

1 keV to 60 keV
Focusable, High Energy Electron Beam, Small Spot Size to 50 μm

FOR USE IN:

- General Vacuum Physics
- Radiation Studies
- Surface Bombardment
- Semiconductor Research
- Biological Specimen Radiation
- X-ray Generation
- Plasma Excitation
- Fluorescence Studies
- Surface Physics Studies

FEATURES / OPTIONS:

- Small Spot Size down to 50 μm
- Medium Current Beams to 5 mA
- High Current Beams to 10 mA
- Magnetostatic Focusing
- Magnetostatic Beam Shaping (optional)
- Magnetostatic Deflection
- Pulse Capability
- Internal Alignment During Operation
- User-Replaceable Firing Units



EGH-6210 Electron Gun mounted on with 2.75" inch CF Flange. Optional Turbo Pump and Ion Gauge not shown

The Kimball Physics EGH-6210 Electron Gun, with its matching EGPS-6210 Power Supply, is a complete subsystem ready to attach to the user's vacuum system and turn on. It can deliver electrons over a very broad range of energies, currents, and power. The EGH-6210 has applications in space materials testing, radiation studies, semiconductor research, x-ray generation and plasma excitation.

The gun uses a single-crystal lanthanum hexaboride (LaB_6) cathode to generate a high energy, focusable, small spot electron beam. Both beam energy and beam current are independently adjustable over wide ranges; the energy from 1 keV to 60 keV, and current from 10 μA to 5 mA. The electron beam can be pulsed by an input signal to the control grid.

The adjustable optics of the gun can adapt to different divergences and a range of working distances, suitable to a variety of applications. The magnetic focusing lens can vary the spot size from 10 mm down to 50 μm . The magnetic

centering and optional shaping coils provide additional beam control, allowing the user to deflect and shape the electron beam. Shaping typically results in an elliptical beam, both axes of which can be independently compressed or extended. The magnetostatic focusing lens and the deflection shaping quadrupole both produce results with low aberration. In addition, the cathode to anode spacing is internally adjustable to change perveance.

The gun features an adjustable cathode feedthrough assembly that allows the mechanical alignment of the firing unit with respect to the anode and the column. This alignment can be done in real-time while the gun is operating with beam on.

UHV technology is used throughout, and the gun can be run in vacuums from 10^{-11} torr to 10^{-7} torr. The electron gun is bakeable to 200°C with cables removed; bakeout is limited by the magnetic focus and deflection coils.

The cathode is single-crystal lanthanum

hexaboride (LaB_6 , small spot, high brightness, min. vacuum 1×10^{-7} torr). The cathode is not damaged by repeated exposure to atmospheric gases or water vapor when cold.

The gun design provides for differential pumping of the Source region with a 4.5" inch CF flange on the source chamber for attachment for a Turbo pump and a 2.75" inch CF flange for an ionization gauge. The gun is usually mounted on a 2.75" inch CF flange and has zero insertion distance, i.e., does not extend into the vacuum chamber. Due to the high-power beam produced by the EGH-6210, *X-ray shielding is essential*.

Firing units are user-replaceable without removing the entire gun from the vacuum chamber; 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. Various stand-alone Faraday cup designs are available.

The Power Supply System for the EGH-6210 is composed of two separate units: the EGPS-6210 Electron Gun Power Supply and a separate H.V. (high voltage) Power Supply controlled by the

EGPS-6210. The EGPS-6210 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, Magnetic Lens, and Magnetic X, Y Deflection, as well as the floating Source/ ECC, and Grid supplies.

The FlexPanel provides a digital display screen and a keypad controller for programming control on the front panel. Rear panel connectors allow remote /computer control and metering of all gun power supplies. A mini-USB, RS-232 or RS-422/485 serial ports 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.

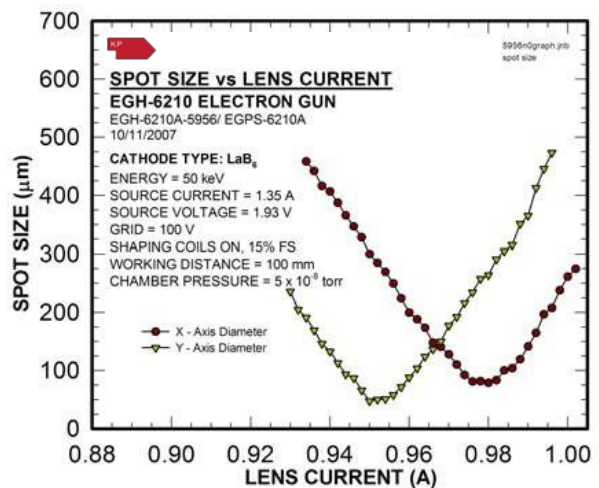
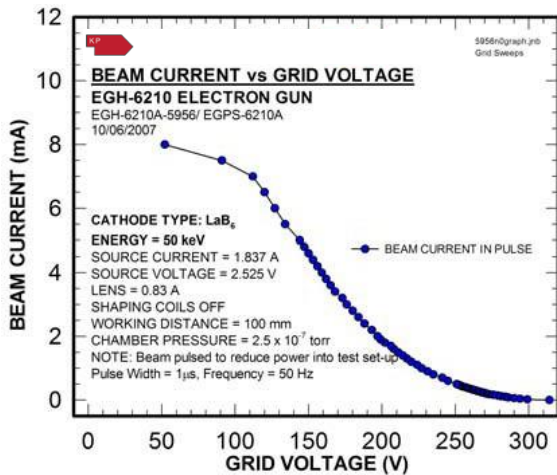
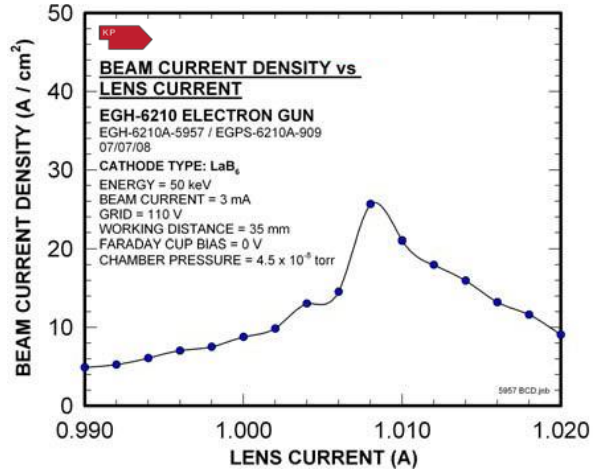
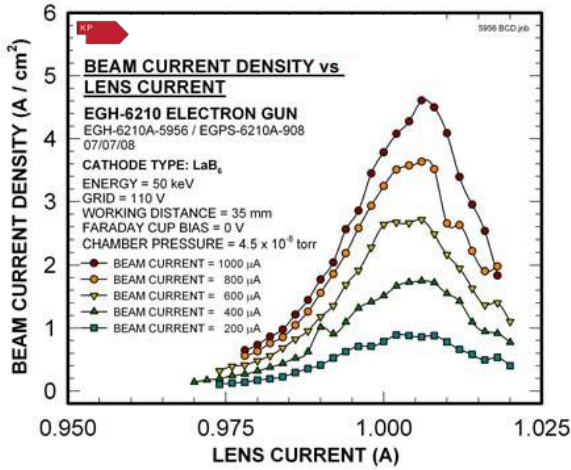
An optional LabVIEW™ computer program designed for the EGH-6210 is available for remote computer control and metering. Software is available in two options: 1) using National Instrument DAQ modules and the 50-pin connector on the EGPS-6210, or 2) via a simple serial connector interface. The program provides a virtual panel of controls and real-time metering on the user's computer screen.

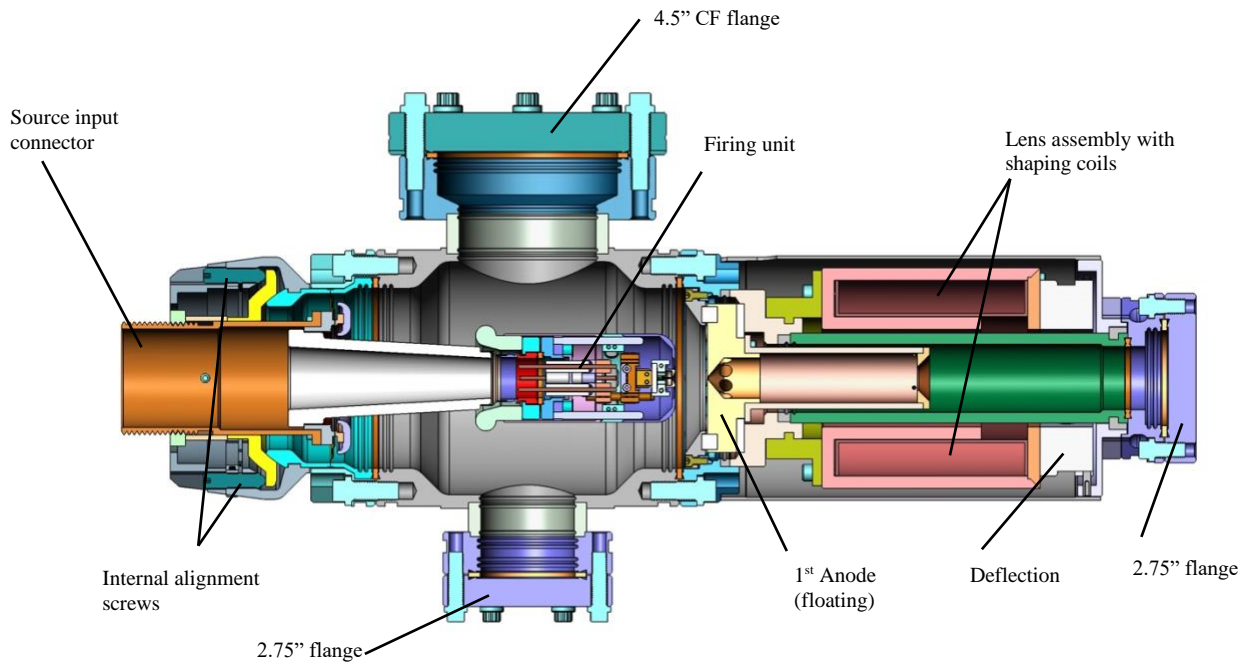


A typical lab set-up of a complete Kimball Physics system with power supplies, electron gun, and optional computer control system

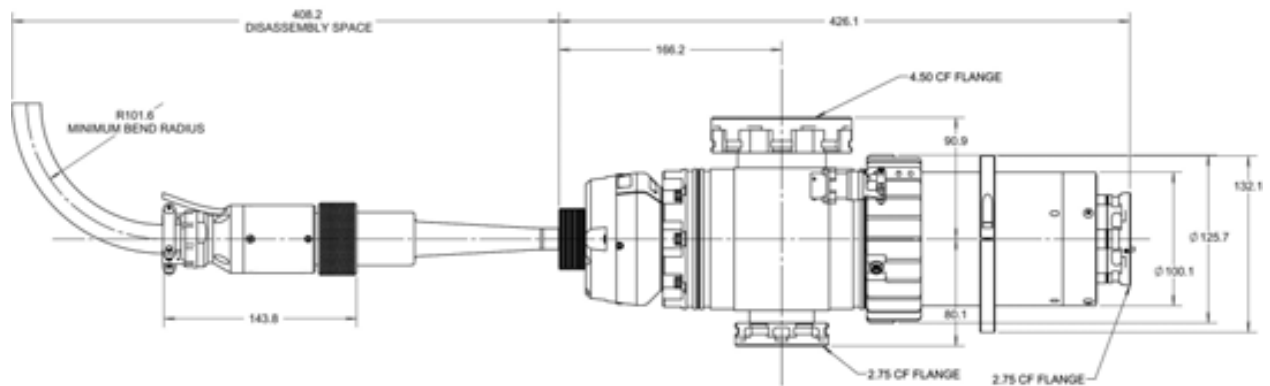
EGH-6210 ELECTRON GUN SPECIFICATIONS	
BEAM ENERGY	1 keV to 60 keV (Independently adjustable)
BEAM CURRENT	10 μ A to 5 mA (Independently adjustable)
ENERGY SPREAD	Approx. cathode thermal spread, calculated: LaB ₆ - 0.4eV
BEAM DIVERGENCE	Magnetostatic (Quadrupole) Optional: Magnetostatic beam shaping
SPOT SIZE	50 μ m to 10 mm
WORKING DISTANCE	50 mm to 1000 mm
BEAM DEFLECTION / ALIGNMENT	Magnetostatic: $\pm 0.5^\circ$ at 60 keV
PULSE CAPABILITY (using appropriate pulse generator, not included)	Optional Dual Grid Power Supply: pulse width 2 μ s to DC, rise/ fall 500 ns, rep rates to 5 kHz with optional LabVIEW™ program pulse generator or user's TTL pulser.
BEAM UNIFORMITY	Gaussian
FIRING UNIT	Customer-replaceable Firing Unit Cartridge includes precision-aligned cathode, and Wehnelt (G-1) assembly Entire firing unit also includes first anode
CATHODE TYPE	Standard: Lanthanum hexaboride (LaB ₆)
BEAM ALIGNMENT	Adjustable Feedthrough for mechanical alignment of firing unit while gun is operating
MOUNTING	Standard: 2 $\frac{3}{4}$ inch CF flange
INSERTION LENGTH	Zero mm
GUN DIMENSIONS	Gun length: 440 mm sealing surface to end of cable connector. Gun diameter: 217 mm max at flange cluster on source chamber (with pump and gauge), 105 mm diameter source chamber and lens support tube
FEEDTHROUGHS	Multi-pin brazed ceramic, threaded aluminum-plated shell for main cable and stainless steel shell for others
CABLES / CONNECTORS	All high voltage fully ground-shielded cables with mating metal to metal connectors, to connect gun and power supply. Standard lengths: 3 m, Optional: longer available
MAXIMUM BAKEOUT	200°C with cables removed (200°C for Magnetic Lens and Deflection coils, 350°C for Source chamber region)

EGPS-6210 POWER SUPPLY SPECIFICATIONS	
OUTPUT	All necessary voltages to drive the EGH-6210 Electron Gun (in combination with H.V. Power Supply)
ENERGY SUPPLY STABILITY	<0.01% per hour with 0.05% RMS ripple at full output
BEAM STABILITY	$\pm 0.1\%$ per hour with optional Emission Current Control or $\pm 10\%$ per hour after warm-up without ECC
CONTROLS	FlexPanel controls: Energy, Source, Grid, Lens, X and Y Deflection, optional Emission Current Control (ECC)
METERING	FlexPanel digital meters: Energy, Source Voltage, Source Current, Emission Current, Grid, Lens Current, X and Y Deflection Currents, Anode Current
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 mini-USB and RS-232 serial ports (RS-232, RS-422 or RS-485 available, if specified at time of order) Optional: NI DAQ Modules
SOFTWARE	Standard configuration designed for mini-USB and RS-232 serial connections. Optional: National Instruments LabVIEW™ file, designed to run with computer DAQ modules
INPUT	115 VAC or 230 VAC, (specify on order) 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)	Two units, total approximately: 17 in. x 20.3 in. x 22 in. excluding handles (432 mm x 516 mm x 560 mm); 19 in. rack mountable





EGH-6210 Electron Gun Solid Model Cross-section



EGH-6210 Electron Gun (Dimensions in mm)

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 11/21/2022

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