John Chubb Instrumentation Ltd
Unit 30, Lansdown Industrial Estate, Gloucester Road,
Cheltenham, GL51 8PL, UK. Tel: +44 (0)1242 573347
Fax: +44 (0)1242 251388 email: jchubb@jci.co.uk

USER MANUAL: JCI 247 Faraday Pail

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For sensitive measurement of electrostatic charge on components, liquids and powders

1. INTRODUCTION

The JCI 247 Faraday Pail is a sensitive instrument for precise and reliable measurement of electrostatic charge. It may be used to measure the charge on individual or multiple items and on liquids and powders. The relatively large dimensions of the JCI 247 make it easy to ensure that items and material enters the pail with minimum risk of spillage or loss. The sensitivity in conjunction with a JCI 178 Charge Measurement Unit allows charge to be measured with a resolution down to 10pC and up to 200nC.

2. PRACTICAL DESIGN FEATURES

JCI 247 Faraday Pail comprises a 300mm diameter 490mm high metal pail. This rests on a metal plate mounted on insulators from the base of a 460mm diameter 580 mm tall metal shielding container with a 260mm diameter aperture in the top cover for entry and exit of samples. A BNC connector is provided for coax cable linkage to a charge measurement unit. The assembly and its parts are shown in Figures 1 and 2.

The charge appearing on the outside of the pail is equal to the nett quantity of charge placed into the pail. It is not necessary that the charge introduced actually conducts to the pail, so measurements are equally applicable to insulating materials and conducting components placed into the pail. The shield over the pail ensures that measurements are little affected by nearby static charges on people or surfaces.

The top cover shield and the pail can easily be removed for emptying the pail, for weighing the quantity of material that has entered the pail and for cleaning.

3. OPERATIONAL USE

For use the JCI 247 Faraday Pail needs to be rested on a stable flat surface and connected to a virtual earth charge measurement unit (such as a JCI 178) by a good quality cable with BNC connectors.

The earthed shield over the pail minimizes the influence of any static charges on surfaces nearby. The depth of the pail ensures that quite large quantities of material may be put into it without the measurement being affected by coupling of the charge on the upper surface of the material to the shield metalwork.

It is desirable for the body of the operator to be bonded to earth and for the operator to wear outer clothing that dissipates static charge easily. It is also wise to avoid insulating surfaces near the unit. If these become highly charged the electric fields from them could couple slightly to the pail through the shield aperture and affect readings. When making high sensitivity measurements it may be helpful to reduce to the size of the entry aperture to improve shielding against external charged surfaces – as far as sensibly compatible with easy entry of samples. If charge is to be measured on items slid down a surface (e.g. semiconductor devices slid down a shipping tube) it is important to connect the sliding surface to earth.

After initial switch-on of the charge measurements unit it is wise to check the stability of the zero setting and the stability of readings. The stability of the zero setting may be checked by pressing the zeroing button on the JCI 178 (or equivalent unit) for a second or so and then observing the reading over a period of several minutes. In making measurements it is important to check and record the pre-test 'zero' reading.

The quality of the insulation of the Pail may be checked by introducing some charge into the Pail and then observing the rate of drift of the reading. Performance should be suitable if the rate of decay of the reading after charge introduction is less than about 10% in 5 minutes.

4. CALIBRATION

By using a virtual earth charge measurement unit, such as the JCI 178, the measurements are essentially independent of the capacitance of the pail and the connection cable. Calibration may be performed using a known value capacitor, for instance 10nF, connected to earth on one lead. If the capacitor is then charged to a known voltage, for instance 1V, and then, after disconnection from the voltage source and contact made to the pail there will be a transfer of a known quantity of charge, for instance 10nC for 10nF and 1V. It is best to avoid use of calibration voltages less than a volt as results can then be affected by contact potential difference effects. Formal calibration is made to the procedures outlined in British Standard BS 7506: Part 2: 1996 - or by use of a JCI 256 Charge Calibrator.

5. SPECIFICATION FEATURES

JCI 247 dimensions:	• Pail: 300mm diameter 490mm high, removable • Shielding container: 410mm diameter 580 mm tall • Weight: about 7½ kg
Sensitivity with JCI 178:	• 20 and 200 nano-Coulombs full scale 10pC resolution • Sensitivity selected via on/off switch on JCI 178 or by external control signal
Zero stability:	• Noise within ±10pC. Zero stable ±100 pC.
Accuracy and linearity:	• Within ±5%FSD on JCI 178 display and analogue output
Response:	• -3dB at 65Hz.
Display on JCI 178:	• 3½ digit liquid crystal display of charge directly in nano-Coulombs with polarity and `LO BATT' indication
JCI 178 Audio alarm:	• Pulsing audio signal when above user set level
JCI 178 Controls:	• On/off slide switch: off - range 1 - range 2 • Screwdriver set alarm threshold • Screwdriver zero setting adjustment
JCI 178 Power supply:	• Replaceable PP3 battery • external floating 12V supply via 8w mini DIN • 2.1mm d.c. power connector for 12V external floating power supply input
External connections:	• via 8w mini DIN connector: - analogue output signal (±2V FSD) - sensitivity range indication and sensitivity external control - earth - external power supply input • 2.1mm 12V d.c. power input
Earth bonding:	• earth connection terminal on side of shielding enclosure

Figure 1: JCI 247 Faraday Pail unit with JCI 178 connected

Figure 2: JCI 247 with shield off to show removable pail