
Rotograph EVO 3D CE 0051



Service Manual

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This manual in English is the original version.



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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.

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.



WARNING:

1. Rotograph EVO 3D 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.
2. The device must be used in compliance with the procedures described, and never be used for purposes different from those herewith indicated.
3. The user is liable as concerns the legal fulfilment related to the installation and the operation of the device.

1.1. Description of the system

The evolution of panoramic X-ray provides, in addition to traditional methods of examination (Panoramic, TMJ, Sinus, etc.). the use of three-dimensional images of the patient's maxillofacial complex, so as to allow the doctor the targeted selection of the procedures to use, both during the planning phase of the treatment as well as diagnosis aid.

Rotograph EVO 3D, produced by VILLA SISTEMI MEDICALI S.p.A., is a complete panoramic system that allows the execution of all X-rays commonly used in dentistry and orthodontics (excluding intraoral radiographs) and also allows the acquisition of volumetric tomographic or 3D X-rays.

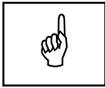
In this type of device, the linear digital sensor traditionally used in the digital panoramic X-rays has been replaced by a wide range Digital Sensor, also known as the Flat Panel.

These sensors allow to capture an area of the maxillofacial complex that include the most important anatomical details, by acquiring a series of two-dimensional images (imaging).

The following options are available that must be ordered separately:

- EVO XP (Additional projection package); allows to perform the following examinations: Emi-panoramic, Improved orthogonality dentition, reduced dose Panoramic, Frontal dentition and Bitewing.
- DIGITAL CEPH; allows the execution of the following exams, available in High Resolution mode or Normal Resolution (high speed):
 - CEPH exam in different formats
 - CARPUS exam.

1.2. 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.

1.3. 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



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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 3D 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.

In compliance with the IEC 60601-1 standard, the modification of the equipment or its parts is strictly prohibited.

2.1. Warnings

Rotograph EVO 3D must be used in dental surgeries, radiology and hospital settings.

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

Do not let water, or other liquids, into the device, as this could cause short-circuits and corrosion.

Before cleaning the device, please disconnect it from the line voltage.

Wherever necessary, use the appropriate accessories, such as the leaded aprons, to protect the patient from radiation.

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

Rotograph EVO 3D has been built to support a continuous operation at intermittent load; therefore please follow the described use cycles to enable the device to cool down.

Rotograph EVO 3D must be switched off while using devices such as electrosurgical devices or similar apparatus.

Clean and disinfect all parts that come into contact with the patient.

The centring bite or the bite protective sleeve, the head strip for 3D examinations and the ear centring devices of the Cephalostat must be replaced after each examination in which they were used.

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

The manual movement is only allowed in case of error 206 (no power to motors) to allow the exit of the patient.

Although the dose supplied by dental X-ray units is quite low and distributed on a small surface, the operator must adopt the precautions and/or suitable protection for the patient and himself, during the execution of radiography. It is advisable to control the X-ray emission from a protected area, by means of a remote control. If it is necessary to operate near the patient, stay as far as the remote control cable allows, or at least 2 m both from the X-ray source and from the patient, as shown in Figure 2-1 and Figure 2-2.

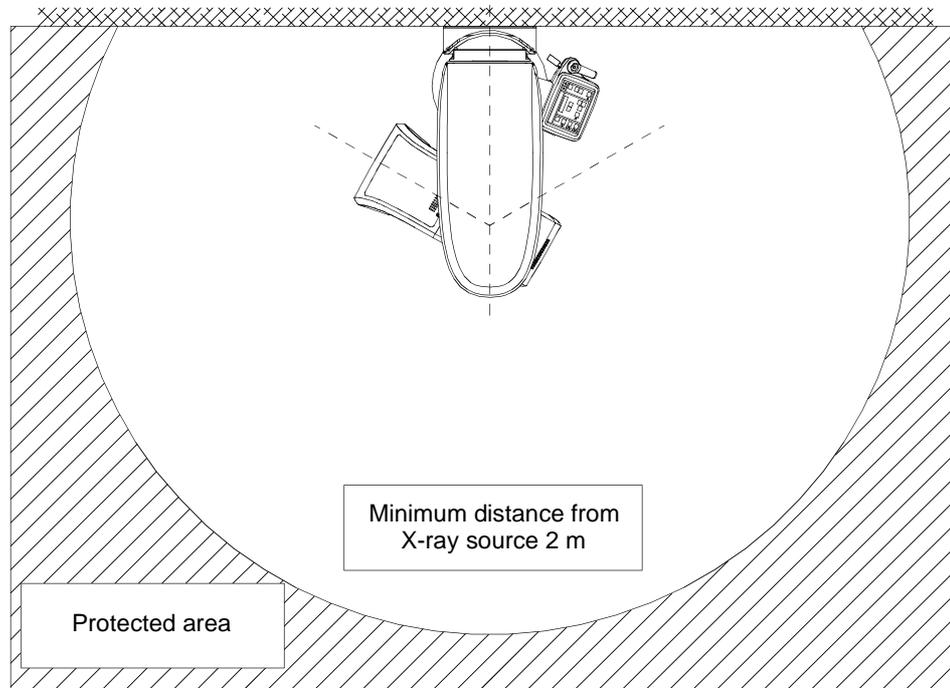


Figure 2-1 - Panoramic version

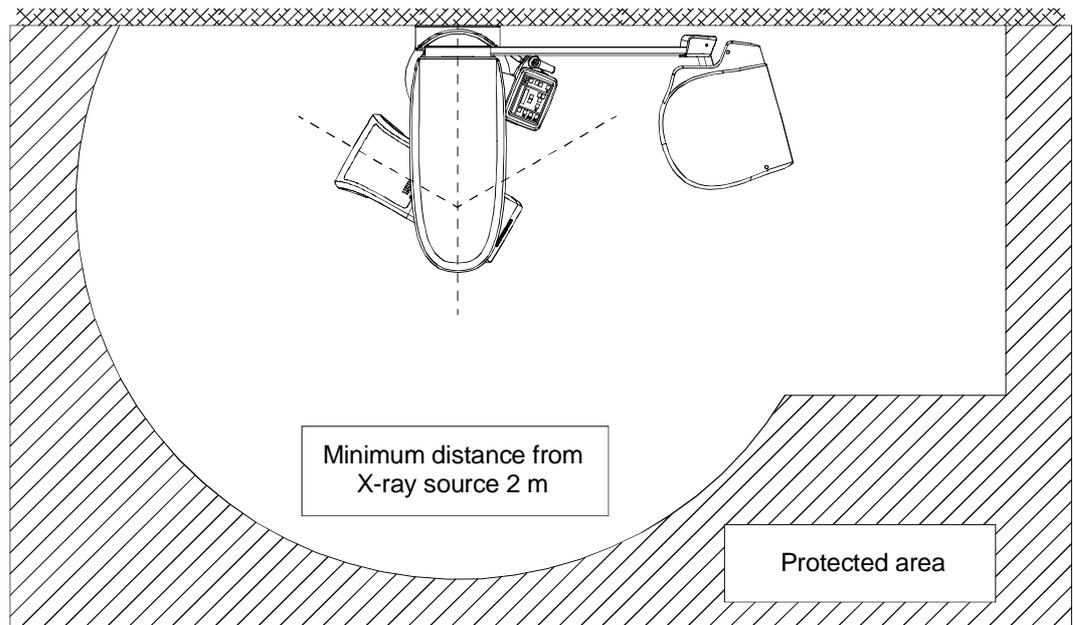


Figure 2-2 - Cephalometric version



WARNING:

The network connector on the base of the Rotograph EVO 3D column must be connected to the dedicated image acquisition and 3D and panoramic reconstruction PC via a shielded Ethernet cable "Cat.5e" or greater.

Do not use this connector to connect the Rotograph Evo 3D to LAN networks.



NOTE:

The dimension of the "patient's environment" is defined as a distance of at least 1.5 m from the actual patient.

If the PC is positioned inside the patient's environment, it must conform to the requirements specified by the IEC 60601-1 standard for medical devices; if located outside of the patient's environment, it must be compliant with the IEC 60950 standard.

If the PC is supplied by Villa (optional), it must be placed outside the patient's environment.



NOTE:

Do not apply movements to the rotating arm or the tube-head when the equipment is on.



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.**

2.1.1. Distribution of stray radiation

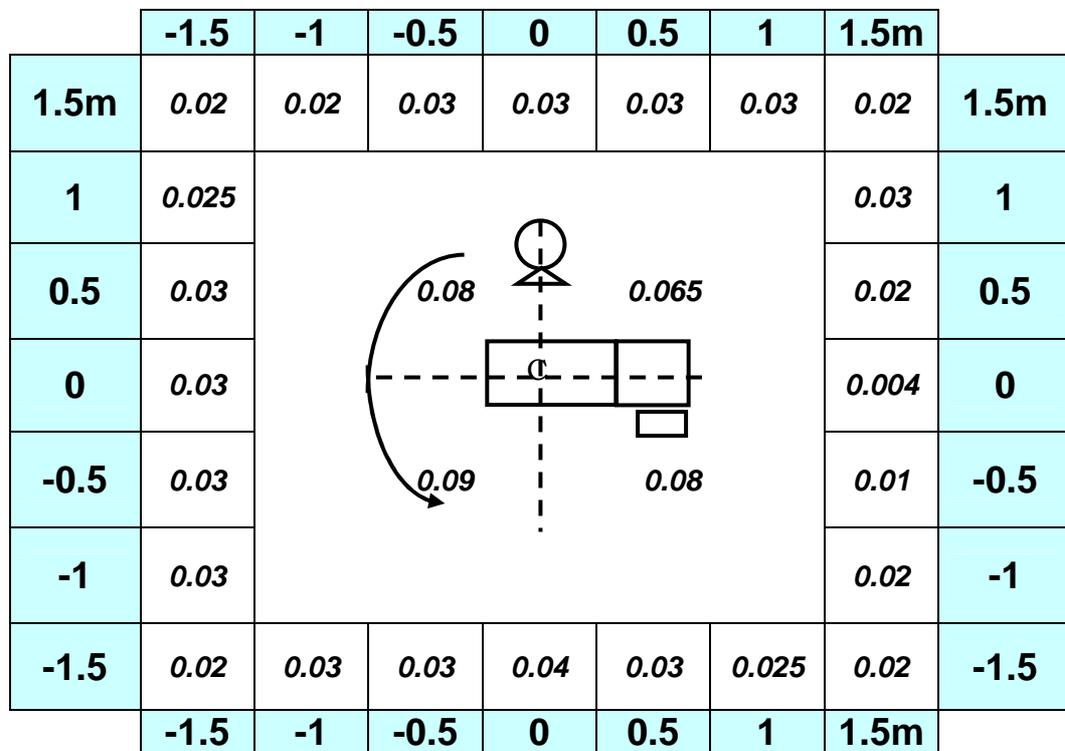


Figure 2-3: Distribution of stray radiation

Figure 2-3 illustrates the distribution of stray radiation in the horizontal plane at the centre of rotation of the scanning unit in the area of a 3 x 3 m rectangle.

The measurement was performed using a cylindrical phantom with a diameter of 320 mm and length of 140 mm placed in the centre of rotation of the scanning unit, with the "3D Dentition" examination mode and the following parameters set: 86 kV, 10 mA, 8 s.

The distribution values in the table are expressed as air Kerma for mAs ($\mu\text{Gy}/\text{mAs}$).

2.1.2. Electromagnetic emissions

In accordance with the IEC 60601-1-2 standard, the Rotograph EVO 3D 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
CISPR 11	Group I	Rotograph EVO 3D uses RF energy only for its the internal function. Therefore, the R.F. emissions is very low and not likely to cause any interference in nearby electronic equipment.
	Class B+12	Rotograph EVO 3D is suitable for use in domestic establishments and in establishments directly connected to the low voltage power supply network which supplies buildings used for domestic purposes.
Harmonics emissions IEC 61000-3-2	Class A	Rotograph EVO 3D is suitable for use in domestic establishments and in establishments directly connected to the low voltage power supply network which supplies buildings used for domestic purposes.
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	Rotograph EVO 3D is suitable for use in domestic establishments and in establishments directly connected to the low voltage power supply network which supplies buildings used for domestic purposes.

2.1.3. Electromagnetic immunity

In accordance with the IEC 60601-1-2 standard, the Rotograph EVO 3D 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 discharges (ESD) IEC 61000-4-2	6 kV contact 8 kV air	Test level IEC 60601-1-2	Residential/Hospital
Electrical fast transient/burst IEC 61000-4-4	2 kV for power supply lines 1 kV for input/output lines > 3 m	Test level IEC 60601-1-2	Residential/Hospital
Surge IEC 61000-4-5	1 kV differential mode 2 kV common mode	Test level IEC 60601-1-2	Residential/Hospital
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	Test level IEC 60601-1-2	Residential/Hospital
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	Test level IEC 60601-1-2	Residential/Hospital

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 3D, 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

Immunity test	IEC 60601-1-2 Test level	Compliance level	Electromagnetic environment
Conducted RF IEC 61000-4-6	3 V 50 kHz to 80 MHz	3 V	$d = 1.2 \times \sqrt{P}$
			<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).</p> <p>Field strength for fixed RF transmitters, as determined by an electromagnetic site survey, should be less than the compliance level in each frequency range.</p> <p>Interference may occur in the vicinity of the equipment marked with the following symbol:</p> 

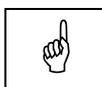
2.1.4. Recommended separation distances for non-life supporting equipment

Rotograph EVO 3D is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled.

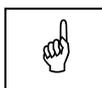
The customer or the user of the system can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the Rotograph EVO 3D as recommended below, according to the maximum output power of the communications equipment.

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 estimated using 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:
At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.



NOTE:
These guidelines may not apply in 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.

In particular, the device contains the following materials and/or components:

- **Tube-head:** 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.
- **Applied parts:** non-biodegradable plastics, iron, aluminium.
- **Digital sensor:** iron, lead, copper, integrated electronic components.

2.3. Symbols used

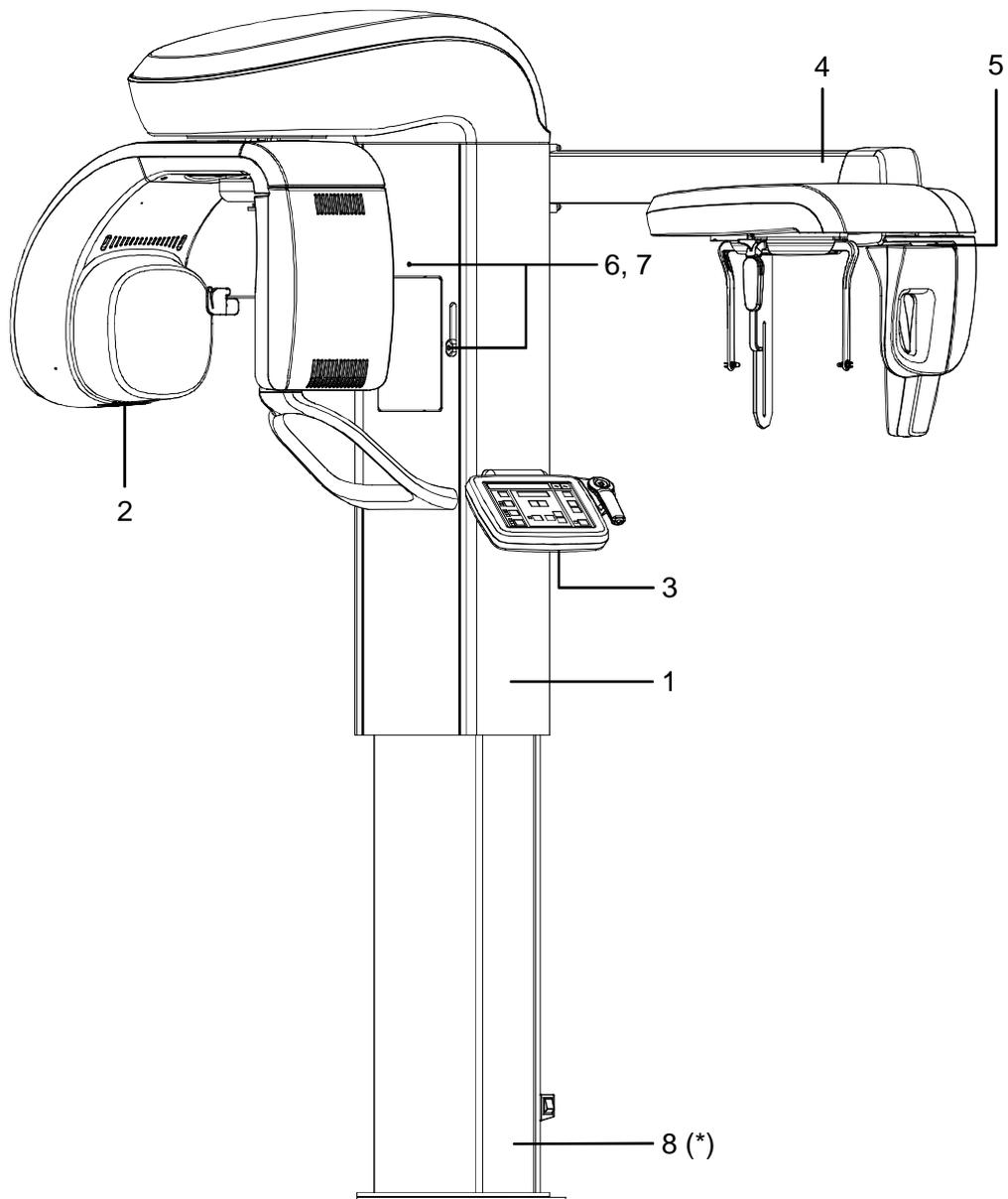
In this manual and on the Rotograph EVO 3D itself, apart from the symbols indicated on the control panel, the following icons are also used:

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
REF	Manufacturer's reference number
SN	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
	Conformity to the CE 93/42 Directive

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3. DESCRIPTION

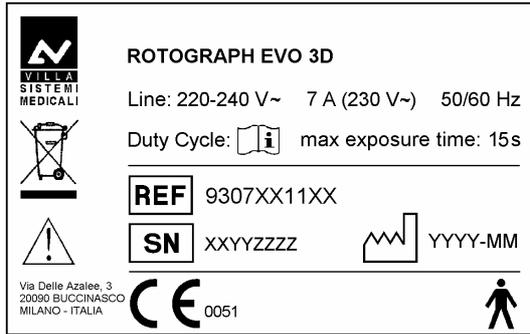
3.1. Identification labels and laser labels



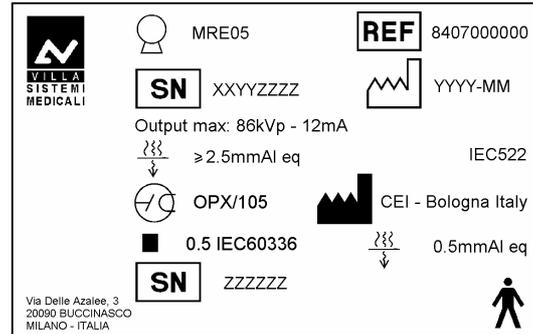
() Only for 110-120V version*

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

1
Rotograph EVO 3D data plate



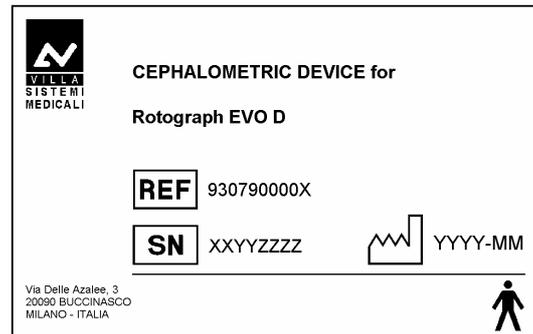
2
Tube-head characteristics plate



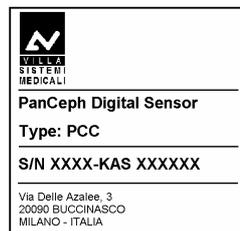
3
EVO XP plate
(Additional projection package)



4
CEPHALOMETRIC device plate



5
PAN CEPH digital
sensor data plate



6
(N° 2) Spot Laser
indicator plate



7
(N° 2) Laser symbol
label



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

1
Rotograph EVO 3D data plate

	ROTOGRAPH EVO 3D
	Line: 110-120 V~ 15 A (115 V~) 50/60 Hz
	Duty Cycle:  max exposure time: 15s
Manufactured: MMMMYYYY	
Type: 9307X51Y91	
S/N: XXYZZZZ	
 Via Delle Azalee, 3 20090 BUCCINASCO MILANO - ITALIA	CE 0051 This product complies with FDA radiation performance standards 21 CFR subchapter J, in effect at date of manufacture

2
Tube-head characteristics plate

	DIAGNOSTIC SOURCE ASSEMBLY
	Model: MRE05 Type: 8407000100
S/N: XXYZZZZ Manufactured: MMMM YYYY	
Output max: 86kVp - 12mA	
Total filtration: ≥2.5mmAl eq IEC522	
X-RAY TUBE OPX/105	
Manufacturer CEI - Bologna Italy	
■ 0.5 IEC336 Inherent Filtr.: 0.5mmAl eq	
S/N:	
Via Delle Azalee, 3 20090 BUCCINASCO MILANO - ITALIA	This product complies with FDA radiation performance standards 21 CFR subchapter J, in effect at date of manufacture

3
EVO XP plate
(Additional projection package)

KIT EXTENDED PROJECTION PACKAGE EVO XP P/N: 7607040100 S/N: XXYZZZZ Manufactured: MMMMYYYY Villa Sistemi Medicali S.p.a. Via Delle Azalee, 3 20090 Buccinasco (MI) Italy

4
CEPHALOMETRIC device plate

	CEPHALOMETRIC DEVICE for
	Rotograph EVO 3D
Model: 9307900004 S/N: XXYZZZZ	
Manufactured: MMMMYYYY	
Via Delle Azalee, 3 20090 BUCCINASCO MILANO - ITALIA	This product complies with FDA radiation performance standards 21 CFR subchapter J, in effect at date of manufacture

5
PANCEPH digital sensor data plate

	PanCeph Digital Sensor
	Type: PCC
S/N XXXX-KAS XXXXXX	
Via Delle Azalee, 3 20090 BUCCINASCO MILANO - ITALIA	

6
(N° 2) Spot Laser indicator label



7
(N° 2) Laser symbol label



8
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. RISK 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 3D, produced by VILLA SISTEMI MEDICALI S.p.A., is a complete panoramic system, which enables to perform all X-rays commonly necessary in dental field (except for endoral X-rays) and volumetric three-dimensional images.

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 examinations. Optional functions enable the system to perform the following additional examinations:

- **EVO XP (Additional projection package)**
Allows you to carry out the following additional examinations: Emi-panoramic, Improved orthogonality dentition, reduced dose Panoramic, Frontal dentition and Bitewing.
- **CEPH**
Allows you to carry out the following examinations:
 - CEPH exam in different formats
 - CARPUS exam.

3.2.1. Basic version

The base version enables to perform the following examinations:

- Adult or Child, with 3 Sizes and 3 Types of mastication 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.
- 3D volumetric examinations of the Dentition, TMJ Left, TMJ Right and Sinus.

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.
- 3D volumetric examinations with the characteristics described for the standard version.
- Digital Cephalometry with a choice between Adult and Child with 3 sizes each. The execution of the high resolution or standard resolution can be selected within each combination, for a total of 12 combinations in Automatic selection. When examining at a Normal Resolution, the examination is conducted with a reduced scan time, allowing a further reduction of dose. In manual selection it is possible to select high voltage between 60kV and 86kV, in 2kV steps and anodic current from 6 mA to 12 mA in 1 mA steps. The positioning of the primary slide collimator, the secondary collimator and the Digital Sensor (in its sensor holder) is automatic, depending on the size/projection selected. The Soft Tissues Filter is powered to attain the best possible result of the facial profile.
- Children only Carpus exam with 3 selectable sizes, for a total of 3 combinations of exam in automatic. In manual selection it is possible to select high voltage between 60kV and 86kV, in 2kV steps and anodic current from 6 mA to 12 mA with 1 mA steps. The positioning of the primary slide collimator is automatic.

The values of exposure factors given in the tables of paragraph 6.7.6.1, set as default, are guidelines.

The real adjustment of these values depends on different conditions, such as the preference of the user for very/little exposed images.

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 (Additional 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 ascending rami of the TMJ from the exams
- The frontal dentition enables to perform examinations of the front part (roughly from canine to canine)
- The dentition 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 3D systems already installed in the field.



NOTE:

The code inserted into Rotograph EVO 3D 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" (7)  will reset this condition, but

only the Panoramic, Sinus and TMJ will be active at the end of the start-up procedure.

The UIC code can be displayed by pressing the "Right Arrow/Left Arrow"



during the start-up phase.

The UIC code is simply an identifier of the single Rotograph EVO 3D unit; in order to enable the optional functions it is necessary to request the activation 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 3D. 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 10.

During the description of the block diagram, please refer to Figure 3-1.

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)
- Keyboard 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 7.3.

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 some jumpers that define the system configuration.

Wrong settings may affect the system functionality.

- **XJ1** = Open
- **XJ2** = Closed
- **XJ6** = 2-3
- **XJ8** = 2-3
- **XJ11** = Open if CEPH is present / Closed if CEPH is not present
- **XJ12** = Open
- **XJ13** = Closed

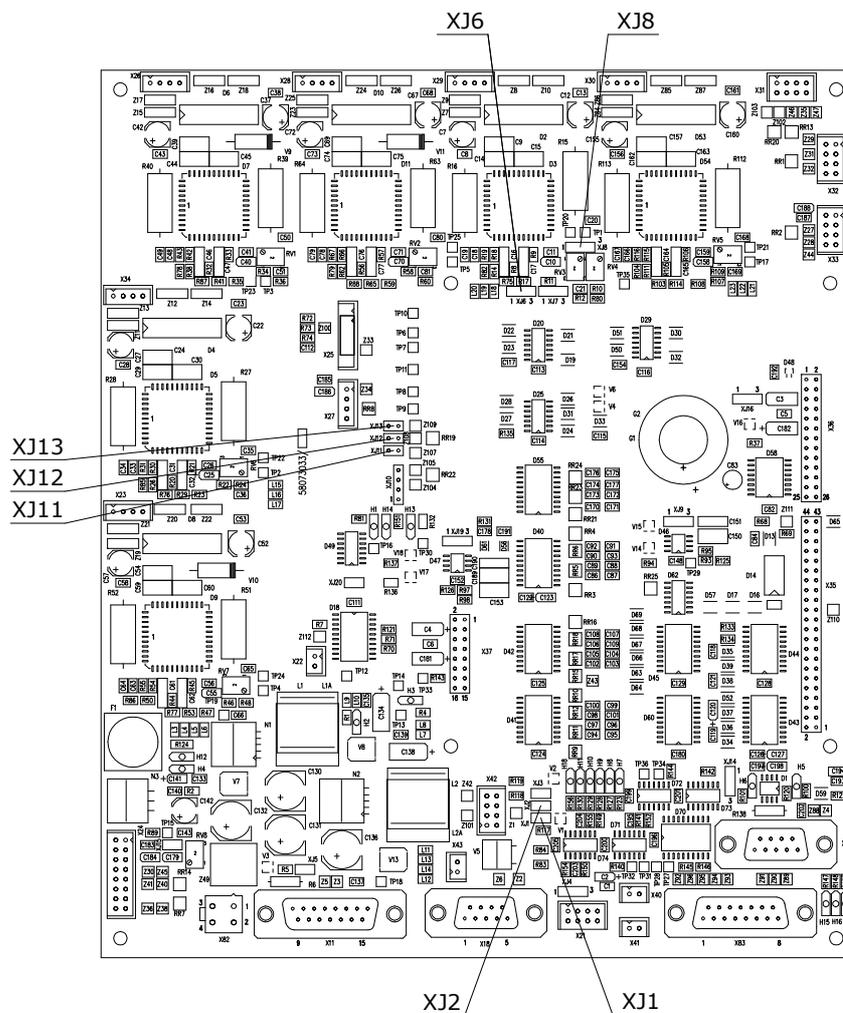


Figura 3-1

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. Keyboard (A4)

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

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

The keyboard PCB is directly connected to the main CPU board (A5) which controls it. The language of the messages shown on the display can be selected among 5 different options (English, Italian, French, German and Spanish). The language selection is only available for the messages dedicated to the user. The messages relative to the service programs (Password) are always in English.

3.4. Control panel - Descriptions and functions

The Rotograph EVO 3D keyboard is divided into function areas, plus a display to view the operative messages and error signals. The next figure shows a general view of the keyboard, while details on each functional area are provided in the following pages.

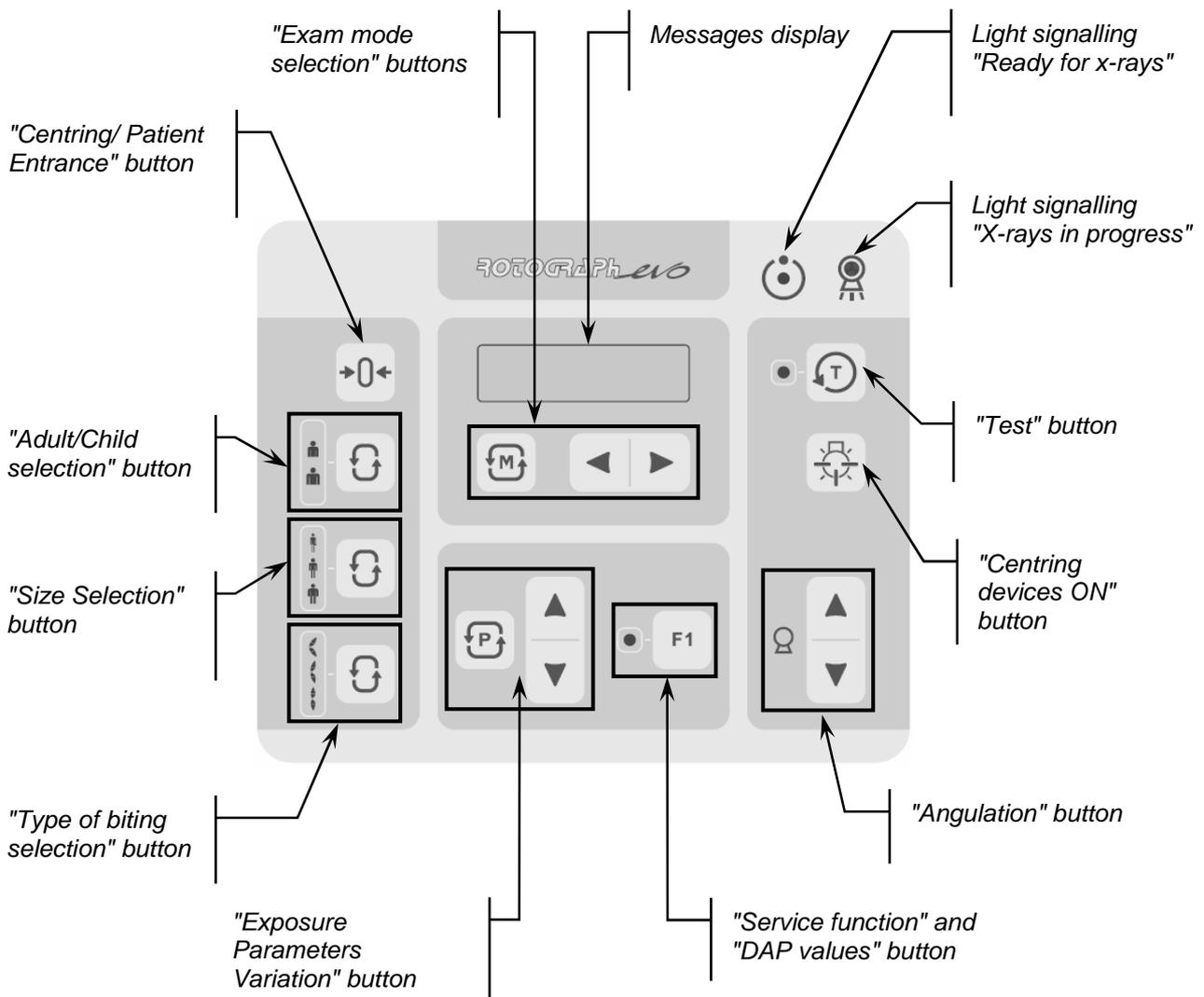


Figure 3-2

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

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



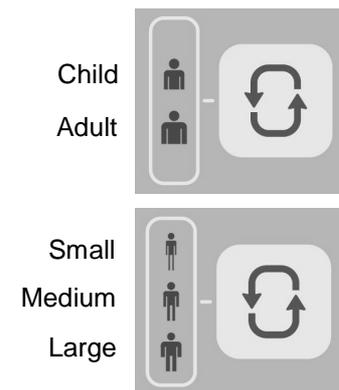
The "Examination Selection Mode" takes place by means of three keys: the first one, identified by the symbol "M" helps select the exam mode between Panoramic, TMJ, Sinus, 3D Dentition and Cephalometric.

The other two, identified by the arrows, allow to move through the examinations of each mode.



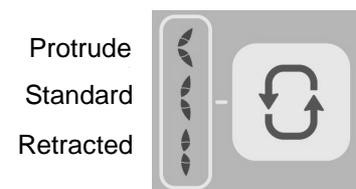
It is possible to select the anatomic mode examinations (anatomic selection), using prefixed exposure values.

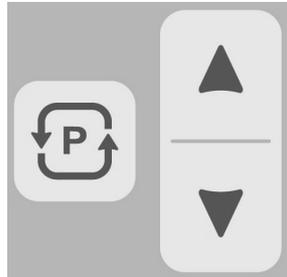
This kind of selection enables to choose between Adult/Child, each with three different sizes (small, medium, large).



The Panoramic mode enables to select the patient's type of biting between: protruded, standard or retracted, marked by the lighting up of one of the three available LEDs.

The arch selection does not influence the values of kV and mA but acts on the position of the focus layer.

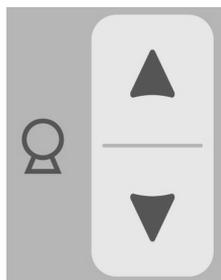




Furthermore there is the possibility to manually select the exposure parameters; in this case, it is necessary to select first the parameter to be modified with the key identified by the symbol "P" and then, using the increase / decrease keys, identified by the arrows, it is possible to set the parameter with the desired value. The parameters available are: kV, mA and time (the latter only in cephalometry).



There are two light indicators; the first one on the left indicates the condition "Machine Ready", indicating the user that by pressing the X-ray button key once more, X-rays emission will start; the second 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 3D 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.



The key "F1" is used to display the DAP (Dose per Area Product) estimate value in μGym^2 relative to the selected exam and exposure parameter.

3.4.1. Key functions description

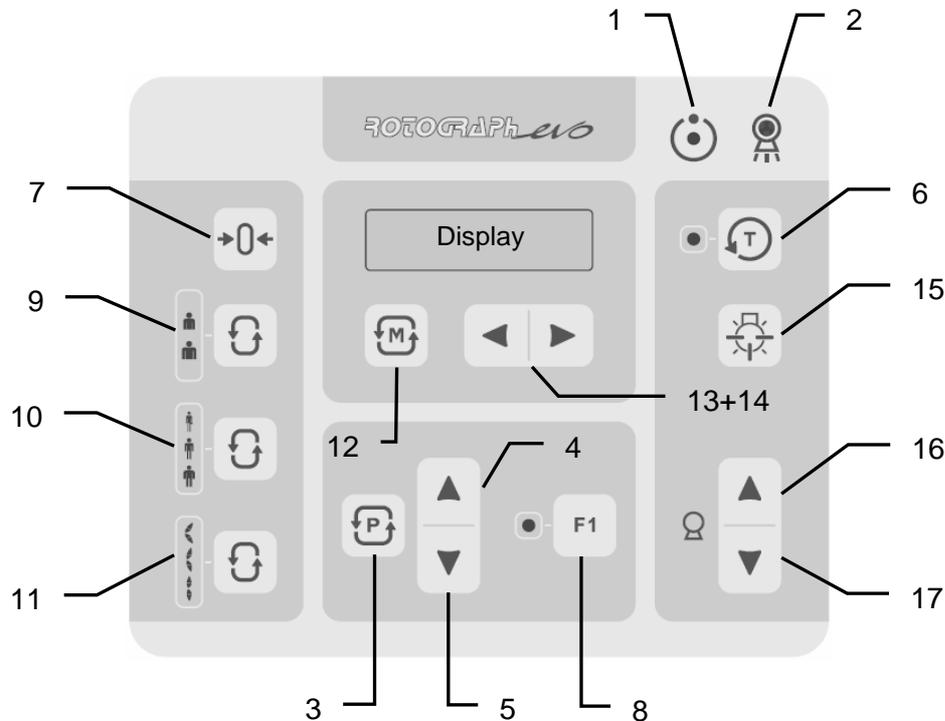


Figure 3-3 - Control panel

LEGEND:

Messages

Display: indicates operative messages, warnings and exposure parameters.

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 - Parameter selection key: kV, s or mA
- 4 - kV, mA or STF increase key
- 5 - kV, mA or STF decrease key

Preparation functions

- 6 - Key to set Test function (green LED)
- 7 - 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
- 8 - Key to display DAP values and service functions

Anatomic selection

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

Examination mode

- 12 - Exam mode selection key
- 13 + 14 - Type of exam selection keys

Centring devices

- 15 - Sagittal and Frankfurt/Ala trago plane centring device ON key

Column height adjustment

- 16 - Column up key
- 17 - Column down key

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4. TECHNICAL DATA

General features		
Device type	Rotograph EVO 3D	
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 	
Operating mode	Continuous with adaptive duty cycle	
Protection degree	IPX0	
Rated line voltage	220-240 V~	110-120 V~
Line frequency	50/60 Hz	
Maximum line current	7 A @ 230 V~ 50/60 Hz	15 A @ 115 V~ 50/60 Hz
Absorbed power	1.5 kVA @ 230 V~ 50/60 Hz	1.6 kVA @ 115 V~ 50/60 Hz
Protection fuse (F1)	7 A T	15 A T
Switching supply protection fuse (F2)	1.6 A T	3 A T
Generator card 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% @ 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, with 1 mA steps for Ceph (up to 76 kVp) 6 ÷ 10 mA, with 1 mA steps for Ceph (from 78 kVp to 86 kVp)	
Additional filter for wide range sensor cover (for 3D exams)	<< 1.2 mm Al eq. @ 70 kVp	
Additional filtration for PANCEPH sensor cover	0.1mm Al eq. @ 70 kVp	

Exposure times	
EVO Panoramic	14.4 s Adult / 13.3 s Child
Panoramic STD	13.8 s Adult/Child
RH/LH EVO Emi-panoramic	7.8 s Adult / 7.3 s Child
RH/LH STD Emi-panoramic	7.4 s Adult / 7.3 s Child
EVO Reduced dose Panoramic	11.9 s Adult / 10.8 s Child
STD Reduced dose Panoramic	11.4 s Adult/Child
Improved orthogonality dentition	11.9 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 for a total of 9.7 s
SINUS	9.4 s
Volumetric 3D exams	11.2 s for Dentition and Sinus 10.1 s for TMJ Left and TMJ Right (each)
Cephalometry (Ceph)	Variable exposure time depending on the type of resolution and size selected. Minimum 4.5 s (18x22nR), maximum 15 s (30x22hR)
Exposure time accuracy	± 10 %
Examination modes	
Examination selection	<ul style="list-style-type: none"> • Automatic selection for Adult and Child, 3 Sizes • Dentition type selection (in Panoramic) • Manual selection • Collimator with automatic positioning
Panoramic NOTE: Some of these exams are optional and depend on the system configuration.	<ul style="list-style-type: none"> • EVO Panoramic • Standard Panoramic • RH and LH Emi-panoramic • Reduced dose Panoramic • Improved orthogonality dentition • Frontal dentition • Bitewing L/R • Bitewing L and R
TMJ (Temporo-Mandibular Joint)	TMJ mouth closed/open

Examination modes	
SINUS	Sinus P/A projection
Volumetric 3D exams	Automatic selection for Adult and Child, 3 sizes chosen between 4 types of exam: Dentition, TMJ Left, TMJ Right, Sinus
Cephalometry and Carpus	<ul style="list-style-type: none"> • Normal resolution in Latero-Lateral or Antero-Posterior projections (different sizes) • High resolution in Latero-Lateral or Postero/Anterior projections (different sizes) • High resolution Carpus exams • Motorised soft tissue filter
Image magnification	
Standard Panoramic	1 : 1.28 Adult and Child
TMJ open/close mouth, 4 images	1 : 1.25 (nominal)
Sinus	1 : 1.27 (nominal)
Ceph	1: 1.10 geometric magnification 1 : 1 magnification after software correction (*)



(*) WARNING:

The declared image magnification value is valid after 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 %
Output radiation linearity	< 0.2 according to standard IEC 60601-2-7:1998 paragraph 50.102.2
Duty cycle	Adaptive duty cycle depending on the exposure parameters: from 1 : 8 (at 60 kV, 6 mA) up to 1 : 20 (at 76 kV, 12 mA). Further reduction for three exposures in close-up sequence: from 1: 3.6 (at 60 kV, 6 mA) up to 1 : 9 (at 76 kV, 12 mA).
Nominal power	1.032 kW (86 kV _p - 12 mA -4s)
Total filtration	2.5mm Al eq. @ 70 kV _p
HVL (Half value layer)	> 2.0 mm Al eq. @ 60 kV _p > 2.7 mm Al eq. @ 74 kV _p > 3.2 mm Al eq. @ 86 kV _p
Transformer insulation	Oil bath
Cooling	By convection
Leakage radiation at 1 m	< 0.5 mGy/h @ 86 kV _p - 12 mA - 3s 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	0.5mm 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
Wide range sensor (Flat Panel)	
Sensitive area	130 x 130 mm
Sensor pixel size	127 µm, 254 µm in binning 2x2
Scintillator screen	Cesium iodide CsI
Number of sensor pixels (H x L)	1024 x 1024 (binning 1x1) 512 x 512 (binning 2x2)
Reconstructed volume (height diameter)	85 x 85 mm
Voxel dimensions	166 µm
PANCEPH sensor	
Sensitive area (H x L)	220 x 6 mm
Pixel dimension	48 µm, 96 µm in binning 2x2 (CEPH hR), 144 µm in binning 3x3 (CEPH nR)
Pixel (H) NOTE: The number of horizontal pixels (columns that make up the image) depends on the type of examination selected and the resolution set.	1536 in nR, 2304 in hR



NOTE:

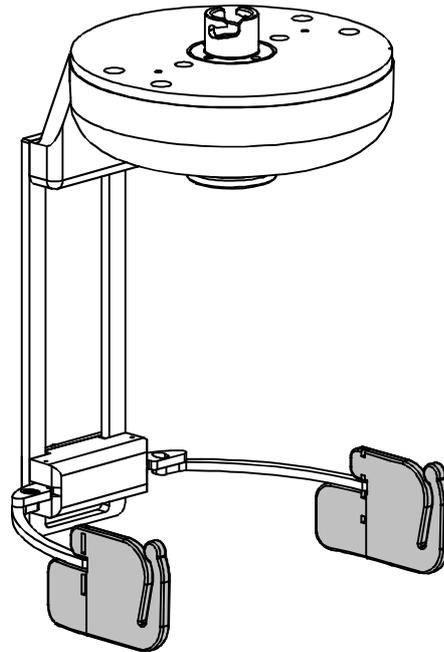
The Rotograph EVO 3D version without cephalometric arm, uses only the wide range sensor both for 3D images as well as for Panoramic images (narrow beam), while is also used the second PANCEPH sensor in the version with Cephalometric arm.

Laser centring devices	
Patient positioning is guaranteed by 2 laser beams that align the sagittal and Frankfurt/Ala trago planes (please refer to relevant paragraphs for detailed explanation).	
Wave length	650 nm ± 10 nm
Divergence	< 2.0 mRad
Optical power	< 1 mW
Classifications	Class 1 laser device according to standard IEC 60825-1:1993 + A1:1997 + A2:2001
Mechanical features	
Image receptor-focus distance (PAN, TMJ and Sinus)	52 cm (20.4")
Image receptor-focus distance (CEPH)	165 cm (65")
Telescopic motorised column run	85 cm (33.5")
Maximum total height	245 cm (96.4")
Weight	<ul style="list-style-type: none"> • 161 kg (354 lb) base version • 186 kg (409 lb) version with Ceph
Column weight	87 kg
Weight of arm support, rotating arm, tube-head and sensor holder	74 kg
Ceph arm weight	25 kg
Leg weight (optional)	30 kg
Sensor holder weight	2 kg
Working conditions	
Minimum dimensions of the room (refer to the Service Manual)	<ul style="list-style-type: none"> • 130 x 120 cm (52" x 47.2") without CEPH arm • 145 x 200 cm (57" x 78.7") with CEPH arm
Recommended dimensions of the room (refer to the Service Manual)	<ul style="list-style-type: none"> • 130 x 140 cm (51.2" x 55.1") without CEPH arm • 160 x 220 cm (63" x 86.6") with CEPH arm
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

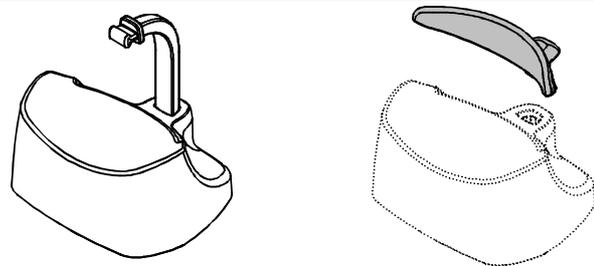
4.1. Separate parts supplied with Rotograph EVO 3D

Rotograph EVO 3D comes with the following removable accessories:

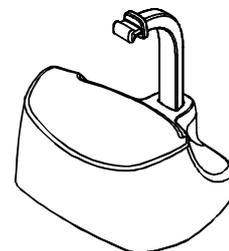
Temple clamp centring device for standardised and volumetric exams



Chin rest for standard panoramic, supplied with removable appendix for edentulous patients



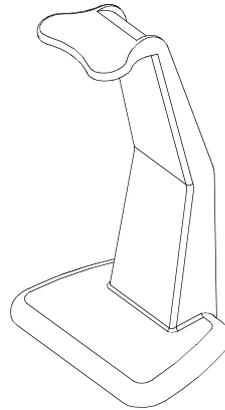
Reduced height chin rest for standard panoramic



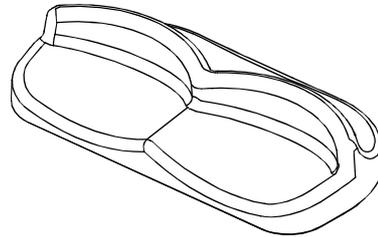
Lowered chin rest for Sinus, in non volumetric 3D mode



Standard TMJ positioning
support



Chin rest centring device for TMJ
volumetric 3D exams



Bites, cephalometry ear centring
pins, head strips for 3D exams,
bite protective sleeves

**Disposable and non-sterilised parts. Replace
after every use.**



NOTE:

These removable parts are considered "type B applied parts", in accordance with IEC 60601-1, 2nd edition.

Some of these parts do not carry identification codes due to their small size. The use of these parts on other devices is not possible, since they are parts designed specifically for the Rotograph EVO 3D.

4.2. Applied safety regulations

Rotograph EVO 3D complies with the following standards:

CE 0051 Ensures the compliance of the Rotograph EVO 3D to the Medical Device Directive 93/42/EEC and its revised version for medical devices issued by the European Community.

- Canadian Medical Device Regulations
- 21 CFR Subchapter J

- General safety:
 - IEC 60601-1:1988+A1:1991+A2:1995
 - IEC 60601-1-1:2000
 - IEC 60601-1-4:1996+A1:1999
 - IEC 60601-2-7:1998
 - IEC 60601-2-28:1993
 - IEC 60601-2-32:1994
 - IEC 60601-2-44:2001
 - UL 60601-1 (1st edition)
 - CAN/CSA C22.2 No. 601.1-M90 (2nd edition) +A1 + A2

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

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

- Usability:
 - IEC 60601-1-6:2004

Classifications

The EVO Rotograph 3D is a class I electro-medical device and Type B as of IEC 60601-1 classification, foreseen for a continuous working at intermittent load.

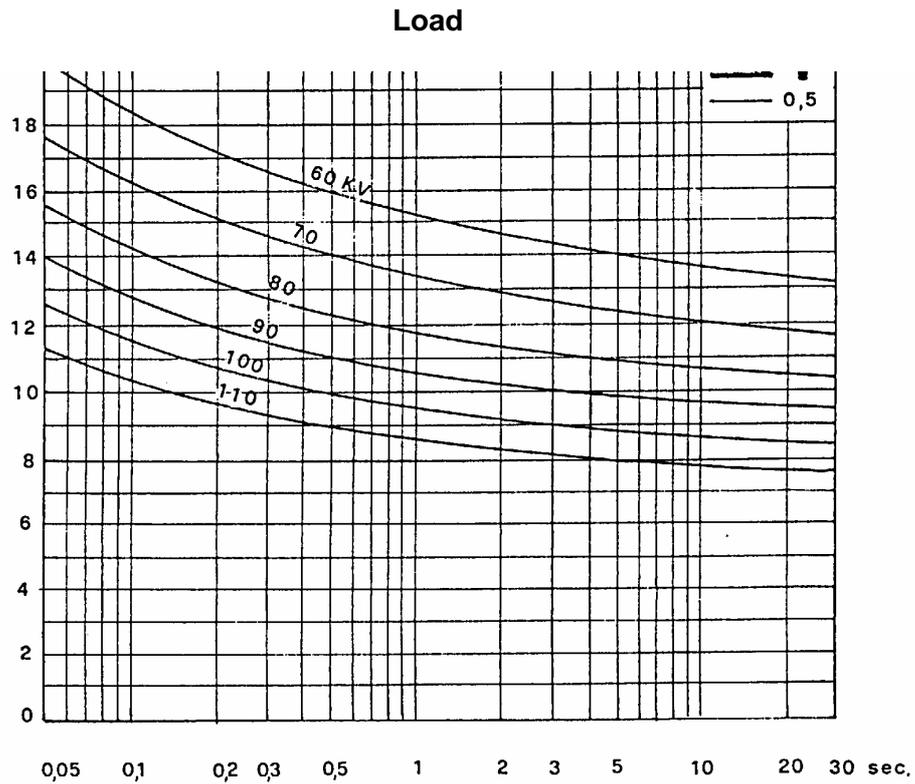
The classification according to EC Directive 93/42 and subsequent amendments for medical devices is Class II B.

According to Canadian MDR, the equipment belongs to class II.

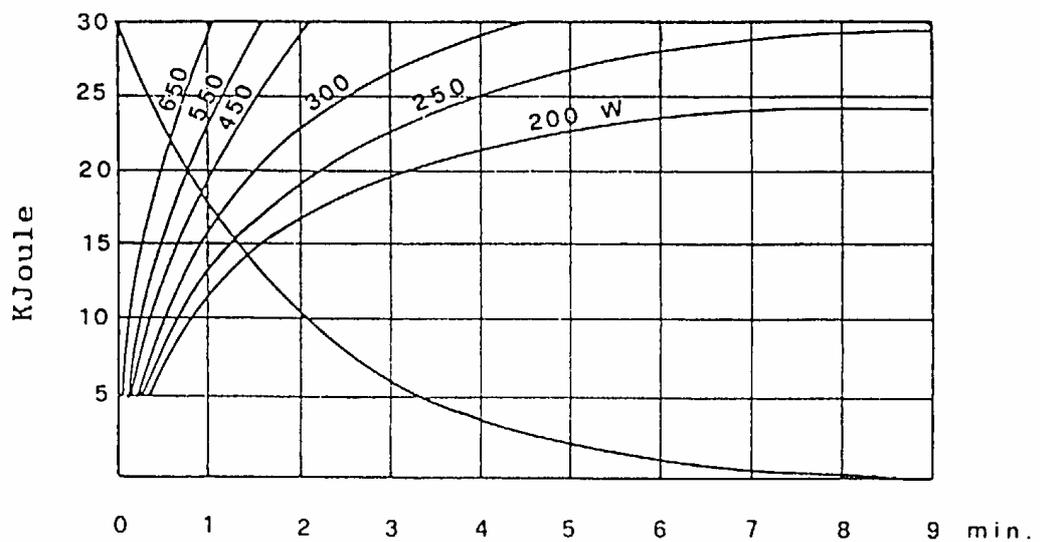
According to FDA 21 CFR, the equipment belongs to class II.

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

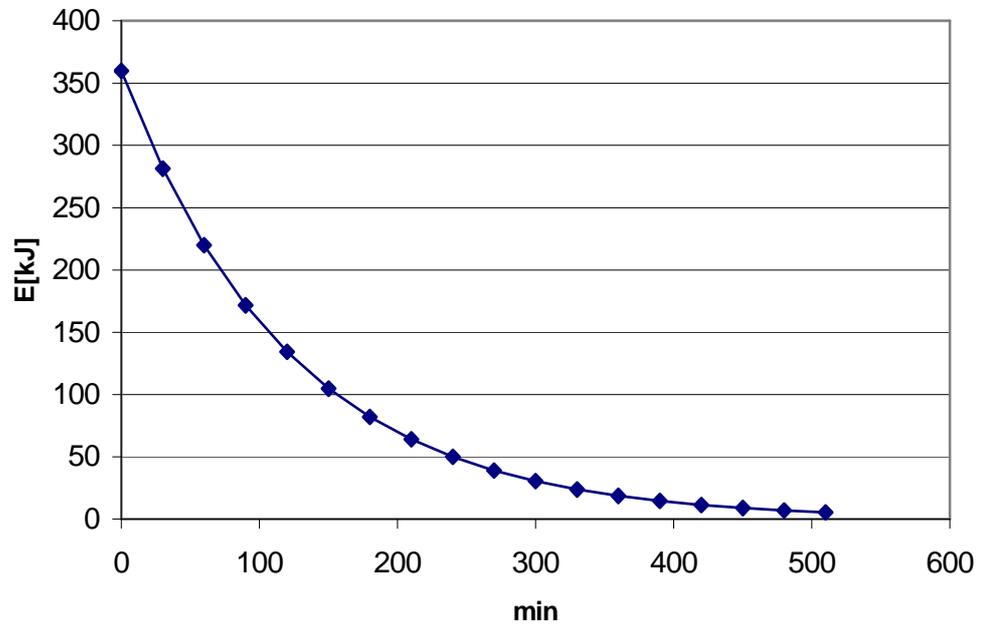
Tube "CEI - OPX / 105" (0.5 IEC 60336)



Anode cooling curve



Tube-head heating and cooling curve



4.4. 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.

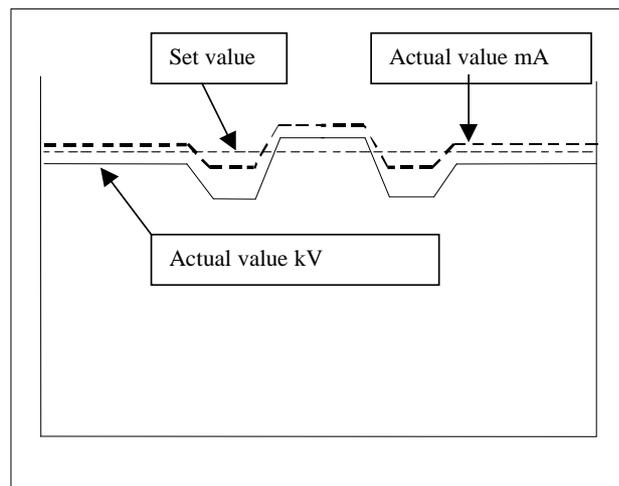
For the measurement of the exposure parameters with the invasive method, please follow the procedure described in paragraphs 6.7.5.1.1, 6.7.5.1.2 and 6.7.5.1.3 of this manual.



WARNING:

During the panoramic examination, the set value of kV and tube current varies according to a pre-determined curve in order to compensate the different absorption of X-ray beam due to different anatomical structures. In this way, it is possible to obtain a good uniformity of the image 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 $\pm 15\%$.

4.5. Dimensions

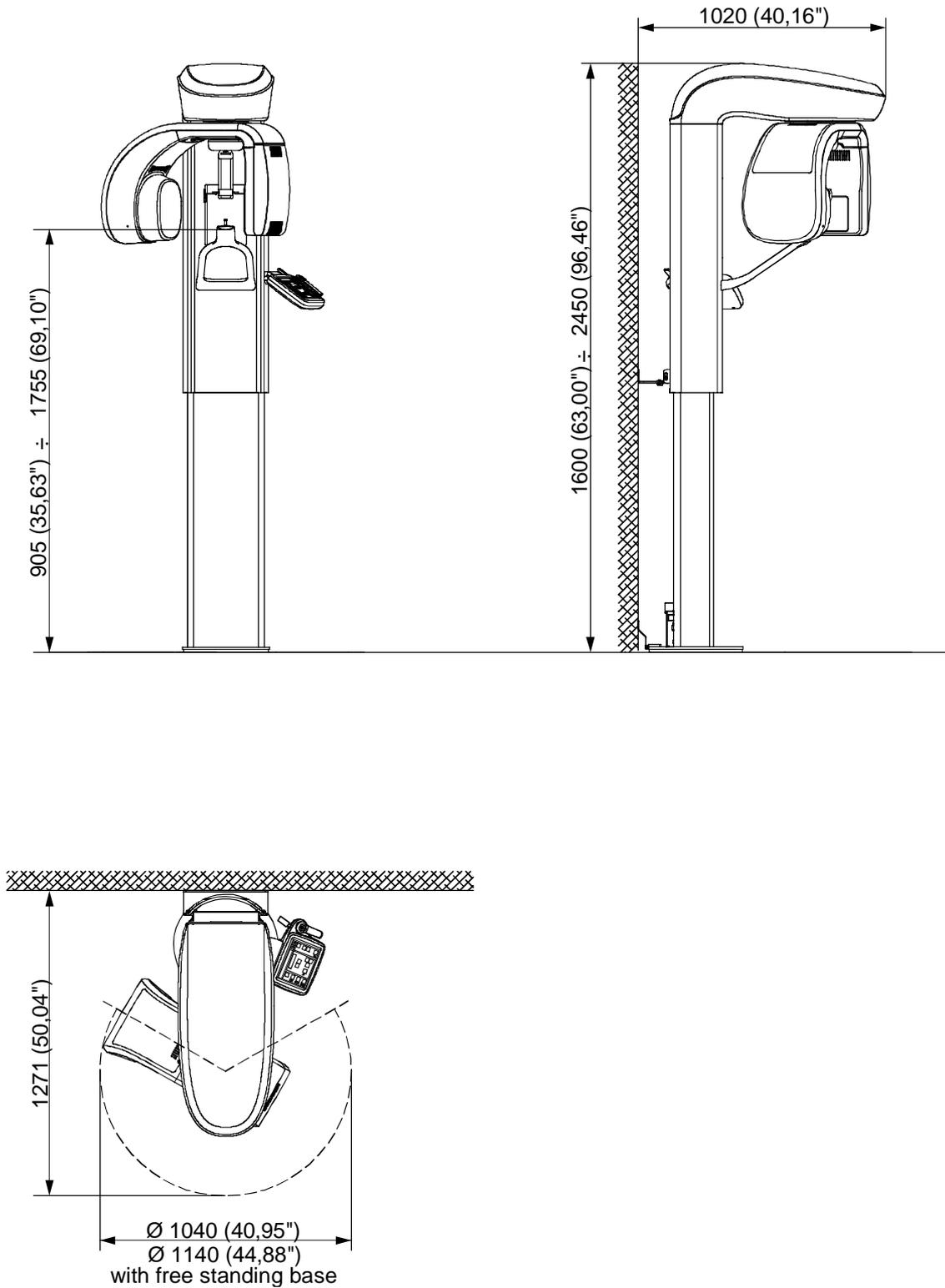


Figure 4-1 - Base version

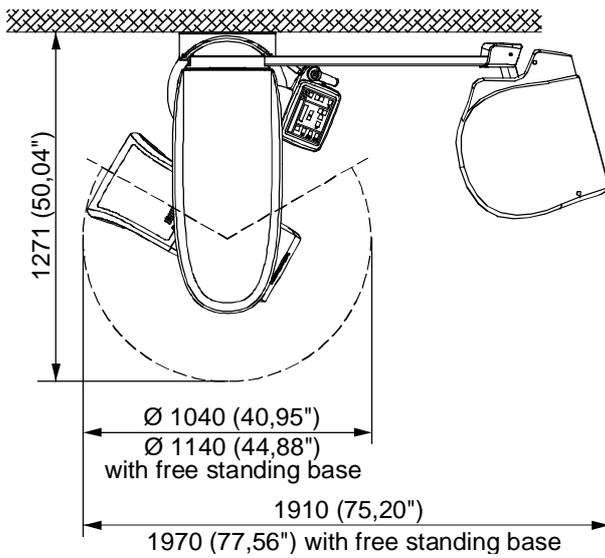
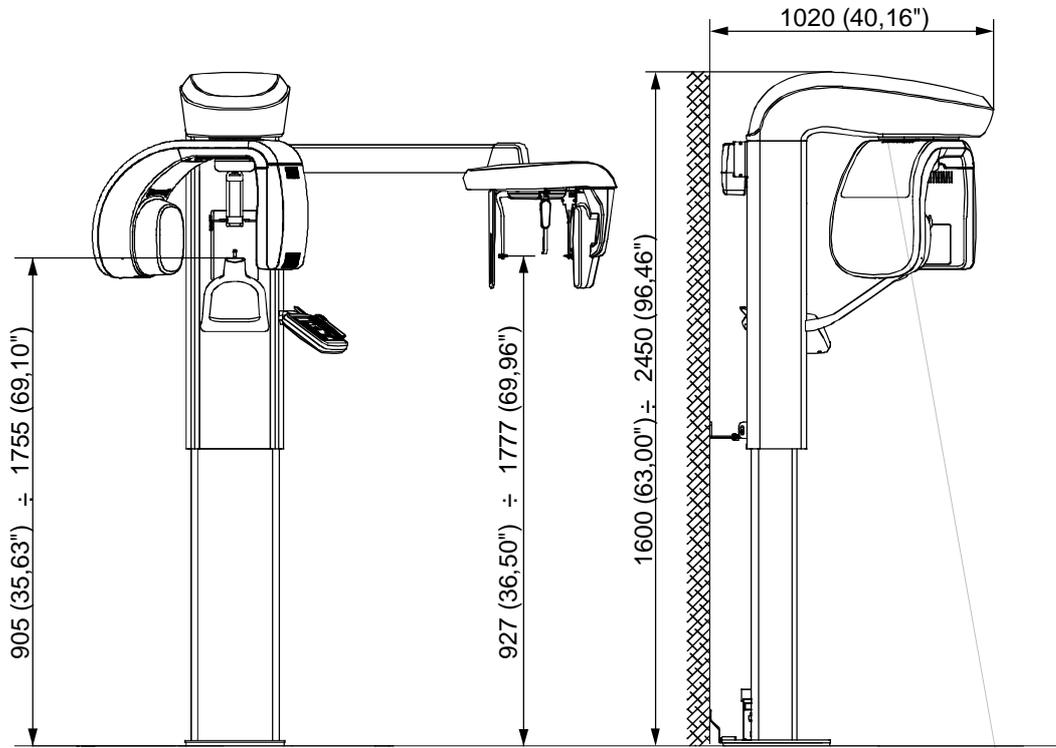


Figure 4-2 - Version with cephalometric unit

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 3D.

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 3D are:

- minimum height of the room: 2.5 m (8.20') and a surface variable according to the configuration of Rotograph EVO 3D 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 3D 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.



NOTE:

Rotograph EVO 3D, 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.).

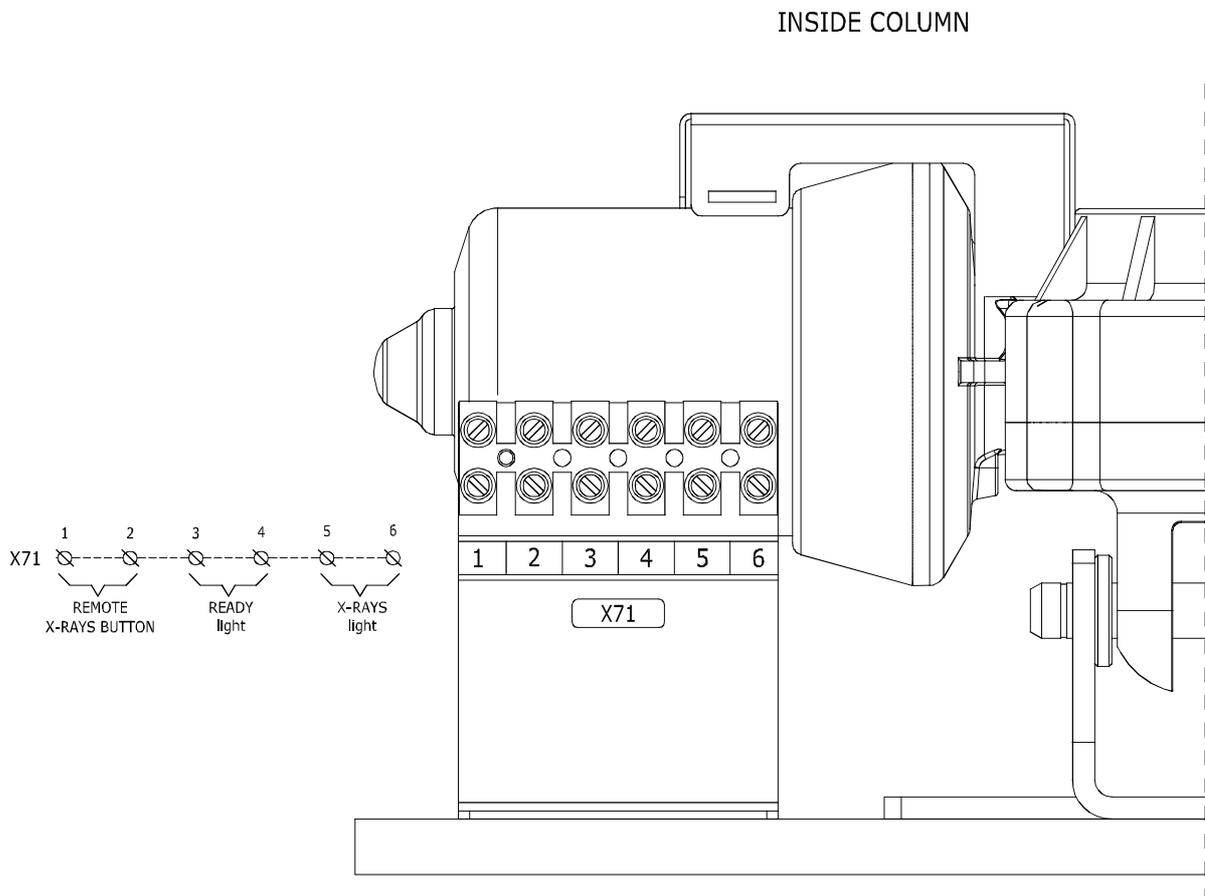


Figure 5-1



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 3D is delivered in two carton-board boxes.

PAN only version			
Contents	Packing dimension	Weight	
		Net	Gross
<ul style="list-style-type: none"> - 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)
<ul style="list-style-type: none"> - 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
<ul style="list-style-type: none"> - 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)
<ul style="list-style-type: none"> - 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.

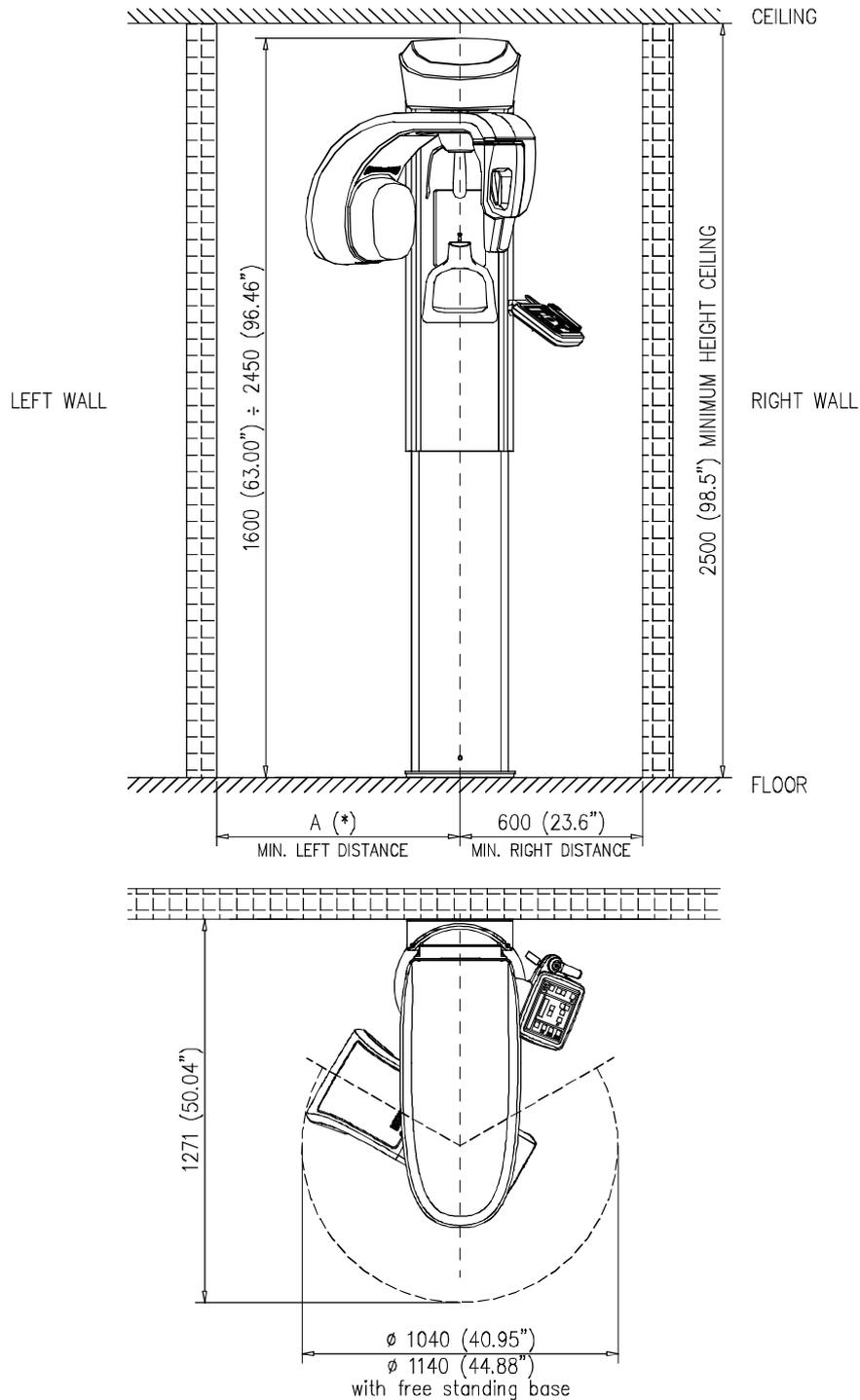


WARNING:

Villa Sistemi Medicali will not bear any responsibility for damages caused to the equipment due to improper unpacking procedure, and for the relevant costs.

5.3. Space requirements

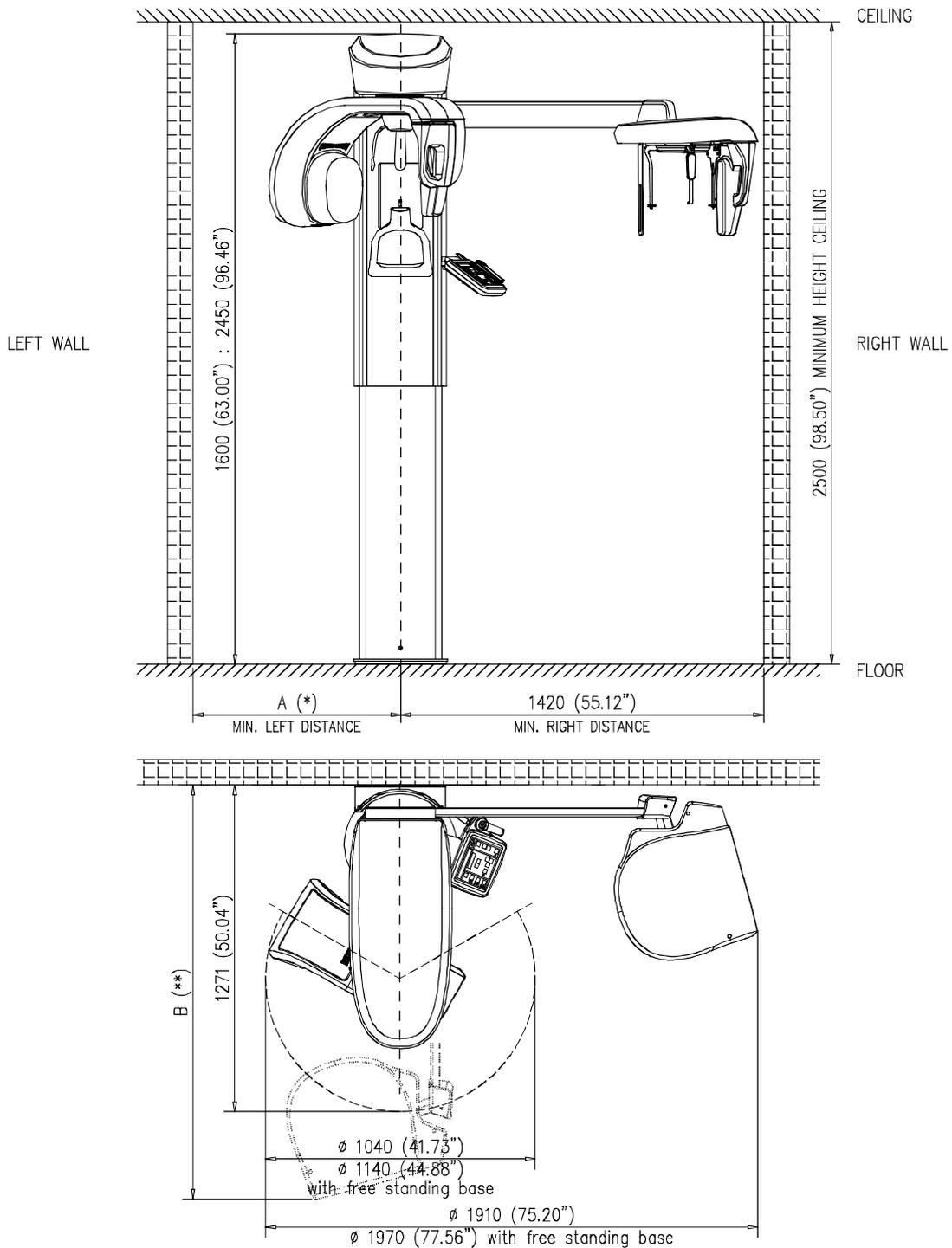
5.3.1. Version without CEPH



(*) **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 3D 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 3D 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).

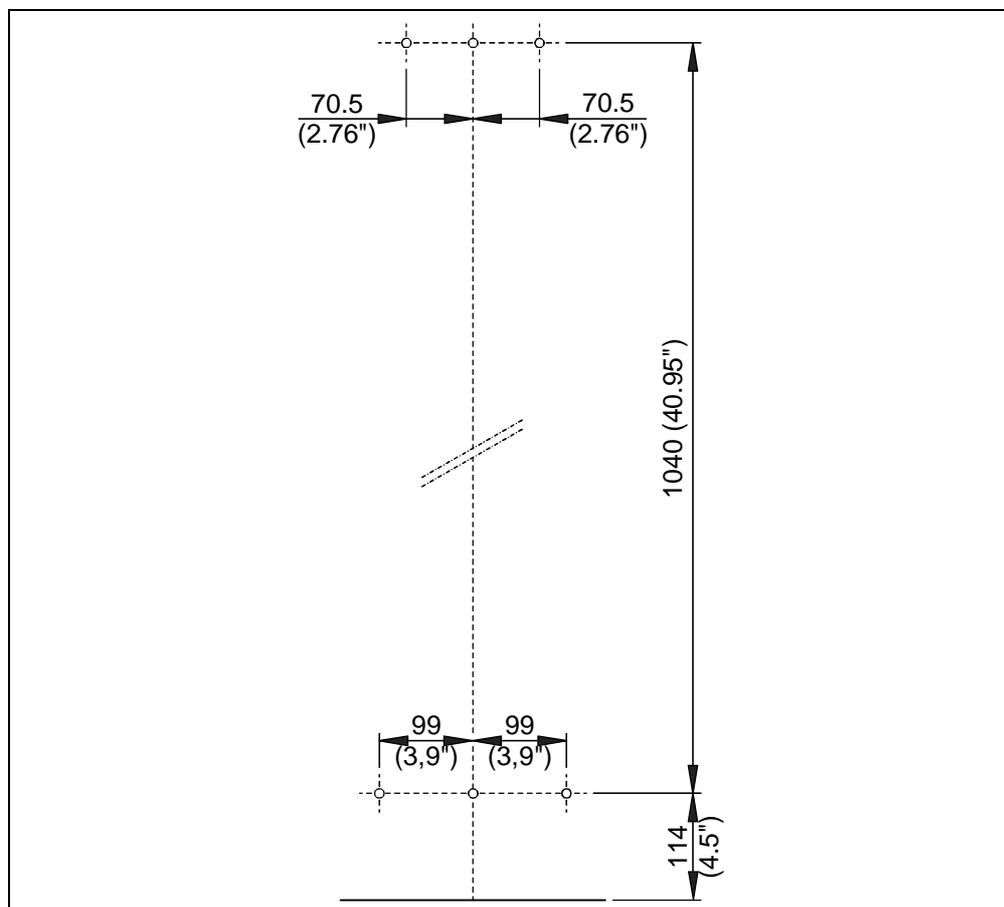


Figure 6-1

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 pallet 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.

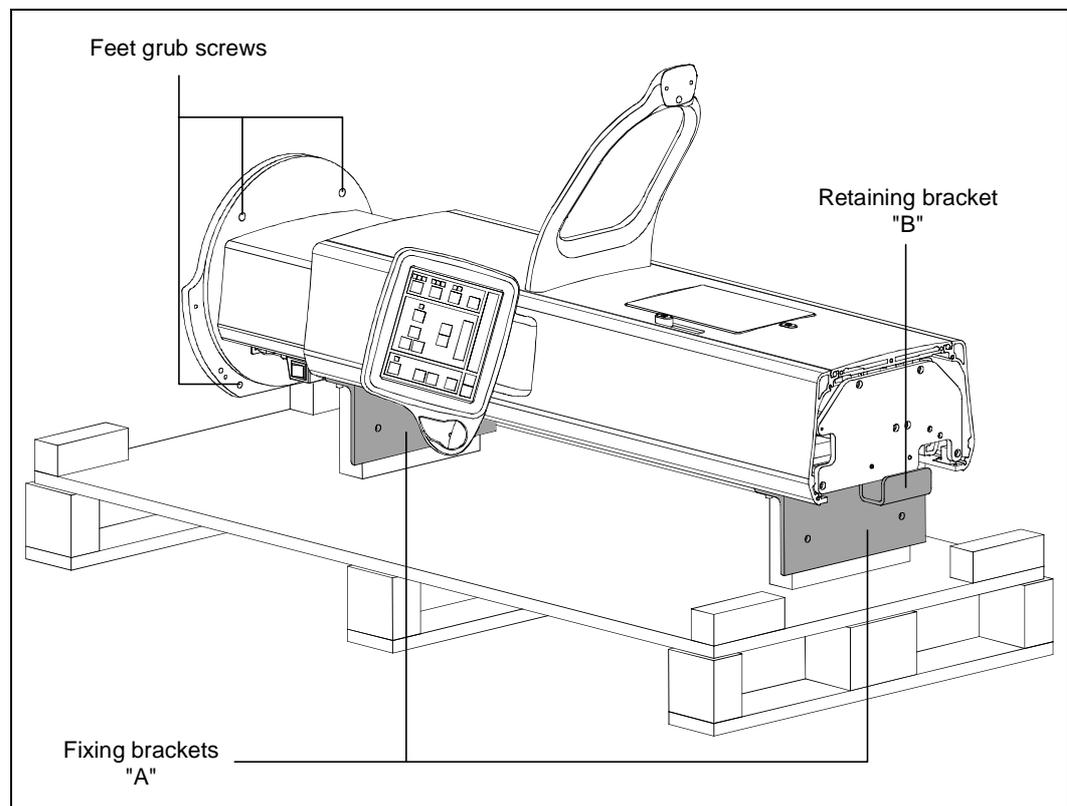


Figure 6-2

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 3D 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 3D 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.

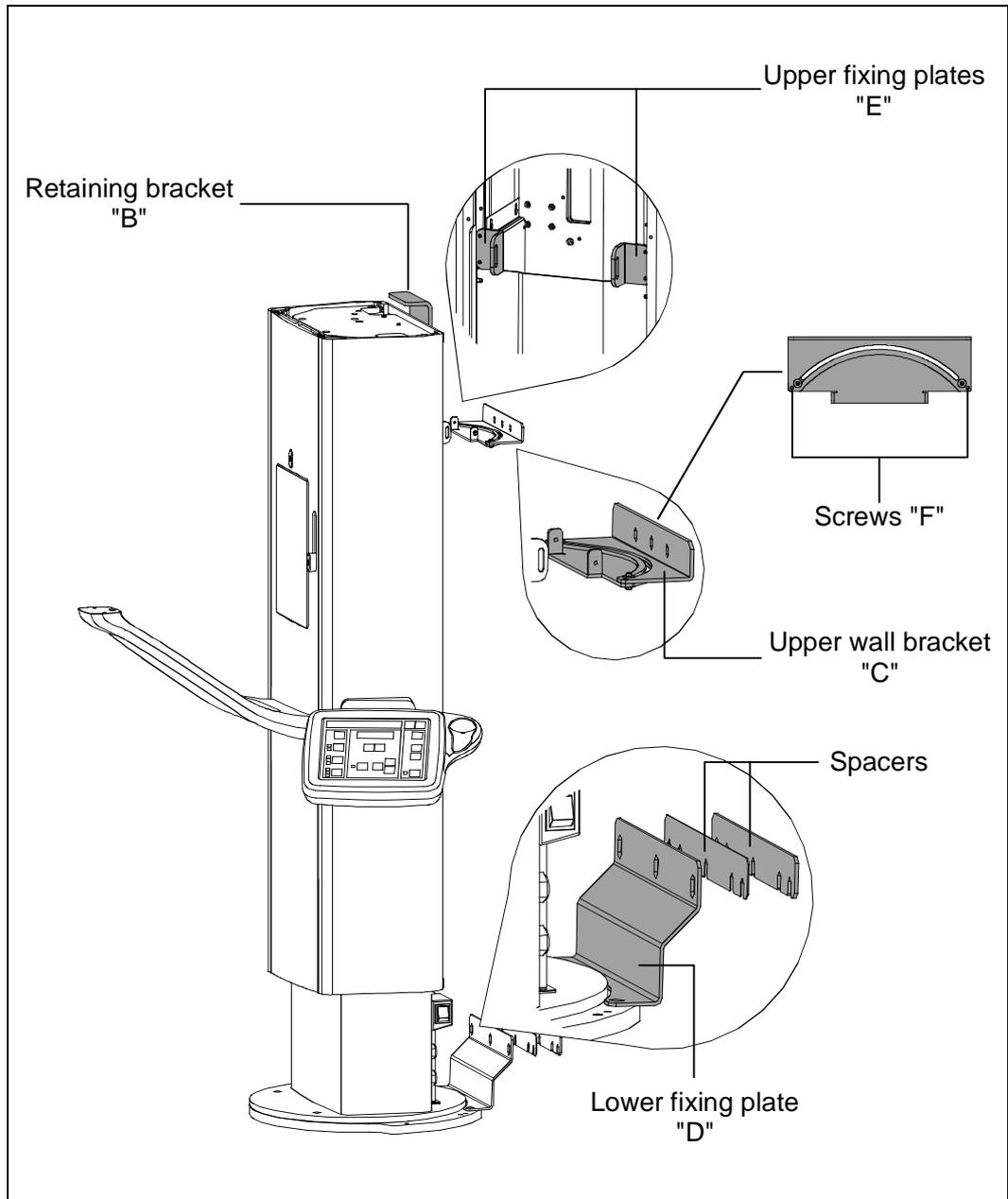


Figure 6-3

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).

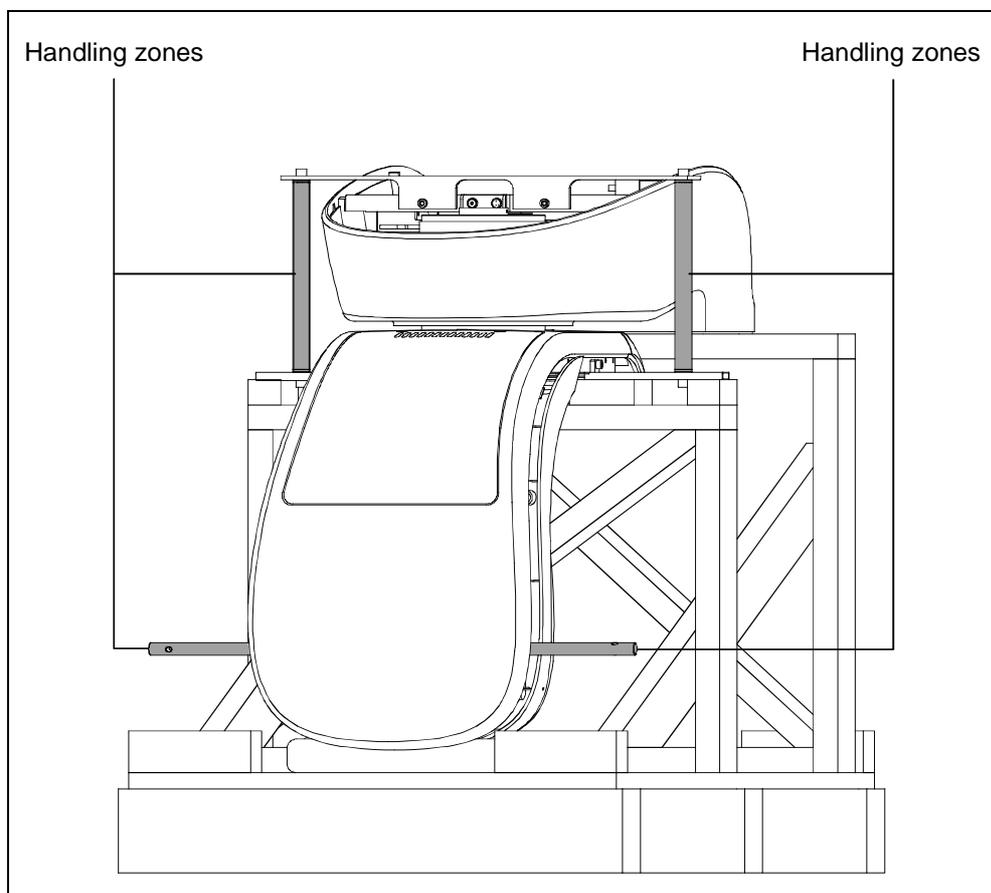


Figure 6-4

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.

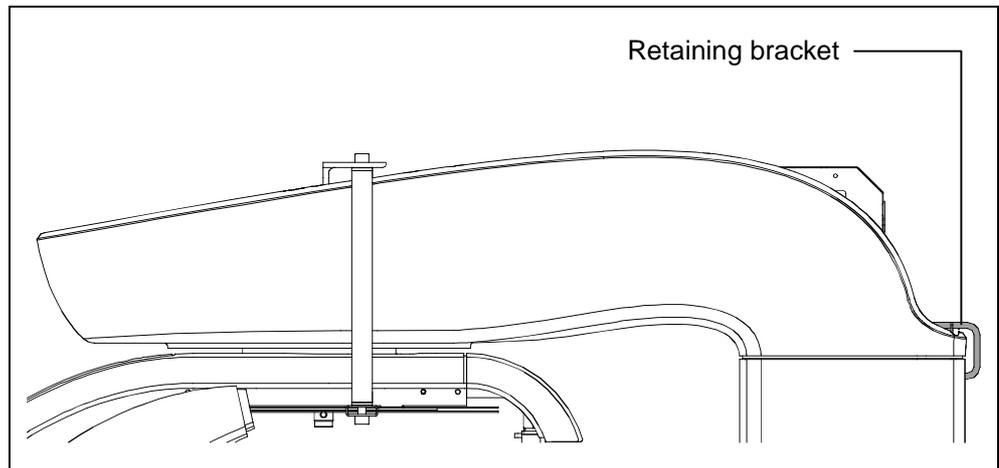


Figure 6-5

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.

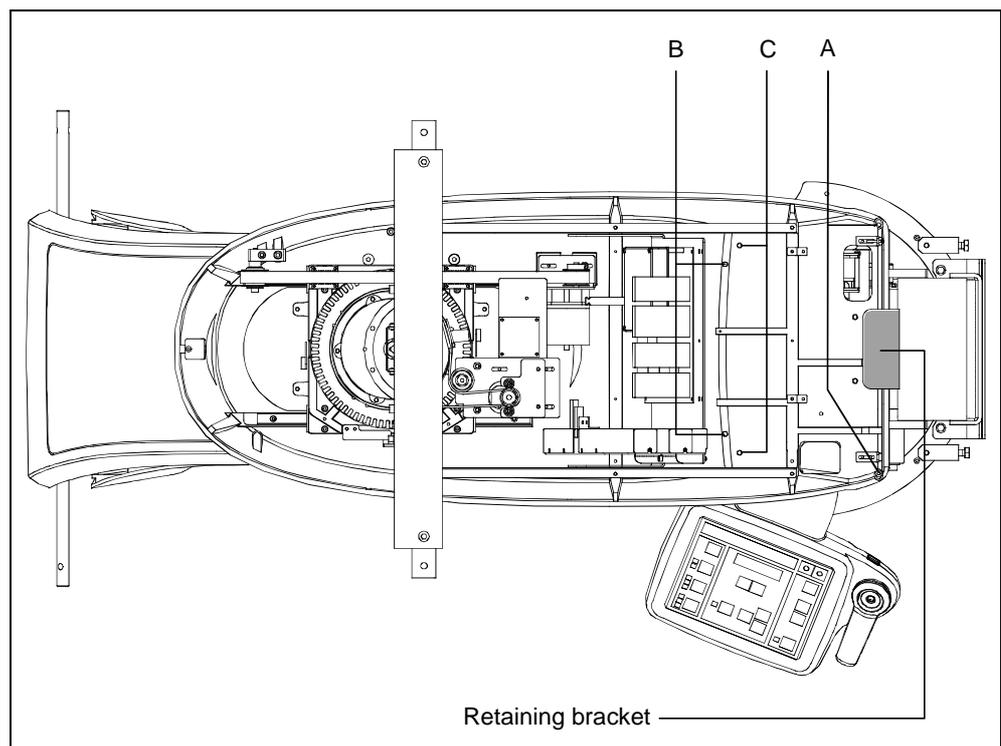


Figure 6-6

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).

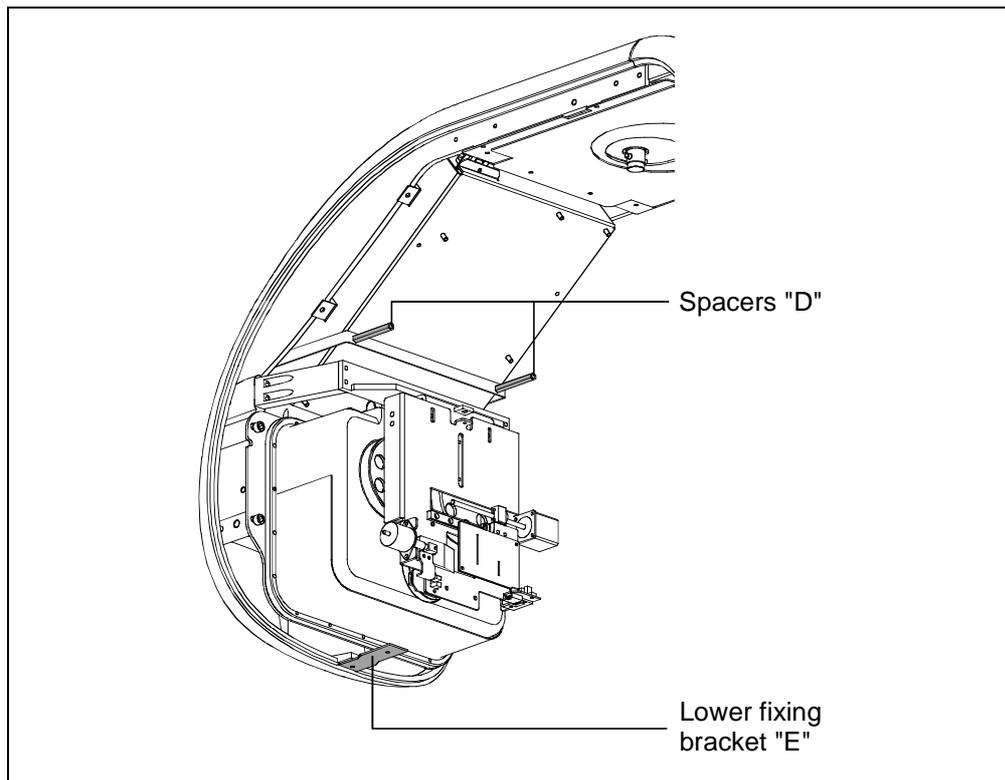


Figure 6-7

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.

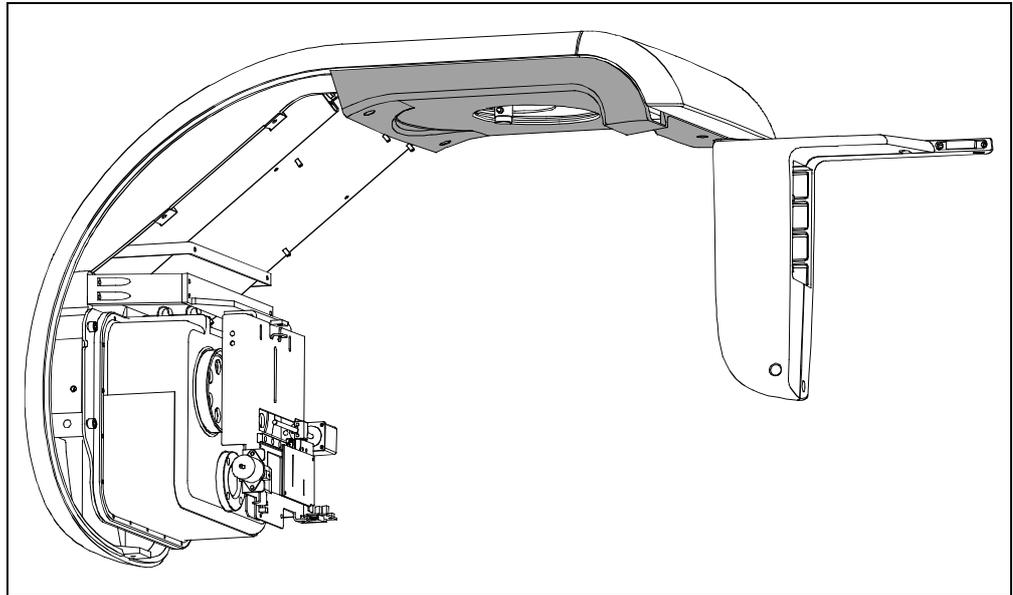


Figure 6-8

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

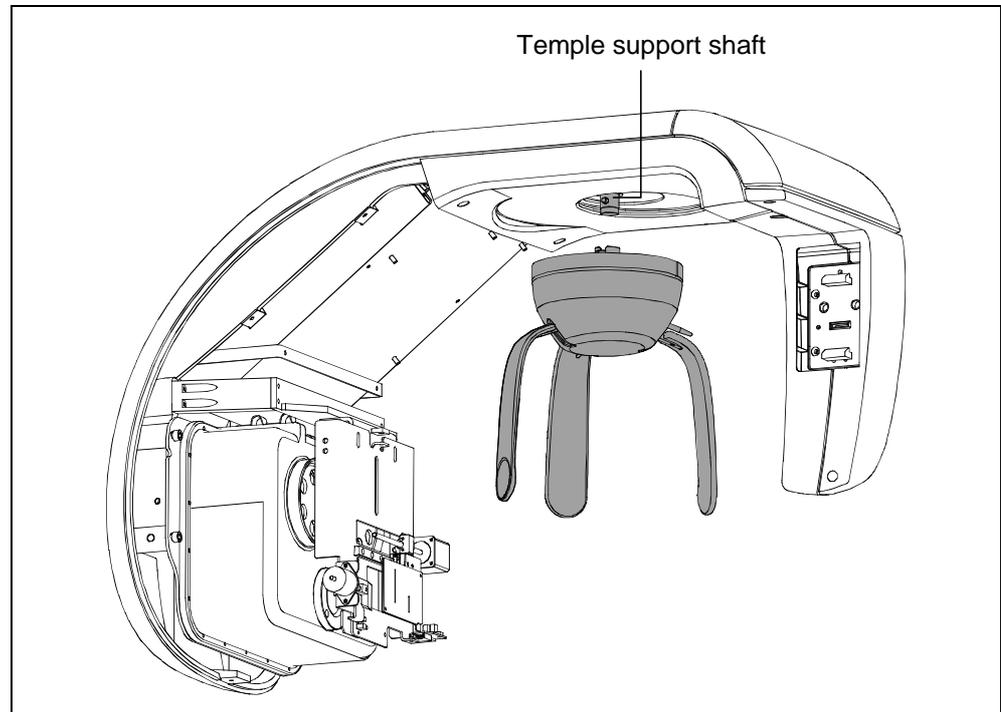


Figure 6-9

- 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 3D 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.

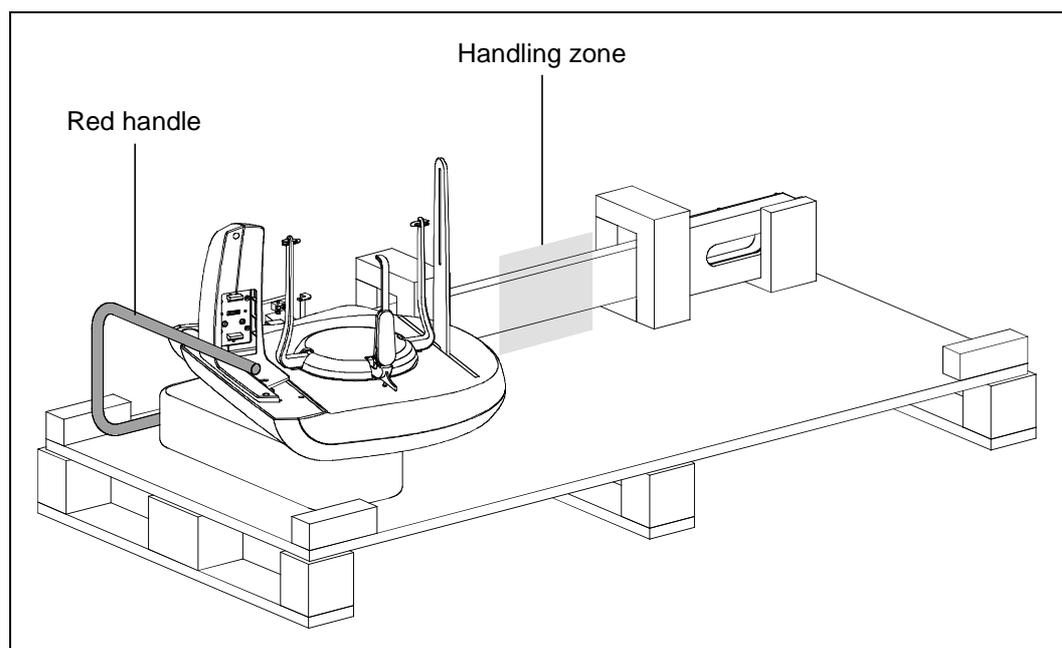
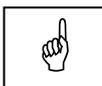


Figure 6-10



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.

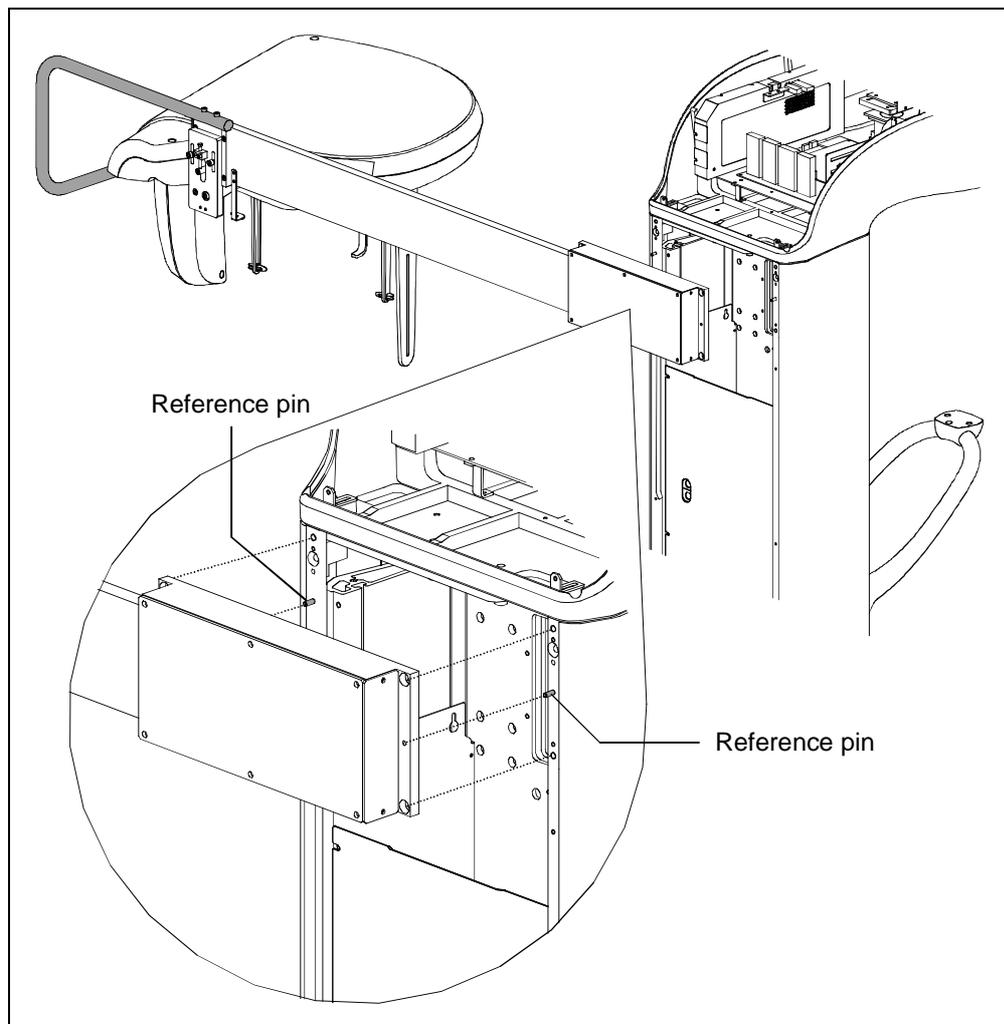


Figure 6-11

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.

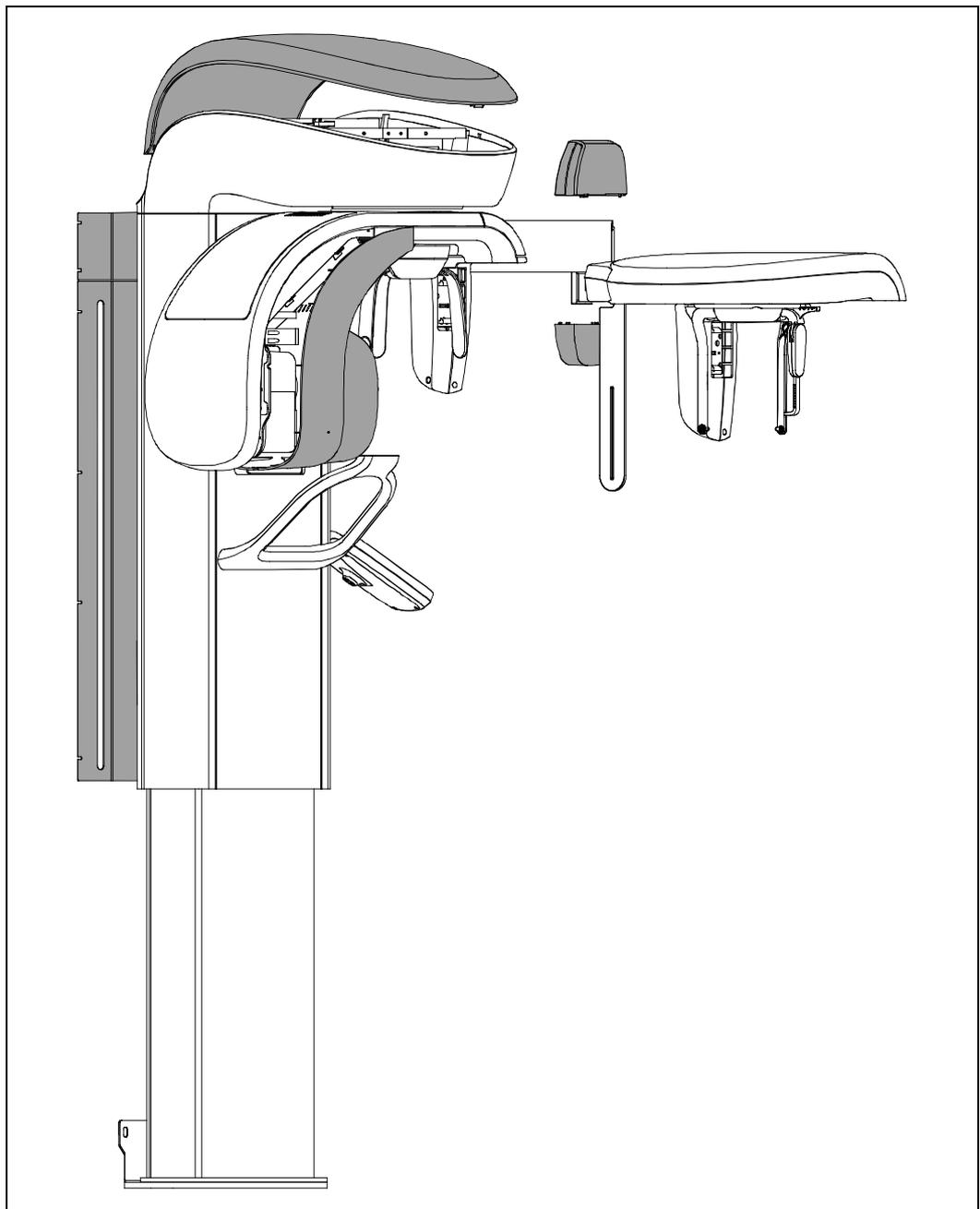


Figure 6-12

6.6. Inserting the CEPH 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:

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. Final checks

6.7.1. PC set up

6.7.1.1. PC – USB protection keys

Before to switch ON the PC, insert the two license USB keys.

6.7.1.2. PC - Rotograph EVO 3D communication

The communication between Rotograph EVO 3D and computer uses a LAN connection. The system is provided with an Ethernet cable in order to permit the PC connection.

In case there is no communication between Rotograph EVO 3D and computer, it is necessary to check the parameters installed in PC and equipment following instruction in paragraph 9.5.5.

6.7.1.3. DICOM set-up

Dental Studio Software allows to make measures on images and print them on a Windows printer.

A Dicom additional package is requested to activate the Dicom modalities "Worklist", "Store" and "Print".

To setup Dicom modalities, select "Utilities" icon in Dental Studio home page, the utilities window will be displayed: select "Program setup" and in the next window select "Dicom" icon. From this menu it will be possible configure "Print", "Worklist" and "Store" modalities.



WARNING:

Do not change the IP address of the network card used to communicate with the Rotograph EVO 3D (usually 192.168.2.xxx). In order to connect the PC in the Dicom network, it is necessary to use the second network card.

6.7.1.4. Image treatment filters setup

To perform filters setup, in the Dental Studio home page, click on "Patients" icon , select a stored patient or create a new one in the Dental Studio database and click on "Images" icon. In the top left side of the program window, select the icon "Options"; select the icon "Panoramic", in the lower part of the displayed window it will be possible to setup the filters used during acquisition; it is suggested to set:

- Sharpen minimum
- Gamma = 1.0

Confirm with "OK".

To setup post processing filters, refer to paragraph 9 of Dental Studio User Manual. It is suggested to use "Sharpen maximum" and "Media standard" filters; for Ceph it is suggested to use "Sharpen medium" filter.

6.7.2. Verification of 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:

In case both Panoramic trajectories (EVO + Standard or Standard + EVO) are enabled (see paragraph 7.3.3.18), this procedure has to be performed first selecting Panoramic STD trajectory and then EVO Panoramic.

1. Switch on the machine and go to Exam Selection.
2. Open a new patient used to make the test images.
3. Select the TAC icon to open the virtual keyboard and select Pan function.

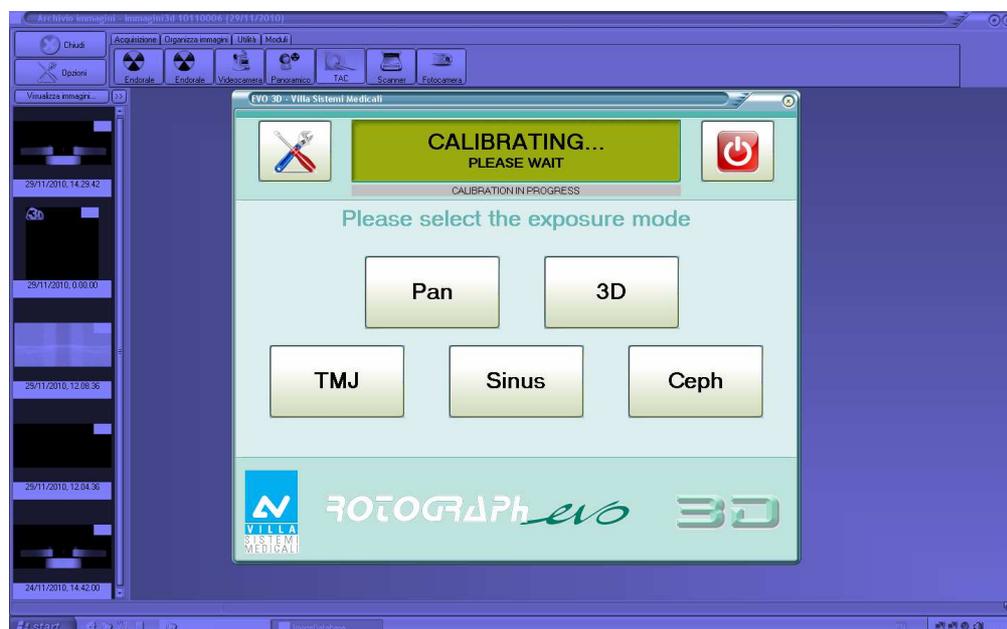


Figure 6-13

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

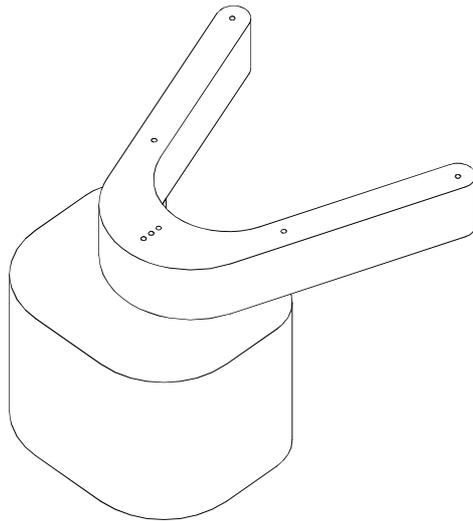


Figure 6-14
Centering tool P/N 6107900200



Figure 6-15
Sensor Calibration tool
P/N 5607900800

5. Make an exposure in Adult mode at 68kV – 6mA using the copper filter or 60kV - 6mA without the copper filter, acquired in the DentalStudio program; the following image will be displayed.

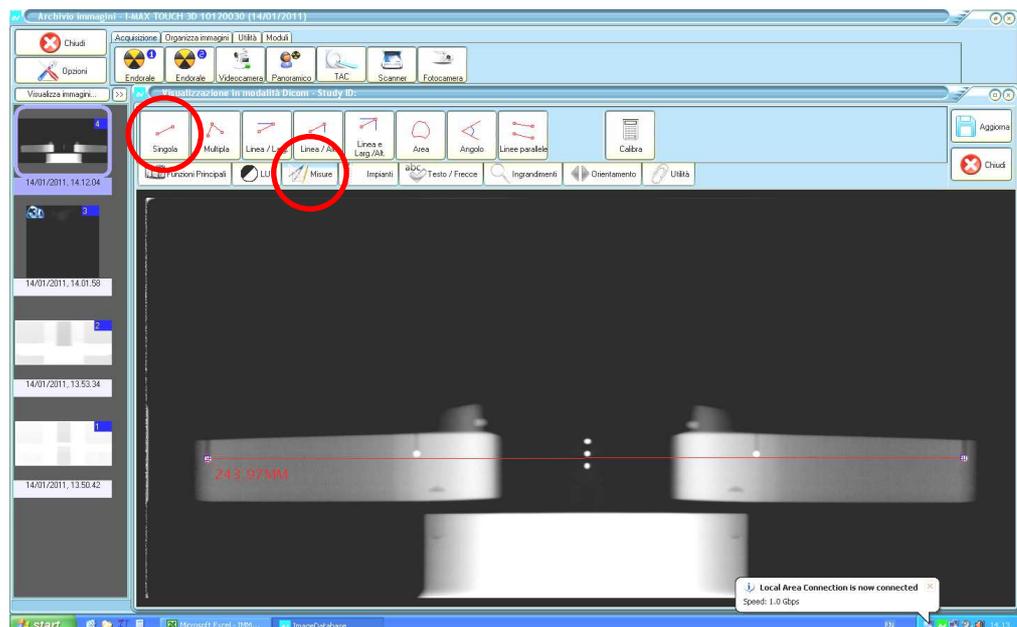


Figure 6-16

6. Set contrast and brightness level to have good visibility of all centering balls. Select from the menu "Measure" (Figure 6-16) the icon "Single" and measure the dimension of the image using as reference the two external balls. The image has to be $244\text{mm} \pm 2\text{mm}$ with Panoramic STD trajectory selected.
7. If distance is outside the tolerance range, adjust the Y axis (see paragraph 7.3.4.2) accordingly and repeat the exposure.
8. Set the parameter "Y Axis zero EVO" to +660 step (see paragraph 7.3.4.3).
9. Make a new exposure selecting EVO Panoramic function. The distance between the most right and most left ball has to be $223\text{ mm} \pm 2\text{mm}$.
10. Measure also the two half of the image in order to check symmetry. The difference has to be max. 1mm.
If there is not symmetry on the image, it is necessary to adjust the rotation offset entering in password 118 (see paragraph 7.3.4.1).

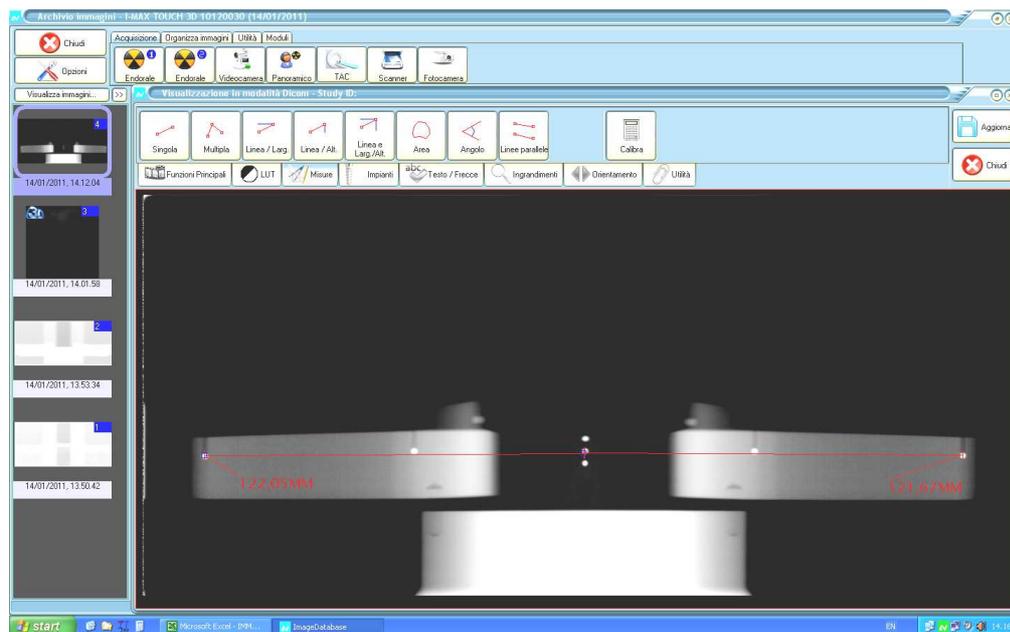


Figure 6-17

6.7.3. Image verification for the 3D function

1. Select the icon TAC and choose the 3D button.
2. Place the centering tool (P/N 6107900200 - Figure 6-14) on the chin rest and set 66kV - 6mA.
3. Press exposure button and wait the end of acquisition. Automatically the unit will reconstruct the 3D image.
4. The image has to provide a continuous line as shown in the following Figure.

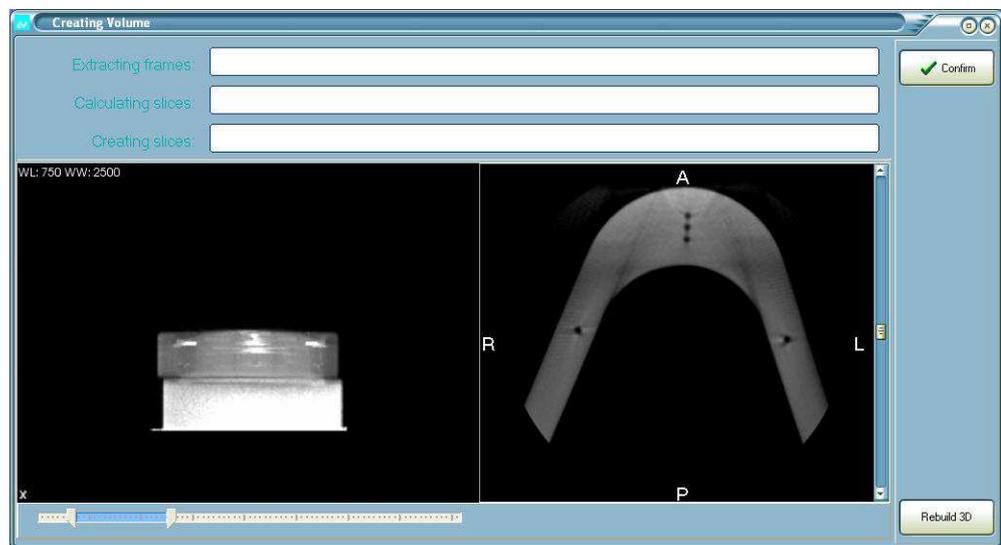


Figure 6-18

5. In case the arc is not correct, it will be necessary to modify the lateral offset as described in the paragraph 9.2.2.

6.7.4. Verification of the CEPH function



NOTE:

The CEPH arm has been adjusted on the unit during testing procedure, and adjustments are not usually necessary in field. Before to proceed, verify if the arm has been properly mounted during field installation.



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.

In case it is present the CEPH arm, it is necessary to verify the alignment of the X-ray beam with ear rings and the digital sensor.
It is possible to make exposure without the presence of the secondary collimator and without movement of the digital sensor entering in password 124 and selecting "Rotation offset" (see paragraph 9.6).

1. Press "Examination mode Selection – M" (11)  key; the Digital Sensor will be aligned to the X-ray beam.
2. Position the ear rings in LL position and make an exposure using 60kV - 6mA - 0,5 s in order to see the image of the primary collimator on the digital sensor.
3. Verify that the rings are centered in the exposed area:
 - If the rings are not centered (Figure 6-19), it is necessary to adjust the mechanical position of the rings (see paragraph 9.6.1).

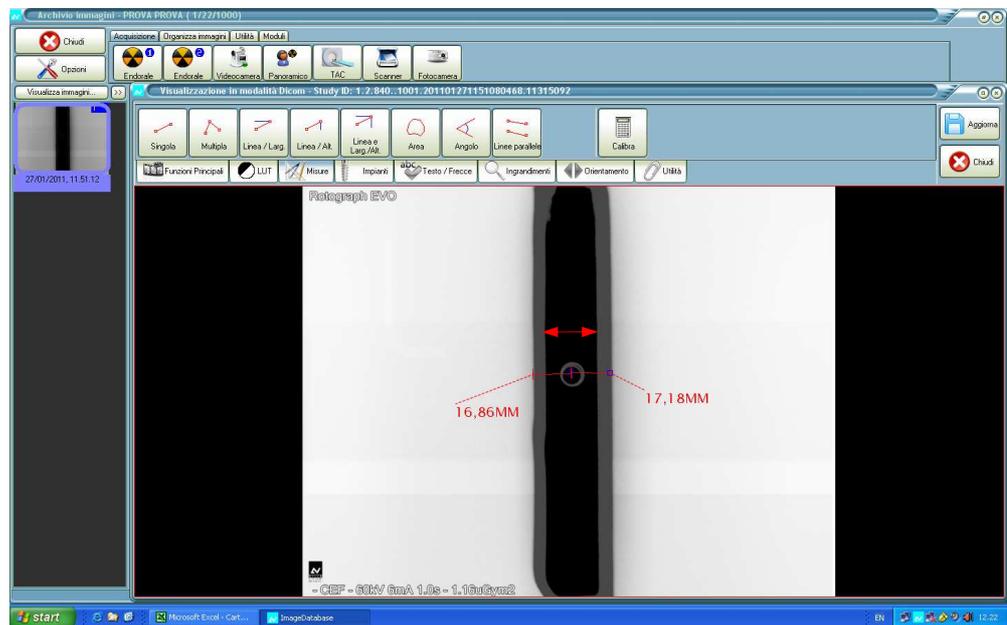


Figure 6-19

- If the image is not symmetric in the window (Figure 6-20), it will be necessary to adjust the CEPH sensor position (see paragraph 9.6.2).

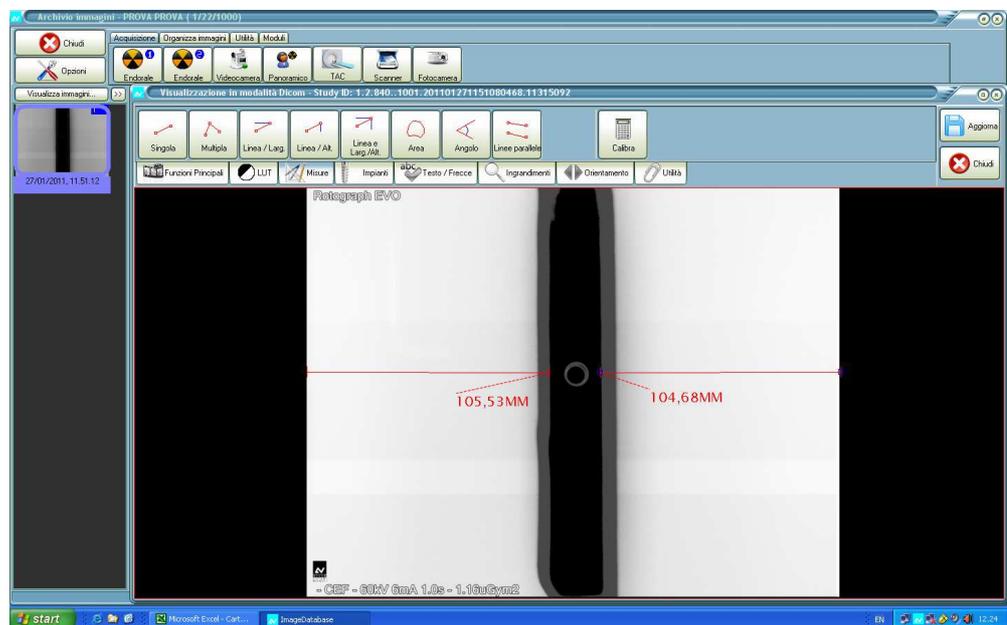


Figure 6-20

4. Select "CEPH sensor zero" menu (see paragraph 9.6.3) to check the secondary collimator position.

- Open the "Sensor Centering" program on the CD (P/N 5807304100) and wait until the message "Board is connected" is displayed on the bottom bar of the program. Check that in menu "Image processing" all the items are not selected.

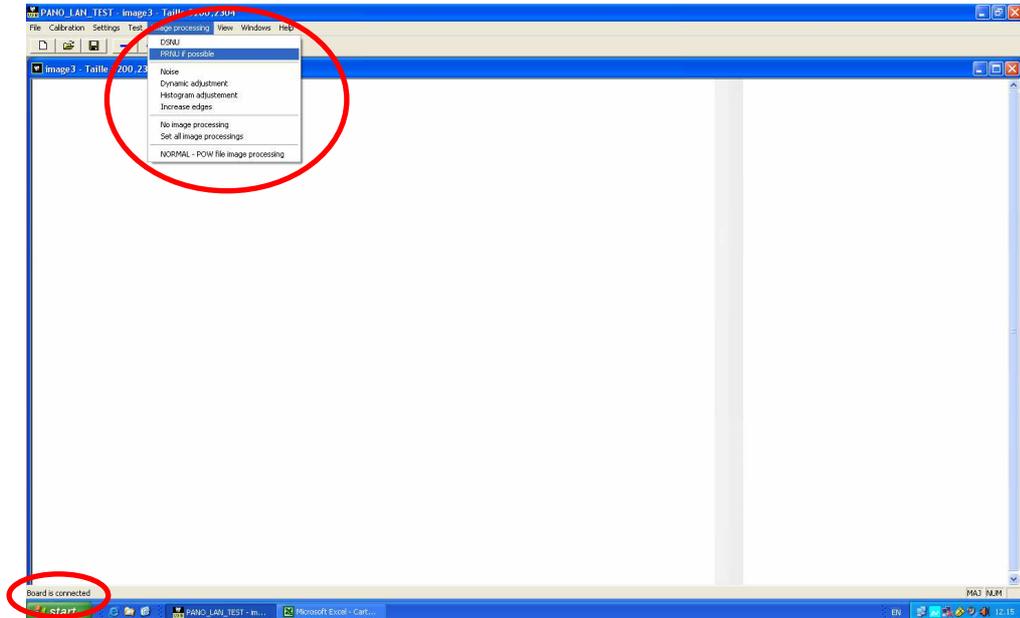


Figure 6-21

- Press key "Patient entrance" (7) . The primary and secondary collimators and the ceph sensor go to the ceph central position. Place the centering tool P/N 5209900900 on the secondary collimator.

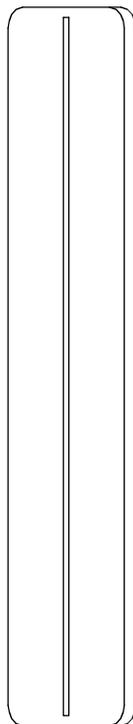


Figure 6-22
Centering tool P/N 5209900900

7. Select with key "Parameter selection" (3)  respectively kV, mA and exposure time and use keys increase (4) or decrease (5)  to set values for the exposure (suggested values: 60kV, 6mA and 0.5s).

8. Take X-ray pressing the X-ray button and check if in the obtained narrow image the projection of the slit of the centering tool is vertical and in the middle of the impressed area, which is defined by the arc identified in the figure.

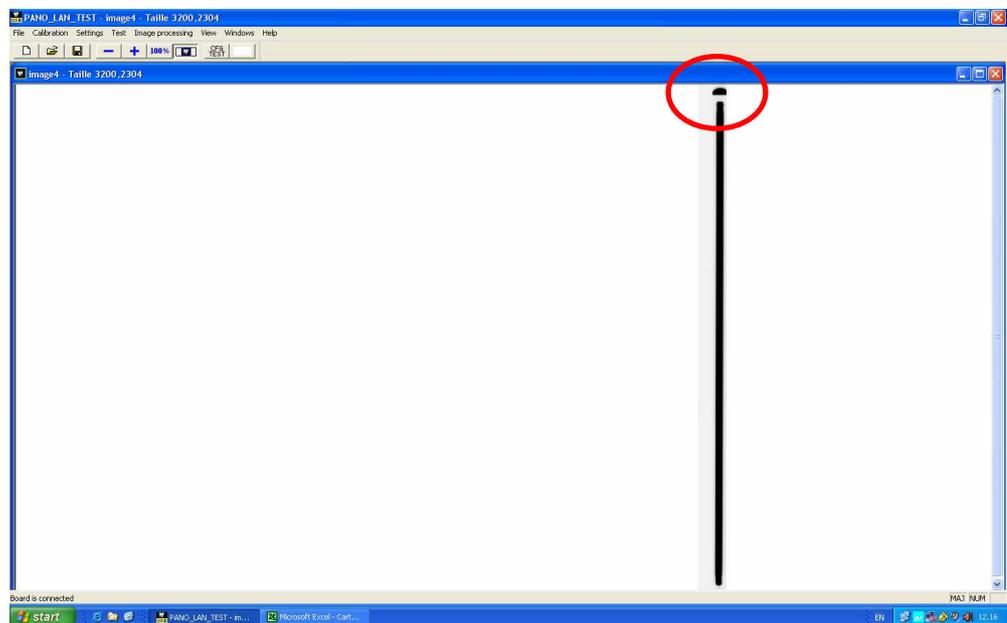


Figure 6-23

9. The image has to be centered with the arc.

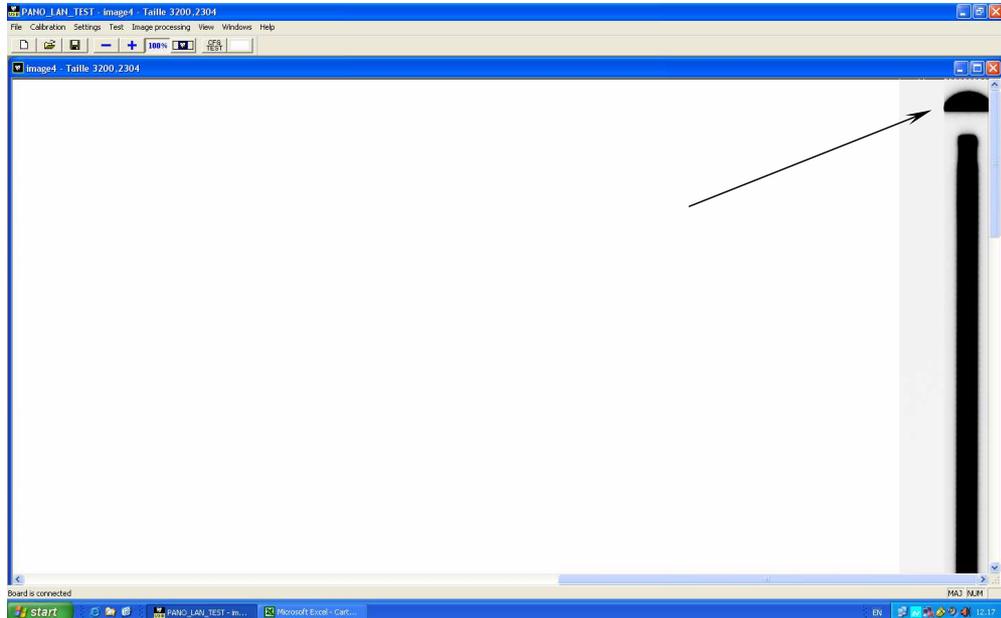


Figure 6-24

10. Enter in "STF zero" (see paragraph 9.6.4) to verify the functionality of the Soft Tissue Filter.
11. Press "Examination mode Selection – M" (11)  key, this operation insert also the secondary collimator in field.
12. Make a exposure with the same parameters (60kV – 6mA – 0.5s).

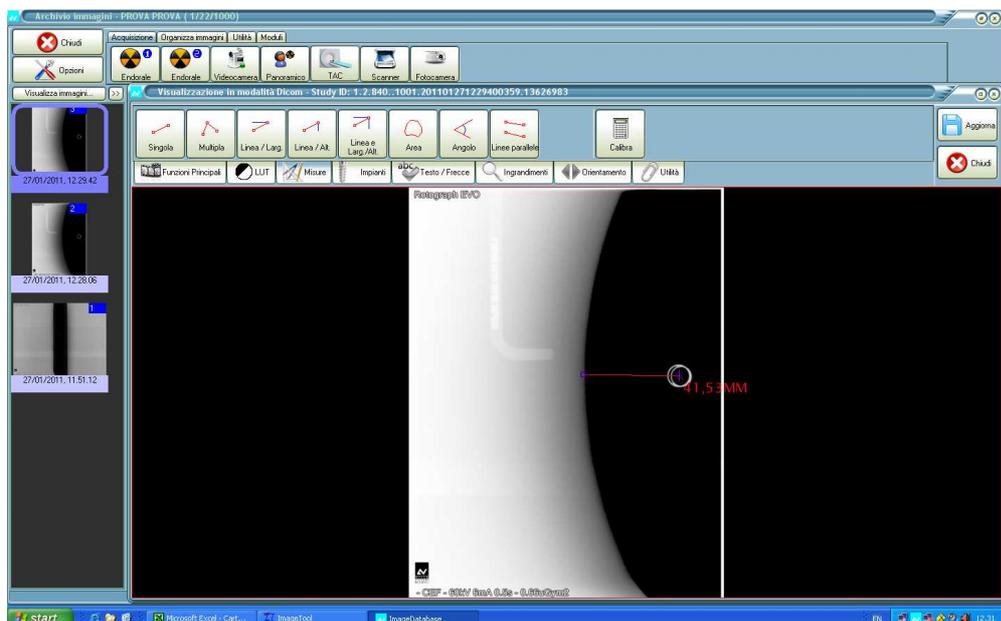


Figure 6-25

- 13.** Measure the distance between the center of the ear rings and the edge of the soft tissue filter. The value has to be around 50mm (considering that the measure scale is not 1:1).

2. Using the scroll right and scroll left keys  to change the message displayed until the "TROUBLESHOOTING" message appears on the lower row.
When the following menu is displayed:

	S	E	R	V	I	C	E		M	E	N	U		
T	R	O	U	B	L	E	S	T	O	O	T	I	N	G

Pressing the key "Patient Entrance" (7)  the next message is displayed:

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

3. Using the increase/decrease keys, set the password equal to 112 and confirm with the key "Patient Entrance" (7).
4. Using the scroll right and scroll left keys  go to the "RX EMISSION" menu and confirm with the key "Patient Entrance" (7).
At the selection of the X-ray emission test, the display will show the following message:

X	-	R	A	Y		E	M	I	S	S	I	O	N	
7	2	k	V		0	6	m	A		1	4	.	0	S



WARNING:

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

Pressing the parameter changes key (3) , it is possible to choose a different combination of parameters. Once pressed, the display will show:

>	7	2	k	V		0	6	m	A		1	4	.	0	S
---	---	---	---	---	--	---	---	---	---	--	---	---	---	---	---

Where the symbol ">" is showing the parameter to be changed; in this case the kV. To move to mA and exposure time, press key (3) once or twice again.

In this situation, the increase key (4) and the decrease key (5)



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.

6.7.5.1.1. kVp

Use a multimeter (R input $\geq 10\text{M}\Omega$) 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 $1\text{V} = 20\text{kV}$, verify that the value indicated by the multimeter ranges from $2.85 \div 3.15\text{ V}$ ($3\text{V} \pm 5\%$).

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 ($3\text{V} \pm 3\%$). 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 $\leq \pm 3\text{kVp}$ 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.

6.7.5.1.2. mA Check

Use a multimeter (R input $\geq 10M\Omega$) 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 \approx 3 mA, verify that the value indicated by the multimeter ranges from 1.86÷2.138V (6mA \pm 8%).

Set 80kV - 12mA - 3s. The value read must range from 3.643 to 4.276 V (12mA \pm 8%).

Measured values 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).

6.7.5.1.3. 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.

6.7.5.2. Non-invasive method

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



WARNING:

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

The exposure parameters can be checked with a non-invasive instrument by performing the following procedure:

1. With the unit switched on, select the Panoramic Examination mode

by pressing key "Examination mode Selection - M" (11)  .

2. Pressing the keys increase (4) - decrease (5)  and F1  at

the same time, the LEDs relating to "Patient type", "Patient size" and "Biting" switch off, and the display shows:

	x	x	k	V		x	x	m	A		x	x	.	x	s
E	M	I	S	S	I	O	N	P	R	O	G	R	A	M	



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 variations due to spine compensation.

3. Place the measuring instrument.

4. To set the exposure parameters, press key (3)  , the display will show respectively one of the following three indications:

```
> x x k V x x m A x x . x s
```

```
x x k V > x x m A x x . x s
```

```
x x k V x x m A > x x . x s
```

The symbol ">" indicates which parameter is being changed.

The selected parameter can be modified by pressing the increase

key (4) and the decrease key (5)



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

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



NOTE:

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

6. To end the control program, press key "Test" (6)  ; the display will indicate:

```
x x k V x x m A x x . x s  
P A N O R A M I C - S T D
```

and the unit will return to standard mode.

6.7.6. Storing of automatic exposure parameters

The pre-set technical exposure factors can be varied according to the needs of the user, or to obtain somewhat more 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 key (3)  to select the parameter to modify; on the display, on the left of the value, the reference character ">" will appear.

3. Press increase (4) or decrease (5) keys  to set the value to store.

At the end of the modifications, the new parameters are stored by

pressing concurrently the decrease (5)  and function "F1" key 

After pressing the keys, the display will show the following message:

S	T	O	R	E	?														
>	0	<	=	S	,	T	=	N											

and the LEDs relating to the keys for patient and size (that are being modified) will light up.

- Press the key "Patient Entrance" (7)  to confirm or the key "Test" (6)  to cancel the setting.

6.7.6.1. Table of pre-set anatomic parameters

PANORAMIC

TMJ open/close mouth

	Adult 	Child 
Small 	68 kV 6 mA	64 kV 6 mA
Medium 	72 kV 6 mA	66 kV 6 mA
Large 	74 kV 6 mA	68 kV 6 mA

	Adult 	Child 
Small 	68 kV 6 mA	62 kV 6 mA
Medium 	72 kV 6 mA	64 kV 6 mA
Large 	76 kV 6 mA	66 kV 6 mA

SINUS

	Adult 	Child 
Small 	66 kV 6 mA	62 kV 6 mA
Medium 	70 kV 6 mA	64 kV 6 mA
Large 	72 kV 6 mA	66 kV 6 mA

3D Dentition

	Adult 	Child 
Small 	76 kV 9 mA	66 kV 8 mA
Medium 	80 kV 9 mA	68 kV 8 mA
Large 	82 kV 9 mA	70 kV 8 mA

3D TMJ Left / 3D TMJ Right

		Adult 	Child 
Small 		68 kV 6 mA	62 kV 6 mA
Medium 		72 kV 6 mA	64 kV 6 mA
Large 		76 kV 6 mA	66 kV 6 mA

3D Sinus

		Adult 	Child 
Small 		66 kV 6 mA	62 kV 6 mA
Medium 		70 kV 6 mA	64 kV 6 mA
Large 		72 kV 6 mA	66 kV 6 mA

CEPHALOMETRY (L.L)

		Adult 	Child 
Small 		66 kV 6 mA	62 kV 6 mA
Medium 		70 kV 6 mA	64 kV 6 mA
Large 		72 kV 6 mA	66 kV 6 mA

CEPHALOMETRY (A/P - P/A)

		Adult 	Child 
Small 		74 kV 12 mA	70 kV 10 mA
Medium 		76 kV 12 mA	72 kV 10 mA
Large 		80 kV 10 mA	74 kV 10 mA

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7. TROUBLESHOOTING

7.1. LEDs

7.1.1. 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 10, 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.

7.1.2. 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 10, 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 7.1.1). If all the previous checks are positive, replace the Generator CPU board A9.
H10	"DSPU CAN-BUS" device	OFF	If blinks, check the cable between DSPU and connectors X42 / X21 and the cable X43 on both sides. If they are OK, replace the DSPU board.
H12	"Motor power supply" presence	OFF	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.

7.2. Displayed messages

Rotograph EVO 3D 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"

(7)  when a movement is in progress.

This message will be displayed as follows:

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

xxx code number of the error message

Operating conditions are reset by pressing key (7)  .

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

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

xxx code number of the error message

- 3 -** Messages related to problems regarding the 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.

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

xxx code number of the error message

The 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	7.2.1.1
110	Main CPU board battery low or fault	7.2.1.2
Rotation motor		
Code	Error description	Reference chapter
200	Zero position optical sensor of rotation axis always activated	7.2.2.1
201	Zero position optical sensor never activated	7.2.2.1
204	Unexpected activation of rotation optical sensor	7.2.2.1
205	Timeout on rotation	7.2.2.2
206	Patient collision	7.2.2.3
Y motor		
Code	Error description	Reference chapter
240	Zero position micro Y always active	7.2.2.4
241	Zero position micro Y never active	7.2.2.4
242	Unexpected activation of Y axis	7.2.2.4
243	Timeout on Y axes	7.2.2.4
Ceph digital Sensor		
Code	Error description	Reference chapter
280	Unexpected activation of optical sensor Ceph Sensor	7.2.2.5
281	Timeout on ceph sensor optical sensor	7.2.2.5
282	Sensor ceph micro never active	7.2.2.5
283	Sensor ceph micro always active	7.2.2.5
Secondary collimator on Digital CEPH		
Code	Error description	Reference chapter
300	Unexpected activation of optical sensor secondary collimator	7.2.3.1
301	Timeout on ceph secondary collimator	7.2.3.1
302	Secondary collimator micro never active	7.2.3.1
303	Secondary collimator micro always active	7.2.3.1

Primary slit collimator		
Code	Error description	Reference chapter
320	Unexpected activation of optical sensor primary collimator for CEPH	7.2.3.2
321	Timeout on primary collimator for CEPH	7.2.3.2
322	Primary collimator for CEPH micro never active	7.2.3.2
323	Primary collimator for CEPH micro always active	7.2.3.2
Sensor holder		
Code	Error description	Reference chapter
340	Sensor holder not on PAN	7.2.3.3
X-ray Controls		
Code	Error description	Reference chapter
360	RX button pressed on start-up or before exam	7.2.3.4
361	Remote RX button pressed on start-up or before exam	7.2.3.4
362	RX button released during emission	7.2.3.5
CanBus		
Code	Error description	Reference chapter
380	Invalid CANBus message	7.2.3.6
381	Timeout on activating CAN unit of Generator board (A10)	7.2.3.7
382	Generator board (A10) not answering	7.2.3.7
Soft Tissue filter		
Code	Error description	Reference chapter
400	Timeout of zero position optical sensor of STF	7.2.4.1
401	STF zero position sensor always active	7.2.4.1
Code	Error description	Reference chapter
420	Wrong setting in PAN + CEPH system configuration	7.3.3.8

Generator Board A10		
Code	Error description	Reference chapter
750	Alarm "power loss" on Generator board	7.2.5.1
751	Alarm "overvoltage kV"	7.2.5.2
752	Alarm "overload on filament" on Generator board	7.2.5.3
753	Alarm "overload anodic current"	7.2.5.3
754	Alarm "filament not OK"	7.2.5.4
755	Alarm "backup timer"	7.2.5.6
756	Alarm "PFC not OK"	7.2.5.5
758	Alarm "NO X-ray"	7.2.5.6
759	Alarm "unexpected emission"	7.2.5.6
760	Alarm "NO RX button command"	7.2.5.7
762	Alarm "NO X-ray feed back"	7.2.5.8
771	Frame longer than 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	7.2.5.9
775	RX button released during emission (on Generator board)	7.2.5.10
776	Watch dog CAN intervention	Action as per E771
Vertical motor		
Code	Error description	Reference chapter
800	Timeout on CAN activation for vertical motor	7.2.6.1
801	ON/OFF command for vertical motor not changed on planned time	7.2.6.2
Keyboard		
Code	Error description	Reference chapter
831	CPU board – VDSIB communication locked	7.2.7
	Keyboard locks during system start-up as HW and SW versions are displayed	
Keyboard		
Code	Error description	Reference chapter
850	More than one key pressed on Power on	7.2.8.1
851	Column up and/or Column down pressed on power on	7.2.8.2
852	Key RESET (patient centering) pressed during movement	7.2.8.3

7.2.1. 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).

7.2.1.1. E108: Hardware key fault

This error is shown when the firmware of the Rotograph EVO 3D does not sense the presence of the U.I.C. (Unique Identification Code). The unique code is read, with its check byte, from the control system at the start-up; if the check byte is incorrect, the system displays the above error number.

In case this error is displayed, a pressure of key " Patient entrance " (7)



allows the system to continue its functioning, but only standard base examination will be possible.

Verify the presence of the key and that it 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.

7.2.1.2. 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).

7.2.2. 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.

7.2.2.1. **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	Z	E	R	O	[f	f]				a	
Z	E	R	O	O	F	F	S		±	e	e	e	e

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.

7.2.2.2. E205 Timeout on rotation

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

7.2.2.3. 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.

**7.2.2.4. 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.

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

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).

**7.2.2.5. 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 sensor 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 M8 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 M8 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.

7.2.3. Errors with code from E300 to E399

- 7.2.3.1. 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 M7.

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 M7 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 M7 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 M7 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.

7.2.3.2. 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 sensor 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.

7.2.3.3. 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.

7.2.3.4. 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.

7.2.3.5. 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.

7.2.3.6. 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.

**7.2.3.7. 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.

7.2.4. Errors with code from E400 to E499

7.2.4.1. 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.

7.2.5. 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.

7.2.5.1. 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 \pm 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.

7.2.5.2. 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 \pm 2% while is 14.3k \pm 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.

7.2.5.3. 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.

7.2.5.4. 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.

7.2.5.5. 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.

**7.2.5.6. 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 chapter 7.1.1.

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.

7.2.5.7. 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).

7.2.5.8. 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).

7.2.5.9. 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.

7.2.5.10. 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.

7.2.6. Errors with code E800 and E801

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

7.2.6.1. 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.

7.2.6.2. 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.

7.2.7. E831: CPU board – VDSIB communication locked

This message is displayed when there is a communication fault between the CPU board and the VDSIB during system start-up.

The following procedure is applicable also if the keyboard locks during system start-up as HW and SW versions are displayed.

Check on the Power HUB board (A21) the LEDs H1, H2, H3 and H4 status; they should be all ON.

If LED H1 is OFF, disconnect the cable X84-X75 (X84 side) and verify if the LED switch ON; if it doesn't light change the cable (there is likely a short circuit between the cable pins), otherwise replace the Power HUB board.

If one of the other LEDs is OFF, replace the Power HUB board.

If all the LEDs of the Power HUB board are ON, check the connections on the VDSIB board, mainly the cable X84-X75 (X75 side); if necessary replace the faulty cable.

Otherwise, the problem can be related to a bad synchronization of the VDSIB board, in this case:

- 1.** Switch OFF the unit
- 2.** Disconnect all the VDSIB cables
- 3.** Turn ON the unit
- 4.** Reconnect the VDSIB cables
- 5.** Switch OFF the unit and ON again to reboot the system and restore communication.

If the problem is still present, replace the VDSIB board.

7.2.8. Errors with code E850, E851 and E852

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

7.2.8.1. 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 keyboard membrane and after the control board.

Otherwise the following message is displayed:

E		8	5	0		(	x	x	x	x	x	x	x	x)
C	A	L	L		T	E	C	H		A	S	S	.		

xxxxxxx code number for message 850

Release the corresponding key if pressed and repeat the power on procedure. Otherwise replace the keyboard membrane and after the control board A4.

7.2.8.2. 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.

7.2.8.3. E852: One key pressed during the movement

During the system movements, 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 involuntarily 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.

7.3. Service programs descriptions

Rotograph EVO 3D 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 7.3.3)
- **Password 112:** Fault check (see paragraph 7.3.6)
- **Password 118:** Test on motors/positioning sensors, setting of the zero offsets of the axes and the collimators (see paragraph 7.3.4)
- **Password 124:** Definition of the parameters for the cephalometric examination (see paragraph 7.3.5).

7.3.2. General information on the use of keyboard

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

	<p>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.</p>
	<p>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.</p>
	<p>Left/Right scroll: are used to scroll into different parameters or menus.</p>
	<p>Parameter increment and decrement: are used to change the value of the selected parameter.</p>
	<p>Adult/Child selection: is used in Password 124, menu "Rotation offset", to switch between "Rotation zero" and "Sensor zero" settings.</p>
	<p>Size selection: is used in Password 124, menu "Rotation offset", to perform an axis zero reset.</p>

7.3.3. Password 92: Configuration menus

When the following menu is displayed,

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

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

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

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

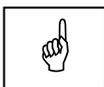
and confirm with the Patient centering key ; now it is possible to access the configuration menus of the following list:

LANGUAGE ⇔ DATE-TIME SET ⇔ DISABLE X-RAY ⇔
 DISPL BRIGHTNESS ⇔ DISPLAY CONTRAST ⇔ LED BRIGHTNESS ⇔
 KEY CLICK SOUND ⇔ KEY CLICK VOLUME ⇔ MANAGE PANO OPT. ⇔
 MANAGE IMPL OPT. ⇔ TOOTH STYLE ⇔ DIGITAL MODE ⇔
 COLL SETUP TYPE ⇔ COLL TECHNOLOGY ⇔ STF SETUP TYPE ⇔
 SENSOR HANDLING ⇔ COLUMN VERSION ⇔ DSPU IP ADDRESS ⇔
 DSPU NET MASK ⇔ QSD IP ADDRESS ⇔ QSD NET MASK ⇔
 X-RAY 3D TIME ⇔ X-RAY CAL 3D TIME ⇔ ENABLE 3D SENSOR ⇔
 ENABLE PAN PLUS ⇔ SKIP SENSOR RDY ⇔ PANO ORDER ⇔
 LANGUAGE



WARNING:
Do NOT modify COLUMN VERSION, X-RAY 3D TIME, X-RAY CAL 3D TIME and SKIP SENSOR RDY menus; changing the set mode will affect the complete system functionality.
These parameters must be:

- **Column version: 1.00**
- **X-ray 3D time: X-RAY ON: 028 / X-RAY OFF: 022**
- **X-ray cal 3D time: X-RAY ON: 020 / X-RAY OFF: 080**
- **Skip sensor ready: SKIP READY OFF**



NOTE:
 Changing on MANAGE IMPL OPT., TOOTH STYLE and ENABLE PAN PLUS menus do not have any effect on system functionality.

The selection is confirmed pressing the Patient centering (>0<) key.
The exit from each menu 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:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
>	0	<		=	Y		,		T		=		N		

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

7.3.3.1. 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 ⇔ ENGLISH ...

7.3.3.2. 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:

D	A	T	E	-	T	I	M	E	S	E	T			
D	A	T	E	:	D	D	/	M	M	/	Y	E	A	R

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

Confirming the Date change, the display changes as follows:

		A	D	J	U	S	T		D	A	T	E		
D	>	X	X		M		Y	Y		Y		Y	Y	

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.

		A	D	J	U	S	T		D	A	T	E		
D		X	X		M	>	Y	Y		Y		Y	Y	

		A	D	J	U	S	T		D	A	T	E		
D		X	X		M		Y	Y		Y	>	Y	Y	

7.3.3.3. 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.

7.3.3.4. Display brightness / Display contrast

These selection allow the set of brightness and contrast of the display in order to set those as a convenient level for the operators. The display brightness will decrease with higher value; the factory set value is set to the maximum level.

7.3.3.5. LED brightness

The LED brightness can be set in a manner to be comfortable for the installation surroundings. The factory set value is 127; increasing it will increase the brightness and viceversa.

7.3.3.6. Key click sound / Key click volume

The "clicking" sound of the pressed key can be set ON/OFF; once set to ON, also its volume can be adjusted at the appropriate volume.

7.3.3.7. 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.

F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
V	A	L	U	E	[	0	]	=		F	F				

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.

7.3.3.8. 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.

7.3.3.9. 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:

C	O	L	L	S	E	T	U	P	T	Y	P	E		
		C	H	I	L	D			S	Y	S	T	E	M

or

C	O	L	L	S	E	T	U	P	T	Y	P	E		
P	A	N		O	N	L	Y		S	Y	S	T	E	M

or

C	O	L	L	S	E	T	U	P	T	Y	P	E		
P	A	N	-	C	E	P	H		S	Y	S	T	E	M

or

C	O	L	L	S	E	T	U	P	T	Y	P	E		
			3	D					S	Y	S	T	E	M

according to the factory setting.

It is possible to change the set value using the parameter

increase/decrease  keys; **select "3D SYSTEM"**.



NOTE:
 Wrong setting affect the system's functionality.

7.3.3.10. 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:

C	O	L	L		T	E	C	H	N	O	L	O	G	Y	
S	C	R	E	W											

or

C	O	L	L		T	E	C	H	N	O	L	O	G	Y	
B	E	L	T												

according to the factory setting.

7.3.3.11. STF Setup type

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

S	T	F		S	E	T	U	P		T	Y	P	E		
			3	D						S	Y	S	T	E	M

or

S	T	F		S	E	T	U	P		T	Y	P	E			
			W	I	T	H	O	U	T		S	Y	S	T	E	M

or

S	T	F		S	E	T	U	P		T	Y	P	E		
P	A	N	-	C	E	P	H			S	Y	S	T	E	M

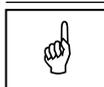
according to the factory setting.

It is possible to change the set value using the parameter

increase/decrease  keys; select "3D SYSTEM" for PAN CEPH units
 and "WITHOUT SYSTEM" for PAN only units.

	NOTE: Wrong setting affect the system's functionality.
---	--

7.3.3.12. Sensor handling



NOTE:

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

After the selection, the display will show the following message:

S	E	N	S	O	R	H	A	N	D	L	I	N	G
S	E	N	S	O	R	I	S	M	O	B	I	L	E

or

S	E	N	S	O	R	H	A	N	D	L	I	N	G
S	E	N	S	O	R	I	S	F	I	X	E	D	

according to the factory setting.

It is possible to change the set value using the parameter

increase/decrease



keys; **select "SENSOR IS FIXED" for**

PAN CEPH units.



WARNING:

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

7.3.3.13. DSPU IP address

The DSPU has its own static IP address, that is used for the connection with the external PC. The default set value for IP address is 192.168.002.215.

7.3.3.14. DSPU NET mask

The DSPU has also a specific net mask, default set value of 255.255.255.0000.

Using the standard method to change the value, set both according to values defined by the Network manager of the installation.



NOTE:

Those values are used only by the DSPU: change those values only to adhere at the specified values of the network manager in case of IP address conflict.

7.3.3.15. QSD IP address

The QSD has its own static IP address, that is used for the connection with the PC. The set value for this IP address is 192.168.002.045.

7.3.3.16. QSD NET mask

The QSD has also a specific net mask, default set value of 255.255.255.000.

Using the standard method to change the value, set both according to values above mentioned.

7.3.3.17. Enable 3D Sensor

In this menu, it is possible to enable the use of the 3D sensor.

This parameter has to be set as "ON".

7.3.3.18. 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:

P	A	N	O		O	R	D	E	R								
E	V	O			+		S	T	A	N	D	A	R	D			

or

P	A	N	O		O	R	D	E	R								
S	T	A	N	D	A	R	D		+		E	V	O				

or

P	A	N	O		O	R	D	E	R								
E	V	O															

or

P	A	N	O		O	R	D	E	R								
S	T	A	N	D	A	R	D										

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.

7.3.4. Password 118: Axis alignment menu

When the following menu is displayed,

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

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

S	E	R	V	I	C	E		M	E	N	U			
A	X	I	S		A	L	I	G	N	E	M	E	N	T

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

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

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 ⇔
CASSETTE ZERO ⇔ PR. COLL. PAN ⇔ PR COLL. 3D ⇔
ROTATION ZERO ..

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

The exit from each menu 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:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
>	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.

7.3.4.1. 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		Z	E	R	O	[	Y	Y	]					a
Z	E	R	O		O	F	F	S		±	x	x	x	x

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.

7.3.4.2. 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	Z	E	R	O	[	Y	Y	]					a
Z	E	R	O	O	F	F	S		±	x	x	x	x

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.

7.3.4.3. 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		Z	E	R	O	[	Y	Y	]					a
Z	E	R	O		O	F	F	S		±	x	x	x	x

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.

7.3.4.4. Cassette zero

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

7.3.4.5. 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:

P	C	C	Z	E	R	O	[Y	Y]			a	
Z	E	R	O		O	F	F	S	±	x	x	x	x	x

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.

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:

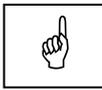
The position of the primary slit is set to the correct value during the factory final test; changes on the stored value must be done only in case of:

- 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.**

7.3.4.6. Primary collimator 3D

Set this parameter with the same value used to set "Primary collimator PAN" (see paragraph 7.3.4.5).

7.3.5. Password 124: CEPH settings



NOTE:

The complete procedure to enter in password 124 is described on paragraph 7.3.1 and following.

When the following menu is displayed:

S	E	R	V	I	C	E		M	E	N	U			
C	E	P	H		S	E	T	T	I	N	G	S		

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

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

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:

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

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:

U	P	D	A	T	E		C	H	A	N	G	E	S	?
	>	0	<		=	Y	,		T		=		N	

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

7.3.5.1. Enable sensor

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

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

or

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

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.

7.3.5.2. Rotation offset

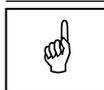
In this menu, it is possible to set the offset of rotation axis in order to set the correct starting value of emission. It is also possible to set the sensor zero offset.

Once the Patient centering (>0<) key is pressed, the following message is displayed:

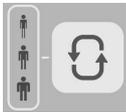
T	Z	E	R	O	[	Y	Y	]					a
Z	E	R	O		O	F	F	S	±	x	x	x	x

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.
- "xxxx" 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.

7.3.5.3. 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	Z	E	R	O	[	Y	Y	]	a	b	c	d
Z	E	R	O	O	F	F	S	±	x	x	x	x

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; "a" is the one of the secondary collimator, that is 0 when not engaged and 1 otherwise.

7.3.5.4. STF zero

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

7.3.5.5. 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:

C	E	P	H	M	E	A	S	.	U	N	I	T
M	E	T	E	R								

or

C	E	P	H	M	E	A	S	.	U	N	I	T
I	N	C	H	E	S							

according to the factory setting.

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

keys  .

7.3.5.6. 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	Z	E	R	O	[	Y	Y	]				a
Z	E	R	O	O	F	F	S	±	x	x	x	x

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.

7.3.5.7. 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		Z	E	R	O		[	Y	Y	]		a	b	c	d
Z	E	R	O		O	F	F	S		±	x	x	x	x	x

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.

7.3.5.8. Digital CEPH HD

This menu is used to enable or disable the High Resolution in digital Ceph examination.

After the selection, the display will show the following message:

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

or

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

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.

7.3.6. Password 112: Troubleshooting

When the following menu is displayed:

S	E	R	V	I	C	E		M	E	N	U			
T	R	O	U	B	L	E	S	T	O	O	T	I	N	G

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

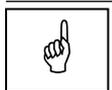
S	E	T		U	P									
		P	A	S	S	W	O	R	D	?		1	0	0

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 menu is performed using the Test (T) button.

7.3.6.1. 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:

C	O	L	U	M	N		T	E	S	T				
I	D	L	E								0	0	0	a b

Using the column up/column down keys  verify that the last two

digits change status:

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

7.3.6.2. 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:

T	E	S	T		I	N	P	U	T		P	O	R	T	S
R	y						7	6	5	4	3	2	1	0	

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.

7.3.6.3. 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:

P	R	E	-	H	E	A	T	I	N	G		T	I	M	E
V	A	L	U	E	=	2	0	0	0						

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

keys  .

7.3.6.4. 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:

I	D	L	E		F	I	L		L	E	V	E	L		
L	E	V	E	L	=				3	0					



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

Pressing the right  key, the next message is displayed:

F	I	L		L	E	V	E	L		@		X	X	m	A
L	E	V	E	L	=				Y	Y	Y				

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  .

7.3.6.5. 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

7	2	k	V	0	6	m	A	1	.	0	0	s		
X	-	R	A	Y	P	A	R	A	M	E	T	E	R	S



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:

>	7	2	k	V	0	6	m	A	1	.	0	0	s

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.

7.3.7. 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.

7.3.8. 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.



NOTE:

The last displayed value is the Hardware Protection Key code; this is an alternate method to view it.

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8. PERIODIC MAINTENANCE

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.
- 3D digital sensor calibration every 6 months (see par. 8.1)



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.

8.1. 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	
5807304100	Calibration programs CD	

8.2. Detector Calibration

It is necessary to perform the 3D detector calibration every 6 months in order to have the digital sensor always calibrated. Expired calibrations may have effect on the image quality.

This procedure has to be performed with the sensor in temperature; for this reason it is necessary to have the Rotograph EVO 3D switched ON for at least one hour.

Here following is described the procedure.

1. Enter in Rotograph EVO 3D set up and select "Configuration" (Password 92 - see paragraph 7.3.3).

2. In "Enable 3D Sensor" menu, using keys  , set the parameter

"Skip Sensor" to ON.

3. Press key  and confirm the change using key  .

4. Enter in normal working modality and select "3D Dentition".

5. **From the task bar menu, click with the right button of the mouse on Villa icon and select "Close Control Panel".**



Figure 8-1

6. From desktop open the software ViVA that permit the direct control of the 3D digital sensor.

7. Select the modality "2x2 0.5pF G1 30fps" corresponding to the 3D modality.

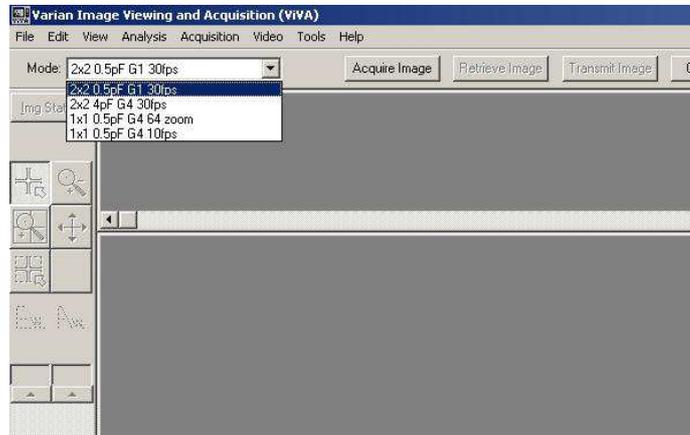


Figure 8-2

8. Click on "Acquisition". Open the window "System settings" and verify that the options "Offset Calibration", "Gain calibration" and "Pixel defect map" are selected.
9. Enter in "Acquisition" drop down menu and select "Mode settings".

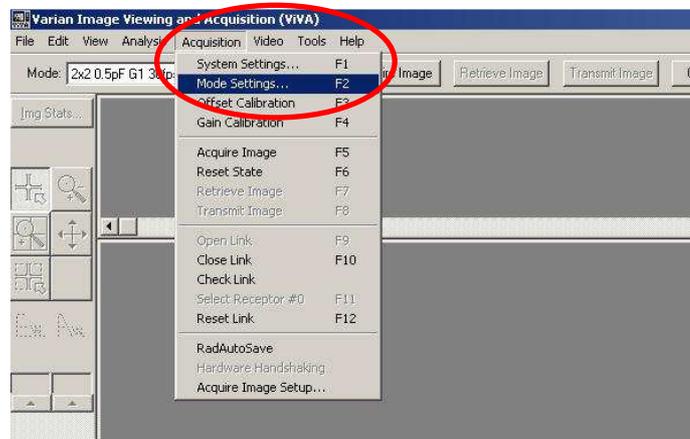


Figure 8-3

- Flag the parameter "User Sync" in order to manage manually the exposure.

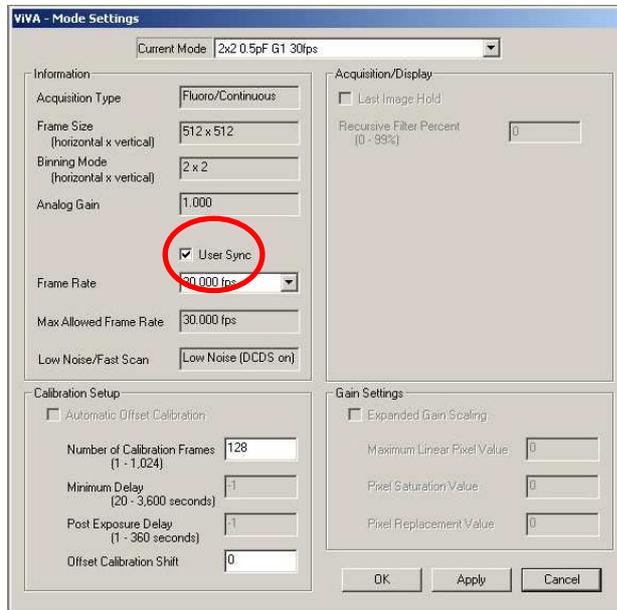


Figure 8-4

- Click on "Acquisition" and perform a "Offset Calibration". This calibration doesn't require X-ray emission. At the end select "Gain Calibration".

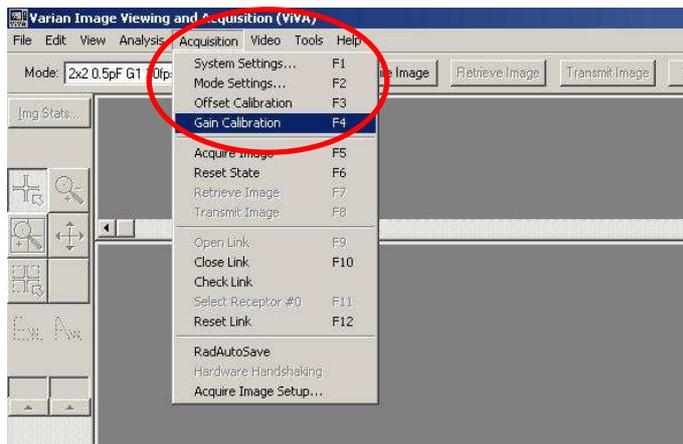


Figure 8-5

12. Set Rotograph EVO 3D in 3D dentition with 76kV 10mA. Position the Cu filter of 1.5mm thickness on the primary collimator. Start X-ray and when the emission starts, press on "Continue" to start acquisition for Gain calibration.

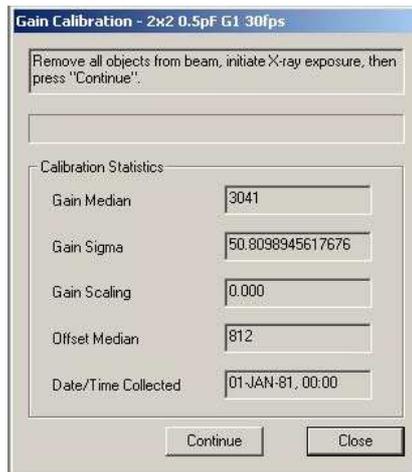


Figura 8-6

13. When the bar is completed, press on "Continue".

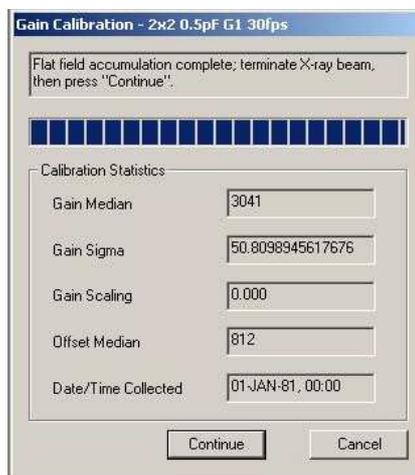


Figure 8-7

14. At the end it will be possible to check the Gain median value that should be between 1600 and 4000. In case the value is not within the range, it will be necessary to repeat the calibration selecting the exposure parameters that provide the correct median value.

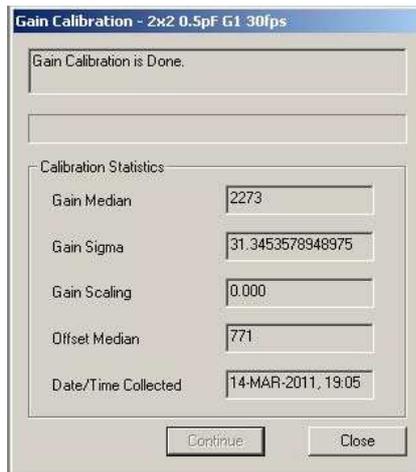


Figure 8-8

15. Repeat the calibration selecting the other 3D modalities which are "2x2 4pF G4 30fps" and "1x1 0,5pF G4 10fps".

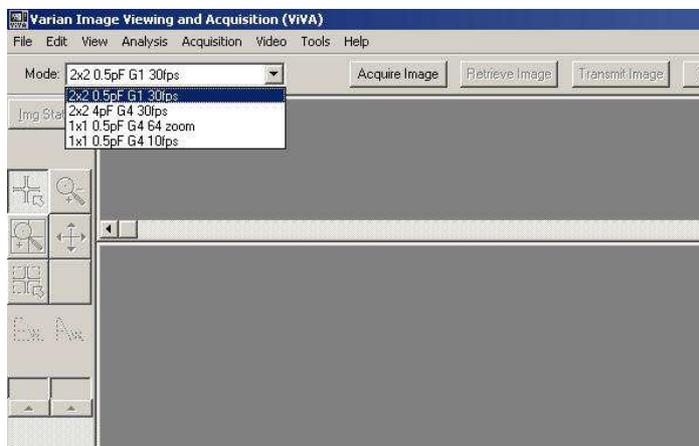


Figure 8-9

16. In order to calibrate the panoramic modality, select "1x1 0,5pF G4 64 zoom".

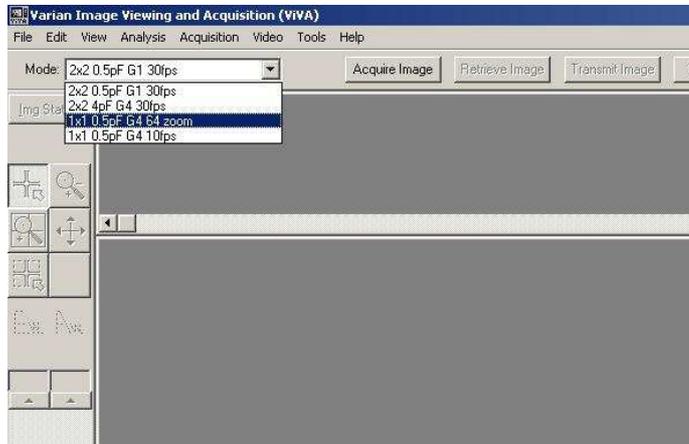


Figure 8-10

17. Disable the parameter "User Sync".

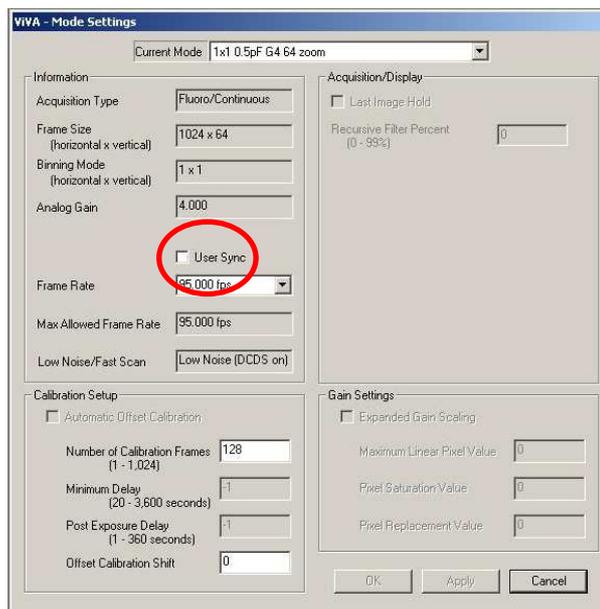


Figure 8-11

18. Click on "Acquisition" and perform a "Offset Calibration". This calibration doesn't require X-ray emission. At the end select "Gain Calibration".

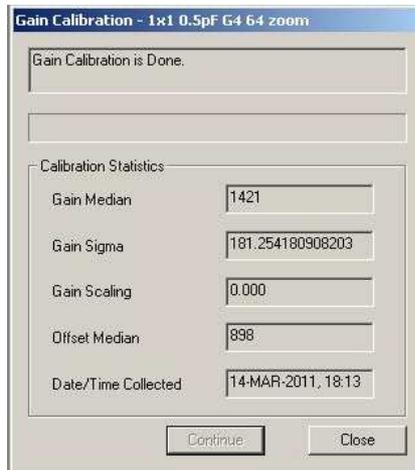


Figure 8-12

19. Set Rotograph EVO 3D in PAN with 60kV – 6mA removing the Cu filter used to calibrate the 3D modality. Start X-ray and when the emission starts, press on "Continue" to start acquisition for Gain calibration.
20. At the end it will be possible to check the Gain median value that should be between 1600 and 4000. In case the value is not within the range, it will be necessary to repeat the calibration selecting the exposure parameters that provide the correct median value.

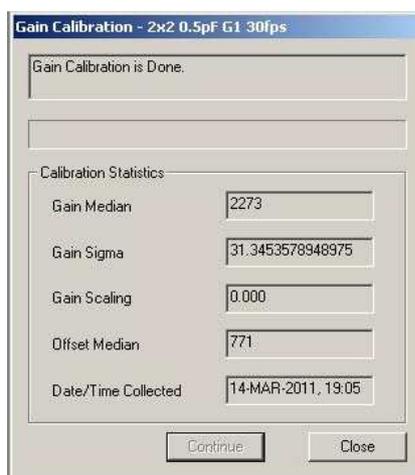


Figure 8-13

21. At the end of calibration verify that the calibration files present in the directory "C:\IMAGERS\S\N of the detector\working modality" have been updated.

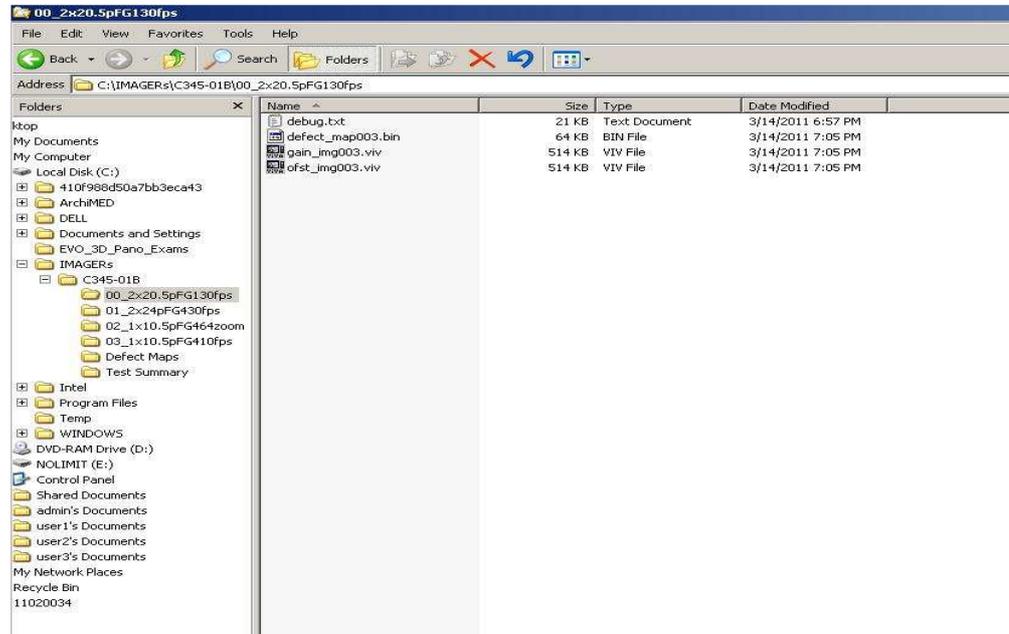


Figura 8-14

22. After the calibration, enter in Rotograph EVO 3D set up and in password 92 (see paragraph 7.3.3) and set the parameter "Skip Sensor" to OFF.

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9. CORRECTIVE MAINTENANCE

In this chapter are included the operation necessary after the replacement of the system main components.

9.1. 3D Digital sensor replacement

In case of 3D digital sensor replacement, it will be necessary to make the following operations and the operation described in paragraph 9.2.

9.1.1. Calibration file installation

The calibration file is included in the CD called "Receptor Installation Disk".

Running the set up, it is automatically created a directory with the name equal to the sensor S/N in the folder "C:\IMAGERS" that includes the calibration and configuration files (receptor config.dat, vivacy.xml e Hcpconfig.ini).

9.1.2. PLEORA PCB communication address enabling (Pleora Mac address)

The Pleora MAC address is indicated in the test report of the digital panel supplied as a spare part.

It is necessary to write the correct address in the file "HcpConfig.ini" (using notepad) included in the directory "C:\IMAGERs*sensor s/n*":

```
[ReceptorControl]
FgDll=HcpFgExPleora
RpDll=HcpRp1313
```

```
[HcpConfigFiles]
HcpFile_01 = *.dat
HcpFile_02 = vivacy.xml
```

```
[ImageAcquisition]
FrameStartAvailable=0
```

```
[HcpFgPleora]
PleoraSerialBaudRate = 9600
PleoraMacAddress=00-11-1C-00-8C-CC
```

```
[VirtCp]
FileRev=3
```

9.1.3. PLEORA PCB communication set up

In order to set the new digital sensor 3D address, once is opened the virtual keyboard (by pressing TAC), select the icon "Utilities".

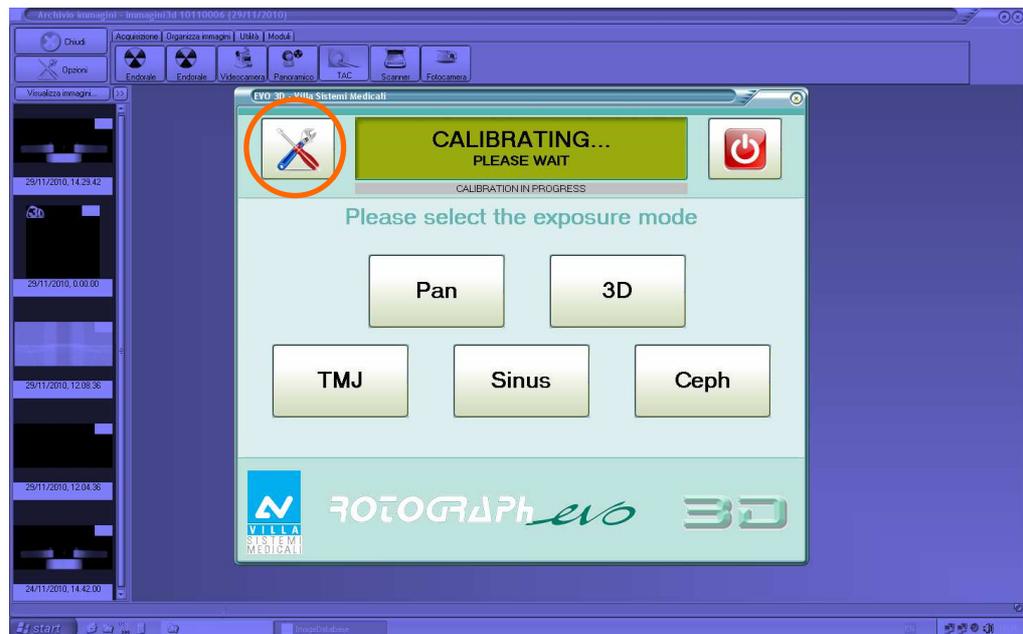


Figure 9-1

The following window will be displayed.

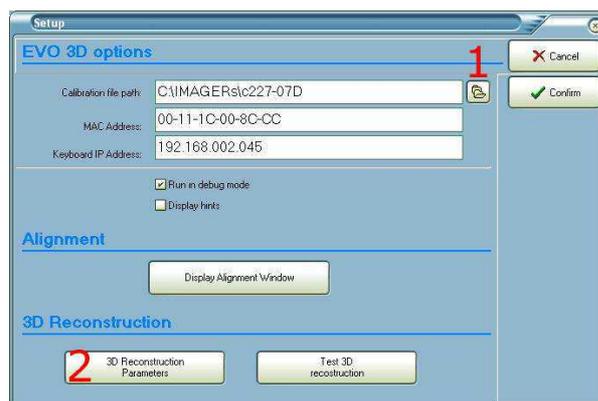


Figure 9-2

Set the correct S/N of the 3D digital sensor using the button "1" and verify that the relevant "MAC Address" is the same you received on the test report.

9.2. 3D Digital sensor or Tubehead replacement

These operation are necessary to center the X-ray beam in panoramic and has to be done in case of digital sensor or tubehead replacement. Before to replace the parts, take note of the mechanical position of the defective ones.

9.2.1. Panoramic X-ray beam centering verification

In order to make this check, enter in Rotograph EVO 3D set up and select "Axis Alignment" (Password 118 – see paragraph 7.3.4.2); confirm

with the Patient centering  key.

1. Enter in "Y Axis zero" menu; the primary collimator will move to the panoramic position.
2. Select "ZERO OFFS" with the Patient centering  key; the rotating arm will move to 90° position and will be ready to start X-ray emission.
3. Pressing the parameter changes  key, set the following exposure values: 66kV – 6mA – 0.5s.
4. Run the ViVa program and verify if the S/N of the sensor is the correct one.

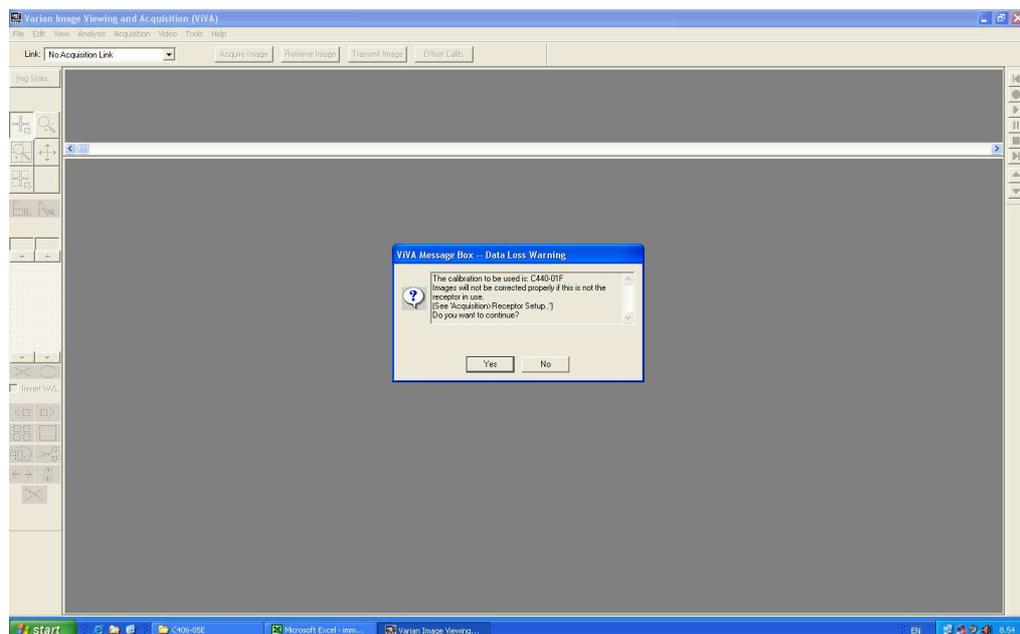


Figure 9-3

In case of digital sensor replacement, select "No" and set the correct sensor S/N selecting the function "Receptor Setup" in the "Acquisition" drop-down menu.

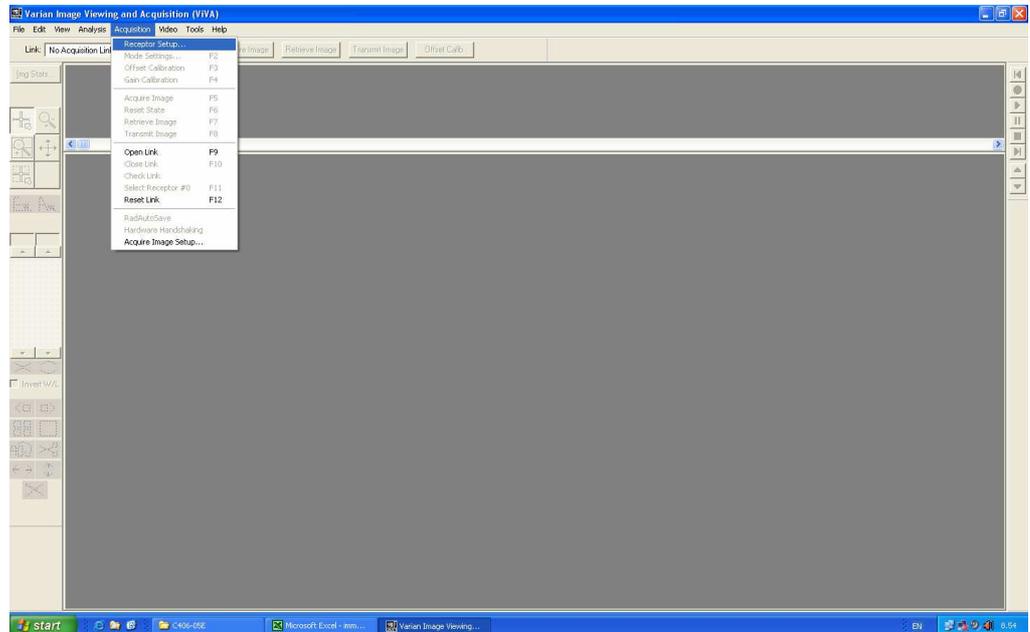


Figure 9-4

It will be possible to select the S/N of the detector (if it has been previously installed in the directory "C:\IMAGERS") in the "Receptor Serial #" window.

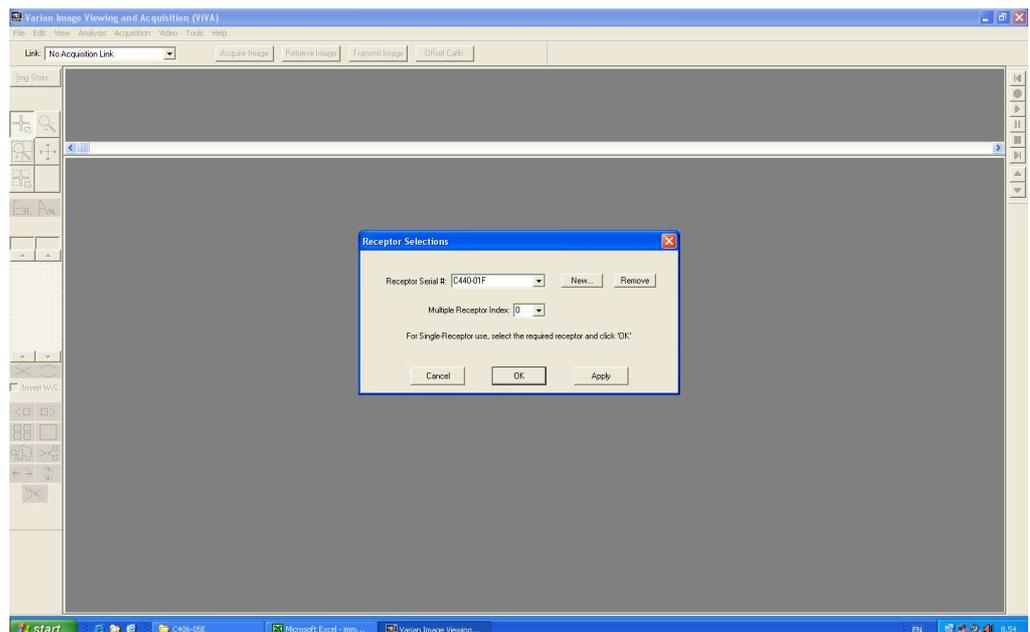


Figure 9-5

Click on "OK" to verify the communication.
If communication is established, on the "Mode" window it will be possible to see the list of the available calibration files of the different modalities of digital sensor: select "1x1 0.5pF G4 64 zoom".

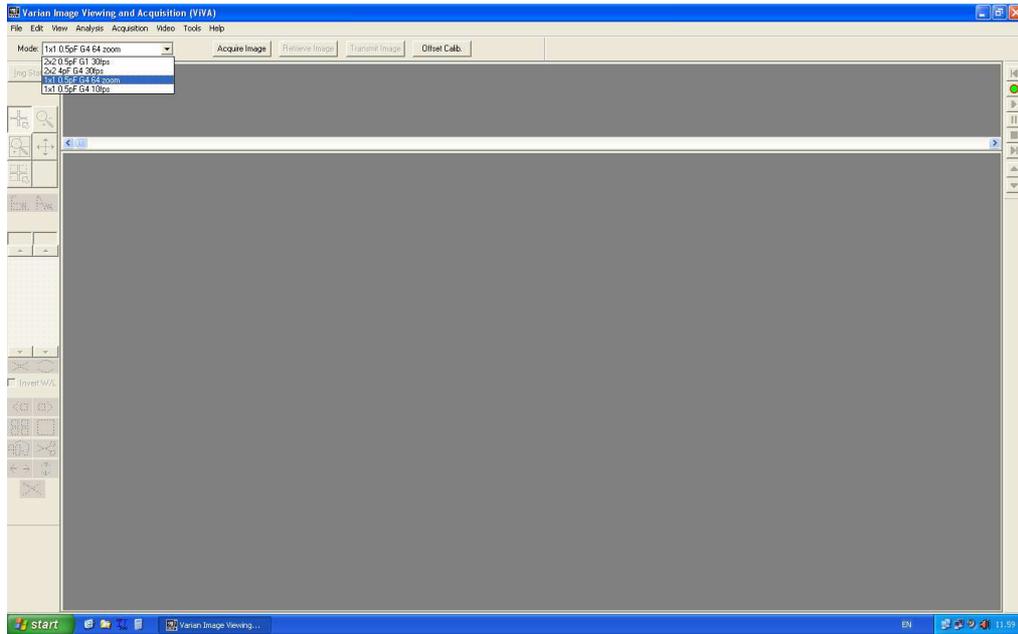


Figure 9-6

5. Press "Acquire Image" button; select a number of frames (acquired images) of 1000.

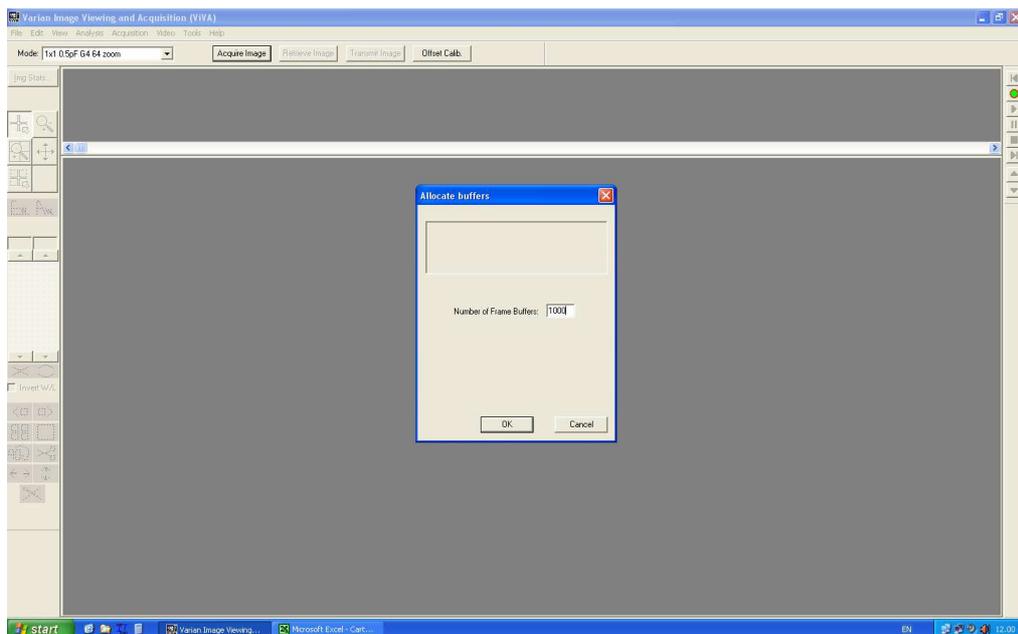


Figure 9-7

Confirm with "OK".

6. Move the small black square present in the upper window of the screen to the lower one and stop acquisition with the red square present in the commands on the right side of the screen. Confirm with "Yes".

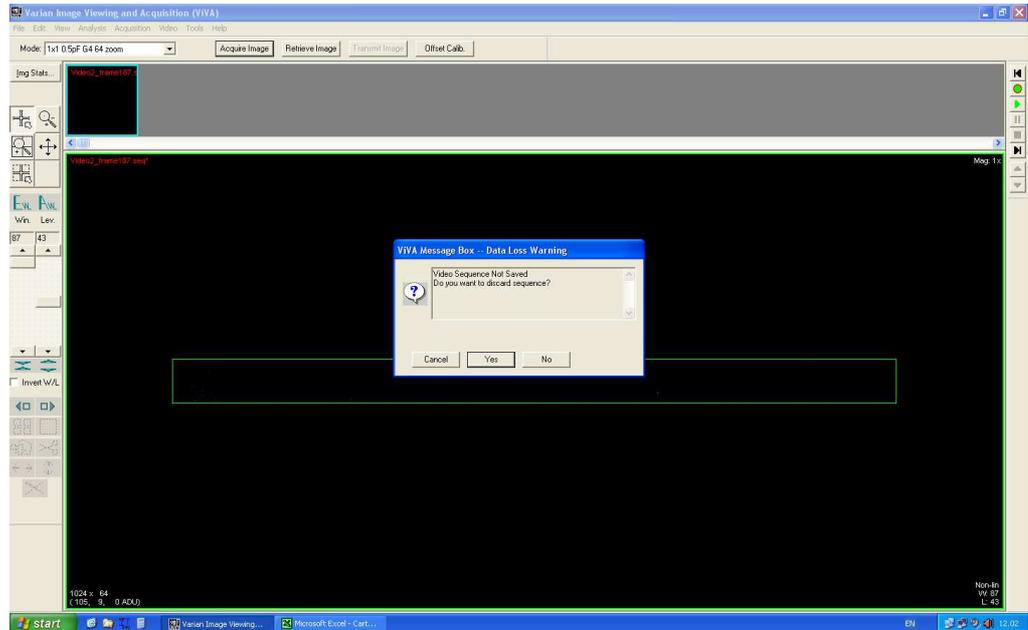


Figure 9-8

7. In order to make the centering of the group tubehead / primary collimator / chin support / digital sensor it is necessary to make exposures without the rotation of the unit. Position the panoramic centering tool (P/N 6107900200 - Figure 6-14) on the chin rest.
8. Start X-ray acquisition; when you see the white image on the monitor, click on the red square button on the right side of the monitor. The green rectangle is the used area of the detector and it is possible to check the centering of the image.
9. Review the acquisition sequence pressing the key "play" (green triangle on the right side of the monitor) and stop the image when you see the white frames. Optimize the image selecting "Aw1" in the left side of the monitor (Figure 9-9) and adjust brightness and contrast with the cursors. It is also possible to select the zoom to enlarge the image in order to easier read the position. The center of the image is to 32 pixels from both sides of the window.



NOTE:

When you replace digital sensor, in order to center the X-ray beam move ONLY the sensor. In case you replace the tubehead, move ONLY the tubehead. It is very important to have a fixed point for the beam centering

Here following the misaligned image.

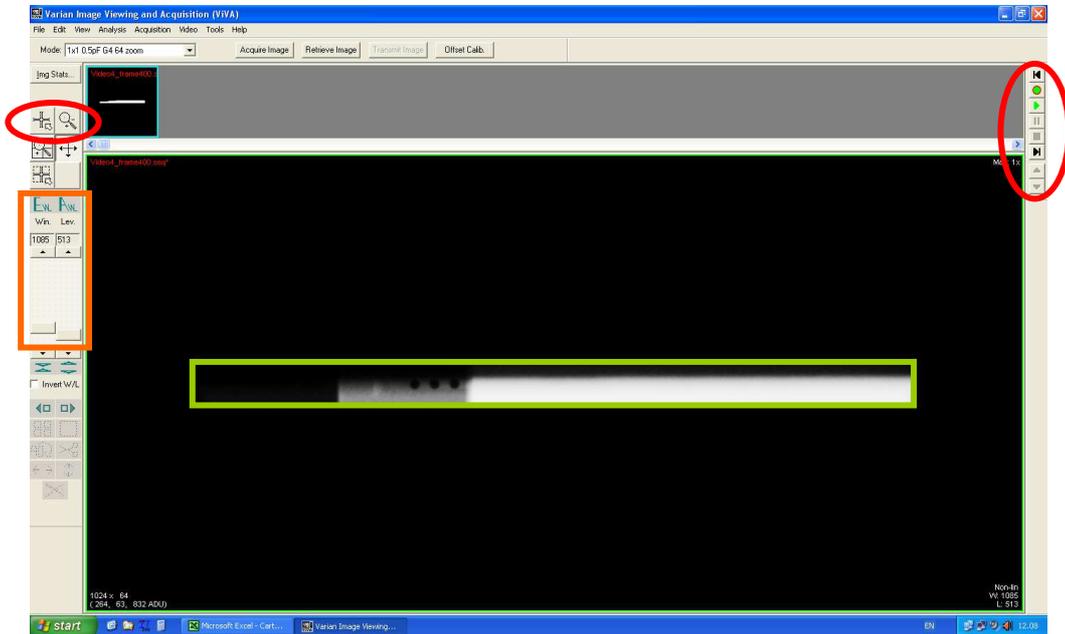


Figure 9-9

- In case the reference pins are aligned and centered on the window, but the X-ray beam is not centered, it is necessary to move the tubehead acting on the screws "4" (Figure 9-10).
- In case the reference pins and the X-ray beam are centered in the window but there is a vertical misalignment of the image (left right side), it is necessary to move the primary collimator acting on the screws **1**, **2** and **3** (Figure 9-10).

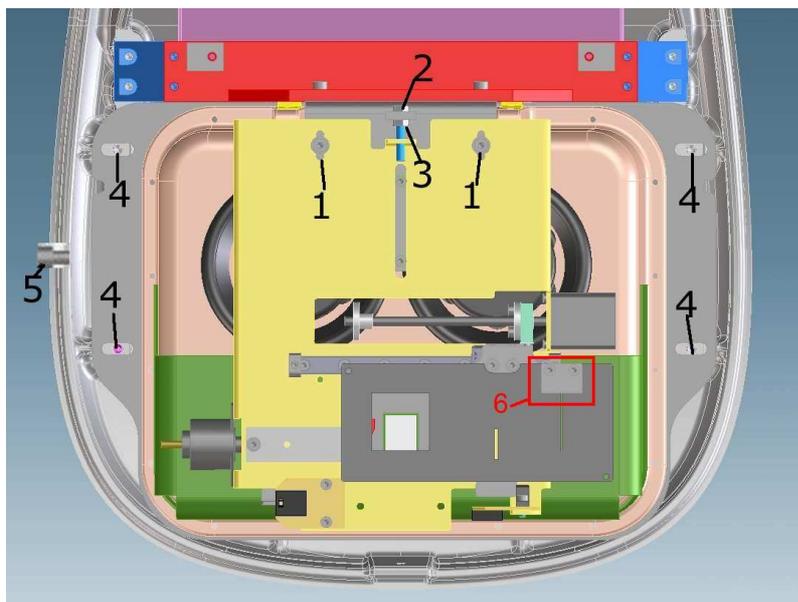


Figure 9-10

- In case the image is not parallel to the window, it is possible to move the digital sensor, aging on the screws "2" (Figure 9-11).
- In case the reference pins are not positioned in the center, it is necessary to move the digital sensor (screws "1" Figure 9-11).

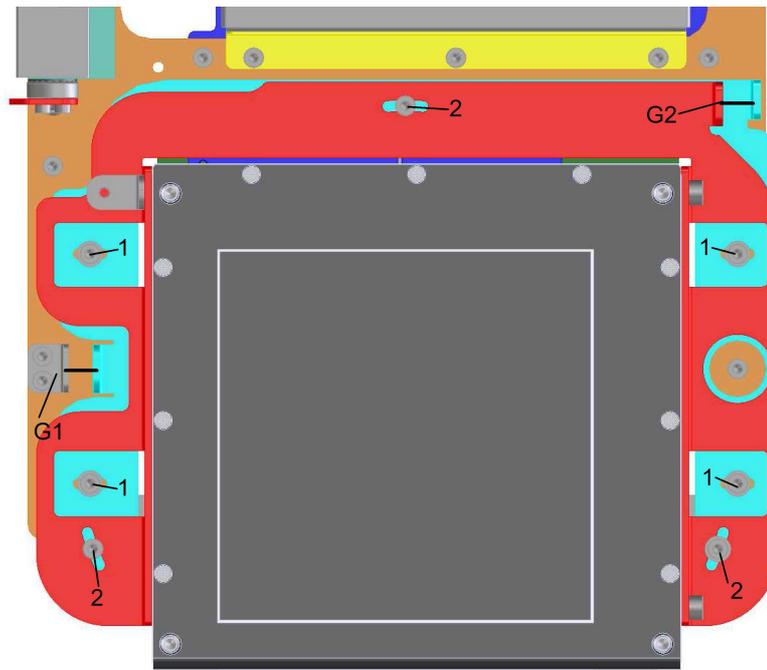


Figure 9-11

At the end of the adjustment, the image must be well centred in the green window.

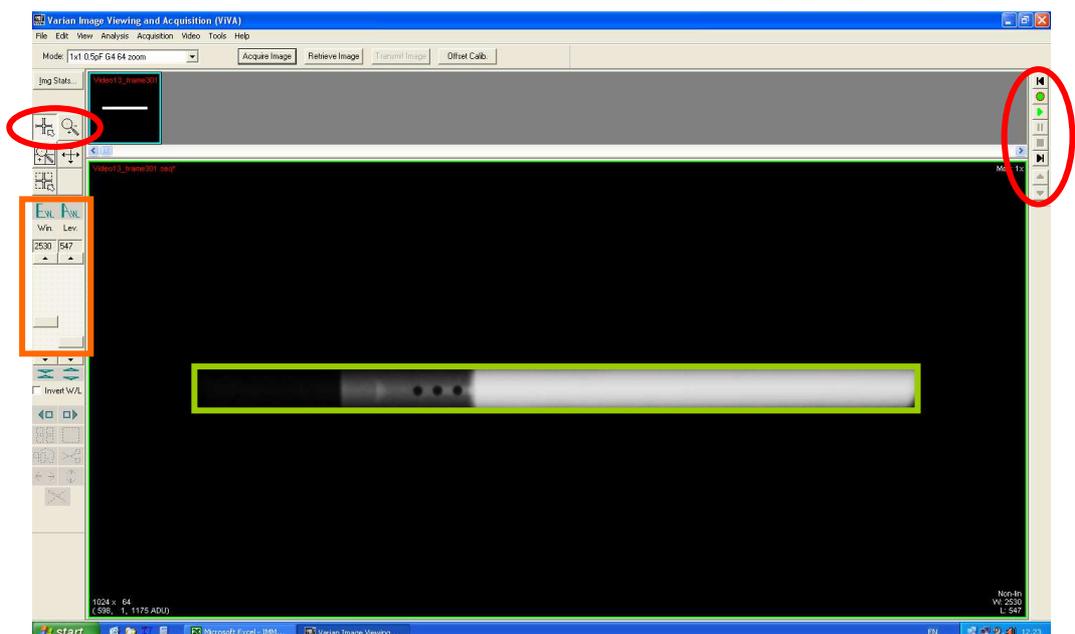
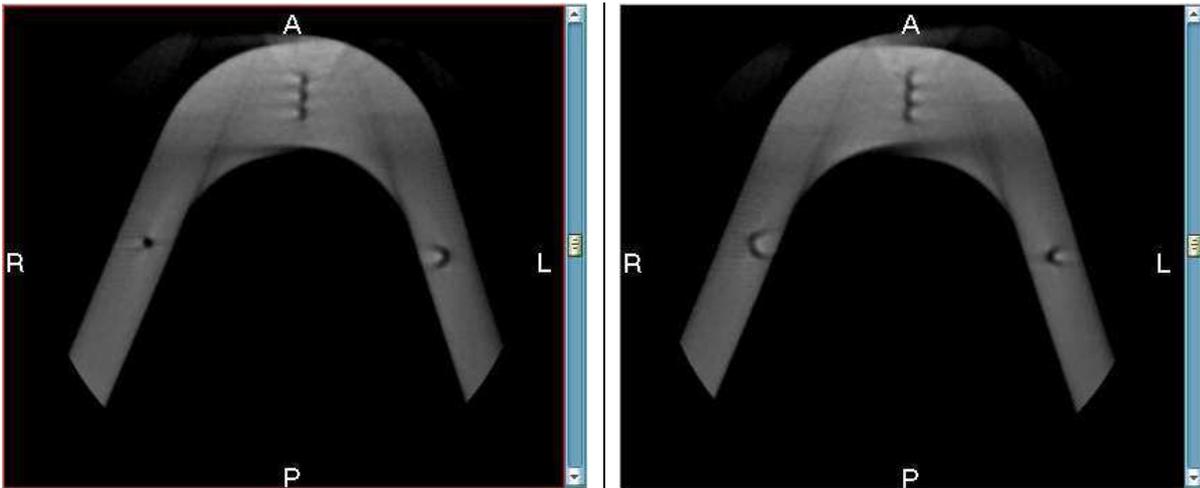


Figure 9-12

9.2.2. 3D image adjustment

In case the 3D image doesn't provide a continuous arc, but the edge line has some interruptions, may be necessary to check the setting of the Lateral Offset parameter.



Decrease the parameter Lateral Offset

Increase the parameter Lateral Offset

In order to modify the parameter, it is necessary to enter in Option from the 3D virtual keyboard with the password 1771 and select the icon 3D reconstruction Parameters.

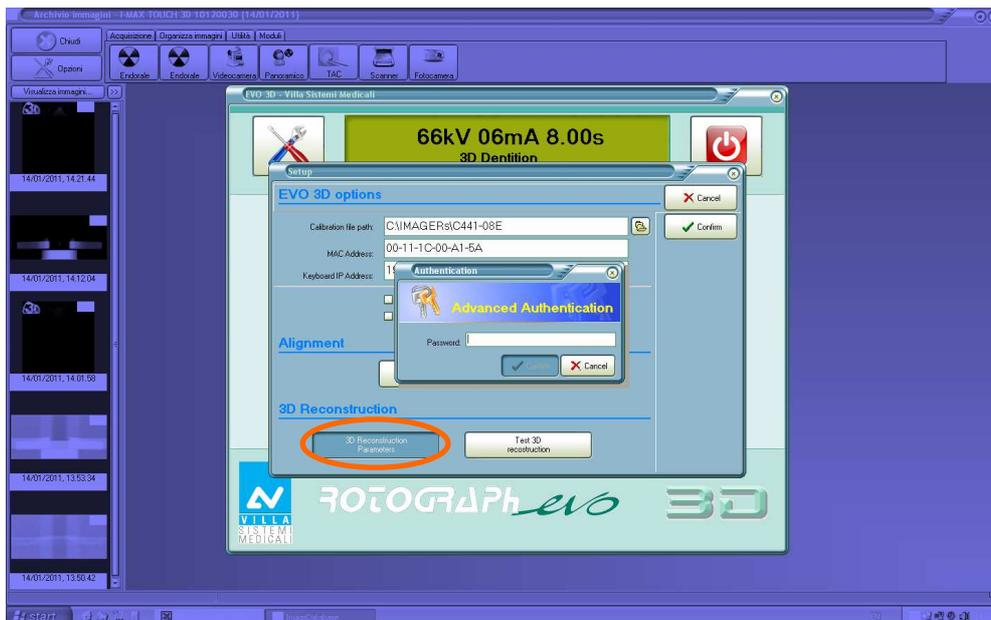


Figure 9-13

Type the password "17713Doptions" to enter in the 3D parameters menu.

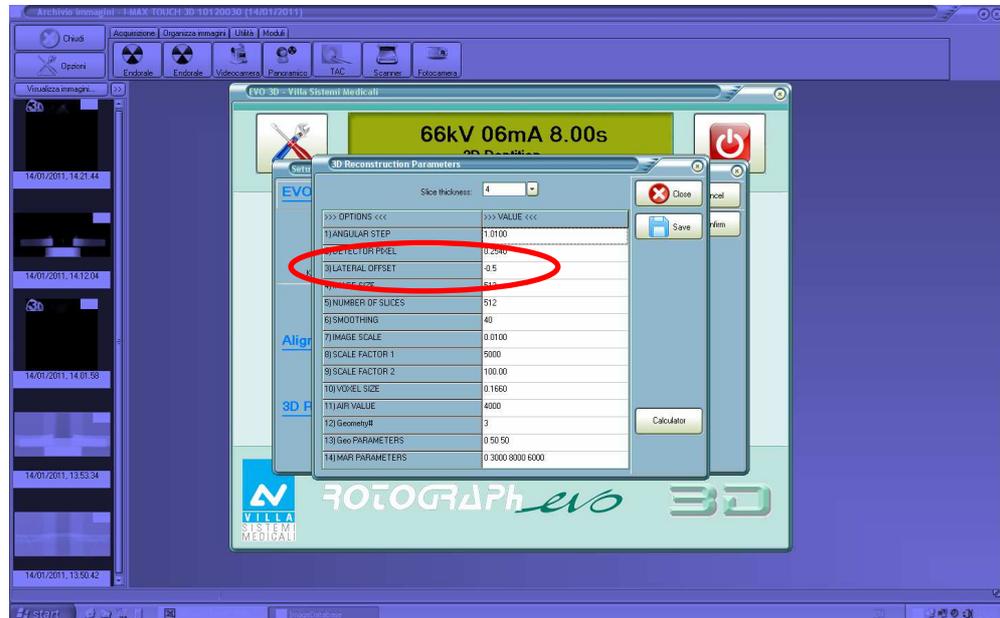


Figure 9-14



NOTE:

The only parameter allowed to be modified is the Lateral Offset. Changes to one of the other parameters may effect the system's functionality.

The Lateral Offset parameter has to be set within the range of ± 2 maximum.

Click on "Save" to store the new parameters and repeat a 3D acquisition in order to verify the effect of the modification.

9.3. CPU board replacement



WARNING:

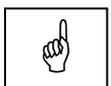
The board shipped as replacement carry the Hardware key and the EEPROM **not configured**.

To make the system working, the Hardware key A13 (code 5807302700) must be retrieved from the failed board and positioned on the new board. This component includes the U.I.C. (Inique Identification Code) witch determines the enabling codes for the radiological exams.

The Hardware key is positioned on the connector XJ26 of the Microprocessor A6 board (code 5807302300) as indicated in the Figure 9-15; to reach the board, remove the metallic cover.

Moreover, on the EEPROM, identified as D19 on the Microprocessor A6 board, has stored the system configuration data; remove the EEPROM from the new board and replace it with the one present on the failed board. In case the old EEPROM was not functioning, it will be necessary to mount the not configured EEPROM and restore manually the configuration data present on the equipment parameters table supplied with the Service Manual, following the procedure present on paragraph "Service programs description".

Check that the jumpers are in the following position: X11 (closed with PAN Only) – X12 always OPEN - X13 always CLOSED



NOTE:

At the end of the replacement, restore the metallic cover and the ground connection. Both parts has to be recovered from the failed board.

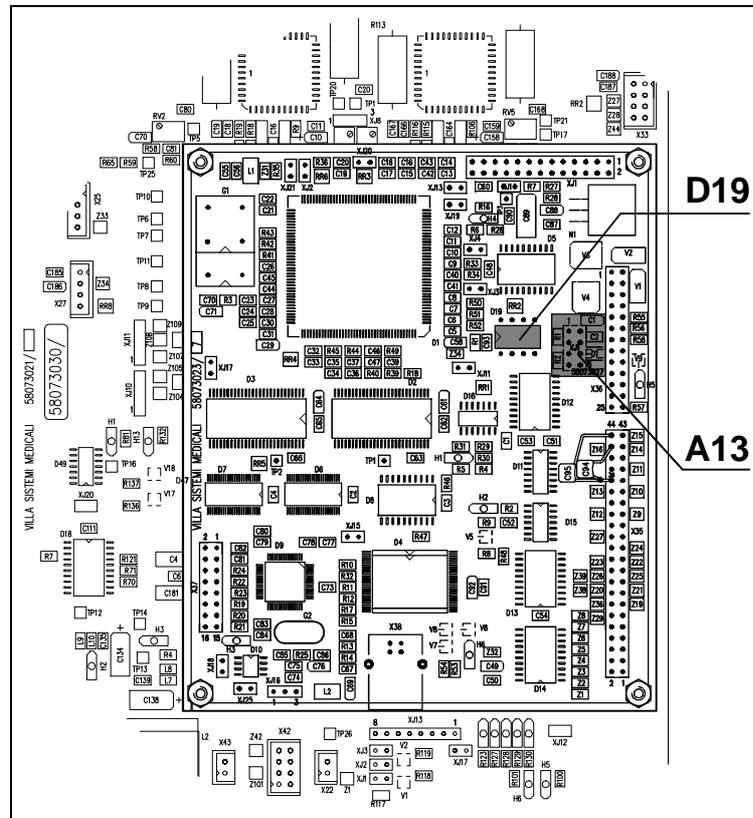


Figure 9-15

9.4. CEPH Digital sensor replacement

In case of CEPH digital sensor replacement copy the Calibration files as described in paragraph 9.5.4 and verify the alignment following instruction in paragraph .

9.5. PC replacement

In case of PC replacement, it will be necessary to install the SW and set properly the communication IP addresses in order to permit the system communication.

9.5.1. Software package

You will receive the following CD:

- Receptor Installation CD including Calibration files.
- System SW Disk
- System and Service Guide
- Dental Studio package
- Windows SW package
- CEPH digital sensor calibration files CD.

9.5.2. Dental Studio installation

For a correct Dental Studio installation it is necessary to insert the CD and follow instruction.

Without the USB license key, install in sequence the SW, the USB drivers, the 3D drivers and if present the CEPH option, also the Panoramic Drivers.

Switch OFF the computer, insert the two USB license keys and restart the PC.



Figure 9-16

At the first use of the SW, it will be required the name of the user. This name will be always stored in the USB key.

In case you need to make some tests, without installing the user name, you can select "Close" without writing any name. The Dicom images will have the warning of "Unregistered license. Only for evaluation" but it will be possible to set the user's data at the next initialization (on customer site).



Figure 9-17

9.5.3. 3D Sensor calibration files installation

Insert the 3D digital sensor calibration files CD following instruction in paragraph 9.1.1.

9.5.4. CEPH Sensor Calibration file installation

The calibration file CD includes the calibration files stored in a folder whit name based on sensor ID (for example 3_KAS21126) also present on the sensor label.

The calibration files have the extension ".FMP".

At the end of Dental Studio software installation, copy the calibration files on the PC; these files are related ONLY to the sensor delivered with the machine and cannot be used with any other sensor.

The folder and its content 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\OWANDY\OSP - LAN PANORAMIC\

- **WINDOWS VISTA and WINDOWS 7**

C:\Program Data\ OWANDY\OSP - LAN PANORAMIC\

Example:

In the folder:

C:\Documents and Settings\All Users\Application Data\OWANDY\
OSP - LAN PANORAMIC\

you must have the following folder:

- 3_KAS21126.

9.5.5. Internal network set up

In order to define the 3D sensor address, once is opened the virtual keyboard (by pressing TAC), select the icon "Utilities".

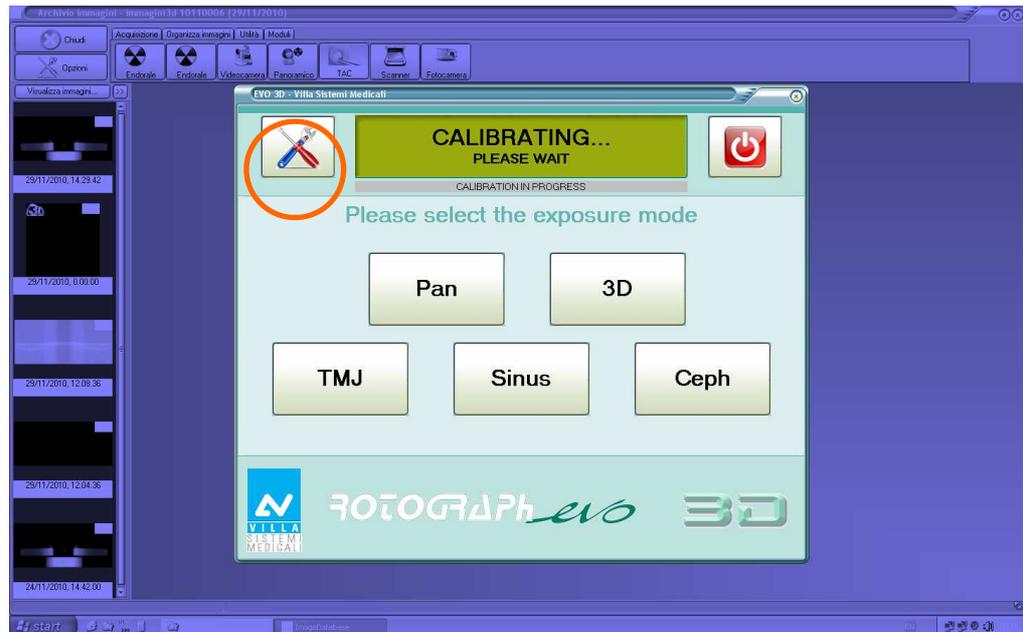


Figure 9-18

Verify that the "Keyboard IP address" is the same stored in Rotograph EVO 3D.

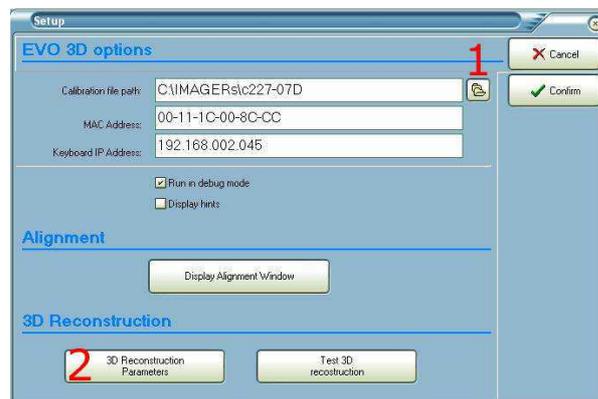


Figure 9-19

Using button "1", select the digital sensor, it will be automatically updated the "MAC address" of the Pleora board.

For the CEPH digital sensor, it is necessary to set the address in the following mask selecting as device "Rotograph Evo".

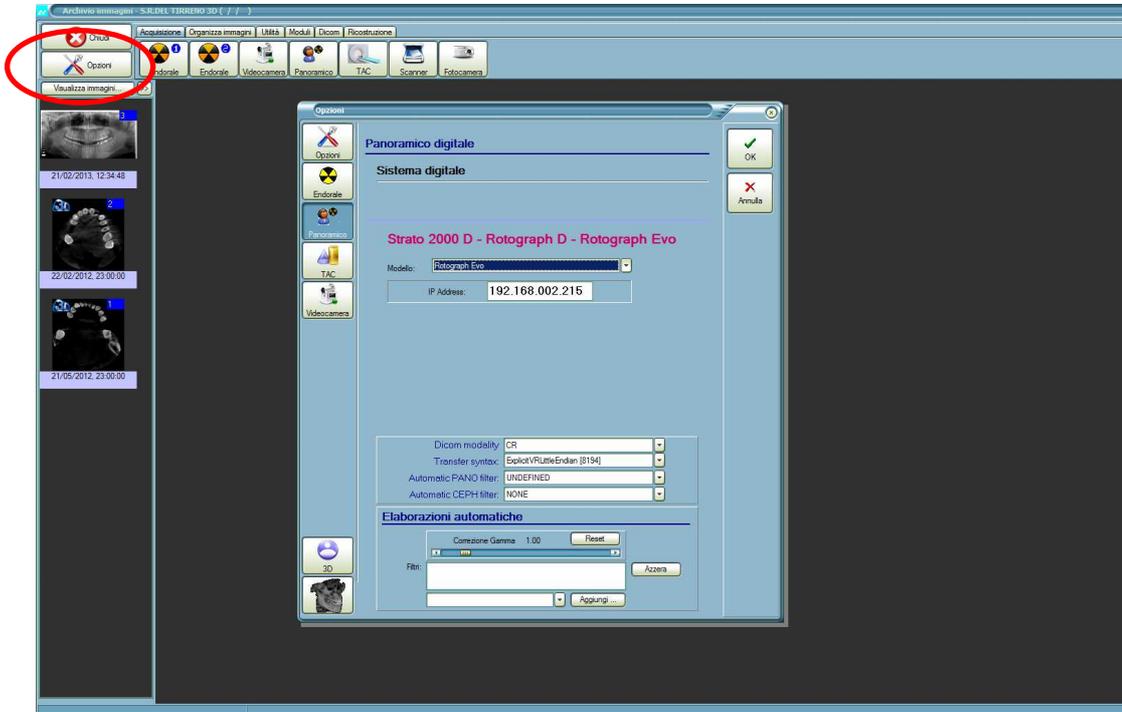


Figure 9-20

9.5.5.1. Direct point-to-point connection between PC and Rotograph EVO 3D

You have to set the IP address in the computer according to the one stored in Rotograph EVO 3D selecting in "My network", with the right button of the mouse, the board Intel Pro 1000 and, selecting with the right button "Properties" and changing the IP address.

Example:

In Rotograph EVO 3D the default address is 192.168.002.215 (subnet mask 255.255.255.0), you have to set the address in the PC to 192.168.002.16 and the same subnet mask 255.255.255.0.

9.6. CEPH arm alignment



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 3D where the "DentalStudio" program is installed and the use of the CD (P/N 5807304100) supplied with the centering tools kit.

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

1. Switch on the machine and access "CEPH SETTING" service program following the operations sequence described in paragraph 7.3.1.

Using the increase key (4) and the decrease key (5)



set the password equal to 124 and confirm with the "Patient entrance" (7)

key  ; the following message will be displayed:

M	A	C	H	I	N	E	S	E	T	T	I	N	G	
		P	R	E	S	S	>	0	<					

2. Press key (7)  . The machine will move and the following messages will be displayed:

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

followed by

C	E	P	H		P	O	S	I	T	I	O	N	I	N	G
P	L	E	A	S	E		W	A	I	T					

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

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

3. Press key (7) , the following message will be displayed:

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

4. Using increase key (4) and the decrease key (5)  select the following option to enable the digital CEPH:

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

5. Press key "Test" (6)  and if the setting has been changed the following message will be displayed:

U	P	D	A	T	E	C	H	A	N	G	E	S	?
>	0	<	=	Y	,	T	=	N					

6. Press key (7)  to store the changes; the following message will be displayed:

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

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

Step	Action	Reference paragraph
I	Verification of the ear rods alignment	9.6.1
II	Ceph sensor centering	9.6.2
III	Secondary collimator centering	9.6.3
IV	Soft Tissue Filter adjustment	9.6.4



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.

9.6.1. Ear rings alignment

To perform the ear rings alignment it is necessary to enter in Rotation Offset menu following procedure from point 6 of paragraph 9.6 and:

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

- Press keys "Arrow right" (13) or "Arrow left" (12)  until the following is displayed:

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

- Press "Patient entrance" (7) . The following message will be displayed:

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

while the slit primary collimator moves to the DIGITAL CEPH central position.

Then the following message will be displayed:

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

- A more precise setting have to be performed with X-ray: pressing on key "Parameter selection" (3)  and on keys increase (4) and

decrease (5)  set values (kV and mA) for the exposure

(suggested values: 60kV and 6mA).

- Open and activate virtual keyboard.

- Press key "Examination mode Selection - M" (11)  on the machine keyboard; the system gets ready to take the Rotation Arm alignment test, moving the sensor to a correct position.



NOTE:
If the following message will be displayed:

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

check the connection with the PC.

Press key (7)  to reset the message and press key (11)  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. Evaluate on the image if the X-ray beam is vertically displaced.

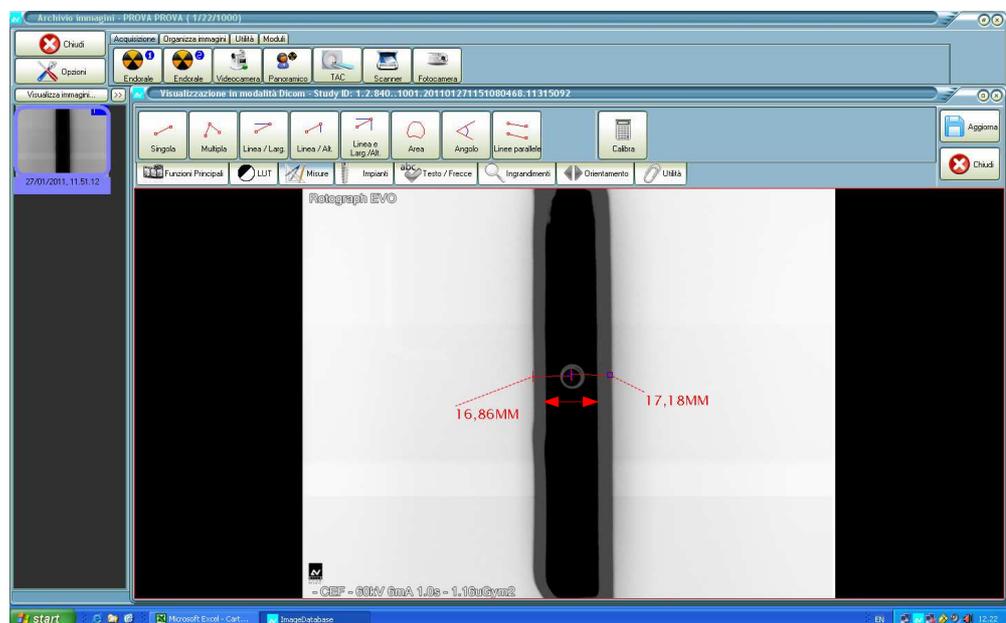


Figure 9-21

- 15.** If it will be necessary to change the height of the CEPH arm, loose the two screws "A" (Figure 9-22), and acting on the screw "B" adjust the height of the Ceph group. Repeat the exposure until the vertical alignment is reached. Tighten the loosened screws "A".

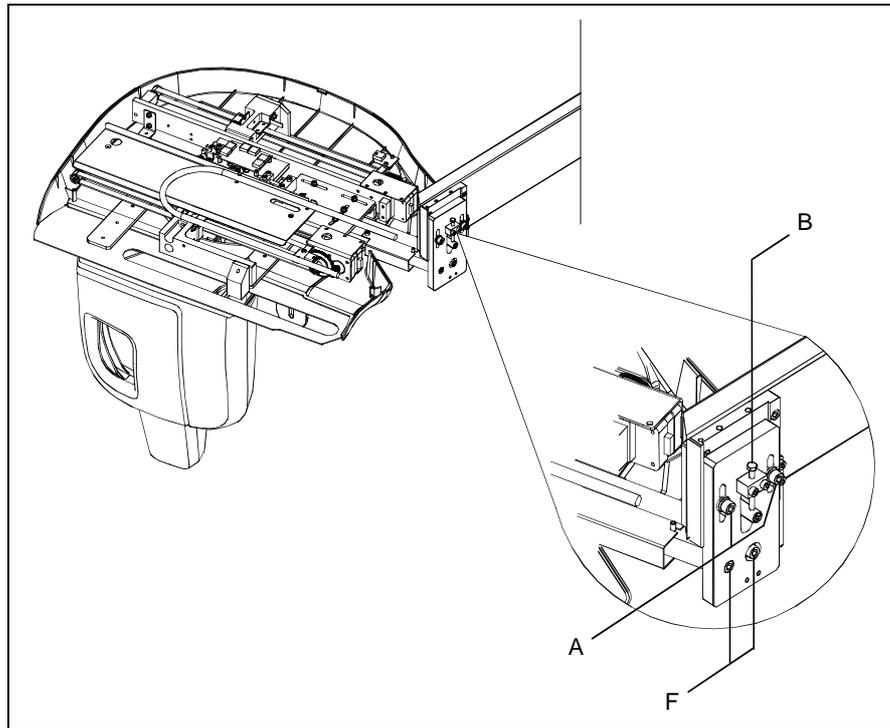


Figure 9-22

- 16.** Check on the image if the Ear Centering Circles are concentric (small circle inside the big circle – i.e. as shown in Figure 9-21).
- 17.** To adjust the vertical alignment between the two rings, loose the two screws "F" (Figure 9-22) and adjust the position of the arm acting on screw "G" (Figure 9-23). Once the aligned position has been reached (test exposures are required), tighten bolt "H" (Figure 9-23) and tighten screws "F".
The performance of this adjustment could require the reiterate of step 15.

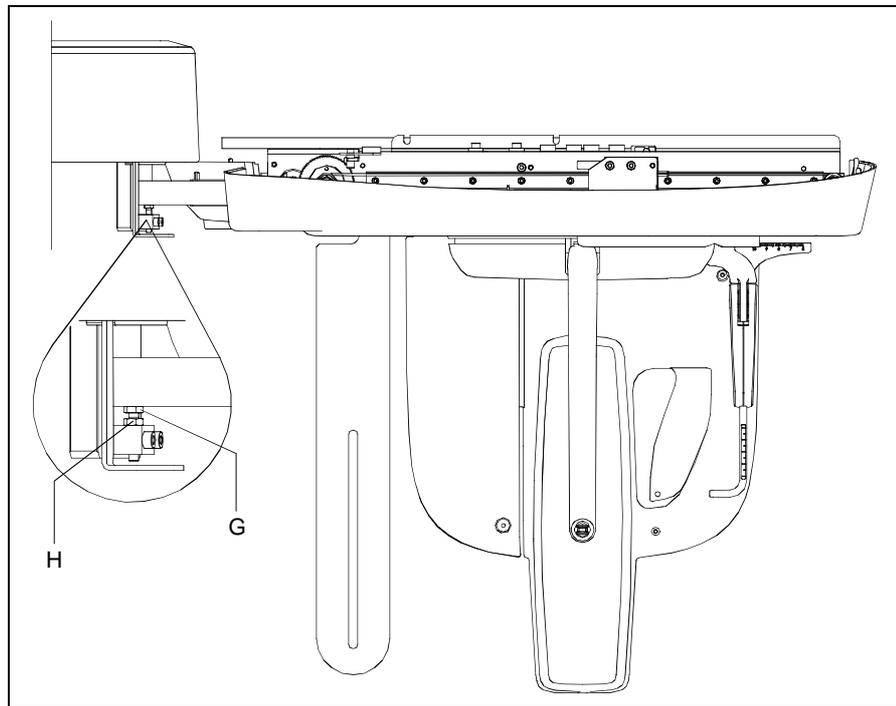


Figure 9-23

- 18.** 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 (4) and decrease (5)  set the speed value
(suggested value 2) and with keys (13) and (12) 

turn the tubehead arm, increasing the displayed offset value if the left distance is lower than the right one or viceversa.

- 19.** In order to reset the unit to the new parameter, exit from

Password 124 pressing key "Test" (6)  ; the following message will be displayed:

U	P	D	A	T	E	C	H	A	N	G	E	S	?	
>	0	<		=		Y	,		T		=		N	

Press key (7)  to store the changes and press key "Test"

(6)  to exit definitively from Password 124.

20. Enter again in Password 124 following procedure explained on paragraph 9.6 and enter in "Rotation Offset" menu as for point 8 and 9.
21. Take a new image and repeat the test from point 18 until the circle is well centered.

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

22. To adjust the horizontally alignment between the two rings, loose the two screws "C" (Figure 9-24) 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".

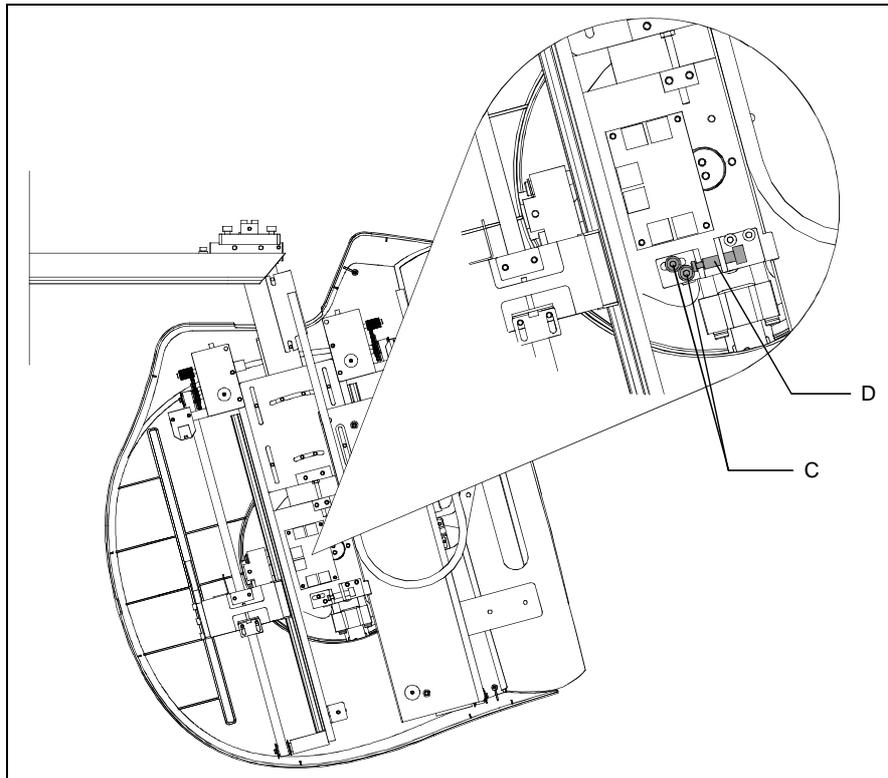


Figure 9-24

9.6.2. CEPH Sensor centering

To verify the CEPH Sensor centering, on the image taken following procedure in paragraph 9.6.1:

23. Measure the distance between the borders of the image and the borders of the central vertical stripe (Figure 9-25).

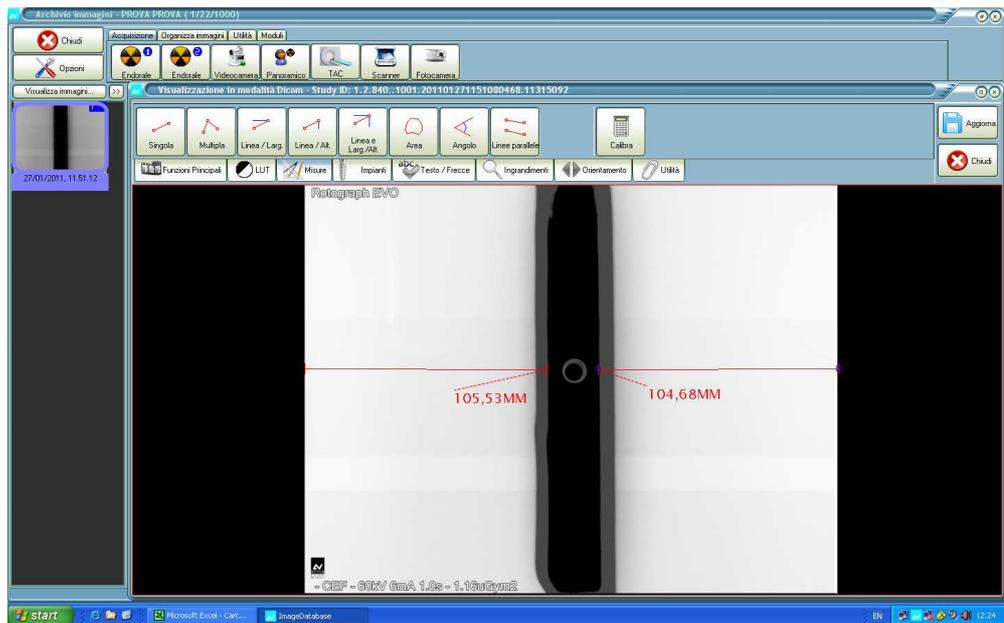


Figure 9-25

The right and left distances must not differ more than $\pm 3\text{mm}$.

24. In case it is not centered, press key "Adult/Child selection"



(8) to select "CEPH SENSOR ZERO" menu; the display will

show:

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

25. With keys increase (4) and decrease (5)  set the speed value (suggested value 2) and with keys (13) and (12) 

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

26. Close the sensor holder, if open and press key "Size selection"

(9) , the following message will be displayed:

U	P	D	A	T	E	C	H	A	N	G	E	S	?
>	0	<	=	Y	,	T	=	N					

Press key (7)  to store the changes and reset axis position.

27. Press key "Examination mode Selection - M" (11)  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.

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

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

30. Once the aligned position has been reached, press key "Test" (6)  to exit from the Rotation offset menu and return in the main menu:

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

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

9.6.3. Secondary collimator centering

To perform the ceph secondary collimator alignment start from point 30 of paragraph 9.6.2 and:

31. 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.

32. Press keys "Arrow right" (13) or "Arrow left" (12)  until the following is displayed:

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

33. Press key "Patient entrance" (7)  and the following message will be displayed:

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

34. Press key " Patient entrance " (7)  on the machine keyboard.

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.

35. Open the "Sensor Centering" program on the CD (P/N 5807304100) and wait until the message "Board is connected" is displayed on the bottom bar of the program. Check that in menu "Image processing" all the items are not selected.

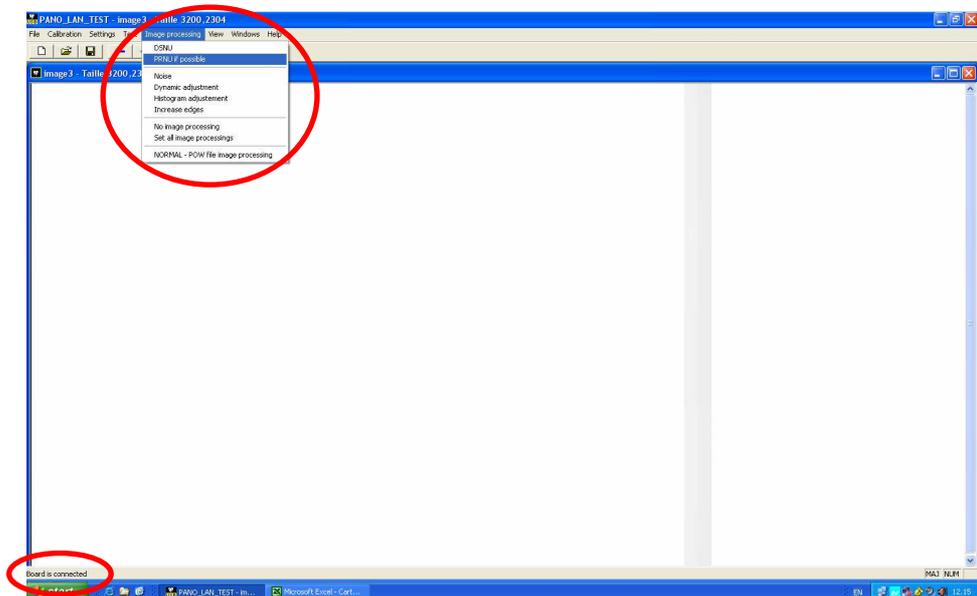


Figure 9-26

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

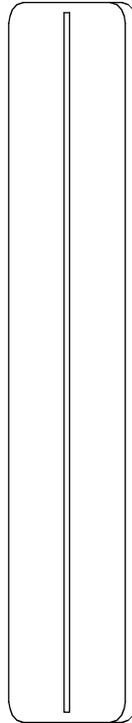


Figure 9-27
Centering tool P/N 5209900900

37. Select with key "Parameter selection" (3)  respectively kV, mA

and exposure time and use keys increase (4) or decrease (5)



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.** Take X-ray pressing the X-ray button and check if in the obtained narrow image the projection of the slit of the centering tool is vertical and centered with the arc (Figure 9-28 and Figure 9-29).

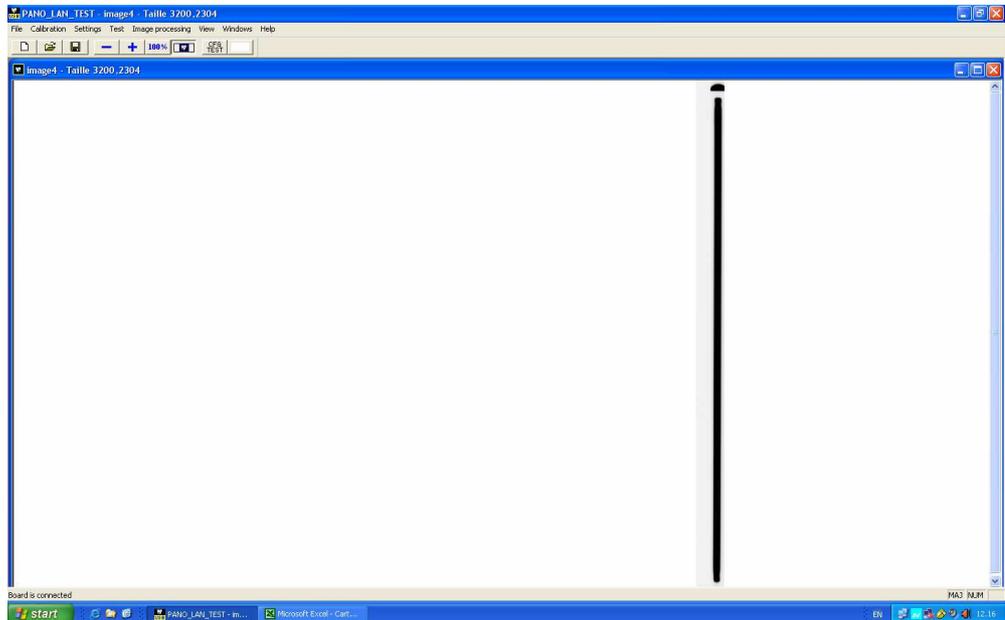


Figure 9-28

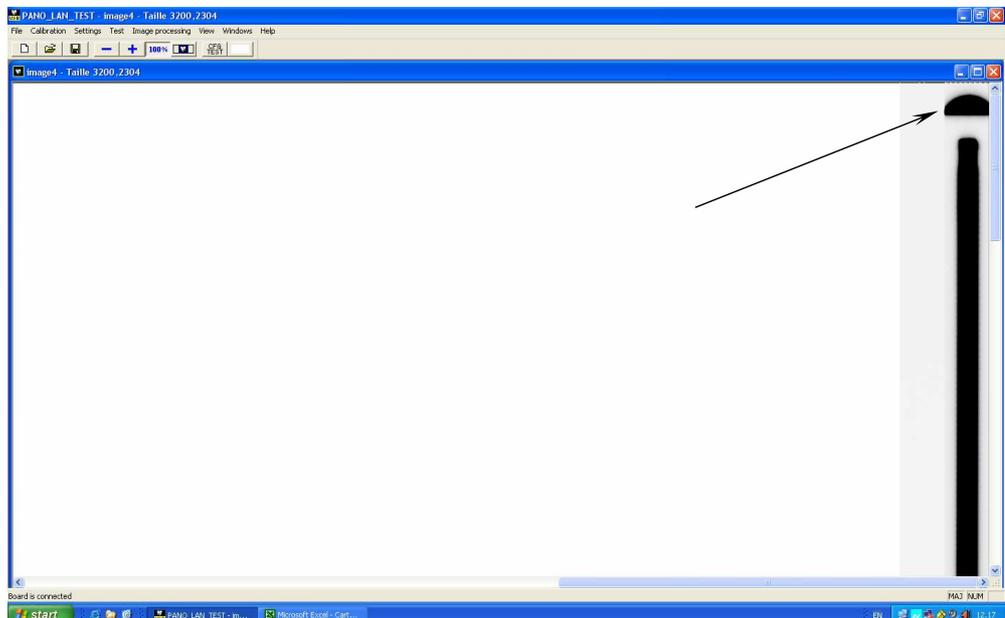


Figure 9-29

39. If it is not the case, with keys increase (4) and decrease (5)  set a speed value (suggested value 3) and with keys (13) and (12)  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 30.

 **NOTE:** This is a fine setting; if the zero offset ($\pm e e e e e$) is lower than -1000 steps or greater than 1000 steps repeat the first step of ceph arm centering described in 9.6.1.

40. When the right setting is reached press key "Test" (6)  to exit the menu item and if modifications have been performed the following message will be displayed:

U	P	D	A	T	E	C	H	A	N	G	E	S	?
>	0	<	=	Y	,	T	=	N					

Press key (7)  to store the changes. While key (6)  to cancel them.

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

9.6.4. Soft Tissue Filter (STF) adjustment



NOTE:

This adjustment needs a personal computer directly connected to Rotograph EVO 3D where the "DentalStudio" program is installed.

This adjustment is accessed by activating password 124 as described in paragraph 9.6.

1. When in password 124 scroll the menu items pressing keys "Arrow right" (13) or "Arrow left" (12)  until reaching the following display:

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

2. Press key "Patient entrance" (7) . The following message will be displayed:

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

and at the end of positioning

S	T	F		Z	E	R	O		[0]				
Z	E	R	O		O	F	F	S	E	T		±	x	x	x

3. Place the ear centering device in a Latero-Lateral position.
4. Acting on keys "Parameter selection" (3)  and on keys increase (4) or decrease (5)  set the exposure parameters, as suggestion set 60kV - 6mA.
5. Open and activate the Virtual Keyboard.
6. Press key "Examination mode Selection - M" (11)  on the machine keyboard. The Soft Tissue Filter will be automatically placed in the X-ray field.



NOTE:
If the following message will be displayed:

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

check the connection with the PC.

Press key (7)  to reset the message and press key (11)  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.

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

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

- On the image, measure the distance "A" (Figure 9-30) between the Soft Tissue Filter (STF) edge and the center of the rings; perform the measure in "mm".

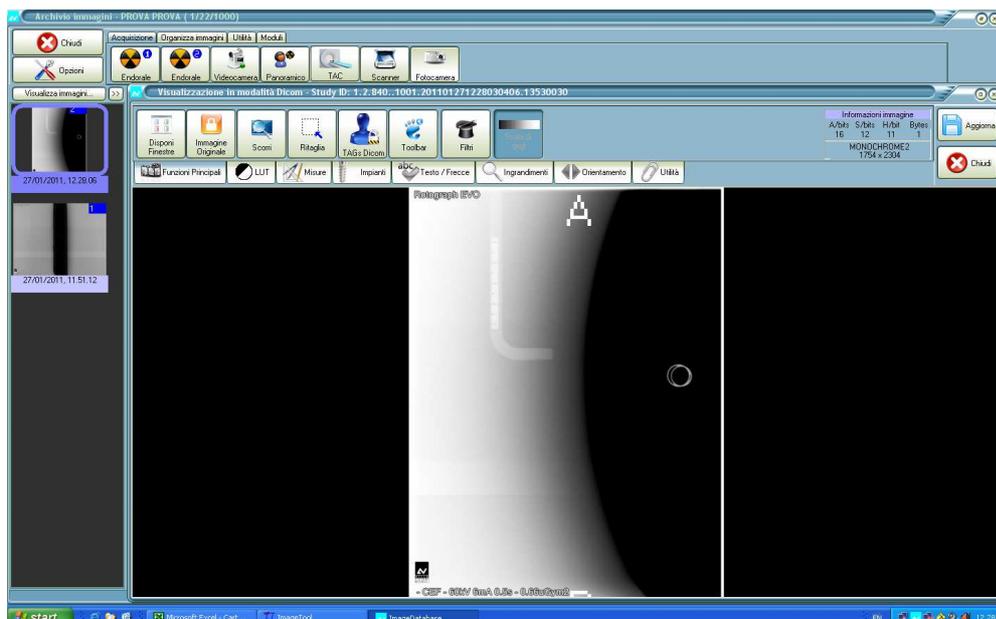


Figure 9-30

9. If the distance "A" is different from 50 ± 2 mm, press keys increase (4)

and decrease (5)  up to reach the measured value; press key
(7)  to store the change.

The system will calculate automatically the new Soft Tissue Filter offset.

If distance "A" is 50 ± 2 mm no correction is needed; press key

"Test" (6)  to exit.

In both cases the following message will be displayed

S	T	F		Z	E	R	O		[	x	x	]			x
Z	E	R	O		O	F	S		±	x	x	x	x	x	x

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 (6) . The display will show:

U	P	D	A	T	E		C	H	A	N	G	E	S	?	
>	0	<		=			Y	,		T		=		N	

Press key (7)  to permanently store the change.

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

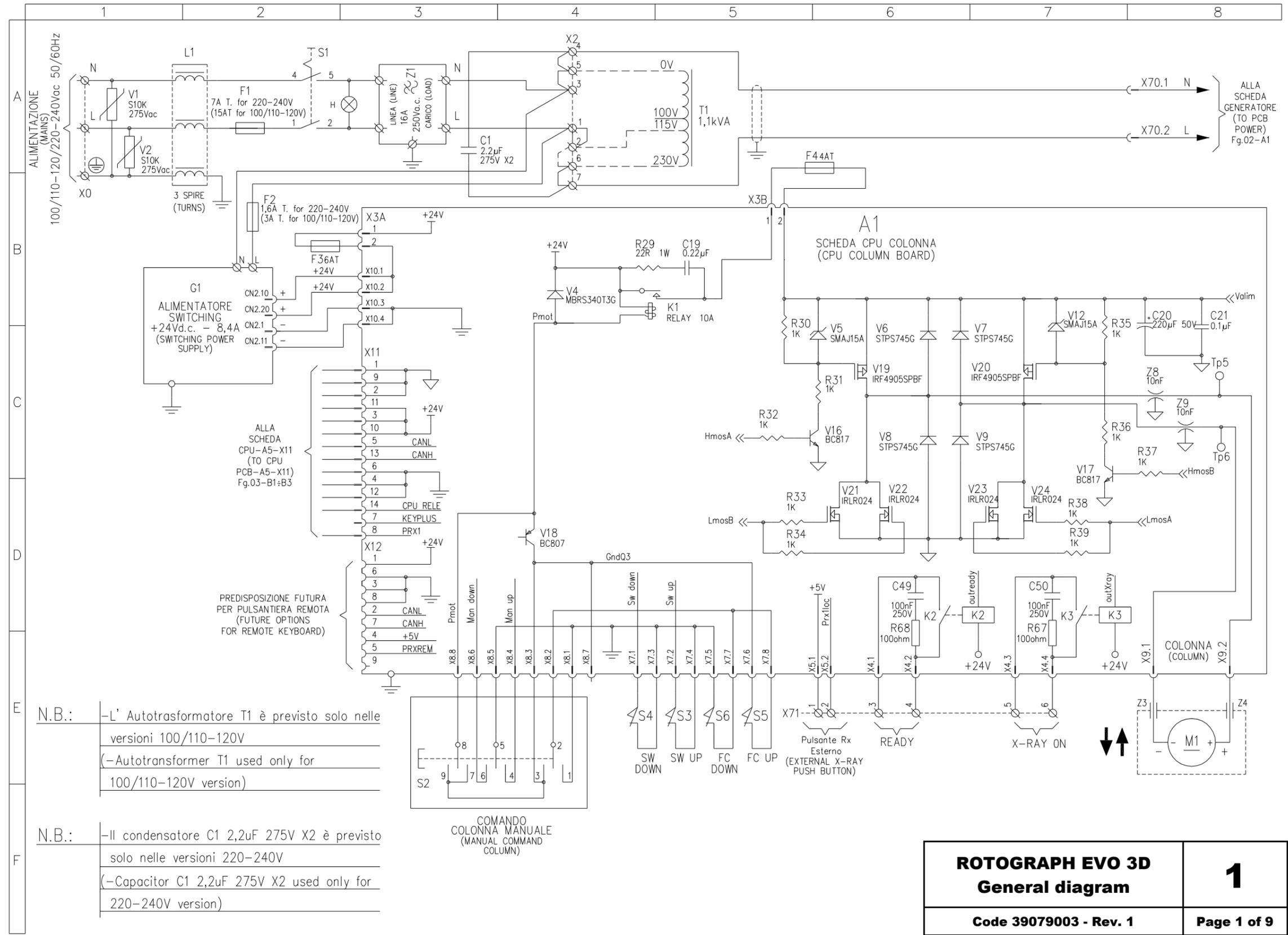
11. Press key (6)  to exit password 124.

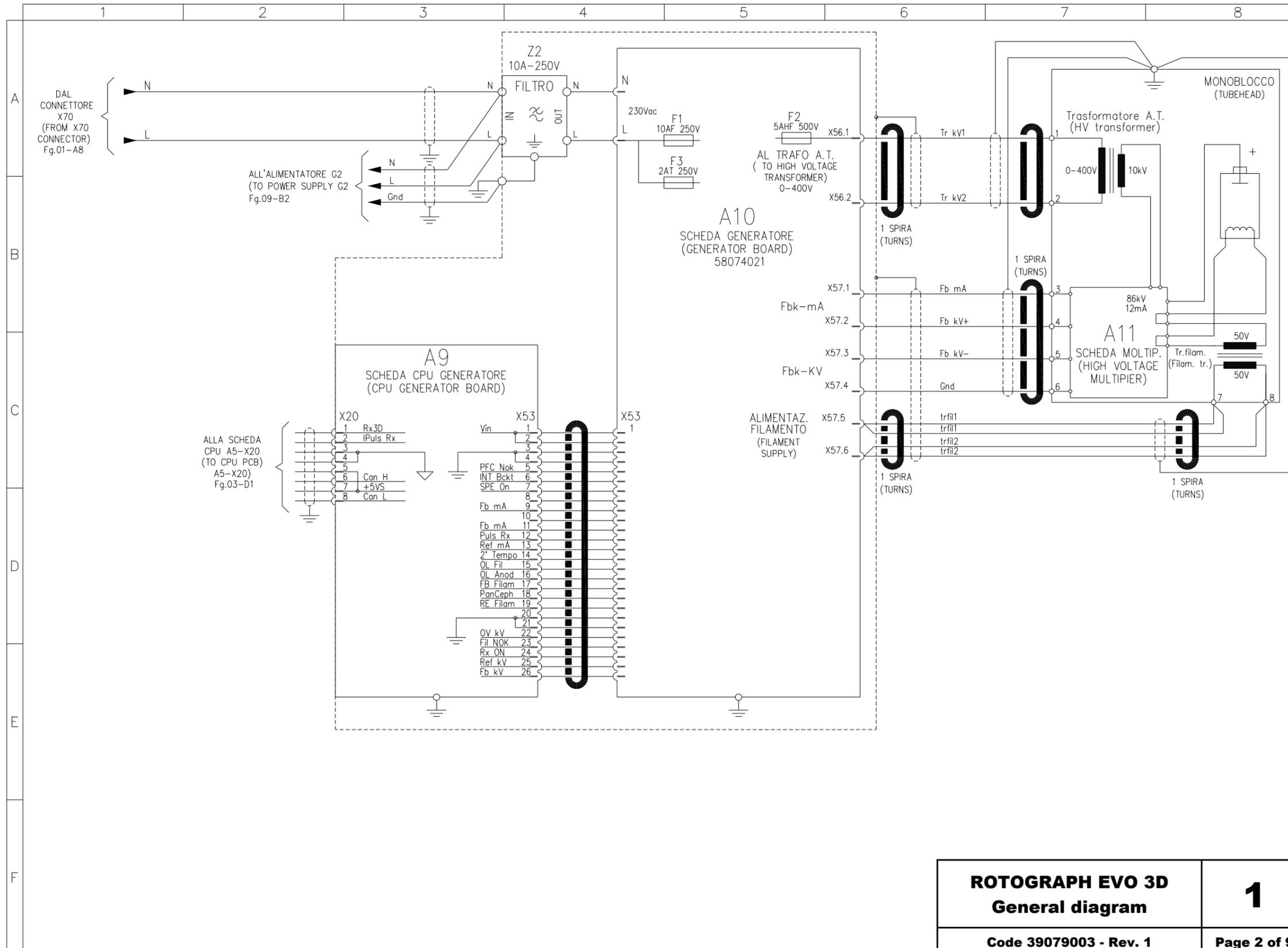
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10. SCHEMATICS AND DRAWINGS

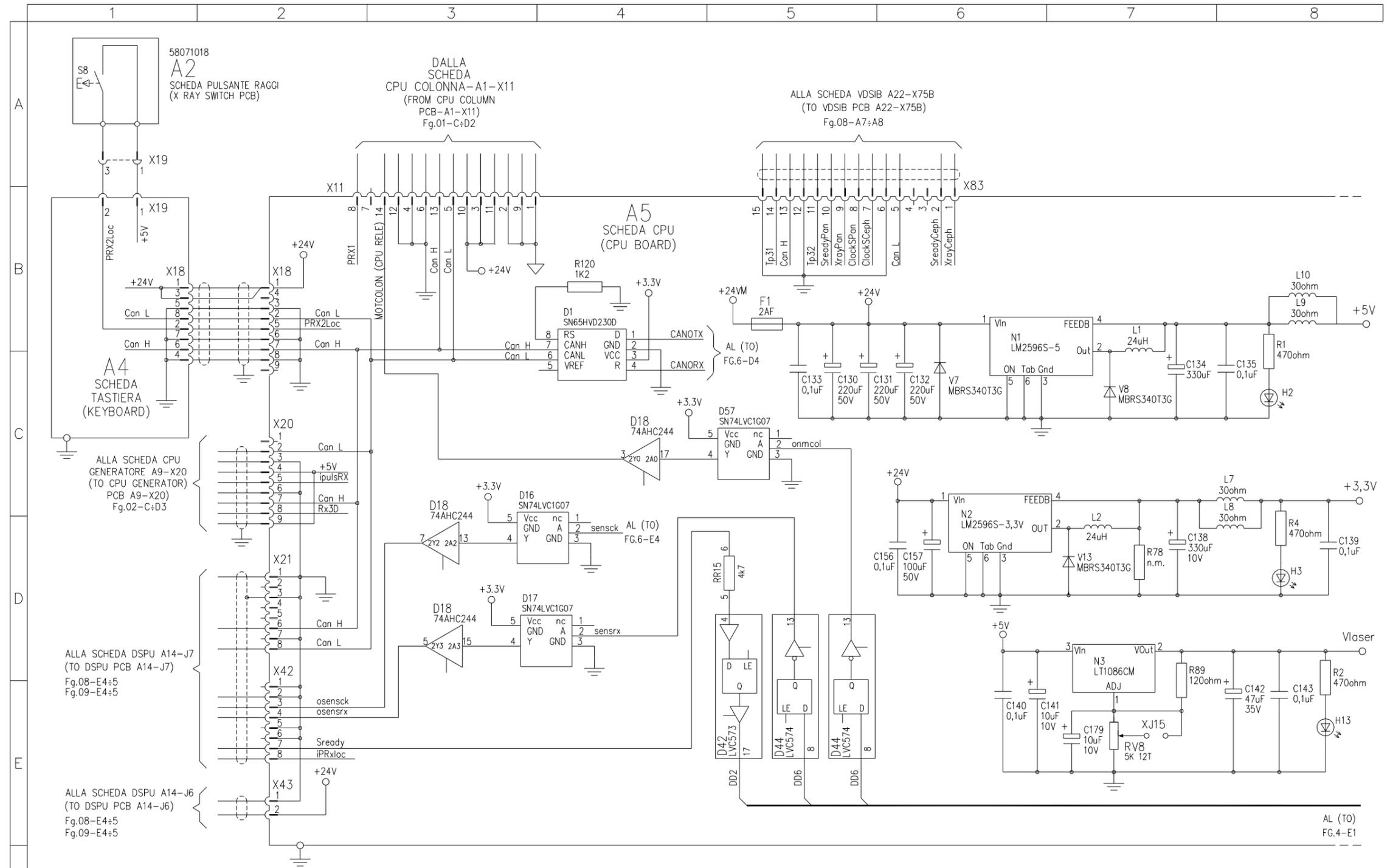
- 1.** General diagram
- 2.** Lay-out Column CPU PCB A1
- 3.** Circuit diagram Column CPU PCB A1
- 4.** Lay-out Keyboard PCB A4
- 5.** Circuit diagram Keyboard PCB A4
- 6.** Lay-out CPU PCB A5
- 7.** Circuit diagram CPU PCB A5
- 8.** Lay-out Microprocessor PCB A6
- 9.** Circuit diagram Microprocessor PCB A6
- 10.** Lay-out and Circuit diagram Rotation Group PCB A7
- 11.** Lay-out Generator CPU PCB A9
- 12.** Circuit diagram Generator CPU PCB A9
- 13.** Lay-out Generator PCB A10
- 14.** Circuit diagram Generator PCB A10
- 15.** Lay-out and Circuit diagram CEPH arm connection PCB A12
- 16.** Lay-out Power HUB PCB A21
- 17.** Circuit diagram Power HUB PCB A21
- 18.** Lay-out VDSIB PCB A22
- 19.** Circuit diagram VDSIB PCB A22
- 20.** Lay-out DSPU PCB A14

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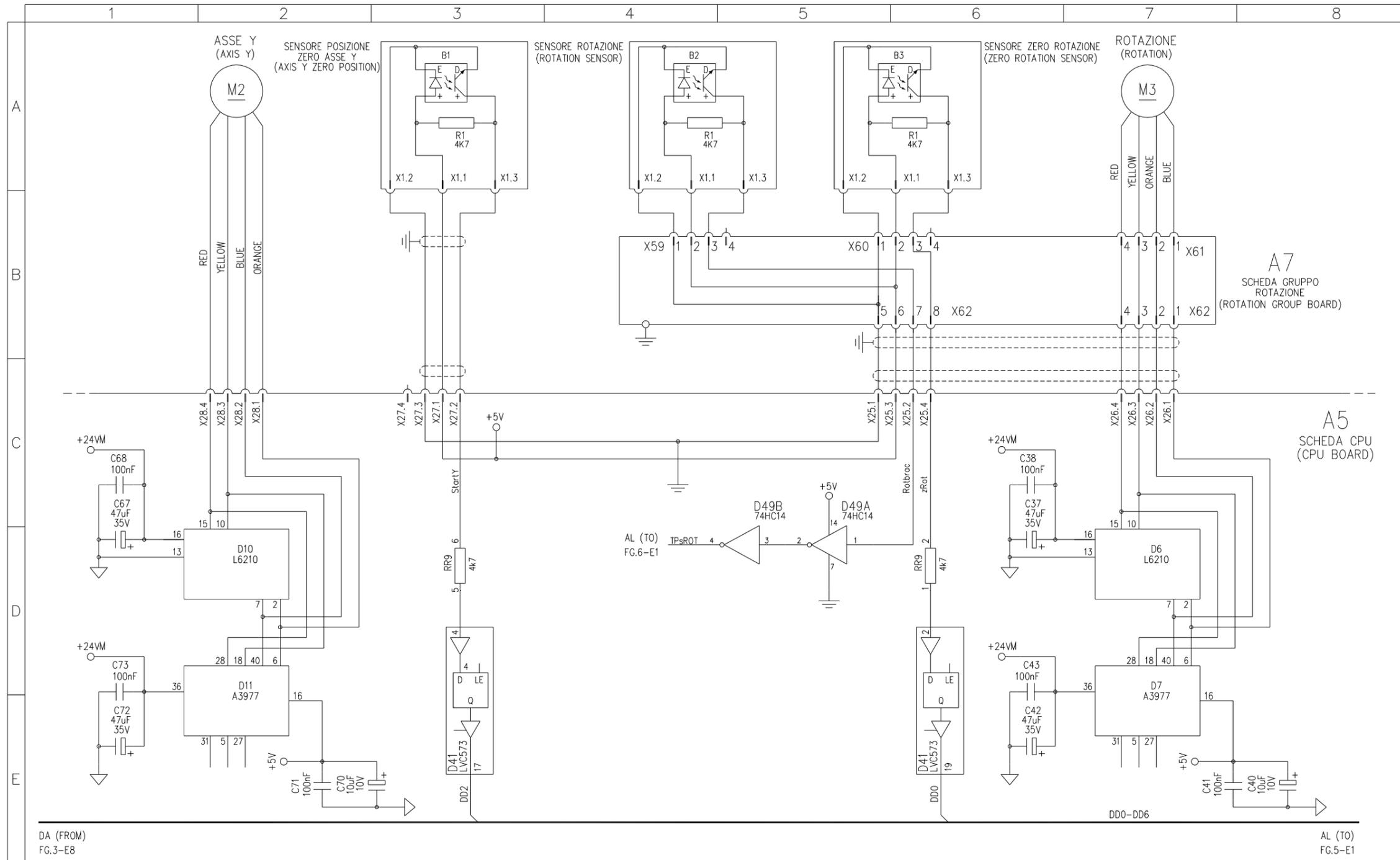




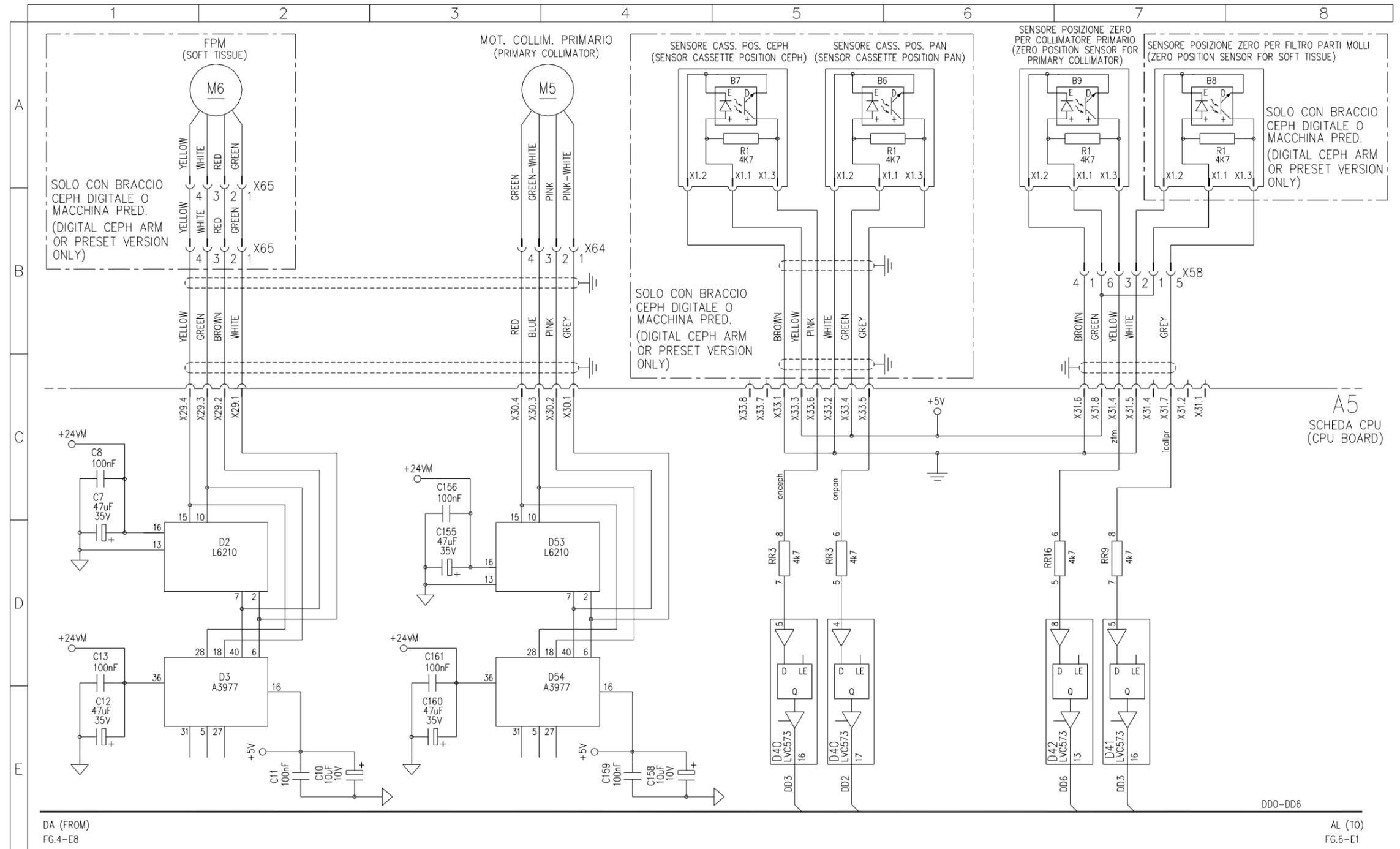
ROTOGRAPH EVO 3D General diagram	1
Code 39079003 - Rev. 1	Page 2 of 9



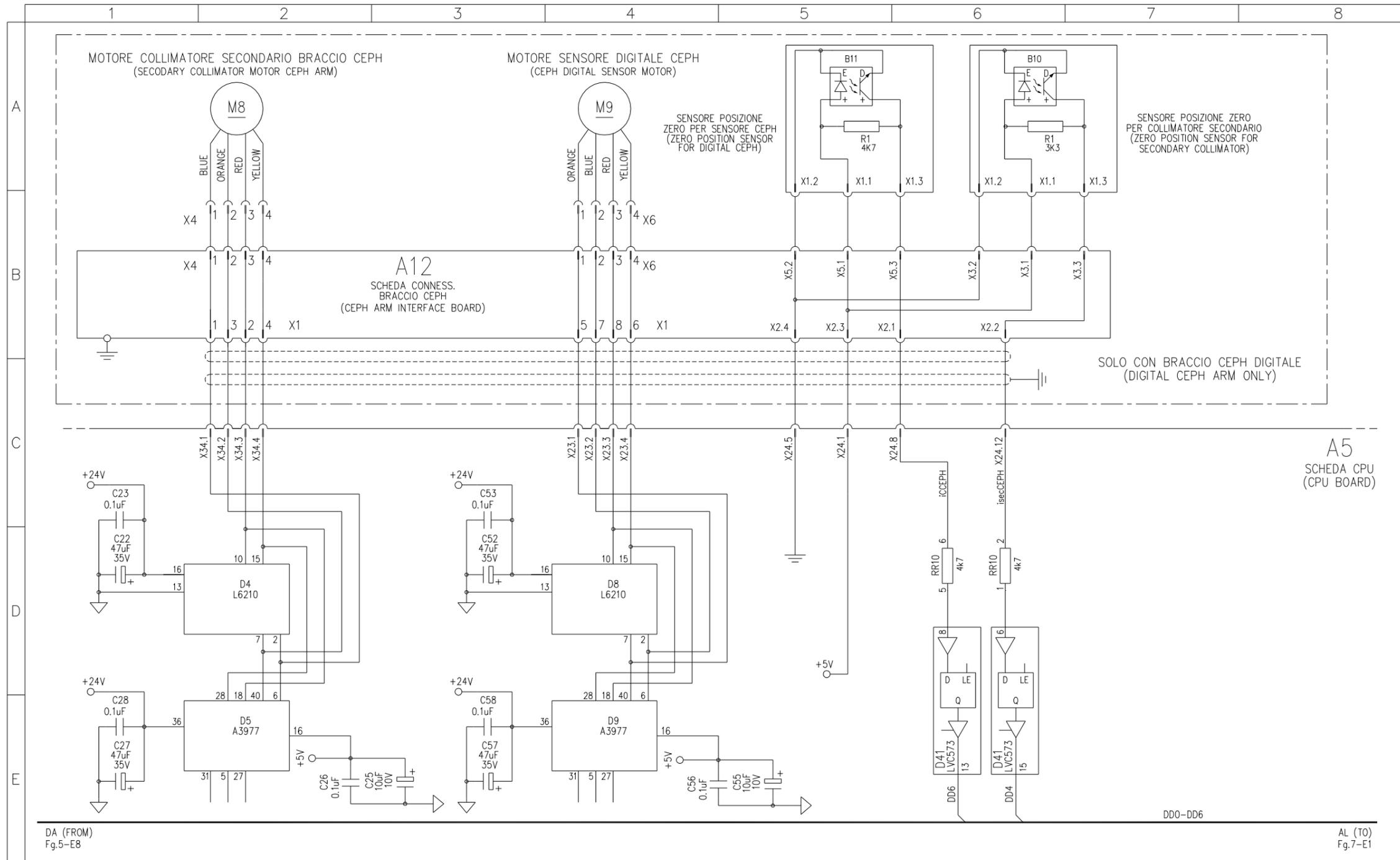
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Code 39079003 - Rev. 1	Page 3 of 9



ROTOGRAPH EVO 3D General diagram	1
Code 39079003 - Rev. 1	Page 4 of 9



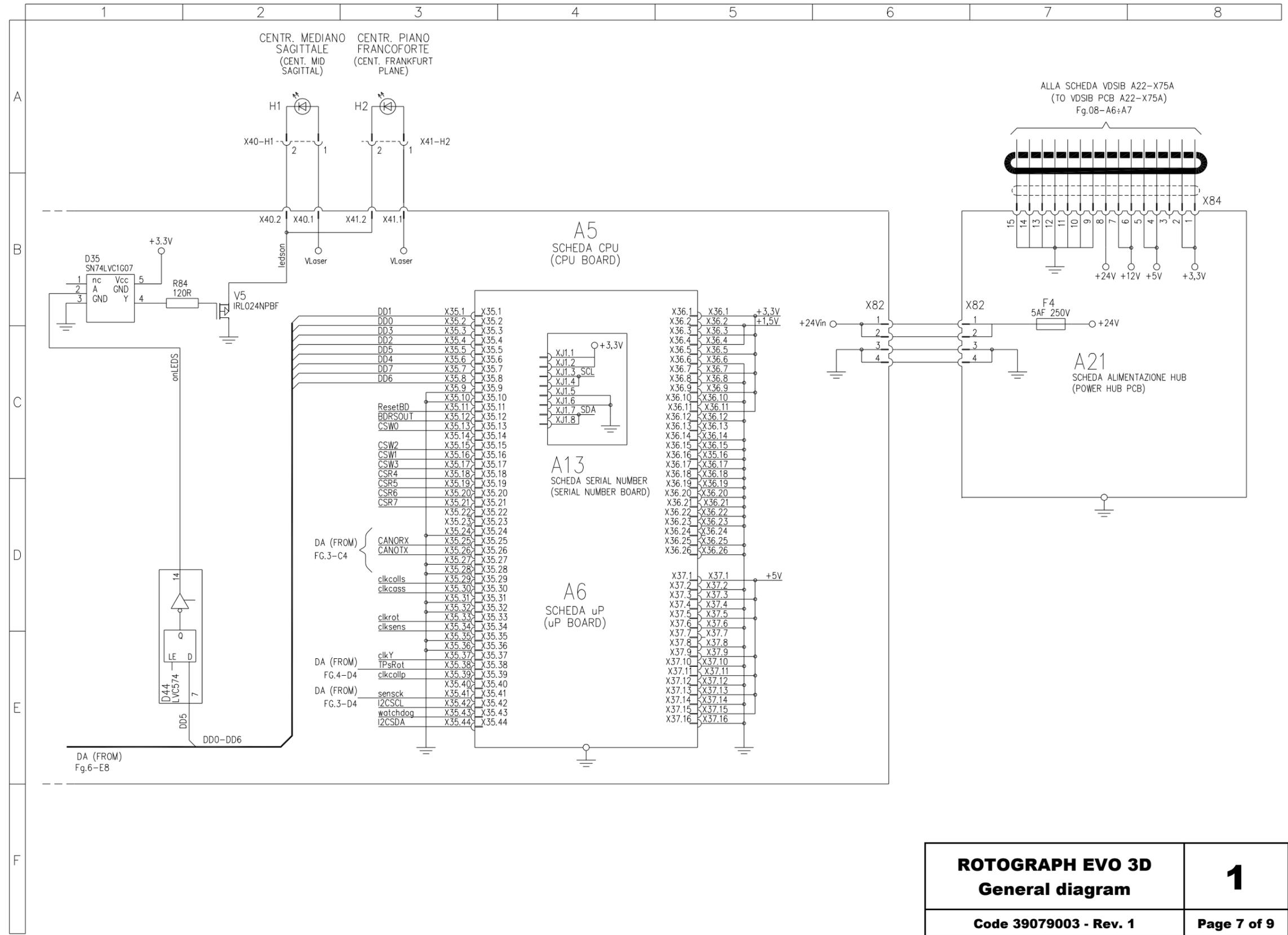
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Code 39079003 - Rev. 1	Page 5 of 9

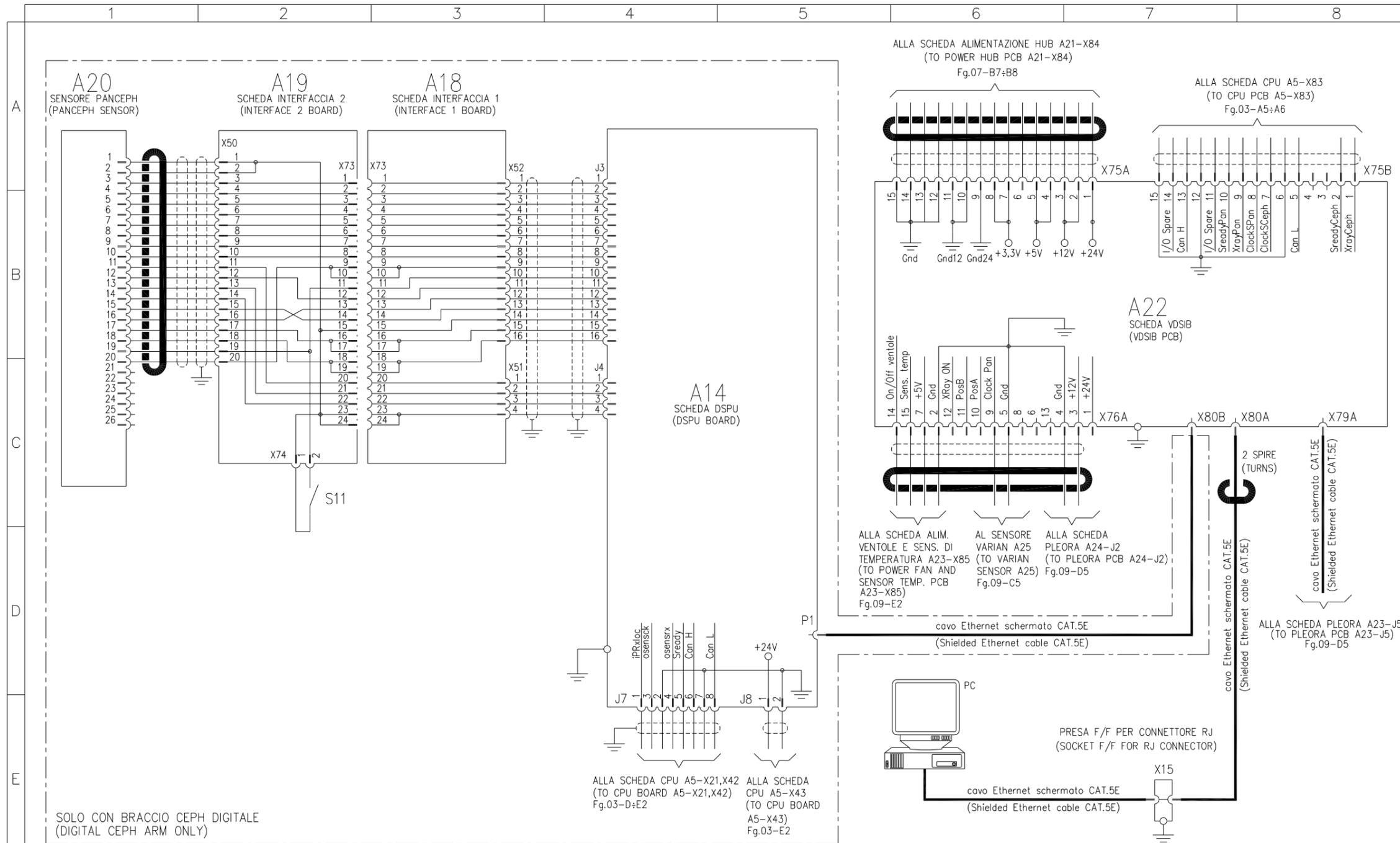


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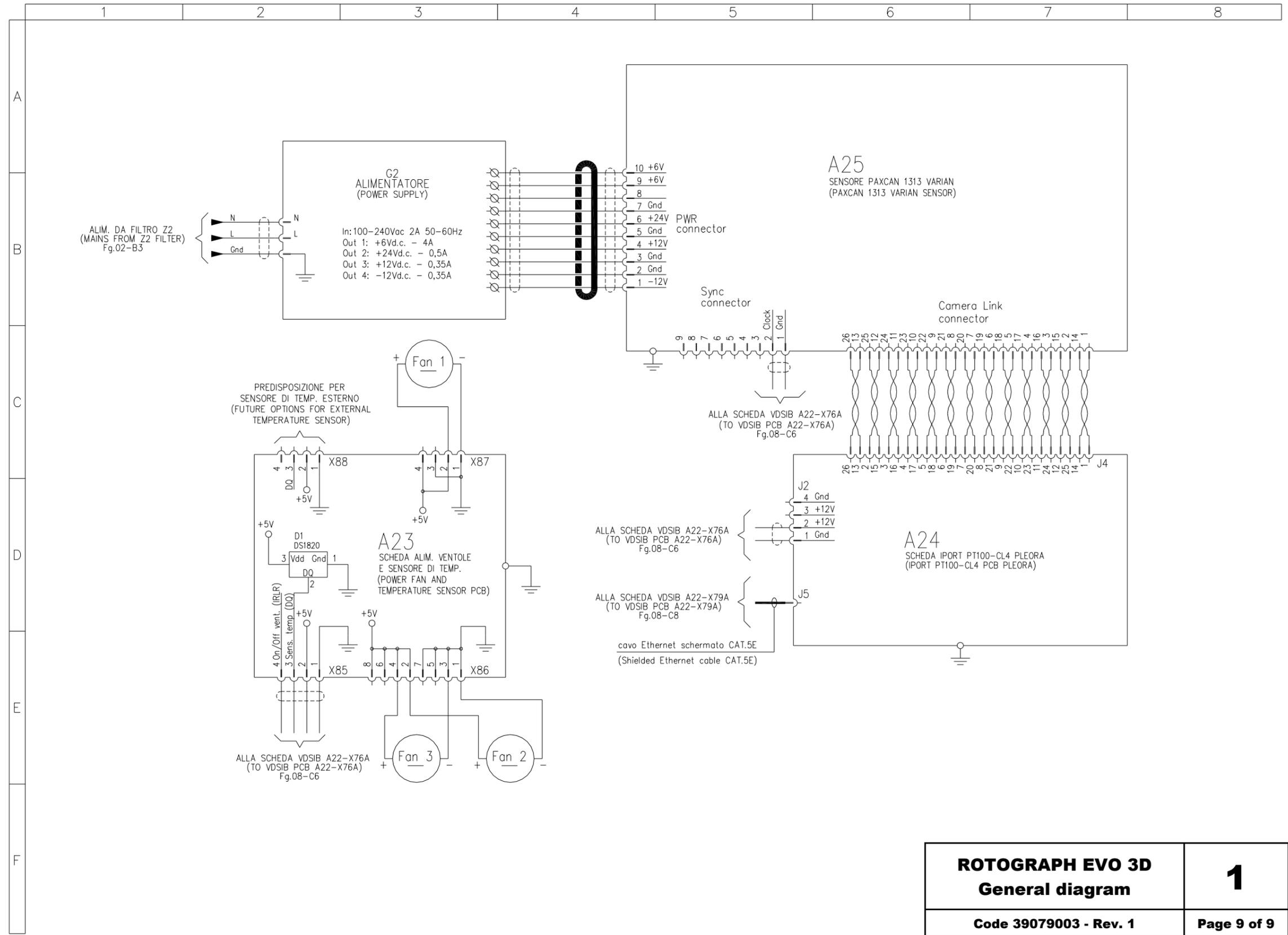
AL (TO)
Fg.7-E1

ROTOGRAPH EVO 3D General diagram	1
Code 39079003 - Rev. 1	Page 6 of 9

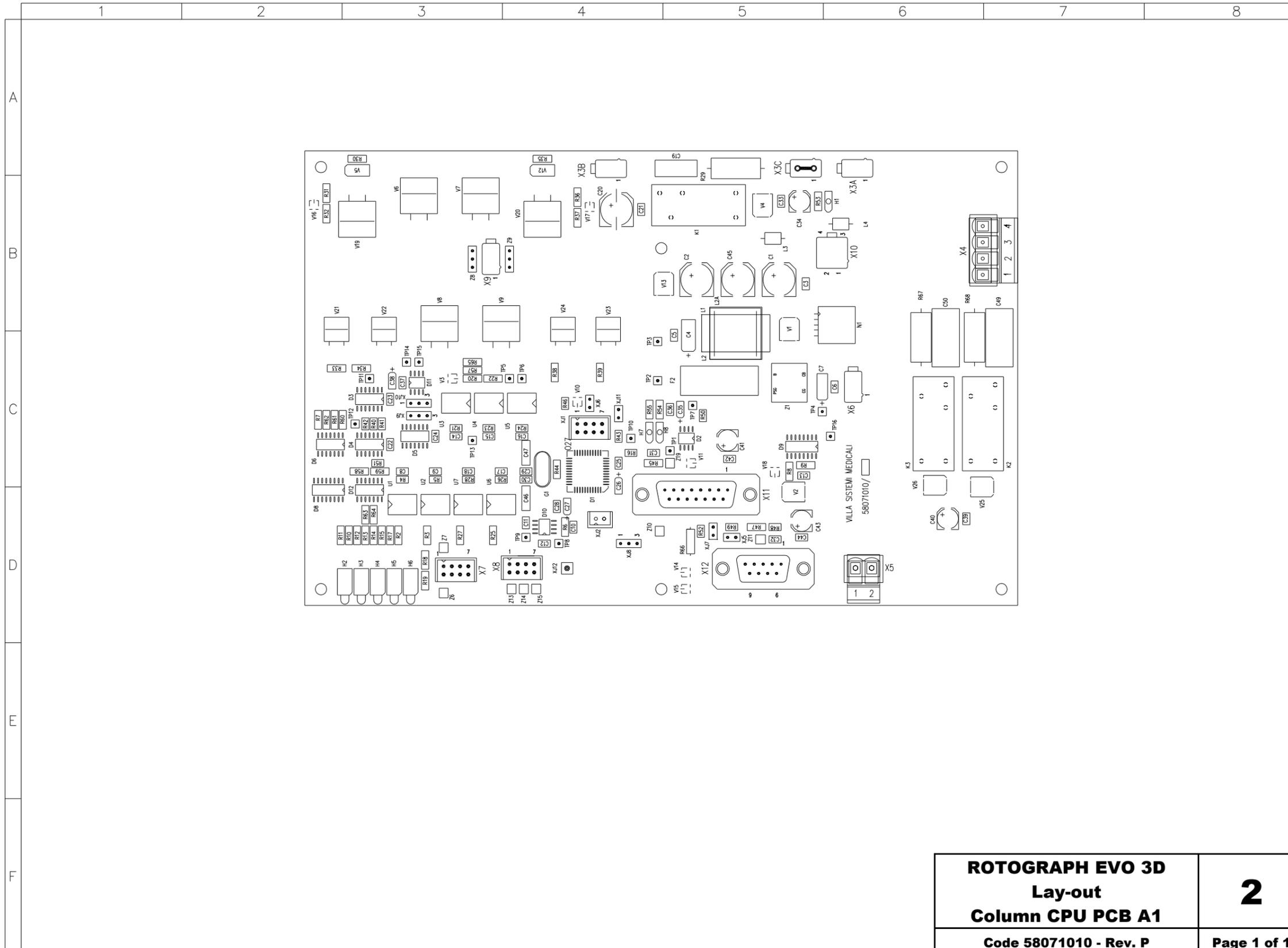




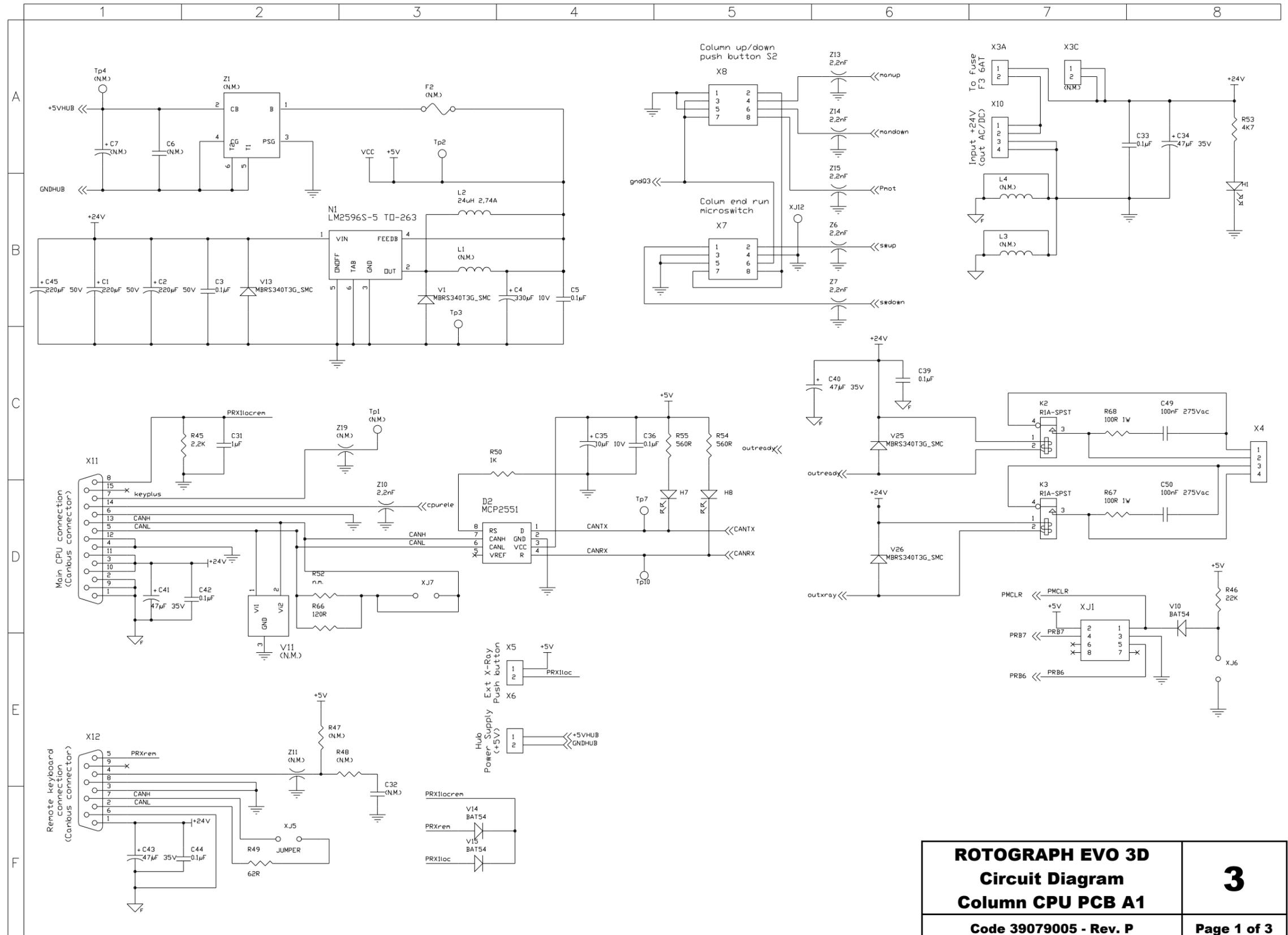
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Code 39079003 - Rev. 1	Page 8 of 9



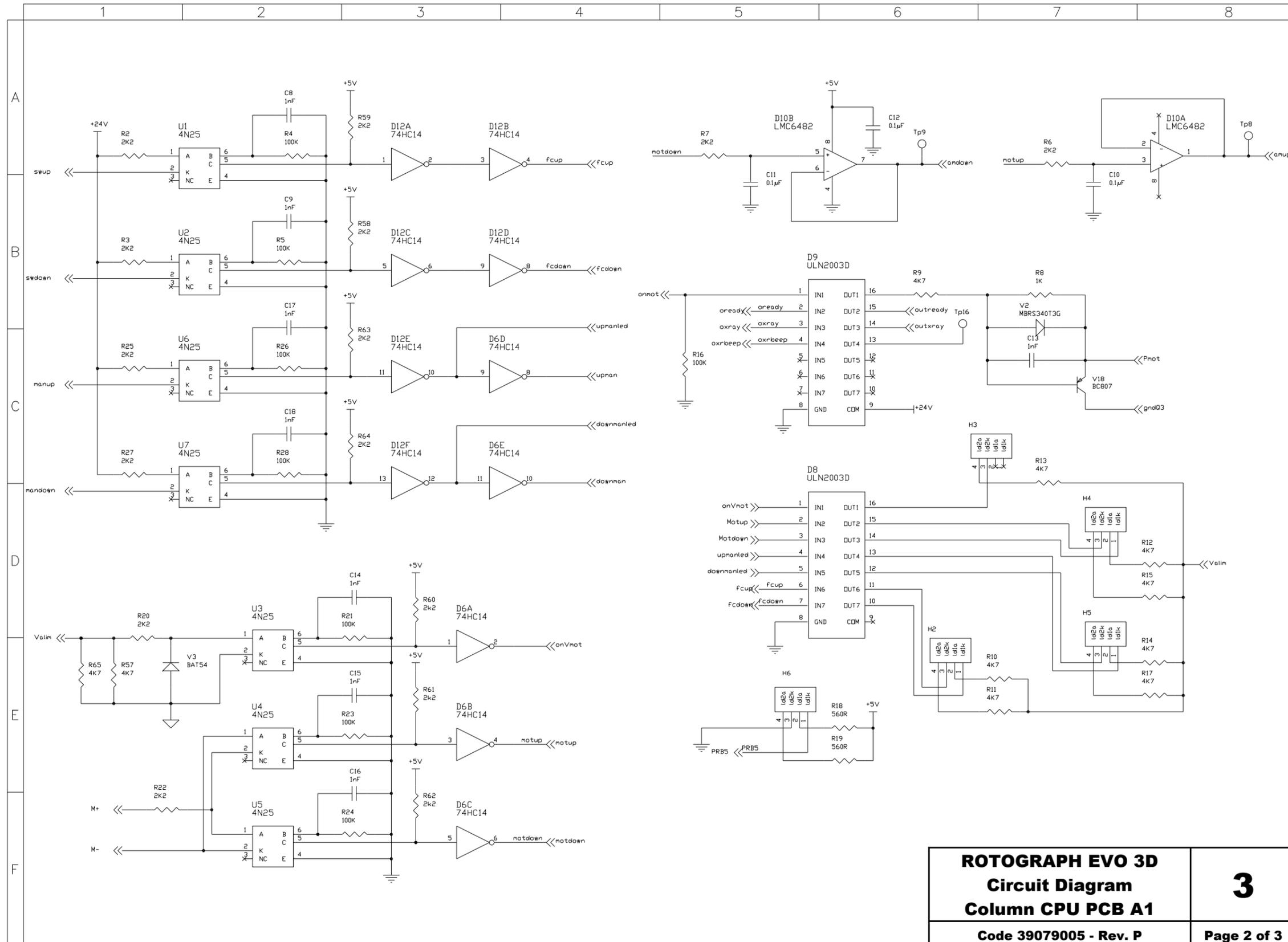
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Code 39079003 - Rev. 1	Page 9 of 9



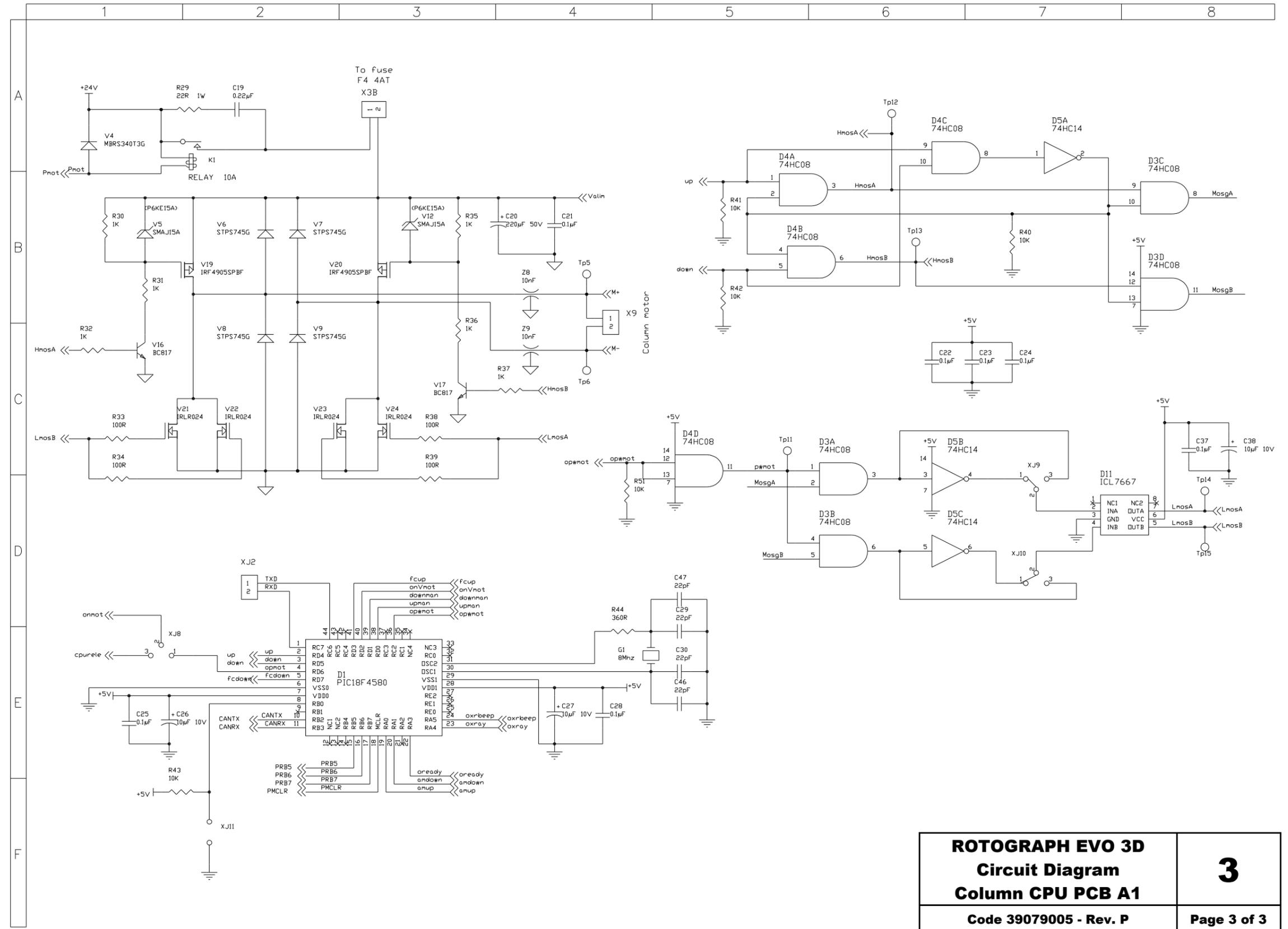
<p>ROTOGRAPH EVO 3D Lay-out Column CPU PCB A1</p>	<p>2</p>
<p>Code 58071010 - Rev. P</p>	<p>Page 1 of 1</p>



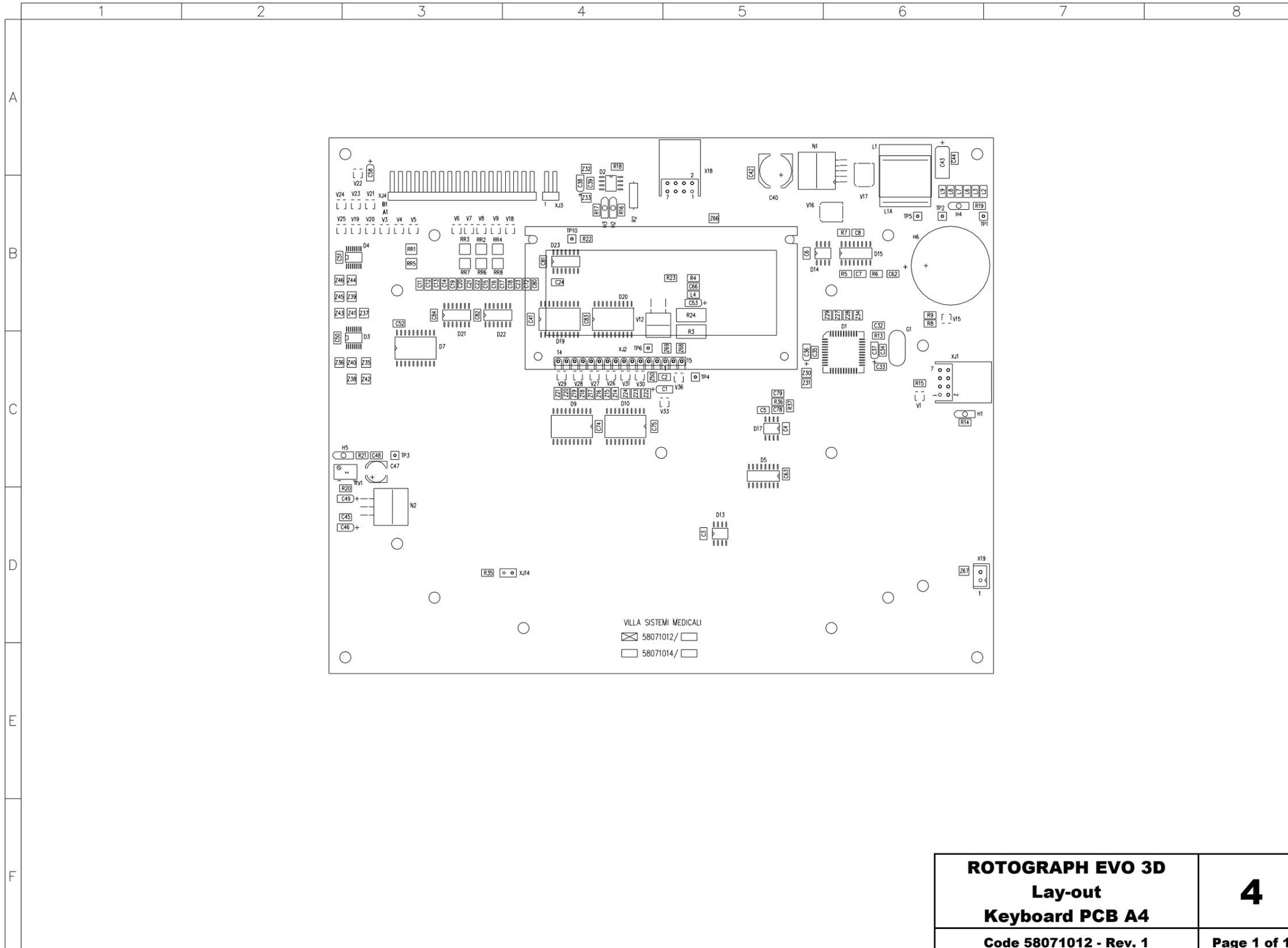
ROTOGRAPH EVO 3D Circuit Diagram Column CPU PCB A1 Code 39079005 - Rev. P	3 Page 1 of 3
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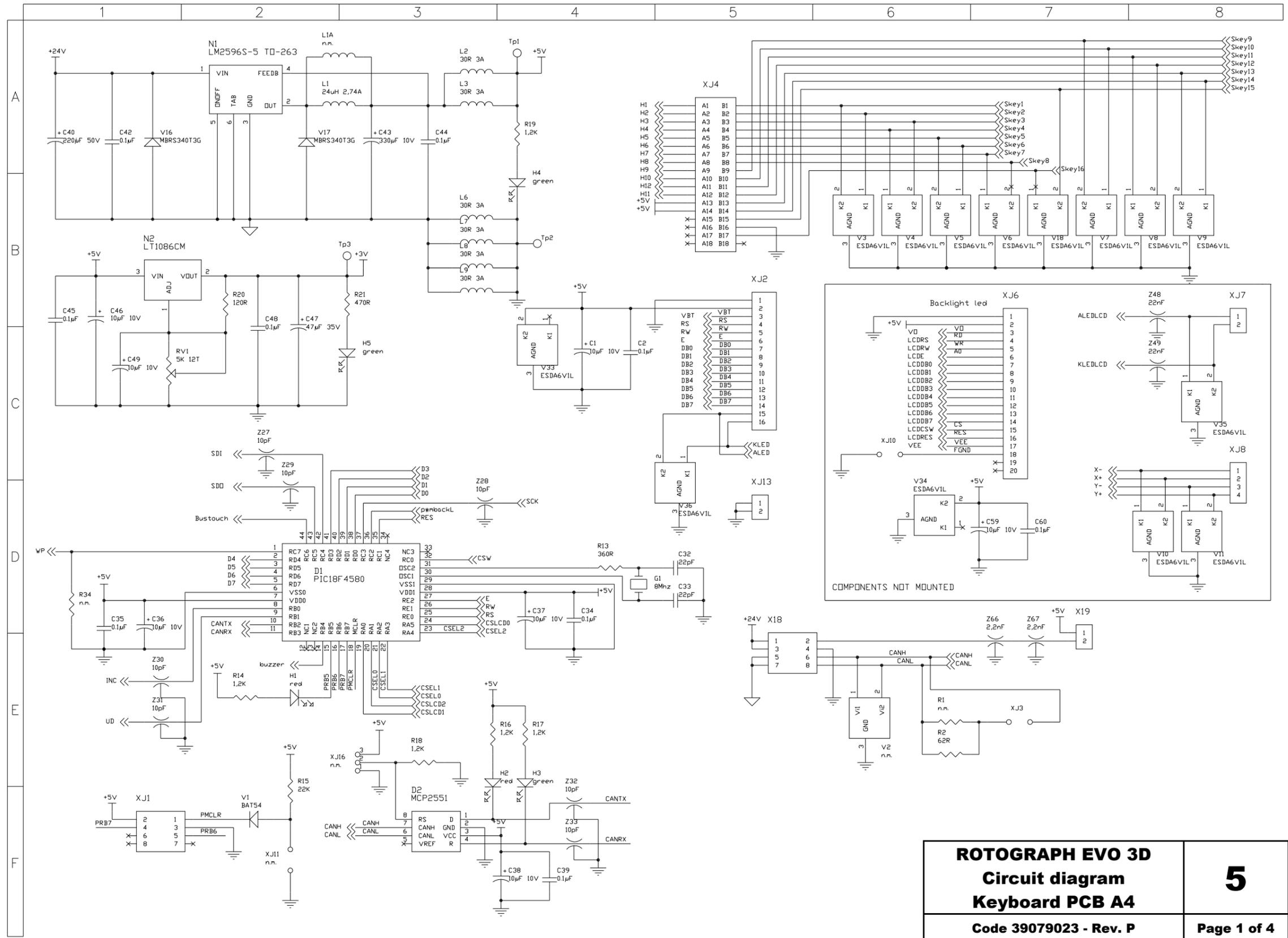
ROTOGRAPH EVO 3D Circuit Diagram Column CPU PCB A1	3
Code 39079005 - Rev. P	Page 2 of 3



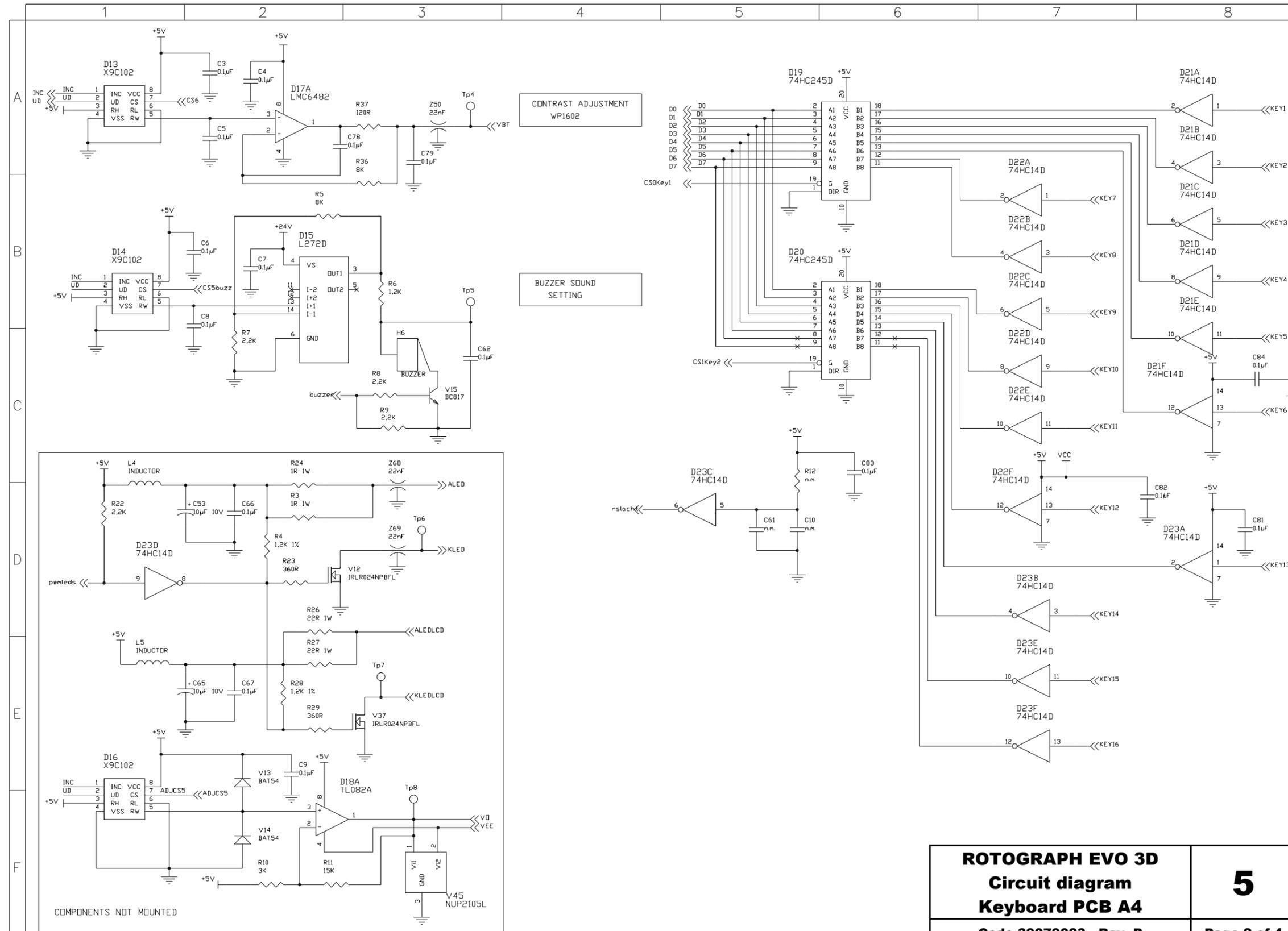
ROTOGRAPH EVO 3D Circuit Diagram Column CPU PCB A1	3
Code 39079005 - Rev. P	Page 3 of 3

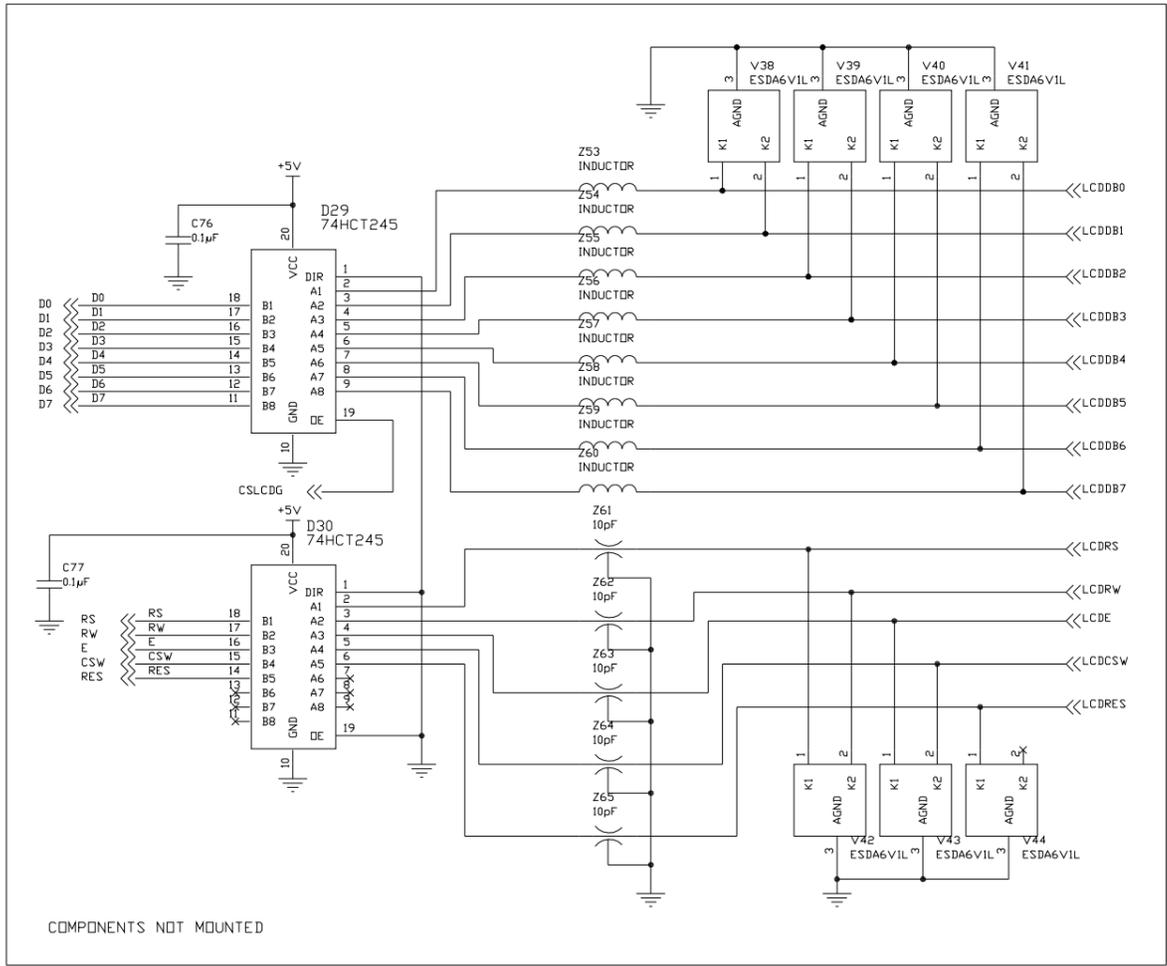
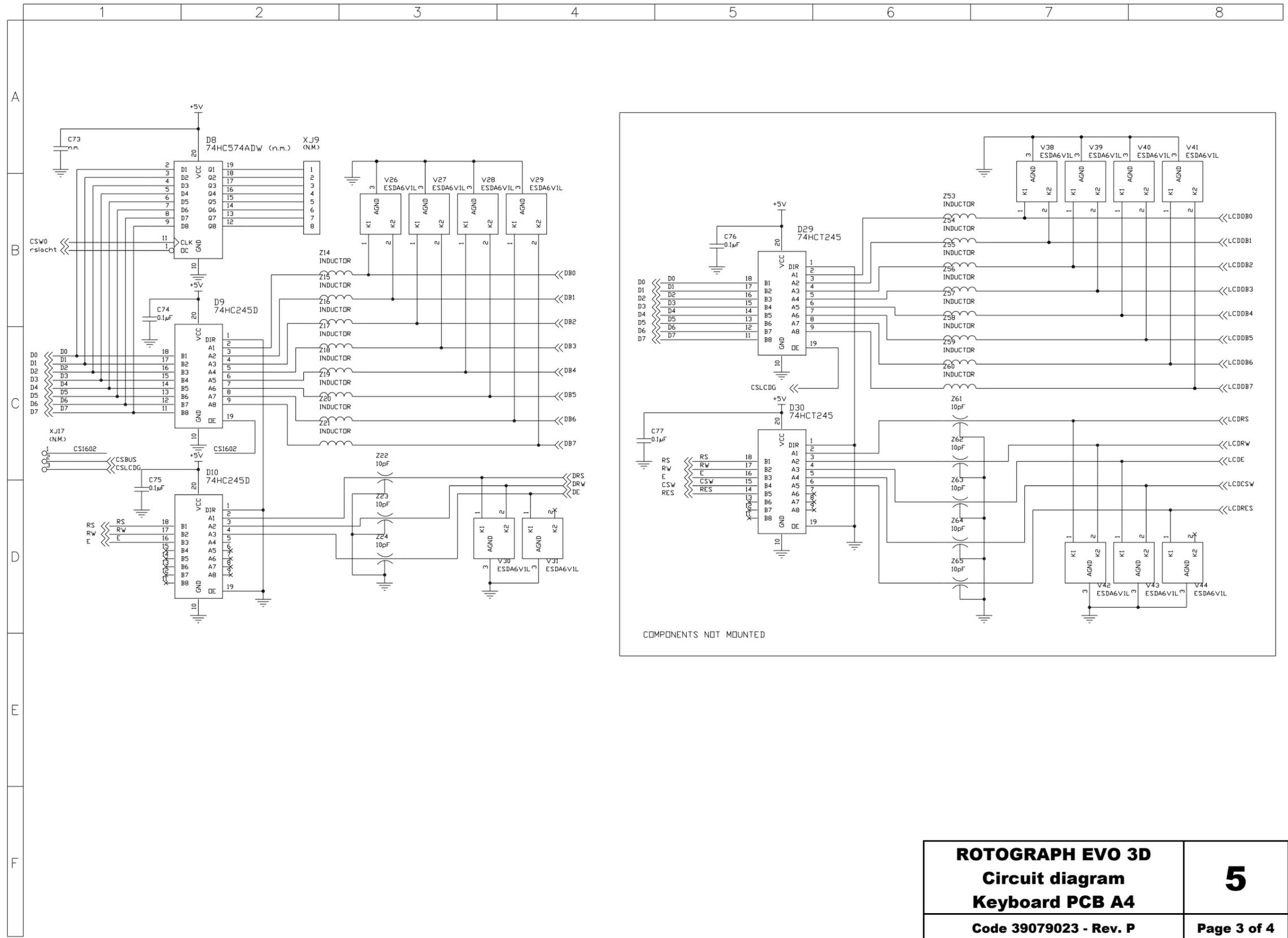


<p>ROTOGRAPH EVO 3D Lay-out Keyboard PCB A4</p>	<p>4</p>
<p>Code 58071012 - Rev. 1</p>	<p>Page 1 of 1</p>

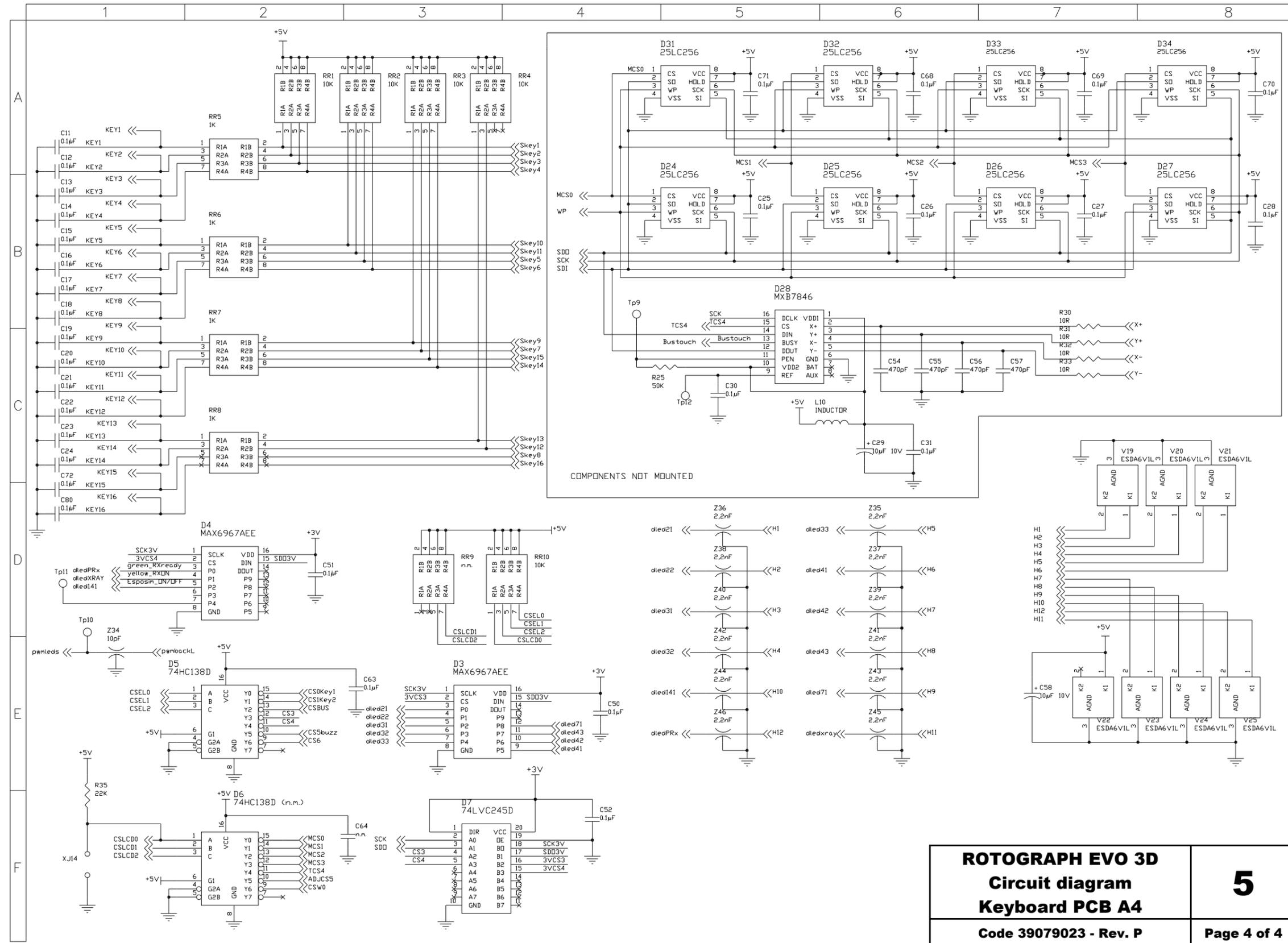


ROTOGRAPH EVO 3D	5
Circuit diagram	
Keyboard PCB A4	
Code 39079023 - Rev. P	Page 1 of 4

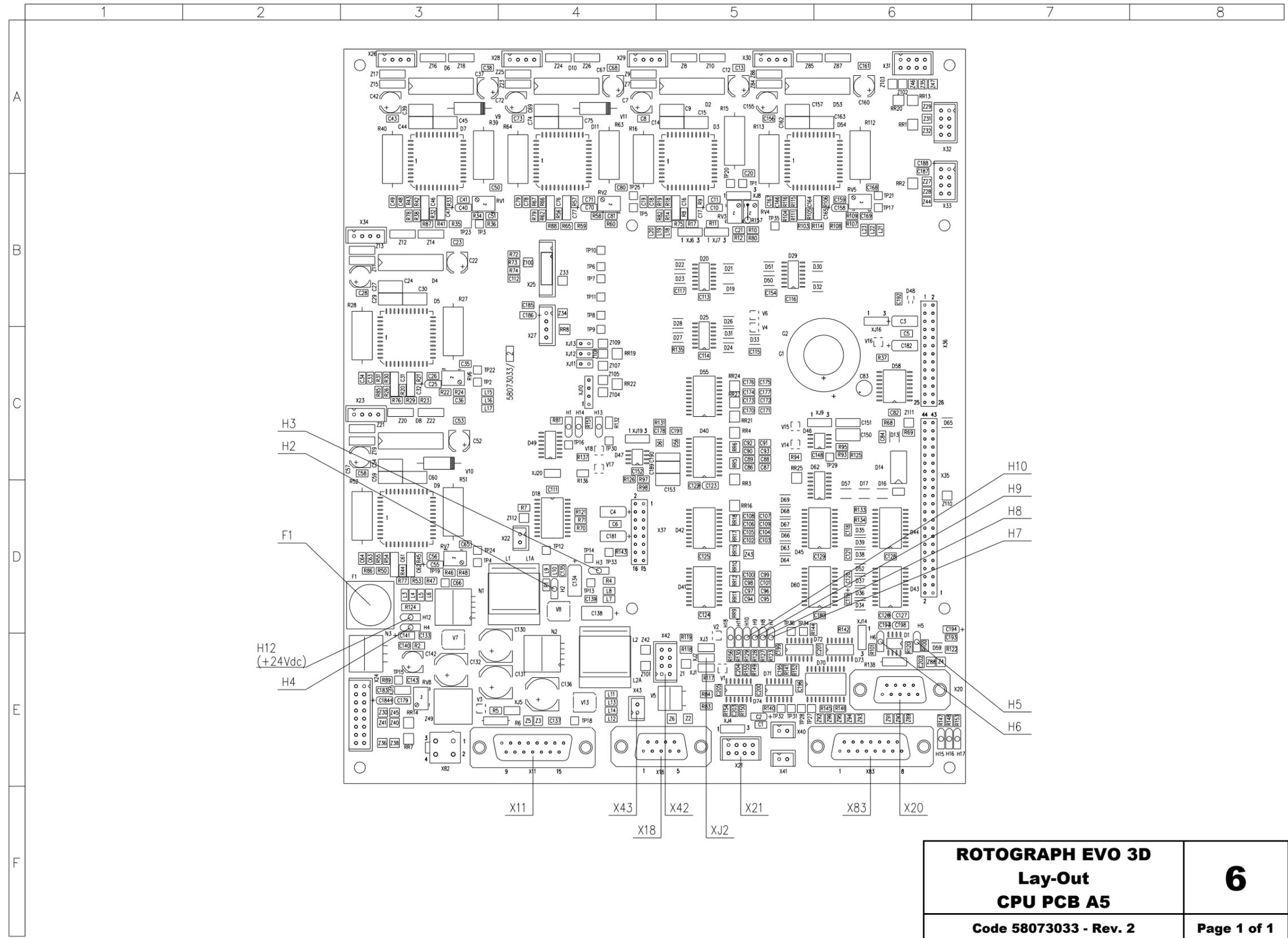




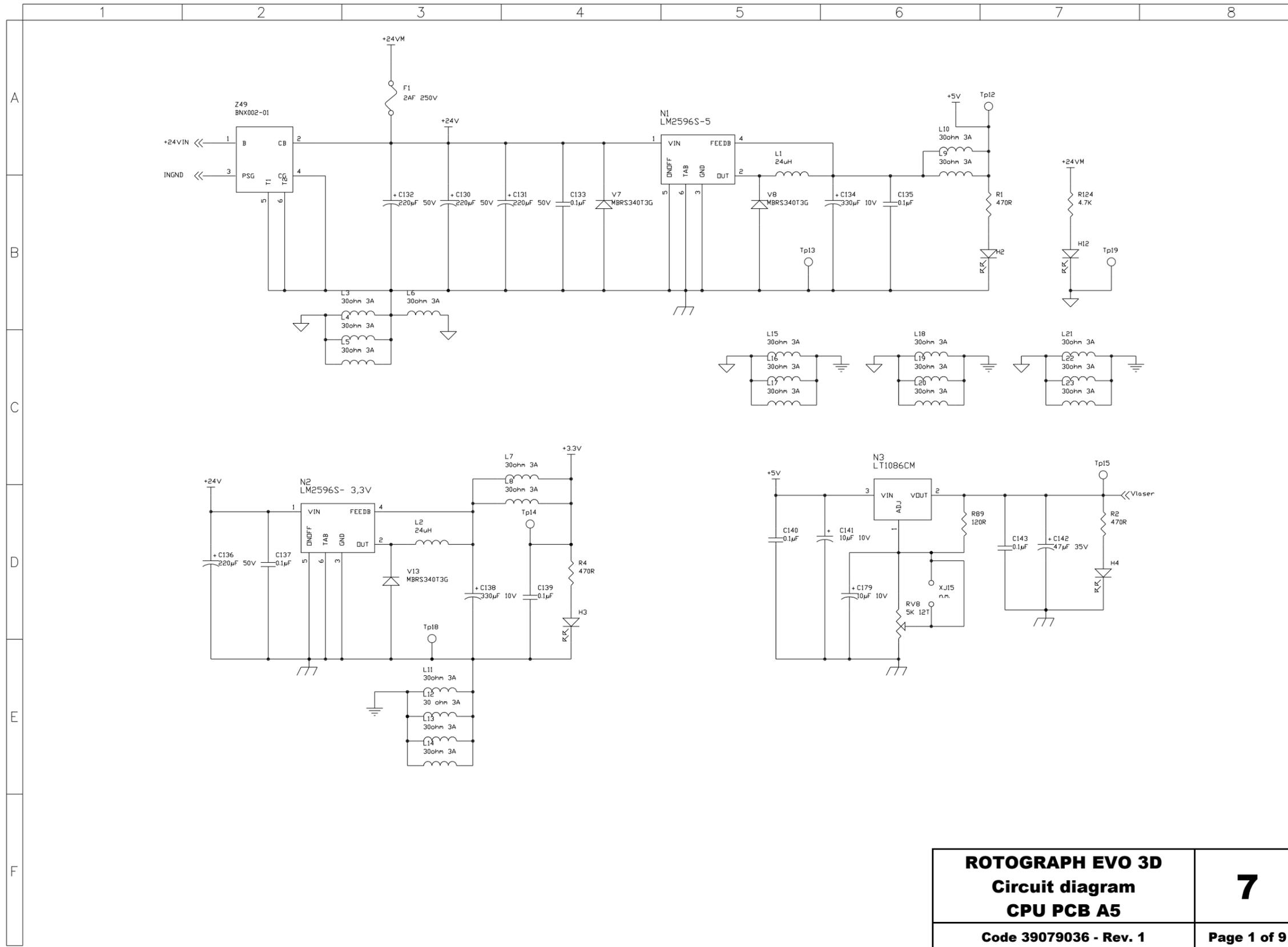
ROTOGRAPH EVO 3D Circuit diagram Keyboard PCB A4	5
Code 39079023 - Rev. P	Page 3 of 4



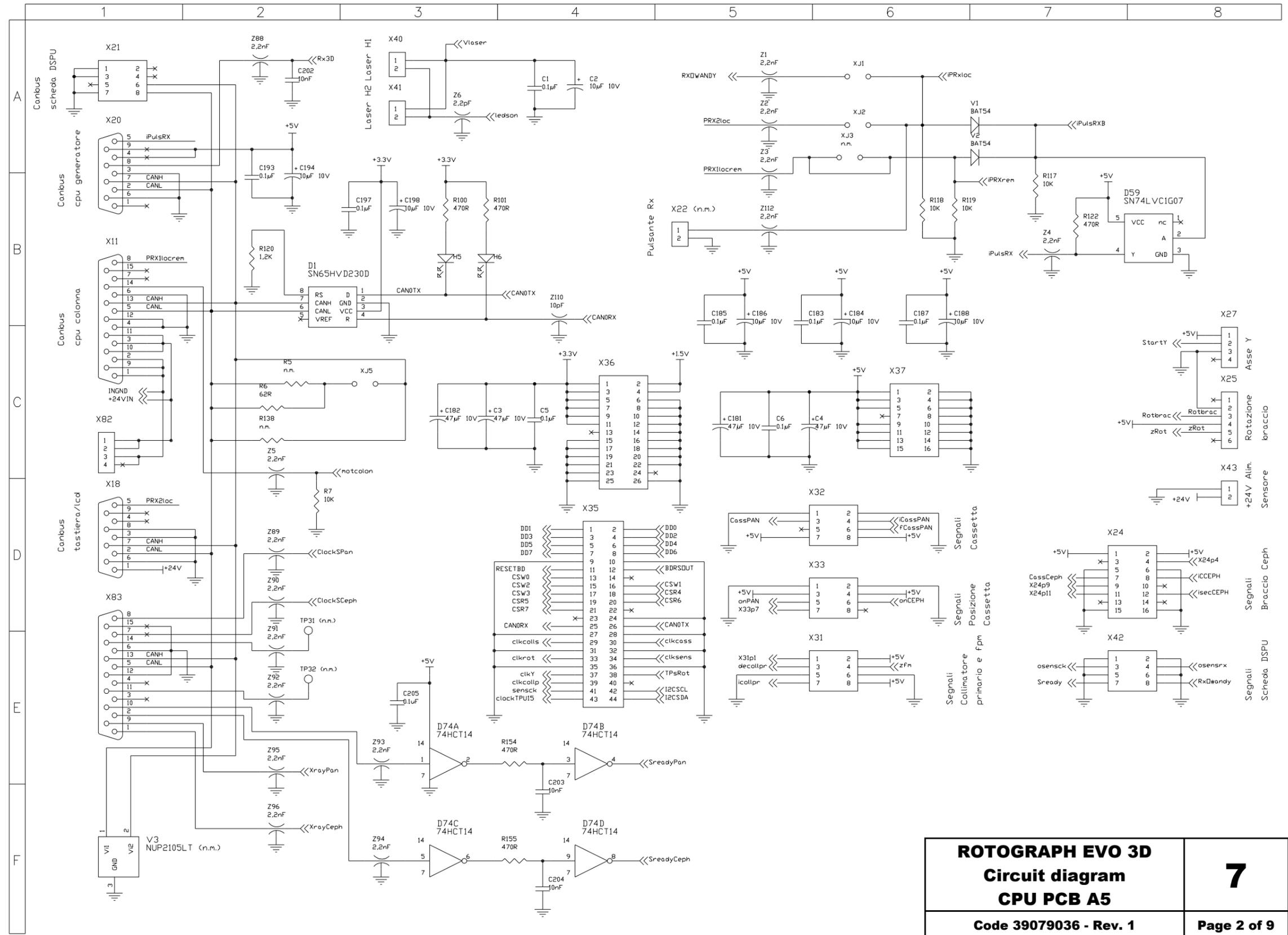
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Circuit diagram	
Keyboard PCB A4	
Code 39079023 - Rev. P	Page 4 of 4



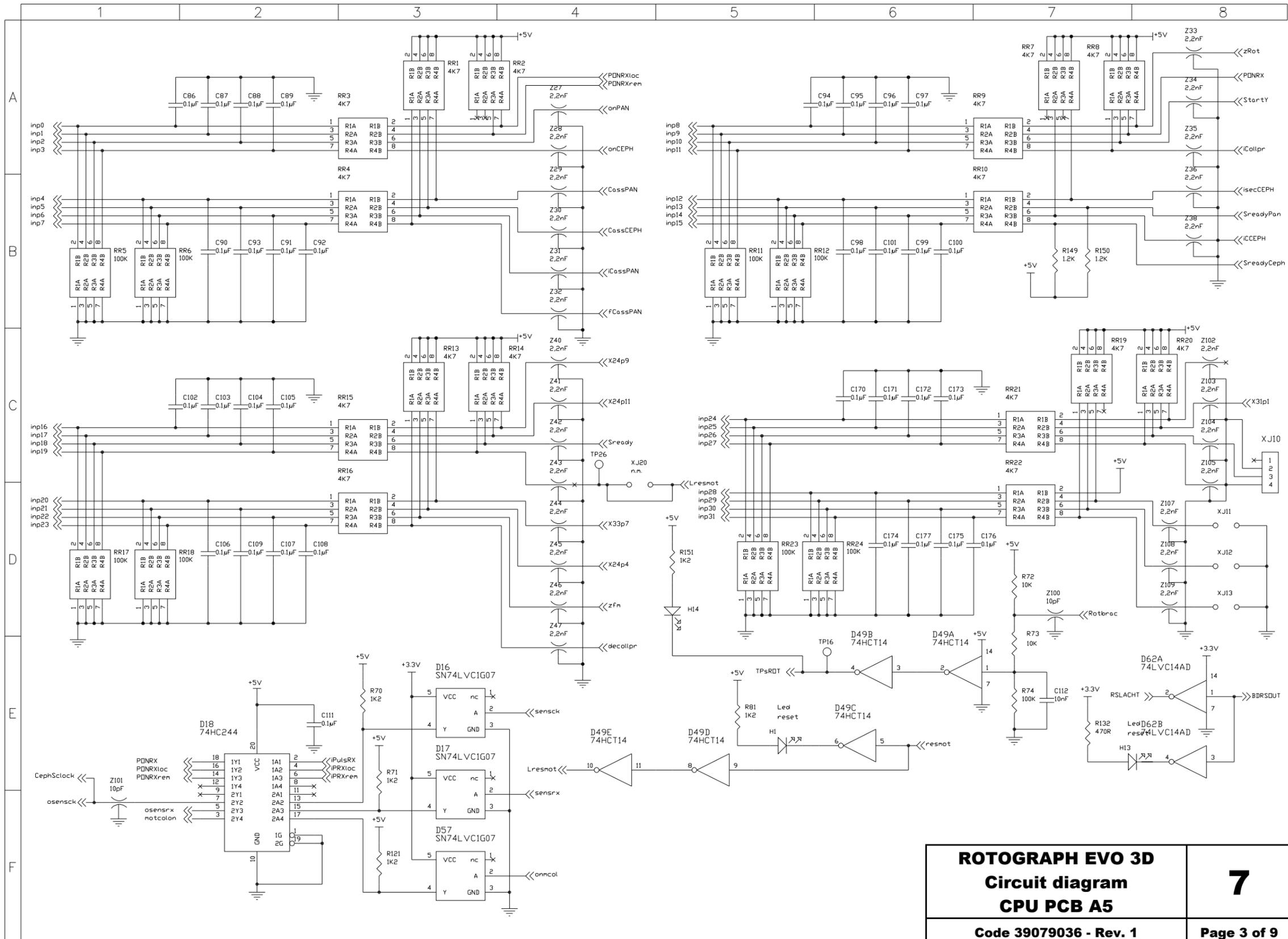
ROTOGRAPH EVO 3D Lay-Out CPU PCB A5	6
Code 58073033 - Rev. 2	Page 1 of 1



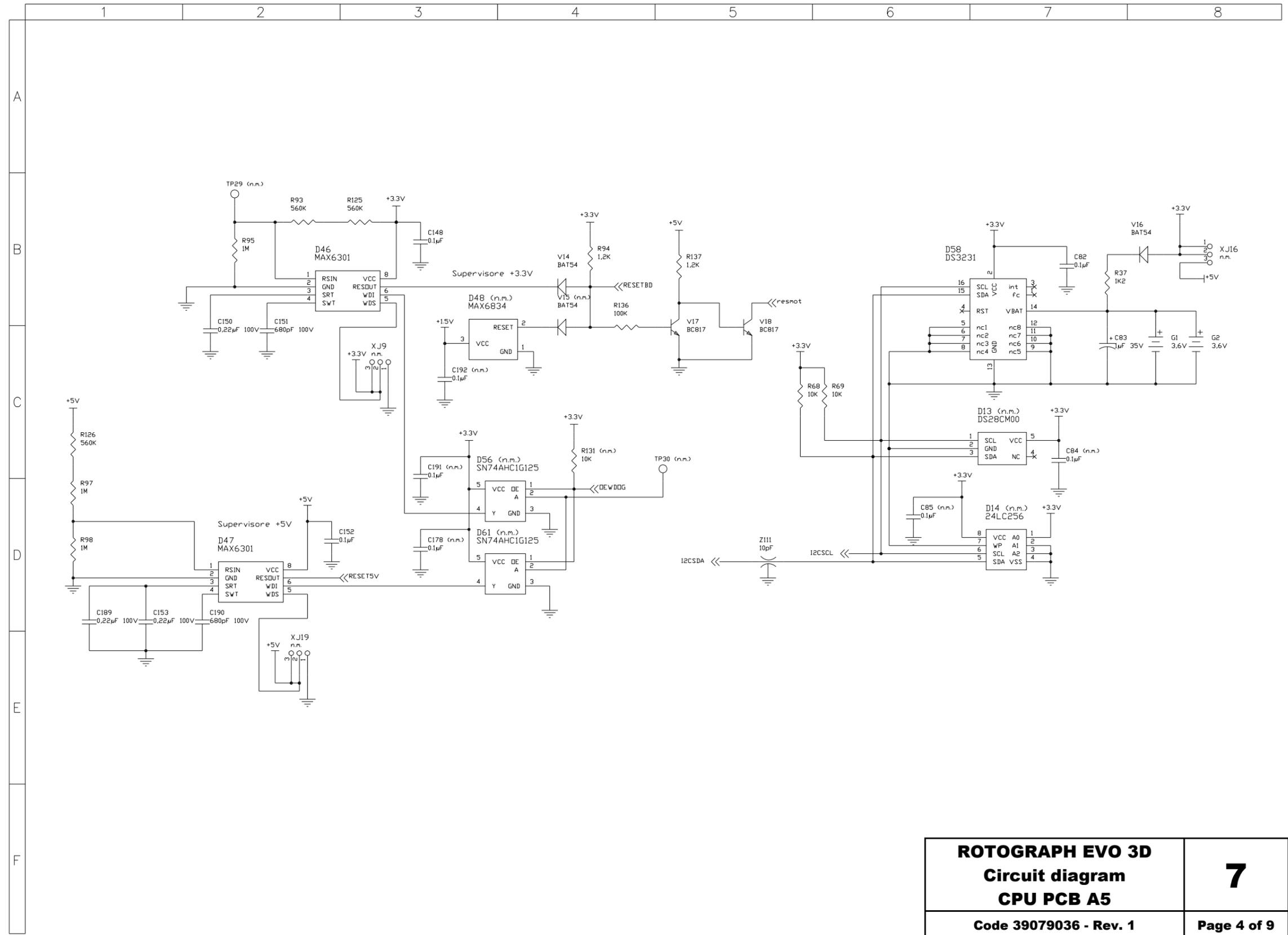
ROTOGRAPH EVO 3D Circuit diagram CPU PCB A5	7
Code 39079036 - Rev. 1	Page 1 of 9



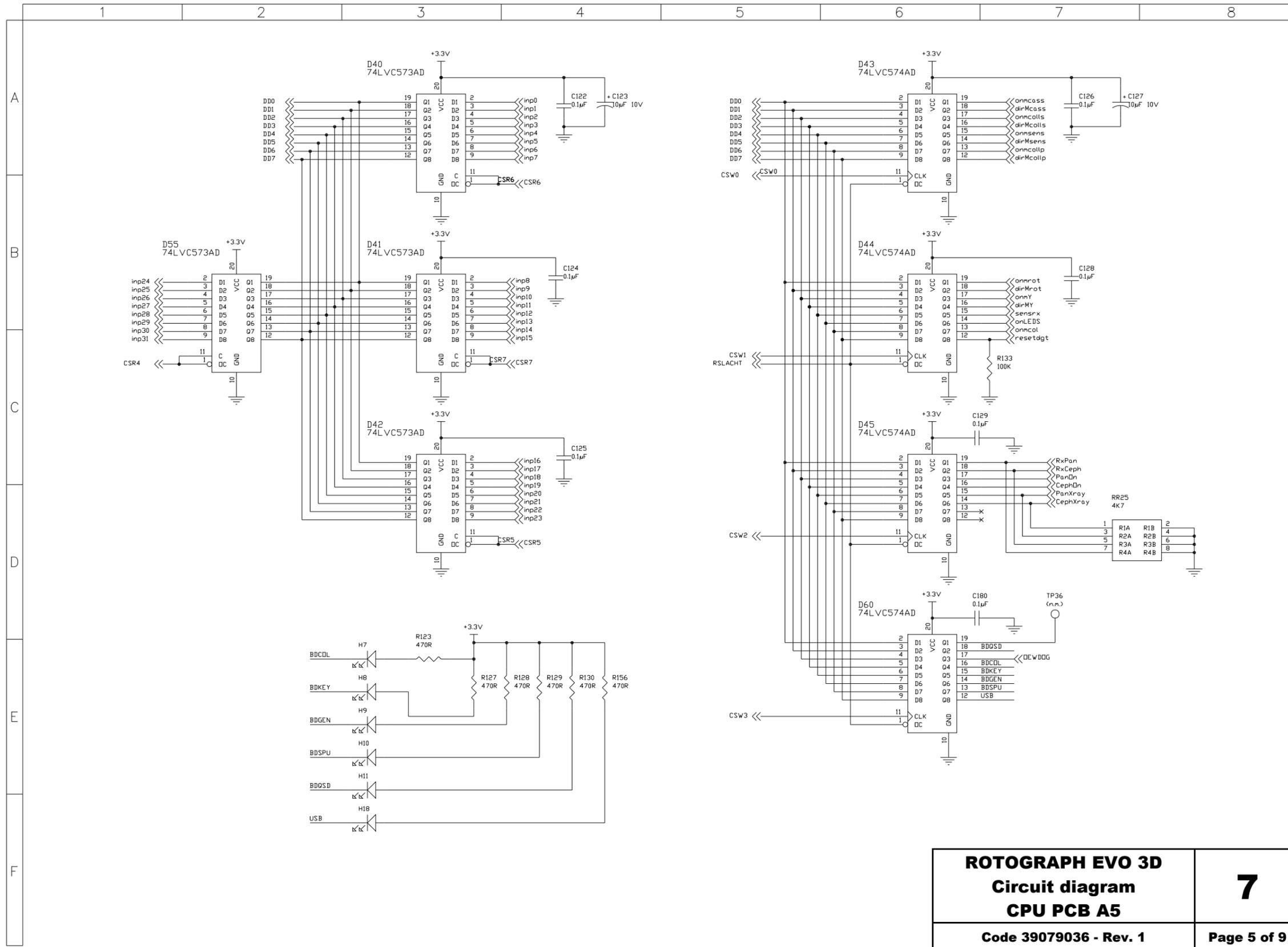
ROTOGRAPH EVO 3D Circuit diagram CPU PCB A5 Code 39079036 - Rev. 1	7 Page 2 of 9
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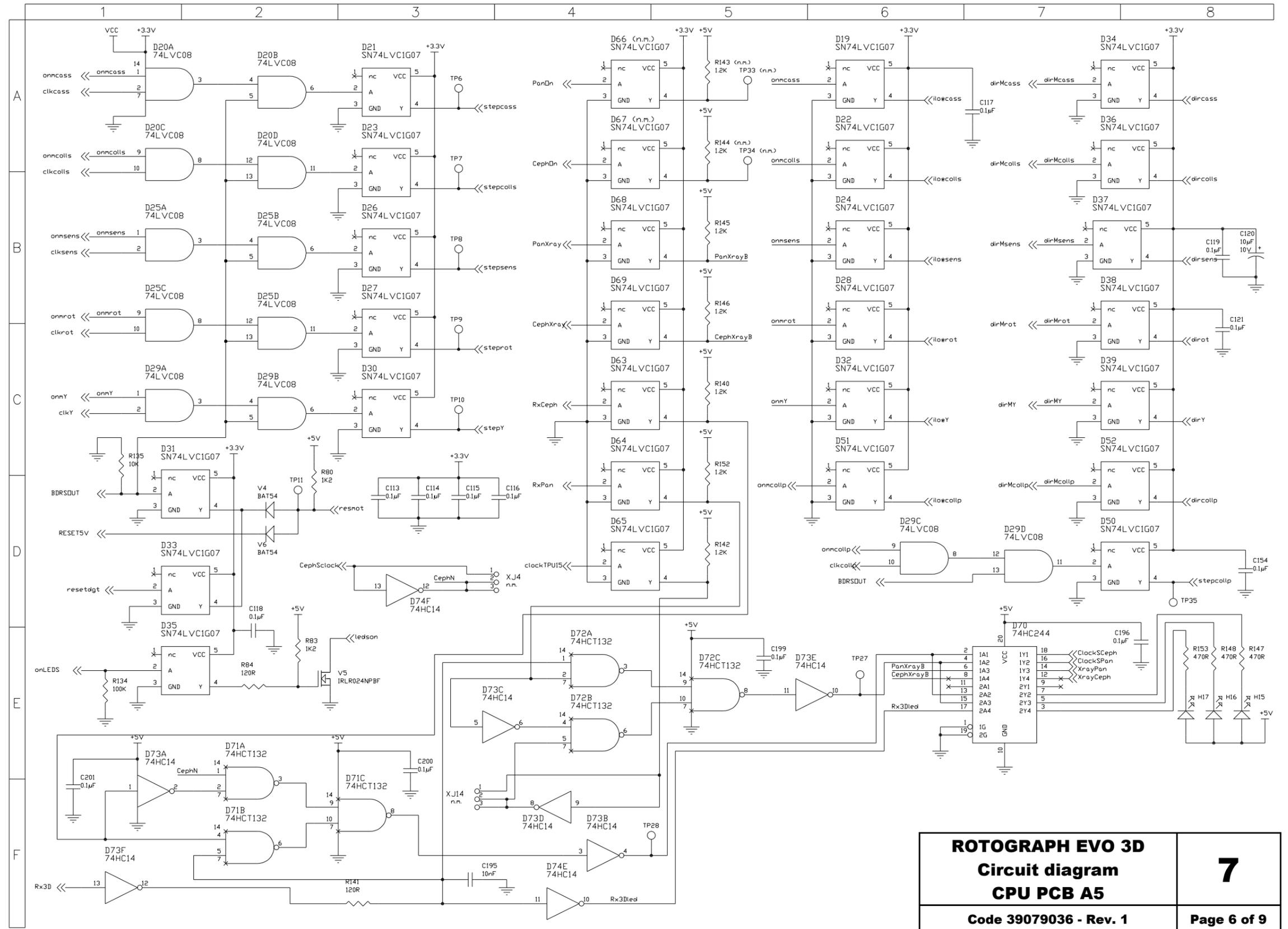
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Circuit diagram	
CPU PCB A5	
Code 39079036 - Rev. 1	7 Page 3 of 9



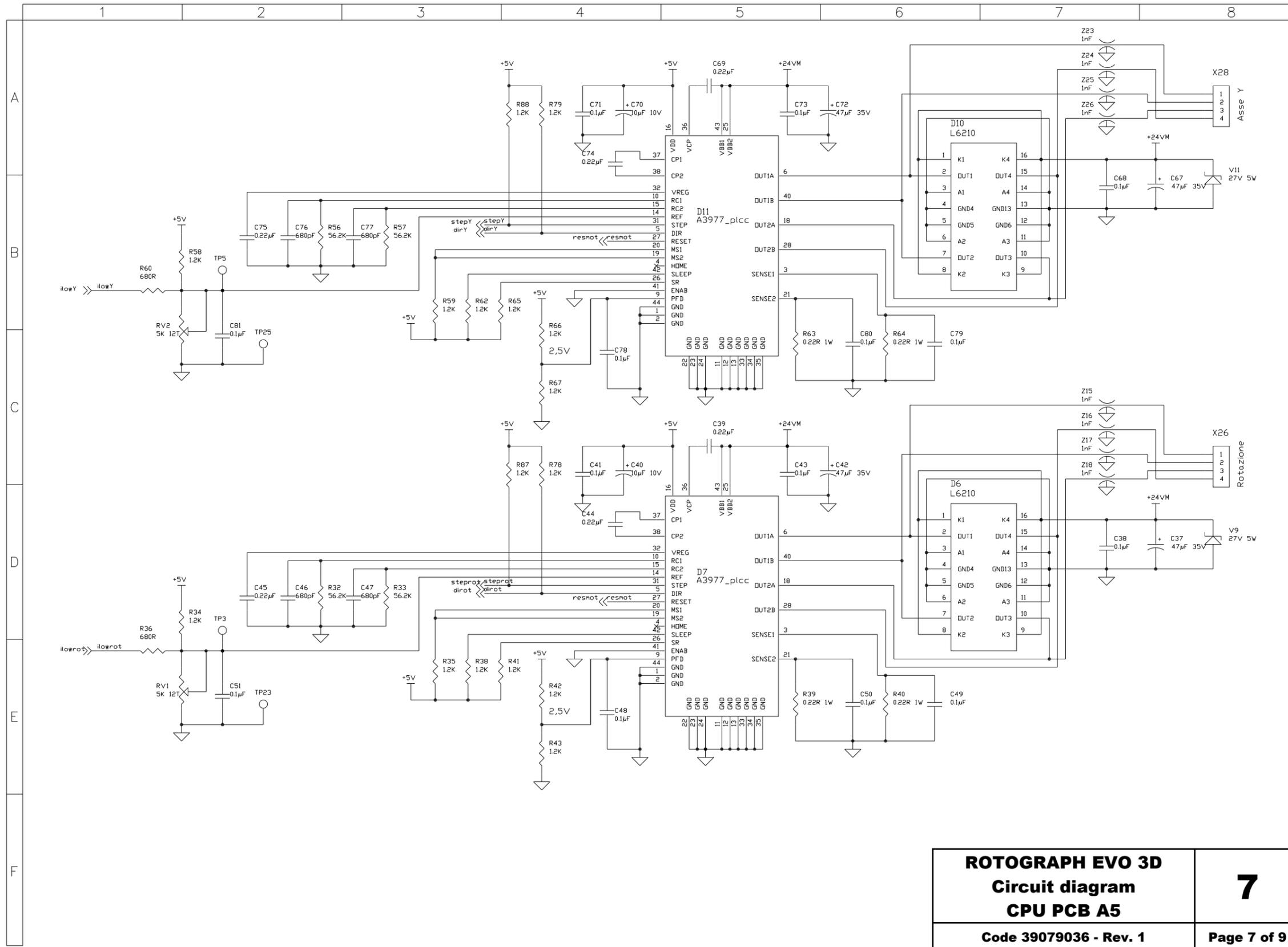
ROTOGRAPH EVO 3D Circuit diagram CPU PCB A5	7
Code 39079036 - Rev. 1	Page 4 of 9



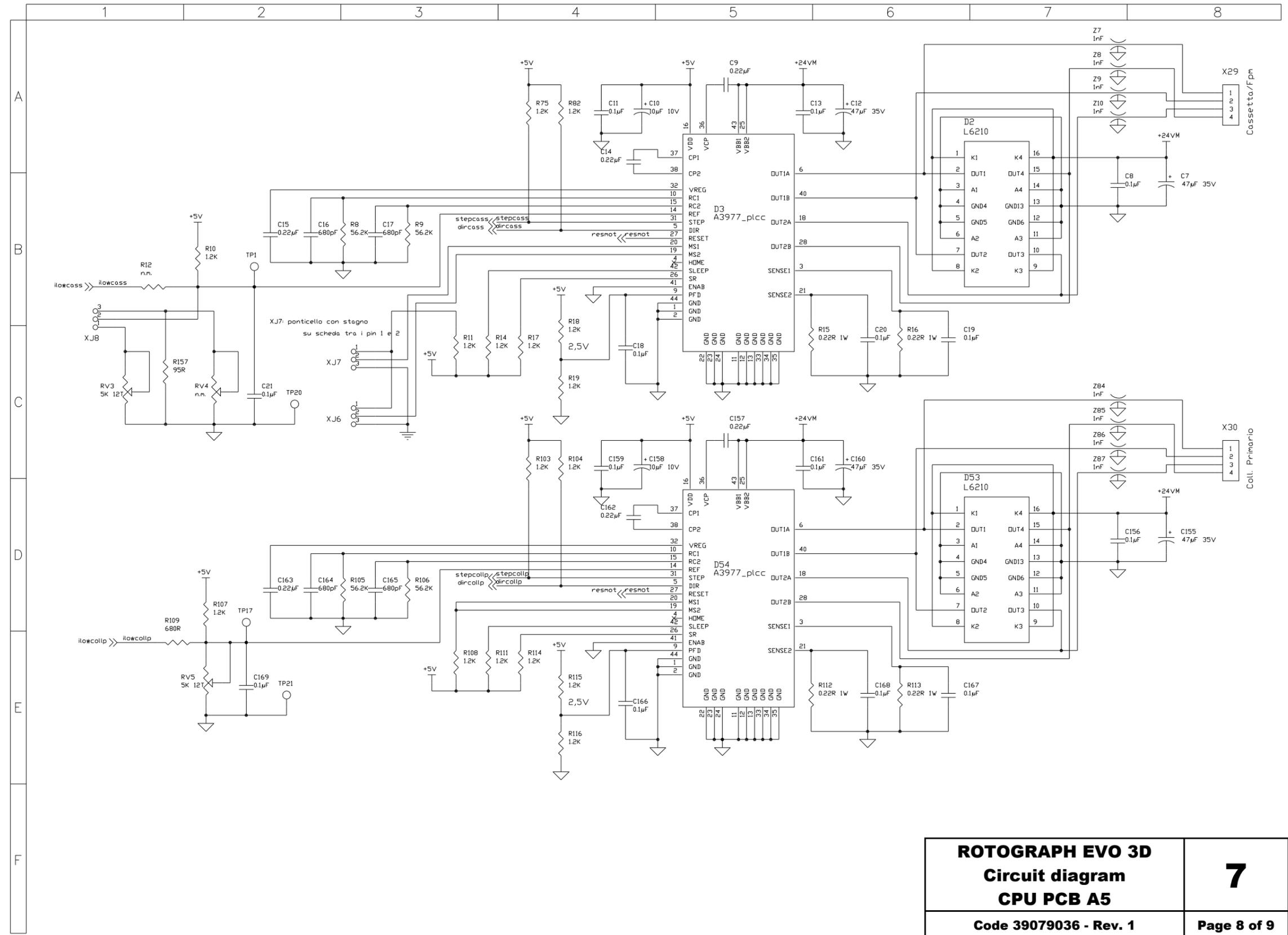
ROTOGRAPH EVO 3D Circuit diagram CPU PCB A5	7
Code 39079036 - Rev. 1	Page 5 of 9



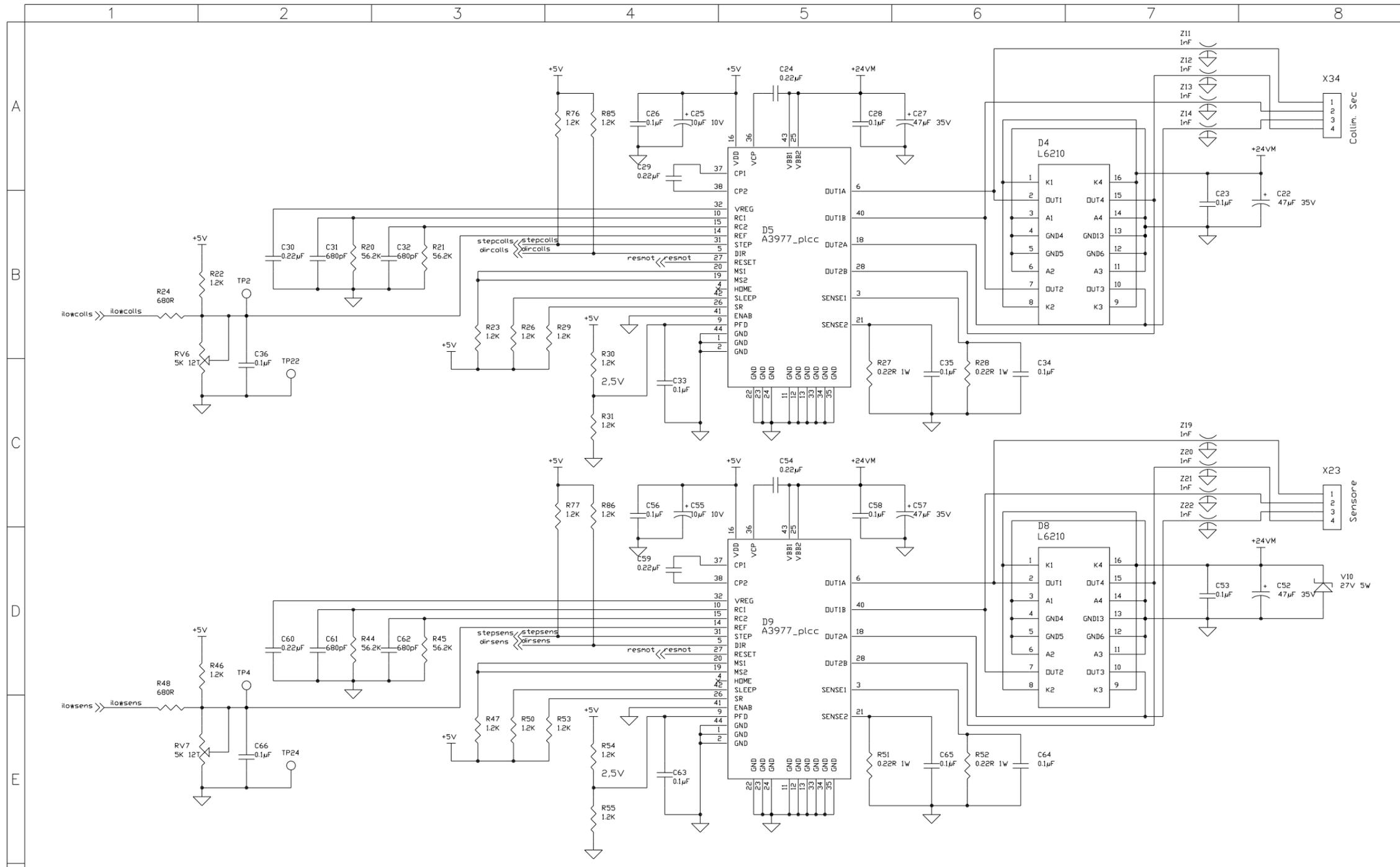
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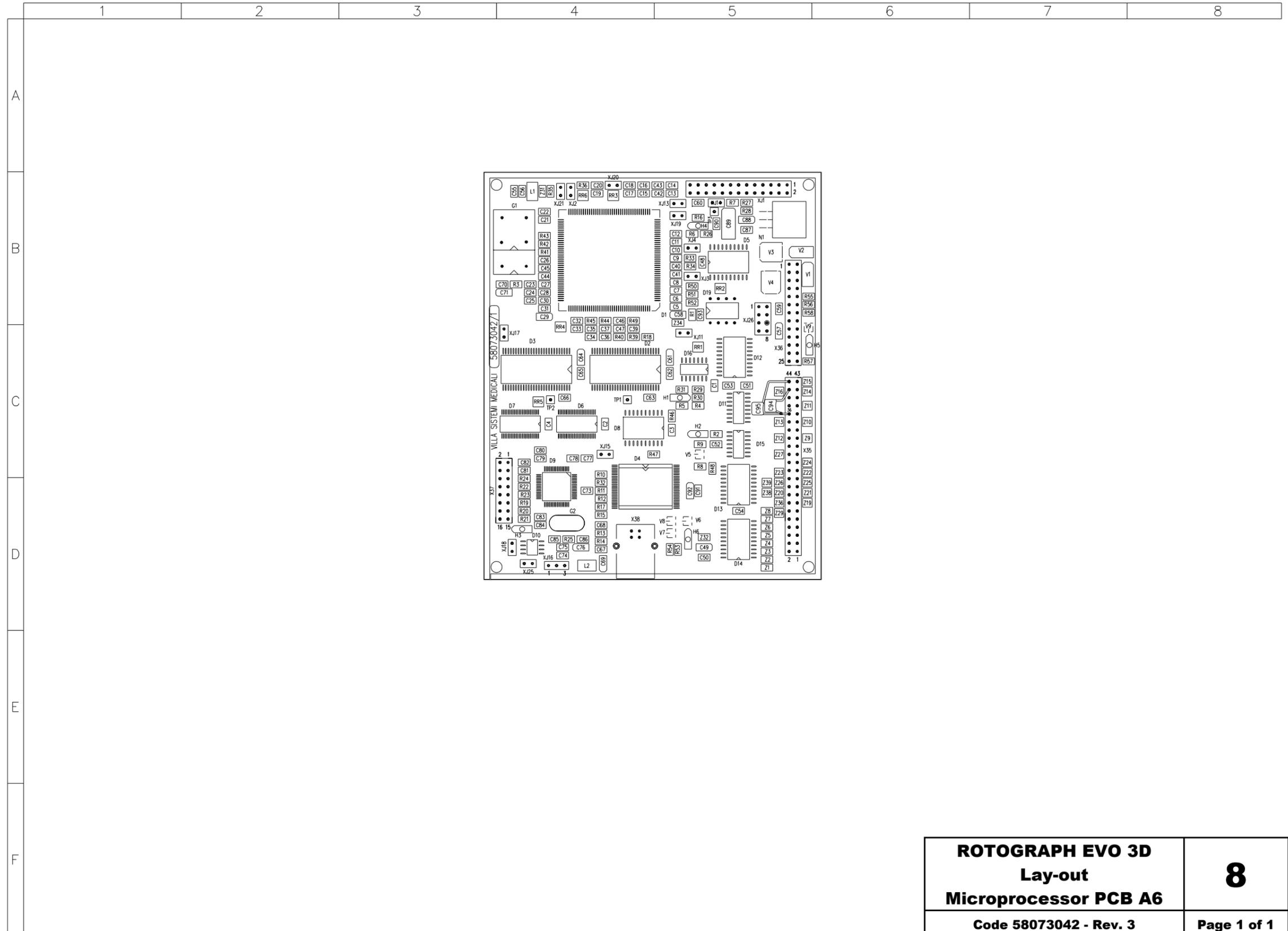
ROTOGRAPH EVO 3D Circuit diagram CPU PCB A5	7
Code 39079036 - Rev. 1	Page 7 of 9

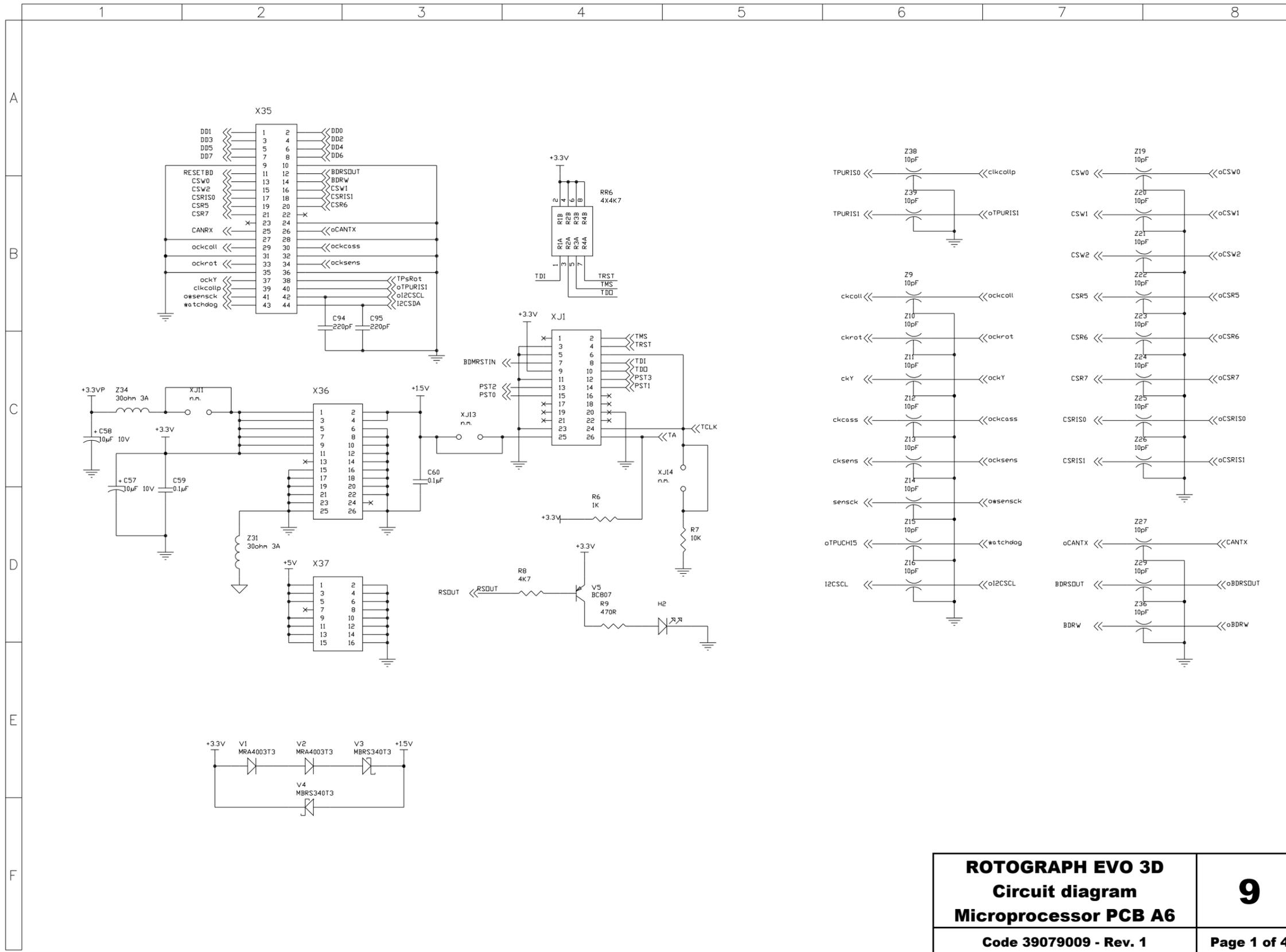


ROTOGRAPH EVO 3D	7
Circuit diagram CPU PCB A5	
Code 39079036 - Rev. 1	Page 8 of 9

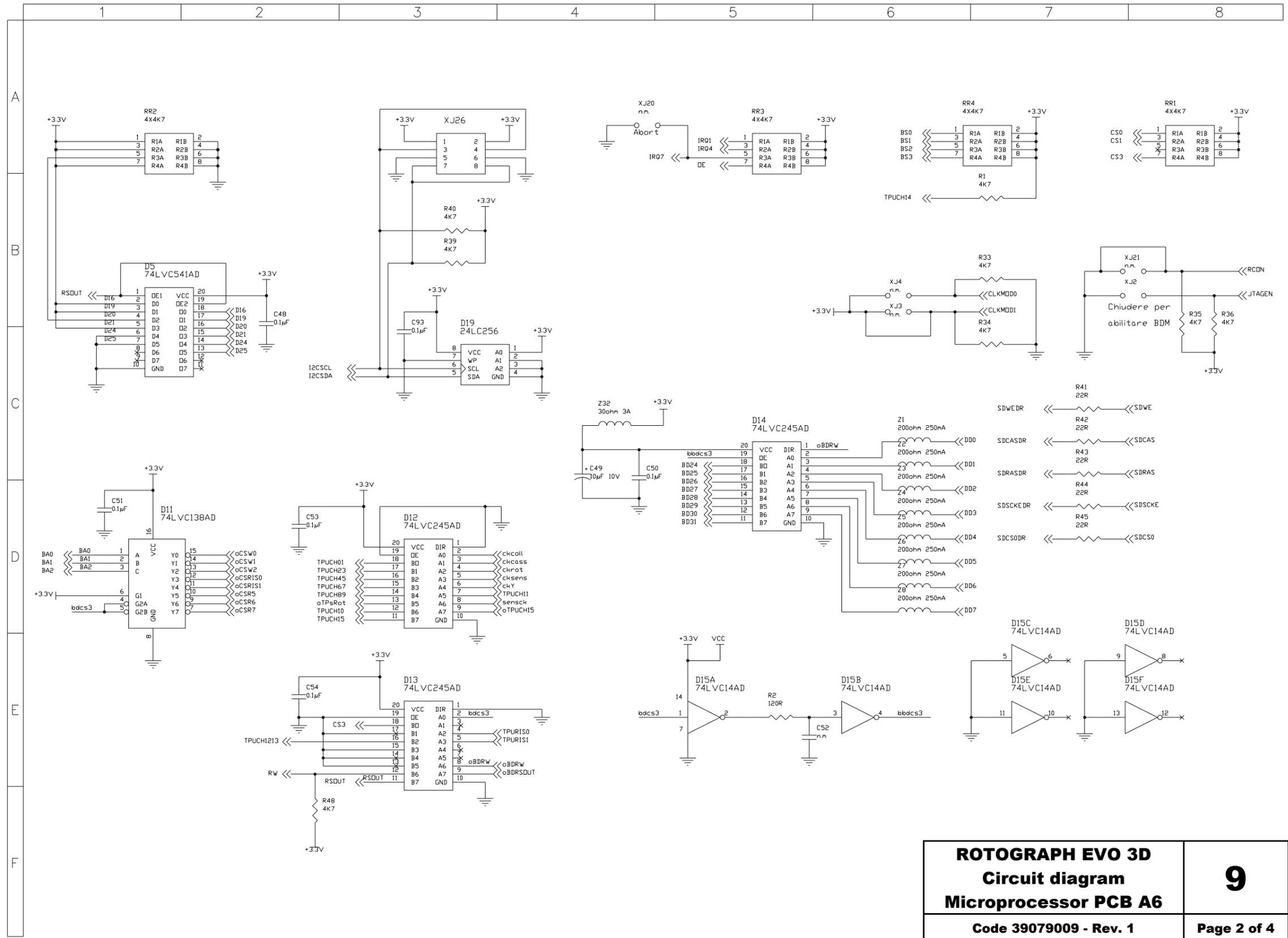


ROTOGRAPH EVO 3D Circuit diagram CPU PCB A5	7
Code 39079036 - Rev. 1	Page 9 of 9

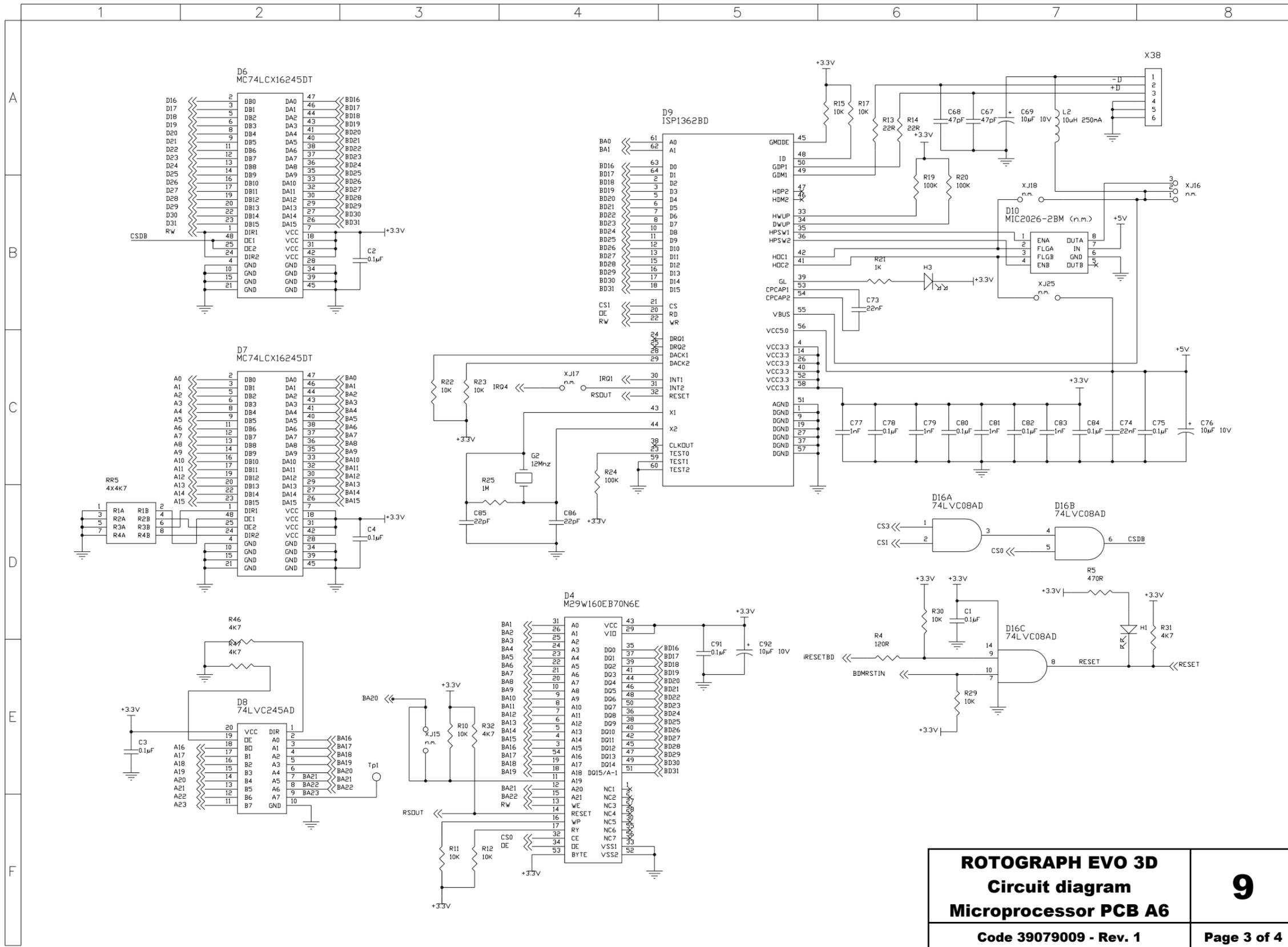




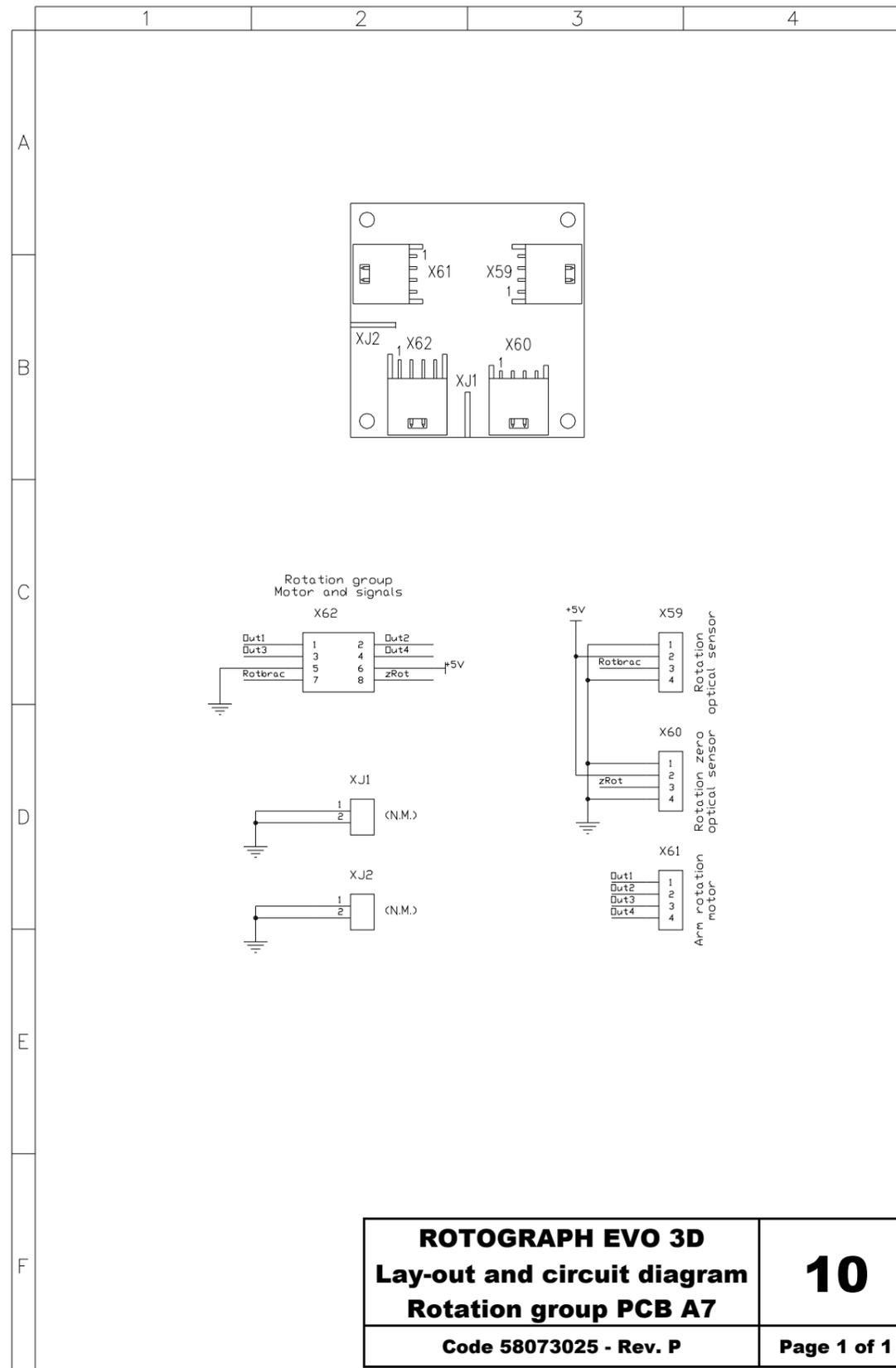
ROTOGRAPH EVO 3D Circuit diagram Microprocessor PCB A6	9
Code 39079009 - Rev. 1	Page 1 of 4

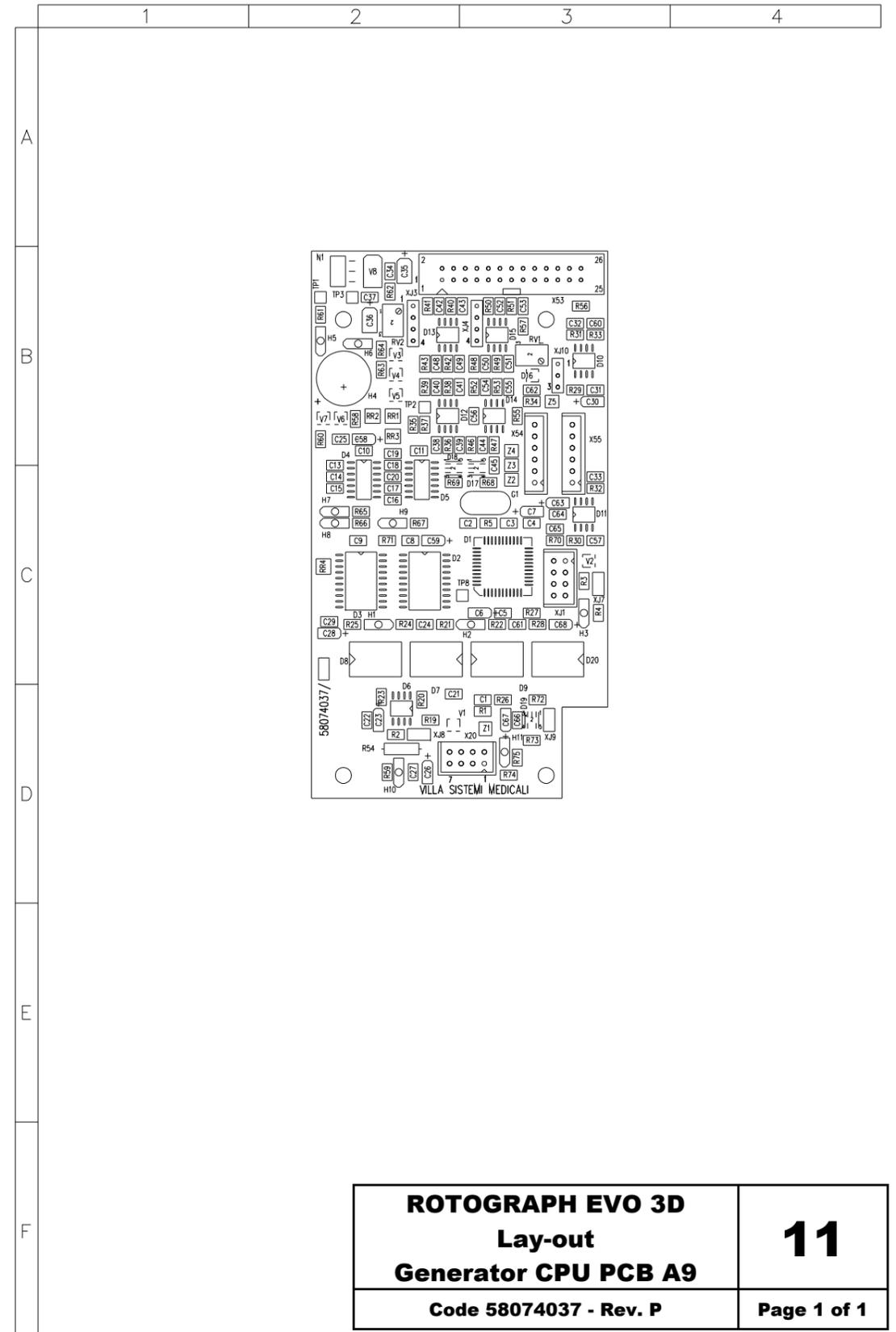


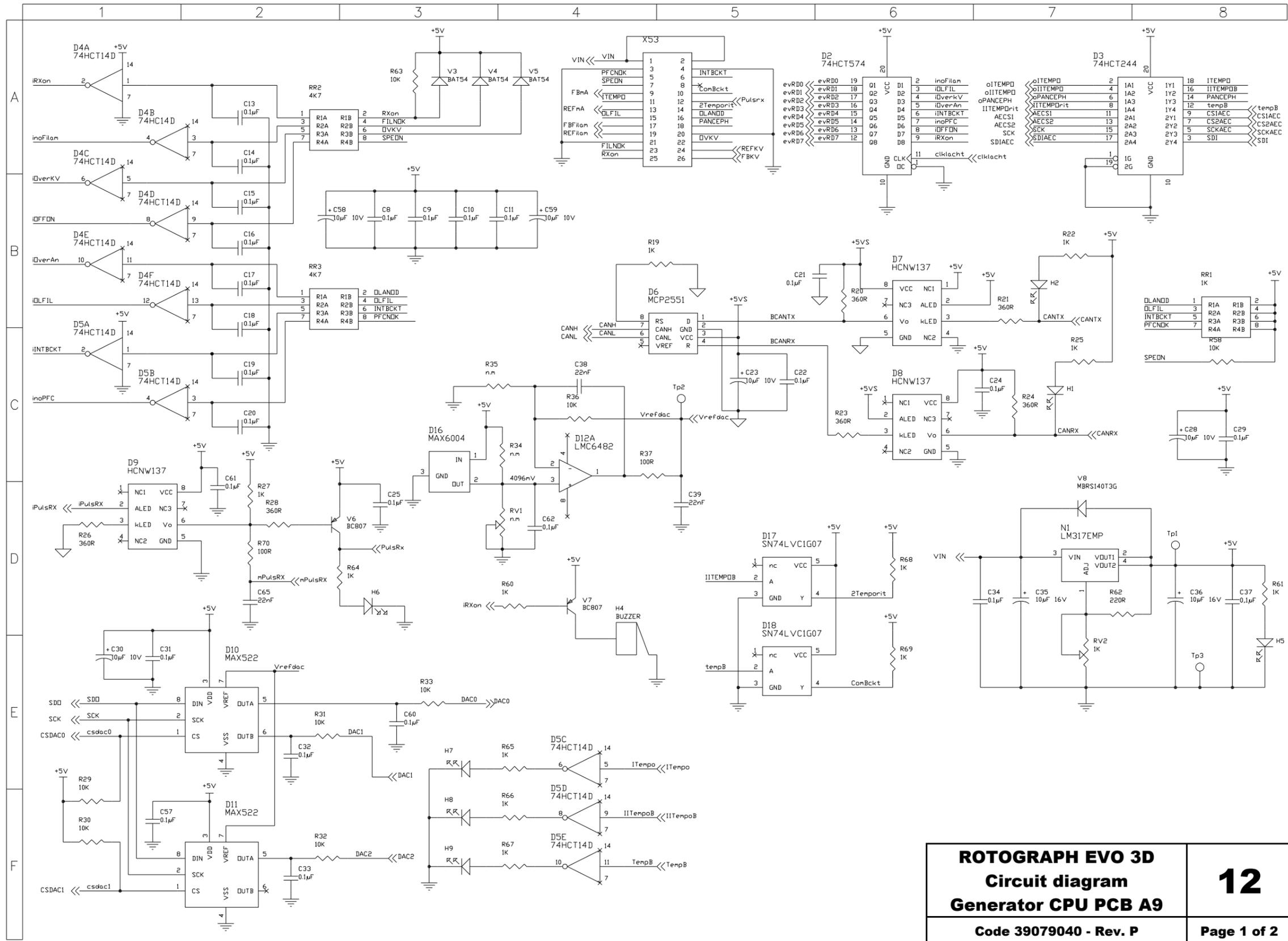
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Microprocessor PCB A6	
Code 39079009 - Rev. 1	Page 2 of 4



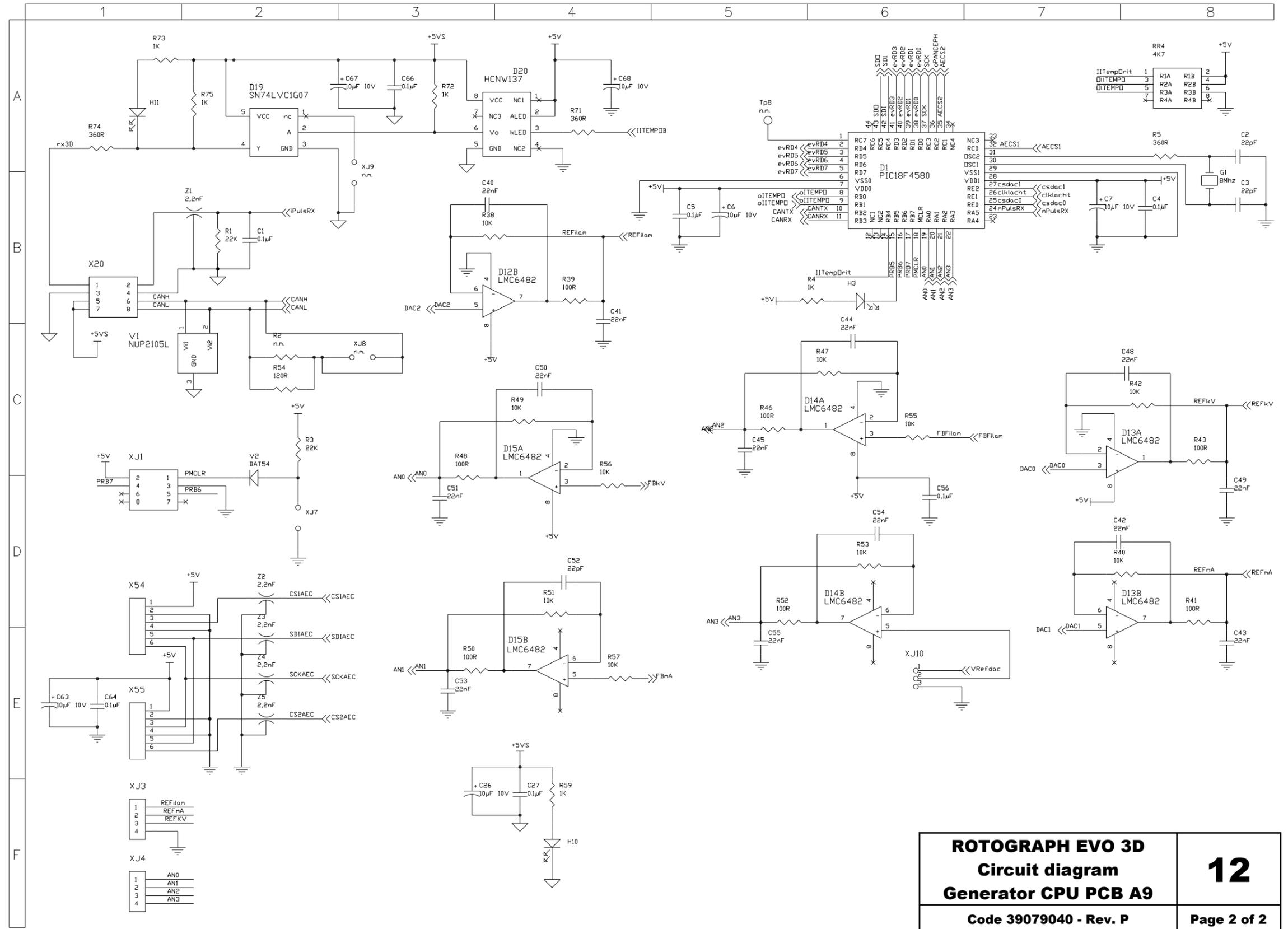
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Circuit diagram	
Microprocessor PCB A6	
Code 39079009 - Rev. 1	Page 3 of 4



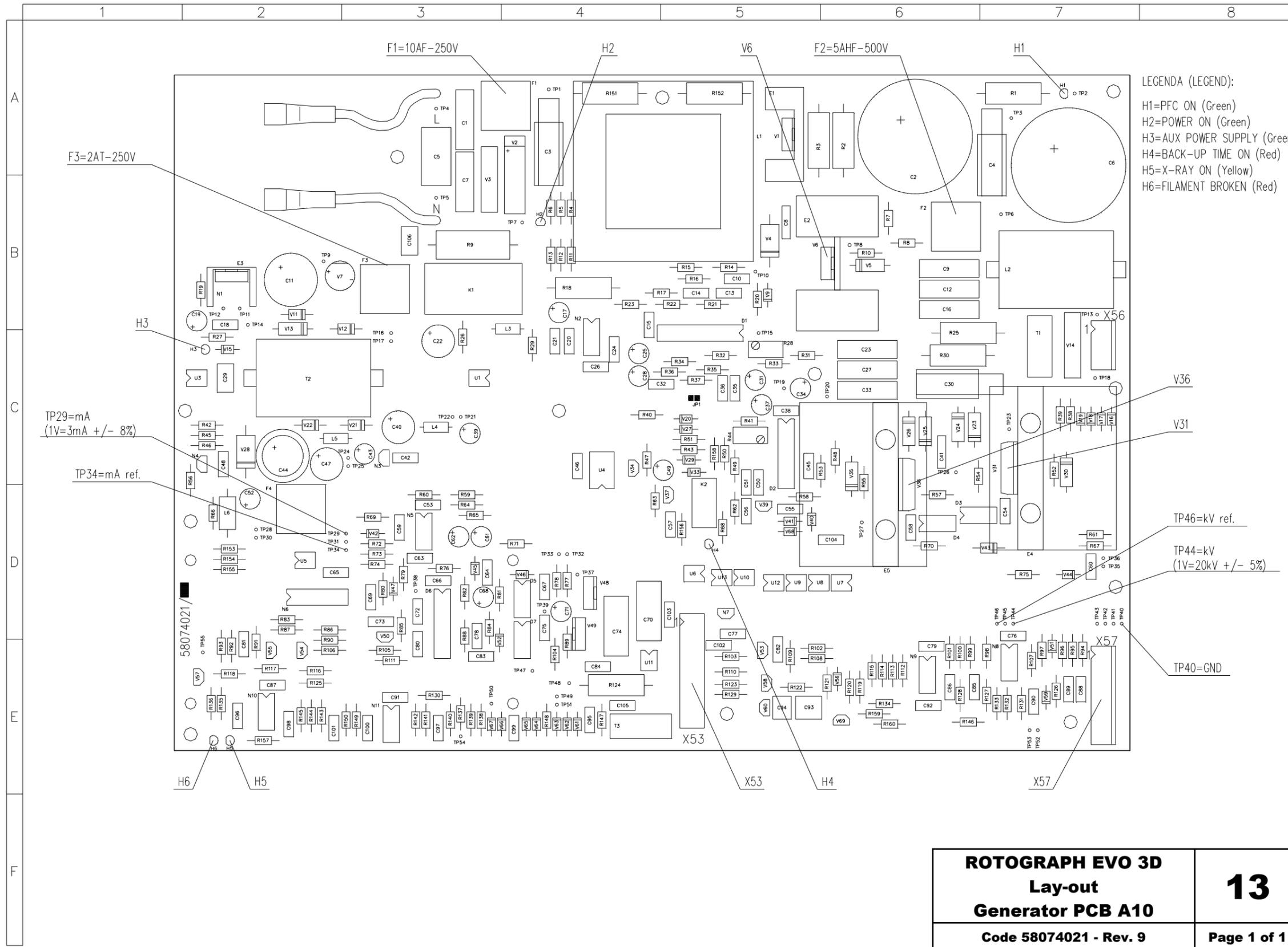




ROTOGRAPH EVO 3D	
Circuit diagram	
Generator CPU PCB A9	
Code 39079040 - Rev. P	12
	Page 1 of 2

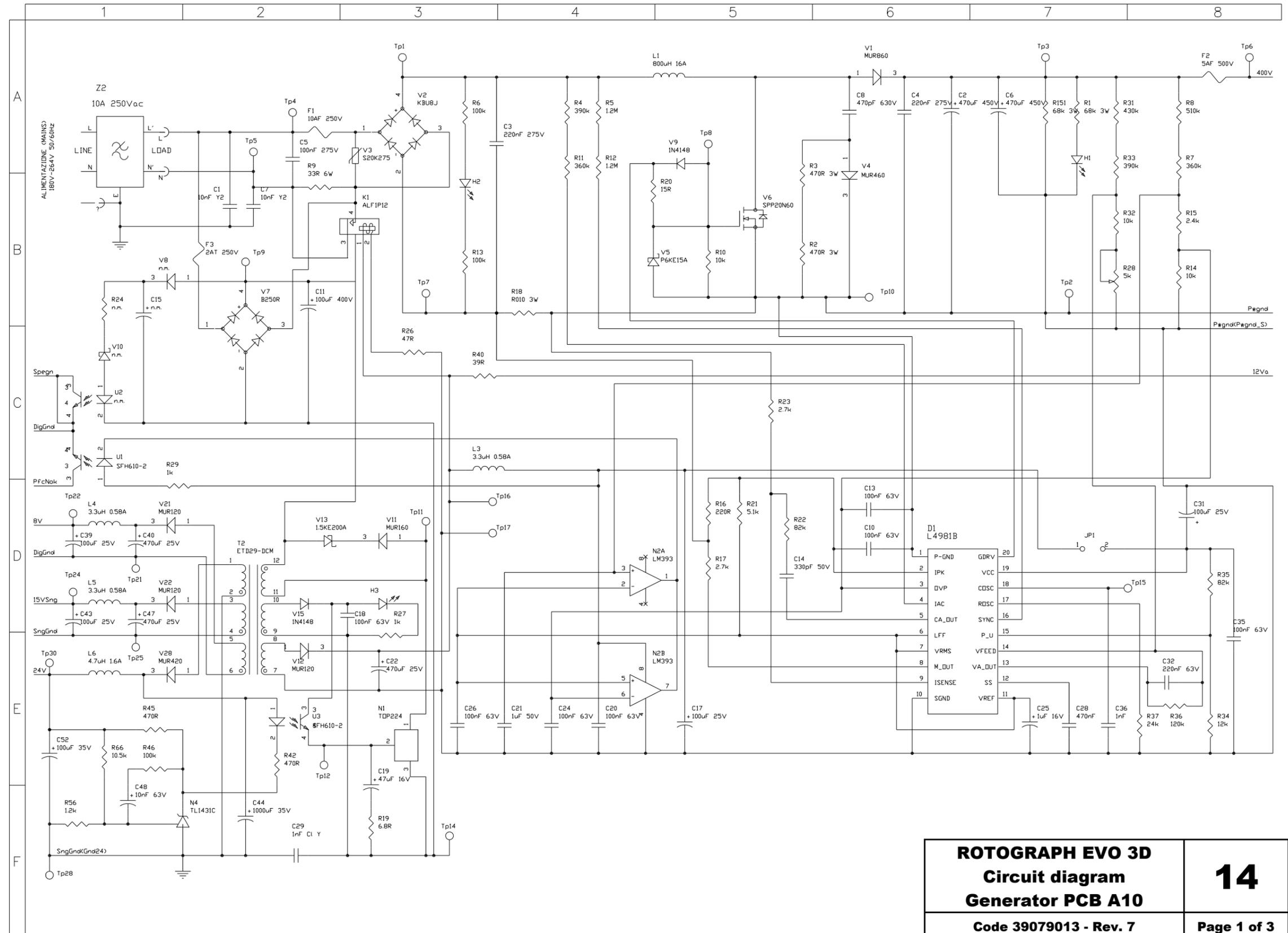


ROTOGRAPH EVO 3D		12
Circuit diagram		
Generator CPU PCB A9		Page 2 of 2
Code 39079040 - Rev. P		

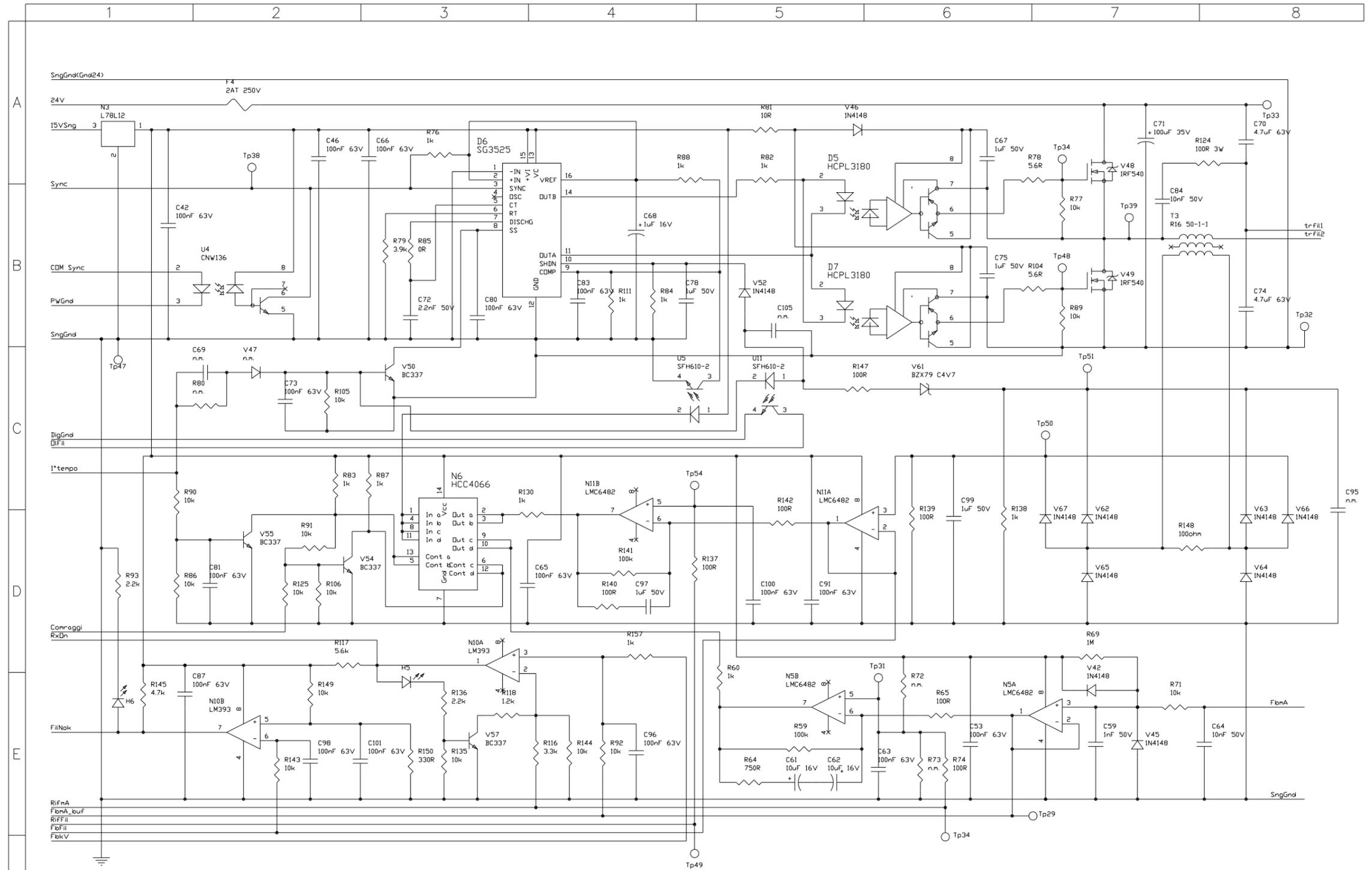


LEGENDA (LEGEND):
 H1=PFC ON (Green)
 H2=POWER ON (Green)
 H3=AUX POWER SUPPLY (Green)
 H4=BACK-UP TIME ON (Red)
 H5=X-RAY ON (Yellow)
 H6=FILAMENT BROKEN (Red)

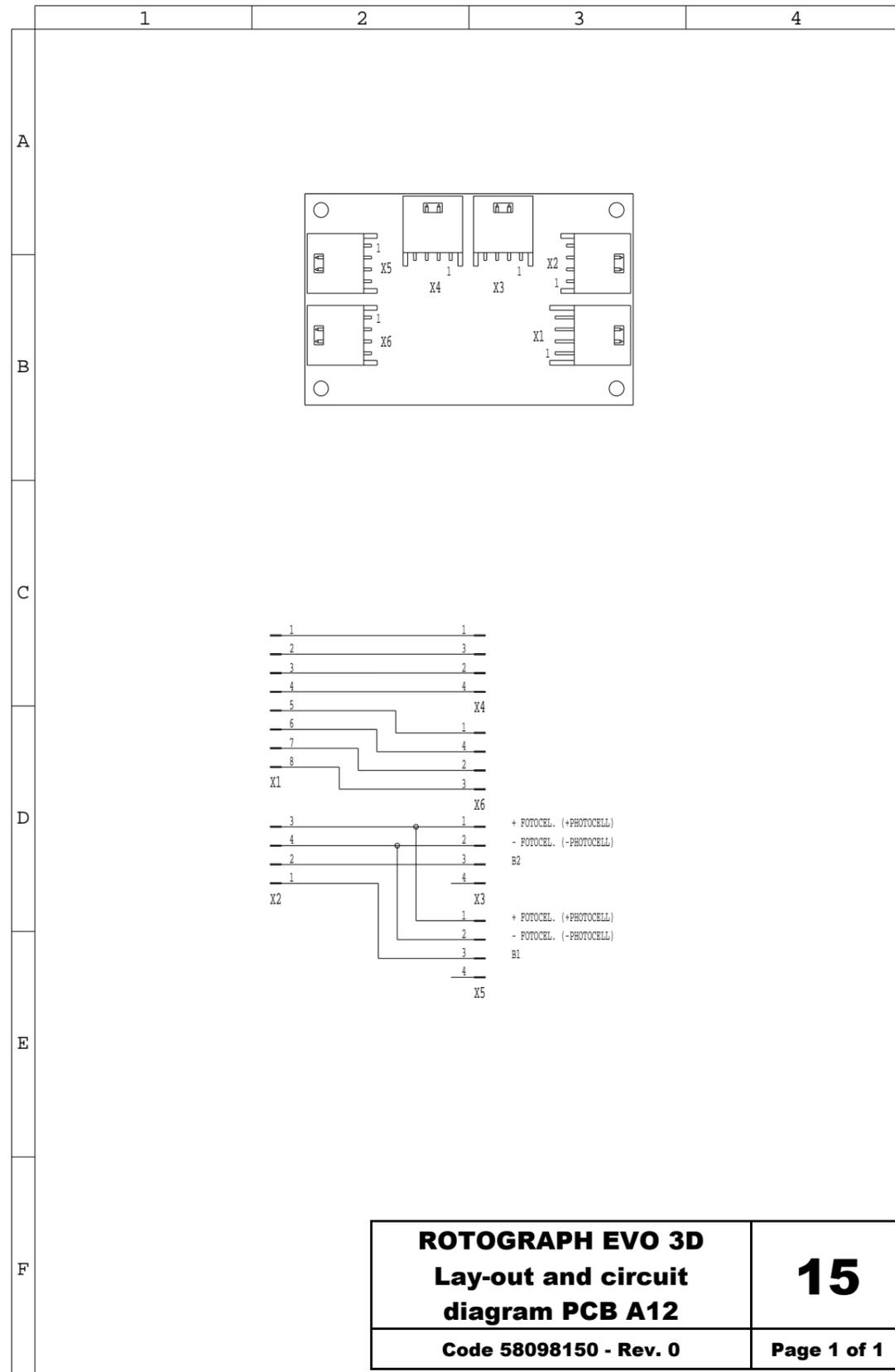
<p>ROTOGRAPH EVO 3D Lay-out Generator PCB A10</p>	<p>13</p>
<p>Code 58074021 - Rev. 9</p>	<p>Page 1 of 1</p>

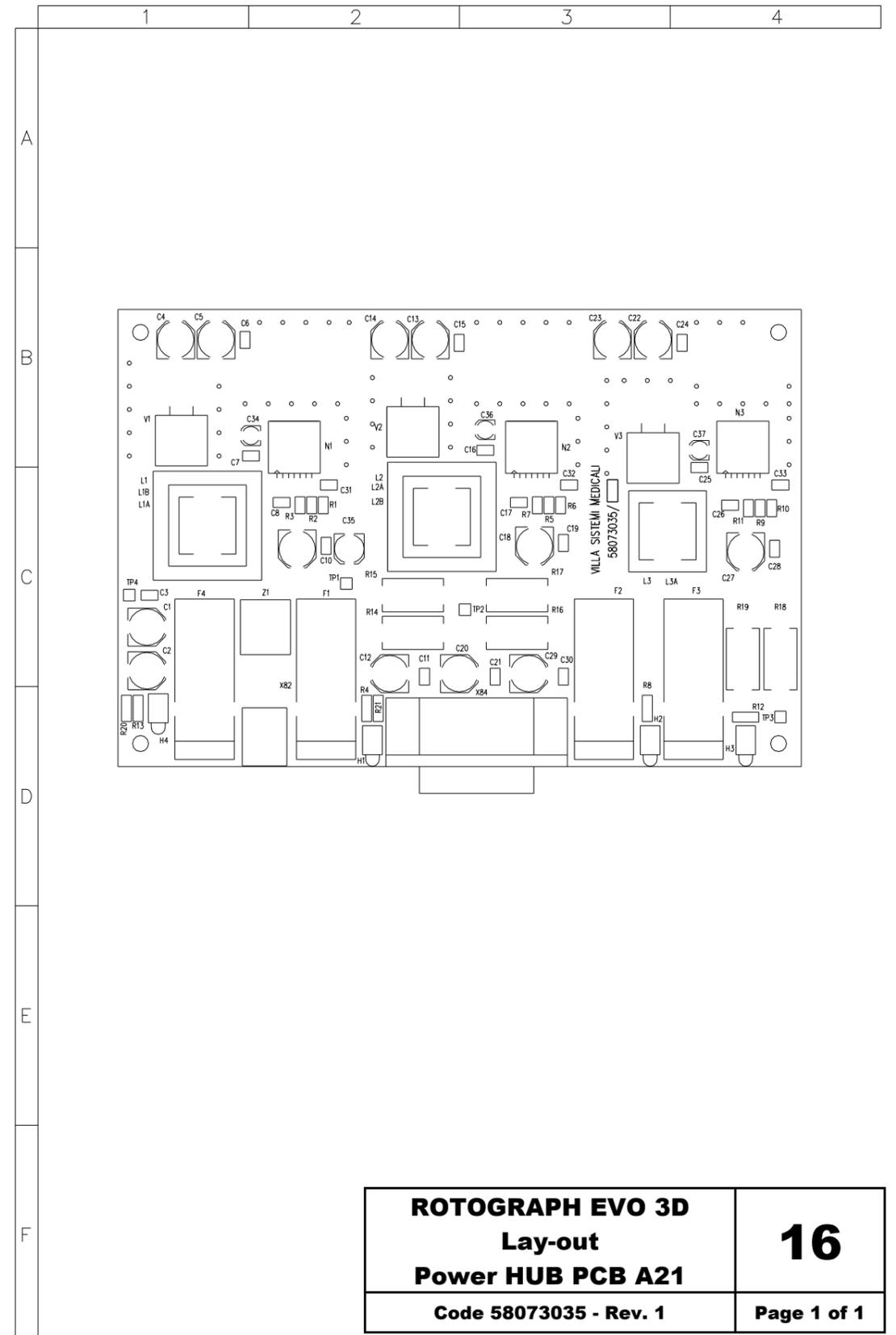


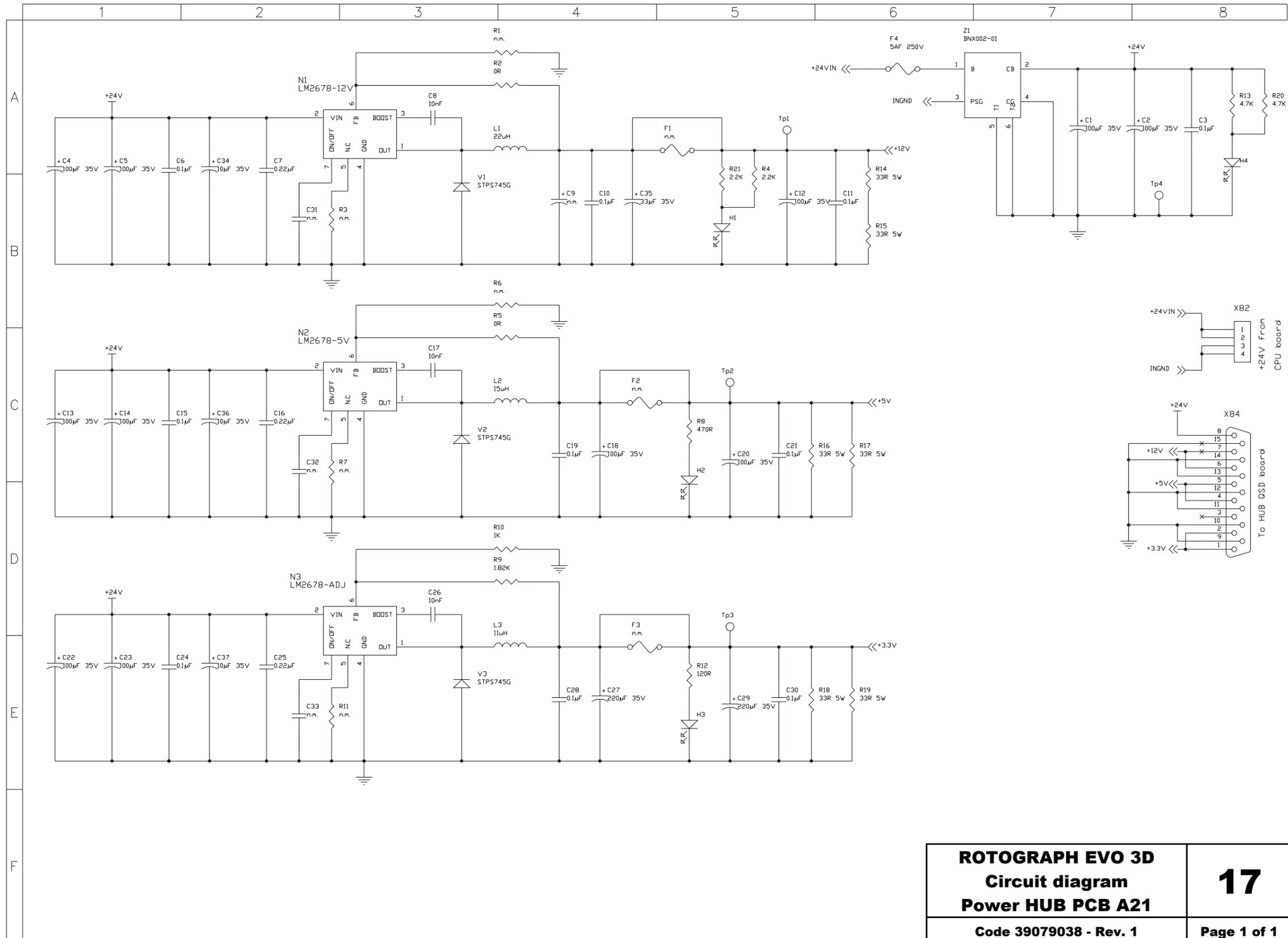
ROTOGRAPH EVO 3D	
Circuit diagram	
Generator PCB A10	
Code 39079013 - Rev. 7	14
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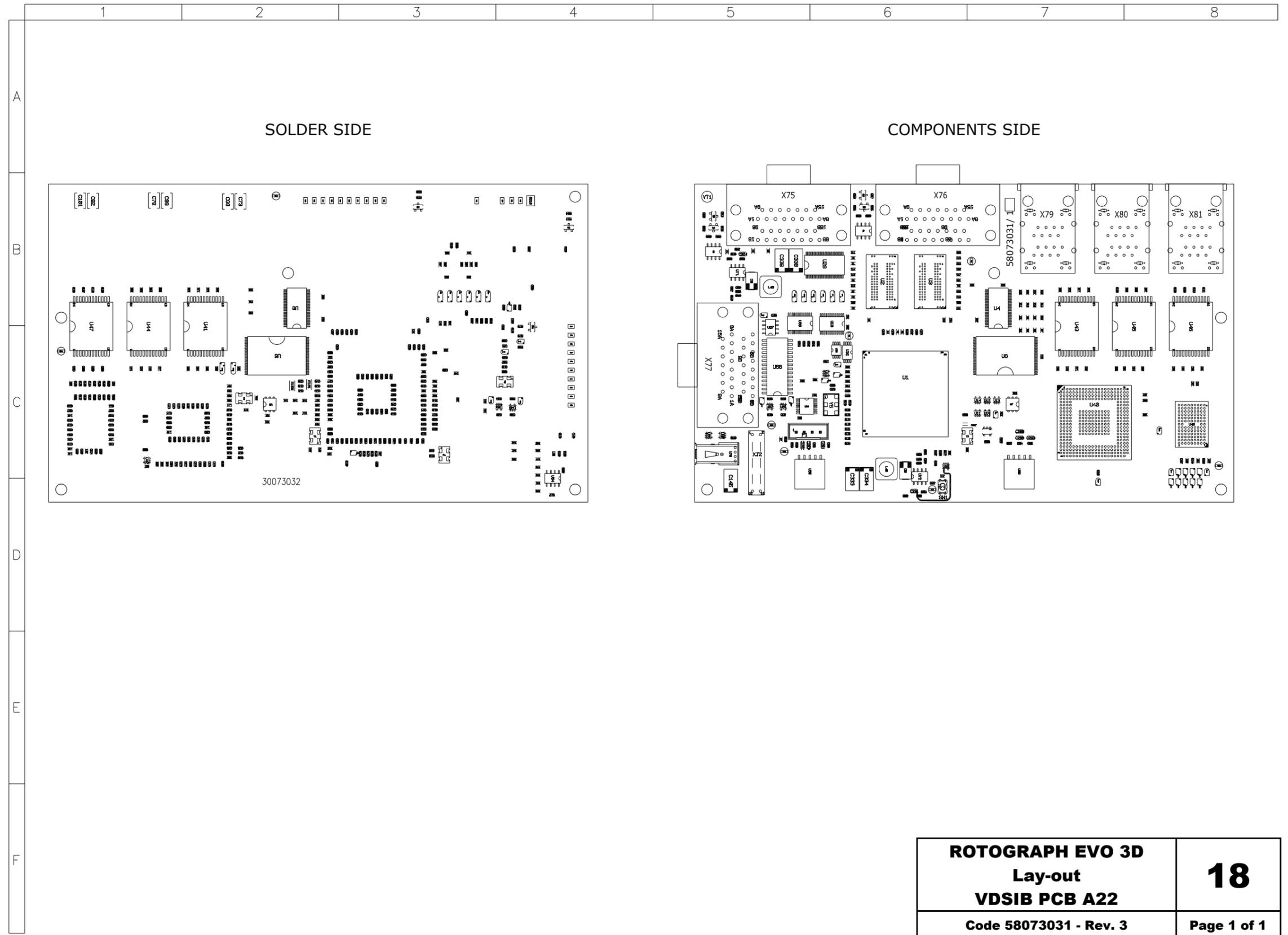
ROTOGRAPH EVO 3D Circuit diagram Generator PCB A10	14
Code 39079013 - Rev. 7	Page 3 of 3







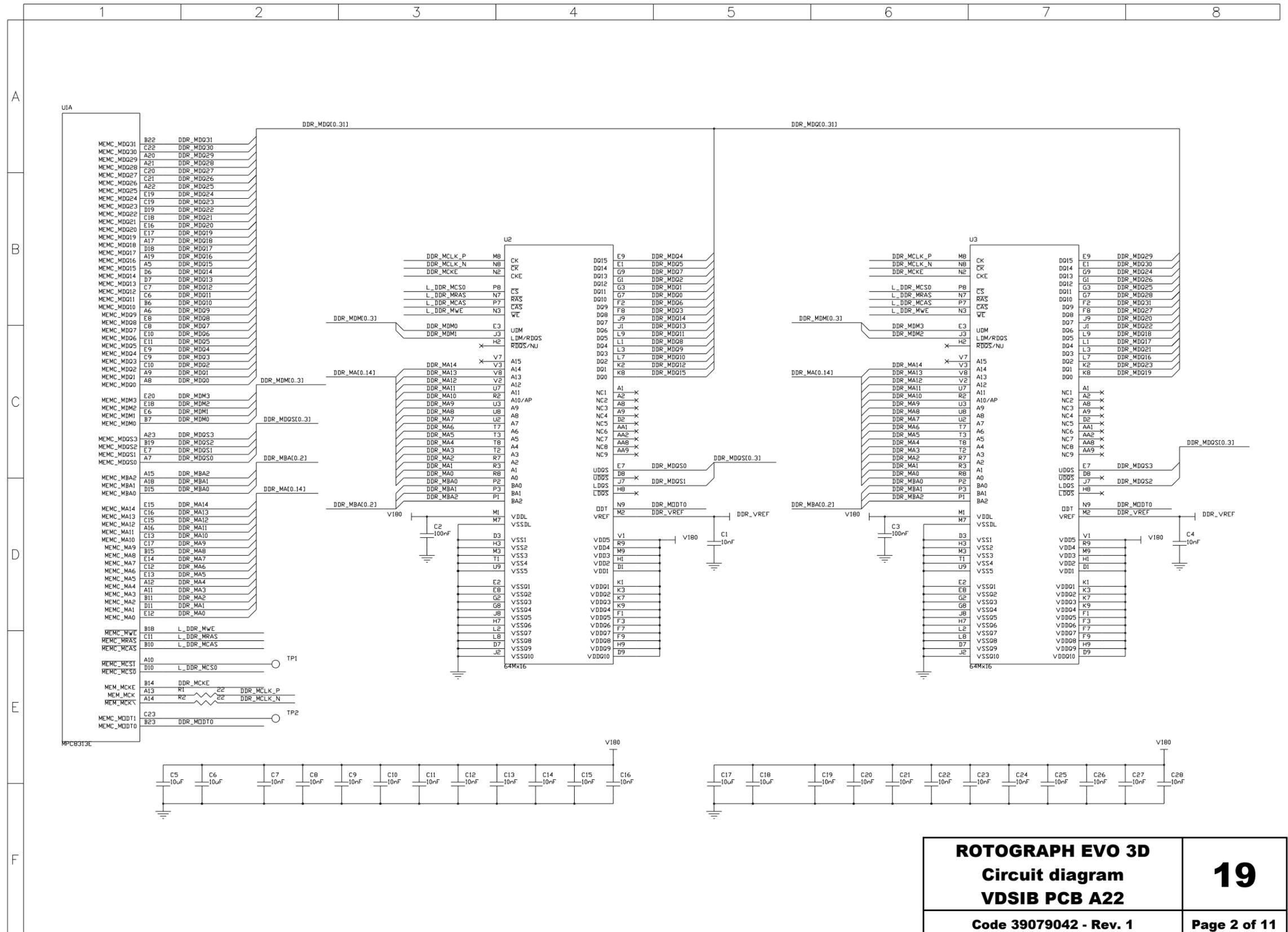
<p>ROTOGRAPH EVO 3D Circuit diagram Power HUB PCB A21</p>	<p>17</p>
<p>Code 39079038 - Rev. 1</p>	<p>Page 1 of 1</p>



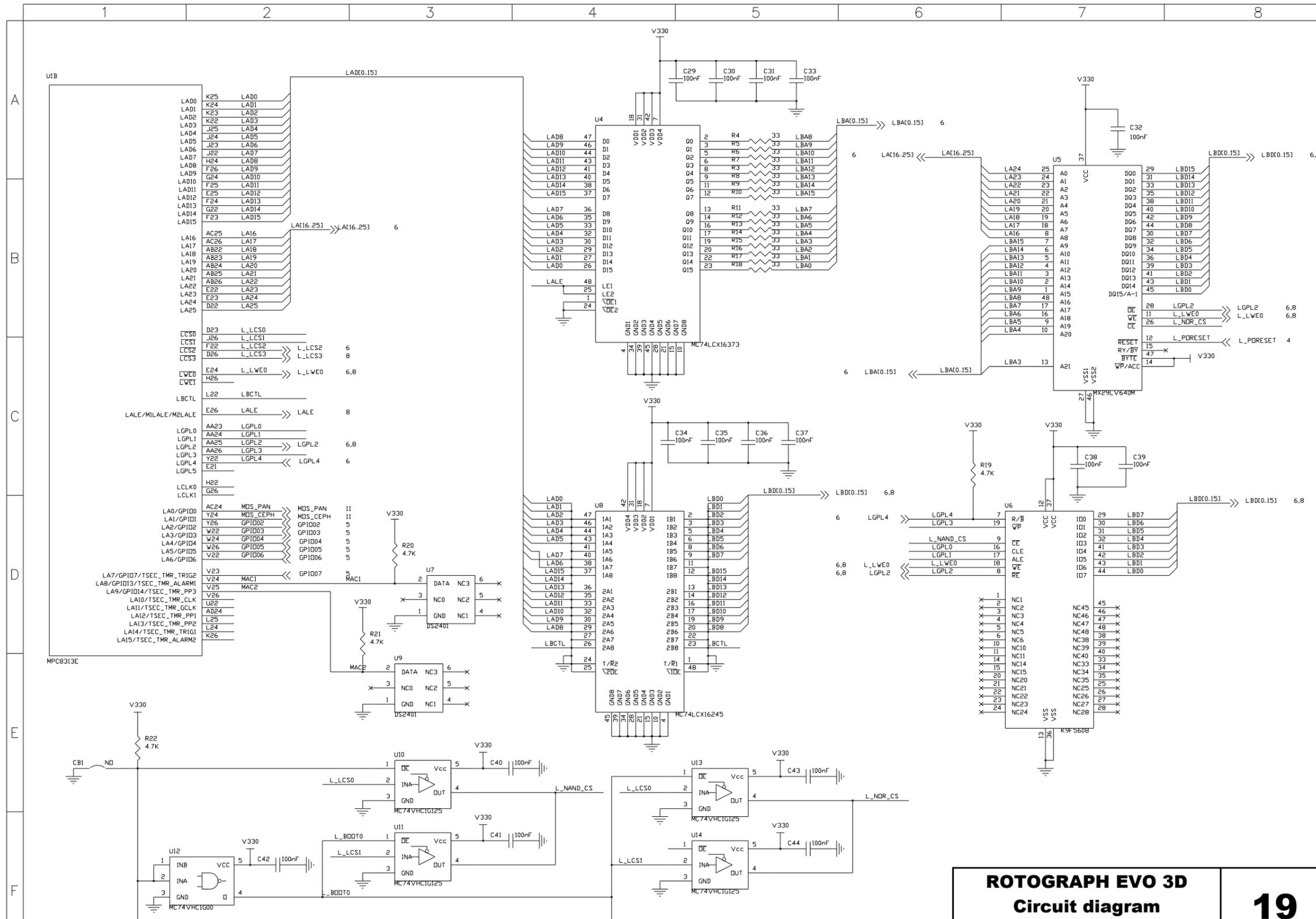
ROTOGRAPH EVO 3D	18
Lay-out VDSIB PCB A22	
Code 58073031 - Rev. 3	Page 1 of 1

	1	2	3	4	5	6	7	8
A								
B	<p>Index:</p> <p>Page1 - Cover page Page2 - DDR2 Page3 - Flash Page4 - Clock, JTAG, Reset, IRQ Page5 - I/O, RS-232, IIC Page6 - Ethernet_WAN Page7 - Ethernet_LAN Page8 - CAN, USB, PCI Page9 - Power WAN Page10 - Power CPU Page11 - Power Supply</p>				<p>Interrupts:</p> <p>IRQ0: CAN, IIC IRQ1: SMAG_PAN IRQ2: SMAG_CEPH IRQ3: Ethernet_WAN IRQ4: Ethernet_LAN</p>			
C					<p>Chip selects:</p> <p>CS0: Flash memory (AND, NOR) CS1: Flash memory (AND, NOR) CS2: Ethernet_WAN CS3: CAN</p>			
D	<p>Power supply:</p> <p>V2400: 24V IN V1200: 12V IN V500: 5V USB V330: 3.3V USB, Flash, CPU, Ethernet_WAN, Ethernet_LAN, IIC, RS232, CAN V250: 2.5V CPU, Ethernet_WAN, Ethernet_LAN V180: 1.8V CPU, DDR2 V120: 1.2V Ethernet_WAN, Ethernet_LAN V100: 1.0V CPU core</p>							
E								
F								

<p>ROTOGRAPH EVO 3D Circuit diagram VDSIB PCB A22</p>	<p>19</p>
<p>Code 39079042 - Rev. 1</p>	<p>Page 1 of 11</p>



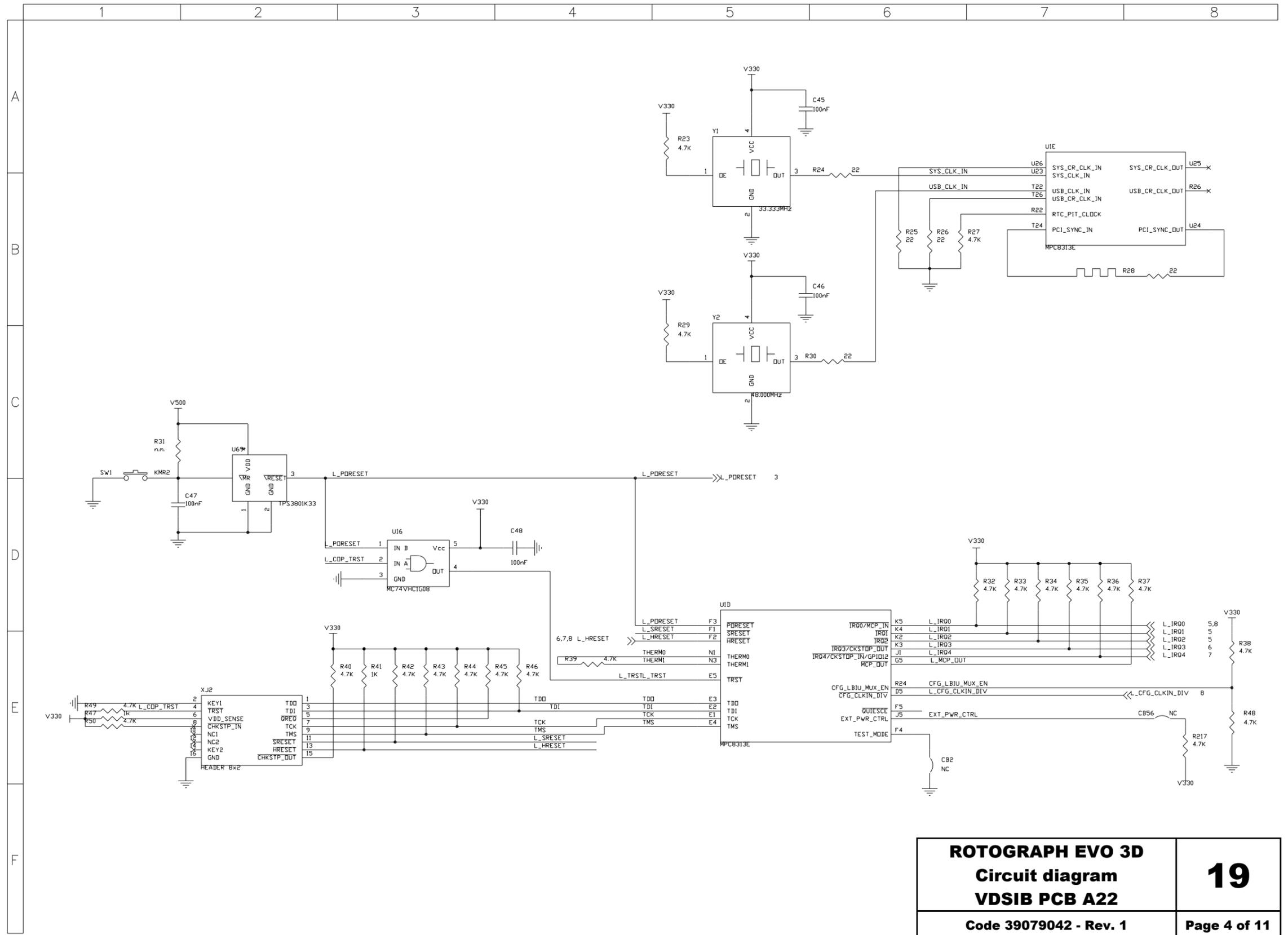
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Circuit diagram
VDSIB PCB A22
Code 39079042 - Rev. 1 **19**
Page 2 of 11



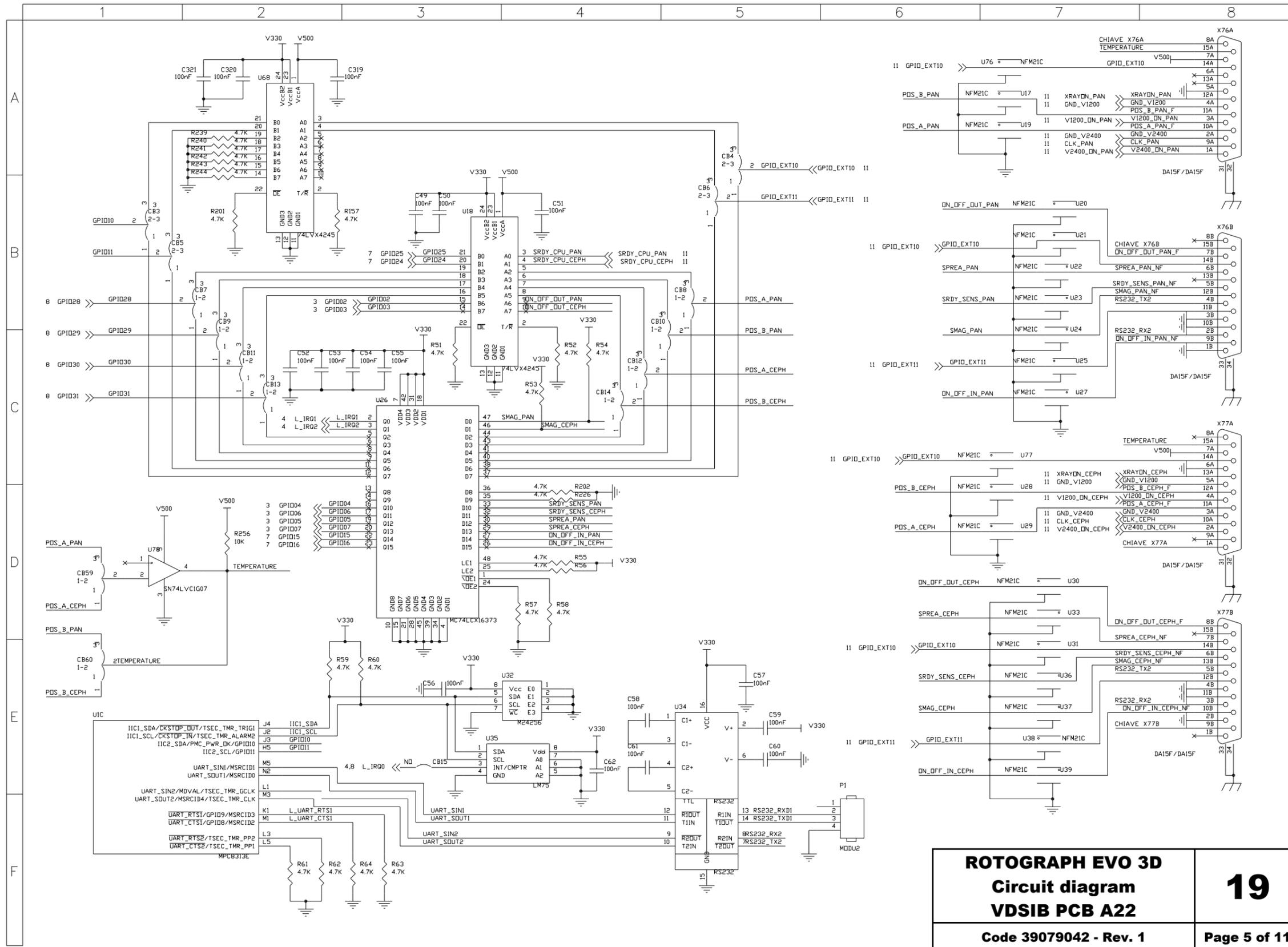
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Circuit diagram
VDSIB PCB A22

19

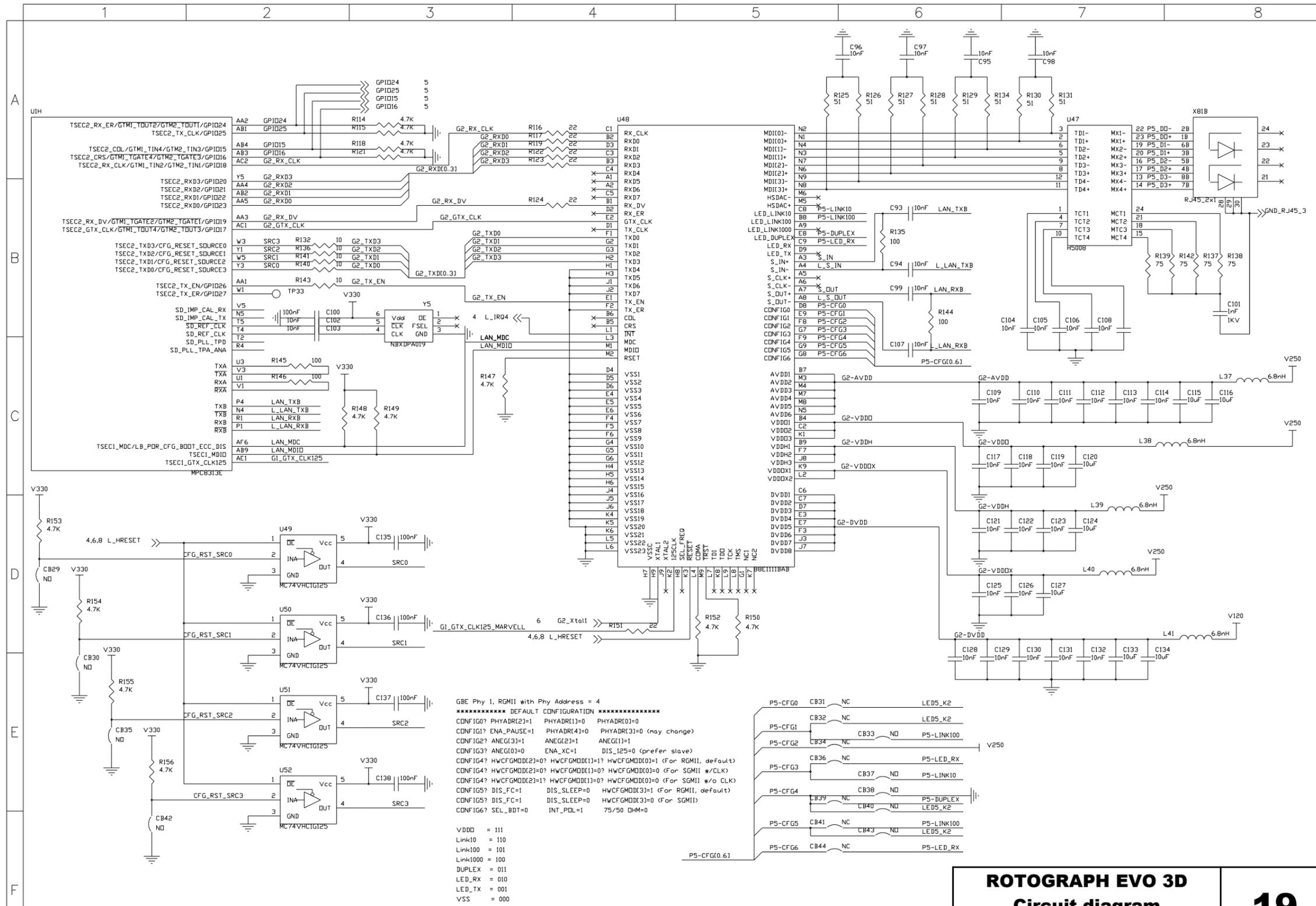
Code 39079042 - Rev. 1 Page 3 of 11



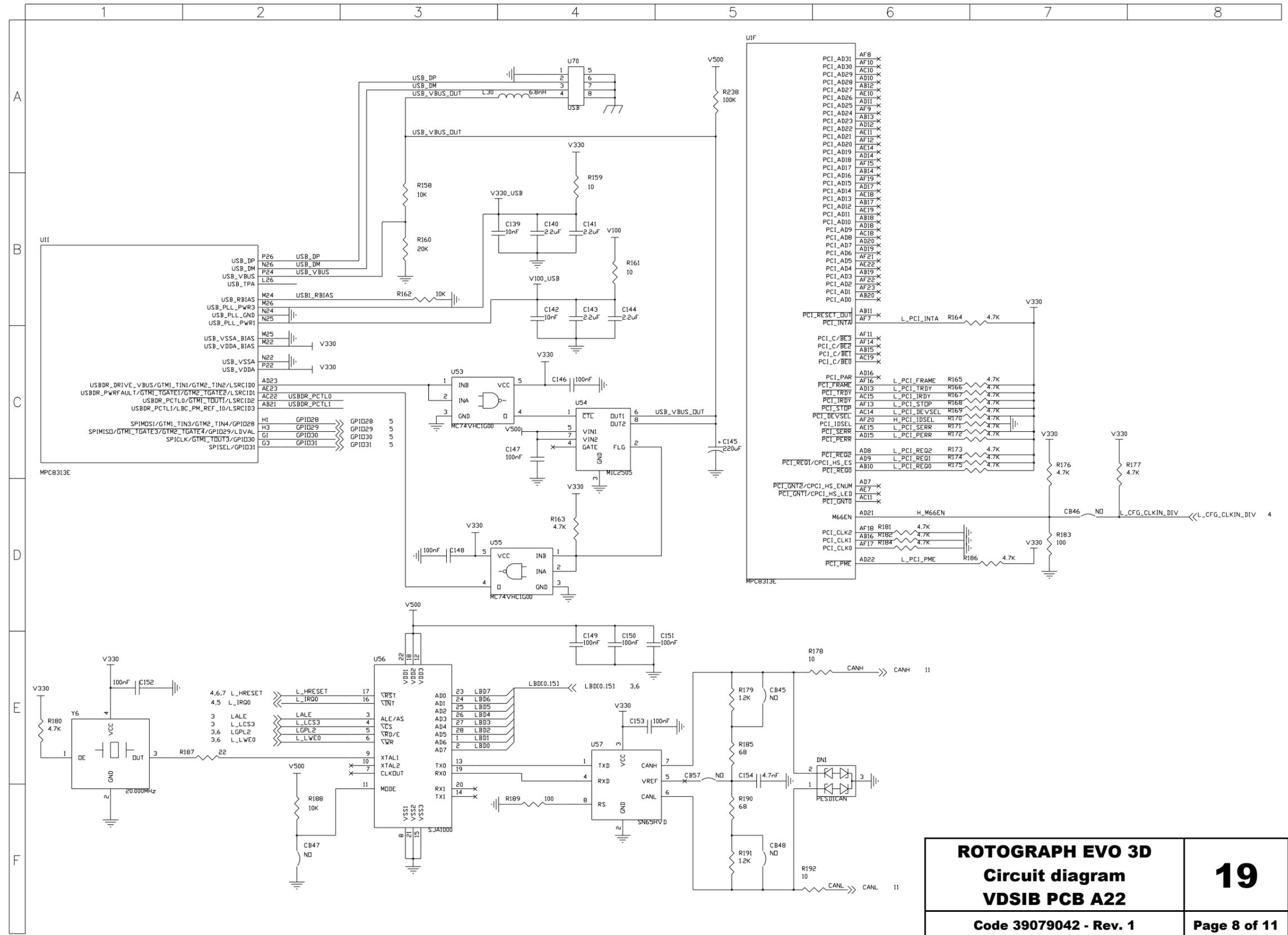
ROTOGRAPH EVO 3D Circuit diagram VDSIB PCB A22	19
Code 39079042 - Rev. 1	Page 4 of 11



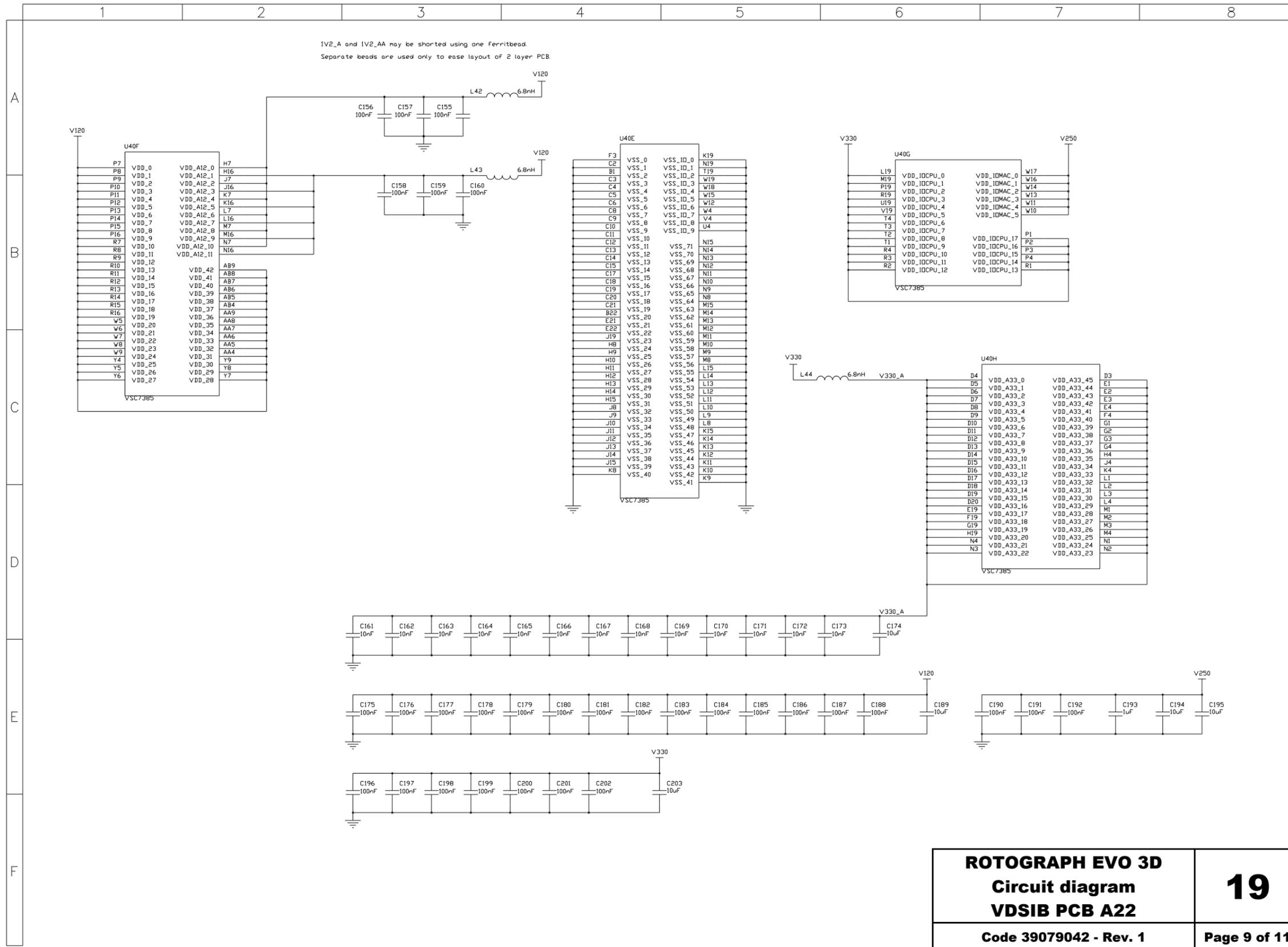
ROTOGRAPH EVO 3D	
Circuit diagram	
VDSIB PCB A22	
Code 39079042 - Rev. 1	19 Page 5 of 11



ROTOGRAPH EVO 3D
Circuit diagram
VDSIB PCB A22
 Code 39079042 - Rev. 1



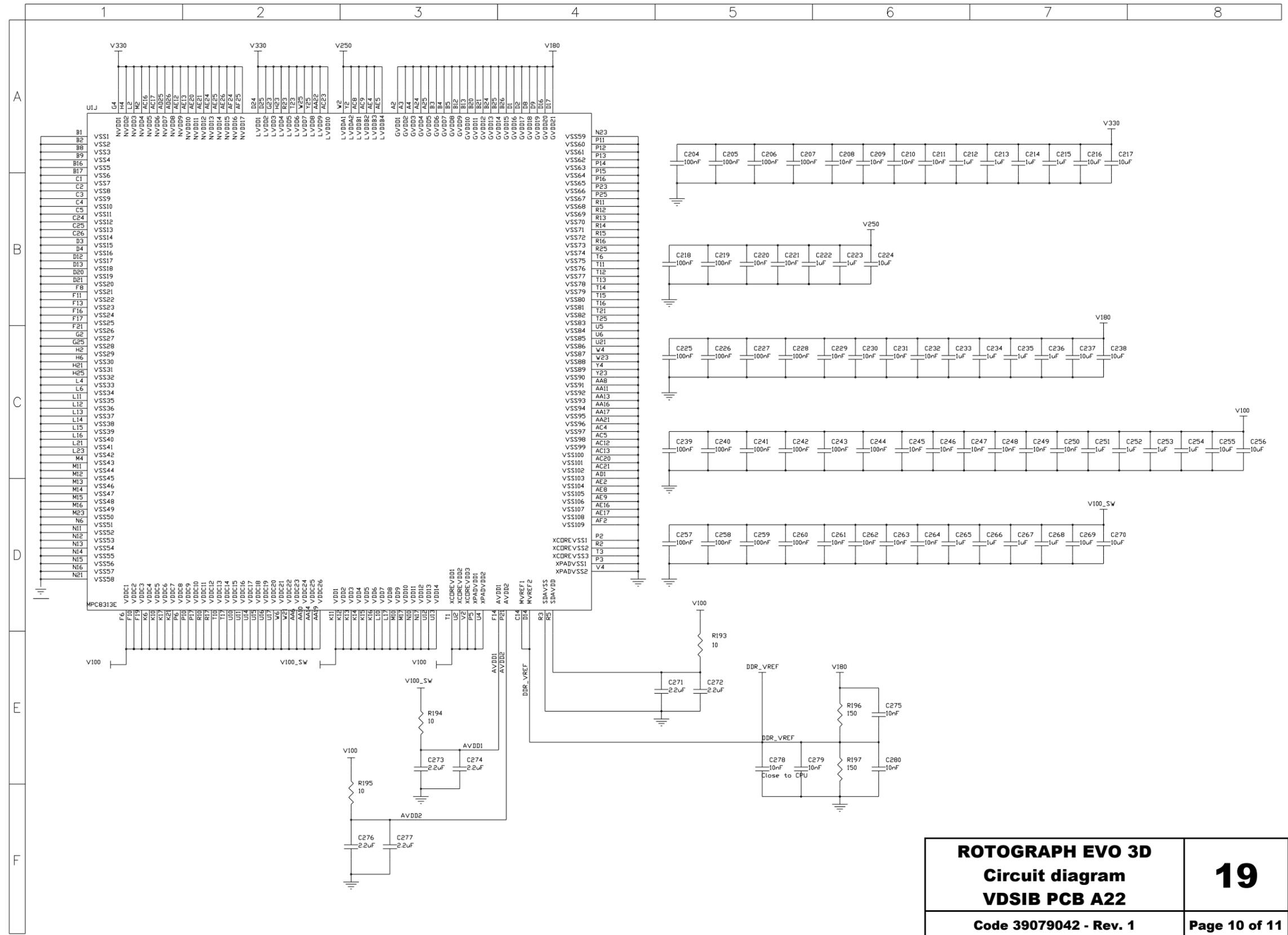
ROTOGRAPH EVO 3D	19
Circuit diagram VDSIB PCB A22	
Code 39079042 - Rev. 1	Page 8 of 11



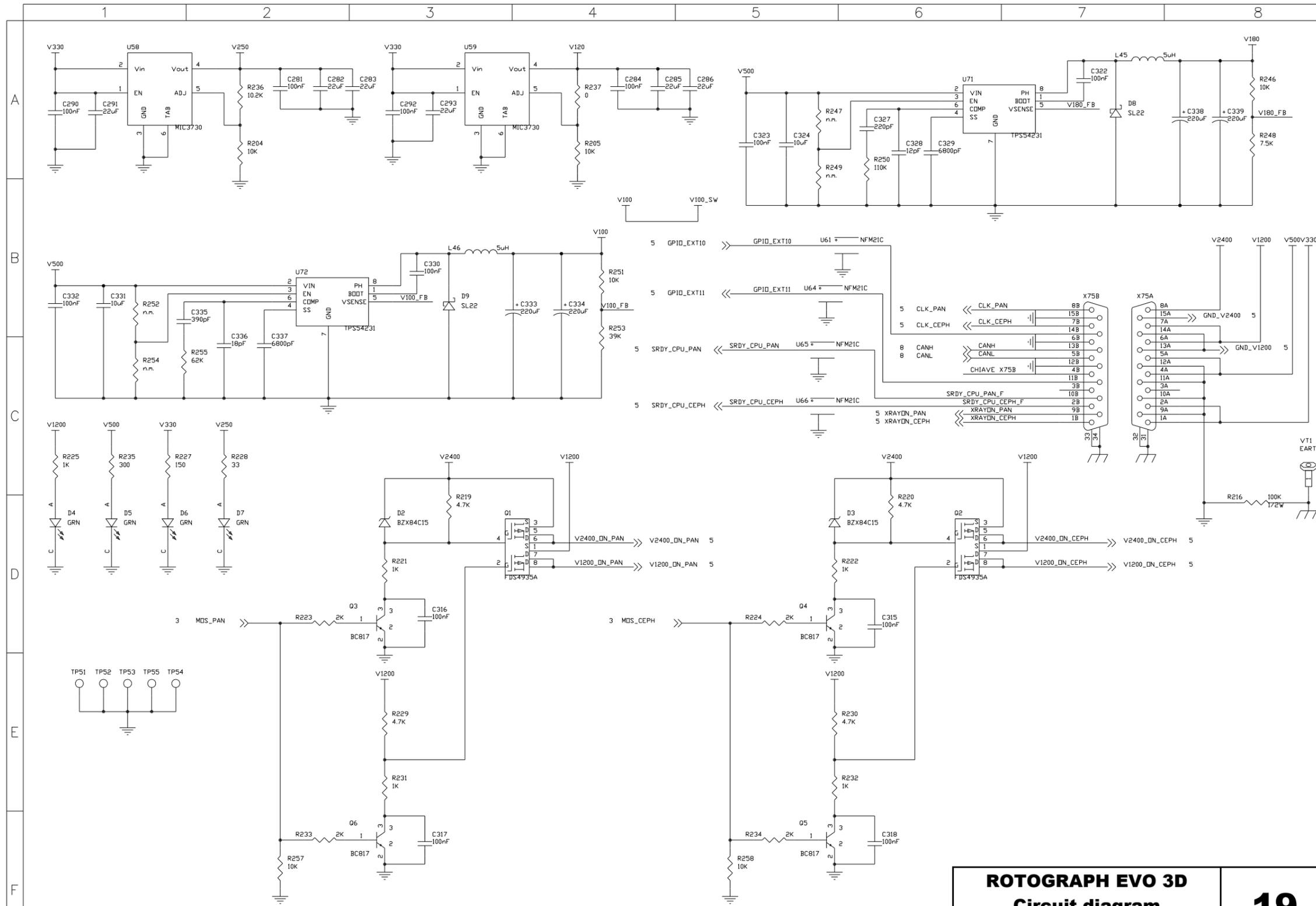
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Circuit diagram
VDSIB PCB A22

19

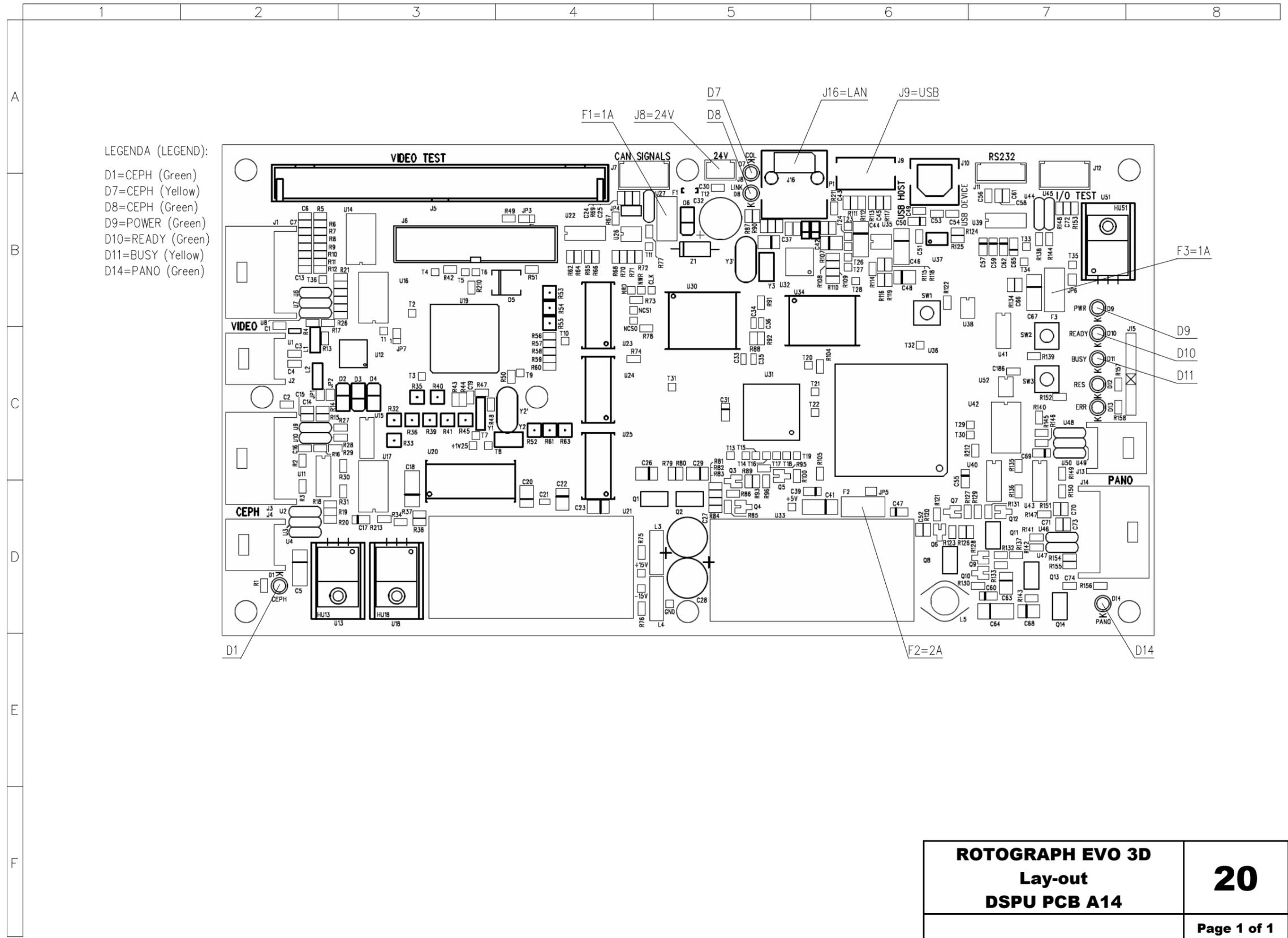
Code 39079042 - Rev. 1 Page 9 of 11



ROTOGRAPH EVO 3D Circuit diagram VDSIB PCB A22	19
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ROTOGRAPH EVO 3D Circuit diagram VDSIB PCB A22	19
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11. SPARE PARTS

1 - COLUMN

Electrical and mechanical parts

Cables

2 - UPPER MOVEMENT ASSY

Cables

Electrical and mechanical parts

3 - ROTATION ARM

4 - COVERS

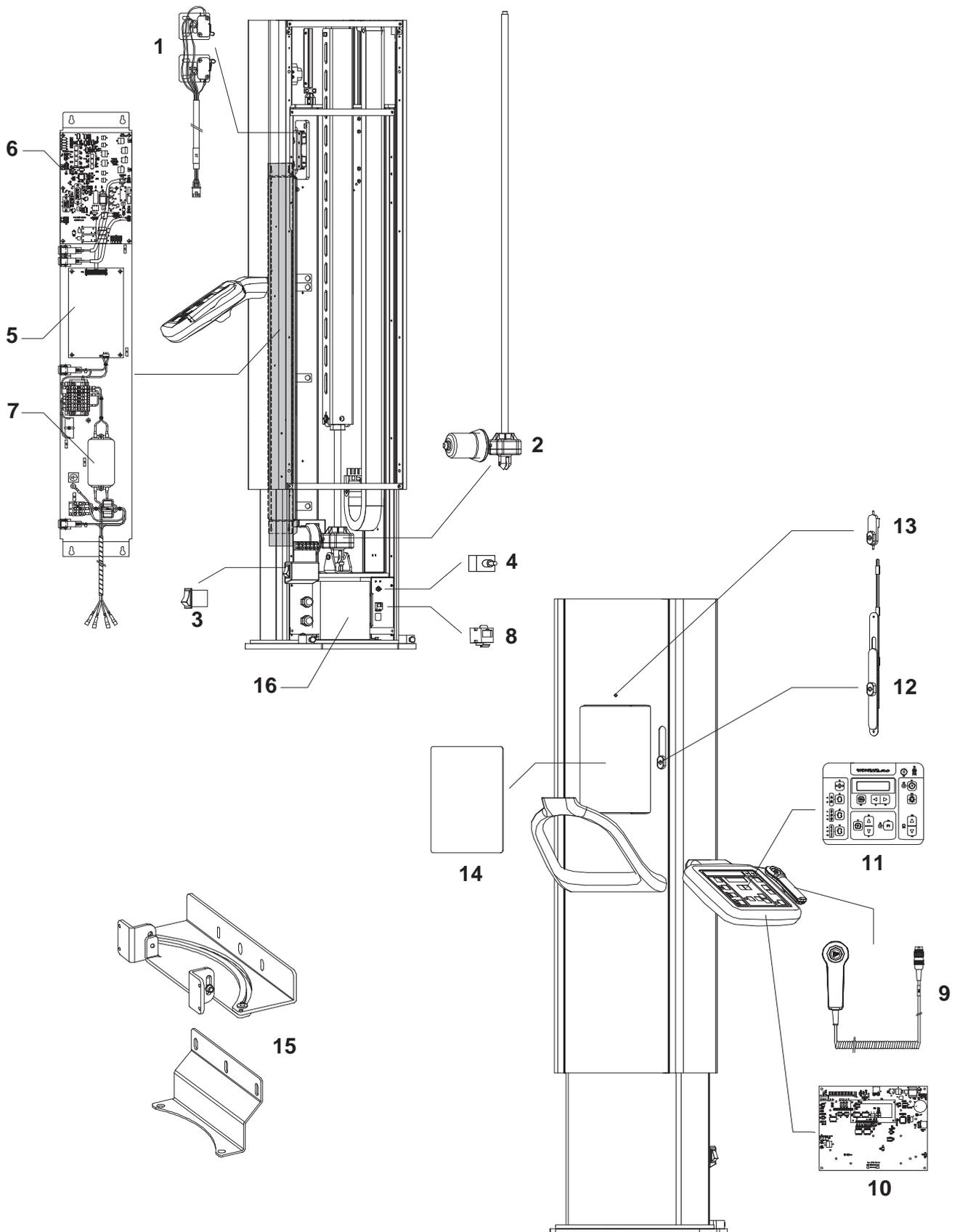
5 - CEPH DEVICE

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	6607091800	Column actuator M1	for S/N ≤ 12051708
	6607092100	Column actuator M1	for S/N ≥ 12051709
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	5807101200	Console keyboard A4	
11	6607150200	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	



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	
--	6207092000	Ethernet cable	
--	5007090200	USB2 cable	

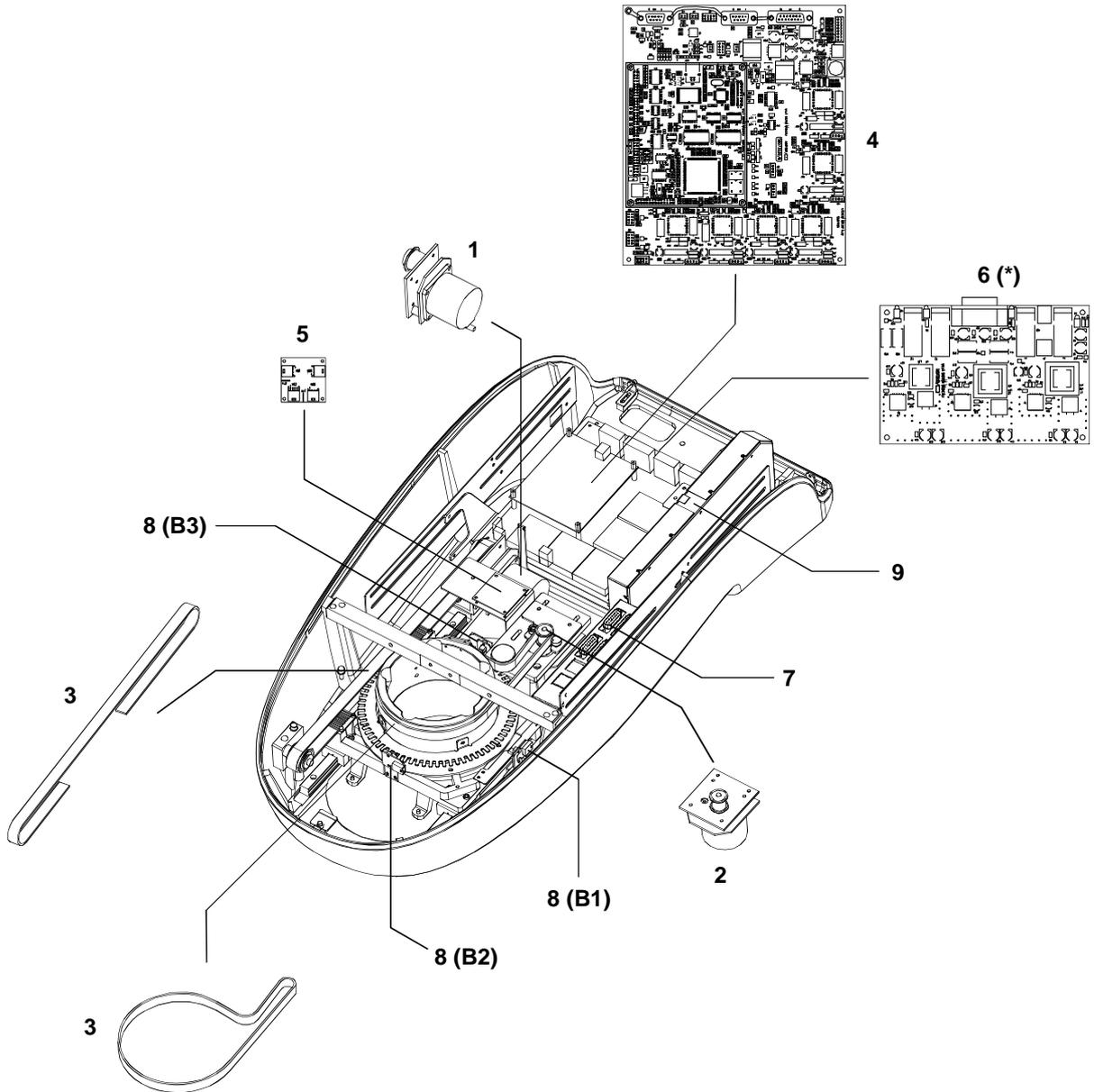
2 - UPPER MOVEMENT ASSY

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	
--	6207042100	Generator board A10 power supply cable X70 – Z2	
--	6207042000	Power and signal 3D sensor cable X76A / X85 / J2 Pleora	
--	6207080900	Ground cable # 3	

Electrical and mechanical parts

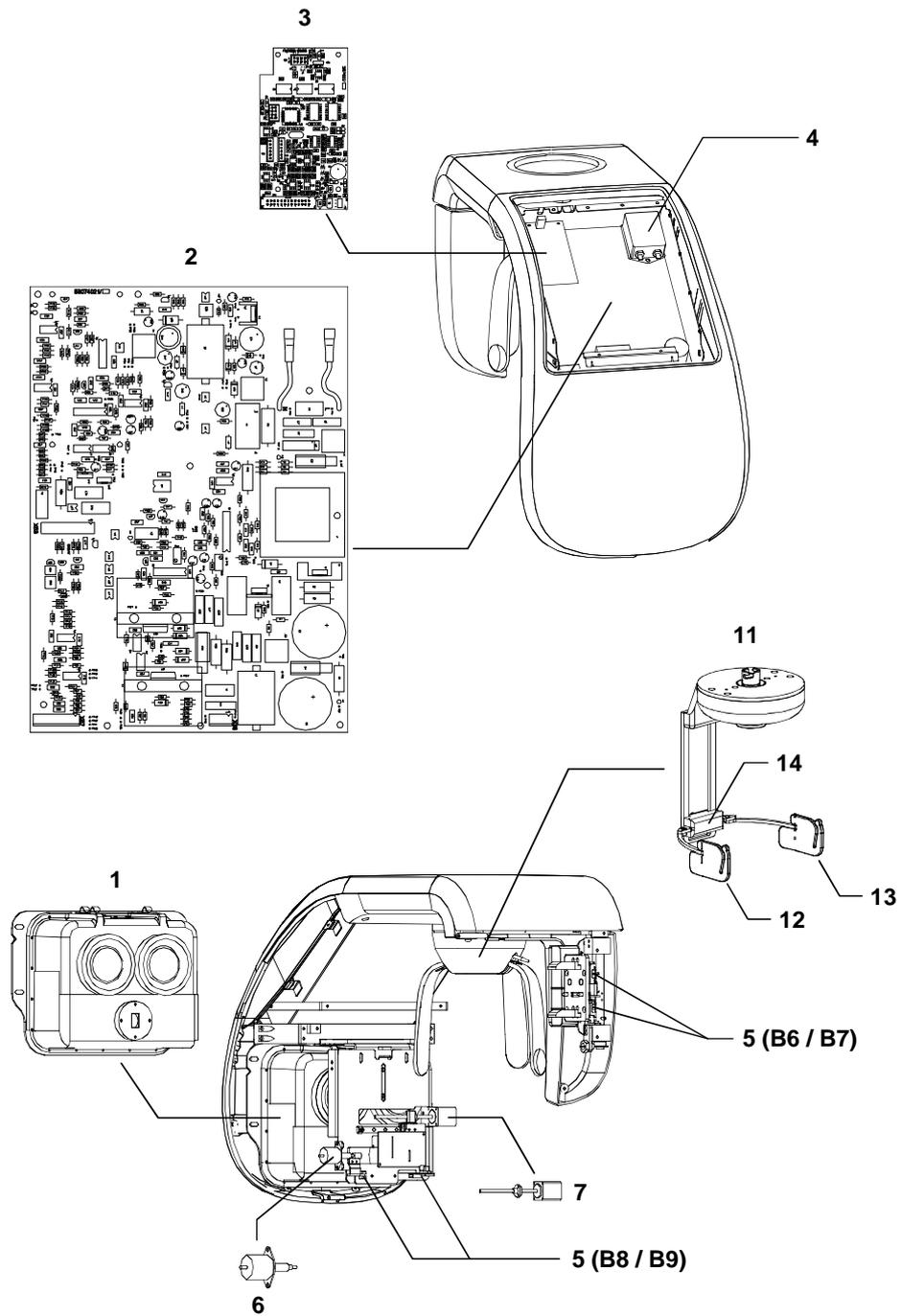
Ref.	Order code	Description	Note
1	6607035000	M2 Y-Axis stepper motor assy	
2	6607025000	M3 rotation stepper motor assy	
3	4990802300	Carriage belt model HTD 843-3M-15	
4	6607304000	CPU board assy	
	6607304200	Microprocessor board A6	
5	5807302500	Rotation group board A7	
6	5807303500	Power HUB board A21	
7	5807303100	VDSIB board A22	
8	5807302900	Optical sersor board B1 / B2 / B3	
9	4695444100	DSPU board	



() Under CPU board support*

3 - ROTATION ARM

Ref.	Order code	Description	Note
1	6607000300	3D HF Tubehead	
2	5807402100	Generator board A10	
3	5807403900	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	6607120100	Primary collimator motor M5	for S/N ≤ 13022114
	6207120500	Primary collimator motor M5	for S/N ≥ 13032115
	4990803900	Primary collimator dragging belt	
8	5807403900	Fans power supply and temperature sensor board A23	for S/N ≥ 13020196
9	6607070600	Upper fun assy	
10	6607070700	Lower funs assy	
11	6607010900	Temple clamp centering device assy	
12	6607010301	SX Temple clamp	
13	6607010401	DX Temple clamp	
14	6607014100	Temple clamps support	
--	4695441900	PAN sensor assy	

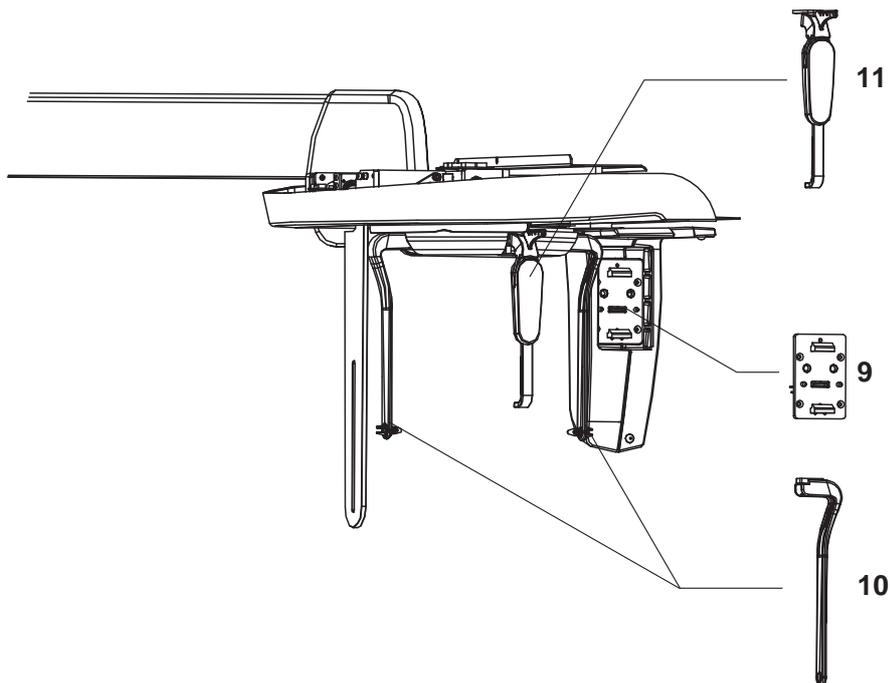
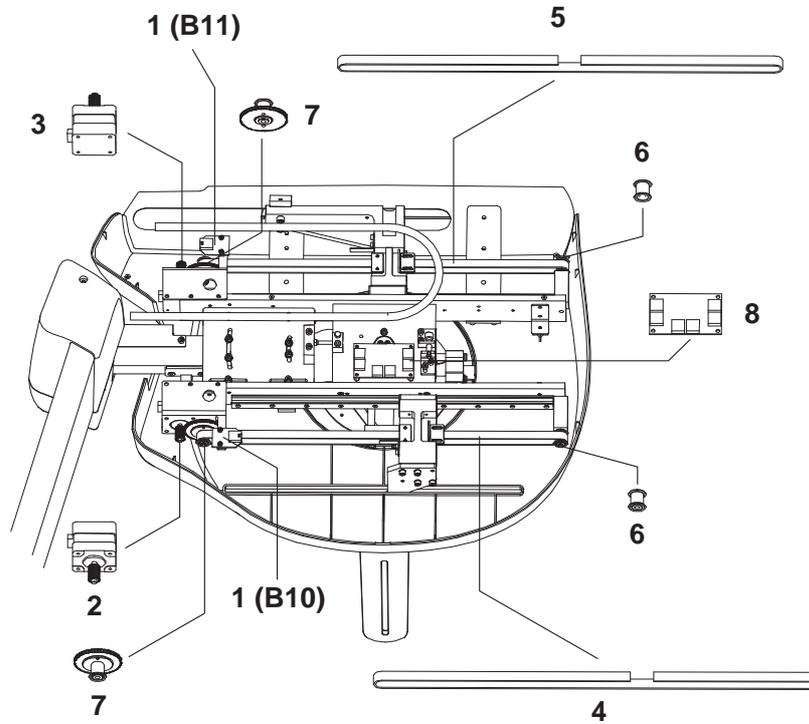


4 – COVERS

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	6607070505	Internal 3D sensor cover	
6	6607070601	External 3D sensor cover	
7	6607150000	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	
13	6607070105	CEPH Sensor holder internal cover	

5 – 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 = 861 mm)	for S/N ≤ 11061331
		Ceph Sensor dragging belt (L = 870 mm)	for S/N ≥ 11061332
6	5207084000	Pulley	
7	6607083300	Motor gear	
8	5809815000	Interconnection board A12	
9	6607070500	Sensor holder connector plate (female)	
10	6607087705	Rod for Ceph centering device (2x)	
11	6607087501	Nose-rest rod assy	
--	6207080700	Ceph arm motor and signals cable X23 / X24 / X34 – X1 / X2	
--	6207080800	Ceph arm cable J3 / J4 – X51 / X52	
--	6207080900	Ground cable # 3	
--	8507071100	CEPH mobile sensor assy	



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	
--	6107110800	TMJ positioner protective sleeves (60 pcs)	
--	6607098205	Volumetric 3D TMJ chin support	
--	6107110900	Disposable head stripes (50 pcs)	
--	6607080900	CARPUS positioning plate	
--	6107900100	Laser centring tool	
--	6107900200	Symmetry check tool	
--	5209900900	Digital sensor centring tool	
--	5607900800	Copper filter for digital sensor	
--	6607900200	Adjustment and calibration tools kit	

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12. APPENDIX

12.1. Appendix A: Setup parameters table

The following table lists those adjustment parameters stored in the unit during factory testing and that must be re-entered into the non-volatile memory in case of replacement of the CPU board (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 3D

Unit code: _____

Unit S/N: _____

U.I.C.: _____

Pleora MAC Address: _____

Parameter	Factory setting	New setting	New setting	New setting	New setting
Date					
Language (English, Italian, French, German, Spanish, Portuguese, Dutch, Turkish)					
Digital Ceph status (OFF=disabled; ON=enabled)					
COLL setup type					
Sensor Handling					
Pano order					
3D sensor (OFF=disabled; 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					
Primary collimator motor 3D 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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Cod. 6907912603_Rev.2



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