

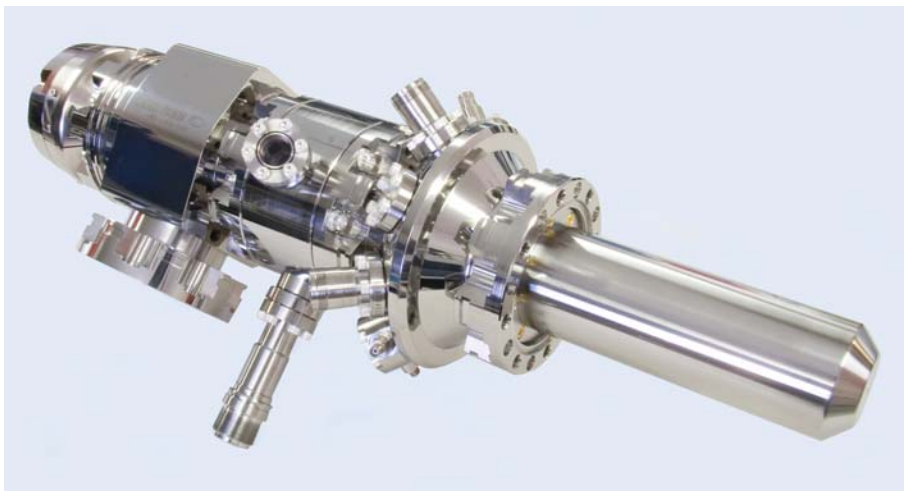
1 keV to 30 keV Medium Energy, Small Spot Electron Beams

FOR USE IN:

SURFACE PHYSICS
VACUUM PHYSICS EXPERIMENTS

FEATURES / OPTIONS:

NEW MODULAR DESIGN
PHOTO EMISSION OPTION
INTERNAL ALIGNMENT WHILE OPERATING
ELECTROSTATIC FOCUSING
QUADRUPOLE ALIGNMENT
OCTOPOLE DEFLECTION / RASTER / STIGMATOR
BEAM BLANKING, IN-LINE FARADAY CUP
INTERNAL MAGNETIC SHIELDING
DIFFERENTIAL PUMPING
SMALL SPOT DOWN TO 25 μm
BEAM CURRENT 1 nA TO 10 μA
UHV COMPATIBLE / BAKEABLE
COMPUTER / REMOTE CONTROL
USER-REPLACEABLE FIRING UNITS



EMG-4193 Electron Gun, 4½ CF mounting flange,

The Kimball Physics EMG-4193 Electron Gun, with its matching EGPS-4190 Power Supply and COPS-4190 Column Optics unit is a medium power Electron Gun for surface physics applications and general vacuum physics research. It is a complete subsystem ready to attach and turn on.

Both beam current and beam energy are independently adjustable over wide ranges; the energy from 1 keV to 30 keV, and current from 1 nA to 10 μA . The beam divergence is also directly controllable.

The gun uses a lanthanum hexaboride (LaB_6) cathode to provide a small spot, down to 25 μm . A constant emission can be maintained by a control grid which is varied by electronic feedback. The LaB_6 cathode can have a lifetime in the thousands of hours. The beam can be rastered for imaging of the target.

The gun's adjustable optics include two focusing lenses as well as three quadrupole alignment and two octopole deflection elements. The gun also features an adjustable feedthrough assembly that allows mechanical alignment of the firing unit while the gun is being operated.

The gun has a blanker element which diverts the electron beam into an in-line Faraday cup. This system is used to measure the beam current in the column. The blanker provides a means of cutting off the beam while the gun is running and could also be used for pulsing.



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

UHV technology is used throughout. The gun may be completely disassembled for cleaning and repair. The cathode firing unit assembly (including the cathode, cathode-mount, and Wehnelt aperture) is user replaceable. The cathode is not damaged by repeated exposure to atmospheric gases or water vapor when cold. The gun can be run in vacuums from 10^{-11} torr to 10^{-7} torr and is bakable to 350°C with all cables removed.

The EGPS-4190/COPS-4190 Electron Gun Power Supply system features a modular design with miniaturized power supply clusters, optically isolated signals, and the FlexPanel digital interface controller. The EGPS-4190 and COPS-4190 Column Optics units contains all power supplies necessary to generate the required voltages to run an EMG-4193 Electron Gun.

The power supplies included in the EGPS-4190 and COPS-4190 units are Beam Energy, Condenser Lens 1, Objective Lens 2, and Blanker, as well as the supplies that float at the negative high voltage, Source and Grid, Aperture Alignment Quadrupole X & Y, Lens Alignment Quadrupole 1 X & Y, Lens Alignment Quadrupole 2 X & Y, Deflection Octopole 1 X & Y, Deflection Octopole 2 X & Y. For rastering, the octopole deflection is varied by computer-generated cyclical signals.

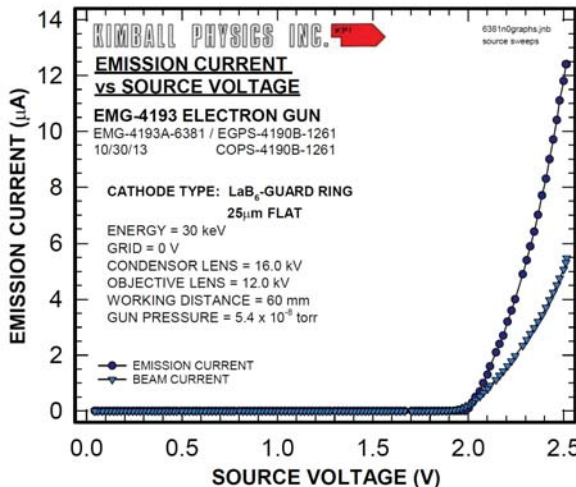
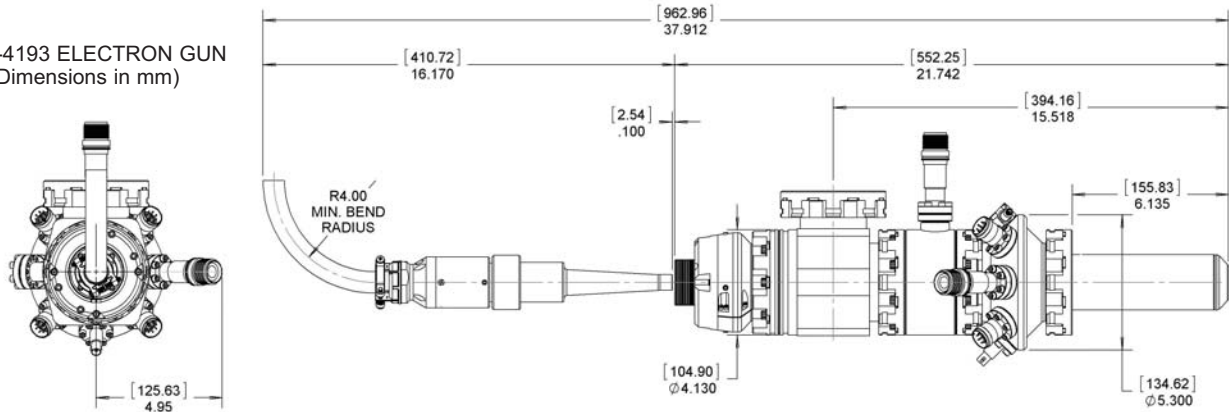
The FlexPanel provides a digital display screen and a keypad for programming control on the front panel. Rear panel connectors allow remote /computer control and metering of all gun power supplies. An RS-232 or RS-422/485 serial port and an analog input/output connector are included on standard power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

An optional LabVIEW™ computer program designed for the EMG-4193 is available for remote computer control and metering. Software is available in two types: Using National Instrument DAQ boards and SCSI connectors on the EGPS-4190, or via a simple serial connector interface. The program provides a virtual panel of controls and real-time metering on the user's computer screen.

EMG-4193 ELECTRON GUN SPECIFICATIONS	
BEAM ENERGY	1 keV to 30 keV (Independently adjustable)
BEAM CURRENT	1 nA to 10 μ A (Independently adjustable) Approx.
ENERGY SPREAD	0.4 eV cathode thermal spread, calculated
SPOT SIZE	25 μ m to 500 μ m
WORKING DISTANCE	30 mm to 200 mm
BEAM DEFLECTION / ALIGNMENT	Two octopole deflection elements: \pm 1 mm max deflection at 30 mm working distance at 30 keV (scales larger at lower energies)
RASTER	Deflection raster size: \pm 1 mm by 1 mm area at 30 mm working distance. raster frequency up to 10 kHz
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 (TTL required)
BEAM BLANKING	Optional: Pulse width 2 μ sec to DC at rep rate to 5 kHz Capacitive pulsing - pulse width to 20 ns
BEAM UNIFORMITY	Gaussian
FIRING UNIT	Customer-replaceable Firing Unit includes precision-aligned cathode and Wehnelt (G-1) assembly
CATHODE TYPE	Custom Lanthanum hexaboride (LaB ₆) ES-423 25 μ m flat. Cathodes not harmed by repeated exposure to atmospheric gases while cold
FARADAY CUP	Faraday cup detector in-line, used with blanker
SHIELDING	Full internal mu-metal magnetic shielding
INTERNAL GUN ALIGNMENT	Adjustable Feedthrough for mechanical alignment of firing unit while gun is operating
MOUNTING	4½ inch CF flange, optional conversion adaptor for mounting to larger flanges
DIFFERENTIAL PUMPING	4½ inch port for pump and 2½ for ionization gauge Optional pump: Varial Turbo-V81 M with controller Optional gauge: Granville-Phillips 356 Micro-Ion Module
INSERTION LENGTH	156 mm standard; varies with mounting adaptor
GUN DIMENSIONS	Gun length: 396 mm outside vacuum, sealing surface to end of cable connector Gun diameter: 144 mm at pumping ports, 180 mm across quad connectors.
FEEDTHROUGHS	Multi-pin brazed ceramic, threaded stainless steel shell
CABLES / CONNECTORS	Multi-conductor 30 kV high voltage fully ground-shielded cable, 25 kV lens cables, and low voltage deflection cables, coaxial blanker cable, with mating aluminum connectors, to connect gun and power supply. Standard lengths: 3 m, Optional: 5 m
MAXIMUM BAKEOUT	200°C with cables removed

EGPS-4190 / COPS-4190 POWER SUPPLY SPECIFICATIONS	
OUTPUT	All necessary voltages to drive the EMG-4193 Electron Gun
ENERGY SUPPLY STABILITY	<0.01% per hour with 0.05% rms ripple at full output
BEAM STABILITY	\pm 0.1% per hour with Emission Current Control or \pm 10% per hour after warm up without ECC
CONTROLS	FlexPanel controls: Energy, Source, Grid, Emission Current Control, Lens1 (condenser), Lens2 (objective), Blanker, Aperture Align Quad X&Y, Lens Align Quad1 X&Y, Lens Align Quad2 X&Y, Deflection Octopole1 X&Y, Deflection Octopole2 X&Y. Raster Frequency, Raster Size, Raster Duty Cycle, Stigmator V1, Stigmator V2
METERING	FlexPanel digital meters: Energy, Source Voltage, Source Current, Emission Current, Grid, Lens 1 (condenser), Lens2 (objective), Aperture Align Quad X & Y, Lens Align Quad 1 X & Y, Lens Align Quad 2 X & Y. Faraday Cup Current, Beam Stop Current, Blanker Optional Ionization Gauge meter
COMPUTER/REMOTE CONTROL & METER	Power supplies: 0 to +10 V (-10 V to +10 V, quadrupoles and octopoles) Metering: 0 to +2 V (-2 V to +2 V, quadrupoles and octopoles) Standard 50-pin connector for analog input/output and RS-232 serial port (RS-422 or RS-485 available, if specified at time of order) Octopoles: 68 pin SCSI programming.
SOFTWARE	National Instruments LabVIEW™ file, designed to run with RS-232 connections and computer DAQ board NI 6733.
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)	Two units, total approx: 17 in. x 14 in. x 22 in. excluding handles (432 mm x 356 mm x 559 mm); 19 in. rack mountable

EMG-4193 ELECTRON GUN
(Dimensions in mm)



Typical performance;
Data for guidance only.

