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# VISION

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CE 0051



## Service manual

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CE 0051

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## Service manual

This Manual belongs to **Vision** equipment serial No. ....

Release 9 April 2004 (Rev. 4)

## Revision history

Rev.	Date	Page/s	Modification description
0	07.08.00		Document approval.
1	19.01.01	All	ETL certification. Deletion of the electrical check of Potter call voltage set-up. Software release check description. Schematics update. Configuration default parameter update. Complete revision. (Ref. RDM 5031, 5050, 5054, 5059, 5064, 5070)
2	21.06.01	i, ii, iii, iv, 3-2, from 7-2 to 7-8, 7-10, 7-11, from 10-3 to 10-6, 11-26, 11-31, 13-5, 13-7, from 22-5 to 22-31, 22-41, 22-47, from 22-55 to 22-85, 22-103, 22-105	New software release. Fluoroscopy foot-switch predisposition. Schematics update. (Ref. RDM 5110, 5128, 5132, 5156, 5195)
3	11.01.02	3-2, 8-2, 8-3, from 22-5 to 22-31, 22-51	New Potter Bucky SD version (120/230V power supply) (Ref. RDM 5216, 5227, 5332)
4	09.04.04	3-2, 4-9, 5-5, 11-22, 11-31, 22-53	Implementation of Gilardoni Measuring Chamber (AEC). Notify body change for CE mark. Software update for collimator adjustment during Fluoroscopy. (Ref. RDM 5463, RDM 5781, RDM 5791)
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This manual in English is the original version.

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# 1. INTRODUCTION



**NOTE:**

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

## 1.1 Overview

**VISION** tilting table is a radiological device, which properly connected to specific accessories like Image Intensifiers (I.I.) with TV chains allows to carry out radiological investigation under **fluoroscopy** or **radiography** mode.

Making use of these modality, it is possible to perform general radiological investigations and special tests using contrast liquid means. Exams of bones, digestive function, double contrast, enema, urological radiography and all fluoroscopic investigations can be performed with this device.

**VISION** table is designed to be connected to new sophisticated **digital acquisition systems** allowing angiographic as well as flebography examinations.

This table has been designed using state of the art technology, achieving the best performance and highest safety.

Movements, digital functions and the interfaces to its accessories, joined to the "single fault" design approach, implemented on all motors, are controlled by microprocessors.

Positions, movements, and speeds are controlled by a CPU using a feed back loop from potentiometers for the detection of positioning parameters.

Tilting, longitudinal and transversal motions of the table top are motorised; longitudinal motion of the X-ray tube and spot film device group is servo-assisted.

Transversal motion and compression motion of the spot film device are manual and very smooth. Electromagnetic brakes grant braking.

SW algorithms can operate according to room dimensions, preventing any risk of collision among different sections of the device and the floor, the ceiling or the wall.

The spot film device is also designed using digital technology.

The spot film device accepts film cassettes having dimensions 18x24 to 35x35 (cm) for the metric types and 8x10 to 14x14 (inches) for the imperial unit's type.

Format sub-divisions program offers a complete set from the 1 on 1 to the sub-division 6 on 1.

The clean and accurate separation between images on the film is granted by the leaded shutters inside the spot film device.

A quick and accurate positioning of the serial changer tray allows a very short transition time between the fluoroscopic and radiographic mode.

Different functions and control of the accessories is made possible by a flat and waterproof panel.

A visual alphanumeric display with 2 lines and 20 characters per line is the user interface with the operator.

The display shows the information about the current cassette format, the number of images still available, the position of the table, the operating mode, alarms, collisions, failure messages, etc.

A complete diagnostic self test is operative in the digital control of the system.

This allows operators to immediately detect possible failures.

The compressor, controlled by the central CPU, is automatically driven in the compression area when a cross sub-division is selected.

Manual operation of the compressor to bring it in and out of field any time during use, can be selected by a key command.

Vibrating grid has the motion synchronised with ray emission.

The spot film device is designed to allow the adoption of an automatic exposure chamber (AEC).

Ergonomic handles allow an easy use of the spot film device in any condition: vertical or horizontal position, right or left handed operators.

To optimise ergonomicity X-ray exposure and fluoroscopy commands are duplicated.

The under table beam limiting device is completely electronic.

Besides the standard automatic function, "Hold" mode is available allowing to maintain the aperture used in fluoroscopy also in radiography mode.

## **1.2 Scope of the manual**

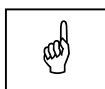
This manual is aimed at supplying the service engineer instruction to obtain a functionality of the unit safe and effective operation of the device.

The device must be operated according to the procedures described in the manual and only for its intended use.

**VISION** is a medical device and as such it can be used only under the supervision of a medical doctor or trained specialists, having the necessary understanding of X-ray radiation protection.

The user is responsible to implement requested legal actions for a proper installation and operation of the device.

## **1.3 Icons appearing in the manual**



**Indicates a “NOTE”**; the utmost attention shall be devoted to the reading of paragraphs marked by this icon.



**Indicates a “WARNING”**; paragraphs marked with this icon cover patient and/or operator safety aspects.

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## 2. SAFETY ASPECTS



### WARNING:

Content of this chapter must be carefully read and implemented to prevent damages to the devices and injures to people.

### 2.1 Warnings

*VILLA SISTEMI MEDICALI S.p.a. designs and builds its devices to meet safety requirements and supplies all necessary information for their proper use.*

***VILLA SISTEMI MEDICALI S.p.a. is not responsible for:***

- *use of **VISION** device different from its intended use*
- *damages to the device, to the operator or to the patient caused by wrong installation, by maintenance operations carried out without following the procedures described in the user or service manuals or by wrong operation techniques*
- *mechanical or electrical changes implemented after installation and not explicitly authorized by VILLA SISTEMI MEDICALI S.p.a..*

**VISION** is suitable for use only in Hospital environment or in all establishments other than domestic and those directly connected to the low voltage power supply network that supplies buildings used for domestic purposes.

*Exclusively Authorized technical engineers from VILLA SISTEMI MEDICALI S.p.a. are allowed to service the device.*

*Authorized technical engineers only can remove the covers of the electrical cabinet and of the device gaining access to parts under voltage and to moving parts.*

*The device has NOT been designed to operate in the presence of vapor, anesthetic gas mixtures, oxygen and nitrogen protoxide.*

*Prevent water or other liquids spillage inside the device to avoid short circuits or corrosion.*

*Always disconnect the device from mains before cleaning it.*

*All movements are controlled by a powerful and sophisticated microprocessors.*

*Speed, positions, start and stop of these movements are controlled and managed by the SW programs of the device. In this approach, protections are fundamental to grant the highest safety for the user and the patient. Notwithstanding this intrinsic safety protections, the operator **MUST ALWAYS ACT CAREFULLY** whenever a movement is activated. The user in case of danger can press the red **EMERGENCY** button on the front part of the device. This button, stopping immediately any operation, is an effective tool available to the user in addition to the intrinsic safety protections of the device.*

*Before activating the tilting motion or the longitudinal motion of the table top, make sure that there are not hurdles close to the table, which may interfere with the motions.*

*While motorized motions are in progress take care of people inside the radiological room.*

*Before activating motorized parts of the unit such as tilting, table top longitudinal and transversal and SFD scanning, make sure that the patient is properly laying on the table top and that both legs and arms are within the borders of the table top itself. Instruct the patient to hold on to the handles.*

*Even though **VISION** has been designed with a high level of protection to electromagnetic fields, it is necessary to install it at a proper distance from electrical energy transformation facilities, continuity suppliers, portable radiotransmitters, and cellular phones. Use of the latest is allowed only at a distance from any part of the device as reported in the table:*

<b>Power of the R.F. source</b>	<b>Distance (m)</b>
10mW	0.3
100mW	1
1W	3
10W	8
100W	30

*Equipment or instruments operating in the vicinity of **VISION** must be complaint with EMC standards. Non compliant instruments, known for their sensitivity to EM fields must be installed at a distance of at least 3 m from **VISION** and must be powered by a dedicated line.*

***VISION** can be used in an electromagnetic environment as specified below:*

Electromagnetic emissions	Compliance	EMC environment requirements
Radiated and conducted emissions CISPR 11	Class A	<b>VISION</b> can be connected to a line other than for domestic appliance.
	Group I	<b>VISION</b> generates radio frequency energy only internally. R.F. energy generated does not cause interference with electrical appliances used in its vicinity
Harmonic emission EN 61000-3-2	Compliant	<b>VISION</b> can be connected to a line other than for domestic appliance.
Voltage spikes/flicker emission EN 61000-3-3	Compliant	<b>VISION</b> can be connected to a line other than for domestic appliance.
Susceptibility EN 60601-1-2 (EN 61000-4-2 /3 /4 / 5 /6 /8 /11)	Compliant	<b>VISION</b> can be connected to a line other than for domestic appliance.

***VISION** cannot be installed in surgery rooms.*

***VISION** must be turned off while electrosurgery cutter or similar equipment is in use.*

*All power wires for motor supply must be tightened rigidly in groups of at least three wires at a distance not greater than 3 cm from their connectors.*

*Take care to clean and decontaminate all parts in contact with the patient, if necessary.*

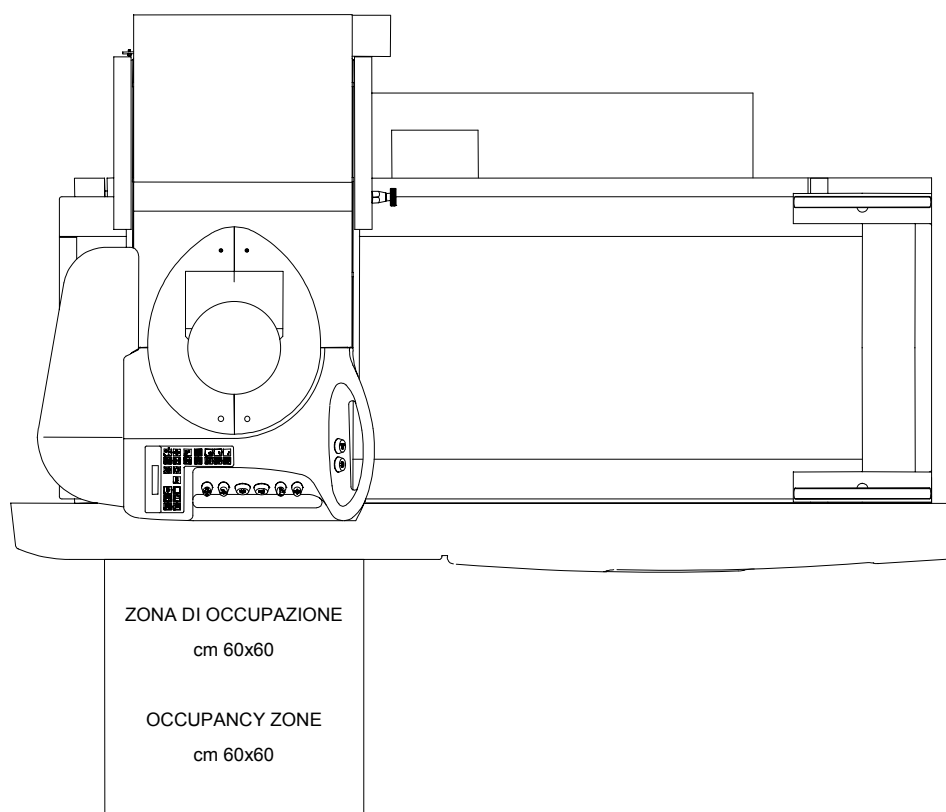
## 2.2 Radiation protection warnings

VILLA SISTEMI MEDICALI S.p.a. designs and manufactures its devices in compliance with safety requirements; besides all information and warning related to the dangers of devices connected to X-ray generators are supplied.

Authorized users of the device for radiological investigations must follow the rules for ionizing radiation protection as listed here below.

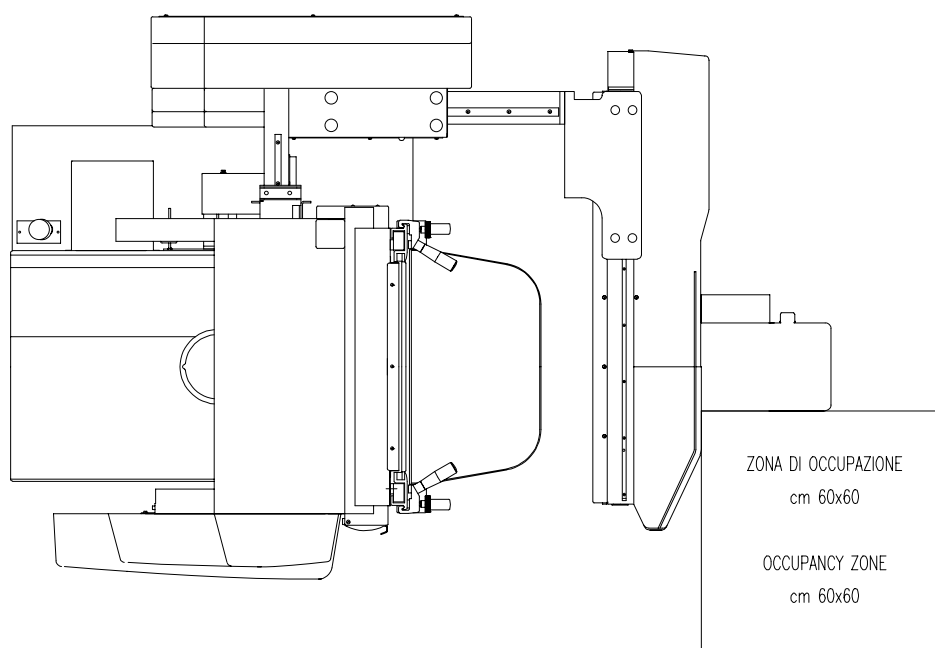
To protect the patient from scattered radiation during the investigation it is necessary to use, where necessary, dedicated barriers (lead coats).

During the investigation only the patient and the operator are allowed to stay in the radiology room and only in case of necessity it is permitted to authorized personnel to stay inside the room. These individuals must wear protective clothes. During exposure the operator must stand in the areas shown in Figure 2-1 e Figure 2-2 shown below. While standing in those areas the operator must protect himself from scattered radiation, using the leaded apron on the lower side of the spot film device positioning it between himself and the X-ray source.



**Figure 2-1 - Planimetry of the device with horizontal table top**





**Figure 2-2 - Planimetry of the device with vertical table top**

Maximum scattered radiation in the standing areas are lower than the limits specified by reference standard IEC 601-1-3, specifically for technique factors of 120 kV, 3 mA doses from scattered radiation are below the value reported in the following table, provided that the leaded protection apron of the spot film device is correctly positioned.

Table Top Position	Height from floor in cm in the standing area	Max allowable dose in 1 hour mGy
Horizontal or vertical	0 - 40	1,5
Horizontal	40 - 200	0,15
Vertical	40 - 170	0,15

Scattered radiation dose in the area of handles and keypad on the spot film device are lower than the limit of the reference standard IEC 601-1-3. Specifically the limit is set at **0.5 mGy/h.**

## 2.3 Environment and disposal risks

Some parts of **VISION** contain materials which have to be disposed of in a controlled way at the end of useful life.










More specifically the device contains:

- **Motor gearbox:** lubricating oil, steel, aluminum
- **Motors:** iron, copper, non biodegradable plastic
- **Printed circuit board:** iron, aluminum, copper, non biodegradable plastic, PCB supporting material.

**Disposable of the device at the end of its life and the cost of this operation cannot be charged to VILLA SISTEMI MEDICALI S.p.a..**

## 2.4 Symbols

The present manual makes use of the symbols described here below:

Symbol	Description
	Type B insulation device with type B applied parts
	Alternating current
	Neutral terminal
	Three phase line connection point
	Protection grounding
	Functional grounding
	Attention: check accompanying documentation
	Attention: hands off
	Dangerous Voltage

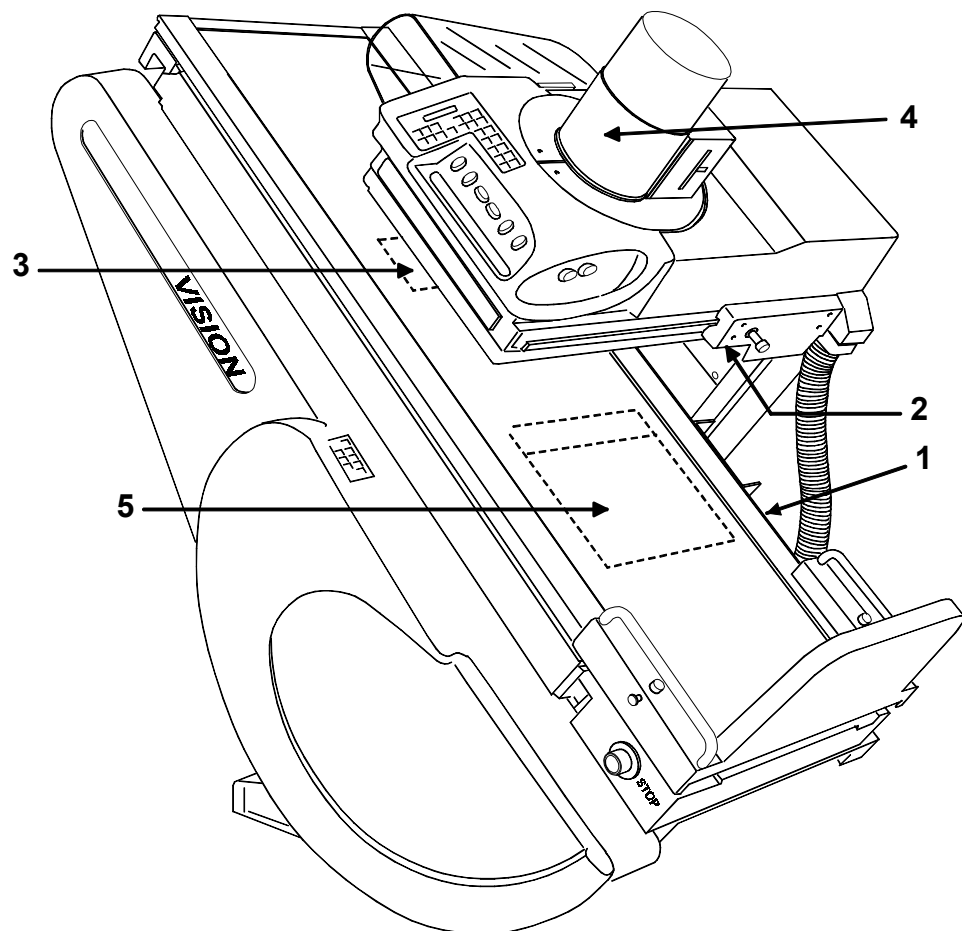
Symbols used in the keyboard are explained in the section describing the functionality of the table.

## **3. DESCRIPTION**

### **3.1 Labeling**




**VISION** is labeled with a set of labels identifying different components according to the requirements of the international standards.

The following picture shows the different labels positioned on **VISION** table:



## 1a

### Table main label

	<b>Made in Italy</b>	
	<b>VISION</b>	Model: 9764X0YZ00
	Line: 380-400Vac 3N 3.5A 50/60Hz	
	S/N:	XXYYZZZZ
	Manufactured:	MMMMYYYY
THIS PRODUCT COMPLIES WITH FDA RADIATION PERFORMANCE STANDARDS 21 CFR SUBCHAPTER J IN EFFECT AT DATE OF MANUFACTURE		
20090 Buccinasco MILANO - ITALIA	 0051	




## 1b

### ETL certification label






## 2

### Spot film device label

	<b>Made in Italy</b>	
	<b>VISION SPOT FILM DEVICE</b>	Model: 8212000X
	S/N:	XXYYZZZZ
	Manufactured:	MMMMYYYY
	THIS PRODUCT COMPLIES WITH FDA RADIATION PERFORMANCE STANDARDS 21 CFR SUBCHAPTER J IN EFFECT AT DATE OF MANUFACTURE	
20090 Buccinasco MILANO - ITALIA	 0051	




## 3

### Undertable collimator label

	<b>Made in Italy</b>	
	<b>VISION BEAM LIMITING DEVICE</b>	Model: 861100XX
	Inherent filtration: 0.5mm Al eq 100kV HVL 2.7mm Al	
	S/N: XXYYZZZZ	Manufactured: MMMMYYYY
	THIS PRODUCT COMPLIES WITH FDA RADIATION PERFORMANCE STANDARDS 21 CFR SUBCHAPTER J IN EFFECT AT DATE OF MANUFACTURE	
20090 Buccinasco MILANO - ITALIA	 0051	



## 4

### I.I. label

	<b>Made in Italy</b>	
	<b>IB SYSTEM</b>	Type: 8716AABCDE
	S/N:	XXYYZZZZ
	Manufactured:	MMMMYYYY
	I.I. Tube-head Sub-assembly	
20090 Buccinasco MILANO - ITALIA	 0051	

## 5

### Potter label (optional)

	<b>Made in Italy</b>	
	<b>Potter SD</b>	Type: 8620XX6XXX
	Line: 120 / 230 Vac	0.22 / 0.11 A 50 / 60 Hz
	S/N:	XXYYZZZZ
	Manufactured:	MMMMYYYY
20090 Buccinasco MILANO - ITALIA		

The codes shown on the "Table main label" (see label 1 of previous page) varies according to the version of the device.

Next table shows the most common versions of the device:

<b>CODE</b>	<b>TABLE TOP TYPE</b>	<b>CASSETTES TYPE</b>	<b>POTTER BUCKY</b>	<b>TUBE STAND</b>	<b>TUBE STAND COLLIMATOR</b>
9764000000	2 WAYS	cm	NO	NO	NO
9764000100	2 WAYS	inch	NO	NO	NO
9764004000	4 WAYS	cm	NO	NO	NO
9764004100	4 WAYS	inch	NO	NO	NO
9764001000	2 WAYS	cm	YES	NO	NO
9764001100	2 WAYS	inch	YES	NO	NO
9764005000	4 WAYS	cm	YES	NO	NO
9764005100	4 WAYS	inch	YES	NO	NO
9764002000	2 WAYS	cm	YES	YES	cm
9764002100	2 WAYS	inch	YES	YES	inch
9764006000	4 WAYS	cm	YES	YES	cm
9764006100	4 WAYS	inch	YES	YES	inch

## 3.2 Description

**VISION** derives from the evolution of technology and design of tilting tables.

**VISION** has been designed according to the international standards necessary for the **CE** mark, and is compliant with **21CFR subchapter J**, granting highest safety standards for the user and for the operator.

**VISION** is an universal table for radiological diagnostics, capable of satisfying all needs. It can be used for digestive tract investigation, cranial investigations, bone, urological and vascular investigation, lungs and breathing apparatus and when equipped with a digital acquisition system for angiographic investigations.

**VISION** is driven by a keypad ergonomically located.

The keypad carries two keys to activate fluoroscopy and radiography mode; these commands are duplicated to be easily used with the table-top both horizontal or vertical, by right handed or left handed users. A second keypad duplicating movements commands (tilting, longitudinal and transversal table top) is located on the edge of the table. His second keypad also allows table top centering.

**VISION** is a device with angle range  $+90^{\circ}$  a  $-15^{\circ}$ , driven by a microprocessor and designed to offer maximum flexibility in its intended use for radiological investigations.

**VISION** is equipped with an electronic beam-limiting device positioned under the table with squared and rectangular beam limitation.

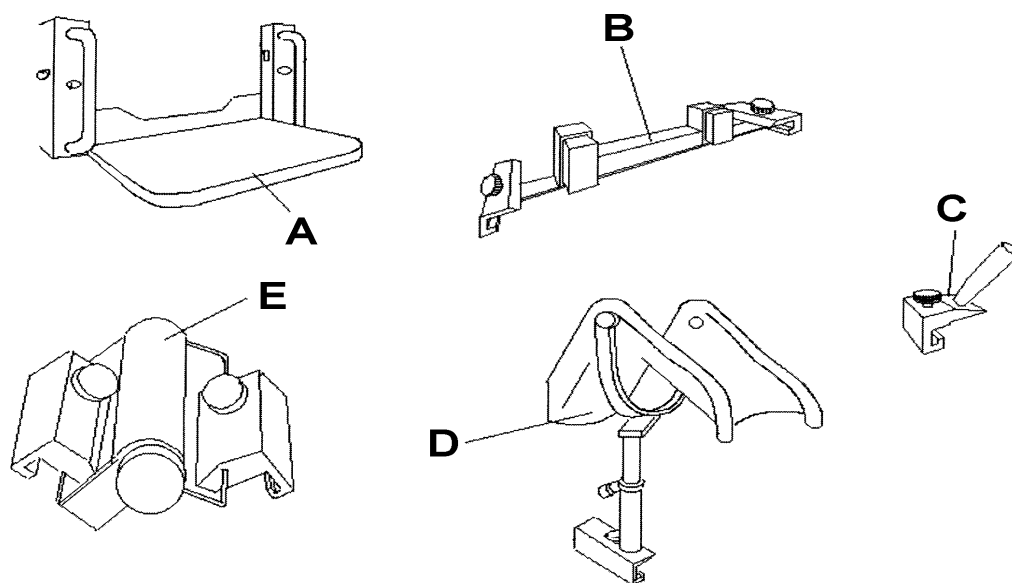
Standard version of **VISION** is equipped with a microprocessor controlled spot film device having the possibility to use all film formats from 18x24 to 35x35 cm or from 8x10 to 14x14 inches with a wide variety of subdivisions and with a self centering cassettes tray.

Besides standard accessories normally supplied with **VISION**, optional accessories may be supplied if specified in the order form.

The following table lists all available accessories.

The "delivery" column states if they are supplied in standard configuration or have to be ordered separately.

Ref.	Description	Delivery
<b>A</b>	Patient foot rest	Standard
<b>B</b>	Shoulder and head support	Standard
<b>C</b>	Patient support handle (N°2 pieces)	Standard
<b>D</b>	Leg support (N°2 pieces)	Optional
<b>E</b>	Compression belt tightener	Optional
<b>F</b>	Lateral cassette holder	Optional




All the available accessories are easily attachable and mounted on suitable rails of the examination table.

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## 4. TECHNICAL DATA

### 4.1 Technical features

General features		
Unit type	VISION	
Manufacturer	Villa Sistemi Medicali S.p.A. 20090 Buccinasco (MI) Italy	
Equipment type and classification according to IEC 60601-1	Class I with type B applied parts	
Equipment type and classification according CFR21	Class II	
Degree of protection according to IEC 60529	IP00	
Mode of operation	Continuous operation	
Mechanical features		
Weight	1030 Kg	
Max height with vertical table top	2695 mm	
Max length with centred table top	2020 mm	
Max width with centred table top	1510 mm	
Distance table top - floor	895 mm	
I.I. predisposition	over table integrated. Maximum size allowed 12". Maximum weight allowed 43 kg	
Serial changer	over table	
X-ray tube and collimator	under table	
Focus to skin distance (under table X-ray source)	405 mm	
Maximum patient weight	135 kg	

<b>Electrical features</b>	
Standard voltage	3N~ 380-400 V ac $\pm 10\%$
Optional voltage	3N~ 208/220/415/480 V ac $\pm 10\%$ with optional external auto transformer
Frequency	50/60 Hz
Maximum current	6.5 A @ 208 Vac $\pm 10\%$ 6.0 A @ 220 Vac $\pm 10\%$ 3.5 A @ 380-400 Vac $\pm 10\%$ 3.5 A @ 415 Vac $\pm 10\%$ 3.0 A @ 480 Vac $\pm 10\%$
Fuses on auto transformer	8 AT @ 208 Vac 8 AT @ 220 Vac 6 AT @ 415 Vac 6 AT @ 480 Vac
Unit electrical protection	4 A breaker
Power	2.5 kVA
Line impedance	<0.5 $\Omega$ @ 208 Vac $\pm 10\%$ <0.5 $\Omega$ @ 220 Vac $\pm 10\%$ <1.0 $\Omega$ @ 380-400 Vac $\pm 10\%$ <1.0 $\Omega$ @ 415 Vac $\pm 10\%$ <1.0 $\Omega$ @ 480 Vac $\pm 10\%$
Line voltage regulation (%)	<2% @ 208 Vac $\pm 10\%$ <2% @ 220 Vac $\pm 10\%$ <1% @ 380-400 Vac $\pm 10\%$ <1% @ 415 Vac $\pm 10\%$ <1% @ 480 Vac $\pm 10\%$
<b>Movements</b>	
Longitudinal table top	motorised
Transversal table top	motorised
SFD longitudinal	manual servo assisted
SFD transversal	manual, moving force <40N
SFD compression (SID movement)	manual, moving force <40N
Tilting	motorised
Motorised movement control	feed back from potentiometer, position and speed control



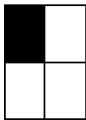
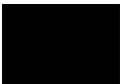





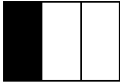

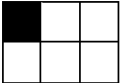
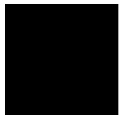
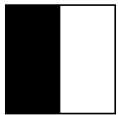
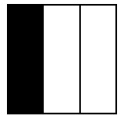

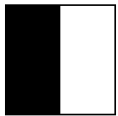
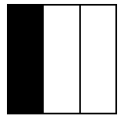
<b>Movements range and speed</b>	
Longitudinal table top head side	600 mm
Longitudinal table top foot side	400 mm
Table top longitudinal speed	31 mm/s @ 50 Hz 37 mm/s @ 60 Hz
Transversal table top inner side	100 mm (optional)
Transversal table top outer side	100 mm (optional)
Table top transversal speed	65 mm/s
Longitudinal SFD / Tube	555 mm
Transversal SFD / Tube	220 mm
Compression (SID)	265 mm
Bucky mode (optional)	SFD retractable out of X-ray field
SID distance (depending by X-ray tube type)	670÷935 mm
SFD - Table top distance	195÷460 mm
SFD bottom - Film distance	69 mm
Tilting vertical	90°
Tilting trendelembourg	-15°
Tilting angular speed	3.2°/s @ 50 Hz 3.9°/s @ 60 Hz
<b>Table top features</b>	
Length	2020 mm
Width	700 mm
Surface	flat
Material	plastic laminated
Filtration	0.8 mm Al eq @ 100 kVp, HVL 2.7 mm Al

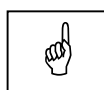
<b>SE6 Electronic serial charger</b>	
Technology	digital electronic, double microprocessor (main + supervisor)
Cassettes dimensions	from 18x24 to 35x35
Sub-division	from 1 on 1 up to 6 on 1
Rapid sequence	on all sub-divisions
Fluoro - Exposure time passage	min 0.7 - max 1.3 sec depending on cassettes size and sub-division
Average time between 2 exposures in rapid sequence	0.4 sec
Cassettes loading	left side
Cassettes tray	auto centring
Collimation	electronic with inside leaded shutters
AEC	predisposed
Grid type	<ul style="list-style-type: none"> <li>• dimensions 360x380 mm</li> <li>• ratio: 10:1</li> <li>• focal 75 cm</li> <li>• lines/cm: 47</li> </ul> others on request
Grid movement	vibrating synchronised with X-ray
Compressor functionality	<ul style="list-style-type: none"> <li>• automatic</li> <li>• manual</li> </ul>
Accessories controls	with pushbutton on control panel
User interface	with alphanumeric display (2 lines for 20 characters each) to visualise: <ul style="list-style-type: none"> <li>• using modality</li> <li>• unit status</li> <li>• internal fault alarm</li> <li>• external accessories alarm</li> </ul>
Digital image acquisition unit	predisposed for connection
SFD X-ray absorption (grid excluded)	0.5 mm Al eq @ 100 kVp, HVL 2.7 mm Al

<b>Under table electronic collimator</b>	
Limitation	square and rectangular
Number of limitation shutters	4
Limitation shutters material	Fe + Pb
Working modality	<ul style="list-style-type: none"> <li>• electronic</li> <li>• electronic + hold mode</li> </ul>
Total collimator filtration	0.5 mm Al eq @ 100 kV HVL 2.7 mm Al
Leakage radiation	≤ 45 mR/hr @ 150 kVp, 350 W
Minimum size of X-ray field @ 1m	< 1 cm <sup>2</sup>
<b>Functionality</b>	
Tilting indicator	on alphanumeric display
SID distance indicator	on alphanumeric display
Table top centring	on control panel on table side
Tilting automatic stop	at limits and on horizontal position
Movements safeties	"dead men controls" with "single fault" function for to stop movement in case of fault
Auto test	on all components
Anti-collision safeties	by software algorithms, room dimensions data used to stop movements in case of collision.
Manual movements stop	with electromagnetic brakes
Command	on SFD control panel: <ul style="list-style-type: none"> <li>• with joystick with single fault for movements</li> <li>• with buttons on control panel</li> </ul>
<b>Accessories</b>	
Foot rest (standard supplied)	with stops every 100 mm
Hand grips (standard supplied)	2
Shoulder support (standard supplied)	continuos adjustment
Legs support (optional)	continuos adjustment
Compression belt (optional)	continuos adjustment

<b>Environmental conditions</b>	
Operating environmental conditions	Temperature: from +10 to +40° Cels. Humidity: from 30 to 75 % Pressure: from 700 to 1060 hPa
Shipping and stocking environmental conditions	Temperature: from -20 to +70° Cels. Humidity: ≤ 95% not condensed Pressure: > 630 hPa
<b>Undertable bucky (Option)</b>	
Longitudinal movements	Manual Moving force < 20N with table in horizontal position Moving force < 30N with table in vertical position
Range of movement	910 mm
Brakes	Electromagnetic
Cassette size	From 13x18 cm to 35x43 cm
Standard cassettes tray	Manual loading – auto centering
Sensing cassettes tray	Predisposed to accept
X-Ray beam to film centering	With spot light on manual collimator
AEC measuring chamber	Predisposed for installation of solid state or ion chambers
Film to table top distance	84 mm
Grid movement	Synchronised with X-ray emission
Grid start voltage	Selectable with jumpers: 220Vac/120Vac/24Vdc
Grid	Preferred models: ratio 10:1 focal 120 cm lines/cm: 34 Other models on request

## 4.2 CENTIMETER cassette sub-division program

<b>18x24</b>		 9x24		 9x12	
<b>24x18</b>		 12x18			
<b>24x30</b>		 12x30			
<b>30x24</b>		 15x24	 10x24	 15x12	 10x12
<b>30x30</b>		 15x30	 10x30		
<b>35x35</b>		 17x35	 12x35		




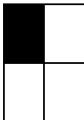
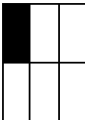
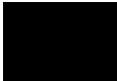


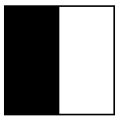
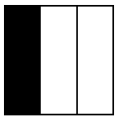
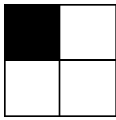
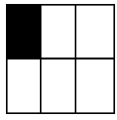




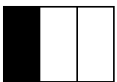
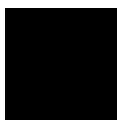
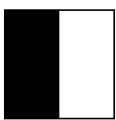
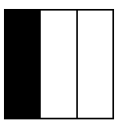


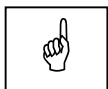
**NOTE:**

First size number is referred to transversal table top axe (patient left-right).

Indicated sizes on different sub-divisions are nominal.

### 4.3 INCH cassette sub-division program

<b>8x10</b>		 4x10	 2.5x10	 4x5	 2.5x5
<b>10x8</b>		 5x8			
<b>9.5x9.5</b>		 4.7x9.5	 3.2x9.5	 4.7x4.7	 3.2x4.7
<b>10x12</b>		 5x12			
<b>12x10</b>		 6x10	 4x10		
<b>14x14</b>		 7x14	 5x14		



**NOTE:**

First size number is referred to transversal table top axe (patient left-right).

Indicated sizes on different sub-divisions are nominal.



## 4.4 Applicable standards and regulations

**VISION** complies with following standards:

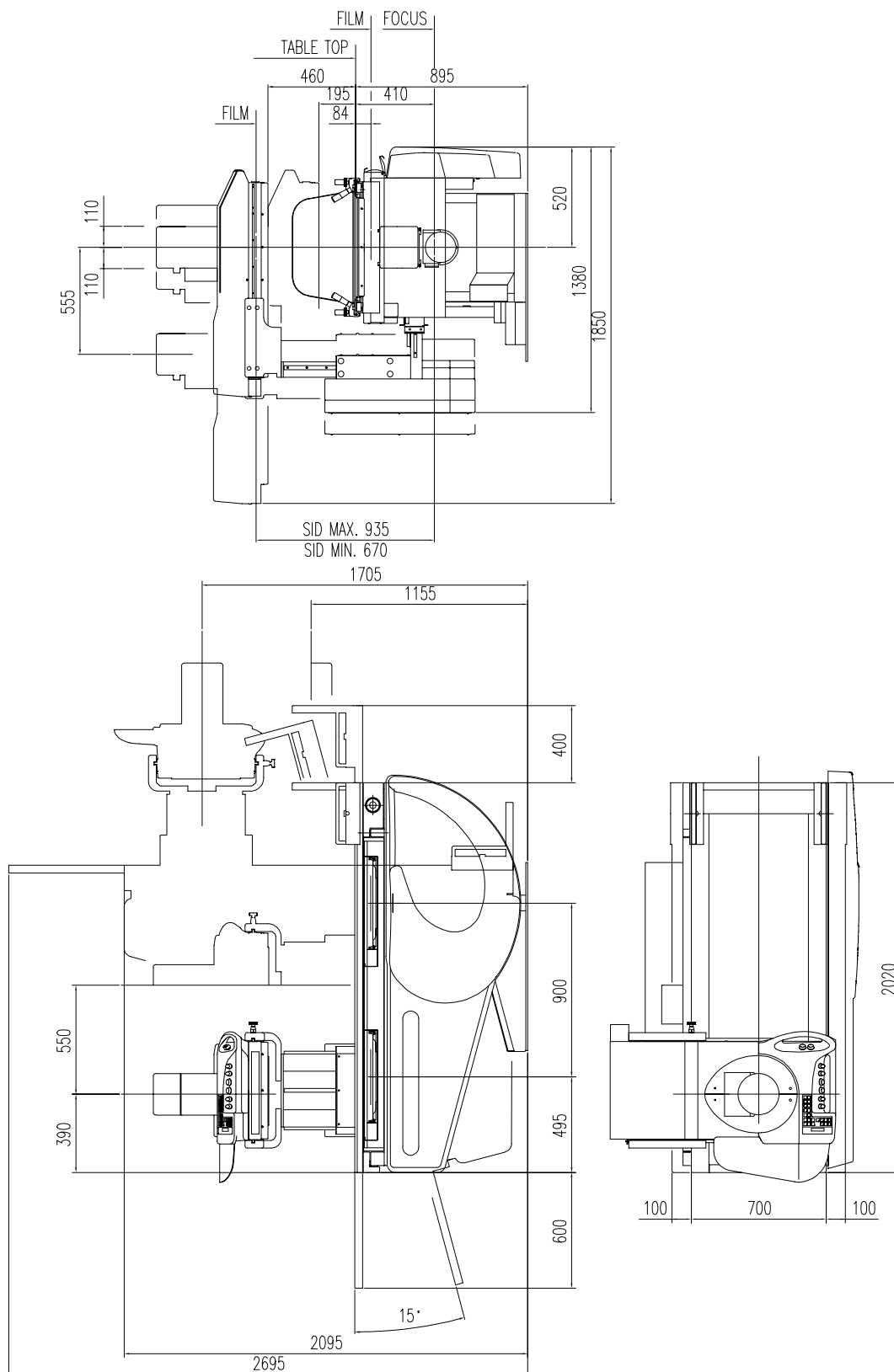
EN 60601-1	Medical electrical equipment. General requirement for safety (including amendments A1+A2+A11+A12+A13)
EN 60601-1-2	Medical electrical equipment. General requirement for safety. 2 – Collateral Standard: Electromagnetic compatibility.
EN 60601-1-3	Medical electrical equipment. General requirement for safety. 3 – Collateral Standard: General requirement for radiation protection in diagnostic X-ray equipment.
EN 60601-2-32	Medical electrical equipment. Particular requirements for safety of associated equipment of X-ray equipment.
IEC 60601-1-4	Medical electrical equipment. General requirement for safety. 3 – Collateral Standard: Programmable electrical medical systems.
IEC 417	Graphical symbols for use on equipment.
IEC 878	Graphical symbols for electrical equipment in medical practice.
ISO 10993-1	Biocompatibility.
CFR 21	Code federal regulation. Sub chapter J
UL 2601-1	Medical electrical equipment, part 1. General requirements for safety



0051

CE symbol grants **VISION** compliance to the European Directive for Medical Devices 93/42 as a class IIB device.

## 4.5 Overall dimensions



**Figure 4-1**

## 5. ACCESSORIES AND COMPATIBLE COMPONENTS

**VISION** is part of a radiological system which incorporates a number of different accessories.

For the purposes of their mechanical and/or electrical interconnection, the compatibility constraints of the various accessories must be known.

The compatibility requirements for **VISION** are set out below:

Accessory	Type of compatibility
Generator	Electrical
X-ray housing	Mechanical
Image intensifier	Mechanical
Grid	Mechanical
Measuring chamber (AEC)	Mechanical

The compatible components are described in the following paragraphs.

### 5.1 Generators

**VISION** can be connected to all X-ray generators which are electrically compatible with the I/O signals (input/output) on general terminal board X0 of **VISION**.

The types of signals and their electrical characteristics are detailed in chapter 10 "*Connecting the IN/OUT interface*".

The standard configurations of **VISION** support the following generators:

Manufacturer	Model
Odel X-ray (I)	Genius 65 HF
Odel X-ray (I)	Genius 80 HF
Radiological Research (I)	EOS 50 HF
CPI (Can)	Millenia (all models)

## 5.2 X-ray housings

**VISION** table can be equipped with an under table X-ray housing whose beam is centred on the serial changer.

The tube housing is fixed to the support on the serial changer – tube carriage and the electronic collimator is mounted on it by means of a lead cone.

The electrical compatibility of the X-ray housing must be checked for proper connection to the generator.

The mechanical compatibility of **VISION** must also be ascertained.

Its weight and dimensions respectively determine the balancing of the carriage and the trendelenbourg limit of the tilting motion.

To ensure correct balancing, the weight of the housing (without HV cables) must not exceed **22 kg**.

To reach the established tilting limit of **-15°** towards trendelenbourg, the housing must be of the types listed below.

Any other housing must be checked to be sure that no collision will be present.

If it happens, caused by a housing with dimensions greater than acceptable, the X-ray tube may collide with the base cover of **VISION** when the trendelenbourg limit is reached.

In such a case, it is necessary to carefully determine what is the minimum tilting value towards trendelenbourg which does not produce a collision, and then proceed to adjust the new limit as described in paragraphs 11.4 *"Dimensions and movements range"* and 11.1 *"Potentiometer adjustments"*.

The standard configurations of **VISION** are compatible with the following tube housings:

Manufacturer	Model
IAE (I)	C52 - C52S (all models)
Comet (CH)	DX (all models)
Dunlee (USA)	PX1300C - PX1400 (all models)
Eureka (USA)	Sapphire (all models)

## 5.3 Image intensifier

**VISION** is equipped with a leaded iron plate for mounting an Image Intensifier.

This plate has a centre hole and a set of fixing holes, as a function of the size of the Image Intensifier (6", 9" or 12").

The maximum weight of the Image Intensifier complete with cables and camera must not exceed **43 kg**.

The standard configurations of **VISION** are compatible with the following Image Intensifiers:

Manufacturer	Model
Toshiba (J)	Series E models: 5794HV P1A-5804HV P1A 5764SD P1A-5765SD P1A 5830SD P1A-5796SD P1A
Thomson (F)	Models HP and HX: all up to 12"

## 5.4 Grids

**VISION** is supplied complete with a scatter-reduction grid. In order to install a different type of grid from the one fitted at the factory, take into account the following dimensional constraints for easy assembly of the grid frame:

- width (patient right-left dimension)     **380 mm**
- height (patient up-down dimension)     **360 mm**
- thickness     **from 2 to 5 mm**
- strip orientation     **parallel to 360 mm side**

Also take into account that the focus-film distance of **VISION** can be varied within the range: min **670 mm** and max **935 mm**. This parameter must be taken into account in order to choose a grid with adequate focusing values for this range. The standard configurations of **VISION** are compatible with the following grids:

Manufacturer	Model
Smit (NL)	all 380x360 models with adequate focusing
Guang Dong (Korea)	all 380x360 models with adequate focusing

The undertable Potter Bucky (optional) is prepared to accept grid with following characteristics:

- width (patient right-left dimension)     **480 mm**
- height (patient up-down dimension)     **438 mm**
- thickness     **from 2 to 5 mm**
- strip orientation     **parallel to 438 mm side**

Also take into account that the focus-film distance between column tube and Potter Bucky film can be varied within the range: min **100 mm** and max **1130 mm**.

This parameter must be taken into account in order to choose a grid with adequate focusing values for this range.

The standard configurations of **VISION** are compatible with the following grids:

Manufacturer	Model
Smit (NL)	all 480x438 models with adequate focusing
Guang Dong (Korea)	all 480x438 models with adequate focusing

## 5.5 Measuring chambers (AEC)

**VISION** serial changer incorporates supports for mounting a semiconductor or ionisation measuring chamber.

The constraints on the use of this accessory concern its maximum dimensions.

The measurement chamber must have the maximum dimensions set out below:

- width (patient left-right direction) **430 mm**
- height (patient up-down direction) **380 mm**
- thickness **max. 10 mm**

The standard configurations of **VISION** are compatible with the following measuring chambers:

Manufacturer	Model
Comet (CH)	Telamat 3 field 360x430
Zhiem (D)	C.I: 3 field 360x430
Gilardoni (I)	Dosemat 3 field 380x390

The under table Potter Bucky (optional) is prepared to accept measuring chambers with maximum dimension as follow:

- width (patient left-right direction) **525 mm**
- height (patient up-down direction) **465 mm**
- thickness **max. 10 mm**

The standard configurations of **VISION** Potter Bucky are compatible with the following measuring chambers:

Manufacturer	Model
Comet (CH)	Telamat 3 field 465x525
Zhiem (D)	C.I: 3 field 465x525
Gilardoni (I)	Dosemat 3 field 455x480

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## **6. PRE-INSTALLATION**

Instructions in the present chapter allows setting up the room where the **VISION** has to be installed to grant an optimal operation.

The manufacturer of **VISION**, can assist and supply technical advice since the pre-installation phase.

In order to carry **VISION** inside the destination room, doors must have a minimal dimension of 110 cm wide before packaging is removed and 90 cm wide after packaging has been removed.

Minimal requirements of room dimension to allow correct operation of all movements is given in Figure 6-3.

Set up of the room must foresee the presence of proper cable guides. This set up can be carried out differently according to specific needs. Figure 6-4 shows a "typical" installation and is supplied as an explanatory example of a room where cable guides are under the floor.

Please keep in mind that **VISION** has a footprint of 0.85 m<sup>2</sup> so the floor must be able to carry at least a 1250 kg/m<sup>2</sup> weight.

In case this requirement is not met, please contact VILLA SISTEMI MEDICALI S.p.a., specifying the floor loading capacity; the device will be supplied with a distribution plate adequate for the resistance of the floor.

**VISION** will be nailed to the floor during installation using expansion plugs Ø 14 mm supplied with the device.

This plugs accept screws M8x55, supplied with the device to nail down the system to the floor.

The area of the floor where the device will be positioned has to be as much flat and smooth as possible.

## 6.1 Electrical setup



**WARNING:**

The prescriptions of this chapter must be followed carefully to grant proper installation, meeting the safety requirements of standards

The device can be directly connected to mains or it is possible to derive the line from the X-ray generator operating with the system.

When mains present is different than standard one (380-400Vac), the unit must be connected to the available autotransformer (see paragraph 6.2 "*Setting the line voltage*").

In all cases, the section of the three phases wires must be larger than 2.5 mm<sup>2</sup> (14 AWG).

Mains unit cable and autotransformer cable (when present) must be always type SJT, SJO, SO or ST when this cable has a total or partial way not protected under floor or into relevant guide.

This cable type is provided with **VISION** installation kit.

Since this installation kit is NOT standard delivered, if necessary require it when ordering the unit.

- **Direct connection to mains:**

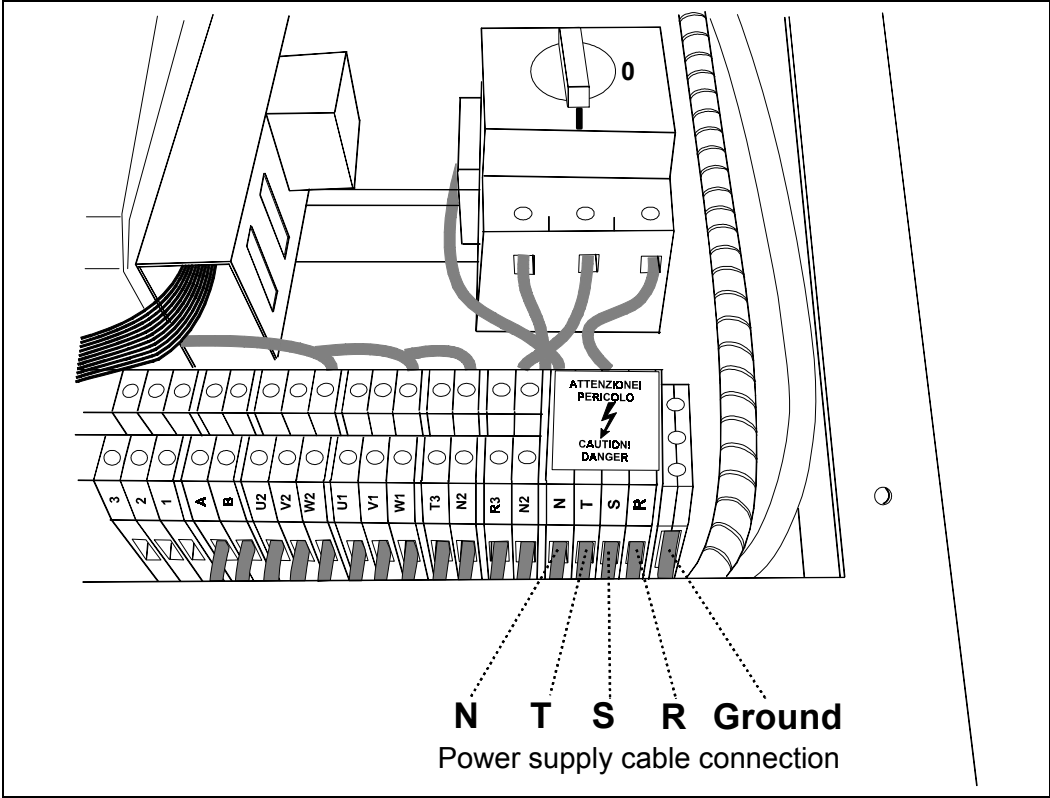
Install an automatic breaker with protection value of 10 A and compliant with IEC 328 standard or to the equivalent standards used in the country of installation.

- **Connection to the generator:**

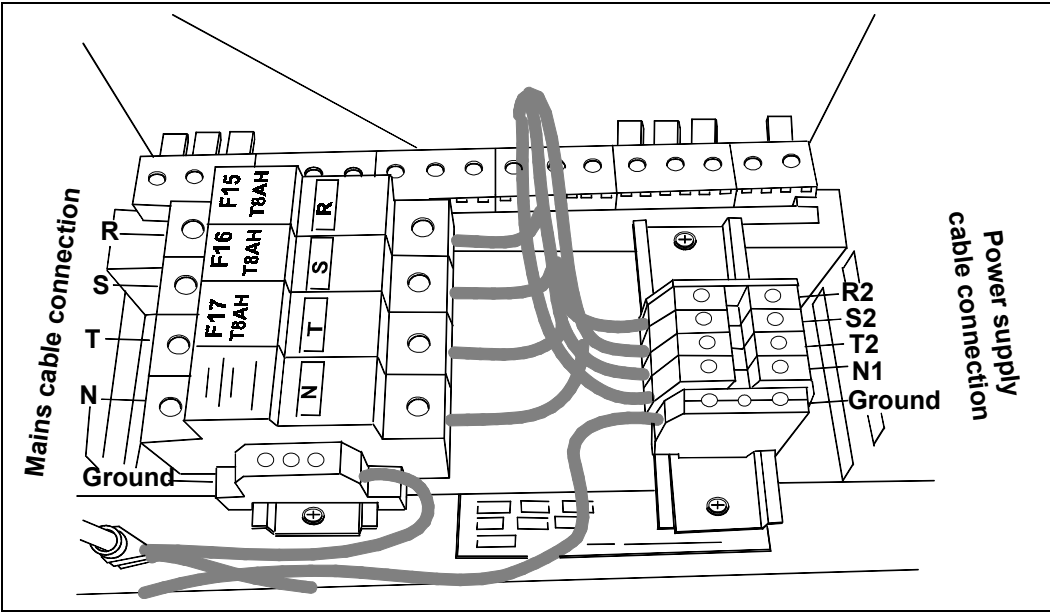
Check the manual of the generator to make sure that connecting points meets the load and insulation requirements of **VISION**.

General grounding must be compliant with regulations of the country of installation. Improper grounding may generate dangers for the safety of the user or an incorrect operation of the electronic circuits in **VISION**.

For **VISION** or auto-transformer mains connections see the layout on Figure 6-1 and Figure 6-2.



**Figure 6-1**



**Figure 6-2**

## **6.2 Setting the line voltage**

**VISION** is designed to operate with line voltage range  
3N~ 380-400 V ac  $\pm 10\%$ .

Check that line voltage meets the requirements of the device.

In case line voltage range is outside the range of the device, contact  
VILLA SISTEMI MEDICALI S.p.a., specifying the line voltage range  
available on site.

The device will be equipped with an autotransformer, which shall bring  
the voltage range within the requirements of **VISION**.

The input voltages of the optional auto transformer are (as indicated in  
data sheet chapter 4) the following:

- 3N~ 208 V ac  $\pm 10\%$
- 3N~ 220 V ac  $\pm 10\%$
- 3N~ 415 V ac  $\pm 10\%$
- 3N~ 480 V ac  $\pm 10\%$

## **6.3 Emergency button connection**

**VISION** is provided by a red emergency button located in frontal cover. This button is electrically connected "normally closed" with wires that reaches the general terminal board X0-35 and X0-36, and it must be connected in such a way it interrupts the general power supply of the system.

Consequently, depending on the way how **VISION** is powered (see paragraph 6.1) the emergency button must be connected as follow:

- **With unit directly connected to mains**

Check that the general mains switch to which **VISION** 3 phase is connected is provided of a relays with low voltage coil (max 24 V a.c.) for automatic switching OFF and intentional switch ON.

**VISION** emergency button must be connected in series to the relays coil.

- **With unit directly connected to the generator**

Check on generator service manual where the switching OFF is connected.

Put the emergency button in series to this circuit.

## **6.4 Environmental conditions**

Shipping, stocking and operating conditions must meet the requirements listed in paragraph 4.1 and summarized here below.

- **Operating environmental conditions:**

Temperature: from +10 to +40° Cels

Humidity: from 30 to 75 %

Pressure: from 700 to 1060 hPa.

- **Shipping and stocking environmental conditions:**

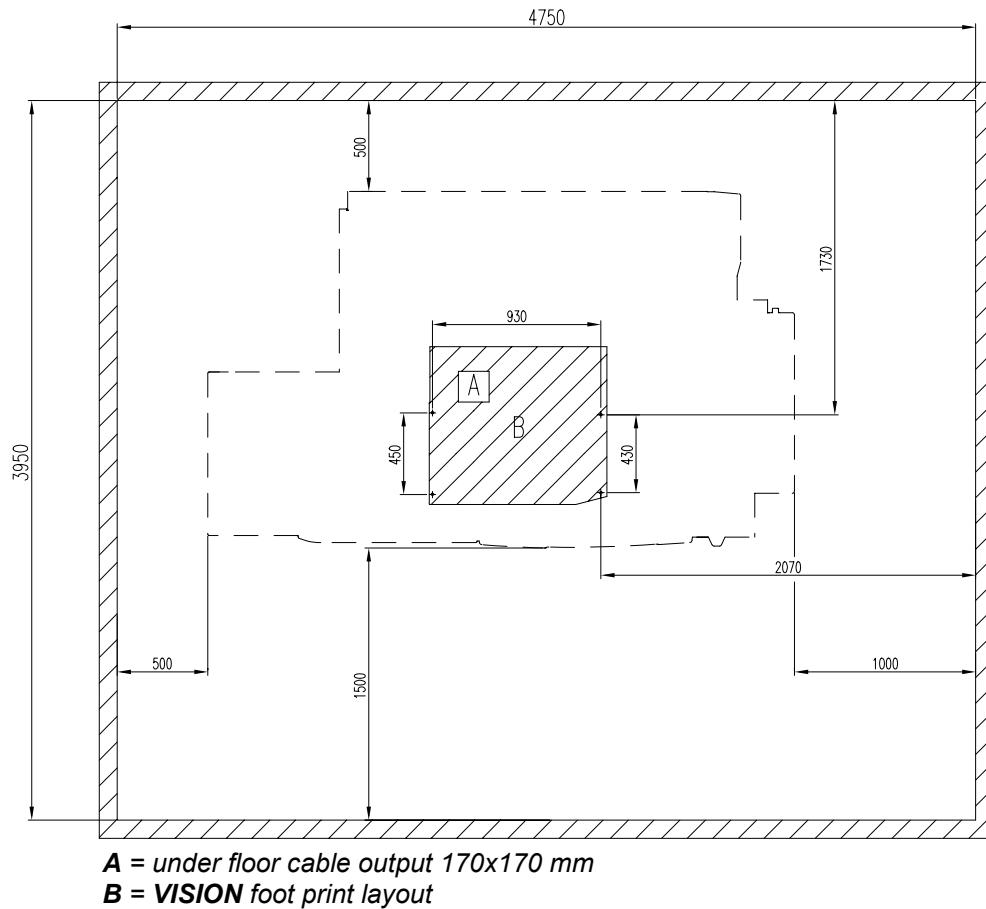
Temperature: from -20 to +70° Cels.

Humidity: ≤ 95% not condensed

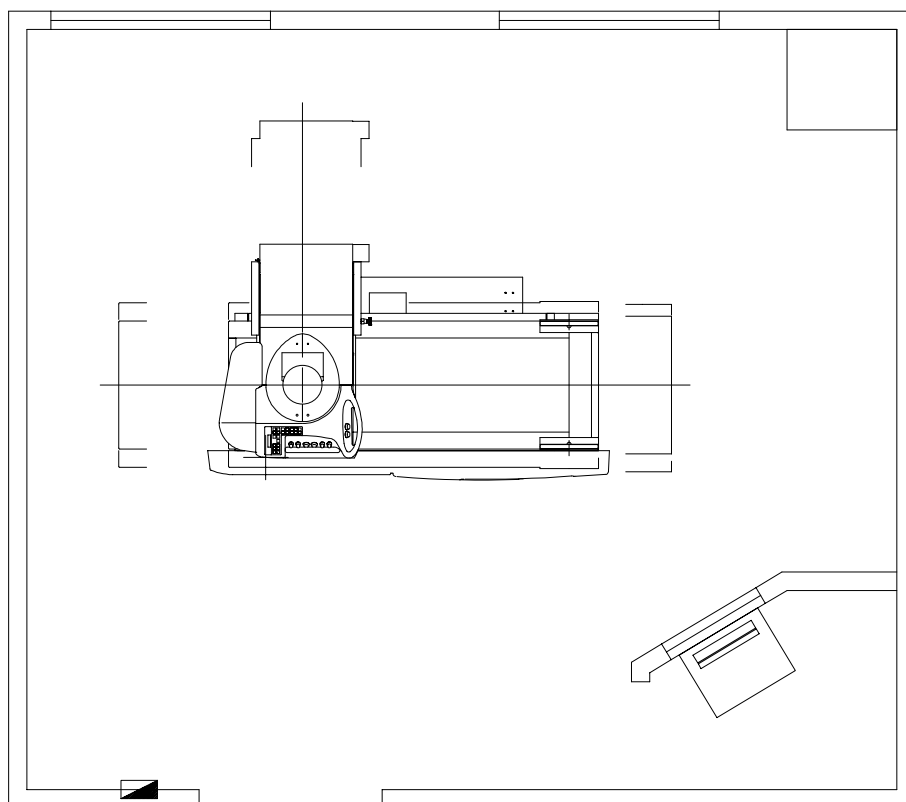
Pressure: > 630 hPa

## 6.5 Room Requirements

The following drawings show the minimal dimensions of the room where to install **VISION** and a typical room configuration where cable guides under the floor are shown.



**Figure 6-3 - Minimal dimensions of the room for installation**



**Figure 6-4 - Setting of a "typical" installation room**

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## 7. INSTALLATION



**WARNING:**

While installing the unit, follow carefully safety precautions for mechanical and electrical hazards:

- wear protective clothes (shoes, gloves, glasses, when necessary)
- do not lift excessive weight
- take care to work in safety conditions
- access electrical components only after having made yourself sure that line voltage is disconnected.

The unit is shipped pre-assembled in sub-assemblies.

Mechanical installation consists of putting together these sub-assemblies.

Chains regulation, ball bearing setting, brakes adjustment and tightening torque is adjusted in manufacturing before delivery.

**Do not change original settings, because besides being useless, it can generate malfunctions.**

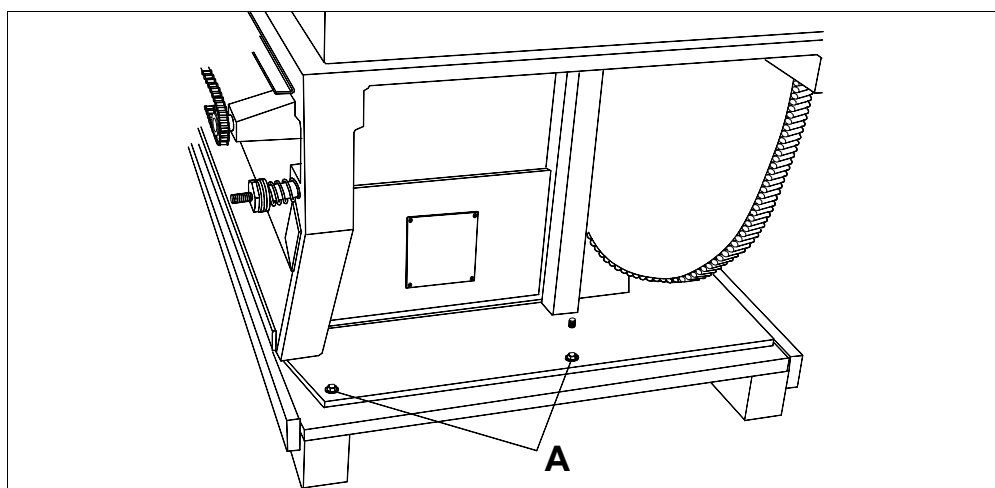
## 7.1 Support base positioning

**VISION** support base including:

- base
- longitudinal carriage
- counterweight box and related mechanism
- patient table top
- mechanical movements subassemblies
- electrical components in the base

is delivered in a single crate.

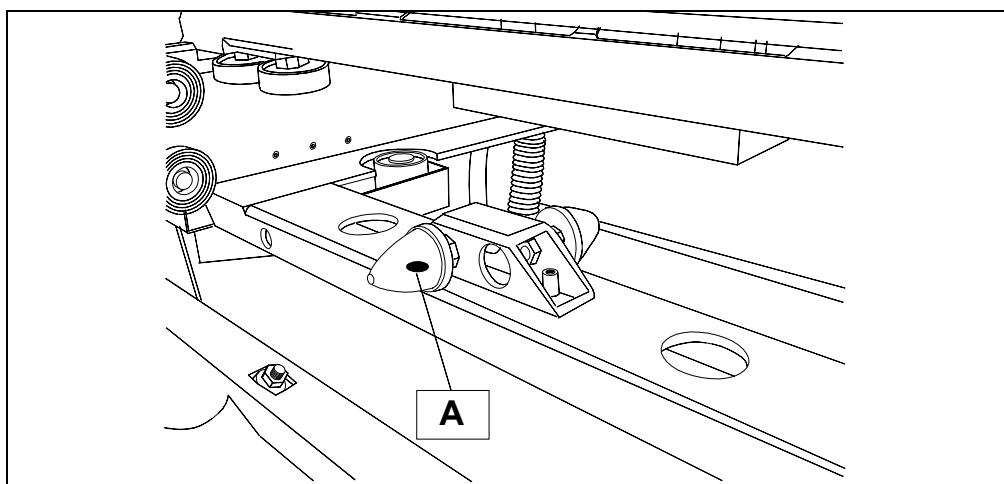
1. Remove the wall of the crate and the four screws "A" Figure 7-1 tightening the base to the bottom of the box.
2. Position the base in the area of final installation.
3. Locate and drill 4 holes Ø 14 mm in the floor to secure the base to the floor using the cast iron plugs supplied in the package.
4. Insert screws M8x55 in the plugs and tight them.
5. By means of a bubble level check that the standing base is horizontal along two perpendicular axes.  
If not, insert metal shims supplied with table between floor and the base until the base is horizontal.
6. Final levelling of the device will be carried out at the end of the installation process and final result of this operation will be critical for the proper operation of the unit.



**Figure 7-1**

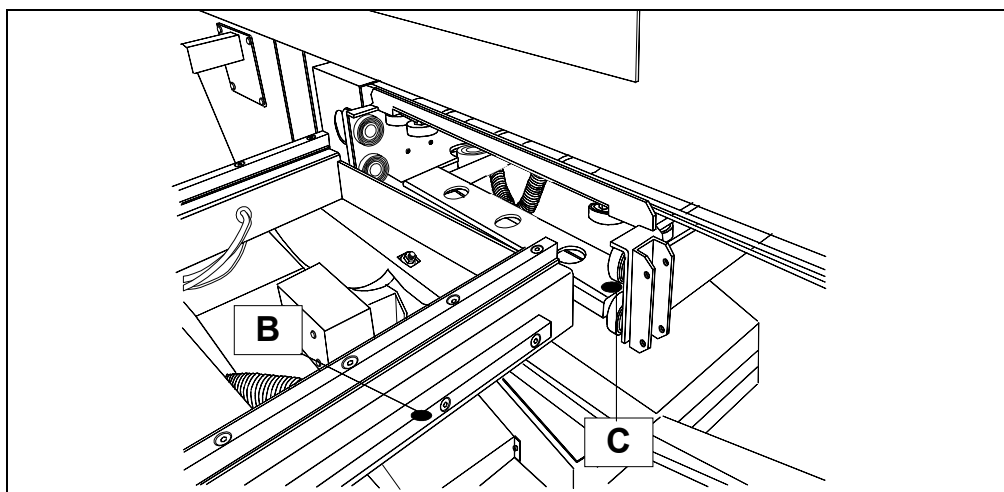
## **7.2 Spot film device carriage assembling**

1. Remove the stopper / bumper assy of the longitudinal movement "A" Figure 7-2 (rear part of the table) located on the SFD / longitudinal carriage.



**Figure 7-2**

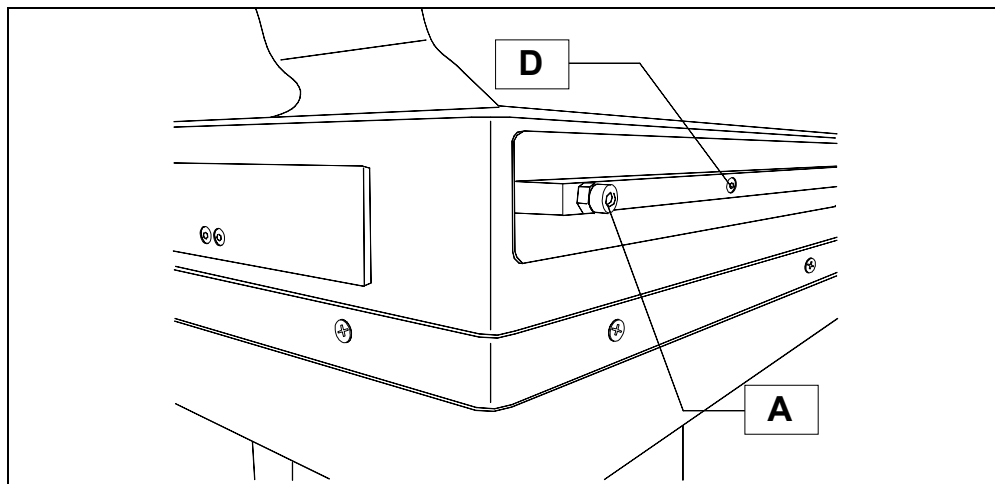
2. Remove X-ray tube support plate "C" Figure 7-11 by removing the 4 screws "F" Figure 7-11 that are not marked in red.
3. From the rear of the unit, insert guides "B" Figure 7-3 of the SFD carriage between ball bearings "C" Figure 7-3 of the longitudinal carriage.  
Be careful not to damage the guides or the ball bearing in this step.  
No adjustment of the ball bearing is necessary because setting has already been carried out during manufacturing
4. Put back the stopper / bumper assy in its original position.



**Figure 7-3**

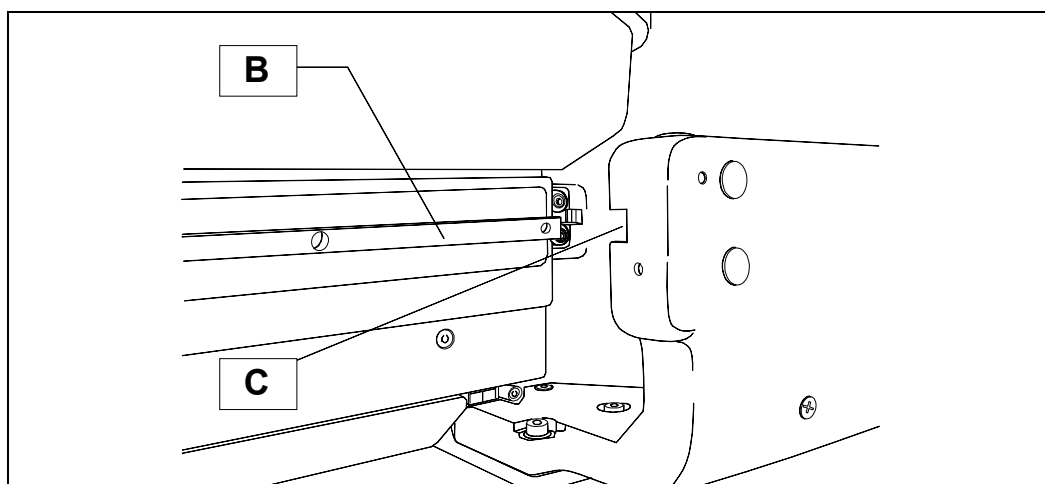
## 7.3 Spot film device assembly

1. Remove safety screw "A" Figure 7-4 in the front side of the side rail of the SFD.



**Figure 7-4**

2. Check that the rear part of the supporting bracket of the SFD, present on the scanning group, is positioned to allow an easy insertion of the SFD.
3. Mount the SFD in the supporting brackets inserting guides "B" Figure 7-5 between ball bearings "C" Figure 7-5 present inside the brackets.  
While inserting the SFD in the brackets, pull the locking handle positioned on the lower bracket when the SFD gets in touch with it.  
Take care to prevent damaging the guides of the ball bearing during this operation.  
No adjustment of ball bearings is necessary, because it has already been done in manufacturing before delivery.



**Figure 7-5**

4. Put back safety screw "**A**" Figure 7-4 on the SFD guide.
5. Check that the locking handle of the SFD, positioned in the lower bracket, locks the SFD when positioned in the "out" of field or in the "in" field positions, entering locking holes "**D**" Figure 7-4 in the lower guide.
6. Check that the handle can be extracted easily from the holes.
7. Check that the microswitch on the rear of the SFD is be pressed when the SFD is "in" field position.

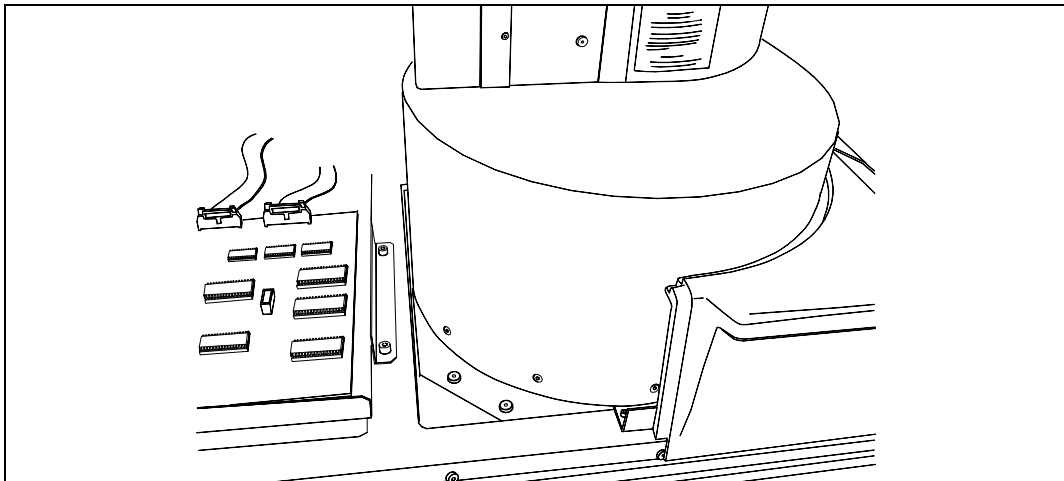
## 7.4 Image intensifier assembling

Mount the image intensifier on the support plate and screw the plate/I.I. sub-assembly on the front plate of the SFD as in Figure 7-6, using supplied screws.



**NOTE:**

Position the I.I. so that cables exit towards the rear part of the SFD.



**Figure 7-6**

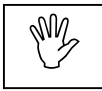
Complete assembling of the SFD accessories:

- lead apron, inserting it in the trail in the lower part of the SFD
- the cough protection, screwing it to the upper edge of the SFD cover
- the compressor, fitting it in the slot of the compressor support, positioned in the rear part of the SFD.

Once all accessories of the SFD are in place, balancing of the SFD can be carried out.

This operation is carried out by inserting the lead and iron plates in the counterweight box "A" Figure 7-7, in the rear part of the SFD carriage. Balancing is reached when the SFD maintains the position where it is left, obviously with brakes not activated.

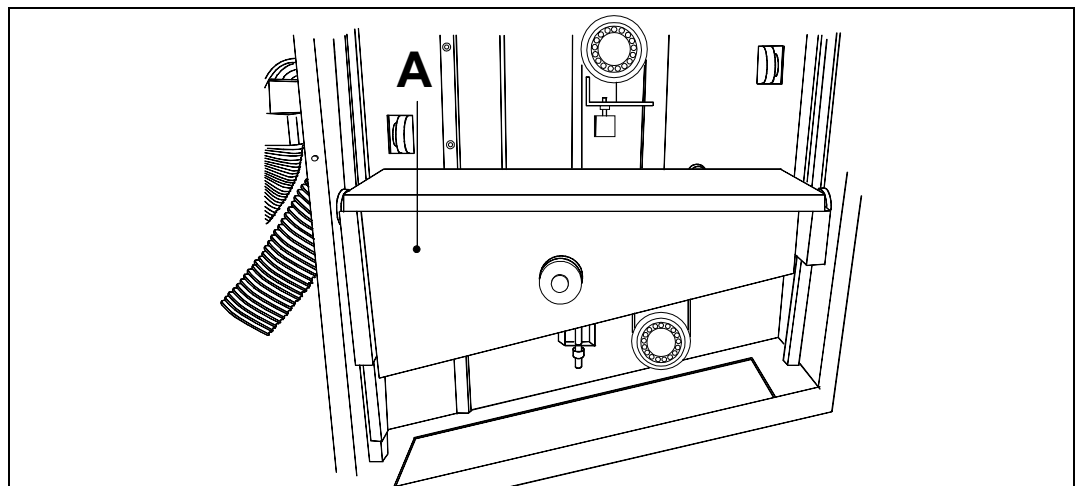
When balancing is correct, beside meeting the above mentioned equilibrium condition, the maximum load to move the SFD along the compression or lateral direction must not be higher than 5 kg (2.27 lbs).



**WARNING:**

Balancing has to be carried out with great care.

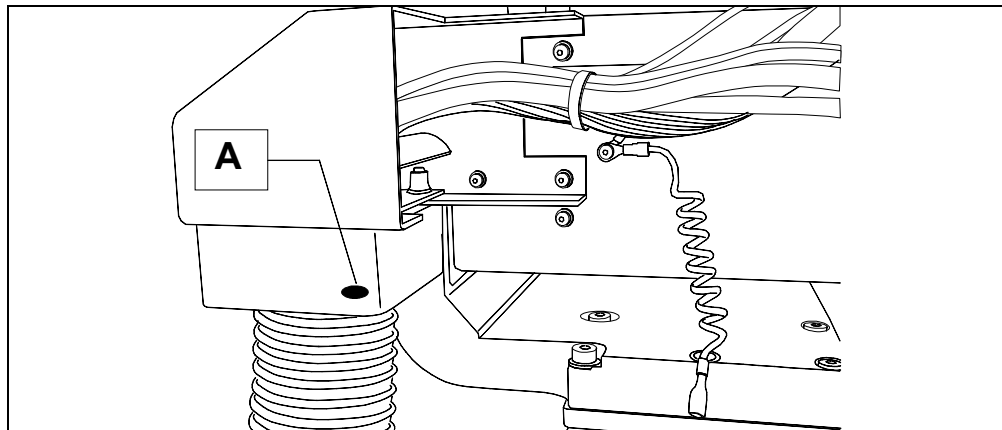
Accuracy of this operation grants correct functionality, long life of the device and a comfortable use for the people operating the device.



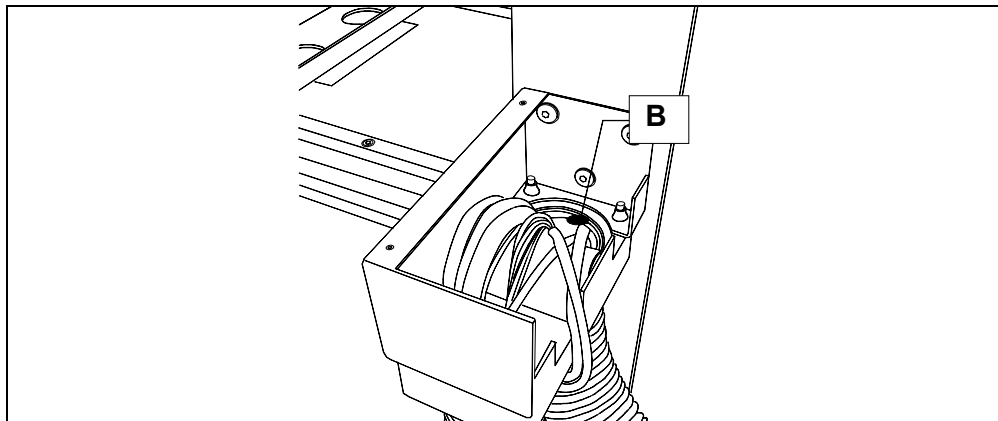
**Figure 7-7**

## 7.5 Assembling of the corrugate hose and electrical connections

1. Mount one end "A" Figure 7-8 of the hose to the SFD. Mount the central part "B" Figure 7-9 of the hose to the SFD carriage, using supplied screws and support it by fixing it to the bracket positioned on the side of the table.



**Figure 7-8**



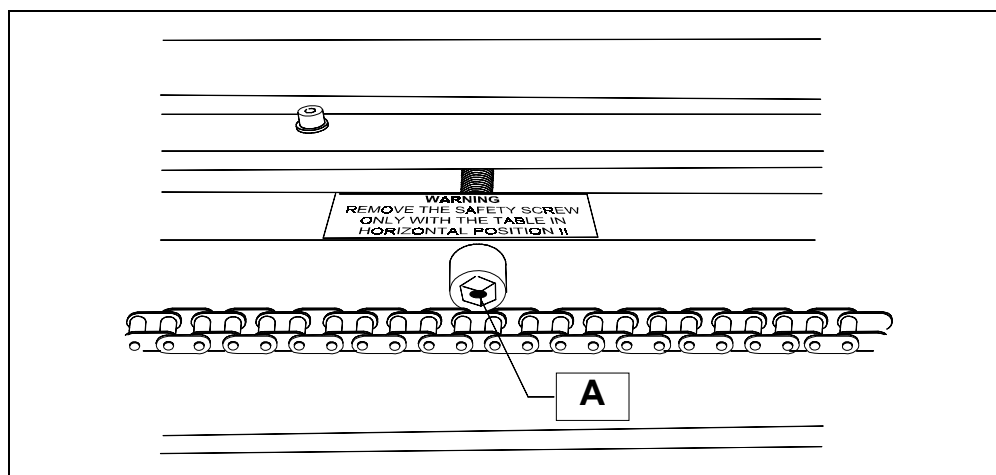
**Figure 7-9**

2. Fix the end of the cable guide to the base of the device in the fork lodging, in the rear part of the base.
3. Connect plugs:
  - to the SFD following numbering
  - to the beam limiting device
  - to the electrical assy in the base of the device.
4. Connect three-phase power line to connectors **R, S, T, N**, and Ground on the main connector X0.
5. Turn power on the device and check for proper phasing by activating the tilt command on the SFD keypad.  
If the movement disagrees with the symbol on the joystick, reverse phases.



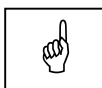
## 7.6 X-ray tube and beam limiting device assembling

1. Remove the screw fixing the frontal counterweight "A" Figure 7-10.



**Figure 7-10**

2. Push the SFD carriage towards the extreme position of foot side and tilt the table until the vertical position is reached.
3. Assembly the X-ray tube and the beam-limiting device on the support plate before screwing it to the SFD carriage.
4. Mount X-ray tube on the support plate "B" Figure 7-11.
5. Mount the beam-limiting device on the support already fixed on plate "C" Figure 7-11.
6. Now assemble the sub-assy composed of:
  - X-ray tube
  - beam limiting support
  - beam limiting device
  - support plate and counter plateon the SFD carriage as shown in Figure 7-11.



**NOTE:**

Support plates for X-ray tube and beam limiting device are pre-set during final testing in manufacturing so no further intervention is needed.

In case it is deemed necessary to correct centering of beam limiting device and X-ray tube with respect to SFD or image intensifier, proceed as follows:

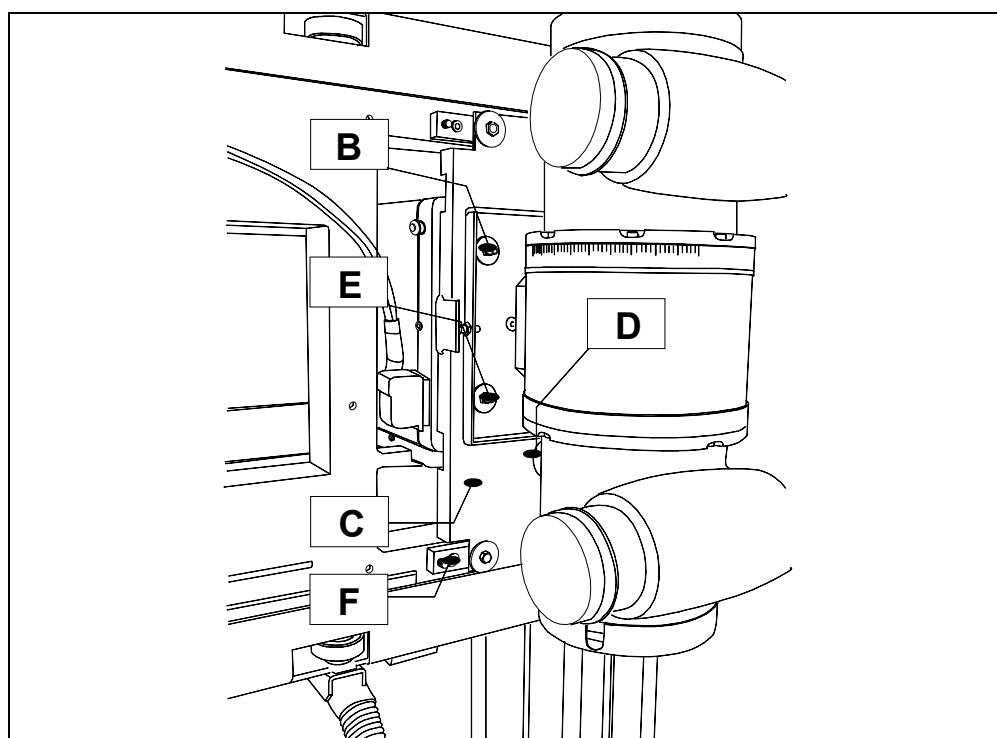
- **Beam limiting device centring:**

Move the centre of the beam limiting device, releasing the 4 screws, blocking it on the support.

- **X-ray tube centring:**

As said above, the X-ray support plate is pre-set in manufacturing, but in case the position has to be corrected act on the 4 bolts "**E**" Figure 7-11 of the counter plate and, acting on the eccentric "**D**" Figure 7-11, modify the position of the X-ray tube.

Connect connectors and wires to the connection positioned on the side of the X-ray tube-beam limiting device subassembly.



**Figure 7-11**

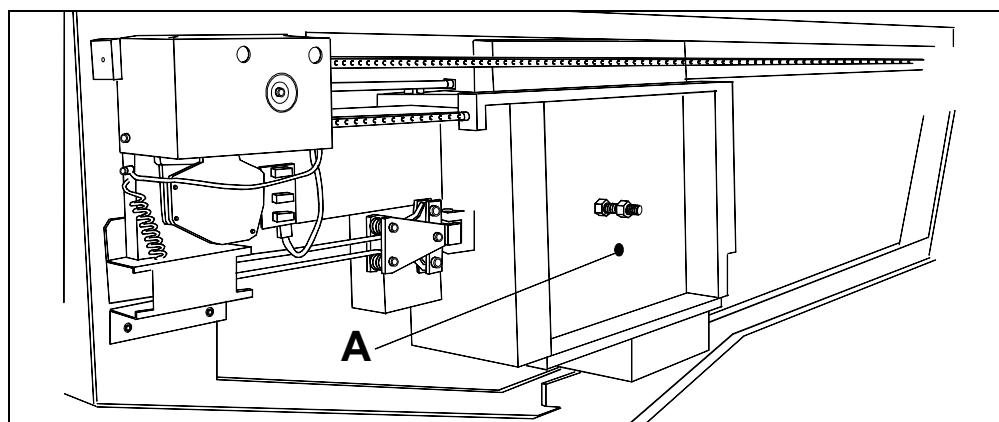
## **7.7 Balancing and final checks**

1. Proceed with the balancing of the longitudinal carriage.  
This operation is achieved by inserting in the counterweight box "A" Figure 7-12, in the front side of the device, lead and iron plates supplied.  
Balancing is complete only when the SFD-X-ray tube carriage remains in the position where it is left, obviously with the table in vertical position and brakes not activated.  
When counter weighing is correct, beside meeting the above mentioned equilibrium condition, the maximum load to move the carriage must not be higher than 15 kg (6.8 lbs) and the servo-assisted motion is uniform and with the same speed in both directions (up and down).



**WARNING:**

Balancing has to be carried out with great care.  
Accuracy of this operation grants correct functionality, long life of the device and a comfortable use for the people operating the device.



**Figure 7-12**

2. Check that the device is properly levelled using a bubble level; the device must be horizontal along its longitudinal and transversal axis. To achieve alignment, unscrew the 4 screws tightening the device to the ground and act on the levelling screws, positioned on the base of the device.
3. Close tightly the 4 screws M8x55.
4. It is now time to install all covers, the accessories like the patient footrest, the handles and the shoulder support.
5. Check that all parts are correctly in place and that all movements, both manual and motorised, are smooth.

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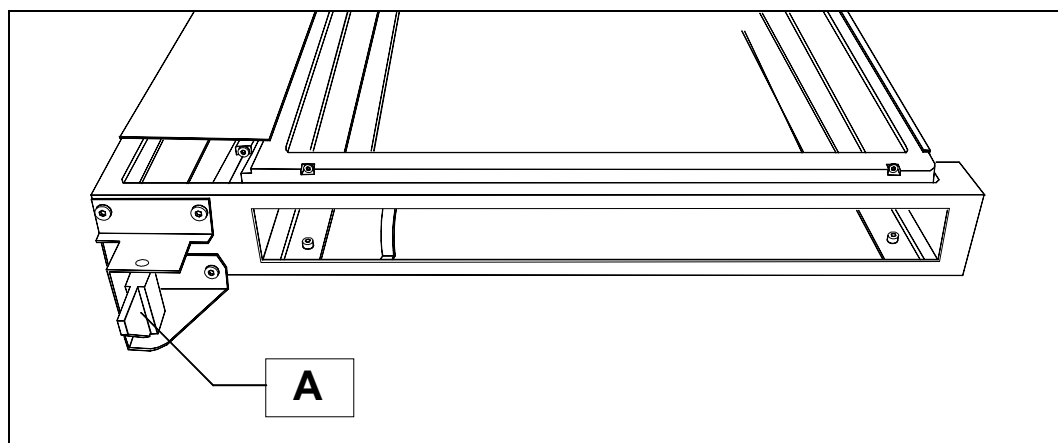
## 8. UNDERTABLE POTTER BUCKY (OPTIONAL)

**VISION** unit is equipped, on request, with an undertable Potter Bucky with cassettes tray and grid.

The Bucky is also prepared to accept measuring or ionisation chambers as specified on chapter 5.

Bucky use is associated to the floor tube-stand for **VISION** (optional), or to a ceiling suspension tube already present in the examination room.

The Bucky tray longitudinal movement is balanced by counterweight and locked by electromagnetic brake. To unlock the brake activate the handle "A" Figure 8-1.



**Figure 8-1**

The Bucky main power is supplied directly by **VISION** circuit (see chapter 22, drawing #1 – page 13 of 14). The Bucky start voltage level can be selected as explained into relevant paragraph.

## 8.1 Bucky start voltage setting

The Bucky control PCB is designed in order to accept three different Bucky start voltages depending on the generator connected. These voltages must be connected to the X0 general terminal board, to pins 49 and 50.

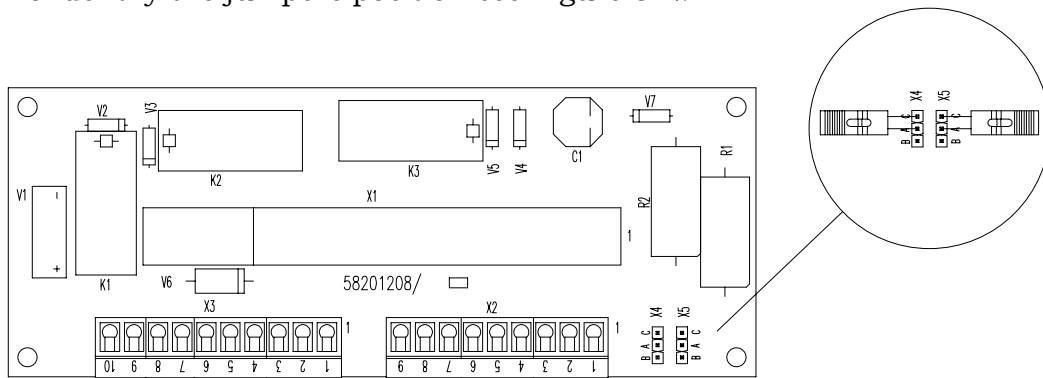
The voltages allowed are: 24Vdc, 120Vac and 230Vac.

The voltage selection is made by jumpers present on Potter-Bucky board (A14) and reference is listed below:

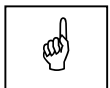
Voltage	Jumper X4	Jumper X5
24 Vdc (*)	A - C	
120 Vac	A - B	A - B
230 Vac	A - B	A - C

(\*) Factory default setting

To identify the jumpers position see Figure 8-2.



**Figure 8-2**



**NOTE:**

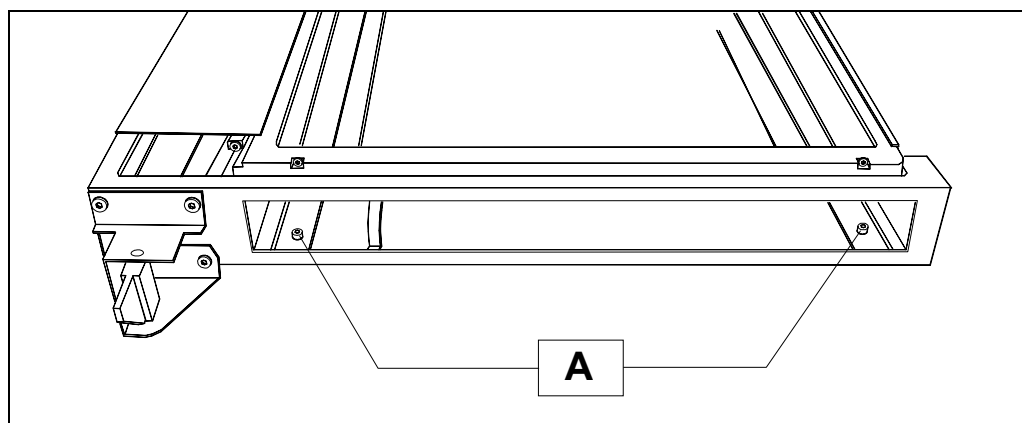
In case the voltage selected is 24Vdc the positive must be connected to X0-49 and negative to X0-50.

## 8.2 Sensing Cassettes Tray installation

The standard Bucky cassettes tray is auto centering in transversal way. To maintain the cassette in vertical position a magnetic support block is used.

The Bucky is also predisposed to accept sensing cassettes tray manufactured by POERSCH and LIEBEL. To adapt the Bucky to use these kind of cassettes tray it is necessary to use the sensing tray kit p/n 7120520500 following the instruction given below:

1. Take out the block "A" Figure 8-3 mounted on frontal lower part of the Bucky. Replace with the washers and the TS M4x5 screws provided in the sensing tray kit. These screws will work as stopping device.

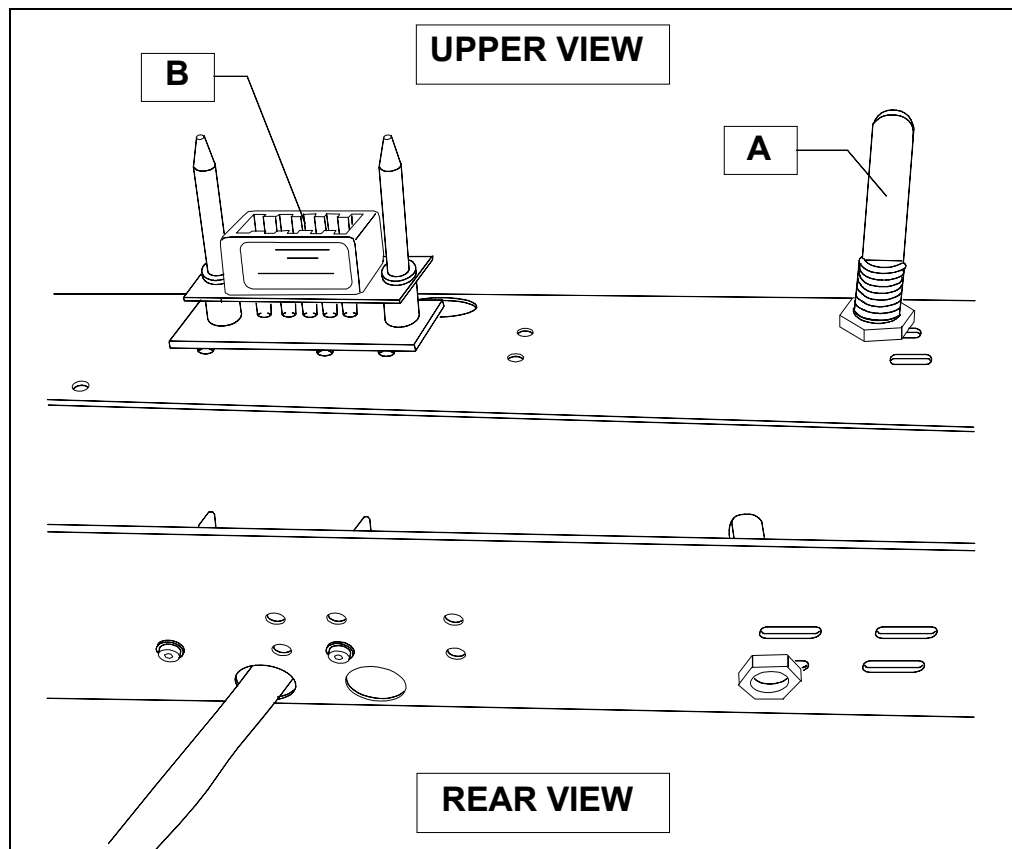


**Figure 8-3**

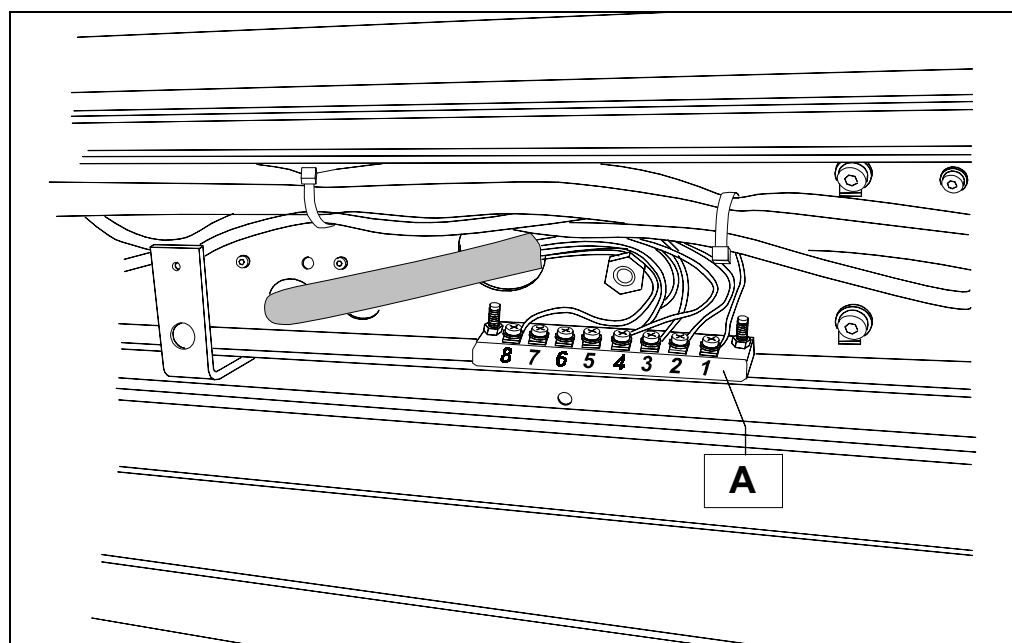
2. The Bucky carriage rear plate is predisposed to fix the three parts necessary to complete the installation:
  - lateral sensing closing device "A" (Figure 8-4 in the next page)
  - shifting connector "B" (Figure 8-4 in the next page)
  - general signals connector "A" (Figure 8-5 in the next page).

The double holes for cable routing and fixing of "A" and "B" items (Figure 8-4 in next page) are pre-set in order to accept the accessories proper of the cassette tray used.

3. The **VISION** is predisposed with a 8 wires shielded cable to connect the sensing cassettes tray. This cable is positioned in such a way to have one terminal in the general signals connector area (Figure 8-5 in the next page) and the other in the table base. Identify which wires must be used and connect them following drawing supplied by sensing cassettes tray manufacturer.
4. Two plastic adapter are supplied with **VISION** to optimise the cassettes sensing tray installation into the Bucky. Stick them on the lateral side of the tray to reduce the clearance present between tray and Bucky guide.



**Figure 8-4**



**Figure 8-5**



## 9. OPERATING LOGIC OF THE TABLE

The electronic control logic of **VISION** consists of:

- one **"CONTROL PANEL"** circuit board containing all the electronic components necessary for its operation, the control keys, and the corresponding indicator LEDs
- one **"CPU"** circuit board containing all the electronic components necessary for its operation, the output drivers and the input ports. On this circuit board there are 2 separate microprocessors.

The first microprocessor, a Motorola type MC68332, is equipped with two 27C1001 128Kx8 EPROMs and has the function of controlling and managing all the table functions.

These 2 EPROMs contain the operating program.

The program version is identified by a revision number on the EPROM labels.

The program contains its date and time of compilation, which identify it unequivocally.

To display this information, proceed as follows:

1. Turn off the system
2. Remove the SFD cover
3. Put switch 2 of dip switch group Q16 on
4. Turn on the system
5. Press the **D** key (Figure 9-1 in next page) for 5 sec.  
When this time has elapsed, the display will show:
  - 002, page number used for entering the passwords.
  - 000, waiting for the password to be entered
6. Press the **E** key (Figure 9-1).  
The display will show the compilation DATE and TIME of the Software version in use:

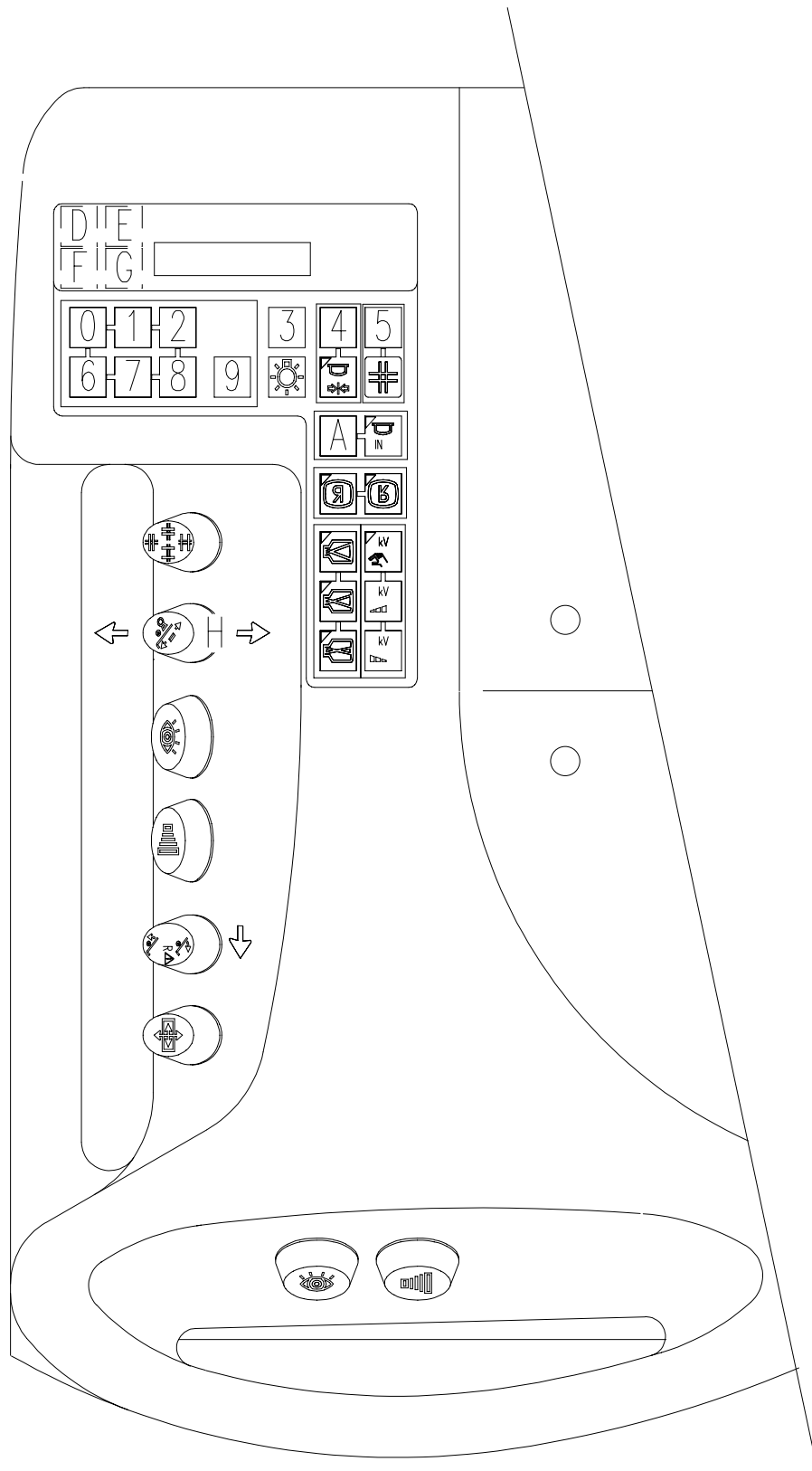
**Version X.X**  
**DD.MM.YY HH.MM**

7. Turn off the system
8. Restore dip switch 2 of dip switch group Q16 to off position
9. Re-install SFD cover
10. Turn on the system. The table reverts to its standard operating mode.

The second microprocessor, an ATMEL 89C2051, has the function of "Supervisor" of the correct operation of the table, providing a backup to the first microprocessor in accordance with the Single Fault (SF) principle.

This operating logic is described in detail in chapter 12 "Single Fault Operating Logic"

- a **"DRIVER" board**, which has the function of driving the principal motors of the serial changer (cassette tray and shutters), modulating the signal by means of dedicated electronic components.



**Figure 9-1**

## 9.1 Operating sequences

### 9.1.1 Power-up sequence and positioning of serial changer and collimator

When the main power supply to the table is switched on, the entire electronics section is supplied through transformer T2.

At this point the main processor and the supervisor initiate the self-test sequences which check that the equipment is functioning correctly.

If the self-test is successful, after a 3 second delay both the main processor and the supervisor activate their respective "ready" relays K1 and K2 on SFD CPU board (A1).

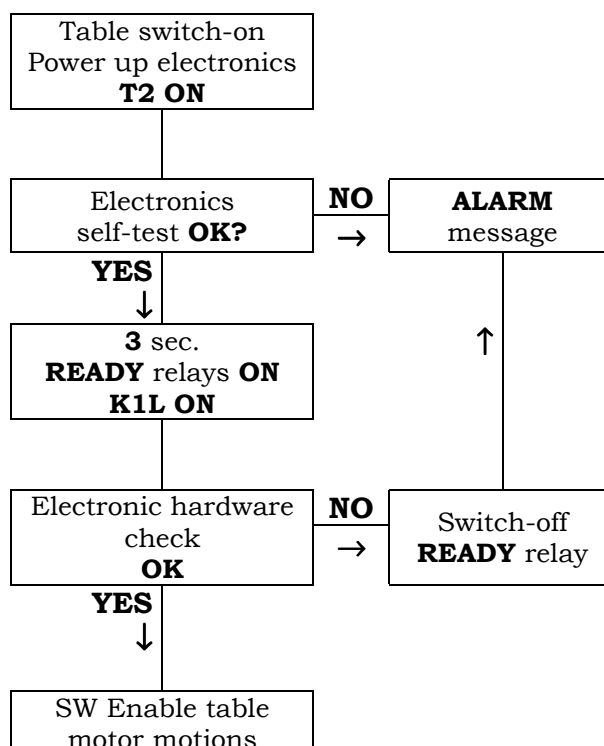
The normally-open contacts of these 2 relays are connected in series. One phase of the coil of power contactor K1L is interrupted by the series connection of these 2 relays.

Therefore, when the relays are energised, the contacts of switch K1L will close, supplying the power circuits of the table.

At the same time, the movements of the shutters, collimator and cassettes tray initiate their power-up sequence to reach the following positions:

- cassette tray at parked position
- shutters and collimator at I.I. size.

The flow diagram below illustrates the operating sequences described above.



### 9.1.2 Sequence for actuating a motion

When the joystick associated with a given motion is operated, 2 switches are simultaneously activated.

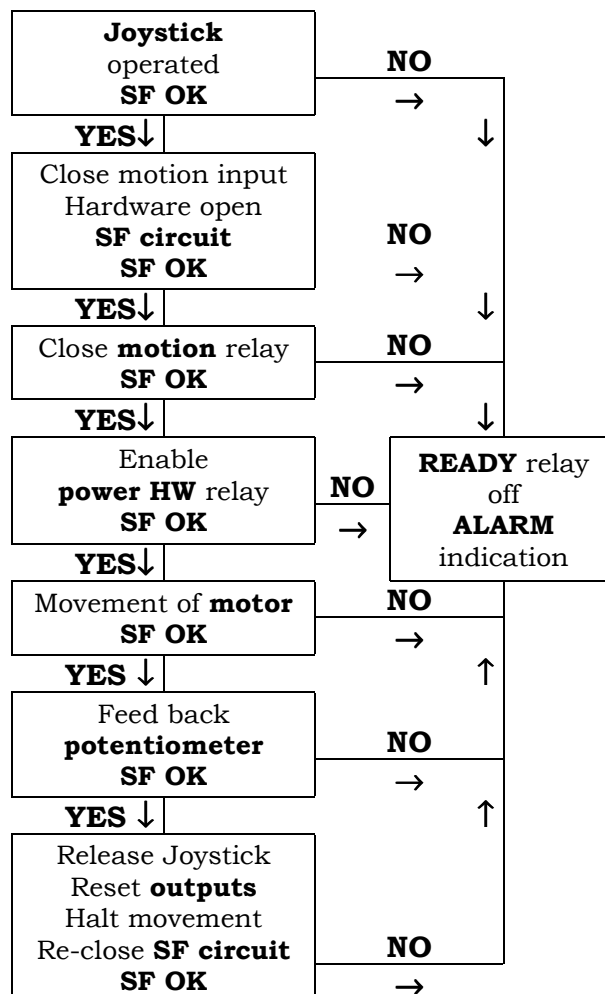
The first sends a motion activation signal to the SFD CPU board (A1), the second opens the SF (Single Fault) circuit which is controlled by both the main and the supervisor microprocessors.

If all the conditions are correct, the microprocessor will actuate the relays on the same board which directly drive the motors, in the case of longitudinal tabletop, compression, grid and longitudinal serial changer servo control motions, whereas in all other cases it actuates the relays which energise the power contactor, whose contacts directly supply the motors (tilting and transverse tabletop).

Once the motion starts, the feedback potentiometer is sampled to determine the position and speed of the motion.

To signal the operating status, all outputs are equipped with an indicator led which illuminates whenever that output, whether it actuates a movement or drives an external accessory, is activated.

The flow diagram below illustrate the operating sequences described above.



## 9.2 Error conditions

During the operation of the equipment, there are 3 different types of error conditions which can occur:

- status error
- functional error
- power circuits error

These 3 different types of errors are handled as follows.

### 9.2.1 Generation of a status alarm

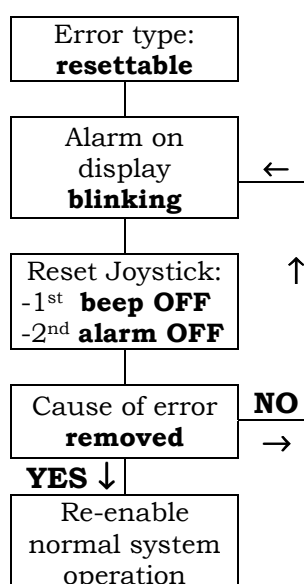
During the operation of the system, an anomaly affecting the table or one of the connected accessories may be detected.

If this malfunction does not compromise the operation of the system (*Example: the generator is not "ready" within the established time-out*), certain motions will be disabled by the SW and the corresponding alarm will blink on the display, accompanied by an intermittent buzzer.

To reset the alarm and re-enable all the movements, shift the table-tilting joystick (Figure 9-1) twice in the reset ("R") direction.

The first joystick movement silences the buzzer, the second resets the alarm and re-enable normal operation.

The flow diagram below illustrates the operating sequences described above.

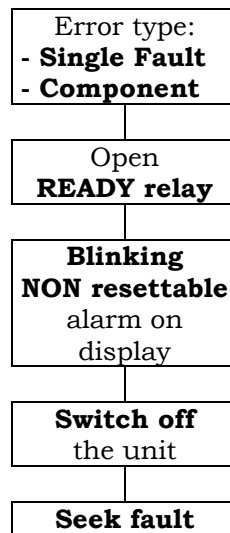


## 9.2.2 Generation of a functional alarm.

If the microprocessor detects an anomaly, generated by the SF circuit or by other components interacting with the microprocessor, which could seriously compromise the operation of the table, the READY relays are de-energised and a blinking alarm indication appears on the display. This condition cannot be reset, because it constitutes a "serious" malfunction.

It will therefore be necessary to diagnose the cause of the problem. The equipment must be switched off to reset the alarm and re-enable the motions.

The flow diagram below illustrate the operating sequences described above.



### 9.2.3 Generation of a power circuits alarm

If a table or serial-changer movement for any reason overshoots the SW travel limit determined by the potentiometer, it will intercept an emergency limit switch.

This will cause one of the power contactors to open:

**K1L** = supply to the power circuits of the entire machine

**KA** = supply to the cassettes tray and shutters motors

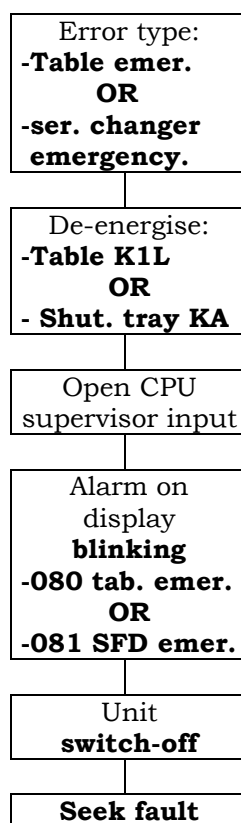
thus interrupting one of the power monitoring inputs terminating on the SFD CPU board (A1).

As a result, the main microprocessor and the supervisor will de-energise the READY relay, and generate a blinking alarm on the console display. These alarms (080 and 081) cannot be reset.

It will therefore be necessary to switch off the equipment to eliminate the alarm condition.

After removing the cause of the malfunction, to re-enable the normal system operation, follow the procedure for described in chapter 14 "*Emergency safeties*".

The flow diagram below illustrate the operating sequences described above.



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## 10. CONNECTING THE I/O INTERFACE

All the input and output signals to and from accessories such as: generator, TV chain etc. are connected to the SFD CPU board (A1) and to general terminal board X0.

The hardware characteristics of these signals are set out below:

A1 connect.	X0	Type	Description	Hardware characteristics	Electrical characteristics
//	1-2	Contact	Room light	Free relay contact	max 220 V a.c. 2 A
<b>X7-20</b>	3	OUT/IN	Common 0 Vs	Polarisation at 0 Vs	NA
<b>X7-21</b>	4	OUT 0 Vs	Fluoroscopy	Transistor open collector NPN	max 100 mA d.c.
<b>X7-22</b>	5	OUT 0 Vs	Preparation	Transistor open collector NPN	max 100 mA d.c.
<b>X7-23</b>	6	OUT 0 Vs	Digital preparation	Transistor open collector NPN	max 100 mA d.c.
<b>X7-24</b>	7	OUT 0 Vs	Exposure switch 2nd step	Transistor open collector NPN	max 100 mA d.c.
<b>X7-25</b>	8	OUT 0 Vs	Exposure	Transistor open collector NPN	max 100 mA d.c.
<b>X7-26</b>	9	OUT 0 Vs	X-ray ON without request	Transistor open collector NPN	max 100 mA d.c.
<b>X7-27</b>	10	OUT 0 Vs	Fluoro kV-mA man./auto	Transistor open collector NPN	max 100 mA d.c.
<b>X7-28</b>	11	OUT	Common 0 V for X0-12	0 V dc for analog manual kV	max 5 mA d.c.
<b>X7-29</b>	12	OUT	Analog for manual kV	Analog output from 1.8 to 6.5 V dc	max 5 mA d.c.
<b>X7-31</b>	14	OUT	I.I. max	Optomos out polaris. in X0-17	max 24 Vac/70Vdc - 70 mA
<b>X7-32</b>	15	OUT	I.I. med	Optomos out polaris. in X0-17	max 24 Vac/70Vdc - 70 mA
<b>X7-33</b>	16	OUT	I.I. min	Optomos out polaris. in X0-17	max 24 Vac/70Vdc - 70 mA
<b>X7-34</b>	17	IN	Common for I.I. circuit	Optomos common input	max 24 Vac/70Vdc - 70 mA
<b>X7-35</b>	18	OUT	Monitor image vertical reverse	Optomos out polaris. in X0-20	max 24 Vac/70Vdc - 70 mA
<b>X7-36</b>	19	OUT	Monitor image horizont. reverse	Optomos out polaris. in X0-20	max 24 Vac/70Vdc - 70 mA
<b>X7-37</b>	20	IN	Common for image reverse	Optomos common input	max 24 Vac/70Vdc - 70 mA
<b>X15-2</b>	21	IN	Generator ready	Input NPN active at 0 Vs	max 10 mA d.c.
<b>X15-3</b>	22	IN	X-ray on	Input NPN active at 0 Vs	max 10 mA d.c.
<b>X15-7</b>	23	IN	Serial changer working station	Input NPN active at 0 Vs	max 10 mA d.c.
<b>X15-8</b>	24	IN	Digital working station	Input NPN active at 0 Vs	max 10 mA d.c.
<b>X69-12</b> <b>X69-13</b>	25-26	OUT	Table at 0° tilting	Free relay contact	max 15 Vac – 500 mA
<b>X69-14</b> <b>X69-15</b>	27-28	OUT	Table at 90° tilting	Free relay contact	max 15 Vac – 500 mA
<b>X15-13</b>	41	OUT 0 Vs	Manual fluoro kV up	Transistor open collector NPN	max 100 mA d.c.
<b>X15-14</b>	42	OUT 0 Vs	Manual fluoro kV down	Transistor open collector NPN	max 100 mA d.c.
<b>X15-15</b>	43	OUT 0 Vs	Motion detection	Transistor open collector NPN	max 100 mA d.c.

The accessory functions on terminal block X0 are detailed below.

A1 connect.	X0	Type	Description	Hardware characteristics	Electrical characteristics
<b>X15-5</b>	29	IN	Inhibit inside tabletop motion	Input NPN active at 0 Vs	max 10 mA d.c.
<b>X15-4</b>	33	IN	Inhibit foot end servo control motion	Input NPN active at 0 Vs	max 10 mA d.c.
<b>NA</b>	35-36	Contact	Emergency button	Button contact	max 24 V ac – 2 A
<b>NA</b>	37-38	OUT	Series interruption of power contactor K1L coil	Coil of contactor K1L	max 24 Vac – 500 mA
<b>NA</b>	39-40	OUT	24 V dc power supply for loads	24 V dc (39 negative – 40 positive)	max 0.5 A



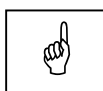
**WARNING:**

The above signals are all referred to ground.  
Therefore, the accessories connected to them must not have any accessible electrical parts.

## 10.1 Optional Fluoro Foot-Switch connection

If required by customer, the **VISION** is predisposed to accept an additional fluoro foot-switch connected to the Interconnection board (A6). The characteristics and connection of the foot-switch are detailed below:

X76	Type	Description	Electrical characteristics
1	Contact NO	Common 0V	Min 10 mA dc, 24 Vdc
2		Fluoro input	
4	Contact NC	Single faults series	Min 10 mA dc, 24 Vdc
5			



**NOTE:**

The foot-switch must be equipped with 2 switches or 1 switches - 2 ways (1NC + 1NO) with contemporary switching.

The relevant layout and drawings are present in chapter 22, drawings #1 (page 10 of 14) and #9.

## 10.2 Input / Output operating logic

The input and output signals are activated and resetted according to certain logic sequences.

The table below describes their operation.

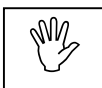
It also describes the impact of the accessory functions on the operation of the equipment.

X0	Description	Activation signal conditions	Reset-signal conditions
1-2	<b>Room light</b>	ON switch operated	OFF switch operated
4	<b>Fluoroscopy</b>	- Serial changer in centre (Switch S10 on) <b>AND</b> - Potter-Bucky in park (Switch S62 on) <b>AND</b> - Cassettes tray parked <b>AND</b> - Control pressed	Any one of the activated-signal conditions absent.
5	<b>Preparation</b>	- Serial changer in centre (Switch S10 on) <b>AND</b> - Potter-Bucky in park (Switch S62 on) <b>AND</b> - Cassette present and sub-division selected (only for serial changer mode and not for DSI mode ) <b>AND</b> - Control pressed (1st step)	Control released <b>OR</b> "X-ray ON" input OFF after an exposure
6	<b>Digital Preparation</b>	- Serial changer in centre (Switch S10 active) <b>AND</b> - Potter-Bucky in park (Switch S62 on) <b>AND</b> - Digital selected <b>AND</b> - Control pressed	Control released
7	<b>Exposure switch 2nd step</b>	- Serial changer in centre (Switch S10 active) <b>AND</b> - Potter-Bucky in park (Switch S62 on) <b>AND</b> - Preparation active <b>AND</b> - Serial changer shutters in position (not for DSI mode) <b>AND</b> - Cassettes tray in position (not for DSI mode) <b>AND</b> - Collimator in position <b>AND</b> - Control pressed (2nd step)	Control released <b>OR</b> one of the conditions absent
8	<b>Radiography</b>	- "Generator ready " input activated <b>AND</b> - Grid start delay elapsed (not for DSI mode)	Control released <b>OR</b> "X-ray ON" input OFF after an exposure
9	<b>"X-ray ON" active without request</b>	Exposure OFF <b>Note:</b> The output is activated during normal operation. It is reset in an alarm condition. This operating logic is inverted relative to all the other OUTPUTS	With "digital" or "serial changer" working station selected and "X-ray ON" active without fluoroscopy or exposure request
10	<b>Manual kV/mA</b>	- Button pressed: • button led ON • output OFF	- Button pressed: • button led OFF • output ON
12	<b>Analog manual fluoroscopy kV V ref</b>	- manual kV control operated - increase voltage with kV+ button - reduce voltage with kV- button <b>Note:</b> voltage range +1.8 - +6.5 V dc.	- automatic kV control operated <b>OR</b> - buttons not pressed
14	<b>I.I. max.</b>	- Button pressed: • button led ON • output ON	- I.I. med. button <b>OR</b> I.I. min button pressed: • button led OFF • output OFF

X0	Description	Activation-signal conditions	Reset-signal conditions
15	<b>I.I. med.</b>	- Button control: • button led ON • output ON	- I.I. max. button <b>OR</b> I.I. min. button pressed: • button led OFF • output OFF
16	<b>I.I. min.</b>	- Control on button: • button led ON • output ON	- I.I. med. button <b>OR</b> I.I. max. button pressed: • button led OFF • output OFF
18	<b>Monitor image vertical reverse</b>	- Button pressed: • button led ON • output ON (with cell 237=0)	- Button pressed: • button led OFF • output OFF
19	<b>Monitor image horizontal reverse</b>	- Button pressed: • button led ON • output ON (with cell 236=0)	- Button pressed: • button led OFF • output OFF
21	<b>Generator ready</b>	Generator ready for exposure	Generator preparation not complete
22	<b>X-ray ON</b>	- Exposure active in generator (kV at 75% of nominal value) - Fluoroscopy active	End of exposure
23	<b>Serial changer</b>	"Serial changer" working station selected	"Serial changer" working station deselected
24	<b>Digital</b>	"Digital" working station selected	"Digital" working station deselected
25-26	<b>Tilting at 0°</b>	Relay contact closed with table tilting between 0 and +10°	Table in any other position
27-28	<b>Tilting at 90°</b>	Relay contact closed with table tilting between +80 and +90°	Table in any other position
29	<b>Inhibit inside tabletop motion</b>	Jumper on terminal block X0 29-30 open	Jumper X0 29-30 closed
33	<b>Inhibit foot-end servomotor motion</b>	Jumper on terminal block X0 33-34 open	Jumper X0 33-34 closed
41	<b>Manual kV increase</b>	- manual kV control activated <b>AND</b> - kV+ button pressed	- automatic kV control activated <b>OR</b> - kV+ button not pressed
42	<b>Manual kV decrease</b>	- manual kV control activated <b>AND</b> - kV- button pressed	- automatic kV control activated <b>OR</b> - kV- button not pressed
43	<b>Motion detection</b>	- foot side tabletop control activated <b>OR</b> - head side tabletop control activated <b>OR</b> - inside tabletop control activated <b>OR</b> - outside tabletop control activated <b>OR</b> - head side servomotor control activated <b>OR</b> - foot side servomotor control activated	All tabletop and servomotor controls inactive

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## 11. PARAMETER SET-UP PROCEDURE



**WARNING:**

This page contains the passwords for accessing the memory of the system. In the remainder of the chapter, only the corresponding references (Rif.1, Rif.2 and Rif.3) will be quoted.

The passwords may ONLY be used by technicians authorised by VILLA SISTEMI MEDICALI S.p.a..

REFERENCE CODE PRESENT IN THE MANUAL	PASSWORD TO USE ON THE CONTROL PANEL
Ref. 1	488591
Ref. 2	48859284
Ref. 3	229879

All the data for the configuration, operation and adjustment of **VISION** system are stored on an EEPROM, including a checksum which is updated whenever the data is changed.

At power-up, the data is copied into RAM, the checksum is recalculated and compared with the value stored in the EEPROM. If the two checksums do not match, alarm 090 is generated.

When the equipment is switched off, the data stored in RAM is lost, whereas the values in the EEPROM are retained.

The backup battery is used only for duplicating the EEPROMs as described in paragraph 11.5.

The parameters contained in the EEPROM are subdivided into different "groups".

Each of these groups can contain up to 99 positions or "cells".

Any given memory cell is therefore identified by the following 3 digits:



To obtain read-only access to the data contained in the cells, simply place the switch corresponding to its group (of DIP-switch Q16 on the SFD CPU board A1) in the ON position.

To be able to modify, i.e. write new data in the cells, it is necessary to enter a password, in addition to enabling the corresponding switch.

The table below lists the sub-divisions of the data groups and their functions, along with the corresponding switches and passwords. As already mentioned, the paragraphs and tables of this chapter indicate the passwords using the references given in the previous page.

Switch	Password	Group	Function
<b>1</b>	Ref. 1	100	Potentiometer adjustments
<b>2</b>	Ref. 2	200	Installation parameters
<b>3</b>	Ref. 1	300	PDI motor data
<b>1 + 2</b>	Ref. 3	400	Unit dimensions and movements range
		500	Cassettes tray travels
		600	Shutters travels
<b>1 + 3</b>	Ref. 1	700	EEPROM copying
<b>2 + 3</b>	Ref. 3	800	Serial changer life test



**NOTE:**

The procedures explained in the next pages make often reference to Figure 11-9 at the end of this chapter. To easily consult this figure, unfold page 11-59 in order to make it visible while reading other pages of the manual.



## **11.1 Accessing group 100: Potentiometer adjustments**

As mentioned previously, the control of **VISION** motions is based on the feedback received from the potentiometers.

These potentiometers must therefore be adjusted, by storing the voltages values of the minimum and maximum travel limits in the corresponding EEPROM cells.

To read the parameters stored in the group 100 cells, proceed as follows:

1. Turn off the equipment and place switch 1 (Dip-switch Q16 of SFD CPU board A1) in the ON position.
2. Turn on the equipment.  
The display will show:
  - the number of the group and the selected cell
  - the blinking value of the position which that motion must reach
  - the potentiometer reading at the current position after the ADC conversion, expressed as a value between 0 and 4095.
3. Use the **G** and **E** keys (Figure 11-9) to respectively increase and decrease the number of the selected cell. As mentioned above, during this phase it is not possible to modify any parameters or actuate any motions.

To edit these parameters and hence correct the potentiometer adjustments, proceed as follows:

4. Press the **D** key (Figure 11-9) for 5 sec.  
When this time has elapsed, the display will show:
  - 002, page number used for entering the passwords
  - 0000000, waiting for the password to be entered.
5. Press the **F** key (Figure 11-9).  
The blinking "\*" symbol appears on the display, prompting for entering the password.
6. Enter the password for this data group (Ref. 1 pg. 11-1) using the number keys (Figure 11-9).  
This value will appear scrolling from right to left on the display.
7. Press the **F** key (Figure 11-9) to confirm.  
If the confirm key is not pressed within 15 sec. of entering the last digit, the blinking "\*" symbol and the previously entered digits disappear from the display, and the unmodified value remains in memory.  
If, instead, the confirm key is pressed within 15 sec., the blinking C137 message appears, indicating that the password has permitted access to groups 100-300-700, depending on which ones have their DIP-switch set to ON.
8. Hold down the **D** key (Figure 11-9) for 5 sec.  
The display reverts to showing the group 100 position previously abandoned to access page 002.

At this point, it is possible to edit the parameters in the cells of this group.

It is also possible to actuate movements for adjusting the potentiometers, using joystick **H** (Figure 11-9).

In this program, only joystick **H** is enabled, and the motion which is actuated will depend on the selected cell.

Shifting the joystick to the right (see Figure 11-9) actuates the selected motion in the direction of its maximum limit, and the potentiometer value shown on the display increases.

Shifting the joystick to the left actuates the selected motion in the opposite direction, towards its minimum limit, and the displayed potentiometer value decreases.

In this program, the speeds of the cassettes tray, collimator and shutters motions are automatically set by the calibration software and cannot be modified.

The anti-collision program is inactive during this adjustment program; therefore, always make sure there is no risk of collision before actuating any motion.

In addition, because the software travel limits are determined precisely by this adjustment program, the motions will not be halted on reaching these limits.

If the selected motion overshoots its maximum travel, it will intercept the emergency switch, causing the equipment to halt.

The default travel limits for the motions are set up during the factory testing of the equipment.

The travel limits for the currently selected cell are shown on the display. These limits can be changed by editing the parameters in the cells of group 400.

The new values entered in the cells will determine the new travel limits for that motion.

The above does not apply for cells 109-110-111-112.

In fact, when these cells are selected, the displayed value, corresponding to the target collimation field size, is determined directly by the software. This number takes into account the setting of the SID potentiometer.

The following table gives the default travel limits for the different motions.

<b>Cell</b>	<b>Movement</b>	<b>Movement direction</b>	<b>Joystick H direction</b>	<b>Travel limit</b>
<b>101</b>	Tilting	Trendelembourg	Left	<b>-15.0</b>
<b>102</b>	Tilting	Vertical	Right	<b>90.0</b>
<b>103</b>	Longitudinal t.top	Foot side	Left	<b>-400</b>
<b>104</b>	Longitudinal t.top	Head side	Right	<b>600</b>
<b>105</b>	Transversal t.top	Inside	Left	<b>-100</b>
<b>106</b>	Transversal t.top	Outside	Right	<b>100</b>
<b>107</b>	SID	Minimum	Left	<b>520</b>
<b>108</b>	SID	Maximum	Right	<b>785</b>
<b>109</b>	Collimator width	Minimum	Left	<b>000</b>
<b>110</b>	Collimator width	Maximum	Right	<b>318</b>
<b>111</b>	Collimator height	Minimum	Left	<b>000</b>
<b>112</b>	Collimator height	Maximum	Right	<b>314</b>
<b>117</b>	Shutters	Both limits	Both	<b>0-375.8</b>
<b>119</b>	Cassettes tray	Both limits	Both	<b>0-557.1</b>

After having accessed group100, proceed as follows to adjust the potentiometers referred to the movements listed above.

### **11.1.1 TILTING potentiometer settings (cell 101-102)**

#### **Adjusting the minimum value**

1. Using the **E** and **G** keys (Figure 11-9), select cell **101** on the display
2. The blinking value **-15.0** appears, corresponding to the target value in degrees for performing the adjustment.
3. The potentiometer value after the ADC conversion is shown on the display, expressed as a number between 0 and 4095.
4. Shift joystick **H** (Figure 11-9) to the **left**, actuating the tilting motion towards **trendelembourg**.
5. The displayed potentiometer value should decrease.  
If this does not happen, it means that the 2 potentiometer terminals have been connected the wrong way round.
6. Place a goniometer with spirit level on the patient support, and check that the minimum position, equivalent to a tilting angle of **-15.0°**, is reached.
7. Check that the potentiometer value is approximately **500**, if it isn't, disengage the gear and turn the potentiometer until the required value is obtained.
8. Press the **F** key (Figure 11-9) to confirm.  
If everything is correct, the blinking **"Accepted"** message will appear on the display for 2 seconds.

#### **Adjusting the maximum value**

9. Use the **G** key to select cell **102**.
10. The display will show the blinking value **90**, corresponding to the target value in degrees for the adjustment, and the potentiometer value after the ADC conversion, expressed as a number between 0 and 4095.
11. Shift joystick **H** to the **right**, actuating the tilting motion towards the **vertical** direction.
12. The displayed potentiometer value should increase.
13. Place a goniometer with spirit level on the patient support, and check that the maximum position, equivalent to a tilting value of **90°**, is reached.
14. Check that the potentiometer value is approximately **3300**.
15. Press the **F** key to confirm.  
If everything is correct, the blinking **"Accepted"** message will appear for 2 sec on the display.

## 11.1.2 Adjusting the LONGITUDINAL TABLE TOP potentiometer (cells 103-104)

### Adjusting the minimum value

1. Using the **E** and **G** keys (Figure 11-9), select cell **103** on the display.
2. The blinking value **-400** appears, corresponding to the target value in mm, relative to the centred position, for performing the adjustment.
3. The potentiometer value after the ADC conversion is shown on the display, as a number between 0 and 4095.
4. Shift joystick **H** (Figure 11-9) to the **left**, actuating the motion toward the **foot side** of the table top.
5. The displayed potentiometer setting should decrease.  
If this does not happen, it means that the 2 potentiometer terminals have been inverted.
6. Using a tape measure, check that the tabletop reaches the minimum position, equivalent to the value indicated, measuring it as shown in Figure 11-1.
7. Check that the potentiometer reading is approximately **900**, and if this is not the case, disengage the gear and turn the potentiometer until the required value is obtained.
8. Press the **F** key (Figure 11-9) to confirm.  
If everything is correct, the blinking **"Accepted"** message appears on the display for 2 sec.

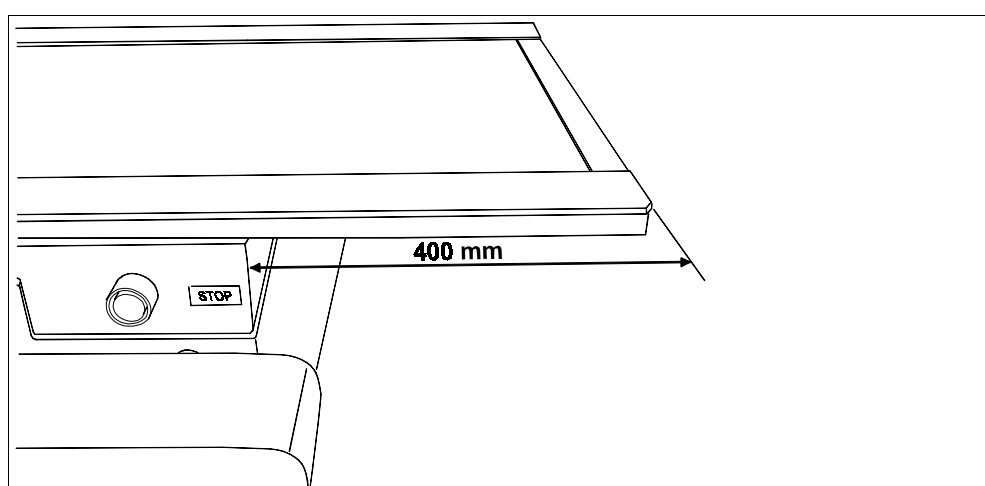
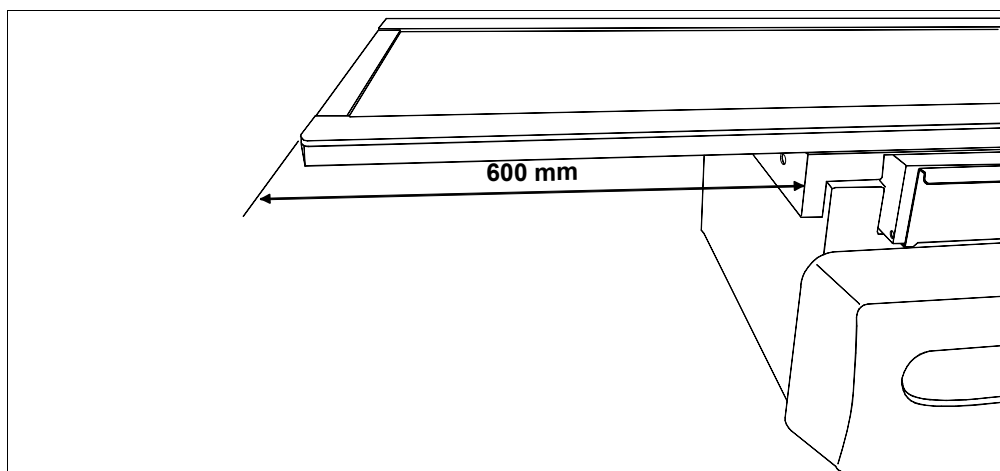


Figure 11-1

### Adjusting the maximum value

9. Use the **G** key (Figure 11-9) to select cell **104**.
10. The display shows the blinking value **600**, which corresponds to the target value in mm, relative to the centred position, for performing the adjustment, and the potentiometer reading after the ADC conversion, expressed as a number between 0 and 4095.
11. Shift joystick **H** (Figure 11-9) to the **right**, actuating the motion toward the **head side**.
12. The displayed potentiometer reading should increase.
13. Using a tape measure, check that the tabletop reaches the maximum position, equivalent to the value indicated, measuring it as shown in Figure 11-2.
14. Check that the potentiometer value is approximately **3200**.
15. Press the **F** key (Figure 11-9) to confirm.  
If everything is correct, the **"Accepted"** message appears on the display for 2 sec.

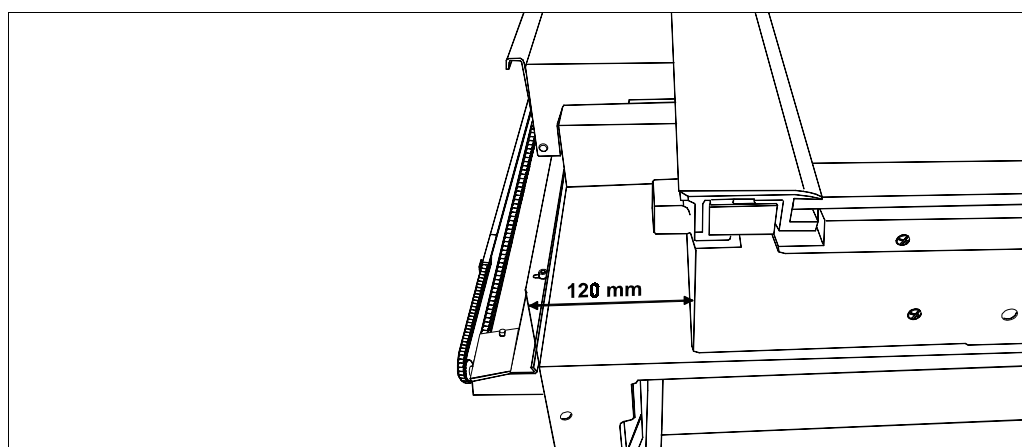


**Figure 11-2**

### 11.1.3 Adjusting the TRANSVERSAL-TABLE TOP potentiometer (cells 105-106)

#### Adjusting the minimum value

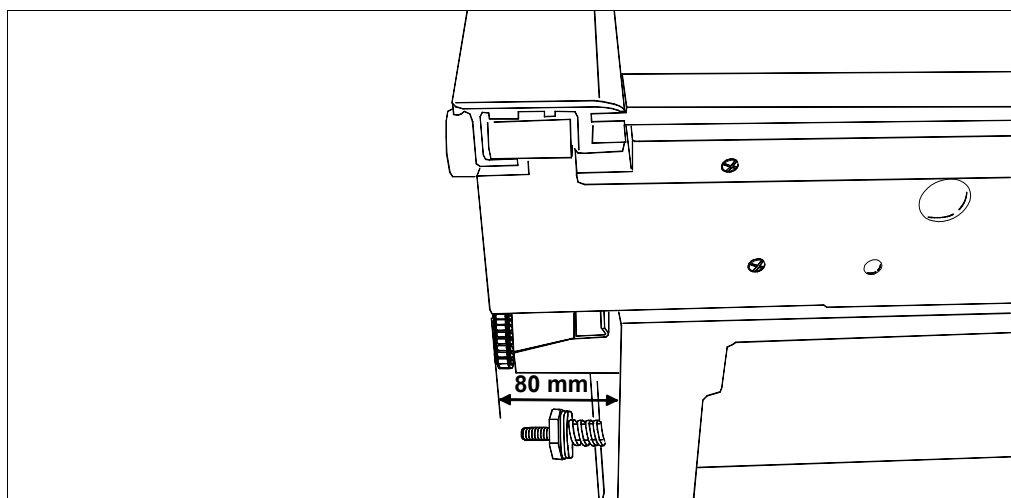
1. Using the **E** and **G** keys (Figure 11-9), select cell **105** on the display.
2. The blinking value **-100** appears, corresponding to the target value in mm, relative to the centred position, for performing the adjustment.
3. The potentiometer value after the ADC conversion is shown on the display, as a number between 0 and 4095.
4. Shift joystick **H** (Figure 11-9) to the **left**, actuating the motion toward the **inside direction**.
5. The potentiometer value shown on the display should decrease. If this does not happen, it means that the 2 potentiometer terminals have been inverted.
6. Using a tape measure, check that the tabletop reaches the minimum position, equivalent to the value indicated, measuring it as shown in Figure 11-3.
7. Check that the potentiometer reading is approximately **600**, and if this is not the case disengage the gear and turn the potentiometer until the required value is obtained.
8. Press the **F** key (Figure 11-9) to confirm. If everything is correct, the blinking **"Accepted"** message appears on the display for 2 sec.



**Figure 11-3**

### Adjusting the maximum value

9. Use the **G** key (Figure 11-9) to select cell **106**.
10. The display shows the blinking value **100**, corresponding to the target value in mm, relative to the centred position, for performing the adjustment, and the value of the potentiometer after the ADC conversion, expressed as a number between 0 and 4095.
11. Shift joystick **H** (Figure 11-9) to the **right**, actuating the movement toward the **outside direction**.
12. The displayed potentiometer value should increase.
13. Using a tape measure, check that the tabletop reaches the maximum position, equivalent to the value indicated, measuring it as shown in Figure 11-4.
14. Check that the potentiometer reading is approximately **3400**.
15. Press the **F** key (Figure 11-9) to confirm.  
If everything is correct, the **"Accepted"** message appears on the display for 2 sec.



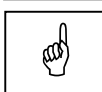
**Figure 11-4**



### 11.1.4 Adjusting the FILM-FOCUS DISTANCE potentiometer (cells 107-108)

#### Adjusting the minimum value

1. Using the **E** and **G** keys (Figure 11-9), select cell **107** on the display.
2. The blinking value **520** appears, corresponding to the target value in mm for performing the adjustment.

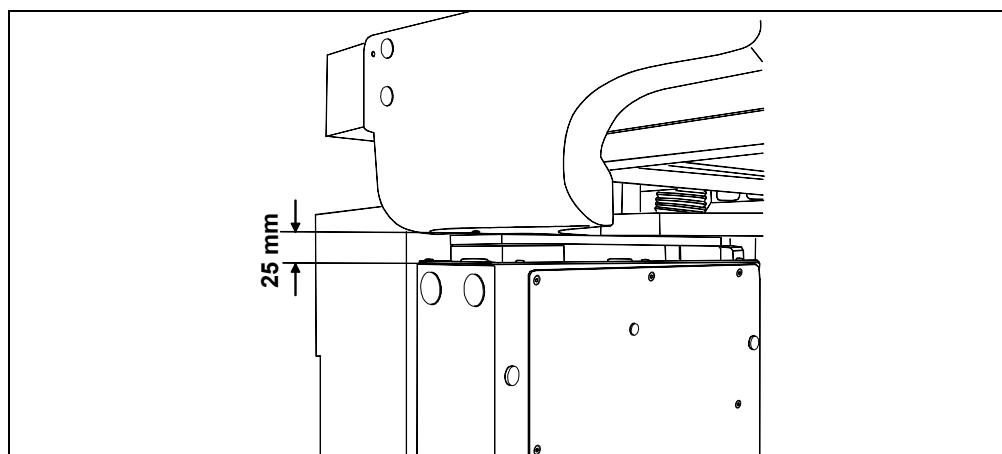


**NOTE:**

The 520 mm value which appears is the distance between the collimator base and the lower Plexiglas window of the serial changer.

The real film-focus distance used for viewing on the display and for the collimator formats is calculated by the operating software, taking into account the adjustment of this potentiometer and the values entered in cells 438 (collimator base – focus distance) and 440 (serial changer base – film distance).

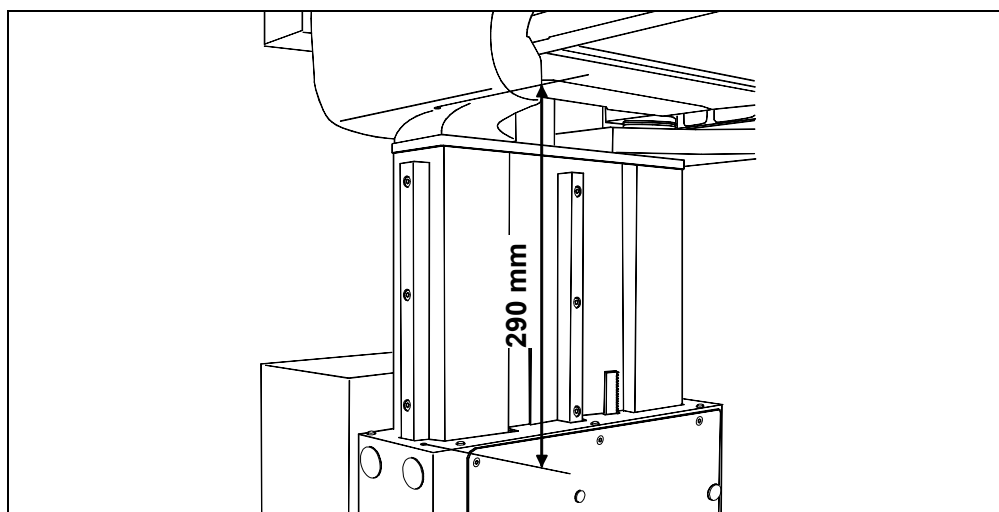
3. The potentiometer value after the ADC conversion is shown on the display, expressed as a number between 0 and 4095.
4. Manually bring the serial changer to its maximum compression position (minimum distance from the patient support).
5. The displayed potentiometer value should decrease.  
If this does not happen, it means that the 2 potentiometer terminals have been inverted.
6. Use a tape measure to check that the minimum position, equivalent to the indicated value, is reached, measuring it as shown in Figure 11-5.
7. Check that the potentiometer value is approximately **600**, and if this is not the case, disengage the gear and turn the potentiometer until the required value is obtained.
8. Press the **F** key (Figure 11-9) to confirm.  
If everything is correct, the **“Accepted”** message will appear on the display for 2 sec.



**Figure 11-5**

## Adjusting the maximum value

9. Use the **G** key (Figure 11-9) to select cell **108**.
10. The display shows the blinking value **785**, corresponding to the target value in mm for performing this adjustment, and the value of the potentiometer after the ADC conversion, expressed as a number between 0 and 4095.
11. Manually bring the serial changer to the minimum compression position (maximum distance from the patient support).
12. The displayed potentiometer value should increase.
13. Use a tape measure to check that the maximum position, equivalent to the indicated value, is reached, measuring it as shown in Figure 11-6.
14. Check that the potentiometer value is approximately **3400**.
15. Press the **F** key (Figure 11-9) to confirm.  
If everything is correct, the blinking **"Accepted"** message appears for 2 sec on the display.



**Figure 11-6**

### 11.1.5 Adjusting the COLLIMATOR WIDTH potentiometer (cells 109-110)

#### Adjusting the minimum value

1. Using the **E** and **G** keys (Figure 11-9), select cell **109** on the display.
2. The blinking value **0** appears, corresponding to the target collimated field size on the film in function of data present into cell 457 for making this adjustment.



**NOTE:**

The minimum value adjustment determine the collimator size for all exposure format.

An adjustment with shutters a little open will therefore lead to sizes bigger than nominal.

3. The potentiometer value after the ADC conversion is shown on the display, as a number between 0 and 4095.
4. Shift joystick **H** (Figure 11-9) to the **left**, actuating the **closing** movement.
5. The displayed potentiometer value should decrease.  
If this does not happen, it means that the 2 terminals of the potentiometer have been inverted.
6. Check that the collimator shutters are closed.
7. Check that the potentiometer value is approximately **940**, and if this is not the case, disengage the gear and turn the potentiometer until the required value is obtained.
8. Press the **F** key (Figure 11-9) to confirm.  
If everything is correct, the blinking **“Accepted”** message appears for 2 sec on the display.

### **Adjusting the maximum value**

9. Use the **G** key (Figure 11-9) to select cell **110**.
10. The display shows the blinking value, calculated by the software, of the target collimated field size in function of data present into cell 457 for making the adjustment, and the potentiometer value after the ADC conversion, expressed as a number between 0 and 4095.



**NOTE:**

The maximum value of this potentiometer is used by the system as linearization limit. Therefore, this adjustment must be performed with the shutters fully open in order to make sure that linearization will be correct for the whole travel of the relevant motion.

11. Shift joystick **H** (Figure 11-9) to the **right**, actuating the **opening** movement.
12. The displayed potentiometer value should increase.
13. Check that the collimated field corresponds to a format larger than 35 cm on the film.
14. Check that the potentiometer value is approximately **3650**.
15. Press the **F** key (Figure 11-9) to confirm.  
If everything is correct, the blinking **“Accepted”** message appears on the display for 2 sec.

### 11.1.6 Adjusting the COLLIMATOR HEIGHT potentiometer (cells 111-112)

#### Adjusting the minimum value

1. Using the **E** and **G** keys (Figure 11-9), select cell **111** on the display.
2. The blinking value **0** appears, corresponding to the target collimated field size on the film as a function of data stored into cell 457 for making this adjustment.



**NOTE:**

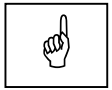
The adjustment of the minimum value determine the collimator size for all exposure format.

An adjustment with shutters a little open will therefore lead to sizes bigger than nominal.

3. The potentiometer value after the ADC conversion is shown on the display, as a number between 0 and 4095.
4. Shift joystick **H** (Figure 11-9) to the **left**, actuating the **closing** motion.
5. The displayed potentiometer value should decrease.  
If this does not happens, it means that the 2 ends of the potentiometer have been inverted.
6. Check that the collimator shutters are closed.
7. Check that the potentiometer value is approximately **940**, if this is not the case, disengage the gear and turn the potentiometer until the required value is obtained.
8. Press the **F** key (Figure 11-9) to confirm.  
If everything is correct, the blinking **“Accepted”** message appears on the display for 2 sec.

### **Adjusting the maximum value**

9. Use the **G** key (Figure 11-9) to select cell **112**.
10. The display shows the blinking value, calculated by the software, of the target collimated field size in function of data present into cell 457 for making the adjustment, and the potentiometer value after the ADC conversion, expressed as a number between 0 and 4095.



**NOTE:**

The maximum value of this potentiometer is used by the system as linearization limit. Therefore, this adjustment must be performed with the shutters fully open in order to make sure that linearization will be correct for the whole travel of the relevant motion.

11. Shift joystick **H** (Figure 11-9) to the **right**, actuating the **opening** movement.
12. The displayed potentiometer value should increase.
13. Check that the collimated field corresponds to a format larger than 35 cm on the film.
14. Check that the potentiometer value is approximately **3650**.
15. Press the **F** key (Figure 11-9) to confirm.  
If everything is correct, the blinking **“Accepted”** message appears for 2 sec on the display.

### 11.1.7 Adjusting the SHUTTERS potentiometer (cell 117)

#### Adjusting the minimum value

1. Using the **E** and **G** keys (Figure 11-9), select cell **117** on the display.
2. The potentiometer value after the ADC conversion appears on the display, expressed as a number between 0 and 4095.
3. Shift joystick **H** (Figure 11-9) to the **left**, actuating the **opening** motion of the shutters toward the minimum position. The display shows the "min" message, signalling the motion of the shutters toward the minimum.
4. The displayed potentiometer value should decrease.  
If this does not happen, it means that the 2 potentiometer terminals has been inverted.
5. When the shutters reach the minimum position switch, the motion is automatically halted and the display shows the blinking "**Accepted**" message for 2 sec.
6. Check that the potentiometer value is approximately **900**, and if this is not the case disengage the gear and turn the potentiometer until the required value is obtained, and repeat the adjustment procedure.

#### Adjusting the maximum value

7. Shift joystick **H** (Figure 11-9) to the **right**, actuating the **closing** motion of the shutters towards the overlap position, which corresponds to the maximum position.
8. The displayed potentiometer value should increase.
9. When the shutters reach the maximum switch the movement is halted automatically and the display shows the blinking "**Accepted**" message for 2 sec.
10. Check that the potentiometer value is approximately **3300**.

### **11.1.8 Adjusting the CASSETTE TRAY potentiometer (cell 119)**

#### **Adjusting the minimum value**

1. Using the **E** and **G** keys (Figure 11-9), select cell **119** on the display.
2. The potentiometer reading after the ADC conversion is shown on the display, as a number between 0 and 4095.
3. Shift joystick **H** (Figure 11-9) to the **left**, actuating a motion of the cassette tray toward the **parked position**, which corresponds to the minimum position. The display shows the "min" message, indicating the movement of the tray towards the minimum.
4. The displayed potentiometer value should decrease.  
If this does not happen it means that the 2 potentiometer terminals have been inverted.
5. When the tray reaches the minimum switch the motion is automatically halted and the display shows the blinking **"Accepted"** message for 2 sec.
6. Check that the potentiometer value is approximately **900**, and if it isn't disengage the gear and turn the potentiometer until the required value is obtained, and repeat the adjustment procedure.

#### **Adjusting the maximum value**

7. Shift joystick **H** (Figure 11-9) to the **right**, actuating a movement of the cassette tray toward the **exit** position, i.e. toward the cassette loading position, which corresponds to the maximum position.
8. The displayed potentiometer value should increase.
9. When the tray reaches the maximum switch, the motion is automatically halted and the display shows the blinking **"Accepted"** message for 2 seconds.
10. Check that the potentiometer value is approximately **3300**.

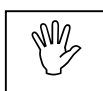


## **11.2 Accessing group 200 - Installation parameters**

Group 200 contains all the parameters connected with the installation of the equipment.

All these cells contain default values, which are entered during the factory testing phase.

The values in these cells must be correct according to installation condition (i.e. room site).



**WARNING:**

This group of cells contains parameters which determine the stopping distance of the tabletop with respect to the floor, walls, and ceiling.

For safety reason, set up these values so that no part of the equipment can EVER stop at a distance of less than 50 mm from any part of the room.

To obtain read-only access to the group 200 parameters, proceed as follows:

1. Turn off the equipment and place switch 2 (Dip-switch Q16 of SFD CPU board A1) in the ON position
2. Turn on the machine.  
The display will show:
  - the number of the group and the selected cell
  - the parameter value stored in memory.
3. Using the **G** and **E** keys (Figure 11-9) it is possible to increase and decrease the number of the selected cell. As mentioned previously, in this phase it is not possible to edit any parameter.

To modify the parameter values stored in memory, proceed as follows:

4. Press the **D** key (Figure 11-9) for 5 sec.  
When this time has elapsed, the display will show:
  - 002, the page number used for entering the passwords
  - 00000, waiting for the password to be entered.
5. Press the **F** key.  
The blinking "\*" symbol appears on the display, prompting for entering the password.
6. Enter the password for this group of cells (Ref. 2 pg.11-1) using the number keys.  
This value will appear scrolling from right to left on the display.

7. Press the **F** (Figure 11-9) key to confirm.  
If the confirm key is not pressed within 15 sec. after entering the last digit, the blinking "\*" symbol and the digits already entered disappear from the display.  
It will then be necessary to re-enter the password.  
If, instead, the confirm key is pressed within the 15 sec. time-out, the blinking C2 message appears on the display, indicating that password has granted access to the group 200 parameters.
8. Hold down the **D** key (Figure 11-9) for 5 sec.  
The display reverts to showing the group 200 position which was previously abandoned to access page 002.

At this point it is possible to modify the parameters stored in the cells of this group. To modify the parameters, proceed as follows:

9. Using the **E** and **G** keys (Figure 11-9), select the desired cell.  
The display will show the selected cell, and the associated value stored in memory.
10. Press the **F** key.  
The blinking "\*" symbol appears on the display.
11. Using the number keys (Figure 11-1) enter the new value for the parameter, which will appear on the display.



**NOTE:**

The **A** key (Figure 11-1) adds or removes the "-" sign in front of the numeric value for those cells where a negative value is allowed.

12. Press the **F** key (Figure 11-9) to confirm.  
If the **F** confirm key is not pressed within 15 sec. after entering the last digit, the blinking "\*" symbol and the previously entered digits will disappear from the display.  
The display will revert to showing the previous, unmodified value of the parameter, which remains in memory.  
If, instead, the confirm key is pressed within the established time-out, the new modified value will be saved in memory.

## **11.2.1 Group 200 cells and their functions**

### **"NUMERIC" cells**

This cells contains "numeric" data which depends on the parameter to be stored.

- **201 - Distance between left wall and table head side.**

This cell contains the measured distance between the left wall and the head-side of the table (Figure 11-7).

Unit of measurement:           mm  
Minimum accepted value:       300  
Maximum accepted value:       3000.

- **202 - Distance between right wall and table foot side.**

This cell contains the measured distance between the right wall and the foot-side of the table (Figure 11-7).

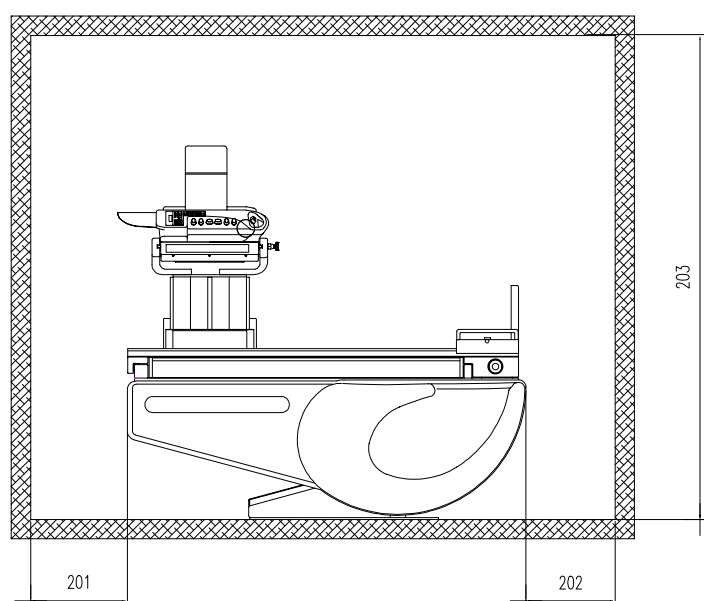
Unit of measurement:           mm  
Minimum accepted value:       -3000  
Maximum accepted value:       -300.

- **203 - Distance between floor and ceiling.**

This cell contains the measured distance between the ceiling and the floor in the area where the table will be used (Figure 11-7).

If there are objects attached to the ceiling within the range of the system's trajectory, the value entered in the cell should take them into account.

Unit of measurement:           mm  
Minimum accepted value:       2000  
Maximum accepted value:       5000.



**Figure 11-7**

- **204 – Minimum I.I. field size.**

If a 3-field Image Intensifier is installed, this cell must contain the diameter of the minimum field.

If the I.I. is of the single field type, enter the diameter of the entrance window.

The value of this parameter is used to make the collimator shutters visible, or puts them outside the Image Intensifier.

Unit of measurement:                      mm

Minimum accepted value:                90

Maximum accepted value:                450.

- **205 – Medium I.I. field size.**

If a 3-field Image Intensifier is installed, this cell must contain the diameter of the medium field.

In the case of a single field I.I., enter the diameter of the entrance window.

The value of this parameter is used to make the collimator shutters visible, or puts them outside the Image Intensifier.

Unit of measurement:                      mm

Minimum accepted value:                90

Maximum accepted value:                450.

- **206 - Maximum I.I. field size.**

If a 3-field Image Intensifier is installed, this cell must contain the diameter of the maximum field.

In the case of a single field Image Intensifier, enter the diameter of the entrance window.

The value of this parameter either makes the collimator shutters visible, or puts them outside the Image Intensifier.

Unit of measurement:                      mm

Minimum accepted value:                90

Maximum accepted value:                450.

## **DEAD BAND**

In this equipment, the dead band is applicable to the transversal and longitudinal table top and tilting motions.

The dead band is the distance from the software travel limit, determined by the position potentiometer, starting from which the motion is halted.

The total value of the dead band is equal to twice the entered value. In fact, if the parameter value is 7 mm, the motion will be halted 7 mm before the software limit determined by the potentiometer, and the motor will be off even if it overshoots this limit by 7 mm.

The dead band is therefore activated upon reaching a travel limit, or when the trajectory has an established arrival point, such as the centring position.

Therefore, the greater the value of this parameter, the larger the “window” within which the motion can position itself.

If the motion is halted by releasing the control, before reaching its arrival point or travel limit, the dead band has no effect.

- **207 – Dead band for tilting motion.**

The value entered in this cell is the dead band for the tilting motion. In this motion, the dead band is triggered at the travel limits and when reaching the horizontal position.

Unit of measurement: degrees

Minimum accepted value: 0.1

Maximum accepted value: 9.0.

- **208 – Dead band for longitudinal tabletop motion.**

The value entered in this cell is the dead band for the longitudinal tabletop motion.

In this motion the dead band is triggered at the travel limits and when reaching the centred position.

Unit of measurement: mm

Minimum accepted value: 0.1

Maximum accepted value: 9.0.

- **209 – Dead band for transverse tabletop motion.**

The value entered in this cell is the dead band for the transversal tabletop motion.

In this motion the dead band is triggered at the travel limits and when reaching the centred position.

Unit of measurement: mm

Minimum accepted value: 0.1

Maximum accepted value: 9.0.

- **210 – Safety distance from the floor.**

The value entered in this cell is the safety distance between the patient support and the floor.

Unit of measurement: mm

Minimum accepted value: 20

Maximum accepted value: 400.

- **211 – Safety distance from the ceiling.**

The value entered in this cell is the safety distance between the patient support and the ceiling.

Unit of measurement: mm

Minimum accepted value: 20

Maximum accepted value: 400.

- **212 – Safety distance from the walls.**

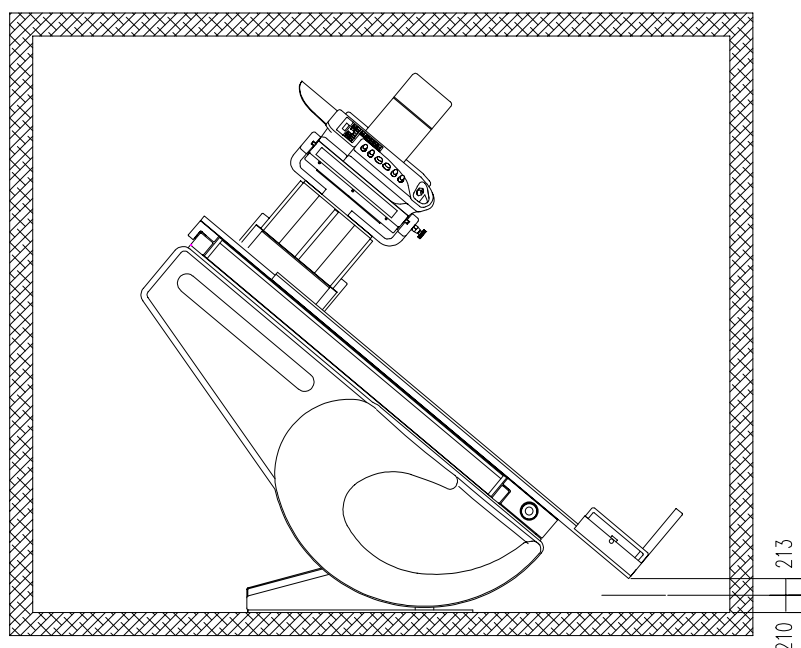
The value entered in this cell is the safety distance between the patient support and the walls (left and right).

Unit of measurement: mm  
Minimum accepted value: 20  
Maximum accepted value: 400.

- **213 – Longitudinal tabletop retract band.**

This cell contains the band in which the tabletop is retracted to the centred position, when the tilting motion is active. This retract movement starts from the floor safety distance entered in cell 210 (Figure 11-8).

Unit of measurement: mm  
Minimum accepted value: 10  
Maximum accepted value: 300.



**Figure 11-8**

- **215 – Start grid motion delay.**

In the standard X-ray exposure sequence, the starting of the grid motion can be delayed with respect to the exposure request sent to the generator. The value entered in this cell is this delay, which is used to synchronise the grid positioning with the exposure.

Unit of measurement: sec  
Minimum accepted value: 0.00  
Maximum accepted value: 2.00.

- **216 – Speed of tilting motion.**

The value entered in this cell is the speed of the tilting motion, expressed in °/sec.

This should be an average value, i.e. one which takes into account the various operating conditions (toward vertical, toward trendelembourg, loaded, etc).

It is possible to view the instantaneous speed on the display by selecting cell 233 and operating the joystick of this motion.

The software uses this value to check that the potentiometer correctly follows the motion while it is taking place.

This value is closely connected to the value in cell 443.

Unit of measurement: °/sec

Minimum accepted value: 1.0

Maximum accepted value: 10.0.

- **217 – Speed of longitudinal tabletop motion.**

The value entered in this cell is the speed of the longitudinal tabletop motion, expressed in mm/sec.

This should be an average value, which takes into account the different operating conditions (vertical, horizontal, loaded, etc).

It is possible to view the instantaneous speed on the display by selecting cell 233 and operating the joystick of this motion.

The software uses this value to check that the potentiometer correctly follows the motion while it is taking place.

This value is closely connected to the value in cell 444.

Unit of measurement: mm/sec

Minimum accepted value: 10

Maximum accepted value: 100.

- **218 – Speed of transversal tabletop motion.**

The value entered in this cell is the speed of the transverse tabletop motion expressed in mm/sec.

This should be an average value, which takes into account the different operating conditions (vertical, horizontal, loaded, etc).

It is possible to view the instantaneous speed on the display by selecting cell 233 and operating the joystick of this motion.

The software uses this value to check that the potentiometer correctly follows the motion while it is taking place.

This value is closely connected to the value in cell 445.

Unit of measurement: mm/sec

Minimum accepted value: 10

Maximum accepted value: 200

- **219 – Horizontal position stop time.**

The value in this cell determines the stopping time of the table in the horizontal position, during the tilting motion.

Unit of measurement:            sec  
Minimum accepted value:        0.01  
Maximum accepted value:        9.99.

- **220 – Collimator base size correction.**

This parameter is used to increase or decrease, by the amount entered in the cell, all the cassette sub-division formats limited by the collimator base. This difference does not apply to the minimum and maximum potentiometer limits.

Unit of measurement:            mm  
Minimum accepted value:        -25.0  
Maximum accepted value:        25.0

- **221 – Display language setting.**

The value entered in this cell selects one of the following languages for the display messages:

- 0- Italian
- 1- English
- 2- French
- 3- to be defined
- 4- to be defined
- 5- to be defined
- 6- to be defined
- 7- to be defined

The alarms and messages will be shown in the chosen language, whereas the technical menu will be displayed in Italian for language setting 0, and in English for any other value.

- **222 – Tabletop stop time in centred position.**

The value entered in this cell determines the stopping time of the tabletop in the centred position for both the longitudinal and transversal motions.

Unit of measurement:            sec  
Minimum accepted value:        0.00  
Maximum accepted value:        9.99.

- **223 – Collimator height size correction.**

This parameter is used to increase or decrease, by the amount entered in the cell, all the cassette sub-division formats limited by the collimator height. This difference does not apply to the minimum and maximum potentiometer limits.

Unit of measurement:            mm  
Minimum accepted value:        -25.0  
Maximum accepted value:        25.0



## **"ON-OFF" cells**

The following cells contain on-off parameters, which are set by entering the value **0** or **1**.

To change these parameter settings, proceed as follows:

1. Press the **F** key (Figure 11-9) to enable editing of the value.  
The blinking "\*" symbol appears on the display.
2. Press the **A** key (Figure 11-9) to toggle the value (0, 1)  
After the selection, the "\*" symbol disappears and the modified value is stored in the EEPROM.

- **230 – Eject cassette at end of program.**

At the end of a cassette sub-division program, the tray can be automatically driven to the cassette loading position, or it can await the manual eject command in the parked position.

**Value 1** = automatic eject

**Value 0** = wait in parked position.

- **231 – Collimator Hold enabled by default.**

The automatic collimator function can be coupled with the Hold function.

This parameter determines whether the hold function is enabled by default each time the equipment is switched on, or whether it is selected manually.

**Value 1** = hold enabled by default with the automatic collimator program

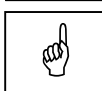
**Value 0** = hold selected manually.

- **232 – Selection of cassette type (cm/inches).**

This parameter selects the type of cassettes that will be used in the serial changer.

**Value 1** = cassette in inches

**Value 0** = cassette in cm.



**NOTE:**

The selection of the cassette type (cm or inches) must be consistent with the hardware (board A11) installed on the unit.  
Never change the factory setting of this cell.

- **233 – Service cell for:**

- collimator motion without limits
- speed display: longitudinal, transverse, tilting.

When this function is enabled, the blinking "SERVICE" message appears on the display.

The collimator can be moved from its minimum to maximum position using the joystick, regardless of the format or cassette sub-division.

This function allows to perform adjustments and checks on the system, without automatic motion of the collimator.

In addition, if the following joystick motions are actuated:

- longitudinal
- transverse
- tilting

the display will show the instantaneous speed of the actuated motion.

**Value 1** = utility setting

**Value 0** = normal operation.

- **234 – Select transversal cassette motion for cross sub-division.**

It allows to run the cross sub-division programs so that the transversal cassette tray motion is toward either the foot end or the head end during the first half of the program.

In consequence, the radiographs will have to be read from the bottom up or vice versa.

**Value 1** = head/foot motion (radiographs read from top to bottom)

**Value 0** = foot/head motion (radiographs read from bottom to top).

- **235 – Select four-way tabletop motion.**

This parameters allows setting the type of tabletop installed on the equipment.

The possibilities are:

- longitudinal motion only (2 way)
- both longitudinal and transversal motion (4 way)

**Value 1** = 4 way tabletop

**Value 0** = 2 way tabletop.



**NOTE:**

The selection of this cell must be consistent with the hardware (type of table top) installed on the unit.

Never change the factory setting of this cell.

- **236 – Monitor image horizontal reverse.**

This parameter sets the default horizontal reverse of the image displayed on the monitor, to suit the type of TV chain that is installed.

With value = 1, on power-up the LED on the horizontal reverse button is off, and the corresponding output (X0-19) is activated. Pressing the button causes the LED to illuminate and resets the output.

Therefore, the LED and output are NOT in phase with each other. With value = 0 instead the LED and output will be in phase.

**Value 1** = Reverse enabled

**Value 0** = Reverse disabled.

- **237 – Monitor image vertical reverse.**

This parameter sets the default vertical reverse of the image displayed on the monitor, to suit the type of TV chain that is installed.

With value = 1, on power-up the LED on the vertical reverse button is off, and the corresponding output (X0-18) is activated. Pressing the button causes the led to illuminate and resets the output.

Therefore, the LED and its output are NOT in phase with each other. With value = 0 instead the LED and output will be in phase.

**Value 1** = Reverse enabled

**Value 0** = Reverse disabled.

- **238 – Re-entry tabletop from head side during tilting.**

If the equipment is powered at a frequency of 60 Hz, the extension of the tabletop from the head side must not exceed 400 mm during the tilting motion.

Therefore, with parameter value = 1, when tilting towards the vertical is activated, the tabletop is retracted to a maximum extension of 400 mm before starting the tilting motion.

Obviously this takes place only when the extension of the tabletop from the head side is greater than 400 mm.

**Value 1** = Retract enabled

**Value 0** = No retraction.



**NOTE:**

The selection of this cell must be consistent with the hardware configuration (version) installed on the unit.  
Never change the factory setting of this cell.

- **239 – Enable manual kV adjustment.**

The function for manually controlling the kV during fluoroscopy, using the increase and decrease kV keys on the control panel, is present on terminal block X0 pins 12 (analog) and 41-42 (digital) and can be inhibited.

**Value 1** = Function enabled

**Value 0** = Function inhibited.



**WARNING:**

Cell 239 is always set to 0 for the US market.

In fact, the function for manually controlling the kV and mA value during fluoroscopy mode is not available for the US market.

---

## 11.2.2 Summary of the group 200 cells and their default settings

### "NUMERIC" cells

Cell	Function	min	max	Default	Modified
<b>201</b>	Left wall distance	300	3000	<b>3000</b>	
<b>202</b>	Right wall distance	-3000	-300	<b>-3000</b>	
<b>203</b>	Floor – ceiling distance	2000	5000	<b>3000</b>	
<b>204</b>	Minimum I.I. screen size	90	450	<b>130</b>	
<b>205</b>	Medium I.I. screen size	90	450	<b>150</b>	
<b>206</b>	Maximum I.I. screen size	90	450	<b>225</b>	
<b>207</b>	Tilting dead band	0.1	9.0	<b>0.5</b>	
<b>208</b>	Longitudinal t.top dead band	0.1	9.0	<b>5</b>	
<b>209</b>	Transversal t.top dead band	0.1	9.0	<b>2</b>	
<b>210</b>	Safety distance from floor	20	400	<b>100</b>	
<b>211</b>	Safety distance from ceiling	20	400	<b>200</b>	
<b>212</b>	Safety distance from walls	20	400	<b>200</b>	
<b>213</b>	Tabletop retract band during tilting	10	300	<b>100</b>	
<b>215</b>	Start grid motion delay	0.00	2.00	<b>0.5</b>	
<b>216</b>	Speed of tilting motion	1.0	10.0	<b>3.2 @ 50Hz</b> <b>3.9 @ 60Hz</b>	
<b>217</b>	Speed of longitudinal t.top motion	10	100	<b>31 @ 50Hz</b> <b>37 @ 60Hz</b>	
<b>218</b>	Speed of transversal t.top motion	0	200	<b>54</b>	
<b>219</b>	Stopping time in horizontal position	0.01	9.99	<b>1.00</b>	
<b>220</b>	Collimator base size correction	-25.0	25.0	<b>00.0</b>	
<b>221</b>	Display language setting	0	7	<b>0</b>	
<b>222</b>	T.top stopping time in centred position	0.01	9.99	<b>0.00</b>	
<b>223</b>	Collimator height size correction	-25.0	25.0	<b>00.0</b>	

## **"ON-OFF" cells**

<b>Cell</b>	<b>Function</b>	<b>Selection</b>	<b>Default</b>	<b>Modified</b>
<b>230</b>	Eject cassette at end of program	1 = yes    0 = no	<b>1</b>	
<b>231</b>	Collimator hold enabled by default	1 = yes    0 = no	<b>1</b>	
<b>232</b>	Selecting of cassette type	1 = inch    0 = cm	<b>0</b>	
<b>233</b>	Service cell	1 = yes    0 = no	<b>0</b>	
<b>234</b>	Select cross sub-division sequence	1 = head-foot 0 = foot-head	<b>0</b>	
<b>235</b>	4 way tabletop motion	1 = 4 way 0 = 2 way	<b>1</b>	
<b>236</b>	Horizontal image reverse	1 = yes    0 = no	<b>0</b>	
<b>237</b>	Vertical image reverse	1 = yes    0 = no	<b>0</b>	
<b>238</b>	Re-entry tabletop during tilting	1 = yes    0 = no	<b>0</b>	
<b>239</b>	Enable manual kV adjustment	1 = active 0 = inhibited	<b>1</b>	

## **11.3 Accessing group 300 - Motor parameters**

Group 300 contains all the parameters connected with the operation of the motors regulated by the PID method (proportional, integral, derivative).

All these cells contain default values, which are entered during the factory testing phase.

The values in these cells can be modified in order to optimise the functioning of the system.

Do not attempt to modify any of the parameters in this program without a complete understanding of its meaning, function and any possible consequences.

The following paragraphs provide an overview of the functions of the different parameters for each of the motors regulated by the PID system.

### **11.3.1 Operating theory of a PID-regulated axis.**

To actuate the motion of an axis, the control software must know:

- the starting point of the motion
- the point of arrival (set point).

The starting point is known, and coincides with the current position of the axis.

The set point is determined by what motion control has been activated, and in what direction.

In order to reach the arrival point it is therefore necessary to follow a trajectory.

This trajectory will be followed using the values entered in the cells for speed and acceleration.

The execution of the motion, therefore requires 2 separate software operations:

- Generation of the trajectory
- Feedback chasing of the trajectory

- **Generation of the trajectory**

The software builds a variable representing the point at which the motion should be at any given instant.

This variable represents the theoretical trajectory.

As the origin is the starting point, the generation of the theoretical trajectory consists of:

- a rising ramp, that is to say a constant-acceleration stretch in which the speed increases linearly
- a constant speed stretch
- a descending ramp, with equal but opposite acceleration to that of the rising ramp.

The speed and acceleration values used to generate the theoretical trajectory are those entered in the corresponding cells.

- **Feedback chasing of the trajectory**

The feedback chasing of the theoretical trajectory builds a variable which generates the real trajectory.

This variable is then translated into the reference signal (Vref), which is sent to the drive or component that controls the axis motor.

This signal will be modulated so that it approximates the preceding theoretical trajectory as closely as possible.

This variable is the sum of 3 components:

- **Proportional**

The proportional component is given by the product of:

**"instantaneous error" X "proportional gain"**

where:

- the **instantaneous error** is the difference between the real position (tracked by the feed back potentiometer) and the theoretical position (calculated by the generation of the trajectory)
- the **proportional gain** is the value entered in the corresponding cell.

This product is opportunely converted for the DAC that is used.

- **Integral**

The integral component is given by the product of:

**"sum of errors" X "integral gain"**

where:

- **sum of errors.**  
Every millisecond, the position error between the real and theoretical trajectories is calculated.  
The error can be a positive or negative value, depending on whether the real trajectory is ahead or delayed with respect to the theoretical one.  
The sum of all these sampled errors will be algebraic, i.e. it will take into account the negative or positive signs of the errors.  
The sum of the errors will therefore be a value that is accumulated during the entire trajectory.
- the **integral gain** is the value entered in the corresponding cell.

This product is opportunely converted for the DAC used.



- **Derivative**

The derivative component is given by the product of:

**"error difference between 2 samplings" X "derivative gain"**

where:

- **error difference between 2 samplings.**

Unlike the integral component, for the derivative calculation the interval between the 2 successive samplings must be entered in the corresponding cell.

This interval is expressed in msec. and is called the "derivative sampling interval".

At each sampling, the position error is calculated, i.e. the difference between the real and theoretical trajectory.

The difference between the errors measured in two successive samplings indicates by what amount the real trajectory has deviated from the theoretical trajectory.

- the **derivative gain** is entered in the corresponding cell.

This product is opportunely converted for the DAC that is used.

- **Integration limit**

This parameter is the maximum allowed value for the error sum of the integral component.

If the sum of the errors exceeds the value entered in this cell, the software will limit it to the maximum allowed value.

If the value entered in this cell is 0, there will be no upper limit on the integral.

This parameter prevents from an excessively energetic action in case the error sum is considerable.

- **Motor STOP error**

This is the error which causes the motion to be halted, and is calculated based on the difference between the real and theoretical positions of the motion. If the value of the error is equal to the value entered in this cell, the motion is halted and a blinking diagnostic message appears on the display.

- **Motor off delay**

This delay determines how long after reaching the theoretical travel limit(set point) the motion is halted.

This delay makes it possible to recover any discrepancies between the real and theoretical positions.

In this way, the integral action can complete its effect.

If the value of this parameter is 0, the motion will always remain enabled.

- **Minimum PID value for start motion**

This parameter determines the minimum torque value which causes the motion to be actuated.

An excessively low value will cause the motion to be activated whenever the joystick is shifted, even if the arrival point coincides with the starting point.

An excessively high value will result in sudden starting of the motion. This is because when the motion is activated the torque has already reached a considerable value.

To obtain read-only access to the data in group 300, proceed as follows:

1. Turn off the equipment and place switch 3 (Dip-switch Q16 of SFD CPU board A1) in the ON position.
2. Turn on the equipment.  
The display shows:
  - the number and group of the selected cell
  - the value currently stored in memory.
3. Using the **G** and **E** keys (Figure 11-9) it is possible to respectively increase and decrease the number of the selected cell. As mentioned previously, during this phase it is not possible to modify any of the parameters.

To edit and correct the parameters:

4. Press the **D** key (Figure 11-9) for 5 sec.  
When this time has elapsed, the display will show:
  - 002, the number of the page used for entering the passwords.
  - 00000, waiting for the password to be entered.
5. Press the **F** key (Figure 11-9).  
The blinking "\*" symbol appears on the display, prompting for entering the password.
6. Enter the password for this data group (Ref. 1 pg.11-1) using the number keys.  
This value will be shown scrolling from right to left on the display.
7. Press the **F** key (Figure 11-9) to confirm.  
If the confirm key is not pressed within 15 sec. after entering the last digit, the blinking "\*" symbol and the previously entered digits disappear from the display.  
It will then be necessary to re-enter the password.  
If, instead, the confirm key is pressed before the 15 sec. time-out, the blinking C137 message appears on the display, indicating that the password has enabled read-write access to groups 100-300-700, depending on which ones have their switch set ON.

8. Hold down the **D** key (Figure 11-9) for 5 sec.  
 The display reverts to the group 300 position which was abandoned at the time of accessing page 002.

At this point it is possible to modify the data in the cells belonging to this group. To edit the parameters, proceed as follows:

9. Using the **E** and **G** keys (Figure 11-9), select the desired cell.  
 The cell in question appears on the display, along with the corresponding value stored in memory.
10. Press the **F** key (Figure 11-9).  
 The blinking "\*" symbol appears on the display.
11. Using the number keys, enter the new value which will appear on the display.
12. Press the **F** key (Figure 11-9) to confirm.  
 If the **F** confirm key is not pressed within 15 sec. after entering the last digit, the blinking "\*" symbol and all the previously entered digits disappear from the display.  
 The previous, unmodified value reappears on the display, and remains stored in memory.  
 If, instead, the confirm key is pressed before the 15 sec time-out, the modified value is stored in memory.

The following table summarises the default settings for the motors regulated by the PID algorithm.

### **Collimator Width Motor**

Cell	Function	Unit	min	max	Default	Modified
<b>301</b>	Derivative sampling interval	sec	0.001	0.1	<b>0.001</b>	
<b>302</b>	Proportional gain	$\Sigma$	1	32000	<b>100</b>	
<b>303</b>	Integral gain	$\Sigma$	0	32000	<b>300</b>	
<b>304</b>	Derivative gain	$\Sigma$	0	32000	<b>100</b>	
<b>305</b>	Integration limit	mm	0	100	<b>10</b>	
<b>306</b>	Manual speed	mm/sec	1	800	<b>100</b>	
<b>307</b>	Manual speed 2	mm/sec	1	800	<b>1</b>	
<b>308</b>	Automatic speed	mm/sec	1	1600	<b>150</b>	
<b>309</b>	Manual acceleration	mm/sec <sup>2</sup>	100	3000	<b>400</b>	
<b>310</b>	Automatic acceleration	mm/sec <sup>2</sup>	200	6000	<b>430</b>	
<b>311</b>	Stop motor error	mm	0	500	<b>50</b>	
<b>312</b>	Motor off delay	sec	0.00	10.00	<b>0.50</b>	
<b>313</b>	Dead band	mm	0	20	<b>5</b>	
<b>314</b>	Minimum PID	DAC unit	0	32	<b>5</b>	

## Collimator Height Motor

Cell	Function	Unit	min	Max	Default	Modified
<b>315</b>	Derivative sampling interval	sec	0.001	0.1	<b>0.001</b>	
<b>316</b>	Proportional gain	$\Sigma$	1	32000	<b>100</b>	
<b>317</b>	Integral gain	$\Sigma$	0	32000	<b>300</b>	
<b>318</b>	Derivative gain	$\Sigma$	0	32000	<b>100</b>	
<b>319</b>	Integration limit	mm	0	100	<b>10</b>	
<b>320</b>	Manual speed	mm/sec	1	800	<b>100</b>	
<b>321</b>	Manual speed 2	mm/sec	1	800	<b>1</b>	
<b>322</b>	Automatic speed	mm/sec	1	1600	<b>150</b>	
<b>323</b>	Manual acceleration	mm/sec <sup>2</sup>	100	3000	<b>400</b>	
<b>324</b>	Automatic acceleration	mm/sec <sup>2</sup>	200	6000	<b>430</b>	
<b>325</b>	Stop motor error	mm	0	500	<b>50</b>	
<b>326</b>	Motor off delay	sec	0.00	10.00	<b>0.5</b>	
<b>327</b>	Dead band	mm	0	20	<b>5</b>	
<b>328</b>	Minimum PID	DAC unit	0	32	<b>5</b>	

## Shutters Motor

Cell	Function	Unit	min	max	Default	Modified
<b>329</b>	Derivative sampling interval	sec	0.001	0.1	<b>0.001</b>	
<b>330</b>	Proportional gain	$\Sigma$	1	32000	<b>2500</b>	
<b>331</b>	Integral gain	$\Sigma$	0	32000	<b>300</b>	
<b>332</b>	Derivative gain	$\Sigma$	0	32000	<b>2500</b>	
<b>333</b>	Integration limit	mm	0.0	500	<b>10</b>	
<b>334</b>	Initial speed	mm/sec	0.1	500	<b>100</b>	
<b>336</b>	Working speed	mm/sec	0.1	3000	<b>500</b>	
<b>337</b>	Initial acceleration	mm/sec <sup>2</sup>	0.1	3000	<b>250</b>	
<b>338</b>	Working acceleration	mm/sec <sup>2</sup>	0.1	3000	<b>500</b>	
<b>339</b>	Stop motor error	mm	0.0	500	<b>30</b>	
<b>340</b>	Motor off delay	sec	0.00	10.00	<b>0.5</b>	
<b>342</b>	Minimum PID	DAC unit	0	32	<b>5</b>	

## **Cassette Tray Motor**

<b>Cell</b>	<b>Function</b>	<b>Unit</b>	<b>min</b>	<b>max</b>	<b>Default</b>	<b>Modified</b>
<b>343</b>	Derivative sampling interval	sec	0.001	0.1	<b>0.001</b>	
<b>344</b>	Proportional gain	$\Sigma$	1	32000	<b>2500</b>	
<b>345</b>	Integral gain	$\Sigma$	0	32000	<b>300</b>	
<b>346</b>	Derivative gain	$\Sigma$	0	32000	<b>3000</b>	
<b>347</b>	Integration limit	mm	0.0	500	<b>10</b>	
<b>348</b>	Initial speed	mm/sec	0.1	500	<b>100</b>	
<b>349</b>	In-out speed	mm/sec	0.1	999.9	<b>500</b>	
<b>350</b>	Working speed	mm/sec	0.1	3000	<b>400</b>	
<b>351</b>	Initial acceleration	mm/sec <sup>2</sup>	0.1	3000	<b>250</b>	
<b>352</b>	Working acceleration	mm/sec <sup>2</sup>	0.1	6000	<b>3000</b>	
<b>353</b>	Stop motor error	mm	0.0	500	<b>30</b>	
<b>354</b>	Motor off delay	sec	0.00	10.00	<b>0.5</b>	
<b>356</b>	Minimum PID	DAC unit	0	32	<b>5</b>	

## **11.4 Accessing group 400/500/600 - Dimensions and movements range**

This group contains a broad range of parameters and functions.

As for the other groups, it is possible to obtain read-only access to the data contained in groups 400-500-600.

Follow the procedure below:

1. Turn off the equipment and place switches 1 and 2 (Dip-switch Q16 of SFD CPU board A1) in the ON position.
2. Turn on the equipment.  
The display shows:
  - the number of the group and the selected cell
  - the value stored in memory.
3. Using the **G** and **E** keys (Figure 11-9) it is possible to respectively increase or decrease the number of the cell shown on the display. As mentioned previously, in this phase it is not possible to modify any of the settings.

To modify the parameters:

4. Press the **D** key (Figure 11-9) for 5 sec.  
After this time has elapsed, the display will show:
  - 002 indicating the page number used for entering the passwords
  - 00000 waiting for the password to be entered.
5. Press the **F** key (Figure 11-9).  
The blinking "\*" symbol appears on the display, prompting for entering the password.
6. Enter the password for this data group (Ref. 3 pg.11-1) using the number keys.  
This value will appear scrolling from right to left on the display.
7. Press the **F** key (Figure 11-9) to confirm.  
If the confirm key is not pressed within 15 sec. after entering the last digit, the blinking "\*" symbol and the previously entered digits disappear from the display.  
It will then be necessary to re-enter the password.  
If, instead, the confirm key is pressed before the 15 sec. time-out, the blinking C456 symbol appears on the display, indicating that the password has provided read-write access to groups 400-500-600, depending on which ones have their switches set to ON.
8. Hold down the **D** key (Figure 11-9) for 5 sec.  
The display reverts to the group 400 position which was abandoned at the time of accessing.

Now the system allows to modify the data in the cells belonging to this group. To modify the data, proceed as follows:

- 9.** Use the **E** and **G** keys (Figure 11-9) to select the desired cell.  
The cell in question appears on the display, and the value stored in memory is shown.
- 10.** Press the **F** key (Figure 11-9).  
The blinking "\*" symbol appears on the display.
- 11.** Using the number keys, enter the new value, which will then appear on the display.
- 12.** Press the **F** key (Figure 11-9) to confirm.  
If the confirm key **F** is not pressed within 15 sec. after entering the last digit, the blinking "\*" symbol and the previously entered digits disappear from the display.  
The display will revert to showing the previous unmodified value, which remains stored in memory.  
If, instead, the confirm key is pressed within the 15 sec time-out, the new modified value will be stored in memory.

### 11.4.1 Travel limits for the motions

As previously described in the section on potentiometer settings, after selecting a cell which contains the minimum or maximum value of the potentiometer being adjusted, the display will show the travel limit which that motion must reach to coincide with that potentiometer value.

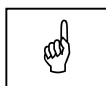
The travel limits are defined within this group of cells.

Changing the default parameter settings will alter the motion travel limits, and it will therefore require the re-positioning the emergency switches.

It will also be necessary to check whether the motion is mechanically able to reach the new travel limit.

The software will divide the new range of travel by the number of potentiometer points that are sampled between the new minimum and maximum limits.

In conclusion, these values **should never be modified** because they are closely bound up with the constructional features of the equipment.



**NOTE:**

If **VISION** is equipped with an X-ray tube with different mechanical characteristics from those set out in paragraph 5.2 "Tubes", modify the value in cell 401 so as to prevent the tube housing from colliding with the equipment base cover, and proceed to adjust the potentiometer as described in paragraph 11.1 "Potentiometer adjustments".

Cell	Function	min	max	Default	Modified
<b>401</b>	Minimum tilting	-32.0	0.0	<b>-15.0</b>	
<b>402</b>	Maximum tilting	0.0	92.0	<b>90.0</b>	
<b>403</b>	Min longitudinal t.top	-999	-200	<b>-400</b>	
<b>404</b>	Max longitudinal t.top	400	1200	<b>600</b>	
<b>405</b>	Min transversal t.top	-200	-50	<b>-100</b>	
<b>406</b>	Max transversal t.top	50	200	<b>100</b>	
<b>407</b>	Min collimator base –serial changer base (for SID)	200	999	<b>520</b>	
<b>408</b>	Max collimator base –serial changer base (for SID)	400	1300	<b>785</b>	
<b>417</b>	Shutters minimum	-9.9	9.9	<b>0</b>	
<b>418</b>	Shutters maximum	300	600	<b>375.8</b>	
<b>419</b>	Cassette tray minimum	-9.9	9.9	<b>0</b>	
<b>420</b>	Cassette tray maximum	300	800	<b>559.0</b>	



## 11.4.2 Dimensions of some parts of the equipment

This block of data contains some typical dimensions of the equipment. These dimensions are used by the software to calculate the collision limits.

Clearly, therefore, these parameters are closely dependent on the equipment hardware, and must **never be modified** to avoid compromising the equipment's operation.

Cell	Function	min	max	Default	Modific
<b>433</b>	Tilting centre height	100	700	<b>700</b>	
<b>434</b>	Tilting centre – lower tabletop distance.	10	400	<b>185</b>	
<b>435</b>	Tabletop thickness	10	100	<b>40</b>	
<b>436</b>	Left tabletop length	900	2500	<b>1395</b>	
<b>437</b>	Right tabletop length.	-1000	-200	<b>-625</b>	
<b>438</b>	Collimator base – focus dist.	10	150	<b>80</b>	
<b>439</b>	Serial changer base – shutters distance	0	100	<b>11</b>	
<b>440</b>	Serial changer base – film distance	10	200	<b>69</b>	
<b>441</b>	Serial changer base -I.I. dist.	0	250	<b>118</b>	
<b>442</b>	Cassette tray loading position.	300	900	<b>562.5</b>	
<b>457</b>	Collimator lamp – adjustment mask distance	300	900	<b>700</b>	
<b>458</b>	Shutters switch 0 offset	-20.0	20.0	<b>0</b>	

### **11.4.3 Potentiometer control data for single fault function**

This group consists of the following cells:

#### **443-444-445**

Which contain the maximum allowed error between the theoretical and real potentiometer values for the tilting, longitudinal and transversal tabletop motions.

The theoretical motion is calculated using the speed values in cells 216, 217 and 218, determined by the characteristics of the equipment.

The unit of measurement of these cells is mm.

#### **446-454**

These cells determine the potentiometer sampling window for the Single Fault (SF) safety. As explained in the separate section, the processor checks that the motion potentiometer values do not change when the motions themselves are inactive.

This is done to assure SF safety.

The value entered in this cell should take into account any residual inertial movements after the motion is halted.

To facilitate the interpretation of this parameter, the units of measurement can be expressed in degrees or millimetres.

The greater the value of this parameter, the longer the movement can continue after the motion is halted before the microprocessor generates an alarm.

#### **455**

This parameter determines the amount of additional travel allowed after reaching the software limits as read by the potentiometer, before an alarm is generated.

This extra travel can be the result of the dead bands, for example.

If the extra travel of the potentiometer exceeds the value entered in this cell, an alarm will be generated to indicate that the potentiometer is too close to the limit.

This makes it possible to detect whether a potentiometer circuit is interrupted at power up.

As for the previous cell, the unit of measurement is in "potentiometer digital value".

#### **456**

This parameter configures the SF safety relative to the joystick movements.

The delay entered in this cell, expressed in seconds, determines a time-window within which no SF alarm is generated (231 or 232), to mask the non-simultaneous mechanical activation of the switches by the joysticks.

<b>Cell</b>	<b>Function</b>	<b>min</b>	<b>max</b>	<b>Default</b>	<b>Modified</b>
<b>443</b>	Max tilting motion potentiometer error	0.5	20	<b>10</b>	
<b>444</b>	Max longitudinal t.top motion potentiometer error	5	500	<b>100</b>	
<b>445</b>	Max. transversal t.top motion potentiometer error	5	500	<b>30</b>	
<b>446</b>	Max tilting travel when motion inactive	0.5	10	<b>2</b>	
<b>447</b>	Max. longitudinal t.top travel when motion inactive	5	100	<b>10</b>	
<b>448</b>	Max. transversal t.top travel when motion inactive	5	100	<b>10</b>	
<b>449</b>	Max SID travel with brakes engaged	5	100	<b>10</b>	
<b>450</b>	Max width collimator travel when motion inactive	0	99	<b>10</b>	
<b>451</b>	Max. height collimator travel when motion inactive	0	99	<b>10</b>	
<b>452</b>	Max shutters travel when motion inactive	0.5	10	<b>10</b>	
<b>453</b>	Max cassette tray travel when motion inactive	0.5	10	<b>10</b>	
<b>454</b>	Max analog. format signal deviation with tray in park	5	4000	<b>2000</b>	
<b>455</b>	SW limit overshoot potentiometers	0	100	<b>100</b>	
<b>456</b>	Joystick S.F. alarm delay	0.10	5.00	<b>5.00</b>	

### 11.4.4 Travel limits for serial changer shutters and cassette tray

This group contains the travel limits for the motion of the serial changer shutters and cassette tray for obtaining the different cassette sub-division programs.

If the lines separating the radiographs of certain divisions needs adjustment, these travel limits can be adjusted by carefully following the instructions in chapter 17 *"Checking the radiographic results"*.



**NOTE:**

1. the cassette tray and shutters positions may not match the value entered in the corresponding cell; this is due to the mechanical inertia of the system.  
In any case, the correction value in mm entered in the cells has the effect of increasing or decreasing the final position by that amount.
2. The shutters values shown in the "Real Size" refer to the shutters window for the passage of the X-ray at the minimum SID. As in point 1 of this note, the values contained in the "default" column do not correspond to the real measurement.

Cell	Format	Division	Default	Real size	Modified
461	18x24	full size	293.0		
462	18x24	2 line-4 cross run 1 and 3	248.5		
463	18x24	2 line-4 cross run 2 and 4	337.5		
464	24x18	full size	323.0		
465	24x18	2 line run 1	263.5		
466	24x18	2 line run 2	382.5		
467	24x30	full size	323.0		
468	24x30	2 line run 1	263.5		
469	24x30	2 line run 2	382.5		
470	30x24	full size	353.0		
471	30x24	2 line-4 cross run 1 and 3	278.5		
472	30x24	2 line-4 cross run 2 and 4	427.5		
473	30x24	3 line-6 cross run 1 and 4	253.7		
474	30x24	3 line-6 cross run 2 and 5	353.0		
475	30x24	3 line-6 cross run 3 and 6	452.3		
476	30x30	full size	353.0		
477	30x30	2 line run 1	278.5		
478	30x30	2 line run 2	427.5		
479	30x30	3 line run 1	253.7		
480	30x30	3 line run 2	353.0		
481	30x30	3 line run 3	452.3		

Cell	Format	Division		Default	Real size	Modified
<b>482</b>	35x35	full size		381.0		
<b>483</b>	35x35	2 line	run 1	292.5		
<b>484</b>	35x35	2 line	run 2	469.5		
<b>485</b>	35x35	3 line	run 1	263.0		
<b>486</b>	35x35	3 line	run 2	381.0		
<b>487</b>	35x35	3 line	run 3	499.0		
<b>488</b>	18	Shutters	full size	176.6	166.2	
<b>489</b>	18	Shutters	2 line	81.8	080.3	
<b>490</b>	18	Shutters	4 cross	89.8	080.3	
<b>491</b>	24	Shutters	full size	237.8	221.6	
<b>492</b>	24	Shutters	2 line	112.5	108.0	
<b>493</b>	30	Shutters	full size	299.7	277.1	
<b>494</b>	30	Shutters	2 line	142.9	135.7	
<b>495</b>	30	Shutters	4 cross	151.0	135.7	
<b>496</b>	30	Shutters	3 line	92.3	089.9	
<b>497</b>	30	Shutters	6 cross	100.5	089.9	
<b>498</b>	35	Shutters	full size	356.3	328.8	
<b>499</b>	35	Shutters	2 line	171.5	161.6	
<b>500</b>	35	Shutters	3 line	111.6	107.1	
<b>501</b>	8x10	full size		302.6		
<b>502</b>	8x10	2 line-4 cross	run 1 and 3	252.2		
<b>503</b>	8x10	2 line-4 cross	run 2 and 4	353.0		
<b>504</b>	10x8	full size		328.0		
<b>505</b>	10x8	2 line	run 1	264.8		
<b>506</b>	10x8	2 line	run 2	391.2		
<b>507</b>	10x12	full size		328.0		
<b>508</b>	10x12	2 line	run 1	264.8		
<b>509</b>	10x12	2 line	run 2	391.2		
<b>510</b>	12x10	full size		353.4		
<b>511</b>	12x10	2 line	run 1	277.6		
<b>512</b>	12x10	2 line	run 2	429.2		
<b>513</b>	12x10	3 line	run 1	252.3		
<b>514</b>	12x10	3 line	run 2	353.4		
<b>515</b>	12x10	3 line	run 3	454.5		
<b>516</b>	9.5x9.5	full size		321.6		
<b>517</b>	9.5x9.5	2 line-4 cross	run 1 and 3	261.9		
<b>518</b>	9.5x9.5	2 line-4 cross	run 2 and 4	381.3		
<b>519</b>	9.5x9.5	3 line-6 cross	run 1 and 4	241.9		
<b>520</b>	9.5x9.5	3 line-6 cross	run 2 and 5	321.6		

Cell	Format	Division		Default	Real size	Modified
<b>521</b>	9.5x9.5	3 line-6 cross	run 3 and 6	401.3		
<b>522</b>	14x14	full size		379.0		
<b>523</b>	14x14	2 line	run 1	290.5		
<b>524</b>	14x14	2 line	run 2	467.5		
<b>525</b>	14x14	3 line	run 1	261.0		
<b>526</b>	14x14	3 line	run 2	379.0		
<b>527</b>	14x14	3 line	run 3	497.0		
<b>528</b>	8	Shutters	full size	200.2	188.0	
<b>529</b>	8	Shutters	2 line	95.0	091.2	
<b>530</b>	10	Shutters	full size	251.4	235.3	
<b>531</b>	10	Shutters	2 line	120.9	114.9	
<b>532</b>	12	Shutters	full size	300.8	281.9	
<b>533</b>	12	Shutters	2 line	146.0	138.1	
<b>534</b>	12	Shutters	3 line	95.2	091.5	
<b>535</b>	9.5	Shutters	full size	237.9	222.6	
<b>536</b>	9.5	Shutters	2 line	113.8	108.5	
<b>537</b>	9.5	Shutters	3 line	73.7	071.7	
<b>538</b>	9.5	Shutters	4 cross	116.9	108.5	
<b>539</b>	9.5	Shutters	6 cross	76.5	071.7	
<b>540</b>	14	Shutters	full size	361.4	328.8	
<b>541</b>	14	Shutters	2 line	171.6	161.6	
<b>542</b>	14	Shutters	3 line	112.3	107.1	
<b>543</b>	8x10	3 line-6 cross	run 1 and 4	235.4		
<b>544</b>	8x10	3 line-6 cross	run 2 and 5	302.6		
<b>545</b>	8x10	3 line-6 cross	run 3 and 6	369.8		
<b>546</b>	8	Shutters	4 cross	97.8	091.2	
<b>547</b>	8	Shutters	3 line	61.1	060.2	
<b>548</b>	8	Shutters	6 cross	64.3	060.2	

### 11.4.5 Safety factors for PID regulated motions

If the software-generated PID value sent to the motor drives differs from the speed feedback measured by the potentiometers, the system must be able to recognise this effect and halt the equipment.

This problem may be due to mechanical binding, or to slippage in the transmission to the potentiometer.

For each of the PID-regulated motions, there are 2 values which determine the amount of deviation between PID and speed which triggers an alarm, and the delay after which such alarm is generated.

- **Deviation time**

Is expressed in seconds and allows to mask any transient spikes in the PID value caused by inertia.

In the event of a real anomaly, the higher this value is, the longer the motion will continue before generating an alarm.

- **k factor**

The factor by which the PID value is divided (PID/k).

The software compares the speed with the value of PID/k. Because **k** is the denominator, the greater the value of **k**, the smaller the value of the fraction.

Because the alarm is generated if  $PID/k > speed$ , the smaller the value of PID/k, the longer the time for which a motion affected by mechanical binding will be accepted without generating an alarm.

In general, increasing the values of **time** and **k** for any given motion will increase its tolerance to "binding", permitting a broad uncontrolled movement before generating an alarm.

Cell	Function	Min	Max	Default	Modified
<b>551</b>	Collimator width: k factor	1	30000	<b>10000</b>	
<b>552</b>	Collimator width: detection delay	0.0	9.9	<b>1.0</b>	
<b>553</b>	Collimator height : k factor	1	30000	<b>10000</b>	
<b>554</b>	Collimator height: detection delay	0.0	9.9	<b>1.0</b>	
<b>555</b>	Shutters: k factor	100	30000	<b>5000</b>	
<b>556</b>	Shutters: detection delay	0.0	9.9	<b>1.0</b>	
<b>557</b>	Cassette tray: k factor	100	30000	<b>10000</b>	
<b>558</b>	Cassette tray: detection delay	0.0	9.9	<b>1.0</b>	

## **11.5 Accessing group 700 - EEPROM duplication**

This program is used for copying the EEPROM data.

This component stores all the parameters necessary for the equipment's operation.

At each power-up, these parameters are loaded into the RAM.

In order to duplicate this data on a second EEPROM for backup purposes, proceed as follows:

1. Turn off the equipment and place switches 1 and 3 (Dip-switch Q16 of SFD CPU board A1) in the ON position.
2. Turn on the equipment.  
The display shows:
  - 701 corresponding to the first phase of this program
  - EEPROM – RAM, indicating the possibility of copying data from EEPROM to RAM.

To perform the data transfer, the system requires entering the password as follows:

3. Press the **D** key (Figure 11-9) for 5 sec.  
After this time has elapsed, the display shows:
  - 002, the page number used for entering the passwords
  - 00000 waiting for the password to be entered.
4. Press the **F** key (Figure 11-9).  
The blinking "\*" symbol appears on the display, prompting for entering the password.
5. Enter the password for this data group (Ref. 1 pg. 11-1) using the number keys.  
The value will be shown scrolling from right to left on the display.
6. Press the **F** key (Figure 11-9) to confirm.  
If the confirm key is not pressed within 15 sec. after entering the last digit, the blinking "\*" symbol and the previously entered digits disappear from the display.  
It will then be necessary to re-enter the password.  
If, instead, the confirm key is pressed within the 15 sec. time-out, the blinking C137 message appears on the display, indicating that the entered password has granted access to groups 100-300-700, depending on which ones have their switch set to ON.
7. Hold down the **D** key (Figure 11-9) for 5 sec.  
The display reverts to the cell position 701 abandoned at the time of accessing page 002.



At this point it is possible to upload the data from the EEPROM to the RAM. To perform the copy operation, proceed as follows:

8. Press the **F** key (Figure 11-9).  
The blinking "\*" symbol appears on the display, indicating that the parameters can be modified.
9. Press the **A** key to enable copying.  
The **"DATA TRANSFER"** message appears on the display.  
After approximately 5 sec., if the copy operation was successful, the **"TRANSFER COMPLETED"** message appears on the display.

At this point, coping of the data from the RAM into a new EEPROM can be done, as follow:

10. Switch off the equipment, remove the EEPROM and insert a new one which must **necessarily** be of the **same type and make (24C16 SGS Thomson)**.
11. Switch on the equipment.  
Alarm 090 appears on the display console. This alarm is generated because the new EEPROM does not contain the Checksum, and therefore the RAM is unable to perform the check and thus generates the mentioned alarm.
12. Reset the alarm using the reset joystick.  
The display shows:
  - 702 corresponding to the first phase of this program
  - RAM – EEPROM, indicating the possibility of copying data from RAM to EEPROM

During this phase it is not necessary to enter the password, which is retained in memory from the previous phase of the EEPROM copying operation.

Now the system allows copying the data from RAM to EEPROM.  
To perform the copy operation, proceed as follows:

13. Press the **A** key (Figure 11-9) to enable copying.  
The **"DATA TRANSFER"** message appears on the display.  
After approximately 5 sec., if the copy operation was successful, the **"TRANSFER COMPLETED"** message appears on the display.

At this point, the procedure of copying data from one EEPROM to another, using the RAM as an intermediate storage location, is complete.

The system allow copying of the data resident in the RAM to several EEPROMs.

This operation is streamlined because, if the equipment is switched off after executing the transfer from RAM to EEPROM, at the next power up the program will reposition itself on cell 702, ready to perform another copy operation as described above, and generating alarm 090 at each power up if a new EEPROM is installed.

If the data transfer from RAM to EEPROM is not performed, when the equipment is switched off and on again, the program repositions itself on cell 701, once again prompting for entering the password and for the data to be loaded into RAM.

If an error occurs during this procedure, the display shows the corresponding diagnostic messages (see paragraph 18.2 "*Non resettable diagnostics*").

## **11.6 Accessing group 800 - Serial changer life test**

This program is used for testing the movements of the serial changer and collimator.

During the testing phase, this program is used to perform a "life test" on the serial changer and collimator by running a given number of cycles. The number of cycles performed by this program is shown on the console display.

It may also be necessary to perform this test after the equipment has been installed.

In fact, this test checks the functionality of all the serial changer components, enabling the service technician to carefully evaluate the performance of the equipment.

To run this test, proceed as follows:

- 1.** Turn off the equipment and place switches 2 and 3 (Dip-switch Q16 of SFD CPU board A1) in the ON position.
- 2.** Turn on the equipment.  
The display shows:
  - 800 corresponding to this program
  - the number of cycles performed so far.
- 3.** Insert a 30x24 cassette in the serial changer tray.
- 4.** Press the load cassette button. If the cassette is recognised, the program begins, otherwise it is ejected and the **"WRONG CASSETTE – INSERT 30x24"** message appears on the display.

In this program, the password needs to be entered only to modify the number of cycles shown on the display.

This parameter can also be edited while the test cycle motions are in progress, as follow:

- 5.** Press the **D** key (Figure 11-9) for 5 sec.  
After this time has elapsed, the display shows:
  - 002, the page number used for entering the password.
  - 00000 waiting for the password to be entered.
- 6.** Press the **F** key (Figure 11-9).  
The blinking "\*" symbol appears on the display, prompting for entering the password.
- 7.** Enter the password for this data group (Ref. 3 pg. 11-1) using the number keys.  
This value will be shown scrolling from right to left on the display.

8. Press the **F** key (Figure 11-9) to confirm.  
If the confirm key is not pressed within 15 sec. after entering the last digit, the blinking "\*" symbol and all the previously entered digits disappear from the display.  
It will then be necessary to re-enter the password.  
If, instead, the confirm key is pressed within the 15 sec. time-out, the blinking C4568 message appears on the display, indicating that the entered password has granted access to groups 400-500-600-800, depending on which switches are set to ON.
9. Hold down the **D** key (Figure 11-9) for 5 sec.  
The display reverts to the cell 800 position which was abandoned at the time of accessing page 002.

At this point it is possible to modify the number of cycles shown on the display. To modify the value:

10. Press the **F** key (Figure 11-9).  
The blinking "\*" symbol appears on the display.
11. Use the number keys to enter the new value.
12. Press the **F** key (Figure 11-9) to confirm.  
If the confirm key **F** is not pressed within 15 sec. of entering the last digit, the blinking "\*" symbol and all the previously entered digits disappear from the display.  
The previous unmodified value will reappear, and remain stored in memory.  
If the confirm key is pressed within the established time-out, the modified value will be stored in memory.

### **11.6.1 Running the life test program**

The life test program consists of 6 different cycles involving a variety of motions.

The cycles are described in detail below.

- **Cycle A**

The following motions are started simultaneously:

- cassette tray to 30 full size position
- shutters to 30 full size format
- grid activated for 2 sec
- collimator to 30x30 format.

After completing the above motions:

- cassette tray to parked position
- shutters to 35x35 full size position
- grid to position 0
- collimator to 35x35 format
- increment the number of cycles executed by 1.

- **Cycle B**

The following motions are started simultaneously:

- cassette tray to 30/2 run 1 position
- shutters to 30/2 format
- grid activated for 2 sec
- collimator to 15x15 format.

After completing the above motions:

- cassette tray to parked position
- shutters to 35x35 full size position
- grid to position 0
- collimator to 35x35 format
- increment number of cycles executed by 1.

- **Cycle C**

The following motions are started simultaneously:

- cassette tray to 30/2 run 2 position
- shutters to 30/2 format
- grid enabled for 2 sec
- collimator to 15x15 format

At the end of the above motions:

- cassette tray to parked position
- shutters to 35x35 full size position
- grid to position 0
- collimator to 35x35 format
- increment number of cycles executed by 1.

- **Cycle D**

The following motions are started simultaneously:

- actuate upper rail coil for 1 sec
- cassette tray to 30/4 cross run 2 position
- shutters in 18/4 cross format
- compressor to field
- grid activated for 2 sec
- collimator to 9x9 format.

At the end of the above motions:

- enable upper rail coil until cassette tray reaches parked position
- cassette tray to parked position
- shutters to 35x35 full size position
- compressor to parked position
- grid to position 0
- collimator to 35x35 format
- increment the number of cycles executed by 1.

- **Cycle E**

The following motions are started simultaneously:

- activate low rail coil for 1 sec
- cassette tray to 30/4 cross run 4 position
- shutters to 18/4 cross format
- compressor in field
- grid enabled for 2 sec
- collimator to 9x9 format.

At the end of the above motions:

- activate low rail coil until cassette reaches the parked pos.
- cassette to parked position
- shutters to 35x35 full size position
- compressor parked
- grid to position 0
- collimator to 35x35 format
- increment number of cycles executed by 1.

- **Cycle F**

The following motions are started simultaneously:

- tray to cassette loading position
- wait 0.5 sec
- tray to parked position
- shutters to 35x35 full size position
- increment number of cycles executed by 1.

The 6 cycles are continually repeated in the above order.

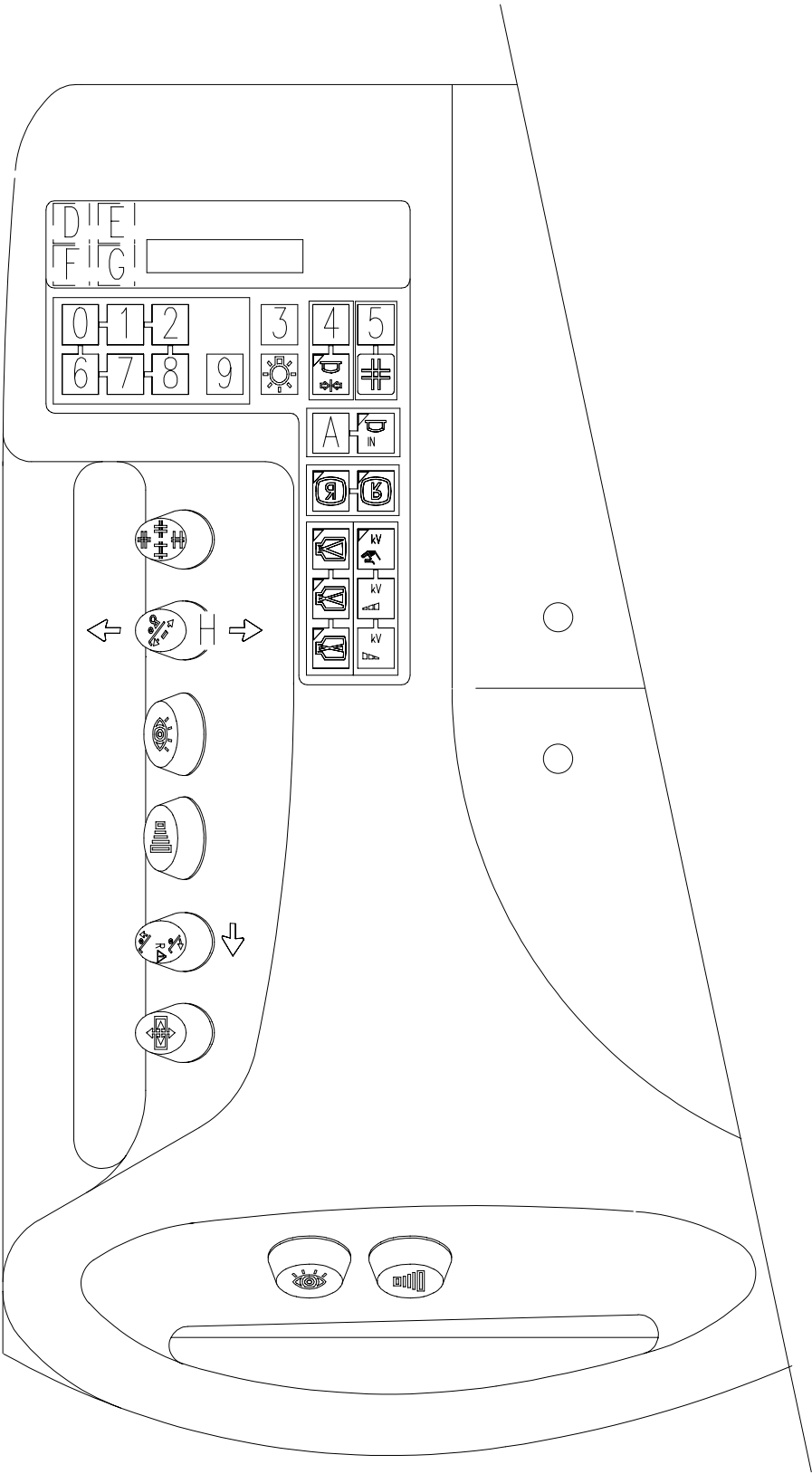


**NOTE:**

These motion sequences have been devised so as to simulate all the movements and cover the full range of travel of each motion.

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**Figure 11-9**

## **12. SINGLE FAULT OPERATION LOGIC**

### **12.1 Theory of operation**

The implementation of "Single Fault" (SF) safety is based on establishing redundant control over the circuits which actuate the table motions, i.e. those functions which could represent a hazard to the patient if they become uncontrolled.

The safety logic is implemented so that, provided only one fault occurs at a time (from which the term Single Fault) at the various levels of the motion actuation chain, the system will be able to identify the fault and immediately halt the motion.

The following paragraphs describe in detail how the single fault concept has been implemented on **VISION**.

This implementation complies with the most stringent interpretation of the regulations, assuring an extremely high safety factor and maintaining a high level of reliability and simplicity.

In the event of a fault at any level of the motion actuation chain, its sophisticated technology and rapid response time enables this system to shut down any uncontrolled linear or angular motions within extremely short travel distances, as measured from the moment when the fault occurs.

## 12.2 Hardware Implementation

The following motions:

- tilting
- longitudinal tabletop
- transversal tabletop

on **VISION** the SF safety concept described above.

The SFD CPU board (A1) incorporates an additional “supervisor” processor, which communicates with the main CPU processor to guarantee a redundant check on the above motions.

All the motion controls of the main panel, preparation-exposure and fluoroscopy switches, as well as those of the on-board table panel, are implemented using complementary-contact switches.

The first open contact (NO) sends the motion request to the CPU.

The second closed contact (NC) is in series with all the other NC contacts of the motion switches, and implements the SF safety function.

The series connection provides a signal which is connected to an input on the CPU processor and to an input on the monitor processor.

This input, polarised at 0 Vs, is activated (active at 0 Vs) when all the motions are at halt, i.e. when no motion control has been operated, and the signal is reset (0 Vs absent) when one or more controls are activated.

Here follows the motions equipped with potentiometer feedback:

- tilting
- longitudinal tabletop
- transverse tabletop.

The HW components installed on **VISION** for implementing the SF safety are:

- **Table**  
2-way switch for all the panel and dual motion controls.
- **Main processor**
  - provision of an input for the NC switch contacts (SF input)
  - provision of 6 outputs for relaying the state of the output ports which control the actuation of the above described motions.
  - provision of a serial link toward the supervisor processor, to cross check the operation of the electronics on both parts of the circuit board.
  - provision of a "ready" relay on the SFD CPU board (A1).
- **Supervisor processor**  
Implementation of a “monitor” function on the SFD CPU board (A1) with:
  - provision of a "ready" relay
  - provision of an input for the NC switch contacts (SF input)
  - 6 inputs for monitoring the motion control ports
  - serial link for communicating with the primary CPU processor.

## **12.3 Software implementation and operating principle**

The software implementation of the SF safety related functions is described below:

- **Switch-on**

When the equipment is powered up, the main processor and the supervisor perform a cross-check on the operation of both electronics sections by means of the serial link.

Both processors check that the motion control input is in the “all controls inactive” status.

The 6 output ports must be inactive, and this is checked by the monitor using the 6 monitoring inputs.

If all the above conditions are met, both the main processor and the supervisor activate their “ready” relays, whose series-connected open contacts energise the coil of power contactor K1L, thereby supplying the power circuits.

When the “ready” relay is energised, none of the motion feedback signals, from the potentiometers must be active.

If the conditions described in the previous points are not met, the “ready” relays will not be energised and the main processor will send an alarm diagnostic to the display.

- **Actuation of one or more motions**

When a motion is requested, the CPU receives the information as to which motion should be actuated via the input lines which connect it to the control panel with dual controls.

At the same time, the SF input of the motion controls changes state. This input is also received by the supervisor.

Both processors enable the activation of one or more output ports, and the main processor checks that the corresponding potentiometers are in motion.

When both the motion control and SF signal are reset, the main processor and the supervisor check that the ports are immediately reset.

The potentiometer feedback signals must also be immediately reset.

- **Malfunctions**

As mentioned in the introduction, the system is able to detect a malfunction at any level of the control chain which actuates the motion.

Therefore, the possible malfunctions are:

1. Motion control microswitch fault
2. SF microswitch fault
3. Main processor fault
4. Supervisor processor fault
5. Motion actuation gate fault
6. Motion drive component fault
7. Feedback element fault.

The system is able to detect all the above mentioned faults, as described below:

## **1 - 2**

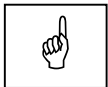
The previous paragraphs describe the conditions for checking the motion actuation inputs and the corresponding alarm codes.

## **3**

A malfunction in the electronics or serial communications section of the main processor is detected by the supervisor via the serial link which, as described previously, resets the "ready" relay and turns on a red alarm led.

## **4**

In the same way, and using the above mentioned serial link, the main processor is able to detect a malfunction in the supervisor.  
If a malfunction is detected, the main processor resets its "ready" relay and sends an alarm diagnostic.



### **NOTE:**

The serial link between the 2 sections, in addition to monitoring the correct operation of the microprocessors, is used by the supervisor to compare the inputs and the ports activated by the main processor.

## **5**

Upon power-up, none of the motion actuation ports must be activated, and no motion request and SF signals should be activated.  
If this anomaly occurs, both the "ready" relays will be reset, and the main processor will generate an alarm diagnostic for the defective port.

## **6**

A malfunction in a hardware component of a motor drive may cause it to remain short circuited.  
The system is able to detect the fault thanks to the feedback received from the potentiometers.  
In this case, no motion control will be activated, no port will be ON, but the main processor will nonetheless receive a feedback signal.  
The ready relays are immediately reset and the corresponding alarm diagnostic is sent to the display.

## **7**

In the event of a malfunction in a hardware component of the motion control or feedback loop, the system detects that a motion control has been activated, causing the SF circuit to open, and it detects that one or more ports have been activated but that the corresponding potentiometer feedback signals are absent.  
Because the system is able to compare the output ports with the feedback signals, after resetting the ready relay, the main processor sends an error diagnostic to the display.

## **13. OPERATING CONDITIONS**

### **13.1 Collision**

In certain cases, when one or more motions are activated, a part of the tabletop may reach the collision safety limit.

This limit is set up in the following cells:

- 201, 202, 203 (floor, wall, ceiling distances)
- 210, 211, 212 (safety distances)

and creates an imaginary software barrier which the motion cannot overcome.

When any part of the table reaches a collision limit, the motion in question is halted.

A message indicating which collision limit has been reached appears on the display.

The collision messages are:

**11** – T.top – left wall

**12** – T.top – right wall

**13** – T.top - ceiling

**14** – T.top - floor

At this point, the software inhibits any tilting and tabletop motions which would take it beyond the collision barrier.

Only motions which retract the equipment from the collision limit will be enabled.

However, all the other functions of the equipment for performing examinations, such fluoroscopy, preparation and radiography modes, remain available.

After removing the collision situation, the message on the display automatically disappears and motions in all directions are once again enabled.

## 13.2 Collimator

**VISION** has been designed to accommodate an automatic collimator with square-rectangular field.

The collimator operating modes are:

- **Automatic mode**

The default positioning of the width and height shutters depends on the selected I.I. field.

The collimation size is determined by the parameter values in cells 204, 205, 206.

In fluoroscopy mode, the reduction joystick can be used to choose an intermediate format between fully-closed position and the active I.I. format.

With a cassette sub-division program, the maximum format which the collimator can reach will be the smallest one between the I.I. format and the selected sub-division format.

When the preparation control is pressed, the collimated format will correspond to the sub-division setting, even if it is larger than the I.I. or if the collimator field was previously reduced using the joystick.

- **Automatic mode with hold**

The operation of the collimator with the hold function enabled is different from its standard operation, in that it retains any format reductions made with the joystick in fluoroscopy mode.

Infact, if a joystick reduction is made prior to pressing the preparation control, this reduction will be retained when the preparation control is pressed.

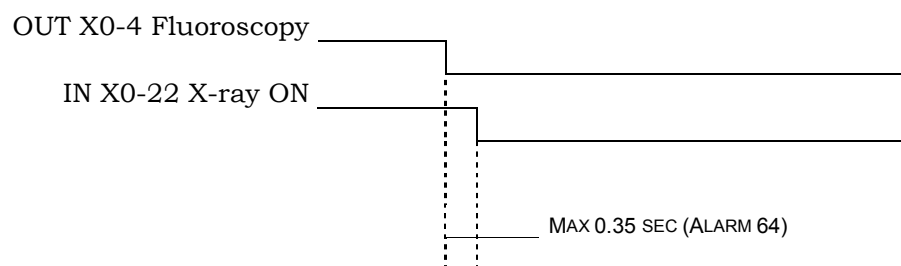
If no format reduction is made, or if the joystick is used to return the shutters to the maximum allowed position, the operation will be identical to that in automatic mode.

## 13.3 Signal timing

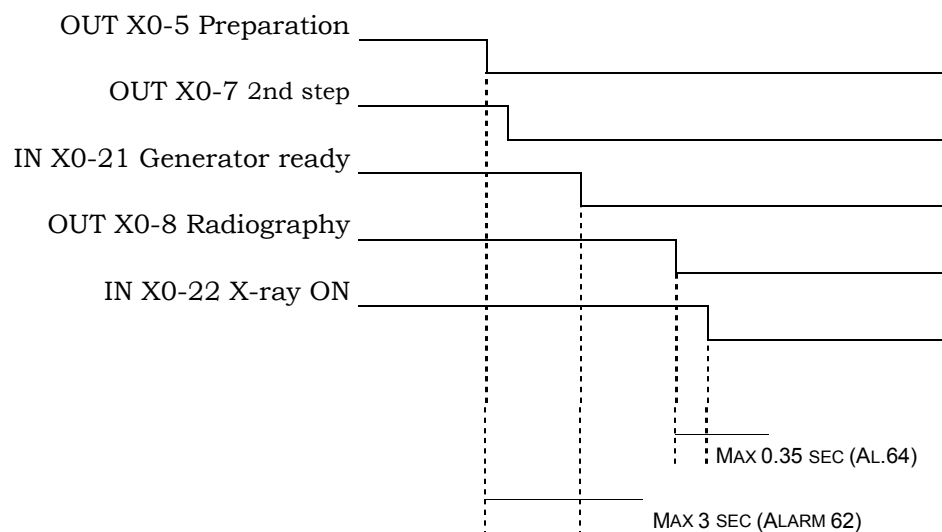
Before analysing in detail the exposure sequences described below, it is important to know the software timing of the output and input signals to and from the generator.

The following graphs provide a clear overview of the signal timing.

### Fluoroscopy mode



### Radiography mode





## 13.4 Standard radiography

To take a standard radiography, it is necessary to follow an established software sequence in order to complete the program.

This sequence is as follows:

### 1. Exposure switch 1st step (preparation):

- start cassette motion from PARKED position toward "exposure" position
- shutters motion toward cassette format if larger than the I.I. format
- "Preparation request" output active toward the generator
- motion of collimator axis toward the radiograph format, if larger than the I.I. format.

### 2. Exposure switch 2nd step:

"2nd step" output active toward generator.

### 3. "Generator ready" input active:

Start grid motion only if all the following conditions are met:

- collimator axis halted on the selected film or sub-division size
- shutters at the film or sub-division position, and motor off delay (cell 340) elapsed
- cassette at "exposure" position and motor off delay (cell 354) elapsed.

### 4. Exposure request:

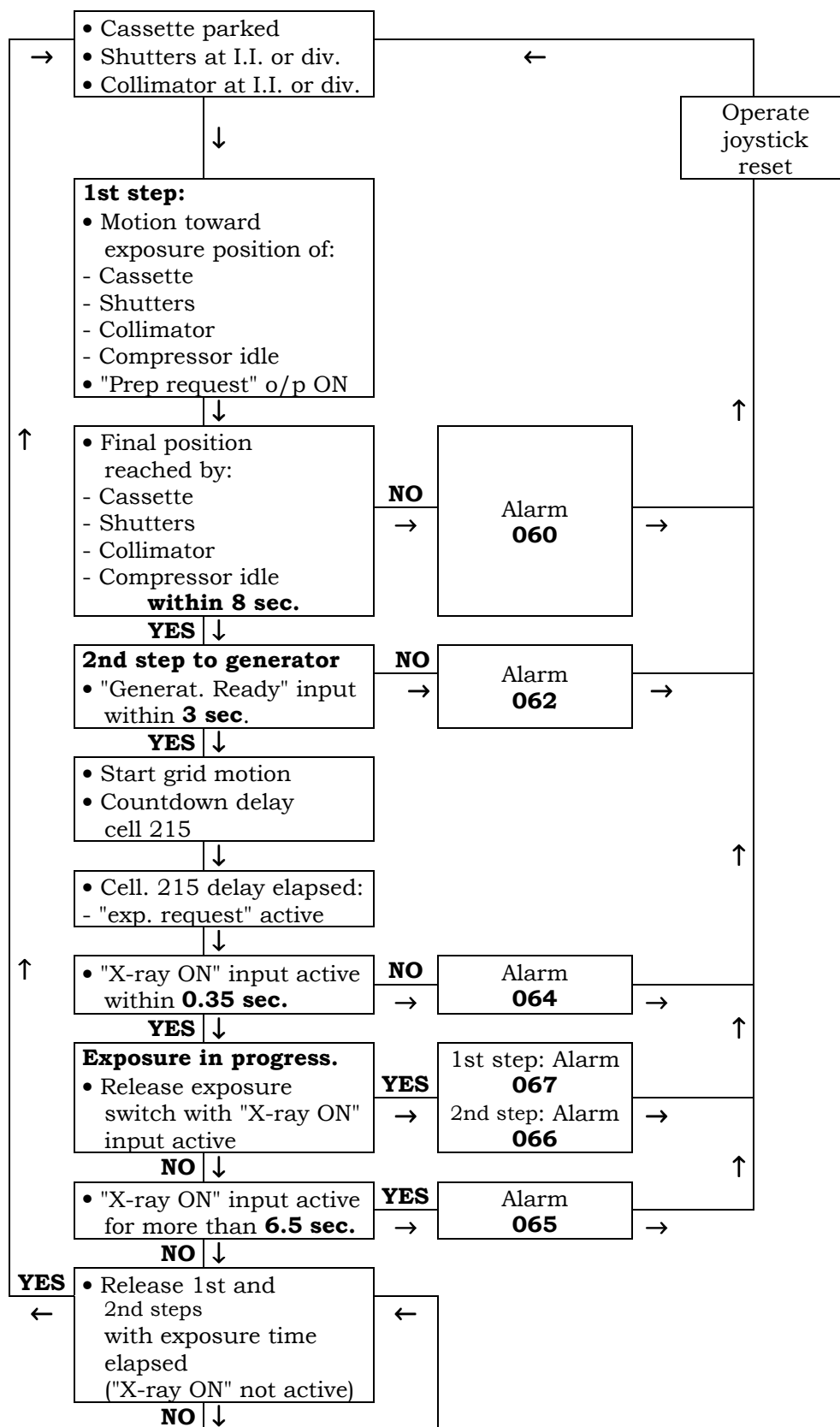
- the grid motion initiates the countdown of the delay entered in cell 215. When this time has elapsed:
- "Exposure request" output active to generator.

### 5. X-ray present:

The "X-ray ON" input must be active within 0.35 sec.  
Otherwise alarm 064 will be generated.

The above described sequences are illustrated in the following flow diagram, which shows the "standard exposure" function and the associated alarm messages.

### 13.4.1 Standard radiograph flow diagram



## 13.5 Rapid sequence

Executing a rapid program involves a different software sequence from the standard program.

The rapid sequence can only be selected for cassette sub-divisions with at least 2 exposures, and provided no exposure has yet been performed. The sequences of this program are:

### 1. Exposure switch 1st step (preparation):

- start cassette motion from PARKED position toward "exposure" position
- shutters motion toward cassette format if larger than the I.I. format
- "Preparation request" output active toward the generator
- motion of collimator axis toward the radiograph format if larger than the I.I. format
- start grid motion.

### 2. Exposure switch 2nd step:

"2nd step" output active to generator.

### 3. "Generator ready" input active:

Exposure request output active toward the generator if the following conditions are true:

- collimator axis halted on the selected sub-division size.
- shutters at the sub-division position and motor off delay (cell 340) elapsed
- cassette at "exposure" position and motor off delay (cell 354) elapsed.

### 4. "X-ray ON" present:

The "X-ray ON" input must be active within 0.35 sec. Otherwise, alarm 064 will be generated.

### 5. Advance with program:

When the "X-ray ON" input is reset:

- the "exposure" request output is reset
- the cassette advances to the next "exposure" position.

### 6. Performing the next radiography:

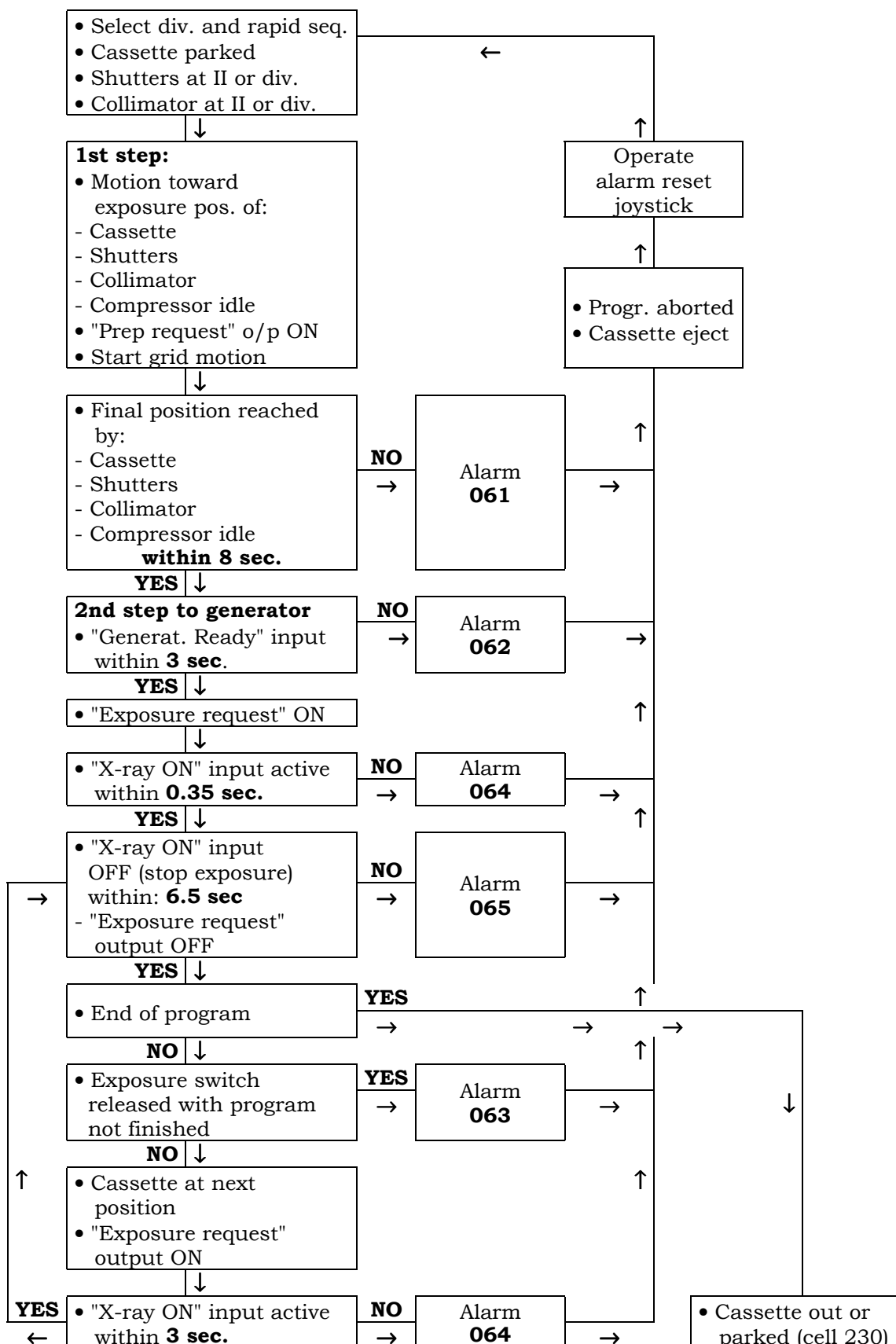
When the cassette has reached the "exposure" position and the motor off delay (cell 354) has elapsed, the "exposure" request is once again activated.

In any part of the sequence, if switch 2nd step is released, the program is aborted and the cassette is ejected, generating alarm 063.

Any alarm which occurs during a rapid sequence program causes the program to be aborted, and the cassette to be ejected.

The above described sequences are illustrated in the following flow diagram, which shows the "standard exposure" function and the associated alarm messages.

### 13.5.1 Rapid sequence program flow diagram



## 13.6 Digital radiography

The digital input can take place with the serial changer in 2 different conditions:

- without sub-divisions
- with sub-divisions.

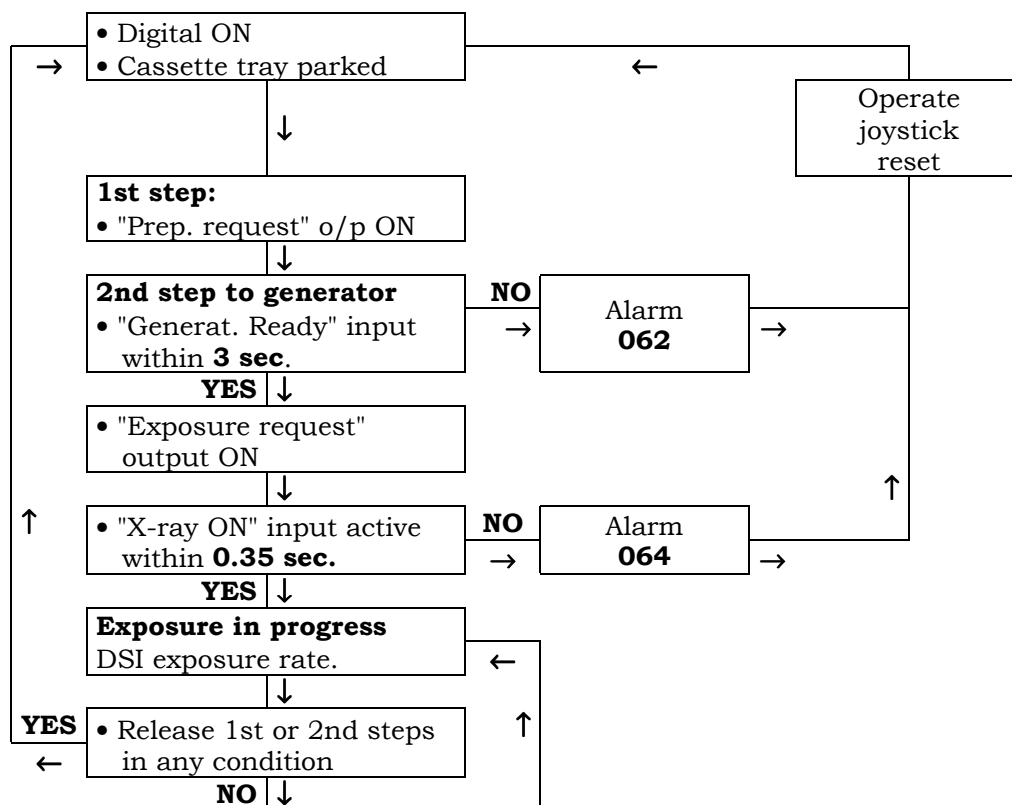
Therefore, if the digital function is selected in the just condition, it will be possible to actuate the cassette motion, whereas in the second condition the cassette will remain locked in the parked position until digital mode is exited.

The sequences of the digital functions are:

- 1. Exposure switch 1st step (preparation):**  
"Digital prep" request output to generator.
- 2. Exposure switch 2nd step:**  
"2nd step" request output to generator.
- 3. "Generator ready" input active:**  
"Exposure request" output to the generator active.
- 4. "X-ray ON" active:**  
"X-ray ON" input must be activated within 0.35 sec.  
Otherwise alarm 064 will appear.

The above described sequence is illustrated in the following flow diagram, which shows the "standard exposure" function and the associated alarms.

### 13.6.1 Digital radiography flow diagram



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## 14. EMERGENCY SAFETIES

As described in paragraph 9.2 "*Error conditions*", if a malfunction causes one of the table or serial changer motions to overshoot its software travel limit, the emergency switch for that motion will be intercepted.

In fact, to ensure maximum reliability and safety for the operator and patient, all the motion travel limits of **VISION** are equipped with emergency switches, situated just a few millimetres beyond the corresponding software travel limits.

If one of these switches is activated, alarm 080 or 081 appears on the display to signal the malfunction.

In the case of alarm 080, it is necessary to determine which of the following motions:

- tilting
- longitudinal tabletop
- transversal tabletop

is in the emergency position.

In the case of alarm 081, it means that the cassette tray or shutters have activated one of the emergency switches on the serial changer.

After switching off the system, it is necessary to identify the cause of this condition.

Remove the cause of the alarm, and proceed as follows to resume operation:

### Alarm 080

1. Press the S1 reset button situated in the "circuit boards" area of the serial changer.
2. While keeping this button pressed, switch on the equipment.
3. Wait for the initialisation cycle to be completed.
4. Operate the joystick so as to retract the motion from the travel limit which caused the alarm.
5. Release button S1.



### WARNING:

Pressing the S1 button bypasses the series of emergency microswitches. Therefore, if the cause of the malfunction has not been corrected, there is the danger of the motion continuing without the safety of the emergency microswitch.

For the same reason, if at this point the motion is actuated in the direction of the mechanical limit, i.e. taking it beyond the emergency switch, no safety will be tripped.

It is therefore important to take every precaution to prevent collisions.



## **Alarm 081**

Unlike the table emergency circuit, there is no bypass switch for resetting the serial changer emergency circuit.

In fact, the 2 motions which can produce this condition, i.e. those of the shutters and the cassette tray, are not equipped with parking brakes.

Therefore, if the shutters or cassette tray are in the emergency position, after correcting the fault it is necessary to manually move the shutters or tray away from the activated switch, with the equipment switched off, in order to resume normal operation.

## 15. HARDWARE ADJUSTMENTS

The design and construction of **VISION** is based on sophisticated, state-of-the-art technology.

However, its complex functionality has been implemented so as to ensure ease of use and servicing.

For this reason, all the settings and adjustments of the table functions are performed via software, as described in chapter 11 "*Parameter set-up procedure*".

There are no trimmers or adjustable components on the circuit boards, and therefore no instructions for hardware adjustments are necessary. The following paragraphs describe the jumper settings which configure the circuit boards for standard operation.

### 15.1 SFD CPU board (A1)

The microprocessor board is supplied already configured as described below.

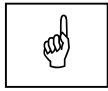
This is true both for the circuit boards installed on the equipment, and for those supplied as spare parts.

A brief description of the various "jumper" settings is nonetheless provided as additional information, and their positions are shown in Figure 15-1.

#### ❖ **Select the type of EPROM or RAM used as component E1 and E2.**

- **Jumpers used:**  
Q1-2-3-4-5-6-7-8-9-10-11-12
- **Possible settings:**

EPROM	Jumpers
512k x 8	1-5-7-9-11
128k x 8	1-5-8-11
64k x 8	1-5-6-11
32k x 8	3-5-6-11
RAM	Jumpers
128k x 8	2-4-6-10-12
32k x 8	2-4-6-12



**NOTE:**

The RAMs which can be used in these positions (E1 and E2) are not the RAMs for standard operation, but those used in the laboratory for emulation purposes.

The components normally used in these positions are EPROMs.

- **Standard operating configuration**

EPROM	Jumpers
128k x 8	1-5-8-11

❖ **Connecting the backup battery**

- **Jumpers used:**

Q13

- **Standard operating configuration**

The battery must be connected and then the jumper must be closed.

❖ **Settings for serial link between the Main and Supervisor processor**

- **Jumpers used:**

Q14-15

- **Possible settings:**

**Q14**

Positions **1-2** closed    normal operation  
Positions **2-3** closed    emulation

**Q15**

Positions **1-2** closed    normal operation  
Positions **2-3** closed    emulation

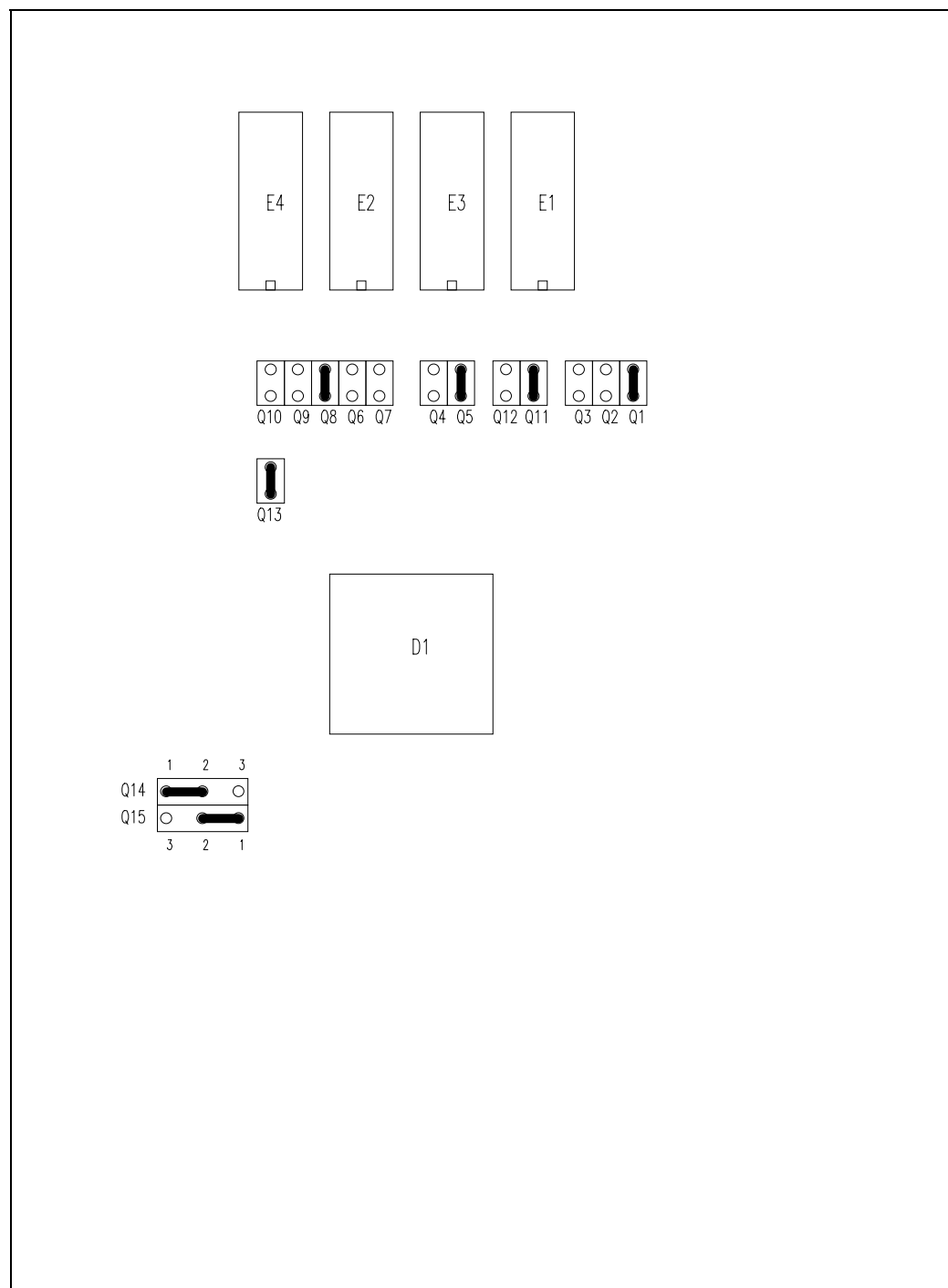
- **Standard operating configuration**

**Q14**

The jumper must be closed on positions **1-2**.

**Q15**

The jumper must be closed on positions **1-2**.



**Figure 15-1**

The " — " symbol indicates which jumpers must be closed.

## **15.2 Cassette tray and shutters motors drive board (A2)**

This drive board does not require any hardware adjustments, and therefore no adjustable components are included on this printed circuit board.

Neither are there any "jumpers" for setting configurations.

## 16. SPOT FILM DEVICE BOARD LED DESCRIPTION

### 16.1 SFD CPU board (A1)

The SFD CPU board (A1) is equipped with groups of LEDs that indicate the following:

- status of the outputs
- status of power supply voltages
- status of the main processor and of the supervisor.



#### NOTE:

If not otherwise specified, normally the LEDs are OFF (not lit).  
When each listed function is active, the relevant LED is ON (lit).

Meaning of each LED is here after described.  
Figure 16-1 shows the LED location on the board.

#### • H5 LED GROUP

- |              |                                       |
|--------------|---------------------------------------|
| <b>Led 1</b> | II minimum field                      |
| <b>Led 2</b> | collimator movement enabling          |
| <b>Led 3</b> | collimator width movement             |
| <b>Led 4</b> | collimator height movement            |
| <b>Led 5</b> | shutters movement                     |
| <b>Led 6</b> | shutters movement enabling            |
| <b>Led 7</b> | SFD cassettes tray movement           |
| <b>Led 8</b> | SFD cassettes tray movement enabling. |

#### • H6 LED GROUP

- |              |   |
|--------------|---|
| <b>Led 1</b> | fluoro request  |
| <b>Led 2</b> | normal preparation request                                |
| <b>Led 3</b> | digital preparation request                               |
| <b>Led 4</b> | second step   |
| <b>Led 5</b> | exposure request  |
| <b>Led 6</b> | X-ray ON alarm without request (normally this LED is lit) |
| <b>Led 7</b> | fluoro automatic kV adjustment                            |
| <b>Led 8</b> | main processor main relays (normally this LED is lit).    |

### • **H7 LED GROUP**

<b>Led 1</b>	room light on
<b>Led 2</b>	tilting movement towards trendelembourg
<b>Led 3</b>	tilting movement towards vertical
<b>Led 4</b>	transversal table top movement towards inside
<b>Led 5</b>	transversal table top movement towards outside
<b>Led 6</b>	longitudinal table top movement towards foot side
<b>Led 7</b>	longitudinal table top movement towards head side
<b>Led 8</b>	servomotor movement towards foot side.

### • **H8 LED GROUP**

<b>Led 1</b>	servomotor movement towards head side
<b>Led 2</b>	longitudinal and transversal brakes active
<b>Led 3</b>	compressor brake active
<b>Led 4</b>	grid in movement
<b>Led 5</b>	compressor moving to field
<b>Led 6</b>	compressor moving to park
<b>Led 7</b>	"UP" rail coil active (for cross sub-division)
<b>Led 8</b>	"DOWN" rail coil active (for cross sub-division)

### • **H9 LED GROUP**

<b>Led 1</b>	Spot Film Device and collimator ready
<b>Led 2</b>	manual mode kV increasing
<b>Led 3</b>	manual mode kV decreasing
<b>Led 4</b>	motion detection
<b>Led 5</b>	0° and +10° tilting position output active
<b>Led 6</b>	+80° and +90° tilting position output active
<b>Led 7</b>	spare
<b>Led 8</b>	spare.

### • **LED FOR OTHER FUNCTIONS**

<b>H1</b>	main processor reset
<b>H2</b>	ready supervisor relays (normally this LED is lit)
<b>H3</b>	supervisor reset
<b>H10</b>	+5V power supply active (normally this LED is lit)
<b>H11</b>	+24Vs power supply active (normally this LED is lit)
<b>H12</b>	+15Vs power supply active (normally this LED is lit)
<b>H13</b>	+12V supervisor power supply active (normally this LED is lit)
<b>H14</b>	+5V supervisor active (normally this LED is lit)



#### **NOTE:**

The status of the output of some functions (e.g. medium II field) are not monitored with LEDs.

Therefore, some of the functions provided by the system are not listed above.

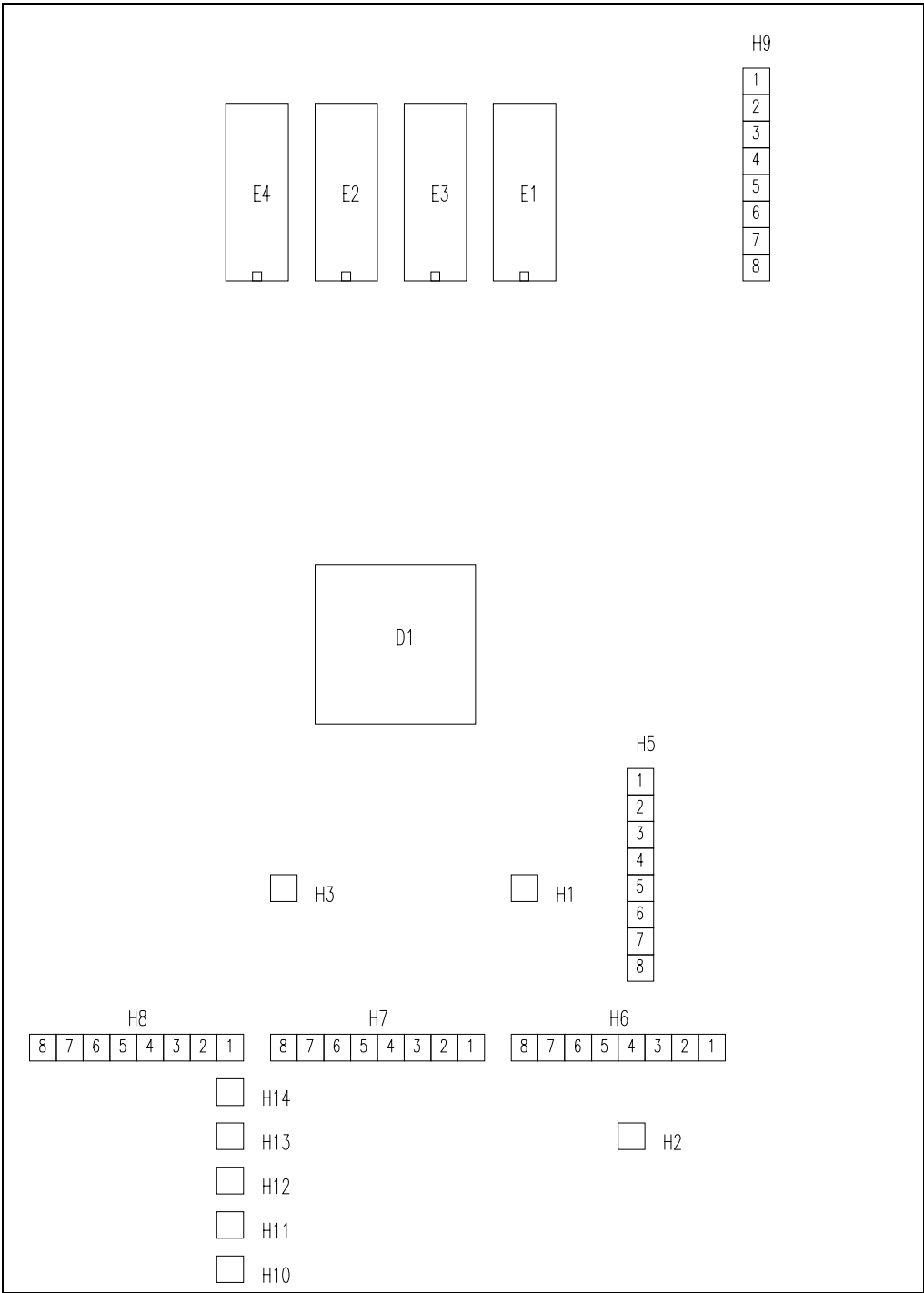


Figure 16-1



## 16.2 Cassette tray and shutters motors drive board (A2)

The motor driver board is equipped with LEDs that monitor the status of the relevant power supply voltages.

The list here after indicates the LEDs and the relevant functions.

Figure 16-2 shows the position of the LEDs on the board.



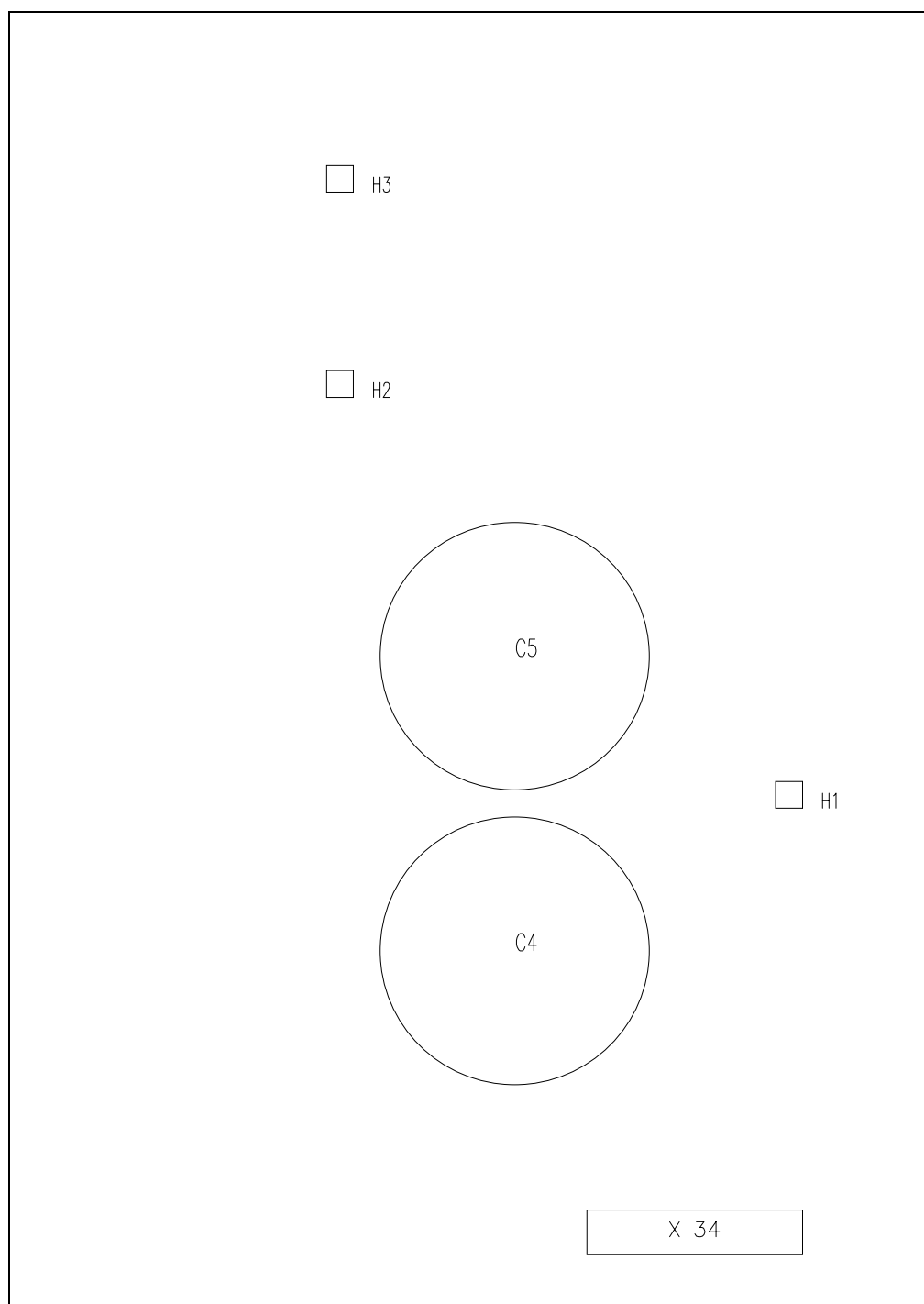
**NOTE:**

If not otherwise specified, normally the LEDs are OFF (not lit).

When each listed function is active, the relevant LED is ON (lit).

- **MEANING OF THE LEDs**

- |           |  |
|-----------|--|
| <b>H1</b> | ready relays ON (normally this LED is lit) |
| <b>H2</b> | cassettes tray motor driver alarm          |
| <b>H3</b> | shutters motor driver alarm                |



**Figure 16-2**

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## 17. CHECKING THE RADIOGRAPHIC RESULTS

After completing the installation of **VISION**, the quality of the films obtained must be checked in order to satisfy the user expectation. Possible anomalies may depend on the adjustment of components of the system. Each of them is here-after described.

The correctness of these adjustments must be evaluated as described below.

### 17.1 Serial changer adjustment

The serial changer is adjusted and checked at the factory, during the assembly and testing of **VISION**. However, after completing the installation of the system and taking some test radiographs, it may be necessary to perform an additional calibration.

To check the correct positioning of the cassette tray along the longitudinal and shutters axis, it is necessary to bypass the automatic collimator function which may interfere with the limiting format. To automatically open the collimator to its largest format, enter value 1 in cell 233 (utility function enabled). When this function is enabled, the "SERVICE mode" message appears on the display.

### 17.1.1 Checking the longitudinal positioning of the cassette tray

The positioning of the cassette tray must be precise, regardless of the travel distance and the weight of the cassette.

An effective method for checking this is the following:

1. Insert a 30x24 cassette and select the 3 in-line sub-division.
2. Run the program and develop the film.
3. The 2 white lines separating the radiographs must be of equal width.
4. Repeat this check using a 35x35 cassette with 3 sub-divisions.

If the separation lines are uneven, the cassette positioning is not correct throughout its range of travel.



**NOTE:**

During this phase it is not significant to measure the width of the separating lines, which is determined by the shutters positions, but it is important to obtain the same width for all the lines, as this is determined by the cassette tray positioning.

Therefore, to correct any irregularities affecting the separating line widths, it is necessary to modify the PID regulation gains in the cells of group 300.



**WARNING:**

Modifying these parameters can produce different effects, some of which are undesirable; it is therefore recommended to change their values only with a good understanding of the PID method, and referring to the *"Operating theory of a PID regulated axis"* in paragraph 11.3.1.

The correction must be performed by adjusting the **gains**, because the irregularity is determined by the error difference accumulated as a function of the travel distance.

In fact, correcting the individual travel distances using the parameters in group 400 would require a slow and laborious procedure, without solving the root of the problem.

However, if the individual is not sufficiently familiar with the PID method, it is also possible to adopt this second approach.

### 17.1.2 Checking the transversal positioning of the cassette tray

When taking a set of radiographs with cross sub-division on 18x24 or 30x24 film, a continuous separation line approximately 2 mm thick should be obtained between the upper and lower radiographs.

If this is not the case, it means that the transversal positioning of the cassettes tray is incorrect.

The accuracy of this motion is determined by the mechanical guides on the serial changer plate.

Therefore, any adjustments can only be made by referring to VILLA SISTEMI MEDICALI S.p.a..

### 17.1.3 Checking the positioning of the shutters

1. Perform exposures on films of different formats with various sub-division settings.
2. All the separator lines, for the various film formats and sub-division settings, should be of equal thickness.
3. If this is not the case, modify the group 400 parameters so as to correct any errors.

**NOTE:**

The cassette tray and shutters positions may not match the measurement entered in the corresponding cell; this is due to the mechanical inertia of the system.

In any case, the mm correction entered in these cells will increase or decrease the final position by an equivalent amount.

The theoretical travel limit of shutters is given in the "Actual travel" column of the tables in paragraph 11.4 *"Dimensions and movements range"*.

## 17.2 Collimator adjustments

The collimator is adjusted and checked at the factory, during the assembly and testing of **VISION**. However, after completing the installation of the system and taking some test radiographs, it may be necessary to perform some additional adjustments.

Using the different format settings, check that the collimator covers the film format in all the table positions (horizontal, vertical, trendelenbourg).

Also check that the collimated format does not deviate from the film or division format by more than 3% of the SID.

To run this check, place a cassette in the serial changer and rest a 35x35 format cassette on the patient support.

Take an exposure and develop the film contained in the cassette placed on the patient support.

Calculate the film-focus distances of the serial changer and patient support, and check that the image format on the 35x35 film corresponds to the serial changer collimation format.

Repeat the procedure with at least 2 formats, at different values of SID.

If the collimations are not correct, repeat the adjustment of the collimator potentiometers as described in paragraph 11.1 *"Potentiometer settings"* or modify the value entered in cell 220 by the amount necessary to bring the collimation value within 3% of the SID.

## **18.   DIAGNOSTICS**

As described in the different sections of this manual, **VISION** is able to detect malfunctions and faults in its own components or in those of some of its connected accessories.

**VISION** informs the operator and the service technician of these faults by means of diagnostic messages shown on the display.

These diagnostics are divided into 2 groups:

- **resettable**
- **non resettable.**



## 18.1 Resettable diagnostics

The resettable diagnostics are generated by functional anomalies which do not entail any type of hazard, and therefore the normal table operation can be resumed by operating the reset joystick 2 times.

As mentioned previously, the first action on the joystick silences the buzzer alarm, and the second resets the alarm.

When an alarm occurs, the program is halted.

The outputs for the generator, serial changer and collimator motions are all halted.

When the alarm is reset, the program can resume from where it left off.

- **Collision DIAGNOSTIC**

The collision diagnostics (11 - 14) are automatically removed once the condition which generated the diagnostic has been eliminated.

- **"SERVICE Mode" DIAGNOSTIC**

When the "SERVICE mode" diagnostic appears on the display it means that cell 233 has been enabled.

In these conditions the collimator will no longer be limited by the cassette formats.

It will therefore be possible to:

- use the joystick to vary the format from the minimum to the maximum limits
- display the speed of the tilting, along-table and across-table movements.

Code	Diagnostic
<b>62</b>	Failed to receive "generator ready" signal
<b>63</b>	Rapid sequence interrupted
<b>64</b>	Failed to receive "X-ray ON" from generator
<b>65</b>	Exposure time longer than 6.5 sec.
<b>66</b>	Radiography control released during the exposure
<b>67</b>	Preparation control released during the exposure
<b>90</b>	Defective EEPROM
<b>133</b>	Max value of tilting potentiometer is less than the min.
<b>134</b>	Max value of long.-t.top potentiometer is less than the min.
<b>135</b>	Max value of transv.-t.top potentiometer is less than the min.
<b>136</b>	Max value of SID potentiometer is less than the min.
<b>137</b>	Max value of collimator width potentiometer is less than the min.
<b>138</b>	Max value of collimator height potentiometer is less than the min.
<b>141</b>	Max value of shutters potentiometer is less than the min.
<b>142</b>	Max value of cassette tray potentiometer is less than the min.
<b>907</b>	Detected a control switch or joystick pressed on power up

## 18.2 Non resettable diagnostics

The non resettable diagnostics are generated by faults or malfunctions in components of the equipment which may represent a hazard for the operator or patient, or compromise the operation of the equipment.



**WARNING:**

After having identified and interpreted the diagnostic, the service technician must carefully ascertain the cause which triggered the diagnostic before powering up the equipment again.

Code	Diagnostic
50	Overcurrent on collimator motor control
51	Overcurrent on shutters motor control
52	Overcurrent on cassette tray motor control
59	"X-ray ON" active without fluoroscopy or radiography request
60	Cassette tray, collimator or shutters failed to reach the position (in standard sequence)
61	Cassette tray, collimators, shutters failed to reach the position (in rapid sequence)
68	Compressor failed to reach its end of travel in time
80	General emergency
81	Serial changer emergency
82	Microprocessor supply voltage too low
86	Defective RAM in cycle test
91	Width collimator shutter exceeded max error (cell 311)
92	Height collimator shutter exceeded max error (cell 325)
93	Shutters exceeded the max error (cell 339)
94	Cassette tray exceeded max error (cell 353)
101	Tilting potentiometer below software minimum
102	Tilting potentiometer above software maximum
103	Longitudinal t.top potentiometer below software minimum
104	Longitudinal t.top potentiometer above software maximum
105	Transversal t.top potentiometer below software minimum
106	Transversal t.top potentiometer above software maximum
107	SID potentiometer below software minimum
108	SID potentiometer above software maximum
109	Width collimator potentiometer under software minimum
110	Width collimator potentiometer above software maximum
111	Height collimator potentiometer below software minimum
112	Height collimator potentiometer above software maximum
117	Shutters potentiometer below software minimum
118	Shutters potentiometer above software maximum
119	Cassette tray potentiometer below software minimum
120	Cassette tray potentiometer above software maximum

<b>Code</b>	<b>Diagnostic</b>
<b>156</b>	No data transmission from supervisor to main on serial line
<b>157</b>	No data transmission from main to supervisor on serial line
<b>158</b>	Supervisor detected SF signal interrupted on power-up
<b>159</b>	Supervisor detected a closed input on power-up
<b>160</b>	Supervisor diagnostic: head side servo control ON but serial bit 0 = 0
<b>161</b>	Supervisor diagnostic: head side servo control OFF but serial bit 0 = 1
<b>162</b>	Supervisor diagnostic: foot side servo control ON but serial bit 1 = 0
<b>163</b>	Supervisor diagnostic: foot side servo control OFF but serial bit 1 = 1
<b>164</b>	Supervisor diagnostic: tabletop head side ON but serial bit 2 = 0
<b>165</b>	Supervisor diagnostic: tabletop head side OFF but serial bit 2 = 1
<b>166</b>	Supervisor diagnostic: tabletop foot side ON but serial bit 3 = 0
<b>167</b>	Supervisor diagnostic: tabletop foot side OFF but serial bit 3 = 1
<b>168</b>	Supervisor diagnostic: tabletop out ON but serial bit 4 = 0
<b>169</b>	Supervisor diagnostic: tabletop out OFF but serial bit 4 = 1
<b>170</b>	Supervisor diagnostic: tabletop in ON but serial bit 5 = 0
<b>171</b>	Supervisor diagnostic: tabletop in OFF but serial bit 5 = 1
<b>172</b>	Supervisor diagnostic: tilting toward vertical ON but serial bit 6 = 0
<b>173</b>	Supervisor diagnostic: tilting toward vertical OFF but serial bit 6 = 1
<b>174</b>	Supervisor diagnostic: tilting toward trendelembourg ON but serial bit 7 = 0
<b>175</b>	Supervisor diagnostic: tilting toward trendelembourg OFF but serial bit 7 = 1
<b>180</b>	Supervisor diagnostic: SF closed but head side servo control ON
<b>181</b>	Supervisor diagnostic: SF closed but foot side servo control ON
<b>182</b>	Supervisor diagnostic: SF closed but tabletop head side ON
<b>183</b>	Supervisor diagnostic: SF closed but tabletop foot side ON
<b>184</b>	Supervisor diagnostic: SF closed but tabletop out ON
<b>185</b>	Supervisor diagnostic: SF closed but tabletop in ON
<b>186</b>	Supervisor diagnostic: SF closed but tilting toward vertical ON
<b>187</b>	Supervisor diagnostic: SF closed but tilting toward trendelembourg ON
<b>191</b>	Collimator width potentiometer halted but motion control activated
<b>192</b>	Collimator height potentiometer halted but motion control activated
<b>193</b>	Shutters potentiometer stopped but motion control activated
<b>194</b>	Cassettes tray potentiometer stopped but motion control activated
<b>201</b>	Tilting potentiometer moved with no motion control activated
<b>202</b>	Longitudinal t.top potentiometer moved with no motion control activated
<b>203</b>	Transversal t.top potentiometer moved with no motion control activated

Code	Diagnostic
<b>205</b>	Collimator width potentiometer moved with no motion control activated
<b>206</b>	Collimator height potentiometer moved with no motion control activated
<b>209</b>	Shutters potentiometer moved with no motion control activated
<b>210</b>	Cassette tray potentiometer moved with no motion control activated
<b>216</b>	Cassette recognition signal moved cassette tray in park
<b>217</b>	Tilting potentiometer exceeded the error
<b>218</b>	Longitudinal t.top potentiometer exceeded the error
<b>219</b>	Transversal t.top potentiometer exceeded the error
<b>231</b>	Inputs reset but SF open
<b>232</b>	Inputs activated but SF closed
<b>500</b>	RAM-EEPROM: failed to recognise byte
<b>501</b>	RAM-EEPROM: write failure
<b>502</b>	RAM-EEPROM: check failed
<b>512</b>	EEPROM re-read incorrect
<b>998</b>	Noise on main processor – keyboard line
<b>999</b>	RAM data loss, Check battery

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## **19. TROUBLESHOOTING**

As described in the various sections of this manual, **VISION** is capable of detecting fault conditions and malfunctions, both in its components and in some of the connected accessories, generating the diagnostics described in chapter 18 "*Diagnostics*".

Using these diagnostics, the service technician is able to precisely pinpoint the fault which occurred.

Because the meanings of the diagnostics and their causes have already been discussed elsewhere in this manual, this chapter details only those faults which may occur on **VISION** system and which are not included in the diagnostics. Otherwise reference will be made to the solutions described in other chapters.

The malfunctions are divided into the following groups:

- **radiological faults**
- **electrical and electronic faults**
- **mechanical faults.**

## 19.1 Radiological faults

Fault	Solution
The collimator does not collimate correctly and the display indicates an incorrect SID	Check that the focus distance is 80 mm from the collimator base on the fixing cone.
The format sub-division line is irregular	See paragraph 17.1
The grid lines are visible on the radiographs	Check that the grid motion is correct
The grid lines are visible on the radiographs	Modify the X-ray start delay (cell 215)
The image on the fluoroscopy monitor is horizontally inverted	Modify the value entered in cell 236
The image on the fluoroscopy monitor is vertically inverted	Modify the value entered in cell 237
The manual kV adjustment in fluoroscopy mode does not work	Modify the value entered in cell 238

## 19.2 Electrical and electronic faults

<b>Fault</b>	<b>Solution</b>
The serial changer does not recognise the cassettes	With the cassette tray parked, check that the position of the magnet is correct relative to the position of the magnetic switch holder circuit.
The serial changer does not recognise the cassettes	Check that the type of cassette is compatible with the type of serial changer (cm or inches)
The motion of the cassette tray is not smooth – there are vibrations and oscillations	See paragraph 11.3
The motion of the shutters is not smooth – there are vibrations and oscillations	See paragraph 11.3
The motion of the collimator shutters is not smooth – there are vibrations and oscillations	See paragraph 11.3
Alarm 217 is generated during tilting	Check the speed of the motion (paragraph 11.2 " <i>Installation parameters</i> ") and correct the value in cell 216
Alarm 218 is generated during the longitudinal tabletop motion	Check the speed of the motion (paragraph 11.2 " <i>Installation parameters</i> ") and correct the value in cell 217
Alarm 219 is generated during the transversal tabletop motion	Check the speed of the motion (paragraph 11.2 " <i>Installation parameters</i> ") and correct the value in cell 218



## 19.3 Mechanical faults

Fault	Solution
When the serial changer is left with the brakes released and the tabletop horizontal, the position is not maintained	The serial changer group has not been correctly balanced
When the serial changer is left with the brakes released and the tabletop vertical, the position is not maintained	The serial changer – tube group has not been correctly balanced
Mechanical binding of the transverse serial changer motion	Check the transverse motion bearings, and that there is no friction between the brakes and guide when the brakes are released
Mechanical hardening of the compression motion of the serial changer	Check the compression motion bearings, and that there is no friction between the brakes and guide when the brakes are released
The table is powered at 60 Hz and with the patient support 400 mm beyond the head side it does not tilt toward the vertical	Enter value 1 in cell 238
The distance between the table top and the floor is incorrect	Modify the value entered in cell 210
The distance between the table top and the walls is incorrect	Modify the value entered in cell 212
The distance between the table top and the ceiling is incorrect	Modify the value entered in cell 211

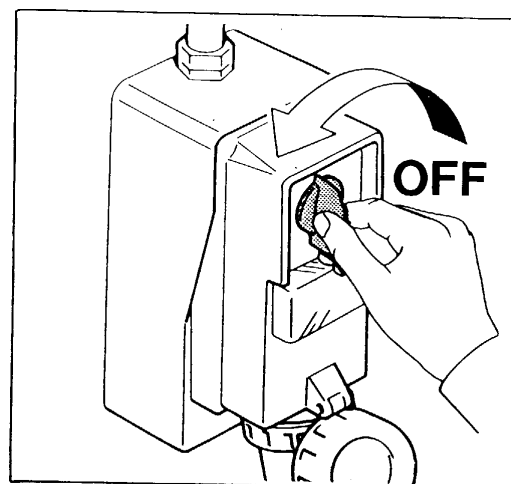
## 20. CLEANING AND DISINFECTION

In order to assure proper cleaning and hygiene, carefully follow the instructions here after provided.



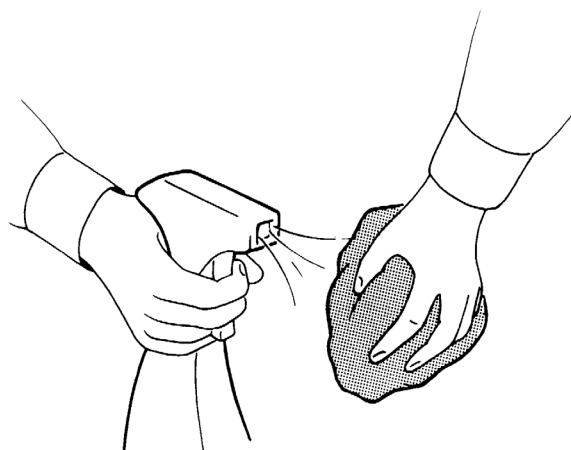
**WARNING:**

Disconnect from the mains before cleaning the unit.



**Do not allow liquids and water to enter inside the unit, to prevent from short circuits and corrosion of inner parts.**

Clean the painted surfaces using only a damp cloth and neutral detergents. Take care to dry the parts with a dry cloth. Do not use corrosive solvents (alcohol, gasoline)



Clean the covers, the table top, the foot rest and the accessories using only a damp cloth.

Periodically and when necessary decontaminate the compressor cone, the table top, the handle, the legs support and the footrest using a 2% solution of Glutharaldeid.

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## 21. MAINTENANCE

### 21.1 Operator maintenance

As for all the electrical devices, in addition to proper use this unit also requires periodical checks and maintenance. These precautions will insure a safe and efficient performance of the device.

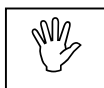
The preventive maintenance consists of checks that can be carried out directly by the operator as outlined in the following table.

#### Checks carried out by the operator.

Interval	Type of check	Method
Daily	No residuals of organic or contrast liquids are left on the device.	visual check
Once a week	Check the integrity of the equipment.	visual check
Once a month	No friction is detected in the functionality of mechanical components. Brakes functionality	visual check
Every 6 months	Labels are present and not damaged	visual check

**WARNING:**

If there are doubts about the collimator correspondence between light field and X-ray field, the operator must contact VILLA SISTEMI MEDICALI S.p.a. authorised service centres.

**WARNING:**

Metallic noise coming from the tube stand may indicate wearing of the counterweight ropes. In this case stop using the unit immediately and contact VILLA SISTEMI MEDICALI S.p.a. authorised service centres.

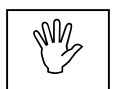
**WARNING:**

If any of the above checks give negative results, the operator must contact VILLA SISTEMI MEDICALI S.p.a. authorised service centres.

## 21.2 Maintenance reserved to the authorised technician

The purpose of this manual is to provide the service technician with the instructions for ensuring safe and efficient operation of the equipment.

In order to maintain intact the characteristics and quality level of **VISION**, it is advisable to perform a general preventive maintenance by a highly specialised service technician authorised by VILLA SISTEMI MEDICALI S.p.a..

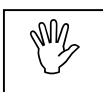


**WARNING:**

Any service operations must be performed exclusively by a specialised technician authorised by VILLA SISTEMI MEDICALI S.p.a..

The maintenance operations performed by the specialised technician must be those described below, and must be carried out in the manner described.

Inspection or maintenance action	Method
Disassemble the guards and clean the underlying parts, taking particular care with the Bucky if it is installed	visual check
Cleanness of the mylar under the patient support	visual check
Cleanness of the serial changer	visual check
Check centring of the beam	see paragraph 17.2
Check the collimation	see paragraph 17.2
Check the cassette format sub-division	see paragraph 17.1
Check the functionality and motions actuated from the control panel and from the keypad located on the table cover	visual check
Check the centring of the tilting, along-table, across-table movements	visual check
Check the condition of the cables	visual check
Check the chain tension	visual check
Check the level of the lubricant in the reduction units	visual check
Check the motor belts	visual check
Check the condition of the motion bearings and guides	visual check
Check the smoothness of the manual motions (transversal and compression)	direct test



**WARNING:**

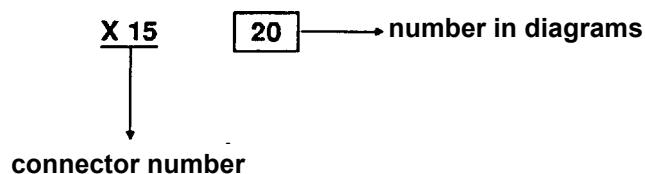
- 1.** In case of replacement of parts or components, always use original spare parts.  
The use of non original spare parts will void all warranties.  
Also, VILLA SISTEMI MEDICALI S.p.a. does not bear any responsibility if non-original spare parts are used and/or the service action is performed by people not authorised by VILLA SISTEMI MEDICALI S.p.a. itself.
- 2.** For cleaning and disinfecting operations, use only solvent-free liquids and non abrasive materials.  
Take the utmost care to prevent the liquids from penetrating inside the inaccessible parts of the equipment.  
Always disconnect the equipment from the electricity supply before performing these operations.

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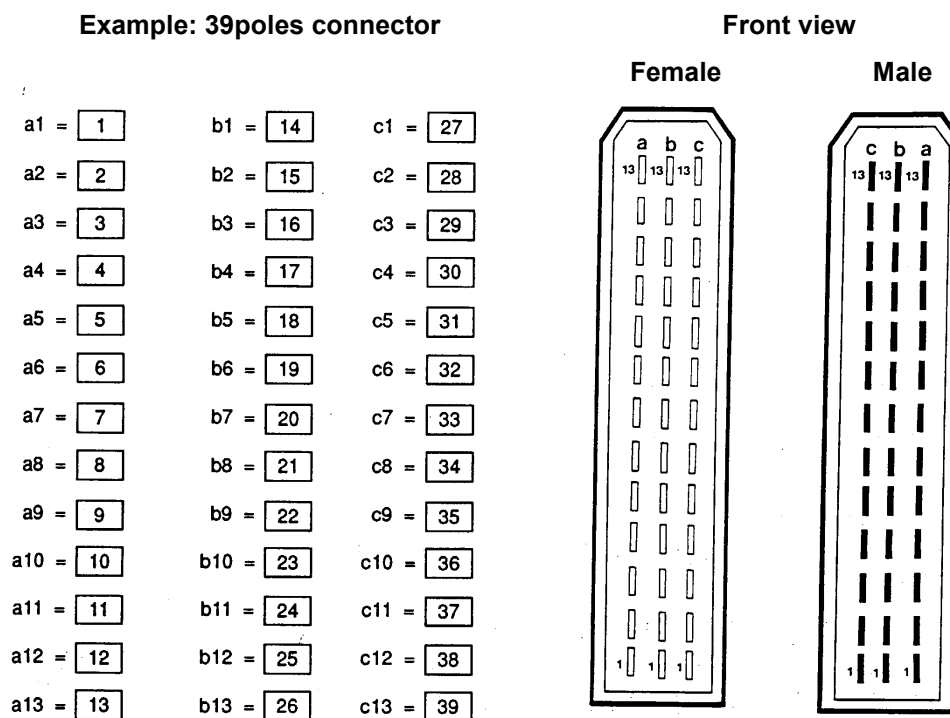
## 22. SCHEMATICS AND DRAWINGS

The circuitry of **VISION** utilises some connectors which are shown in the schematics of this chapter.

9, 15, 37 and 39 poles connectors are used on **VISION**.  
The 39 poles connector must be read as follows:

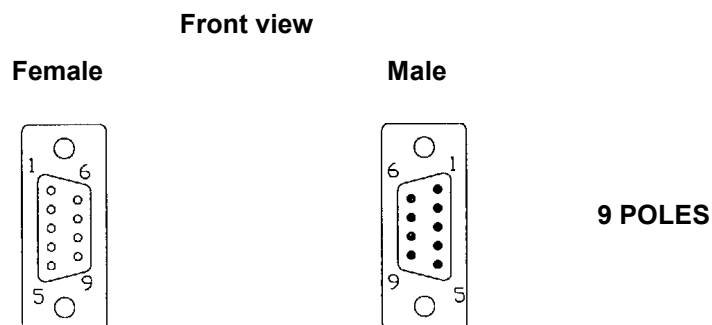
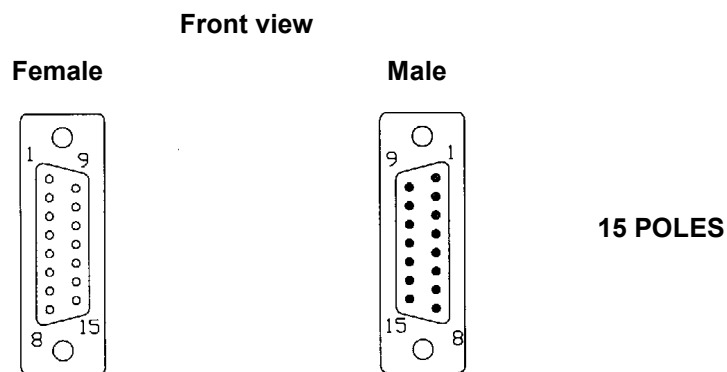
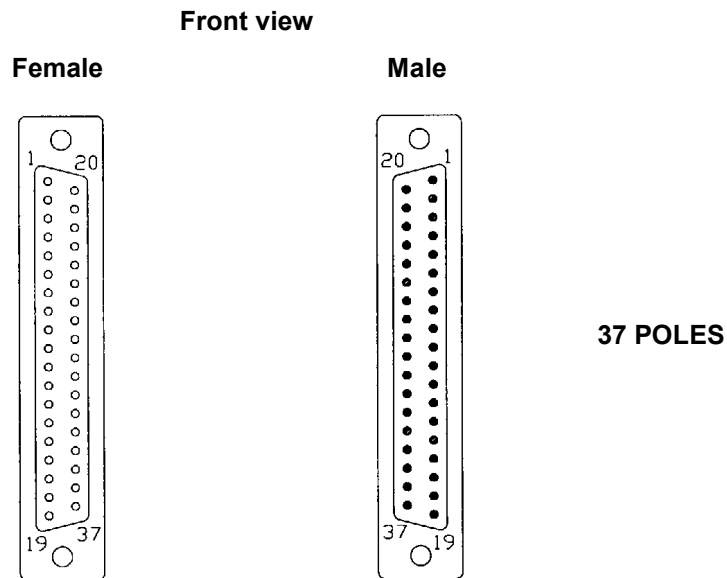


Pin number identification is shown in the next picture.





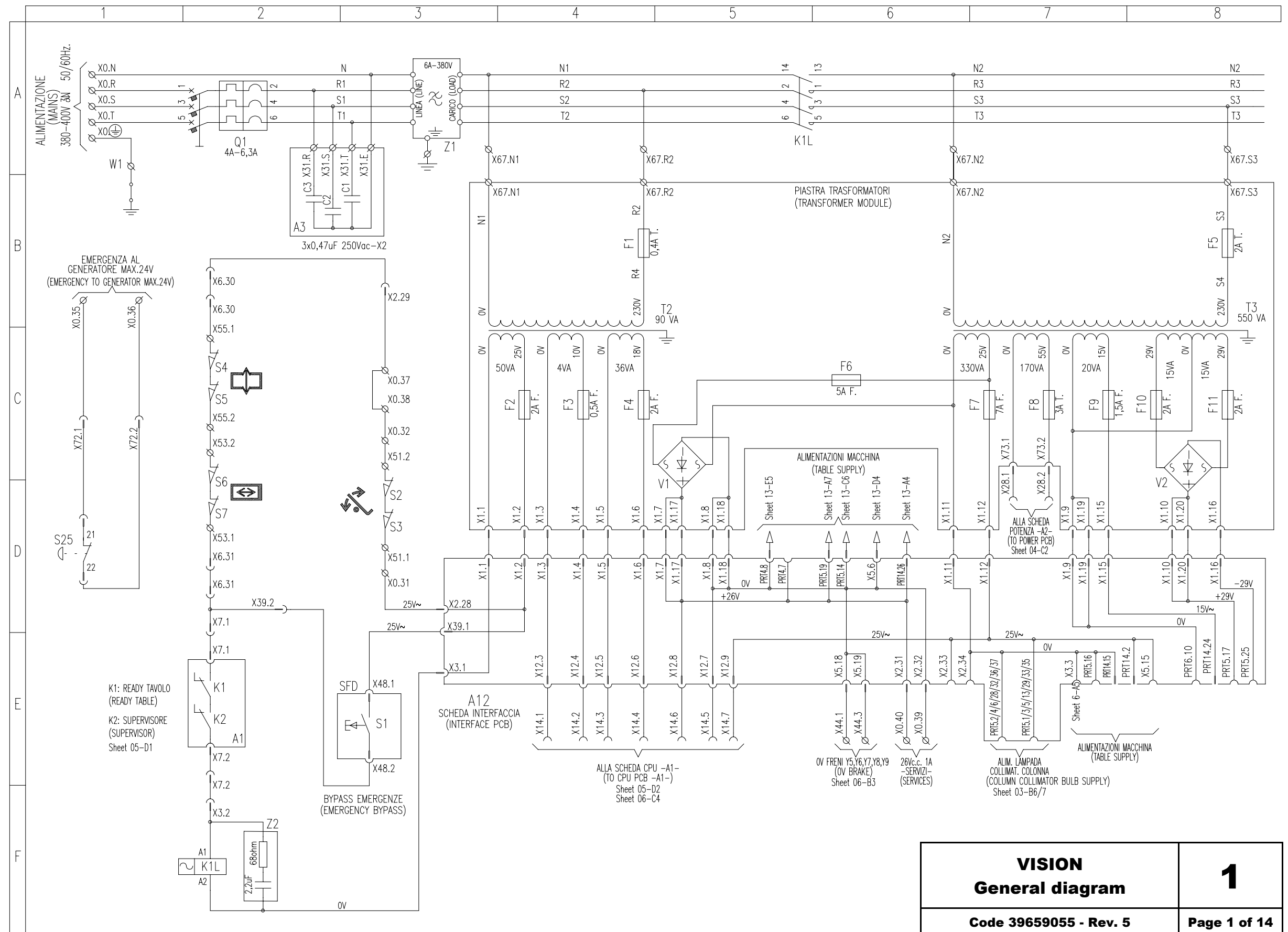
Next figure shows pin identification for 37, 15 and 9 poles connectors (both male and female).

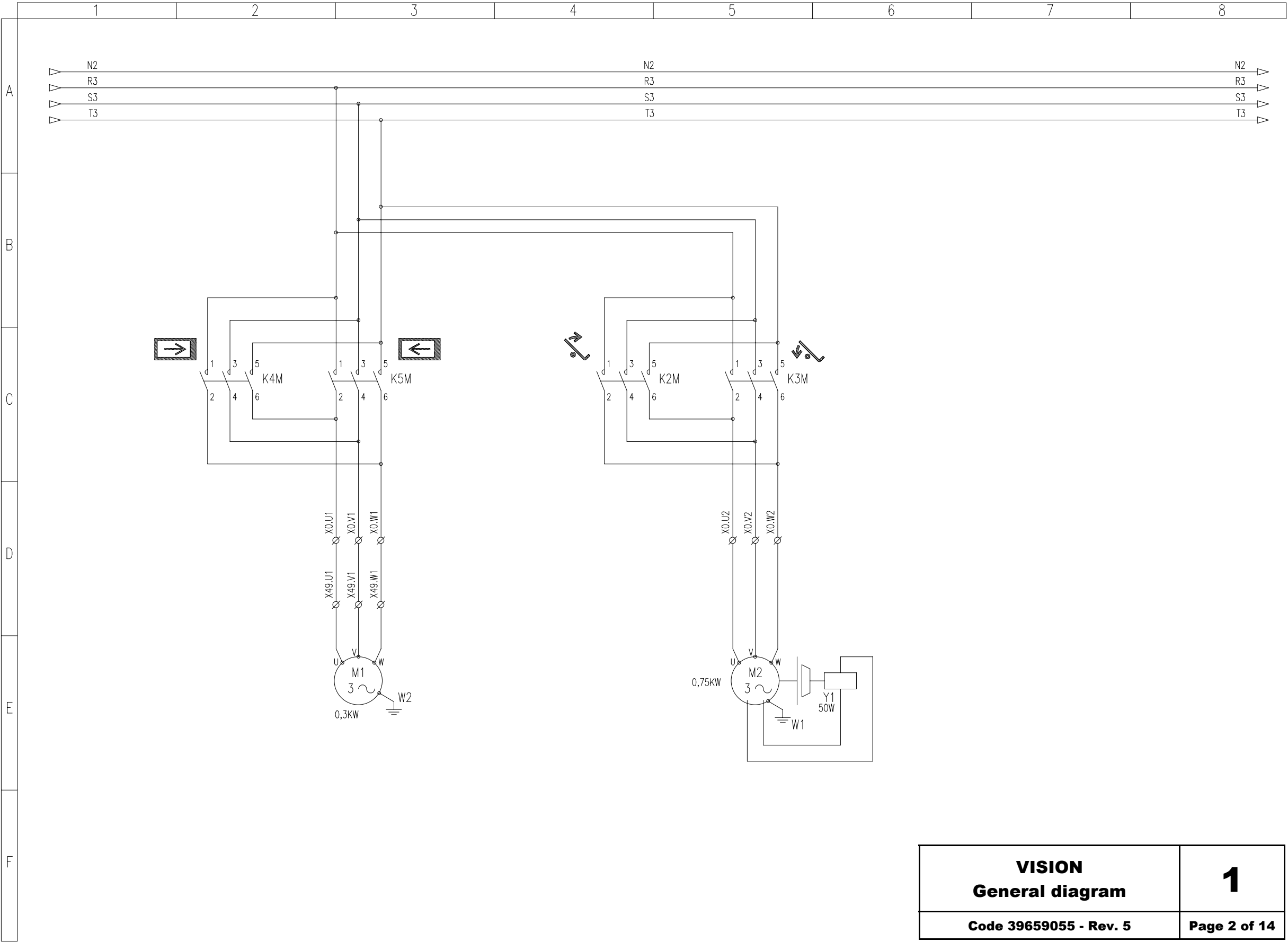


## **22.1 Schematics and drawings list**

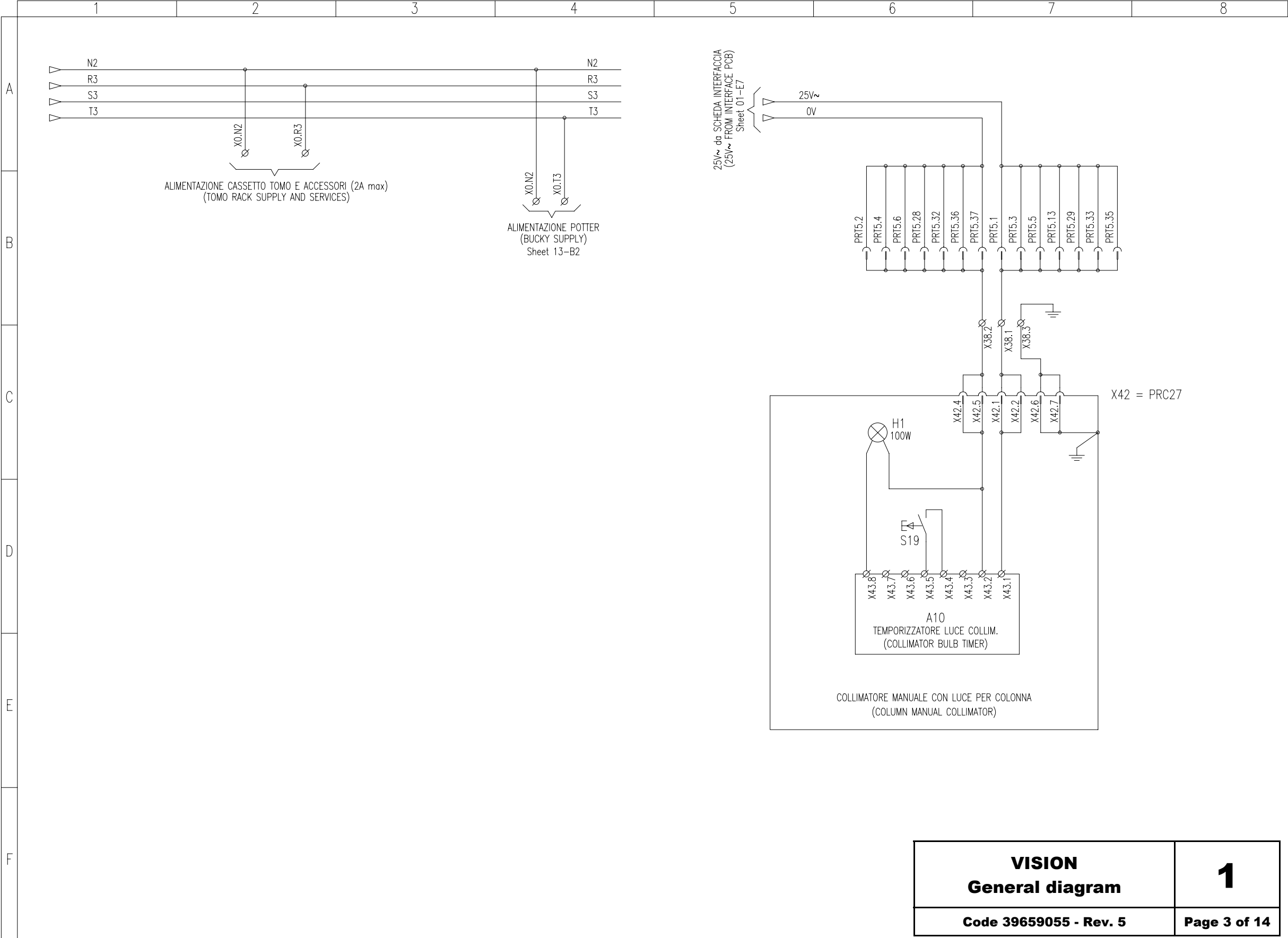
- 1. General diagram**
- 2. Table & Potter Bucky components layout**
- 3. Spot Film Device (SFD) components layout**
- 4. Collimator components layout**
- 5. A13 Front panel push buttons board layout & schematic**
- 6. Components plate layout**
- 7. A12 Connectors board layout**
- 8. A12 Connectors board schematic**
- 9. A6 Interconnection board layout & schematic**
- 10. Transformer plate layout**
- 11. A14 Potter Bucky board layout**
- 12. A1 SFD CPU board layout**
- 13. A1 SFD CPU board schematic**
- 14. A2 SFD Motor Driver board layout**
- 15. A2 SFD Motor Driver board schematic**
- 16. A4 SFD keyboard & display board layout**
- 17. A4 SFD keyboard & display board schematic**
- 18. A5 SFD joystick board layout**
- 19. A5 SFD joystick board schematic**

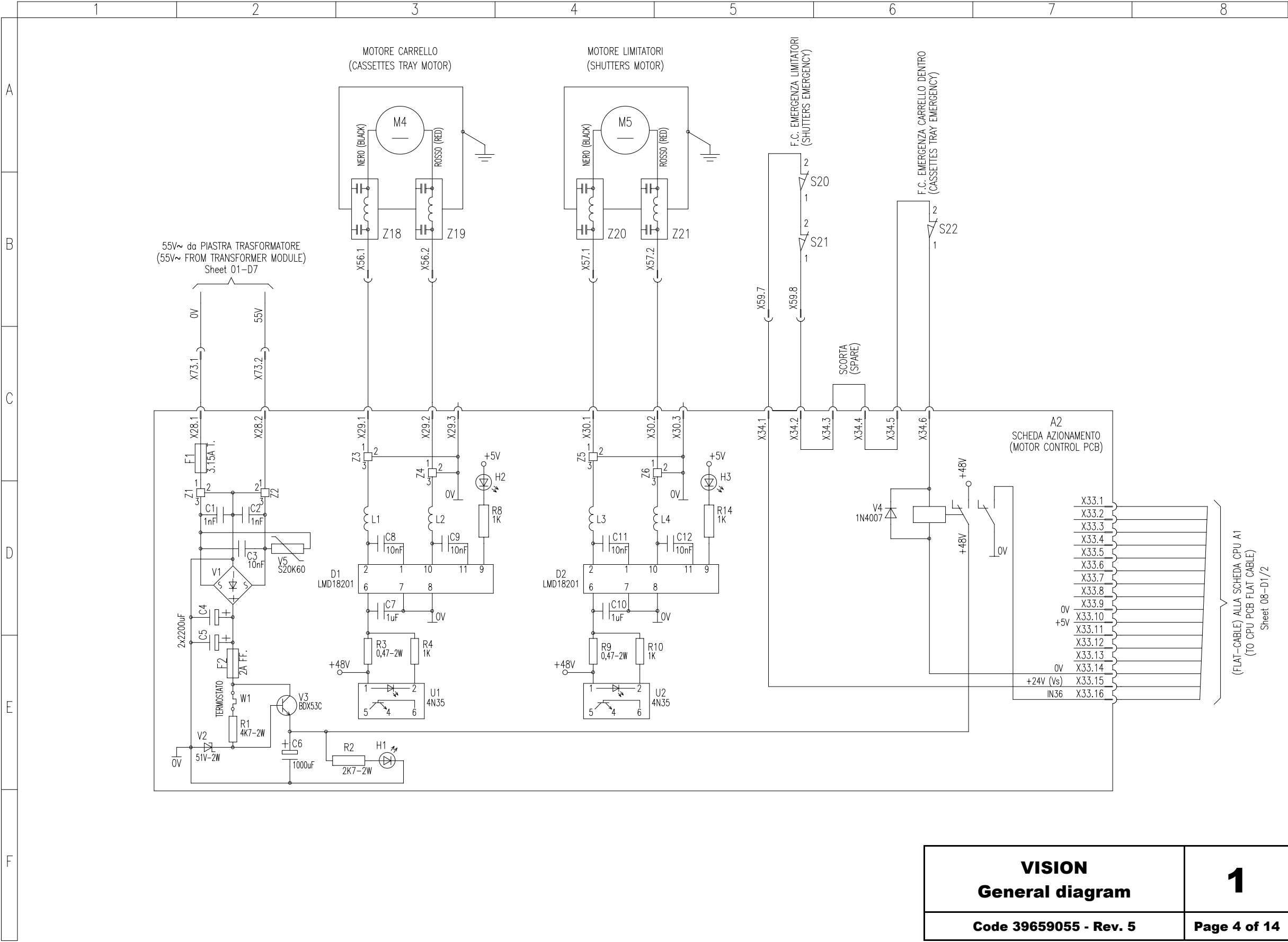
- 20. A7 Prep. - Exposure board layout**
- 21. A7 Prep. - Exposure board schematic**
- 22. A11 Magnetic switch board layout & schematic (cm)**
- 23. A11 Magnetic switch board layout & schematic (inch)**
- 24. Autotransformer module layout**
- 25. Autotransformer module schematic**

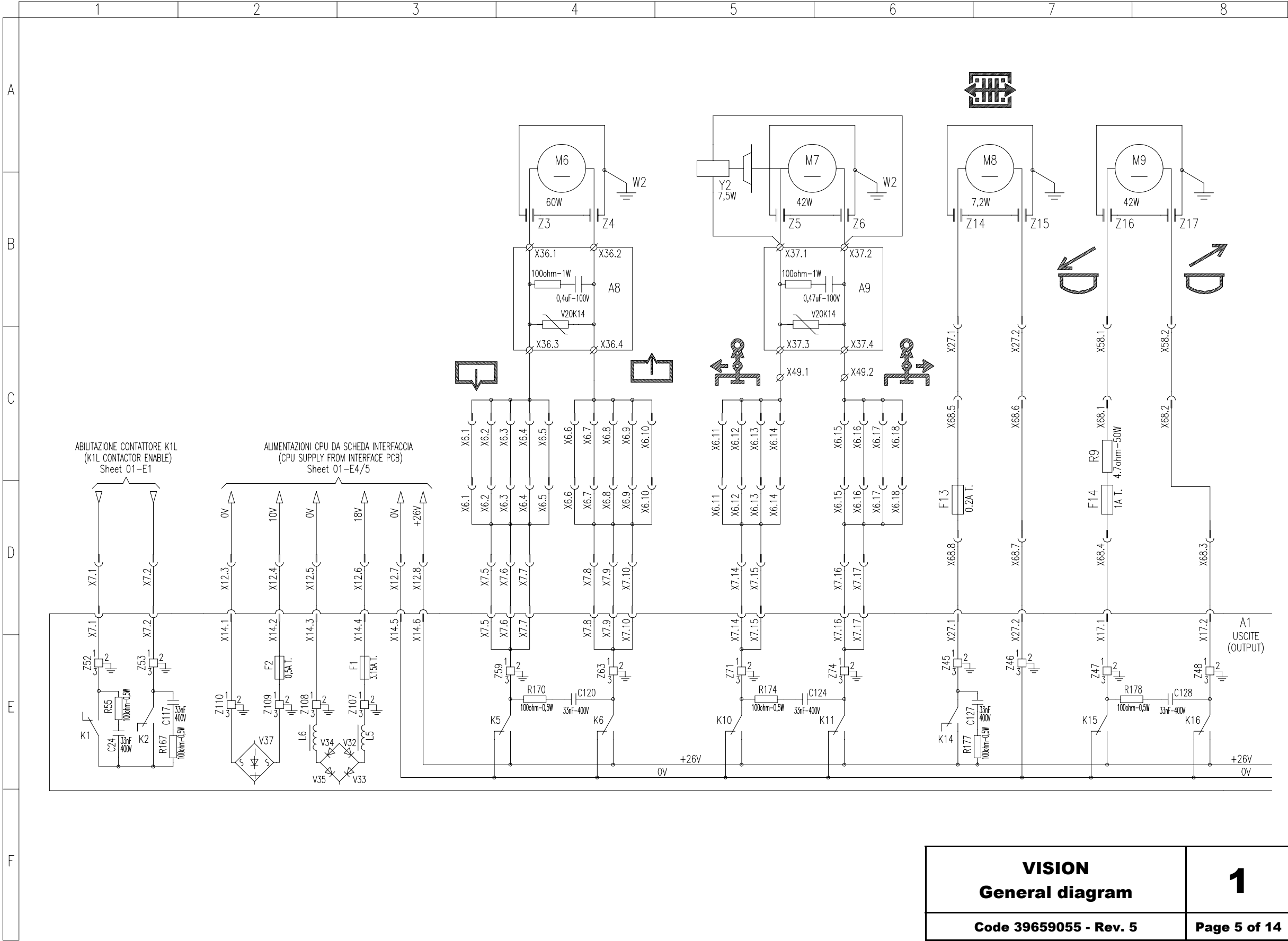




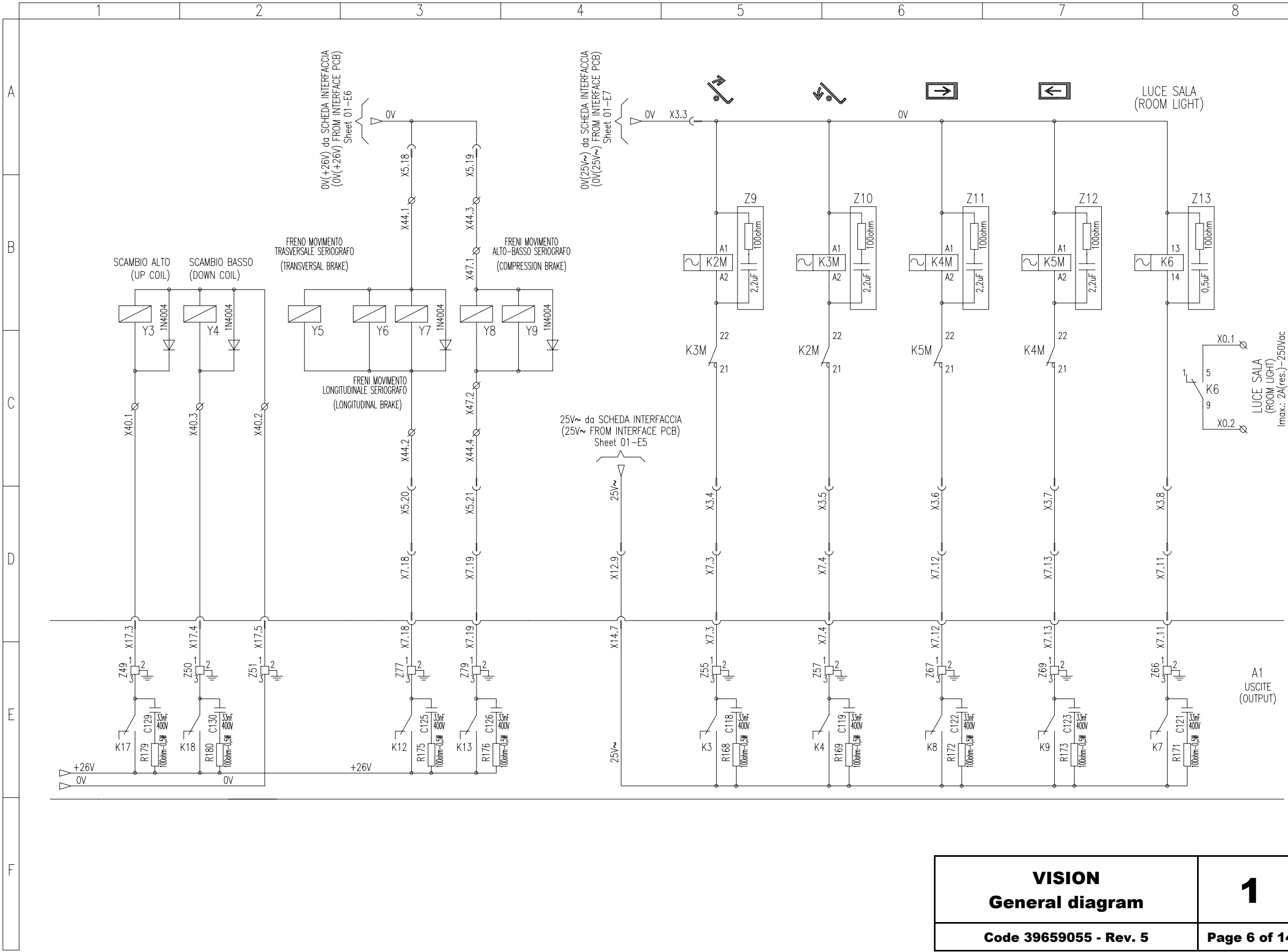
<b>VISION</b> <b>General diagram</b>	<b>1</b>
Code 39659055 - Rev. 5	Page 2 of 14

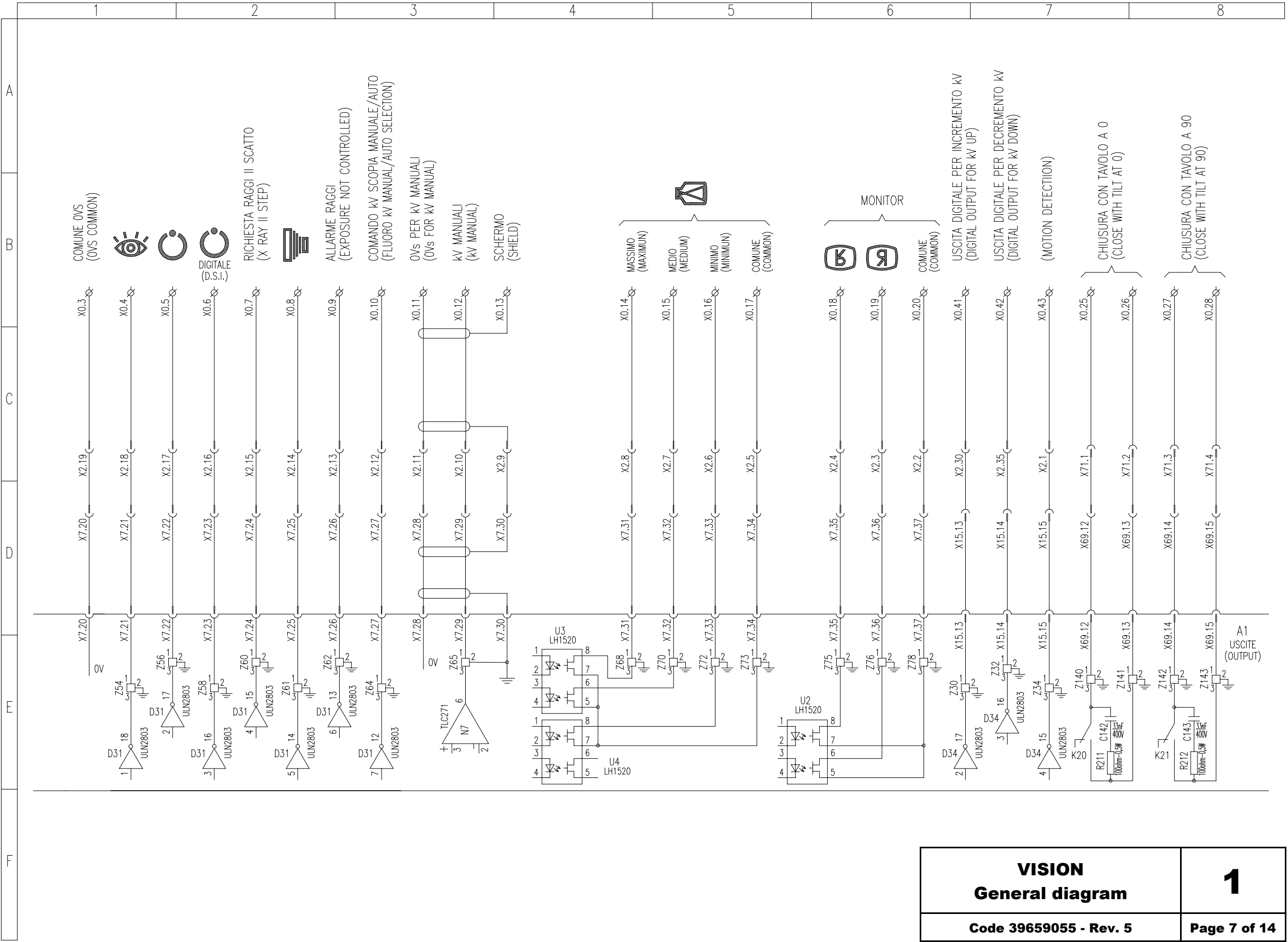


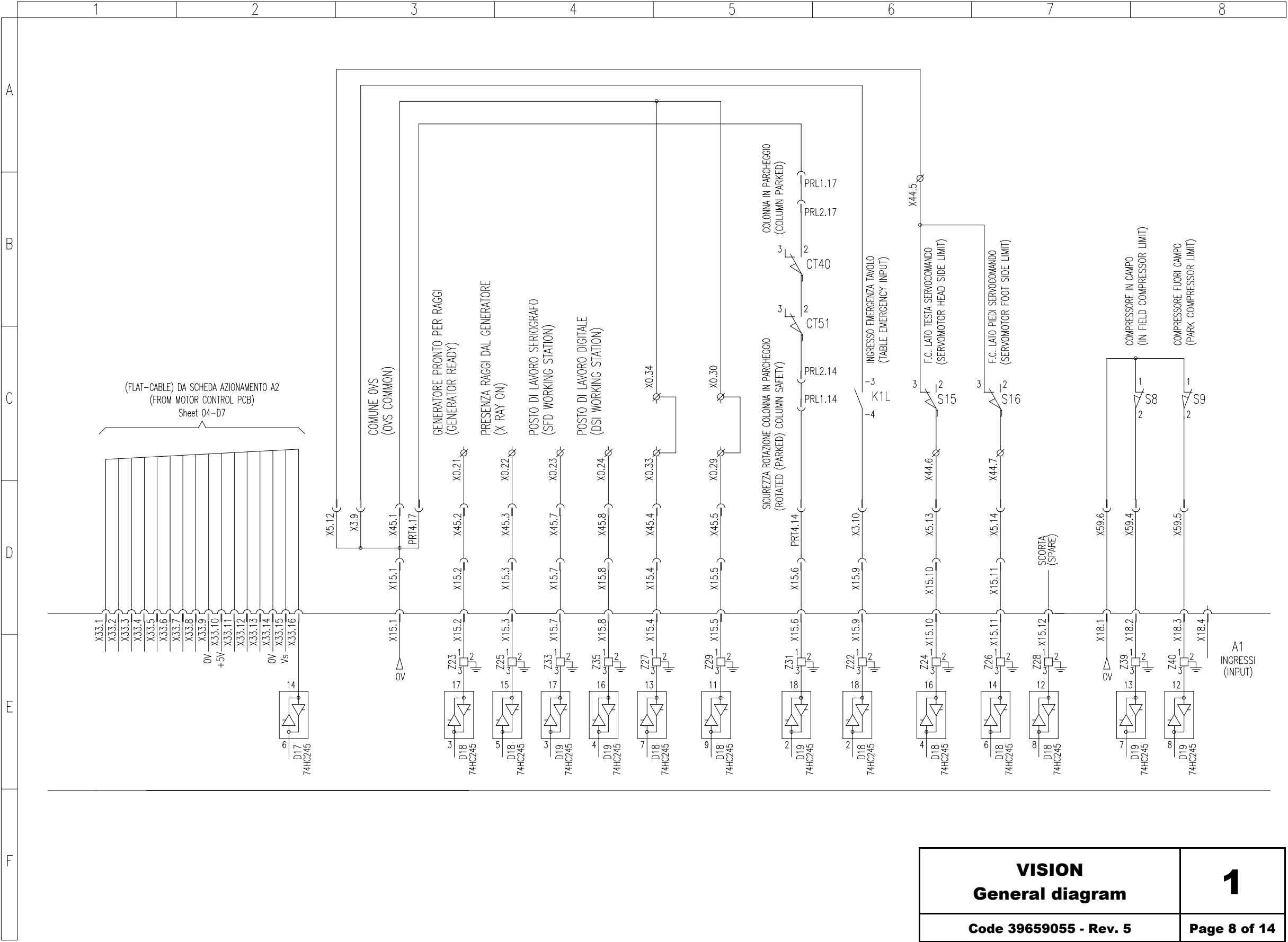




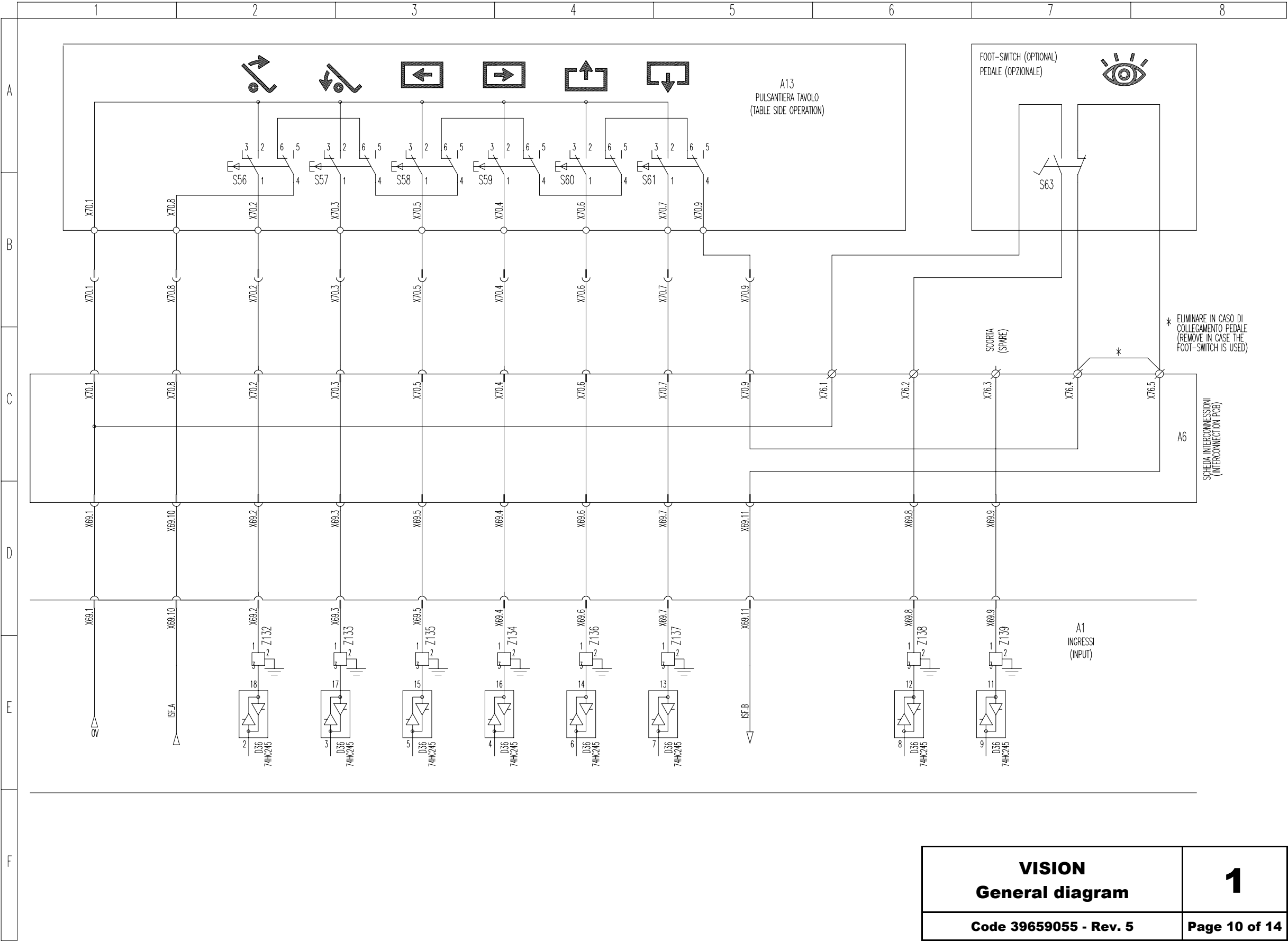


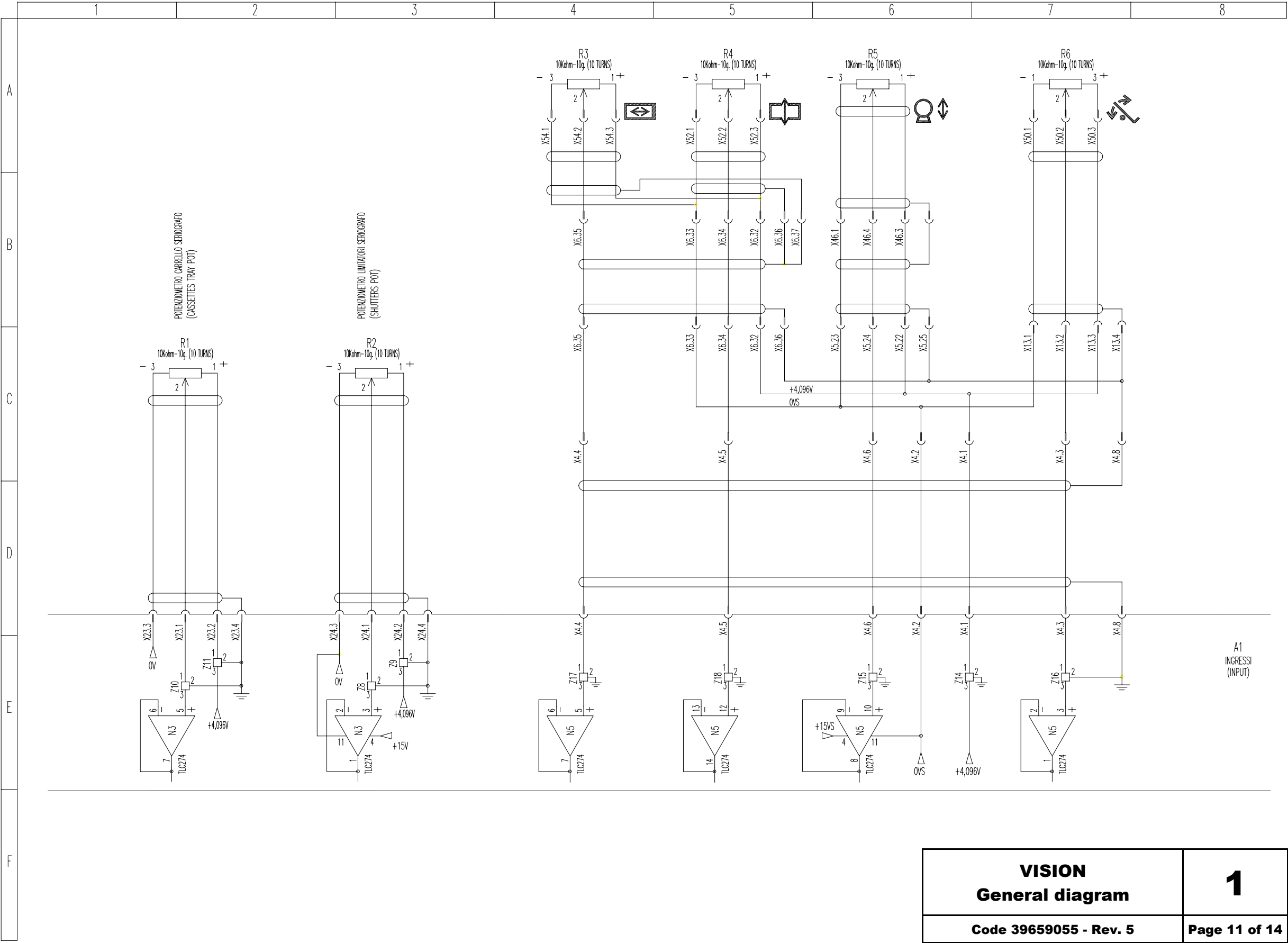


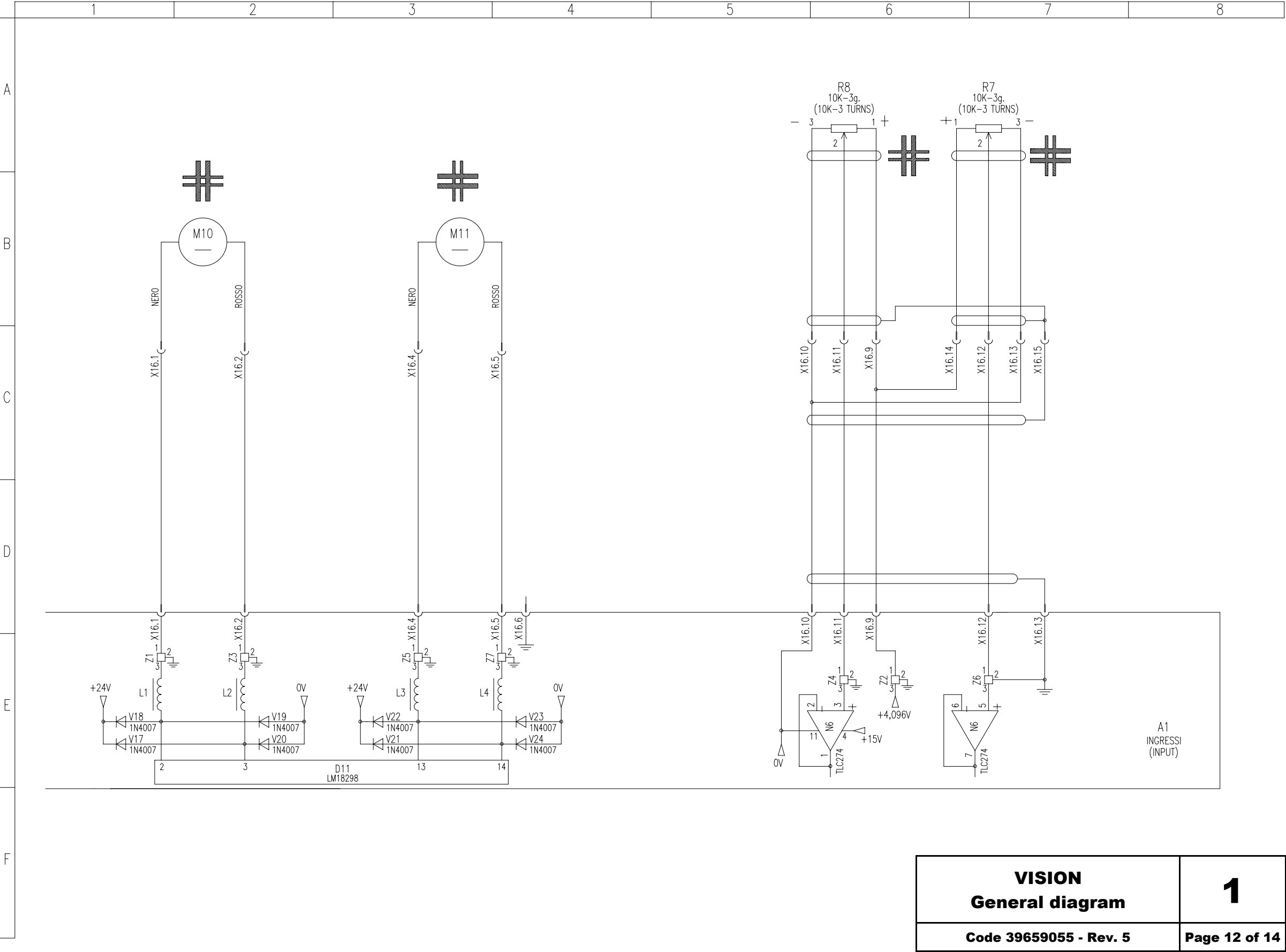


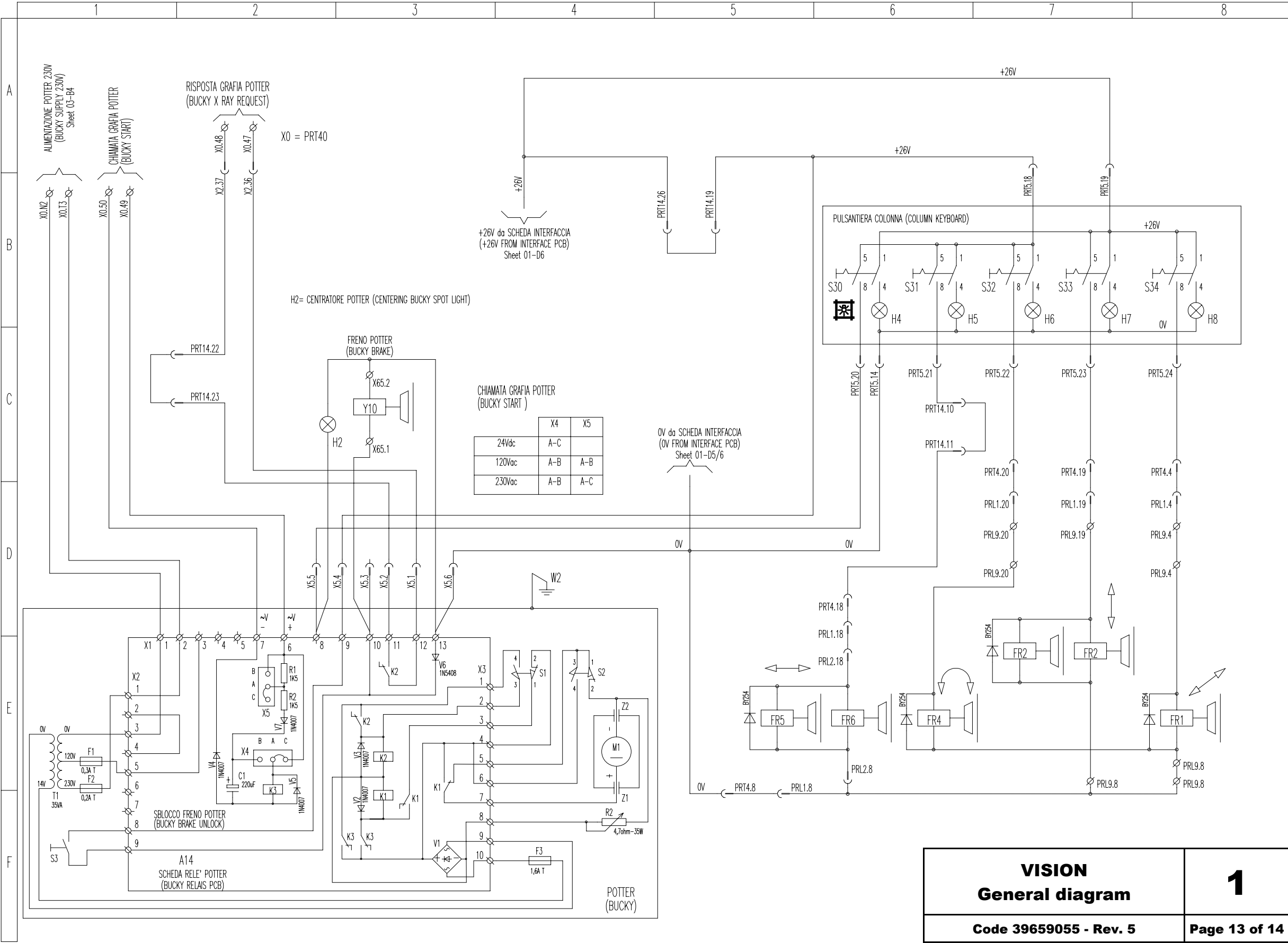




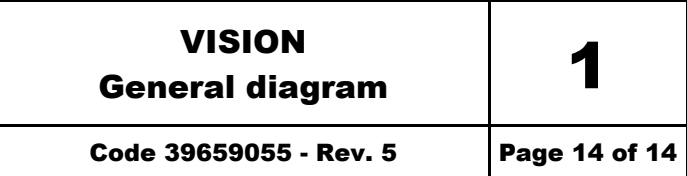


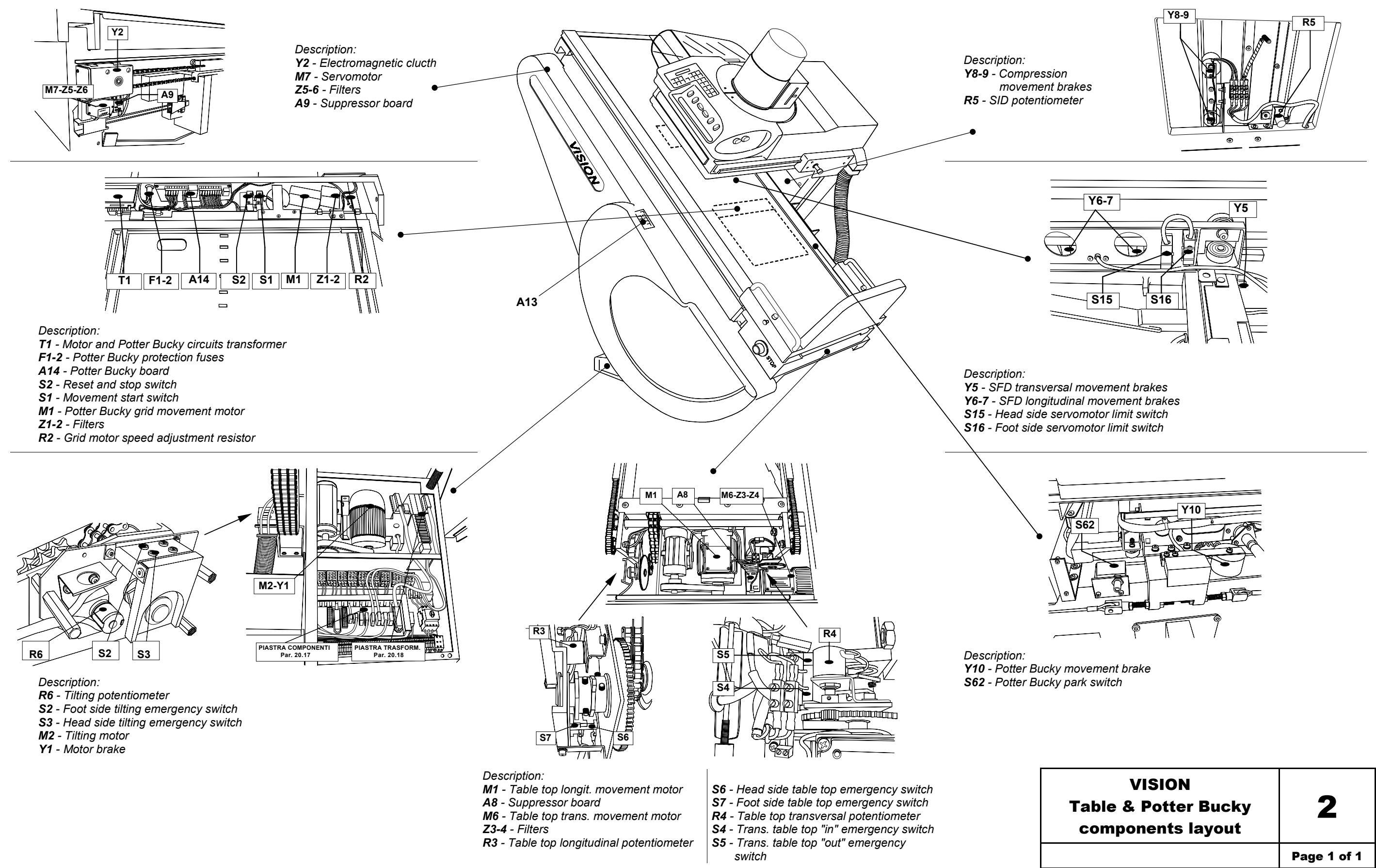


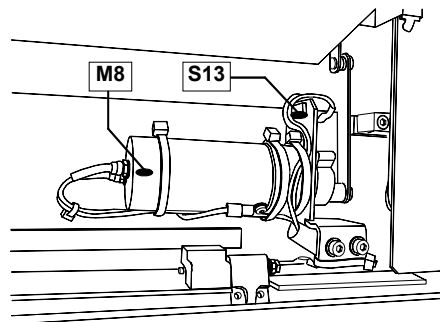




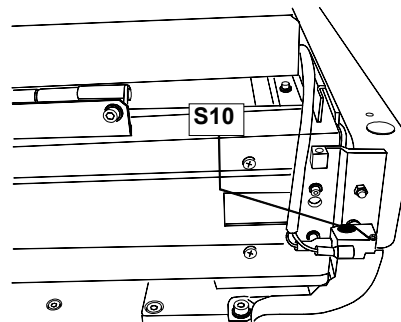




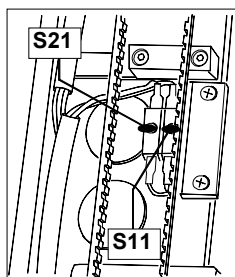
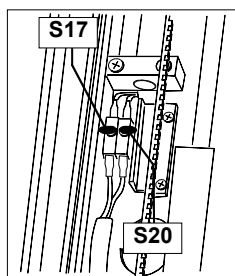




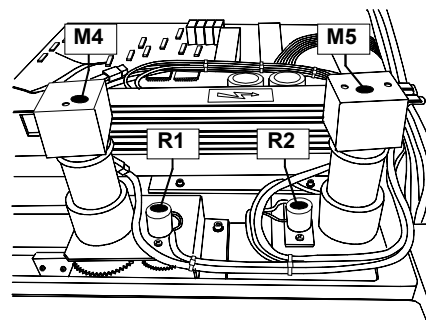
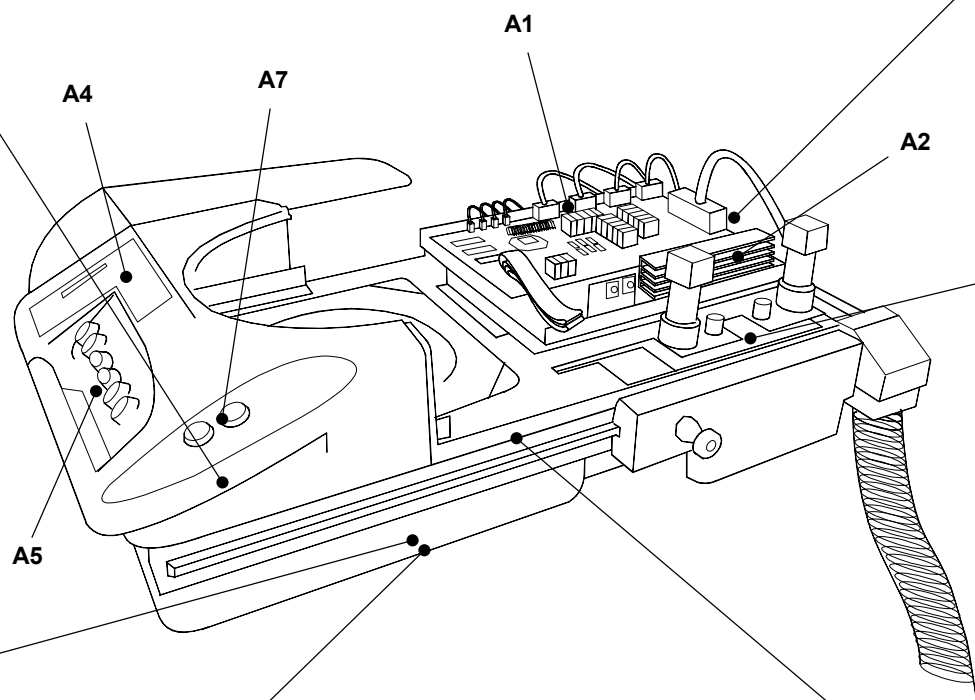
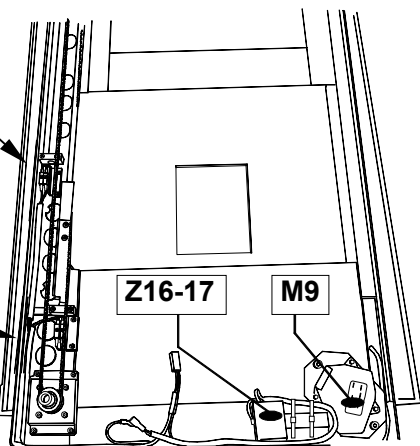
Description:  
**M8** - SFD grid movement motor  
**S13** - Grid "zero position" switch



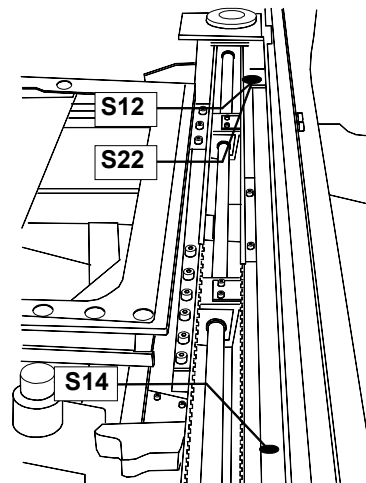
Description:  
**S10** - "SFD centered on X-ray" switch



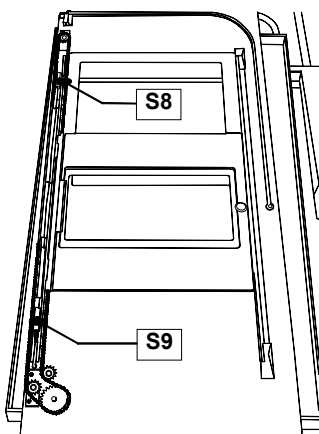
Description:  
**S11** - Shutters initialisation "MIN" switch  
**S17** - Shutters initialisation "MAX" switch  
**S20** - "Close shutters" emergency switch  
**S21** - "Open shutters" emergency switch  
**Z16-17** - Filters  
**M9** - SFD compressor movement motor



Description:  
**M4** - SFD cassettes tray movement motor  
**M5** - SFD shutters movement motor  
**R1** - Cassette holder carriage potentiometer  
**R2** - SFD shutters potentiometer

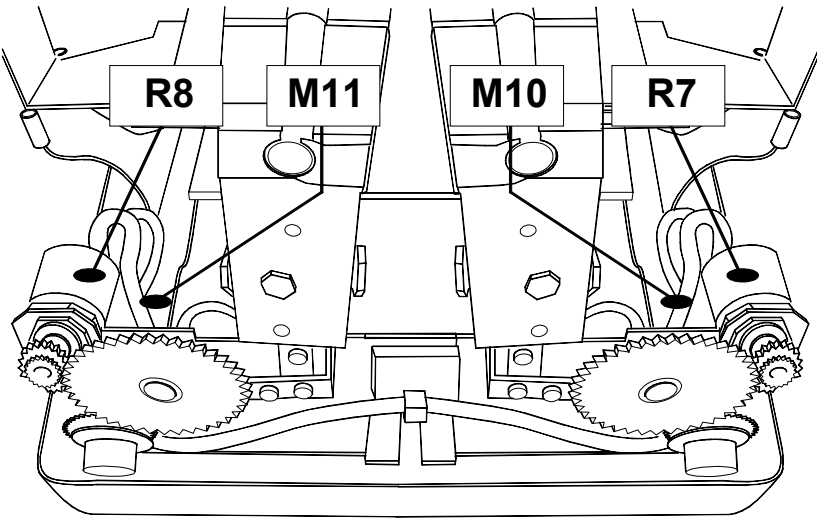


Description:  
**S12** - Cassettes tray initialisation "MIN" switch  
**S14** - Cassettes tray initialisation "MAX" switch  
**S22** - Cassettes tray holder emergency switch



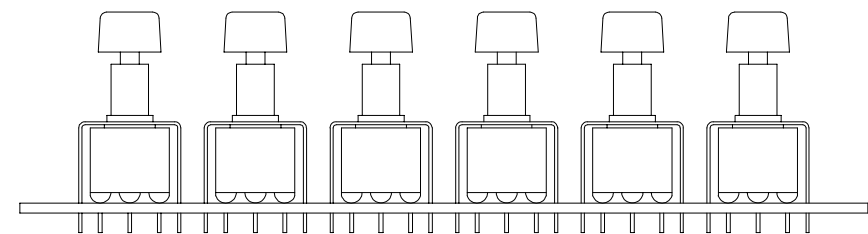
Description:  
**S8** - Compressor "IN" limit switch  
**S9** - Compressor "OUT" limit switch

<b>VISION</b> <b>Spot Film Device (SFD)</b> <b>components layout</b>	<b>3</b>
	Page 1 of 1

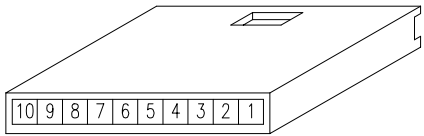
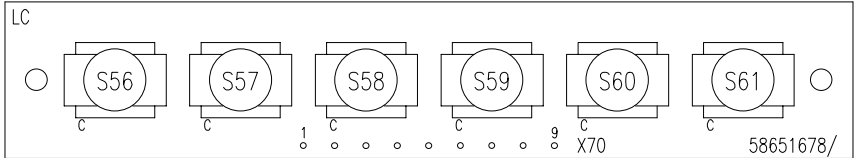
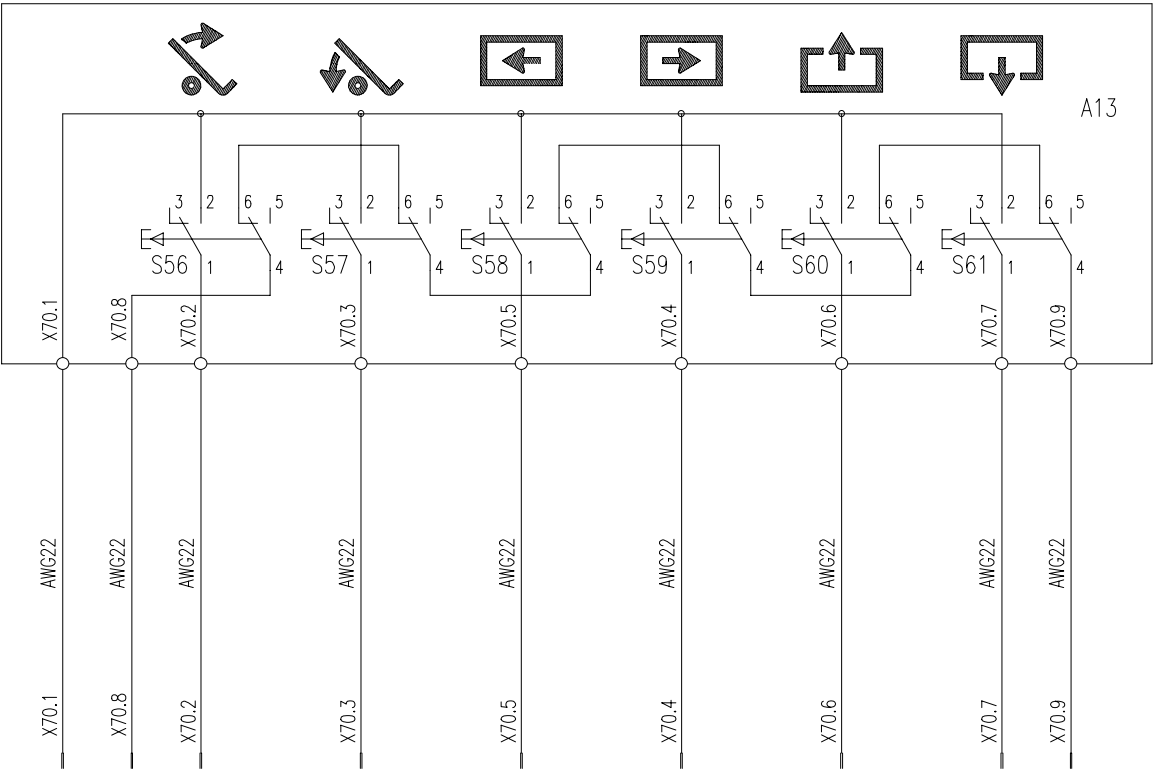
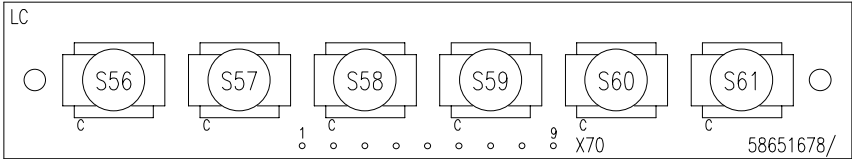


*Description:*  
**M10** - "High reduction" jaws movement motor  
**M11** - "Width reduction" jaws movement motor  
**R7** - "High reduction" jaws potentiometer  
**R8** - "Width reduction" jaws potentiometer

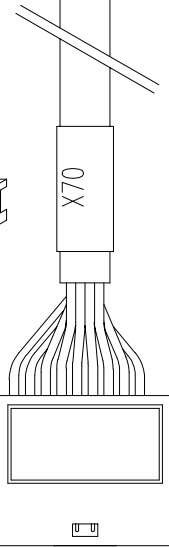
<b>VISION</b> <b>Collimator components</b> <b>layout</b>	<b>4</b>
	Page 1 of 1



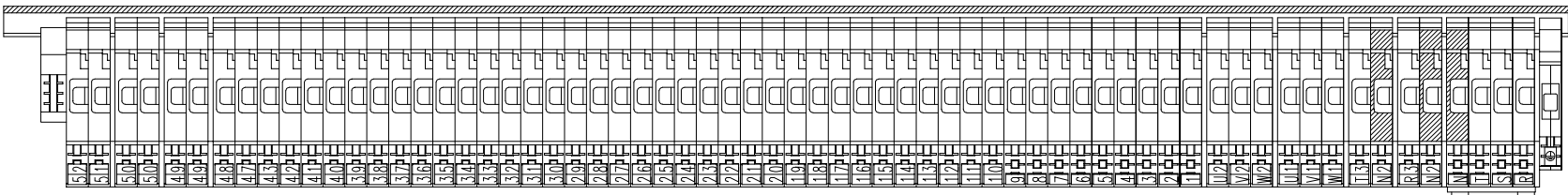
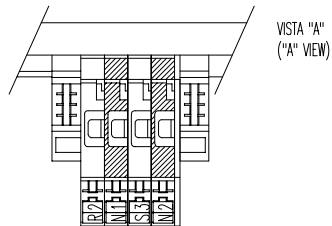
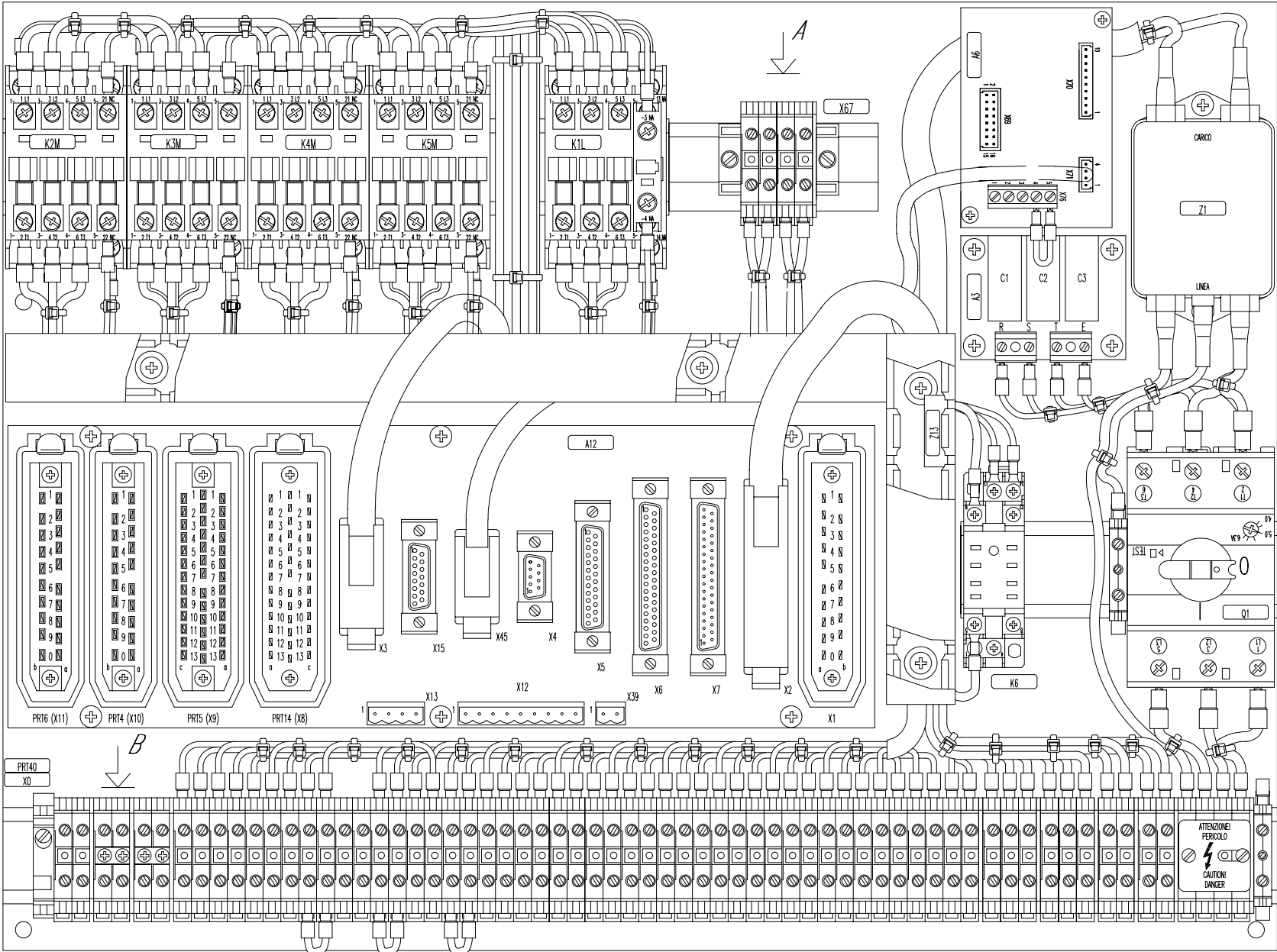
A13



VISTA INSERIMENTO PIN  
(INSERTION PIN VIEW)

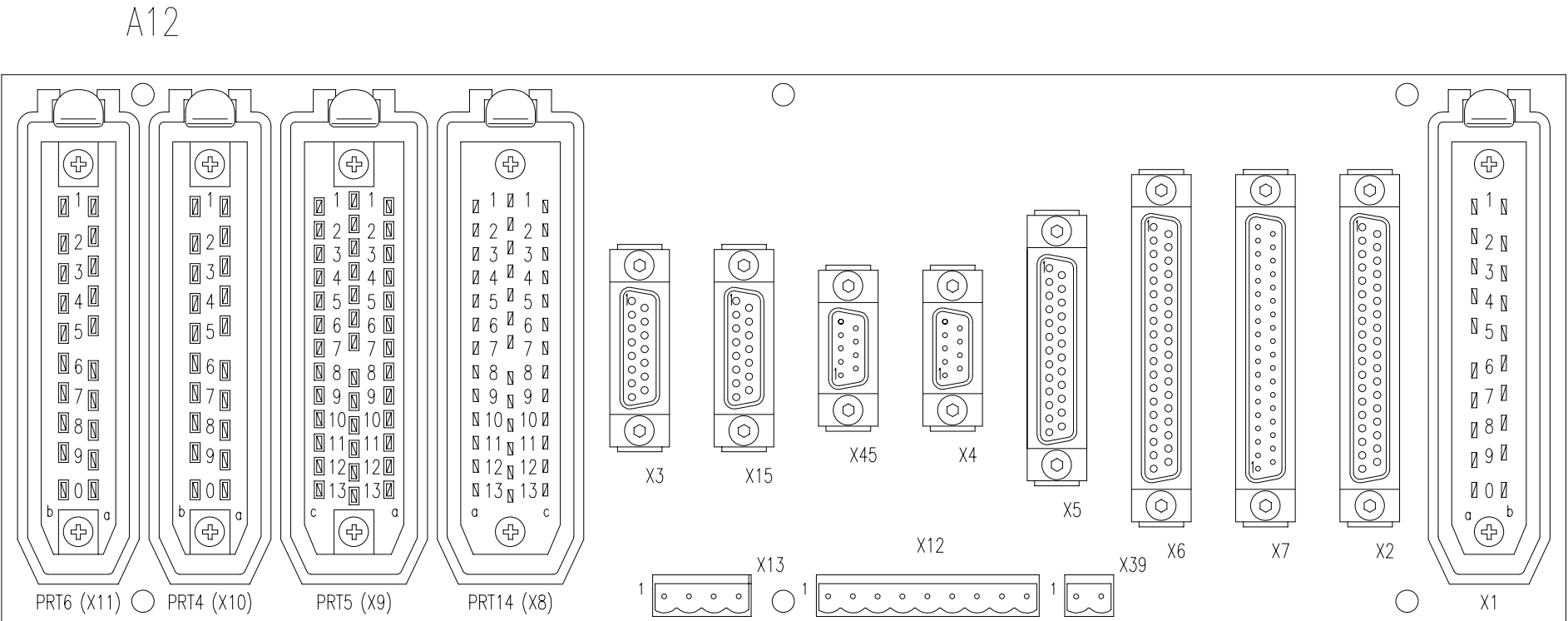


<b>VISION</b> <b>A13 Front panel push buttons</b> <b>board layout &amp; schematic</b>	<b>5</b>
<b>Code 58651678 - Rev. 0</b>	<b>Page 1 of 1</b>

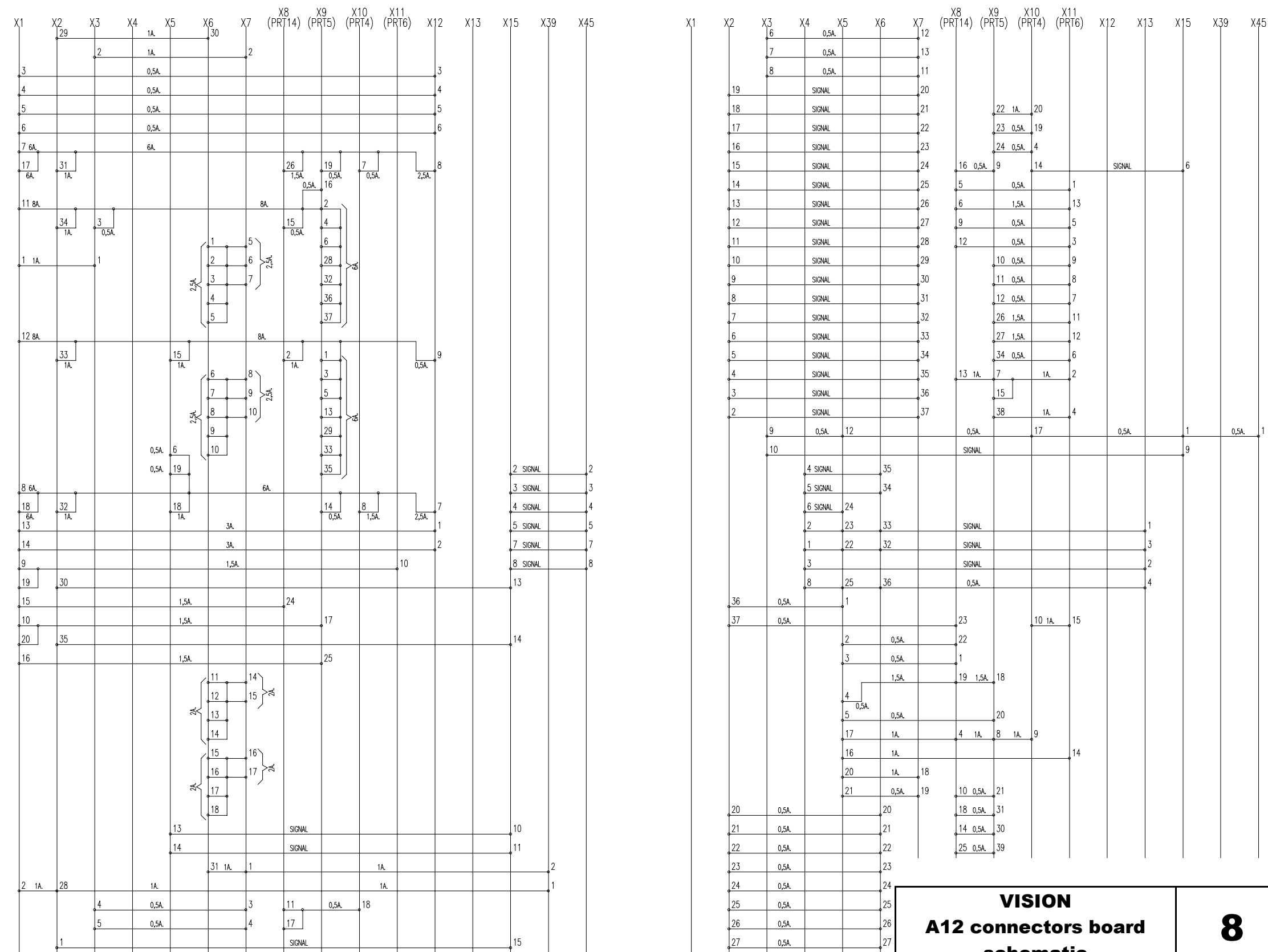


**NOTE:**  
For schematic, see drawing # 1  
(code 39659055)

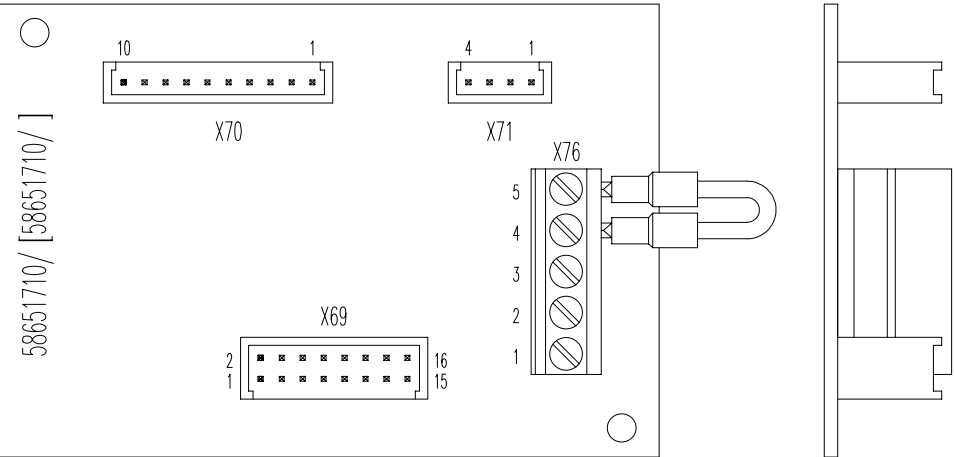
<b>VISION</b> <b>Component plate layout</b>	<b>6</b>
Code 72651620 - Rev. 1	Page 1 of 1



<b>VISION</b> <b>A12 connectors board</b> <b>layout</b>	<b>7</b>
Code 58651597 - Rev. 0	Page 1 of 1

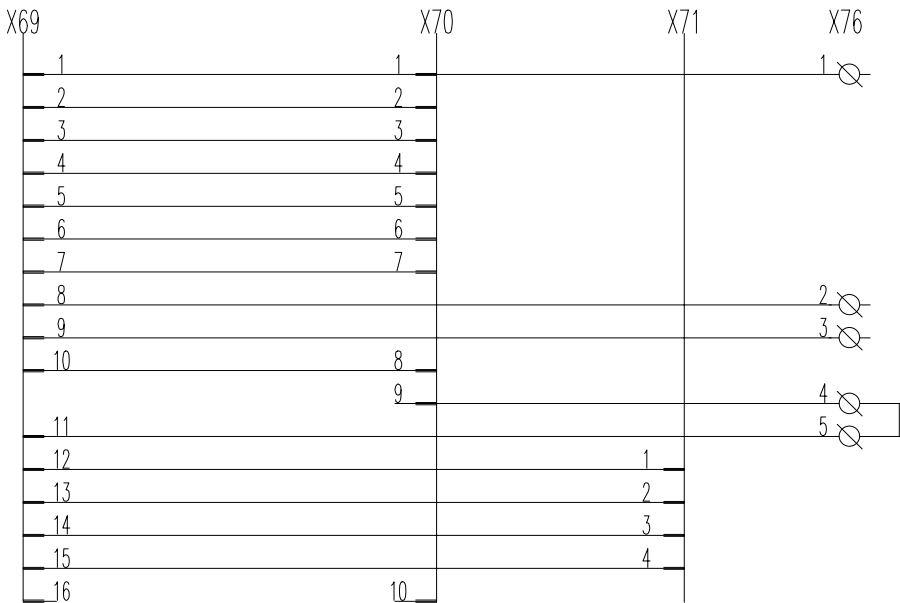




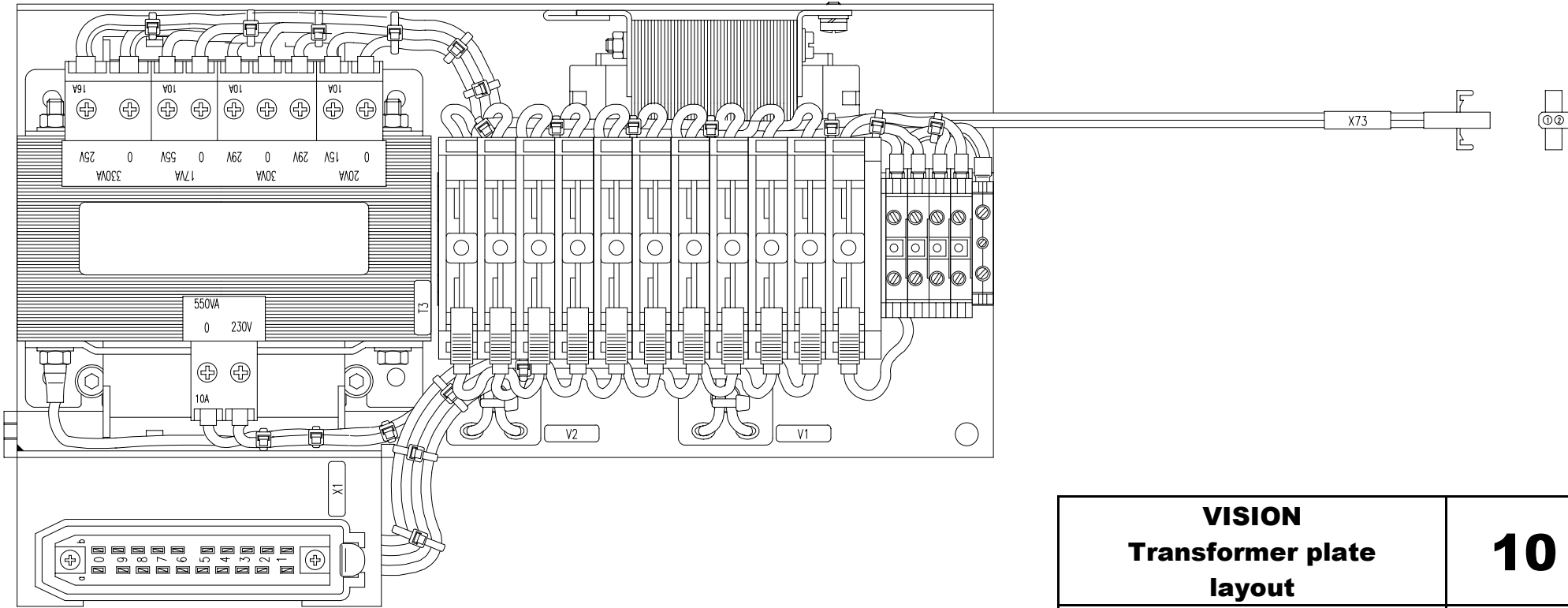
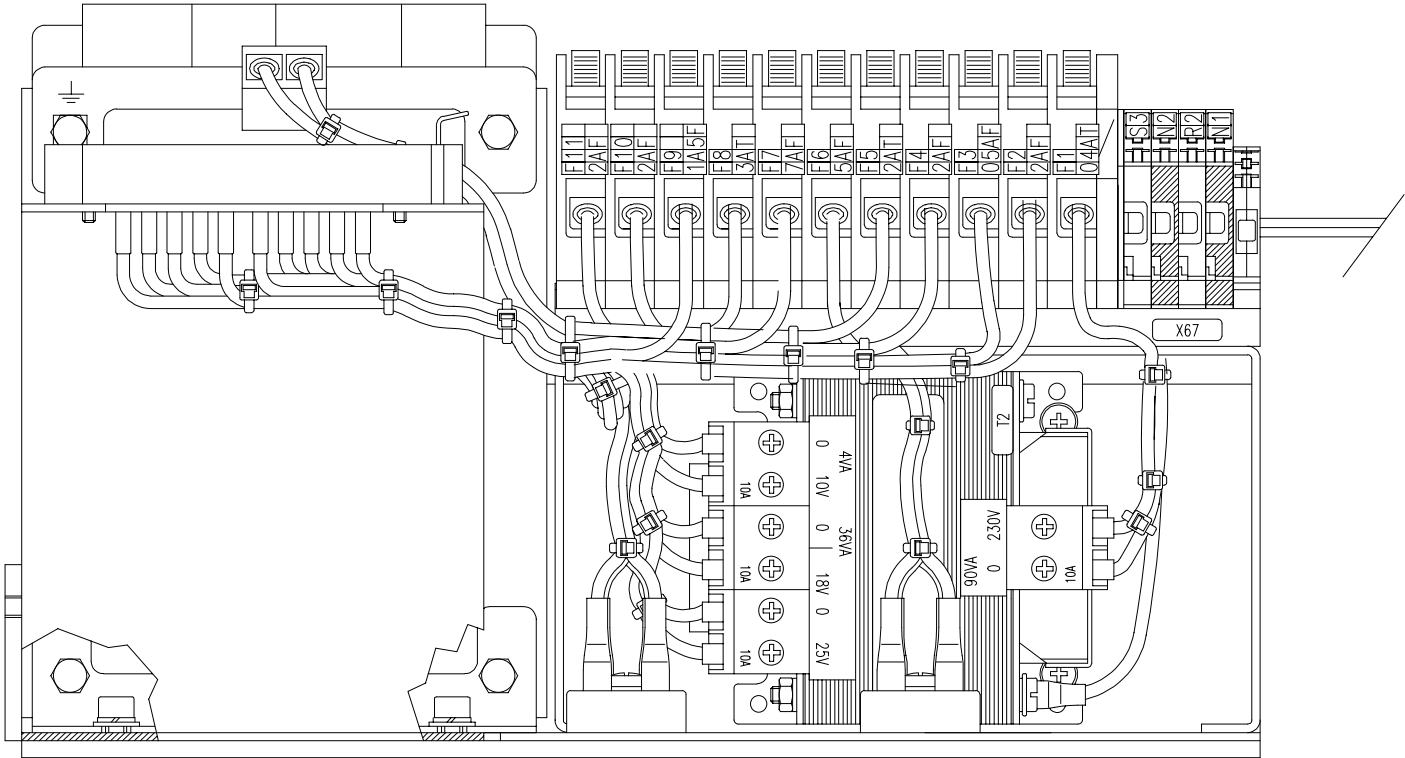


A6

SCHEMA DI COLLEGAMENTO  
(CONNECTION DIAGRAM)

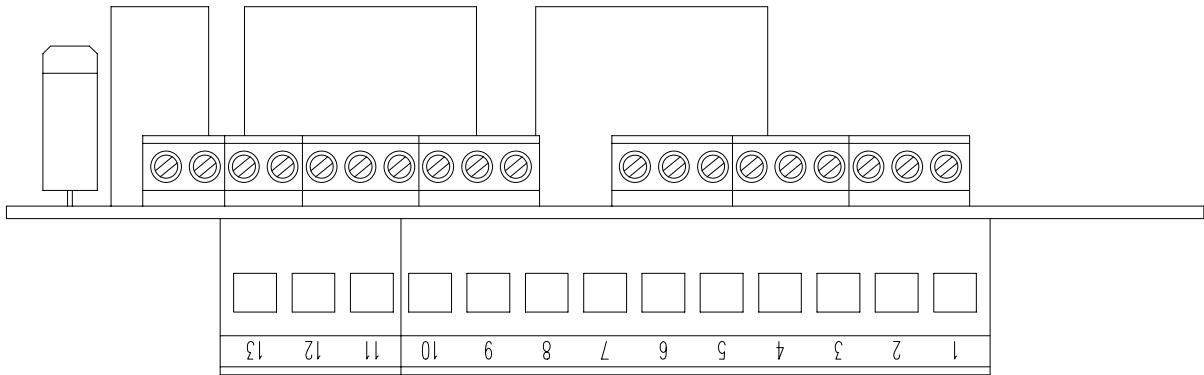
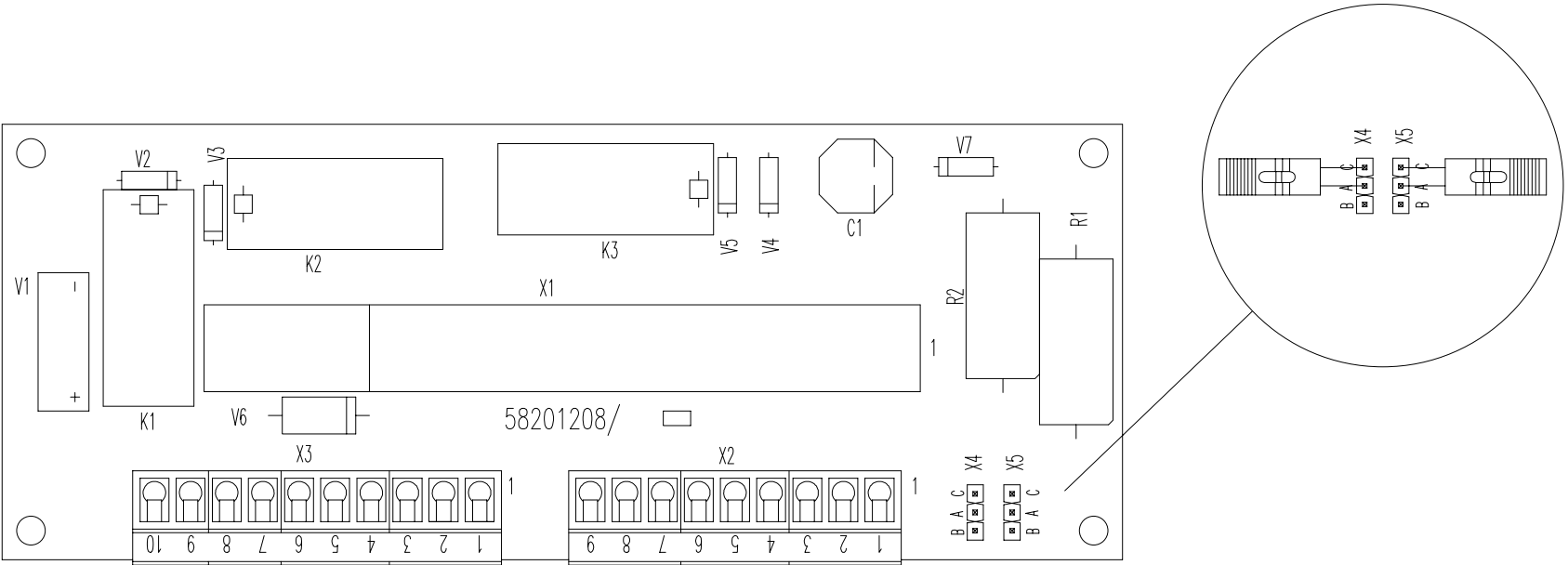


<b>VISION</b> <b>A6 Interconnection board</b> <b>layout &amp; schematic</b>	<b>9</b>
<b>Code 58651710 - Rev. 0</b>	<b>Page 1 of 1</b>



**NOTE:**  
For schematic, see drawing # 1  
(code 39659055) page 1

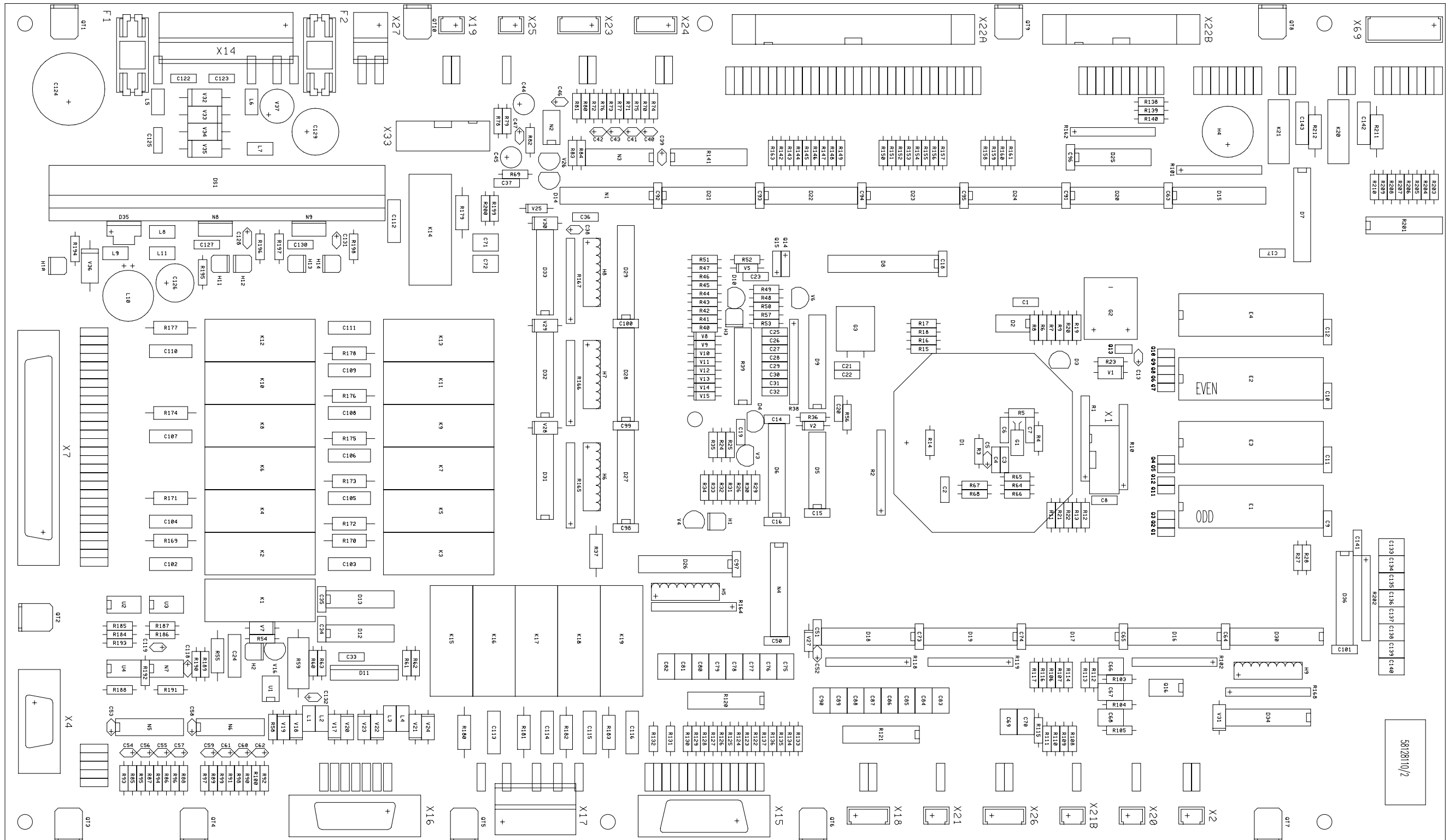
<b>VISION</b> Transformer plate layout	<b>10</b>
Code 72651630 - Rev. 0	Page 1 of 1



**NOTE:**  
For schematic, see drawing # 1  
(code 39659055) page 13

Voltage	Jumper X4	Jumper X5
24 Vdc	A - C	
120 Vac	A - B	A - B
230 Vac	A - B	A - C

<b>VISION</b> <b>A14 Potter-Bucky board</b> <b>layout</b>	<b>11</b>
Code 58201208 - Rev. 0	Page 1 of 1

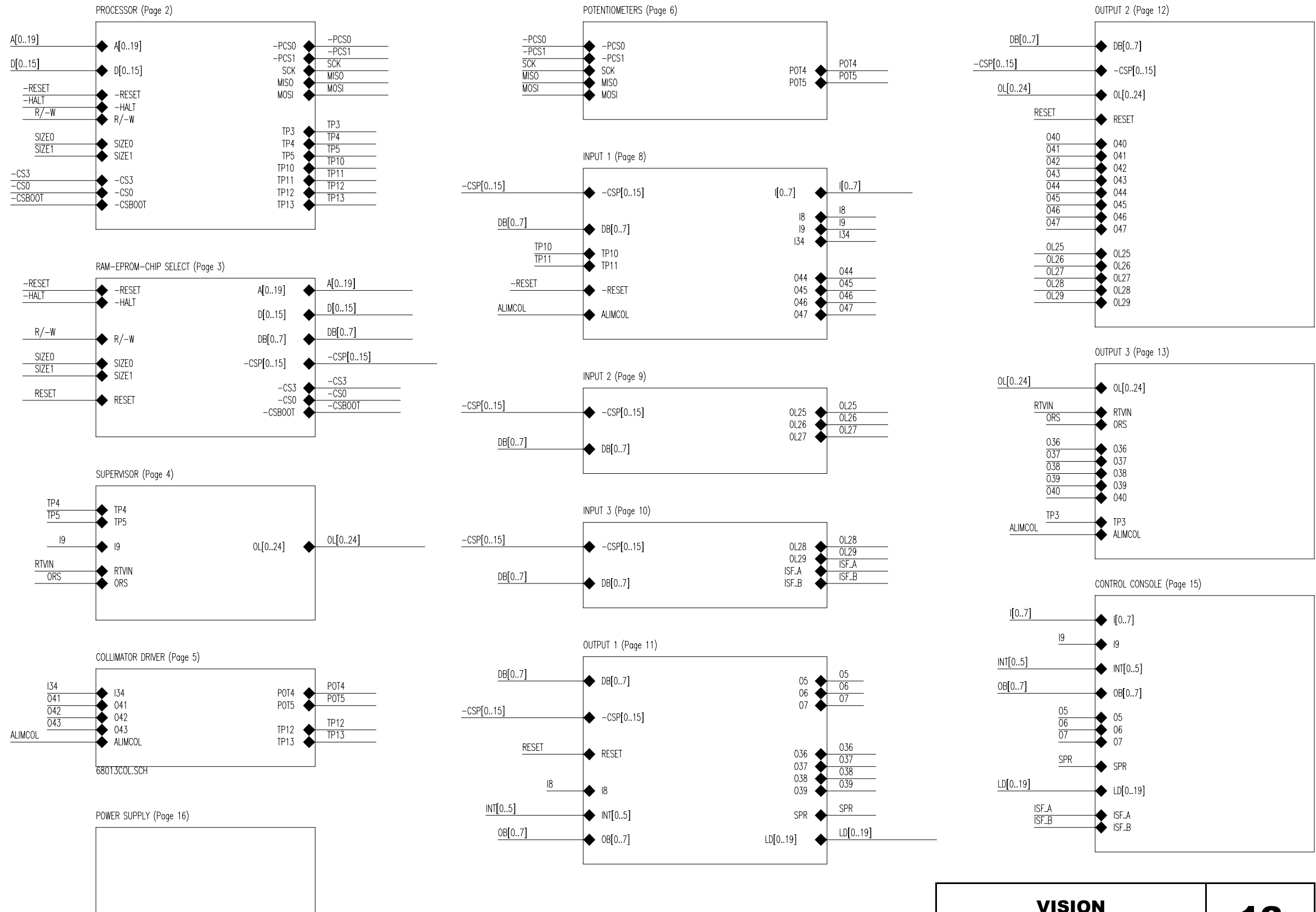


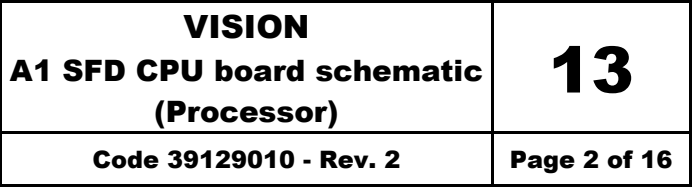
**VISION**  
**A1 SFD CPU board layout**

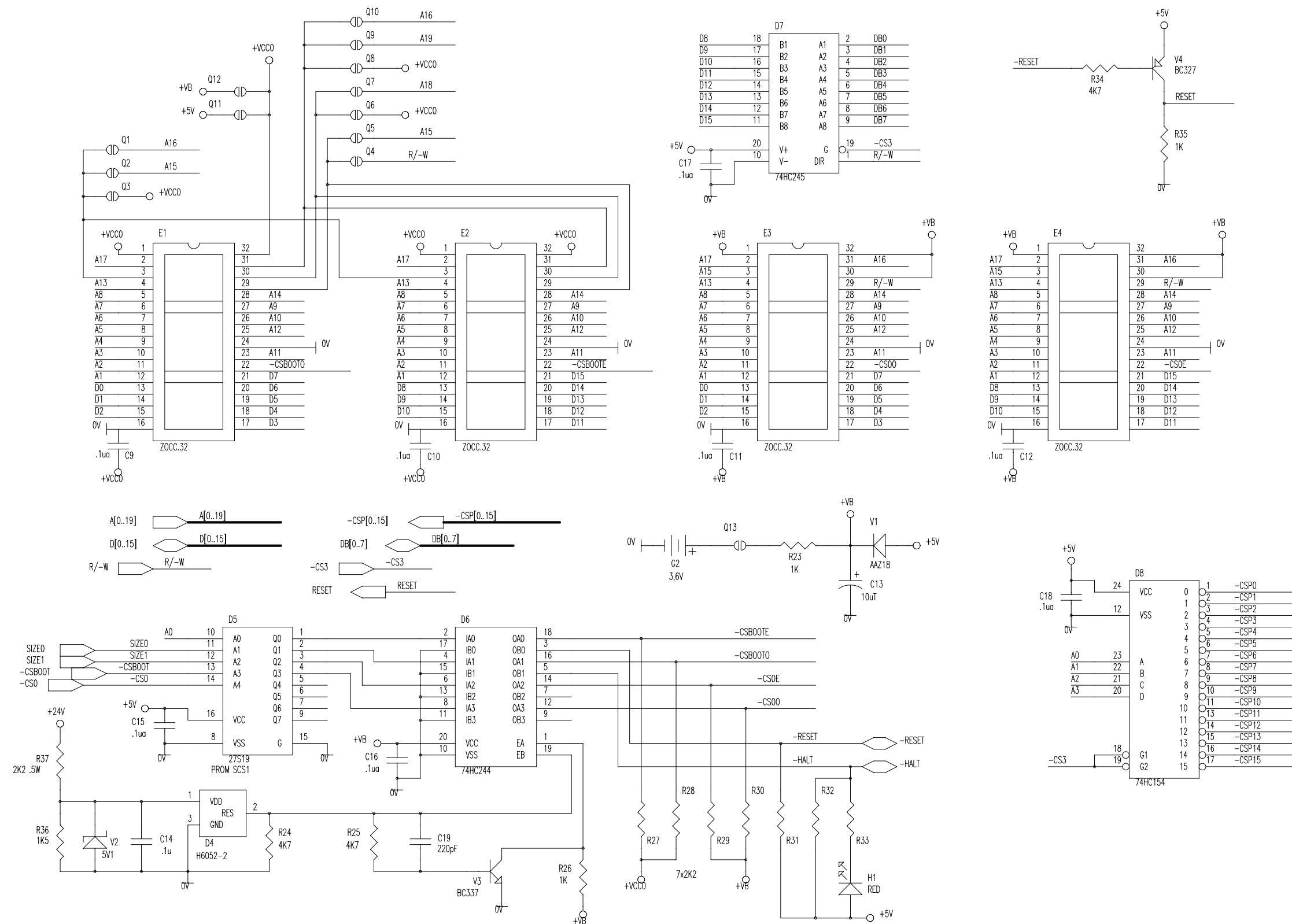
**Code 58128110 - Rev. 2**

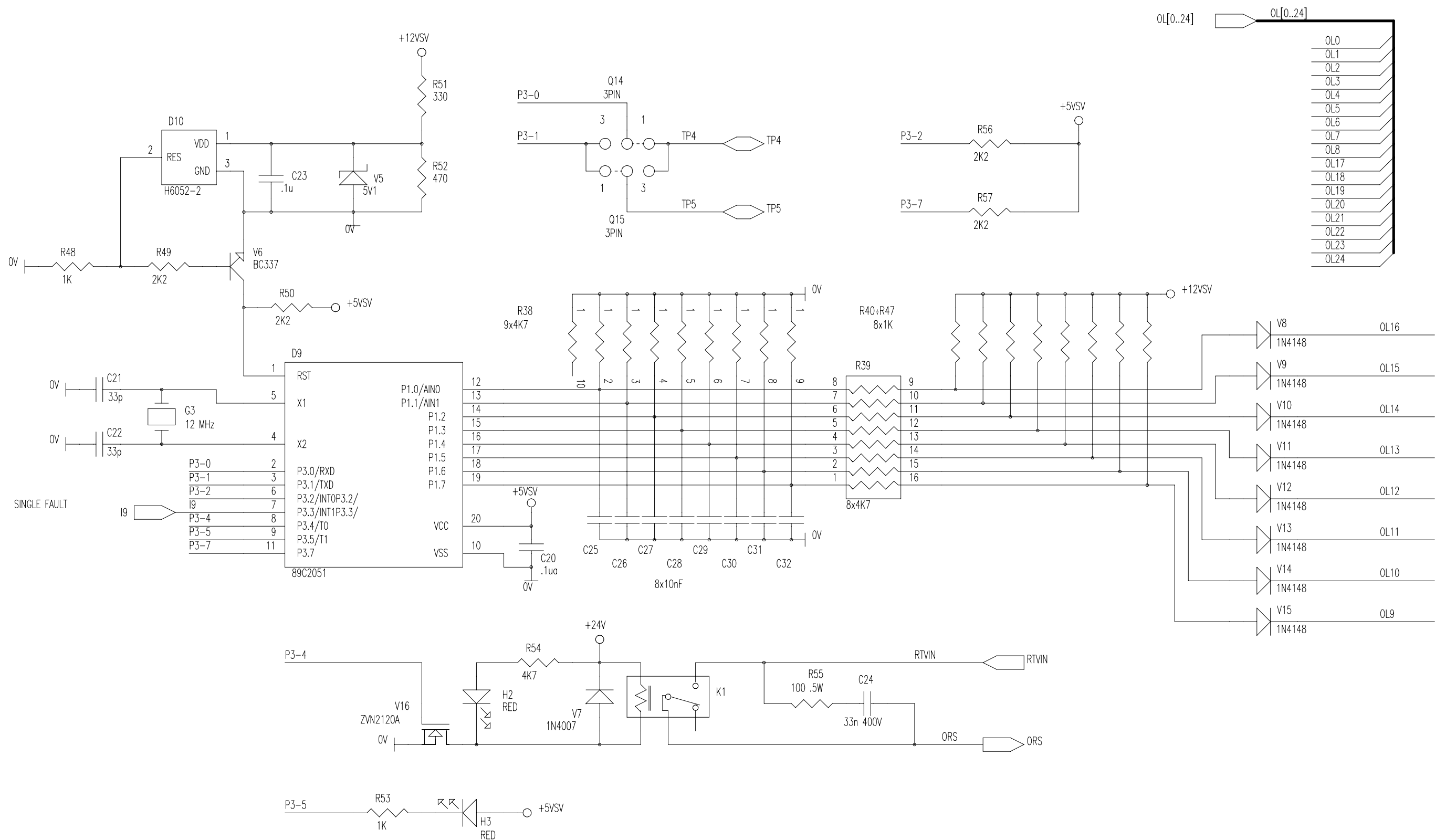
**12**

**Page 1 of 1**

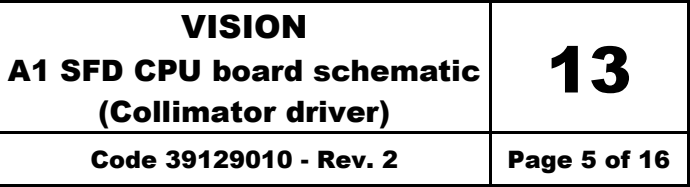


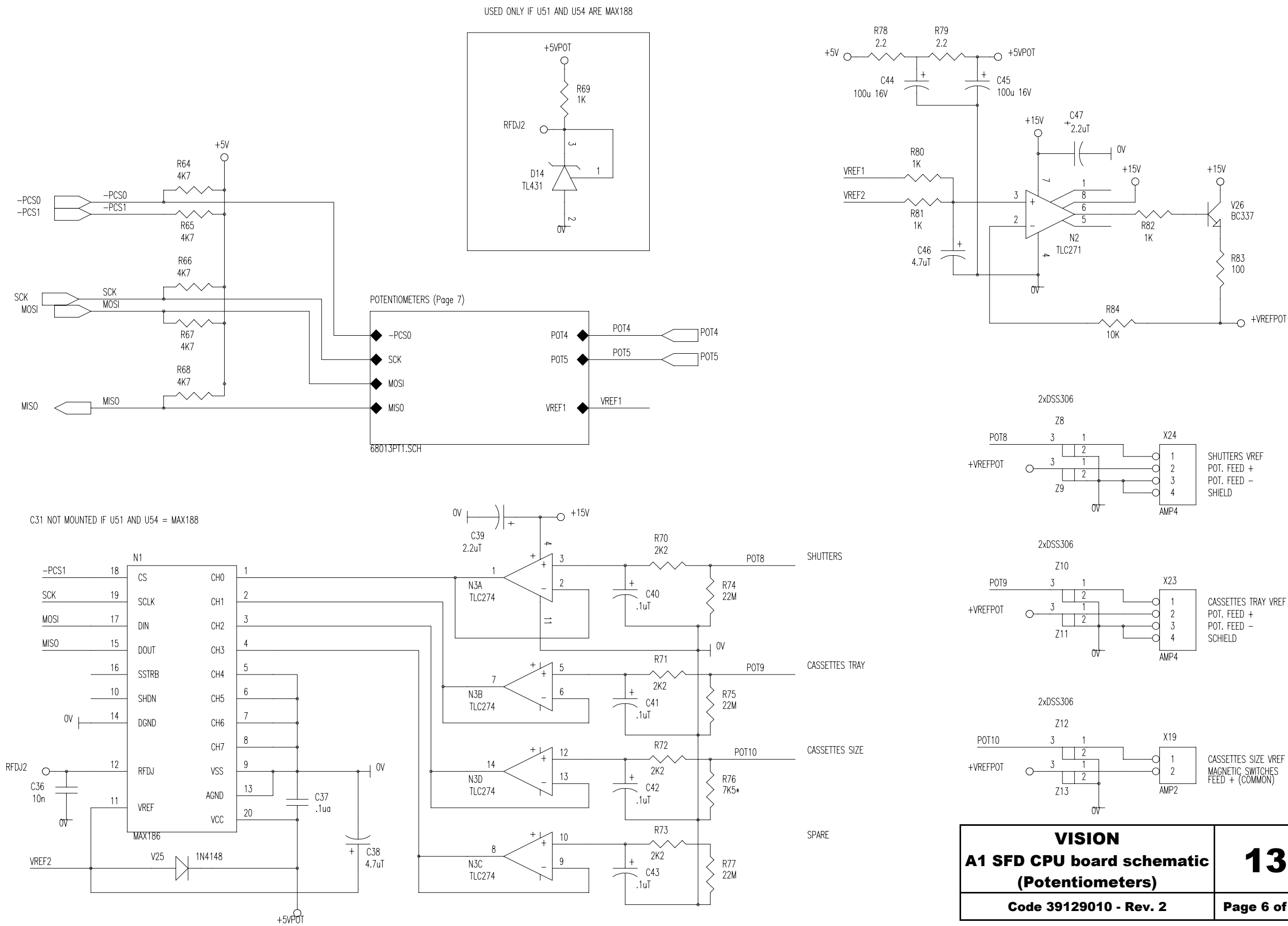


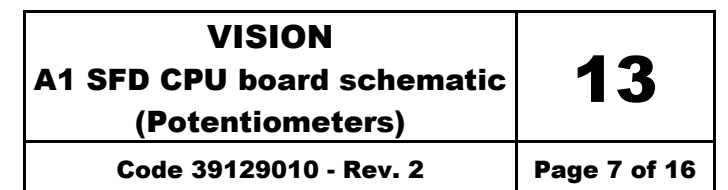


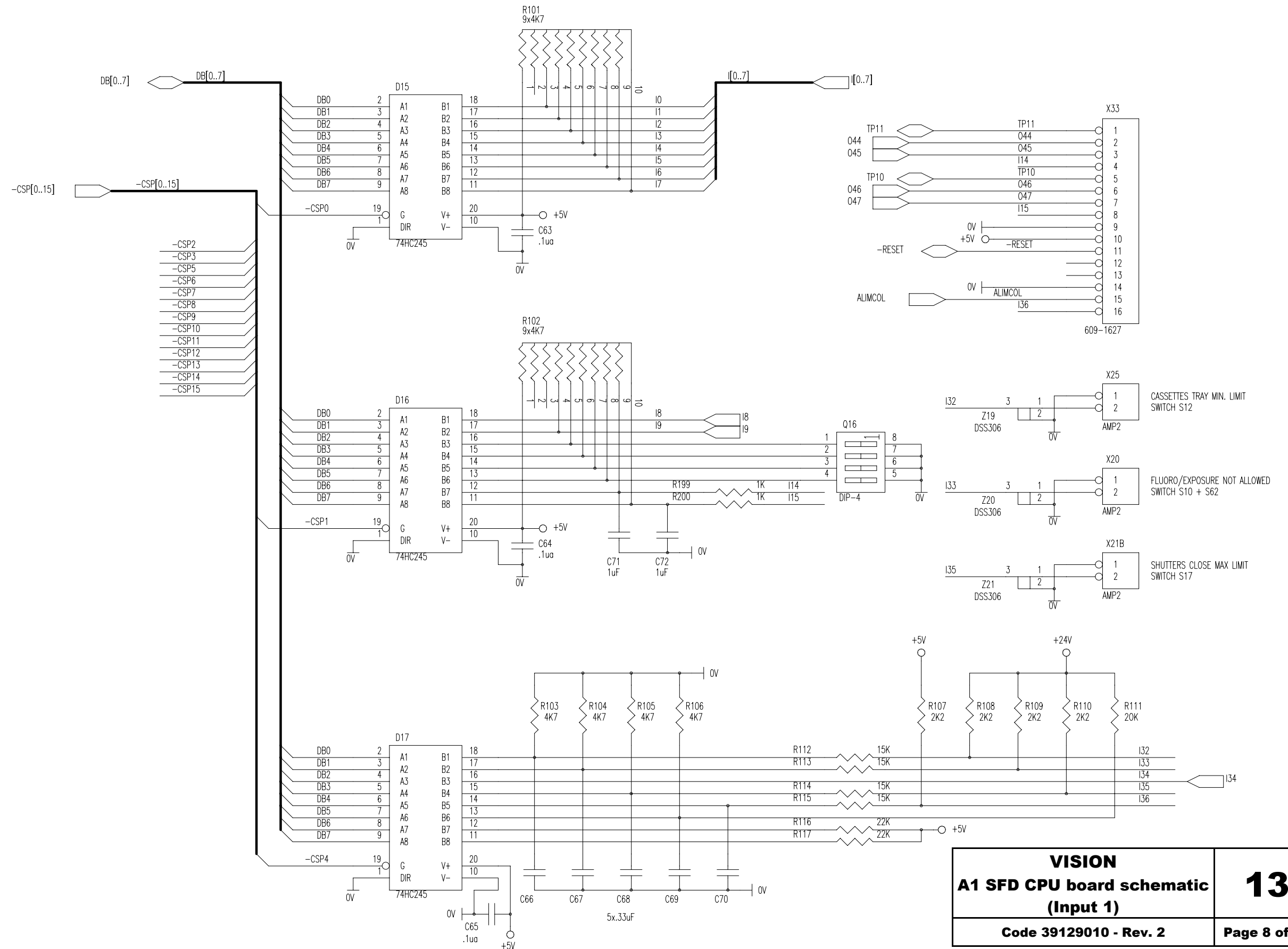


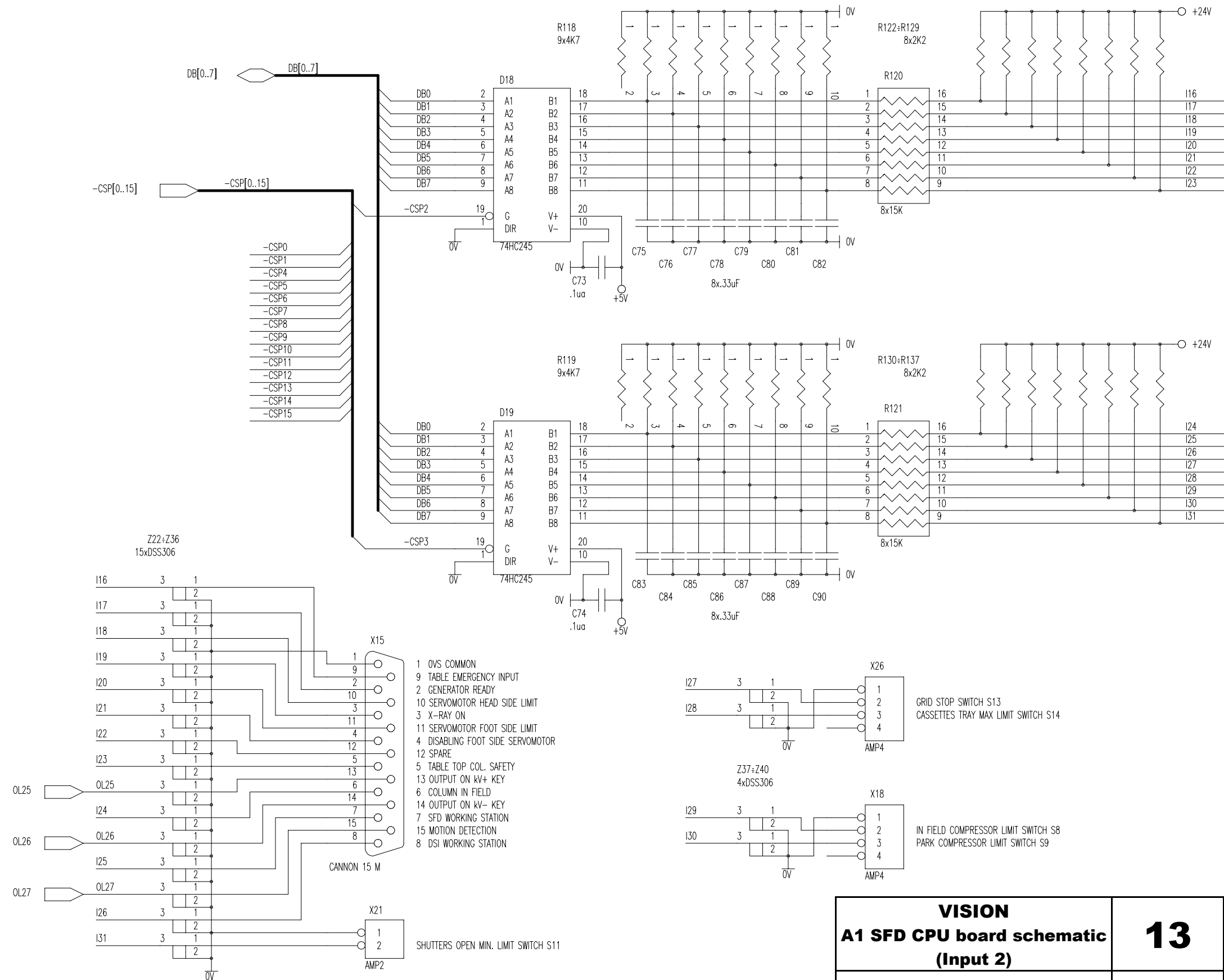


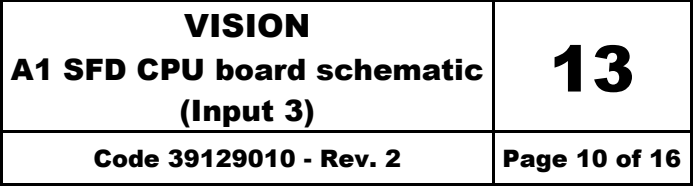


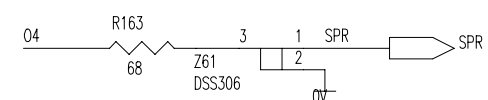
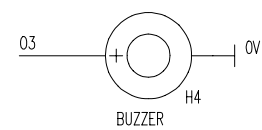
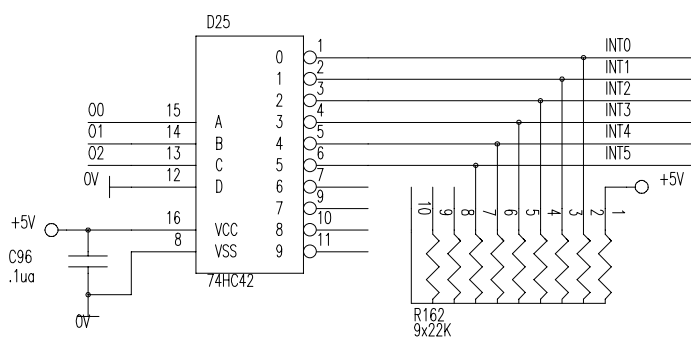
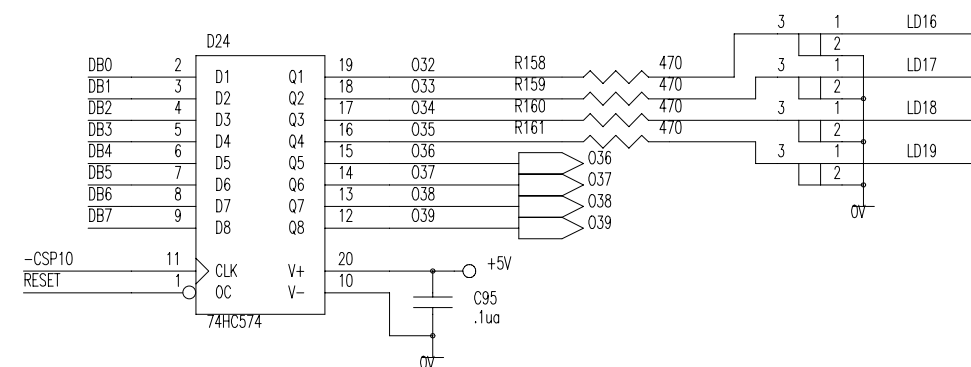
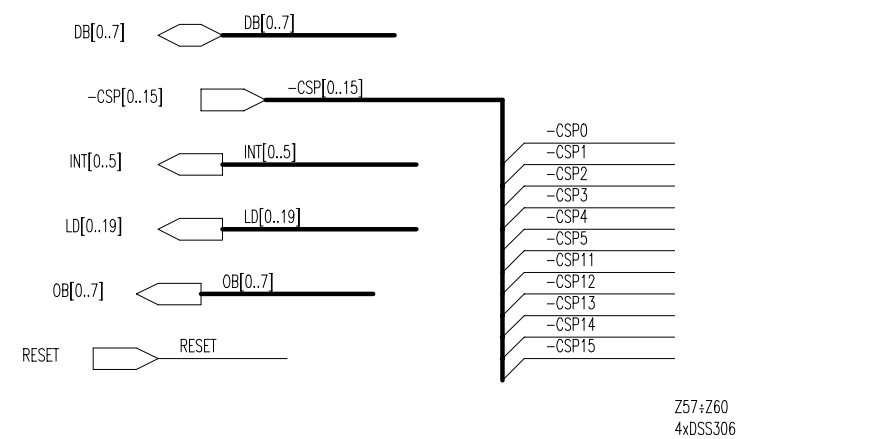
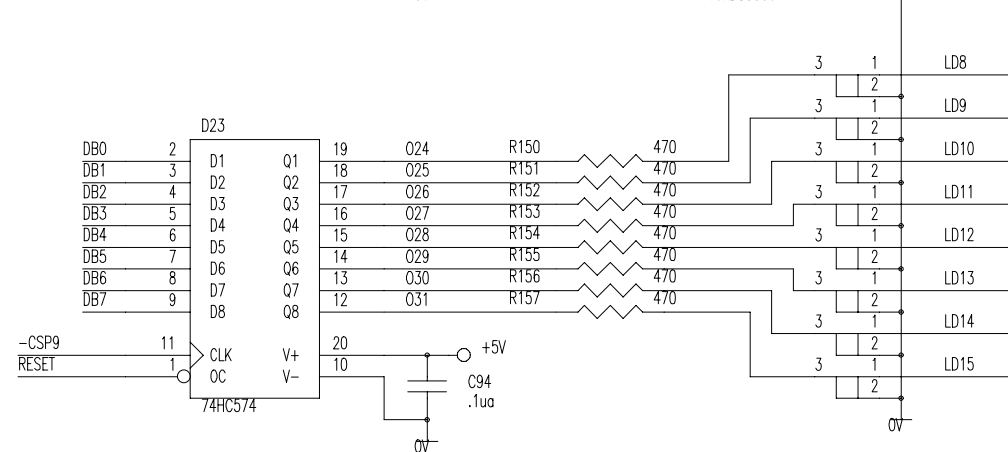
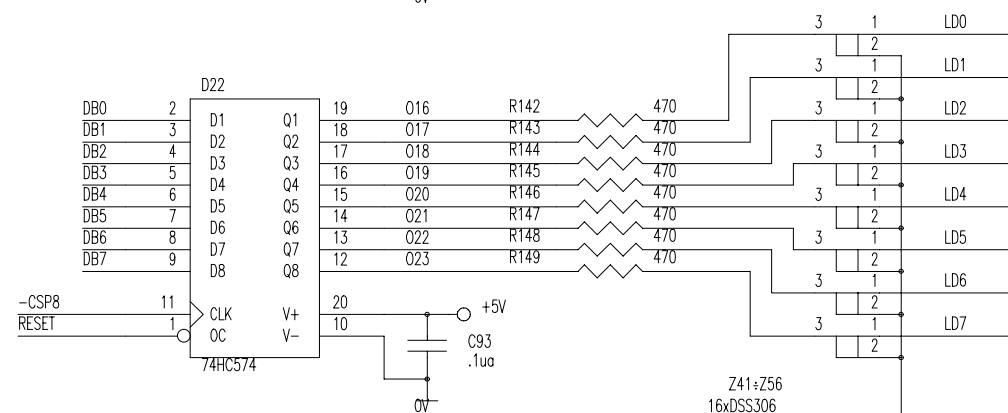
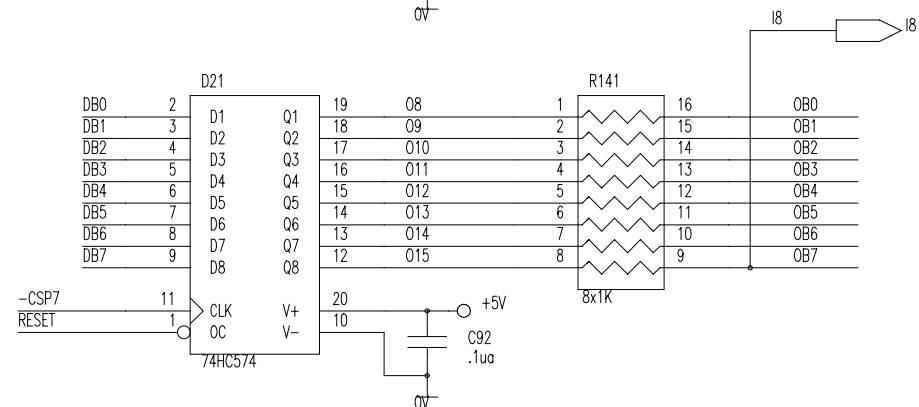
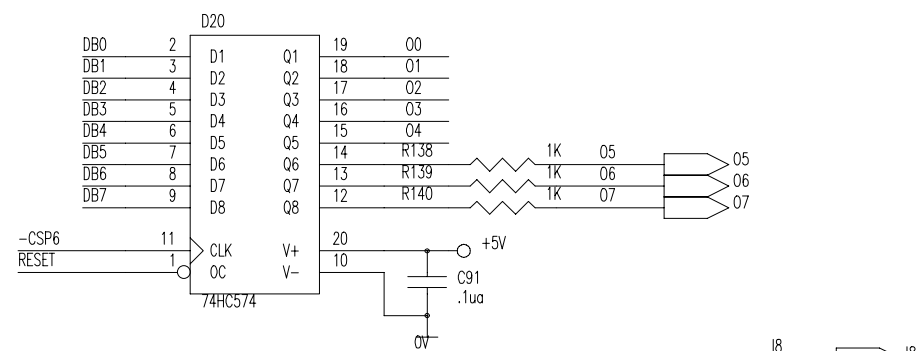


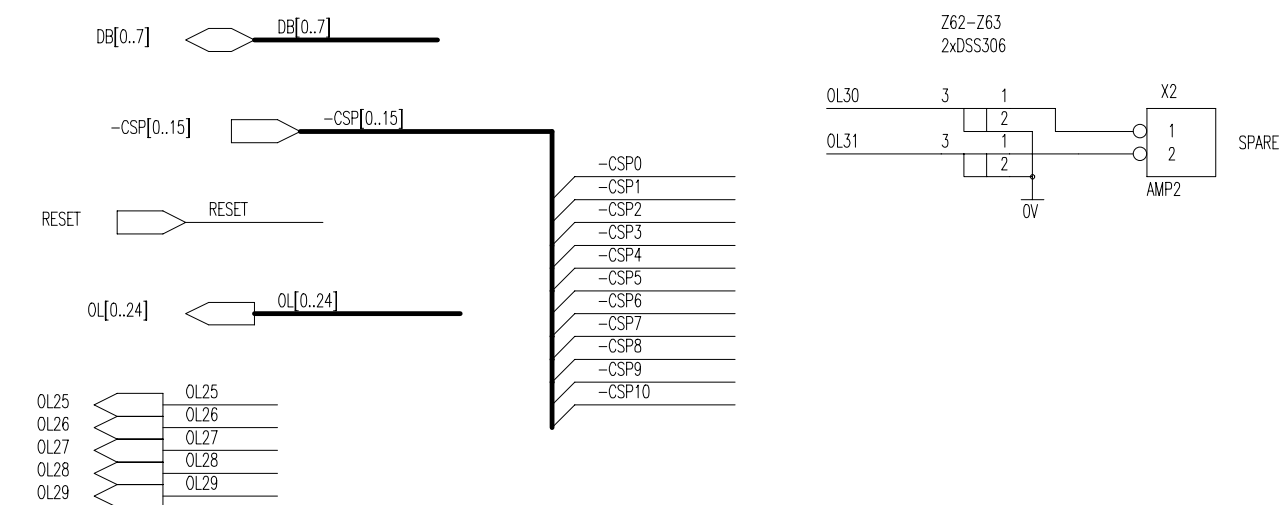
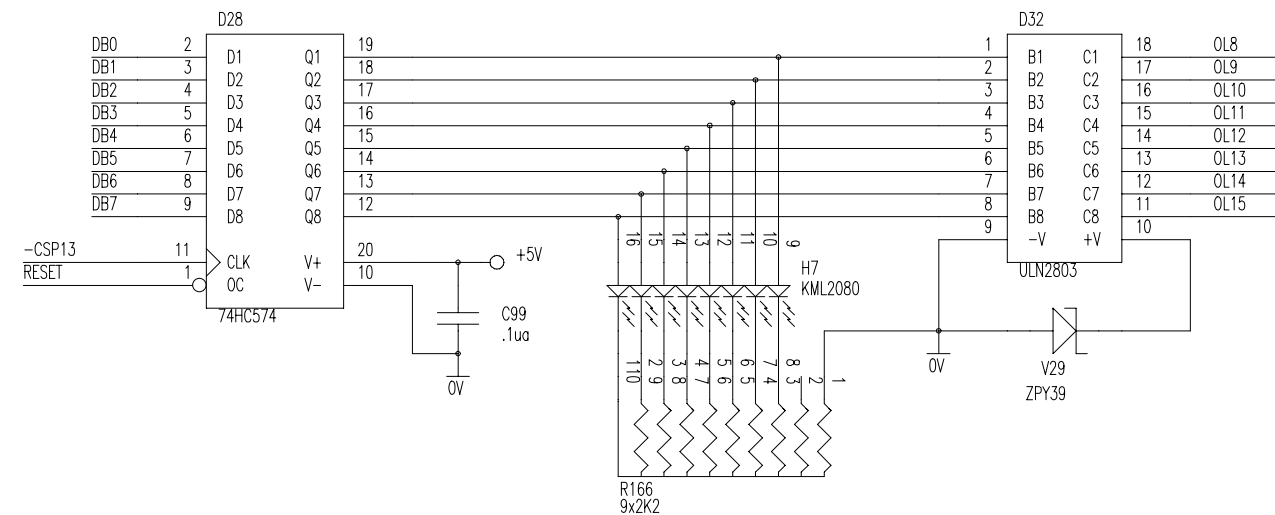
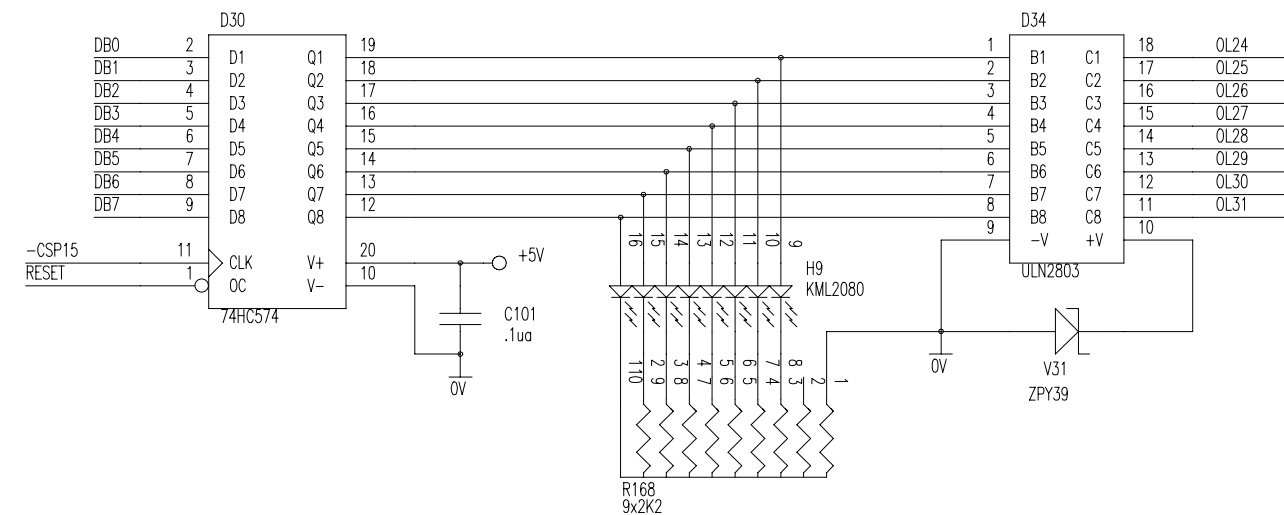
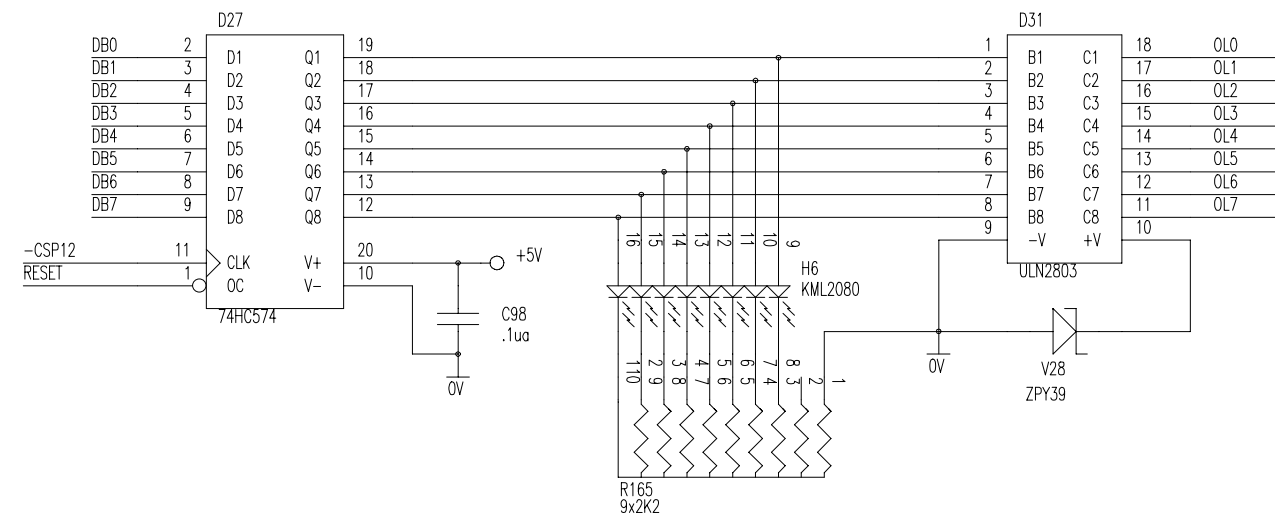
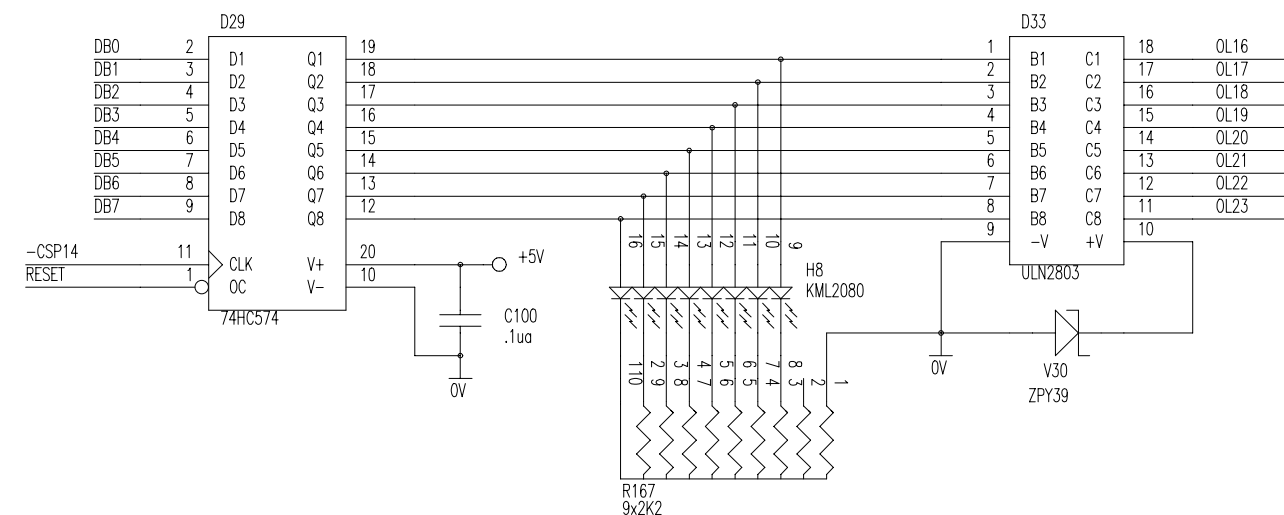
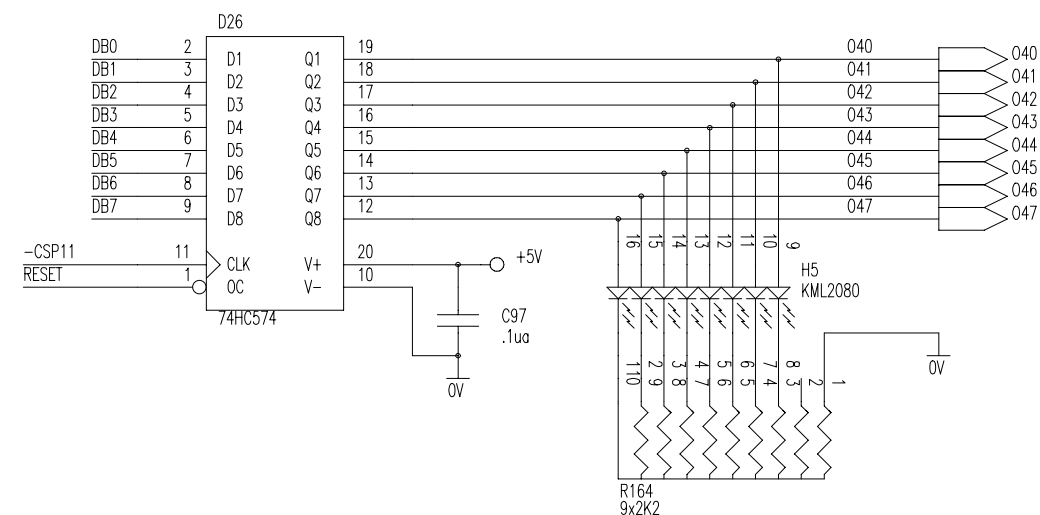




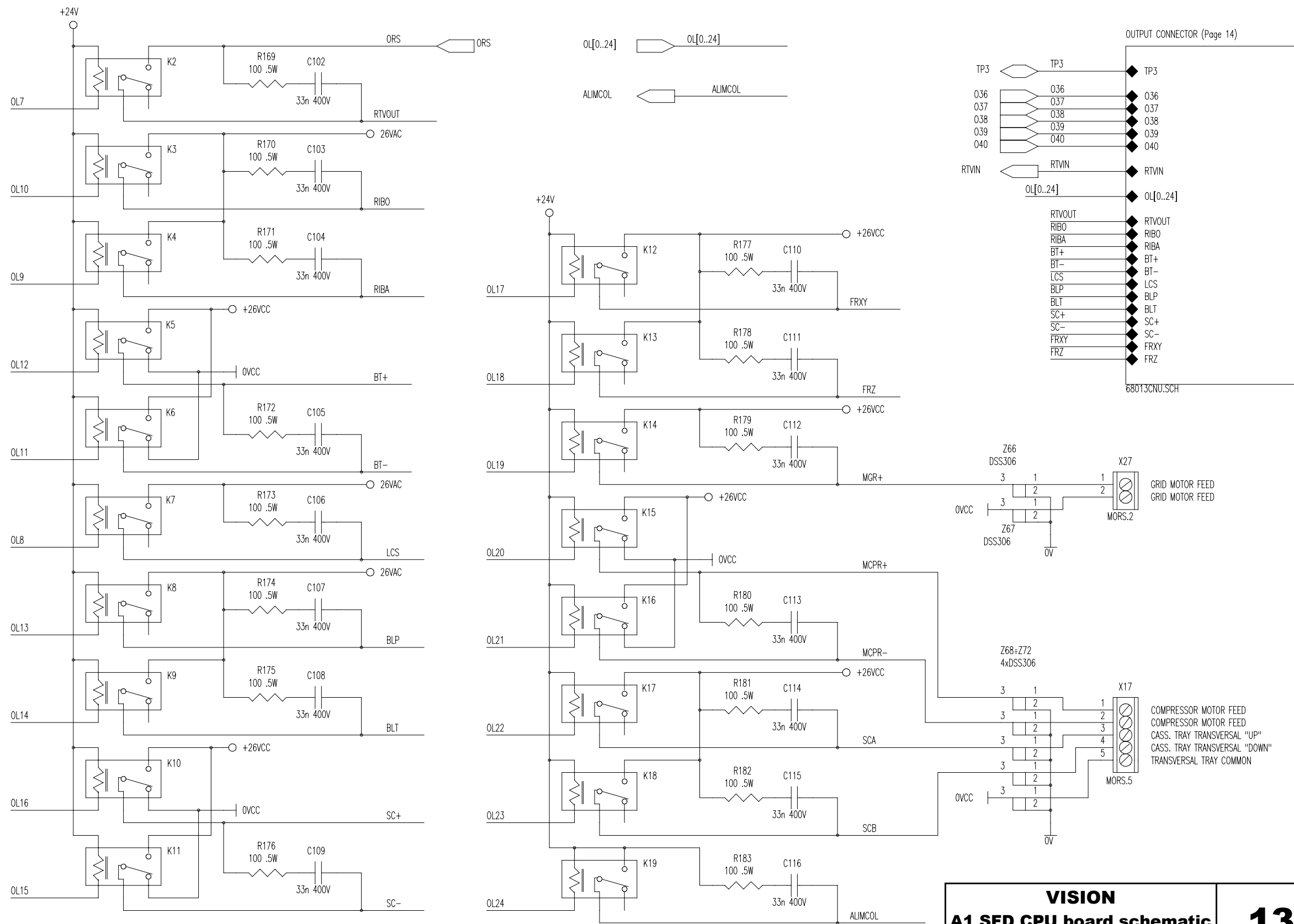




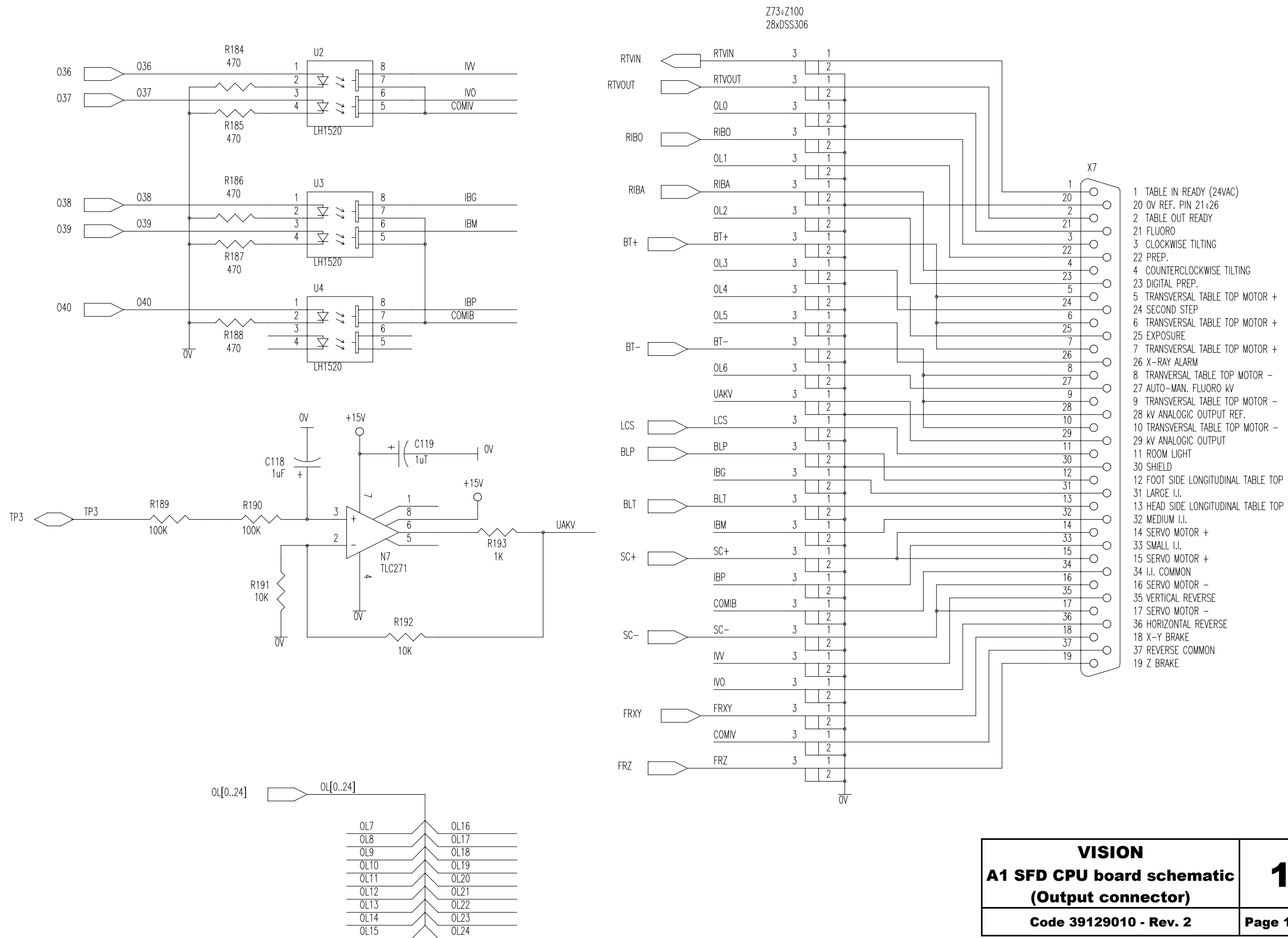


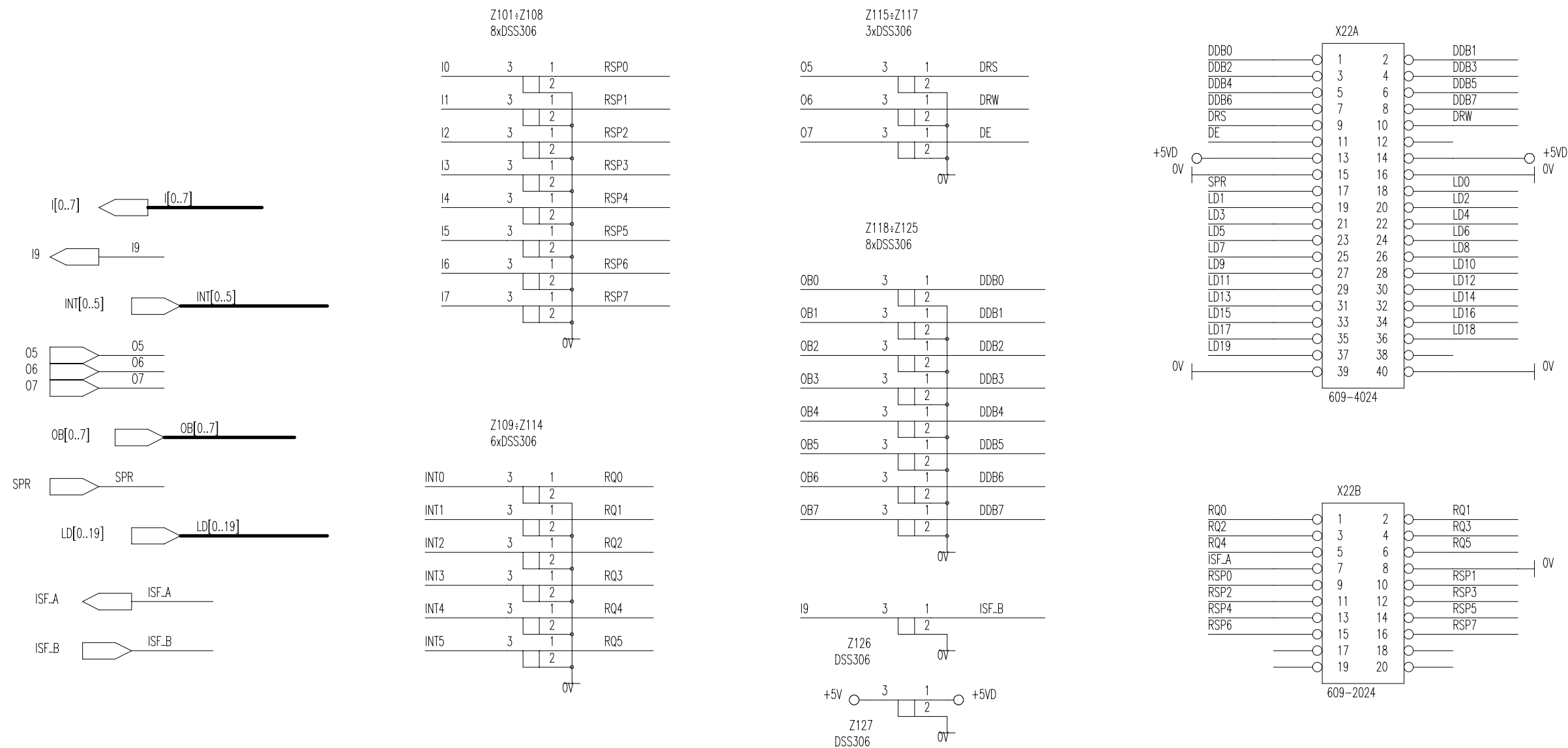


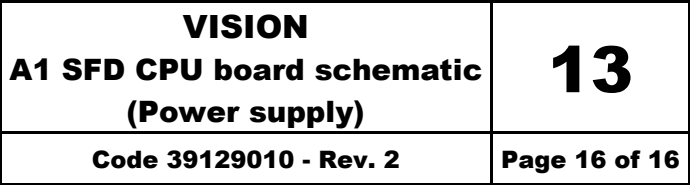


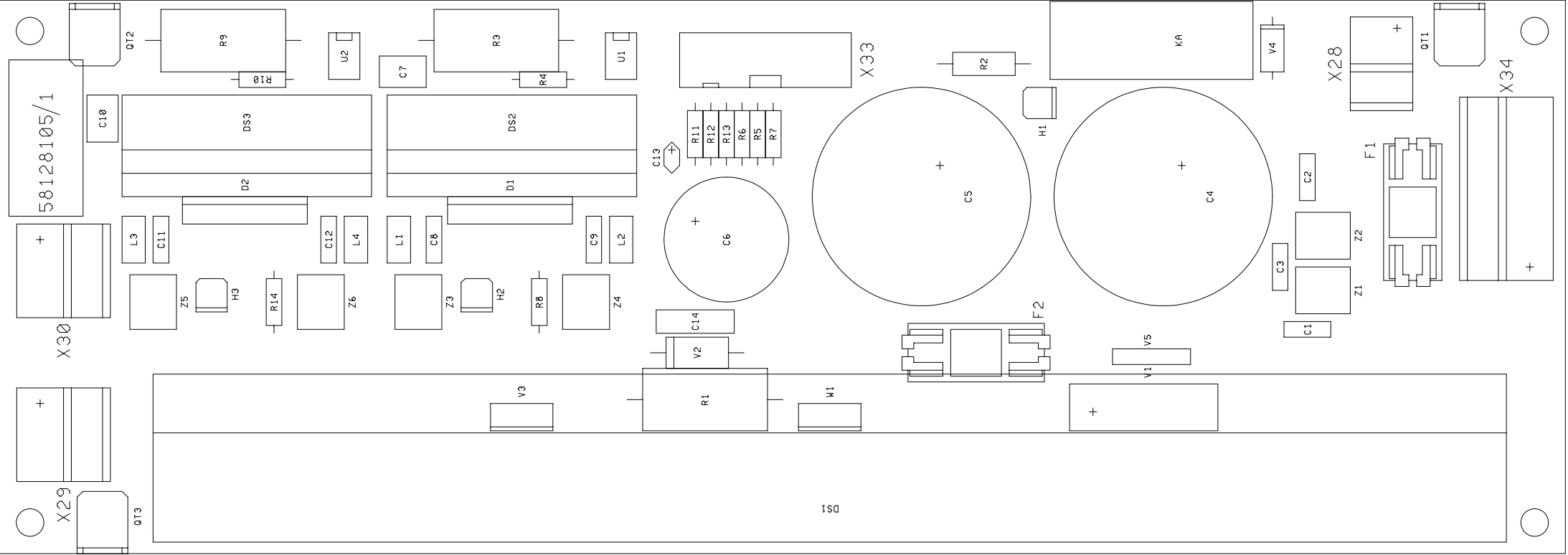


<b>VISION</b> <b>A1 SFD CPU board schematic</b> <b>(Output 3)</b>	<b>13</b>
Code 39129010 - Rev. 2	Page 13 of 16



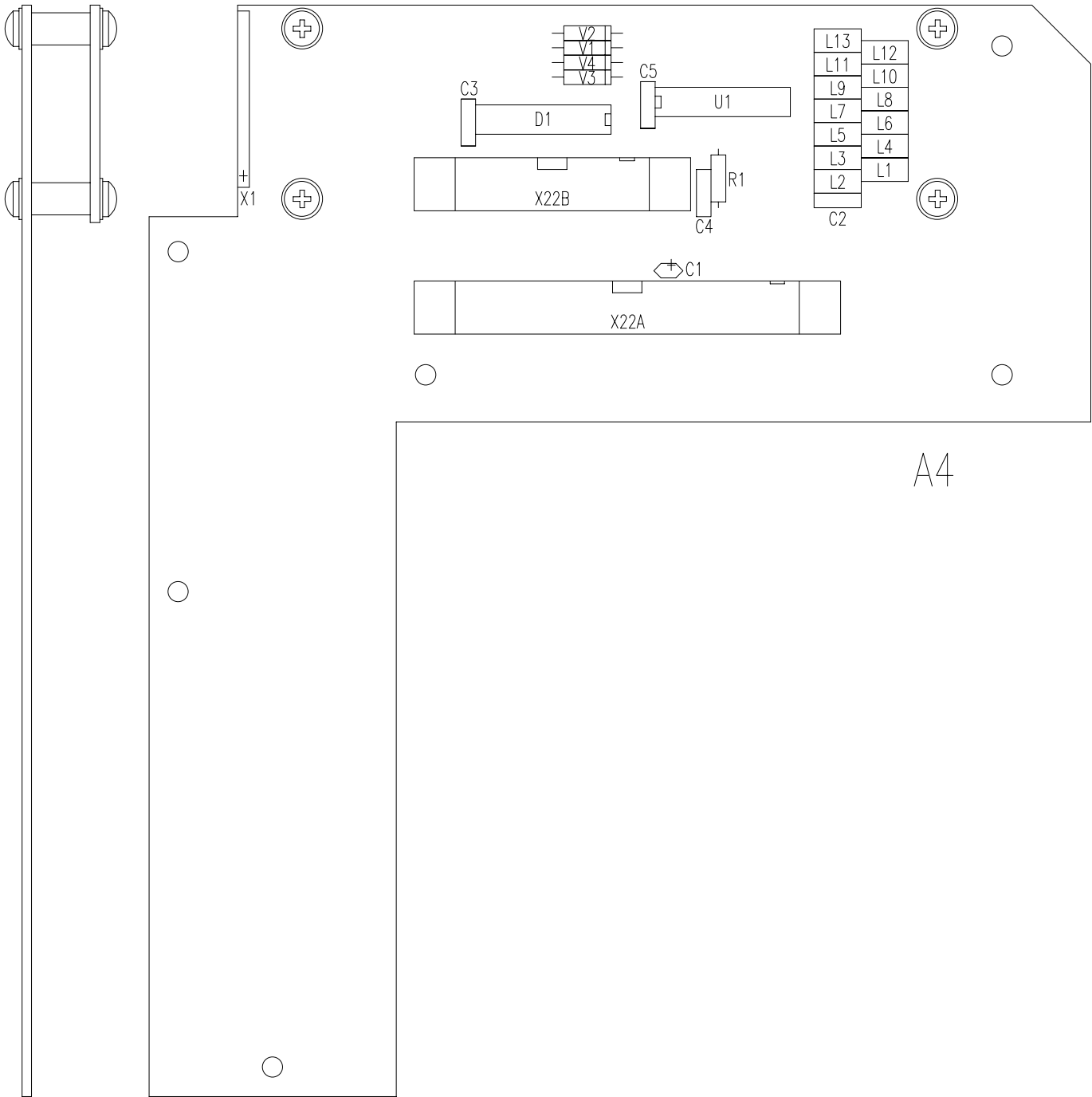
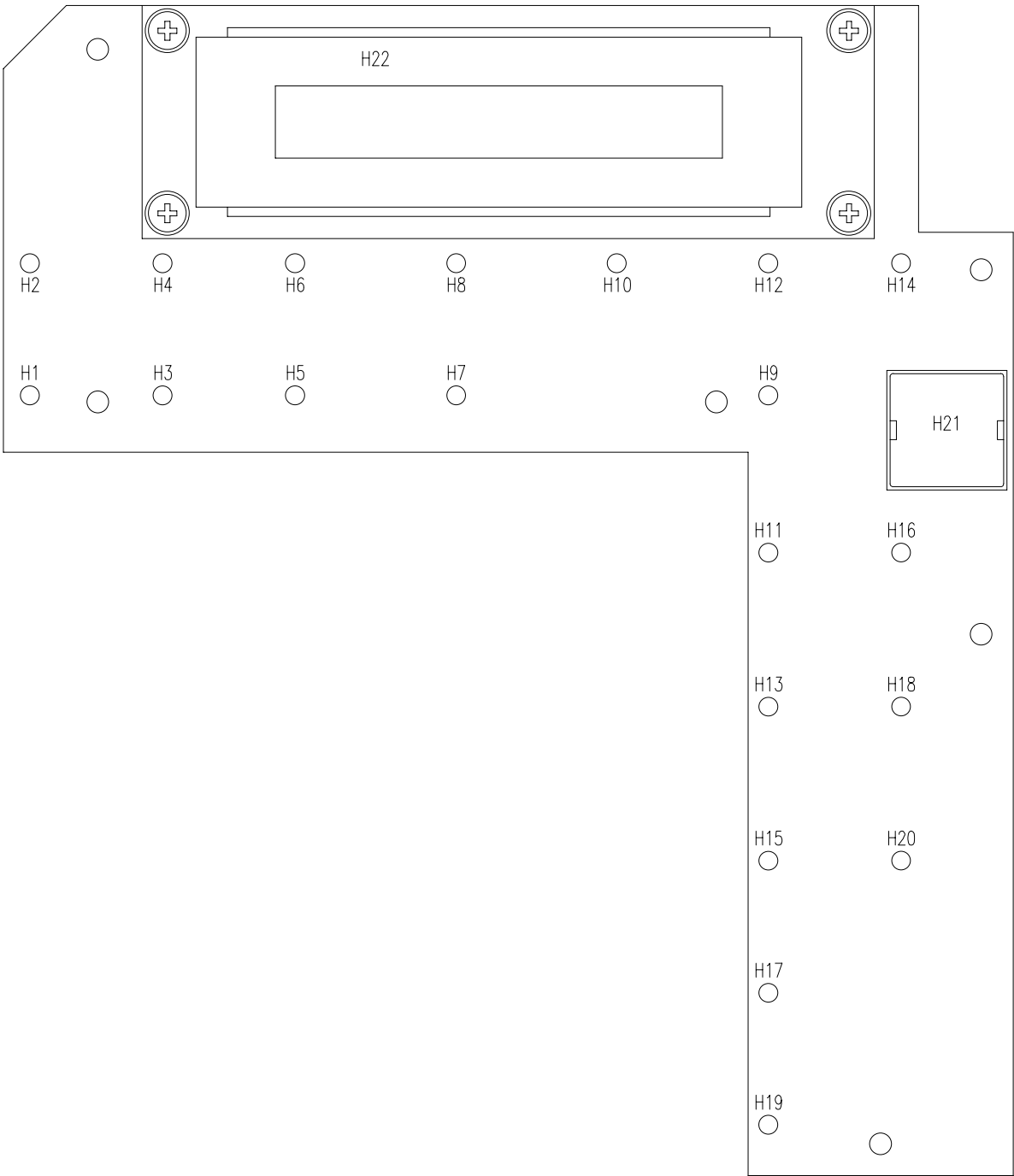




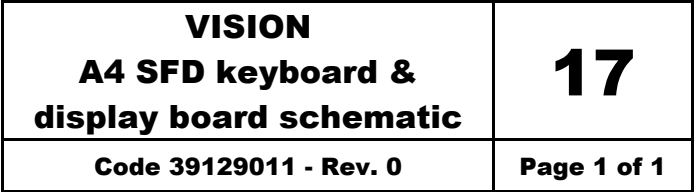


<b>VISION</b> <b>A2 SFD Motor Driver</b> <b>board layout</b>	<b>14</b>
Code 58128105 - Rev. 1	Page 1 of 1

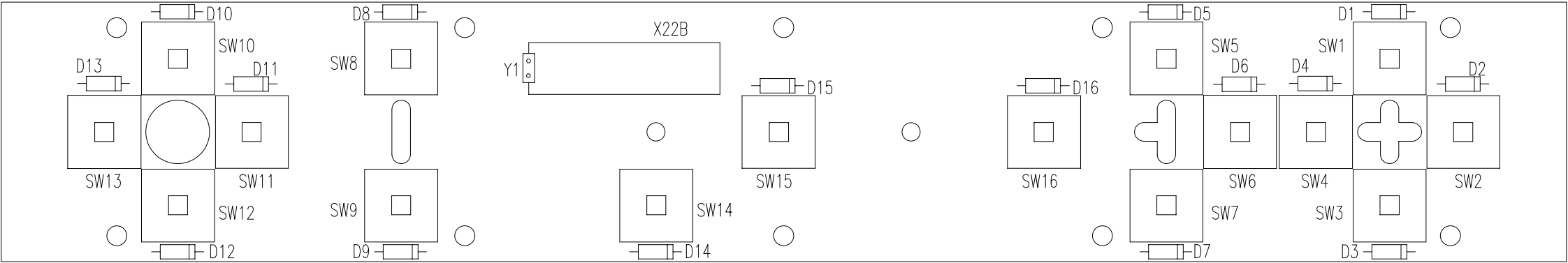




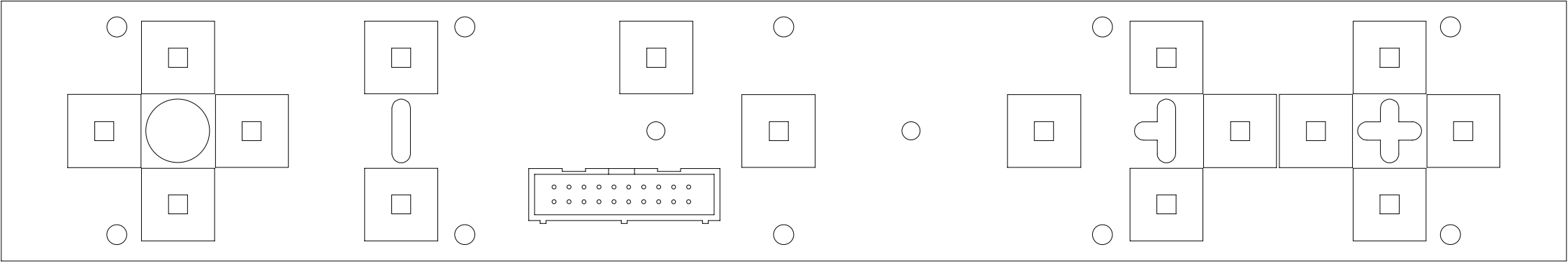
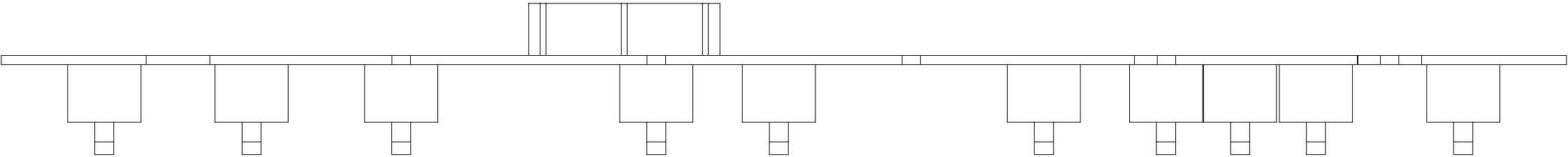
<b>VISION</b> <b>A4 SFD keyboard &amp; display board layout</b>	<b>16</b>
Code 58126110 - Rev. 0	Page 1 of 1



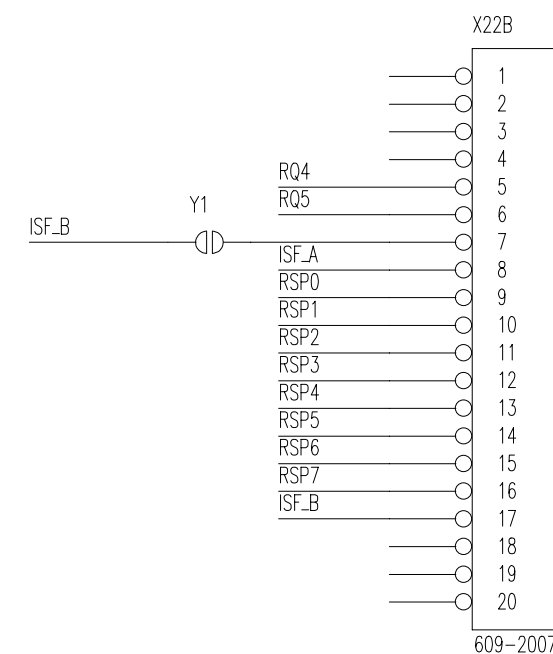
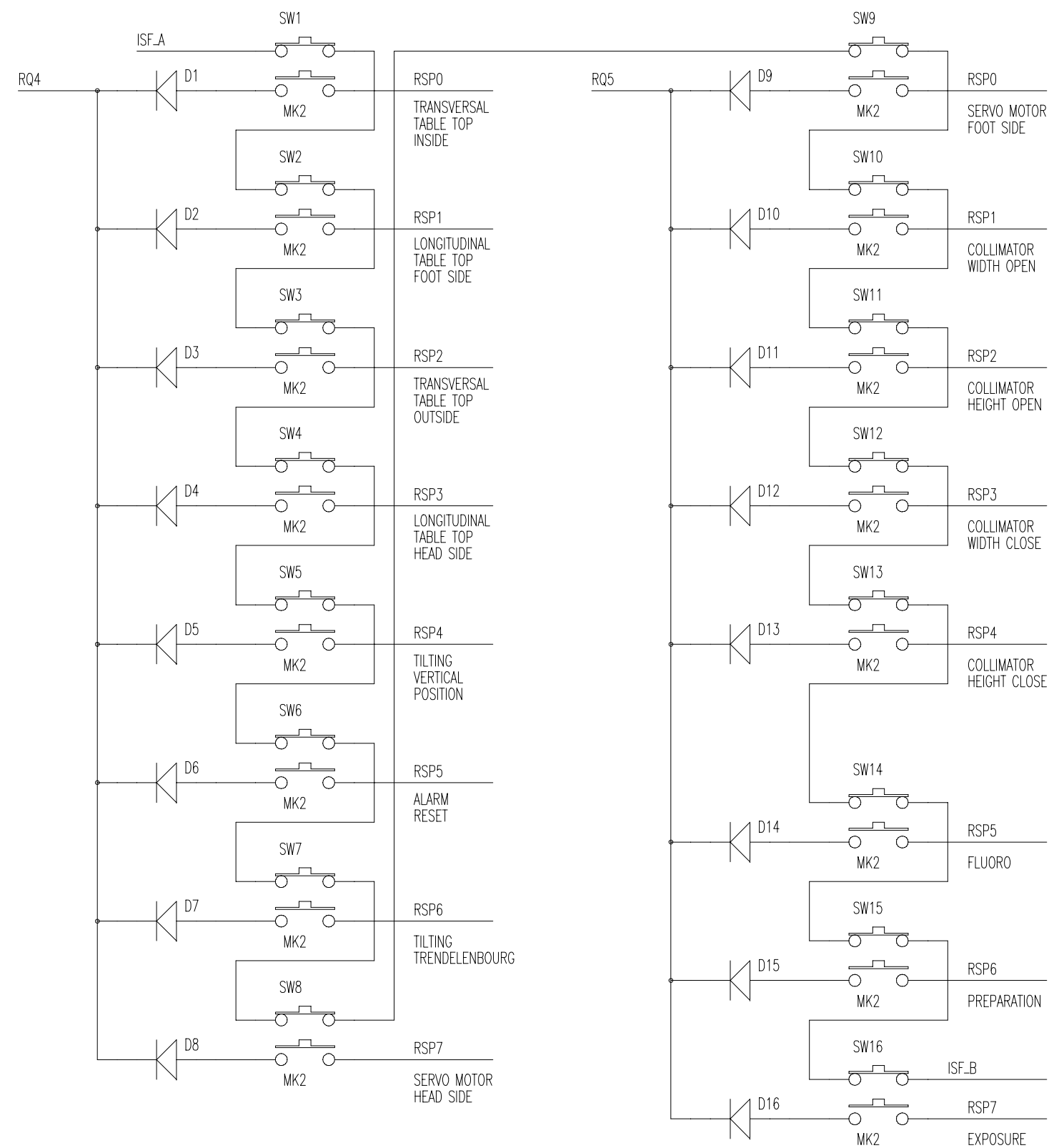




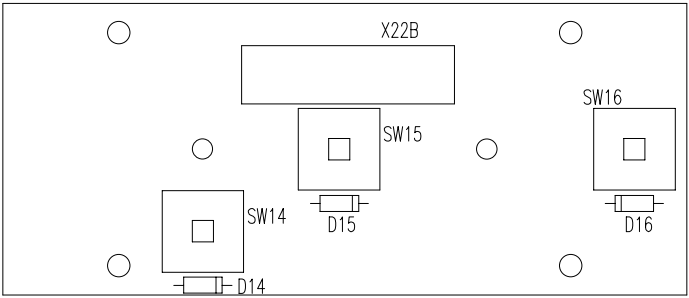
A5



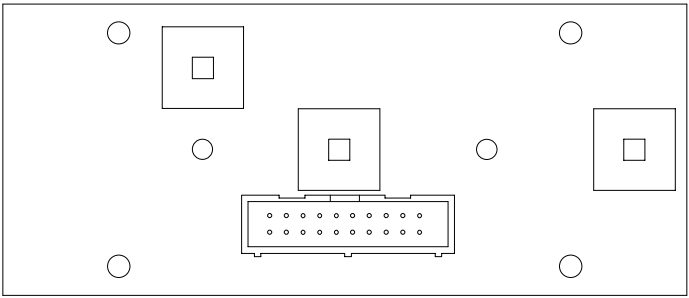
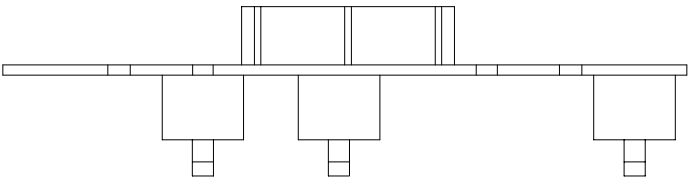
<b>VISION</b> <b>A5 SFD joystick</b> <b>board layout</b>	<b>18</b>
Code 58126112 - Rev. 0	Page 1 of 1



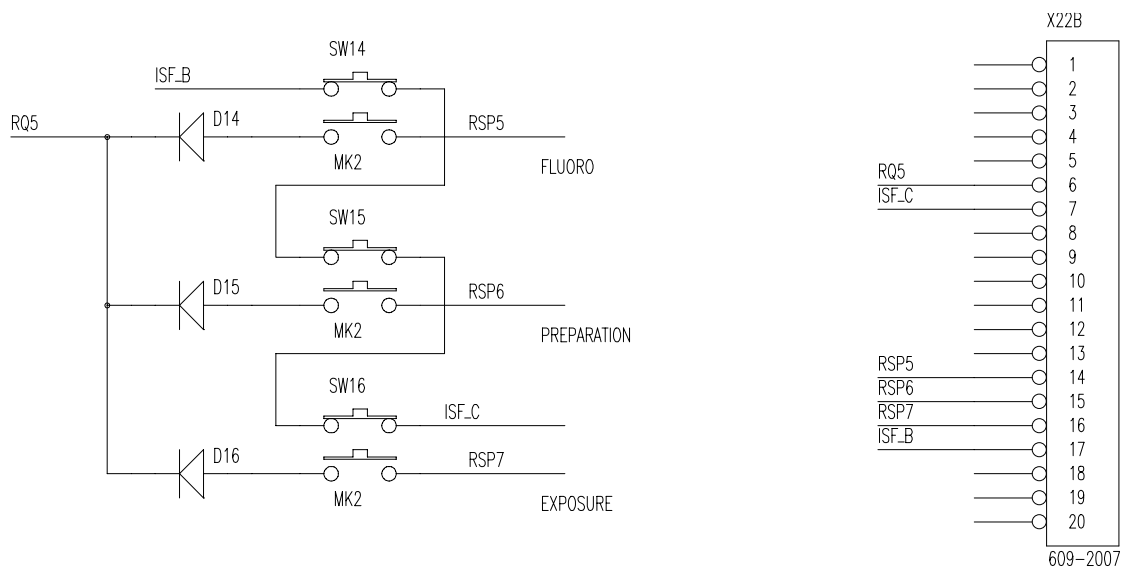
<b>VISION</b> <b>A5 SFD joystick</b> <b>board schematic</b>	<b>19</b>
<b>Code 39129004 - Rev. 0</b>	<b>Page 1 of 1</b>



A7

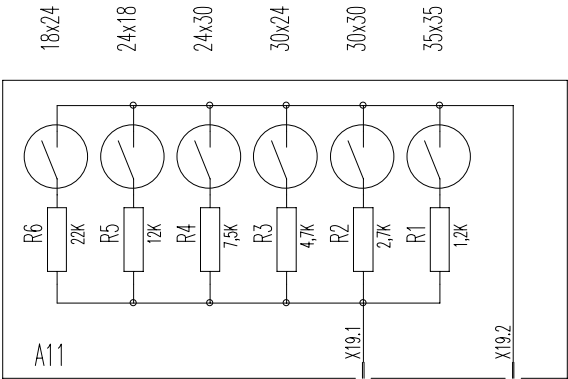
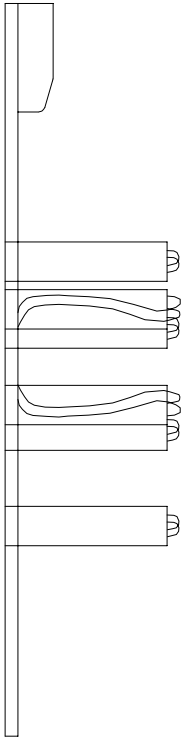
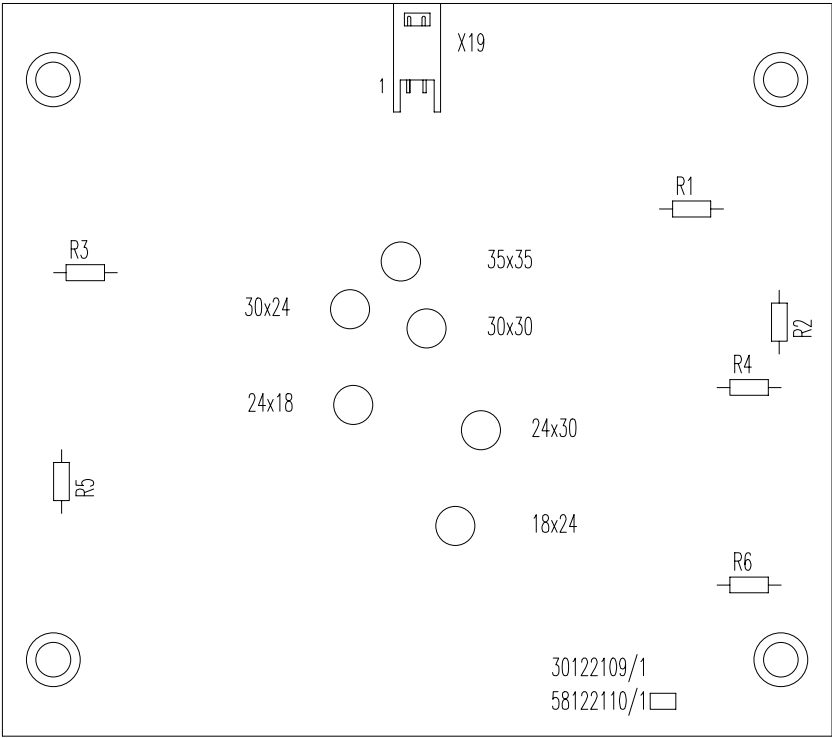


<b>VISION</b> <b>A7 Prep - Exposure</b> <b>board layout</b>	<b>20</b>
<b>Code 58126114 - Rev. 0</b>	<b>Page 1 of 1</b>



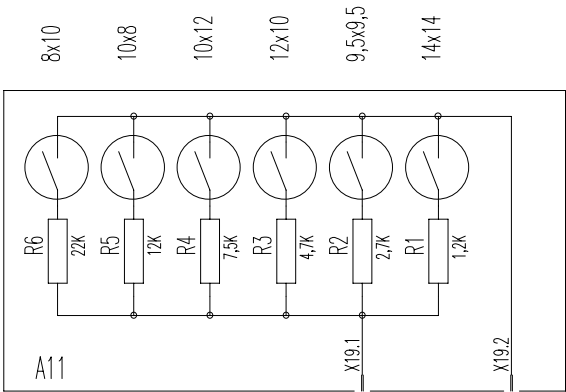
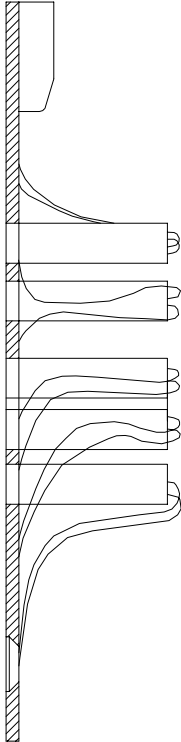
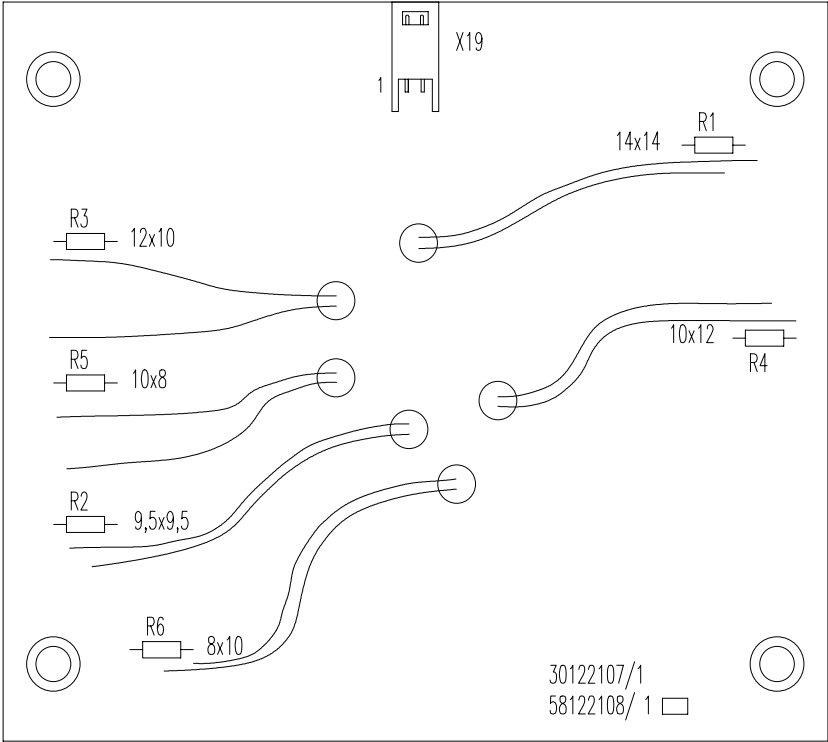
<b>VISION</b> <b>A7 Prep - Exposure</b> <b>board schematic</b>	<b>21</b>
<b>Code 39129002 - Rev. 0</b>	<b>Page 1 of 1</b>

A11

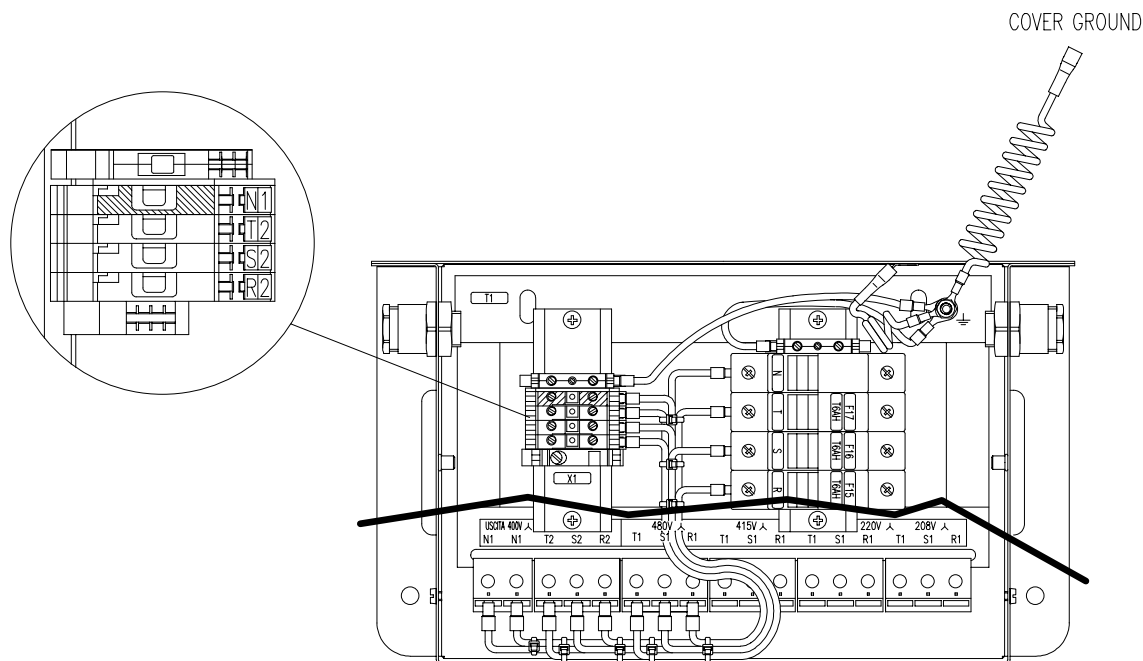


<b>VISION</b> <b>A11 Magnetic switch board</b> <b>layout &amp; schematic (cm)</b>	<b>22</b>
<b>Code 58122110 - Rev. 1</b>	<b>Page 1 of 1</b>

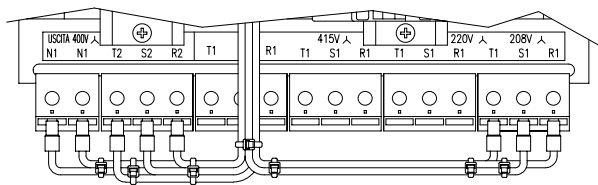
A11



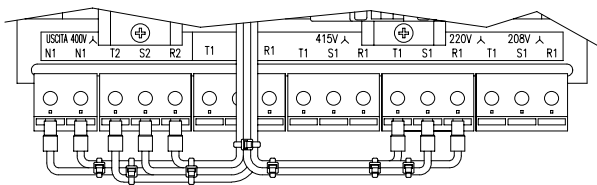
<b>VISION</b> <b>A11 Magnetic switch board</b> <b>layout &amp; schematic (inch)</b>	<b>23</b>
<b>Code 58122108 - Rev. 1</b>	<b>Page 1 of 1</b>



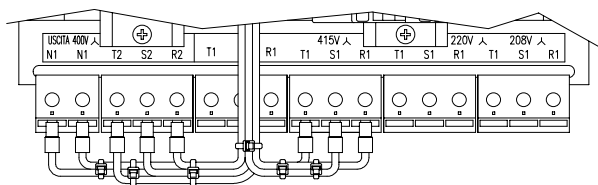
For proper wiring (mains voltage setting),  
see drawings below



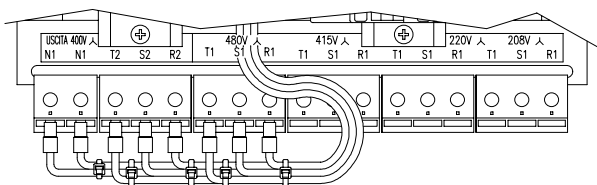
Set for 208V



Set for 220V

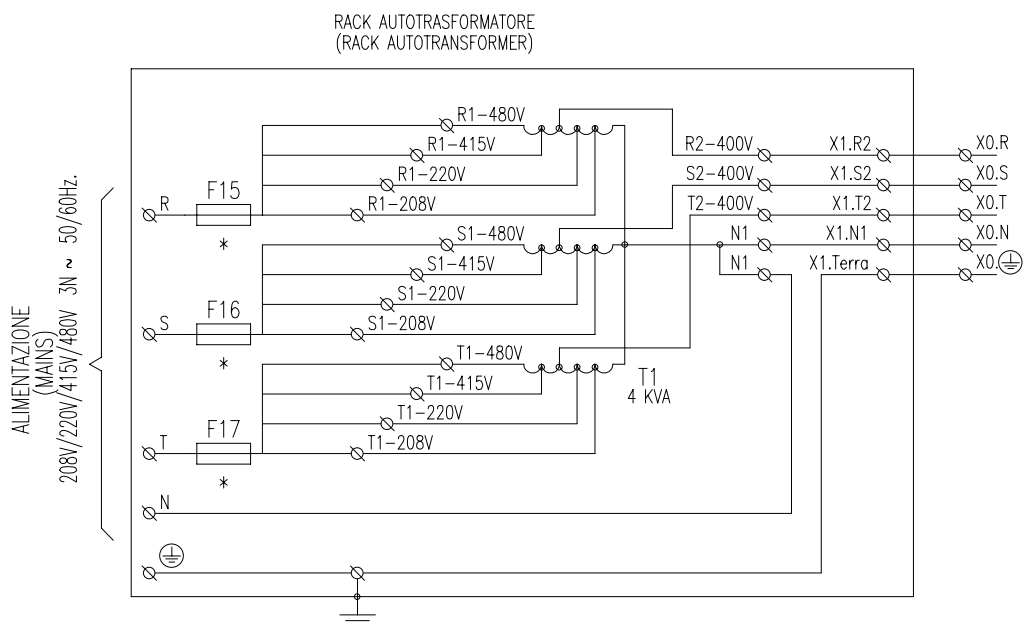


Set for 415V



Set for 480V

<b>VISION</b> <b>Autotransformer module</b> <b>layout</b>	<b>24</b>
	Page 1 of 1



\* : Fusibili da T8A per alimentazione (Fuses T8A for mains) 208V/220V  
Fusibili da T6A per alimentazione (Fuses T6A for mains) 415V/480V

<b>VISION</b> <b>Autotransformer module</b> <b>schematic</b>	<b>25</b>
<b>Code 39659054 - Rev. 0</b>	<b>Page 1 of 1</b>





Cod. 6965900703\_Rev.4



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