



# BEAM DIAGNOSTIC COMPONENTS

## National Electrostatics Corp.

## Faraday Cups

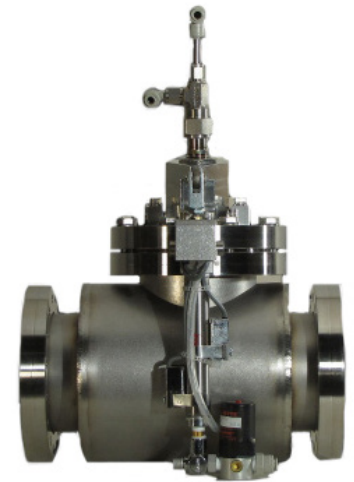
### Applications

NEC manufactures various types of Faraday cups for a variety of applications involving the monitoring of ion beam currents. The NEC Faraday cups are ideal for applications requiring accurate measurement of ion beam intensity in cases where the ion beam diameter is one inch or less.

For applications involving high energy or high current beams, the Model FC18 is designed to handle 1 kW of continuous beam power. The FC50, capable of handling 50 kW of beam power, is designed for applications requiring maximum beam clearance when the cup is retracted. For applications involving nanosecond pulsed beams, the Model FC28 is specifically designed to measure the coincidence and/or duration of pulsed beams. This model is not retractable.

Model	Beam Power Rating	Aperture
FC18	1000 W	1.0" (2.54 cm)
FC50	50 W	1.0" (2.54 cm)
FC28	100 W	0.375" (0.95 cm)

*The above beam power ratings are for a continuous beam with a diameter of 3mm or greater and with appropriate cooling.*



**Model FC18**

*NEC's highest power cup with a conservative 1kW power rating for beams with a minimum diameter of 3mm.*

### Design

The configuration of NEC Faraday cups varies from model to model dependent upon power rating and application requirements. However, there are several main features with which all NEC Faraday cups are equipped. They include electron suppression assemblies, which return secondary electrons, resulting in accurate beam current readings. The electron suppression assembly can be biased separately to a maximum of 500 V. Tantalum collectors are used to limit neutron production. Molybdenum beam apertures are used to protect the insertion mechanism and assure proper operation of the suppression assembly. Standard connectors (MHV and BNC) are used for current reading from the cup and for providing suppression voltage.

As with all NEC components, the Faraday cups are ultra-high vacuum compatible. Though some varieties of the Faraday cups contain vacuum grade polyimide as bearing material, most varieties are of all-metal and ceramic construction and are fully bakeable.

The position of the Faraday cup (excluding the FC28 fixed position model) is controlled by a pneumatic cylinder, which is actuated by air pressure. The motion is transmitted through a bellows seal to move the Faraday cup to one side of the beam path.

Standard housings are available, dependent on model. The Faraday cups can also be inserted into customer supplied housings, again, dependent on model. Common flanges include ConFlat, Dependex, and NEC; however, custom flanges are available upon request.

## Accessories

A complete Faraday cup system for local control includes a Faraday cup, a controller for actuation, and a picoammeter for current reading.

NEC offers a local controller that can control up to four Faraday cups. NEC can provide or suggest a suitable model picoammeter upon request.

If incorporating the Faraday cup into an NEC control system with AccelNET and ACT/CAMAC, logarithmic amplifiers are needed to convert current readings from the Faraday cup to voltage output. Various amplifiers are available from NEC including positive or negative in both 115 V and 230 V options.



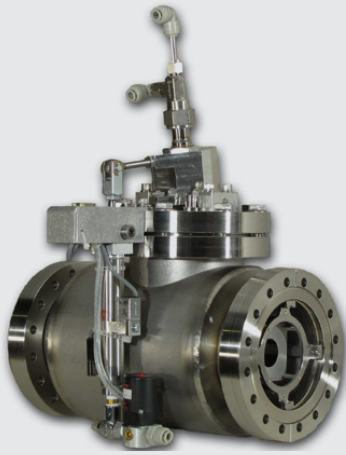
*Model FC50 in a standard 4" dia. housing with 6" OD flanges.*

The specific variation of log amp used with the Faraday Cup system is based on the following parameters:

- Beam Polarity (Positive or Negative)
- Input A.C. Voltage (115 V or 230 V)
- Internal on/off relay (Yes or No)
- Output Voltage (typically 0-6V)



*Multi-Unit Faraday Cup controller for local control. Controls up to four (4) Faraday Cups.*



### FC18

**Power Rating:** 1000 W (fixed position)

Designed for applications where high energy or high beam currents are expected.

The FC18 Faraday cup configuration is a unique tantalum cone design. This steep cone shape spreads the beam power over the side of the cone which decreases the effective power density on the tantalum surface, eliminating local hot spots. This cone is indirectly water cooled to allow a conservative beam power rating of 1000 W for a continuous beam with a minimum diameter of 3 mm. The indirect cooling design allows the use of ordinary tap water without current leakage.

This deep tantalum cone design, combined with the electron suppression assembly, provides very accurate beam current measurements.



### FC50

**Power Rating:** 50 W

Designed for applications requiring maximum beam clearance when the Faraday cup is retracted.

The cup assembly is mounted on a single flange with feedthroughs. This allows the complete FC50 to be conveniently mounted into the customer's vacuum chamber. The Model FC50 is an insertion Faraday cup mounted on a welded bellows assembly. This assembly has a 2" (50mm) stroke. The minimum recommended vacuum housing is a 4" O.D. 16 gauge tube. Custom insertion lengths and mounting flanges are available. Custom housings are also available upon request.



### FC28

**Power Rating:** 100 W

Designed primarily as a timing device by measuring the coincidence and/or duration of pulsed ion beams.

The FC28 is a fixed position assembly and cannot be removed from the beam path. There is a .002" thick tungsten grid at the exit of the suppressor assembly. This grid has an 85% to 90% optical transparency. The purpose of the grid is to limit the spread of the delivered pulse which is affected by the transit time of the beam across the gap between the grid and the target. However, the grid does affect the accuracy of the current intensity measurement. Due to the fixed nature of this model, its usage is limited to the end of beamlines.

	FC18	FC50	FC28
<b>Beam Power Rating: (for a ≥3mm beam dia.)</b>	1000 Watts	50 Watts	100 Watts
<b>Beam Aperture</b>	1" (25mm) dia. molybdenum	1" (25mm) dia. molybdenum	3/8"(9.5mm) dia. molybdenum
<b>Cup Material</b>	Tantalum cone	Tantalum	Tantalum sheet with copper heat sink
<b>Housing</b>	6.0" dia., Stainless steel	Available as an option (min. port clearance is 2.37")	1.5" dia., Stainless steel
<b>Insertion Time</b>	Approximately 1 second	Approximately 1 second	N/A (fixed assembly)
<b>Insertion Drive</b>	Pneumatic, bellows sealed, solenoid control requires 24 V	Pneumatic, bellows sealed, solenoid control requires 24 V	N/A (fixed assembly)
<b>Suppression and Bias</b>	500 V maximum	500 V maximum	500 V maximum
<b>Cooling</b>	Water (indirect), 1/4" tubing	Radiation only	Air, 3 cfm, 1/2" tubing (no cooling required below 10W)
<b>Electrical Connection</b>	<ul style="list-style-type: none"> <li>■ Two - MHV connectors (Mating connectors are provided)</li> <li>■ One - D connector (Mating connector is provided)</li> </ul>	<ul style="list-style-type: none"> <li>■ Two - MHV connectors (Mating connectors are provided)</li> <li>■ One - 9 pin D connector (Mating connector is provided)</li> </ul>	<ul style="list-style-type: none"> <li>■ One - BNC (Mating connector is provided)</li> <li>■ One - Wire connection</li> </ul>
<b>Compressed Air</b>	60 to 110 psig, 1/4" tubing	60 to 80 psig , 1/4" tubing	N/A
<b>Overall Length*</b>	9.00" (229mm) with 6" O.D. Conflat flanges	N/A	9.25" (235mm) with 6" O.D. ConFlat flanges

\*Overall Length dependent on flange type/size. Custom flanges available upon request.

## Contact NEC

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