

APPLIED KILOVOLTS

XF X-RAY PSUs

Safety Instructions

Aug 07

SAFETY & INSTALLATION INSTRUCTIONS FOR XF Series

PLEASE READ CAREFULLY BEFORE INSTALLING OR OPERATING THIS POWER SUPPLY

Power Supply Warning Symbols

Caution,
Risk of electric shock



Caution
Refer to accompanying documentation



Input Supply Voltage 24Vdc \pm 1V at 7A .

Mounting

4 off M4 clearance holes.

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.
Maximum relative humidity 80% for temperatures up to 31°C, decreasing linearly to 50% relative humidity at 40° C,
The unit is to be supplied from a current limited supply providing 24Vdc, impulse limited to (overvoltage) Category I of IEC60364-4-443.
For use in an environment of pollution degree 2.

Input Connectors:

Power input Connector P1 just below the fan:

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 dc \pm 1V
Pin2 = 0V

Control Input Connector (right front, on top PCB.):

10Way Molex

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

Control Input Connections:

Pin 1	Cathode current monitor o/p.
Pin 2	24V
Pin 3	Cathode voltage monitor o/p.
Pin 4	Cathode voltage control i/p.
Pin 5	Inhibit i/p.
Pin 6	Over-current trip o/p.
Pin 7	Over-temperature trip o/p.
Pin 8	Heater current monitor o/p.
Pin 9	Beam control i/p.
Pin 10	0V signal.

Pin 1 of the input connector is the Left Hand pin.

APPLIED KILOVOLTS

XF X-RAY PSUs
Safety Instructions
Aug 07

- Pin 1 Cathode Current Monitor
0-10V o/p represents beam current – 0-100%
O/P impedance 10kohm
- Pin 2 24Vdc $\pm 1V$
Direct connection (unfused) to 24V supply to the unit. This is not the connection for supplying power to the XF PSU, but can be used for monitoring that power is applied to it,
This supply would be removed by the safety gating interlock, which removes power to the Unit.
- Pin 3 Cathode voltage monitor
0 to +10V o/p represents 0 to 100% cathode voltage.
O/p impedance is 10kohm.
- Pin 4 Cathode voltage control i/p
0 to +10V i/p controls the cathode o/p voltage from 0 to 100%.
Input impedance >10kohm.
- Pin 5 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 6 Over-current Cut-out
Active LOW digital o/p if Beam Current exceeds cut-out threshold.
Cut-out is cleared when over-current condition clears.
Open collector o/p with 10kohm pull-up to 5V
- Pin 7 Over Temperature Trip
Active LOW digital o/p if the unit is over-temperature.
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 0-100% filament current
O/p impedance 10kohm.
- Pin 9 Beam Control i/p
0-10V i/p sets the beam current from 0 to 100%.
Input impedance >10kohms
- Pin 10 0V
Ground reference for all signals.

Potentiometer Control of running parameters:

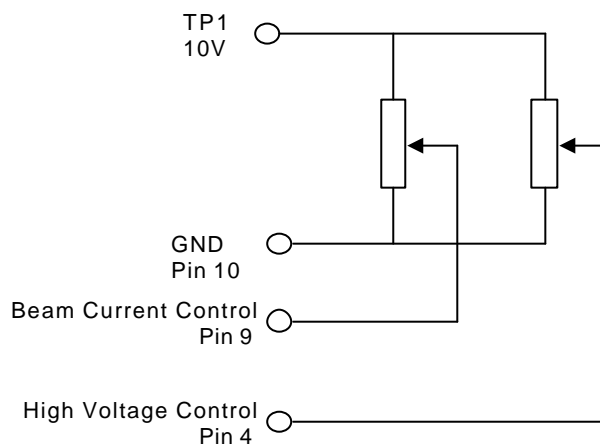
[The unit is intended to be run with 0V to 10V control signals for Cathode Voltage, and Beam Current. However these can be generated from potentiometers if required.]

On the middle pcb, below the Right Hand end of the input connector there is a test point labelled TP1, near the front edge of the board.

This is a 10V reference used by various parts of the circuit.

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.

This point is not separately buffered. The unit will not work correctly, and damage may result if this point is shorted to ground.



Indicators

D3 Power ON indicator RED near the power input connector.
This confirms 24V power is applied to the unit.

D2 Tripped indicator ORANGE LH end of the middle pcb.
This indicates that the unit has tripped.
This led is not lit in normal running.

[To clear the trip, take INH – pin 5 High, or open-circuit, and then re-assert Low.]

APPLIED KILOVOLTS

XF X-RAY PSUs
Safety Instructions
Aug 07

User Adjustments:

There are 2 potentiometers for user adjustment of the limits of the filament current. These are positioned to the right of the unit on the middle pcb.

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

Left Potentiometer:

- "S BY" - 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.
Anticlockwise turns this to zero.

Right Potentiometer:

- "MAX" - 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.
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 1 of the input connector, and the filament current on Pin 8.
- 3/ With the unit in stand-by mode, i.e. Pin 5 - INH - High or open circuit, confirm both the beam current and filament current are at zero.
- 4/ Apply the required control voltages to Pin 4 to set the required cathode voltage, and Pin 9 for the required beam current.
- 5/ Take Pin 5 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 5, 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 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 lowering a little.

APPLIED KILOVOLTS

Safety Instructions

X-RAY PSUs
Safety Instructions
Aug 07

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.

It is essential that the person undertaking the installation and set-up of this power supply 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.

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.

Care should be taken not to 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 for installation in equipment conforming to EN61010 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 : 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. It is intended to be installed in an electrical enclosure and the unit and its input connector should not be accessible to the operator. Access should be restricted to authorised service personnel only, with use of a tool. Care should be taken to prevent access to the interior of the unit and protect against items (e.g. tools or wires) inadvertently entering the interior of the unit.
- d. The unit is not fitted with a fuse and so should be operated from a limited supply of <8 amp.
- e. The primary safety interlock must remove the 24Vdc supply, thereby removing the source of energy, NOT relying on the Inhibit input.

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 should be operated from a limited supply. Fuses may be fitted externally to the unit to protect unit and interconnecting wiring etc. but these should be rated to prevent nuisance failures. Care should be taken in the design of the interconnecting wiring within the system to ensure that connectors with hazardous voltages cannot be connected to accessible circuits.

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 either the high voltage or return joint should be avoided as this will cause corona which will make the output appear noisy. In general a tracking distance (creepage distance) of 25mm (1 inch), per 10kV to earth is advised as a minimum to ensure no breakdown or corona occurs, a much greater distance will be required under adverse conditions. Care must be taken not to damage the cable inner when forming the connections.

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 using the screen (shield) of the output cable. Failure to observe this will result in the control terminals of the unit seeing large voltage spikes during arcing and radiation of electromagnetic interference.

Adequate ventilation should be provided to keep the unit cool and the ventilation inlets should not be covered in any way. The ambient air temperature around the inlet must not exceed 45 °C. The unit is fitted with a thermal cut-out to protect itself should the ambient 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, however it is not recommended to operate with the silk-screened face as the lowest face.

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 control pin connections.
- 3/ TO ENABLE THE UNIT, PIN 8 MUST BE TAKEN TO LESS THAN 1.5V WITH RESPECT TO PIN 9.