MODEL FC-66 FARADAY CUP

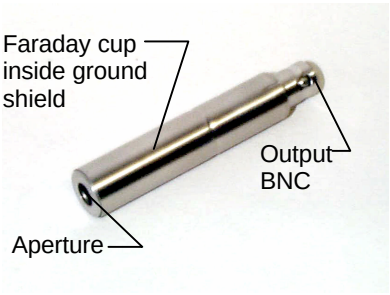

Figure 1 FC-66 Faraday Cup

INTRODUCTION

The Kimball Physics model FC-66 Faraday cup, connected to an ammeter, is used to collect and measure charged particle current, such as the beam emitted from an electron or ion gun. The FC-66 is UHV compatible and fully bakeable

The Faraday cup consists of a hollow stainless steel cylinder closed at the base, with an appropriately-sized aperture for collecting the electrons or ions. An outer, grounded cylinder provides shielding. An electrical connection is made to the base of the Faraday cup, terminating in a BNC. The current is then conducted to a vacuum feedthrough and so to an ammeter.

A feedthrough on a 1**a** CF or larger flange, or a custom-designed feedthrough, is available from Kimball Physics as a separate option.

POWER INPUT CAUTIONS

For continuous measurement, the maximum beam power recommended into the standard FC-66 Faraday cup is 4 watts. The Faraday cup temperature should not be raised above 350ºC due to outgassing

The power input can be calculated by multiplying the beam current times the electron acceleration voltage; for example, 1 mA at 20 keV gives 20 W, which is much too high for continuous measurement. The temperature of the Faraday cup increases approximately linearly with the power input. A 2 W input results in approximately 150ºC, and a 4 W input results in 300ºC.

To use the Faraday cup at high power, measure currents briefly and then let the Faraday cup cool down before repeating the measurement. Due to heat capacity of the cup, a 20 W input for 10 sec into the FC-66 will raise the cup temperature by approximately 150ºC. The cup will cool from 200ºC to room temperature in about 15 min.

Care must always be exercised with a highly focused beam, as a high power density can bring the Faraday cup to melting temperature in the impact area of the beam. For example, an electron gun with an output of 1 mA at 10 keV focused to a 1 mm spot size has a power density of approximately 13 kW/cm^2. Assuming no heat flow, this would bring the Faraday cup stainless steel at the spot to its melting point in only 11 sec.

SPECIFICATIONS

FC-66	
Aperture size	5.1 mm dia.
Length	70 mm, including BNC
Diameter	13.2 mm dia. shield
Operating temperature	350ºC max.
Input power continuous	4 watts max. recommended

INSTALLATION AND OPERATING PROCEDURE

⚠ CAUTION

High beam power can melt Faraday cup components. Maximum recommended beam power into the Faraday cup is 4 W continuous.

1. Position the Faraday cup in the target area inside the vacuum chamber.
2. Connect the output BNC on the back of the Faraday cup to an electrical feedthrough on the vacuum system (an in-vacuum coaxial cable/ CF flange/ BNC assembly is available from Kimball Physics).
3. Connect the feedthrough to a suitable user-supplied ammeter. ***NEVER* collect beam current in the Faraday cup unless the cup output is connected to an ammeter or grounded.** Without proper termination, the Faraday cup terminal will charge up to full beam energy and electrical discharging will result.
4. Calculate the expected power input into the Faraday cup and check that it is within the acceptable range. See the discussion of power input cautions.
5. Measure electron or ion current with the ammeter.

BIASING THE FARADAY CUP

The Faraday cup can be electrically biased to reduce scattering of electrons or ions collected in the Faraday cup and to reduce secondary electron emission. For electrons or negative ions, +50 V is typically adequate, and for positive ions, -50 V. This can be accomplished by placing a battery between the vacuum feedthrough and the ammeter.

FC-66 info.01.doc
FC-66 drawing #: 292 FC-71 partial

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