

**Chapter VIII:**  
*PCBs LAYOUT, CONFIGURATION AND  
CONTROL LED*

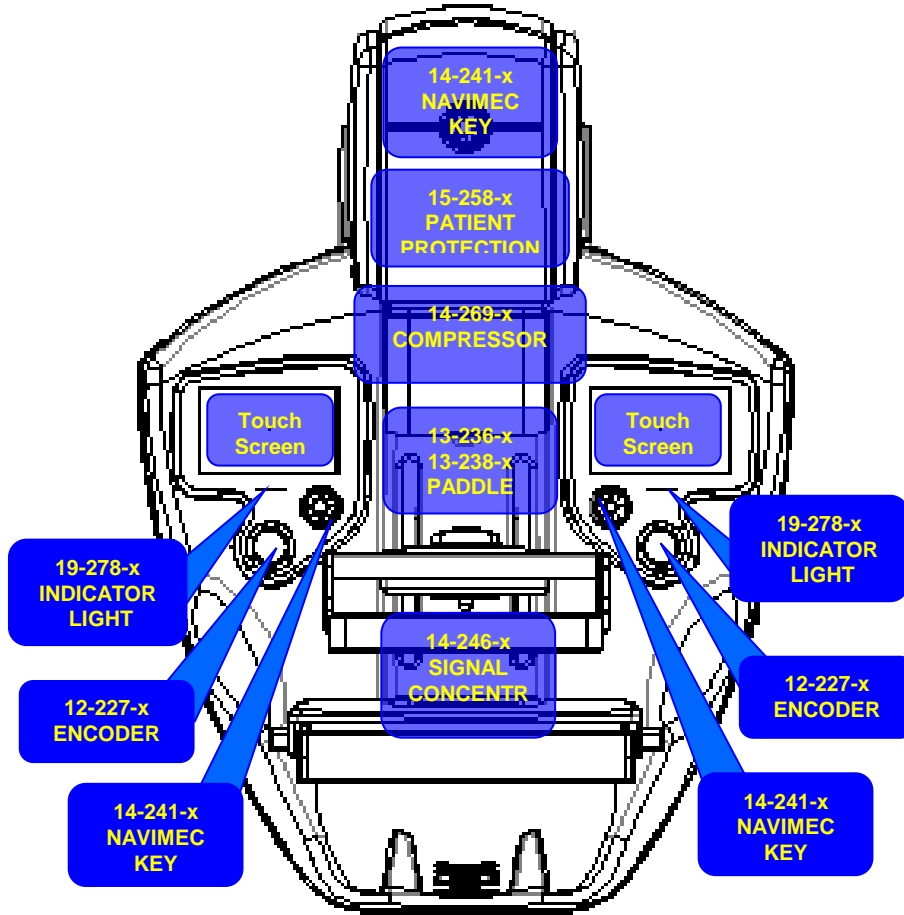
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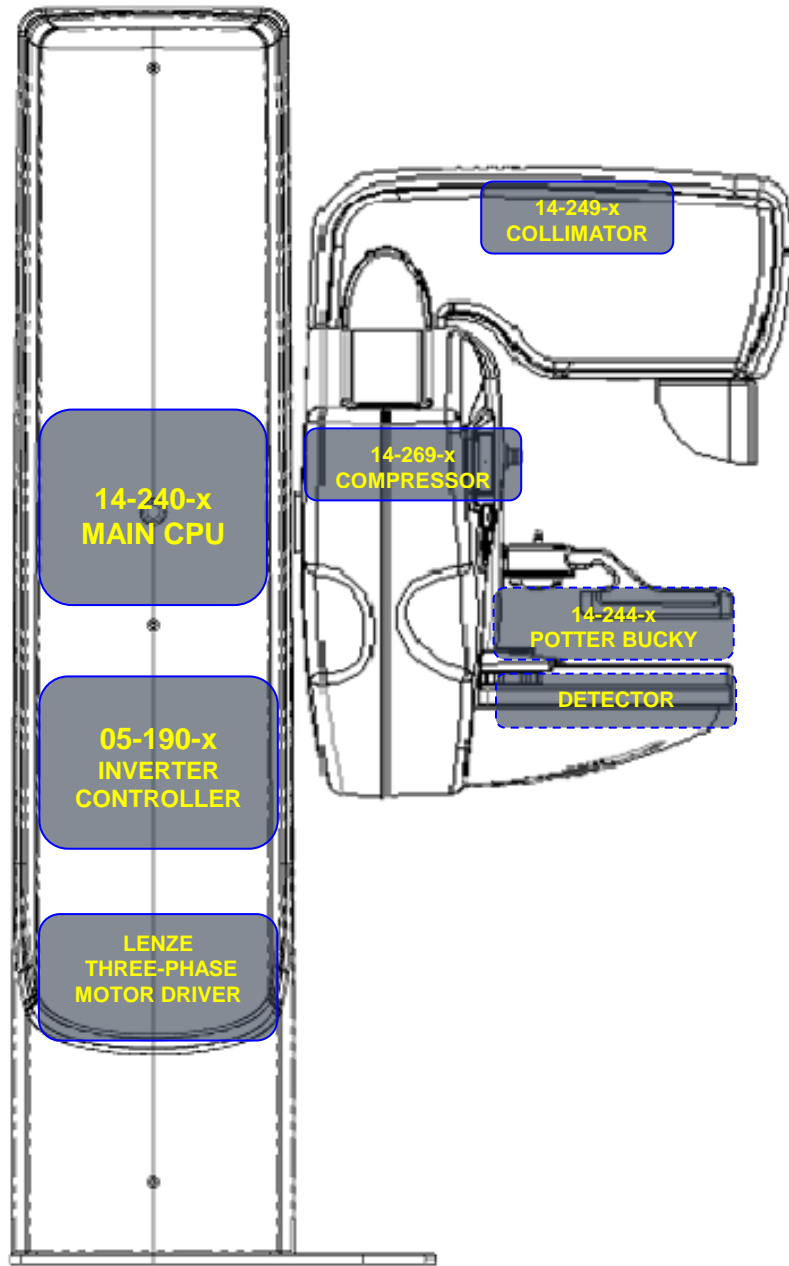
# **PCBs WITH FACTORY SETTINGS**

**PROGRAMMABLE DEVICES AVAILABLE**

**GANTRY FRONT VIEW**



**GANTRY RIGHT SIDE VIEW**



**DESCRIPTION OF PROGRAMMABLE DEVICES**

<b>Device</b>	<b>Architecture</b>	<b>Description</b>	<b>Communication media</b>
<b>MAIN-CPU</b>	SODDIM dual core A5/M4 Arm Vybrid architecture.	The Main Cpu is the MIND of the system. It is composed by two Touch-Screens called Master and Slave and, together, they provide all the main features of the Gantry.	<ul style="list-style-type: none"> <li>• ETHERNET: TCP/IP based connections, it allow the communication with the acquisition PC (if present) and the intercommunication between displays. Other connections are possible for service purpose;</li> <li>• UART RS232: every Terminal provides one RS232 115200 b/s character output streaming for debug purpose;</li> <li>• MASTER UART RS422: a 4800 b/s proprietary protocol connects all the internal boards equipped with uC;</li> <li>• CAN BUS: standard CANOpen, 1Mb/s communication protocol connects both Master Terminal and Slave Terminal with the C-Arm rotation driver, Tube Arm rotation driver and C-ARM Up/Down driver.</li> </ul>
<b>PCB\14-240-x</b>	PIC16F877A microcontroller based board, 16MHz XT oscillator quartz; PIC16F876A microcontroller for remote firmware upgrade;	<p>This board implements several basic feaures:</p> <ul style="list-style-type: none"> <li>• UPS over the 24VDC system power supply;</li> <li>• Rotation C-ARM ant Tube-Arm power control;</li> <li>• Hardware system I/O interfaces;</li> <li>• System power On/Off control</li> </ul>	The board communicates point to point to the Master Terminal with a dedicated UART RS422, 56Kb/s, proprietary protocol.

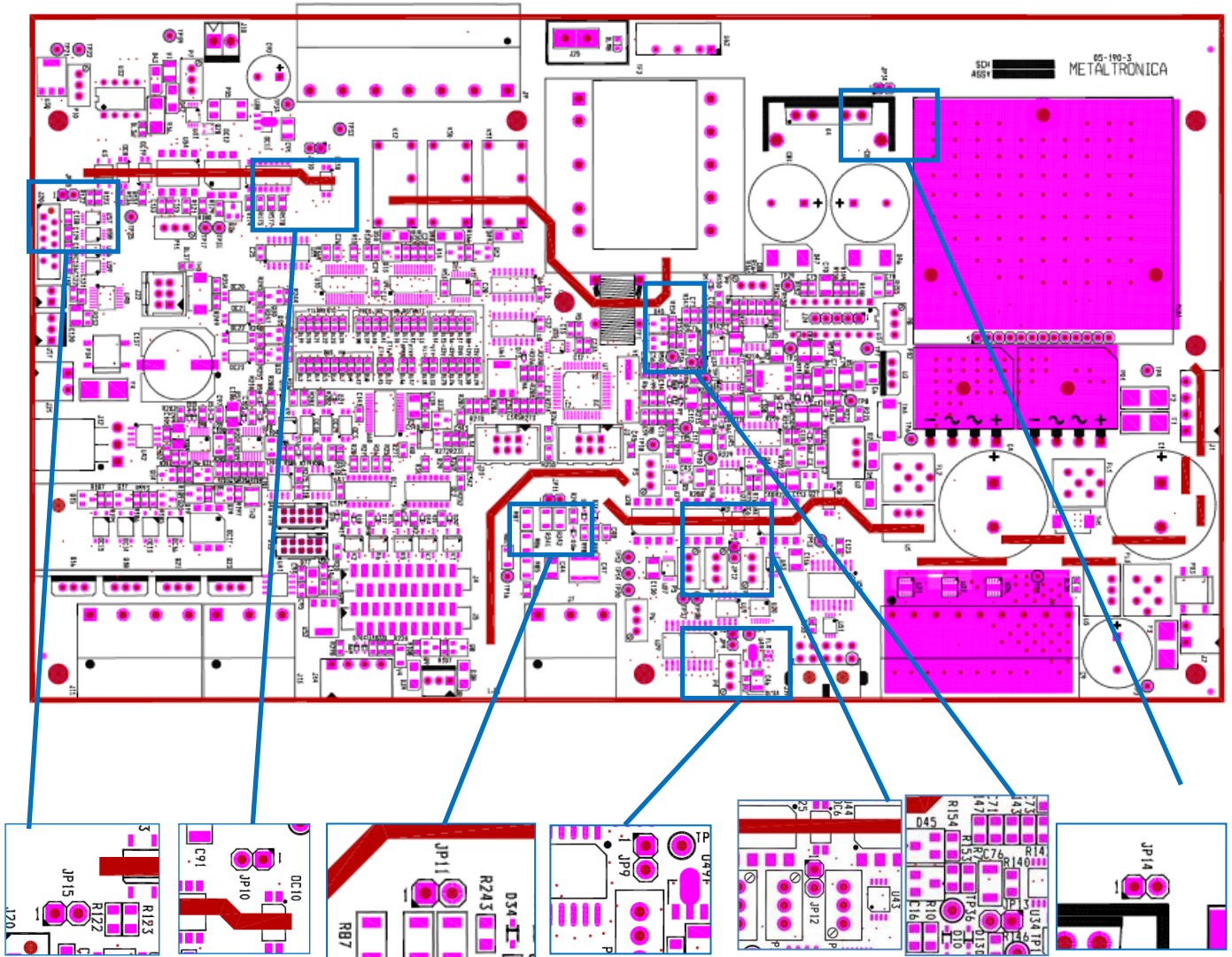
<b>Device</b>	<b>Architecture</b>	<b>Description</b>	<b>Communication media</b>
<b>PCB\05-190-x</b>	PIC16F877A microcontroller based board, 4MHz XT oscillator quartz; PIC16F876A microcontroller for remote firmware upgrade;	This board controls the XRAY Tube generator parameters: <ul style="list-style-type: none"> <li>• kV level control;</li> <li>• Anodic current control;</li> <li>• mAs integration;</li> </ul> In case of a digital detector should be present, the board synchronizes the exposure along with the detector integration slots.	RS422, 4800 b/s proprietary protocol.
<b>PCB\12-227-x</b>	No uC on board	This board provides the hardware interface to manage the Manual compression system. The board connects to the <b>PCB\19-269-x</b> .	no communication media.
<b>PCB\13-236-x</b>	No uC on board	This board provides the hardware interface to detect the Paddle code. The board interacts with the PCB269 providing an analog level encoding the Paddle detected.	no communication media.
<b>PCB\13-238-x</b>	No uC on board	This board provides the Lock/Unlock Paddle detection. This board interact with the PCB\13-236 board.	no communication media.
<b>PCB\14-241-x</b>	No uC on board	This board provides the hardware interface for the Manual push buttons used to trigger the C-ARM manual rotation and C-ARM Up/Down manual activation.	no communication media.

<b>Device</b>	<b>Architecture</b>	<b>Description</b>	<b>Communication media</b>
<b>PCB\14-244-x</b>	PIC16F877A uC based board, 4MHz XT oscillator quartz; PIC16F876A uC for remote firmware upgrade;	This board implements the Potter Bucky functions: <ul style="list-style-type: none"> <li>• 2D grid control;</li> <li>• 3D grid control;</li> <li>• Magnifier coefficient detection;</li> </ul>	RS422, 4800 b/s proprietary protocol.
<b>PCB\14-246-x</b>	No uC on board	This board provides the signal distribution node for the following signals: <ul style="list-style-type: none"> <li>• Hardware Bus;</li> <li>• Manual C-ARM rotation and Up-Down;</li> </ul>	no communication media.
<b>PCB\15-257-x</b>	No uC on board	This board is mounted inside the Biopsy device assembly, providing the RS422 Bus insulation and power supply Hot-Swap feature.	no communication media.
<b>PCB\15-258-x</b>	No uC on board	This board provides the hardware front-end to detect the presence of the patient protection. This board provides an analog signal output to the PCB\14-249 board.	no communication media.
<b>PCB\15-267-x</b>	No uC on board	This board is mounted in the power inverter, providing the Fuse interface and the power voltage read back.	no communication media.
<b>PCB\19-269-x</b>	PIC16F877A uC based board, 16MHz XT oscillator quartz; PIC16F876A	This board controls the breast compression activities.	RS422, 4800 b/s proprietary protocol.

<b>Device</b>	<b>Architecture</b>	<b>Description</b>	<b>Communication media</b>
	uC for remote firmware upgrade;		
<b>PCB\14-249-x</b>	Dual PIC16F877A uC based board, 4MHz XT oscillator quartz; PIC16F876A uC for remote firmware upgrade;	<p>This board controls the collimator device providing:</p> <ul style="list-style-type: none"> <li>• format collimation control;</li> <li>• dynamic collimation for Tomo scans;</li> <li>• filter selection;</li> <li>• collimation light control.</li> </ul> <p>An internal inclinometer provides the absolute system inclination, used in order to determine the C-ARM inclination.</p>	RS422, 4800 b/s proprietary protocol.
<b>PCB\12-228-x</b>	No uC on board	This board provides the Power Capacitors discharge hardware.	no communication media.
<b>PCB\12-231-x</b>	No uC on board	This board provides the signal adaptation hardware for the Digital Detector.	no communication media.
<b>PCB\19-273-x</b>	No uC on board	This board provides the opto-coupler signal to the C-ARM Tilt driver in order to perform the zero setting procedure. The board detects a possible C-ARM tilt out of control condition, triggering a mechanical lock system in case of detected fault.	no communication media.
<b>PCB\19-278-x</b>	No uC on board	This board manages the power presence led.	no communication media.

# PCB/05-190-X (X-ray tube supply board)

## TOP SIDE VIEW



**FW = Y**

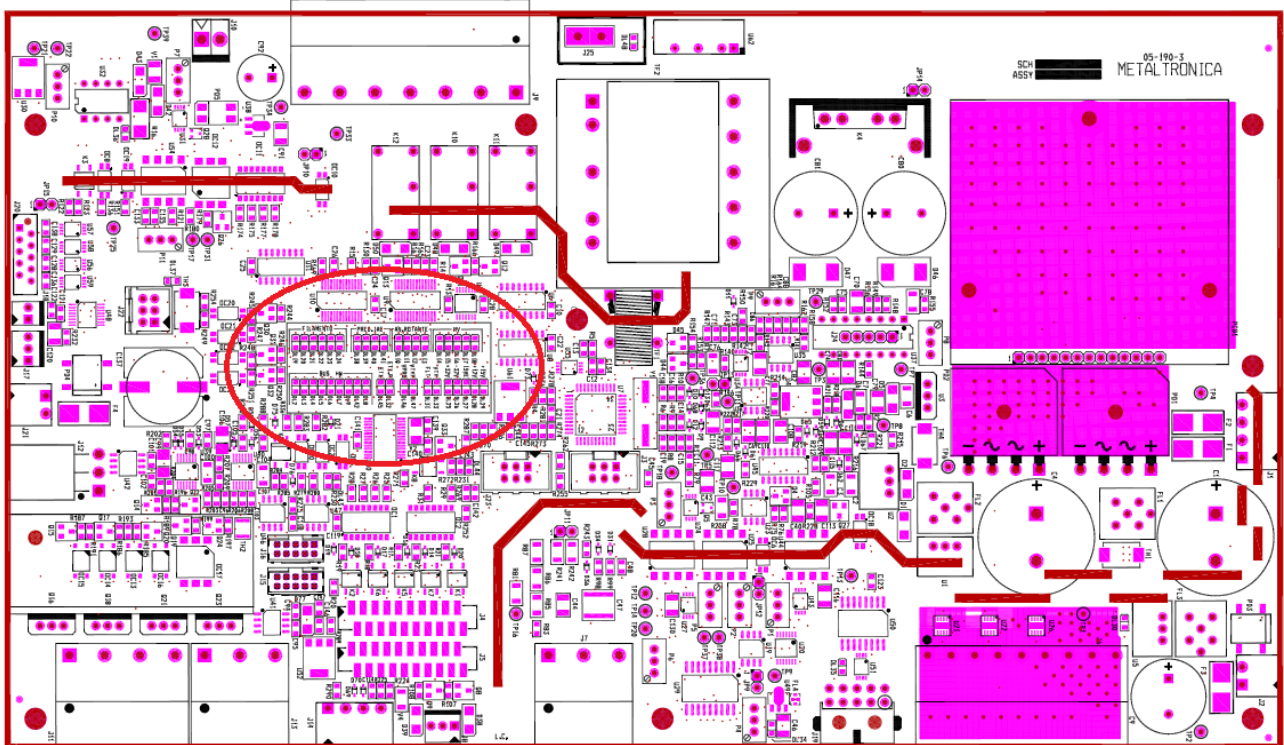
**DIP-SWITCHES = N.A.**

### JUMPER SETTINGS

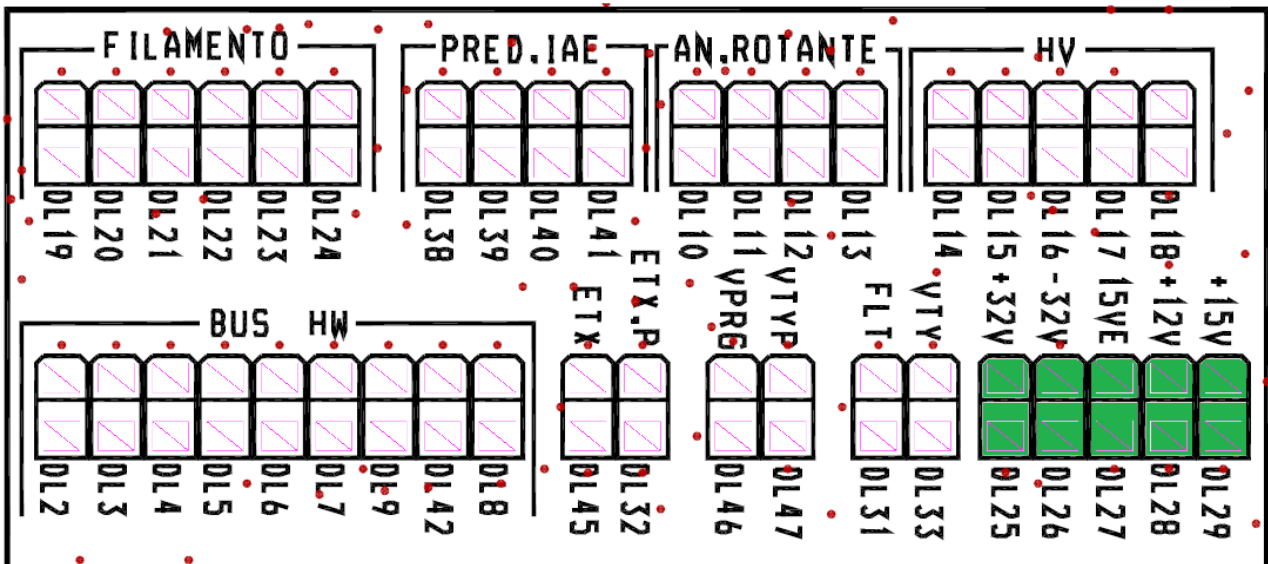
Ref.	Open	Short 1-2	Short 2-3	Type
<b>JP9</b>		<b>X</b>	----	<b>2 P</b>
<b>JP10</b>	X		----	<b>2 P</b>
<b>JP11</b>	X		----	<b>2 P</b>
<b>JP12</b>	X		----	<b>2 P</b>
<b>JP13</b>	X		----	<b>2 P</b>
<b>JP14</b>	X		----	<b>2 P</b>
<b>JP15</b>	X		----	<b>2 P</b>

**CONTROL LED**

**TOP SIDE VIEW**

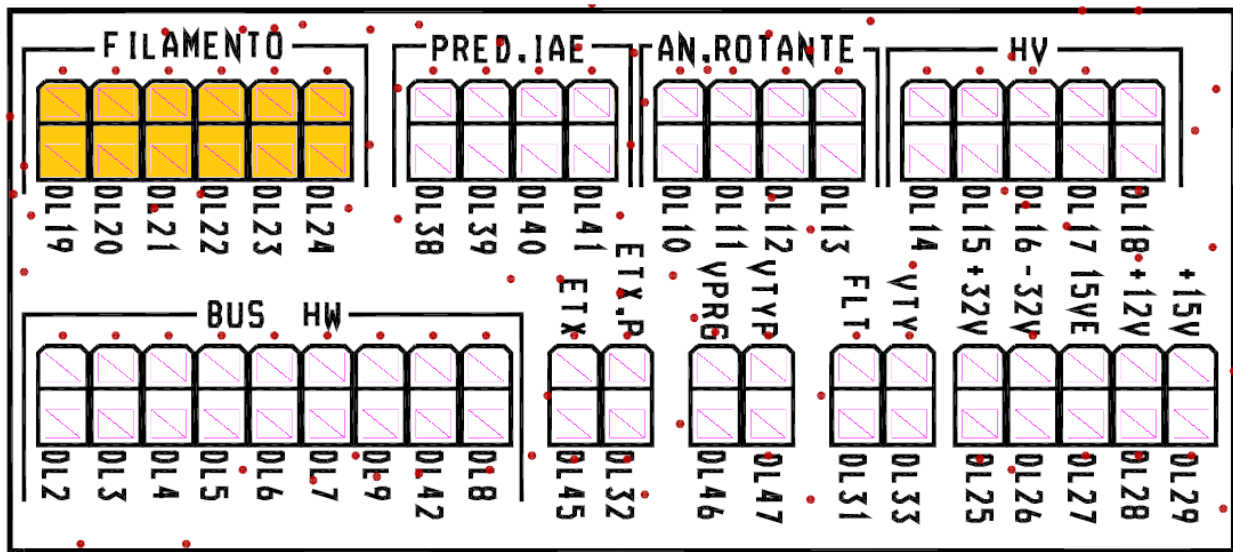


**Power suppliers**



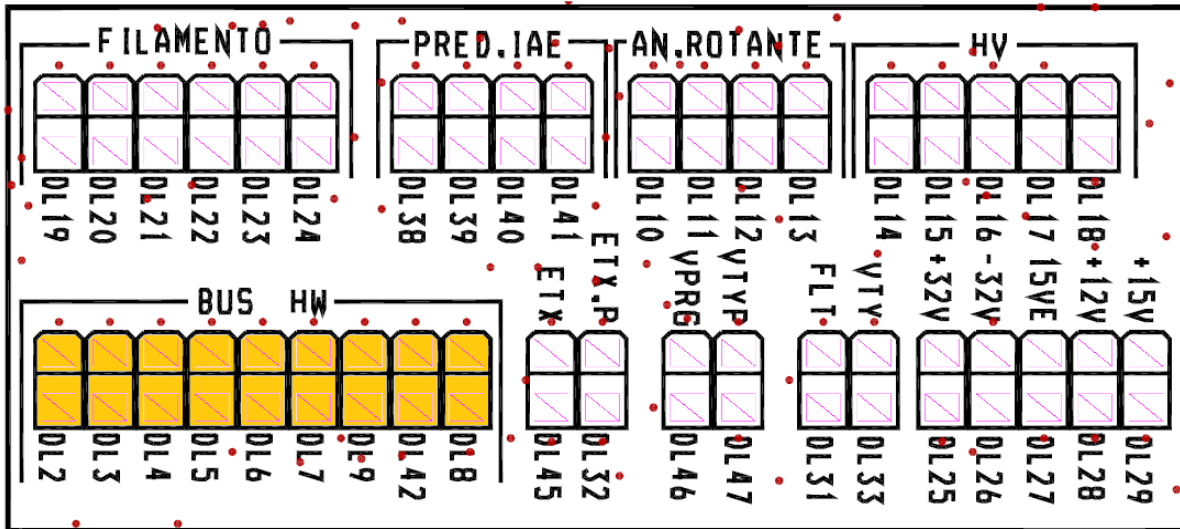
LED	Signal	Description
DL25	+32V	Filament Power Supply
DL26	-32V	Filament Power Supply
DL27	+15V EXT	Power Supply of Vcc Power external reading
DL28	+12V	Filament Power Supply
DL29	+15V	Inverter Controller Power supply

**Filament**



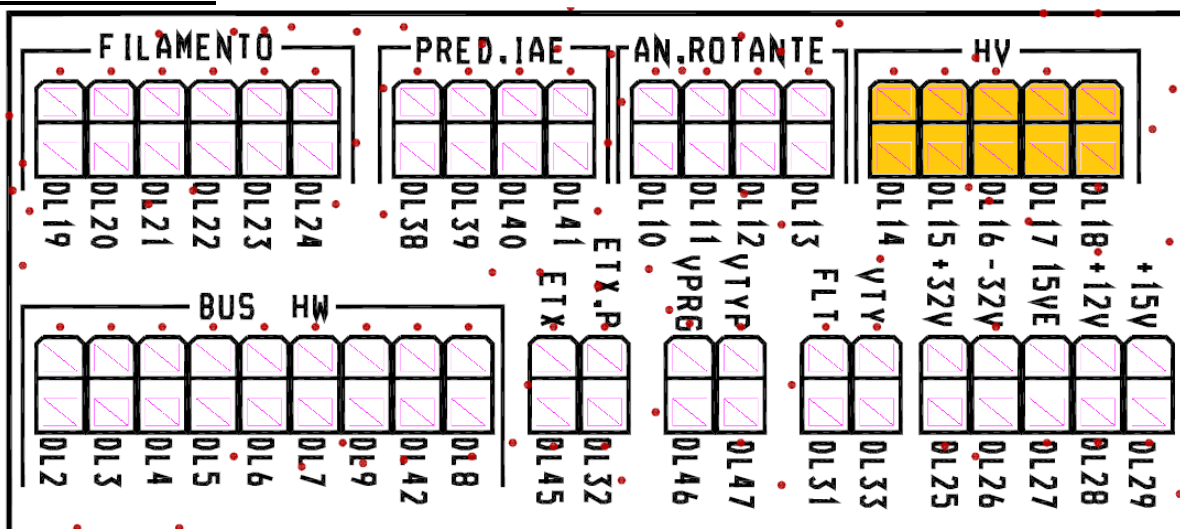
LED	Signal	Description
DL19	FILON	Filament ON
DL20	MOLIB_P	Molybdenum-Small Focus selection
DL21	MOLIB_G	Molybdenum-Large Focus selection
DL22	W_P	Tungsten-Small Focus Selection
DL23	W_G	Tungsten-Large Focus Selection
DL24	GRID_ON	Grid ON

**Bus Hardware**



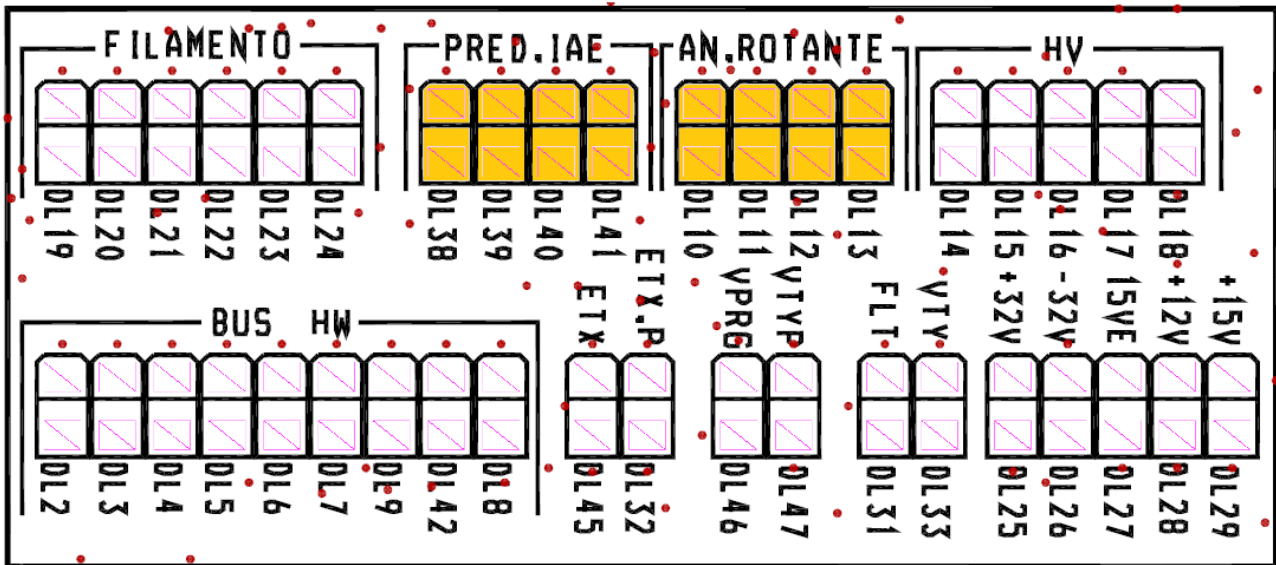
LED	Signal	Description
DL2	MAINS_ON	Power Supply "OK" from PCB240
DL3	MASTER_ENA	General Enable signal from TS
DL4	XRAY_ENA	Xray enabled (Xray push button pressed on)
DL5	DETECTOR_EXPWIN	Exp-Win signal from Detector (during Xray exposure)
DL6	DETECTOR_READY	"Ready" signal from Detector
DL7	DETECTOR_PREP	PREP Signal to Detector during Xray exposure (from PCB190)
DL9	DETECTOR_ON	DETECTOR ON signal to Detector during Xray exposure (from PCB 190)
DL42	XRAY_COMPLETED	Xray completed Signal (from PCB190)
DL8	XRAY_DIS	Xray disabled (grid inversion) from PCB244

**HV Controller**



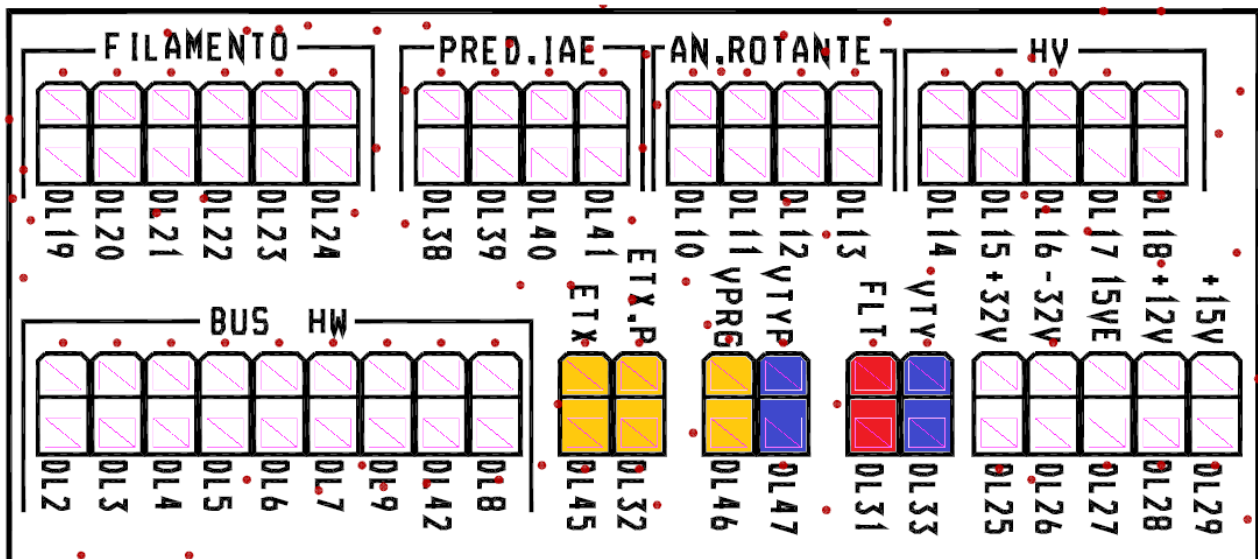
LED	Signal	Description
DL14	MAIN_SW1	SW1 Primary Switching
DL15	MAIN_SW2	SW2 Primary switching
DL16	MAS_TEST	activation of Masmeter Test Current
DL17	MAS_CNT	masmetro counter pulsers
DL18	HV_ENA	KV enabled

**Starter (IAE+Internal Starter)**



LED	Signal	Description
DL10	ANODO_ON	Internal Starter Power enable
DL11	ANODO_RUN	Internal Starter Launch
DL12	ANODO_BRK	Internal Starter Braking
DL13	ANODO_KEEP	Internal Starter maintening
DL38	IAE_LOW	Low Speedactivation
DL39	IAE_RX	Burst disable
DL40	IAE_ROT	IAE Starter launch
DL41	IAE_OK	OK speed

**Attività uC**

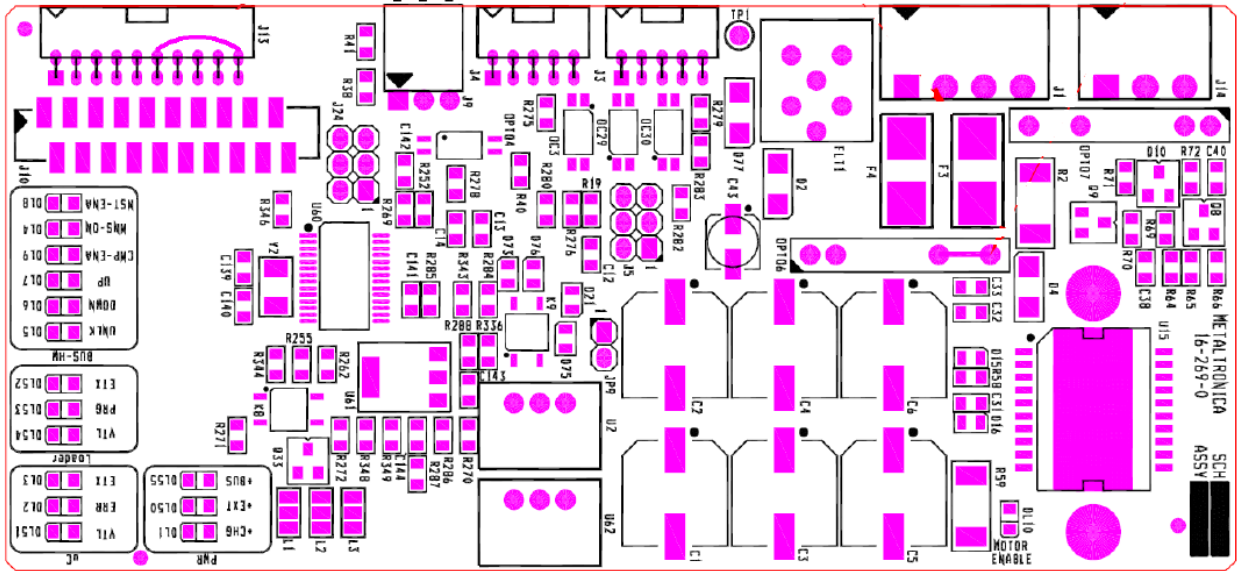


LED	Signal	Description
DL31	FAULT	Fault active
DL32	ETX_PROG	programmator serial activity
DL33	VITALITY	Vitalità uC vitality
DL45	ETX_uC	uC serial activity
DL46	VPROG_ENA	EnableProgramming
DL47	VITALITY	Programmator vitality

# ***PCB/16-269-X (COMPRESSION SYSTEM CONTROLLER)***

**(UNDER REVIEW)**

## **TOP SIDE VIEW**



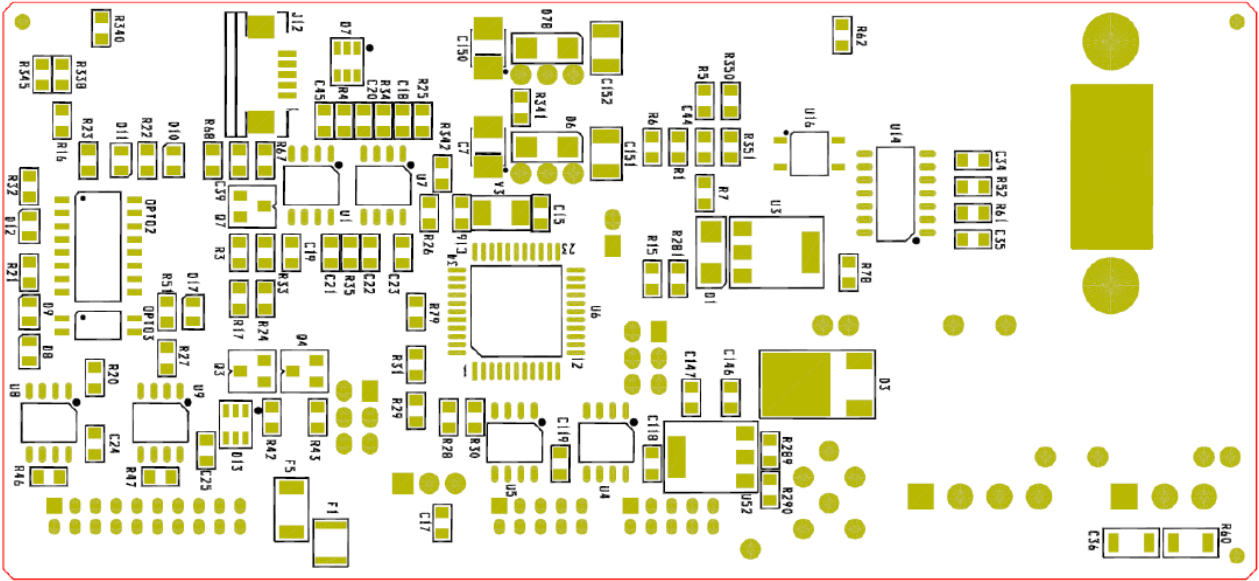
***FW = Y***

***DIP-SWITCHES = N.A.***

### ***JUMPER SETTINGS***

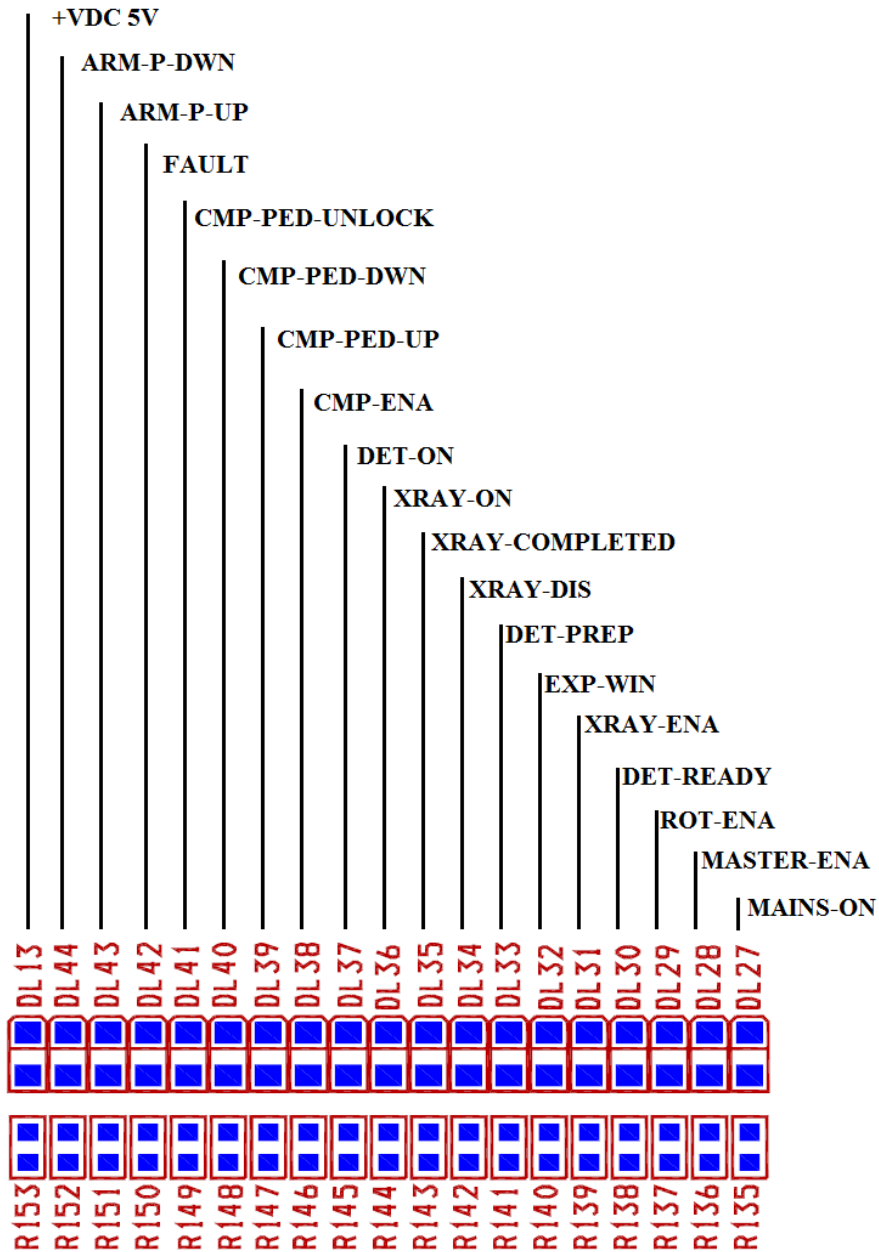
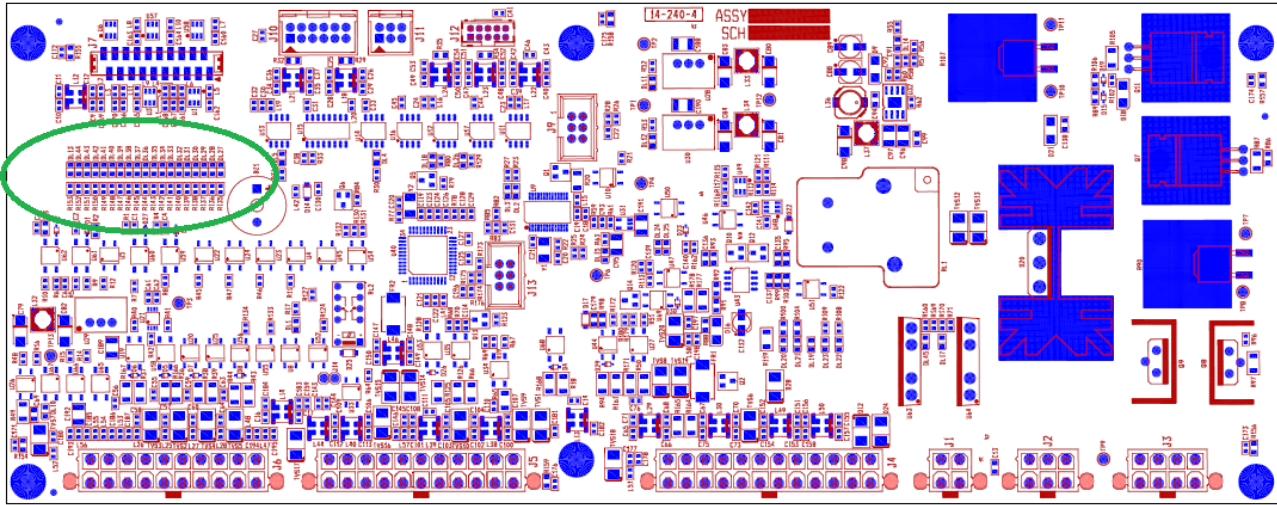
<b><i>Ref.</i></b>	<b><i>Open</i></b>	<b><i>Short 1-2</i></b>	<b><i>Short 2-3</i></b>	<b><i>Type</i></b>
<b><i>JP1</i></b>	<b><i>X</i></b>	<b><i>----</i></b>	<b><i>----</i></b>	<b><i>2 P</i></b>
<b><i>JP2</i></b>	<b><i>X</i></b>	<b><i>----</i></b>	<b><i>----</i></b>	<b><i>2 P</i></b>
<b><i>JP5</i></b>	<b><i>X</i></b>	<b><i>----</i></b>	<b><i>----</i></b>	<b><i>2 P</i></b>
<b><i>JP6</i></b>	<b><i>----</i></b>	<b><i>X</i></b>	<b><i>----</i></b>	<b><i>2 P</i></b>
<b><i>JP7</i></b>	<b><i>X</i></b>	<b><i>----</i></b>	<b><i>----</i></b>	<b><i>2 P</i></b>
<b><i>JP8</i></b>	<b><i>X</i></b>	<b><i>----</i></b>	<b><i>----</i></b>	<b><i>2 P</i></b>
<b><i>JP9</i></b>	<b><i>X</i></b>	<b><i>----</i></b>	<b><i>----</i></b>	<b><i>2 P</i></b>
<b><i>JP10</i></b>	<b><i>----</i></b>	<b><i>----</i></b>	<b><i>X</i></b>	<b><i>3 P</i></b>
<b><i>J5</i></b>	<b><i>X</i></b>	<b><i>----</i></b>	<b><i>----</i></b>	<b><i>2x3 P</i></b>

**BOTTOM SIDE VIEW**





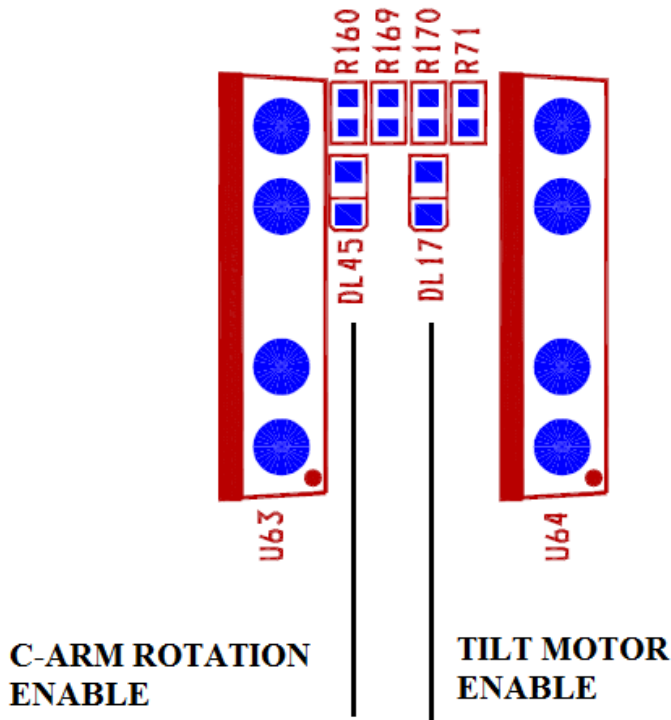
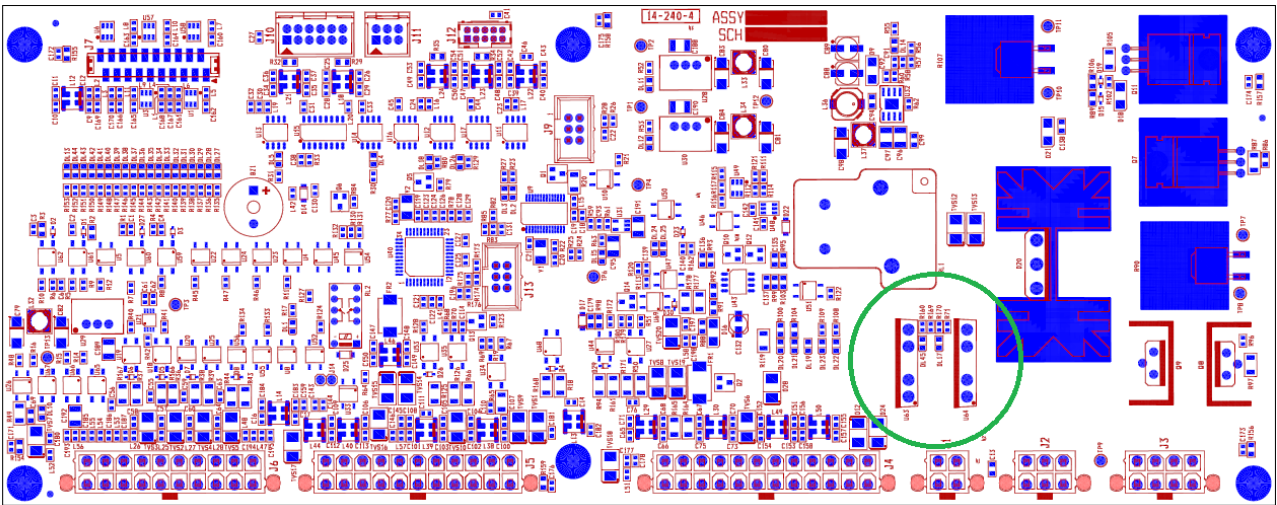
**BUS HARDWARE LEDS**



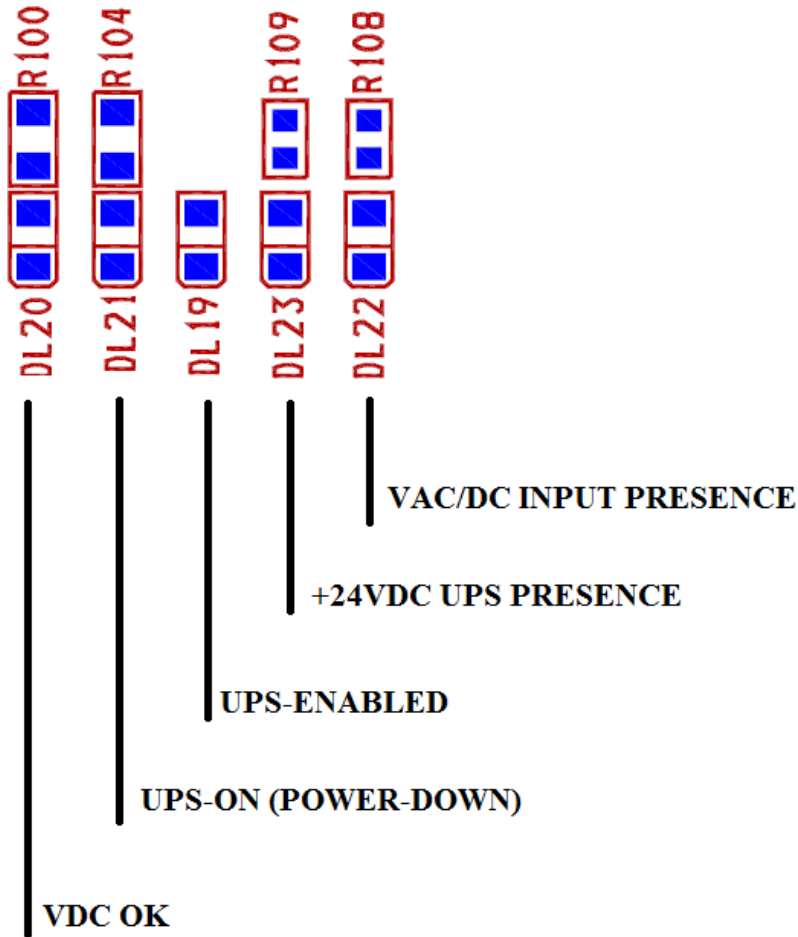
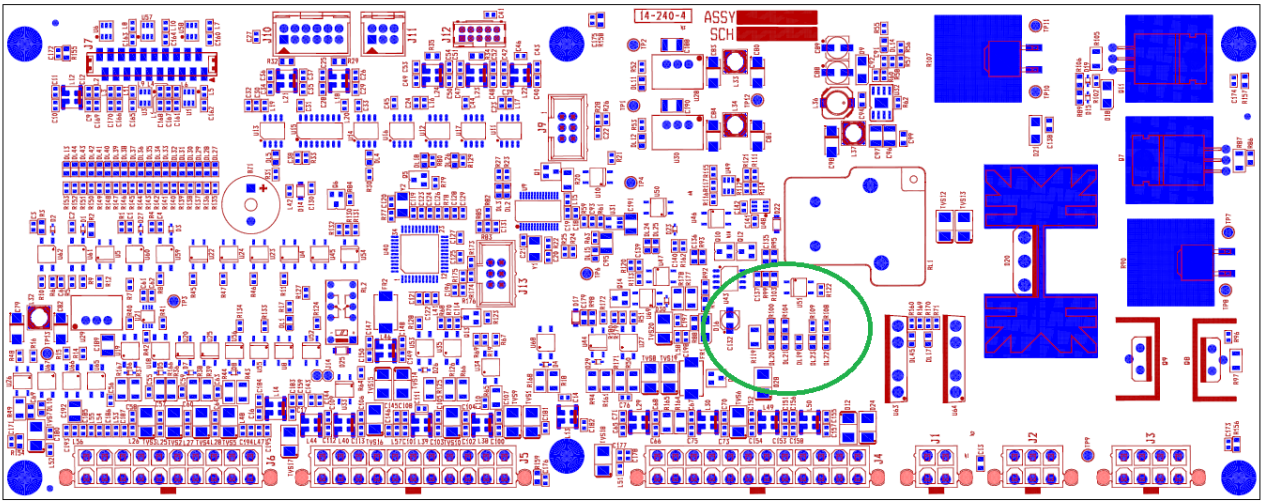
**DESCRIPTION**

- VDC: 5Volt BUS power supply presence;
- ARM-P-DWN: C-ARM -UP- pedal activated or manual push button activation;
- ARM-P-UP: C-ARM -DOWN- pedal activated or manual push button activation;
- FAULT: not used;
- CMP-PED-UNLOCK: Compression pedals unlock activation;
- CMP-PED-DWN: Compression pedal DOWN activation;
- CMP-PED-UP: Compression pedal UP activation;
- CMP-ENA: Compressor Enable signal activated;
- DET-ON: Detector On signal activated ;
- XRAY-ON: XRAY-ON signal activated;
- XRAY-COMPLETED: XRAY-COMPLETEDsignal activated;
- XRAY-DIS: XRAY-DISABLE signal activated;
- DET-PREP: Detector Prep signal activated;
- EXP-WIN: EXP-WIN signal activated;
- XRAY-ENA: XRAY-ENA signal activated;
- DET-READY: Detector Ready signal activated;
- ROT-ENA: Not Used;
- MASTER-ENA: MASTER Enable signal activated;
- MAINS-ON: MAINS-ON signal activated;

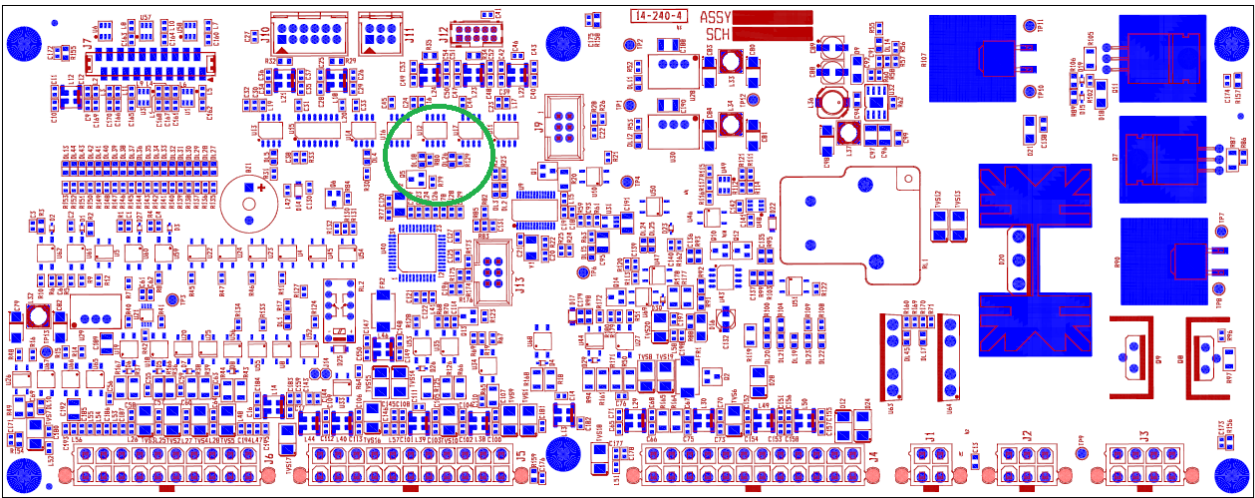
# C-ARM AND TILT POWER ACTIVATION



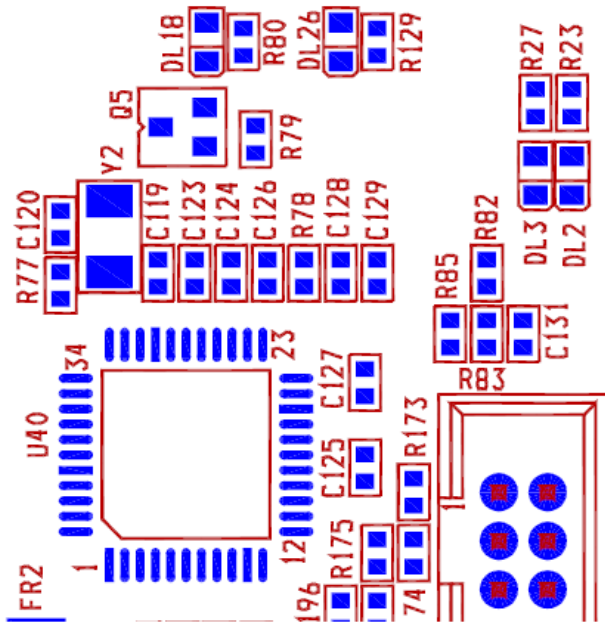
UPS STATUS



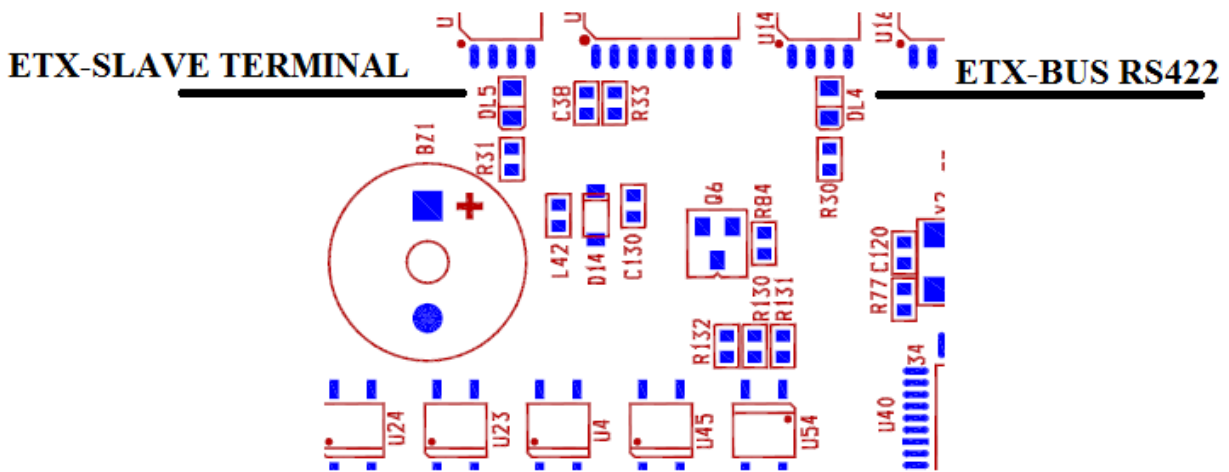
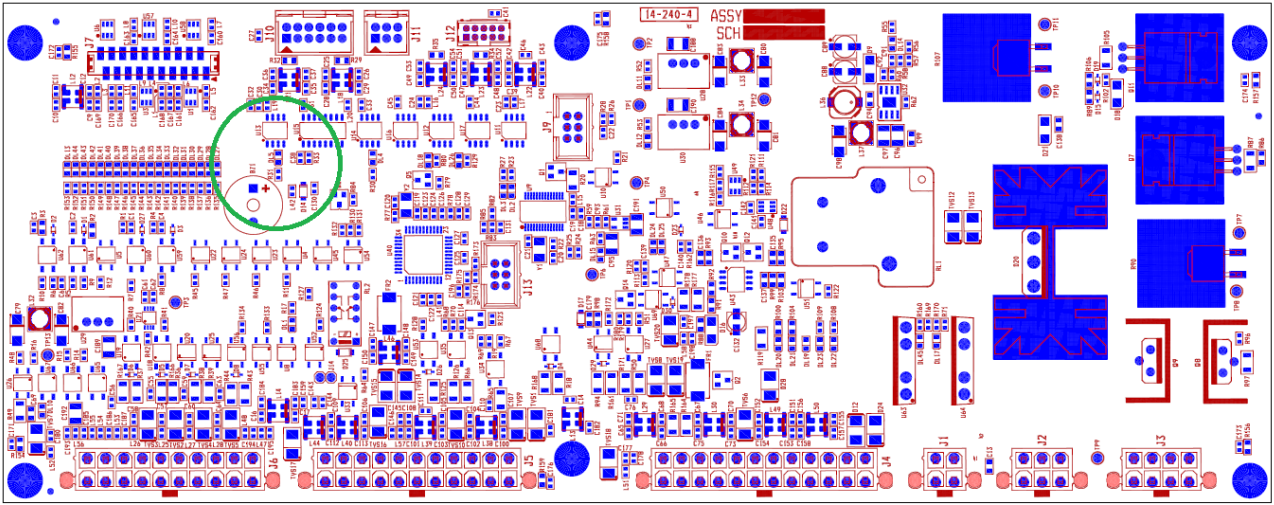
# X-RAY PUSH BUTTON



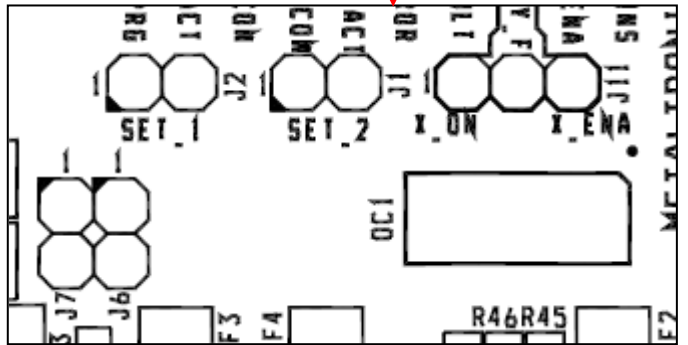
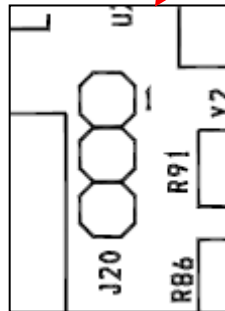
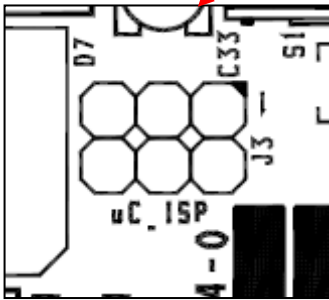
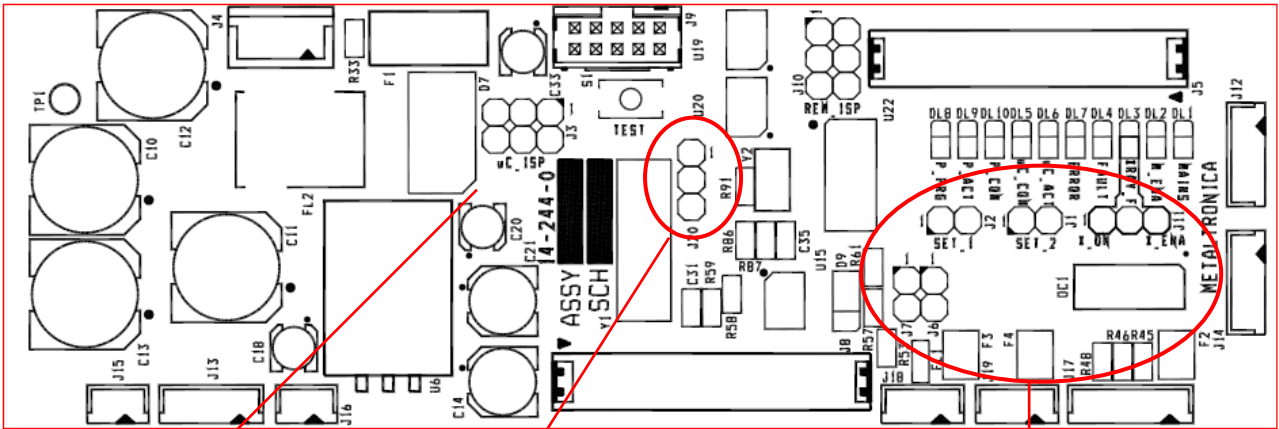
## XRAY-REQUEST



# SERIAL BUS ETX (VITALITY) LEDS



# PCB/14-244-X (POTTER / MAGNIFIER CONTROLLER)



**FW = Y**

**DIP-SWITCHES = N.A.**

## JUMPER SETTINGS (ALL OPTIONS)

Ref.	Open	Short 1-2	Short 2-3	Type
J3	X	----	----	2x3 P
J11	----	----	X	3 P
J20	----	----	X	3 P

## 2D POTTER

Ref.	Open	Short 1-2	Short 2-3	Type
SET_1	----	X	----	2 P
SET_2	X	----	----	2 P

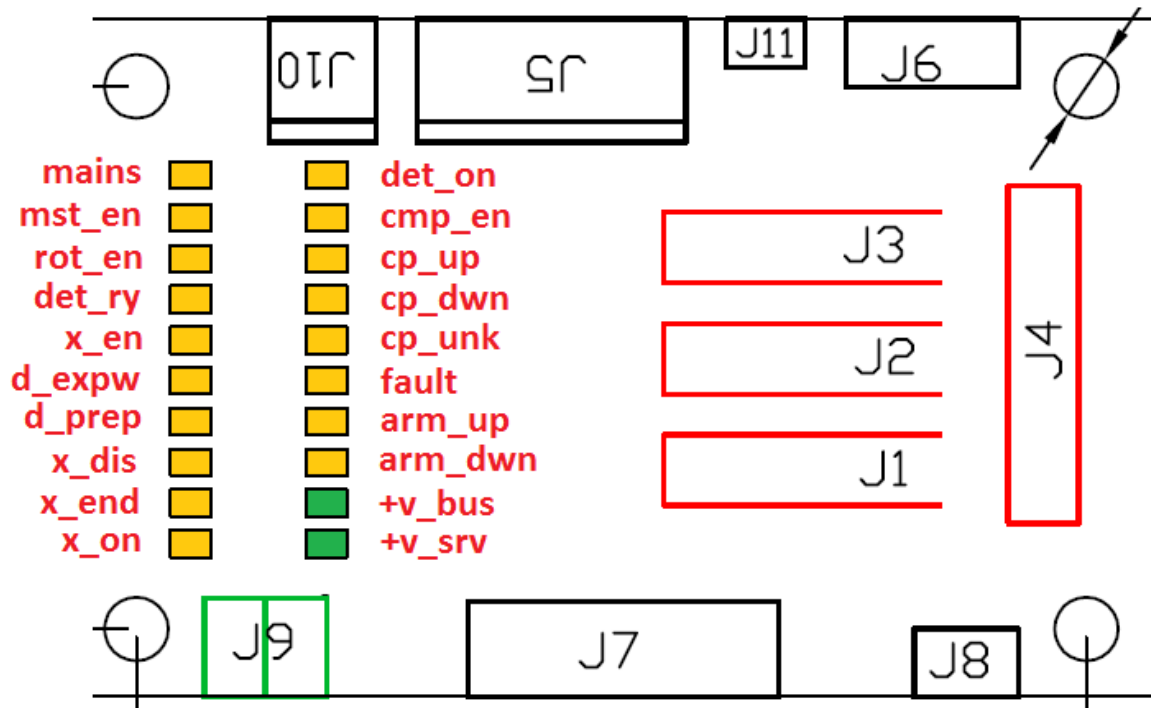
## TOMO POTTER

Ref.	Open	Short 1-2	Short 2-3	Type
SET_1	----	X	----	2 P
SET_2	----	X	----	2 P

## MAGNIFIER

Ref.	Open	Short 1-2	Short 2-3	Type
SET_1	X	----	----	2 P
SET_2	----	X	----	2 P

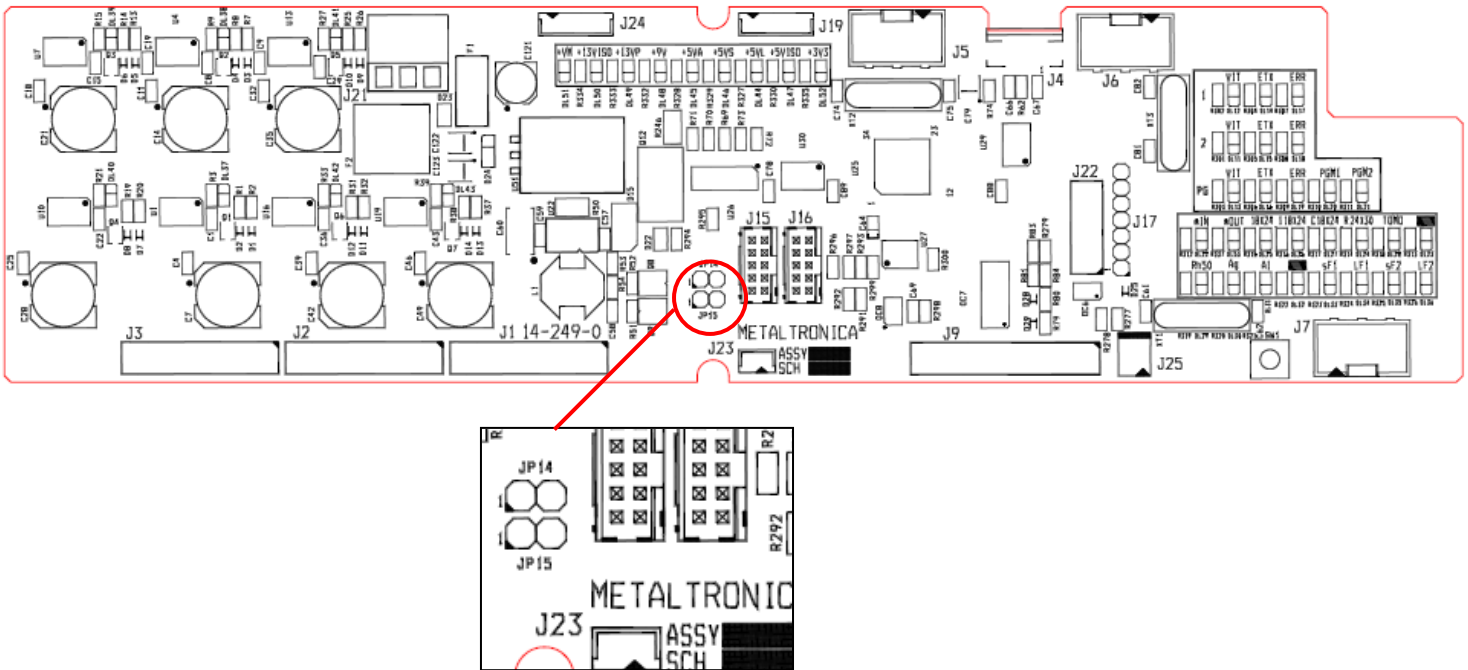
# PCB/14-246-X



Signal	Description
ARM-DWN	Push button for request of ARM DOWN
ARM-UP	Push button for request of ARM UP
CMP-EN	Hardware enable of compressor paddle movement
X_ON	Signal XRAYON active to enable the 2D grid (from PCB 190)
X_END	Signal for completed XRAY (from PCB 190)
X_DIS	Signal for X-Ray disable ( grid inversion) from PCB 244
CP_UP	Compression paddle UP requested with foot control
CP_DWN	Compression paddle DOWN requested with foot control
CP_UNK	Motor driven compression unlock requested with the foot pedal
D_EXPW	Exp-Win signal from Detector (during X-ray emission)
X_EN	Signal for X-Ray enable (X-Ray push button pressed)
D_RY	Signal for "Ready" from the Detector
ROT_EN	Hardware enable for motorized rotation (only C-Arm)
MST_EN	Signal for general enable from TS
MAINS	Signal for power supply OK from PCB 240
FAULT	FAULT signal on BUS Hardware
D_PREP	Signal for PRE to the Detector during X-Ray (from PCB 190)
DET_ON	Signal of DETECTOR ON to the Detector during X-Ray (PCB 190)
+V_BUS	+5V on bus hardware
+V_SRV	+12V service power supply

# PCB/14-249-X (AUTOMATIC COLLIMATOR, MIRROR AND FILTER CONTROLLER)

## TOP SIDE VIEW



**FW = Y**

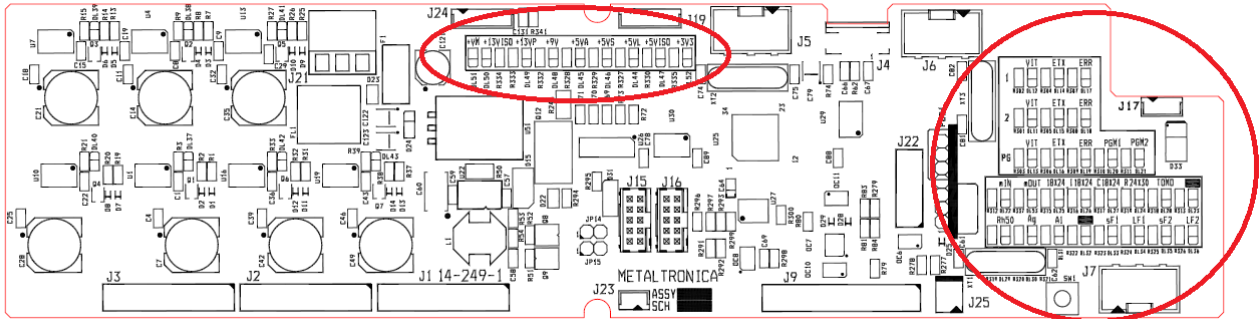
**DIP-SWITCHES = N.A.**

### JUMPER SETTINGS

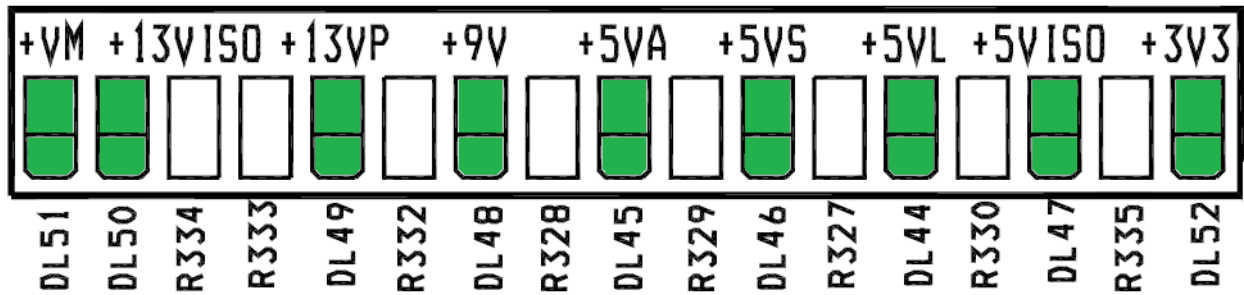
Ref.	Open	Short 1-2	Short 2-3	Type
JP14	X	----	----	2 P
JP15	X	----	----	2 P

**CONTROL LED**

**TOP SIDE VIEW**

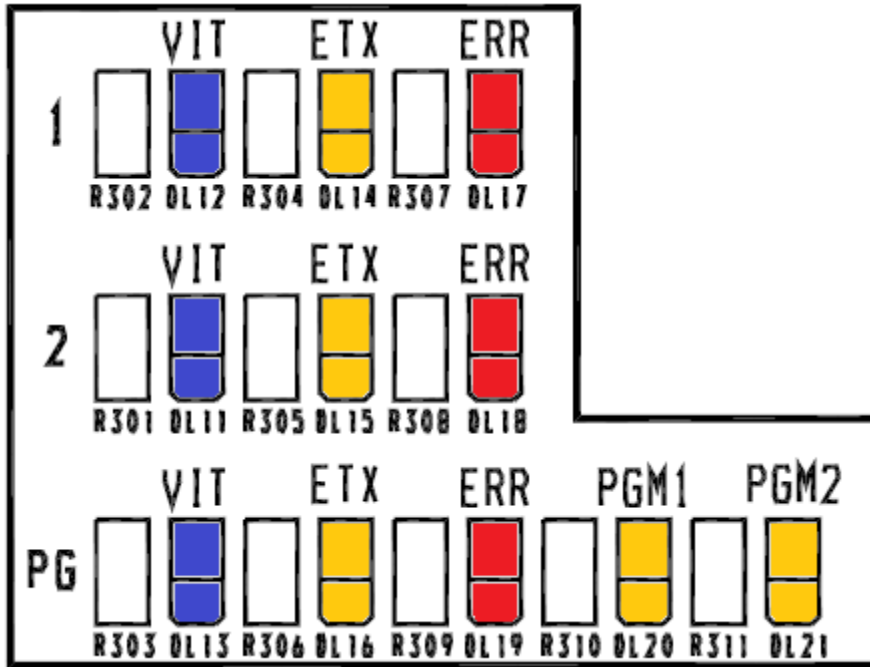


**Power**



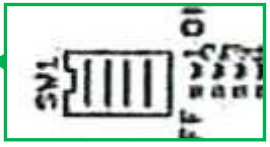
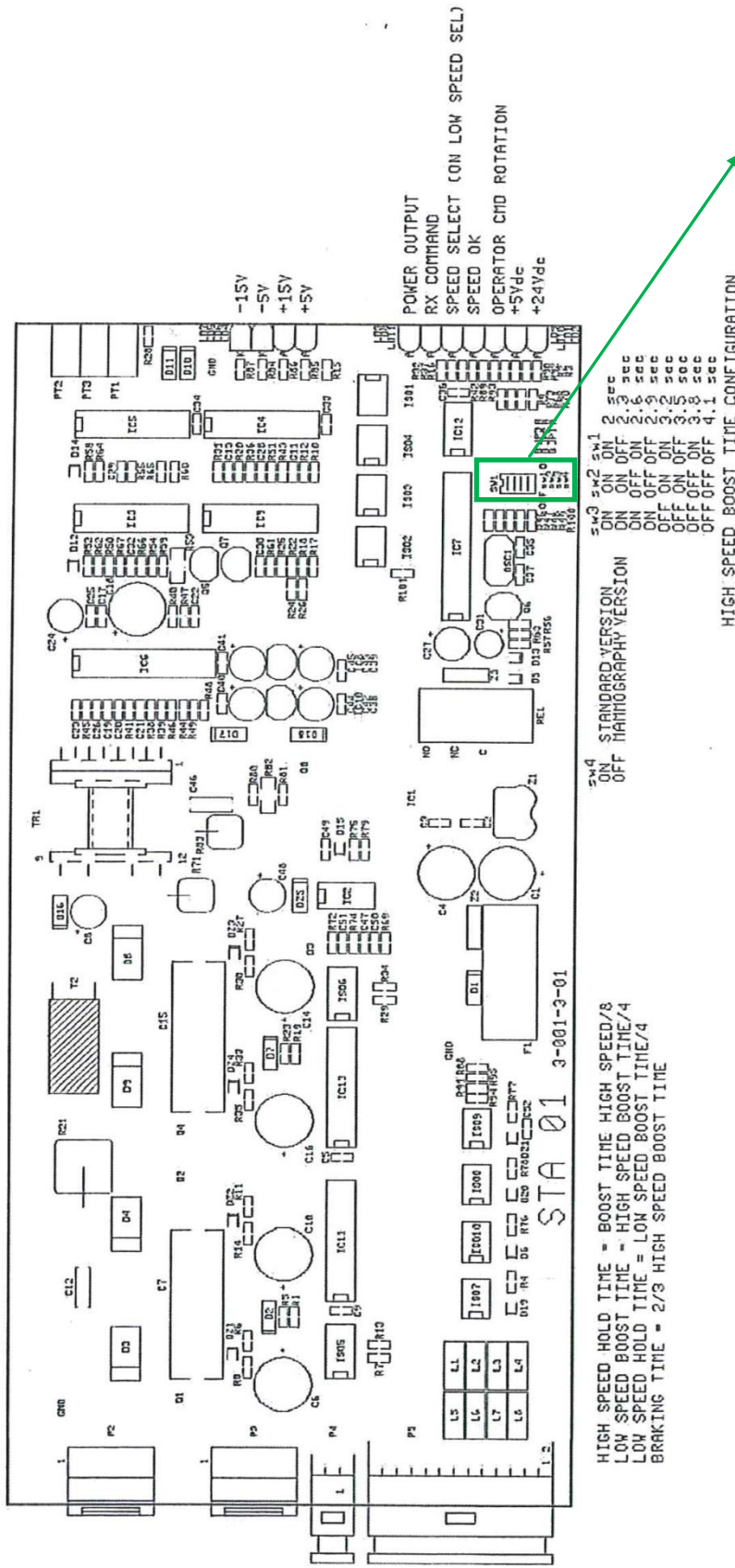
LED	Signal	Description
DL44	+5VL	Signal of presence of logic 5V
DL45	+5VA	Signal of presence of analogic 5V
DL46	+5VS	Signal of presence of sensors 5V
DL47	+5VISO	Signal of presence of power supply on BUS Hardware
DL48	+9V	Signal of presence of +9V
DL49	+13VP	Signal of programmer power supply
DL50	+13V ISO	Signal of BUS 422 power supply
DL51	+VM	Signal of presence of motors power supply

uC activity



LED	Signal	Description
DL12	VIT	uC 1 vitality
DL14	ETX	uC 1 activity signal BUS 422
DL17	ERR	Fault signal from uC 1
DL11	VIT	uC 2 vitality
DL15	ETX	uC 2 activity signal BUS 422
DL18	ERR	Fault signal from uC 2
DL13	VIT	Programmator vitality
DL16	ETX	Programmator activity signal BUS 422
DL19	ERR	Programmator fault signal
DL20	PGM1	uC 1 programming
DL21	PGM2	uC 2 programming

# TRF/10KRPM (HIGH SPEED STARTER option)



**DIP-SWITCHES SW1 (factory SETTINGS)**

<b>Ref.</b>	<b>OFF</b>	<b>ON</b>
<b>sw1</b>	----	<b>X</b>
<b>sw2</b>	----	<b>X</b>
<b>sw3</b>	<b>X</b>	----
<b>sw4</b>	----	<b>X</b>

This configuration of sw1/sw2/sw3 corresponds to an High Speed Boost time of 3.2 sec  
This configuration of sw4 corresponds to a STANDARD modality version of functioning

**CONTROL LED**

	<b>Color</b>	<b>Function</b>
<b>DL7</b>	GREEN	<b>-15 V</b> (Main Power Supply provided; for details, see CV0425-xx)
<b>DL5</b>	GREEN	<b>-5 V</b> (Main Power Supply provided; for details, see CV0425-xx)
<b>DL6</b>	GREEN	<b>+15 V</b> (Main Power Supply provided; for details, see CV0425-xx)
<b>DL4</b>	GREEN	<b>+5 V</b> (Main Power Supply provided; for details, see CV0425-xx)
<b>DL3</b>	YELLOW	<b>POWER OUTPUT</b>
<b>DL8</b>	YELLOW	<b>RX COMMAND</b>
<b>DL11</b>	YELLOW	<b>SPEED SELECT (ON Low Speed selected)</b>
<b>DL9</b>	YELLOW	<b>SPEED OK</b>
<b>DL10</b>	YELLOW	<b>OPERATOR CMD ROTATION</b>
<b>DL1</b>	GREEN	<b>+5 Vdc</b> (Auxilar Power Supply provided; for details, see CV0431-xx)
<b>DL2</b>	GREEN	<b>+24 Vdc</b> (Auxiliary Power Supply provided; for details, see CV0431-xx)

**CONTROL LED STATE DESCRIPTION****FUNCTION MODALITY (factory set): OPERATOR CMD ROTATION**

- 1) **OPERATOR CMD ROTATION ON:**  
LD10: always ON  
LD3: ON
- 2) **ROTATION PHASE START:**  
LD10: always ON  
LD9: ON
- 3) **ROTATION PHASE UPKEEP:**  
LD10: always ON  
LD9: OFF

- POWER OUTPUT PROVIDED TO THE ANODE:  
LD3: ON
- ROTATION PHASE:  
LD3: OFF  
LD9: ON

4) **BRAKING PHASE:**

LD10: always ON  
LD8: ON  
LD9: ON  
LD3: ON

5) **BRAKING PHASE END:**

DL3: OFF  
DL8: OFF  
DL11: OFF  
DL9: OFF  
DL10: OFF