

## 100 eV to 5 keV Focused or Uniform Wide-Angle Flood Electron Beams

### FOR USE IN:

SURFACE PHYSICS STUDIES  
VACUUM PHYSICS EXPERIMENTS  
CHARGE NEUTRALIZATION  
ELECTRON DESORPTION  
SURFACE SCRUBBING  
PHOSPHOR TESTING  
IONIZATION EXPERIMENTS  
SEMICONDUCTOR PROCESSING

### FEATURES / OPTIONS:

WIDELY CONTROLLABLE PARAMETERS  
FLOOD BEAMS or NARROW ANGLE BEAMS  
ELECTROSTATIC FOCUSING  
DEFLECTION, RASTERING, PULSING  
DEMOUNTABLE GUN  
COMPUTER / REMOTE CONTROL

The Kimball Physics 5 keV EFG-7 Electron Gun, with its matching EGPS-2017 Power Supply, is intended for use in a variety of UHV, surface physics, and processing applications. It is a complete subsystem ready to attach and turn on. Beam energy, beam current and spot size are independently adjustable over wide ranges.

The EFG-7 Electron Gun uses a refractory metal cathode to generate a uniform flood beam. The gun design allows for generation of the beam down to low energies, and very low currents. The 5 keV model EFG-7 produces a beam current of 1 nA to 100  $\mu$ A and energies of 100 eV to 5 keV.

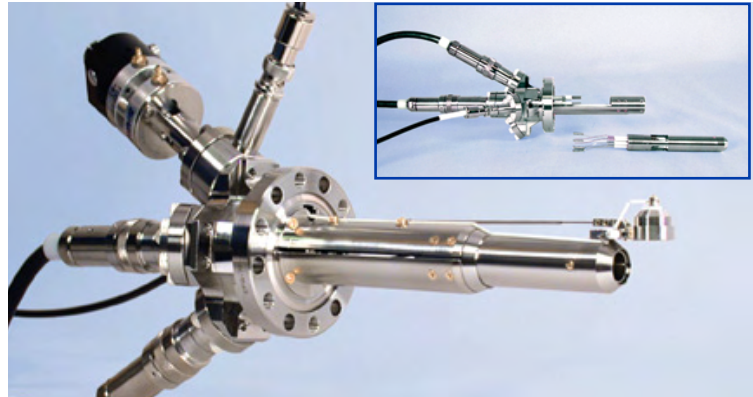
Centering deflection, rastering and pulsing are all available as options. Because the design has been optimized as a flood gun and uses a cylindrical 4-pole deflector, deflection aberrations can be severe when the beam is focused into a small spot.

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: barium oxide discs (BaO, low light, low energy spread, min. vacuum  $1 \times 10^{-7}$  torr) and yttria-coated iridium discs ( $Y_2O_3$  - Ir, rugged, vacuum up to  $10^{-4}$  torr, may survive brief loss of vacuum). With the exception of 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.

The EFG-7 Electron Gun is available in three different mounting configurations. The standard gun is without deflection and is mounted on a 2 3/4 CF Flange Adaptor with a single cable connector. With optional deflection, the gun is mounted on a 2 3/4 CF Flange Multiplexer with separate source, grid and deflection connectors. A demountable style is also available for a gun with deflection. The demountable gun can be used as mounted gun, or it can be removed by the user from its



*EFG-7 Electron Gun with Deflection  
(Inset shows gun demounted)*

mounting and used as an unmounted gun with the Flange Multiplexer as a separate vacuum feedthrough.

The control 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) and Flange Multiplexer mounting. Pulsing of the electron beam can also be accomplished with dual grid supplies, 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-2017 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, Focus, and optional X,Y Deflection, as well as the floating Source/ECC and Grid supplies.

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 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 EFG-7 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-2017, 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.

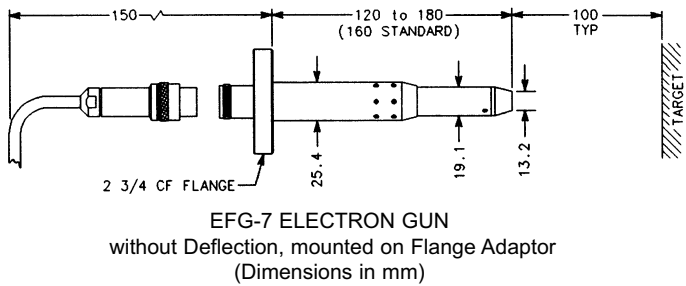


*EGPS-2017 Electron Gun Power Supply with FlexPanel controller*

5 keV MODEL EFG-7 ELECTRON GUN SPECIFICATIONS	
BEAM ENERGY	100 eV to 5 keV (Independently adjustable)
BEAM CURRENT	Standard: 1 nA to 100 $\mu$ A (Independently adjustable) High Current option: 1 nA to 1 mA
ENERGY SPREAD	Approx. 0.4 eV cathode thermal spread, calculated
SPOT SIZE	Standard: 1 mm to 100 mm (Independently adjustable) High Current option: 3 mm to 100 mm
WORKING DISTANCE	Variable: 25 mm to 200 mm
BEAM DEFLECTION	Optional: 4 pole electrostatic: $\pm 3^\circ$ 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 $\mu$ s, rise/fall 10 ns, 50 $\Omega$ impedance, 1 W standard (higher power available) Optional Dual Grid Power Supply: pulse width 2 $\mu$ s to DC, rise/fall 500 ns, rep rates to 5kHz (TTL required)
BEAM UNIFORMITY	Gaussian or uniform, depending on operation
FIRING UNIT	Customer-replaceable Firing Unit includes precision-aligned cathode and Wehnelt (G-1) assembly and anode, with insulators and connectors
CATHODE TYPES	Standard: Tantalum disc Optional: Barium oxide (BaO) or Yttrium oxide ( $Y_2O_3$ ) With the exception of Barium oxide, cathodes not harmed by repeated exposure to atmospheric gases while cold
MOUNTING	Standard: Flange Adaptor with a 2 3/4 inch CF (no deflect) Optional: Flange Multiplexer with a 2 3/4 inch rotatable CF, including both tapped and clear mounting holes Optional: Demountable (Unmounted / Mounted) with a Flange Multiplexer with a 2 3/4 inch rotatable CF
BEAM ALIGNMENT	Optional: Mechanical alignment with $\pm 2^\circ$ Port Aligner
INSERTION LENGTH	Standard: 160 mm, Range: 120 mm to 180 mm. Demounted gun: Gun length with pins 135 mm standard Custom lengths available. Gun manufactured at standard length unless otherwise specified at time of order.
GUN DIAMETER	25.4 mm at the gun flange, necks down to 19.1 mm at 100 mm from the flange
FEEDTHROUGHS	Multi-pin brazed ceramic, threaded stainless steel shell
CABLES / CONNECTORS	Multiconductor 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-2017 ELECTRON GUN POWER SUPPLY SPECIFICATIONS	
OUTPUTS	All necessary voltages to drive the High Energy EFG-7 Electron Gun
ENERGY 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 or $\pm 10\%$ per hour after warm up without ECC
CONTROLS	FlexPanel controls: Energy, Source, Grid, Focus, Emission Current Control, optional X and Y Deflection
METERING	FlexPanel digital meters: Energy, Source Voltage, Source Current, Emission Current, Grid, Focus, optional 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 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 6034E/6036 and NI 6703/6713. The DAQ boards appropriate for a given system (determined by options & custom features) will be determined by the Kimball Physics engineering department.
INPUT	115 VAC switchable to 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 RGDU-4A RASTER GENERATOR 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 RS-232, RS-422, RS-485, analog input, or computer control with LabVIEW™ software option.
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



Typical performance; data for guidance only.

