VILLA SISTEMI MEDICALI

6907914503

Rotograph EVO 3D CE 0051

Service Manual

Version 20 September 2017 (Rev. 1)

Revision history Manual code 6907914503

Rev.	Date	Page/s	Modification description
0	25.07.16	-	Document approval.
1	20.09.17	3-21, 4-5, 6-15, from 6-19 to 6-26, 6-42, 6-43, 7-37, 8-3, 8-8, 8-10, from 9-14 to 9-16, 9-22, 11-13, A-2	Release of 3D service tools kit. Updated lateral offset setting paragraph. Installation procedure improvements (Windows 10 compatibility, Ethernet connection). Added paragraph "Verification of laser reference lines". (Ref. RDM 8260, RDM 8480, RDM 8607)

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Contents

1. INTRODUCTION

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

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.

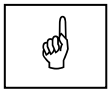
Rotograph EVO 3D, produced by VILLA SISTEMI MEDICALI S.p.A., is a complete panoramic system that allows the execution of all X-rays commonly used in dentistry and orthodontics (excluding intraoral radiographs) and also allows the acquisition of volumetric tomographic or 3D X-rays.

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.

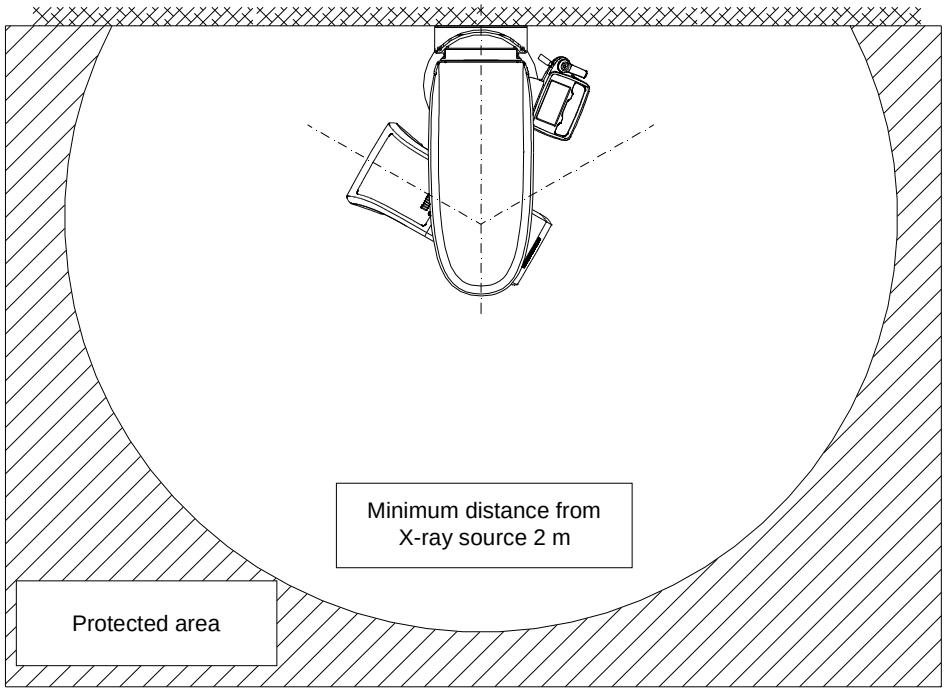


Figure 2-1 - Panoramic version

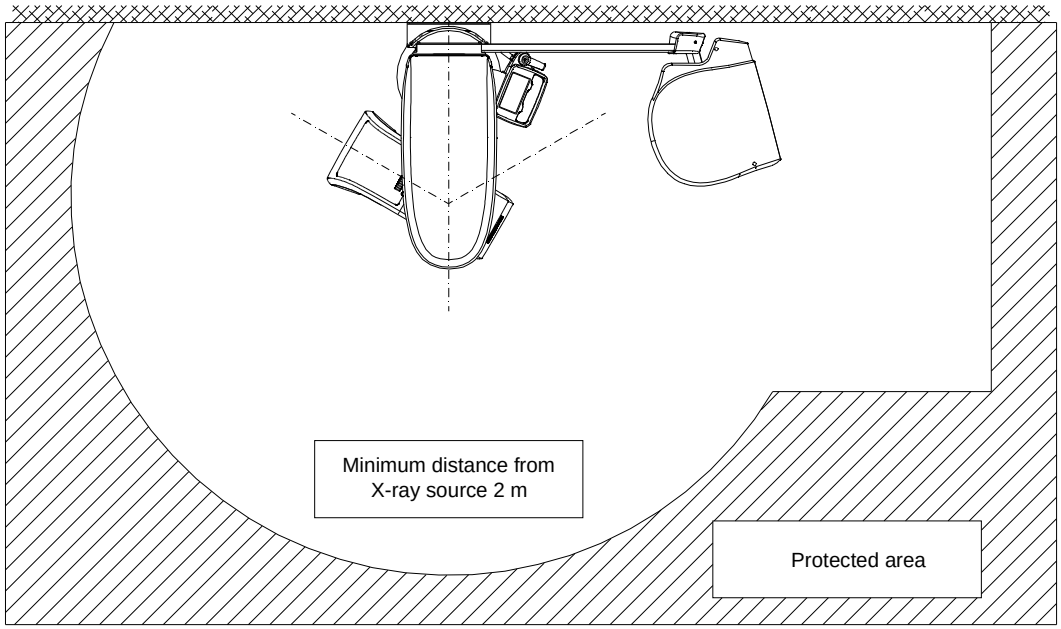


Figure 2-2 - Cephalometric version

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 in Panoramic examination

	-1.5	-1	-0.5	0	0.5	1	1.5m	
	0,000198	0,000253	0,000451	0,000379	0,00036	0,000282	0,000171	
1.5 m	0,000228						0,000168	1.5 m
1	0,000464						0,000211	1
0.5	0,000567						0,00024	0.5
0	0,000417			C			0,000139	0
-0.5	0,000404						0,000227	-0.5
-1	0,00032						0,000211	-1
-1.5	0,000213	0,000383	0,000558	0,000501	0,000381	0,000155	0,000369	-1.5
	0,00027						0,000194	
	-1.5	-1	-0.5	0	0.5	1	1.5m	

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

The Figure above illustrates the distribution of 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 as scattering element an anthropomorphic phantom complete of soft tissues simulating the head of the typical patient (in size, dimensions and tissues) of the intended use of the machine.
This phantom was placed in the same position as a patient taking a panoramic exam.C is the center of patient head.
The measures were taken during a panoramic exam setting the following parameters: 86kV, 10mA, 14.4s.

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

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

2.1.2. Distribution of stray radiation in volumetric examination

	-1.5	-1	-0.5	0	0.5	1	1.5m	
1.5m	0.02	0.02	0.03	0.03	0.03	0.03	0.02	1.5m
1	0.025						0.03	1
0.5	0.03						0.02	0.5
0	0.03						0.004	0
-0.5	0.03						0.01	-0.5
-1	0.03						0.02	-1
-1.5	0.02	0.03	0.03	0.04	0.03	0.025	0.02	-1.5
	-1.5	-1	-0.5	0	0.5	1	1.5m	

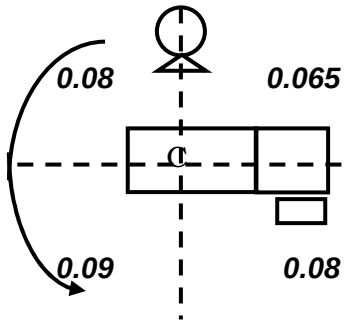


Figure 2-4: Distribution of stray radiation in volumetric examination

The Figure above 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: 86kV, 10mA, 8s.

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

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

2.1.3. Distribution of stray radiation in Ceph examination

	-1.5	-1	-0.5	0	0.5	1	1.5m	
1.5 m	*0.00031*	*0.00034*	*0.00038*	*0.00036*	*0.00028*	*0.0006*	*0.00093*	1.5m
1(1)	*0.00012*						*0.00155*	1
0.5(1)	*0.00023*						*0.0022*	0.5
S		Primary x-ray		C			*0.0008*	0
-0.5(1)	*0.00022*						*0.0003*	-0.5
-1(1)	*0.00012*						*0.00021*	-1
-1.5	*0.00029*	*0.00032*	*0.00034*	*0.00033*	*0.00019*	*0.00015*	*0.00012*	-1.5
	-1.5	-1	-0.5	0	0.5	1	1.5m	

Figure 2-5: Distribution of stray radiation in Ceph examination

NOTE (1):
The doses reported on the source side (S) are just the head scattering term and these values does not take into account of tubehead leakage radiation.

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

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

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

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

2.1.4. 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.

2.1.5. 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	$d = 1.2 \times \sqrt{P}$
			Where "*P*" is the maximum output rating of the transmitter in watts (W) according to the transmitter manufacturer and "*d*" is the recommended separation distance in meters (m). Field strength for fixed RF transmitters, as determined by an electromagnetic site survey, should be less then the compliance level in each frequency range. Interference may occur in the vicinity of the equipment marked with the following symbol: 

2.1.6. 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.

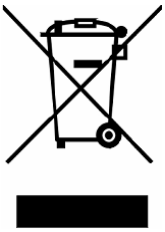
2.2. Environmental risks and displacement

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.

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



The symbol with the waste bin crossed on the equipment or its packaging, indicates that the product must be separately collected from other waste at the end of its life.

The separate collection of the present equipment that has reached the end of its life is organised and managed by the manufacturer. The user who wishes to dispose of this equipment must contact the manufacturer and follow their system to enable the separate collection of the equipment at the end of its life.

Suitable separate waste collection for the subsequent start of the equipment discarded for recycling, for treatment and for environmentally friendly disposal, contributes in preventing possible adverse effects on the environment and health and promotes the reuse and/or recycling of materials of which the equipment is comprised.
Illegal disposal of the product by the holder implies the application of administrative sanctions provided by law

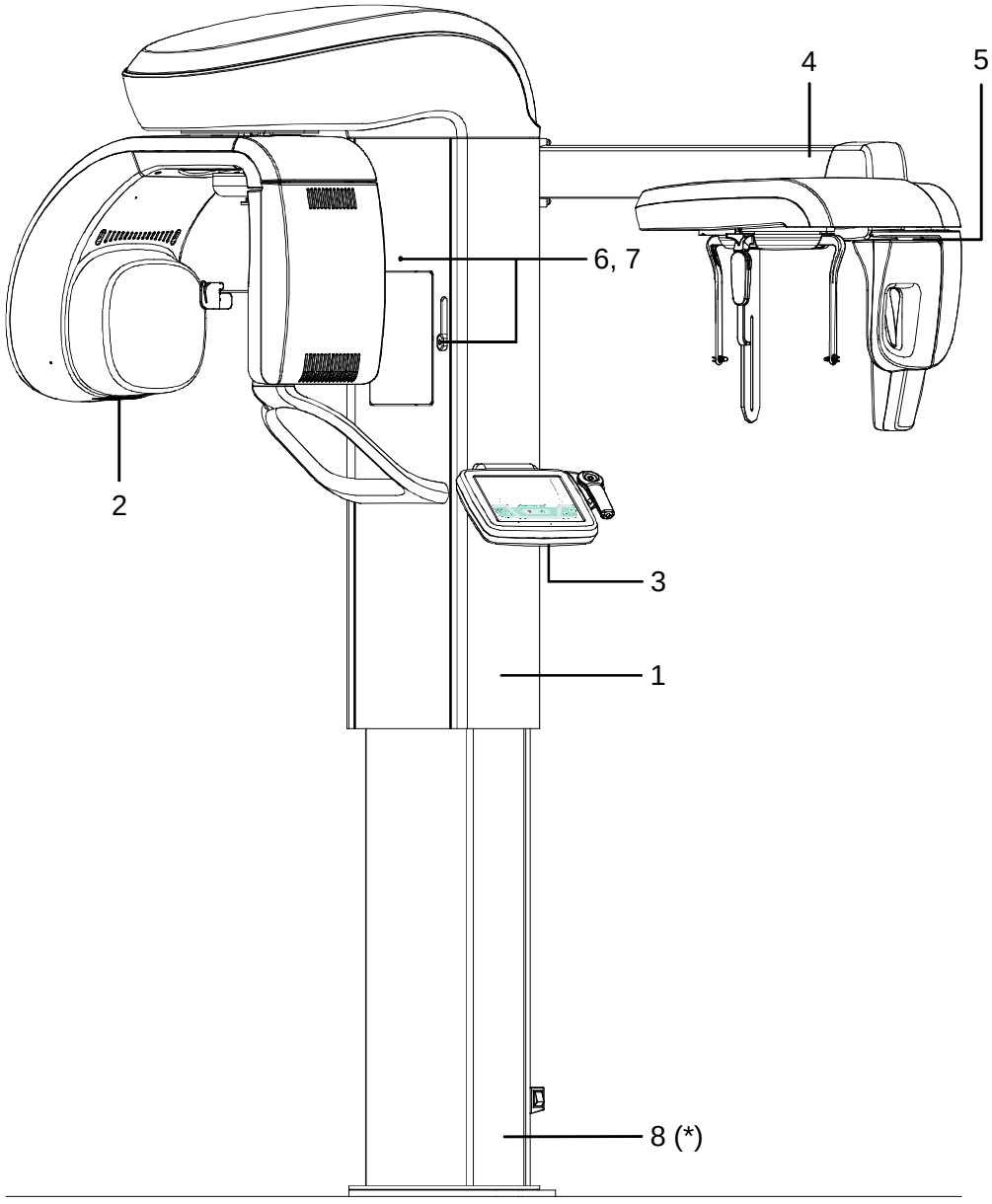
2.3. Symbols used

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
	Manufacturer's reference number
	Manufacturer's serial number
	Date of manufacturer (year and month)
	Name and address of the manufacturer
	Filtration
	Diagnostic source assembly
	X-Ray tube
	Consult instruction for use
CE 0051	Conformity to the CE 93/42 Directive

3. DESCRIPTION

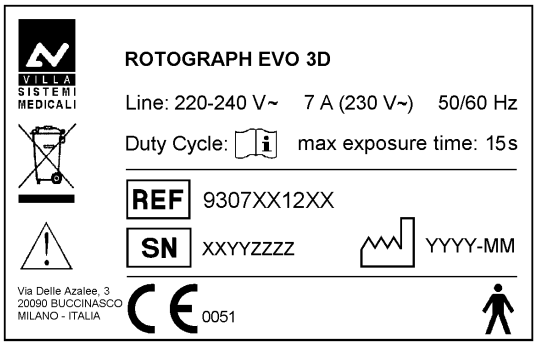
3.1. Identification labels and laser labels



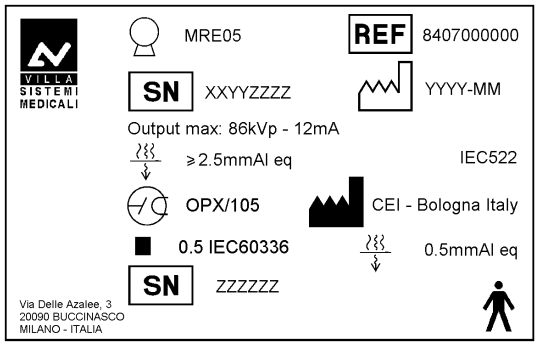
(*) Only for 110-120V version

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

1
Rotograph EVO 3D data plate

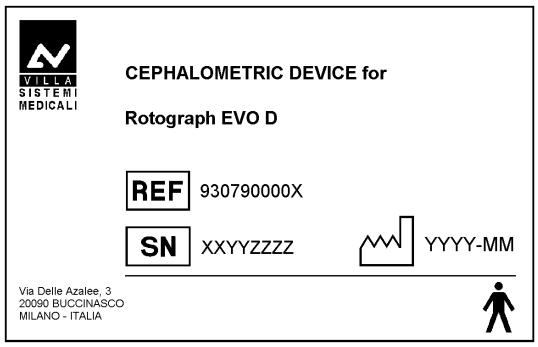


2
Tube-head characteristics plate

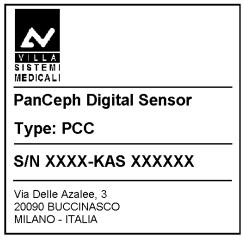


3
EVO XP plate
(Additional projection package)

4
CEPHALOMETRIC device plate



5
PANCEPH digital
sensor data plate

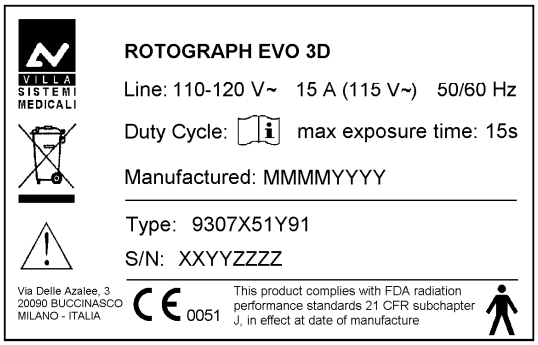


6
(N° 2) Spot Laser
indicator plate

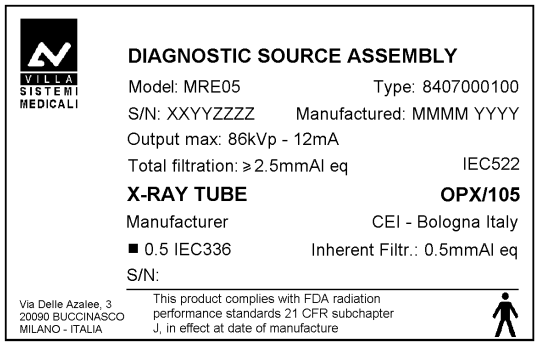
7
(N° 2) Laser symbol
label

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

1
Rotograph EVO 3D data plate

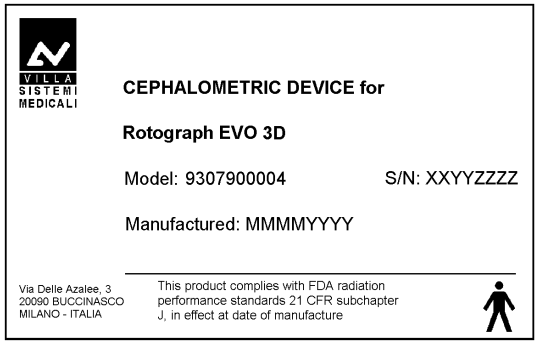


2
Tube-head characteristics plate

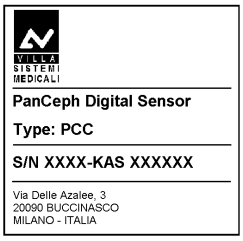


3
EVO XP plate
(Additional projection package)

4
CEPHALOMETRIC device plate



5
PANCEPH digital
sensor data plate



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. EISK OF EXPLOSION - DO NOT USE IN PRESENCE OF FLAMMABLE ANESTHETICS.
FOR CONTINUED PROTECTION AGAINST RISK OF FIRE, REPLACE ONLY WITH SAME TYPE AND RATING OF FUSE.

DANGER:

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

3.2. Function, Models and Version

Rotograph EVO 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.
- 3D volumetric examinations of Dentition with Partial Volumes to perform exposition only on mandibular or maxillary region when the patient is know to have a problem only on one part of the dentition in order to reduce the dose.

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 6.7.7.1, 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" (6)  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 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 3-2.

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

- Power supply assembly
- Main CPU board (A5)
- Generator board (A10), Generator CPU board (A9) and tubehead
- Column CPU board (A1)
- 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.
- Driving of the 2 SMA actuators.
- 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** = Closed
- **XJ2** = Open
- **XJ6** = 2-3
- **XJ8** = 2-3
- **XJ11** = Open
- **XJ12** = Closed
- **XJ13** = Closed
- **XJ15** = Open
- **XJ16** = Open

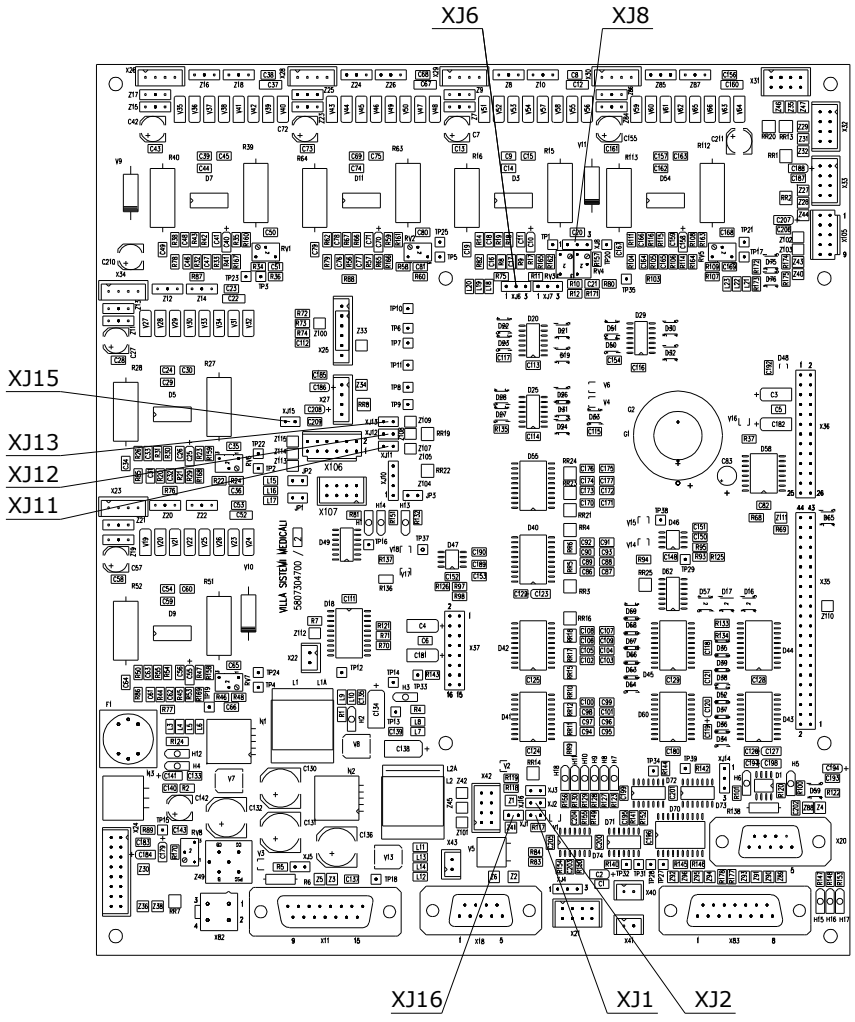


Figure 3-1

3.3.3. Generator Board (A10) and Tubehead

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

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

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

The Generator board receives the signals concerning the X-ray dose to provide (kV and mA), from the CPU board through CANBus messages; it is the Generator CPU that generates the commands used for the X-ray emission. The Generator board provides to the tubehead the voltages that drive the high voltage transformers that then drive anode and filament of the X-ray tube, also giving the relevant timing.

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

Checking of proper functioning of the X-ray emitting system is achieved through the analysis of feed back signals generated inside the tubehead and transmitted to the Generator board and relevant Generator CPU. Possible anomalous conditions are then communicated to the main CPU board (A5) which in turn generates error codes to alert the operator.

3.3.4. Control panel

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

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

The Touch Screen control PCB is directly connected to the main CPU board (A5) which controls it. The language of the messages shown on the display can be selected among different options (English, Italian, French, German, Spanish, Portuguese, Dutch, Turkish, Russian, simplified Chinese, Arabic and Farsi). The language selection is only available for the messages dedicated to the user. The messages relative to the service programs (Password) are always in English.

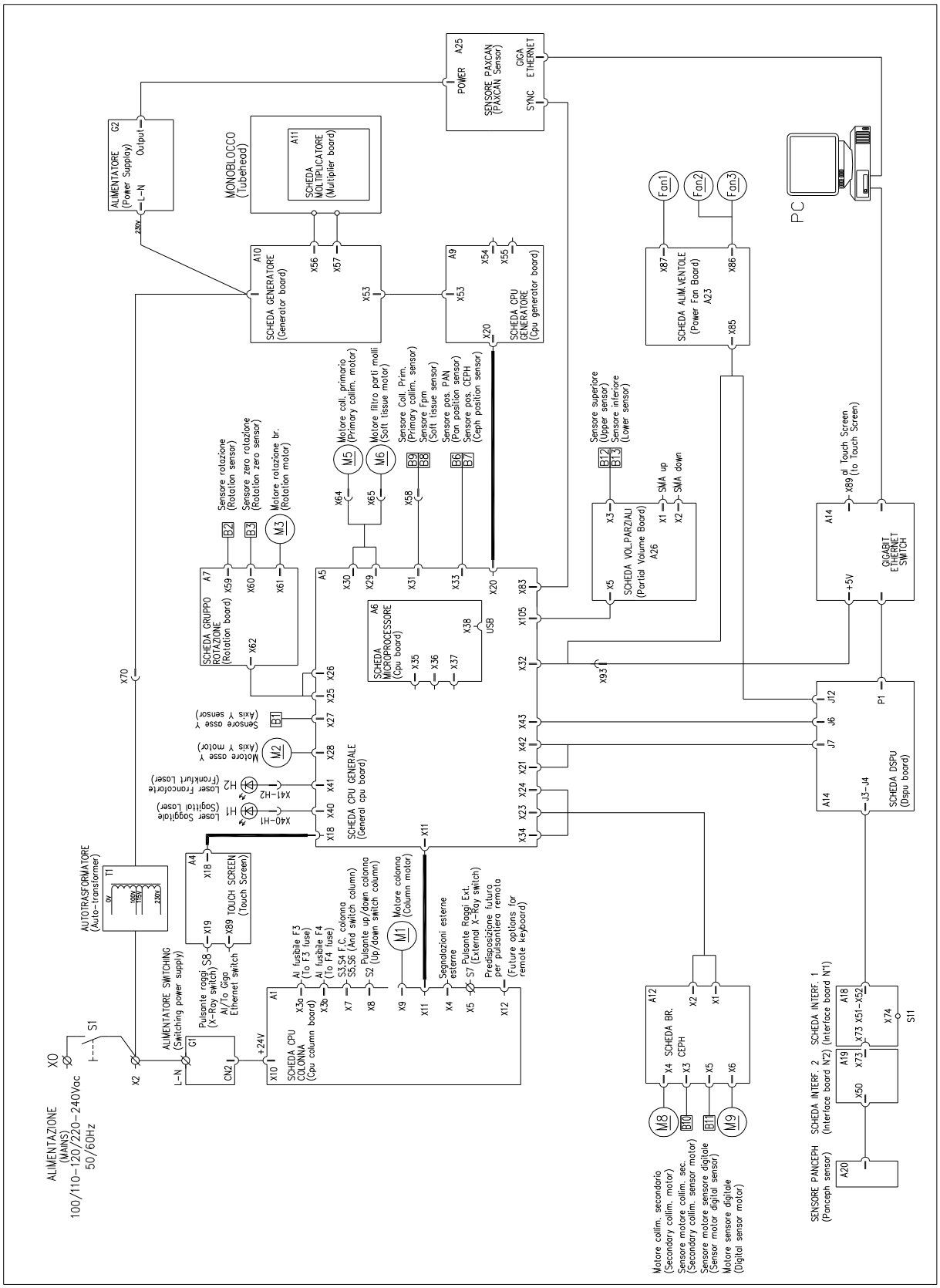
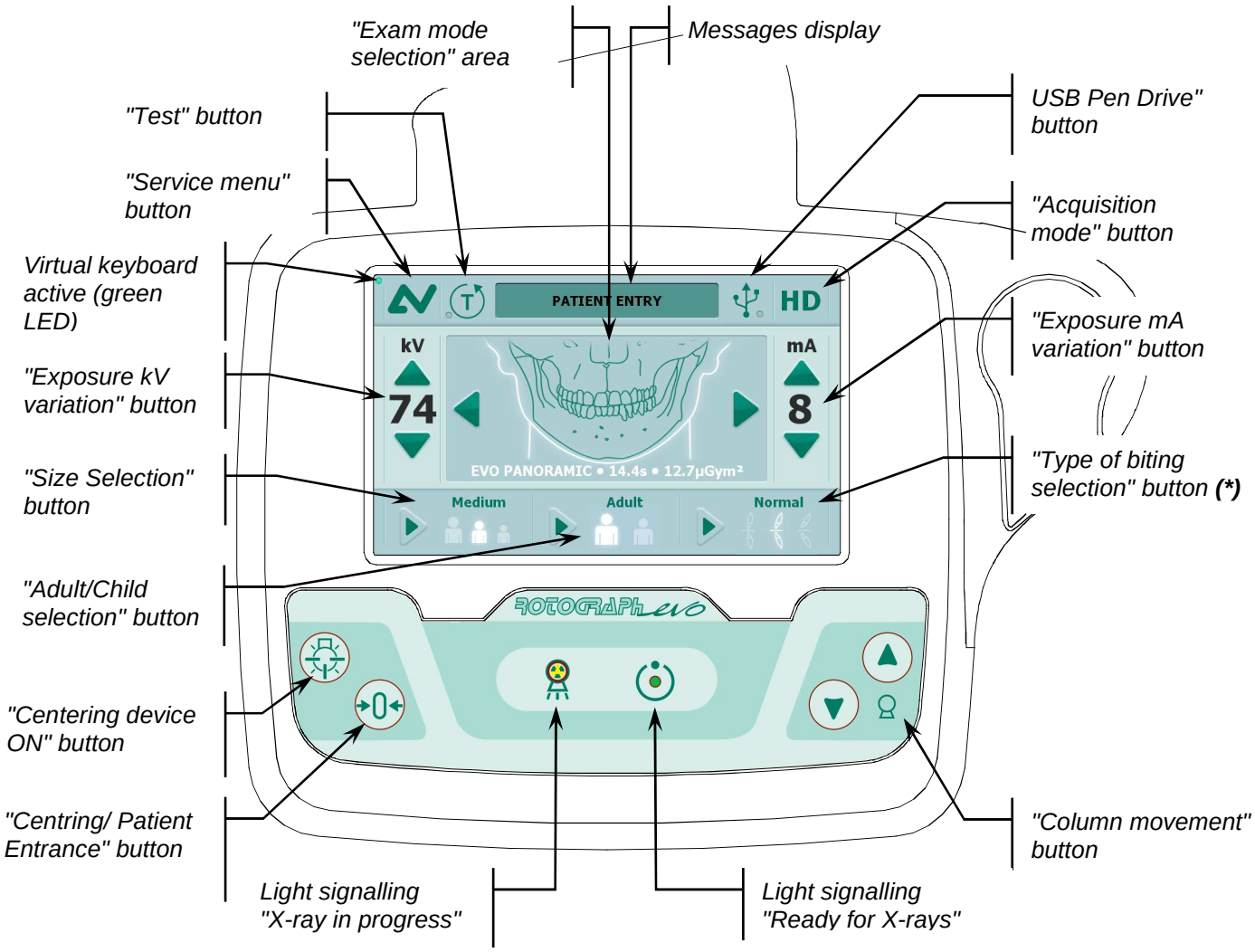


Figure 3-2 – Block diagram

3.4. Control panel - Descriptions and functions

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



(*) *In 3D Dentition exam menu, this button is replaced by the "Partial volume selection" button. See following pages for more information.*

Figure 3-3

WARNING:
The USB port on the keyboard is used only for service purpose.
Do not connect USB Pen or external Hard Disk.

The next figures show a general view of the displays of the Service menu.

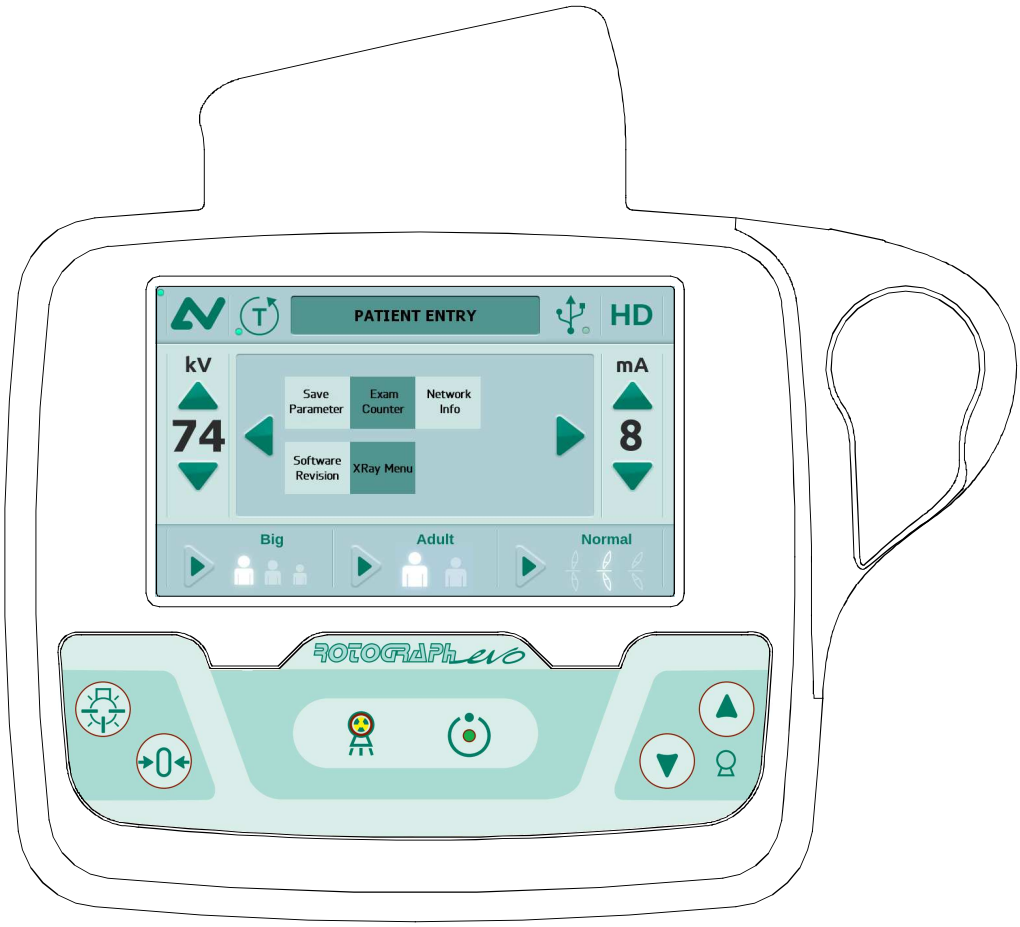


Figure 3-4: Service Menu display - Page 1

Here following a sample description of each key functionality:

- **Save parameter**: allows to store the automatic exposure parameters (see paragraph 6.7.7)
- **Exam counter**: allows to display the numbers of exam performed in each exam mode
- **Network info**: allows to display the IP addresses and SubNet mask of the devices connectet to the Network
- **Software revision**: allows to display the software revision of the Rotograph EVO D system microcontroller
- **XRay Menu**: this key is reserved to authorised personnel.

Figure 3-5: Service Menu display - Page 2

- **Graphic Custom**: this key is reserved to authorised personnel.

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

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

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

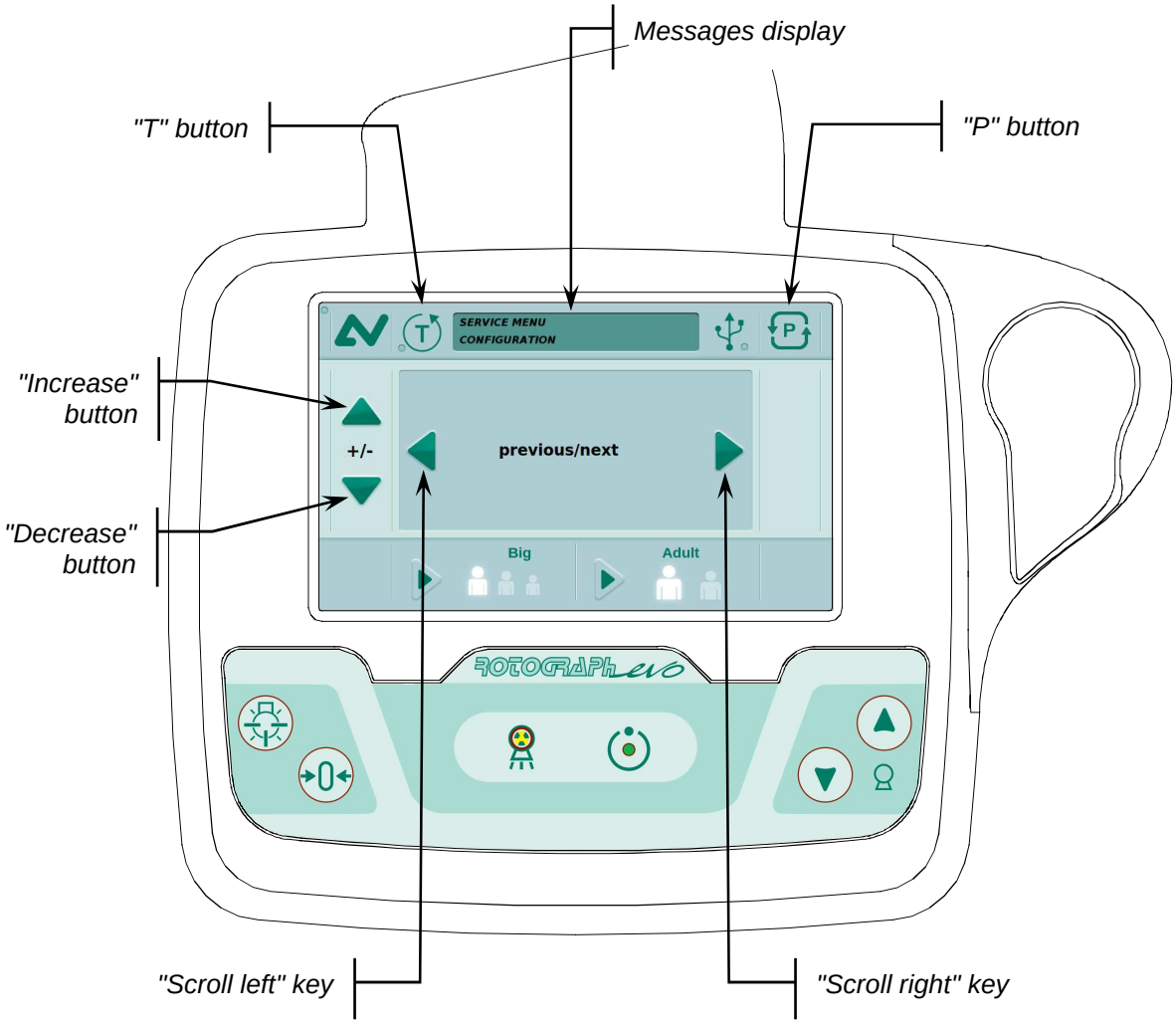
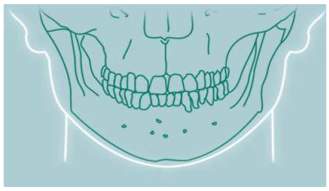


Figure 3-6

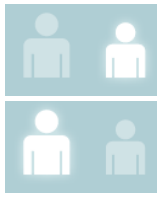
The "Centring/Patient Entrance" key is used for:

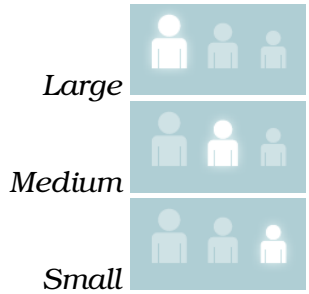
- start/finish the exam procedure
- bring the rotation arm to the patient entrance position at the end of the exam.

The "Exam Selection Mode" area takes place by means of three keys: the first one, the main area, helps select the exam mode between Panoramic, TMJ, Sinus, 3D Dentition and Cephalometric.
The other two, identified by the arrows, help navigate within the exams of each mode.

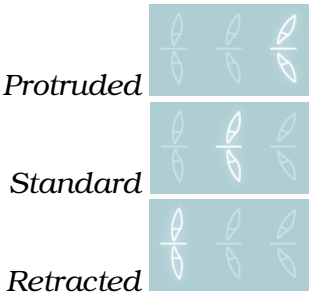


It is possible to select the anatomic mode examinations (anatomic selection), using prefixed exposure values.
This kind of selection enables to choose between Adult/Child, each with three different sizes (small, medium, large).

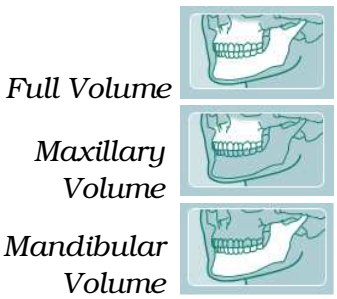




The Panoramic mode enables to select the patient's type of biting between: protruded, standard or retracted, as indicated within the button.
The arch selection does not influence the values of kV and mA but acts on the position of the focus layer.



The portion of the volume of the patient can be selected in the 3D Dentition mode, between: Full Volume, Maxillary Volume or Mandibular Volume, as indicated within the button.
This selection acts on the partial volume collimators that exposes the patient to a different irradiation.



Furthermore there is the possibility to manually select the exposure parameters; in this case, it is possible to set the parameter with the desired value.
The parameters available are: kV and mA (Soft Tissue Filter position only in cephalometry).

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

The movement of the column is controlled by the appropriate keys.
Two pre-set speeds are possible.
The movement of the column is inhibited during the preparation of the unit.

The key "Luminous centring device" helps turn ON/OFF the laser centring devices that allow the correct positioning of the medial-sagittal and Frankfurt/Ala trago 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.
When the LED is green, the test function is enabled.

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

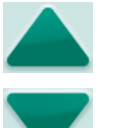
This key is used to un-mount the Pen Drive inserted in the USB connector of the control panel.
When the LED is green, the pen drive is recognised.

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

High Definition

High Speed

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



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

3.4.1. Key functions description

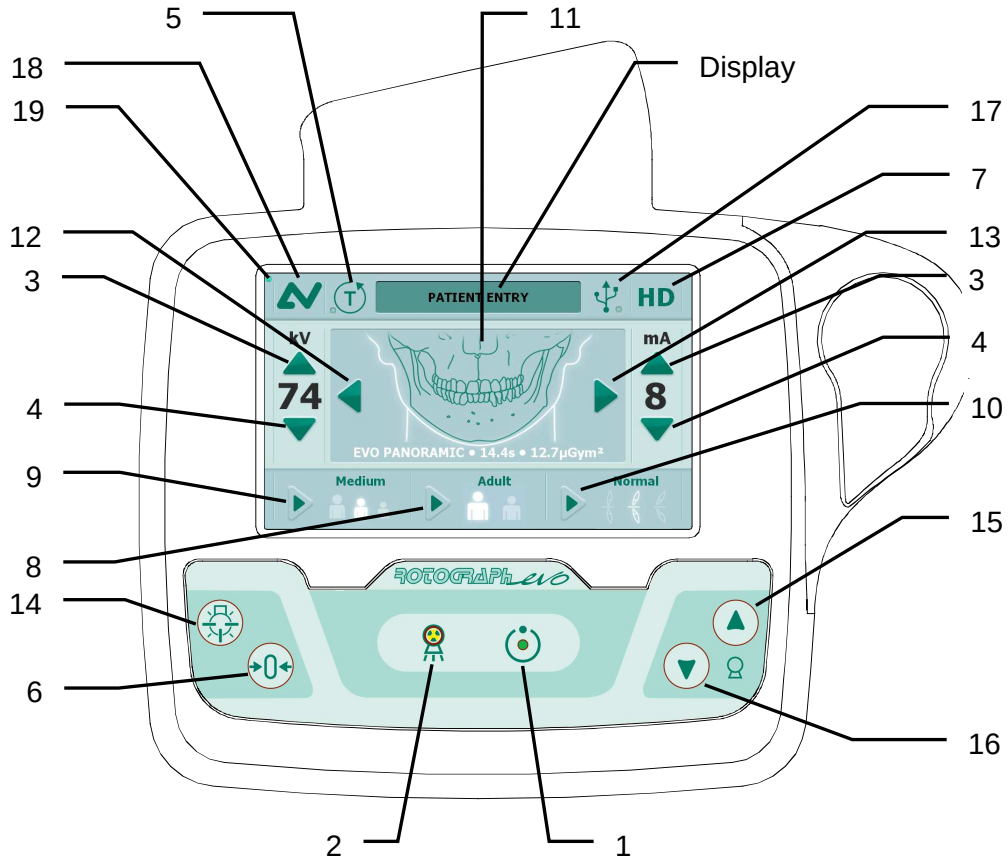


Figure 3-7 - Control panel

LEGEND:

Messages

Display: indicates operative messages and warnings

Signal lights

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

2 - Yellow LED indicating X-ray emission

Manual setting of exposure parameters

3 - kV/mA increase key

4 - kV/mA decrease key

Preparation functions

5 - Key to set Test function (green LED)

6 - Key for:
> Resetting and realigning the device's axes (in case of collision with patient or in case of release of rays button)
> Repositioning the rotation group (to bring the group to the initial position after the examination and to exit from the "making an exposure") mode
> Confirmation

7 - Key to select the modality in use:
> High Definition or High Speed in Ceph exams
> High Definition or eXtra Definition in Partial Volume exams

Anatomic selection

8 - Patient selection key: Adult or Child

9 - Size selection key: Small, Normal, or Large

10 - Key for:
> Arch selection: Protruded, Standard or Retracted (for panoramic execution)
> Partial Volume selection: Full, Maxillary or Mandibular (for 3D Dentition examination)

Examination mode

11 - Exam mode selection area

12 +13 - Type of exam selection keys

Centring devices

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

Column height adjustment

15 - Column up key

16 - Column down key

Other

17 - USB Pen Drive key

18 - Service menu key

19 - Virtual keyboard active (green LED)

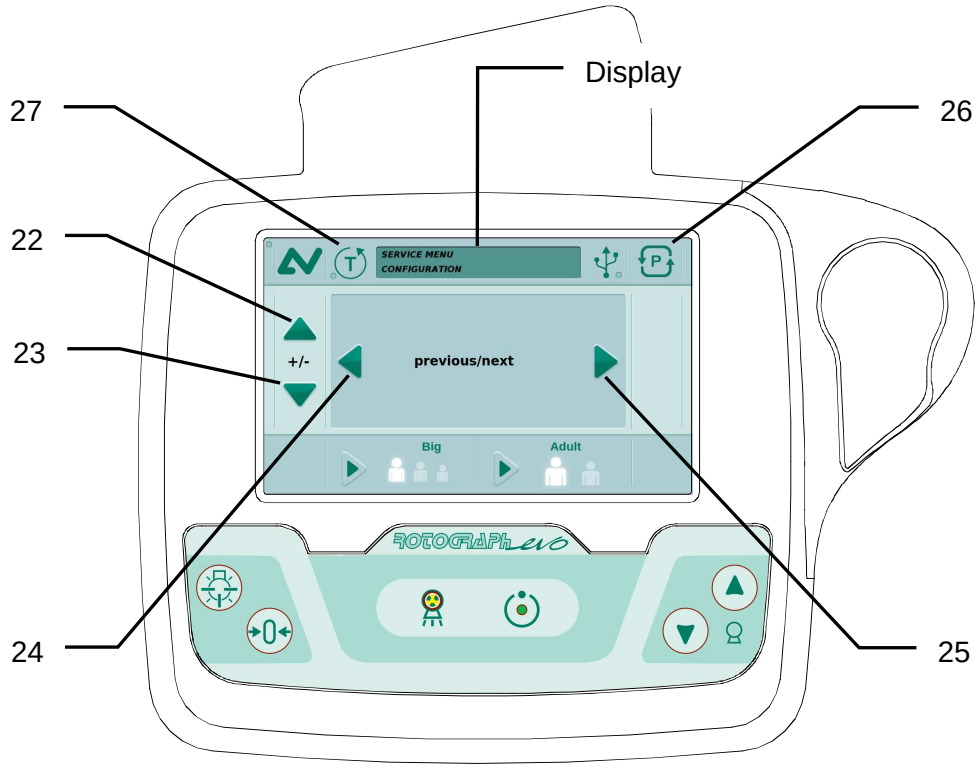


Figure 3-8 – Setup display

LEGEND:

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

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

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	• 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.	• 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 6 types of exam: entire Dentition, Mandibular Dentition, Maxillary Dentition, TMJ Left, TMJ Right, Sinus	
Cephalometry and Carpus	• 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	
3D Dentition reconstructed volume (*)		
Entire volume	93 mm x 82 mm (Diameter x Height)	
Mandibular volume	93 mm x 52 mm (Diameter x Height)	
Maxillary volume	93 mm x 40 mm (Diameter x Height)	
Image magnification	**Geometric magnification**	**Magnification after software correction**
Adult / Child standard Panoramic	1 : 1.28 (constant over dentition part)	1 : 1 (**)
TMJ open/closed mouth, 4 images	1 : 1.25 (nominal)	1 : 1 (**)
Sinus	1 : 1.27 (nominal)	1 : 1 (**)
Ceph (on the sagittal medial plane in LL projection)	1 : 1.10	1 : 1 (**)

(*) NOTE:
For Canadian market, the 3D reconstructed volume are:
- Entire volume: 80 mm x 80 mm (Diameter x Height)
- Mandibular volume: 80 mm x 52 mm (Diameter x Height)
- Maxillary volume: 80 mm x 40 mm ((Diameter x Height).

(**) 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

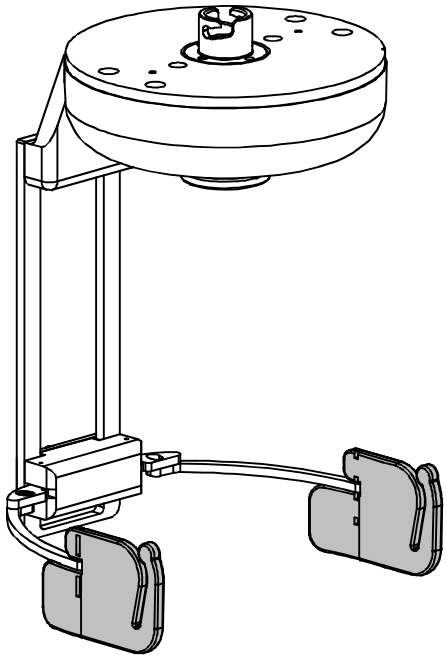
X-ray tube characteristics	
Manufacturer	CEI Bologna (Italy)
Type	OPX 105
Nominal focus size	0.5 IEC 60336
Inherent filtration	0.5mm Al eq.
Anode tilt	5°
Anode material	Tungsten
Nominal maximum voltage	105 kV_p
Filament max current	4 A
Filament max voltage	8 V
Anode thermal capacity	30 kJ
Wide range sensor (Flat Panel)	
Sensitive area	130 x 130 mm
Sensor pixel size	127 µm, 254 µm in binning 2x2
Scintillator screen	Cesium iodide C_sI
Number of sensor pixels (H x L)	1024 x 1024 (binning 1x1) 512 x 512 (binning 2x2)
Voxel dimensions	185 µm (binning 2x2) 93 µm (binning 1x1) available in partial volume exams
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

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	• 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)	• 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)	• 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

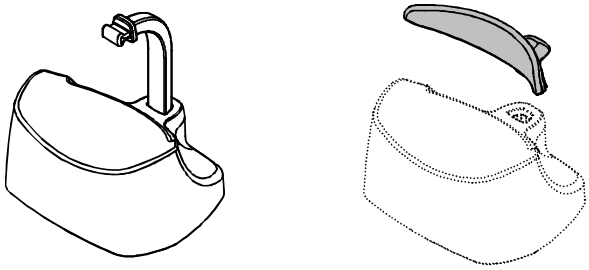
4.1. Separate parts supplied with Rotograph EVO 3D

Rotograph EVO 3D comes with the following removable accessories:

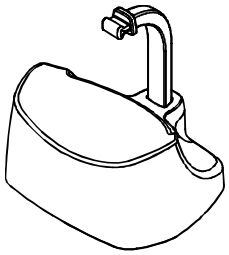
Temple clamp centring device for standardised and volumetric exams



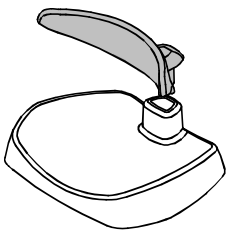
Chin rest for standard panoramic, supplied with removable appendix for edentulous patients

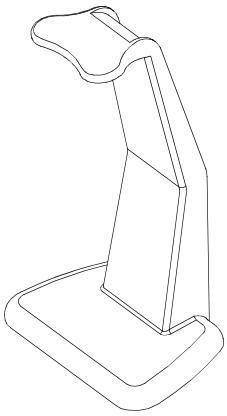
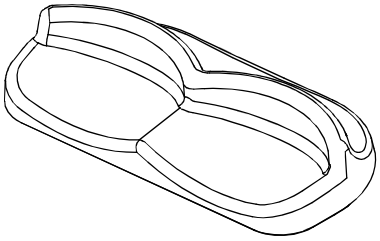


Reduced height chin rest for standard panoramic



Chin rest for Sinus, in non volumetric 3D mode, made by lowered chin rest and appendix for edentulous patients



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

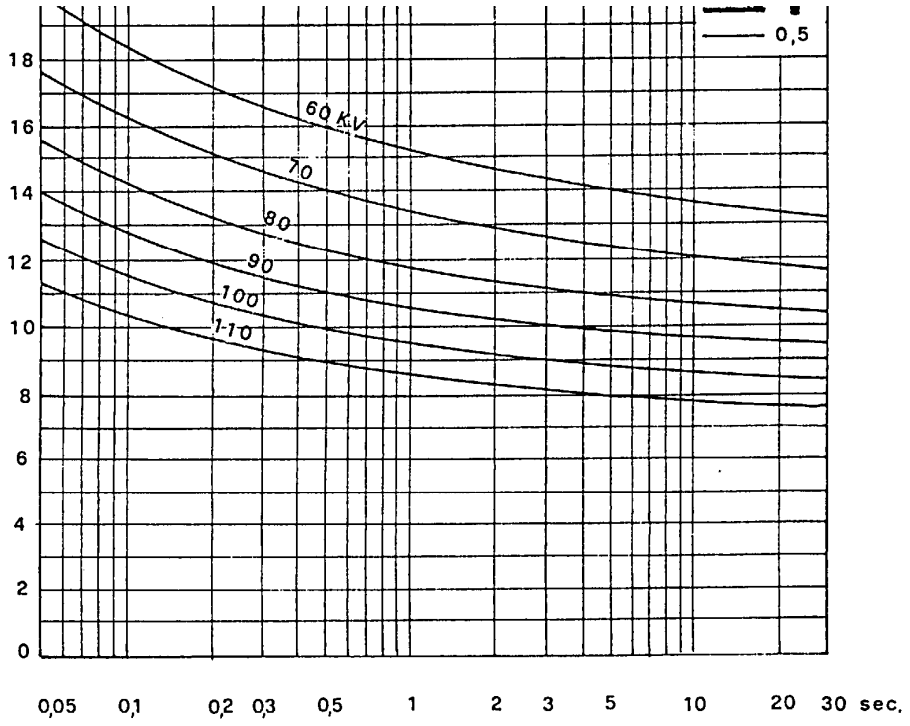
Classifications

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.

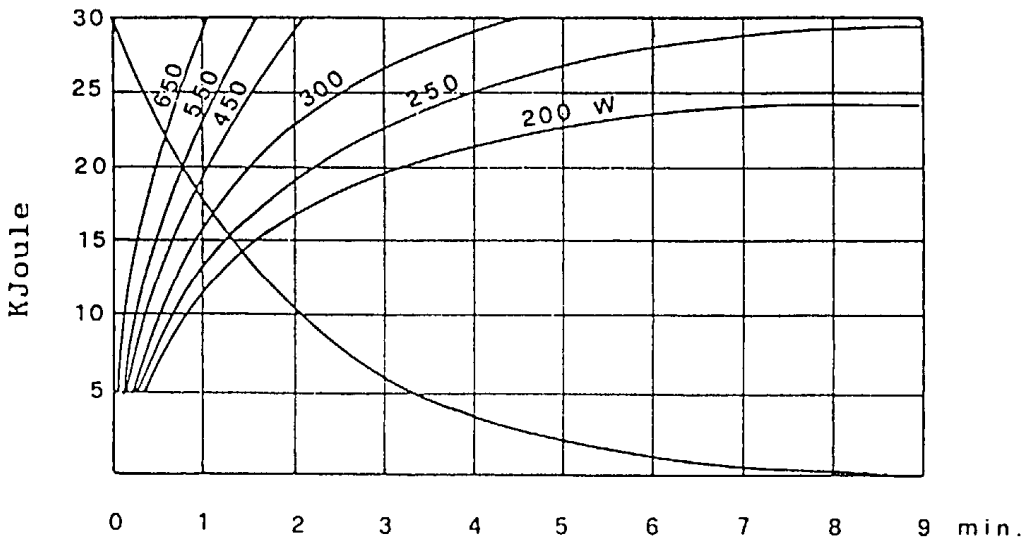
4.3. Loading curve of the tube and cooling curve of the anode

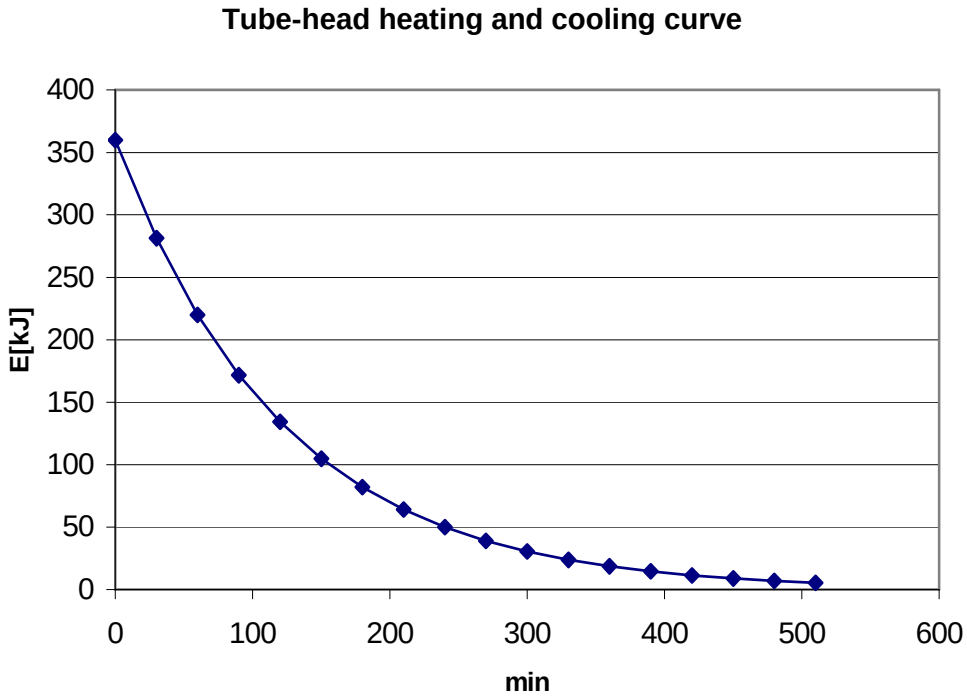
Tube "CEI - OPX / 105" (0.5 IEC 60336)

Load



Anode cooling curve



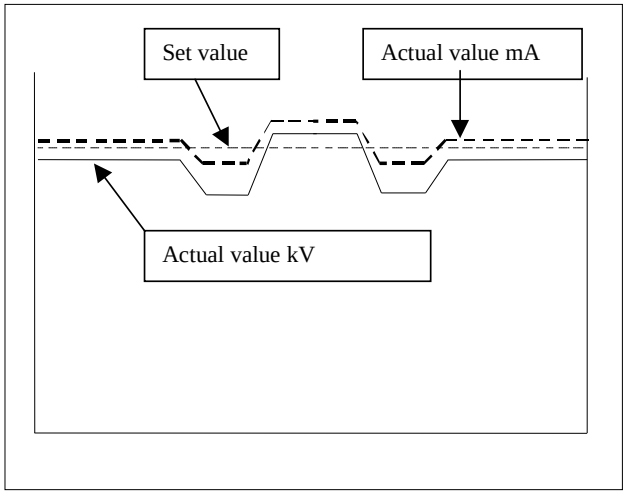

Tube-head heating and cooling curve
400
350
300
250
200
150
100
50
0
E[kJ]
0
100
200
300
400
500
600
min

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.

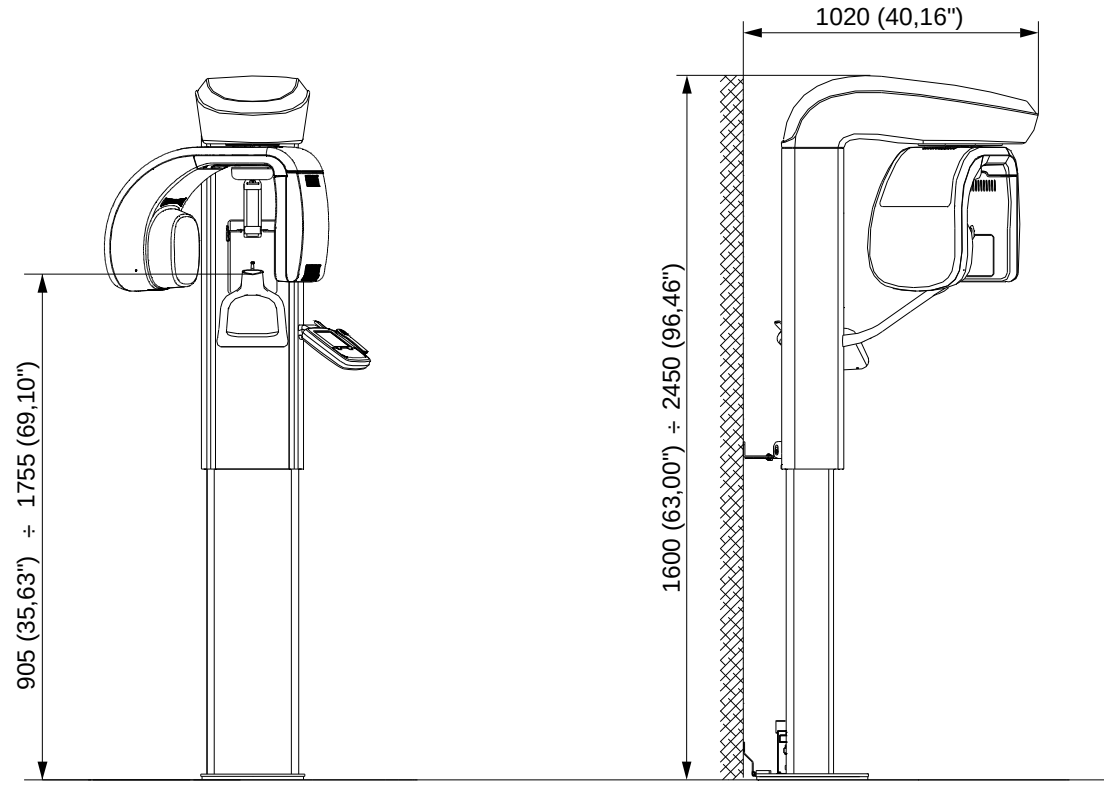
For the measurement of the exposure parameters with the invasive method, please follow the procedure described in paragraphs 6.7.6.1.1, 6.7.6.1.2 and 6.7.6.1.3 of this manual.

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 ± 15%.

4.5. Dimensions



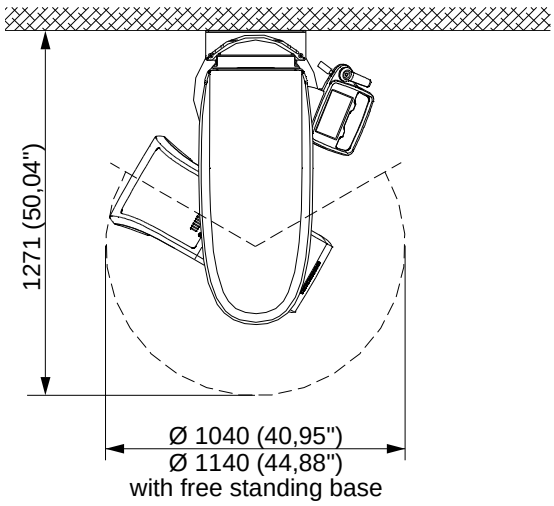
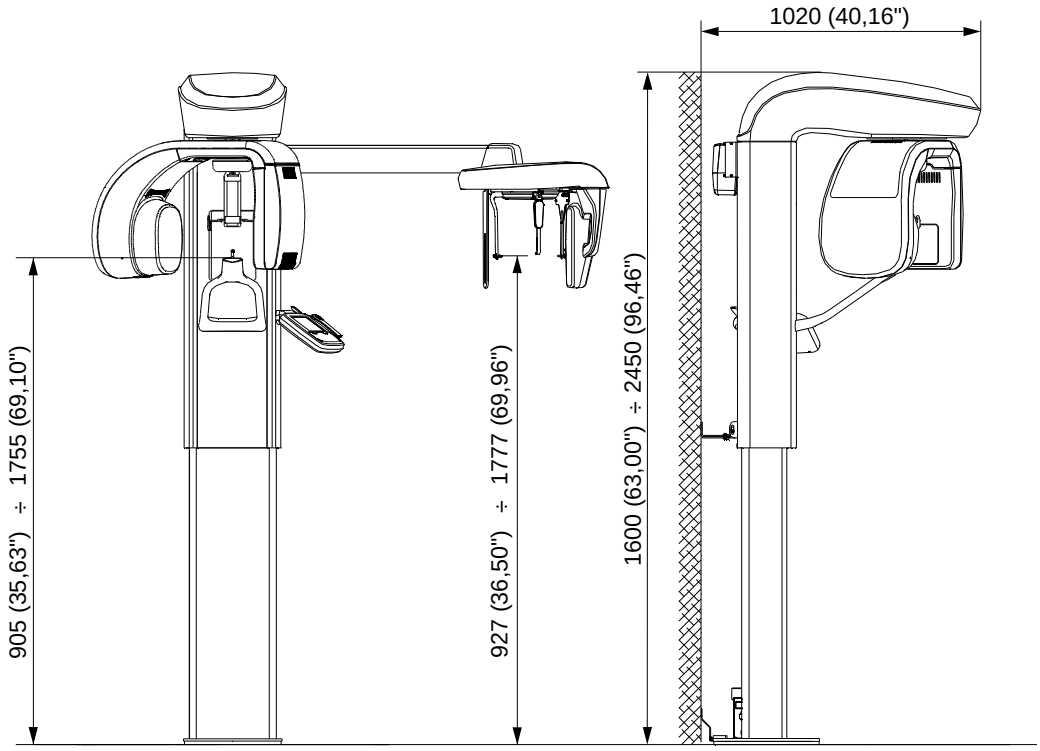


Figure 4-1 - Base version



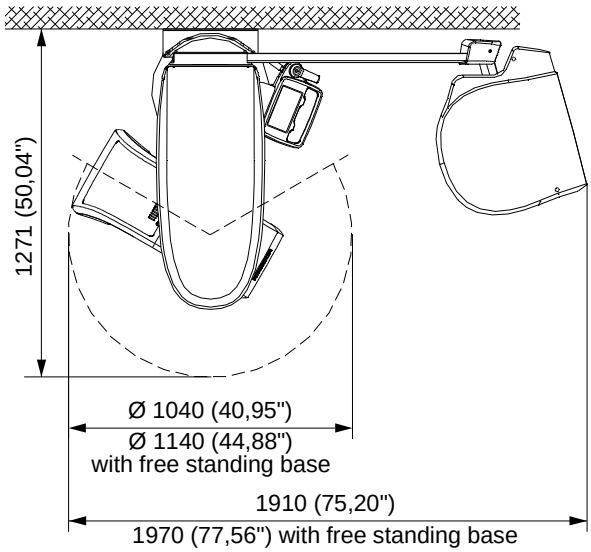


Figure 4-2 - Version with cephalometric unit

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.

5.1. Electrical setting up

• Single-phase grounding supply	220-240 V ~ 110-120 V ~
• Frequency	50/60 Hz
• Power consumption	1.5 kVA (at 230 V) 1.6 kVA (at 115 V)
• Current consumption	7 A (at 230 V) 15 A (at 115 V)
• Apparent line resistance	0.5 Ω max (for 220-240 V version)
• Line voltage regulation	< 3 % at 99 V (for 110-120 V version)

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

The unit must be connected to a differential magneto-thermal switch, to separate the unit from the supply. This switch must comply with the electrical regulations in force in the country of installation.
The supply conductors must have a 1,5 mm^2 (16 AWG) section.
The general grounding must comply with the rules in force; a wrong quality of the grounding could be dangerous for the operator's safety and cause a bad function of the electrical devices.

NOTE:
The electrical connection must be done on the terminal board X0 (see operation circuit diagram – chapter 10).

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.).

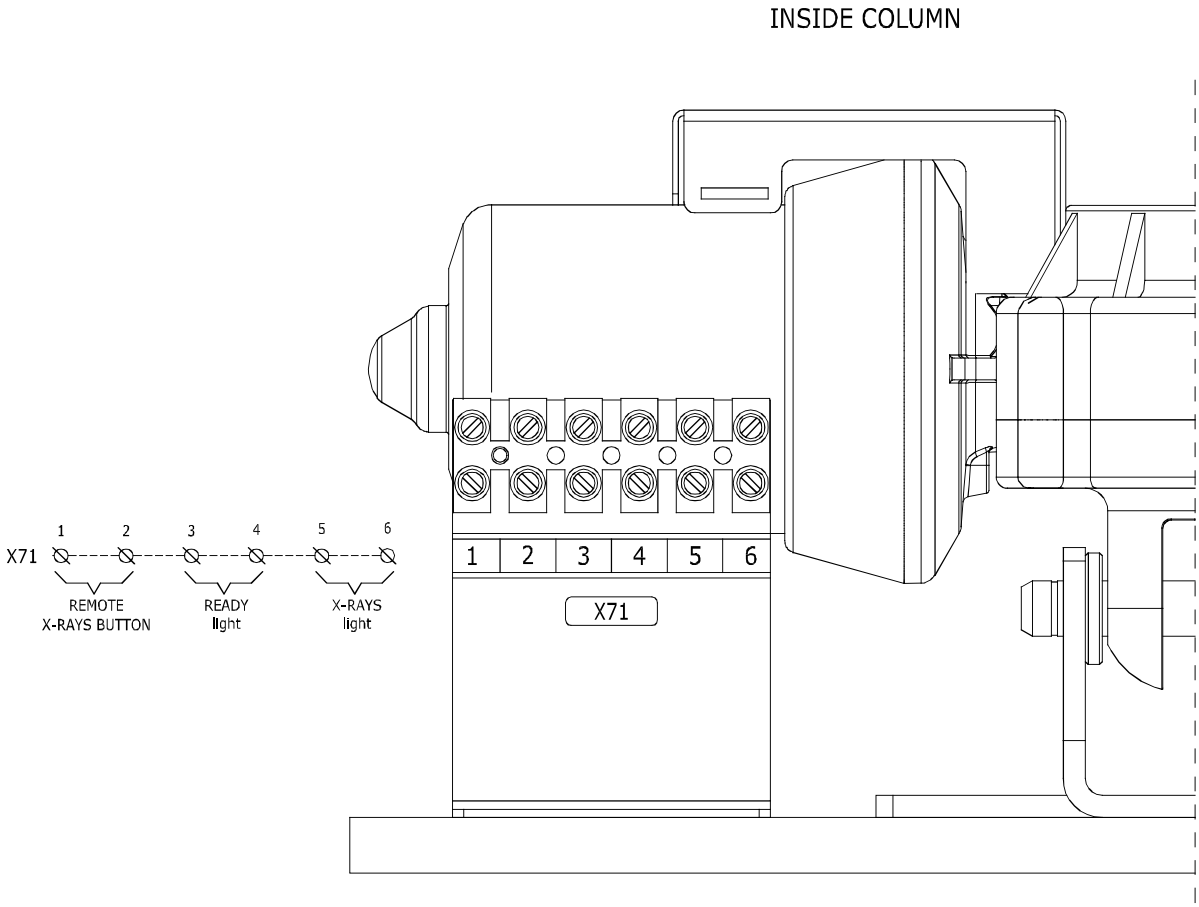


Figure 5-1

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

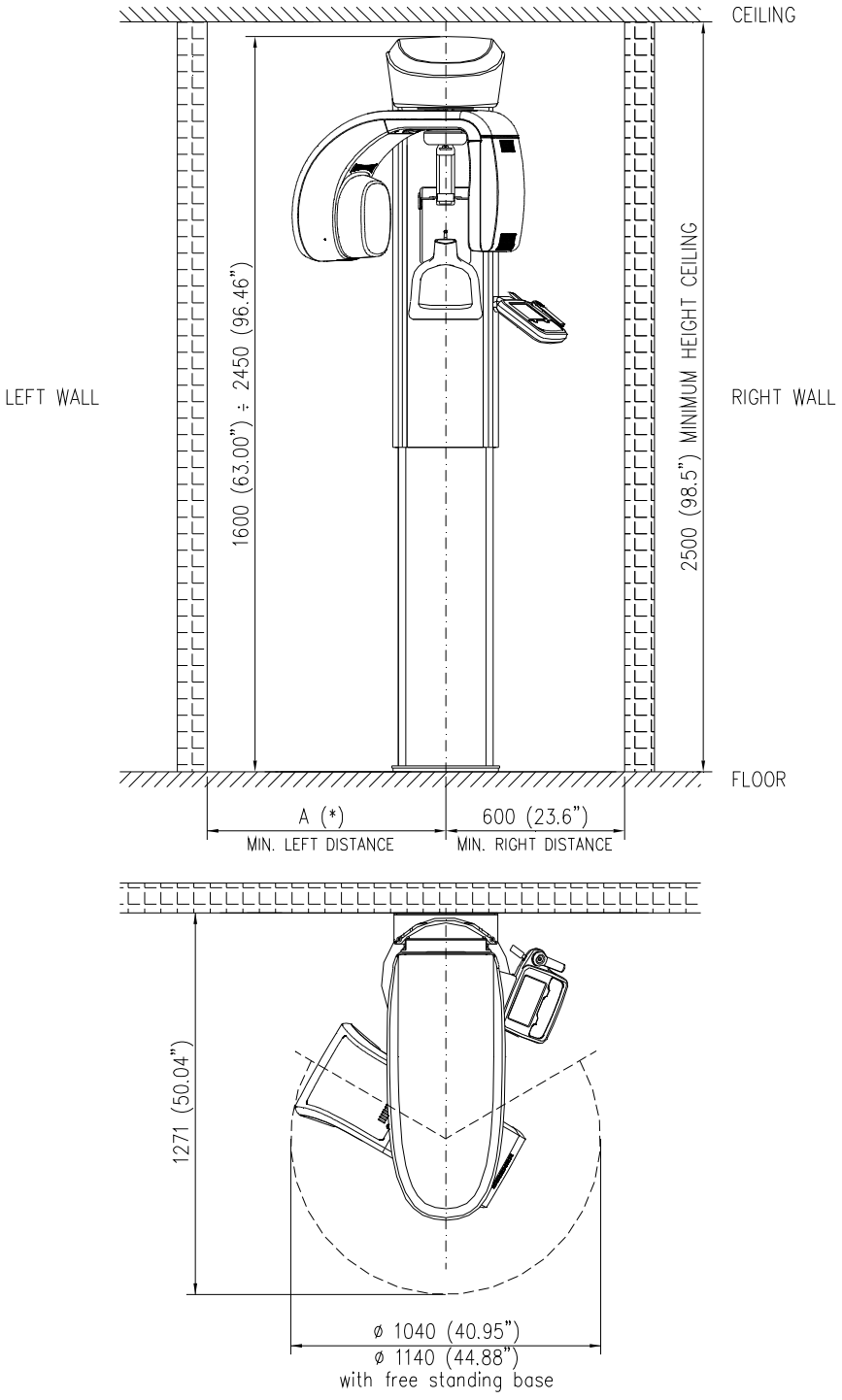
PAN + CEPH version			
Contents	Packing dimension	Weight	
		Net	Gross
- Axis movement device, complete with tubehead - Digital sensor holder - Covers	120x80x67 cm (47.3"x31.5"x26.4")	80 kg (176 lbs)	90 kg (198 lbs)
- Column complete of touch screen - Cephalometric device - Covers - Accessories	162x72x112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

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

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

5.3. Space requirements

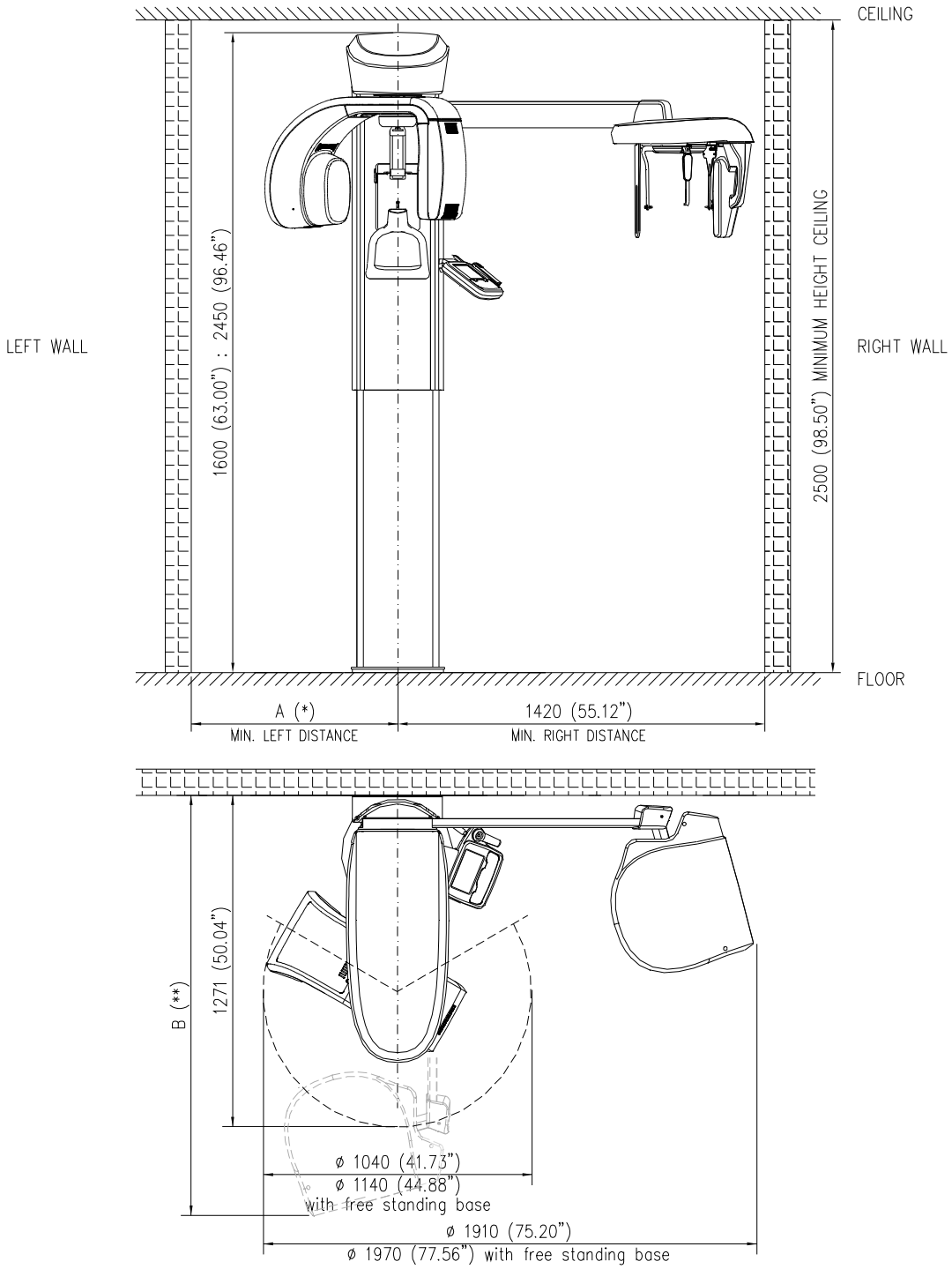
5.3.1. Version without CEPH



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

Figure 5-2

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 5-3

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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).

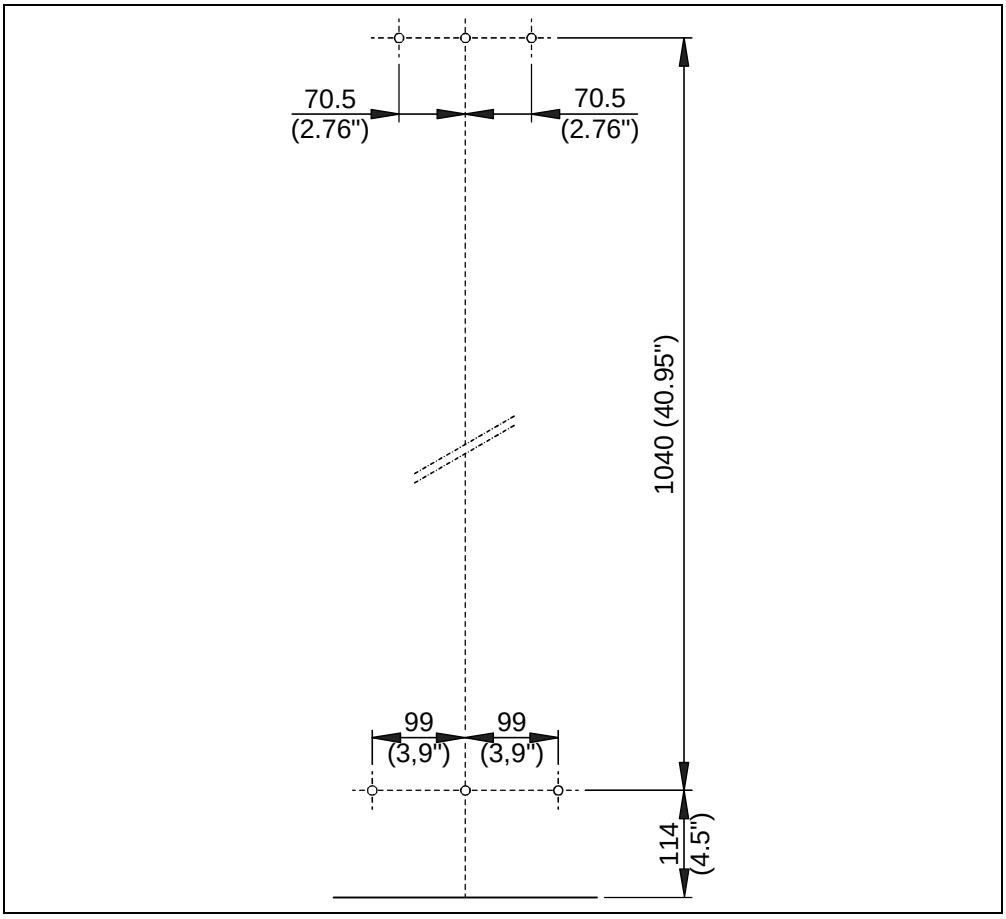


Figure 6-1

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 palled using two fixing brackets (A); an additional retaining bracket (B) is fixed at the upper part of the column (Figure 6-2).
Verify the presence of the four adjustment feet grub screws in the lower side of the column.

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

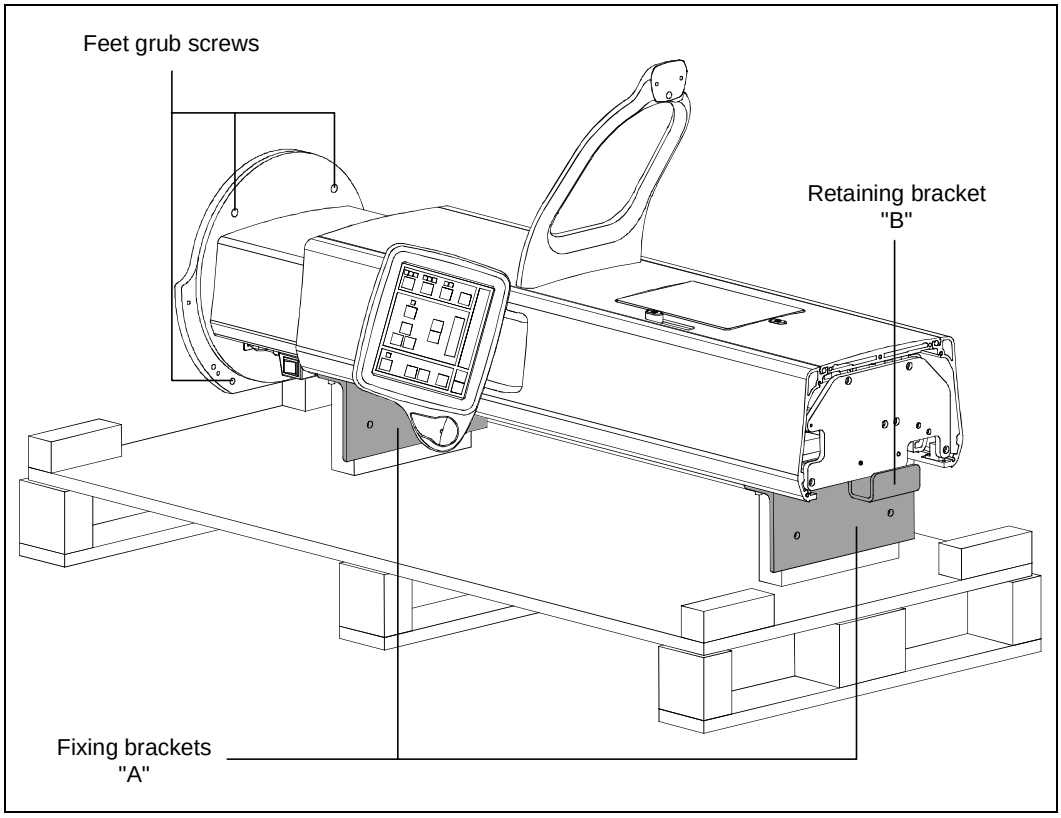


Figure 6-2

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

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

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

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

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

NOTE:
Rotograph EVO 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.

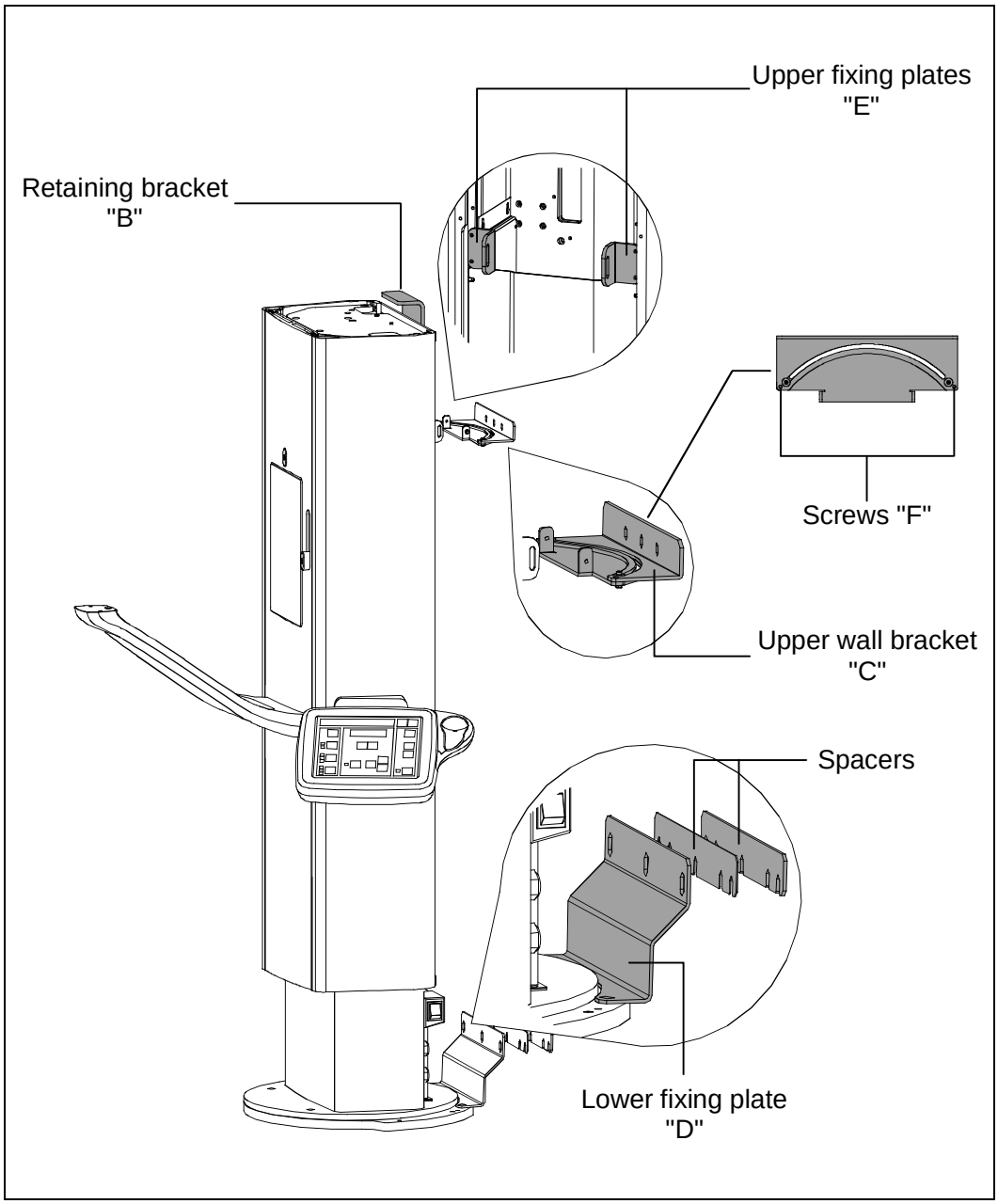

Upper fixing plates
"E"
Retaining bracket
"B"
Screws "F"
Upper wall bracket
"C"
Spacers
Lower fixing plate
"D"

Figure 6-3

6.3. Mounting of the rotating arm assembly

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

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

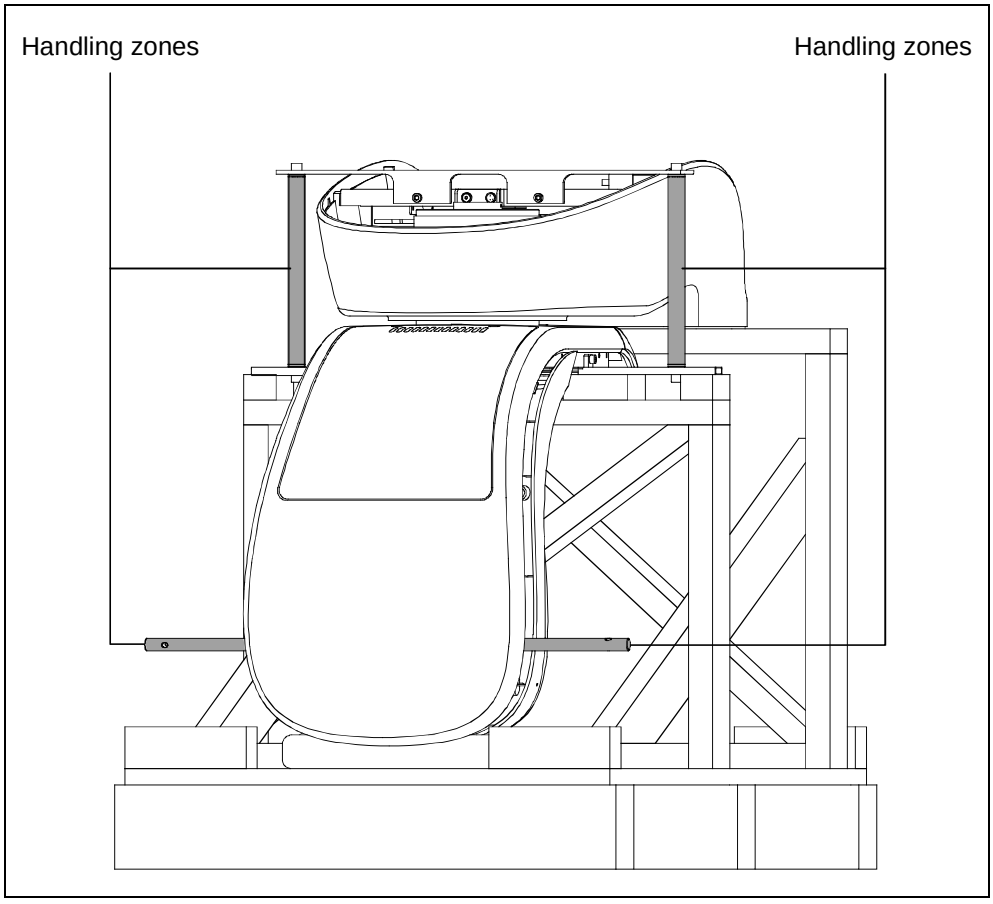


Figure 6-4

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

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

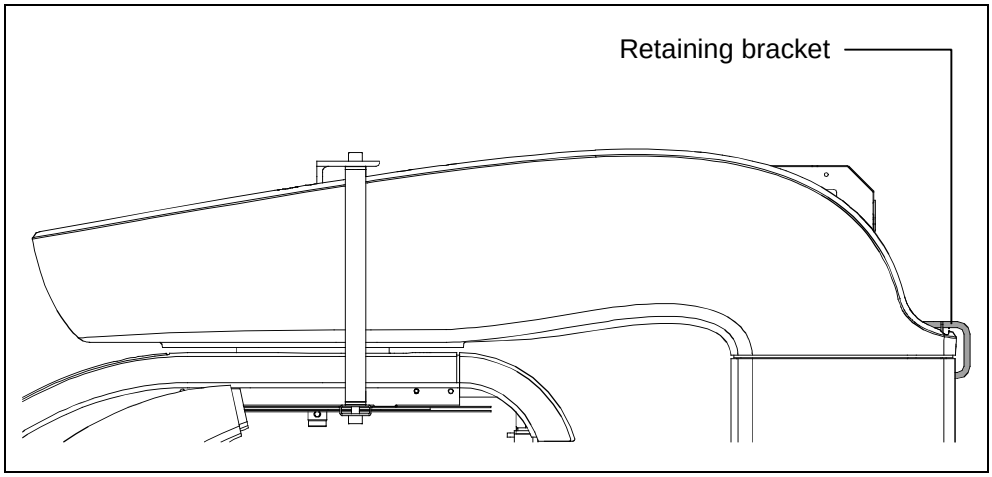


Figure 6-5

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

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

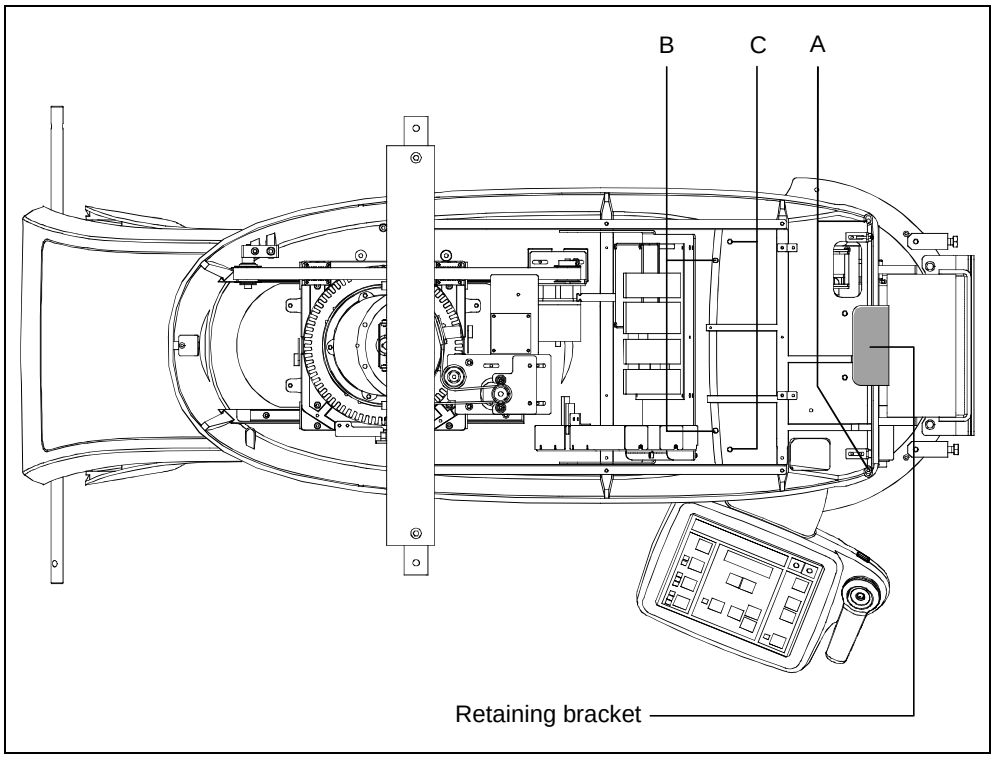


Figure 6-6

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

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

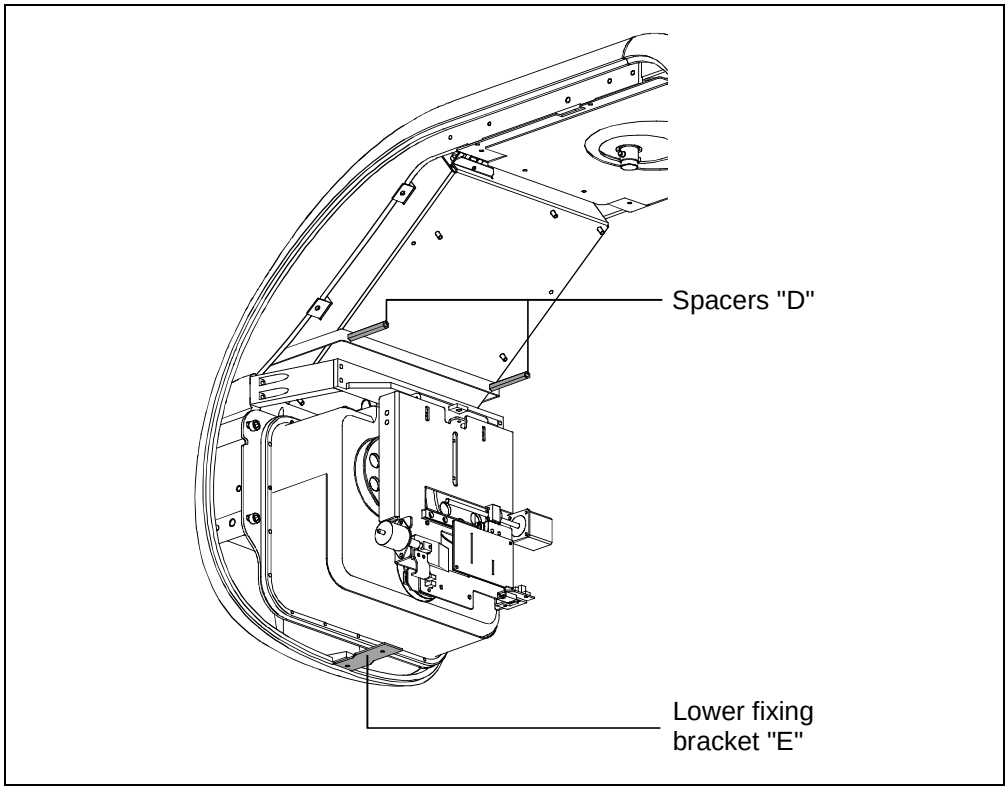


Figure 6-7

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

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

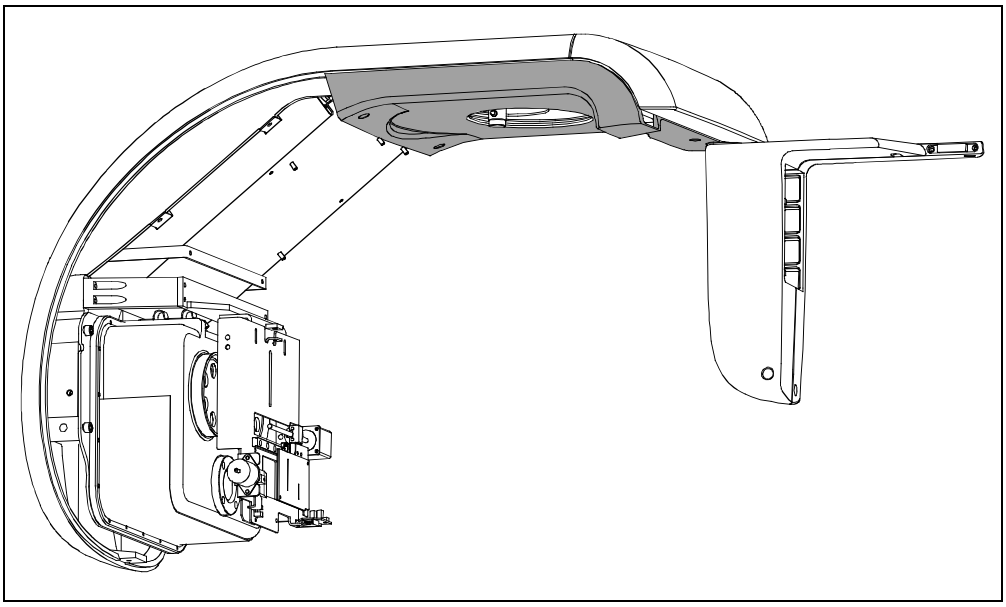


Figure 6-8

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

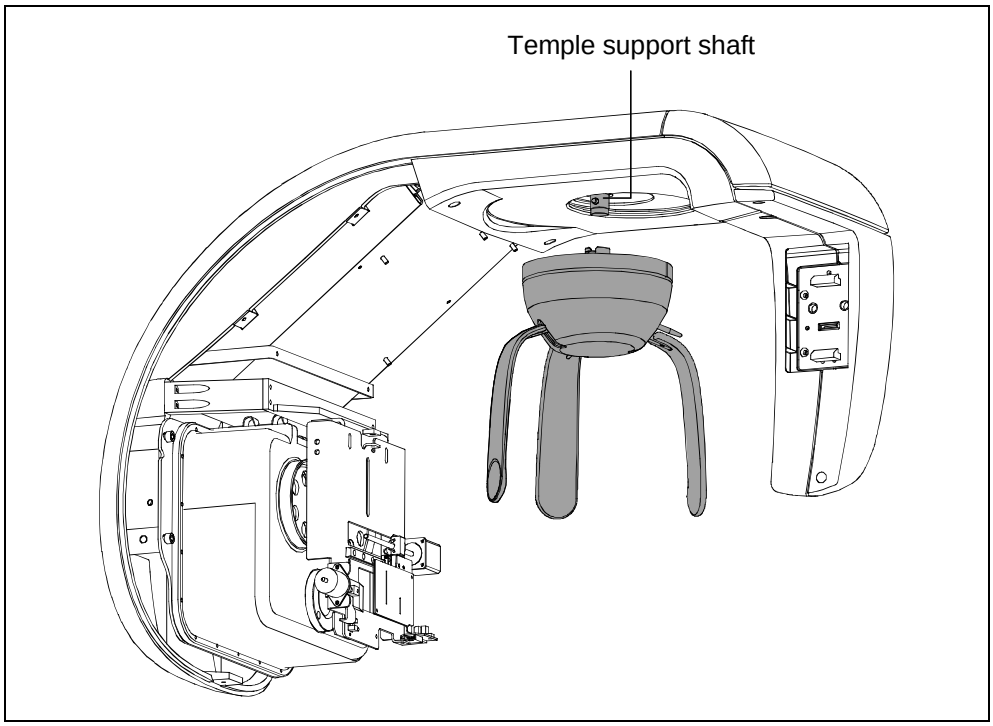


Figure 6-9

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

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

6.4. Mounting of CEPH-arm (Optional)

The CEPH kit can be installed on the machine both during the first installation and later as updating of the device. In case the Rotograph EVO 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.

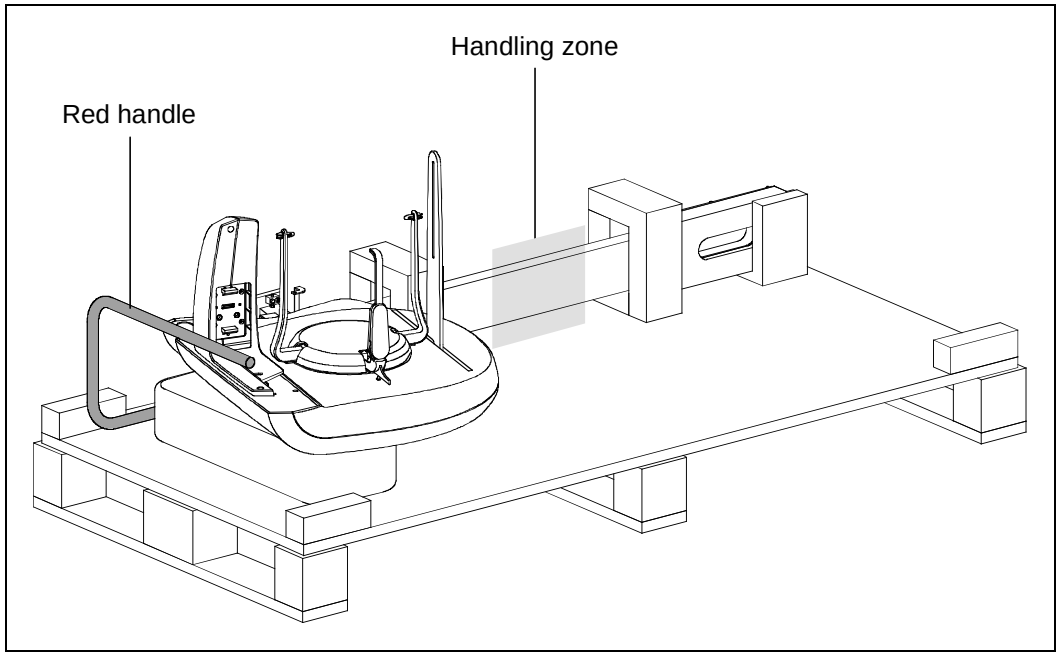


Figure 6-10

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.

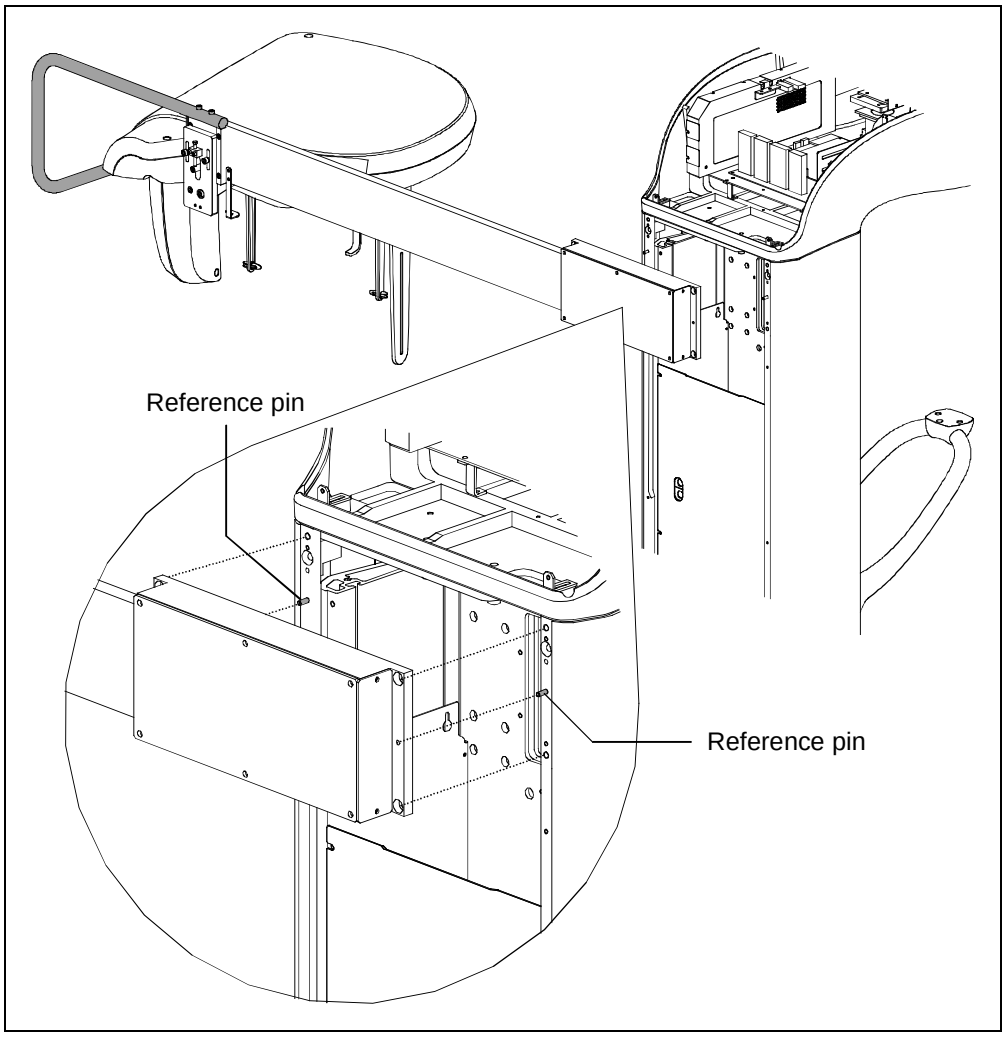


Figure 6-11

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.

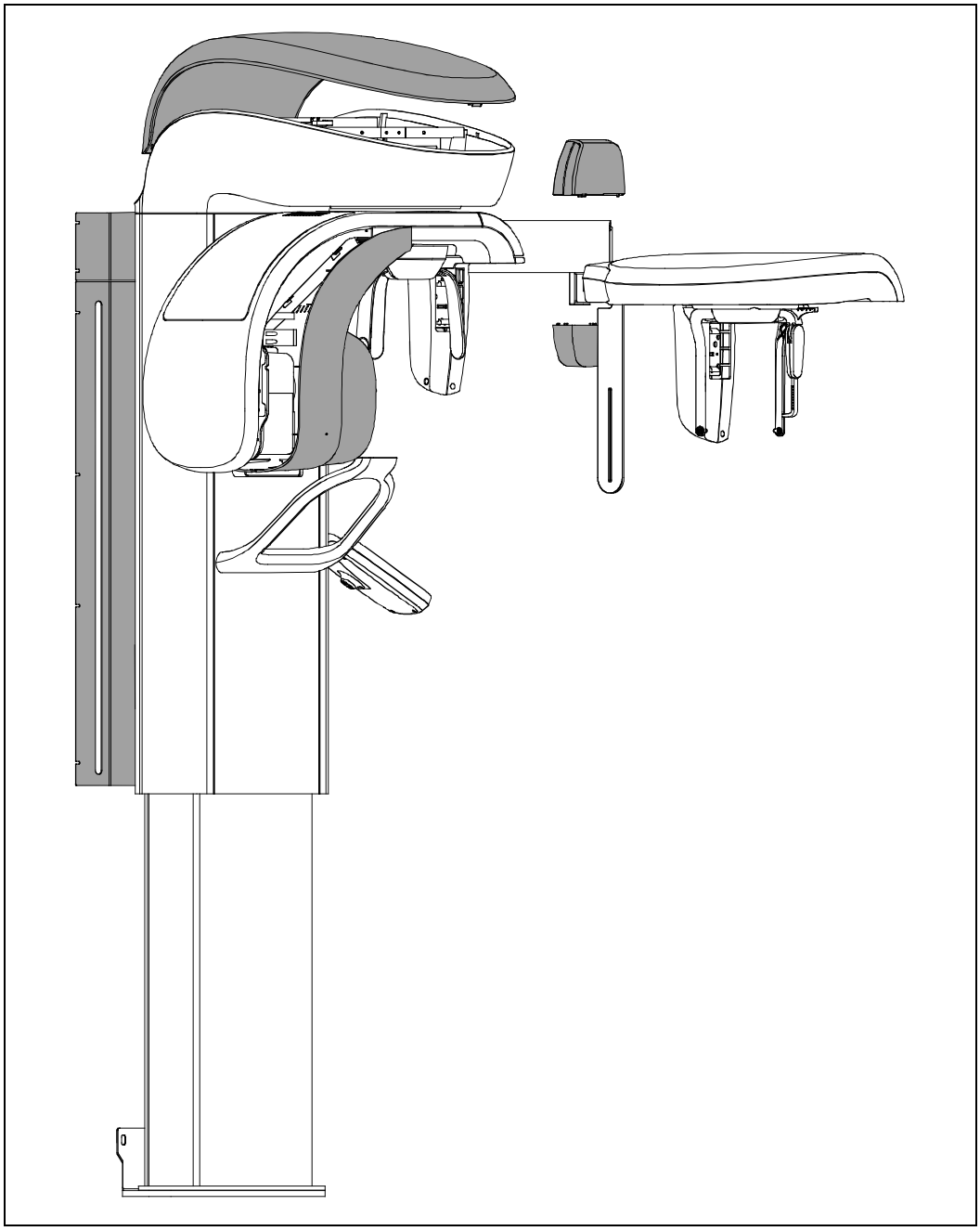


Figure 6-12

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 Dental Studio license USB key.

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 2 Ethernet cables in order to permit the PC connection.
To connect the 2 cables between PC and Rotograph EVO 3D, make reference to the labels of the Ethernet ports on the equipment and on the PC.

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 9.6.5.

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 third network card (not labeled).

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. Authorized 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 7.3.3.17), this procedure has to be performed first selecting Panoramic STD trajectory and then EVO Panoramic.

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

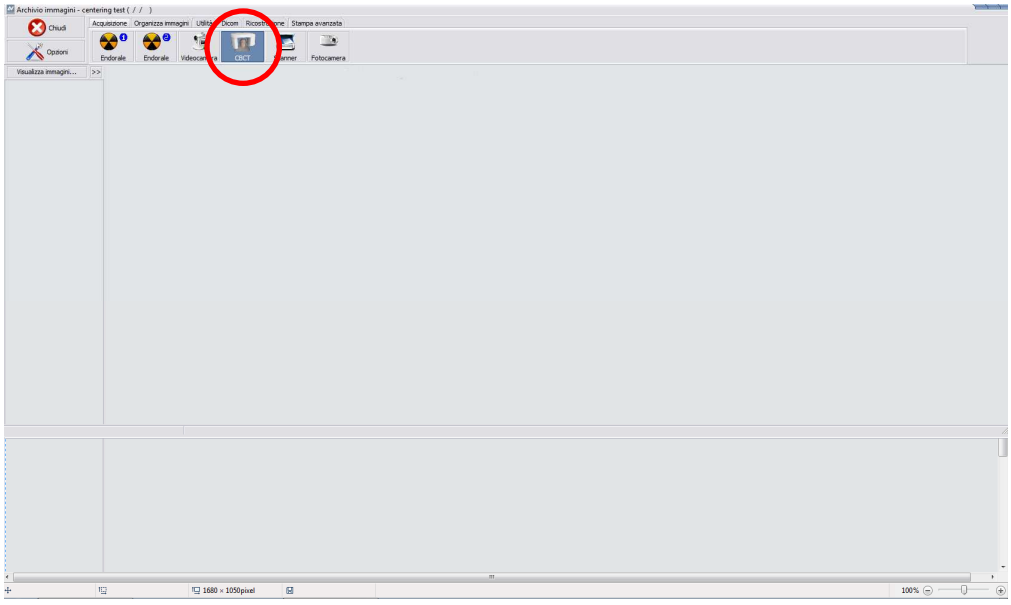


Figure 6-13

3. Select a Panoramic exam.

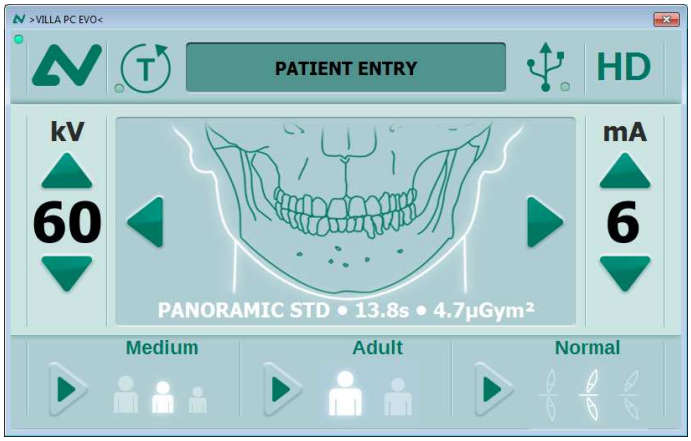


Figure 6-14

4. Place the centering tool (P/N 6195170200) on the support plate (P/N 6195170100) and place it on the chin rest.

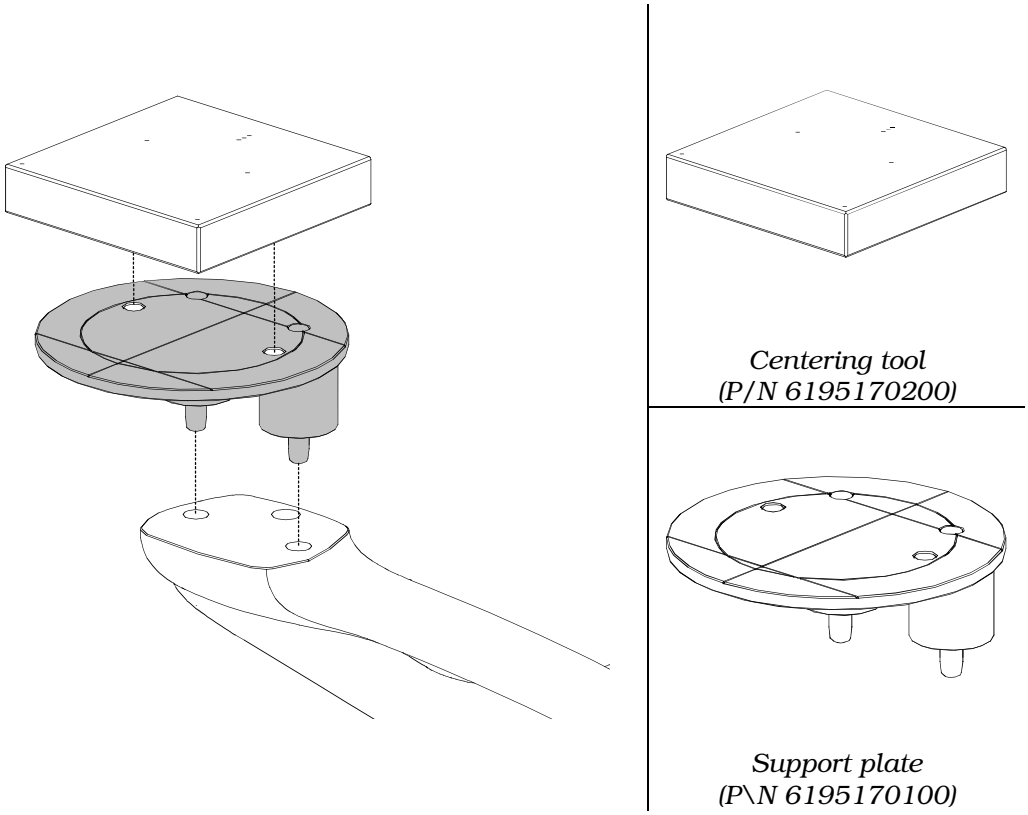


Figure 6-15: Support plate and centering tool positioning

5. Make an exposure in Adult mode at 60kV - 6mA, acquired in the DentalStudio program; the following image will be displayed.

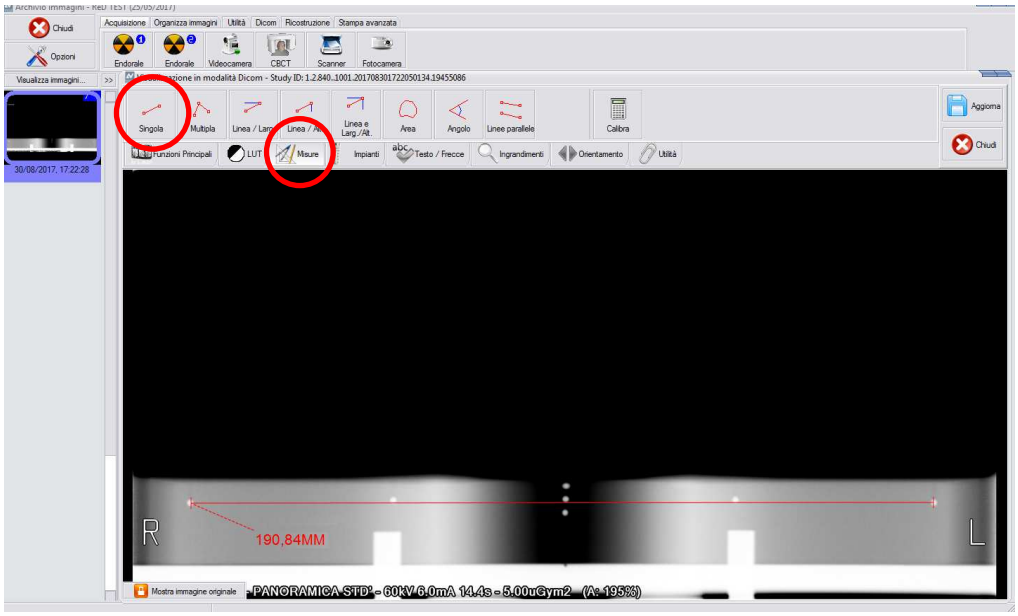


Figure 6-16

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 191mm ± 2mm 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 174 mm ± 2mm.

10. Measure also the two half of the image in order to check symmetry. The difference has to be max. 2mm.
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).

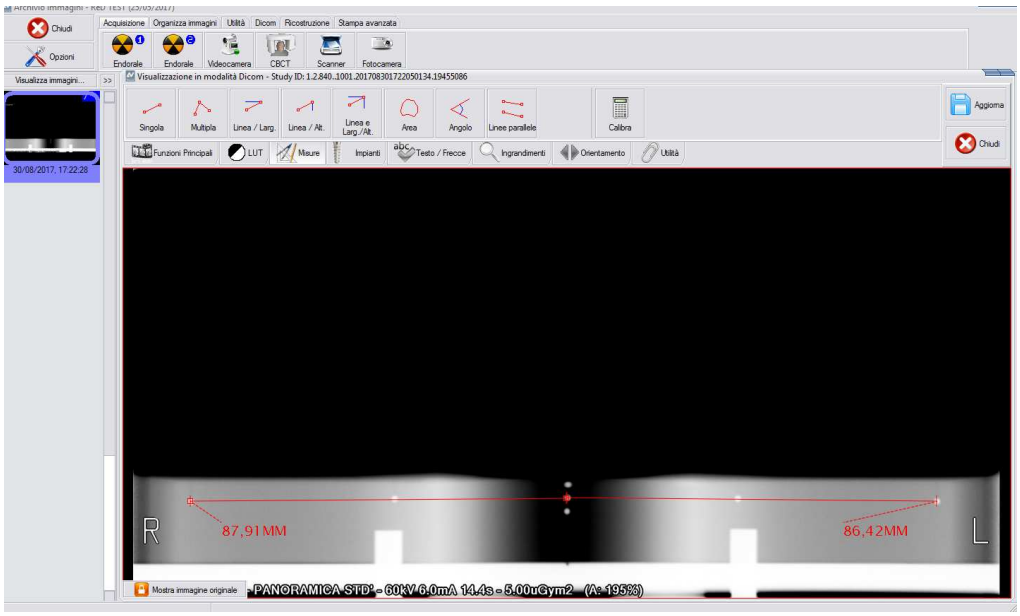


Figure 6-17

6.7.3. Image verification for the 3D function

6.7.3.1. Lateral offset check

1. On Dental Studio program, open a test patient used to make the test images and select the "CBCT" icon (Figure 6-13) to open the virtual keyboard. Select a 3D Dentition exam, full volume and set the parameters to 60kV - 5mA.
2. Place the support plate (P/N 6195170100) on the chin rest and place the centering cylinder (P/N 5207900900) in the middle of the plate.

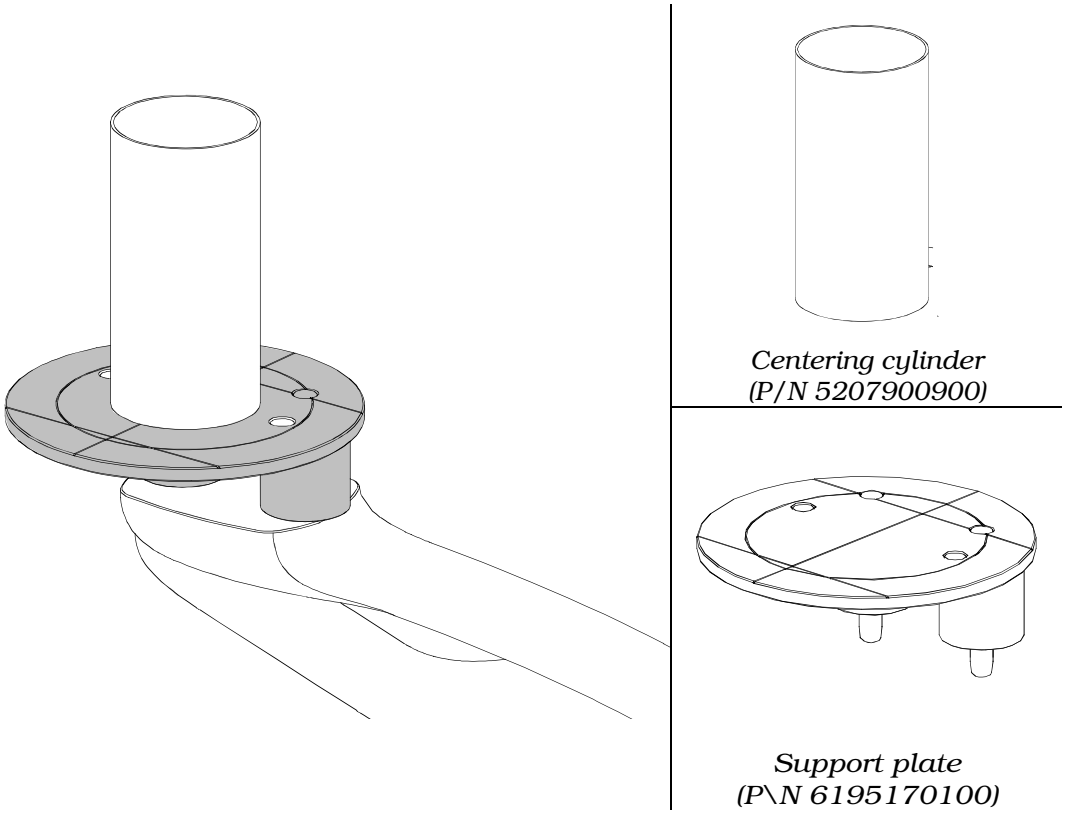


Figure 6-18: Support plate and centering cylinder positioning

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.

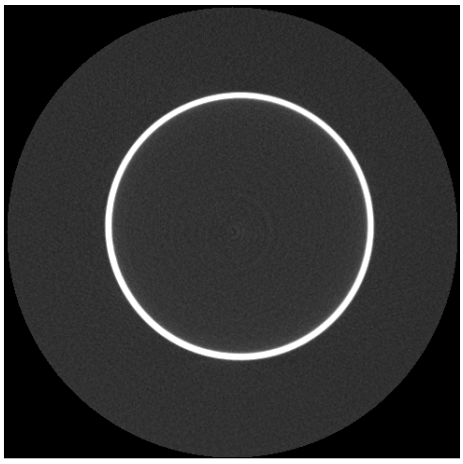


Figure 6-19

5. In case the arc is not correct (see example in Figure 6-20), it will be necessary to modify the lateral offset as described in the paragraph 9.3.2.

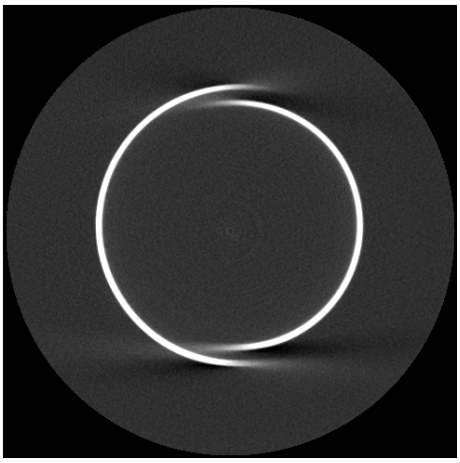


Figure 6-20

6.7.3.2. Partial Volumes calibration check

1. On Dental Studio program, open a test patient used to make the test images and select the "CBCT" icon (Figure 6-13) to open the virtual keyboard. Select 3D Dentition exams.
2. Place the centering tool (P/N 6195170200) on the support plate (P/N 6195170100) and place it on the chin rest (Figure 6-15). Set 60kV - 6mA.
3. Select a mandibular volume exam  and set HD mode 
4. Press "Patient entrance" (6)  . Press exposure button and wait the end of acquisition.
5. Verify that the mandibular volume is well reconstructed; select the "Full Cross" view and verify that the reconstructed volume includes the full height of the phantom.

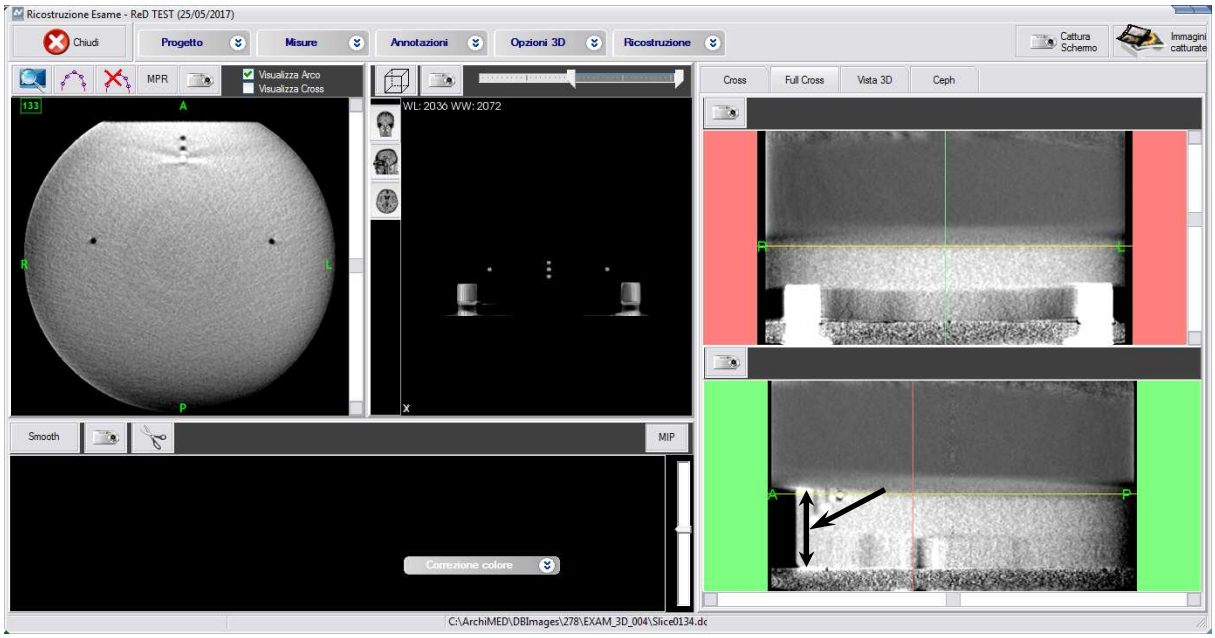


Figure 6-21: Mandibular volume 3D views

6. Place the centering cylinder (P/N 5207900900 -) on the top of the centering tool already present.

7. Select a maxillary volume exam  and set HD mode 

8. Press "Patient entrance" (6)  . Press exposure button and wait the end of acquisition.

9. Verify that the maxillary volume is well reconstructed; select the "Full Cross" view and verify that only the cylinder is visible in the reconstructed volume.

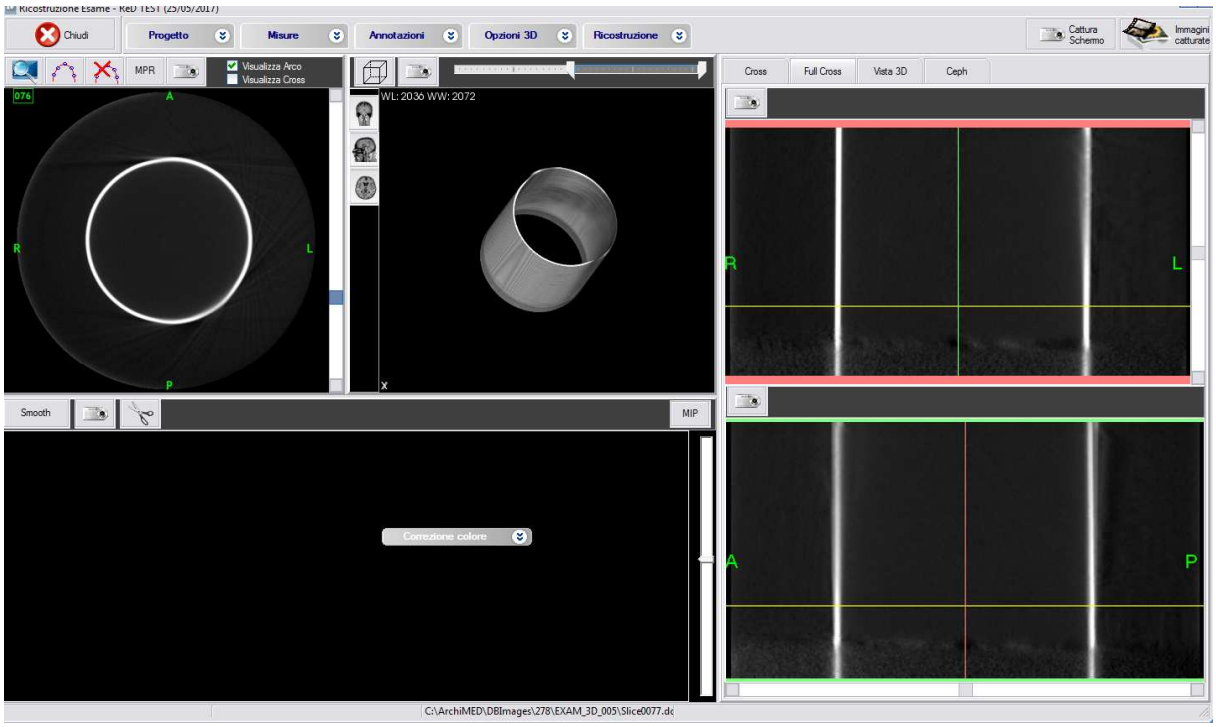


Figure 6-22: Maxillary volume 3D views

6.7.4. Verification of laser reference lines

To check the laser reference line positions place the Laser centering tool (code 6607900400) on the unit handle in the same position of the patient chinrest; place the face where the check lines are signed in a way the laser beams light them (Figure 27).
Power on the laser and check (Figure 28):

- the mid saggittal laser line is within ± 1mm of the central line of the tool
- the frankfurt laser line is parallel to the corresponding reference on the tool.

In case the laser lines don't meet the checks call the technical assistance to fix the problem.

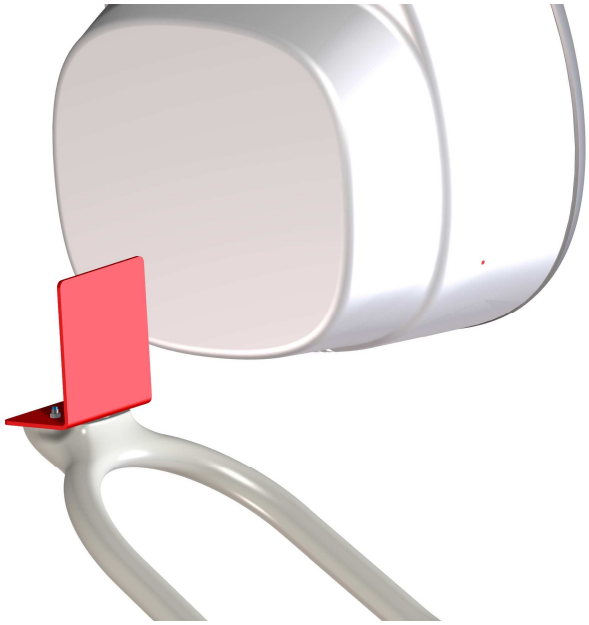


Figure 6-23
Tool position

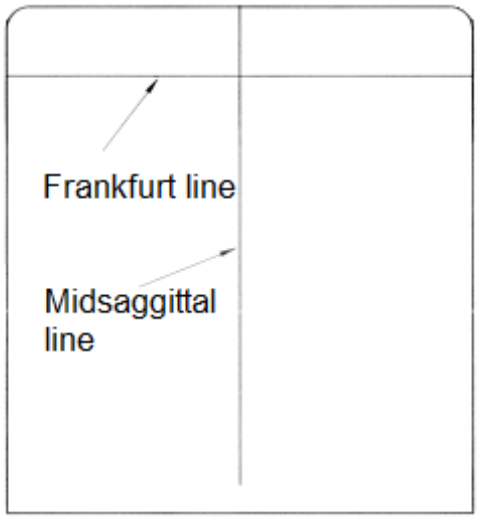


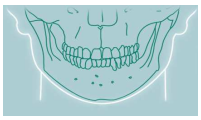
Figure 6-24
Reference lines on the tool

6.7.5. 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 9.7).

1. Press "Exam Mode Selection" area (11)  ; 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 6-25), it is necessary to adjust the mechanical position of the rings (see paragraph 9.7.1).

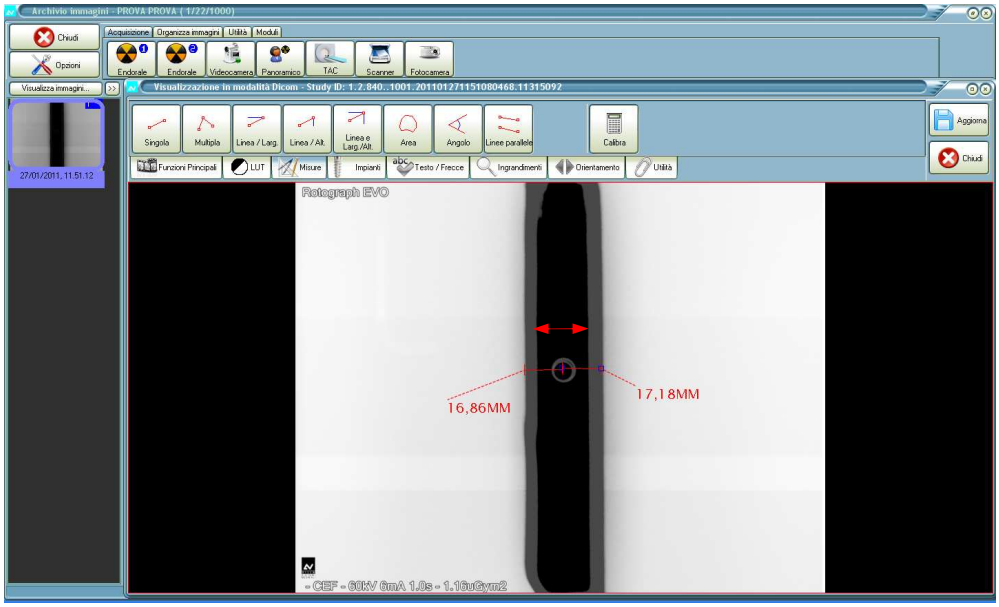


Figure 6-25

– If the image is not symmetric in the window (Figure 6-26), it will be necessary to adjust the CEPH sensor position (see paragraph 9.7.2).

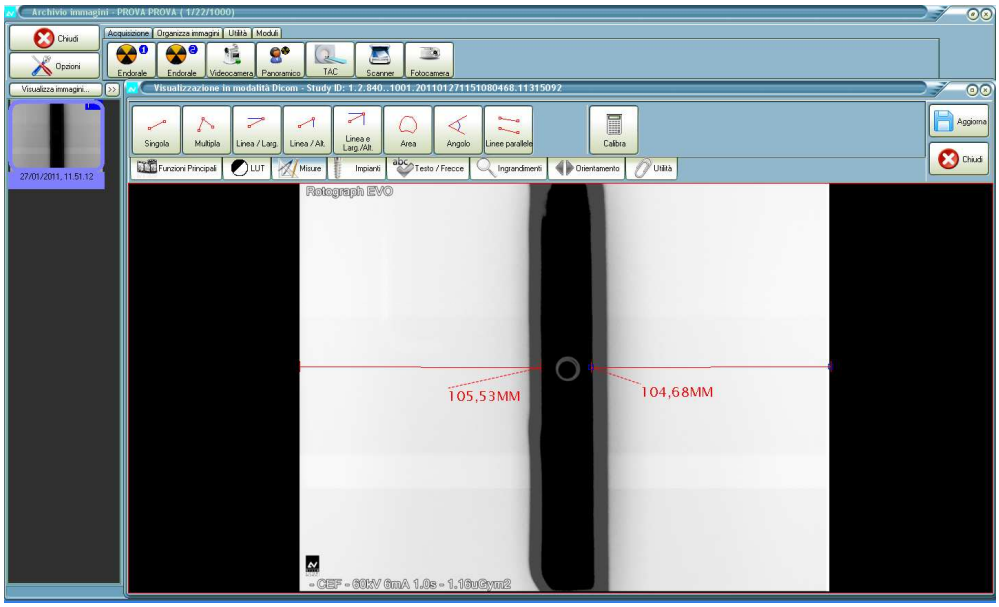


Figure 6-26

4. Select "CEPH sensor zero" menu (see paragraph 9.7.3) to check the secondary collimator position.

5. 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.

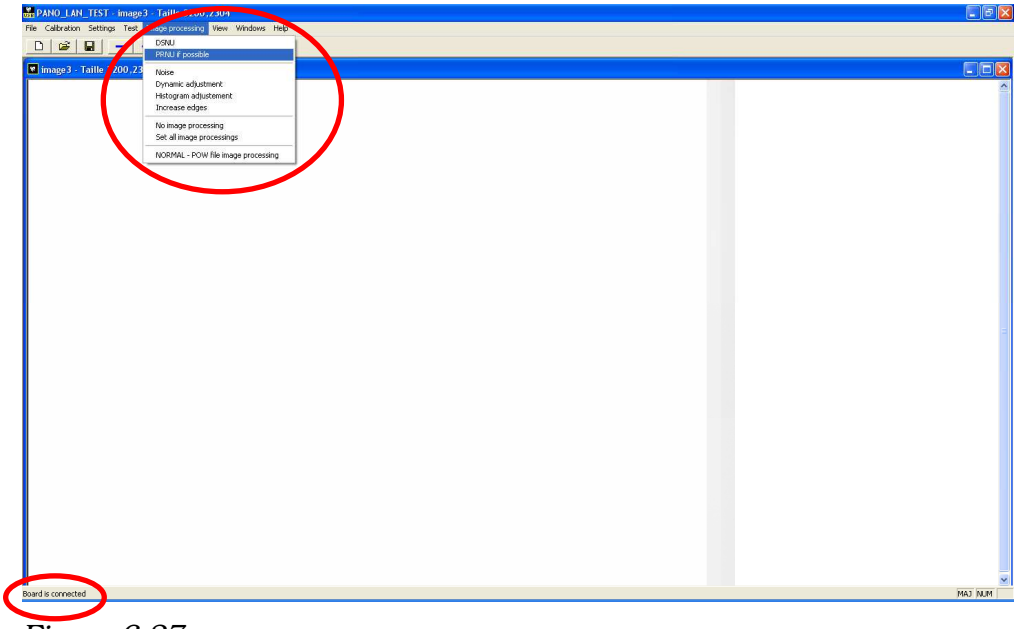


Figure 6-27

6. Press key "Patient entrance" (6)  . 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.

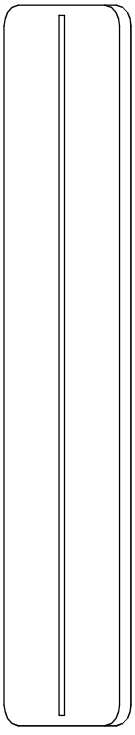


Figure 6-28
Centering tool P/N 5209900900

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

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.

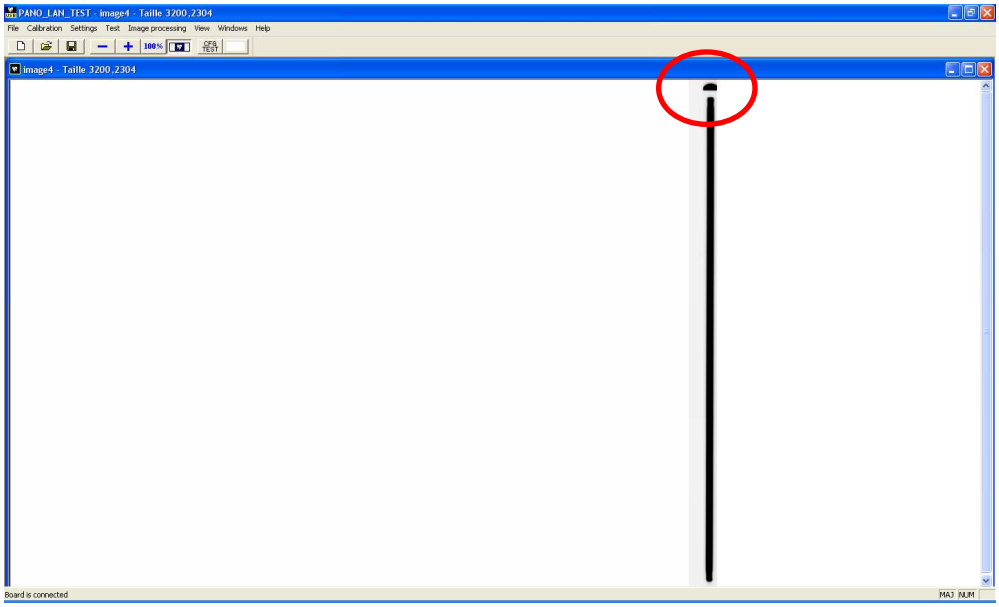


Figure 6-29

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

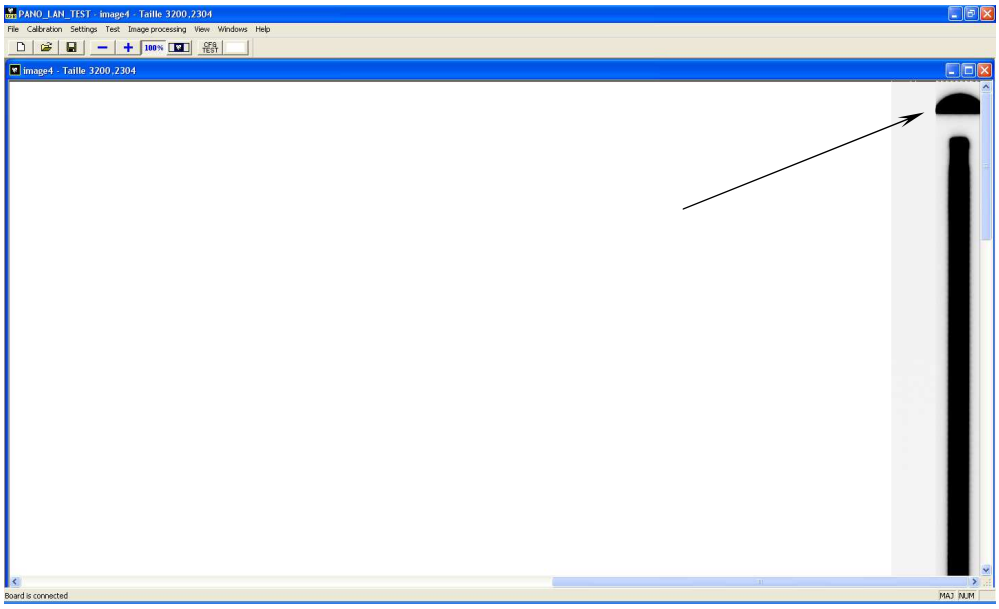
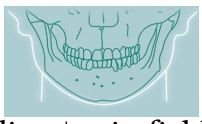


Figure 6-30

10. Enter in "STF zero" (see paragraph 9.7.4) to verify the functionality of the Soft Tissue Filter.

11. Press "Exam Mode Selection" area (11)  key, this operation insert also the secondary collimator in field.

12. Make a exposure with the same parameters (60kV – 6mA – 0.5s).

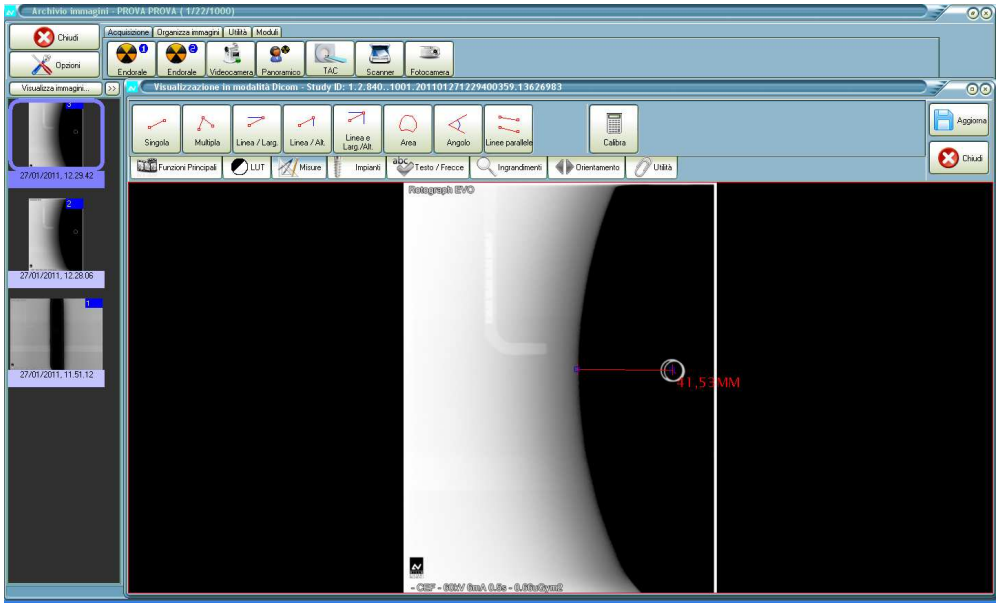


Figure 6-31

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).

6.7.6. Verification of exposure parameters

6.7.6.1. Invasive method

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

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

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

b. Remove the protection grid of the Generator board.

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

The exposure parameters can be checked with the procedure described:

1. Power OFF and ON the unit: the display shows the starting image for about 1 minute. After this time the "Ready for X-ray" and the "X-ray emission" LEDs blink two times and on the display will be present the Villa logo.
During this phase, press the column up and column down keys  simultaneously and hold them pressed. After 3 seconds, the setup display will be visualized (Figure 3-8).

2. Using the scroll right (25) and scroll left (26) keys  to change the message displayed until the following menu is displayed:

" SERVICE MENU
TROUBLESHOOTING "

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

" SET UP
PASSWORD? 100 "

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

4. Using the scroll right (25) and scroll left (26) keys  go to the "RX EMISSION" menu and confirm with the key "Patient Entrance" (6).
At the selection of the X-ray emission test, the display will show the following message:

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

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

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

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

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

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

Pressing the X-ray button will start the emission.

The allocable values for exposure parameters are on the following table:

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

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

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

6.7.6.1.1. kVp

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

Should this last value be outside the specified limit, detect the "set kV" voltage supplied by CPU, connecting the voltmeter between TP40 GND test points and TP46 kV (set nearby X57). The value on these points must range from 2.7 and 3.3 V (3V±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 ≤ ±3kVp tolerance. The high voltage value must be within 8% of the set value, while the time value must be within 10% of the set value. If the voltage is not within the expected range, replace the tubehead; otherwise replace Generator CPU board.

6.7.6.1.2. mA Check

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

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

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

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

6.7.6.1.3. Time

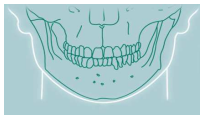
Verify the accuracy of the exposure time using an oscilloscope connected at the same test points used to measure mA (TP40 for GND and TP29 mA) of the Generator board (A10). The exposure time calculated at about 75% of the maximum kV value, must correspond to the set one ±10%. In case the time is outside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

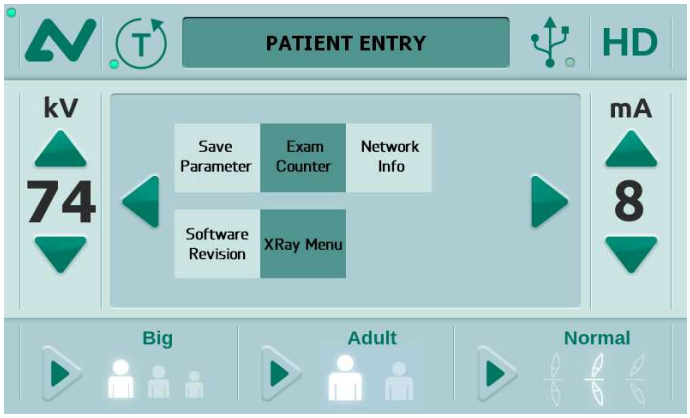
6.7.6.2. Non-invasive method

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.

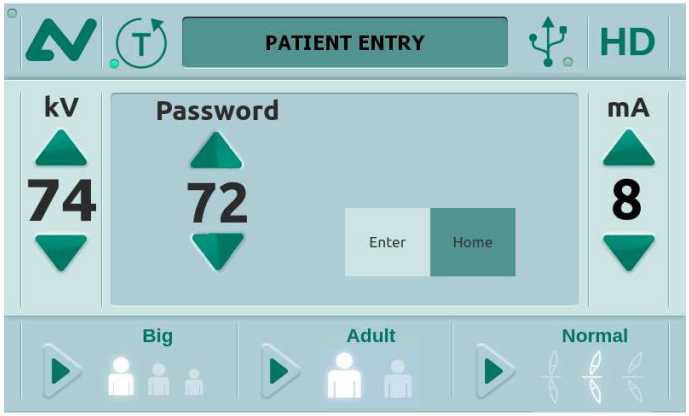
The exposure parameters can be checked with a non-invasive instrument by performing the following procedure:

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

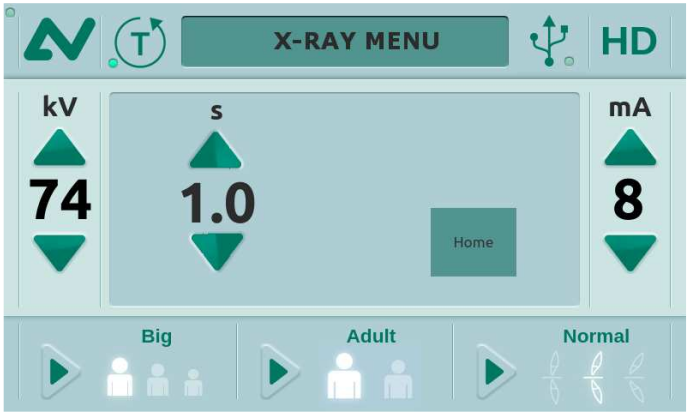


3. Select "XRay Menu".

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



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



WARNING:
The following operations foresee the emission of rays, therefore the Authorised Technician should pay the utmost attention and respect the safety standard in force in the related country.

NOTE:
This program allows to perform the measurement of the exposure parameters with the tube-head in the fixed position (not rotating) and constant parameters.

6. Position the measuring instrument.

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

Parameter	Minimum value	Maximum value
kV	60	86
mA	6	12
s	0,2	15

Table 1

8. Perform an exposure by pressing the rays button; the technical factors can then be read on the instrument.

NOTE:
Performances are insured if the measurement of technical factors occurs with invasive method. Measurements taken with a non-invasive method could introduce errors due to the tolerance of the instruments or incorrect implementation of the measurement.

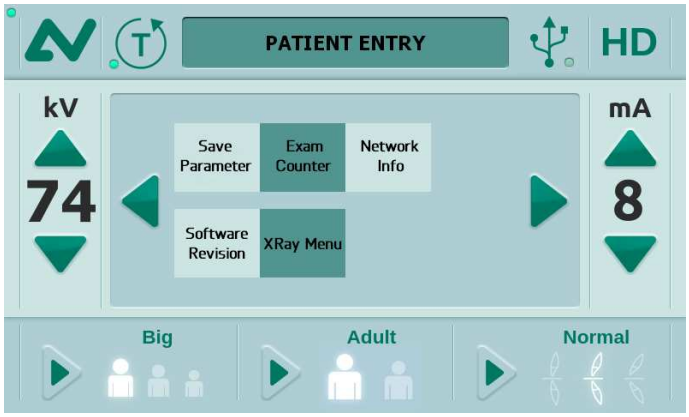
9. Press key "Home" to end the control program, the display will visualize the "Service Menu". Pressing key (18)  the unit will return to standard mode.

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



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

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

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

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

6.7.7.1. Table of pre-set anatomic parameters

PANORAMIC

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

TMJ open/close mouth

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

SINUS

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

3D Dentition

	Adult	Child
Small	78 kV 8 mA	64 kV 9 mA
Medium	80 kV 8 mA	66 kV 9 mA
Large	82 kV 8 mA	68 kV 9 mA

	Adult	Child
Small	82 kV 9 mA	64 kV 10 mA
Medium	84 kV 10 mA	66 kV 10 mA
Large	86 kV 10 mA	68 kV 10 mA

3D TMJ Left / 3D TMJ Right

	Adult	Child
Small	80 kV 8 mA	64 kV 9 mA
Medium	82 kV 9 mA	66 kV 9 mA
Large	84 kV 10 mA	68 kV 9 mA

3D Sinus

	Adult	Child
Small	76 kV 8 mA	64 kV 9 mA
Medium	78 kV 9 mA	66 kV 9 mA
Large	80 kV 10 mA	68 kV 9 mA

CEPHALOMETRY (L.L)

	Adult	Child
Small	70 kV 6 mA	70 kV 6 mA
Medium	74 kV 6 mA	72 kV 6 mA
Large	76 kV 6 mA	74 kV 6 mA

CEPHALOMETRY (A/P - P/A)

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

6.7.8. Touch screen calibration

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

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

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

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 previows checks are positive, replace the Generator CPU board A9.
H10	"DSPU CAN-BUS" device	OFF	If blinks, check the cable between DSPU and cannectors X42 / X21 and the cable X43 on both sides. If they are OK, replace the DSPU board.
H12	"Motor power supply" presence	ON	Check fuse F1: if blown, replace with new one respecting the value and types. If it blows again, replace the CPU.

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

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" (6)  when a movement is in progress.

This message will be displayed as follows:

" ERROR: xxx PRESS >0< "

Operating conditions are reset by pressing key (6)  .

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

" ERROR: xxx CALL TECH SUPP "

3 - Messages related to problems regarding the Generator board (A10). In this case, the unit must be switched off. Wait a few seconds for the circuit capacitors to discharge and then switch the unit on again. If the problem persists, call the Technical Service.

" ERROR: xxx POWER OFF "

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

Main CPU board (A5)		
Code	**Error description**	**Reference chapter**
108	Hardware key A13 fault or missing	**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**
363	Interruption of the link between PC and equipment	**7.2.3.6**
CanBus		
Code	**Error description**	**Reference chapter**
380	Invalid CANBus message	**7.2.3.7**
381	Timeout on activating CAN unit of Generator board (A10)	**7.2.3.8**
382	Generator board (A10) not answering	**7.2.3.8**
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	**7.3.3.5**

Partial volumes collimators		
Code	**Error description**	**Reference chapter**
441	Upper Partial Volumes collimator IN instead OUT of X-ray field	**7.2.4.2**
442	Upper Partial Volumes collimator OUT instead IN of X-ray field	**7.2.4.3**
443	Lower Partial Volumes collimator IN instead OUT of X-ray field	**7.2.4.2**
444	Lower Partial Volumes collimator OUT instead IN of X-ray field	**7.2.4.3**
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 that expected	Protocol errors; power off the unit and on again. If error is still present, call Technical Assistance
772	Invalid Analogue channel selection	
773	Unknown command	
774	RX button not pressed on Generator board	**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**

Code	**Error description**	**Reference chapter**
831	CPU board – DSPU communication fault	**7.2.7**
	Touch screen locks during system start-up	
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 is check byte, from the control system at the start-up; if the check byte is incorrect, the system displays the above error number.

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

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

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

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 ZERO [ff] a
ZERO OFFS ±eeee "

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

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

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

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.

"T ZERO [ff] a
ZERO OFFS ±eeee "

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

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

1. If there is no variation of the above signal, if the arm does not move or moves with difficulty or jumps.
   - Check the belt and verify that it is not broken; if the belt is loose, adjust its tension
   - Check cables of the Y axes motor; there can be a short circuit or a broken wire; check also for a loosen contact. In case of short circuit, replace the cable, verifying also that no damage has been caused to the motor driver (D27) on the CPU.

2. If there is no variation of the above signal and the arm moves, verify the cable from the optical sensor up to the CPU board (A5). If still there is no variation of the signals when there is an activation of the switches, change the CPU board.

In case of no motion, it is possible that the problem is related to the motor: in order to check this, connect the driver of the Y-axis motor to the rotation motor, putting cable X28 into connector X26 on CPU board (A5).

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 senor activation has occurred before the expected time. This can be caused by the loss of motion of the stepper motor due to a collision with the patient or a fault of the motor stepper driver.
In case that no collision has been observed or the message is frequently displayed, follow the procedure.

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

- Check that during the power on phase there are movements on these axes; the normal motion is going to engage the sensor and a reverse motion to disengage it. If no motion is observed, the fault can be the stepper motor or the cable connecting it to the main CPU. Check that the cables between the motor 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 senor activation has occurred before the expected time. This can be caused by the loss of motion of the stepper motor.

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

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

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

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

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

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

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. E363: Interruption of the link between PC and equipment

This error can be related to a delay on the TCP / IP communication.

Check firewall and antivirus setting, check network settings, Ethernet cables and their interconnections (Sensor-PC and DSPU-PC), check software installation. If the problem persists check computer network card and sensor.

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

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

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

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

7.2.4.2. E441: Upper Partial Volumes collimator IN instead OUT of X-ray field / E443: Lower Partial Volumes collimator IN instead OUT of X-ray field

Perform the following procedures:

1. Perform an exposure and verify that the X-ray field is free of interferences due to the presence of one of the Partial Volumes collimators in the field.
If there are interferences, switch OFF the unit and remove the tubehead cover. Move gently the maxillary and mandibular collimators and visually check the proper functioning of the mechanical components (spring, screws, slides etc...). If the mechanical problem cannot be easily solved, go to point 4.

2. Remove the upper cover and verify, with unit ON, LED H3 status on CPU board (see drawing 5 - chapter 10):
- LED ON: perform the following checks:
  - Verify the proper functioning of X105 cable
  - Verify the proper functioning of the "Hall sensors": enter in Password 118, "Primary collimator 3D" menu (see paragraph 7.3.4.7) and verify if the fields dedicated to the diagnostic of the Partial Volumes collimators (see Table below) indicate a logic value of "1" while the Partial Volumes collimators are out of X-ray field, if yes go to point 4.

Logic value	Description
PCC ZERO [00]000	This code indicates that the two collimators are out of X-ray field
PCC ZERO [00]001	This code indicates that the Maxillary collimator is in the X-ray field
PCC ZERO [00]010	This code indicates that the Mandibular collimator is in the X-ray field

- LED OFF: disconnect cable X105:
  - If the LED remain OFF, check the CPU board
  - If the LED lights up, verify the proper functioning of cable X105 and afterwards of the "Hall sensors" as previously explained.

3. Change the Partial Volumes driving board A26.

4. Enter in Password 92, "3D Volume option" menu (see paragraph 7.3.3.16) and disable the Partial Volumes exams. Disconnect cable X105 on CPU board in order to temporarily use the unit without the partial volumes option. Replace the whole collimator as soon as possible.

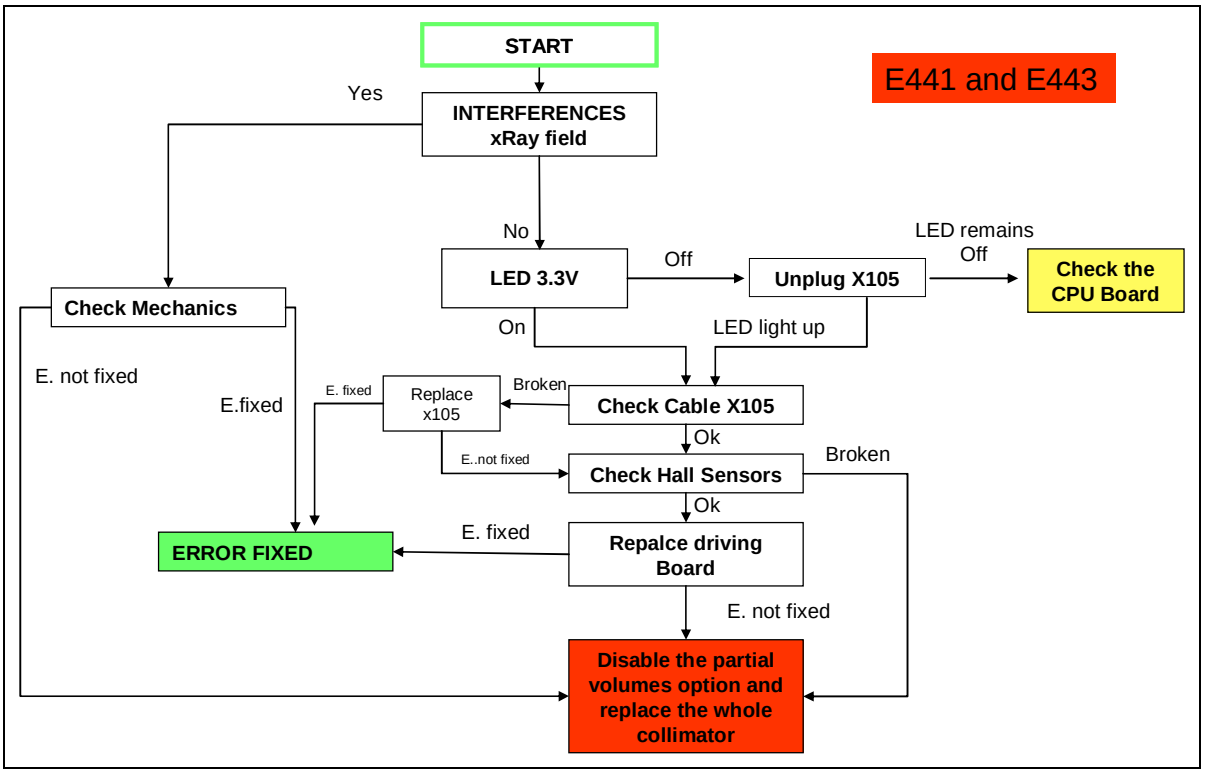


Figure 7-1: E441 / E443 fixing flowchart

7.2.4.3. E442: Upper Partial Volumes collimator OUT instead IN of X-ray field / E444: Lower Partial Volumes collimator OUT instead IN of X-ray field

Perform the following procedures:

1. Visually check the Partial Volumes wires (behind the collimator frame) and if one of them is broken, go to point 6.

2. Switch OFF the unit and measure the resistance through the PINs X1 (upper mandibular SMA) and X2 (lower maxillary SMA) on the Partial Volumes driving board A26 (see drawing 16 - chapter 10).
If the resistance is higher than 50 Ω, go to point 5.

3. Switch ON the unit, enter in "Primary collimator 3D" menu (paragraph 7.3.4.7) and select one of the mandibular or maxillary volume icon.
On the Partial Volumes driving board A26 (see drawing 16 - chapter 10), verify the applied voltage between ground (one point on the frame of the collimators) and connector X1 pin1 or X2 pin 1.
If the voltage after a short transitory isn't in the range 2.2V ± 0.2V, replace the Partial Volumes driving board.

4. Switch OFF and remove the tubehead cover. Visually check the proper functioning of the mechanical components (springs, screws, slides etc...) moving gently the maxillary and mandibular collimators.
If the mechanical problems cannot be easily solved, go to point 5.

5. Enter in Password 92, "3D Volume option" menu (see paragraph 7.3.3.16) and disable the partial volumes exams. Disconnect cable X105 on CPU board in order to temporarily use the unit without the partial volume option. Replace the whole collimator as soon as possible.

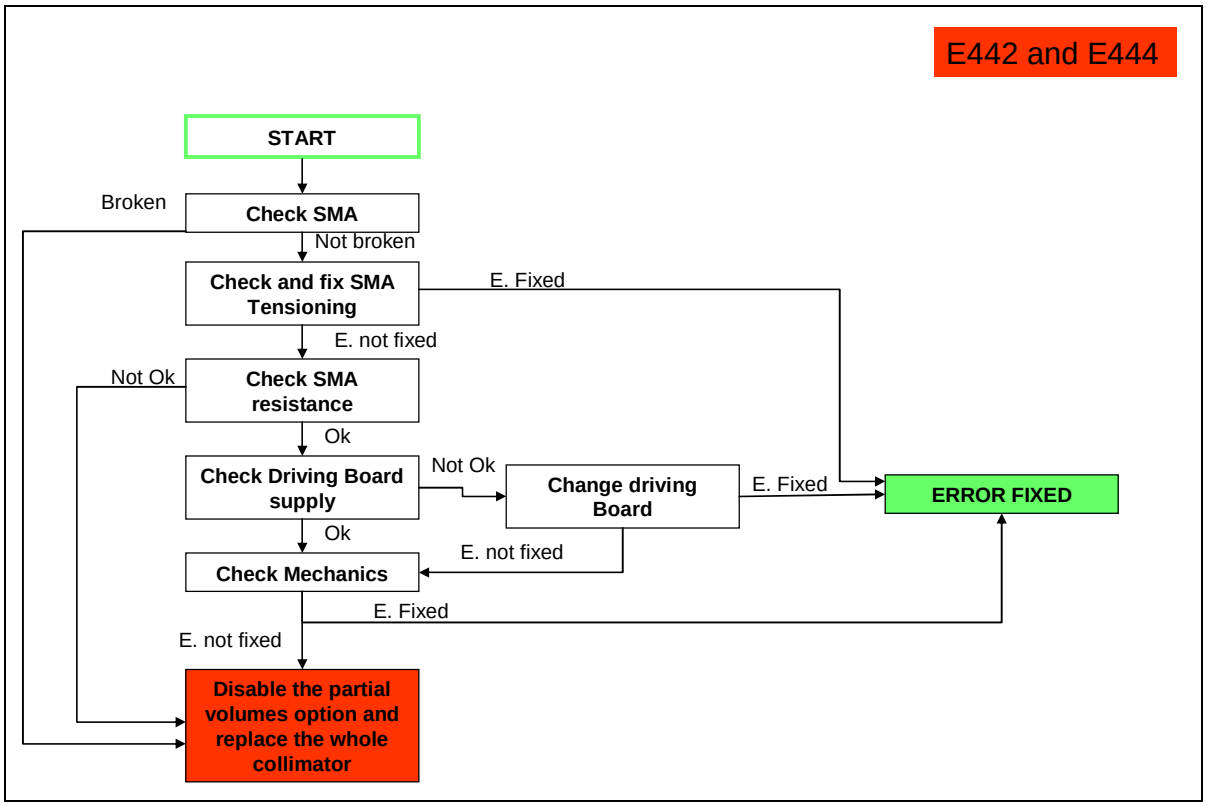


Figure 7-2: E442 / E444 fixing flowchart

NOTE:
In case of collimator replacement, perform the X-ray beam alignment in Panoramic, 3D and CEPH mode (see paragraph 9.3 and 9.7).
In any case, after any changes, check if the functionality of the partial volume collimator is correct (see paragraph 6.7.3.2).

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 ± 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 ± 2% while is 14.3k ± 2% between pins 4 and 3 of the same connector; if correct values are measured, replace before the tubehead and, eventually, the Generator board.
If incorrect values are measured, replace the tubehead and then the Generator board.

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 – DSPU communication fault

This message is displayed when there is a communication fault between the CPU board and the DSPU during system start-up.
The error can be generated by a bad connection of the CANBus or a fault on the DSPU board.

Check the CANBus cable X24/X42-J9 and the DSPU power supply cable X43-J8: replace them if faulty.

If the problem is still present, replace the DSPU board and after the CPU board (A5).

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.

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

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.

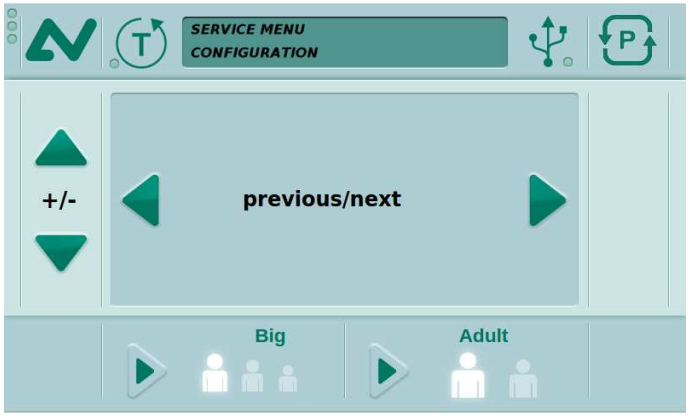
The service programs available are the following:

- ***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/SMA actuators/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).

7.3.1. Accessing the service programs

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

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



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

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

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

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

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

7.3.2. General information on the use of keyboard

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

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

7.3.3. Password 92: Configuration menus

When the following menu is displayed,

" SERVICE MENU
CONFIGURATION "

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

" SET UP
PASSWORD? 100 "

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

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

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

WARNING:
Do NOT modify COLUMN VERSION, X-RAY 3D HD TIME, X-RAY 3D cal TIME, X-RAY 3D sHD 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 HD time: X-RAY ON: 028 / X-RAY OFF: 022**
- **X-ray 3D cal time: X-RAY ON: 020 / X-RAY OFF: 080**
- **X-ray 3D sHD time: X-RAY ON: 028 / X-RAY OFF: 022**
- **Skip sensor ready: SKIP READY OFF**

The following menus are not active: XRAY 3D HS TIME and XRAY 3D HG TIME. If selected Error 420 is displayed.

NOTE:
Changing on MANAGE IMPL OPT., TOOTH STYLE, QSD IP ADDRESS, QSD NET MASK, SENSOR 1 IP ADDR, SENSOR 2 IP ADDR 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 menus is performed using the Test (T) button; the value is updated or not by pressing the appropriate button as an answer to the following message:

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

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

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:

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

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

Confirming the Date change, the display changes as follows:

" ADJUST DATE
D>XX M YY Y ZZ "

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

" ADJUST DATE
D XX M>YY Y ZZ "

" ADJUST DATE
D XX M YY Y>ZZ "

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. Manage pano opt.

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

" FFFFFFFFFFFFFFFF
VALUE [x] = FF "

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

7.3.3.5. 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.

7.3.3.6. Collimator setup type

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

"COLL SETUP TYPE
CHILD SYSTEM "

or

"COLL SETUP TYPE
PAN ONLY SYSTEM "

or

"COLL SETUP TYPE
PAN-CEPH SYSTEM "

or

"COLL SETUP TYPE
3D SYSTEM "

according to the factory setting.

It is possible to change the set value using the parameter

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

NOTE:
Wrong setting affect the system's functionality.

7.3.3.7. Collimator technology

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

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

"COLL TECHNOLOGY
SCREW "

or

"COLL TECHNOLOGY
BELT "

according to the factory setting.

7.3.3.8. 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:

"STF SETUP TYPE
3D LONG SYSTEM "

or

"STF SETUP TYPE
3D SYSTEM "

or

"STF SETUP TYPE
PAN-CEPH SYSTEM "

or

"STF SETUP TYPE
WITHOUT SYSTEM "

according to the factory setting.

It is possible to change the set value using the parameter increase/decrease  keys; select "3D LONG SYSTEM" for PAN CEPH units with Partial Volumes, "3D SYSTEM" for PAN CEPH units (without Partial Volumes) and "WITHOUT SYSTEM" for PAN only units.

NOTE:
Wrong setting affect the system's functionality.

7.3.3.9. 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:

" SENSOR HANDLING
SENSOR IS MOBILE "

or

" SENSOR HANDLING
SENSOR IS FIXED "

according to the factory setting.

It is possible to change the set value using the parameter increase/decrease  keys; **select "SENSOR IS FIXED" for PAN CEPH units**.

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

7.3.3.10. 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.

7.3.3.11. 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.

7.3.3.12. TSEVO IP address

It is the static IP address assigned to the touch screen, that is used enabling the communication with the others network elements (Sensor and external PC). The default set value for IP address is 192.168.002.045.

7.3.3.13. TSEVO NET mask

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

7.3.3.14. 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".

7.3.3.15. Set 3D mode

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

In this menu, it is possible to set the 3D image resolution.
After the selection, the display will show the following message:

" 3D Mode: HD "

or

" 3D Mode: HS "

or

" 3D Mode: HG "

or

" 3D Mode: SuperHD "

according to the factory setting.
To set the "SuperHD" mode, the PC must be equipped with a dedicated graphic card with the following minimum requirements:

- chipset Nvidia
- Global memory ≥ 2048 Mbytes
- Capability (=architecture) ≥ Fermi (that's to say: Fermi, Kepler, Maxwell).

7.3.3.16. 3D volume option

In this menu, it is possible to enable the Partial Volumes option.
After the selection, the display will show the following message:

"ENABLE VOLUME OP
VOLUME OP IS ON "

or

"ENABLE VOLUME OP
VOLUME OP IS OFF "

according to the factory setting.

It is possible to change the set value using the parameter

increase/decrease  keys; select "VOLUME OP IS ON" for units with

Partial Volumes, "VOLUME OP IS OFF" for units without Partial Volumes.

NOTE:
Wrong setting affect the system's functionality.

7.3.3.17. Pano order

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

"PANO ORDER
EVO + STANDARD "

or

"PANO ORDER
STANDARD + EVO "

or

"PANO ORDER
EVO "

or

"PANO ORDER
STANDARD "

according to the factory setting.

It is possible to change the set value using the parameter

increase/decrease  keys.

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

7.3.4. Password 118: Axis alignment menu

When the following menu is displayed,

**" SERVICE MENU
CONFIGURATION "**

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

**" SERVICE MENU
AXIS ALIGNEMENT "**

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

**" SET UP
PASSWORD? 100 "**

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

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

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

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

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

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

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

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

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

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

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 ZERO [YY] a
ZERO OFFS ±xxxxx "

where:

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

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 ZERO [YY] a
ZERO OFFS ±xxxxx "

where:

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

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 ZERO [YY] a
ZERO OFFS ±xxxxx "

where:

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

7.3.4.4. Y Axis zero BiteWing

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

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

" Y ZERO [YY] a
OF ±xxxx ±yyyyyy "

7.3.4.5. Cassette zero

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

7.3.4.6. Primary collimator PAN

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

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

"PCC ZERO [YY] a
ZERO OFFS ±xxxxx "

where:

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

In both cases, the X-ray beam aligment must be checked as described in paragraphs 9.3 and 9.7.

7.3.4.7. Primary collimator 3D

Set this parameter with the same value used to set "Primary collimator PAN" (see paragraph 7.3.4.6).

7.3.4.8. Y zero 3D

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

This function allows the adjustment of the field of view centre position (Y direction) in 3D Dentition and 3D Sinus exams.
After the selection, the display will show the following message:

"3D offset
±xxxxx "

7.3.4.9. Y zero 3D TMJ

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

This function allows the adjustment of the field of view centre position (Y direction) in 3D TMJ exam.
After the selection, the display will show the following message:

"3D Tmj offset
±xxxxx "

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:

" SERVICE MENU
CEPH SETTINGS "

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

" SET UP
PASSWORD? 100 "

Using the increase/decrease  keys, set the password equal to "124"

and confirm with the Patient centering  key. The system will begin

the sequence to align the X-ray beam to the Ceph arm.
The operations contained in this menu are useful to enable the Ceph examination and perform all operation to center the Ceph.
Once completed the zeroing, the following message is visualized:

" DIGITAL CEPH
ENABLE SENSOR "

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

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

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

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

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

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:

" DIGITAL CEPH
CEPH IS ENABLED "

or

" DIGITAL CEPH
CEPH IS DISABLED "

according to the factory setting.

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

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

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

"T ZERO [YY] a
ZERO OFFS ±xxxxx "

where:

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

, "s" character will be displayed instead of "T".
- "YY" is the stepper motor speed, that can be changed using the parameter increase/decrease  keys.
- "a" is the status of the zero optical barrier; 1 means engaged (i.e. barrier interrupted), 0 otherwise.
- "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 ZERO [YY] abcd
ZERO OFFS ±xxxxx "

where:

- "YY" is the stepper motor speed, that can be changed using the parameter increase/decrease  keys.
- "xxxx" is the zero offset actual value, that can be changed with the left/right  keys.
- "abcd" represents the status of various optical barrier sensors; "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:

" CEPH MEAS. UNIT
METER "

or

" CEPH MEAS. UNIT
INCHES "

according to the factory setting.

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

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 ZERO [YY] a
ZERO OFFS ±xxxxx "

where:

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

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 ZERO [YY] abcd
ZERO OFFS ±xxxxx "

where:

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

7.3.5.8. Digital CEPH HD

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

"DIGITAL CEPH HD
HD IS DISABLED "

or

"DIGITAL CEPH HD
HD IS ENABLED "

according to the factory setting.

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

WARNING:
Wrong setting affect the system's functionality.

7.3.5.9. Sensor extra-run

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

"E ZERO [YY] a
ZERO OFFS ±xxxxx "

where:

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

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

7.3.6. Password 112: Troubleshooting

When the following menu is displayed:

" SERVICE MENU
TROUBLESHOOTING "

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

" SET UP
PASSWORD? 100 "

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

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

access the configuration menus of the following list:

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

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

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

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:

" COLUMN TEST
IDLE 000ab "

Using the column up/column down keys  verify that the

last two digits change status:

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

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:

"TEST IMPUT PORTS
Ry 76543210 "

where:

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

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

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

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

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

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:

" PRE-HEATING TIME
VALUE = 2000 "

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:

" IDEL FIL LEVEL
LEVEL = 30 "

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

Pressing the right  key, the next message is displayed:

" FIL LEVEL @ XXmA
LEVEL = YYY "

where:

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

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

" 74kV 06mA 1.00s
X-RAY PARAMETERS "

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

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

">74kV 06mA 1.00s
X-RAY PARAMETERS "

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

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.

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
6195170100	Support plate	--
6195170200	Symmetry check tool	Used for Panoramic function adjustment and calibration
5207900900	Centering cylinder	Used for 3D function adjustment and calibration
--	3D Sensor calibration files	
5209900900	Digital sensor centering tool	Used for Cephalometric arm checks
6607900400	Laser centering tool	Verification of laser reference lines

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 "SKIP SENSOR RDY" menu, using keys  , set the parameter "SKIP SENSOR ON".
3. Press key  and confirm the change using key  .
4. Enter in normal working modality and select "3D Dentition".
5. From desktop open the software ViVA that permit the direct control of the 3D digital sensor.
6. Select the modality "2x2 1pF VG1" corresponding to the 3D modality.

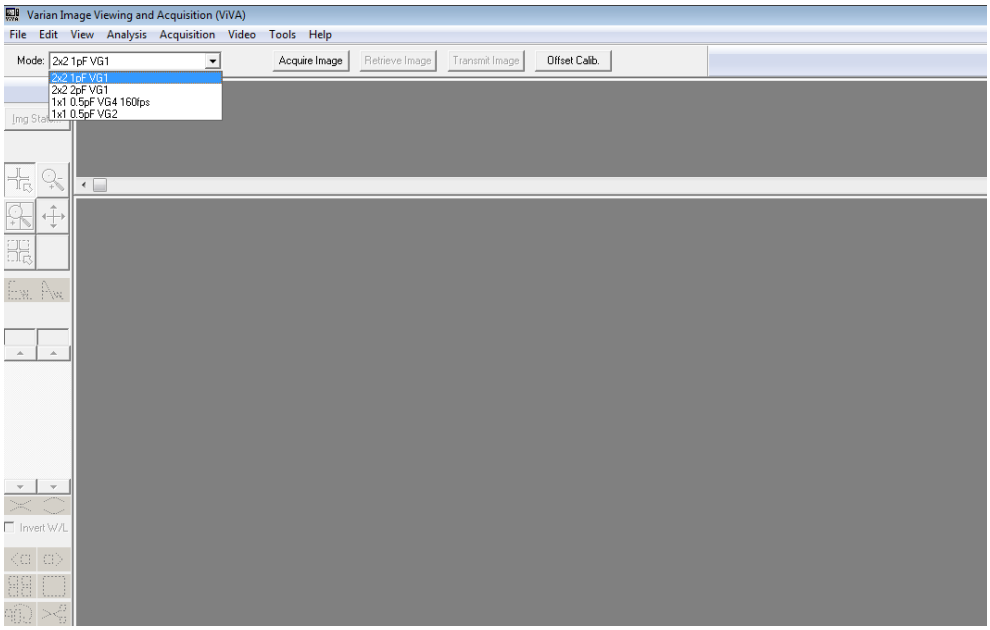


Figure 8-1

7. Click on "Acquisition". Open the window "System settings" and verify that the options "Offset Calibration", "Gain calibration" and "Pixel defect map" are selected.

8. Enter in "Acquisition" drop down menu and select "Mode settings".

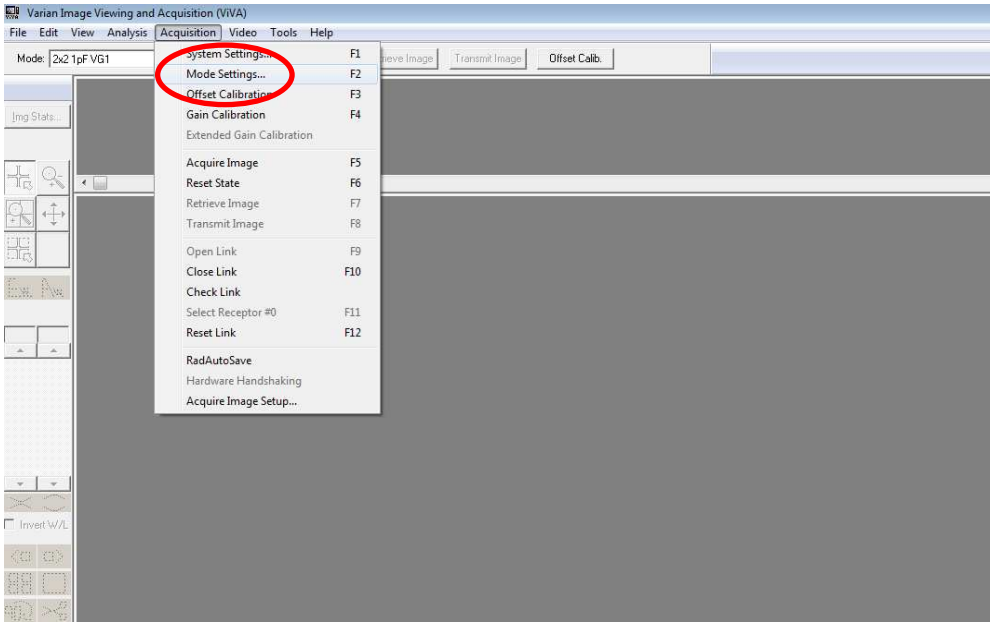


Figure 8-2

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

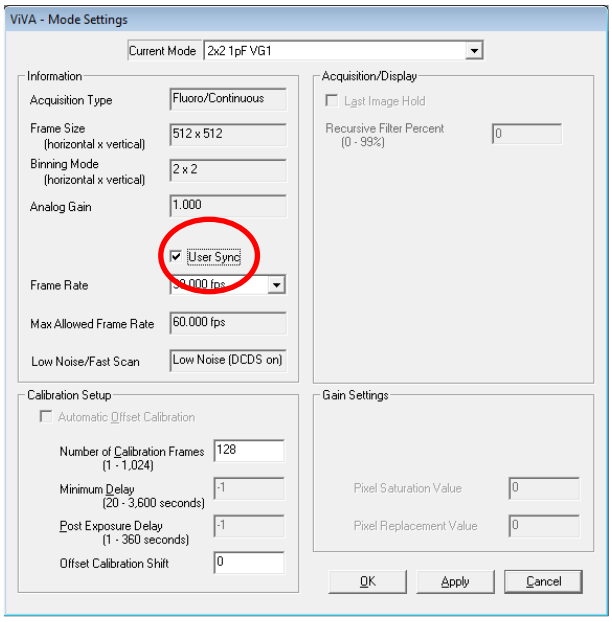


Figure 8-3

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

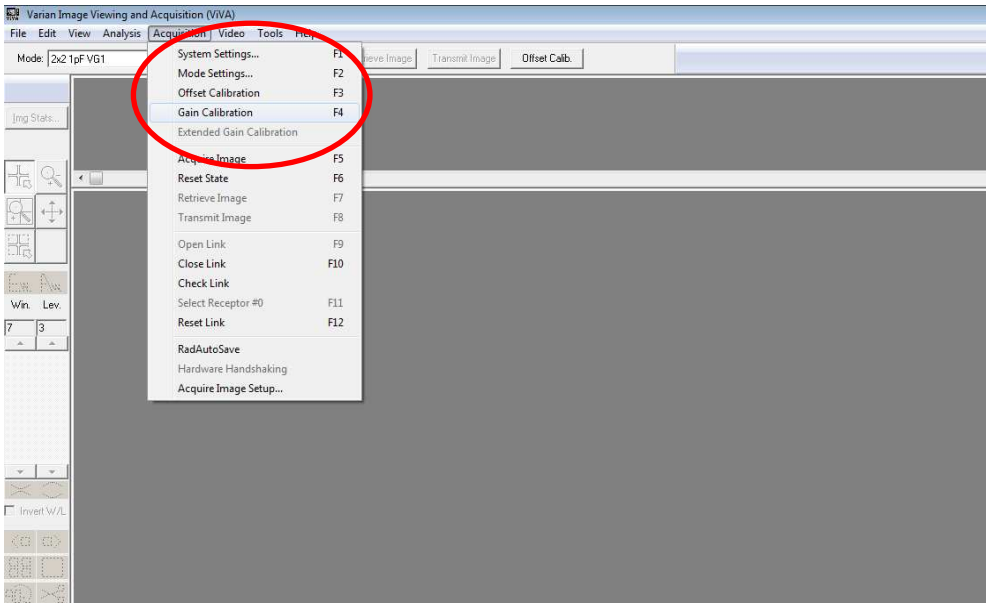


Figure 8-4

11. 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.

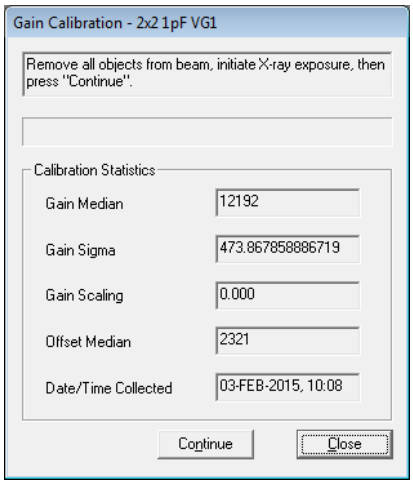


Figure 8-5

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

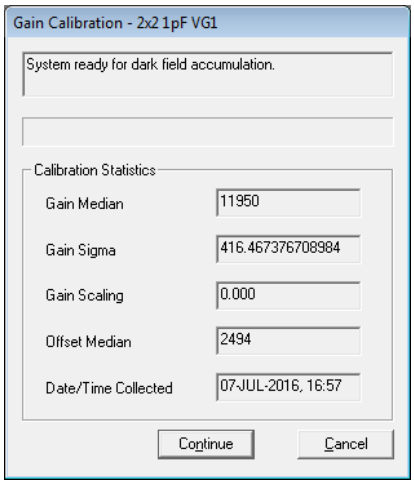


Figure 8-6

13. At the end it will be possible to check the Gain median value that should be between 6000 and 25000. 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.

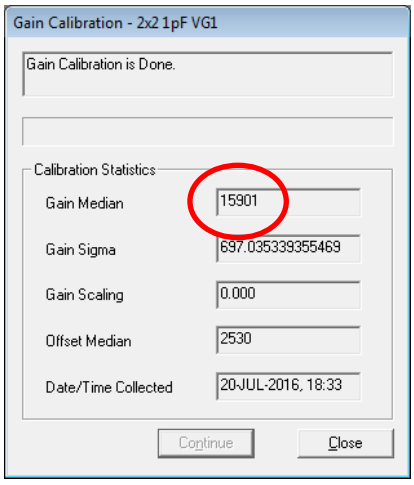


Figure 8-7

14. In order to calibrate the 3D eXtra Definition modality, select "1x1 0.5pF VG2" and repeat step from 8 to 13.

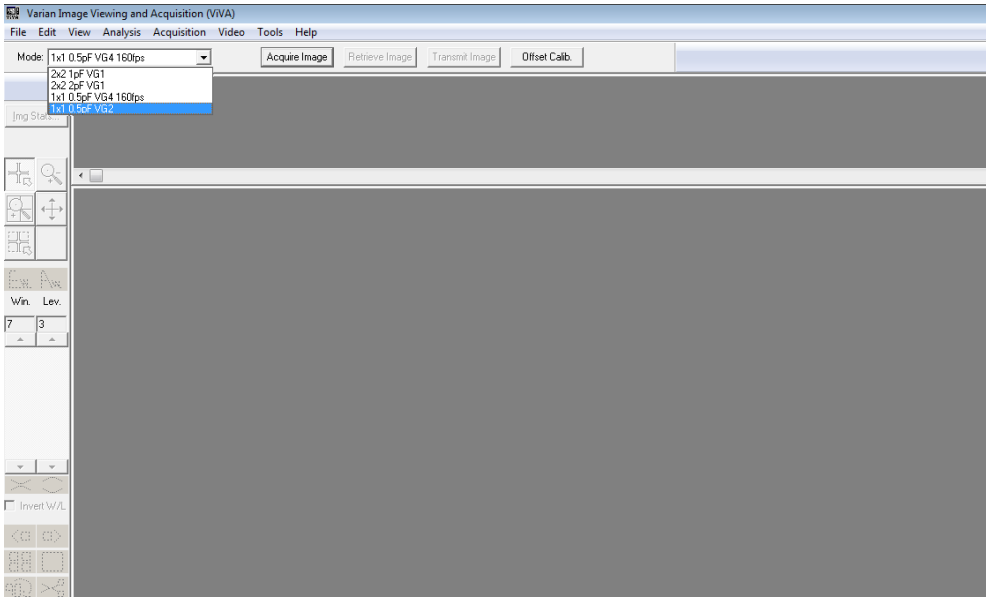


Figure 8-8

15. In order to calibrate the panoramic modality, select "1x1 0.5pF VG4 160fps".

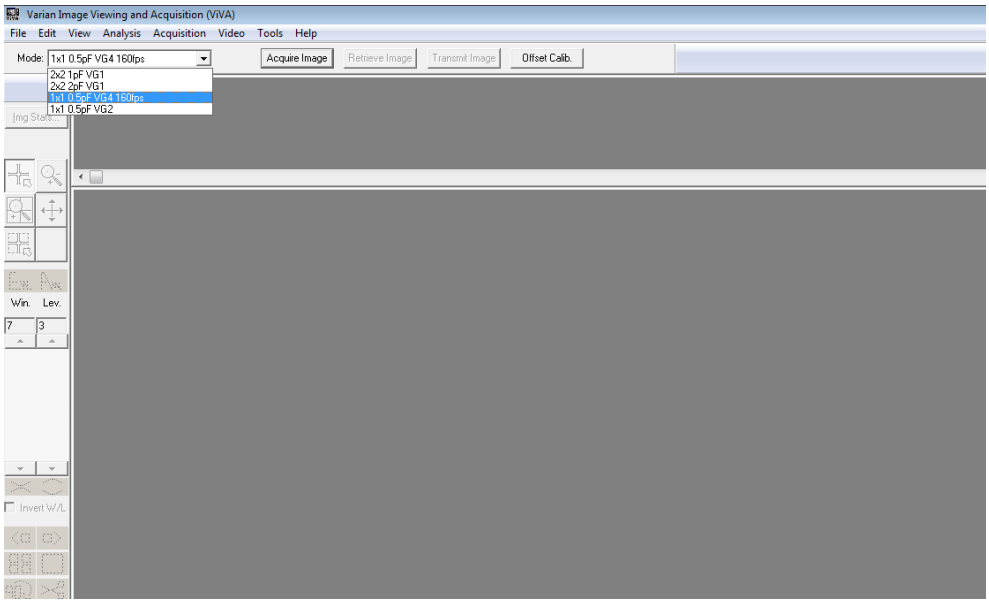


Figure 8-9

16. Disable the parameter "User Sync".

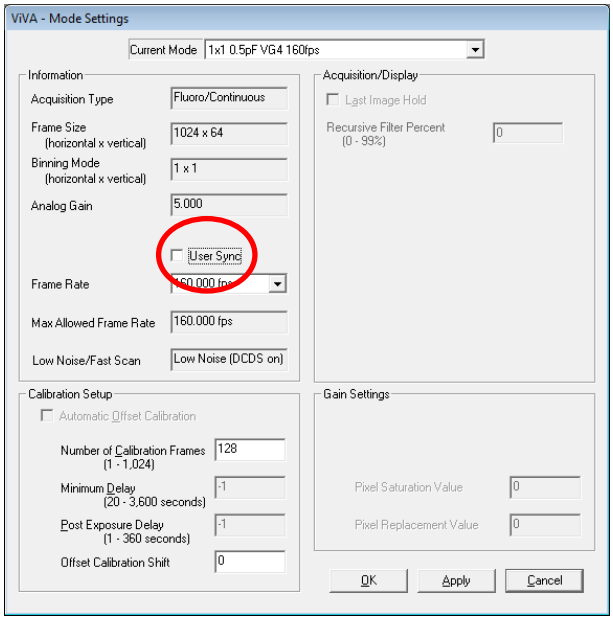


Figure 8-10

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

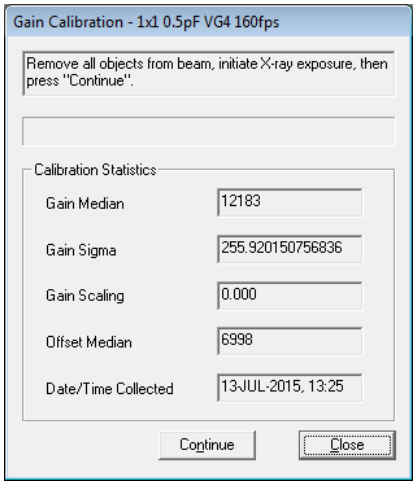


Figure 8-11

18. 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.

19. At the end it will be possible to check the Gain median value that should be between 6000 and 25000. 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.

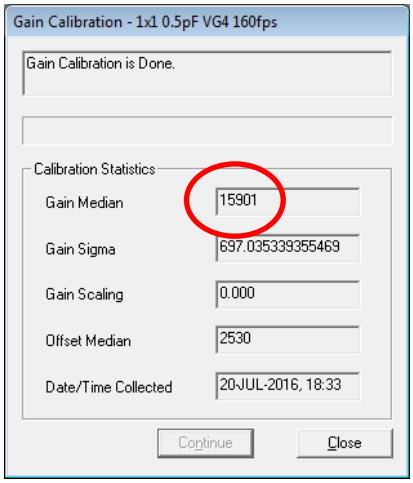


Figure 8-12

20. At the end of calibration verify that the calibration files present in the directories:

- "C:\IMAGERs*S/N of the sensor*\00_2x21pFVG1"
- "C:\IMAGERs*S/N of the sensor*\02_1x10.5pFVG4160fps"
- "C:\IMAGERs\S/N of the sensor\03_1x10.5pFVG2

have been updated.

21. Copy the content of folder "C:\IMAGERs*SN of the sensor*" to "C:\Program data\VILLA SM\OSP-LAN PANORAMIC\Calibration"; do not copy the "*SN of the sensor*" folder but only its content

22. After the calibration, enter in Rotograph EVO 3D set up and in password 92 (see pararagraph 7.3.3) and set the parameter "SKIP SENSOR OFF".

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 9.3.

9.1.1. Calibration file installation

The calibration file is included in the "Calibration files" CD.

Copy the CD content (including the sensor S/N folder) in the folder "C:\IMAGERs".
Copy the content of folder "C:\IMAGERs*SN of the sensor*" to "C:\Program data\VILLA SM\OSP-LAN PANORAMIC\Calibration"; do not copy the "*SN of the sensor*" folder but only its content.

9.2. Collimator replacement

NOTE:
The new collimator is sent after factory calibration. It is important do not change the position of the red painted screws. Act only on the screws required by the procedure described in the following paragraphs.

1. Remove the old collimator and mount the new one using the screws 1, 2 and 3 Figure 9-8.

2. Verify the X-ray beam centering, starting from the panoramic window (paragraph 9.3.1), passing through the 3D window (paragraph 9.3.2) and finally, if it is present the cephalometric arm, the Ceph window (paragraph 9.7).

9.3. 3D Digital sensor, Tubehead or collimator replacement

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

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.
In case you replace the collimator, move ONLY the collimator.
It is very important to have a fixed point for the beam centering.

If the tubehead or the whole collimator are been changed, it is important to verify that the cephalometric arm is still well aligned.
Refer to paragraph 9.7 for the verification of the cephalometric X-ray field.

9.3.1. 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.

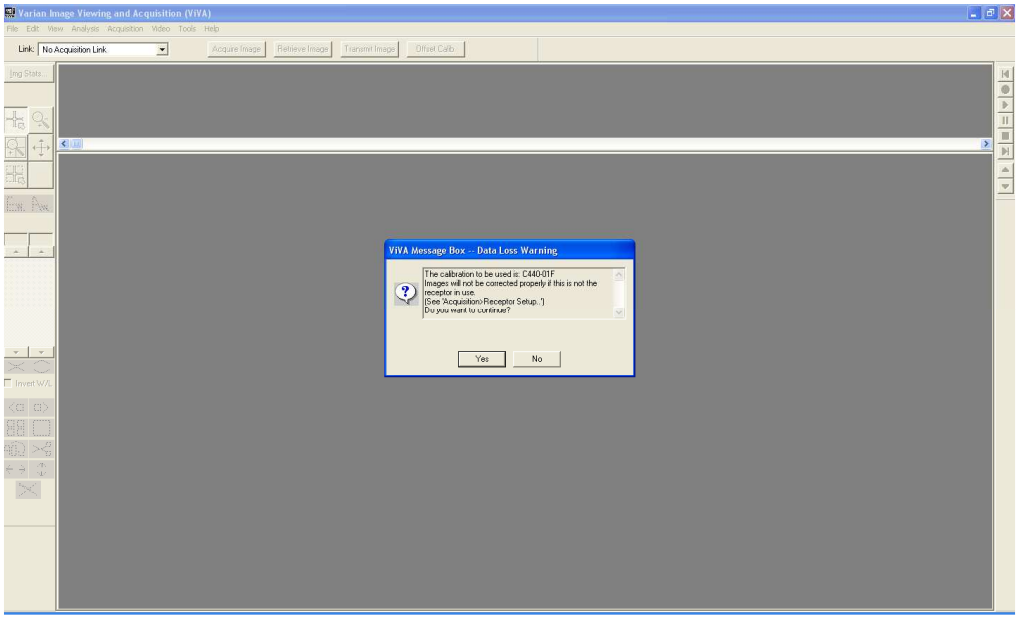


Figure 9-1

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.

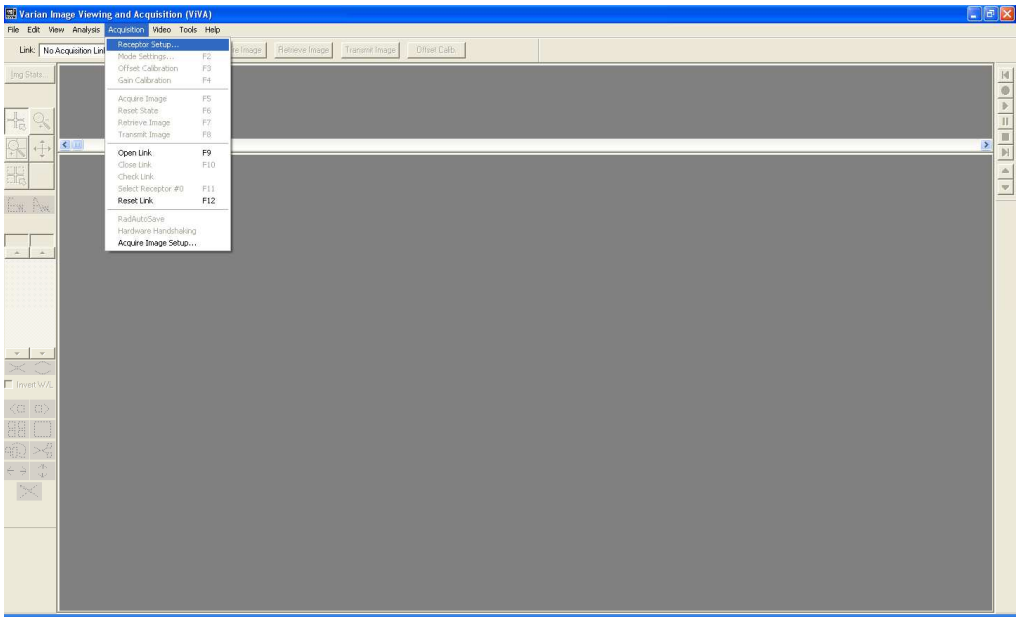


Figure 9-2

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.

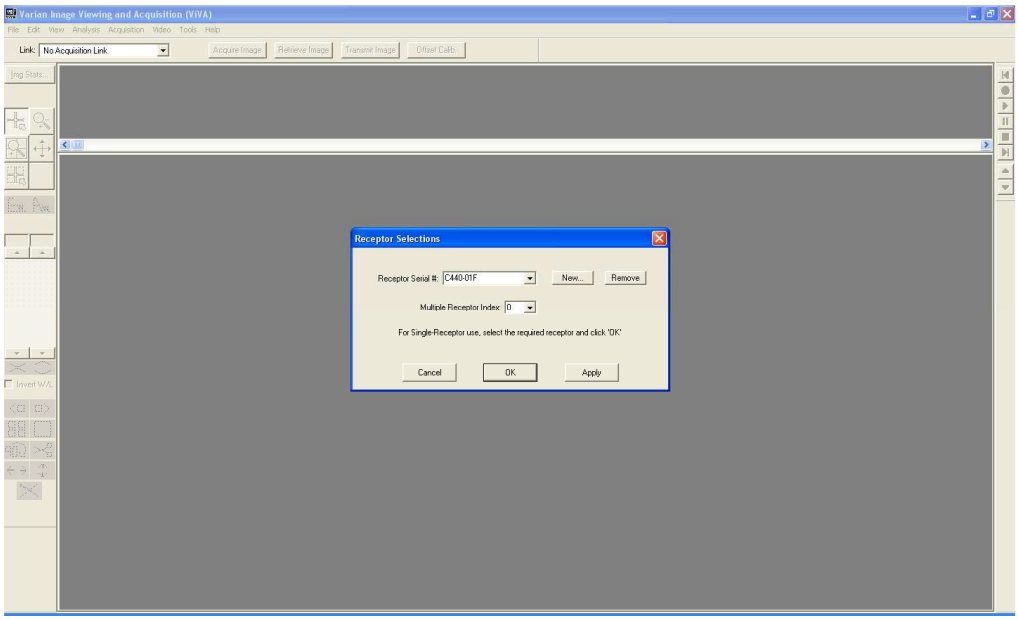


Figure 9-3

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".

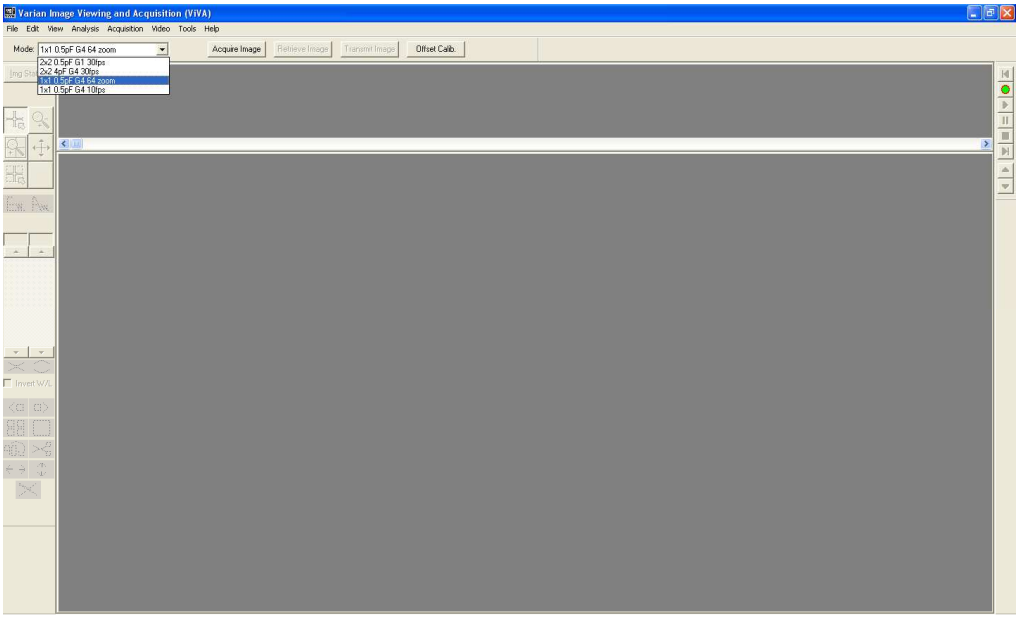


Figure 9-4

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

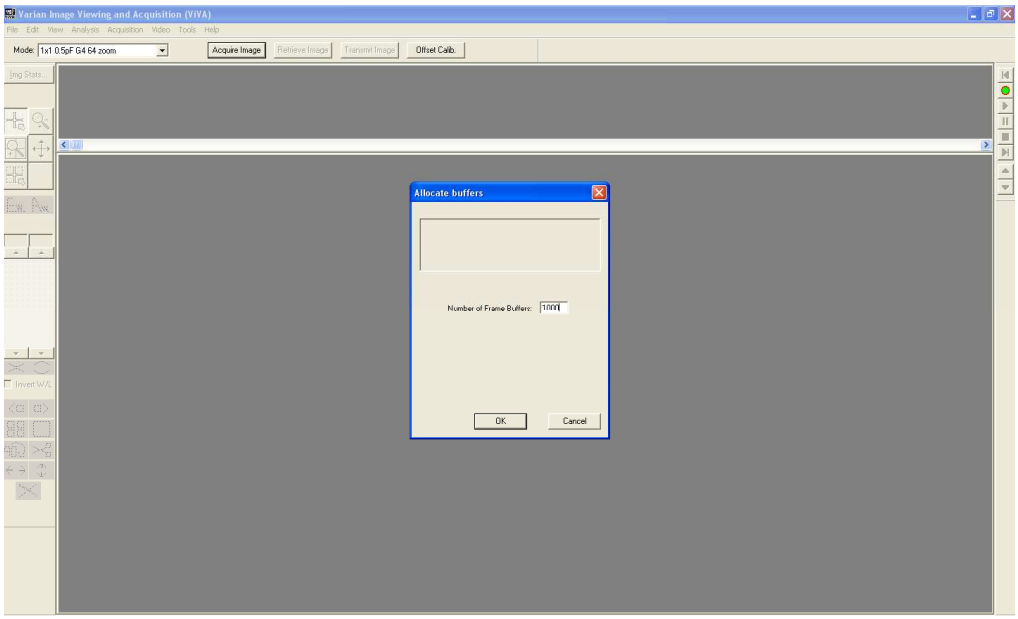


Figure 9-5

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".

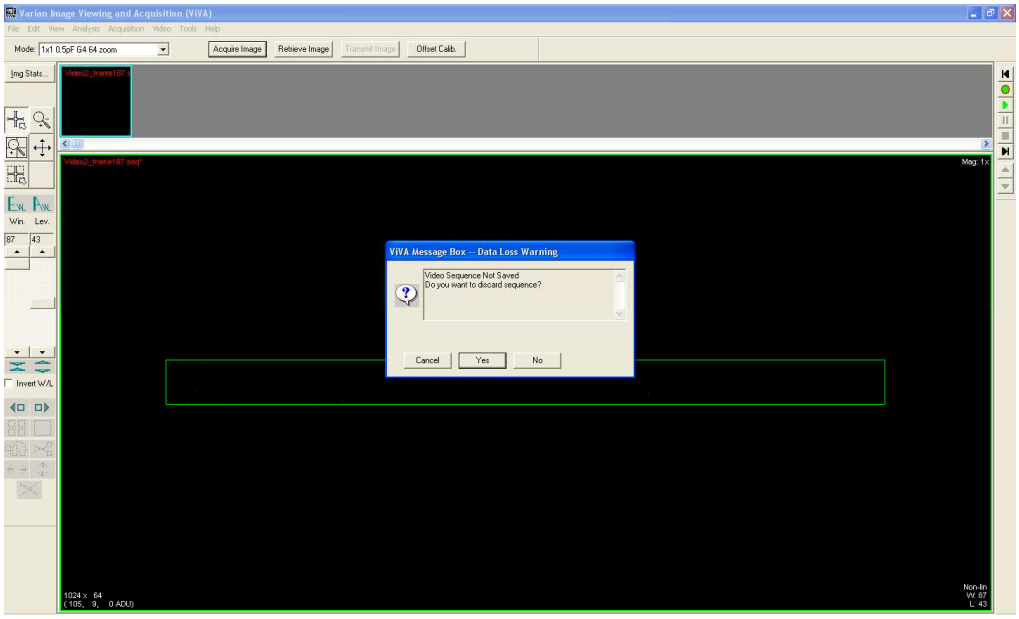


Figure 9-6

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 6195170200 - Figure 6-15) 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 "Awl" in the left side of the monitor (Figure 9-7) and adjust brightness and contrast with the cursors. It is also possible to select the zoon 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.

Here following the misaligned image.

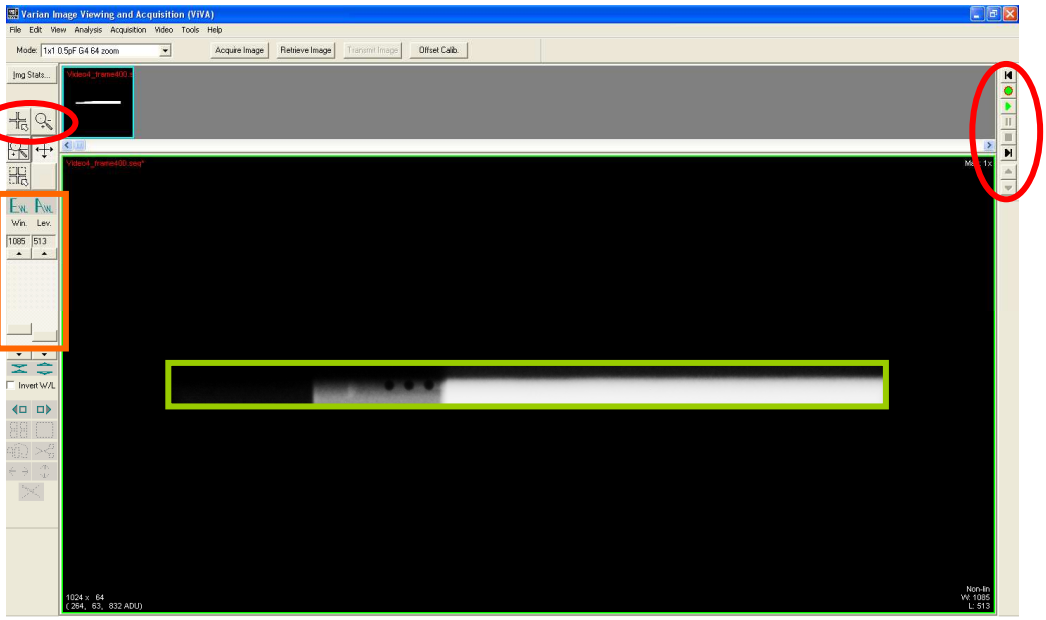


Figure 9-7

- 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 9-8).
- 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 9-8).

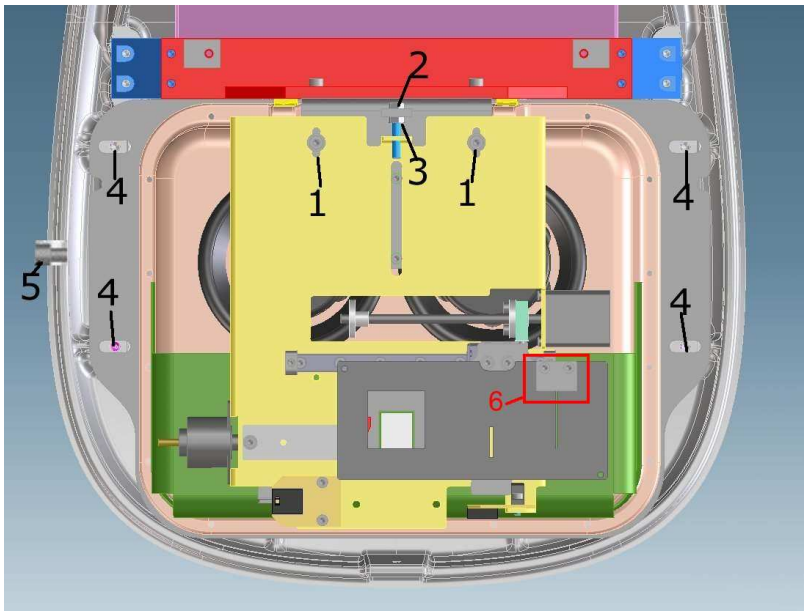


Figure 9-8

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

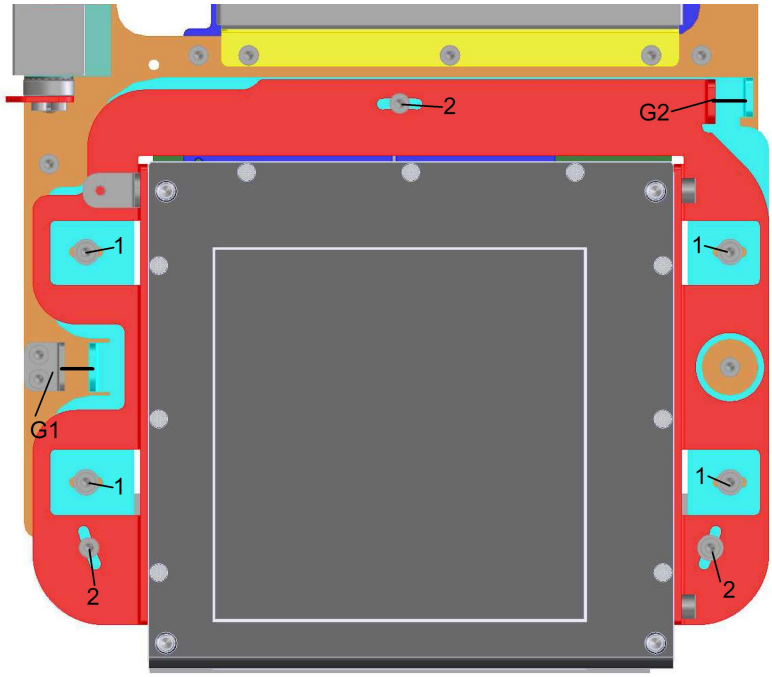


Figure 9-9

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

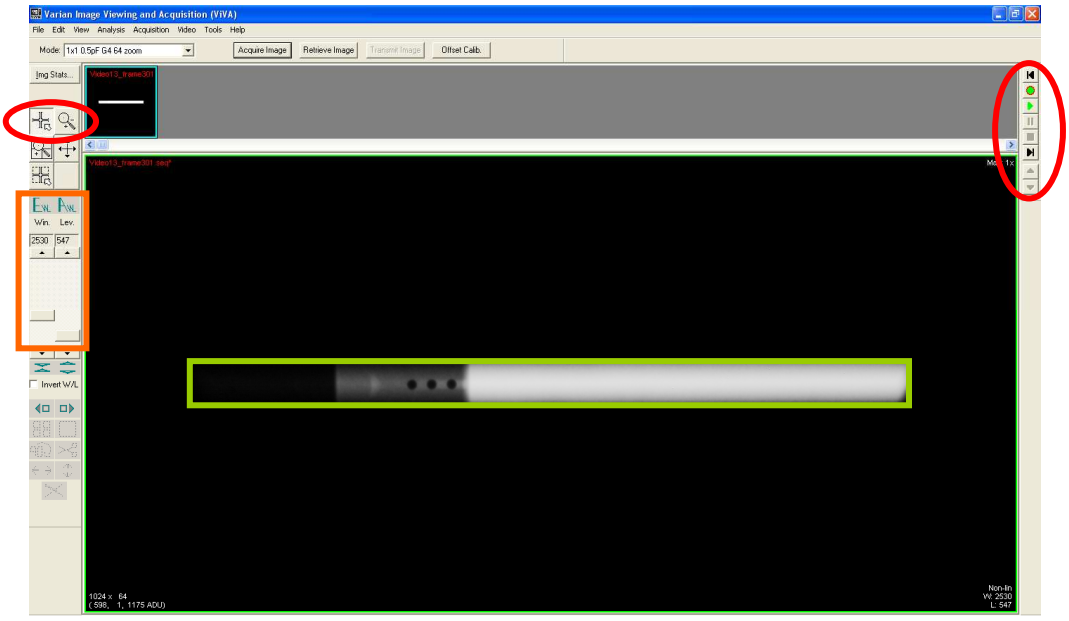


Figure 9-10

9.3.2. 3D image adjustment

9.3.2.1. 3D X-ray beam centering verification

In order to verify the 3D X-ray beam centering, proceed as follow:

1. Enter in Rotograph EVO 3D set up and select "PR. COLL 3D" (Password 118 - see paragraph 7.3.4.7); confirm with the Patient centering key and wait until the axis positioning.
2. Position the panoramic centering tool (P/N 6195170200 - Figure 6-15) on the chin rest.
3. Pressing the parameter changes key, set the following exposure values: 66kV – 6mA – 0.5s.
4. Run the ViVa program and select "2x2 0.5pf G1" mode.

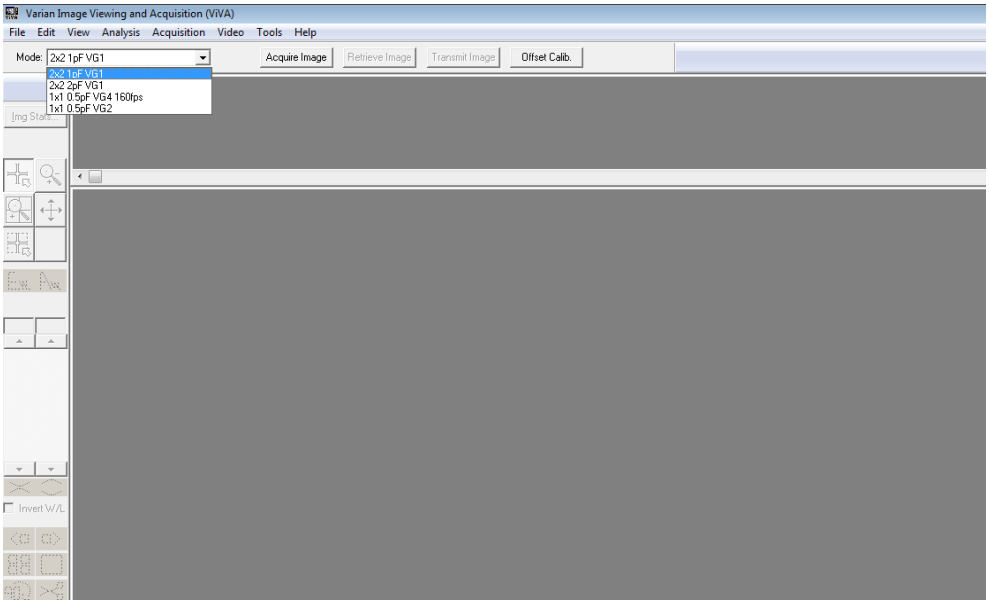


Figure 9-11

5. Enter in "Acquisition" drop down menu and select "Mode settings".

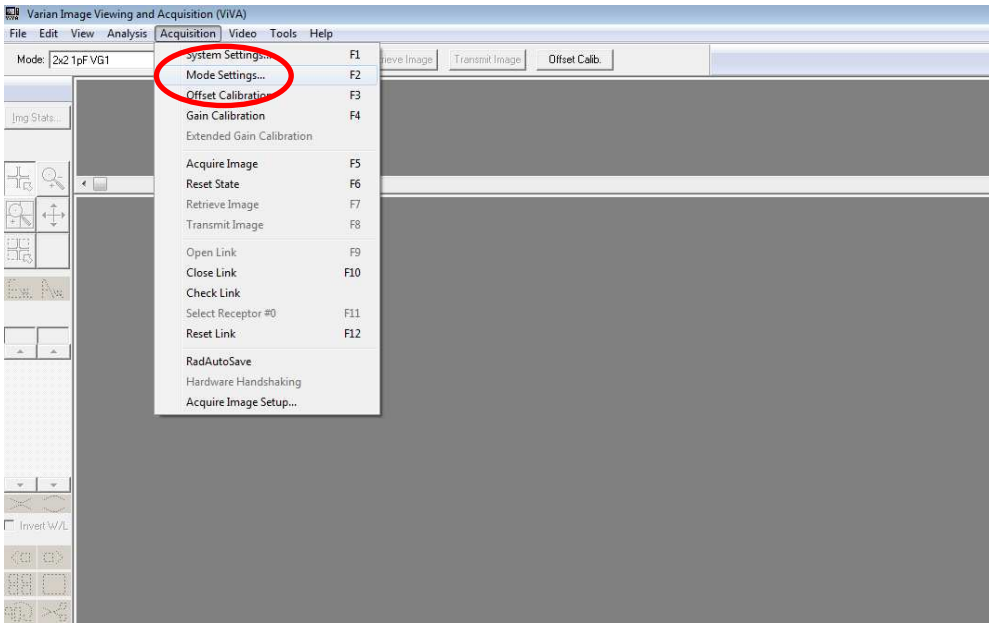


Figure 9-12

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

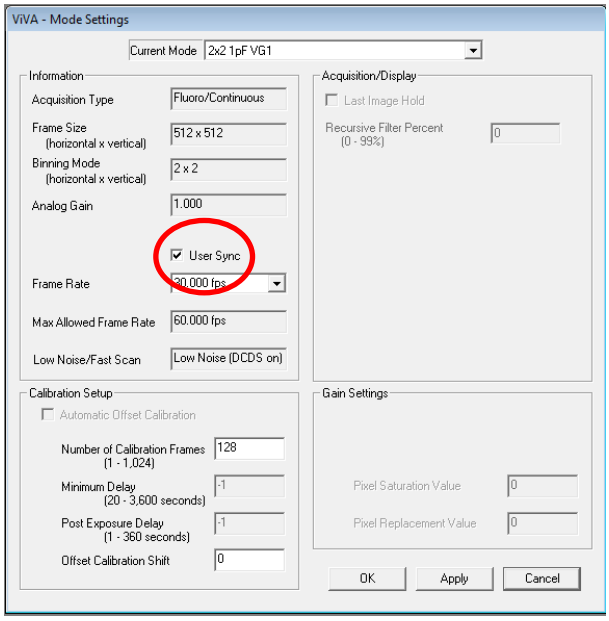


Figure 9-13

7. Click on the "Acquire image" button, an "Allocate buffers" window will be displayed. Fill the two field (e.g. USER-SYNC Frame Rate (HZ) = 20 and Number of Frame Buffers = 100).

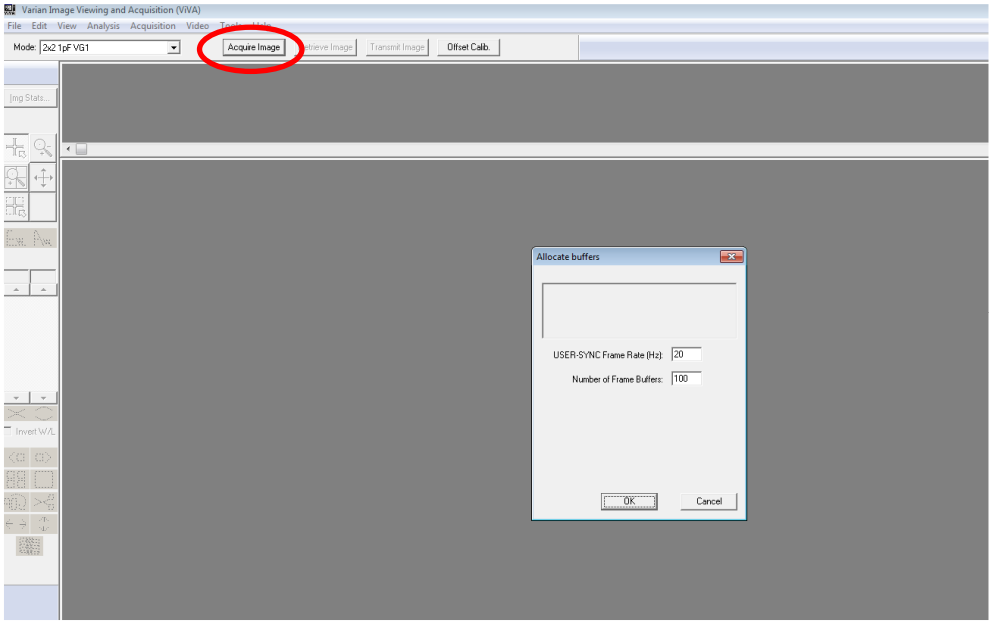


Figure 9-14

8. Click "OK" to start the acquisition and then press the X-ray button.

9. When a white image appears in the square area in the centre of the screen, stop the acquisition with the "Red square" on the right frame. Finally release the X-ray button.

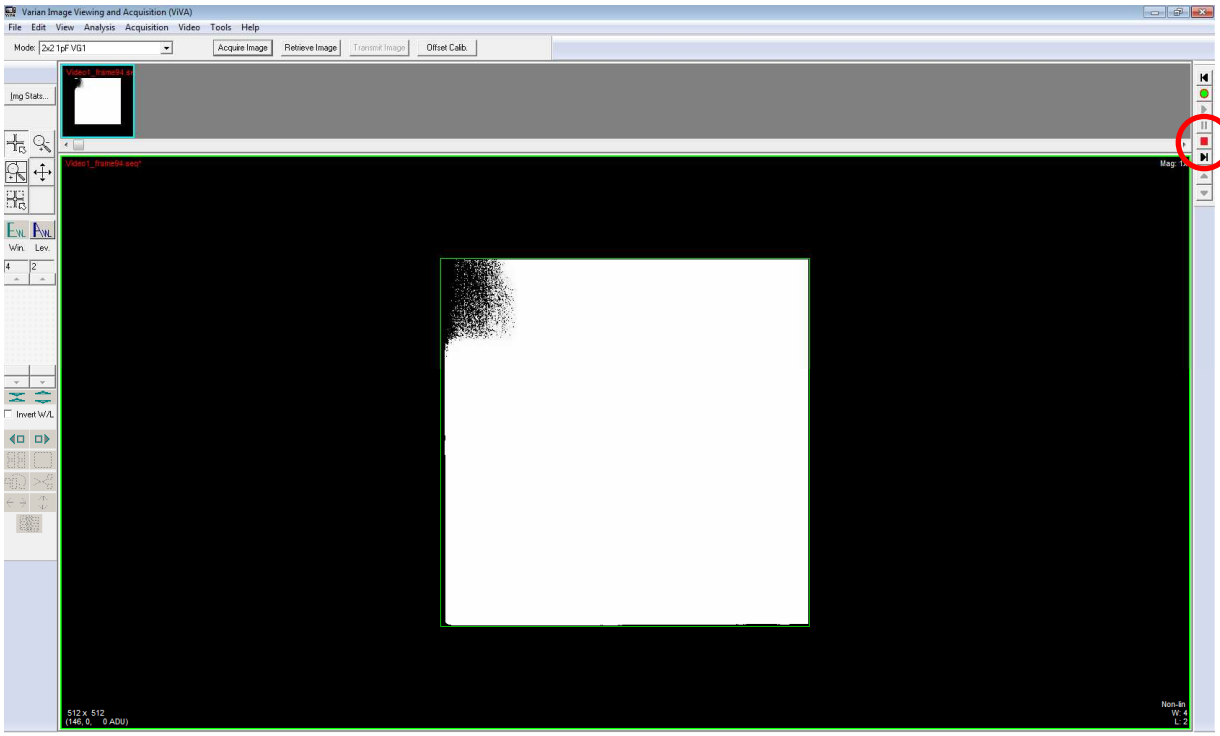


Figure 9-15

The square area is the area of the detector that is used and allows checking the centering of the image.

10. The acquisition sequence can be reviewed by pressing the "Play" button (green triangle) on the right of the screen and freeze the image when the white frames appear. Optimize the image selecting "Awl" on the left side of the screen and adjust brightness and contrast with the cursor.

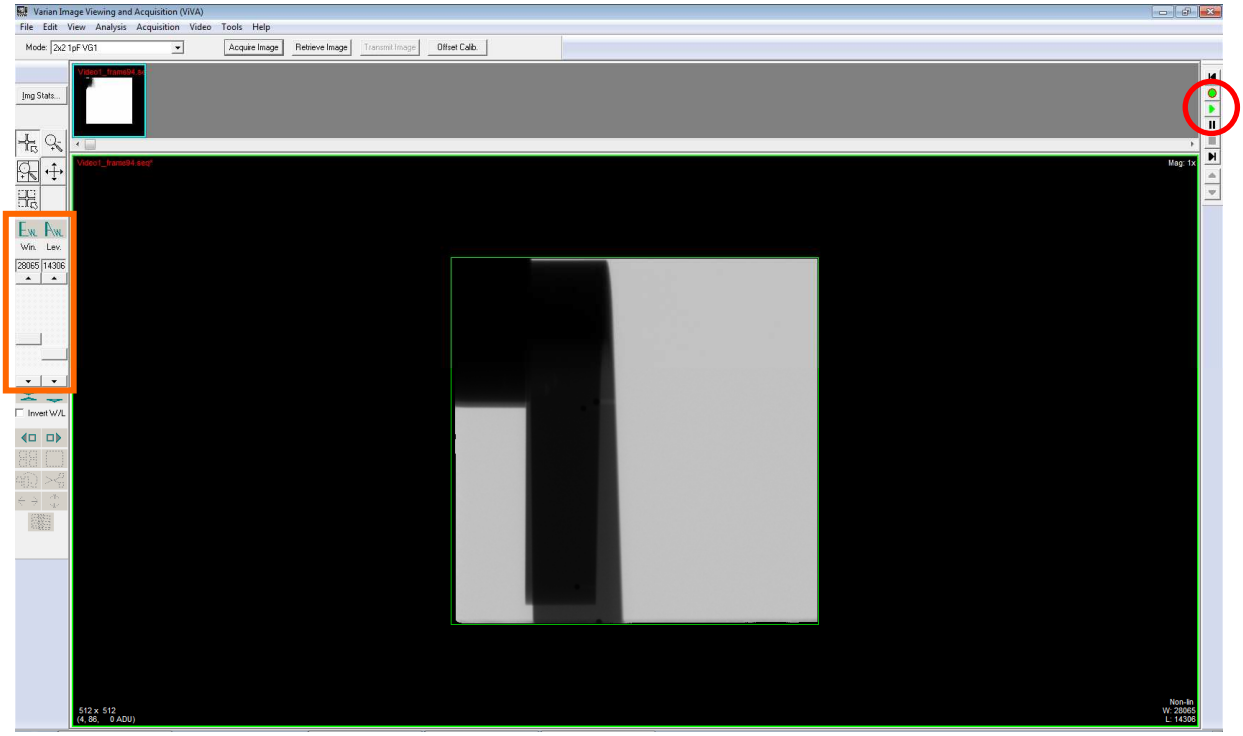


Figure 9-16

11. Verify that the irradiated area is well centered in the sensor area. If the irradiated area is not well aligned to the sensor area, regulate the collimator position through its regulation screws 1, 2 and 3 (Figure 9-8).

12. If on the top or on the bottom of the image is present the collimator shadow (1 - Figure 9-17a), adjust the primary 3D collimator offset (e.g. reduce the offset - see paragraph 7.3.4.7).

13. If the shadow is on the left or right side (2 - Figure 9-17a), verify the mechanical alignment of the whole collimator.

14. Verify that the Soft Tissue Filter is not in the X-ray field (3 - Figure 9-17b), if it is the case, adjust the SFT offset (see paragraph 9-39).

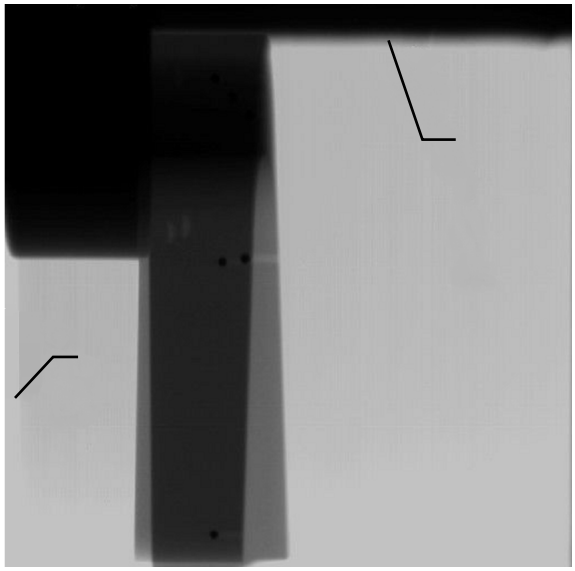


Figure 9-17a

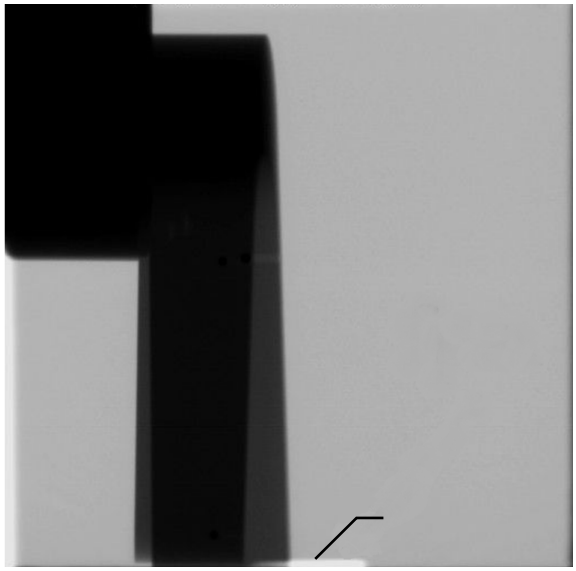


Figure 9-17b

9.3.2.2. Lateral offset setting

To verify the lateral offset for the 3D acquisitions, the following procedure must be followed:

1. Open folder "ROTOGRAPH EVO" in the "VILLA PANO" folder in your Windows desktop and double click the "ROTOGRAPH EVO TEST" shortcut to start the Panolan utility.
2. Select on the menu "Image processing" the modality "3D offset computing".

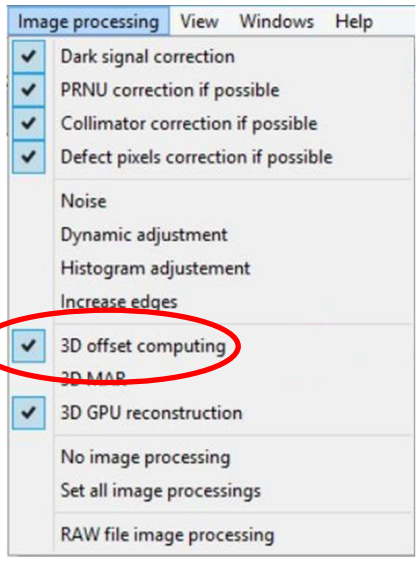


Figure 9-18

3. On the displayed windows, set the following parameters:

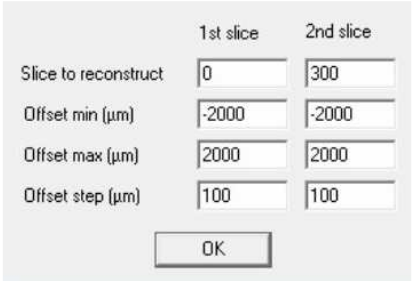


Figure 9-19

4. Insert support plate (P/N 6195170100) on the chin rest and place the centering cylinder (P/N 5207900900) in the middle of the support plate.

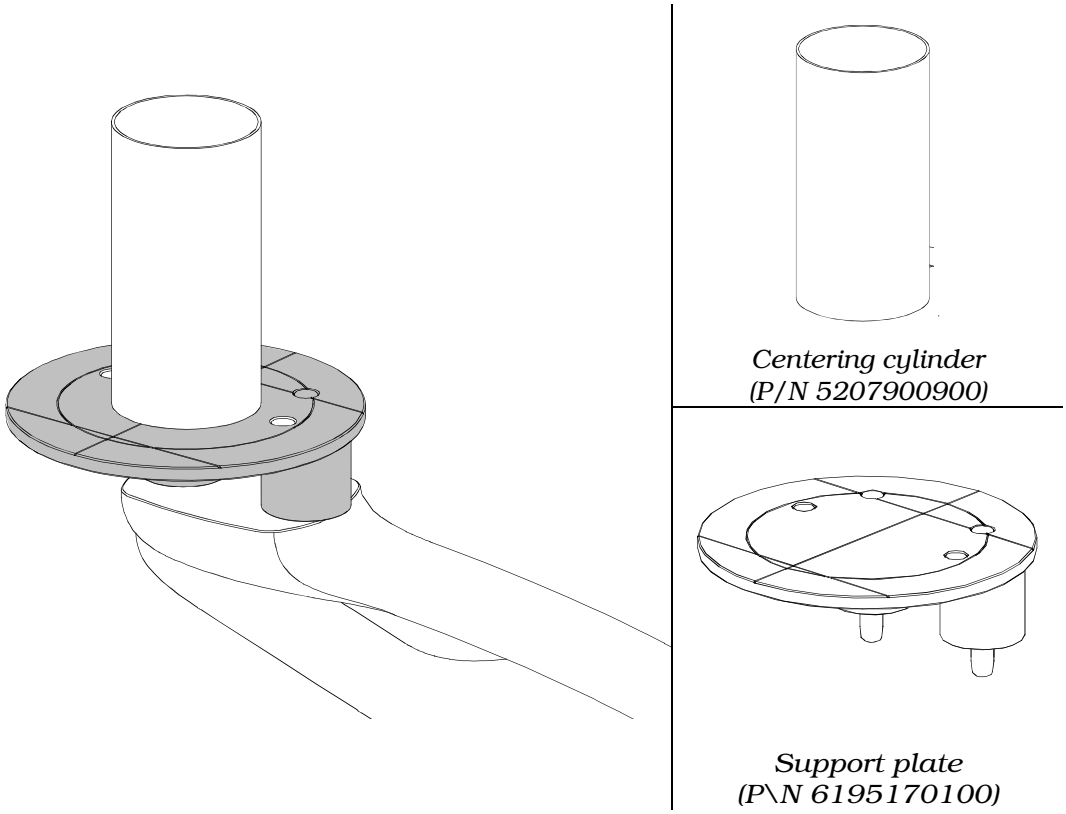


Figure 9-20

5. Make a 3D Full Dentition exposure setting the parameters to 60kV - 5mA.

6. Open the files located in "C:\ProgramData\VILLA SM\OSP-LAN PANORAMIC\Centring" with an image viewer; the name of these files contains two values: OFFSET_HORIZONTAL_Z and OFFSET_HORIZONTAL_UM.

7. Among the files named OFFSET_HORIZONTAL_Z=000 look for the file in which the reconstructed circle is the most continuous (Figure 9-21 - right image) and write down the corresponding value OFFSET_HORIZONTAL_UM contained in the name of the file.

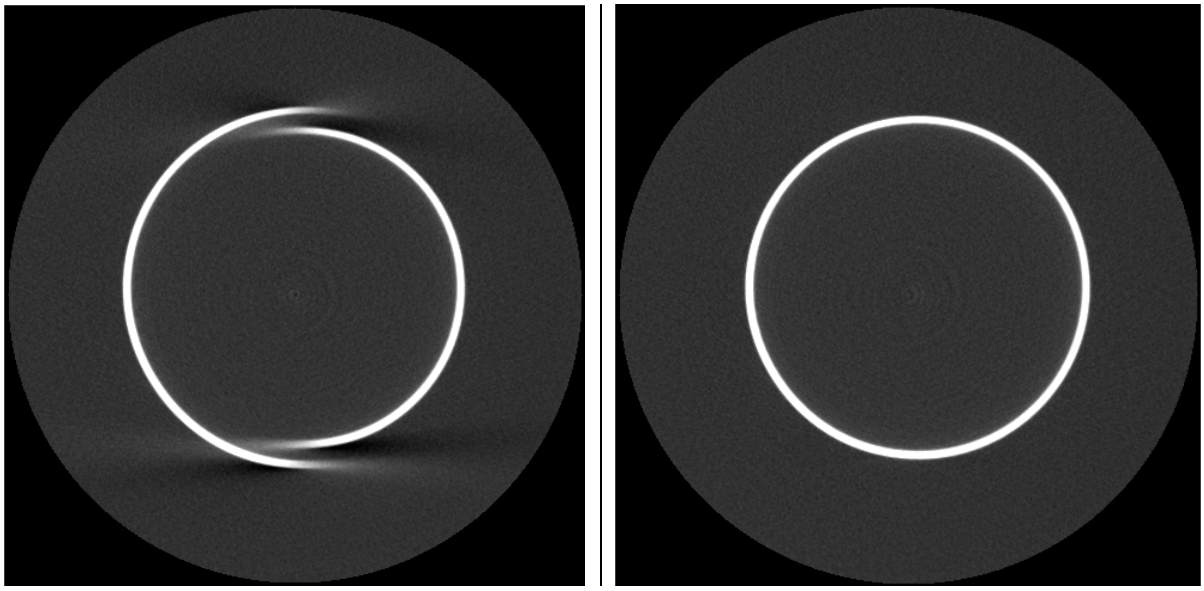


Figure 9-21

8. Repeat the operation for the files named OFFSET_HORIZONTAL_Z=300 and take note of the OFFSET_HORIZONTAL_UM value.

9. Open the file "PANO_LAN_DLL.ini" in C\Program Data\VILLA SM\OSP-LAN PANORAMIC.

10. Insert the values HORIZONTAL_OFFSET_UM previously chosen for each slice number:

[EVO3D_3D_XRAYS_SENSOR]
OFFSET_HORIZONTAL_UM=0 ← *offset chosen at point 7*
OFFSET_HORIZONTAL2_UM=0 ← *offset chosen at point 8*
OFFSET_HORIZONTAL_Z=0 ← *slice number chosen at point 3*
OFFSET_HORIZONTAL2_Z=300 ← *slice number chosen at point 3*

11. In the Panolan utility, select the "3D offset computing" option in the "Image processing" menu again to disable it.

12. Switch OFF and ON the unit and verify that the offset is properly applied following the instruction at paragraph 6.7.3.1.

9.4. 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 9-22; 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.

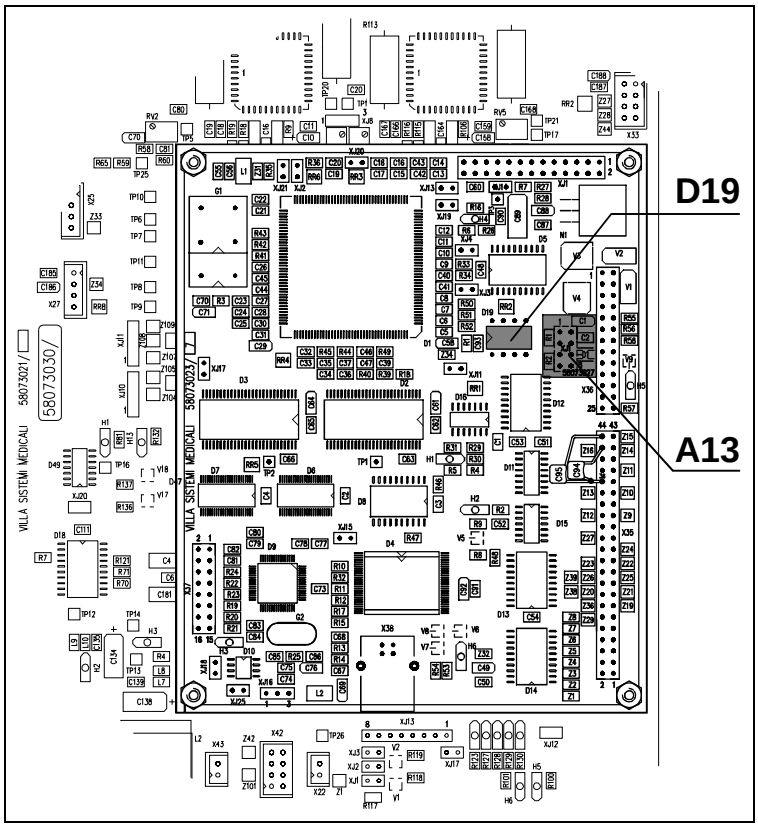


Figure 9-22

9.5. CEPH Digital sensor replacement

In case of CEPH digital sensor replacement copy the Calibration files as described in paragraph 9.6.4 and verify the alignment following instruction in paragraph 9.7.

9.6. 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.

9.6.1. 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.

9.6.2. 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 Dental Studio license USB key and restart the PC.

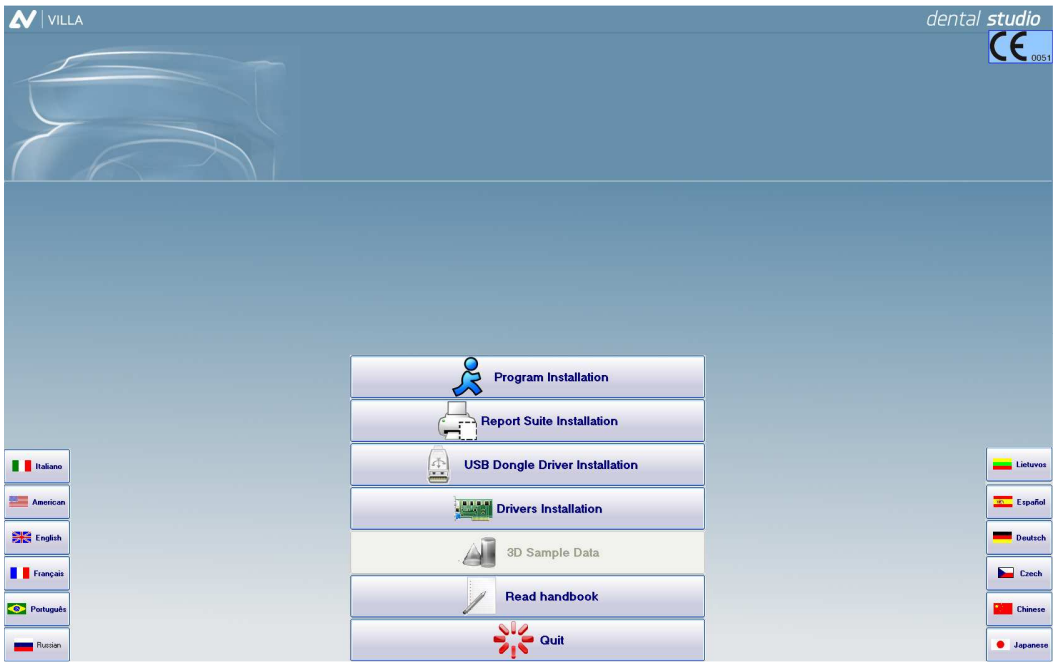


Figure 9-23

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 "Unregistred license. Only for evaluation" but it will be possible to set the user's data at the next initialization (on customer site).

Figure 9-24

9.6.3. 3D Sensor calibration files installation

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

9.6.4. 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 7, WINDOWS 10**

  C:\Program Data\ VILLA SM\OSP - LAN PANORAMIC\

Example:

In the folder:

C:\ Program Data\ VILLA SM\OSP - LAN PANORAMIC

you must have the following folder:

- *3_KAS21126.*

9.6.5. Internal network set up

To set/check the IP addresses, proceed as follow:

1. On Dental Studio program click on "Options" icon; the following musk will be displayed.

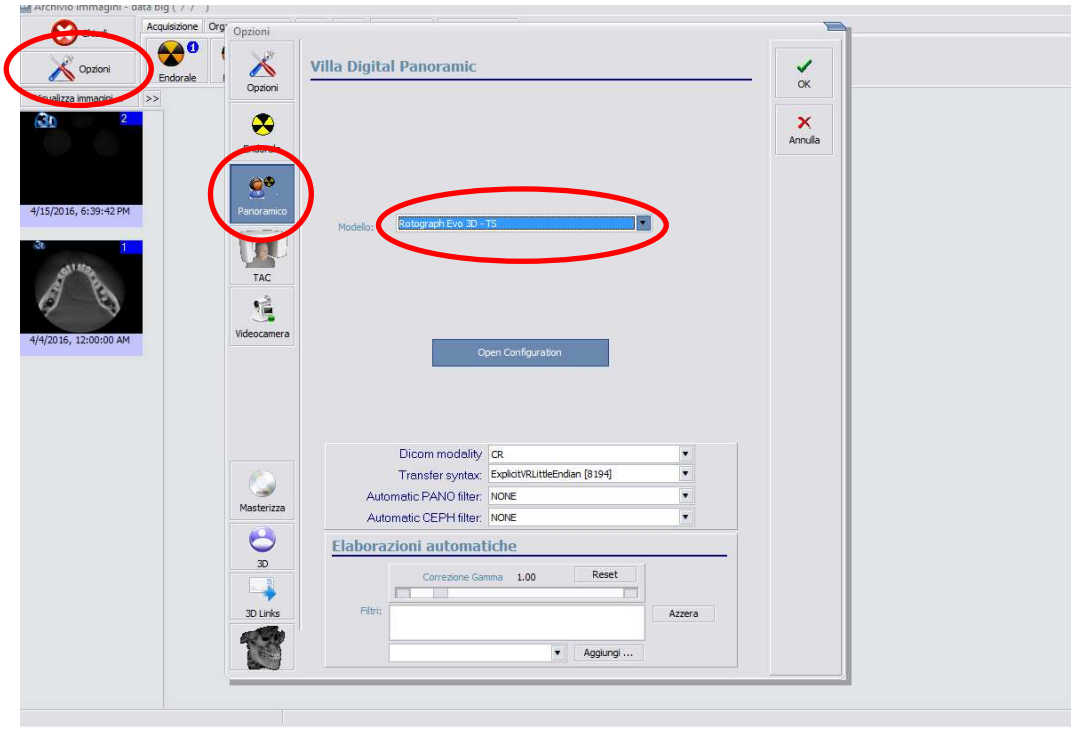


Figure 9-25

2. Select "Panoramic" icon and select as device "Rotograph Evo 3D - TS".
3. Click on "Open Configuration", the "Panoramic configuration" window will be displayed.

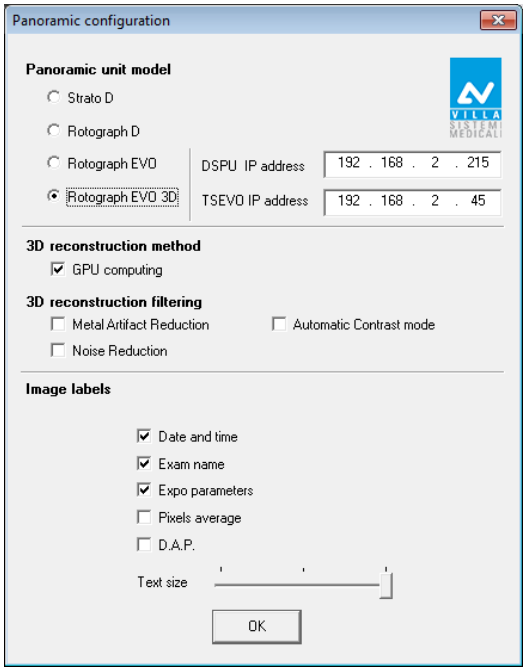

Panoramic configuration
Panoramic unit model
Strato D
Rotograph D
Rotograph EVO
Rotograph EVO 3D
DSPU IP address
192 . 168 . 2 . 215
TSEVO IP address
192 . 168 . 2 . 45
3D reconstruction method
GPU computing
3D reconstruction filtering
Metal Artifact Reduction
Automatic Contrast mode
Noise Reduction
Image labels
Date and time
Exam name
Expo parameters
Pixels average
D.A.P.
Text size
OK

Figure 9-26

9.6.5.1. 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.

9.7. CEPH arm aligment

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

"MACHINE SETTING
PRESS >0< "

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

"WAIT FOR
MACHINE SETTING "

followed by

"CEPH POSITIONING
PLEASE WAIT... "

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

"DIGITAL CEPH
ENABLE SENSOR "

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

"DIGITAL CEPH
CEPH IS DISABLED "

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

"DIGITAL CEPH
CEPH IS ENABLED "

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

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

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

"DIGITAL CEPH
ENABLE SENSOR "

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

Step	Action	Reference paragraph
I	Verification of the ear rods alignment	9.7.1
II	Ceph sensor centering	9.7.2
III	Secondary collimator centering	9.7.3
IV	Soft Tissue Filter adjustment	9.7.4

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.

9.7.1. 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 9.7 and:

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

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

" DIGITAL CEPH
ROTATION OFFSET "

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

" PLEASE WAIT... "

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

" T ZERO [ff] a
ZERO OFFS ±eeeee "

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

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

12. Press on the touch screen central area 

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

NOTE:
If message:

" DIGITAL SENSOR IS NOT READY "

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

Press key  to reset the message and press on the touch screen central area 

again.

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

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

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

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

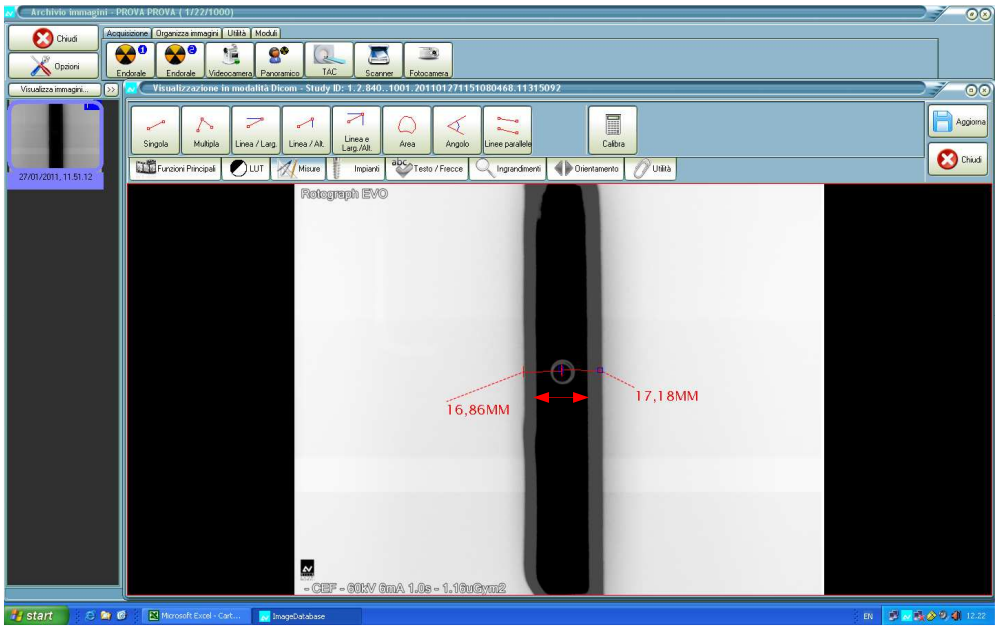


Figure 9-27

16. If it will be necessary to change the height of the CEPH arm, loose the two screws "A" (Figure 9-28), 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".

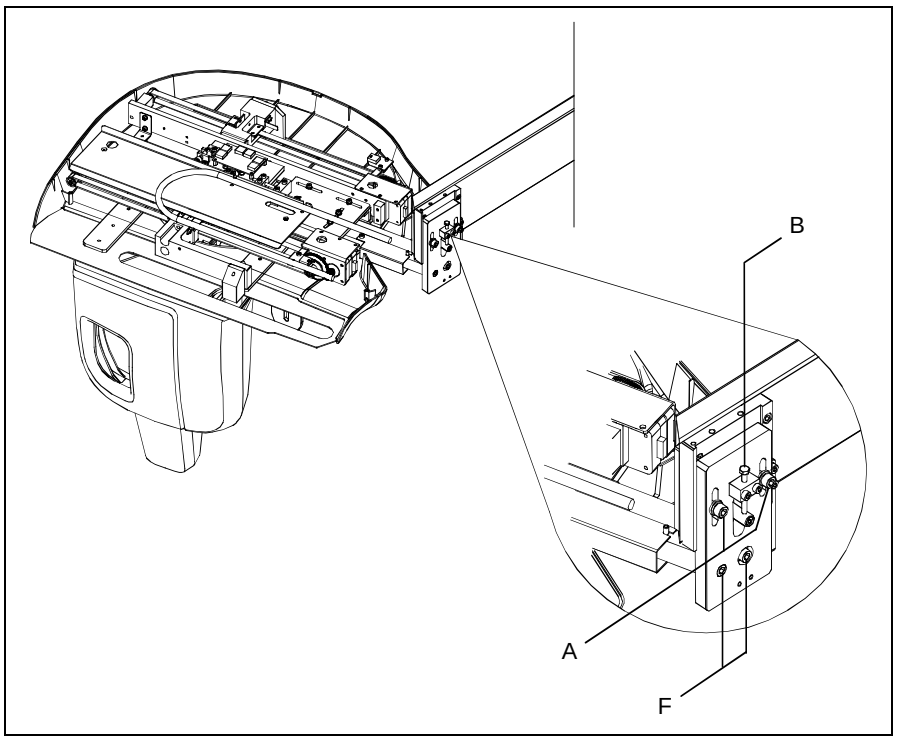


Figure 9-28

17. Check on the image if the Ear Centering Circles are concentric (small circle inside the big circle – i.e. as shown in Figure 9-27).

18. To adjust the vertical alignment between the two rings, loose the two screws "F" (Figure 9-28) and adjust the position of the arm acting on screw "G" (Figure 9-29). Once the aligned position has been reached (test exposures are required), tighten bolt "H" (Figure 9-29) and tighten screws "F".
The performance of this adjustment could require the reiterate of step 15.

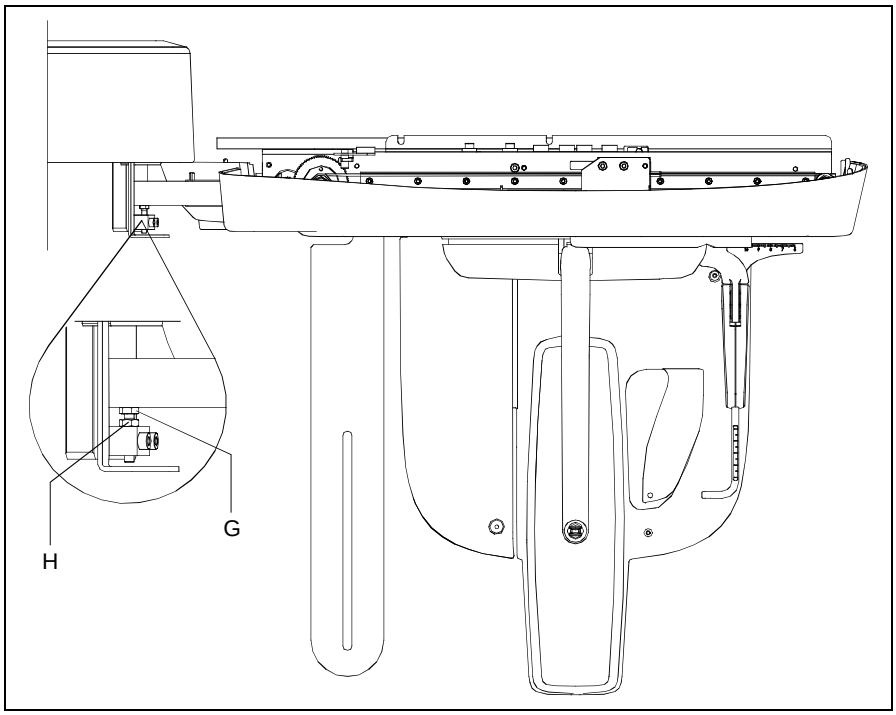


Figure 9-29

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

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

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

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

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

21. Enter again in Password 124 following procedure explained on paragraph 9.7 and enter in "Rotation Offset" menu as for point 8 and 9.

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

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

23. To adjust the horizontally alignment between the two rings, loose the two screws "C" (Figure 9-30) 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".

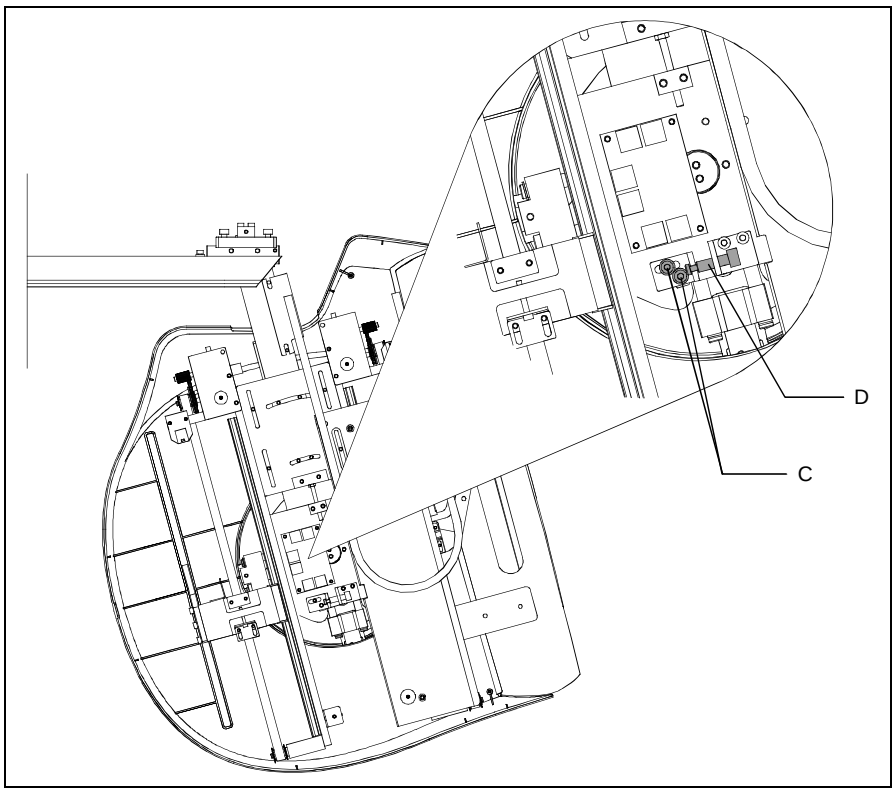


Figure 9-30

9.7.2. CEPH Sensor centering

To verify the CEPH Sensor centering, on the image taken following procedure in paragraph 9.7.1:

24. Select form the menu "Measure" the icon "Single" and mesure the distance between the borders of the image and the borders of the central vertical stripe (Figure 9-31).

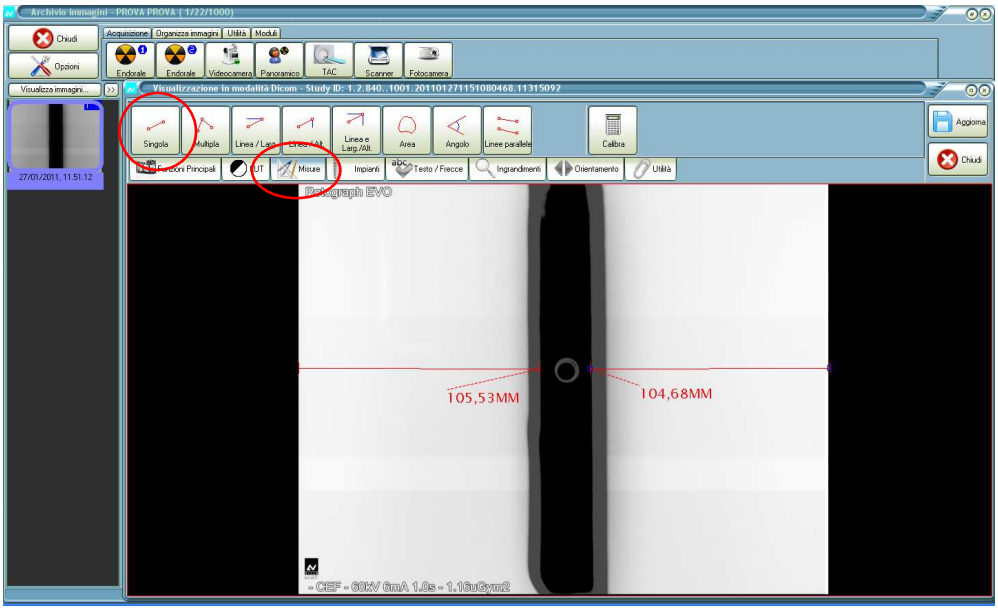


Figure 9-31

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

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

(8) 

to select "CEPH SENSOR ZERO" menu; the display will show:

"S ZERO [ff] a
ZERO OFFS ±eeeee "

26. With keys increase (22) and decrease (23)  set the speed value (suggested value 2) and with keys (25) and (24)  move the CEPH Sensor, increasing the displayed offset value if the left distance is higher than the right one or viceversa.

27. Close the sensor holder, if open and press key "Size selection" (9) 

, the following message will be displayed:

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

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

28. Press the touch screen central area 

to move the Ceph sensor in the acquisition start position.

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

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

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

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

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

"DIGITAL CEPH
ROTATION OFFSET "

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

9.7.3. Secondary collimator centering

To perform the ceph secondary collimator alignment start from point 30 of paragraph 9.7.2 and:

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

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

"DIGITAL CEPH
CEPH S.COL. ZERO "

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

"C ZERO [ff] abcd
ZERO OFFS ±eeeee "

35. Press key " Patient entrance " (6)  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.

36. 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.

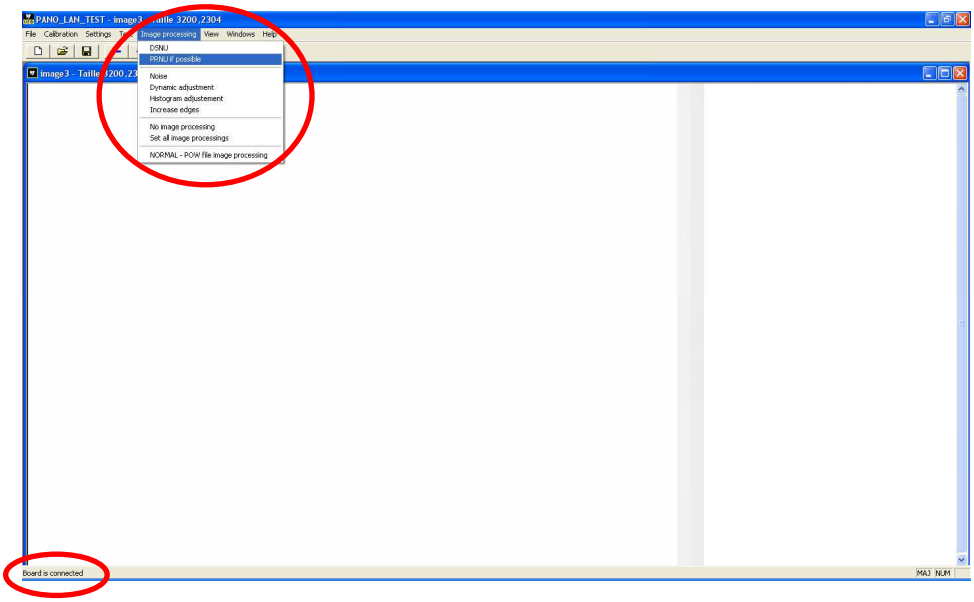


Figure 9-32

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

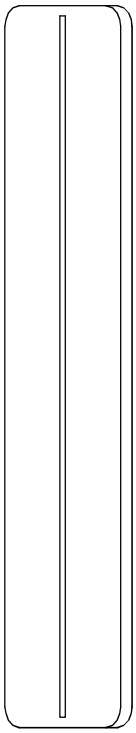


Figure 9-33
Centering tool P/N 5209900900

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

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

39. 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 9-34 and Figure 9-35).

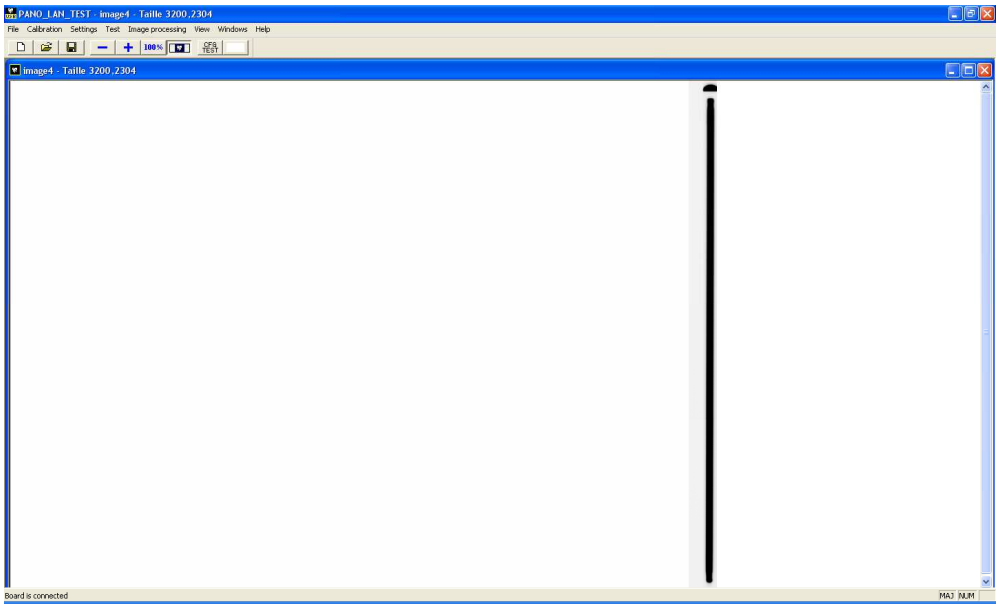


Figure 9-34

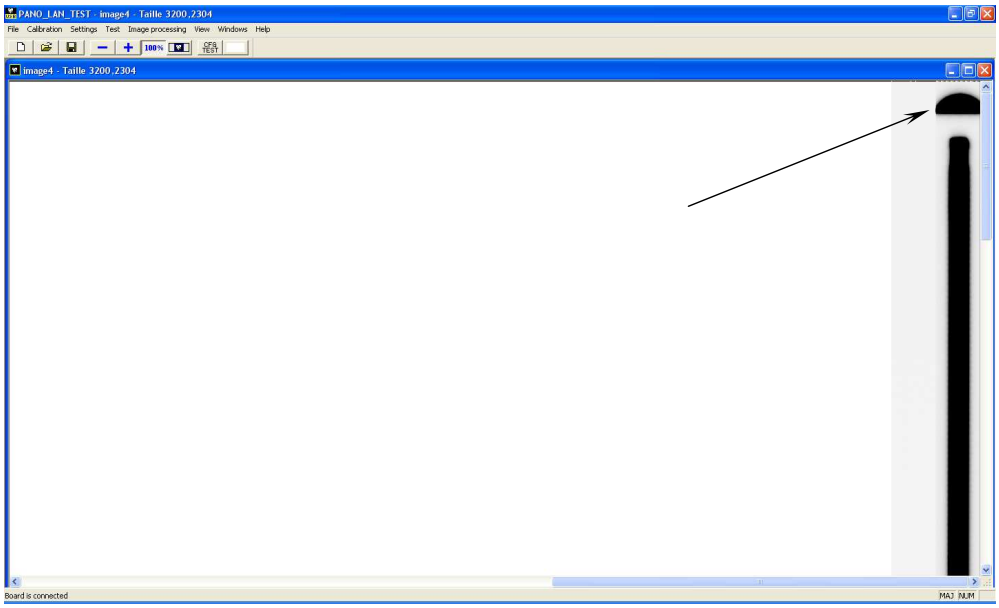


Figure 9-35

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

set a speed value (suggested value 3) and with keys (24) and (25)  move the secondary collimator, increasing the displayed offset value if the left distance is lower than the right one or vice versa; repeat the test from point 30.

NOTE:
This is a fine setting; if the zero offset (±eeeee) is lower than –1000 steps or greater than 1000 steps repeat the first step of ceph arm centering described in 9.7.1.

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

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

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

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

9.7.4. 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 9.7.

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

   "DIGITAL CEPH
   STF ZERO OFFSET "

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

   "PLEASE WAIT... "

   and at the end of positioning

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

3. Place the ear centering device in a Latero-Lateral position.
4. Acting on keys "P" (26)  and on keys increase (22) or decrease (23)  set the exposure parameters, as suggestion set 60kV - 6mA.
5. Open and activate the Virtual Keyboard.
6. Press the central area of the touch screen 

.

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

NOTE:
If message:

" DIGITAL SENSOR IS NOT READY "

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

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

again.

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

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

"ENTER IMG OFFSET
OFFSET (mm) 50 "

8. Select from the menu "Measure" the icon "Singles" and measure the distance "A" (Figure 9-36) between the Soft Tissue Filter (STF) edge and the center of the rings; perform the measure in "mm".

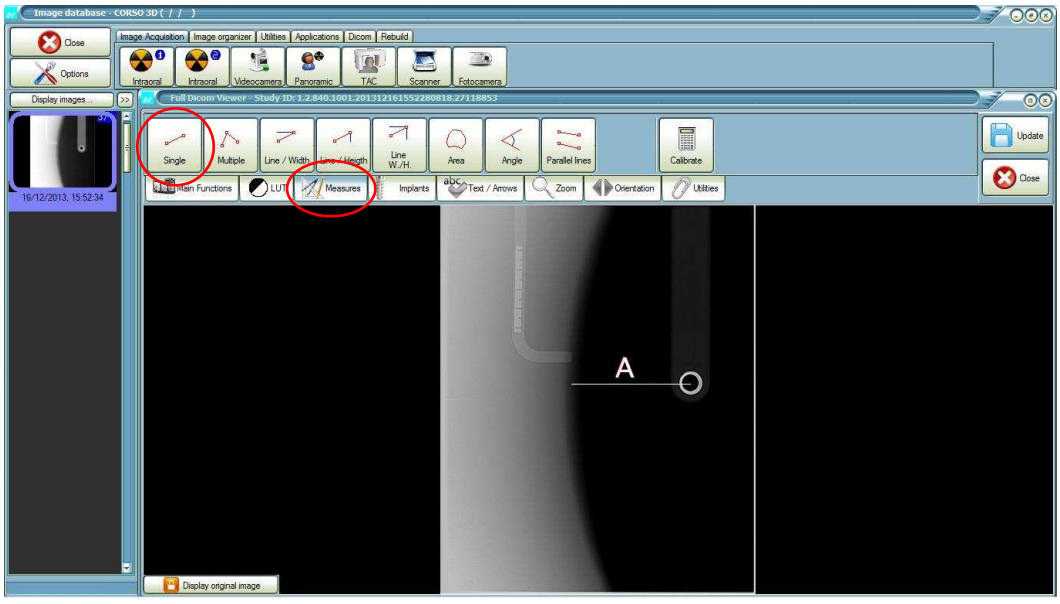


Figure 9-36

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

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

If distance "A" is 50±2mm no correction is needed; press key "T" (27)  to exit.

In both cases the following message will be displayed

" STF ZERO [xx] x
ZERO OFS ±xxxxx "

10. Check proper alignment of the Soft Tissue Filter by performing a new exposure (repeat the actions from point 3 to point 8).
If the alignment is correct, store it into the non-volatile memory of the unit by pressing key "T" (27)  . The display will show:

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

Press key (6)  to permanently store the change.

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

11. Press key (27)  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 Touch Screen Control PCB A4

5. Lay-out CPU PCB A5

6. Circuit diagram CPU PCB A5

7. Lay-out Microprocessor PCB A6

8. Circuit diagram Microprocessor PCB A6

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

10. Lay-out Generator CPU PCB A9

11. Circuit diagram Generator CPU PCB A9

12. Lay-out Generator PCB A10

13. Circuit diagram Generator PCB A10

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

15. Lay-out DSPU PCB A14

16. Lay-out Partial Volume PCB A26

17. Circuit diagram Partial Volume PCB A26

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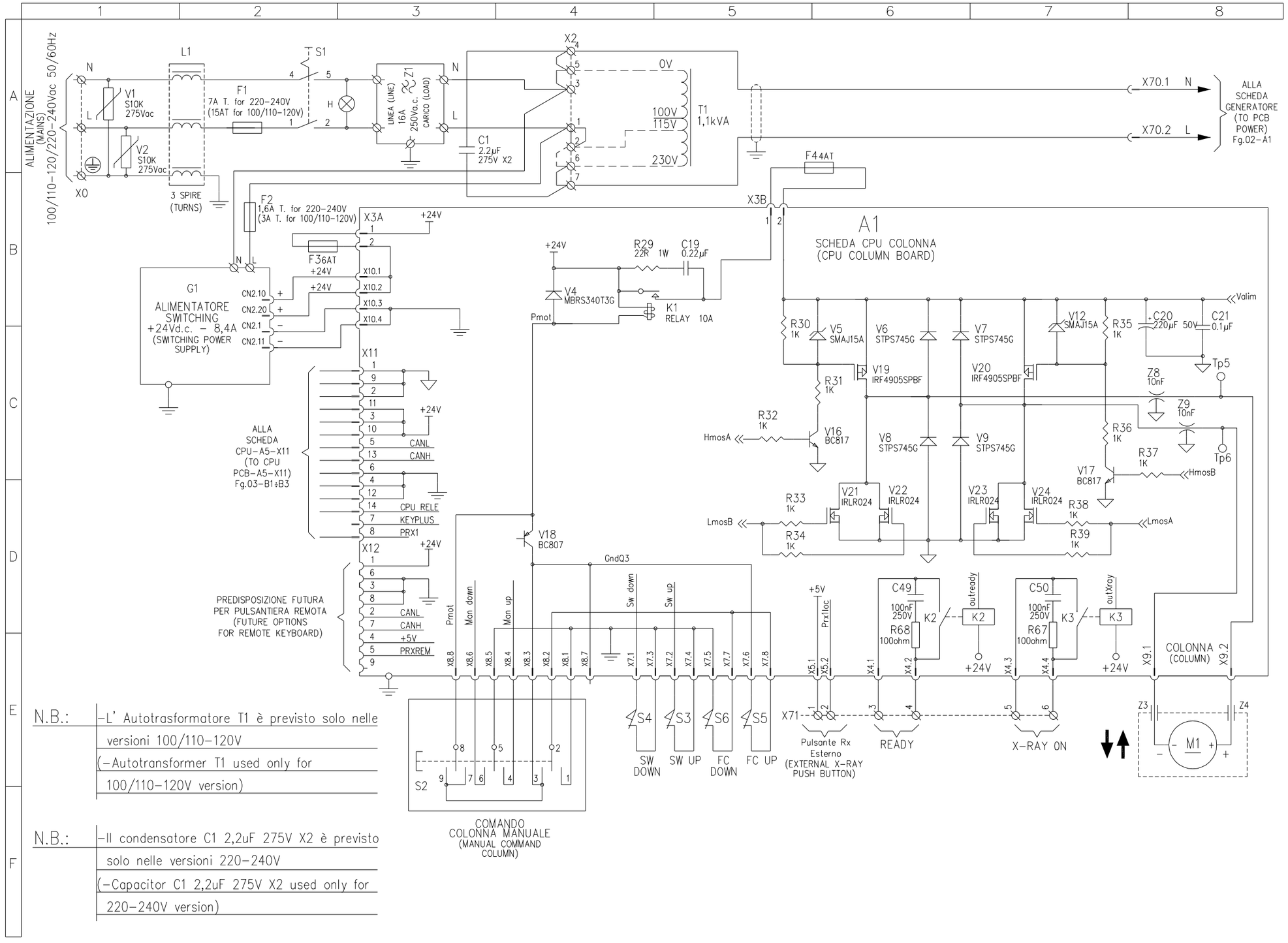
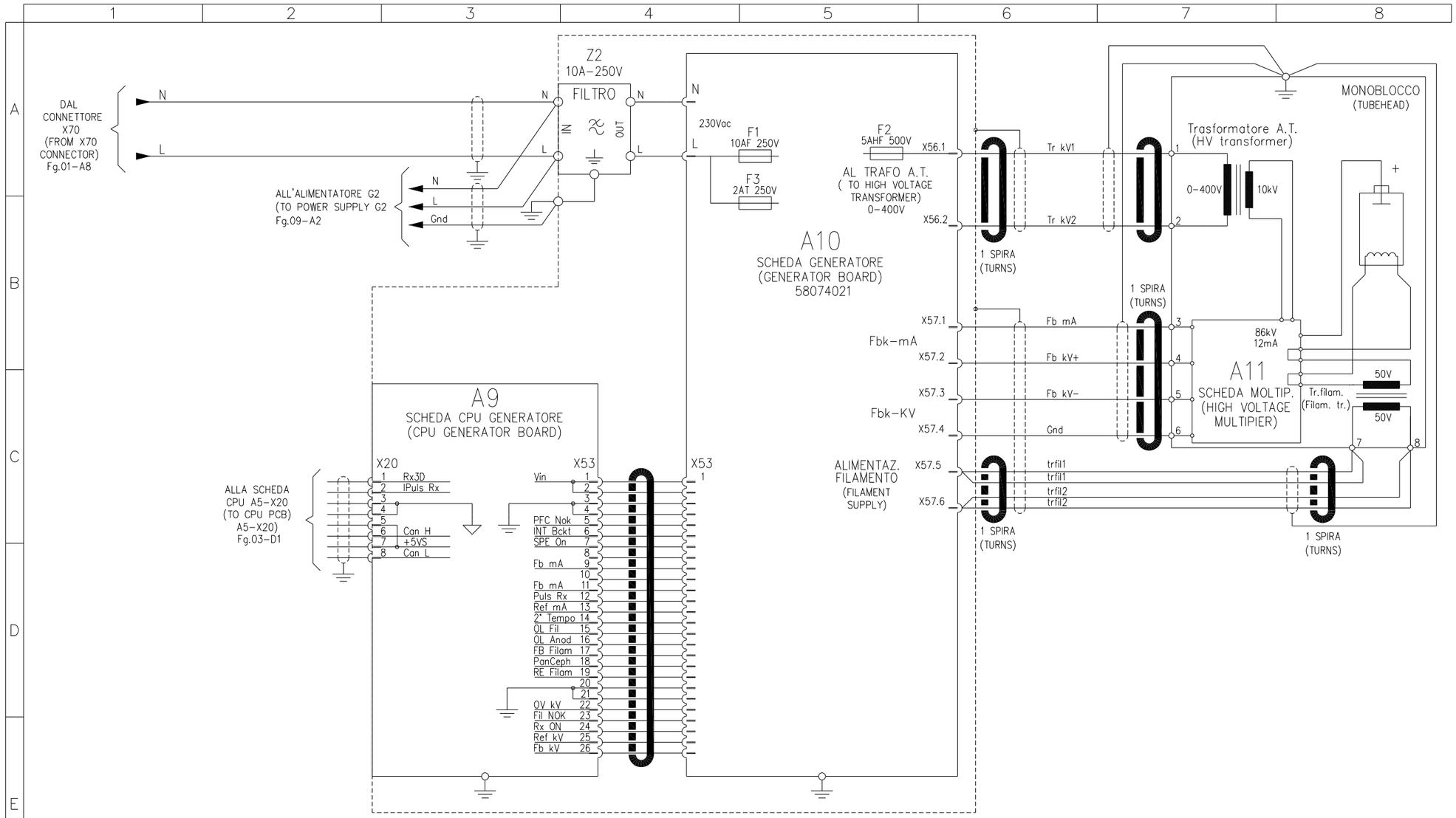
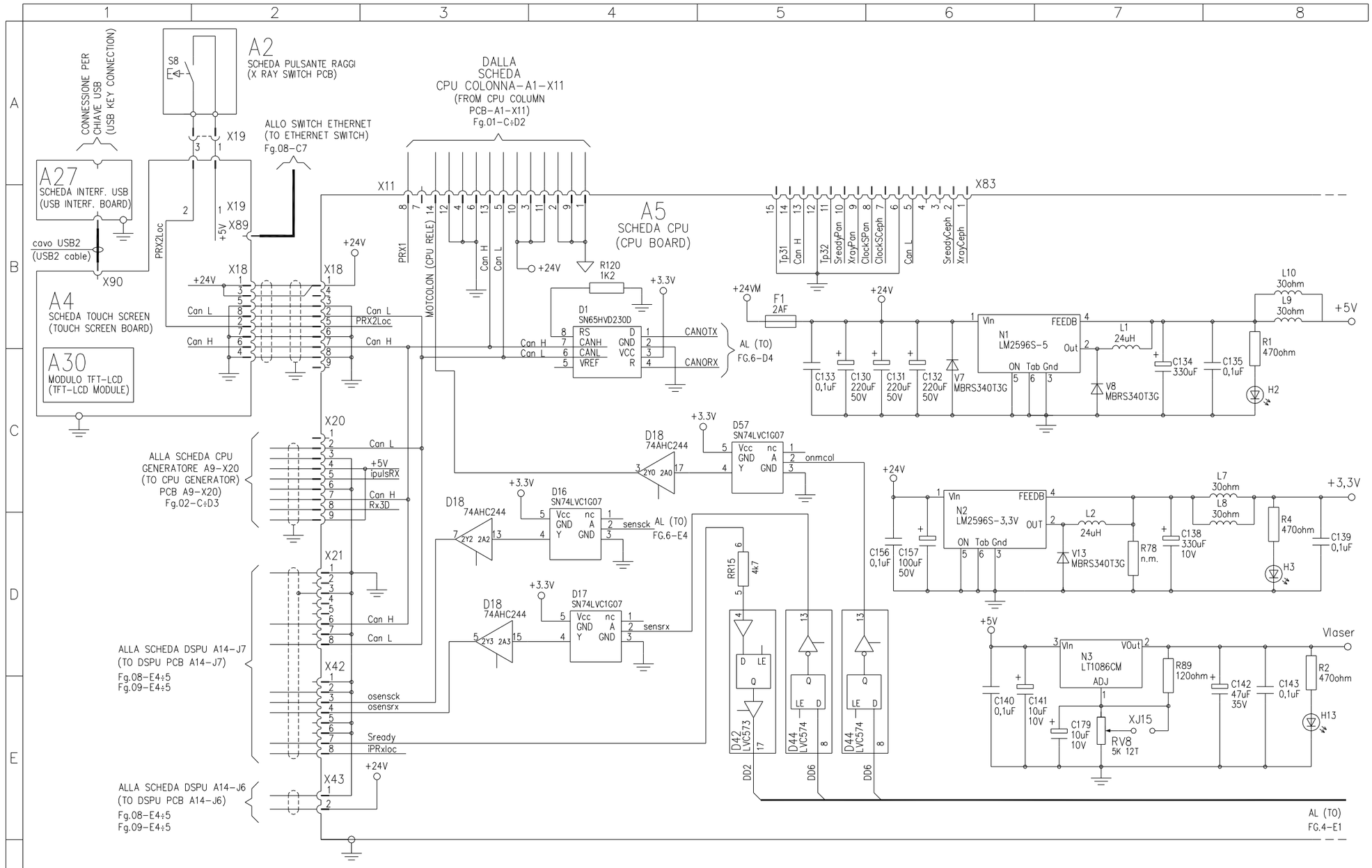
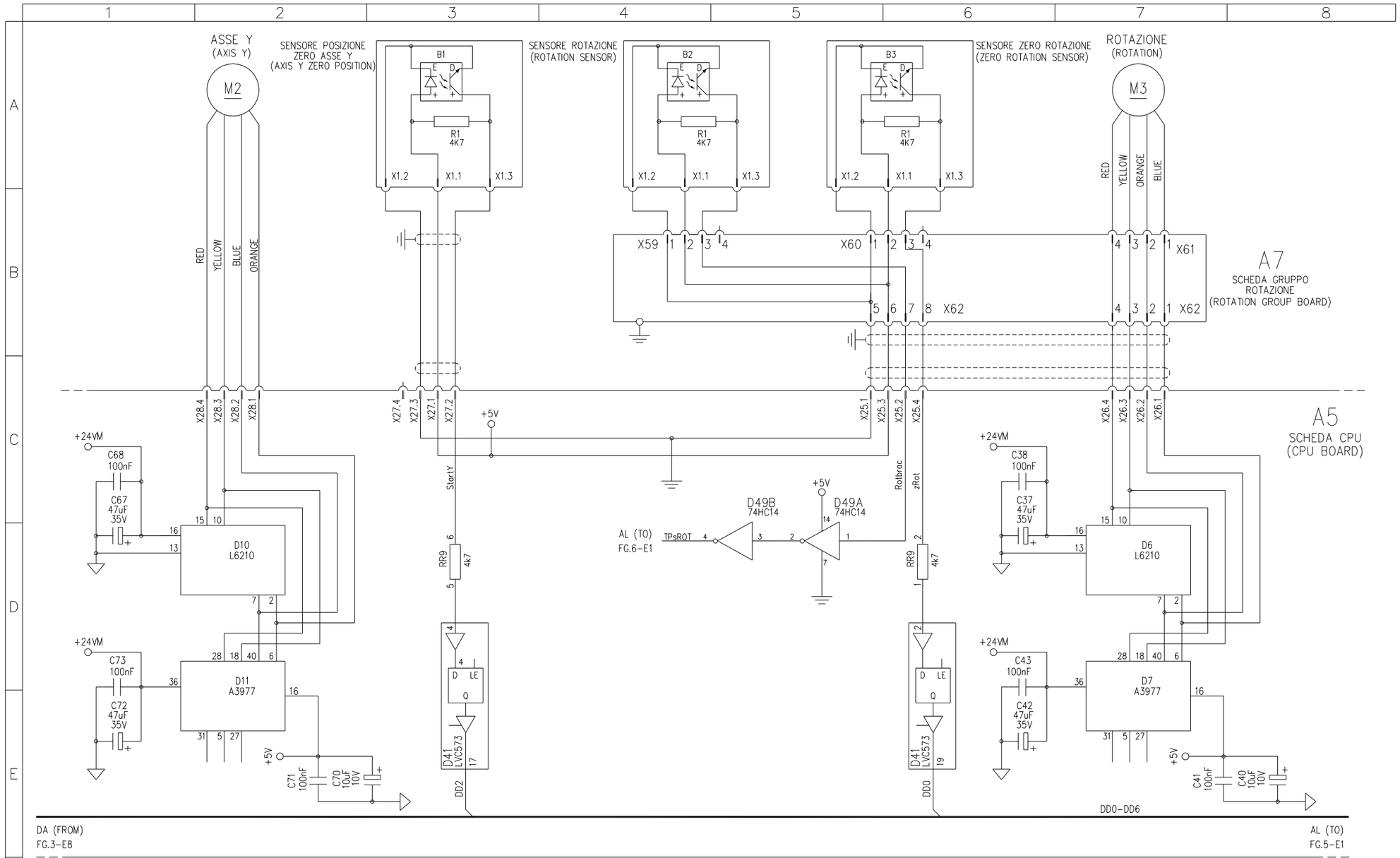
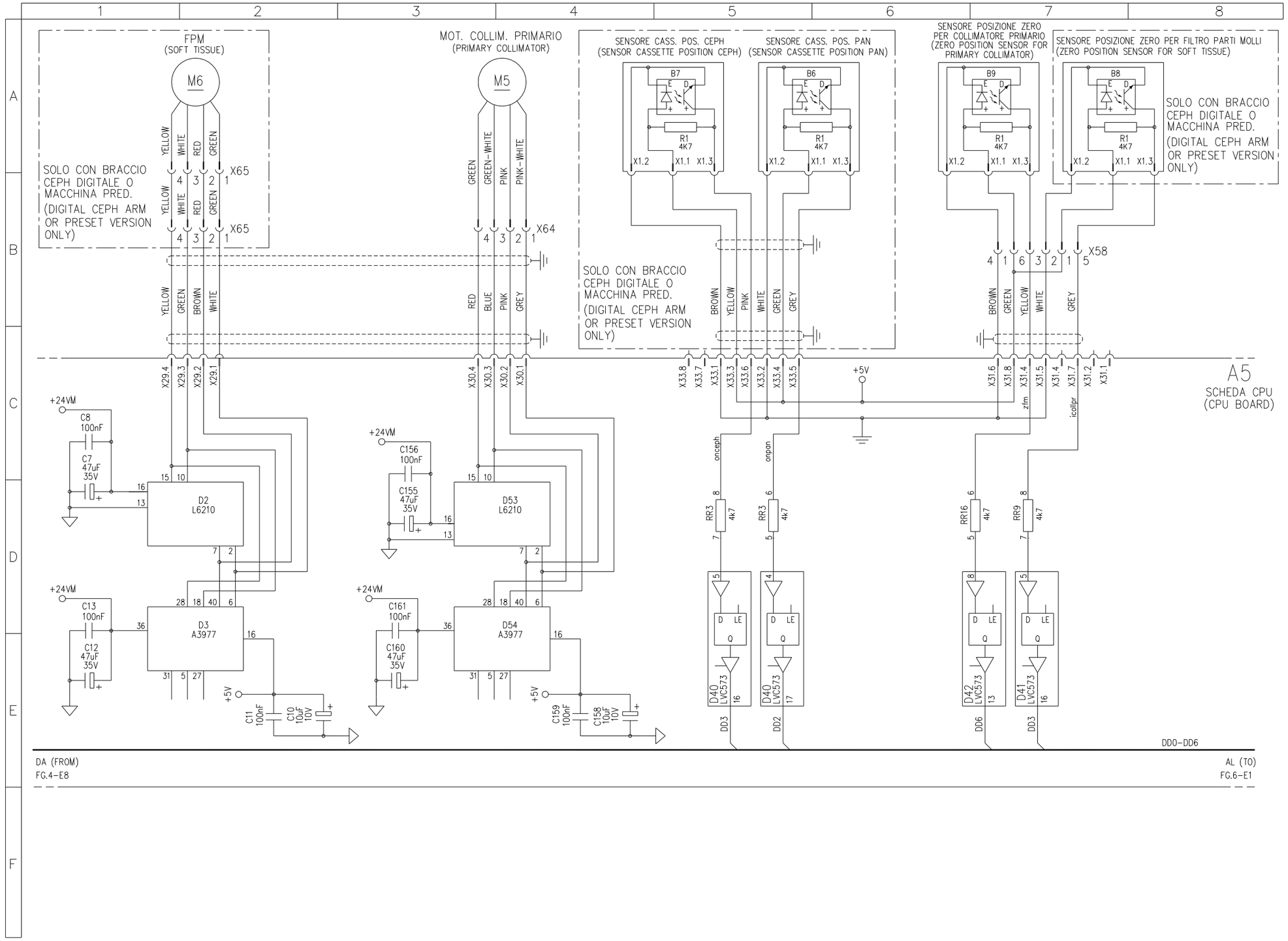
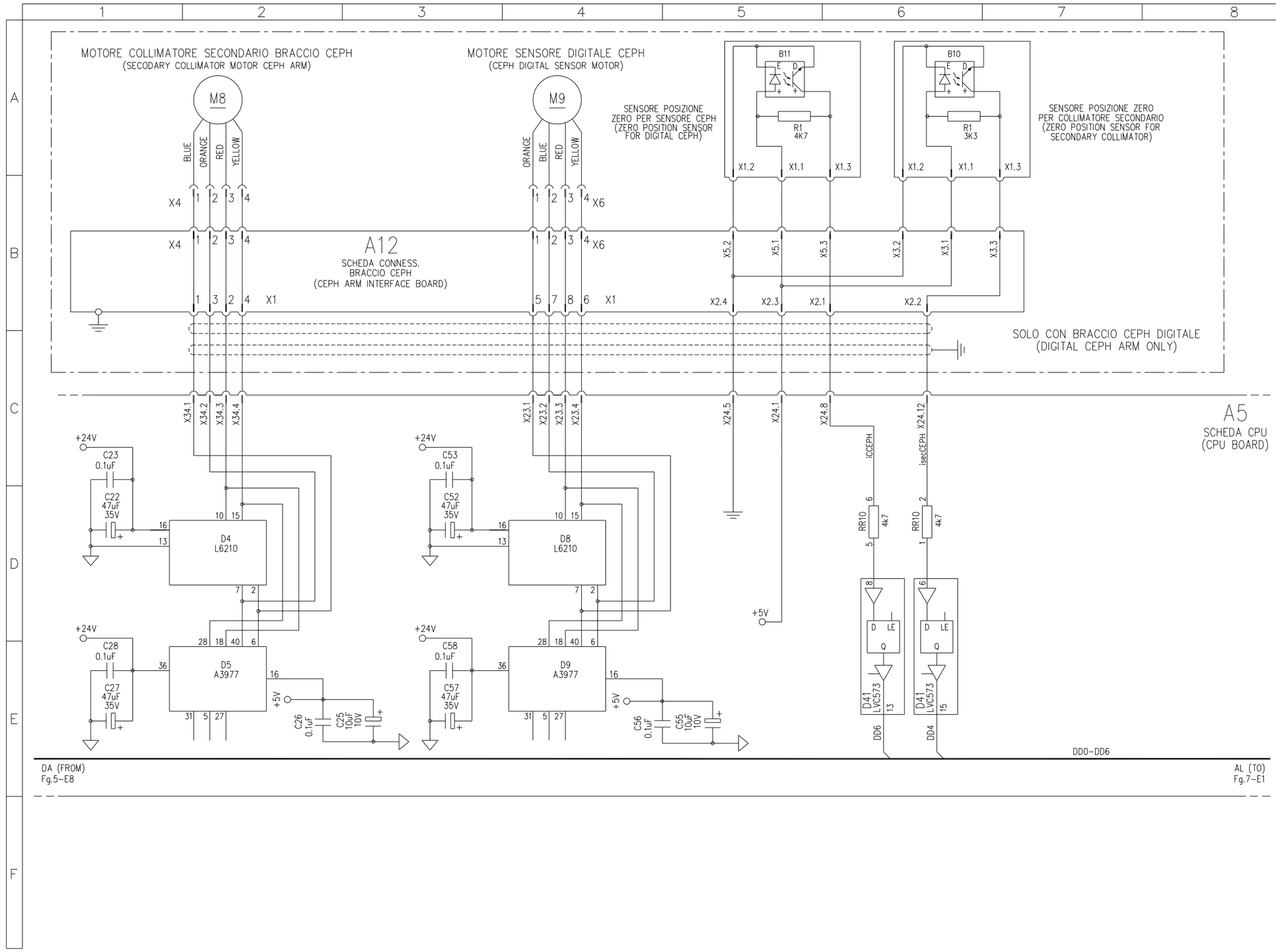

ALIMENTAZIONE (MAINS) 100/110-120/220-240Vac 50/60Hz
N
L
V1 S10K 275Vac
V2 S10K 275Vac
X0
L1
3 SPIRE (TURNS)
F1 7A T. for 220-240V (15AT for 100/110-120V)
S1
H
LINEA (LINE) 16A 250Va.c. CARICO (LOAD)
Z1
C1 2.2µF 275V X2
X2
0V
100V 115V
230V
T1 1,1kVA
X70.1 N
X70.2 L
ALLA SCHEDA GENERATORE (TO PCB POWER) Fg.02-A1
F44AT
X3B
F2 1,6A T. for 220-240V (3A T. for 100/110-120V)
F36AT
X3A
+24V
G1 ALIMENTATORE SWITCHING +24Vd.c. - 8,4A (SWITCHING POWER SUPPLY)
CN2.10
CN2.20
CN2.1
CN2.11
X10.1
X10.2
X10.3
X10.4
A1 SCHEDA CPU COLONNA (CPU COLUMN BOARD)
R29 22R 1W
C19 0.22µF
V4 MBRS340T3G
K1 RELAY 10A
Pmot
Valim
R30 1K
V5 SMAJ15A
V6 STPS745G
V7 STPS745G
V12 SMAJ15A
R35 1K
C20 220µF 50V
C21 0.1µF
Tp5
R31 1K
V19 IRF4905SPBF
V20 IRF4905SPBF
Z8 10nF
Z9 10nF
Tp6
R32 1K
HmosA
V16 BC817
V8 STPS745G
V9 STPS745G
R36 1K
R37 1K
V17 BC817
HmosB
R33 1K
V21 IRLR024
V22 IRLR024
V23 IRLR024
V24 IRLR024
R38 1K
LmosB
R34 1K
R39 1K
LmosA
X11
X12
ALLA SCHEDA CPU-A5-X11 (TO CPU PCB-A5-X11) Fg.03-B1÷B3
CANL
CANH
CPU RELE
KEYPLUS
PRX1
PRXREM
PREDISPOSIZIONE FUTURA PER PULSANTIERA REMOTA (FUTURE OPTIONS FOR REMOTE KEYBOARD)
V18 BC807
GndQ3
Pmot
Man down
Man up
Sw down
Sw up
+5V
Prxlloc
C49 100nF 250V
R68 100ohm
K2
outready
C50 100nF 250V
R67 100ohm
K3
outXray
COLONNA (COLUMN)
X8.8
X8.6
X8.5
X8.4
X8.3
X8.2
X8.1
X8.7
X7.1
X7.3
X7.2
X7.4
X7.5
X7.7
X7.6
X7.8
X5.1
X5.2
X4.1
X4.2
X4.3
X4.4
X9.1
X9.2
S2
S4
S3
S6
S5
SW DOWN
SW UP
FC DOWN
FC UP
X71
Pulsante Rx Esterno (EXTERNAL X-RAY PUSH BUTTON)
READY
X-RAY ON
Z3
Z4
M1
COMANDO COLONNA MANUALE (MANUAL COMMAND COLUMN)
N.B.: -L' Autotrasformatore T1 è previsto solo nelle versioni 100/110-120V (-Autotransformer T1 used only for 100/110-120V version)
N.B.: -Il condensatore C1 2,2uF 275V X2 è previsto solo nelle versioni 220-240V (-Capacitor C1 2,2uF 275V X2 used only for 220-240V version)

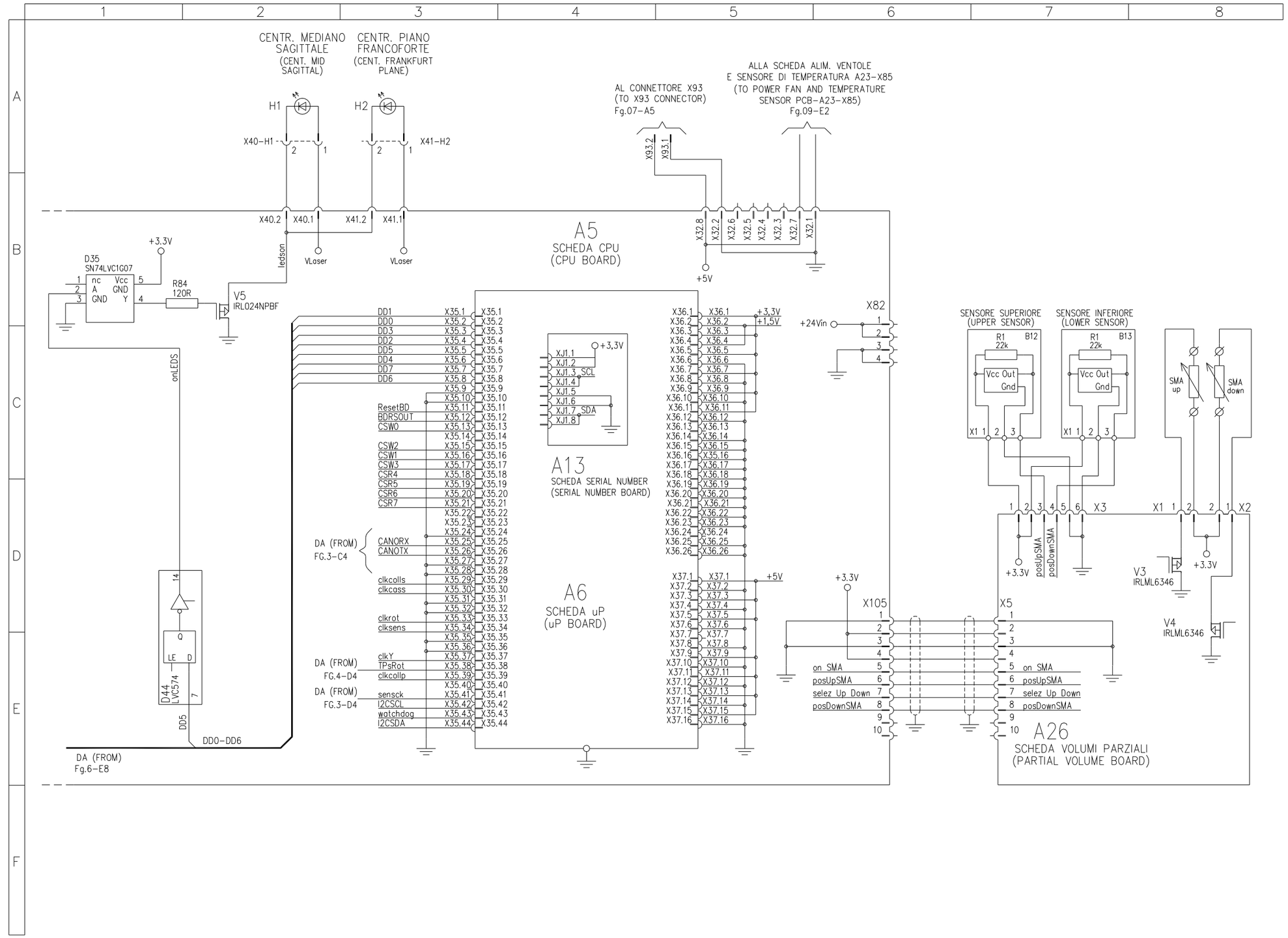

1
2
3
4
5
6
7
8
A
B
C
D
E
F
DAL CONNETTORE X70 (FROM X70 CONNECTOR) Fg.01–A8
N
L
Z2
10A–250V
FILTRO
IN
OUT
230Vac
F1
10AF 250V
F3
2AT 250V
ALL'ALIMENTATORE G2 (TO POWER SUPPLY G2 Fg.09–A2
Gnd
A10
SCHEDA GENERATORE (GENERATOR BOARD)
58074021
F2
5AHF 500V
X56.1
X56.2
AL TRAFO A.T. (TO HIGH VOLTAGE TRANSFORMER) 0–400V
Tr kV1
Tr kV2
1 SPIRA (TURNS)
MONOBLOCCO (TUBEHEAD)
Trasformatore A.T. (HV transformer)
0–400V
10kV
+
A9
SCHEDA CPU GENERATORE (CPU GENERATOR BOARD)
X20
X53
ALLA SCHEDA CPU A5–X20 (TO CPU PCB) A5–X20) Fg.03–D1
Rx3D
IPuls Rx
Can H
+5VS
Can L
Vin
PFC Nok
INT Bckt
SPE On
Fb mA
Puls Rx
Ref mA
2° Tempo
QL Fil
QL Anod
FB Filam
PanCeph
RE Filam
OV kV
Fil NOK
Rx ON
Ref kV
Fb kV
X57.1
X57.2
X57.3
X57.4
Fbk–mA
Fbk–KV
Fb mA
Fb kV+
Fb kV–
Gnd
86kV 12mA
A11
SCHEDA MOLTIP. (HIGH VOLTAGE MULTIPIER)
50V
Tr.filam. (Filam. tr.)
ALIMENTAZ. FILAMENTO (FILAMENT SUPPLY)
X57.5
X57.6
trfil1
trfil2
1 SPIRA (TURNS)

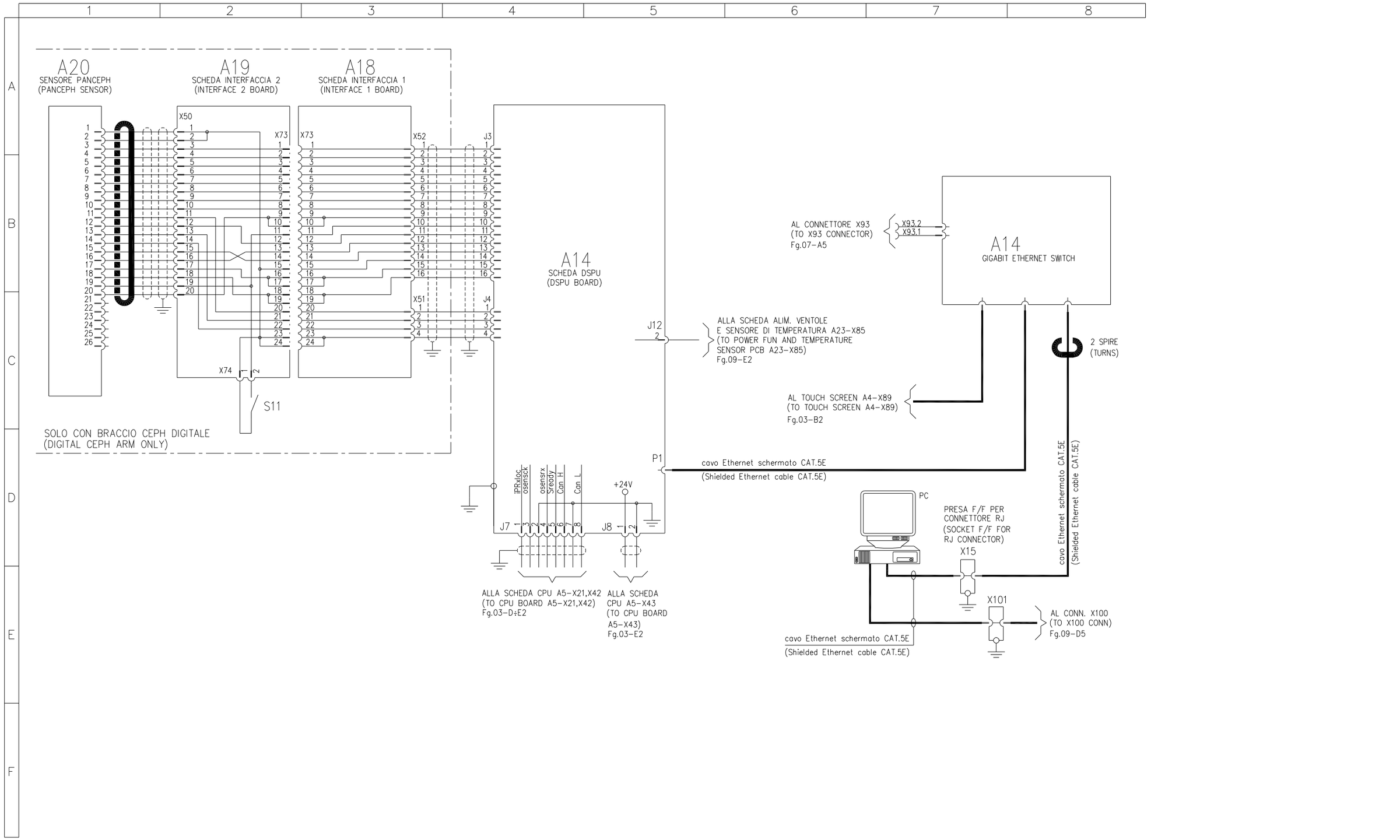

A2
SCHEDA PULSANTE RAGGI
(X RAY SWITCH PCB)
S8
X19
CONNESSIONE PER
CHIAVE USB
(USB KEY CONNECTION)
A27
SCHEDA INTERF. USB
(USB INTERF. BOARD)
cavo USB2
(USB2 cable)
X90
ALLO SWITCH ETHERNET
(TO ETHERNET SWITCH)
Fg.08-C7
DALLA
SCHEDA
CPU COLONNA-A1-X11
(FROM CPU COLUMN
PCB-A1-X11)
Fg.01-C÷D2
X11
X89
+5V
PRX2Loc
PRX1
MOTCOLON (CPU RELE)
A4
SCHEDA TOUCH SCREEN
(TOUCH SCREEN BOARD)
A30
MODULO TFT-LCD
(TFT-LCD MODULE)
X18
Can L
Can H
PRX2Loc
A5
SCHEDA CPU
(CPU BOARD)
X83
Tp31
Tp32
SreadyPan
XrayPan
ClockSPan
ClockSCeph
SreadyCeph
XrayCeph
R120
1K2
D1
SN65HVD230D
RS
CANH
CANL
VREF
D
GND
VCC
R
CANOTX
CANORX
AL (TO)
FG.6-D4
+24VM
F1
2AF
C133
0,1uF
C130
220uF
50V
C131
220uF
50V
C132
220uF
50V
V7
MBRS340T3G
N1
LM2596S-5
Vin
FEEDB
Out
ON
Tab Gnd
L1
24uH
C134
330uF
C135
0,1uF
V8
MBRS340T3G
L10
30ohm
L9
30ohm
R1
470ohm
H2
X20
ALLA SCHEDA CPU
GENERATORE A9-X20
(TO CPU GENERATOR)
PCB A9-X20)
Fg.02-C÷D3
+5V
ipulsRX
Can H
Rx3D
D18
74AHC244
D57
SN74LVC1G07
Vcc
nc
GND
A
Y
onmcol
D16
SN74LVC1G07
sensck
AL (TO)
FG.6-E4
X21
ALLA SCHEDA DSPU A14-J7
(TO DSPU PCB A14-J7)
Fg.08-E4÷5
Fg.09-E4÷5
D17
SN74LVC1G07
sensrx
X42
osensck
osensrx
Sready
iPRxloc
RR15
4k7
D42
LVC573
D44
LVC574
DD2
DD6
X43
ALLA SCHEDA DSPU A14-J6
(TO DSPU PCB A14-J6)
Fg.08-E4÷5
Fg.09-E4÷5
N2
LM2596S-3,3V
OUT
L2
24uH
V13
MBRS340T3G
R78
n.m.
C156
0,1uF
C157
100uF
50V
C138
330uF
10V
L7
30ohm
L8
30ohm
R4
470ohm
C139
0,1uF
H3
+3,3V
N3
LT1086CM
VOut
ADJ
R89
120ohm
C140
0,1uF
C141
10uF
10V
C179
10uF
10V
RV8
5K 12T
XJ15
C142
47uF
35V
C143
0,1uF
R2
470ohm
H13
Vlaser
AL (TO)
FG.4-E1

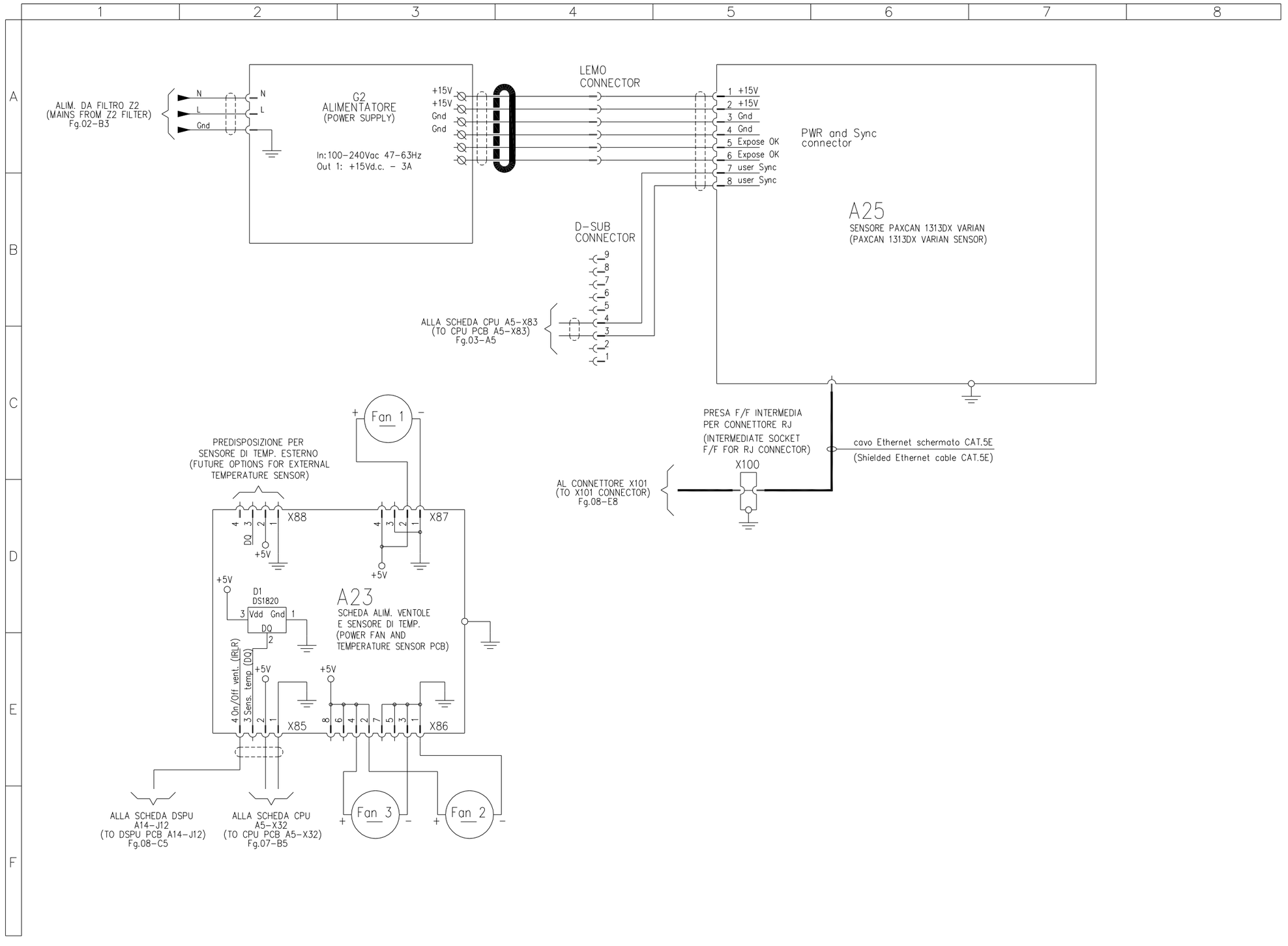

ASSE Y
(AXIS Y)
M2
SENSORE POSIZIONE
ZERO ASSE Y
(AXIS Y ZERO POSITION)
B1
SENSORE ROTAZIONE
(ROTATION SENSOR)
B2
B3
SENSORE ZERO ROTAZIONE
(ZERO ROTATION SENSOR)
ROTAZIONE
(ROTATION)
M3
R1
4K7
X1.2
X1.1
X1.3
RED
YELLOW
BLUE
ORANGE
X59
X60
X61
X62
A7
SCHEDA GRUPPO
ROTAZIONE
(ROTATION GROUP BOARD)
A5
SCHEDA CPU
(CPU BOARD)
X28.4
X28.3
X28.2
X28.1
X27.4
X27.3
X27.1
X27.2
X25.1
X25.3
X25.2
X25.4
X26.4
X26.3
X26.2
X26.1
+24VM
+5V
C68
100nF
C67
47uF
35V
D10
L6210
C73
100nF
C72
47uF
35V
D11
A3977
C71
100nF
C70
10uF
10V
StartY
RR9
4k7
D41
LVC573
DD2
D49B
74HC14
D49A
74HC14
AL (TO)
FG.6-E1
TPsROT
Rotbrac
zRot
DD0
C38
100nF
C37
47uF
35V
D6
L6210
C43
100nF
C42
47uF
35V
D7
A3977
C41
100nF
C40
10uF
10V
DD0-DD6
DA (FROM)
FG.3-E8
AL (TO)
FG.5-E1


FPM
(SOFT TISSUE)
M6
MOT. COLLIM. PRIMARIO
(PRIMARY COLLIMATOR)
M5
SENSORE CASS. POS. CEPH
(SENSOR CASSETTE POSITION CEPH)
SENSORE CASS. POS. PAN
(SENSOR CASSETTE POSITION PAN)
SENSORE POSIZIONE ZERO
PER COLLIMATORE PRIMARIO
(ZERO POSITION SENSOR FOR
PRIMARY COLLIMATOR)
SENSORE POSIZIONE ZERO PER FILTRO PARTI MOLLI
(ZERO POSITION SENSOR FOR SOFT TISSUE)
SOLO CON BRACCIO
CEPH DIGITALE O
MACCHINA PRED.
(DIGITAL CEPH ARM
OR PRESET VERSION
ONLY)
A5
SCHEDA CPU
(CPU BOARD)
DA (FROM)
FG.4-E8
AL (TO)
FG.6-E1
DD0-DD6


MOTORE COLLIMATORE SECONDARIO BRACCIO CEPH
(SECODARY COLLIMATOR MOTOR CEPH ARM)
MOTORE SENSORE DIGITALE CEPH
(CEPH DIGITAL SENSOR MOTOR)
M8
M9
BLUE
ORANGE
RED
YELLOW
SENSORE POSIZIONE ZERO PER SENSORE CEPH (ZERO POSITION SENSOR FOR DIGITAL CEPH)
B11
B10
R1 4K7
R1 3K3
SENSORE POSIZIONE ZERO PER COLLIMATORE SECONDARIO (ZERO POSITION SENSOR FOR SECONDARY COLLIMATOR)
A12
SCHEDA CONNESS. BRACCIO CEPH
(CEPH ARM INTERFACE BOARD)
SOLO CON BRACCIO CEPH DIGITALE
(DIGITAL CEPH ARM ONLY)
A5
SCHEDA CPU
(CPU BOARD)
+24V
+5V
C23 0.1uF
C22 47uF 35V
C28 0.1uF
C27 47uF 35V
C53 0.1uF
C52 47uF 35V
C58 0.1uF
C57 47uF 35V
D4 L6210
D5 A3977
D8 L6210
D9 A3977
C26 0.1uF
C25 10uF 10V
C56 0.1uF
C55 10uF 10V
RR10 4k7
D41 LVC573
iCCEPH
isecCEPH
DD6
DD4
DD0-DD6
DA (FROM) Fg.5-E8
AL (TO) Fg.7-E1


CENTR. MEDIANO SAGITTALE (CENT. MID SAGITTAL)
CENTR. PIANO FRANCOFORTE (CENT. FRANKFURT PLANE)
H1
H2
X40-H1
X41-H2
AL CONNETTORE X93 (TO X93 CONNECTOR) Fg.07-A5
ALLA SCHEDA ALIM. VENTOLE E SENSORE DI TEMPERATURA A23-X85 (TO POWER FAN AND TEMPERATURE SENSOR PCB-A23-X85) Fg.09-E2
A5
SCHEDA CPU
(CPU BOARD)
D35
SN74LVC1G07
R84
120R
V5
IRL024NPBF
+3.3V
+5V
VLaser
ledson
onLEDS
D44
LVC574
DD5
DD0-DD6
DA (FROM) Fg.6-E8
A13
SCHEDA SERIAL NUMBER
(SERIAL NUMBER BOARD)
A6
SCHEDA uP
(uP BOARD)
DA (FROM) FG.3-C4
DA (FROM) FG.4-D4
DA (FROM) FG.3-D4
X82
+24Vin
SENSORE SUPERIORE (UPPER SENSOR)
SENSORE INFERIORE (LOWER SENSOR)
R1 22k
Vcc Out
Gnd
SMA up
SMA down
posUpSMA
posDownSMA
V3
IRLML6346
V4
IRLML6346
X105
X5
on SMA
posUpSMA
selez Up Down
posDownSMA
A26
SCHEDA VOLUMI PARZIALI
(PARTIAL VOLUME BOARD)


A20
SENSORE PANCEPH
(PANCEPH SENSOR)
A19
SCHEDA INTERFACCIA 2
(INTERFACE 2 BOARD)
A18
SCHEDA INTERFACCIA 1
(INTERFACE 1 BOARD)
X50
X73
X74
S11
SOLO CON BRACCIO CEPH DIGITALE
(DIGITAL CEPH ARM ONLY)
A14
SCHEDA DSPU
(DSPU BOARD)
X52
X51
J3
J4
J12
ALLA SCHEDA ALIM. VENTOLE
E SENSORE DI TEMPERATURA A23-X85
(TO POWER FUN AND TEMPERATURE
SENSOR PCB A23-X85)
Fg.09-E2
AL CONNETTORE X93
(TO X93 CONNECTOR)
Fg.07-A5
X93.2
X93.1
A14
GIGABIT ETHERNET SWITCH
2 SPIRE
(TURNS)
AL TOUCH SCREEN A4-X89
(TO TOUCH SCREEN A4-X89)
Fg.03-B2
P1
cavo Ethernet schermato CAT.5E
(Shielded Ethernet cable CAT.5E)
iPRxloc
osensck
osensrx
Sready
Can H
Can L
+24V
J7
J8
ALLA SCHEDA CPU A5-X21,X42
(TO CPU BOARD A5-X21,X42)
Fg.03-D÷E2
ALLA SCHEDA
CPU A5-X43
(TO CPU BOARD
A5-X43)
Fg.03-E2
PC
PRESA F/F PER
CONNETTORE RJ
(SOCKET F/F FOR
RJ CONNECTOR)
X15
X101
AL CONN. X100
(TO X100 CONN)
Fg.09-D5
cavo Ethernet schermato CAT.5E
(Shielded Ethernet cable CAT.5E)


1
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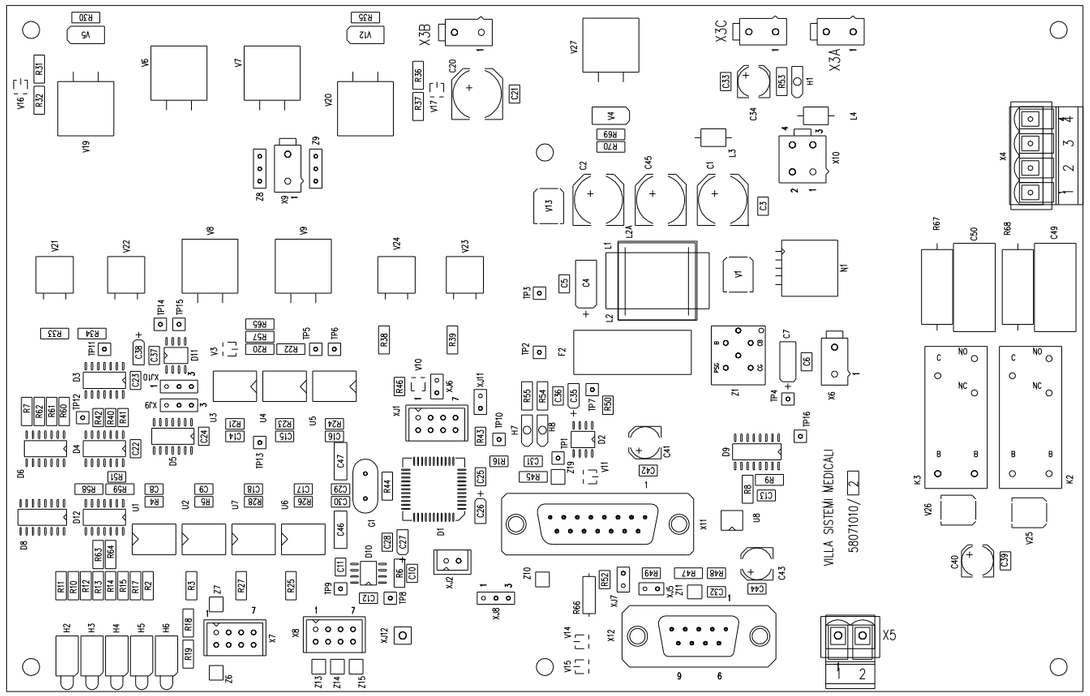
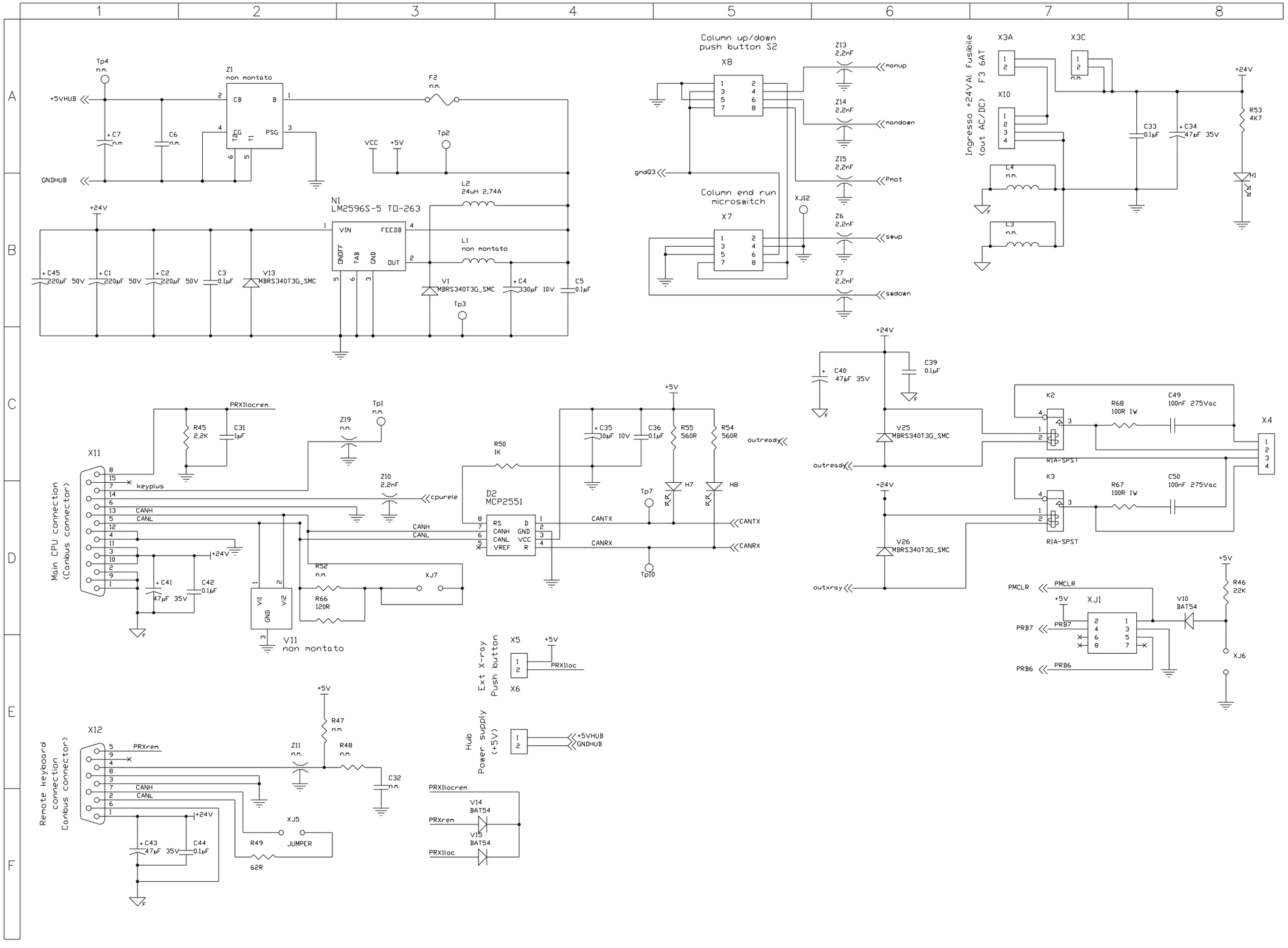
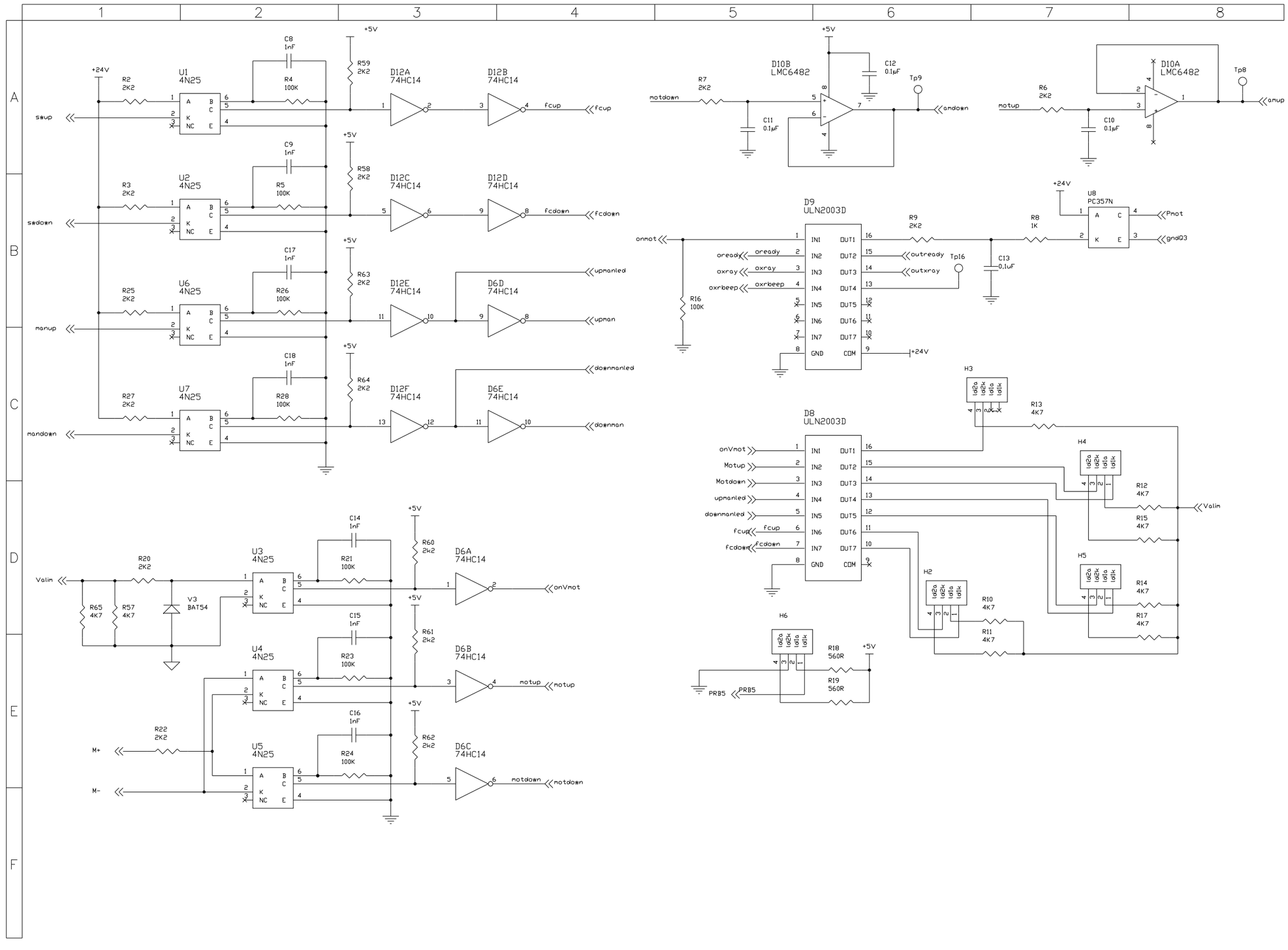
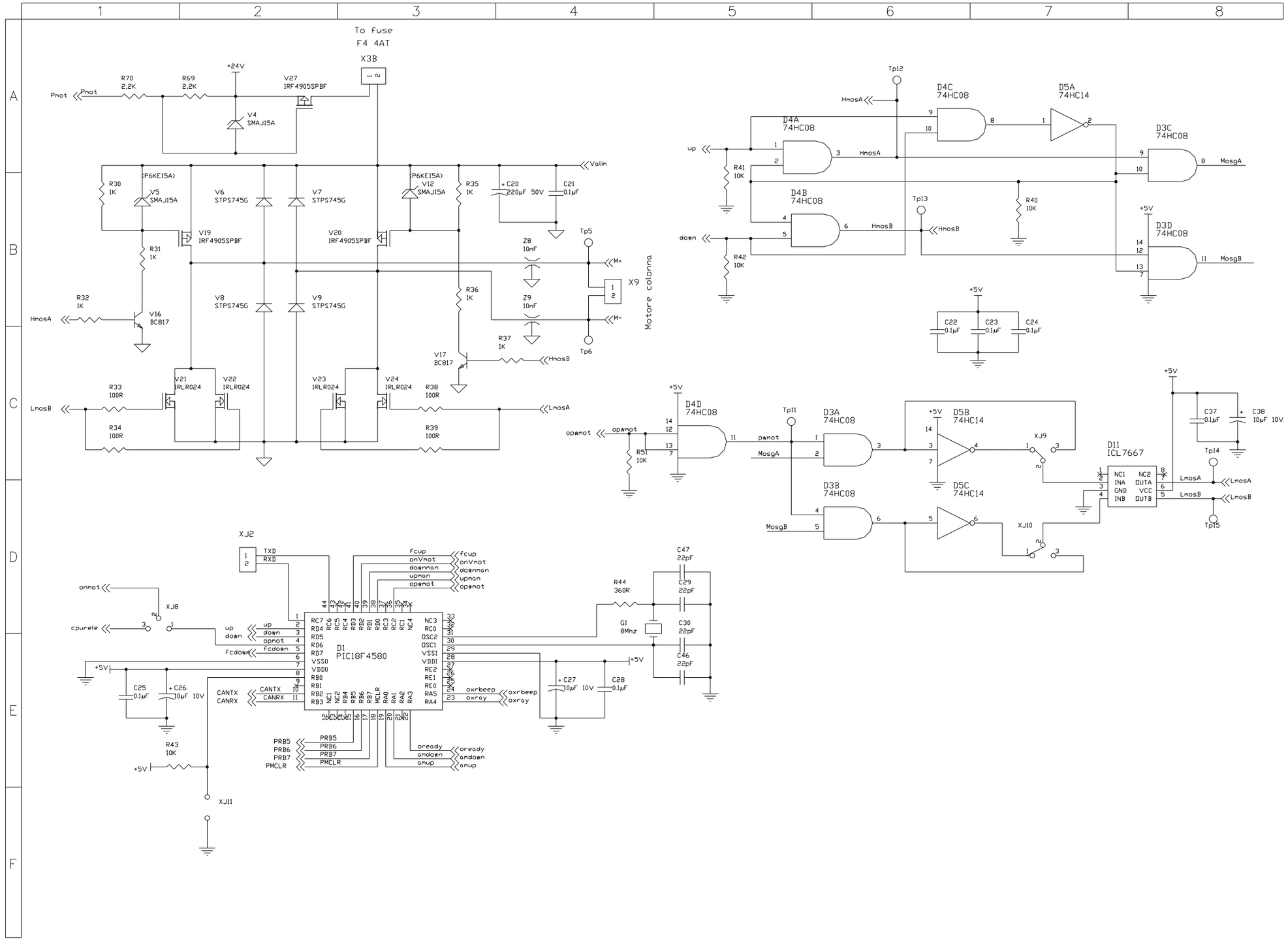
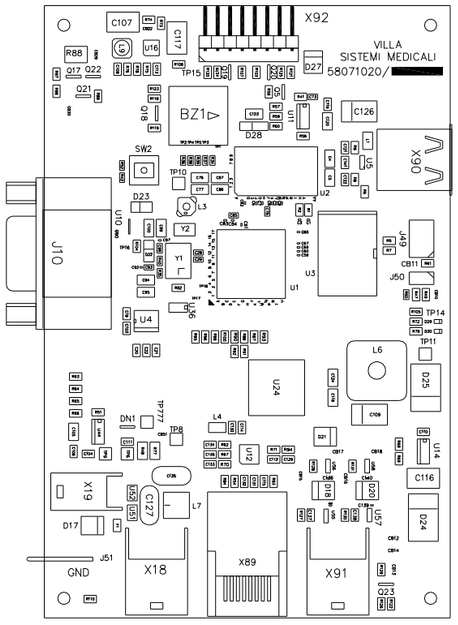
7
8
A
B
C
D
E
F
ALIM. DA FILTRO Z2
(MAINS FROM Z2 FILTER)
Fg.02-B3
N
L
Gnd
G2
ALIMENTATORE
(POWER SUPPLY)
In:100-240Vac 47-63Hz
Out 1: +15Vd.c. - 3A
+15V
+15V
Gnd
Gnd
LEMO
CONNECTOR
1 +15V
2 +15V
3 Gnd
4 Gnd
5 Expose OK
6 Expose OK
7 user Sync
8 user Sync
PWR and Sync
connector
A25
SENSORE PAXCAN 1313DX VARIAN
(PAXCAN 1313DX VARIAN SENSOR)
D-SUB
CONNECTOR
9
8
7
6
5
4
3
2
1
ALLA SCHEDA CPU A5-X83
(TO CPU PCB A5-X83)
Fg.03-A5
PRESA F/F INTERMEDIA
PER CONNETTORE RJ
(INTERMEDIATE SOCKET
F/F FOR RJ CONNECTOR)
X100
cavo Ethernet schermato CAT.5E
(Shielded Ethernet cable CAT.5E)
AL CONNETTORE X101
(TO X101 CONNECTOR)
Fg.08-E8
Fan 1
PREDISPOSIZIONE PER
SENSORE DI TEMP. ESTERNO
(FUTURE OPTIONS FOR EXTERNAL
TEMPERATURE SENSOR)
X88
X87
DQ
+5V
+5V
+5V
D1
DS1820
Vdd Gnd
DQ
A23
SCHEDA ALIM. VENTOLE
E SENSORE DI TEMP.
(POWER FAN AND
TEMPERATURE SENSOR PCB)
4 On/Off vent. (IRLR)
3 Sens. temp (DQ)
X85
X86
ALLA SCHEDA DSPU
A14-J12
(TO DSPU PCB A14-J12)
Fg.08-C5
ALLA SCHEDA CPU
A5-X32
(TO CPU PCB A5-X32)
Fg.07-B5
Fan 3
Fan 2


VILLA SISTEMI MEDICALI
58071010/

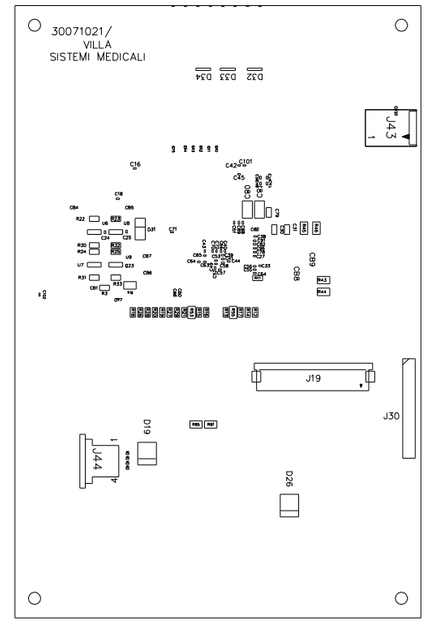

Tp4
n.m.
+5VHUB
GNDHUB
Z1
non montato
CB
B
PSG
F2
n.m.
+ C7
n.m.
C6
n.m.
VCC
+5V
Tp2
N1
LM2596S-5 TO-263
VIN
FEEDB
ON/OFF
TAB
GND
OUT
L2
24uH 2,74A
L1
non montato
+24V
+ C45
220µF 50V
+ C1
220µF 50V
+ C2
220µF 50V
C3
0.1µF
V13
MBRS340T3G_SMC
V1
MBRS340T3G_SMC
+ C4
330µF 10V
C5
0.1µF
Tp3
Column up/down
push button S2
X8
Z13
2,2nF
manup
Z14
2,2nF
mandown
Z15
2,2nF
Pmot
gnd03
Column end run
microswitch
X7
XJ12
Z6
2,2nF
swup
Z7
2,2nF
swdown
Ingresso +24VAI fusibile
(out AC/DC) F3 6AT
X3A
X3C
X10
L4
n.m.
L3
n.m.
C33
0.1µF
+ C34
47µF 35V
+24V
R53
4K7
H1
PRX1locrem
R45
2,2K
C31
1µF
Tp1
n.m.
Z19
n.m.
X11
Main CPU connection
(Canbus connector)
keyplus
Z10
2,2nF
cpurele
CANH
CANL
+24V
+ C41
47µF 35V
C42
0.1µF
V11
non montato
R52
n.m.
R66
120R
XJ7
D2
MCP2551
RS
CANH
CANL
VREF
D
GND
VCC
R
CANTX
CANRX
R50
1K
+ C35
10µF 10V
C36
0.1µF
R55
560R
R54
560R
H7
H8
Tp7
Tp10
outread
+5V
+24V
+ C40
47µF 35V
C39
0.1µF
V25
MBRS340T3G_SMC
V26
MBRS340T3G_SMC
outxray
K2
K3
R68
100R 1W
R67
100R 1W
C49
100nF 275Vac
C50
100nF 275Vac
RIA-SPST
X4
Ext X-ray
Push button
X5
X6
PRX1loc
Hub
Power supply
(+5V)
+5VHUB
GNDHUB
X12
Remote keyboard
connection
Canbus connector)
PRXrem
Z11
n.m.
R47
n.m.
R48
n.m.
C32
n.m.
+ C43
47µF 35V
C44
0.1µF
XJ5
JUMPER
R49
62R
V14
BAT54
V15
BAT54
PRX1locrem
PRXrem
PRX1loc
PMCLR
XJ1
PRB7
PRB6
V10
BAT54
R46
22K
XJ6


1
2
3
4
5
6
7
8
A
B
C
D
E
F
+24V
+5V
U1
4N25
U2
4N25
U6
4N25
U7
4N25
U3
4N25
U4
4N25
U5
4N25
R2 2K2
R3 2K2
R25 2K2
R27 2K2
R20 2K2
R22 2K2
R4 100K
R5 100K
R26 100K
R28 100K
R21 100K
R23 100K
R24 100K
C8 1nF
C9 1nF
C17 1nF
C18 1nF
C14 1nF
C15 1nF
C16 1nF
R59 2K2
R58 2K2
R63 2K2
R64 2K2
R60 2K2
R61 2K2
R62 2K2
D12A 74HC14
D12B 74HC14
D12C 74HC14
D12D 74HC14
D12E 74HC14
D12F 74HC14
D6A 74HC14
D6B 74HC14
D6C 74HC14
D6D 74HC14
D6E 74HC14
swup
swdown
manup
mandown
fcup
fcdown
upmanled
upman
downmanled
downman
onVmot
motup
motdown
M+
M-
Valin
R65 4K7
R57 4K7
V3 BAT54
D10B LMC6482
D10A LMC6482
R7 2K2
R6 2K2
C11 0.1µF
C10 0.1µF
C12 0.1µF
Tp9
Tp8
amdown
amup
D9 ULN2003D
D8 ULN2003D
onmot
oready
oxray
oxrbeep
R16 100K
R9 2K2
R8 1K
C13 0,1uF
Tp16
outready
outxray
U8 PC357N
Pmot
gndQ3
onVmot
Motup
Motdown
upmanled
downmanled
fcup
fcdown
H3
H4
H5
H2
H6
R13 4K7
R12 4K7
R15 4K7
R14 4K7
R17 4K7
R10 4K7
R11 4K7
R18 560R
R19 560R
PRB5

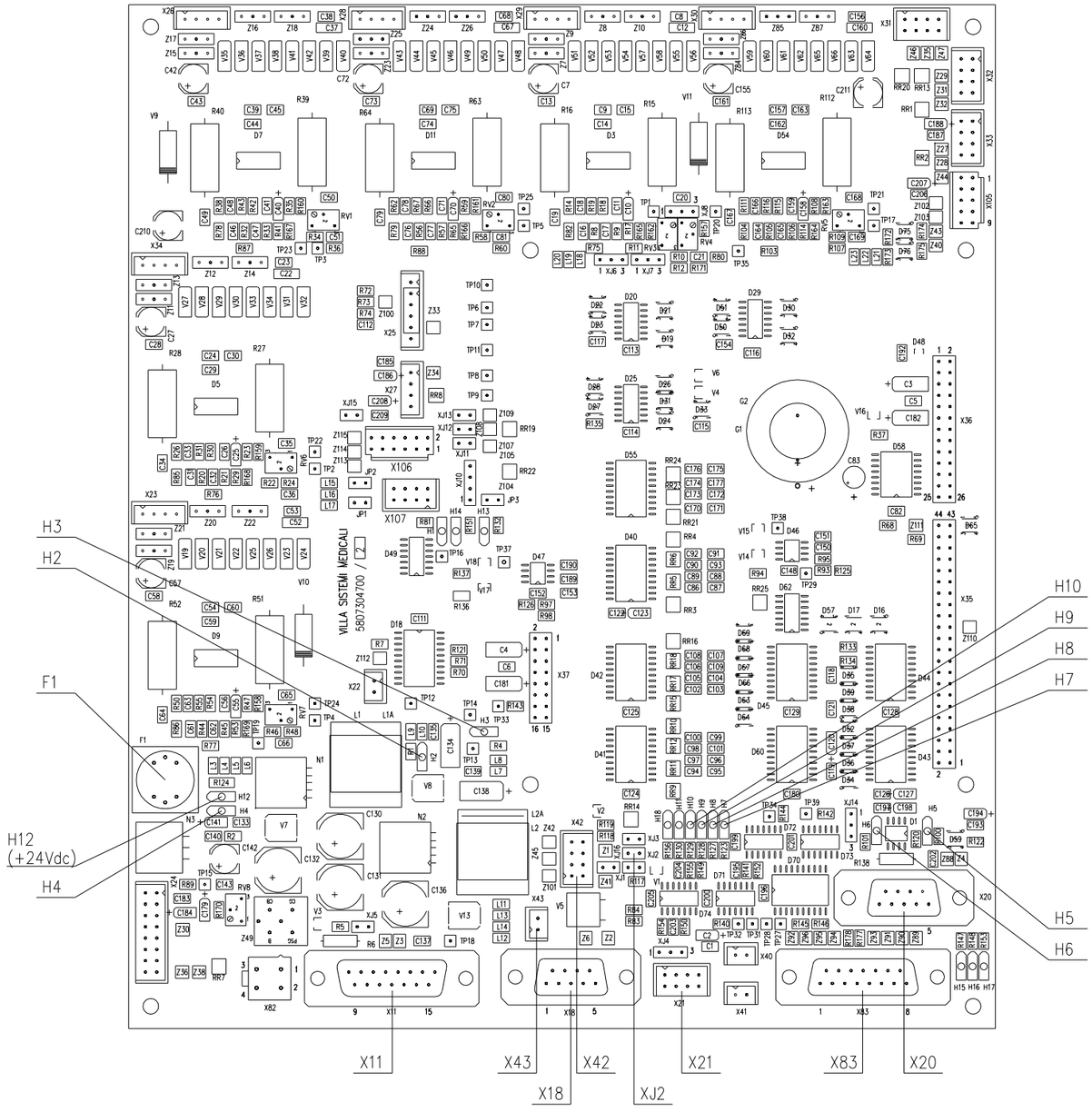

To fuse
F4 4AT
X3B
+24V
R70 2,2K
R69 2,2K
V27 IRF4905SPBF
V4 SMAJ15A
Pmot
R30 1K
(P6KE15A)
V5 SMAJ15A
V6 STPS745G
V7 STPS745G
(P6KE15A)
V12 SMAJ15A
R35 1K
+ C20 220µF 50V
C21 0.1µF
Valin
V19 IRF4905SPBF
V20 IRF4905SPBF
R31 1K
Z8 10nF
Z9 10nF
Tp5
Tp6
M+
M-
X9
Motore colonna
R32 1K
V16 BC817
HmosA
V8 STPS745G
V9 STPS745G
R36 1K
R37 1K
V17 BC817
HmosB
V21 IRLR024
V22 IRLR024
V23 IRLR024
V24 IRLR024
R33 100R
R34 100R
R38 100R
R39 100R
LmosB
LmosA
Tp12
HmosA
D4C 74HC08
D5A 74HC14
D4A 74HC08
D3C 74HC08
up
R41 10K
MosgA
D4B 74HC08
Tp13
R40 10K
+5V
D3D 74HC08
down
R42 10K
HmosB
MosgB
C22 0.1µF
C23 0.1µF
C24 0.1µF
D4D 74HC08
opmot
R51 10K
pwmot
Tp11
D3A 74HC08
D3B 74HC08
D5B 74HC14
D5C 74HC14
XJ9
XJ10
DI1 ICL7667
C37 0.1µF
C38 10µF 10V
Tp14
Tp15
XJ2
TXD
RXD
fcup
onVmot
downman
upman
opmot
onmot
XJ8
cpurele
up
down
fcdown
D1 PIC18F4580
C47 22pF
C29 22pF
C30 22pF
C46 22pF
R44 360R
G1 8Mhz
C25 0.1µF
+ C26 10µF 10V
C27 10µF 10V
C28 0.1µF
CANTX
CANRX
oxrbeep
oxray
PRB5
PRB6
PRB7
PMCLR
oready
andown
anup
R43 10K
XJ11



COMPONENT SIDE



SOLDER SIDE


1
2
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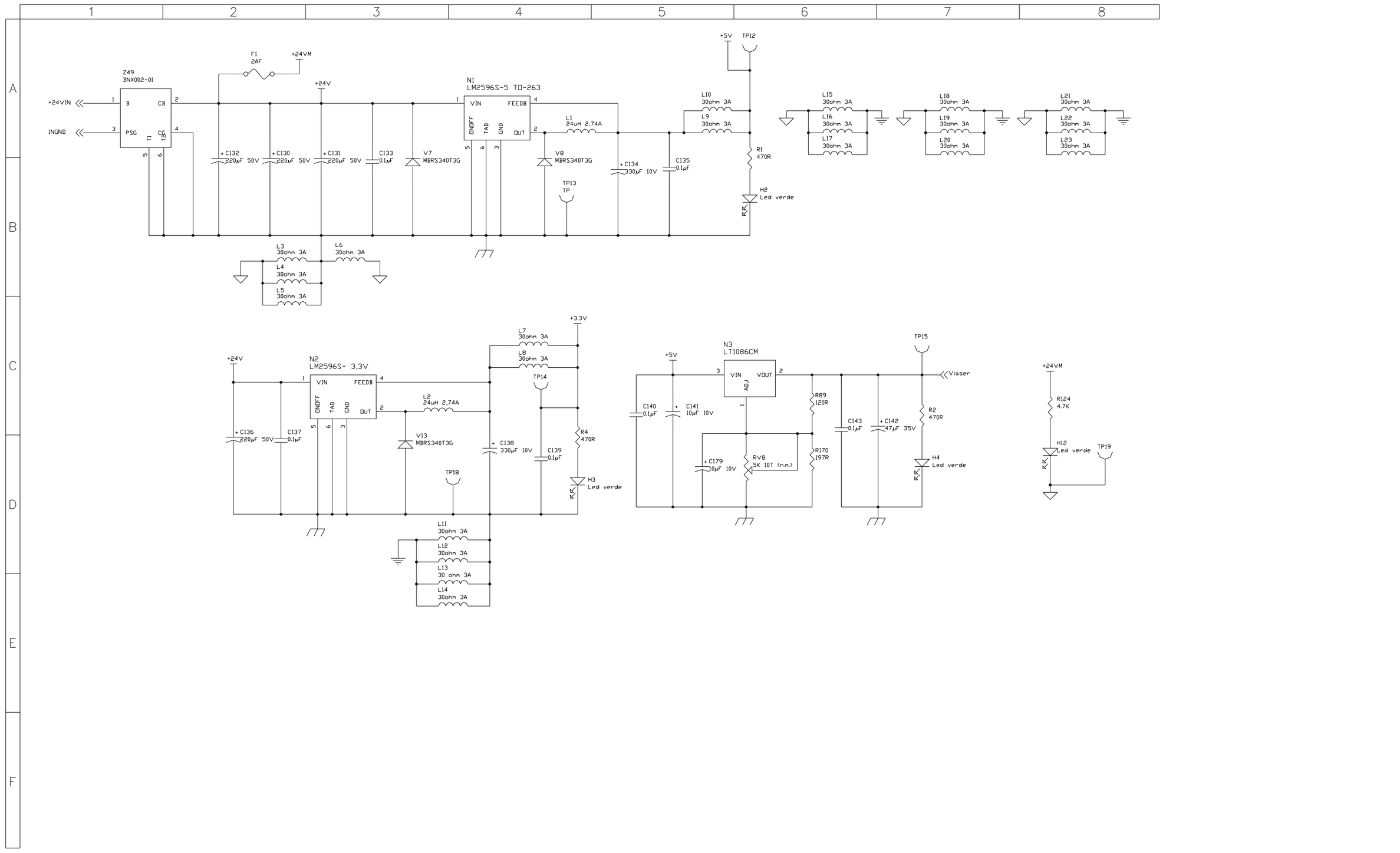
7
8
A
B
C
D
E
F
H3
H2
F1
H12
(+24Vdc)
H4
H10
H9
H8
H7
H5
H6
X11
X43
X42
X21
X83
X20
X18
XJ2
VILLA SISTEMI MEDICALI
5807304700 / L2


1
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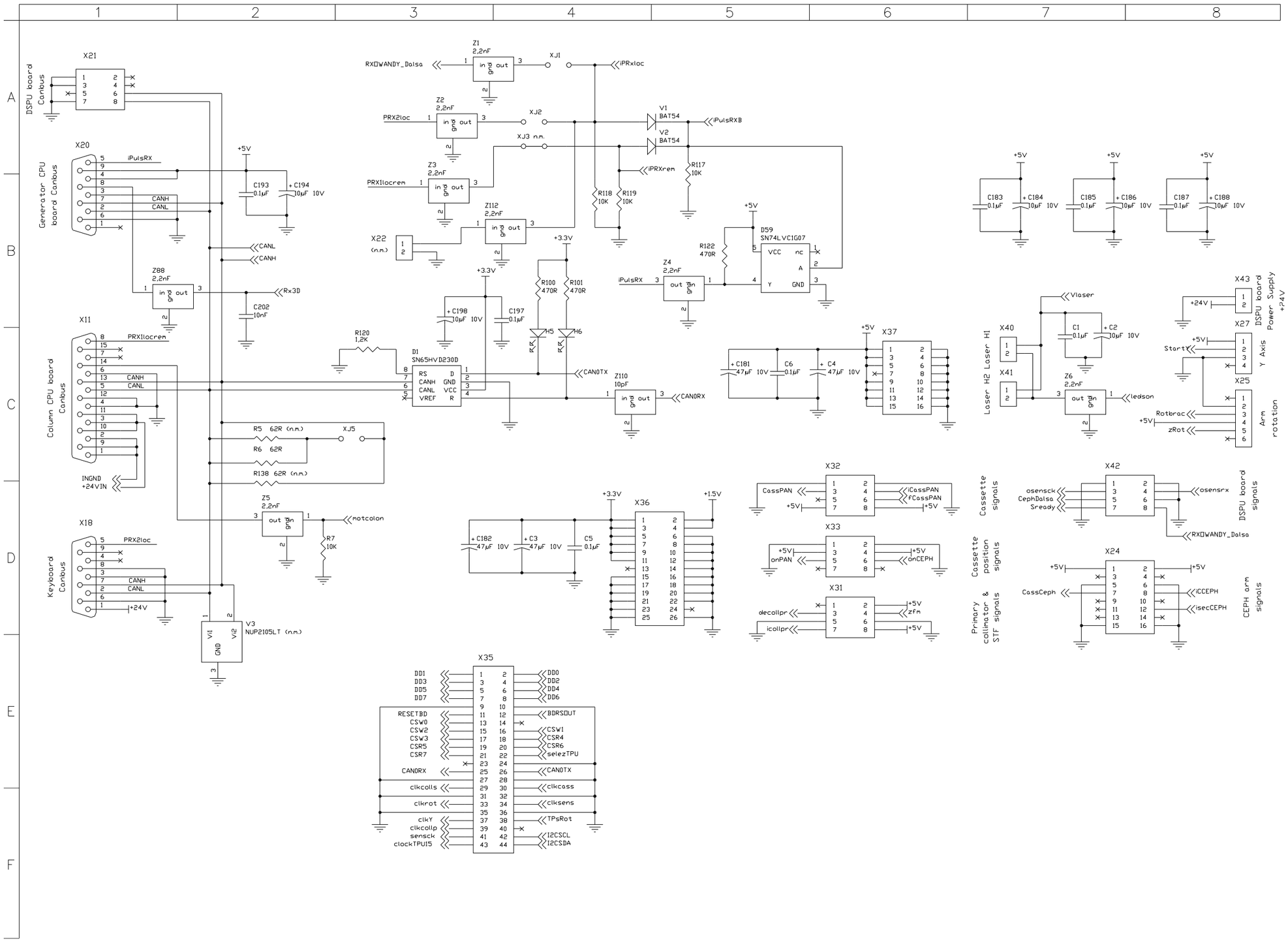
7
8
A
B
C
D
E
F
Z49
BNX002-01
+24VIN
INGND
B
CB
PSG
CG
T1
T2
F1
2AF
+24VM
+24V
+ C132 220µF 50V
+ C130 220µF 50V
+ C131 220µF 50V
C133 0.1µF
V7 MBRS340T3G
N1
LM2596S-5 TO-263
VIN
FEEDB
ON/OFF
TAB
GND
OUT
L1 24uH 2,74A
V8 MBRS340T3G
+ C134 330µF 10V
C135 0.1µF
+5V
TP12
L10 30ohm 3A
L9 30ohm 3A
R1 470R
H2 Led verde
TP13 TP
L15 30ohm 3A
L16 30ohm 3A
L17 30ohm 3A
L18 30ohm 3A
L19 30ohm 3A
L20 30ohm 3A
L21 30ohm 3A
L22 30ohm 3A
L23 30ohm 3A
L3 30ohm 3A
L4 30ohm 3A
L5 30ohm 3A
L6 30ohm 3A
N2
LM2596S- 3,3V
+ C136 220µF 50V
C137 0.1µF
V13 MBRS340T3G
L2 24uH 2,74A
+ C138 330µF 10V
C139 0.1µF
R4 470R
H3 Led verde
TP18
TP14
+3.3V
L7 30ohm 3A
L8 30ohm 3A
L11 30ohm 3A
L12 30ohm 3A
L13 30 ohm 3A
L14 30ohm 3A
N3
LT1086CM
VIN
VOUT
ADJ
C140 0.1µF
+ C141 10µF 10V
+ C179 10µF 10V
RV8 5K 10T (n.m.)
R89 120R
R170 197R
C143 0.1µF
+ C142 47µF 35V
R2 470R
H4 Led verde
TP15
Vlaser
R124 4.7K
H12 Led verde
TP19


1
2
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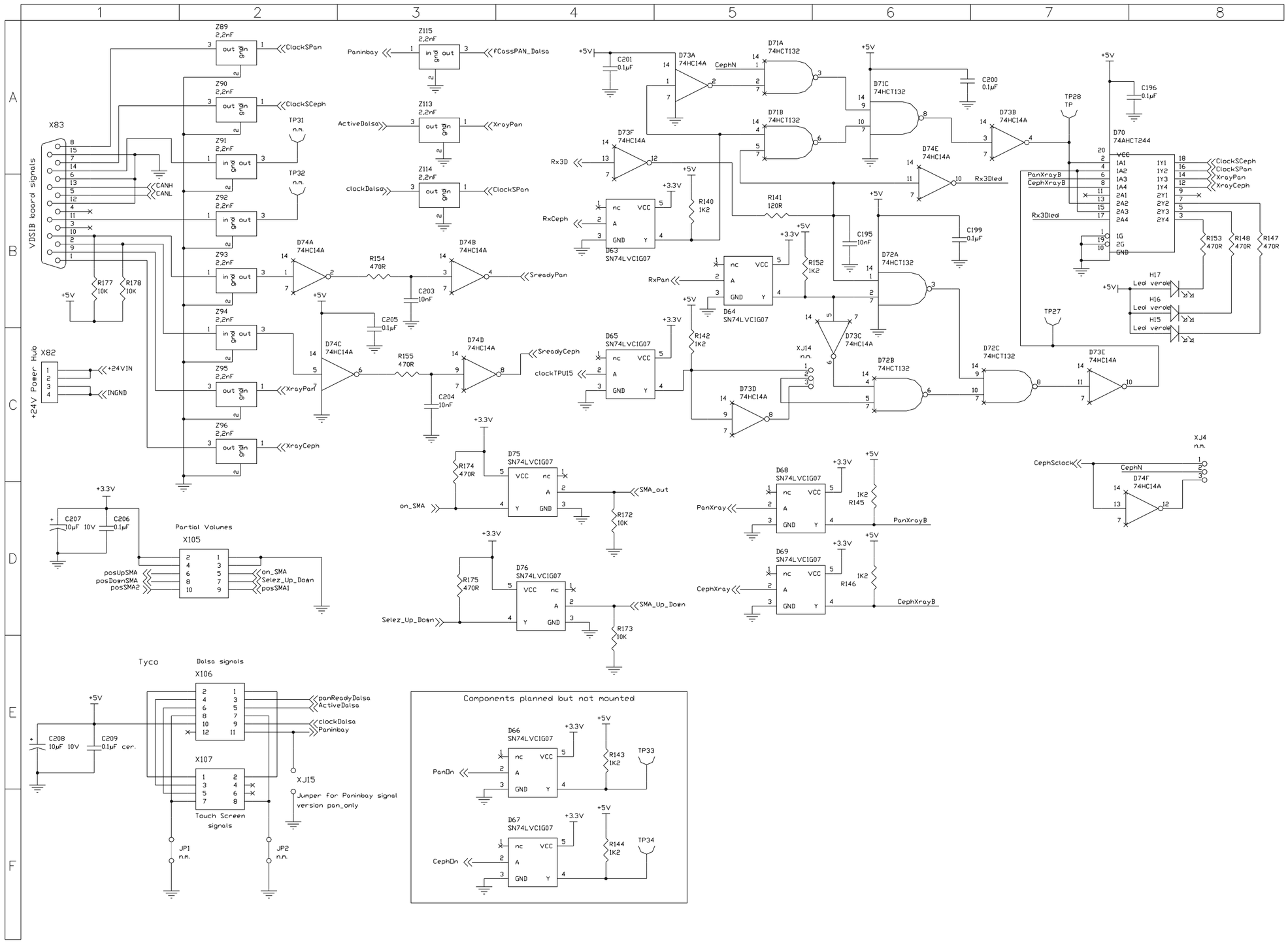
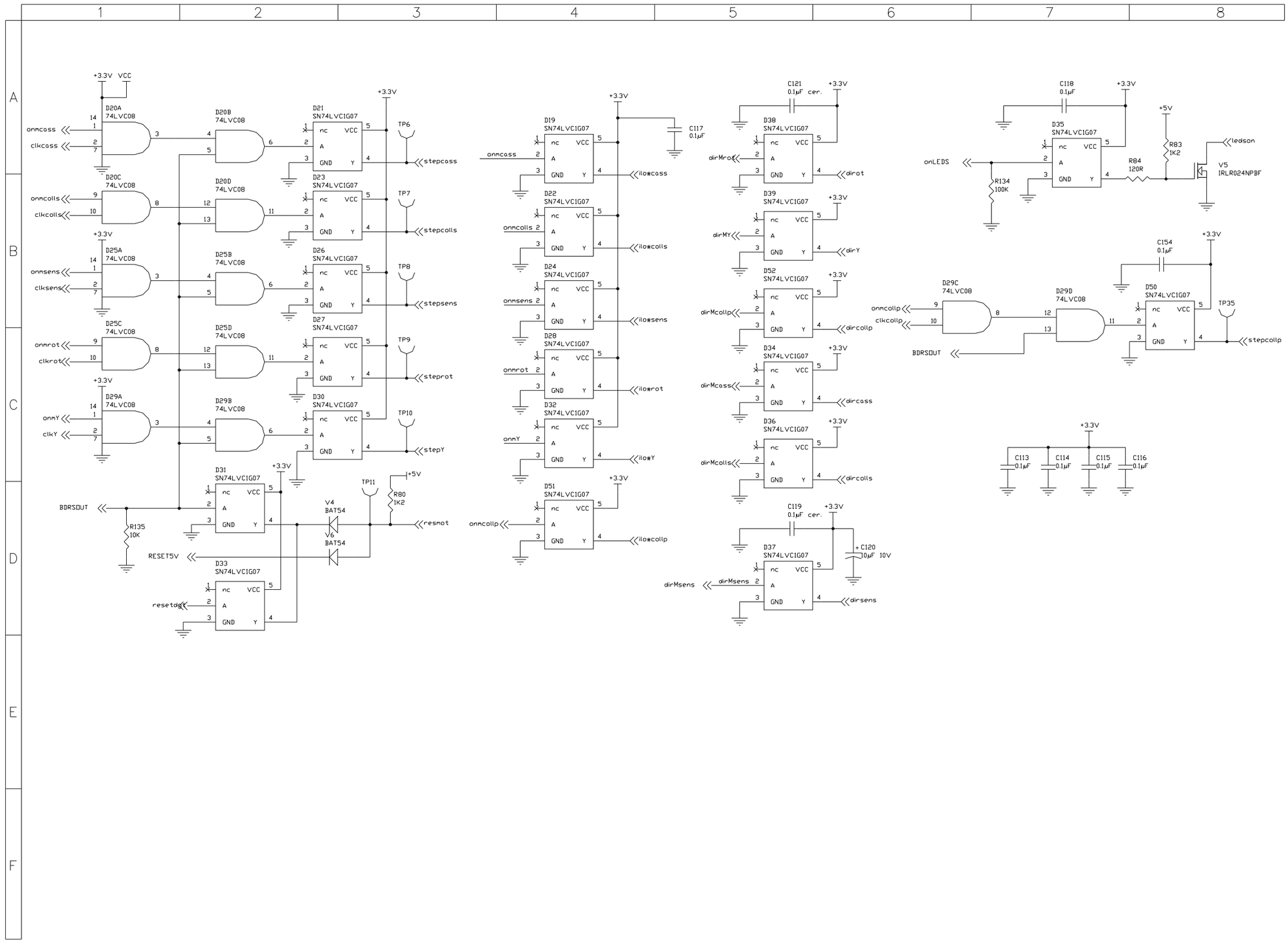
A
B
C
D
E
F
X21
DSPU board Canbus
X20
Generator CPU board Canbus
iPulsRX
CANH
CANL
X11
Column CPU board Canbus
PRXIlocrem
INGND
+24VIN
X18
Keyboard Canbus
PRX2loc
+24V
+5V
C193 0.1µF
+ C194 10µF 10V
CANL
CANH
Z88 2,2nF
Rx3D
C202 10nF
Z1 2,2nF
RXDWANDY_Dalsa
XJ1
iPRXloc
Z2 2,2nF
PRX2loc
XJ2
V1 BAT54
V2 BAT54
iPulsRXB
XJ3 n.m.
iPRXrem
R117 10K
Z3 2,2nF
PRXIlocrem
R118 10K
R119 10K
Z112 2,2nF
X22 (n.m.)
+3.3V
R100 470R
R101 470R
+ C198 10µF 10V
C197 0.1µF
H5
H6
R120 1,2K
D1 SN65HVD230D
RS D
CANH GND
CANL VCC
VREF R
CANOTX
Z110 10pF
CANORX
R5 62R (n.m.)
R6 62R
XJ5
R138 62R (n.m.)
Z5 2,2nF
motcolon
R7 10K
V3 NUP2105LT (n.m.)
VI1
VI2
GND
Z4 2,2nF
iPulsRX
R122 470R
D59 SN74LVC1G07
VCC nc
A
Y GND
+ C181 47µF 10V
C6 0.1µF
+ C4 47µF 10V
X37
C183 0.1µF
+ C184 10µF 10V
C185 0.1µF
+ C186 10µF 10V
C187 0.1µF
+ C188 10µF 10V
X43
DSPU board Power Supply +24V
+24V
X27
Start
Y Axis
X25
Arm rotation
Ratbrac
zRot
Vlaser
X40
Laser H2 Laser H1
X41
C1 0.1µF
+ C2 10µF 10V
Z6 2,2nF
ledson
X32
CassPAN
iCassPAN
fCassPAN
X33
onPAN
onCEPH
X31
decollpr
icollpr
zfm
Cassette position signals
Primary collimator & STF signals
X42
osensck
CephDalsa
Sready
osensrx
RXDWANDY_Dalsa
DSPU board signals
X24
CassCeph
iCCEPH
isecCEPH
CEPH arm signals
X36
+3.3V
+1.5V
+ C182 47µF 10V
+ C3 47µF 10V
C5 0.1µF
X35
DD1
DD3
DD5
DD7
DD0
DD2
DD4
DD6
RESETBD
CSW0
CSW2
CSW3
CSR5
CSR7
BDRSDOUT
CSW1
CSR4
CSR6
selezTPU
CANORX
CANOTX
clkcolls
clkcass
clkrot
clksens
clkY
clkcollp
sensck
clockTPU15
TPsRot
I2CSCL
I2CSDA


VDSIB board signals
X83
CANH
CANL
TP31
n.m.
TP32
n.m.
+24V Power Hub
X82
+24VIN
INGND
Z89
Z90
Z91
Z92
Z93
Z94
Z95
Z96
2,2nF
ClockSPan
ClockSCeph
XrayPan
XrayCeph
R177 10K
R178 10K
+5V
+3.3V
C207 10µF 10V
C206 0.1µF
Partial Volumes
X105
posUpSMA
posDownSMA
posSMA2
on_SMA
Selez_Up_Down
posSMA1
Paninbay
fCassPAN_Dalsa
ActiveDalsa
clockDalsa
Z115
Z113
Z114
D74A 74HC14A
D74B 74HC14A
D74C 74HC14A
D74D 74HC14A
R154 470R
R155 470R
C203 10nF
C204 10nF
C205 0.1µF
SreadyPan
SreadyCeph
D75 SN74LVC1G07
R174 470R
R175 470R
R172 10K
R173 10K
SMA_out
SMA_Up_Down
Tyco
Dalsa signals
X106
X107
C208 10µF 10V
C209 0.1µF cer.
panReadyDalsa
ActiveDalsa
clockDalsa
Paninbay
XJ15
Jumper for Paninbay signal version pan_only
Touch Screen signals
JP1 n.m.
JP2 n.m.
Components planned but not mounted
D66 SN74LVC1G07
D67 SN74LVC1G07
R143 1K2
R144 1K2
TP33
TP34
PanOn
CephOn
Rx3D
RxCeph
RxPan
clockTPU15
D73A 74HC14A
D73F 74HC14A
D63 SN74LVC1G07
D64 SN74LVC1G07
D65 SN74LVC1G07
R140 1K2
R142 1K2
R152 1K2
R141 120R
C201 0.1µF
C195 10nF
C200 0.1µF
C199 0.1µF
D71A 74HCT132
D71B 74HCT132
D71C 74HCT132
D72A 74HCT132
D72B 74HCT132
D72C 74HCT132
D73B 74HC14A
D73C 74HC14A
D73D 74HC14A
D73E 74HC14A
D74E 74HC14A
CephN
Rx3Dled
XJ14 n.m.
D68 SN74LVC1G07
D69 SN74LVC1G07
R145 1K2
R146 1K2
PanXray
CephXray
PanXrayB
CephXrayB
TP28 TP
TP27
C196 0.1µF
D70 74AHCT244
ClockSCeph
ClockSPan
XrayPan
XrayCeph
R153 470R
R148 470R
R147 470R
H17 Led verde
H16 Led verde
H15 Led verde
XJ4 n.m.
CephSclock
D74F 74HC14A


1
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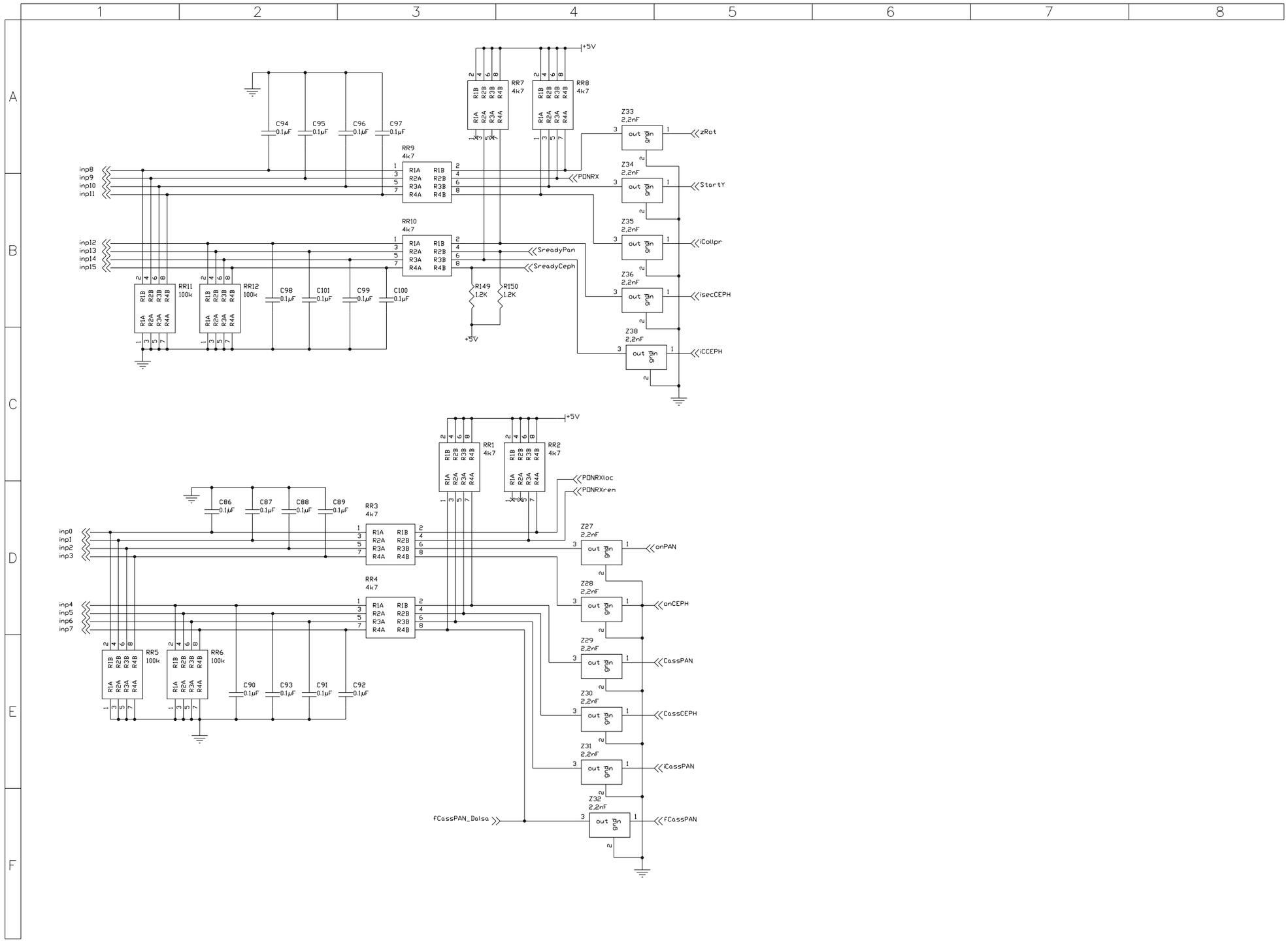
8
A
B
C
D
E
F
+3.3V
VCC
D20A
74LVC08
onmcass
clkcass
D20B
74LVC08
D20C
74LVC08
onmcolls
clkcolls
D20D
74LVC08
D25A
74LVC08
onmsens
clksens
D25B
74LVC08
D25C
74LVC08
onmrot
clkrot
D25D
74LVC08
D29A
74LVC08
onmY
clkY
D29B
74LVC08
D21
SN74LVC1G07
nc
A
GND
Y
TP6
stepcass
D23
SN74LVC1G07
TP7
stepcolls
D26
SN74LVC1G07
TP8
stepsens
D27
SN74LVC1G07
TP9
steprot
D30
SN74LVC1G07
TP10
stepY
D31
SN74LVC1G07
BDRSOUT
R135
10K
TP11
+5V
R80
1K2
resmot
V4
BAT54
V6
BAT54
RESET5V
D33
SN74LVC1G07
resetdgt
D19
SN74LVC1G07
onmcass
C117
0.1µF
ilowcass
D22
SN74LVC1G07
onmcolls
ilowcolls
D24
SN74LVC1G07
onmsens
ilowsens
D28
SN74LVC1G07
onmrot
ilowrot
D32
SN74LVC1G07
onmY
ilowY
D51
SN74LVC1G07
onmcollp
ilowcollp
C121
0.1µF cer.
D38
SN74LVC1G07
dirMrot
dirot
D39
SN74LVC1G07
dirMY
dirY
D52
SN74LVC1G07
dirMcollp
dircollp
D34
SN74LVC1G07
dirMcass
dircass
D36
SN74LVC1G07
dirMcolls
dircolls
C119
0.1µF cer.
D37
SN74LVC1G07
dirMsens
dirsens
C120
10µF 10V
C118
0.1µF
D35
SN74LVC1G07
onLEDS
R134
100K
R84
120R
R83
1K2
ledson
V5
IRLR024NPBF
C154
0.1µF
D29C
74LVC08
D29D
74LVC08
onmcollp
clkcollp
BDRSOUT
D50
SN74LVC1G07
TP35
stepcollp
C113
0.1µF
C114
0.1µF
C115
0.1µF
C116
0.1µF


1
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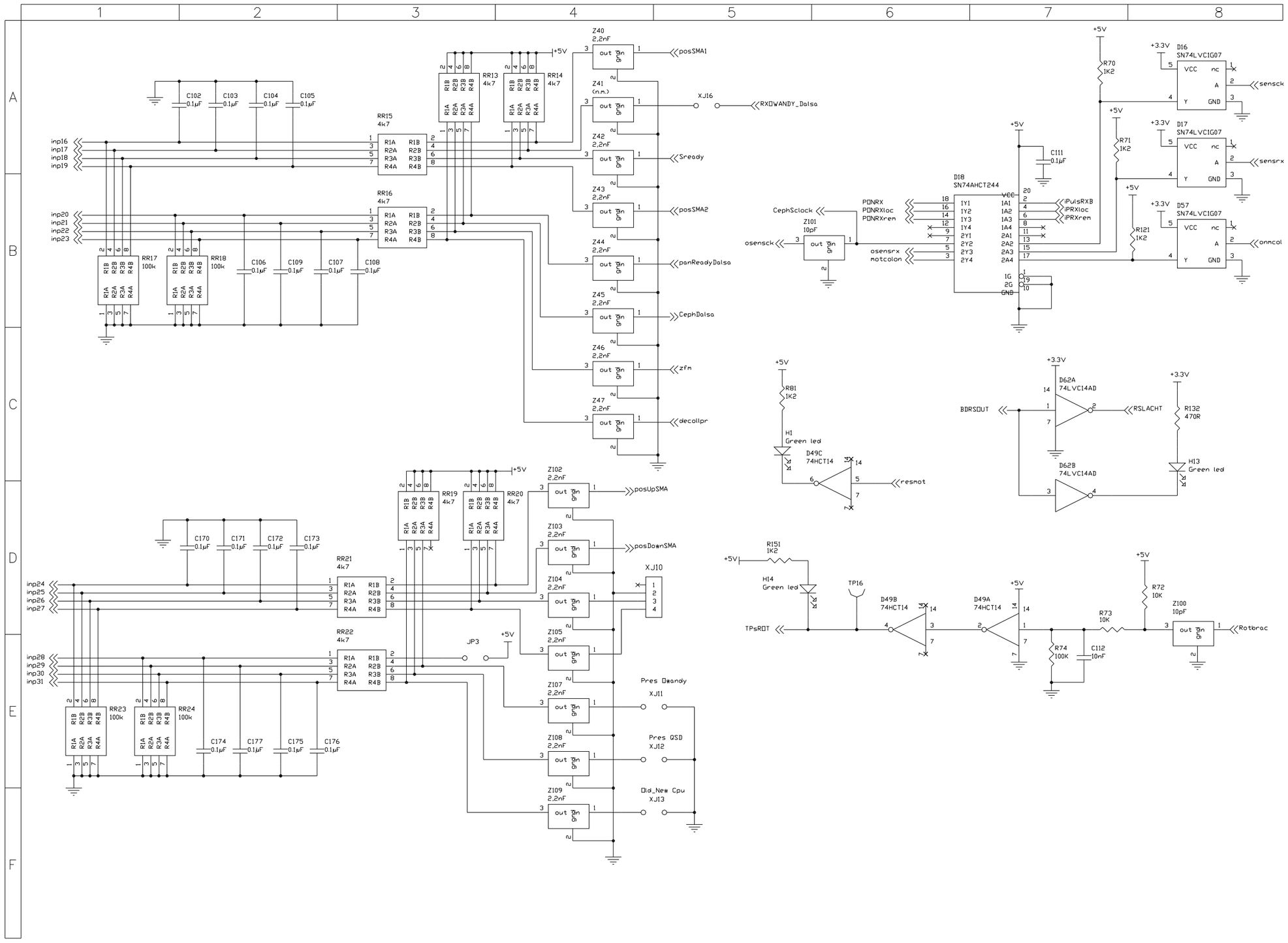
A
B
C
D
E
F
+5V
C94 0.1µF
C95 0.1µF
C96 0.1µF
C97 0.1µF
RR7 4k7
RR8 4k7
RR9 4k7
RR10 4k7
Z33 2,2nF
Z34 2,2nF
Z35 2,2nF
Z36 2,2nF
Z38 2,2nF
inp8
inp9
inp10
inp11
inp12
inp13
inp14
inp15
PONRX
SreadyPan
SreadyCeph
zRot
StartY
iCollpr
isecCEPH
iCCEPH
RR11 100k
RR12 100k
C98 0.1µF
C101 0.1µF
C99 0.1µF
C100 0.1µF
R149 1.2K
R150 1.2K
RR1 4k7
RR2 4k7
PONRXloc
PONRXrem
C86 0.1µF
C87 0.1µF
C88 0.1µF
C89 0.1µF
RR3 4k7
RR4 4k7
Z27 2,2nF
Z28 2,2nF
Z29 2,2nF
Z30 2,2nF
Z31 2,2nF
Z32 2,2nF
inp0
inp1
inp2
inp3
inp4
inp5
inp6
inp7
onPAN
onCEPH
CassPAN
CassCEPH
iCassPAN
fCassPAN
fCassPAN_Dalsa
RR5 100k
RR6 100k
C90 0.1µF
C93 0.1µF
C91 0.1µF
C92 0.1µF


1
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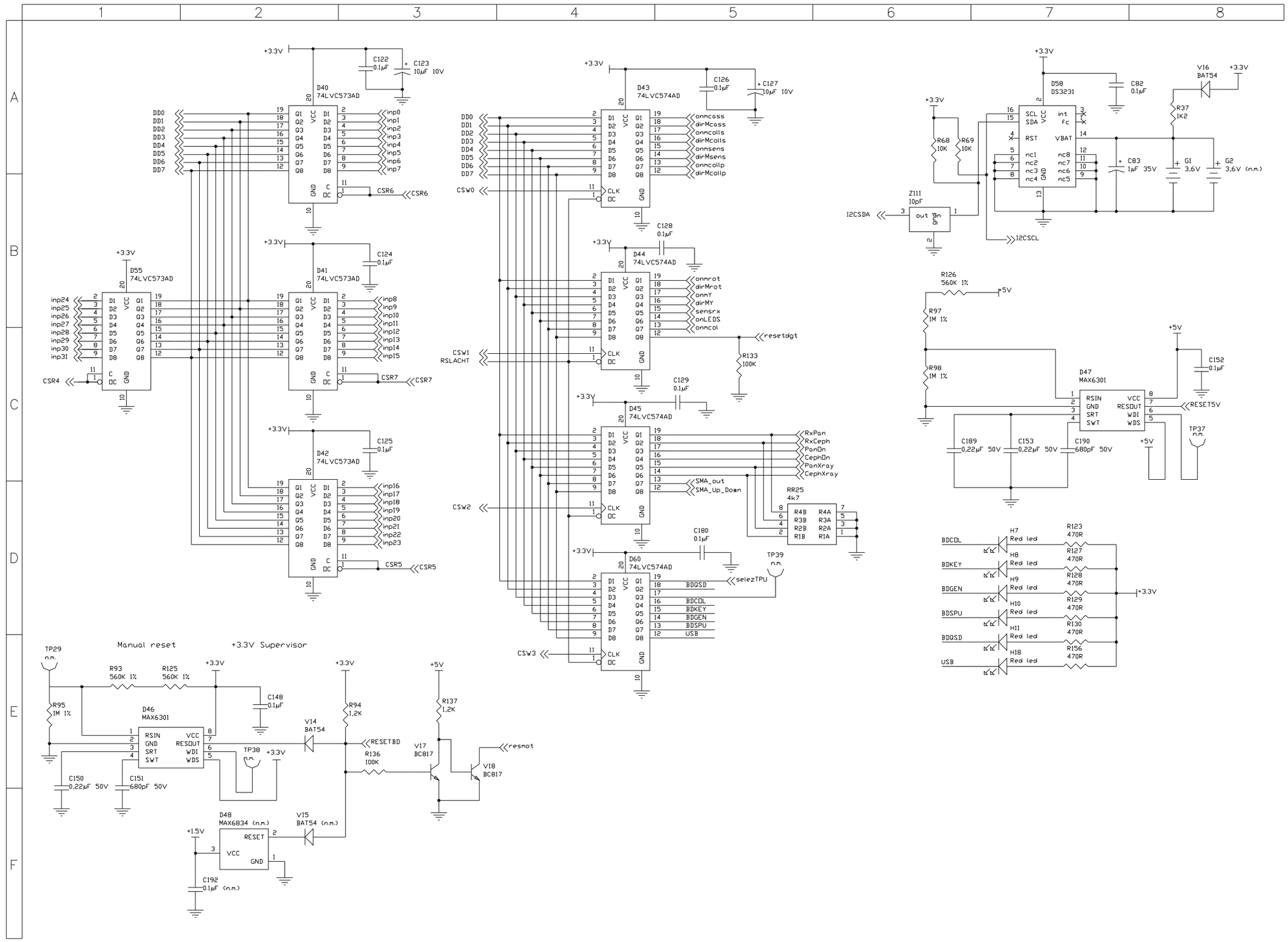
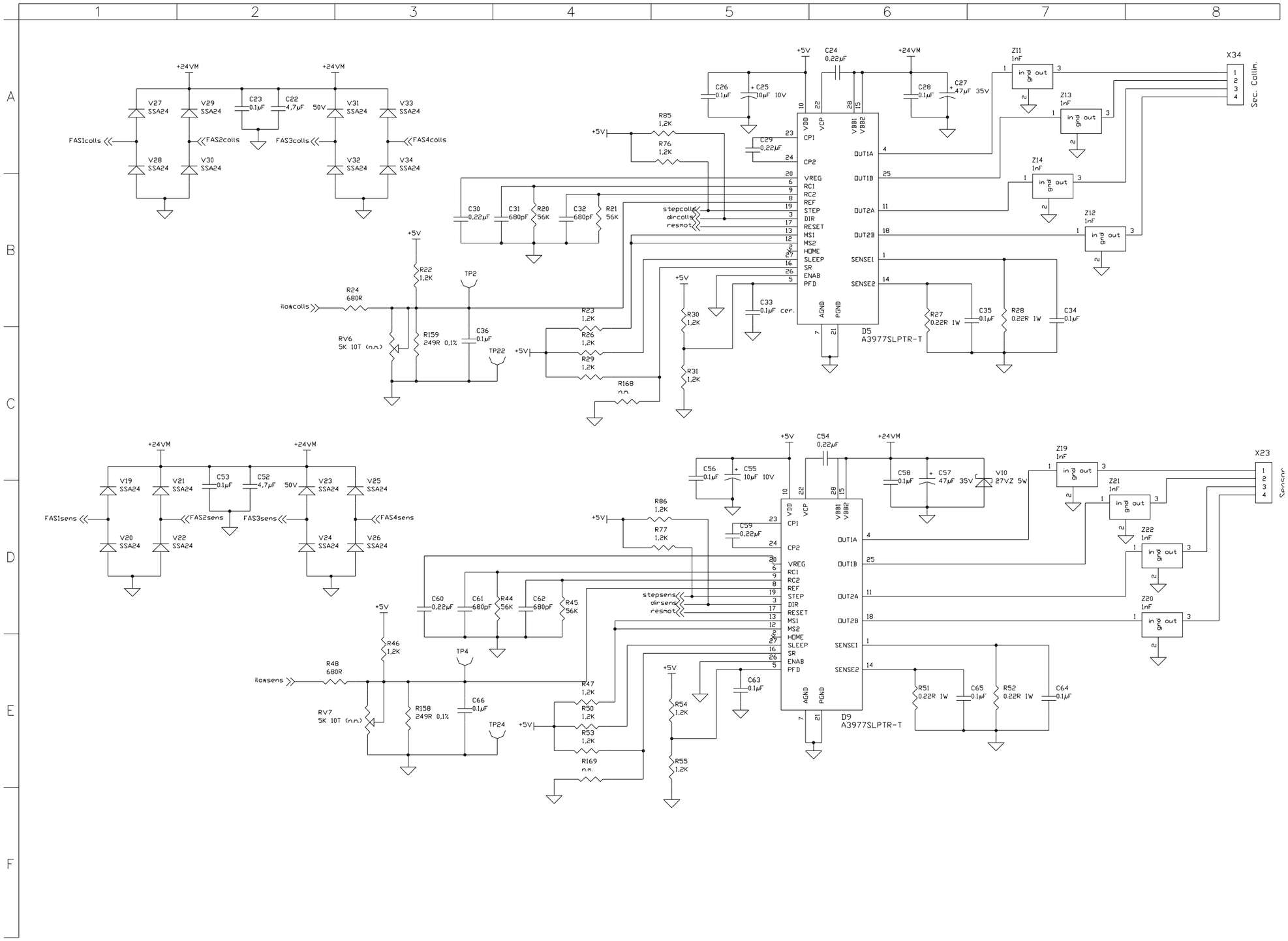
A
B
C
D
E
F
inp16
inp17
inp18
inp19
inp20
inp21
inp22
inp23
inp24
inp25
inp26
inp27
inp28
inp29
inp30
inp31
C102 0.1µF
C103 0.1µF
C104 0.1µF
C105 0.1µF
C106 0.1µF
C107 0.1µF
C108 0.1µF
C109 0.1µF
C170 0.1µF
C171 0.1µF
C172 0.1µF
C173 0.1µF
C174 0.1µF
C175 0.1µF
C176 0.1µF
C177 0.1µF
RR15 4k7
RR16 4k7
RR17 100k
RR18 100k
RR19 4k7
RR20 4k7
RR21 4k7
RR22 4k7
RR23 100k
RR24 100k
R1A R2A R3A R4A
R1B R2B R3B R4B
Z40 2,2nF
Z41 (n.m.)
Z42 2,2nF
Z43 2,2nF
Z44 2,2nF
Z45 2,2nF
Z46 2,2nF
Z47 2,2nF
Z102 2,2nF
Z103 2,2nF
Z104 2,2nF
Z105 2,2nF
Z107 2,2nF
Z108 2,2nF
Z109 2,2nF
out gnd
posSMA1
XJ16
RXDWANDY_Dalsa
Sready
posSMA2
panReadyDalsa
CephDalsa
zfm
decollpr
posUpSMA
posDownSMA
Pres Dwandy
XJ11
Pres QSD
XJ12
Old_New Cpu
XJ13
XJ10
JP3
+5V
+3.3V
CephSclock
Z101 10pF
osensck
PDNRX
PDNRXloc
PDNRXrem
osensrx
motcolon
DI8 SN74AHCT244
iPulsRXB
iPRXloc
iPRXren
DI6 SN74LVC1G07
DI7 SN74LVC1G07
DI57 SN74LVC1G07
VCC nc A Y GND
sensck
sensrx
onncol
R70 1K2
R71 1K2
R121 1K2
C111 0.1µF
R81 1K2
H1 Green led
D49C 74HCT14
resmot
BDRSOUT
D62A 74LVC14AD
D62B 74LVC14AD
RSLACHT
R132 470R
H13 Green led
R151 1K2
H14 Green led
TP16
TPsROT
D49B 74HCT14
D49A 74HCT14
R72 10K
R73 10K
R74 100K
C112 10nF
Z100 10pF
Rotorac


D40 74LVC573AD
D41 74LVC573AD
D42 74LVC573AD
D43 74LVC574AD
D44 74LVC574AD
D45 74LVC574AD
D55 74LVC573AD
D60 74LVC574AD
C122 0.1µF
C123 10µF 10V
C124 0.1µF
C125 0.1µF
C126 0.1µF
C127 10µF 10V
C128 0.1µF
C129 0.1µF
C180 0.1µF
CSR4
CSR5
CSR6
CSR7
CSW0
CSW1 RSLACHT
CSW2
CSW3
resetdgt
R133 100K
RxPan
RxCeph
PanDn
CephDn
PanXray
CephXray
SMA_out
SMA_Up_Down
RR25 4k7
selezTPU
TP39 n.m.
BDQSD
BDCOL
BDKEY
BDGEN
BDSPU
USB
D58 DS3231
C82 0.1µF
V16 BAT54
R37 1K2
R68 10K
R69 10K
C83 1µF 35V
G1 3,6V
G2 3,6V (n.m.)
Z111 10pF
I2CSDA
I2CSCL
R126 560K 1%
R97 1M 1%
R98 1M 1%
D47 MAX6301
C152 0.1µF
RESET5V
C189 0,22µF 50V
C153 0,22µF 50V
C190 680pF 50V
TP37 n.m.
H7 Red led
H8 Red led
H9 Red led
H10 Red led
H11 Red led
H18 Red led
R123 470R
R127 470R
R128 470R
R129 470R
R130 470R
R156 470R
Manual reset
+3.3V Supervisor
TP29 n.m.
R93 560K 1%
R125 560K 1%
R95 1M 1%
C148 0.1µF
D46 MAX6301
V14 BAT54
R94 1,2K
R137 1,2K
RESETBD
R136 100K
V17 BC817
V18 BC817
resmot
TP38 n.m.
C150 0,22µF 50V
C151 680pF 50V
D48 MAX6834 (n.m.)
V15 BAT54 (n.m.)
C192 0.1µF (n.m.)


1
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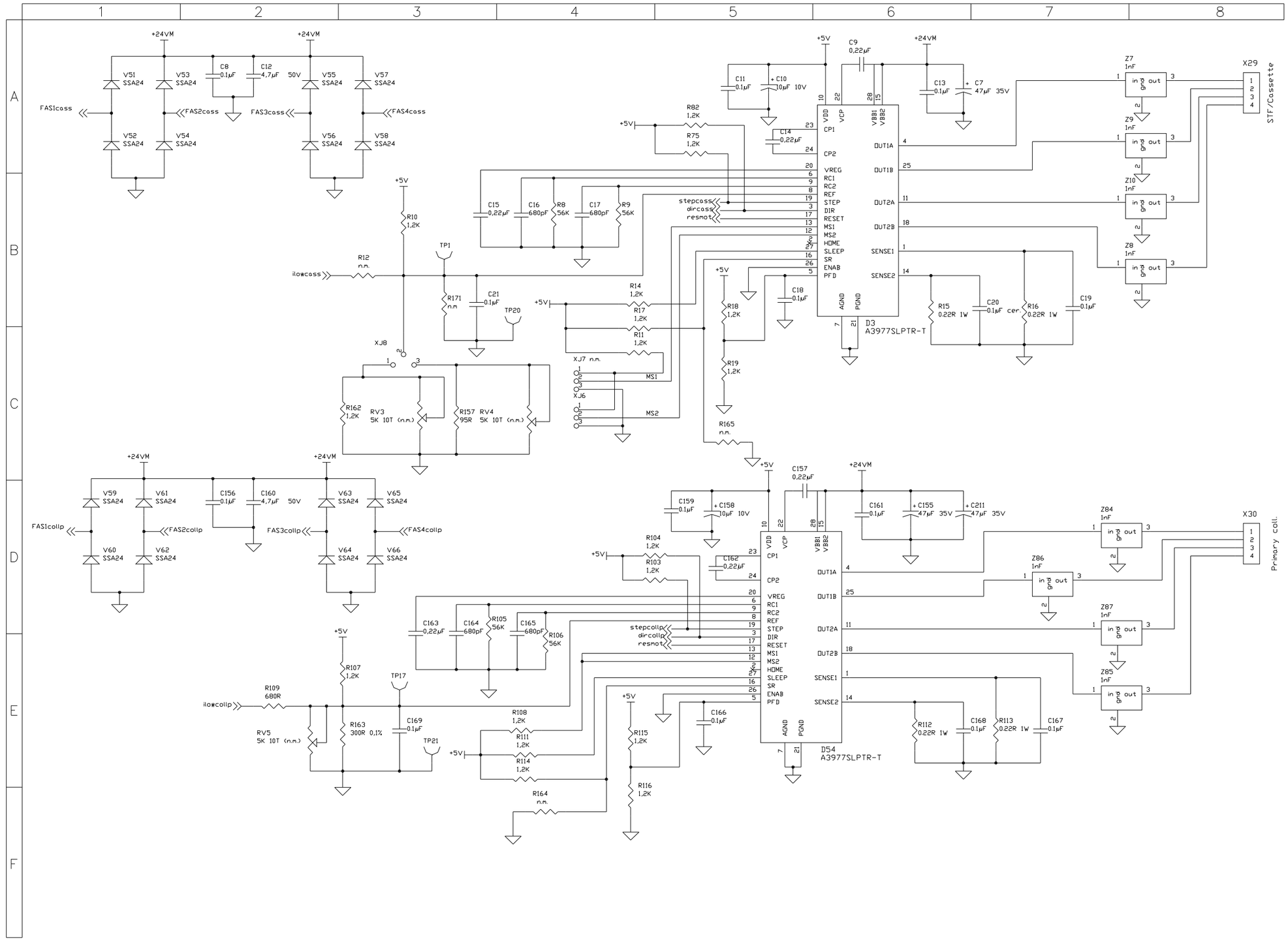
A
B
C
D
E
F
+24VM
V27 SSA24
V29 SSA24
V28 SSA24
V30 SSA24
C23 0.1µF
C22 4,7µF 50V
V31 SSA24
V33 SSA24
V32 SSA24
V34 SSA24
FAS1colls
FAS2colls
FAS3colls
FAS4colls
+5V
C24 0,22µF
C26 0.1µF
C25 10µF 10V
C28 0.1µF
C27 47µF 35V
R85 1,2K
R76 1,2K
C29 0,22µF
C30 0,22µF
C31 680pF
R20 56K
C32 680pF
R21 56K
stepcolls
dircolls
resnot
R22 1,2K
TP2
R24 680R
ilowcolls
RV6 5K 10T (n.m.)
R159 249R 0,1%
C36 0.1µF
TP22
R23 1,2K
R26 1,2K
R29 1,2K
R168 n.m.
R30 1,2K
R31 1,2K
C33 0.1µF cer.
VDD
VCP
CP1
CP2
VREG
RC1
RC2
REF
STEP
DIR
RESET
MS1
MS2
HOME
SLEEP
SR
ENAB
PFD
AGND
PGND
VBB1
VBB2
OUT1A
OUT1B
OUT2A
OUT2B
SENSE1
SENSE2
D5
A3977SLPTR-T
R27 0.22R 1W
C35 0.1µF
R28 0.22R 1W
C34 0.1µF
Z11 1nF
Z13 1nF
Z14 1nF
Z12 1nF
in
gnd
out
X34
Sec. Collin.
+24VM
V19 SSA24
V21 SSA24
V20 SSA24
V22 SSA24
C53 0.1µF
C52 4,7µF 50V
V23 SSA24
V25 SSA24
V24 SSA24
V26 SSA24
FAS1sens
FAS2sens
FAS3sens
FAS4sens
+5V
C54 0,22µF
C56 0.1µF
C55 10µF 10V
C58 0.1µF
C57 47µF 35V
V10 27VZ 5W
R86 1,2K
R77 1,2K
C59 0,22µF
C60 0,22µF
C61 680pF
R44 56K
C62 680pF
R45 56K
stepsens
dirsens
resnot
R46 1,2K
TP4
R48 680R
ilowsens
RV7 5K 10T (n.m.)
R158 249R 0,1%
C66 0.1µF
TP24
R47 1,2K
R50 1,2K
R53 1,2K
R169 n.m.
R54 1,2K
R55 1,2K
C63 0.1µF
VDD
VCP
CP1
CP2
VREG
RC1
RC2
REF
STEP
DIR
RESET
MS1
MS2
HOME
SLEEP
SR
ENAB
PFD
AGND
PGND
VBB1
VBB2
OUT1A
OUT1B
OUT2A
OUT2B
SENSE1
SENSE2
D9
A3977SLPTR-T
R51 0.22R 1W
C65 0.1µF
R52 0.22R 1W
C64 0.1µF
Z19 1nF
Z21 1nF
Z22 1nF
Z20 1nF
in
gnd
out
X23
Sec. Collin.


1
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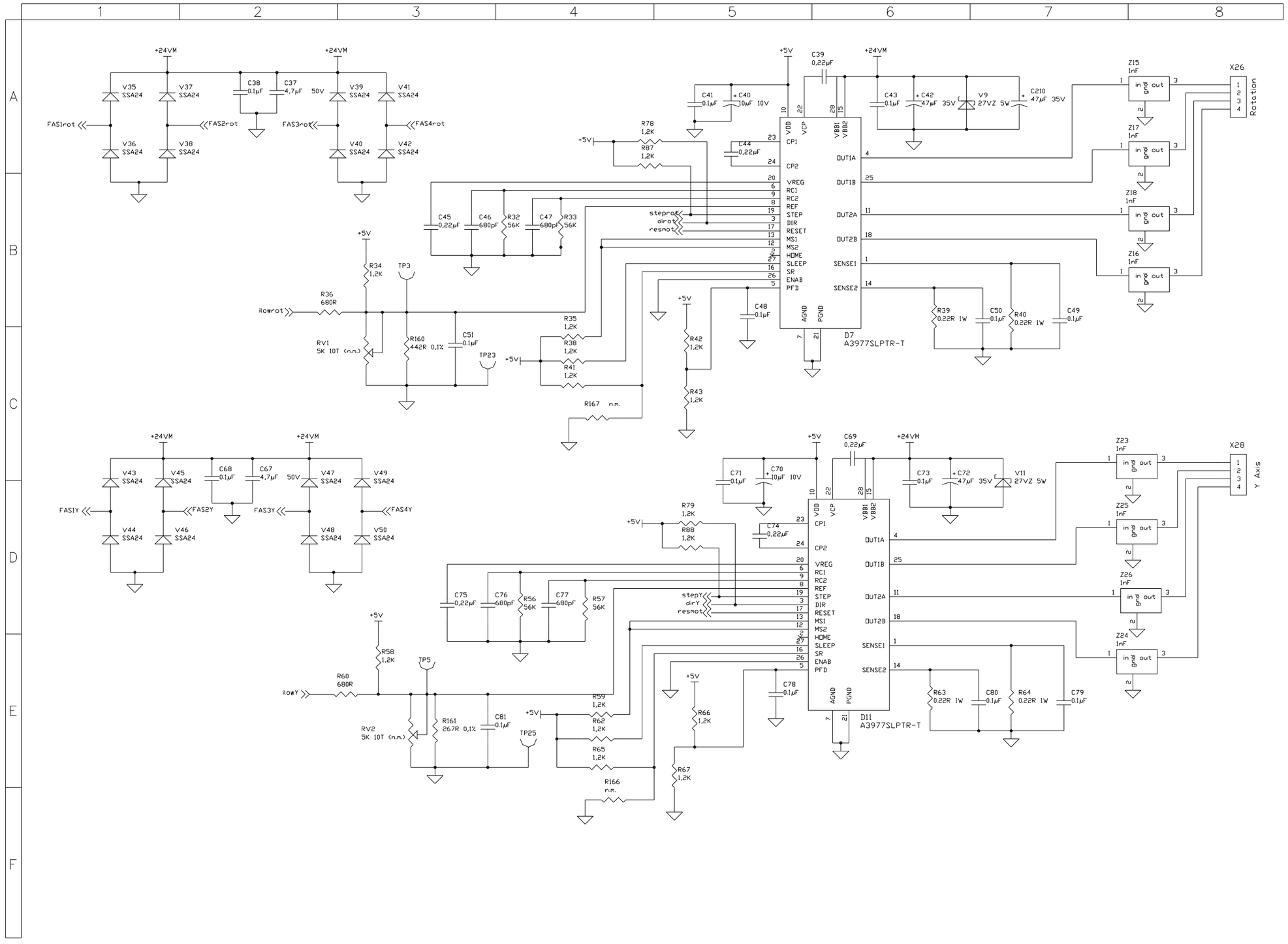
A
B
C
D
E
F
+24VM
V51 SSA24
V53 SSA24
C8 0,1µF
C12 4,7µF 50V
V55 SSA24
V57 SSA24
V52 SSA24
V54 SSA24
V56 SSA24
V58 SSA24
FAS1coss
FAS2coss
FAS3coss
FAS4coss
+5V
C9 0,22µF
C11 0,1µF
C10 10µF 10V
C13 0,1µF
C7 47µF 35V
R82 1,2K
R75 1,2K
C14 0,22µF
C15 0,22µF
C16 680pF
R8 56K
C17 680pF
R9 56K
stepcoss
dircoss
resmot
R10 1,2K
TP1
R12 n.m.
ilowcoss
R171 n.m
C21 0,1µF
TP20
R14 1,2K
R17 1,2K
R11 1,2K
R18 1,2K
C18 0,1µF
R19 1,2K
XJ8
XJ7 n.m.
XJ6
MS1
MS2
R165 n.m.
R162 1,2K
RV3 5K 10T (n.m.)
R157 95R
RV4 5K 10T (n.m.)
VDD
VCP
VBB1
VBB2
CP1
CP2
VREG
RC1
RC2
REF
STEP
DIR
RESET
MS1
MS2
HOME
SLEEP
SR
ENAB
PFD
AGND
PGND
OUT1A
OUT1B
OUT2A
OUT2B
SENSE1
SENSE2
D3
A3977SLPTR-T
R15 0,22R 1W
C20 0,1µF cer.
R16 0,22R 1W
C19 0,1µF
Z7 1nF
Z9 1nF
Z10 1nF
Z8 1nF
in
gnd
out
X29
stat.coss/JTF
C157 0,22µF
C159 0,1µF
C158 10µF 10V
C161 0,1µF
C155 47µF 35V
C211 47µF 35V
R104 1,2K
R103 1,2K
C162 0,22µF
C163 0,22µF
C164 680pF
R105 56K
C165 680pF
R106 56K
stepcoilp
dircoilp
resmot
R107 1,2K
TP17
R109 680R
ilowcoilp
RV5 5K 10T (n.m.)
R163 300R 0,1%
C169 0,1µF
TP21
R108 1,2K
R111 1,2K
R114 1,2K
R164 n.m.
R115 1,2K
C166 0,1µF
R116 1,2K
D54
A3977SLPTR-T
R112 0,22R 1W
C168 0,1µF
R113 0,22R 1W
C167 0,1µF
Z84 1nF
Z86 1nF
Z87 1nF
Z85 1nF
X30
Primary coil.
V59 SSA24
V61 SSA24
C156 0,1µF
C160 4,7µF 50V
V63 SSA24
V65 SSA24
V60 SSA24
V62 SSA24
V64 SSA24
V66 SSA24
FAS1coilp
FAS2coilp
FAS3coilp
FAS4coilp


1
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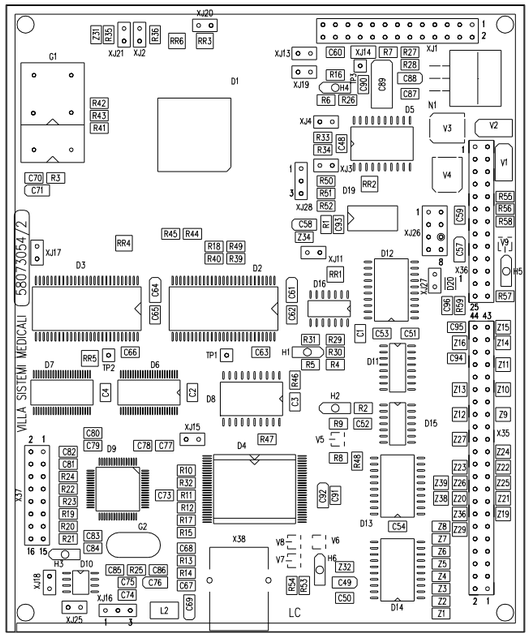
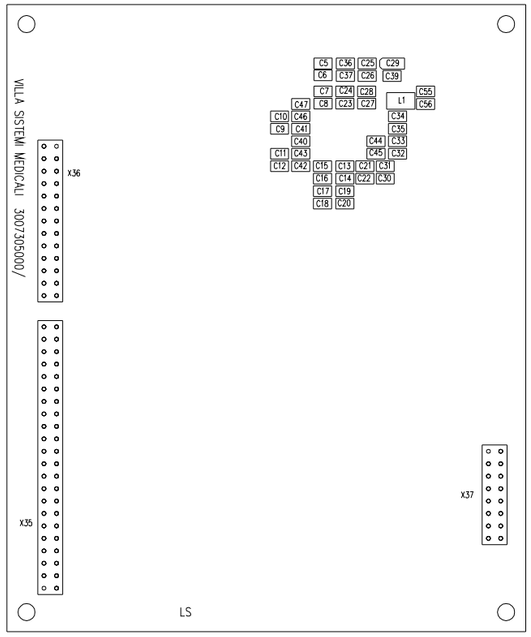
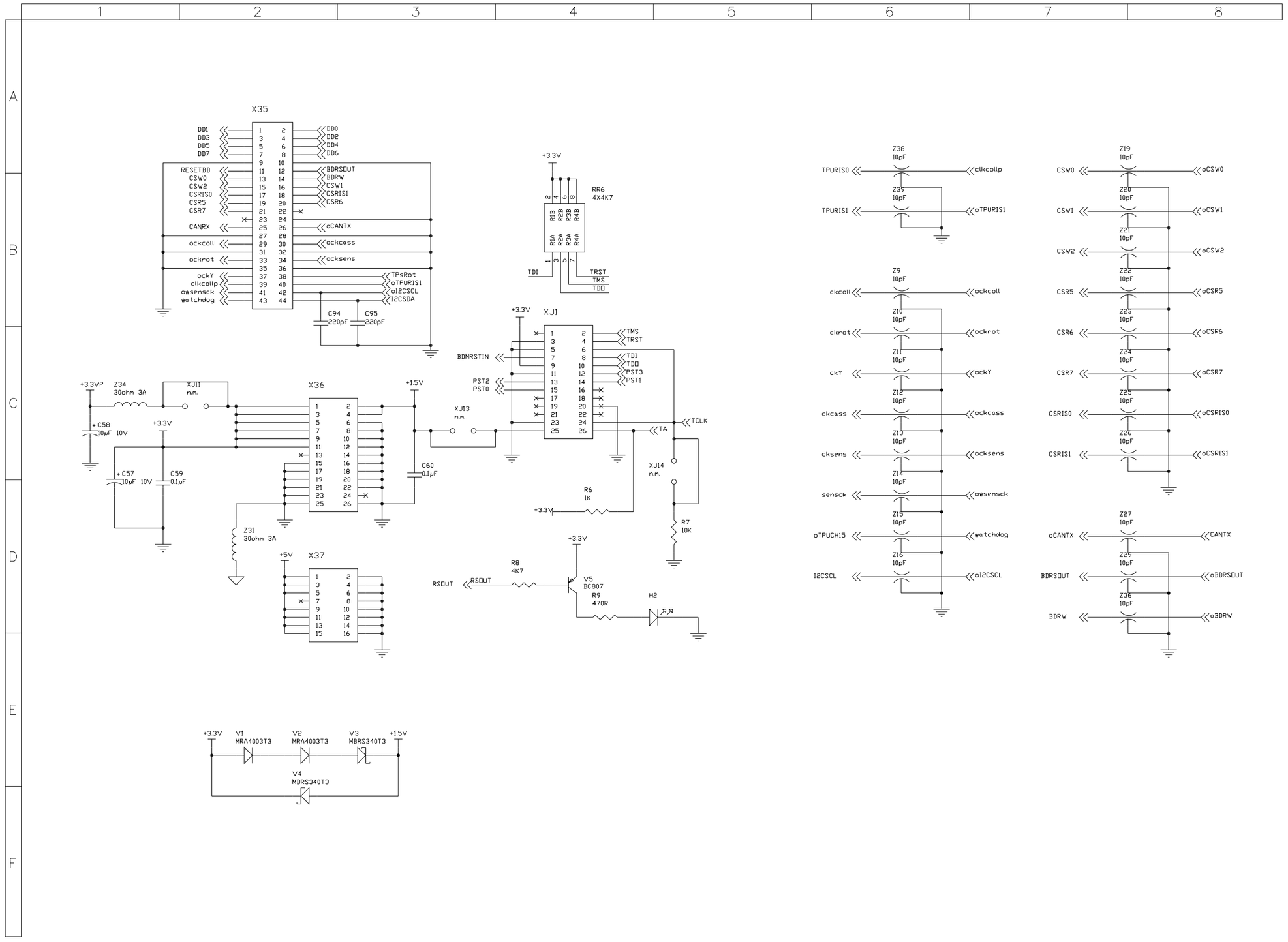
7
8
A
B
C
D
E
F
+24VM
V35 SSA24
V37 SSA24
V36 SSA24
V38 SSA24
FAS1rot
FAS2rot
C38 0,1µF
C37 4,7µF 50V
V39 SSA24
V41 SSA24
V40 SSA24
V42 SSA24
FAS3rot
FAS4rot
+5V
C39 0,22µF
C41 0,1µF
C40 10µF 10V
C43 0,1µF
C42 47µF 35V
V9 27VZ 5W
C210 47µF 35V
R78 1,2K
R87 1,2K
C44 0,22µF
C45 0,22µF
C46 680pF
R32 56K
C47 680pF
R33 56K
steprot
dirot
resrot
R34 1,2K
TP3
R36 680R
ilowrot
RV1 5K 10T (n.m.)
R160 442R 0,1%
C51 0,1µF
TP23
R35 1,2K
R38 1,2K
R41 1,2K
R167 n.m.
R42 1,2K
R43 1,2K
C48 0,1µF
VDD
VCP
CP1
CP2
VREG
RC1
RC2
REF
STEP
DIR
RESET
MS1
MS2
HOME
SLEEP
SR
ENAB
PFD
VBB1
VBB2
OUT1A
OUT1B
OUT2A
OUT2B
SENSE1
SENSE2
AGND
PGND
D7
A3977SLPTR-T
R39 0,22R 1W
C50 0,1µF
R40 0,22R 1W
C49 0,1µF
Z15 1nF
Z17 1nF
Z18 1nF
Z16 1nF
in
gnd
out
X26
Rotation
+24VM
V43 SSA24
V45 SSA24
V44 SSA24
V46 SSA24
FAS1Y
FAS2Y
C68 0,1µF
C67 4,7µF 50V
V47 SSA24
V49 SSA24
V48 SSA24
V50 SSA24
FAS3Y
FAS4Y
+5V
C69 0,22µF
C71 0,1µF
C70 10µF 10V
C73 0,1µF
C72 47µF 35V
V11 27VZ 5W
R79 1,2K
R88 1,2K
C74 0,22µF
C75 0,22µF
C76 680pF
R56 56K
C77 680pF
R57 56K
stepY
dirY
resrot
R58 1,2K
TP5
R60 680R
ilowY
RV2 5K 10T (n.m.)
R161 267R 0,1%
C81 0,1µF
TP25
R59 1,2K
R62 1,2K
R65 1,2K
R166 n.m.
R66 1,2K
R67 1,2K
C78 0,1µF
D11
A3977SLPTR-T
R63 0,22R 1W
C80 0,1µF
R64 0,22R 1W
C79 0,1µF
Z23 1nF
Z25 1nF
Z26 1nF
Z24 1nF
X28
Y Axis

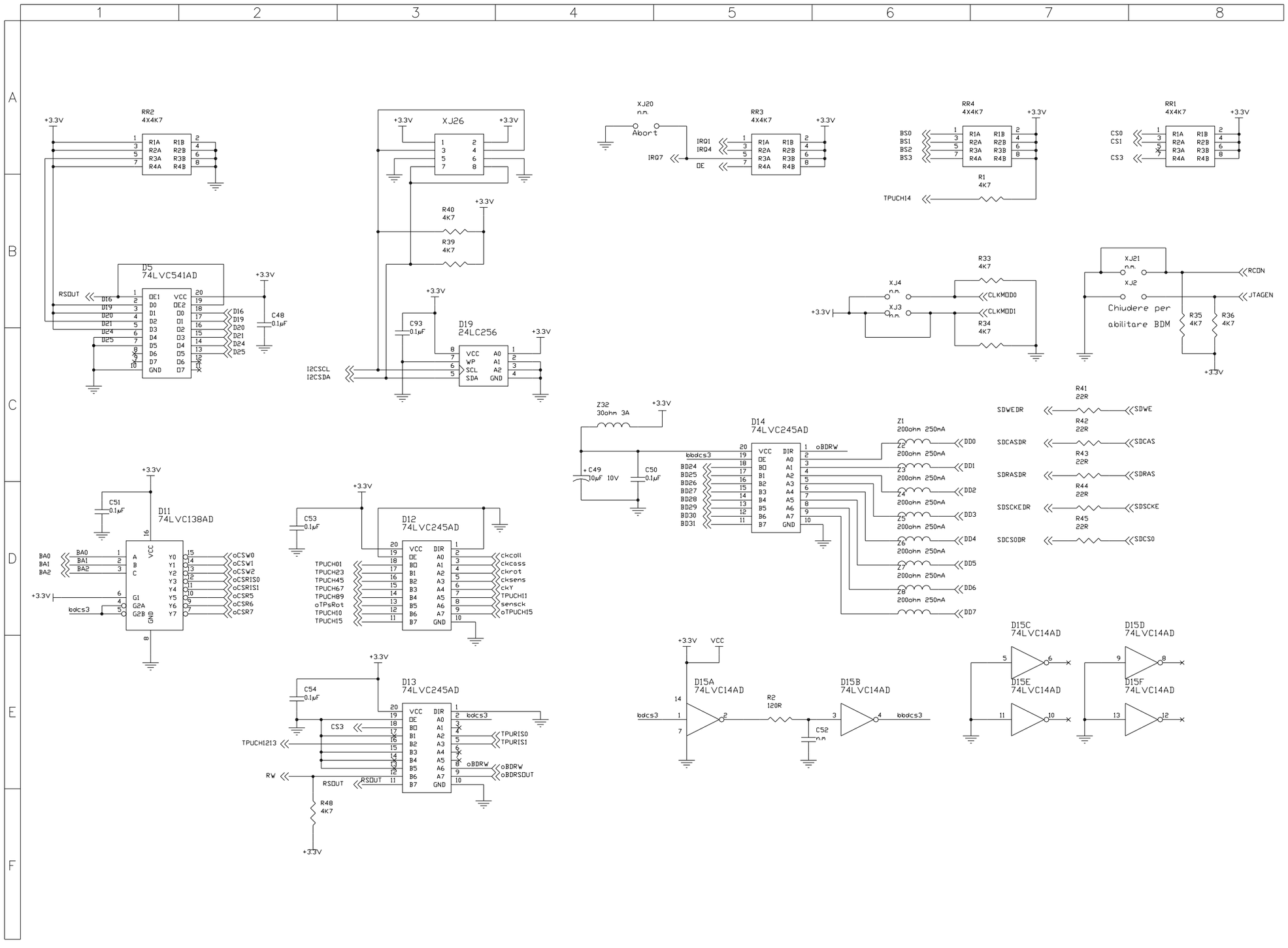


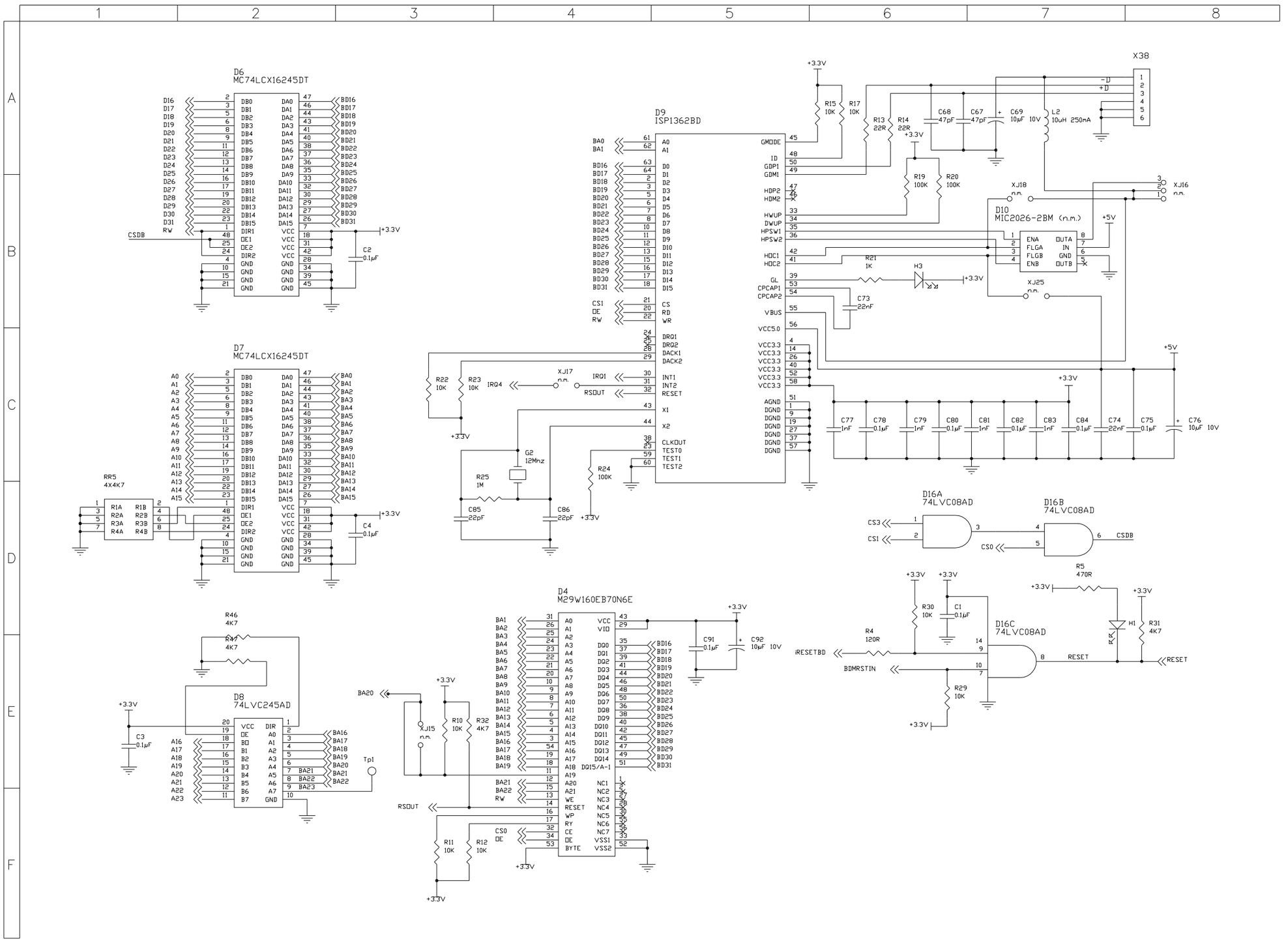
TOP VIEW

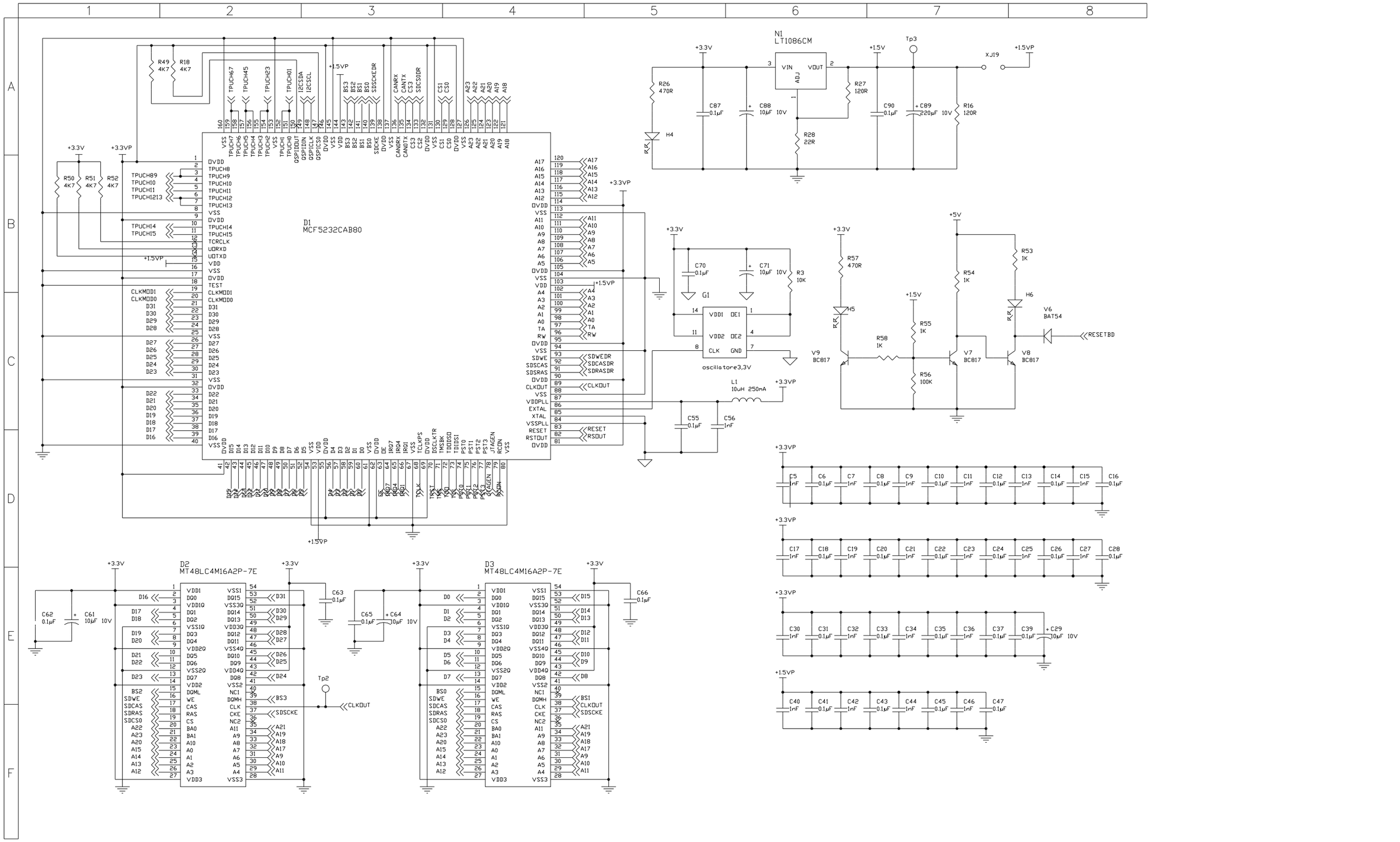


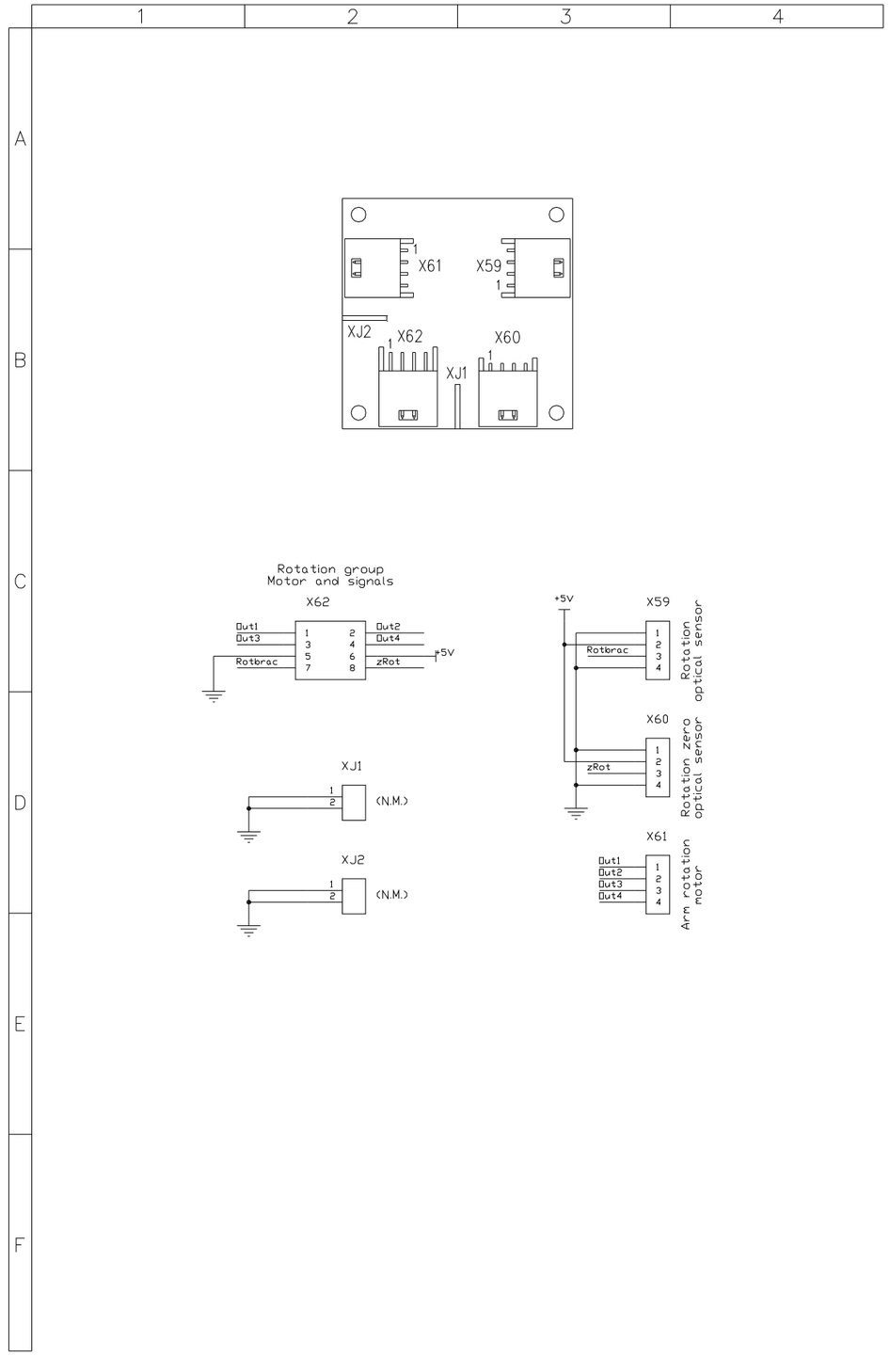
BOTTOM VIEW

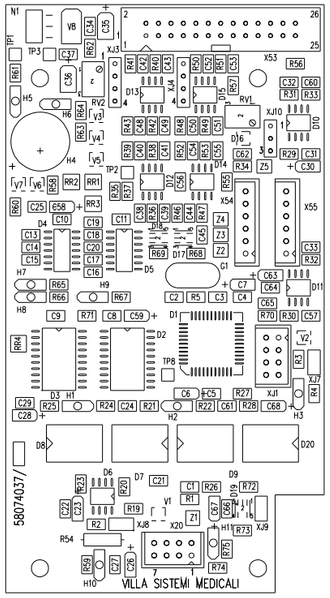

1
2
3
4
5
6
7
8
A
B
C
D
E
F
X35
DD1
DD3
DD5
DD7
DD0
DD2
DD4
DD6
RESETBD
CSW0
CSW2
CSRIS0
CSR5
CSR7
BDRSOUT
BDRW
CSW1
CSRIS1
CSR6
CANRX
oCANTX
ockcoll
ockcass
ockrot
ocksens
ockY
clkcollp
o#sensck
watchdog
TPsRot
oTPURIS1
oI2CSCL
I2CSDA
C94
220pF
C95
220pF
+3.3V
RR6
4X4K7
R1B
R2B
R3B
R4B
R1A
R2A
R3A
R4A
TDI
TRST
TMS
TDO
+3.3VP
Z34
30ohm 3A
XJ11
n.m.
X36
+1.5V
+C58
10µF 10V
+3.3V
+C57
10µF 10V
C59
0.1µF
C60
0.1µF
Z31
30ohm 3A
XJ1
BDMRSTIN
PST2
PST0
PST3
PST1
XJ13
n.m.
TCLK
TA
XJ14
n.m.
R6
1K
R7
10K
+5V
X37
R8
4K7
RSOUT
V5
BC807
R9
470R
H2
V1
MRA4003T3
V2
MRA4003T3
V3
MBRS340T3
V4
MBRS340T3
Z38
10pF
TPURIS0
clkcollp
Z39
10pF
TPURIS1
oTPURIS1
Z9
10pF
ckcoll
ockcoll
Z10
10pF
ckrot
ockrot
Z11
10pF
ckY
ockY
Z12
10pF
ckcass
ockcass
Z13
10pF
cksens
ocksens
Z14
10pF
sensck
o#sensck
Z15
10pF
oTPUCHIS
watchdog
Z16
10pF
I2CSCL
oI2CSCL
Z19
10pF
CSW0
oCSW0
Z20
10pF
CSW1
oCSW1
Z21
10pF
CSW2
oCSW2
Z22
10pF
CSR5
oCSR5
Z23
10pF
CSR6
oCSR6
Z24
10pF
CSR7
oCSR7
Z25
10pF
CSRIS0
oCSRIS0
Z26
10pF
CSRIS1
oCSRIS1
Z27
10pF
oCANTX
CANTX
Z29
10pF
BDRSOUT
oBDRSOUT
Z36
10pF
BDRW
oBDRW

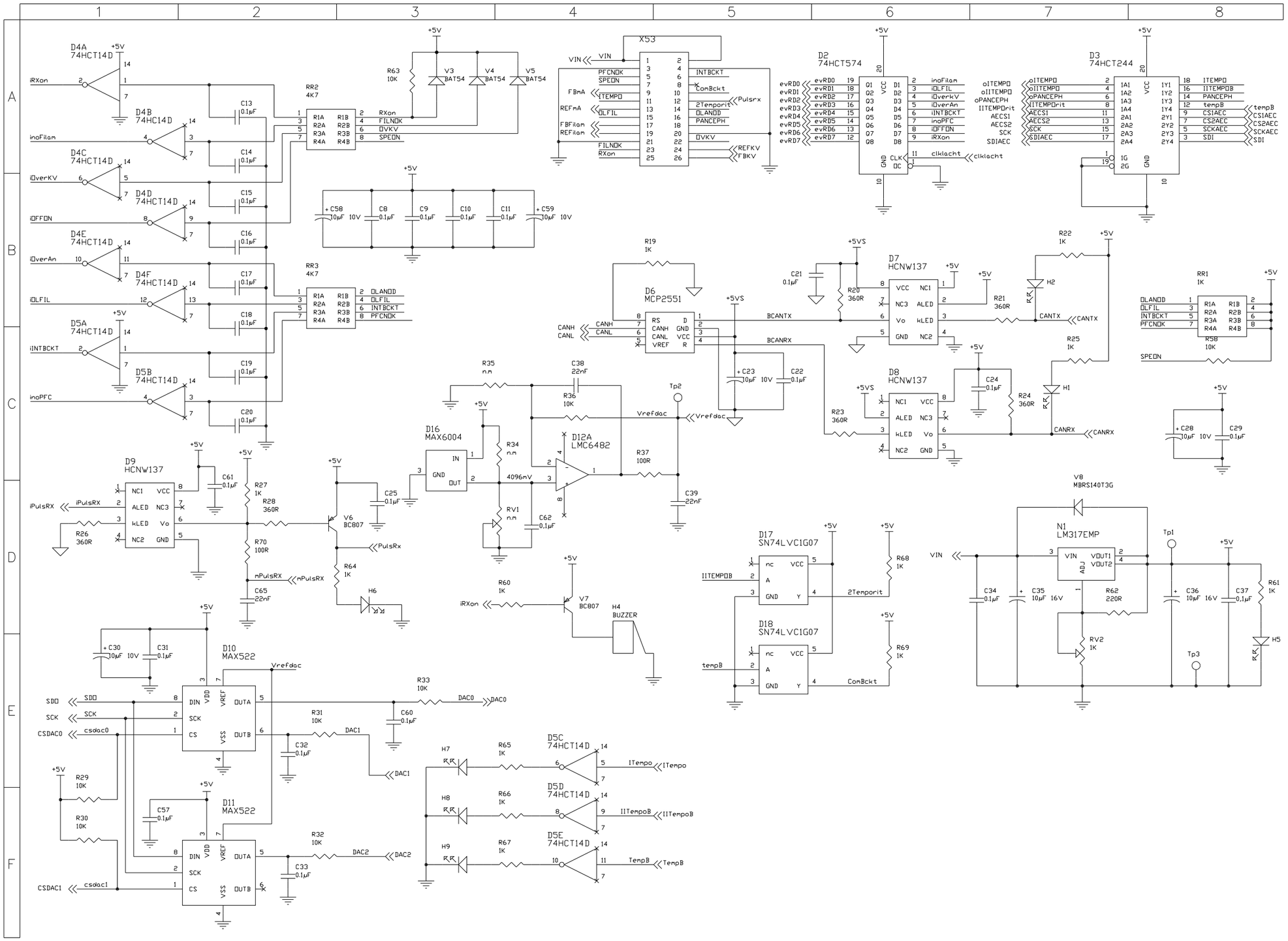

RR2
4X4K7
+3.3V
D5
74LVC541AD
RSOUT
C48
0.1µF
XJ26
R40
4K7
R39
4K7
C93
0.1µF
D19
24LC256
I2CSCL
I2CSDA
XJ20
n.m.
Abort
IRQ7
IRQ1
IRQ4
DE
RR3
4X4K7
RR4
4X4K7
BS0
BS1
BS2
BS3
R1
4K7
TPUCH14
RR1
4X4K7
CS0
CS1
CS3
XJ4
n.m.
XJ3
n.m.
R33
4K7
CLKMOD0
CLKMOD1
R34
4K7
XJ21
n.m.
XJ2
Chiudere per
abilitare BDM
R35
4K7
R36
4K7
RCON
JTAGEN
Z32
30ohm 3A
C49
10µF 10V
C50
0.1µF
D14
74LVC245AD
bbdcs3
oBDRW
BD24
BD25
BD26
BD27
BD28
BD29
BD30
BD31
Z1
200ohm 250mA
Z2
200ohm 250mA
Z3
200ohm 250mA
Z4
200ohm 250mA
Z5
200ohm 250mA
Z6
200ohm 250mA
Z7
200ohm 250mA
Z8
200ohm 250mA
BD0
BD1
BD2
BD3
BD4
BD5
BD6
BD7
R41
22R
R42
22R
R43
22R
R44
22R
R45
22R
SDWEDR
SDCASDR
SDRASDR
SDSCKEDR
SDCSODR
SDWE
SDCAS
SDRAS
SDSCKE
SDCS0
C51
0.1µF
D11
74LVC138AD
BA0
BA1
BA2
oCSW0
oCSW1
oCSW2
oCSRIS0
oCSRIS1
oCSR5
oCSR6
oCSR7
C53
0.1µF
D12
74LVC245AD
TPUCH01
TPUCH23
TPUCH45
TPUCH67
TPUCH89
oTPsRot
TPUCH10
TPUCH15
ckcall
ckcass
ckrot
cksens
ckY
TPUCH11
sensck
oTPUCH15
C54
0.1µF
D13
74LVC245AD
CS3
TPUCH1213
TPURIS0
TPURIS1
RW
RSOUT
oBDRW
oBDRSOUT
R48
4K7
D15A
74LVC14AD
D15B
74LVC14AD
R2
120R
C52
D15C
74LVC14AD
D15D
74LVC14AD
D15E
74LVC14AD
D15F
74LVC14AD

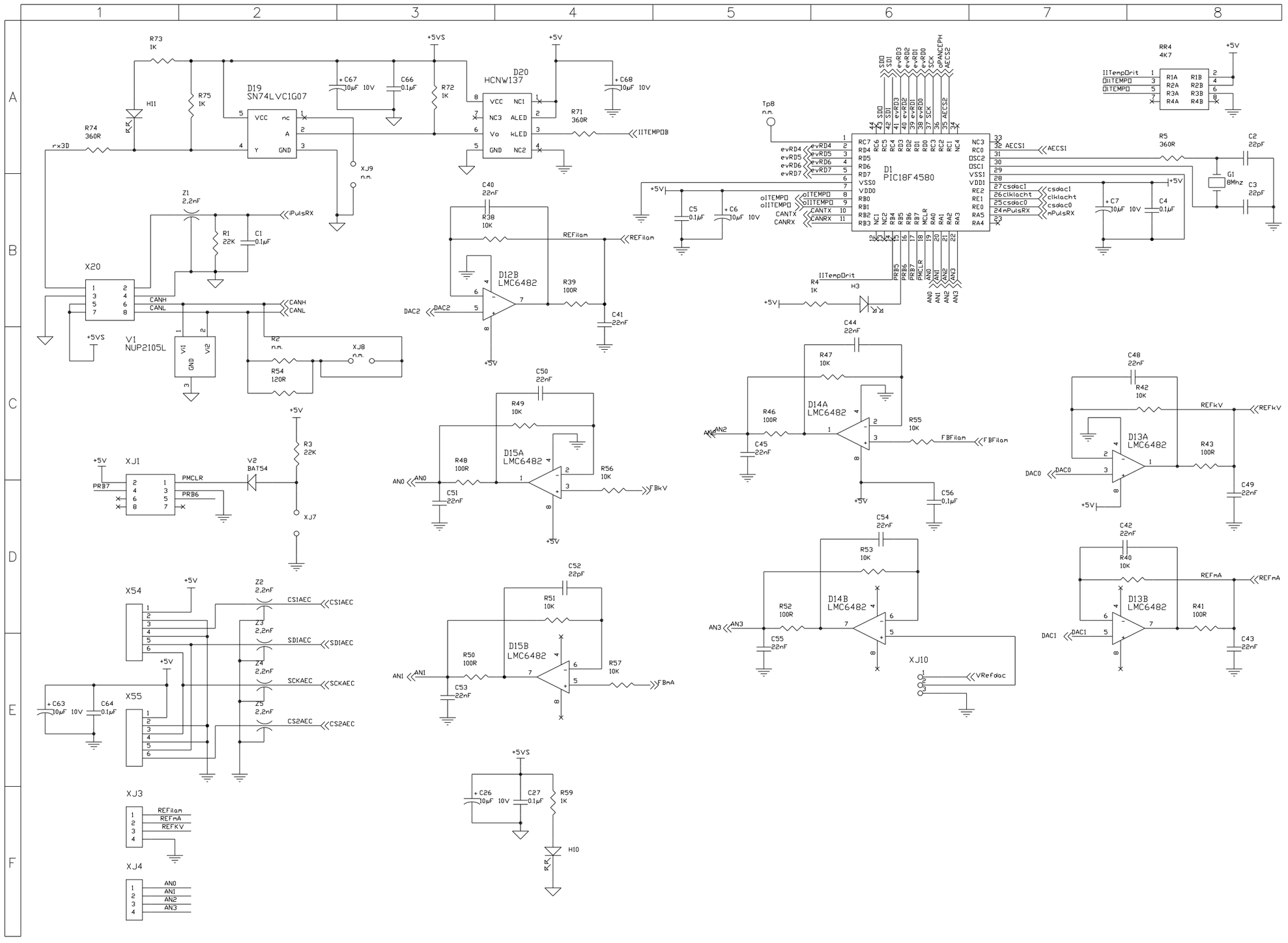

1
2
3
4
5
6
7
8
A
B
C
D
E
F
D6
MC74LCX16245DT
D7
MC74LCX16245DT
D8
74LVC245AD
D9
ISP1362BD
D10
MIC2026-2BM (n.m.)
D4
M29W160EB70N6E
D16A
74LVC08AD
D16B
74LVC08AD
D16C
74LVC08AD
X38
XJ16
XJ17
XJ15
XJ18
XJ25
RR5
4X4K7
+3.3V
+5V
CSDB
RESET
RESETBD
BDMRSTIN
RSOUT
IRQ4
Tp1
G2
12Mhz

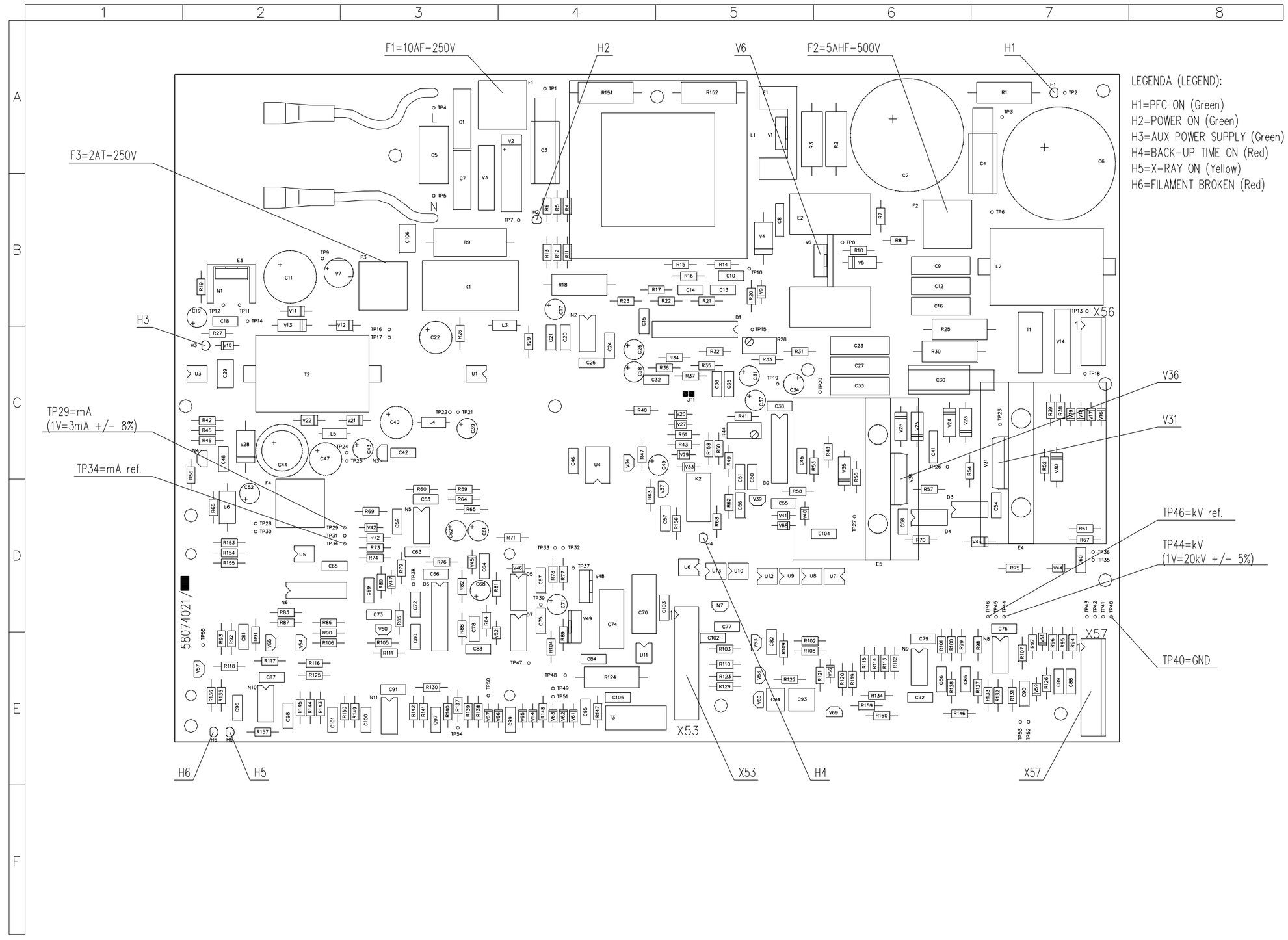

D1
MCF5232CAB80
N1
LT1086CM
VIN
VOUT
ADJ
oscillatore3,3V
D2
MT48LC4M16A2P-7E
D3
MT48LC4M16A2P-7E
V6
BAT54
RESETBD
V7
BC817
V8
BC817
V9
BC817

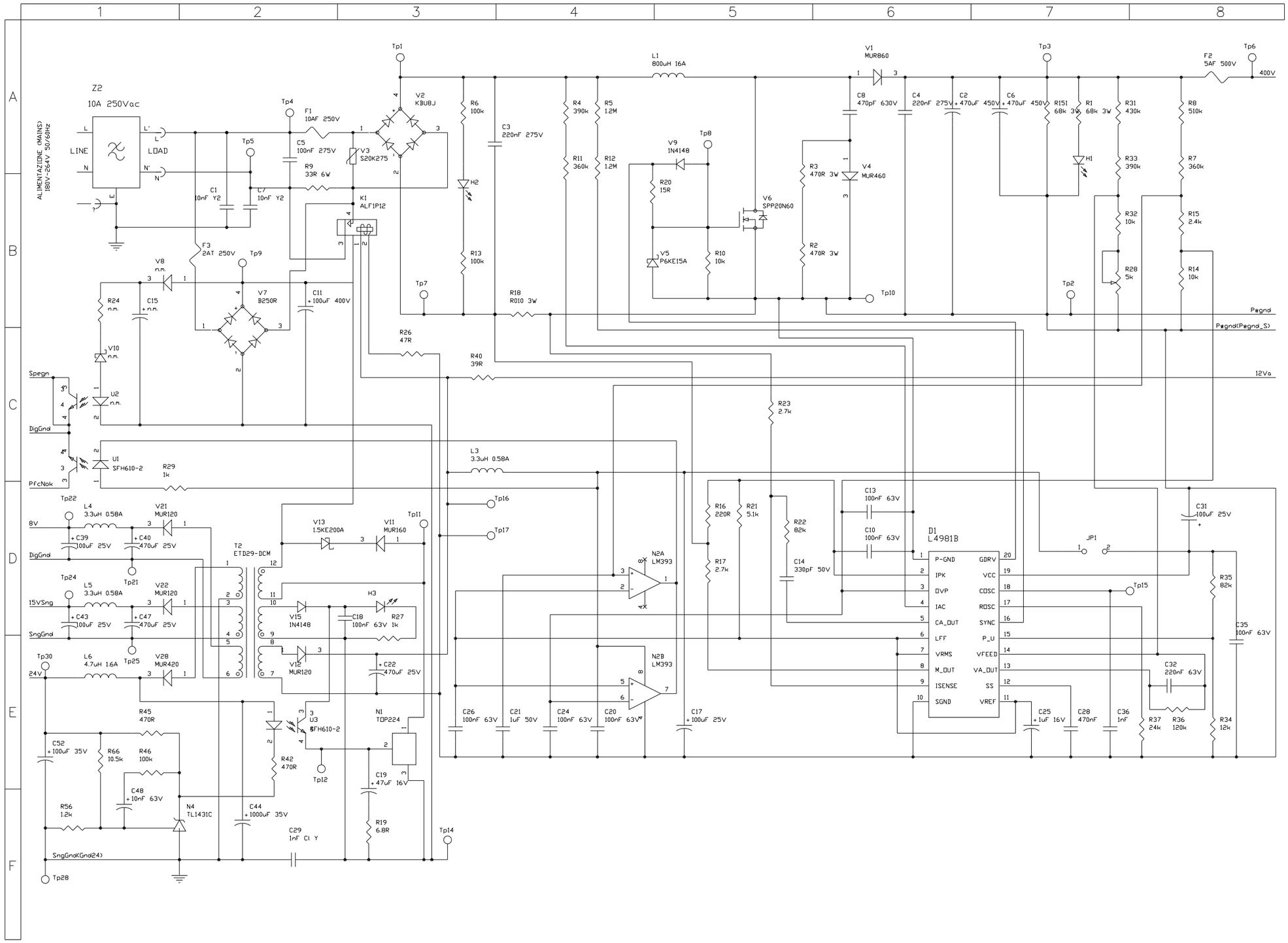

1
2
3
4
A
B
C
D
E
F
X61
X59
XJ2
X62
X60
XJ1
Rotation group
Motor and signals
X62
Out1
Out3
Rotbrac
1
3
5
7
2
4
6
8
Out2
Out4
+5V
zRot
XJ1
(N.M.)
XJ2
(N.M.)
+5V
X59
Rotbrac
Rotation optical sensor
X60
zRot
Rotation zero optical sensor
X61
Out1
Out2
Out3
Out4
Arm rotation motor

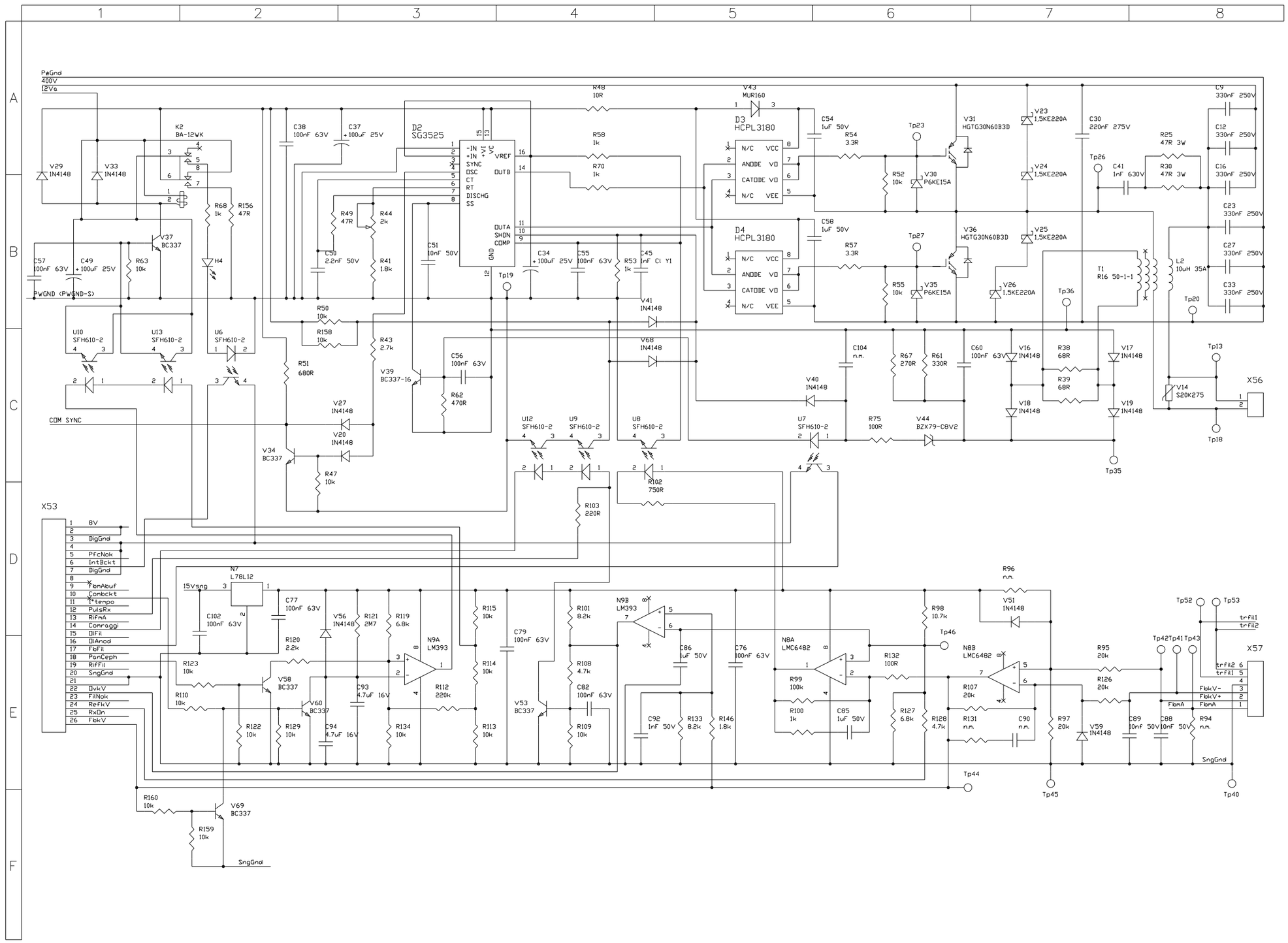

58074037/
VILLA SISTEMI MEDICALI


D4A 74HCT14D
D4B 74HC14D
D4C 74HCT14D
D4D 74HCT14D
D4E 74HCT14D
D4F 74HCT14D
D5A 74HCT14D
D5B 74HCT14D
iRXon
inoFilam
iOverKV
iOFFON
iOverAn
iOLFIL
iINTBCKT
inoPFC
RR2 4K7
RR3 4K7
R63 10K
V3 BAT54
V4 BAT54
V5 BAT54
X53
VIN
PFCNOK
SPEON
FBmA
ITEMPO
REFmA
OLFIL
FBFilam
REFilam
FILNOK
RXon
INTBCKT
ComBckt
Pulsrx
2Temporit
OLANOD
PANCEPH
OVKV
REFKV
FBKV
D2 74HCT574
D3 74HCT244
evRD0
evRD1
evRD2
evRD3
evRD4
evRD5
evRD6
evRD7
oITEMPO
oIITEMPO
oPANCEPH
IITEMPOrit
AECS1
AECS2
SCK
SDIAEC
iOLFIL
iOverKV
iOverAn
iINTBCKT
inoPFC
iOFFON
clklacht
ITEMPOB
PANCEPH
tempB
CS1AEC
CS2AEC
SCKAEC
SDI
C58 10µF 10V
C8 0.1µF
C9 0.1µF
C10 0.1µF
C11 0.1µF
C59 10µF 10V
C13 0.1µF
C14 0.1µF
C15 0.1µF
C16 0.1µF
C17 0.1µF
C18 0.1µF
C19 0.1µF
C20 0.1µF
R19 1K
D6 MCP2551
CANH
CANL
BCANTX
BCANRX
C21 0.1µF
C23 10µF 10V
C22 0.1µF
R20 360R
R21 360R
R22 1K
R25 1K
R24 360R
R23 360R
D7 HCNW137
D8 HCNW137
H2
H1
CANTX
CANRX
RR1 1K
R58 10K
SPEON
C24 0.1µF
C28 10µF 10V
C29 0.1µF
R35 n.m
C38 22nF
R36 10K
Tp2
Vrefdac
D16 MAX6004
D12A LMC6482
R34 n.m
RV1 n.m
4096mV
R37 100R
C62 0.1µF
C39 22nF
D9 HCNW137
iPulsRX
R26 360R
C61 0.1µF
R27 1K
R28 360R
R70 100R
mPulsRX
C65 22nF
V6 BC807
C25 0.1µF
PulsRx
R64 1K
H6
R60 1K
iRXon
V7 BC807
H4 BUZZER
V8 MBRS140T3G
N1 LM317EMP
VIN
VOUT1
VOUT2
ADJ
C34 0.1µF
C35 10µF 16V
R62 220R
RV2 1K
C36 10µF 16V
C37 0.1µF
R61 1K
H5
Tp1
Tp3
D17 SN74LVC1G07
D18 SN74LVC1G07
IITEMPOB
tempB
2Temporit
ComBckt
R68 1K
R69 1K
C30 10µF 10V
C31 0.1µF
D10 MAX522
D11 MAX522
SDO
SCK
CSDAC0
CSDAC1
csdac0
csdac1
R33 10K
R31 10K
R32 10K
DAC0
DAC1
DAC2
C60 0.1µF
C32 0.1µF
C33 0.1µF
C57 0.1µF
R29 10K
R30 10K
H7
H8
H9
R65 1K
R66 1K
R67 1K
D5C 74HCT14D
D5D 74HCT14D
D5E 74HCT14D
ITempo
IITempoB
TempB


R73 1K
R75 1K
H11
R74 360R
rx3D
D19 SN74LVC1G07
+ C67 10µF 10V
C66 0.1µF
+5VS
R72 1K
D20 HCNW137
+5V
+ C68 10µF 10V
R71 360R
IITEMPOB
XJ9 n.m.
Z1 2,2nF
iPulsRX
R1 22K
C1 0.1µF
X20
CANH
CANL
V1 NUP2105L
R2 n.m.
XJ8 n.m.
R54 120R
R3 22K
XJ7
XJ1
PMCLR
PRB7
PRB6
V2 BAT54
Tp8 n.m.
D1 PIC18F4580
evRD4
evRD5
evRD6
evRD7
SDO
SDI
evRD3
evRD2
evRD1
evRD0
SCK
oPANCEPH
AECS2
AECS1
C5 0.1µF
+ C6 10µF 10V
olTEMPO
olITEMPO
CANTX
CANRX
csdac1
clklacht
csdac0
nPulsRX
IITempOrit
R4 1K
H3
RR4 4K7
R5 360R
C2 22pF
G1 8Mhz
C3 22pF
+ C7 10µF 10V
C4 0.1µF
C40 22nF
R38 10K
REFilam
D12B LMC6482
R39 100R
C41 22nF
DAC2
C44 22nF
R47 10K
D14A LMC6482
R46 100R
R55 10K
FBFilam
C45 22nF
C56 0.1µF
C48 22nF
R42 10K
REFkV
D13A LMC6482
R43 100R
C49 22nF
DAC0
C50 22nF
R49 10K
D15A LMC6482
R48 100R
R56 10K
FBkV
C51 22nF
AN0
AN2
C54 22nF
R53 10K
D14B LMC6482
R52 100R
C55 22nF
AN3
XJ10
VRefdac
C42 22nF
R40 10K
REFmA
D13B LMC6482
R41 100R
C43 22nF
DAC1
C52 22pF
R51 10K
D15B LMC6482
R50 100R
R57 10K
FBmA
C53 22nF
AN1
X54
CS1AEC
SDIAEC
SCKAEC
CS2AEC
Z2 2,2nF
Z3 2,2nF
Z4 2,2nF
Z5 2,2nF
X55
+ C63 10µF 10V
C64 0.1µF
XJ3
REFilam
REFmA
REFkV
XJ4
AN0
AN1
AN2
AN3
+5VS
+ C26 10µF 10V
C27 0.1µF
R59 1K
H10


1
2
3
4
5
6
7
8
A
B
C
D
E
F
F1=10AF-250V
H2
V6
F2=5AHF-500V
H1
F3=2AT-250V
H3
TP29=mA
(1V=3mA +/- 8%)
TP34=mA ref.
V36
V31
TP46=kV ref.
TP44=kV
(1V=20kV +/- 5%)
TP40=GND
X56
X57
X53
H4
H6
H5
58074021/
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)


1
2
3
4
5
6
7
8
A
B
C
D
E
F
Z2
10A 250Vac
ALIMENTAZIONE (MAINS)
180V-264V 50/60Hz
LINE
LOAD
Tp1
Tp2
Tp3
Tp4
Tp5
Tp6
Tp7
Tp8
Tp9
Tp10
Tp11
Tp12
Tp14
Tp15
Tp16
Tp17
Tp21
Tp22
Tp24
Tp25
Tp28
Tp30
F1 10AF 250V
F2 5AF 500V
F3 2AT 250V
400V
C1 10nF Y2
C7 10nF Y2
C5 100nF 275V
R9 33R 6W
V3 S20K275
V2 KBU8J
K1 ALF1P12
R6 100k
C3 220nF 275V
H2
R13 100k
L1 800uH 16A
R4 390k
R5 1.2M
R11 360k
R12 1.2M
V9 1N4148
R20 15R
V5 P6KE15A
R10 10k
V6 SPP20N60
V1 MUR860
C8 470pF 630V
C4 220nF 275V
C2 470uF 450V
C6 470uF 450V
R151 68k 3W
R1 68k 3W
H1
R3 470R 3W
V4 MUR460
R2 470R 3W
R31 430k
R33 390k
R32 10k
R28 5k
R8 510k
R7 360k
R15 2.4k
R14 10k
V8 n.m.
R24 n.m.
C15 n.m.
V7 B250R
C11 100uF 400V
R18 R010 3W
R26 47R
R40 39R
Pwgnd
Pwgnd(Pwgnd_S)
12Va
V10 n.m.
Spegn
U2 n.m.
DigGnd
U1 SFH610-2
R29 1k
PfcNok
L3 3.3uH 0.58A
L4 3.3uH 0.58A
V21 MUR120
8V
C39 100uF 25V
C40 470uF 25V
T2 ETD29-DCM
V13 1.5KE200A
V11 MUR160
L5 3.3uH 0.58A
V22 MUR120
15VSng
C43 100uF 25V
C47 470uF 25V
SngGnd
V15 1N4148
C18 100nF 63V
R27 1k
H3
L6 4.7uH 1.6A
V28 MUR420
24V
V12 MUR120
C22 470uF 25V
N2A LM393
N2B LM393
R16 220R
R21 5.1k
R17 2.7k
R22 82k
C14 330pF 50V
C13 100nF 63V
C10 100nF 63V
D1 L4981B
P-GND
IPK
OVP
IAC
CA_OUT
LFF
VRMS
M_OUT
ISENSE
SGND
GDRV
VCC
COSC
ROSC
SYNC
P_U
VFEED
VA_OUT
SS
VREF
JP1
C31 100uF 25V
R35 82k
C35 100nF 63V
C32 220nF 63V
R37 24k
R36 120k
R34 12k
C25 1uF 16V
C28 470nF
C36 1nF
C26 100nF 63V
C21 1uF 50V
C24 100nF 63V
C20 100nF 63V
C17 100uF 25V
R45 470R
C52 100uF 35V
R66 10.5k
R46 100k
C48 10nF 63V
R56 1.2k
N4 TL1431C
C44 1000uF 35V
C29 1nF CI Y
R19 6.8R
U3 SFH610-2
R42 470R
N1 TOP224
C19 47uF 16V
SngGnd(Gnd24)


1
2
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4
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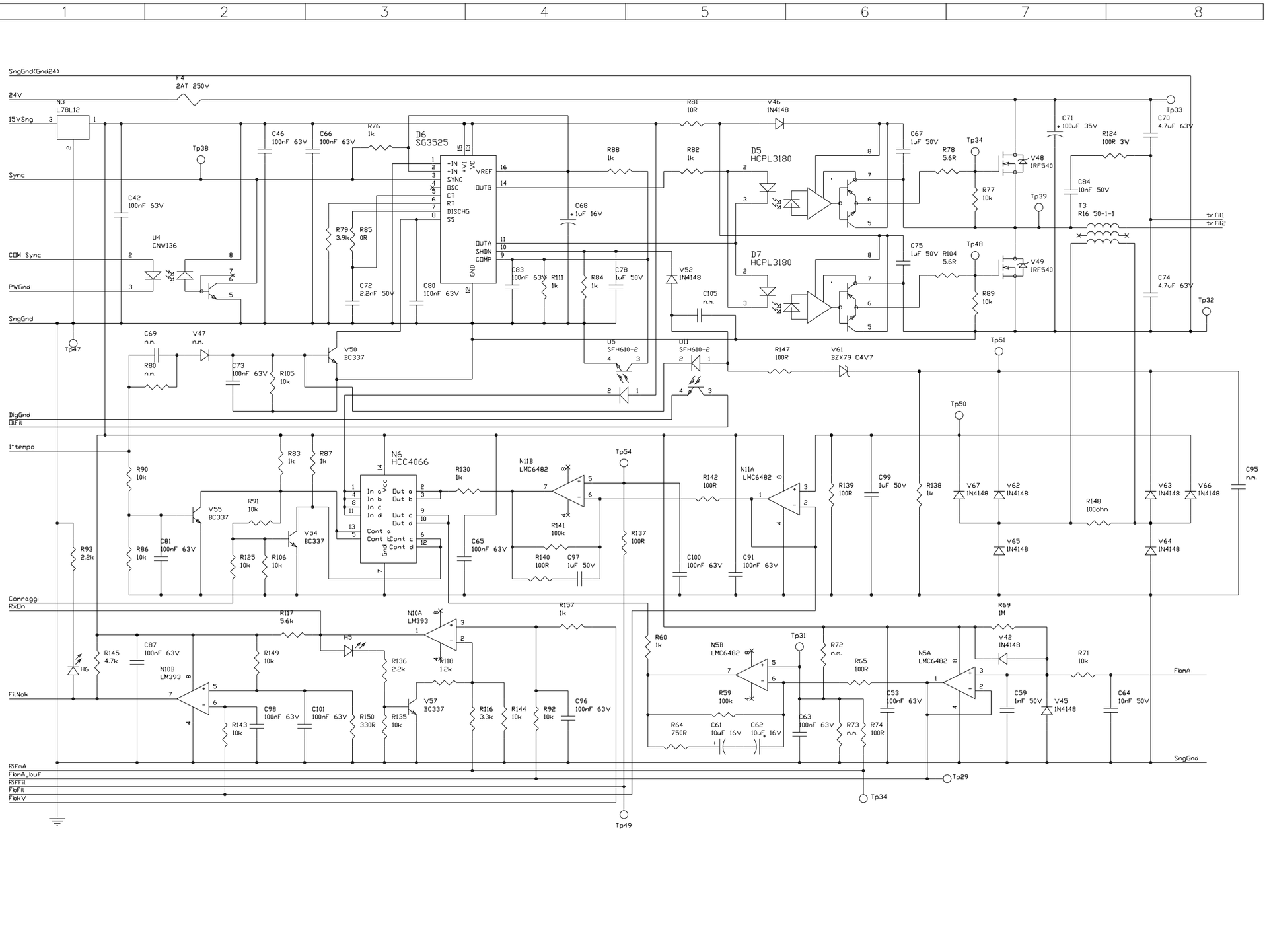
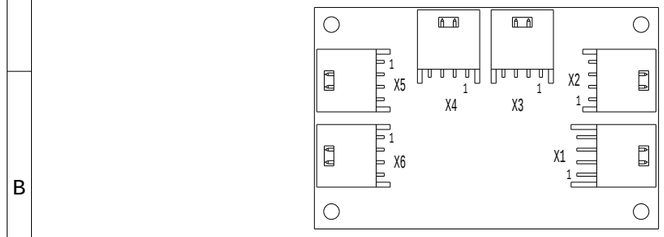
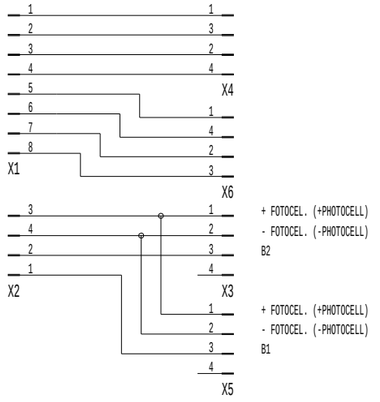
7
8
A
B
C
D
E
F
PwGnd
400V
12Va
K2
BA-12WK
V29
1N4148
V33
1N4148
C38
100nF 63V
C37
100uF 25V
D2
SG3525
R48
10R
R58
1k
R70
1k
V43
MUR160
D3
HCPL3180
D4
HCPL3180
C54
1uF 50V
C58
1uF 50V
R54
3.3R
R57
3.3R
Tp23
Tp27
V31
HGTG30N60B3D
V36
HGTG30N60B3D
V30
P6KE15A
V35
P6KE15A
V23
1.5KE220A
V24
1.5KE220A
V25
1.5KE220A
V26
1.5KE220A
C30
220nF 275V
R25
47R 3W
R30
47R 3W
C41
1nF 630V
Tp26
Tp36
C9
330nF 250V
C12
330nF 250V
C16
330nF 250V
C23
330nF 250V
C27
330nF 250V
C33
330nF 250V
T1
R16 50-1-1
L2
10uH 35A
Tp20
R68
1k
R156
47R
V37
BC337
C57
100nF 63V
C49
100uF 25V
R63
10k
H4
PWGND (PWGND-S)
C50
2.2nF 50V
R49
47R
R44
2k
R41
1.8k
C51
10nF 50V
C34
100uF 25V
C55
100nF 63V
R53
1k
C45
1nF C1 Y1
Tp19
V41
1N4148
R50
10k
R158
10k
R43
2.7k
R51
680R
U10
SFH610-2
U13
SFH610-2
U6
SFH610-2
V68
1N4148
C104
n.m.
R67
270R
R61
330R
C60
100nF 63V
V16
1N4148
R38
68R
V17
1N4148
R39
68R
V18
1N4148
V19
1N4148
Tp13
X56
V14
S20K275
Tp18
C56
100nF 63V
R62
470R
V39
BC337-16
V40
1N4148
COM SYNC
V27
1N4148
V20
1N4148
V34
BC337
R47
10k
U12
SFH610-2
U9
SFH610-2
U8
SFH610-2
U7
SFH610-2
R75
100R
V44
BZX79-C8V2
R102
750R
R103
220R
Tp35
X53
1 8V
2
3 DigGnd
4
5 PfcNok
6 IntBckt
7 DigGnd
8
9 TbmAbuf
10 Combckt
11 Tempo
12 PulsRx
13 RifmA
14 Comraggi
15 DiFil
16 DiAnod
17 FbFil
18 PanCeph
19 RiFfil
20 SngGnd
21
22 DvkV
23 FilNok
24 RefkV
25 RxOn
26 FbkV
N7
L78L12
15Vsng
C102
100nF 63V
C77
100nF 63V
V56
1N4148
R121
2M7
R119
6.8k
N9A
LM393
R120
2.2k
R123
10k
R110
10k
V58
BC337
V60
BC337
C93
4.7uF 16V
R112
220k
R122
10k
R129
10k
C94
4.7uF 16V
R134
10k
R115
10k
R114
10k
R113
10k
C79
100nF 63V
V53
BC337
R101
8.2k
R108
4.7k
C82
100nF 63V
R109
10k
N9B
LM393
C86
1uF 50V
C92
1nF 50V
R133
8.2k
R146
1.8k
C76
100nF 63V
N8A
LMC6482
R99
100k
R100
1k
C85
1uF 50V
R132
100R
R127
6.8k
R98
10.7k
Tp46
N8B
LMC6482
R107
20k
R131
n.m.
C90
n.m.
R128
4.7k
R96
n.m.
V51
1N4148
R97
20k
V59
1N4148
R95
20k
R126
20k
C89
10nF
C88
10nF 50V
R94
n.m.
Tp52
Tp53
Tp42
Tp41
Tp43
X57
trFil2
trFil1
FbkV-
FbkV+
FbmA
FbmA
SngGnd
Tp44
Tp45
Tp40
R160
10k
V69
BC337
R159
10k
SngGnd

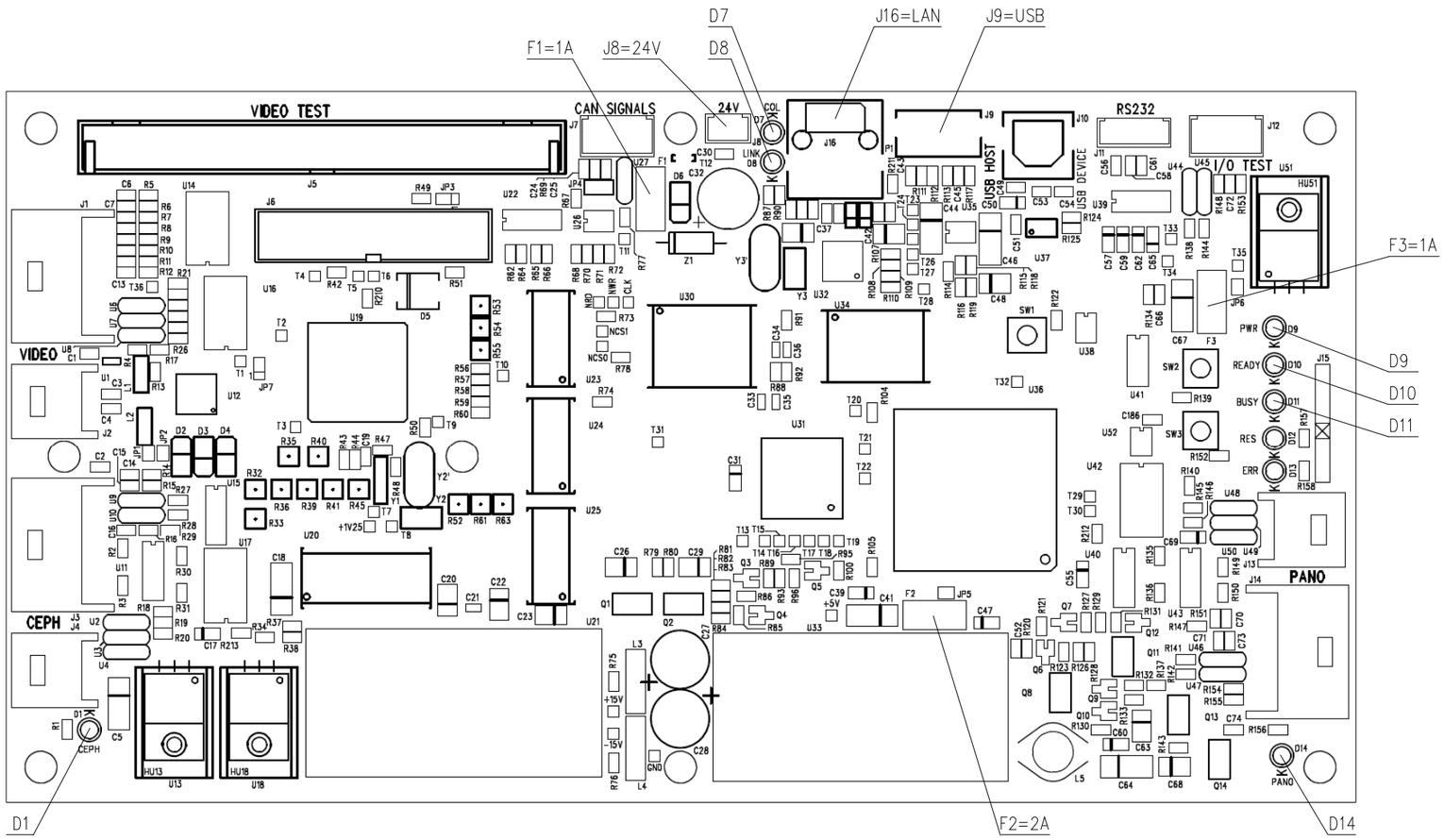

SngGnd(Gnd24)
24V
F4
2AT 250V
N3
L78L12
15VSng
Tp38
Sync
C42
100nF 63V
U4
CNW136
COM Sync
PWGnd
SngGnd
Tp47
C46
100nF 63V
C66
100nF 63V
R76
1k
D6
SG3525
-IN
+IN
SYNC
OSC
CT
RT
DISCHG
SS
VI
VC
VREF
OUTB
OUTA
SHDN
COMP
GND
R79
3.9k
R85
0R
C72
2.2nF 50V
C80
100nF 63V
C68
+ 1uF 16V
C83
100nF 63V
R111
1k
R84
1k
C78
1uF 50V
R88
1k
R82
1k
R81
10R
V46
1N4148
D5
HCPL3180
D7
HCPL3180
V52
1N4148
C105
n.m.
C67
1uF 50V
R78
5.6R
Tp34
R77
10k
V48
IRF540
Tp39
C75
1uF 50V
R104
5.6R
Tp48
R89
10k
V49
IRF540
C71
+ 100uF 35V
R124
100R 3W
C84
10nF 50V
T3
R16 50-1-1
trfil1
trfil2
Tp33
C70
4.7uF 63V
C74
4.7uF 63V
Tp32
C69
n.m.
V47
n.m.
R80
n.m.
C73
100nF 63V
R105
10k
V50
BC337
U5
SFH610-2
U11
SFH610-2
R147
100R
V61
BZX79 C4V7
Tp51
Tp50
DigGnd
DIFil
1°tempo
R90
10k
R83
1k
R87
1k
N6
HCC4066
R130
1k
N11B
LMC6482
R141
100k
R140
100R
C97
1uF 50V
Tp54
R137
100R
R142
100R
N11A
LMC6482
R139
100R
C99
1uF 50V
R138
1k
V67
IN4148
V62
IN4148
V63
IN4148
V66
IN4148
V65
IN4148
V64
IN4148
R148
100ohm
C95
n.m.
R93
2.2k
R86
10k
C81
100nF 63V
V55
BC337
R91
10k
V54
BC337
R125
10k
R106
10k
C65
100nF 63V
C100
100nF 63V
C91
100nF 63V
Comaggi
RxDn
R117
5.6k
H5
N10A
LM393
R157
1k
R69
1M
V42
1N4148
R71
10k
H6
R145
4.7k
C87
100nF 63V
N10B
LM393
R149
10k
R136
2.2k
R118
1.2k
FilNok
C98
100nF 63V
C101
100nF 63V
R150
330R
R135
10k
V57
BC337
R116
3.3k
R144
10k
R92
10k
C96
100nF 63V
R143
10k
R60
1k
N5B
LMC6482
R59
100k
Tp31
R72
n.m.
R65
100R
N5A
LMC6482
FbmA
C53
100nF 63V
C59
1nF 50V
V45
IN4148
C64
10nF 50V
R64
750R
C61
10uF 16V
C62
10uF 16V
C63
100nF 63V
R73
n.m.
R74
100R
SngGnd
RifmA
FbmA_buf
RiFil
FbFil
FbkV
Tp29
Tp34
Tp49

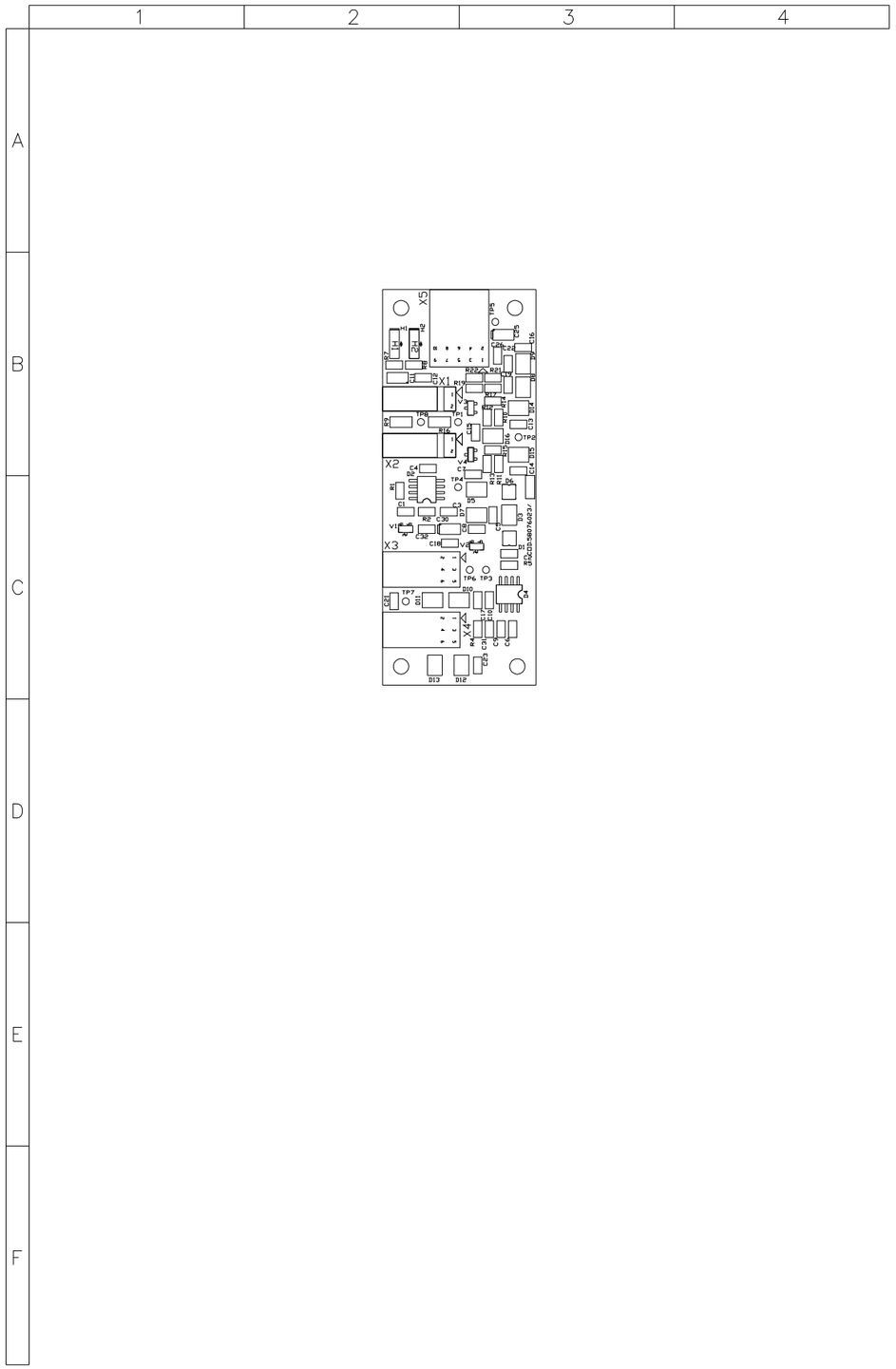

X5
X4
X3
X2
X6
X1


X1
X4
X6
X2
X3
X5
+ FOTOCEL. (+PHOTOCELL)
- FOTOCEL. (-PHOTOCELL)
B2
+ FOTOCEL. (+PHOTOCELL)
- FOTOCEL. (-PHOTOCELL)
B1

LEGENDA (LEGEND):

D1=CEPH (Green)
D7=CEPH (Yellow)
D8=CEPH (Green)
D9=POWER (Green)
D10=READY (Green)
D11=BUSY (Yellow)
D14=PANO (Green)

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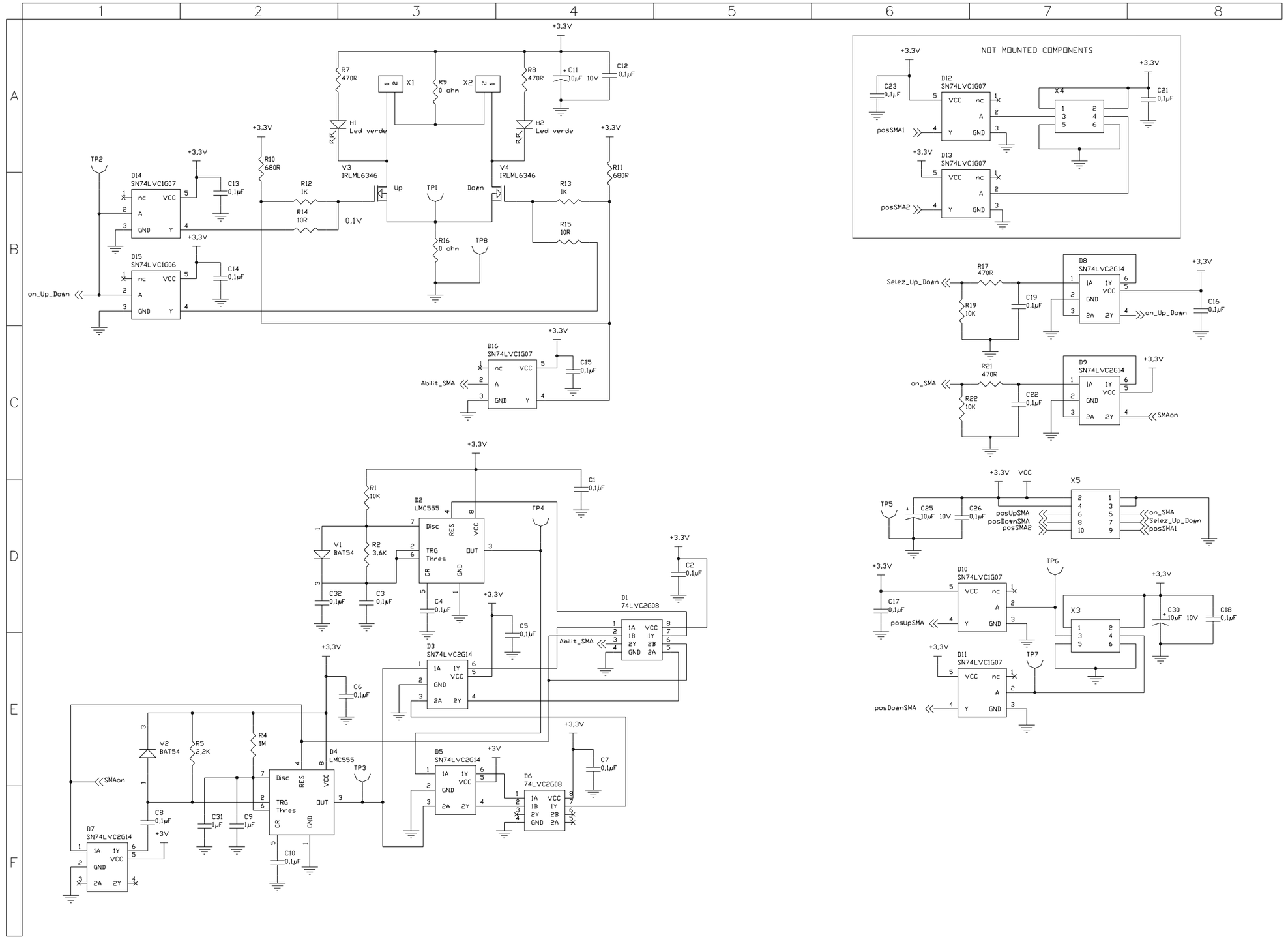
F

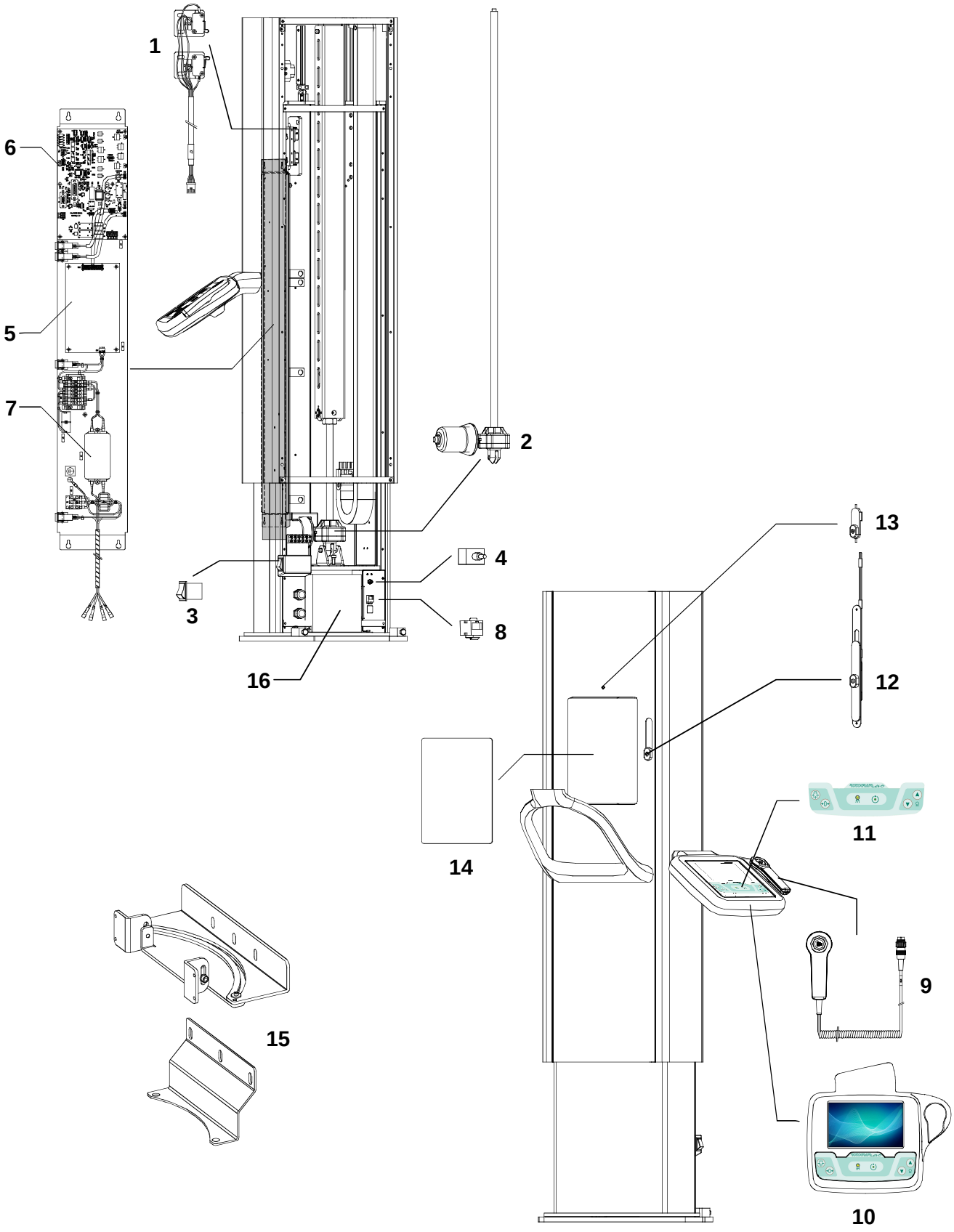

1
2
3
4
5
6
7
8
A
B
C
D
E
F
+3,3V
R7 470R
X1
R9 0 ohm
X2
R8 470R
+ C11 10µF 10V
C12 0,1µF
H1 Led verde
H2 Led verde
V3 IRLML6346
V4 IRLML6346
TP2
D14 SN74LVC1G07
C13 0,1µF
R10 680R
R12 1K
R14 10R
0,1V
Up
TP1
Down
R13 1K
R11 680R
R15 10R
R16 0 ohm
TP8
D15 SN74LVC1G06
C14 0,1µF
on_Up_Down
D16 SN74LVC1G07
C15 0,1µF
Abilit_SMA
R1 10K
D2 LMC555
C1 0,1µF
TP4
V1 BAT54
R2 3,6K
C32 0,1µF
C3 0,1µF
C4 0,1µF
C5 0,1µF
C2 0,1µF
D1 74LVC2G08
D3 SN74LVC2G14
C6 0,1µF
V2 BAT54
R5 2,2K
R4 1M
D4 LMC555
TP3
SMAon
C8 0,1µF
C31 1µF
C9 1µF
C10 0,1µF
D5 SN74LVC2G14
D6 74LVC2G08
C7 0,1µF
D7 SN74LVC2G14
NOT MOUNTED COMPONENTS
C23 0,1µF
D12 SN74LVC1G07
X4
C21 0,1µF
posSMA1
D13 SN74LVC1G07
posSMA2
R17 470R
D8 SN74LVC2G14
C16 0,1µF
Selez_Up_Down
R19 10K
C19 0,1µF
R21 470R
D9 SN74LVC2G14
on_SMA
R22 10K
C22 0,1µF
SMAon
TP5
C25 10µF 10V
C26 0,1µF
posUpSMA
posDownSMA
posSMA2
X5
on_SMA
Selez_Up_Down
posSMA1
TP6
D10 SN74LVC1G07
C17 0,1µF
posUpSMA
X3
C30 10µF 10V
C18 0,1µF
TP7
D11 SN74LVC1G07
posDownSMA
VCC
nc
A
Y
GND
1A
1B
2A
2B
1Y
2Y

11. SPARE PARTS

1 - COLUMN

Electrical and mechanical parts

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

Rif.	Order code	Description	Note
--	6207091200	General supply cable	
--	6207091300	Ground cable #1	
--	6207091900	Generator board A10 power supply cable X2-X70	
--	6207090900	CanBus cable X18	
--	6207090600	CanBus cable X11	
--	5007040100	Touch screen Ethernet cable (L=2m)	
--	5007090100	Ethernet cable (L=5m)	
--	6207092000	Ethernet cable with ferrite choke (L=5m)	

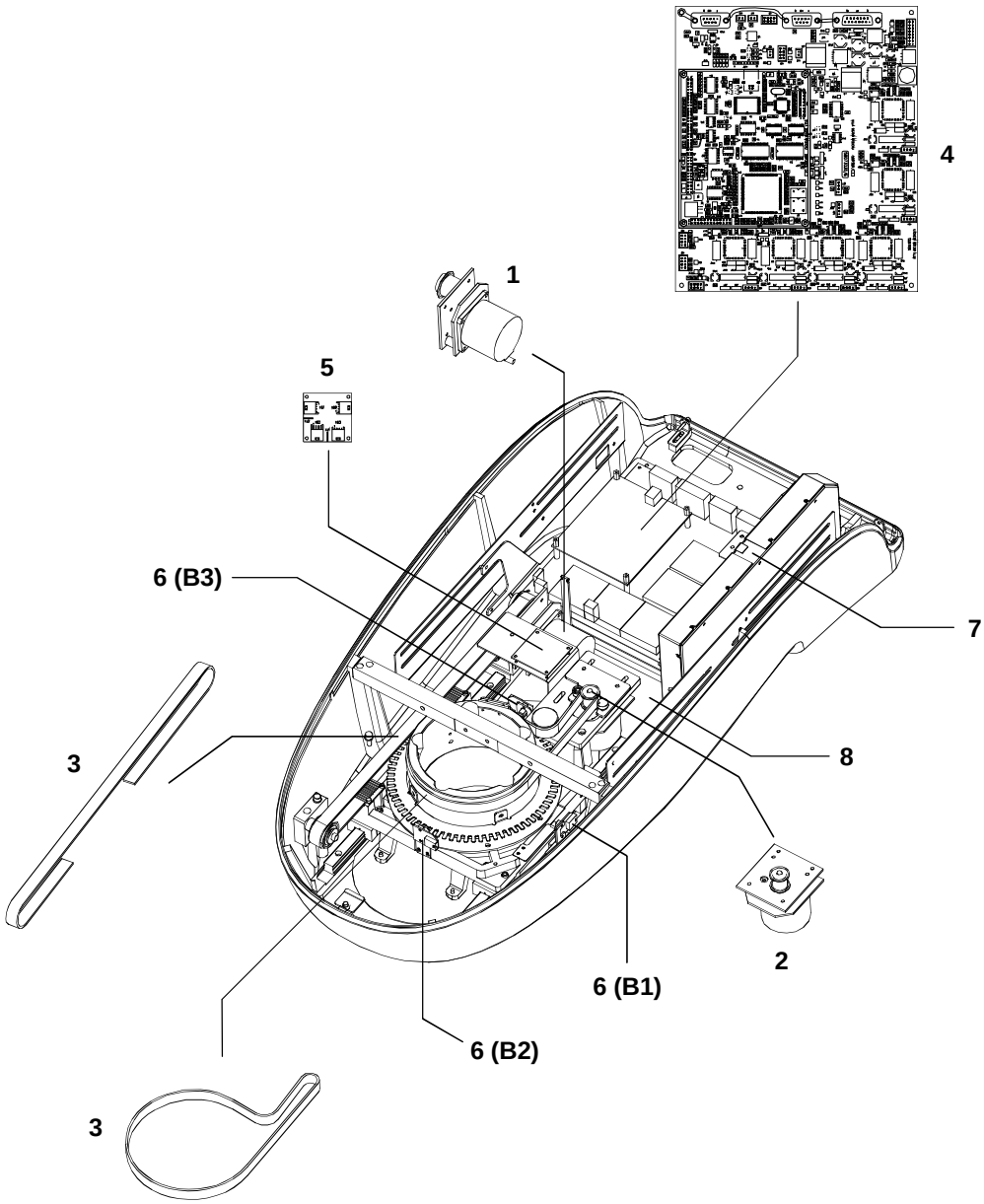
2 - UPPER MOVEMENT ASSY

Cables

Ref.	Order code	Description	Note
--	6207042200	Rotation group motor and signals cable X25 / X26 – X62	
--	6207040200	Y-axis signal cable X27 – B1	
--	6207040600	CanBus cable X20	
--	6207040700	Ground cable # 2	
--	6207040900	Collimator optical sensor cable X70 – Z2	
--	6207041000	Collimator motor power supply cable X29 / X30 – X64 / X65	
--	6207041300	Sensor holder position signal cable X33 – B6 / B7	
--	6207042100	Generator board A10 power supply cable X70 – Z2	
--	6207043400	Partial Volume cable X105 – X5	
--	6207043600	Power and signal 3D sensor cable X83 / X32 / X93 – X85 / Varian sensor	
--	6207080900	Ground cable # 3	

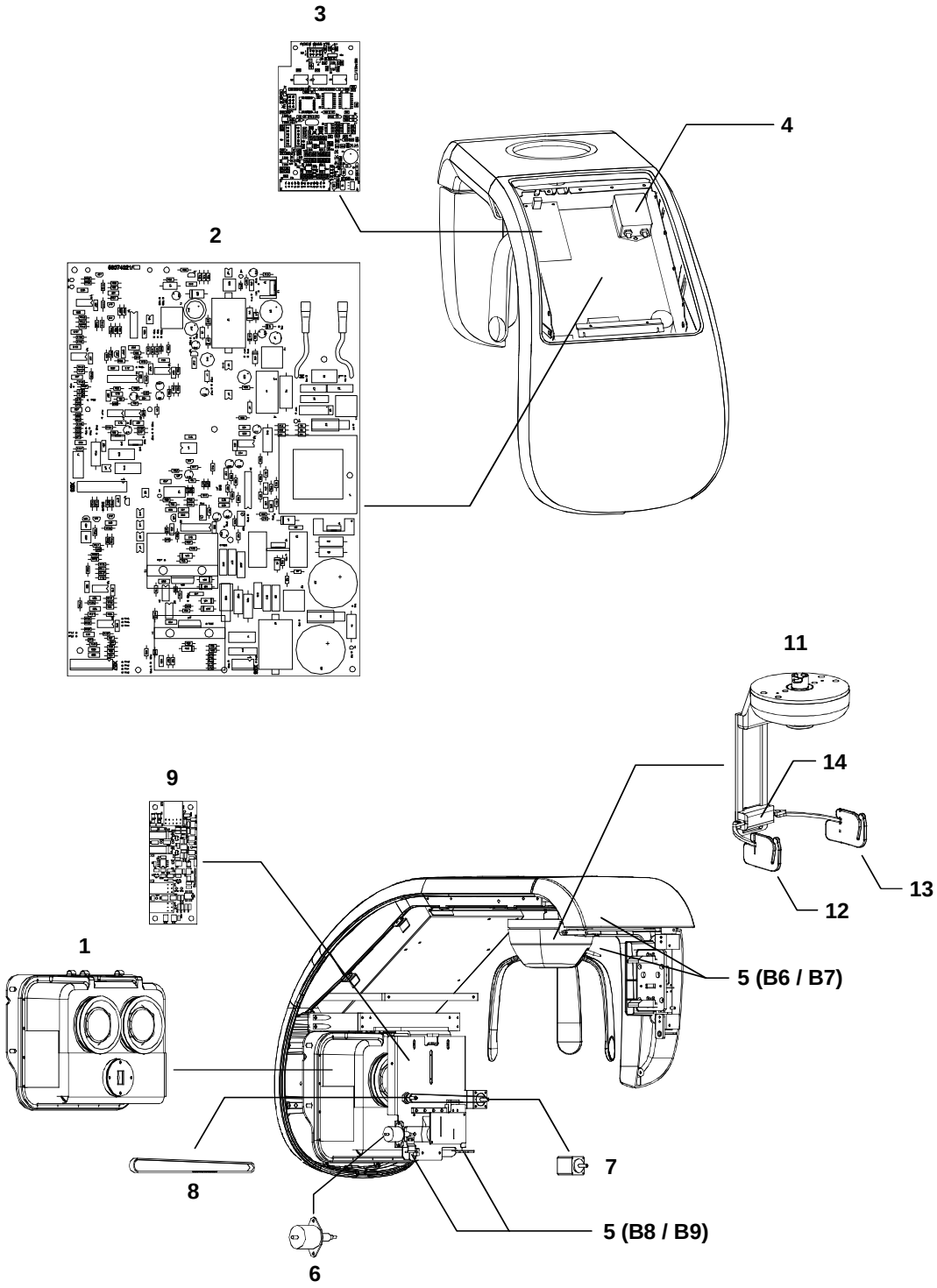
Electrical and mechanical parts

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	5807302900	Optical sersor board B1 / B2 / B3	
7	4695444100	DSPU board	
8	4695456700	HUB D-Link	


4
1
5
6 (B3)
7
3
8
2
6 (B1)
6 (B2)
3

3 - ROTATION ARM

Ref.	Order code	Description	Note
1	6607000300	3D HF Tubehead	
2	5807402100	Generator board A10	
3	5807403700	Generator CPU board A9	
4	4192212300	Line filter Z2	
5	5807302900	Optical sensor board B6 / B7 / B8 / B9	
6	6607120200	Soft Tissue Filter motor M6	
7	6207120500	Primary collimator motor M5	
8	4990803900	Primary collimator dragging belt	
9	5807602300	Partial Volume board A26	
--	2300940400	Partial Volume shutter driving wire	
--	6207120800	Partial Volume all sensor board B12 / B13	
11	6607010900	Temple clamp centering device assy	
12	6607010301	SX Temple clamp	
13	6607010401	DX Temple clamp	
14	6607014100	Temple clamps support	
--	4695472900	PAXSCAN 1313DX sensor assy	
--	5807403900	Fans power supply and temperature sensor board A23	
--	6607070600	Upper fun assy	
--	6607070700	Lower funs assy	


3
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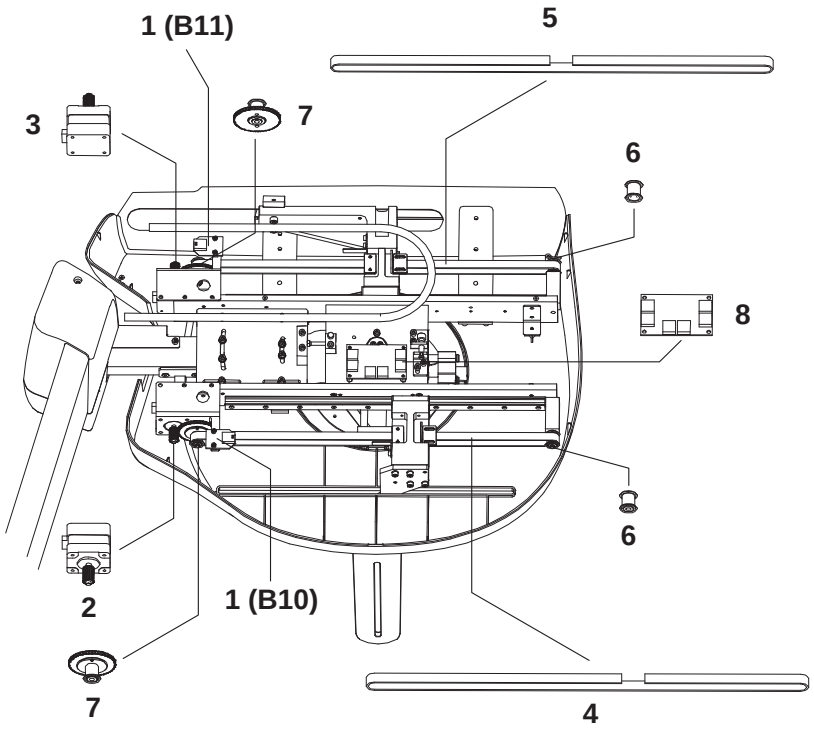
2
11
14
9
13
12
1
5 (B6 / B7)
7
8
5 (B8 / B9)
6

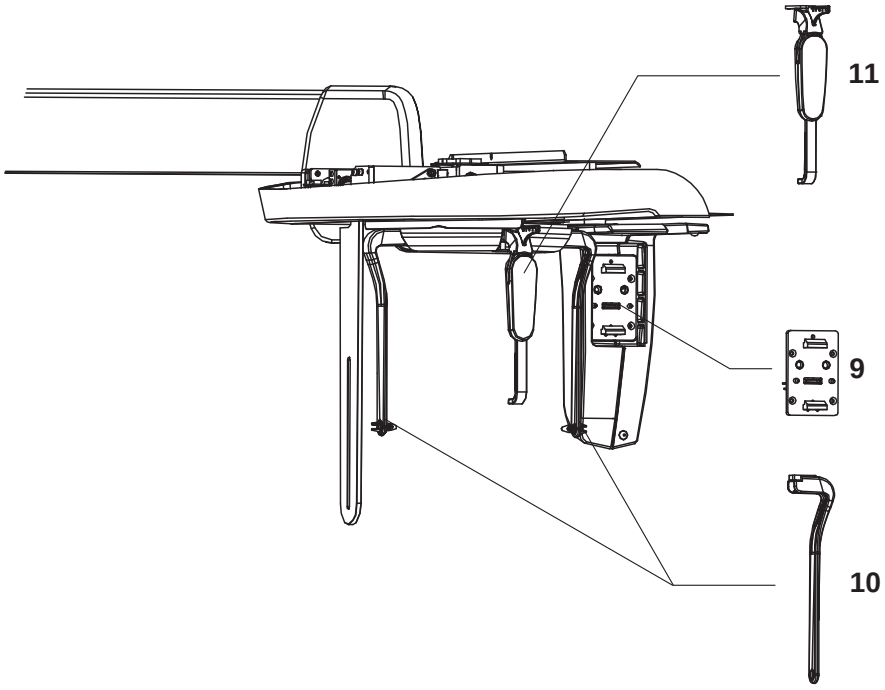
4 – COVERS

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	6607150100	Console covers (upper + lower)	
8	5407086601	Ceph device upper cover	
9	5407086905	Ceph device lower cover	
10	5407087005	Ceph centring device lower cover	
11	5407086705	Ceph arm lower cover	
12	5407086805	Ceph arm upper cover	
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 = 870 mm)	
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	


1 (B11)
5
3
7
6
8
6
2
1 (B10)
7
4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6 – ACCESSORIES AND SERVICE TOOLS

Ref.	Order code	Description	Note
--	6607090100	PAN centring bite (50 pcs)	
--	6107110700	Disposable bite protective sleeves (100 pcs)	
--	6607080200	Ceph ear pivot (50 pcs)	
--	6607098005	Panoramic standard chin support	
--	6607099305	Panoramic chin support (reduced height)	
--	5407098105	Edentulous patients appendix	
--	6107090805	Lowered chin support for SINUS	
--	6607099800	TMJ positioner	
--	6107110800	TMJ positioner protective sleevers (60 pcs)	
--	6607098205	Volumetric 3D TMJ chin support	
--	6107110900	Disposable head stripes (50 pcs)	
--	6607080900	CARPUS positioning plate	
--	6607900400	Laser centring tool	
--	5209900900	Digital sensor centring tool	
--	5607900800	1.5mm copper filter for digital sensor	
--	6695190000	3D service tools kit (includes: support plate, centering tool for Panoramic and centering cylinder)	

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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					
Offset_Horizontal					
Offset_Horizontal_2					
Digital Ceph sensor offset					
Primary collimator motor offset					

Parameter		**Factory setting**	**New setting**	**New setting**	**New setting**	**New setting**
Date						
Secondary collimator motor offset						
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						
Set 3D mode						
3D volume options						
User exam select						
Y offset 3D						

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