

## Combi Power Supply for electron beam heating e-beam heating power supply

The tectra Combi Power Supply is a general purpose high-power, high-voltage, DC power supply with a separate AC high current floating output. Applications in which two such power circuits are required include e-beam heating (electron beam heating), where the high current circuit is used to heat a filament and the high-voltage circuit to accelerate the thermionic electrons towards a target.



This rugged straightforward power supply is based on dependable high voltage (HV) transformer and Variac technology. Two separate transformers are used for the two circuits allowing independent control.

A full-wave rectifier and low pass filter provide an unregulated smoothed DC output. Under no load, the output voltage will rise to >3.0kV falling back when a load is applied. This has the advantage of allowing the supply also to be used in applications where a striking voltage is required followed by lower voltage sustained operation e.g. gas discharges.

The output is configurable during manufacture (and optionally by the user) such that (a) the filament output is floated at the potential of the HV circuit or (b) the filament circuit is grounded and the HV is available on a separate output.

The power supply is offered complete with cables and HV connector with matching HV vacuum feedthrough mounted on an NW35CF (2 $\frac{3}{4}$ " ) flange.

Other parts such as might be needed for construction of simple e-beam evaporators/ heaters including barrel connectors, linear feedthroughs, cooling jackets and filaments are also available from tectra.

### Applications:

The power supply is ideal for e-beam heating applications where the electrons are directly attracted from the filament to the item to be heated. Small samples can be heated to over 3.400°C e.g. Tantalum can be evaporated from 2mm rod or foil: Iron can be evaporated from a 6mm rod: A 1cm<sup>2</sup> sample, 1mm thick, could easily be heated to well over 2.000°C.

E-beam heating is very energy efficient since the vast majority of the electron energy is delivered directly to where it's needed and very little is reflected. This is in stark contrast to more usual thermal heating methods where energy from the heater is radiated in all directions and partially reflected from the sample.

The power supply could also be used for broad-beam/high-power electron guns, although the relatively large ripple voltage makes it unsuitable for fine focus electron optics.

The two output configurations described above allow the filament to be floated at high potential and the target to be grounded. This is required for electron gun type applications and can also be very convenient for electron beam heating where the sample is held in a holder which is not easily isolated to 3kV. Some shielding of the filament is recommended to guide the electrons towards the target.

However electron beam heating may also be achieved by biasing the target to high potential and grounding the filament. This has the advantage that less filament shielding may be required since the chamber walls are at the same potential as the filament and therefore have no attraction for the electrons.

### Options:

- Control Input: External low level DC voltage (0-10VDC) can be used via this analogue input, to control the electron emission current by varying the filament temperature.
- Temperature Control Option: This enables the power supply to be used as part of a control loop e.g. with a temperature controller and thermocouple. Temperature stability of  $\pm 0.5^{\circ}\text{C}$  can be achieved even with inexpensive temperature controllers. PID controller and Control Input option above included. Requires Type C thermocouple.
- Polarity Switch Option: Permits user selectable output polarity. Polarity and output configuration selected internally. Filament circuit may be floated at negative potential or grounded. When grounded, the +HV is available on a separate output (SHV). Additional HV cable with SHV vacuum feedthrough on NW16CF (1.33" OD) flange included.



### Specification:

<b>HV Output</b> (full wave rectifier and low pass filter)	
Max Voltage	2.0 kV
Max current:	300mA
Max Power:	600W
Voltage control:	Manual (PID control optional)
Fuses:	electronic fuse to switch off at excess current
<b>Low Voltage Output</b>	
Max voltage:	30V
Max current:	16A regulated
Max Power:	480W
Current control:	Manual (PID control optional)
Fuses:	lead fuse
<b>Displays</b>	
HV circuit:	Current and voltage
LV circuit:	Current
Mains supply:	240VAC/50Hz (115VAC/60Hz option)
Housing:	19" rack mounting, 3U height
Cables:	HV cables rated to 15kV and 16A hardwired at power supply end and Power Gloves at feedthrough end, SHV cable and socket for High-Voltage circuit (according to polarity)