

MODEL FC-70C FARADAY CUP

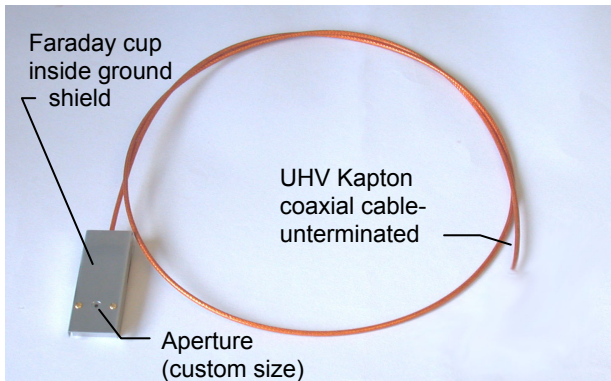


Figure 1 FC-70C Faraday Cup with optional 1 m cable

INTRODUCTION

The Kimball Physics model FC-70C 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-70C is UHV compatible and bakeable to 250°C.

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. The standard aperture diameter is 1.596 mm which yields a 2.0 mm² area; however, custom aperture sizes are available. An outer, grounded box completely encloses the Faraday cup to provide shielding. An electrical connection is made from the side of the Faraday cup to a shielded, Kapton-insulated coaxial cable with an unterminated end. The current is then conducted through a user-supplied vacuum electrical feedthrough to an ammeter.

A feedthrough on a 1½ CF or larger flange, or a custom-designed feedthrough, is available from Kimball Physics as a separate option.

To reduce scattering of electrons or ions collected in the Faraday cup and to reduce secondary electron emission, the Faraday cup can be electrically biased. 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.

POWER INPUT CAUTIONS

For continuous measurement, the maximum beam power recommended into the standard FC-70C Faraday cup is 100 milliwatts. The Faraday cup temperature should not be raised above 150°C due to outgassing.

The wattage can be calculated by multiplying the beam current times the electron acceleration voltage; for example, 1 mA at 1000 eV gives 1 W, which is much too high for continuous measurement. The temperature of the Faraday cup increases approximately linearly with the power input. A 50 mW input results in approximately 150°C.

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 500 mW input into the FC-70C will raise the cup temperature from room temperature to approximately 150°C in 80 sec. The cup will cool from 200°C 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. Spot size should be greater than 1 µm.

SPECIFICATIONS

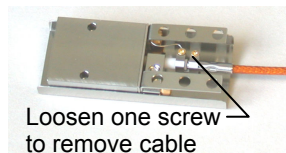
FC-70C	
Aperture size (Custom available)	1.596 mm dia. = 2mm ² area
Input power continuous	100 mW max.
Shield size	53 mm x 22 mm x 10 mm (2.1" x 0.9" x 0.4")
Cable length	30 cm, Optional: 1 m or 3 m
Operating temperature	150°C max.
Bakeout temperature	250°C max.
Vacuum level	10 ⁻¹⁰ torr min.

INSTALLATION AND OPERATING PROCEDURE

CAUTION

High beam power can melt Faraday cup components. Maximum recommended beam power into the Faraday cup is 100 mW continuous.

1. If desired, attach a user-supplied connector to the unterminated end of the cable which has one exposed conductor and the outside at ground.
2. Position the Faraday cup in the target area inside the vacuum chamber.
3. Connect the Faraday cup cable to a user-supplied feedthrough on the vacuum chamber.
4. Connect the feedthrough to a suitable user-supplied pico-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.
5. 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.
6. Measure electron or ion current with the pico-ammeter.
7. If desired, the cable can be removed from the Faraday cup by loosening the outer 0-80 screw on the back of the body. When replacing cable, insert its end fully and tighten screw. Check continuity between cup and cable end.



FC-70C info.02
FC-70 drawing #173F020

Figure 2 Back of FC-70C assembly

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