EMG-4103 / EGPS-4103
ELECTRON GUN / POWER SUPPLY

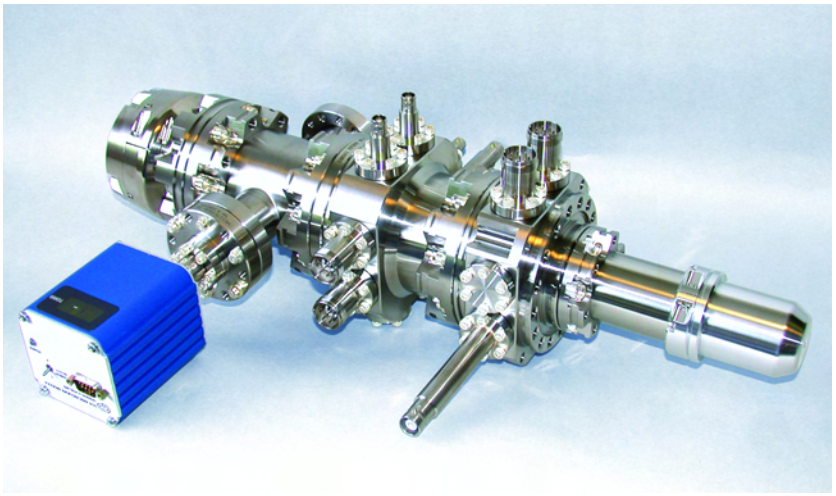
1 keV to 30 keV
Medium Energy, Small Spot Electron Beams

FOR USE IN:

SURFACE PHYSICS
VACUUM PHYSICS EXPERIMENTS

FEATURES / OPTIONS:

NEW MODULAR DESIGN
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 15 μm
BEAM CURRENT 100 nA TO 10 μA
UHV COMPATIBLE / BAKEABLE
COMPUTER / REMOTE CONTROL
USER-REPLACEABLE FIRING UNITS



EMG-4103 Electron Gun, 4½ CF or 6 CF mounting flange, (optional ion gauge and custom flange shown)

The Kimball Physics EMG-4103 Electron Gun, with its matching EGPS-4103 Power Supply and DACU-4103 Deflection 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 100 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 15 μm. A constant emission is maintained by the control grid which is varied using electronic feedback. The LaB_6 cathode has 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 350ºC with all cables removed.

The EGPS-4103 Electron Gun Power Supply system features a modular design with miniaturized power supply clusters, optically isolated signals, and the new FlexPanel digital interface controller. The EGPS-4103 with the DACU-4103 Deflection Amplifier Control Unit contains all power supplies necessary to generate the required voltages to run an EMG-4103 Electron Gun.

The power supplies included in the EGPS-4103 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. The power supplies included in the DACU 4103 are 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 new 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 accommodated, by use of appropriate digital to analog converters.

An optional LabVIEW™ computer program designed for the EMG-4103 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-4103, 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.

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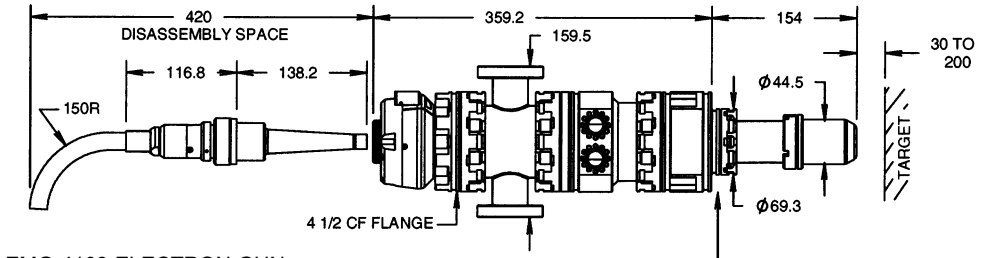
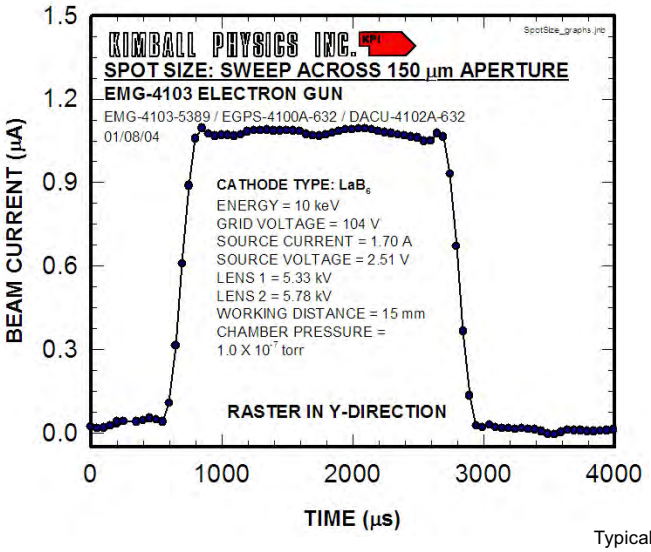
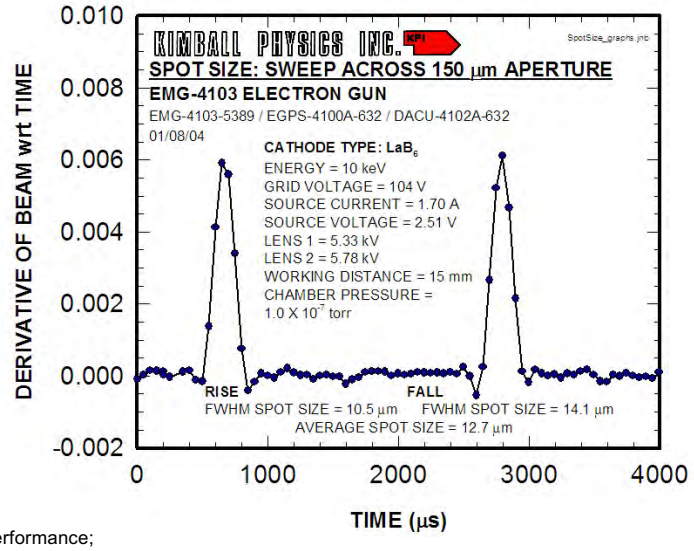
EMG-4103 ELECTRON GUN SPECIFICATIONS	
BEAM ENERGY	1 keV to 30 keV (Independently adjustable)
BEAM CURRENT	100 nA to 10 µA (Independently adjustable)
ENERGY SPREAD	Approx. 0.4 eV cathode thermal spread, calculated
SPOT SIZE	15 µm to 500 µm
WORKING DISTANCE	30 mm to 200 mm
BEAM DEFLECTION / ALIGNMENT	Two octopole deflection elements: ± 1.5° at 30 keV Three quadrupole elements (one for aperture alignment, two for lens alignment
RASTER	Deflection raster size: ± 1.5° at 30 keV, raster frequency DC to 10 Hz
PULSE CAPABILITY (using appropriate pulse generator, not included)	Optional Dual Grid Power Supply: pulse width 2 µs to DC, rise/ fall 500 ns, rep rates to 5 kHz (TTL required)
BEAM BLANKING	Optional: Pulse width 1 µsec to DC at rep rate to 10 kHz (Faster rep rates available) Blanking cut off ratio: 10^6 : 1
BEAM UNIFORMITY	Gaussian
FIRING UNIT	Customer-replaceable Firing Unit includes precision-aligned cathode and Wehnelt (G-1) assembly
CATHODE TYPE	Lanthanum hexaboride (LaB_6) ES-423 90°-50 µm flat Cathodes not harmed by repeated exposure to atmospheric gases while cold
FARADAY CUP	Faraday cup detector in-line, used with blanking
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	2¾ inch ports for pump and ionization guage Optional pump: Varial Turbo-V70 LP with controller Optional gauge: Granville-Phillips 354 Micro-Ion Module
INSERTION LENGTH	147.4 mm; varies with mounting adaptor
GUN DIMENSIONS	Gun length: 430.7 mm outside vacuum, sealing surface to end of cable connector Gun diameter: 160 mm at pumping ports, 106.2 mm for most of column
FEEDTHROUGHS	Multi-pin brazed ceramic, threaded stainless steel shell
CABLES / CONNECTORS	Multi-conductor 30 kV high voltage fully ground-shielded cable, 20 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	350°C with cables removed

EGPS-4103 / DACU-4103 POWER SUPPLY SPECIFICATIONS	
OUTPUT	All necessary voltages to drive the EMG-4103 Electron Gun
ENERGY SUPPLY STABILITY	<0.01% per hour with 0.05% rms ripple at full output
BEAM STABILITY	±0.1% per hour with Emission Current Control or ±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. Optional with LabVIEW™: 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, Deflection Octopole1 X&Y, Deflection Octopole2 X&Y. Faraday Cup Current, Beam Stop Current Optional with LabVIEW™: Ionization Gauge
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) Optional: SCSI metering and programming connectors
SOFTWARE	Optional: National Instruments LabVIEW™ file, designed to run with computer DAQ boards NI 6713 / 6036. Standard configuration designed for RS-232 connections. SCSI optional
INPUT	115 VAC or 230 VAC, 50 to 60 Hz single phase, 250 VA
ENVIRONMENT	Temperature: 0 to 40ºC, 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 19 in. x 22 in. excluding handles (425 mm x 485 mm x 560 mm); 19 in. rack mountable



EMG-4103 ELECTRON GUN
(Dimensions in mm)





Typical performance;
data for guidance only.