GENERAL INFORMATION

Embedded tool for low level PCB test is provided in the aim of checking PCB functionality before to take the decision of eventually replace the board.
Low level functionality means checking each single PCB function out of the interaction with other boards in the high level operations of the unit.
Embedded tool is intended for field use but NO instructions for PCB repair are supplied as field repair is not allowed.
For proper use of Embedded tool, basic knowledge of electronic is recommended as all the tests are related to electronic schematic drawings.

By means of Embedded tool the tests .
Digital Inputs ON/OFF status
Analog Inputs voltage level
Jumper configuration Open/Closed
Output ON/OFF manual stimulation
Serial ports communication

On the following PCBs:
92-074 Rotating anode starter
92-083 Control panel keyboard
01-170 main CPU
03-186 service board
03-188 CPU mother board
02-179 Collimator control board

can be performed.

Tests for PCB **92-073** Filament power supply, PCB **02-179** collimator driver and inverter block are not available, please refer to *Technical manual*
All tests are displayed on the LCD display of existing control panel, no external tools are necessary other than screwdriver, reference Voltmeter and loop back connectors for serial ports. (Loop back connector can be easily made using a DB9 female connector (socket) and connecting pin 2 with pin 3)

In the following instructions reference conditions and values are described.

For maximum operator protection and safety, **no x-ray** are generated with all the tests described.
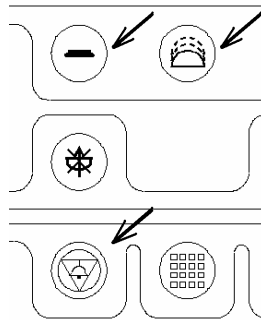
ACCESSING AND EXITING THE EMBEDDED TOOLS

To display the technical screen of the Embedded Tools, it is necessary to enter the technical menu first, by pushing the two buttons "Alarm reset" and "Screen film selection" at same time:
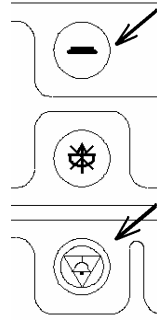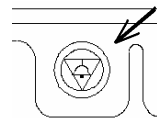
From the technical menu, press and keep pressed the three buttons "Alarm reset", "Screen film selection" and "AEC sensor position" at same time:

After few seconds the display the screen of the Embedded tools appears, related to the first PCB.
Any time you want to advance to the following PCB, press the alarm reset button.

To exit and return to normal operation, switch off the unit or push the master reset button on the CPU PCB 01-170.

SYMBOLS

ANALOG INPUTS
Direct ADC output values are shown on the LCD.

DIGITAL INPUTS
The following symbols that appear on the screen of the Embedded Tools:

refer to the status of the related input. By stimulating the switch connected to the specified PIN number of specified connector CN, symbol must change showing the functionality of the circuit.

RELAY CONTACT

The following symbols that appear on the screen of the Embedded Tools:

refer to the status of the contact of the specified Relay.

OUTPUT (U)

For the PCBs 03-186 and 03-188 only, Output U can be selected by means of mAs [+] and mAs [-], ID code will appear on the LCD and status can be changed by pressing x-ray pushbutton (NO XRAY generated !!)

PCB 92-074 ROTATING ANODE STARTER

RY5 must be CLOSED for normal operation, if OPEN : Check onboard fuse F3 or flat cable connection to the CPU or RY5 relay and contact.
To check PCB functionality, push x-ray pushbutton, the tube rotation will start.
After tube rotation boost, the anode boosting time will appear at the right position of START LABEL and RY6 must change to CLOSED, if not check at sight that RY6 changes status (energized) and eventually check RY6 itself, flat cable or PCB 01-170 interface.
Normal boost time is **1120** +/-10% if boost time is different, PCB must be replaced.
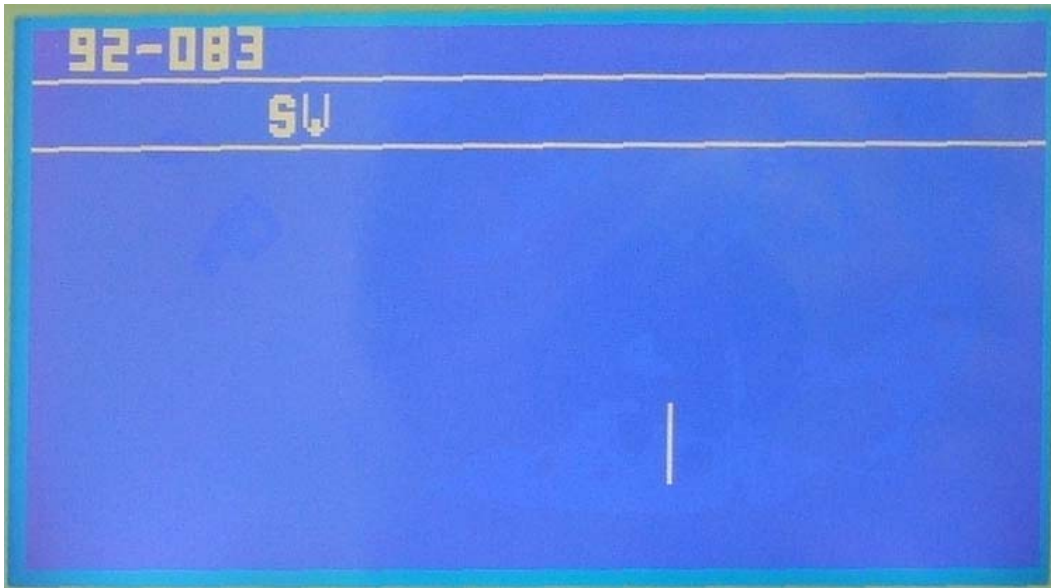Label STOP and related time is provided for future expansion and has no meaning at the moment.

For jumper settings and other information please refer to *Technical Manual*

NOTE
Never swap relays of PCB 92-074 between them or with others of same type from other boards.

PCB 92-083 CONTROL PANEL (Keyboard)

Key code is displayed when a key is pressed, buzzer will BEEP.
For key codes refer to component location of PCB 92-083
SW1 key code is the only one that doesn't appear on the screen as it's used to select different PCB tests.
If the above test works properly, bidirectional communication with the CPU also works.
If missing lines or dots are present on the LCD display in NORMAL operation or TEST mode they depends on the LCD and not on the PCB 92-083.

LATO
SALDATURE
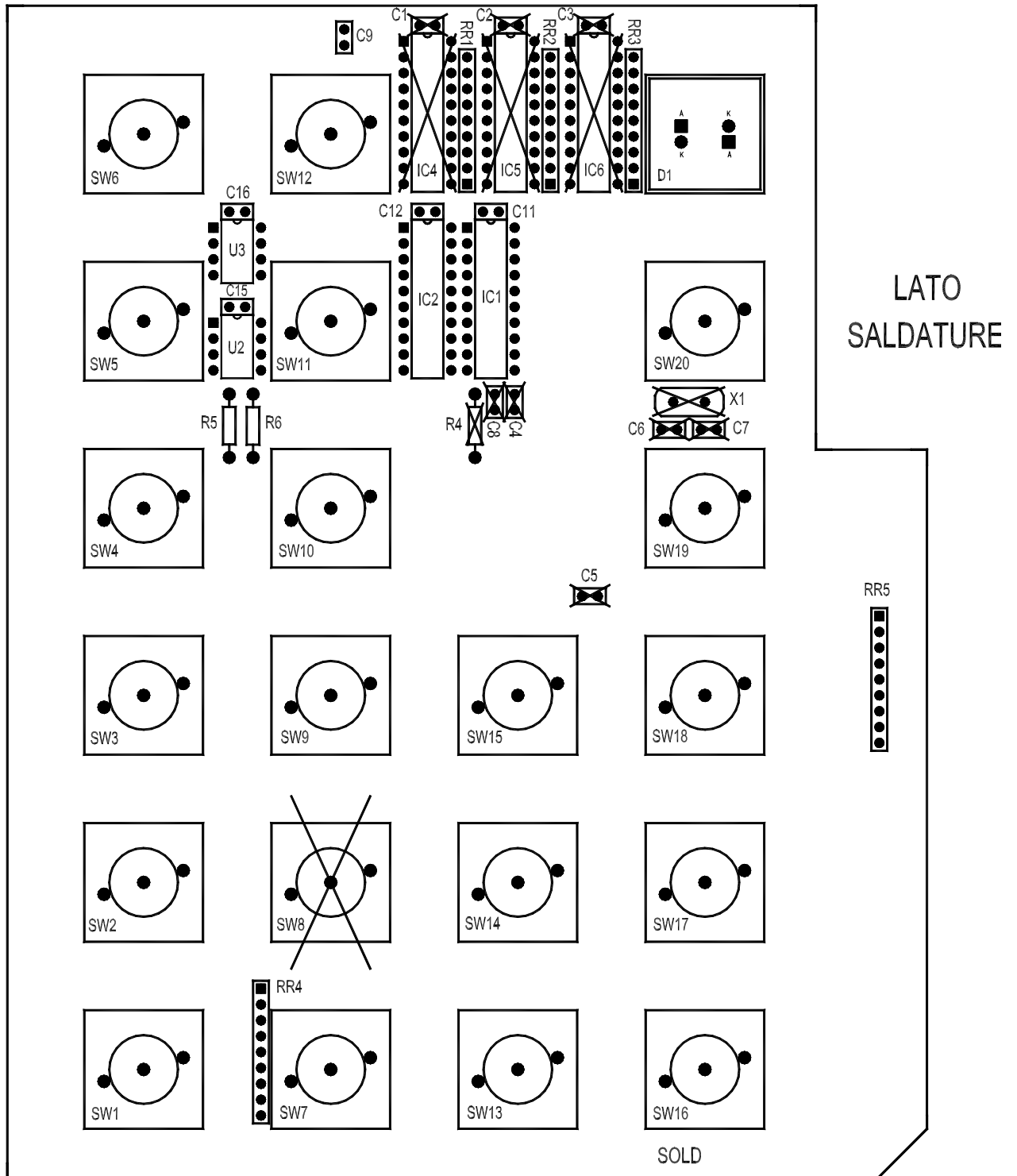
PCB 01-170 MAIN CPU

The information regards:

Analog Inputs (all values are direct output of ADC converter)
- AEC 1, AEC 2, AEC 3 = OFFSET = Offset voltage of each one of the three fields of AEC detector, number that appear in TEST mode are 3 times more of the OFFSET value displayed on LCD in normal operating mode.
- CMPR = ZERO value (no compression applied) of the compression trolley, normal values are less than 300
- TEMP = the tube temperature sensor from PCB 02-171 (1222=25°)
- DIGI   = not in use for Lilyum
- DOSE = voltage of skin to source distance potentiometer (about 200 with paddle UP and about 1300 with paddle down) .
- Vdc   = DC voltage across input capacitors of Inverter (1168=583Vdc)
- GONI = C-arm digital inclination normal value with C-Arm in Vertical position =1025
- Connector CN 10, Pins 9, 11, 13 and 15 = not in use for Lilyum

PCB 03-186 SERVICE BOARD

- Connector CN9, pin 2 = Door of diagnostic room. Normally CLOSED to make exposure otherwise "DOOR OPEN" alarm is generated .
- Connector CN11, pin 2 = C-ARM UP normally OPEN(if CLOSED without push button pressed, "CHECK C-ARM PUSHBUTTON" alarm is generated in normal operating mode.
- Connector CN11, pin 4 = C-ARM DOWN normally OPEN(if CLOSED without push button pressed, "CHECK C-ARM PUSHBUTTON" alarm is generated in normal operating mode.
- Connector CN12, pin 1 = Foot Pedal compression DOWN normally OPEN(if CLOSED without Foot Pedal pressed, "CHECK FOOT PEDAL SWITCHES " alarm is generated in normal operating mode. (same of CN17 pin 3 of PCB 03-188)
- Connector CN12, pin 3 = Foot Pedal compression UP normally OPEN(if CLOSED without Foot Pedal pressed, "CHECK FOOT PEDAL SWITCHES "alarm is generated in normal operating mode. (same of CN17 pin 1 of PCB 03-188)
- Connector CN17, pin 1 = Gas Spring safety switch normally CLOSED, if contact is OPEN "GAS SPRING DEFECTIVE " alarm is generated in normal operating mode.
- Connector CN18, pin 2 = x-ray push button, normally OPEN.

Select Output by means of mAs [+] mAs [-]
Press x-ray pushbutton to activate selected Output.

- U13 = RY05 normally OFF. External Lamp
- U16 = RY04 normally OFF. Before testing disconnect CN7 to avoid that C-ARM moves !!
- U17 = RY08+RY04 normally OFF . Before testing disconnect CN7 to avoid that C-ARM moves !!

PCB 03-188 CPU MOTHER BOARD

The screens related to this board are two, not having room enough to show all the information together.

- Jumper 1 normally OPEN not in use for Lilyum
- Jumper 16 normally OPEN not in use for Lilyum
- Jumper 17 normally OPEN not in use for Lilyum
- Jumper 18 normally OPEN (refer to Technical Manual for more details)
- Connector CN17, pin 1 = Foot Pedal compression UP normally OPEN(if CLOSED without Foot Pedal pressed, "CHECK FOOT PEDAL SWITCHES " alarm is generated in normal operating mode. (same of CN12 pin 3 of PCB 03-186)
- Connector CN17, pin 3 = Foot Pedal compression DOWN normally OPEN(if CLOSED without Foot Pedal pressed, "CHECK FOOT PEDAL SWITCHES "alarm is generated in normal operating mode. (same of CN12 pin 1 of PCB 03-186)
- Connector CN17, pin 7 = C-ARM rotation Brake normally OPEN(if CLOSED without push button pressed, "CHECK BRAKE PUSH BUTTON "alarm is generated in normal operating mode.
- Connector CN32, pin 2 and 3 not in use for Lilyum
- Connector CN33, pin 1 and 3 not in use for Lilyum
- Connector CN34, pin 2 normally CLOSED. If OPEN, overcompression safety has been activated, RED LED2 of PCB 06-198 located on the top of compression trolley must be bright. In such circumstance only a power OFF / ON sequence can recover if there is no failure.
- Connector CN34, pin 3 not in use for Lilyum
- +15 = Y if onboard +15Vdc voltage is present and sensed
- -15 = Y if onboard -15Vdc voltage is present and sensed (-15Vdc is also used for LCD bias and if not present LCD doesn't work)
- +24 = Y if onboard +24Vdc voltage is present and sensed
- VDC = Power Inverter DC input. Correct voltage reading at this point depends on RV1 of same PCB connect a DC voltmeter to Inverter DC input and adjust RV1 till to have same reading.
- **Applied compression force** The last number on the right of VDC= xxx is the same of CMPR of PCB 01-170 and is only provided to check on board connection

between the load cell (onboard of compression trolley) and the AD converter (onboard of CPU 01-170). (number 0202 actually showed on the screen image)

Select Output by means of mAs [+] mAs [-]
Press x-ray pushbutton to activate selected Output.
Clutch power supply (digitally programmable current generator)
- U01 = current generator for Clutch supply normally OFF. Connect a current meter in series with the clutch at CN27, press x-ray pushbutton and check that current will increase of about 1,9mA
- U02 = current generator for Clutch supply normally OFF. Connect a current meter in series with the clutch at CN27, press x-ray pushbutton and check that current will increase of about 3,7mA
- U03 = current generator for Clutch supply normally OFF. Connect a current meter in series with the clutch at CN27, press x-ray pushbutton and check that current will increase of about 10mA
- U04 = current generator for Clutch supply normally OFF. Connect a current meter in series with the clutch at CN27, press x-ray pushbutton and check that current will increase of about 20mA
- U05 = current generator for Clutch supply normally OFF. Connect a current meter in series with the clutch at CN27, press x-ray pushbutton and check that current will increase of about 40mA
- U06 = current generator for Clutch supply normally OFF. Connect a current meter in series with the clutch at CN27, press x-ray pushbutton and check that current will increase of about 86mA
- U21 TR24 (CN27) Clutch boost, press x-ray pushbutton to apply 24Vdc to the clutch

Compression motor driver
- U09 RY01 output press x-ray pushbutton and check if RY01 goes ON other related parts can be checked according to the schematic.
- U14 RY04 output press x-ray pushbutton and check if RY04 goes ON other related parts can be checked according to the schematic. (compression motor will start moving paddle DOWN))
- U22 20V output at CN24 compression motor when x-ray pushbutton is pressed
- U23 18V output at CN24 compression motor when x-ray pushbutton is pressed
- U24 14V output at CN24 compression motor when x-ray pushbutton is pressed

C-arm brake motor driver
- U11 TR13 output press x-ray pushbutton and check if +24 appears at CN21 and/or the C-ARM brake motor rotates.
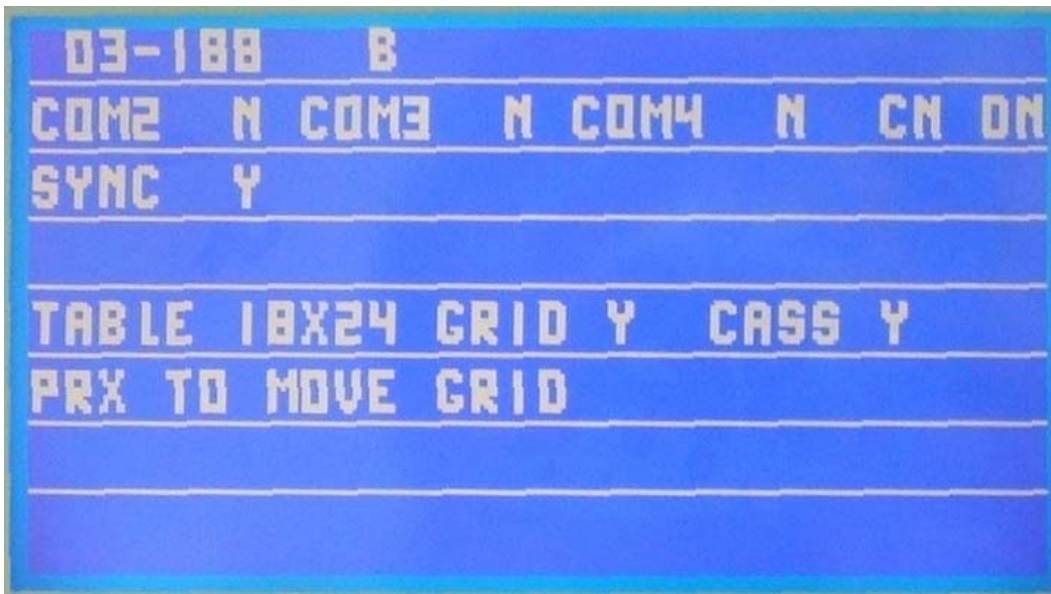
Buzzer
- U18 Buzzer output press x-ray pushbutton and check if Buzzer sounds.

Exposure counter
- U19 CNTP1 output press x-ray pushbutton and check if exposure counter increments counts number.

IC17 LOW or HIGH is not relevant as not in use for Lilyum
- U20 IC10   not in use for Lilyum
- EXTRA1 CN33   not in use for Lilyum
- EXTRA2 TR35   not in use for Lilyum

- COM 2 = has only TX and RX lines, if such lines are connected with a loop back connector, N must change to Y if serial port is working properly.
- COM 3 = has only TX and RX lines, if such lines are connected with a loop back connector, N must change to Y if serial port is working properly.
- COM 4, C , D = are not in use for Lilyum .
- SYNC = normal condition Y. If N check IC4 H11L1 or replace the board.
- TABLE = size 18x24 or 24x30 depending on the table connected. No table size appears if no table is connected or table is not detected for a fault. Check with another table or use an external cable CV0156before to replace the board 03-188.
- GRID = Y with grid table, N with grid-less table. If grid/no grid detection doesn't work, check with another table or use an external cable CV0156 before to replace the board 03-188.
- CASS = Y with cassette in or N with cassette out or not detected for fault. In case of malfunction check cable or use a spare external cable before to replace PCB 03-188
- PRX = press x-ray pushbutton to check grid movement.