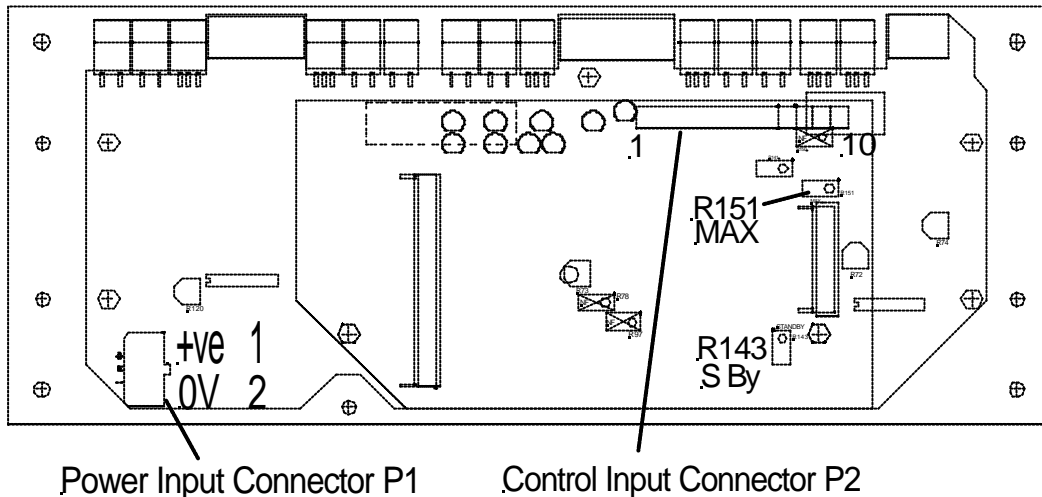


APPLIED KILOVOLTS

XL X-RAY PSUs
In Oil
Safety Instructions
MAY07

XL series of X-ray Power Supplies With HV section in Oil

Installation & Safety Instructions



Input Connectors:

Power Connections:

Input Connector P1:

Via Molex Sabre Series Straight Header:
Molex Part no 43160-2102 pcb mounted

– RS part no 363-9932

Use mating Molex Part no 44441-2002
Fitted with Molex crimped terminals 43375-1001

- RS part no 363-9875
- RS part no 364-0055

Pin1 = +24V $\pm 0.5V$ @ <7A

Pin2 = 0V

Note the unit is not fused, and relies on the 24Vdc supply having appropriate current limiting, or fusing to protect the wiring and the XL Power supply.

Control Input Connections :

10Way Molex

The Molex pins are part no 8500108 & the 10 pin socket 10011104

Control Input Connections:

Pin 1	Inhibit i/p.
Pin 2	Cathode voltage control i/p.
Pin 3	Beam current control i/p
Pin 4	Cathode voltage monitor o/p.
Pin 5	GND
Pin 6	Cathode current monitor o/p.
Pin 7	Fault o/p.
Pin 8	Filament Current monitor o/p.
Pin 9	10V reference o/p
Pin 10	Wiper of pot R150 (normally not fitted)

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- Pin 1 Inhibit
TTL Logic compatible input - Cathode Voltage on/off control
LOW = unit ON.
When the unit has tripped, this needs to be released High, and on re-asserting Low it clears the trips, turns the Cathode voltage on, and starts the sequencer.
Note this is NOT a safety input, and must not be used as a safety interlock input.
- Pin 2 Cathode voltage control i/p. MUST not exceed -0.25V, or +10.25V with respect to Pin 5.
0 to +10V i/p controls the cathode o/p voltage from 0 to 100%.
Input impedance >10kohm.
- Pin 3 Beam Current Control i/p. MUST not exceed -0.25V, or +10.25V with respect to Pin 5.
0-10V i/p sets the beam current from 0 to 100%.
Input impedance >10kohms
- Pin 4 Cathode voltage monitor
0 to +10V o/p represents 0 to 100% cathode voltage.
O/P impedance 10kohm.
- Pin 5 GND reference for all signals.
- Pin 6 Cathode Current Monitor
0-10V o/p represents 0 to 100% beam current
O/P impedance 10kohm
- Pin 7 Fault Trip o/p
Active LOW digital o/p if the unit is over-temperature, or other fault asserted.
Trip is latched, and cleared (if unit has cooled down) by de-asserting, and re-asserting INH.
Open collector o/p with 10kohm pull-up to 5V
- Pin 8 Filament Current Monitor
0-10V o/p represents beam current – 0-100%
O/P impedance 10kohm
- Pin 9 10V reference o/p for use when using potentiometers to set control voltages.
- Pin 10 Wiper of Potentiometer R150 (normally not fitted)

Potentiometer Control of running parameters:

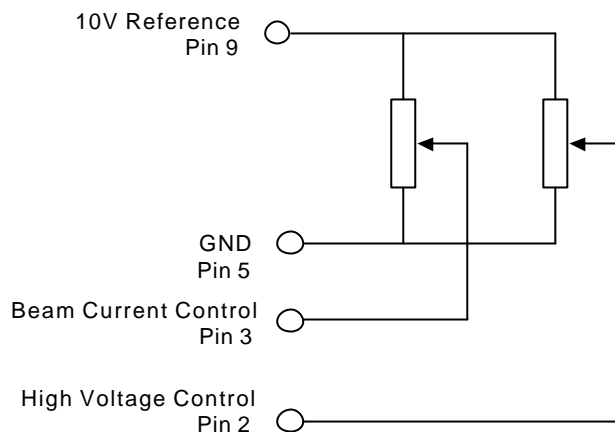
The unit is intended to be run with 0V to 10V control signals for Cathode Voltage, and Beam Current. However either or both of these can be generated from potentiometers if required.

Pin 9 of the Signal Connector is a 10V reference o/p for connection to the high side of the potentiometers. This point is not separately buffered. The unit will not work correctly, and damage may result if this point is shorted to ground.

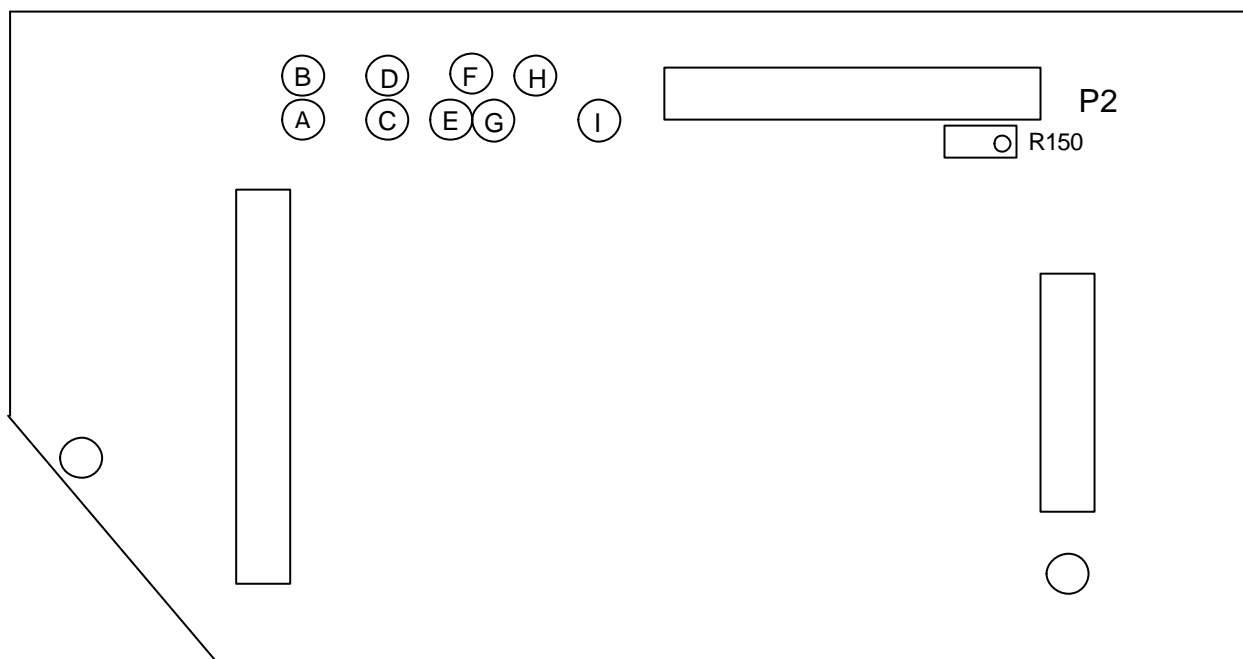
Where either the High Voltage or the Beam Current is required to be set by a potentiometer, then the potentiometer should be put between this point and Ground, with the wiper giving the control voltage. Potentiometers should be 10kohms or greater. When fitted, R150 can be used to provide the fixed control signal by linking to Pin 10 of the input connector.

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Indicators



A = Under voltage warning
B = Under voltage latch
C = Under current warning
D = Under current latch
E = Positive over current warning

F = Over current latch
G = negative over current warning
H = over temperature latch
I = Unit Enabled

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User Adjustments:

There are 2 potentiometers for user adjustment of the limits of the filament current. The position of these is shown at the top of this document.

Please note that **all** other potentiometers are set in the factory and are not adjustable by the customer.

- | | |
|-----------------|--|
| “S BY”
R143 | sets the filament current while the unit is in Stand-by mode, i.e. not running.
By leaving the filament with a stand-by current, the thermal shock to the filament at turn-on, is minimised. This is set to 30% before shipping.
Anticlockwise turns this to zero. |
| “MAX” -
R151 | sets the maximum current the filament can draw under any conditions. This particularly limits the maximum current the filament draws during turn-on, minimising this stress on the filament. This is set to 100% before shipping.
Clockwise turns this to the maximum current the unit can provide. |

Suggested set-up procedure:

- 1/ Set ‘S BY’ fully anticlockwise, and ‘Max’ fully anticlockwise.
- 2/ Monitor the X-ray tube’s beam current on Pin 6 of the input connector, and the filament current on Pin 8.
- 3/ With the unit in stand-by mode, i.e. Pin 1 - INH - High or open circuit, confirm both the beam current and filament current are at zero.
- 4/ Apply the required control voltages to Pin 2 to set the required cathode voltage, and Pin 3 for the required beam current.
- 5/ Take Pin 1 low to turn the unit ON.
- 6/ Progressively wind up the ‘MAX’ potentiometer, while monitoring the beam current, and filament current. Note the filament current required to achieve any beam current. The ‘S BY’ potentiometer will need to be set at a figure below this level.
- 7/ Continue to increase the ‘MAX’ potentiometer value. Note the filament current required to achieve the required beam current. As the tube ages this figure will increase. The ‘MAX’ potentiometer will need to be set at a figure sufficiently above this level to allow for the tube’s ageing.
Note that if the tube is used at a variety of cathode voltages, then the lowest cathode voltage will require the highest filament current for a given beam current.
- 8/ Put the unit into Stand By mode (Take pin 1, INH, High) and set ‘S BY’ potentiometer to give the required stand-by current, as determined at step 6/.
- 9/ Set the beam current control, Pin 3, to zero, turn the unit back on, into its normal running mode, and confirm that the beam current remains at zero. If there is significant beam current, then the ‘S BY’ potentiometer needs to be reduced.

Cleaning

Use a lint free cloth soaked with isopropyl alcohol, ensuring the unit is completely dry before use.

Environmental Conditions

Indoor use only,
Altitude up to 2000m,
Operating Temperature 0°C to +50°C,
Storage Temperature -35°C to +85°C.
The unit is to be supplied from a current limited supply providing 24Vdc, impulse limited to (overvoltage) Category I of IEC60364-4-443.

(Low Voltage Section) Maximum relative humidity 80% for temperatures up to 31°C, decreasing linearly to 50% relative humidity at 40° C,

For use in an environment of pollution degree 2.

(High Voltage Section) Fully submerged in appropriate High Voltage Insulation Oil.

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GENERAL

On receipt the unit should be carefully unpacked and inspected to ensure that no transit damage has occurred. Provided that this inspection is satisfactory and reveals no evidence of damage then installation can proceed.

If an electrical test is to be carried out prior to fitting the power supply, it is essential that the person undertaking this work has received appropriate technical training to be aware of the hazards to which that person may be exposed in performing the tests, and of measures to minimise the risks to themselves, and other personnel. Metallic or conductive tools should not be used to adjust any of the potentiometers. The unit has no user serviceable parts and should not be dismantled. The high voltage section must only be operated in a fully enclosed oil-filled tank.

DO NOT HANDLE OR TOUCH THESE UNITS WHEN THE SUPPLY IS CONNECTED. AFTER DISCONNECTION FROM THE SUPPLY, ALLOW 30 SECONDS BEFORE HANDLING SO THAT ALL THE CAPACITORS CAN DISCHARGE. To ensure that the output is fully discharged short to ground before touching any high voltage circuit.

Do not operate the unit outside the specified limits given above; failure to do so may damage the unit.

COMPLIANCE WITH SAFETY STANDARDS

The unit is designed to meet Normalised European Safety Standards and hence installation of the power supply unit into the equipment should comply with the following requirements.

- a. A PROTECTIVE EARTH must be provided for safety in accordance with EN61010 Part 1 : latest : Clause 6.5.1. The case of the units should be bonded to this protective earth.
- b. The output is classed as hazardous and must therefore not be accessible to operators. The output must be isolated from accessible circuits by Double Insulation or a protective screen as defined in EN61010-1.
- c. The High Voltage section is intended to be installed in a fully enclosed oil-filled tank and should not be accessible to the operator. Access should be restricted to authorised service personnel only, with use of a tool.
- d. The low voltage section, external to the tank, has no hazardous voltages, however for safe operation of the X-ray tube, and the high voltage section, must not be operated outside the limits defined in this document.

INSTALLATION

The outputs of these units are considered hazardous and should be installed such that they cannot become accessible. The output should be connected such that the shortest creepage and clearance path is to a protective earth connection. ENSURE that a LOW IMPEDANCE connection is made to the unit chassis from the system PROTECTIVE EARTH. The safety earth conductor must not contain any switches or fuses.

Under worst case conditions the unit draws a current of 7A and any input supply cable must be of a suitable type and rating. The unit is not fitted with a fuse and so must be operated from a limited supply with a current limit <8 amps. Fuses may be fitted externally to the unit to protect the unit and interconnecting wiring etc. but these should be rated to prevent nuisance failures.

Ensure that the filaments outputs are connected to the load prior to operation of the unit and that a good low impedance, high voltage joint is made. Sharp points on the joints to the filament connections should be avoided as this will cause high voltage stress points within the oil. Care must be taken to ensure appropriate creepage and clearance distances from these connections to earth are maintained to ensure no breakdown occurs. These distances will depend upon the oil used – please note that many oils degrade over time in this environment, and allowance needs to be made for this over and above the manufacturer's rated insulation values for 'fresh' oil. Care must be taken not to damage the filament wire insulation when forming the connections to the filament.

During arcing, currents exceeding 1000 Amps will flow. It is important that these currents return to the high voltage power supply by the shortest possible route. For this reason it is imperative that the High Voltage PCB is bolted directly to the oil tank, and the resistance of the electrical connection be checked to be <0.1ohm.

Adequate ventilation should be provided to keep the unit cool. The ambient air temperature around the low voltage section must not exceed 45 °C. The oil temperature must not exceed 70 °C. The unit is fitted with a thermal cut-out to protect itself should the oil temperature exceed this level. To restart the unit it must be allowed to cool. De-asserting and re-asserting the INH input will then clear the trip. The unit will operate in any orientation.

OPERATING NOTES

- 1/ HIGH VOLTAGES ARE DANGEROUS. ENSURE THE OUTPUT IS FULLY DISCHARGED BY SHORTING TO GROUND BEFORE TOUCHING ANY HIGH VOLTAGE CIRCUIT.
- 2/ The unit is short circuit proof but care should be taken that the high voltage cannot be shorted into one of the low voltage interconnections.
- 3/ TO ENABLE THE UNIT PIN 1 MUST BE TAKEN TO LESS THAN 1.5V WITH RESPECT TO PIN 5.

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