

50 eV to 5 keV
Energy Sweeping: Constant Beam Current and Approximately
Constant Spot Size Electron Beam

FOR USE IN:

- Surface Physics Studies
- Ionization Experiments
- Charge Neutralization

FEATURES / OPTIONS:

- Wide Energy Range
- Constant Beam Current
- Constant Spot Size
- Zoom Lens Focusing
- High Speed Pulsing
- Deflection, Rastering
- Computer / Remote Control



EGL-2022 Electron Gun Mounted on 2.75" CF Multiplexer

The Kimball Physics EGL-2022 Electron Gun, with its matching EGPS-2022 Power Supply, has applications in a variety of surface physics, ionization, charge neutralization, and other vacuum physics studies. It is a complete subsystem ready to attach to the user's vacuum system and turn on.

Beam energy, beam current, and spot size are independently adjustable over wide ranges. The energy is variable from 50 eV to 5 keV and the beam current from 1 nA to 100 μ A. By use of multi-staging and a computer-designed electron zoom lens, a constant beam current is maintained over a two-order-of-magnitude change in energy, with a spot size also roughly constant. The electron gun uses a unipotential cathode to generate a beam of low energy spread.

The gun design can include a positively biased acceleration grid to enhance emission and collimate the beam. A negative potential is typically applied to this grid element to collimate the beam, suppress emission, and cut off the beam.

UHV technology is used throughout. The gun can be run in vacuums from 10^{-11} torr up to 10^{-5} torr for the standard Ta disc cathode. The electron gun is bakable to 350°C with cables removed.

Optional cathodes include: 1) barium oxide discs (BaO, low light, low energy spread, min. vacuum 1×10^{-7} torr), 2) single-crystal lanthanum hexaboride (LaB6, small spot, high brightness, minimum vacuum 1×10^{-7} torr) and 3) yttria-coated iridium discs (Y_2O_3 - Ir, rugged, vacuum up to 10^{-4} torr, may survive brief loss of vacuum). Except for BaO, the cathodes are not damaged by repeated exposure to atmospheric gases or water vapor when cold. Cathode lifetime is a function of vacuum conditions and beam current as related to cathode temperature. Cathode lifetime at low currents in good vacuum may be in the many hundreds of hours, or even over a thousand hours.

Firing units are user-replaceable; spare firing units can be purchased new and used firing units may be returned to the factory for rebuild. Alternatively, the entire electron gun can be sent back to the factory for complete cleaning,

rebuild, cathode replacement, and optional in-vacuum testing. Stand-alone Faraday cup designs are available.

The extraction grid allows pulsing options: either fast capacitive beam pulsing or dual grid pulsing. Capacitive beam pulsing, using a Pulse Junction Box, permits fast beam pulsing down to 20 ns with 20% maximum duty cycle. Capacitive pulsing requires an external, variable-voltage pulse generator (not included). Pulsing of the electron beam can also be accomplished with dual grid supplies (variable and fixed), requiring only a TTL pulse input.

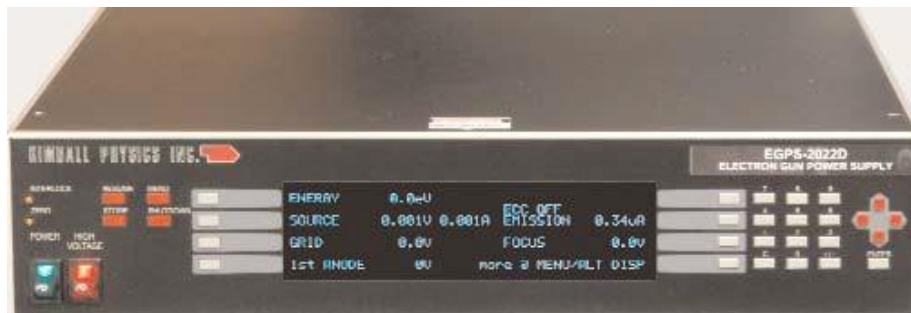
A rastering option can be provided by an on-board power supply module or as an additional feature in a LabVIEW™ software package.

The EGPS-2022 Power Supply features a modular design with miniaturized power supply clusters, optically isolated signals, and the new FlexPanel digital interface controller. The included power supplies are Beam Energy and X,Y Deflection, as well as floating Source/Emission

Current Control (ECC), Grid, First Anode and Focus supplies.

The FlexPanel provides a digital display screen and a keypad for programming control on the front panel. Rear panel connectors allow remote /computer control and metering of all gun power supplies. An RS-232 and mini-USB serial port and an analog input/output connector are included on standard power supply units. All common computer interface bus types can be accommodated, by use of appropriate digital to analog converters. RS-422/485 conversion is possible.

An optional LabVIEW™ computer program designed for the EGL-2022 is available for remote computer control and metering. Software is available in two options: 1) standard configuration via a simple serial connector interface, 2) using National Instrument DAQ modules and the 50-pin connector on the EGPS-2022. The program provides a virtual panel of controls and real-time metering on the user's computer screen.

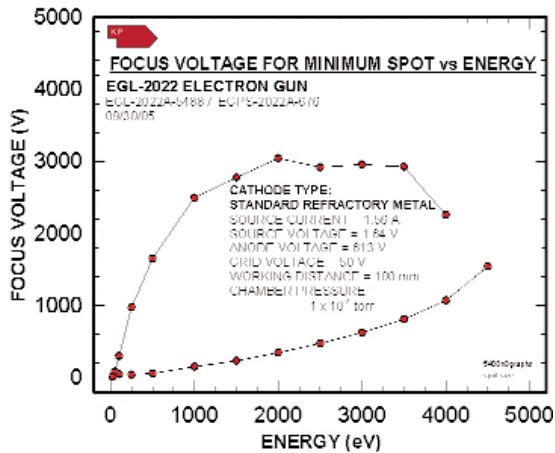
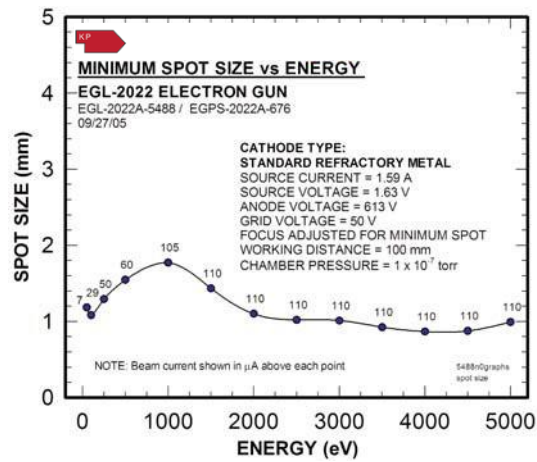
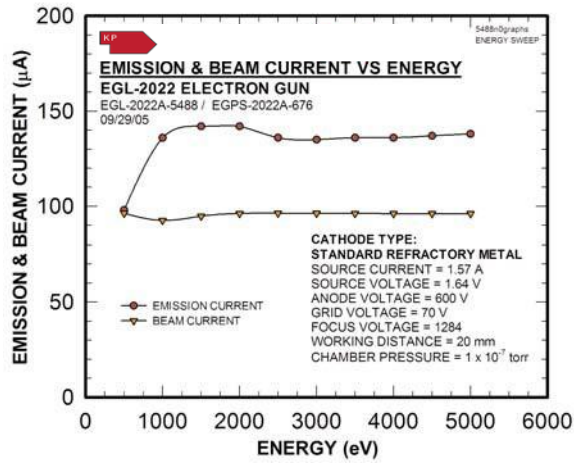


EGPS-2022 Electron Gun Power Supply with FlexPanel controller system.

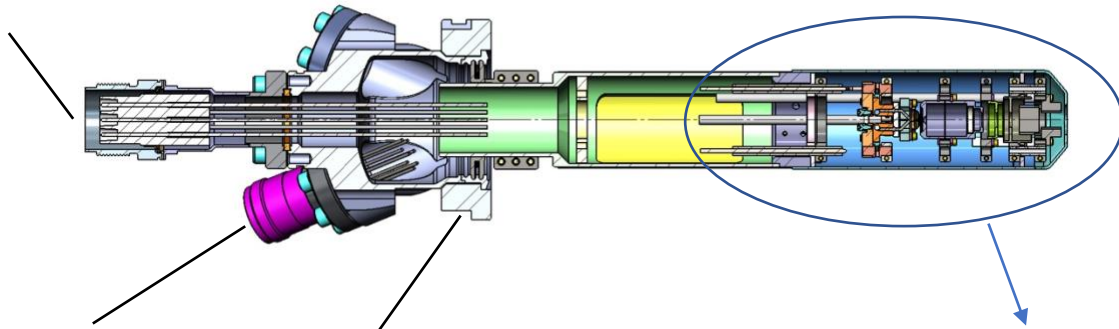
EGL-2022 ELECTRON GUN SPECIFICATIONS	
BEAM ENERGY	50 eV to 5 keV (Independently adjustable)
BEAM CURRENT	Standard: 1 nA to 100 μ A (Independently adjustable)
ENERGY SPREAD	Approx. cathode thermal spread, calculated: Ta - 0.5eV Y ₂ O ₃ - 0.4eV BaO - 0.3eV LaB ₆ - 0.4eV
SPOT SIZE	1 mm to 10 mm (Independently adjustable)
WORKING DISTANCE	Variable: 20 mm to 100 mm
BEAM DEFLECTION	4 pole electrostatic: $\pm 2^\circ$ approx. at 5 keV. Scales larger at lower energies
PULSE CAPABILITY (using appropriate pulse generator, not included)	Optional capacitive Pulse Junction Box: pulse width 20 ns to 100 μ s, rise/ fall 10 ns, 50 ohms impedance, 1 W standard (higher power available) Optional Dual Grid Power Supply: pulse width 2 μ s to DC, rise/ fall 500 ns, rep rates to 5kHz (TTL required)
BEAM UNIFORMITY	Gaussian
FIRING UNIT	Customer-replaceable Firing Unit includes precision-aligned cathode and Wehnelt (G-1) assembly, with insulators and connectors
CATHODE TYPE	Standard: Tantalum disc Optional: Lanthanum hexaboride (LaB ₆), Barium oxide (BaO), or Yttrium oxide (Y ₂ O ₃) Except for Barium oxide, cathodes not harmed by repeated exposure to atmospheric gases while cold
BEAM ALIGNMENT	Optional: Mechanical alignment with $\pm 2^\circ$ Port Aligner
MOUNTING	Flange Multiplexer with a 2 $\frac{3}{4}$ inch rotatable CF, including both tapped and clear mounting holes. Optional unmounted model with 9 in-vacuum leads.
INSERTION LENGTH	Standard: 200 mm, Range: 200 mm to 300 mm. Custom lengths available. Gun manufactured at standard length unless otherwise specified at time of order.
GUN DIMENSIONS	Gun diameter 34 mm, gun tube in vacuum
FEEDTHROUGHS	Multi-pin brazed ceramic, threaded stainless steel shell
CABLES / CONNECTORS	Multi-conductor high voltage fully ground-shielded cable, coaxial grid cable, low voltage deflection cable, with mating aluminum shell connectors, to connect gun and power supply. Standard lengths: 3 m Optional: 5 m
MAXIMUM BAKEOUT	350°C with cables removed

EGPS-2022 POWER SUPPLY SPECIFICATIONS	
OUTPUT	All necessary voltages to drive the EGL-2022 Electron Gun
ENERGY SUPPLY STABILITY	$\pm 0.01\%$ per hour; $\pm 0.02\%$ per 8 hours at full output
BEAM STABILITY	$\pm 0.1\%$ per hour with Emission Current Control (ECC) or $\pm 10\%$ per hour after warm-up without ECC
CONTROLS	FlexPanel controls: Energy, Source, Grid, First Anode, Focus, X and Y Deflection, Emission Current Control
METERING	FlexPanel digital meters: Energy, Source Voltage, Source Current, Emission Current, Grid, First Anode Voltage, Focus, X and Y Deflection
COMPUTER/REMOTE CONTROL & METER	Power supplies: 0 to +10 V (-10 V to +10 V, deflection) Metering: 0 to +2 V (-2 V to +2 V, deflection) Standard 50-pin connector for analog input/output and RS-232 and mini-USB serial port (RS-422 or RS-485 available, if specified at time of order)
SOFTWARE	Standard configuration designed for RS-232 and USB serial connections. Optional: National Instruments LabVIEW™ file, designed to run with NI DAQ modules
INPUT	115 VAC or 230 VAC, 50 to 60 Hz single phase, 250 VA
ENVIRONMENT	Temperature: 0 to 40°C, Relative humidity: 0 to 75% RH non-condensing, Classified as a pollution degree 2, installation category (overvoltage category) II environment unit
DIMENSIONS (width x height x depth)	17 in. x 3.5 in. x 22 in. excluding handles (425 mm x 90 mm x 560 mm); 19 in. rack mountable

OPTIONAL HARDWARE RASTER SPECIFICATIONS	
RASTER GENERATOR	Continuous control of X & Y Raster Amplitude, variable offset (Centering) and Frequency, with 0-10 kHz (X) and 0-100 Hz (Y) standard. All parameters controllable via serial interface, analog input, or computer control with LabVIEW™ software option.

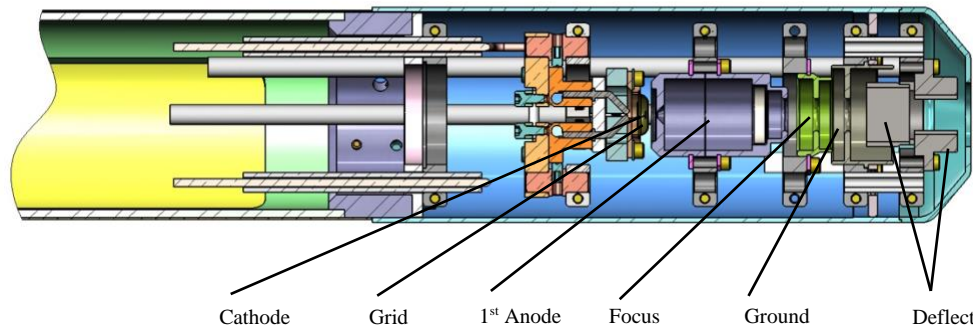


Source connector



Deflection connector

2.75" CF flange



Cathode

Grid

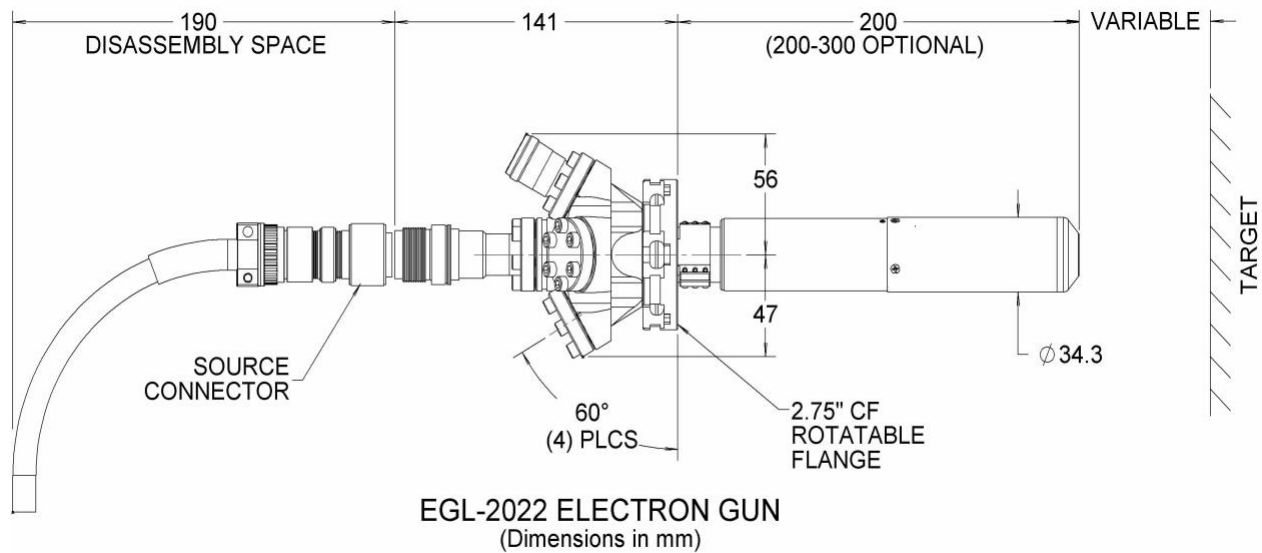
1st Anode

Focus

Ground

Deflection

EGL-2022 Electron Gun solid model cross-section.



References

For more information on electron sources / gun operations (and the technical bulletins and additional documents listed below), please visit the Resources and Documents section of our website.

General Operating Hints

Operating Instructions, Typical LabVIEW™ Electron Gun Systems

Beam Pulsing Options

Note: A comprehensive custom manual is supplied with each system.

Notes:

1. Charts /graphs show typical performance, data is for guidance only
2. It is not necessarily possible to achieve all maximum specifications simultaneously.
3. Specifications Subject to Change Without Notice.
4. DE Altobelli, DT Taylor 12/13/2022

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