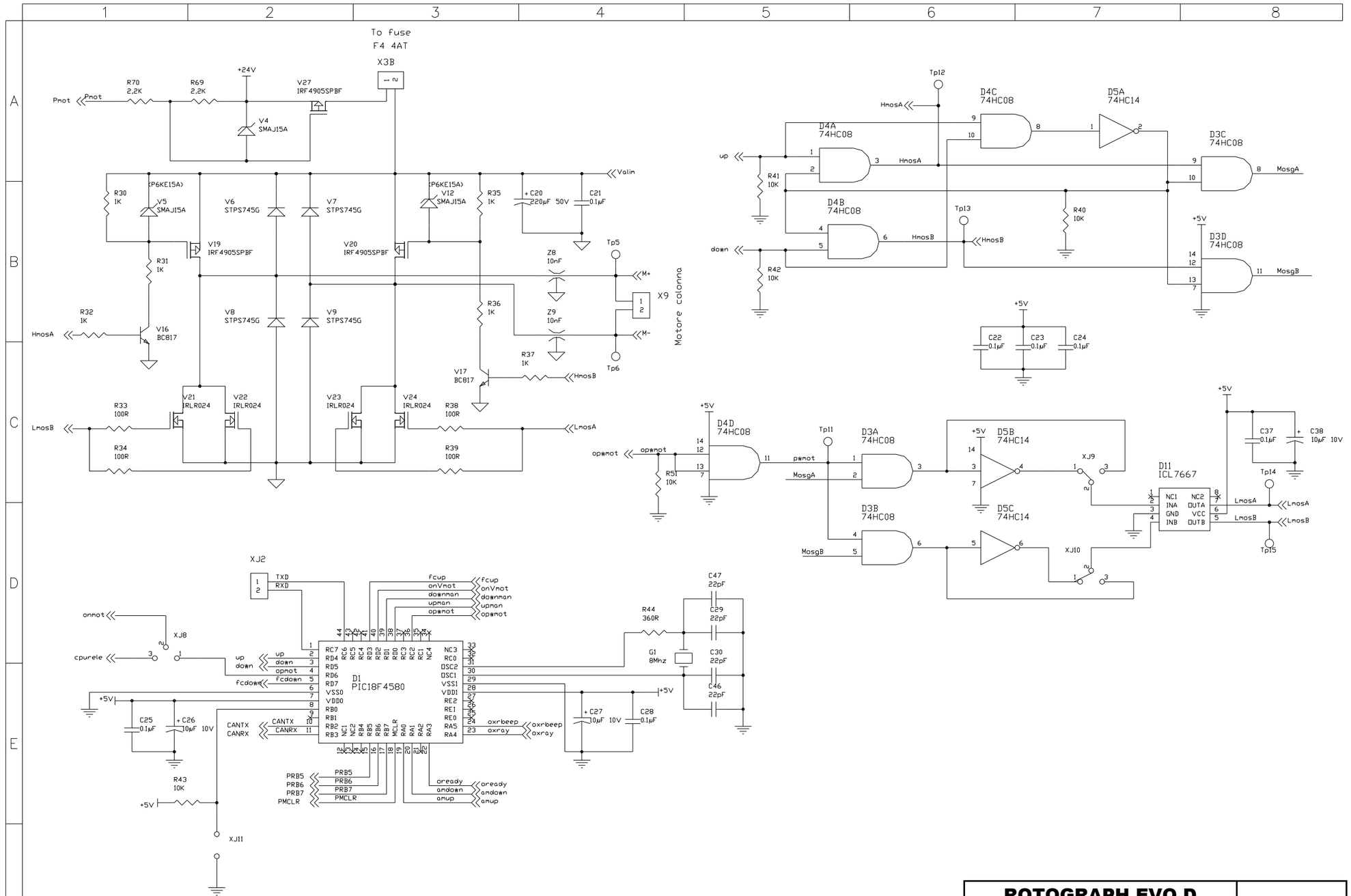
ROTOGRAPH EVO D Lay-out Column CPU PCB A1	2
Code 58071010 - Rev. 2	Page 1 of 1



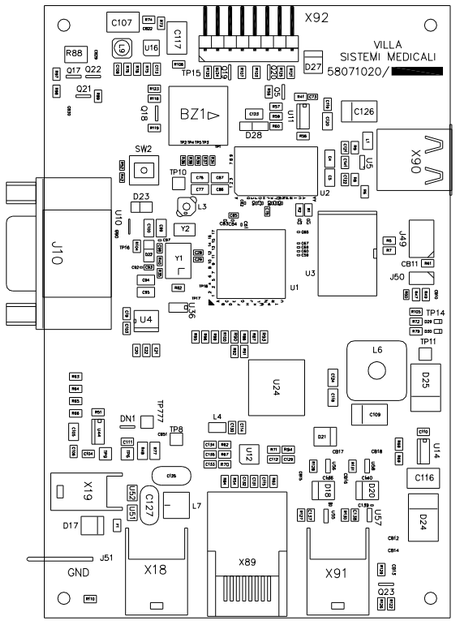
ROTOGRAPH EVO D **Circuit Diagram** **Column CPU PCB A1**	**3**
Code 39079005 - Rev. 1	**Page 1 of 3**



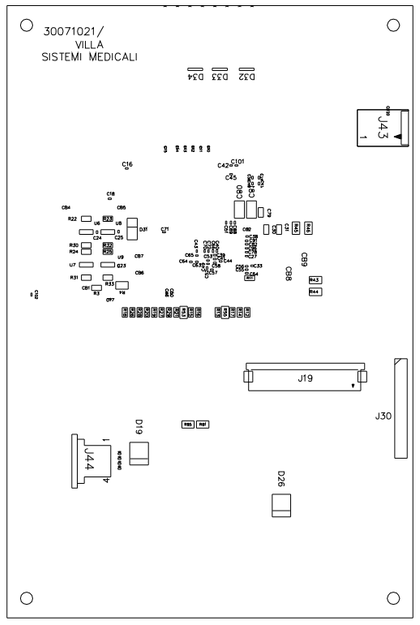
ROTOGRAPH EVO D Circuit Diagram Column CPU PCB A1	3
Code 39079005 - Rev. 1	Page 2 of 3



ROTOGRAPH EVO D **Circuit Diagram** **Column CPU PCB A1**	**3**
Code 39079005 - Rev. 1	**Page 3 of 3**

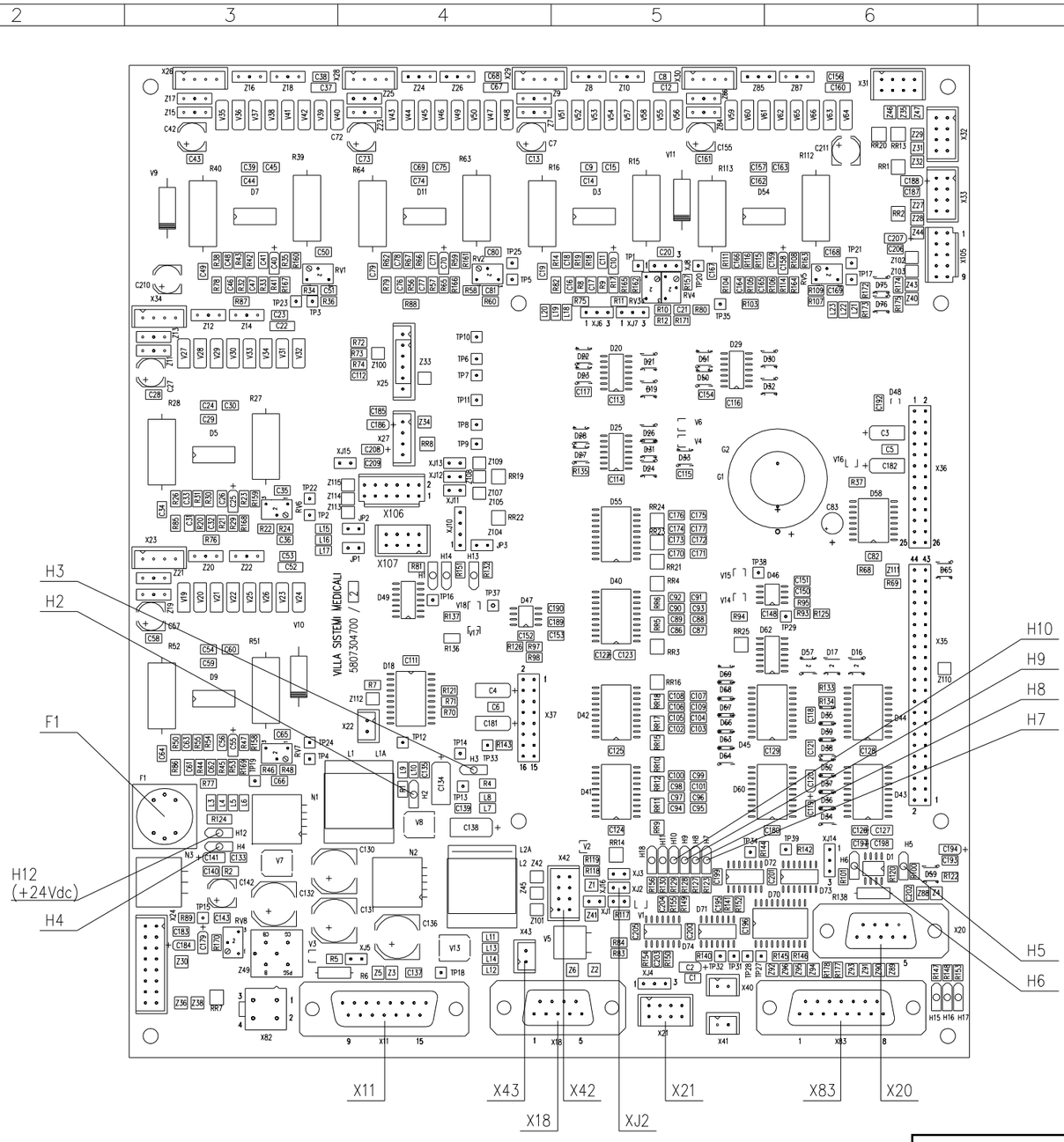


COMPONENT SIDE

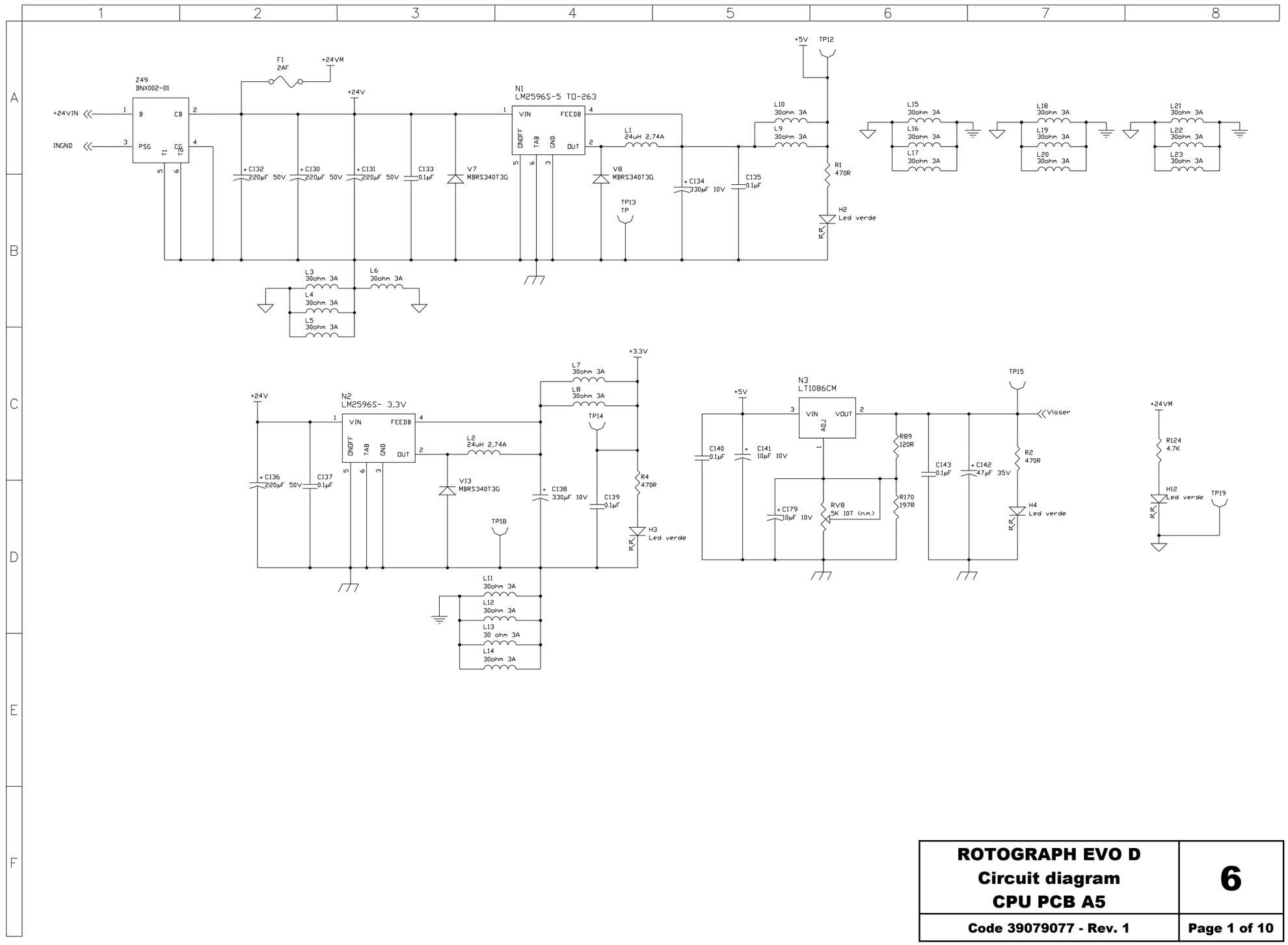


SOLDER SIDE

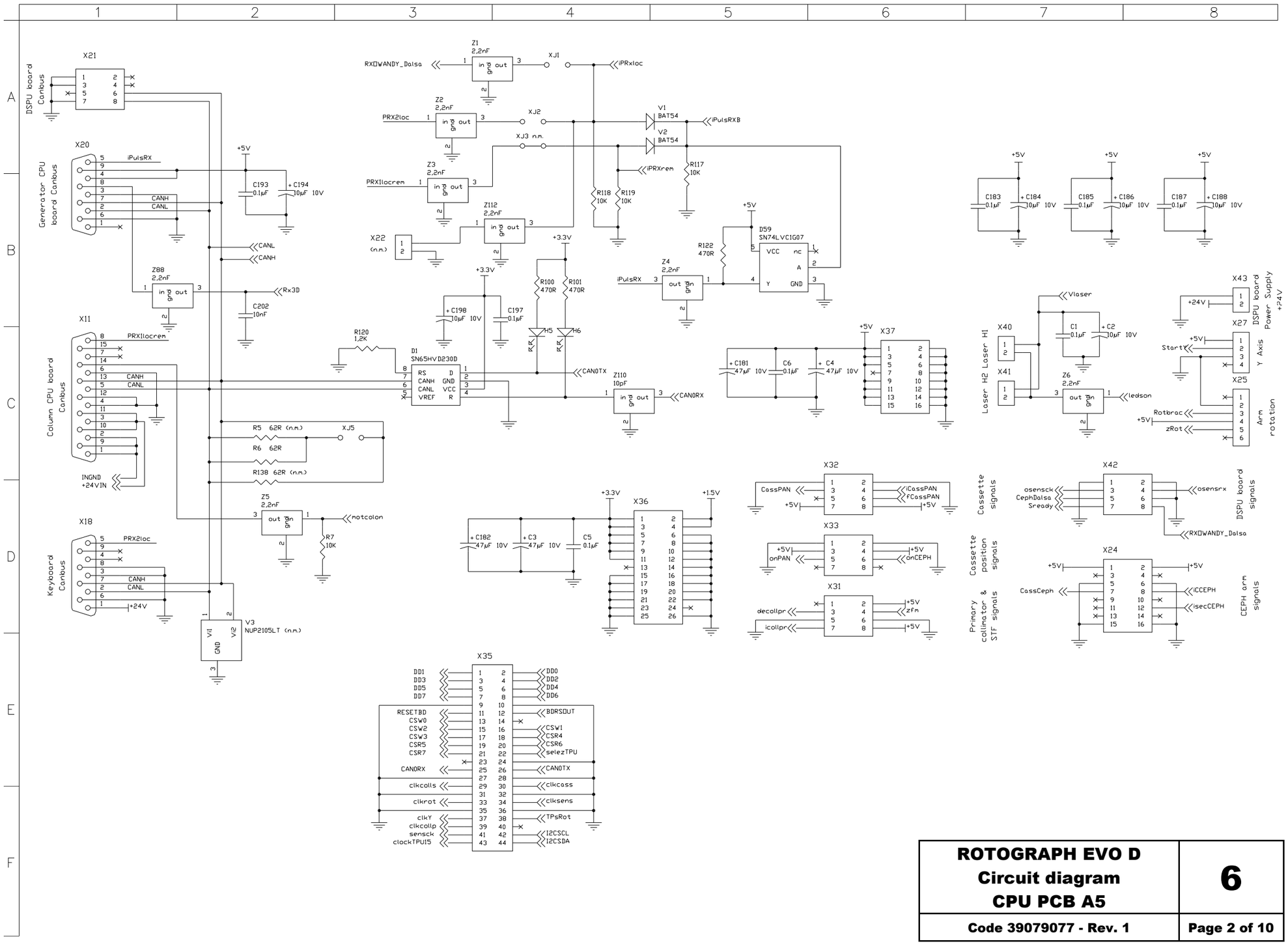
ROTOGRAPH EVO D **Lay-out** **Touch Screen PCB A4**	**4**
Code 58071020 - Rev. 5	**Page 1 of 1**



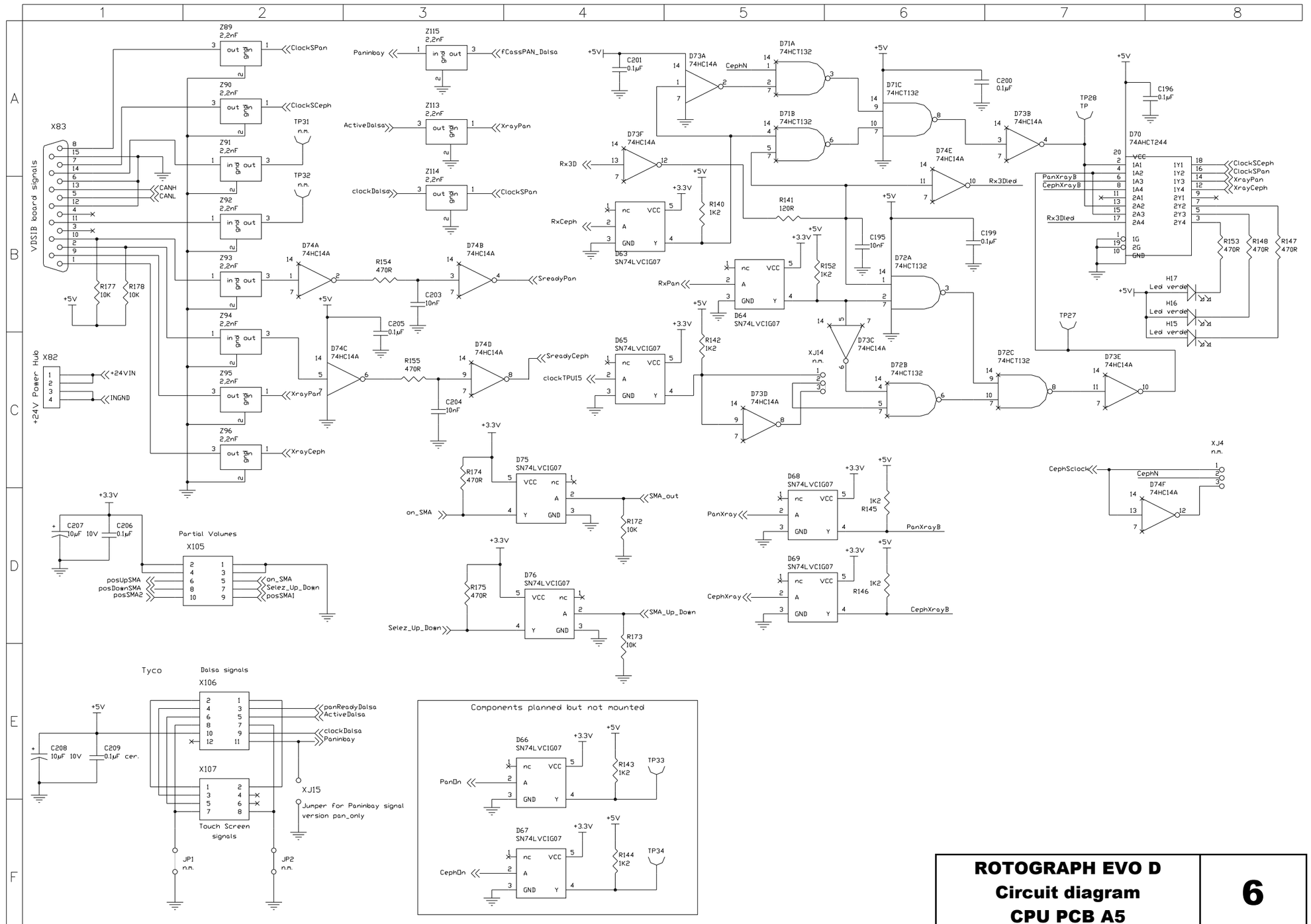
ROTOGRAPH EVO D **Lay-Out** **CPU PCB A5**	**5**
Code 58073047 - Rev. 2	**Page 1 of 1**



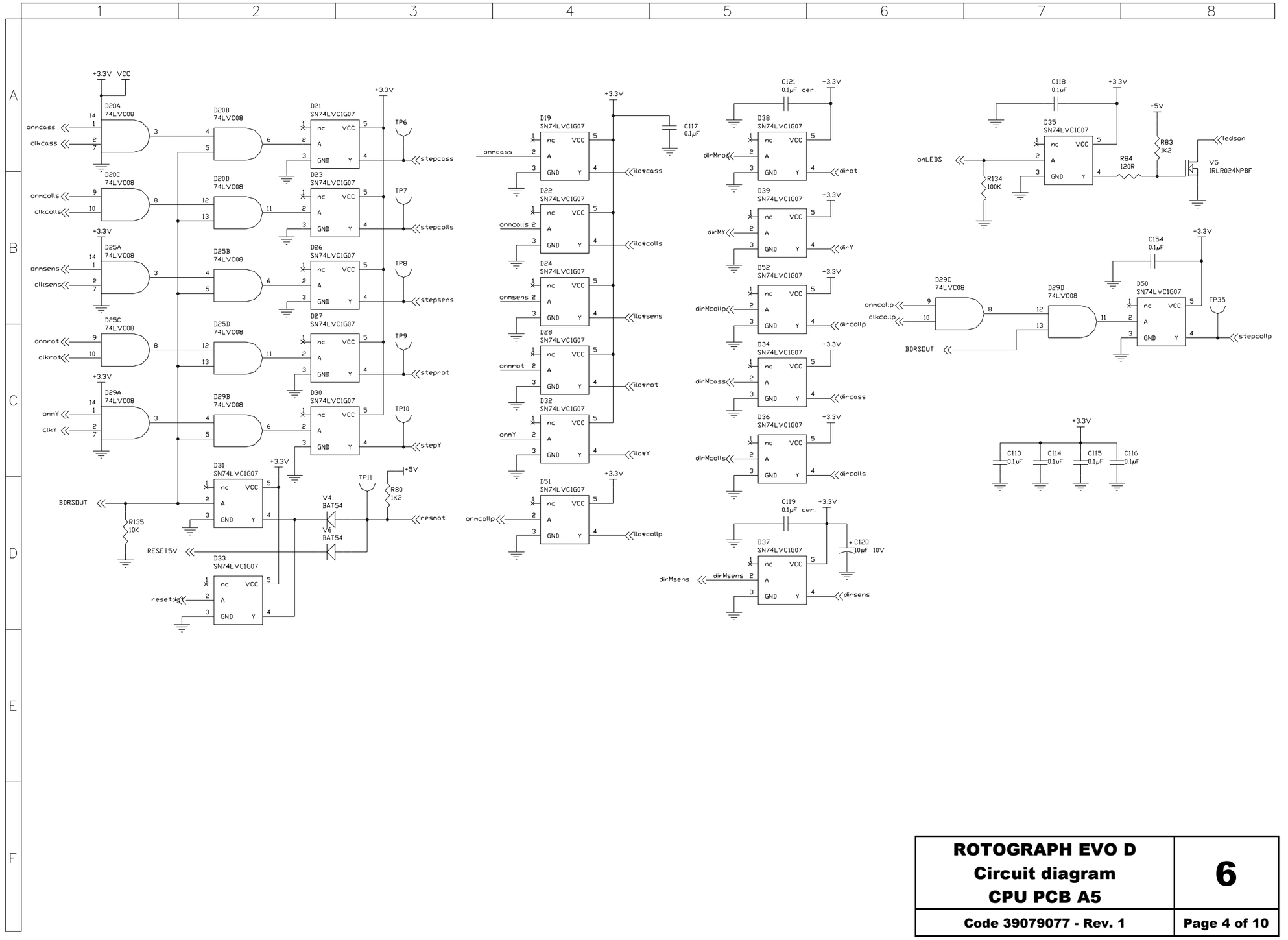
ROTOGRAPH EVO D Circuit diagram CPU PCB A5	6
Code 39079077 - Rev. 1	Page 1 of 10



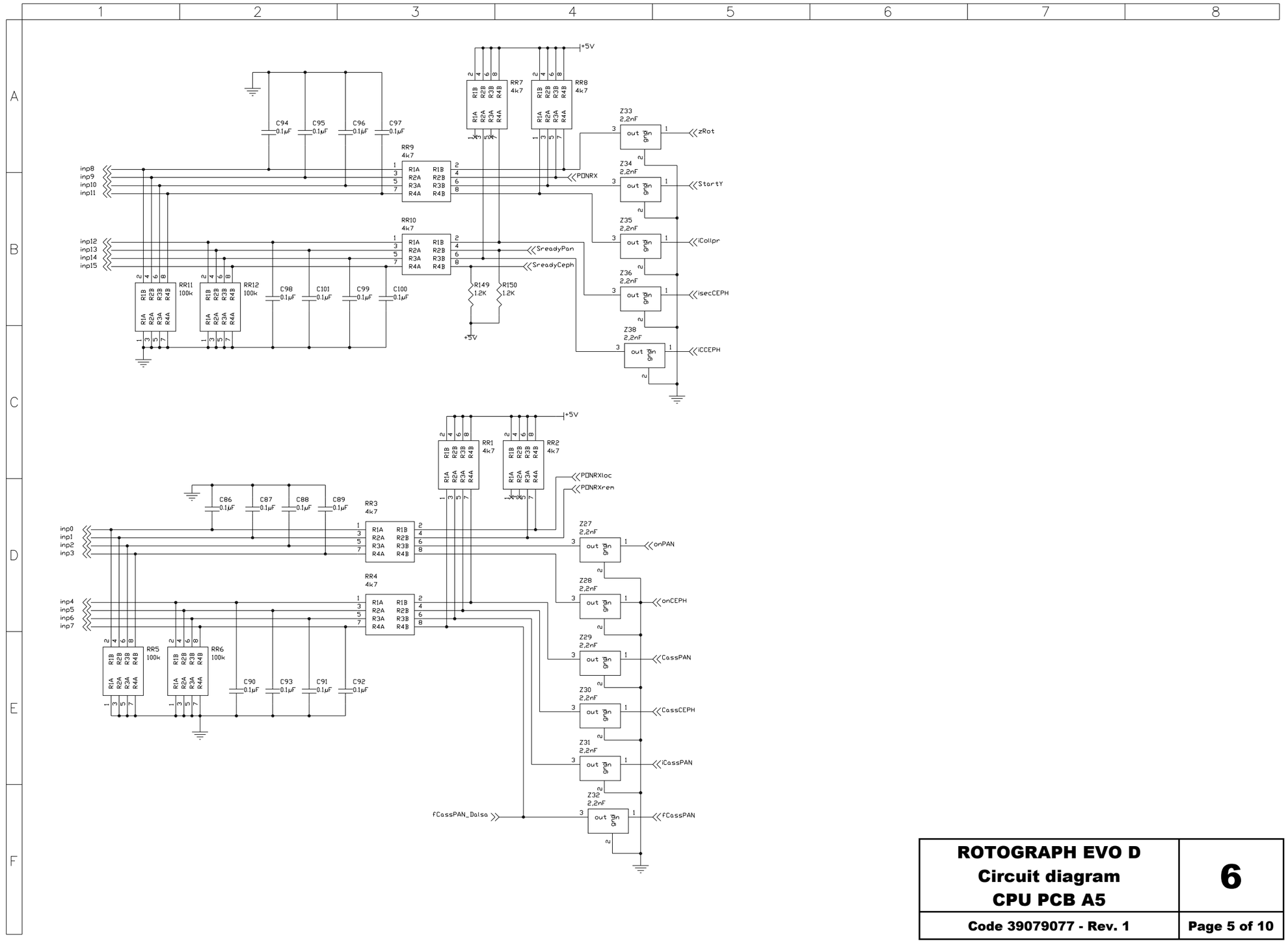
ROTOGRAPH EVO D **Circuit diagram** **CPU PCB A5**	**6**
Code 39079077 - Rev. 1	**Page 2 of 10**



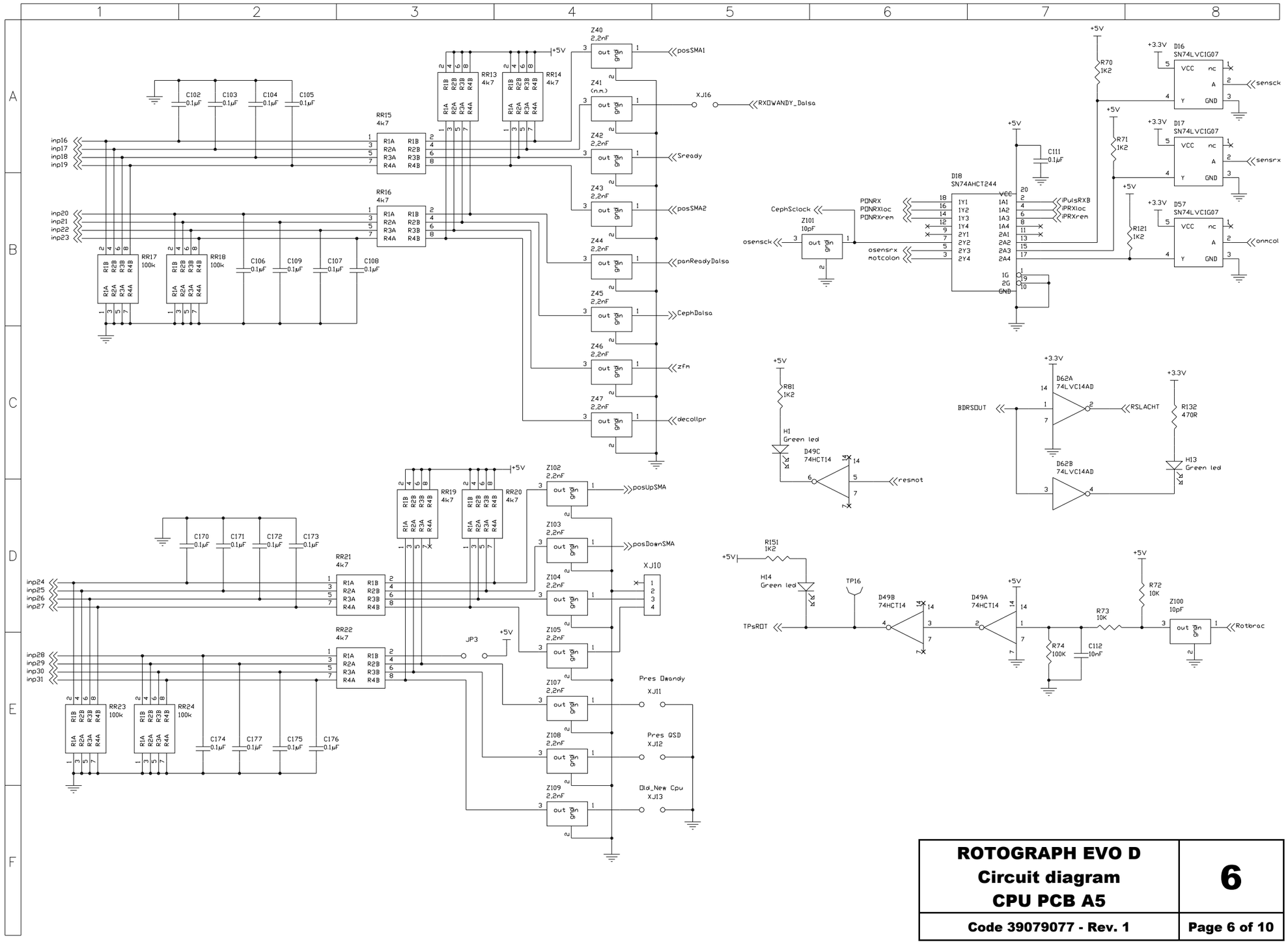
ROTOGRAPH EVO D **Circuit diagram** **CPU PCB A5**	**6**
Code 39079077 - Rev. 1	**Page 3 of 10**



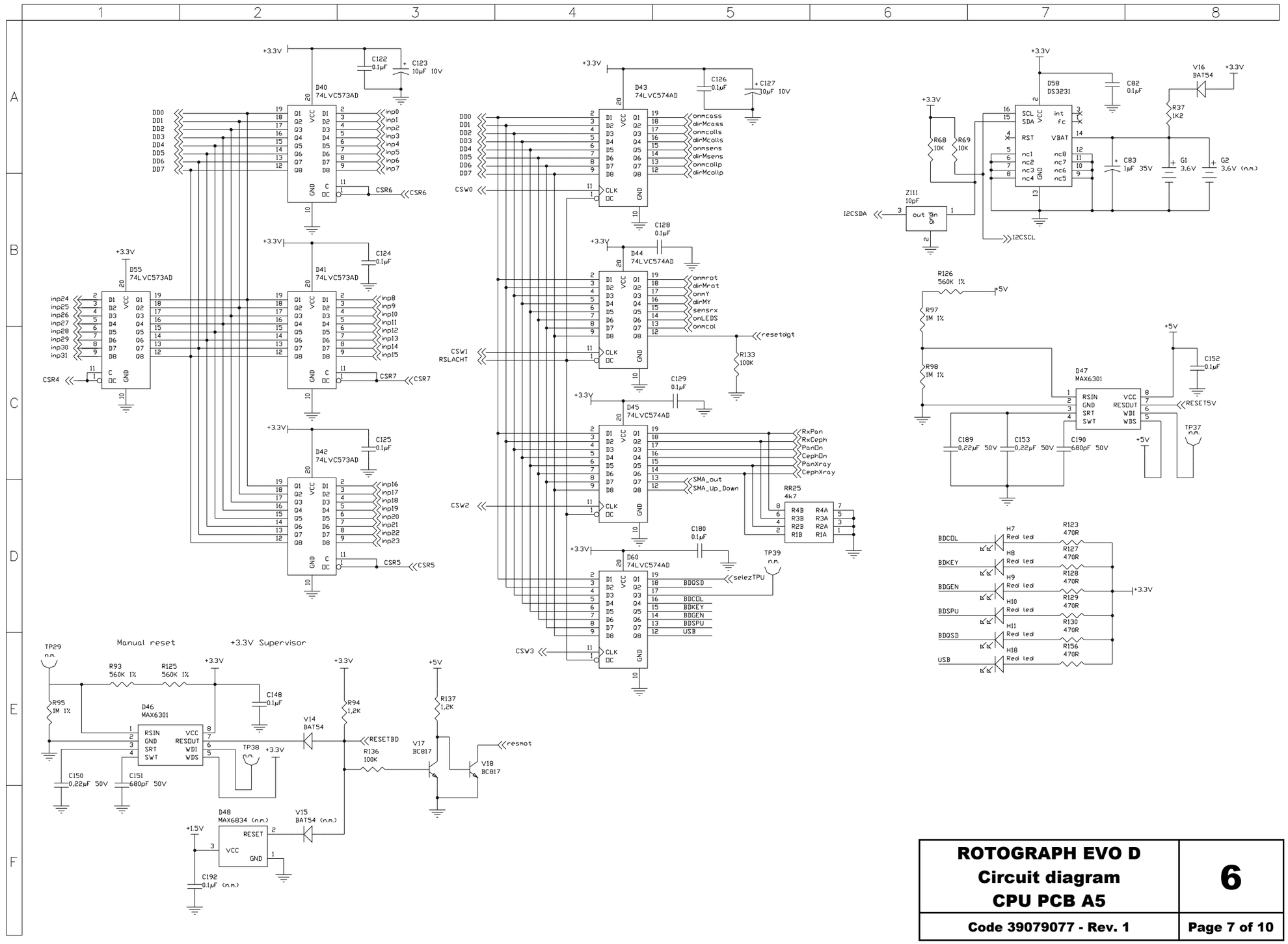
ROTOGRAPH EVO D **Circuit diagram** **CPU PCB A5**	**6**
Code 39079077 - Rev. 1	**Page 4 of 10**



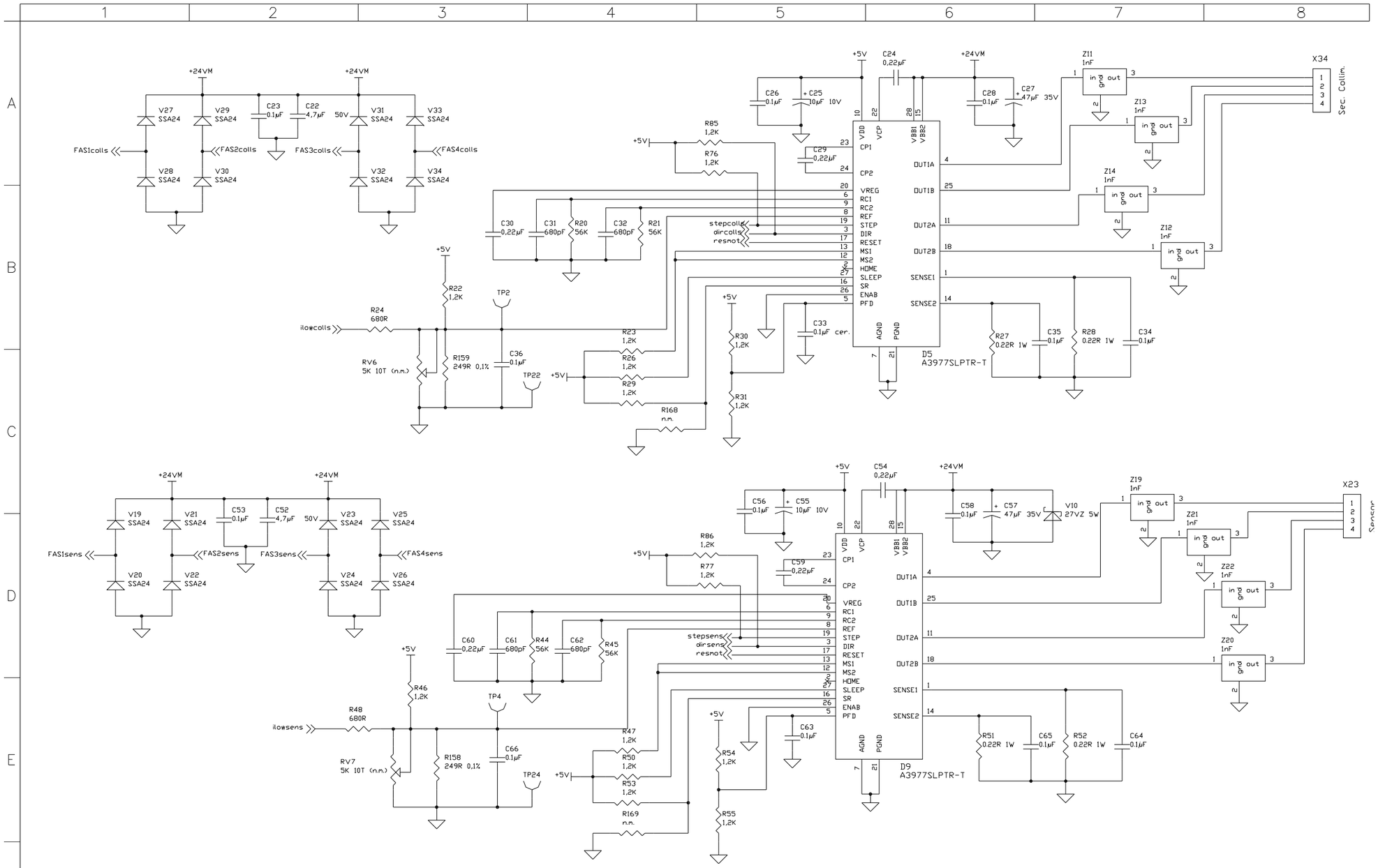
ROTOGRAPH EVO D Circuit diagram CPU PCB A5	6
Code 39079077 - Rev. 1	Page 5 of 10



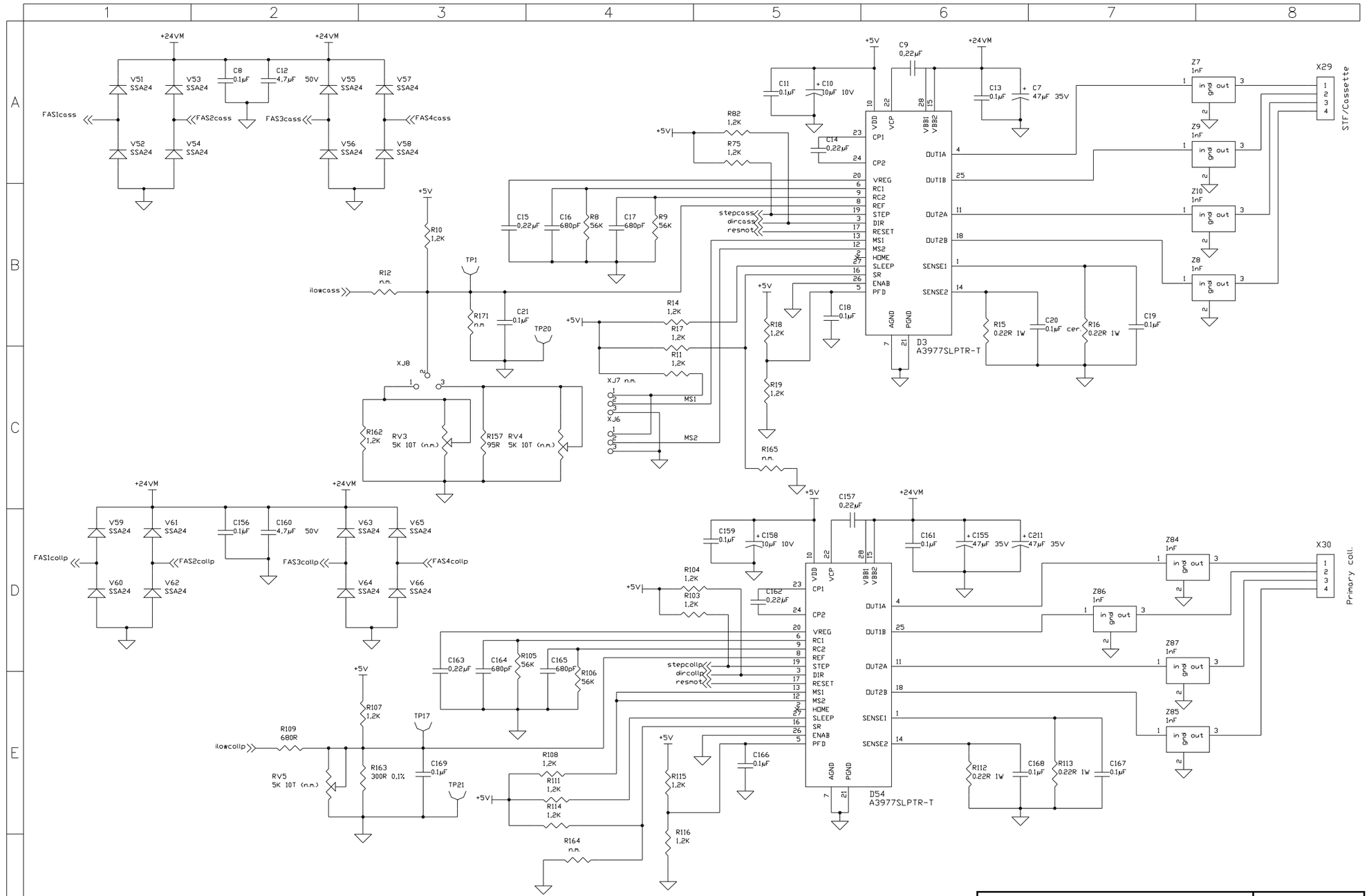
ROTOGRAPH EVO D **Circuit diagram** **CPU PCB A5**	**6**
Code 39079077 - Rev. 1	**Page 6 of 10**



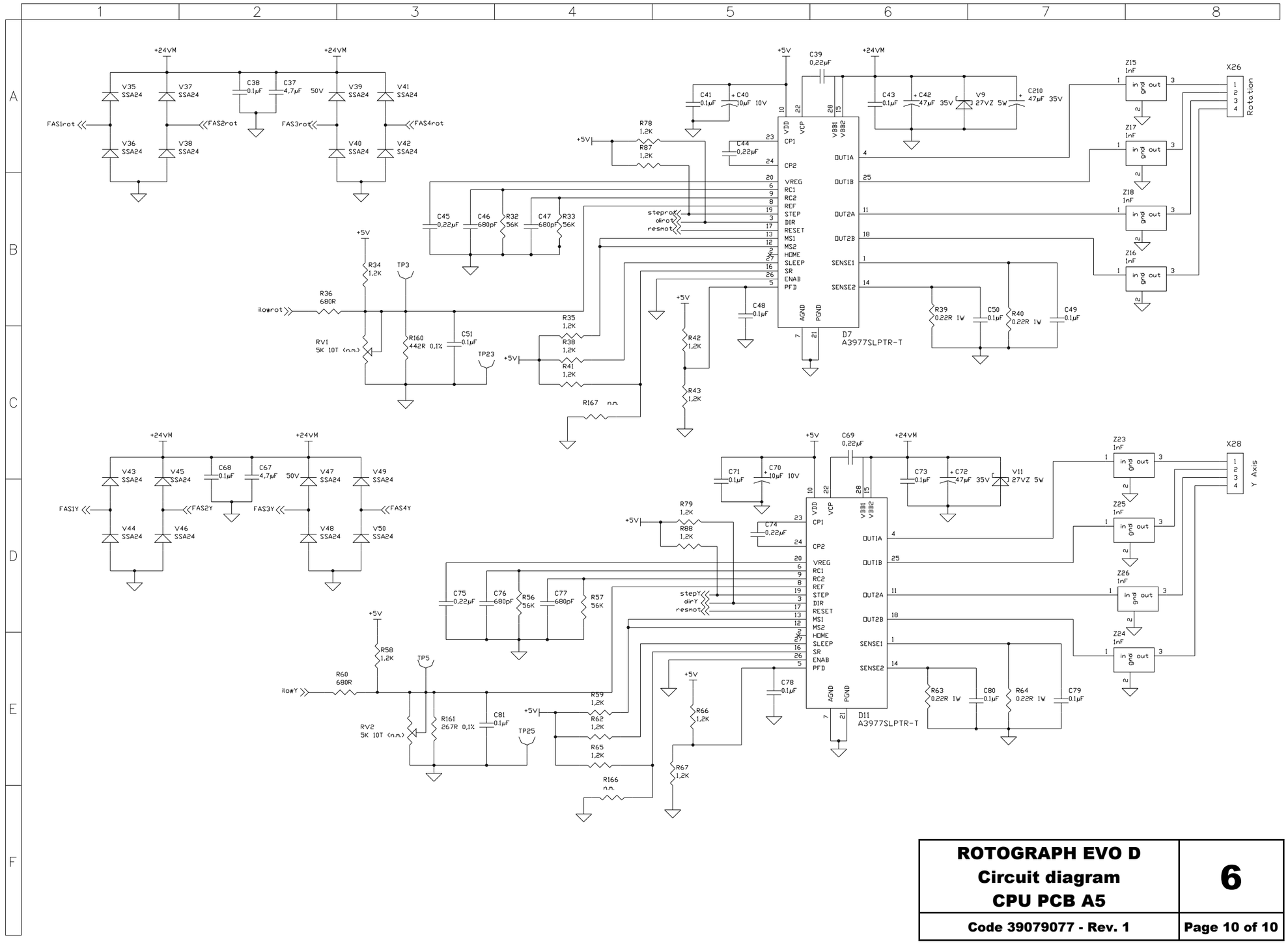
ROTOGRAPH EVO D **Circuit diagram** **CPU PCB A5**	**6**
Code 39079077 - Rev. 1	**Page 7 of 10**



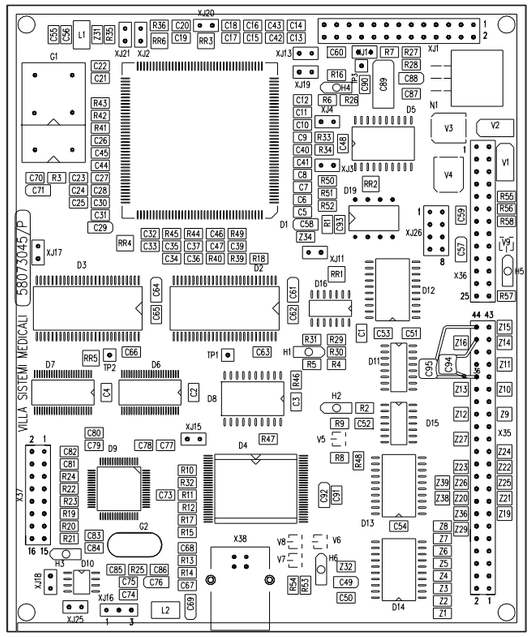
ROTOGRAPH EVO D Circuit diagram CPU PCB A5	6
Code 39079077 - Rev. 1	Page 8 of 10



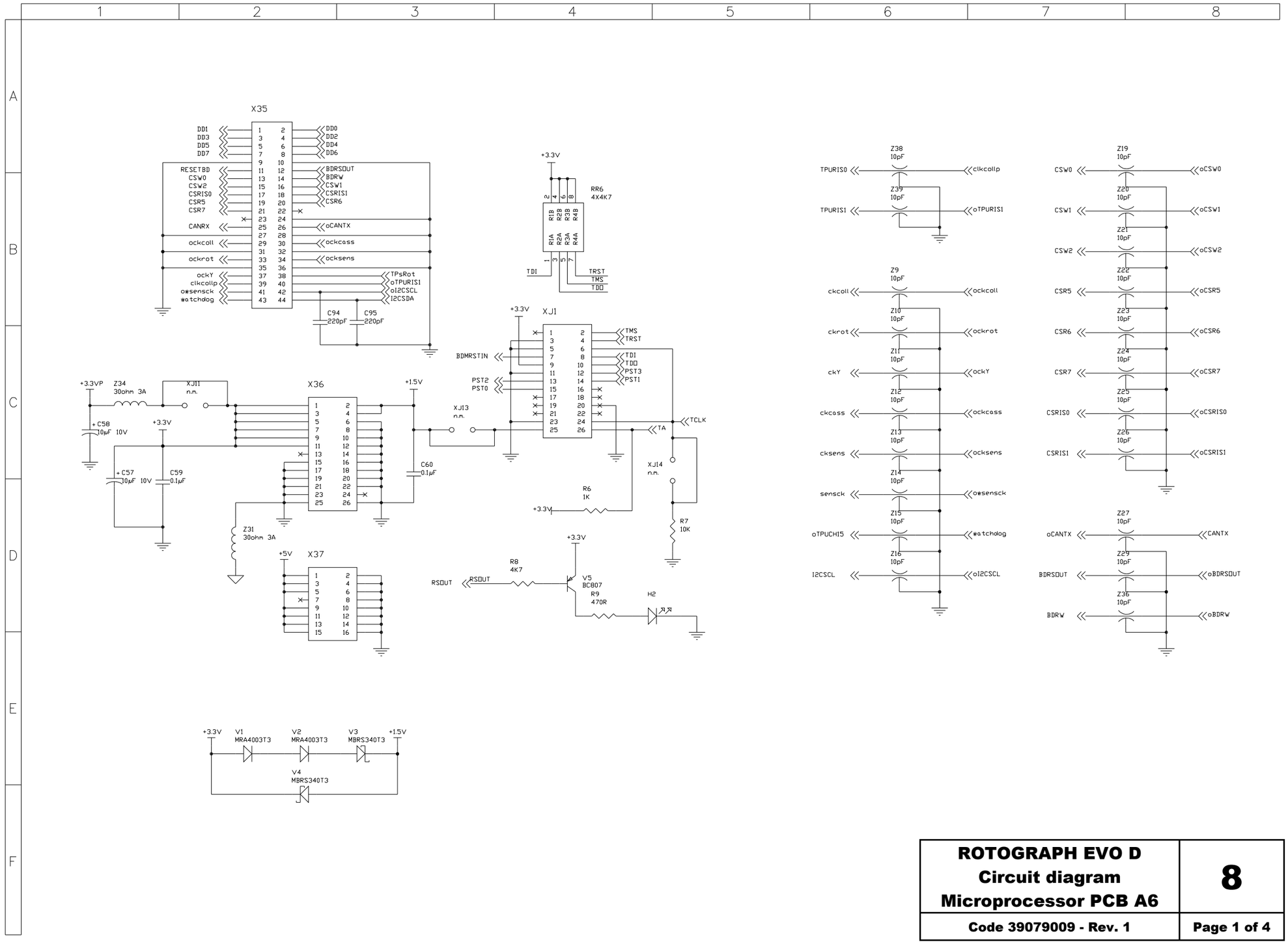
ROTOGRAPH EVO D Circuit diagram CPU PCB A5	6
Code 39079077 - Rev. 1	Page 9 of 10



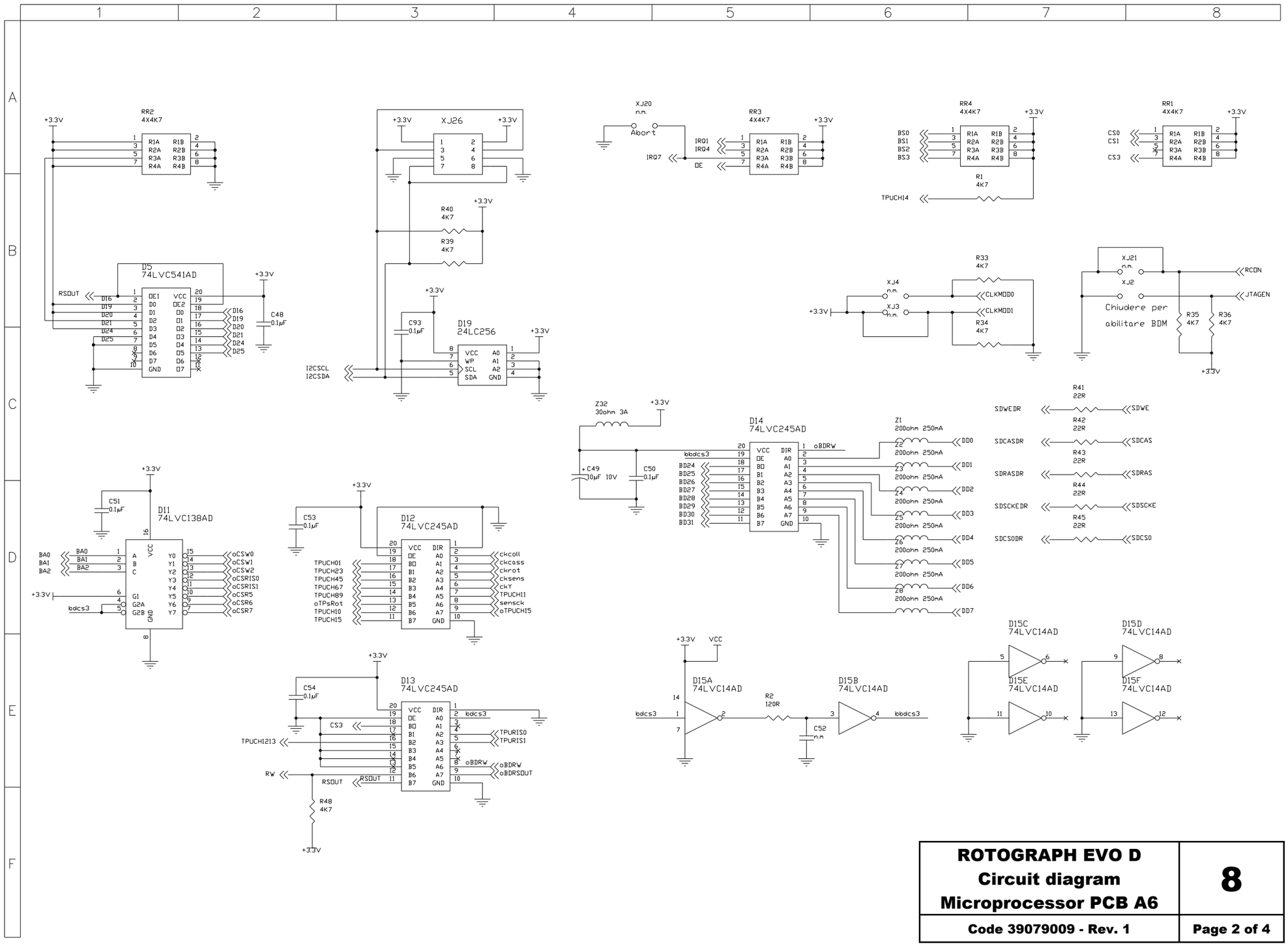
ROTOGRAPH EVO D **Circuit diagram** **CPU PCB A5**	**6**
Code 39079077 - Rev. 1	**Page 10 of 10**



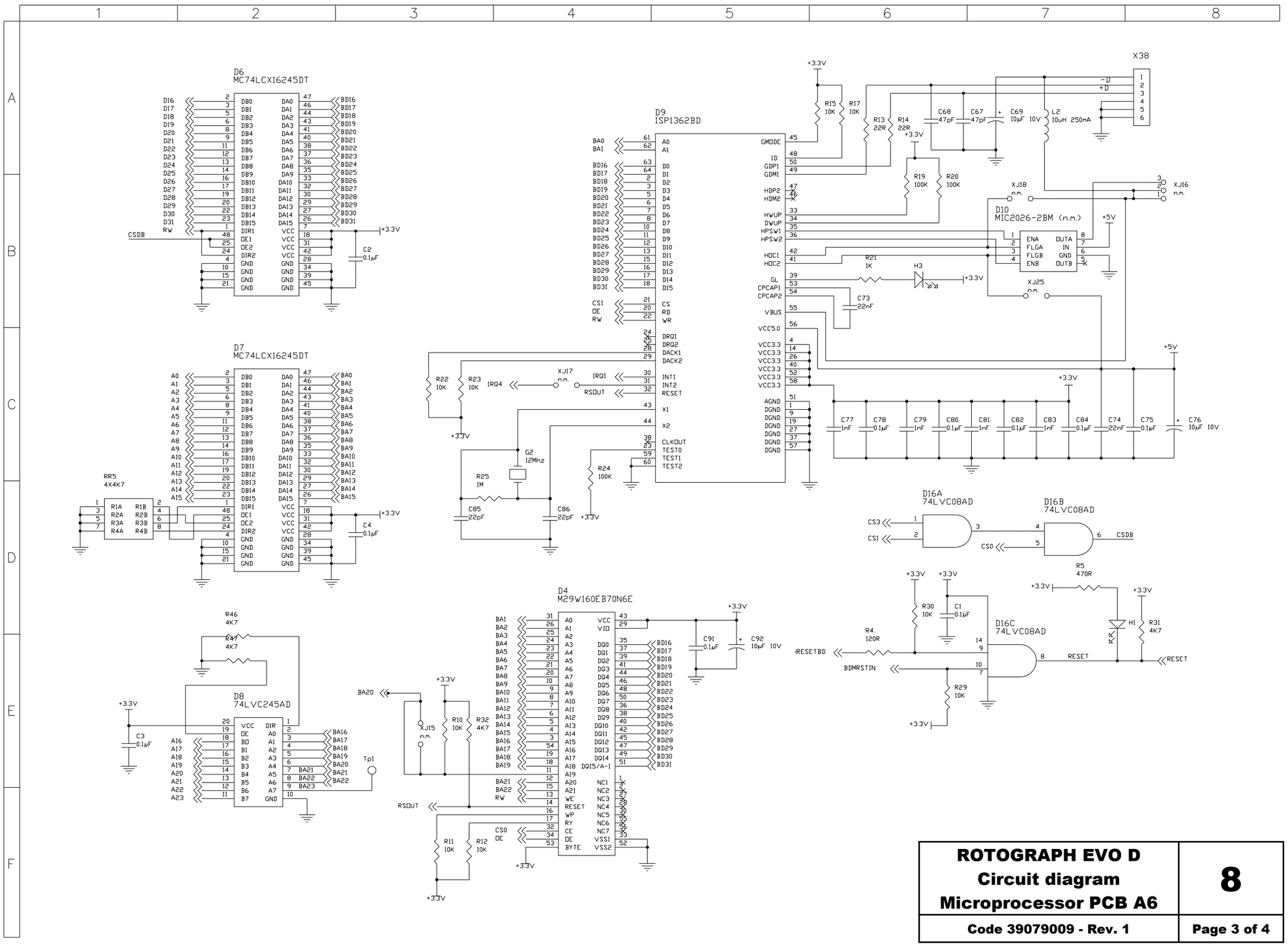
ROTOGRAPH EVO D **Lay-out** **Microprocessor PCB A6**	**7**
Code 58073045 - Rev. 0	**Page 1 of 1**



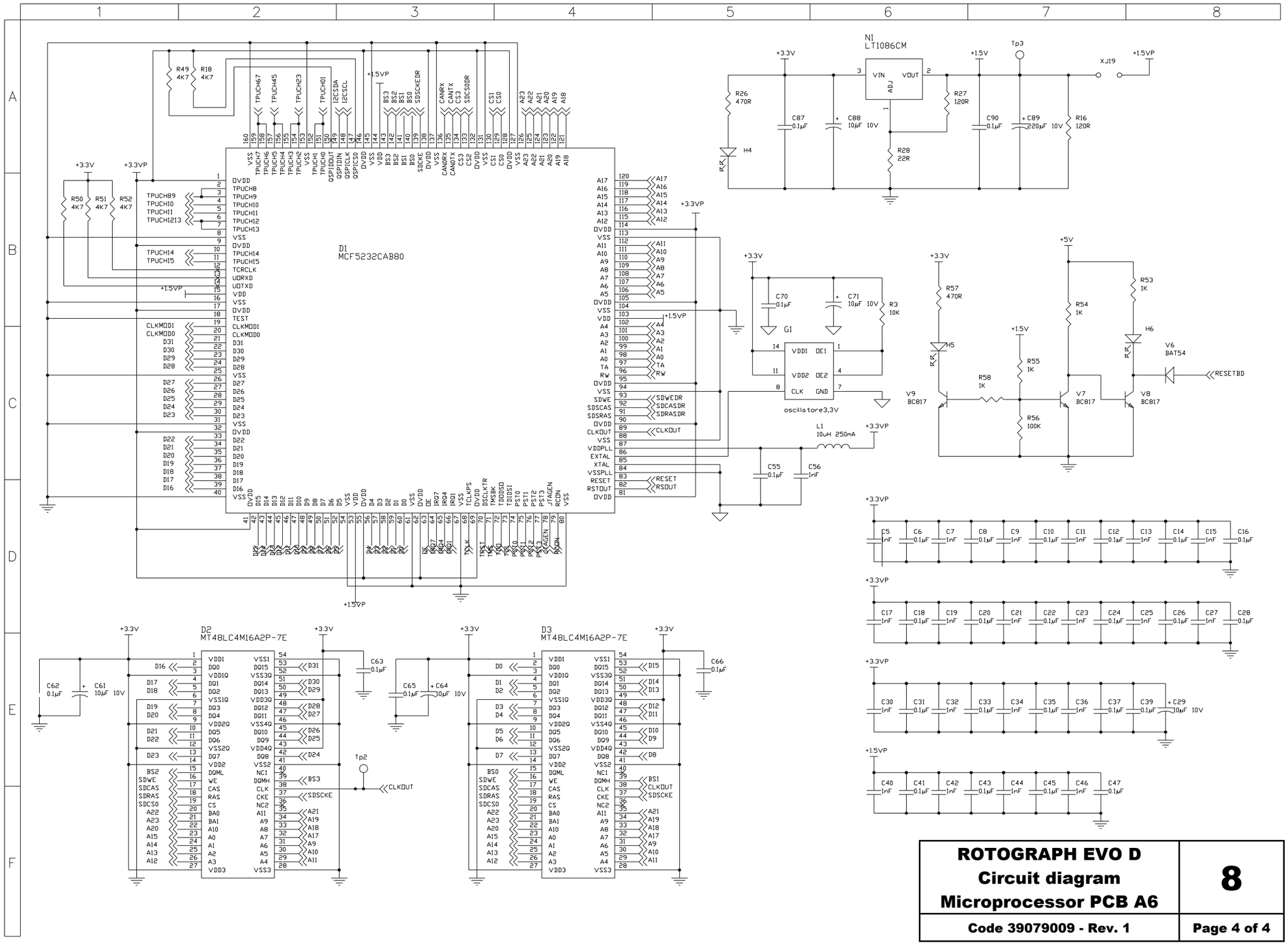
ROTOGRAPH EVO D Circuit diagram Microprocessor PCB A6	8
Code 39079009 - Rev. 1	Page 1 of 4



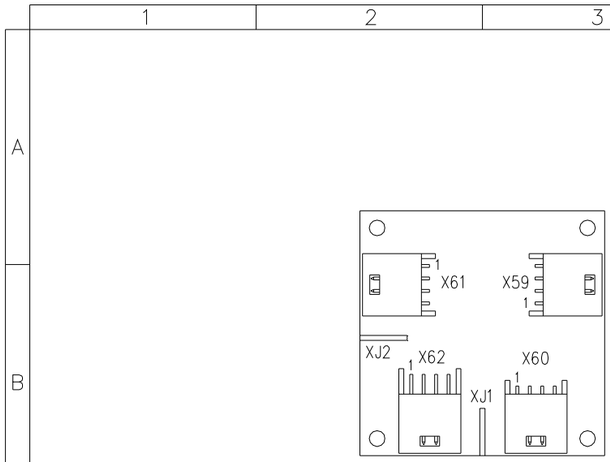
ROTOGRAPH EVO D **Circuit diagram** **Microprocessor PCB A6**	**8**
Code 39079009 - Rev. 1	**Page 2 of 4**

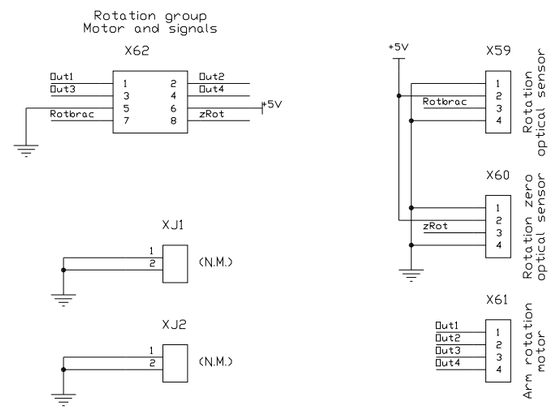


ROTOGRAPH EVO D **Circuit diagram** **Microprocessor PCB A6**	**8**
Code 39079009 - Rev. 1	**Page 3 of 4**

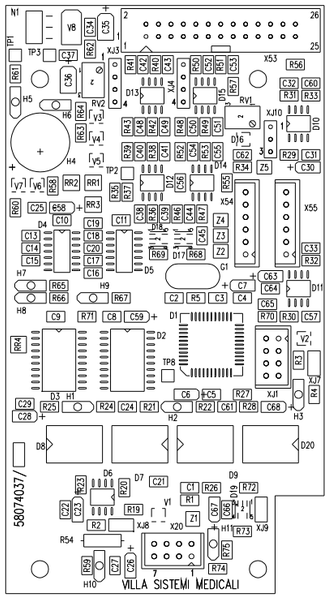


ROTOGRAPH EVO D Circuit diagram Microprocessor PCB A6	8
Code 39079009 - Rev. 1	Page 4 of 4

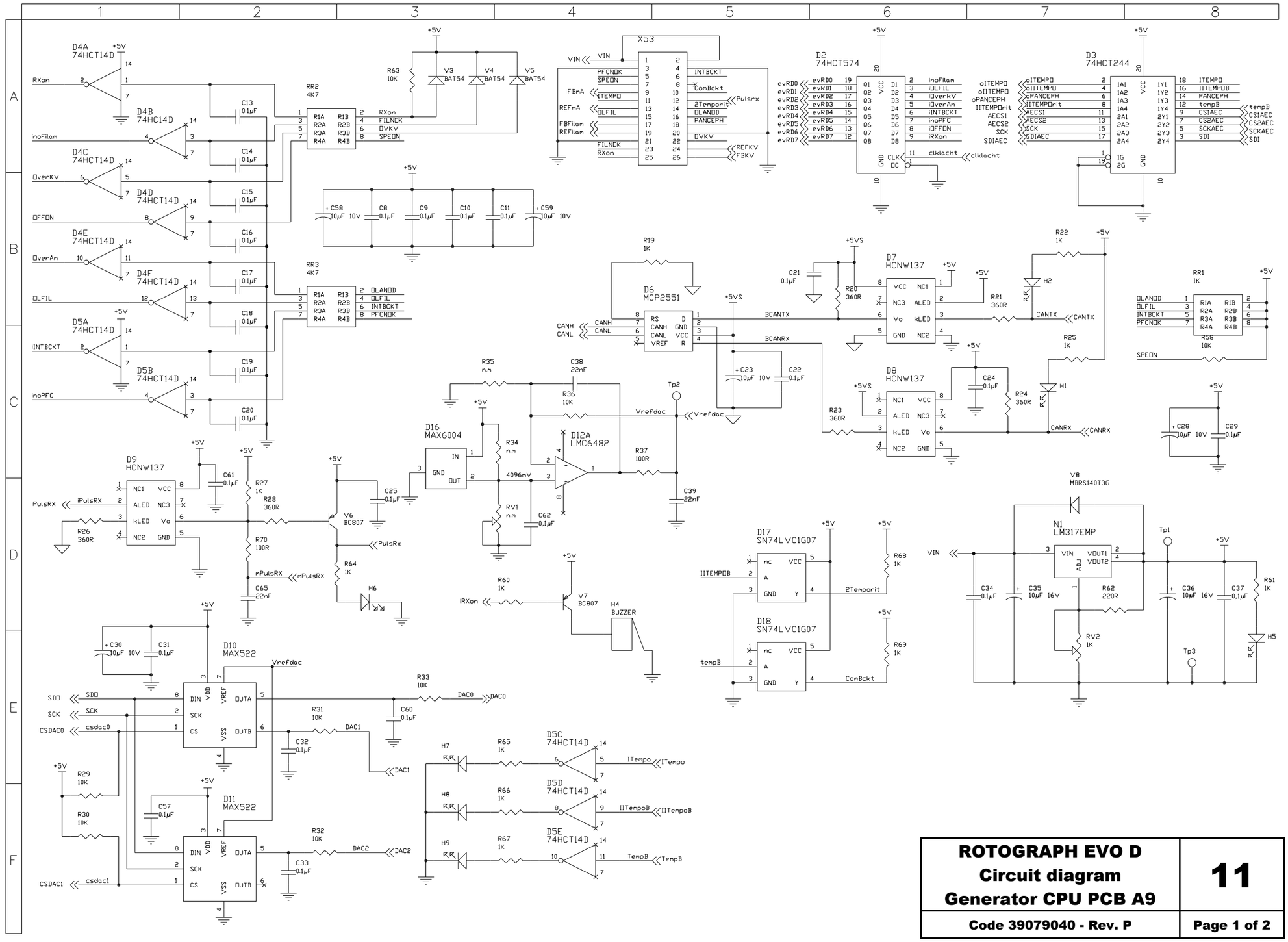




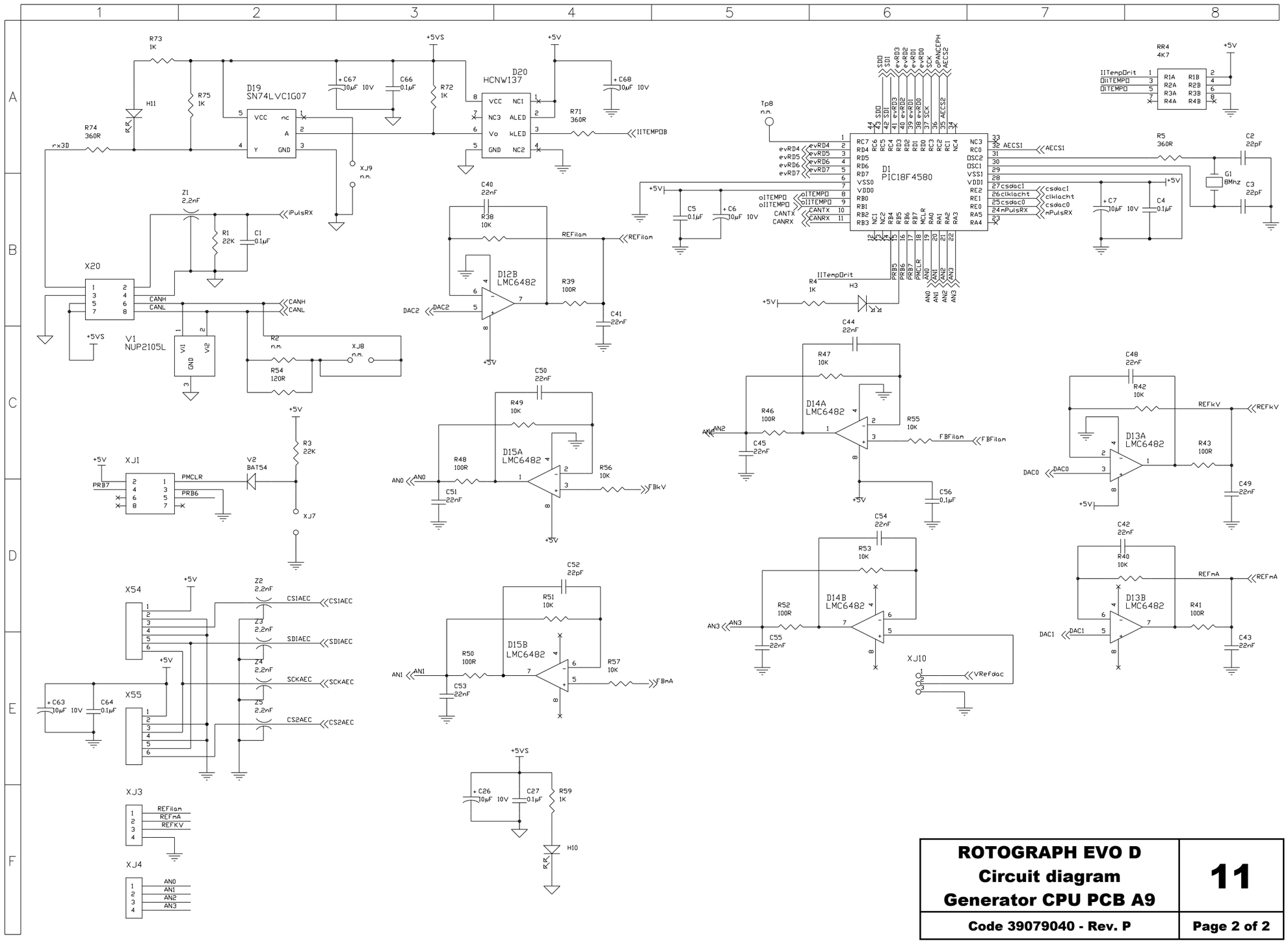
ROTOGRAPH EVO D **Lay-out and circuit diagram** **Rotation group PCB A7**	**9**
Code 58073025 - Rev. P	**Page 1 of 1**



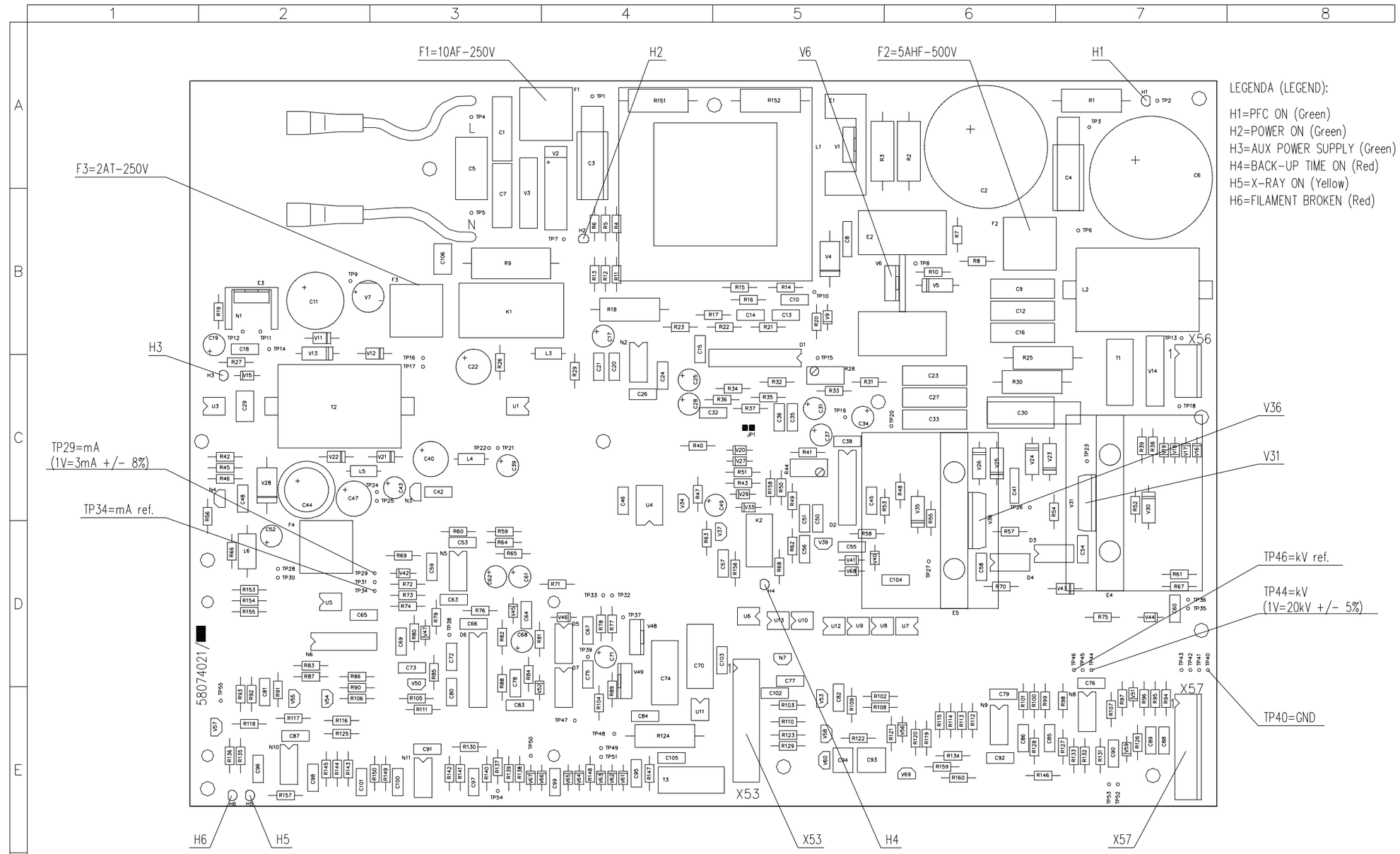
ROTOGRAPH EVO D Lay-out Generator CPU PCB A9	10
Code 58074037 - Rev. P	Page 1 of 1



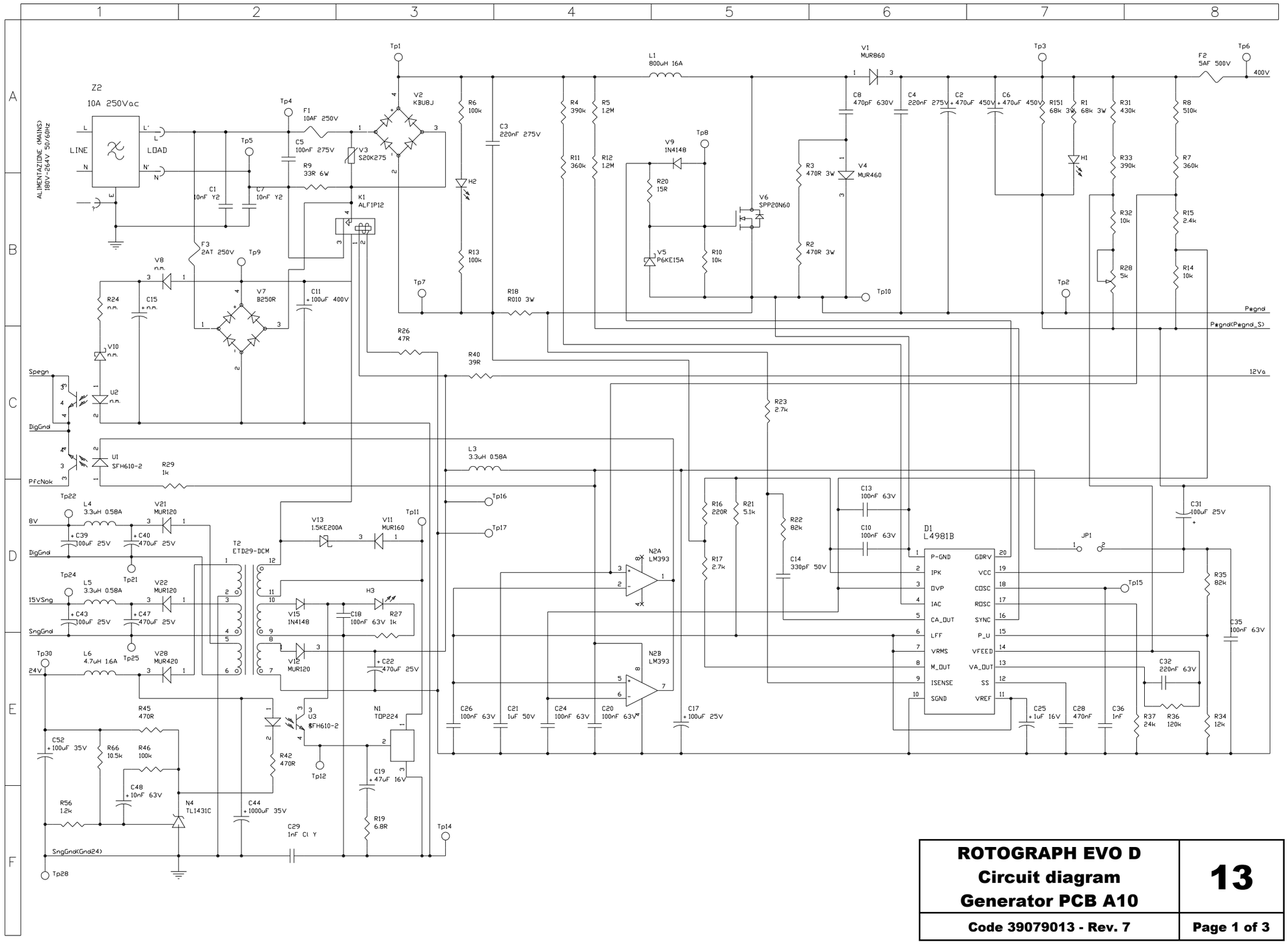
ROTOGRAPH EVO D **Circuit diagram** **Generator CPU PCB A9**	**11**
Code 39079040 - Rev. P	**Page 1 of 2**



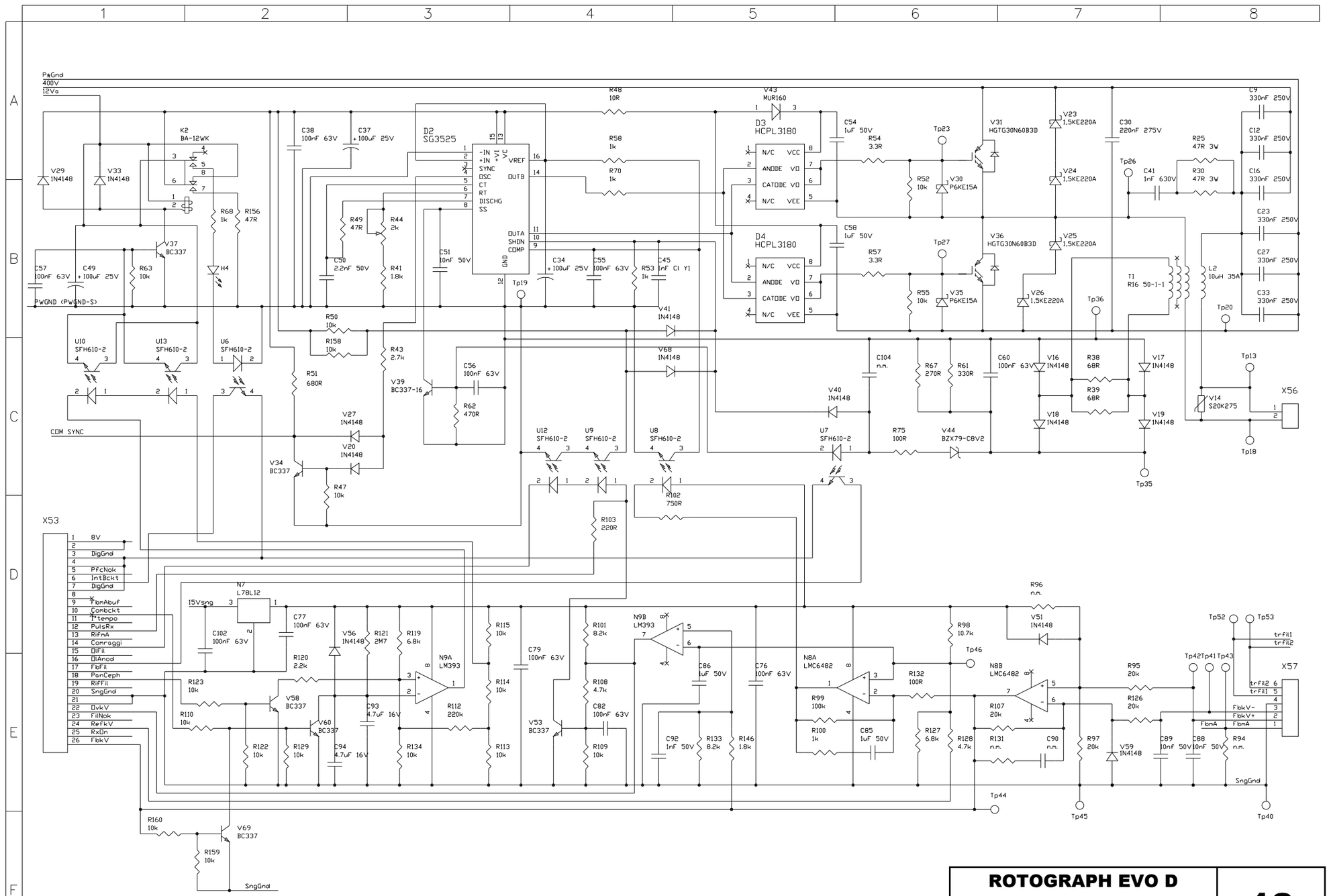
ROTOGRAPH EVO D **Circuit diagram** **Generator CPU PCB A9**	**11**
Code 39079040 - Rev. P	**Page 2 of 2**



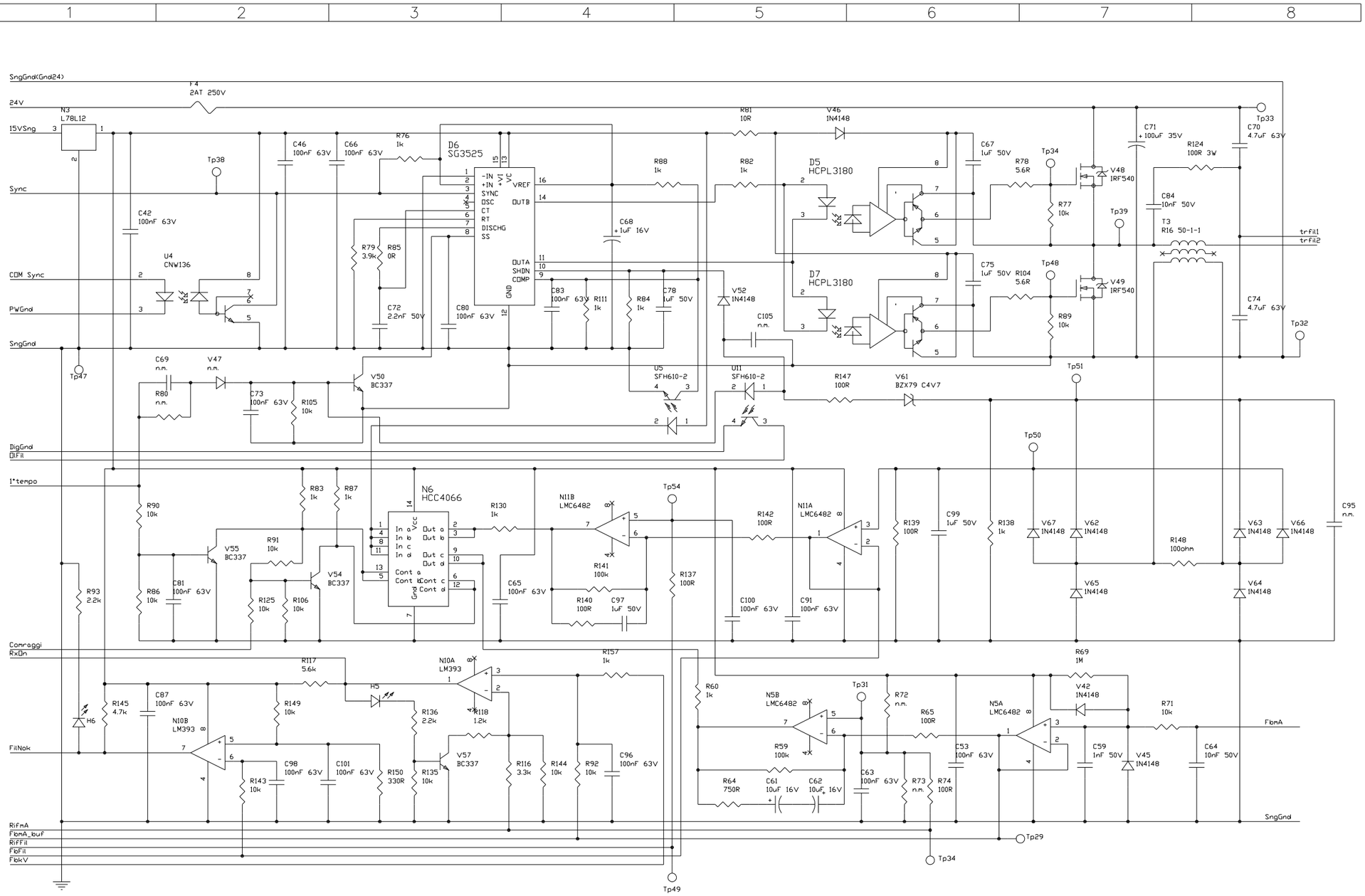
ROTOGRAPH EVO D Lay-out Generator PCB A10	12
Code 58074021 - Rev. 9	Page 1 of 1



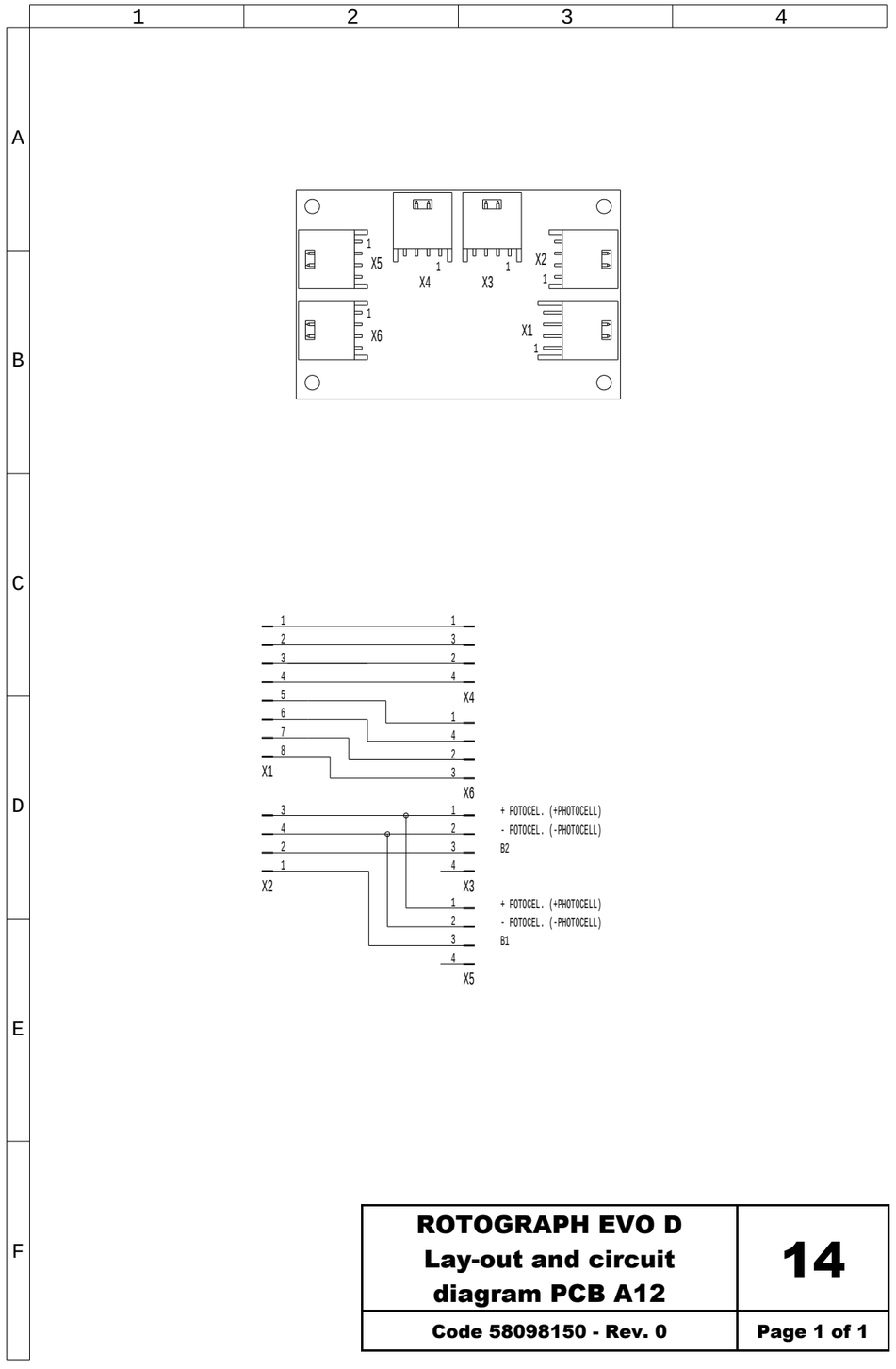
ROTOGRAPH EVO D Circuit diagram Generator PCB A10	13
Code 39079013 - Rev. 7	Page 1 of 3



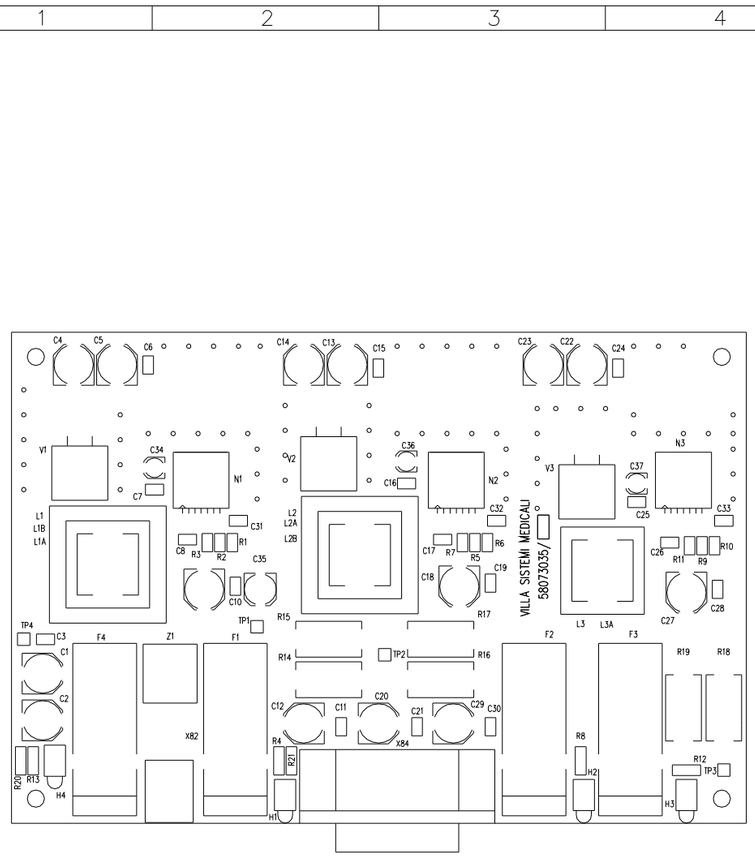
ROTOGRAPH EVO D **Circuit diagram** **Generator PCB A10**	**13**
Code 39079013 - Rev. 7	**Page 2 of 3**



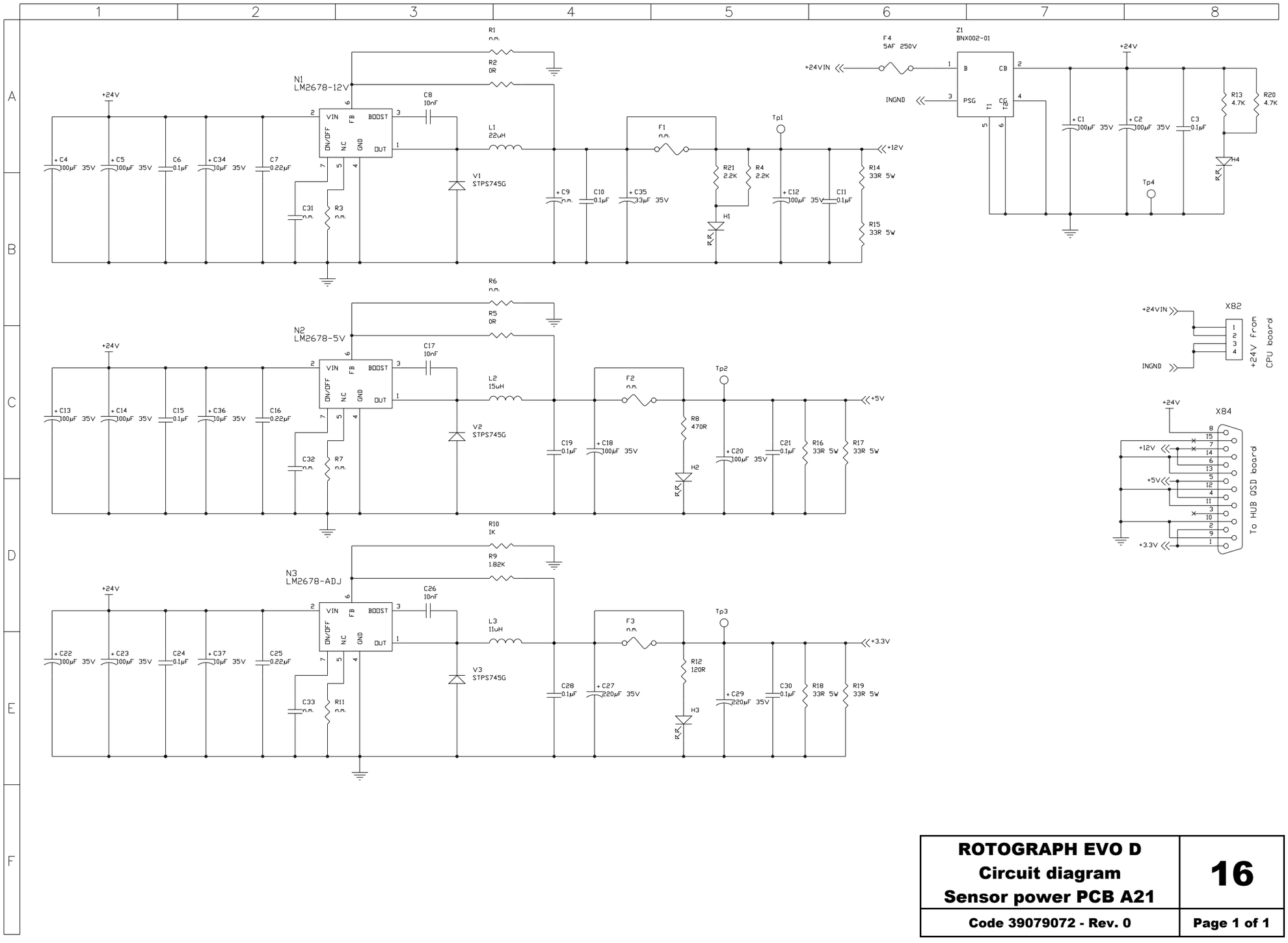
ROTOGRAPH EVO D **Circuit diagram** **Generator PCB A10**	**13**
Code 39079013 - Rev. 7	**Page 3 of 3**



ROTOGRAPH EVO D **Lay-out and circuit diagram PCB A12**	**14**
Code 58098150 - Rev. 0	**Page 1 of 1**



ROTOGRAPH EVO D **Lay-out** **Sensor power PCB A21**	**15**
Code 58073043 - Rev. 0	**Page 1 of 1**



ROTOGRAPH EVO D Circuit diagram Sensor power PCB A21	16
Code 39079072 - Rev. 0	Page 1 of 1

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10. SPARE PARTS

1 - COLUMN

2 - UPPER MOVEMENT ASSY

Electrical and mechanical parts

Cables

3 - ROTATION ARM

4 - CEPH DEVICE

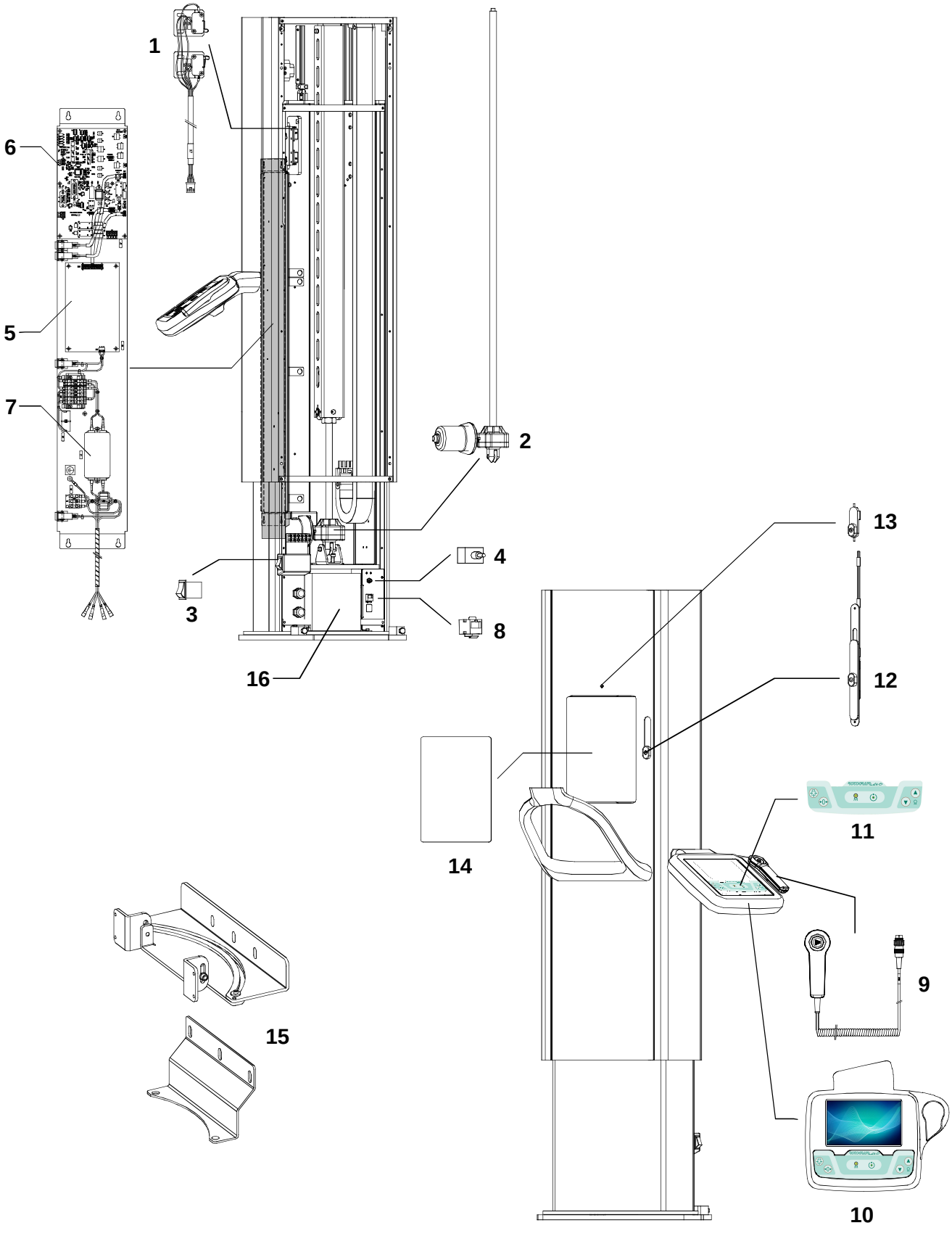
5 - COVERS

6 - ACCESSORIES AND SERVICE TOOLS

1 - COLUMN

Electrical and mechanical parts

Rif.	Order code	Description	Note
1	6207090700	Column end travel microswitches with cable	
2	6607092100	Column actuator M1	
3	4291415900	Mains switch	
4	6207090200	Up / Down column switch S2	
5	4492823000	+24V switch mode power supply	
6	5807101000	Column CPU board A1	
7	4192212200	Line Filter Z1	
8	4591845200	RJ45 connector	
9	6207150900	X-ray push button with cable	
10	6607150400	Touch Screen assy	
11	5407092300	Console overlay	
12	6607098300	Frankfurt plane laser	
13	6607098400	Mid Sagittal plane laser	
14	6607098800	Mirror	
	5107094100	Mirror Rotograph EVO logo	
15	6607099000	Wall fixing brackets kit including spacers and screws	
	6607091900	US adapter plates	
16	4492822900	Transformer T1	only for 110-120V version
--	6607090200	Fuses kit	220-230V version
	6607090300	Fuses kit	110-120V version
--	2100440400	Column base grub screw cap diam.12.7 mm (1x)	
--	2100440200	Column base grub screw cap diam.4.8 mm (1x)	
--	3998305100	Column front Villa logo	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Cables

Rif.	Order code	Description	Note
--	6207091200	General supply cable	
--	6207091300	Ground cable #1	
--	6207091900	Generator board A10 power supply cable X2-X70	
--	6207090900	CanBus cable X18	
--	6207090600	CanBus cable X11	
--	5007040100	Touch screen Ethernet cable (L=2m)	
--	5007090100	Ethernet cable (L=5m)	

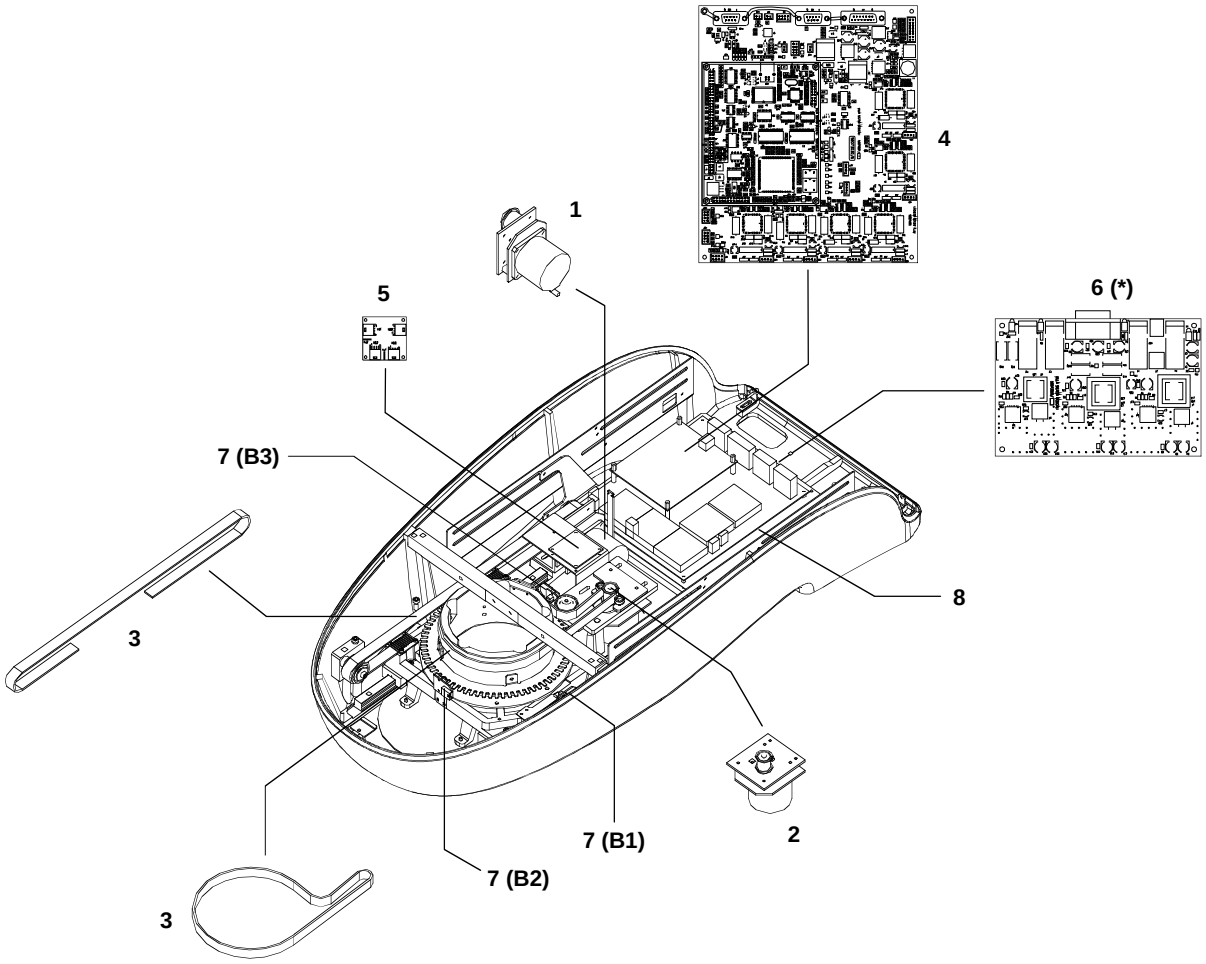
2 - UPPER MOVEMENT ASSY

Cables

Ref.	Order code	Description	Note
--	6207042200	Rotation group motor and signals cable X25 / X26 – X62	
--	6207040200	Y-axis signal cable X27 – B1	
--	6207040600	CanBus cable X20	
--	6207040700	Ground cable # 2	
--	6207040900	Collimator optical sensor cable X70 – Z2	
--	6207041000	Collimator motor power supply cable X29 / X30 – X64 / X65	
--	6207041300	Sensor holder position signal cable X33 – B6 / B7	
--	6207042700	Sensor signal and power cable X32 / X94 – Sensor	PAN only version
	6207042400	Sensor signal and power cable X32 / X94 – Sensor	PANCEPH version
--	6207041500	Generator board A10 power supply cable X70 – Z2	
--	6207080900	Ground cable # 3	
--	5007040100	Ethernet cable (L=2m) Sensor to HUB connection	

Electrical and mechanical parts

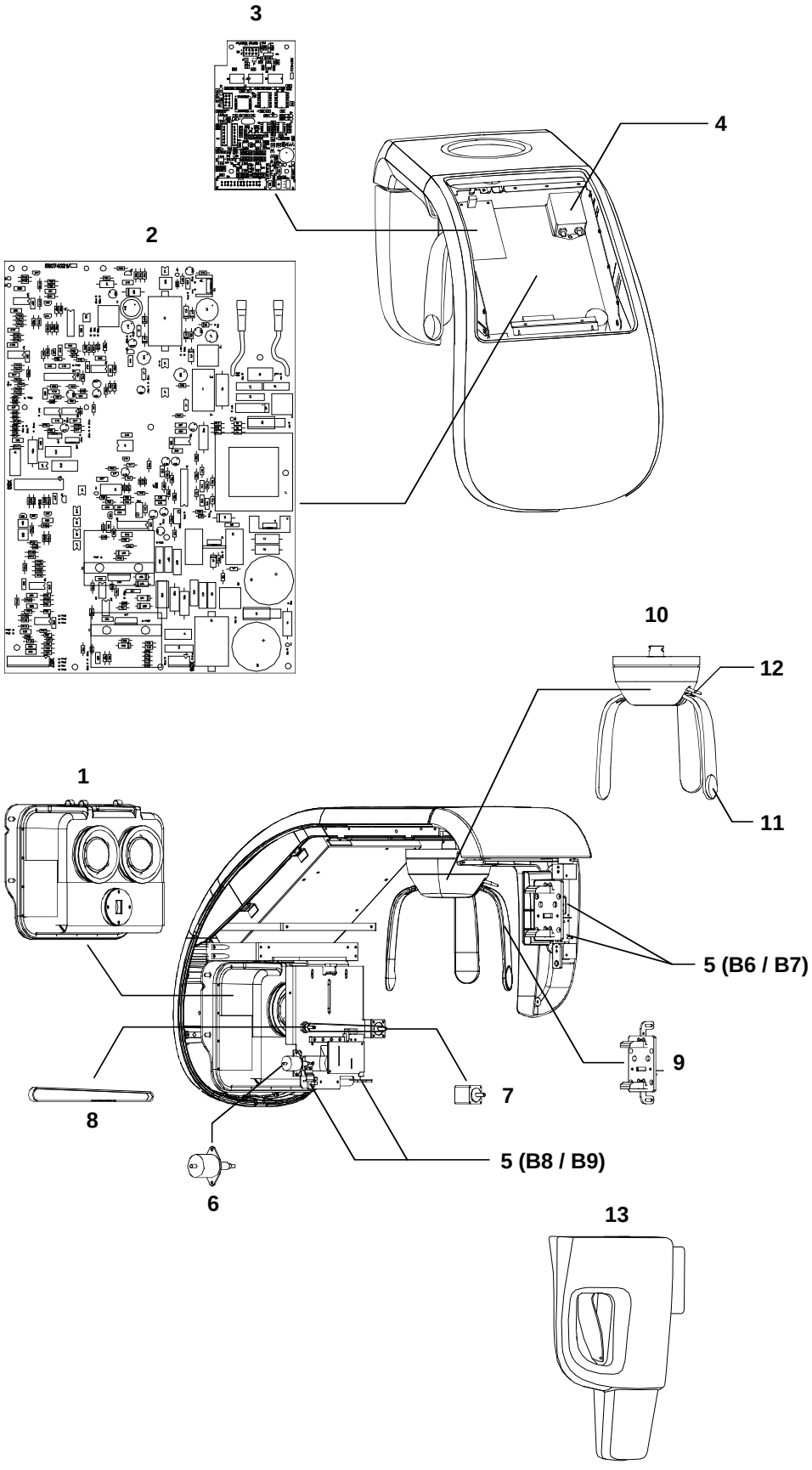
Ref.	Order code	Description	Note
1	6607035000	M2 Y-Axis stepper motor assy	
2	6607025000	M3 rotation stepper motor assy	
3	4990802300	Carriage belt model HTD 843-3M-15	
4	6607304600	CPU board assy	
	5807304700	CPU board A5	
	6607304500	Microprocessor board A6	
5	5807302500	Rotation group board A7	
6	5807304300	Sensor power board A21	
7	5807302900	Optical sersor board B1 / B2 / B3	
8	4695456700	HUB D-Link	



(*) *Under CPU board support*

3 - ROTATION ARM

Ref.	Order code	Description	Note
1	6607000000	HF Tubehead	
2	5807402100	Generator board A10	
3	5807403700	Generator CPU board A9	
4	4192212300	Line filter Z2	
5	5807302900	Optical sensor board B6 / B7 / B8 / B9	
6	6607120200	Soft Tissue Filter motor M6	
7	6207120500	Primary collimator motor M5	
8	4990803900	Closed toothed belt	
9	6607070900	Sensor holder connector plate (female)	
10	6607010700	Temple clamp assy	
11	5407012001	Temple clasps (1x)	
12	5207010705	Temple clasps release knob (1x)	
13	6607071500	PAN mobile sensor covers kit (without sensor)	
	6607071600	PAN/CEPH mobile sensor covers kit (without sensor)	
--	6607071300	PAN mobile sensor assy	
--	6607071400	PAN/CEPH mobile sensor assy	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5 (B8 / B9)
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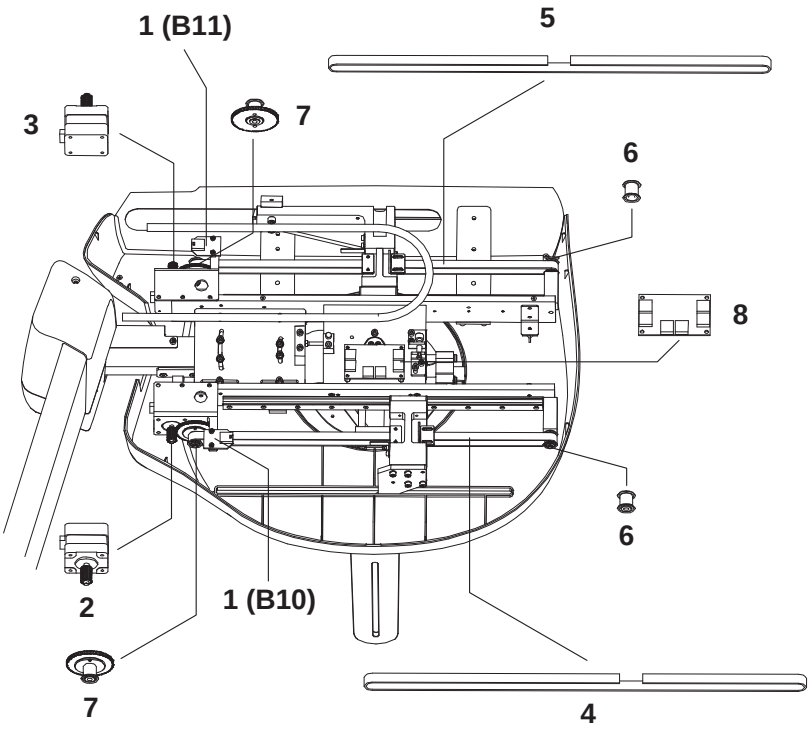
4 – CEPH DEVICE

Ref.	Order code	Description	Note
1	5807302900	Optical sensor board B10 / B11	
2	6607081000	Secondary collimator motor M8	
3	6607081200	Ceph Sensor motor M9	
4	4990804800	Secondary collimator dragging belt L= 861 mm	
5	4990804800	Ceph Sensor dragging belt L= 870 mm	
6	5207084000	Pulley	
7	6607083300	Motor gear	
8	5809815000	Interconnection board A12	
9	6607070900	Sensor holder connector plate (female)	
10	6607087705	Rod for Ceph centering device (2x)	
11	6607087501	Nose-rest rod assy	
--	6207080200	Ceph arm motor and signals cable X23 / X24 / X34 – X1 / X2	
--	6207080800	Ceph arm cable X42 / X95 / X97 – X51	
--	5007080100	Ethernet cable (L=3m)	
--	6207080900	Ground cable # 3	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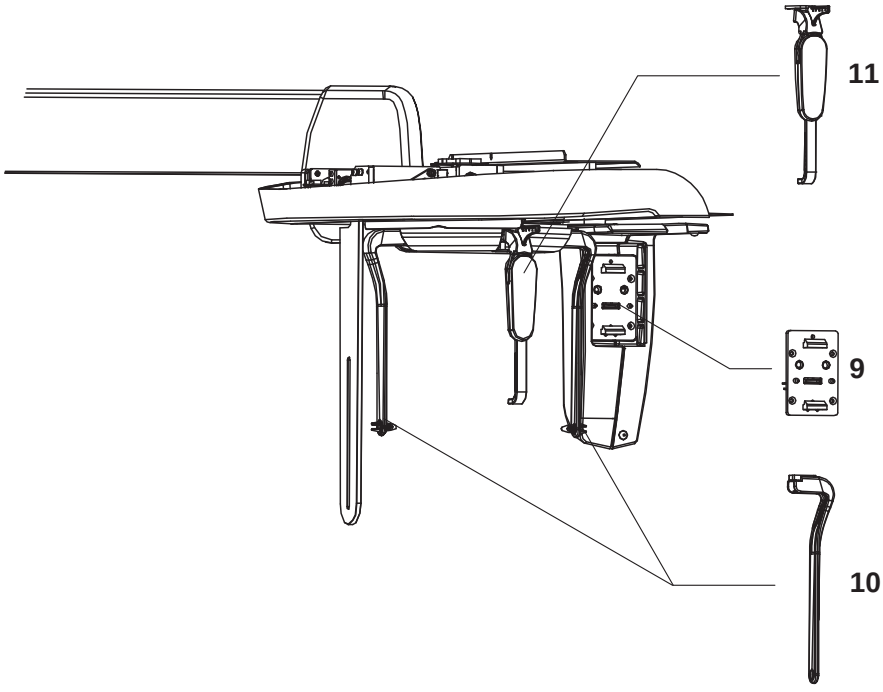
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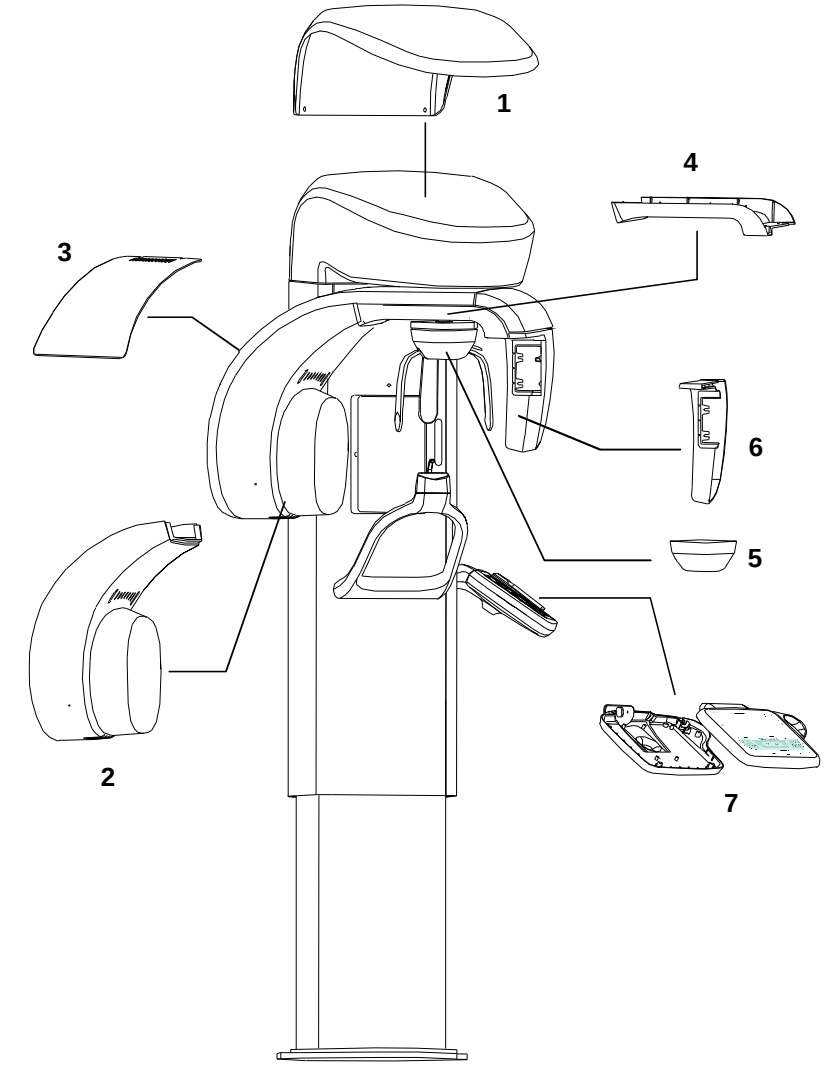
5 - COVERS

Ref.	Order code	Description	Note
1	6607040201	Upper cover	
2	5407201005	Tubehead cover	
3	6607201201	Generator board A10 cover	
	5107094200	Generator board A10 cover Rotograph EVO logo	
4	5407201105	Rotation arm lower cover	
5	5407011905	Temple clamp cover	
6	6607070105	PAN / CEPH Sensor holder internal cover	
7	6607150100	Console covers (upper + lower)	
8	5407086601	Ceph device upper cover	
9	5407086905	Ceph device lower cover	
10	5407087005	Ceph centring device lower cover	
11	5407086705	Ceph arm lower cover	
12	5407086805	Ceph arm upper cover	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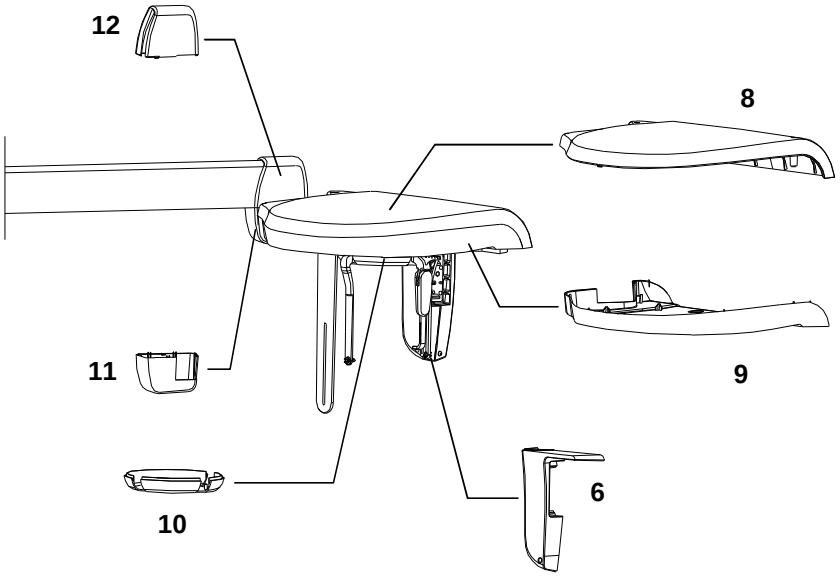
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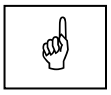
6 - ACCESSORIES AND SERVICE TOOLS

Ref.	Order code	Description	Note
--	6607090100	PAN centring bite (50 pcs)	
--	6107110700	Disposable bite protective sleeves (100 pcs)	
--	6607080200	Ceph ear pivot (50 pcs)	
--	6607098005	Panoramic standard chin support	
--	6607099305	Panoramic chin support (reduced height)	
--	5407098105	Edentulous patients appendix	
--	6607098105	SINUS chin support	
--	6607099800	TMJ positioner	
--	6609503600	IMPLANT centering bite (2 pcs)	
--	6607090600	Maxilla Implant bite block assy (FDI type)	
	6607090400	Maxilla Implant bite block assy (US type)	
	5407098500	Maxilla centering bite support	
--	6607090500	Mandible Implant bite block assy (FDI type)	
	6607090700	Mandible Implant bite block assy (US type)	
	5407098400	Mandible centering bite support	
--	6107110800	TMJ positioner / Implant bite protective sleevers (50 pcs)	
--	6607080900	CARPUS positioning plate	
--	6107900100	Laser centring tool	
--	6107900200	Symmetry ceck tool	
--	5209900900	Digital sensor centring tool	
--	5607900800	Copper filter for digital sensor	
--	6607900200	Adjustment and calibration tools kit	

11. APPENDIX

11.1. 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 (A5). 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).

Rotograph EVO D

Unit code:_____

Unit S/N:_____

U.I.C.:_____

Parameter	Factory setting	New setting	New setting	New setting	New setting
Date					
Language (English, Italian, French, German, Spanish, Portuguese, Dutch, Turkish, Chinese, Russian, Arabic, Iran)					
Digital Ceph status (OFF=disabled; ON=enabled)					
COLL setup type					
Sensor Handling					
Pano order					
3D sensor (OFF=disable; ON=enabled)					
Soft Tissue Filter (STF) setup type					
Y axis zero motor offset					
Y axis zero Evo motor offset					
Rotation axis motor offset					
Digital Ceph sensor offset					
Primary collimator motor offset					
Secondary collimator motor offset					

Parameter		**Factory setting**	**New setting**	**New setting**	**New setting**	**New setting**
Date						
Soft Tissue Filter (STF) motor offset						
Digital Ceph rotation offset						
Tubehead pre-heating values	6mA					
	7mA					
	8mA					
	9mA					
	10mA					
	11mA					
	12mA					
Ceph extra run						
HF board selection (0=12mA; 1=16mA)						
Ceph HD (OFF=disabled; ON=enabled)						
COLL technology						

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